

Hardie

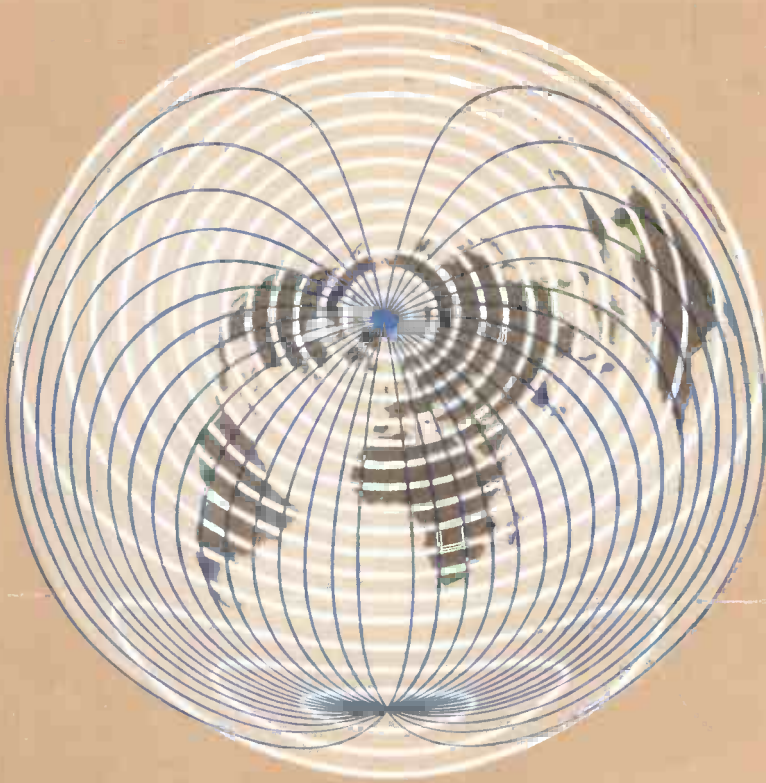
OCTOBER 1957 TWO SHILLINGS

Show Review

Wireless World

ELECTRONICS

Radio · Television



FORTY-SEVENTH YEAR OF PUBLICATION

For continuous use at

130°C

Teramel is BICC's new polyester enamel covering for winding wires. It combines the excellent electrical and mechanical properties called for in BS 1844/1952 with high thermal stability—*Teramel wires can safely be used at continuous temperatures of 130°C.*

They are ideal for:—



- ▷ Armature and field windings for industrial and traction motors
- ▷ Air cooled windings for transformers
- ▷ Coils for motor starters

BICC

TERAMEL

Winding Wires

Hard and strongly adhesive to the copper wire. Negligible thermoplastic flow.

Flexible — can be twisted, stretched or flattened without damage.

Resistant to varnish solvents, moisture and chemically contaminated atmospheres.

▷ Further information is contained in
Publication No. 391—available on request

Wireless World

ELECTRONICS, RADIO, TELEVISION

Managing Editor: HUGH S. POCOCK, M.I.E.E.
Editor: F. L. DEVEREUX, B.Sc.
Editorial Consultant: H. F. SMITH

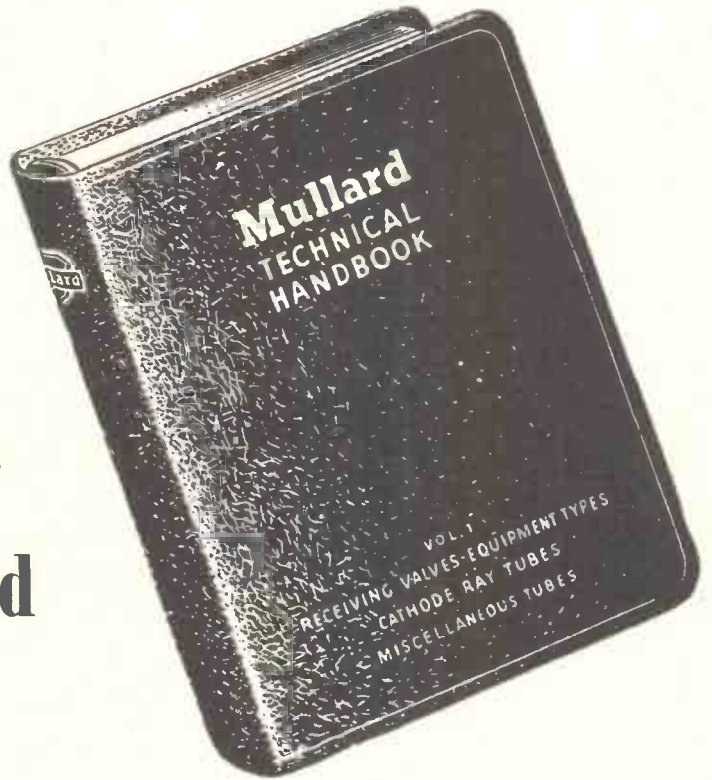
OCTOBER 1957

In This Issue

	459	Editorial Comment	
	460	Farnborough Air Show	
	462	World of Wireless	
	465	Radio Show Review	
	474	Short-Wave Conditions	
	475	"Nearest Approach" Calculator	By A.L.P. Milwright
	477	New Radio Telescope	
	479	Loudspeakers in Parallel	By J. Moir
	482	Component Developments	By G. W. A. Dummer
VOLUME 63 No. 10	485	More Jobs for Computers	
PRICE: TWO SHILLINGS	487	Letters to the Editor	
	488	Modern Thermionic Cathodes	By R. W. Fane
FORTY-SEVENTH YEAR	491	Stabilization of A.C. Supplies	By O. E. Dzierzynski
OF PUBLICATION	497	The Gyrator—2	By Thomas Roddam
◆ ◆ ◆ ◆ ◆ ◆	501	Technical Notebook	
Offices: Dorset House, Stamford Street, London, S.E.1.	503	Scientific Theories	By "Cathode Ray"
Please address to Editor, Advertisement Manager or Publisher, as appropriate.	505	Ferrites for F.M.	By T. W. G. Calvert
Telephone: WATERloo 3333 (60 lines)	508	Subjective Colour for Television?	By C. E. M. Hansel
Telegraphic Address: "Ethaworld, Sedist, London".	510	News from the Industry	
	512	Random Radiations	By "Diallist"
	514	Unbiased	By "Free Grid"

PUBLISHED MONTHLY (4th Tuesday of preceding month) by ILIFFE & SONSLTD., Dorset House, Stamford Street, London, S.E.1. Telephone: Waterloo 3333 (60 lines). Telegrams: "Iliffepres, Sedist, London." Annual Subscription, Home and Overseas £1 15s. 0d: Canada and U.S.A. \$5.00. Application for second-class mailing pending at Post Office, New York, N.Y. BRANCH OFFICES: BIRMINGHAM: King Edward House, New Street, 2. Telephone: Midland 7191. COVENTRY: 8-10, Corporation Street. Telephone: Coventry 5210. GLASGOW: 26B Renfield Street, C.2. Telephone: Central 1265. MANCHESTER: 260, Deansgate, 3. Telephone: Blackfriars 4412. OVERSEAS OFFICES: U.S.A.: 111, Broadway, New York, 6, N.Y. Telephone: Digby 9-1197. CANADA: 67 Yonge Street, Toronto, 1, Ontario. Telephone: Empire 6-0873.

A service for all who need complete data on Mullard valves, tubes and semiconductor devices



The Mullard Technical Handbook is a loose-leaf publication, issued on a subscription basis and containing data sheets on all Mullard valves, tubes and semiconductor devices in current production.

From one to twenty pages are devoted to each type, data including: standard ratings, recommended operating conditions and performance figures for various applications, limiting values, characteristic and performance curves. Subscribers receive supplementary or revised sheets automatically as they are issued and thereby have early intimation of new introductions.

At present the Handbook comprises four volumes with the following contents:—

Mullard

Mullard Limited, T.S.D., Data and Publications Section,
Mullard House, Torrington Place, London, W.C.1.

VOLUMES 1 and 1A

Data on current Receiving and Amplifying Valves. Cathode Ray Tubes. Crystal Diodes and Transistors. Photocells. Cold Cathode Tubes. Small Thyratrons. Miscellaneous and Special Tubes.

VOLUME 2

Data on earlier type Receiving and Amplifying Valves and Cathode Ray Tubes still in limited production for the maintenance of existing equipment.

VOLUME 3

Data on Power Valves for Transmitting and Industrial Equipment. Power Rectifiers. Large Thyratrons. Microwave Devices.

For full details of this service, including subscription rates and application form, write to the address below.



The "Ideal" Receiver?

ARGUMENTS as to whether this year's Radio Show was better, as good as, or worse than last year's have subsided without leaving any conclusion which is not to some extent coloured by prejudice. Our own view would be that it was a better show, but by a margin too small to justify any claim for recognition as a landmark in any future history of the development of broadcast receivers. Although, as our review elsewhere in this issue points out, most of the changes seen this year are developments of trends already discernible a year or more ago, there has been ample food for thought in the rate at which some of these changes are taking place, and the reaction of the buying public to the new types of set which are offered to them.

Take, for example, the combined television and v.h.f./f.m. sound receiver. From the technical point of view this is a particularly neat and logical combination, since not only the audio-frequency amplifier but also the early intermediate-frequency stages can be made to fulfil dual functions. There is no more economical way, either in first cost or in the space taken up in the living room, of making provision for the reception of all the domestic broadcast services in this country. In spite of this, according to reports published in the trade Press, there has been no spectacular swing in popular favour towards this type of receiver, though there were more sets to choose from this year than last. According to some dealers, many of their customers still want medium and long waves if only for the reception of the popular Luxembourg programmes; others point to the fact that some members of the same family may wish to receive the sound programmes while others are viewing television—clearly a case for separate sets in different rooms. Even those for whom these objections do not carry any weight may still argue that the small power outputs and loudspeakers which are perfectly adequate for the sound accompaniment to television and, indeed, for many of the sound programmes themselves cannot do full justice to all the qualities of the B.B.C.'s v.h.f./f.m. service.

The truth is that no single receiving system can completely satisfy all the varying tastes and requirements of all sections of the community and, at the same time, fall within the price limits that most

people can pay. Accordingly, manufacturers produce a range of sets giving permutations and combinations of those features which they judge will make the widest appeal. For economic reasons it is obvious that such a range cannot be expected to be complete, and that some potential customers must go without or put up with a set which to them is second best.

As a way out of this impasse there is, in our view, a case for a return to unit construction; but, before the indulgent smiles of the conservative body of the radio industry give place to ribald laughter, let us hasten to add that we do not visualize a return to the block system, which we in this journal are old enough to remember, in which every stage was built as a separate unit, but rather to an extension of the ideas which have found favour with the "hi-fi" enthusiasts. The basic unit would be a vision receiver with alternative input tuners and a plug-and-socket take-off point for sound which would go either to a small internal conventional rectifier/discriminator/amplifier and loudspeaker, or to an external high-quality sound-reproducing system. No system other than one based on units could hope to satisfy the individuality expressed by those with strong ideas of what constitutes good sound reproduction, and to any who may think that a unit system must look like a laboratory test bench we commend the many fine examples of "custom built" sectional furniture which have recently been introduced. There is no need for the "electronics" to be any more apparent than they are in a conventional receiver, and for those who are prepared to pay the cost, even knobs and dials can be discreetly tucked away behind panels or concentrated in neat remote-control units.

By these means it should be feasible to give the man who wants, say, television with high-quality sound all that he wants without forcing him to buy also an automatic record changer and a cocktail cabinet.

We know only too well that there will always be those who want to combine X's amplifier with Y's tone-equalizer and Z's loudspeaker, but we have every reason to believe that an experienced dealer will have either the technical knowledge to help the customer to do this or the arguments to persuade him to stick to one make.

Farnborough Air Show

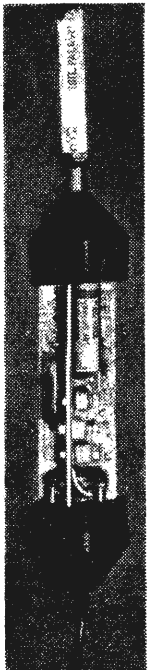
DEVELOPMENTS IN RADIO AND ELECTRONICS

AS in most technological industries and services, electronics plays a significant and, in some cases, a dominant part in all branches of aviation. Manufacturers make use of computers for design, vibration generators and strain gauges for testing, and computers again for the more advanced flight data instruments. None but the smallest light aeroplanes may fly without v.h.f. communications equipment and long distance radio communication and radar are essential aids to the flight controller.

Developments in ground-to-air communications equipment are toward the provision of a wider selection of channels and greater flexibility in selection. In the new Murphy MR370 transmitter a decade switching system tunes to any of 622 channels at 90kc/s separation (56 at 100kc/s) in the 100-156Mc/s band. In the Murphy airborne v.h.f. receiver (MR300) 44 channels (100kc/s) are available and with the Standard Telephones STR9X conversion kit to give 44 channels with automatic tuning instead of the former 10, is now in full production.

Redifon have brought out a new medium-frequency (200-525kc/s) beacon, the layout of which is designed to reduce routine maintenance time. It is available as a dual installation where continuity of service is essential together with an automatic change-over and alarm unit.

Two developments in air rescue beacons were noted. Burndepth have introduced a crystal-controlled u.h.f. beacon transmitter ("SARBE") in two forms with or without two-way speech facilities, and Ultra are making an inexpensive version of "SARAH," with built-in transistor h.t. supply, for use on small fishing vessels.



Ultra SARAH transistorized rescue beacon with cover removed.

With the growing density of traffic, the work of the air traffic controller is becoming increasingly onerous. Much thought has been given to ways and means of simplifying his task and in a new Decca display system now under development the controller is presented only with the essential information required to make decisions. All radar and flight report material is sifted by a team of operators before appearing on his screen. The basis of the display is a 405-line projection television plan of the airport and its approaches, derived from a transparency in the outer control office by the "Deccafax" system (described on p. 470 of this issue).

Superimposed on this "static" display are moving symbols indicating all aircraft in the area. Small numbered squares represent aircraft under radar observation, while circles indicate movements, based on reports, of aircraft not yet in radar range.

The method of generating, controlling and displaying the flight symbols is ingenious. The symbols and numbers are first selected from a monoscope tube with a store of 100 digits by a 20-line spiral scan and are fed into the main radar display tube during the flyback period between each radial sweep. Their position is deter-

mined by "gated" currents in auxiliary horizontal and vertical deflection coils and normally the symbols are stored in a row at the top of the tube. When a target is identified it is "boxed" by one of the symbols, first using manual control of deflection, and is then followed by putting on a traverse with the right speed and direction. Adjustment of the rate may be required from time to time to keep the target "boxed"; but it is hoped later to incorporate auto-following. The video signals corresponding to the symbols and their position coordinates are repeated on a separate c.r. tube which is scanned at 405 lines, synchronized and mixed with the "static" Deccafax information and applied to the controller's projection display tube.

Unwanted permanent echoes in a radar screen are reduced in the Cossor CR21 surveillance radar by a cancellation technique and rain echoes by the use of circular polarization in conjunction with a quarter-wave filter plate in the radar beam. This equipment, which was shown in prototype form last year, has recently undergone extensive official trials and in its mobile form has been widely demonstrated abroad.

Marconi's have introduced a high-power (3MW peak), 10-cm radar (Type SR1000) for long-range civil and military requirements which breaks new ground in combining transmitter, receiver and all power supplies in a single compact cabinet measuring only 87 in x 81 in x 40 in.

Doppler Navigation

Where navigational assistance from ground stations is either impracticable or inexpedient the Doppler system of independent course tracking by the change of apparent frequency of radio reflections from the ground is without a serious rival. The general principles were described in our May issue (p. 225) and since then more details have been disclosed of the equipment developed by the Ministry of Supply and the Marconi Company for use by the R.A.F. This employs a four-element slotted waveguide aerial system switched to direct downward-pointing beams, forward to port and aft to starboard or alternately forward to starboard and aft to port. The use of simultaneous fore and aft beams gives an increase in the Doppler frequency shift and compensates for small changes in the transmitted frequency. The Doppler

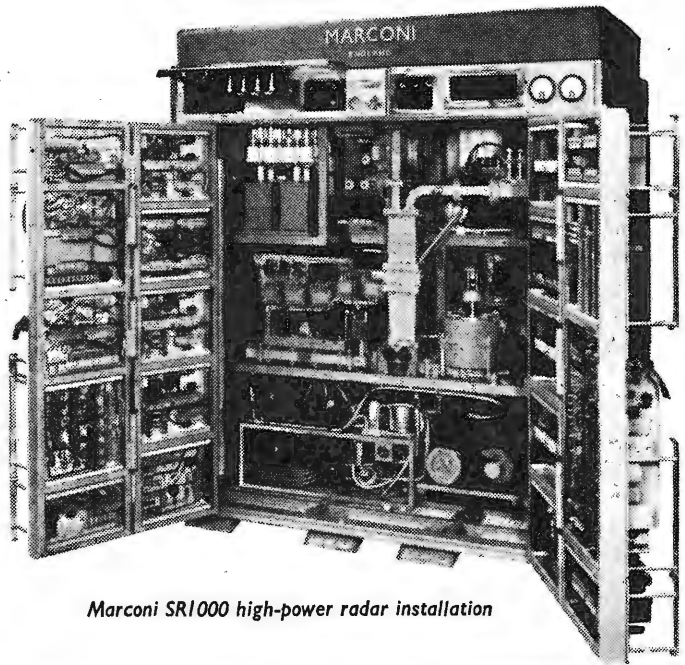


Murphy MR370 v.h.f. transmitter/receiver.

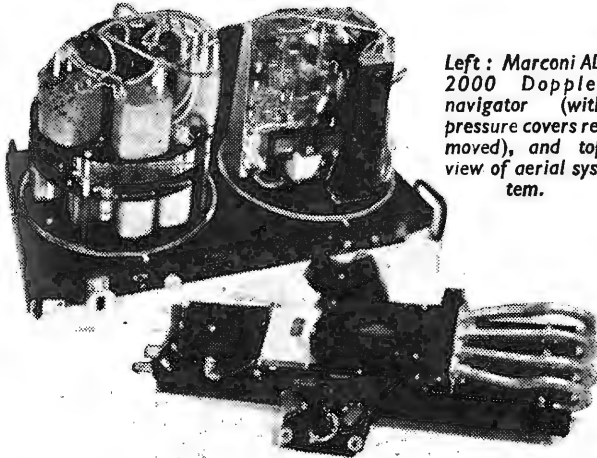
shifts given by the alternating beam positions are the same only when the axis of the aerial system is in line with the aircraft's track over the ground; any frequency difference can be used as an error signal to turn the aerial system automatically into the line of flight, and so indicate the drift angle.

Since the beam widths are finite there are multiple reflections from the ground, each with a slightly different frequency shift and this gives a whole spectrum with a Gaussian distribution about a centre frequency of maximum amplitude. In the Marconi AD2000 (military) and AD2300 (civil) Doppler Navigators phonic wheels are synchronized with and follow the Doppler centre frequency and are used to drive a computer which gives the pilot accurate information of course and distance flown, or his instantaneous position in latitude and longitude.

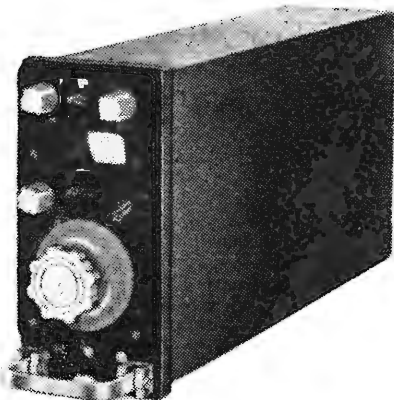
Ekco have introduced a drift unit (Type 153) for use with their E-120 airborne search radar which is relatively simple. It makes use of the single forward beam of the search radar (with the scan stopped in the forward and downward position)



Marconi SR1000 high-power radar installation



Left: Marconi AD 2000 Doppler navigator (with pressure covers removed), and top view of aerial system.

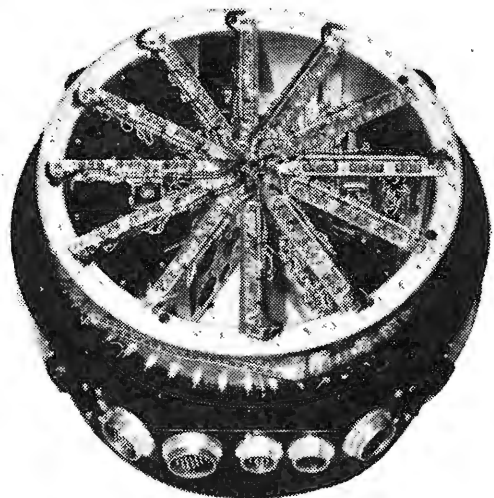


Ekco Type 153 Doppler drift indicator.

and displays the ground responses on a small c.r. tube with a single horizontal time base ("A" scope). Beating between component frequencies of the Doppler response spectrum causes amplitude modulation and "fuzziness" of the trace. The beam can be deflected through a servo system from a dial on the display unit calibrated in degrees of drift and is adjusted until the "flutter rate" of the display is a minimum (when the beam is pointing along the ground track). The angle between the aircraft heading and the track is then read off the scale. Accuracy depends on the operator's skill in estimating the null, but is stated to be generally of the order of $\pm 1^\circ$.

The four-beam method has been adopted by Decca for their Doppler radar unit, since it lends itself to integration with the Decca Navigator and Dectra hyperbolic systems. A complete navigation system incorporating all the necessary computers and known as "DIAN" (Decca Integrated Airborne Navigation system) is now under development.

Electro-mechanical computers of small size are being used to simplify the preparation and presentation of flight data such as air speed, Mach number, vertical speed, altitude, etc. Hitherto these quantities have been measured and displayed by separate instruments, but



Elliott air data computer.

can now be derived from a two-capsule pressure transducer giving electrical analogues of static and dynamic pilot tube pressures. The calculations made by the computer take into account temperature and are based on the characteristics of a "standard atmosphere." Development has been initiated by the Ministry of Supply and practical interpretations were shown by Elliott Brothers and Kelvin-Hughes. An interesting feature of the displays used in these instruments is the fixed-pointer, moving-band type scale giving greatly increased length. In the Elliott computer there are 12 transistor amplifiers and these are arranged radially in the cylindrical pressurized container.

Many other interesting items were noted including an intercomm. system with long trailing leads and special headphones for use by ground servicing crews under severe ambient noise conditions (Ultra); a capacitance bridge sensitive enough to measure the dilation of rotors under centrifugal force (Wayne Kerr); a "breadboard" system for assembling and testing prototype servomechanisms (Vactric); new types of aircraft wiring cables for continuous operating temperatures up to 240°C (B.I.C.C.); a magnetic tape data recording system for analogue, PDM or FM signals (Solartron); and a vibration generator, Model VG109, developing a thrust of 8,000lb (Goodmans).

WORLD OF WIRELESS

Valves and C.R. Tube Restrictions

REGISTERED agreements relating to the supply of valves and c.r. tubes are among those recently referred by the Board of Trade to the Restrictive Practices Court, which has to decide "whether the restrictions which have made an agreement registrable are contrary to the public interest or not." Anyone who can furnish information from his own experience of the effects of these agreements covering exclusive dealing arrangements between manufacturers, dealers and users, the fixing of maximum discounts and restrictions on imports, is invited to communicate with the Solicitor to the Registrar of Restrictive Trading Agreements, Chancery House, Chancery Lane, London, W.C.2. (Tel.: Chancery 2858.)

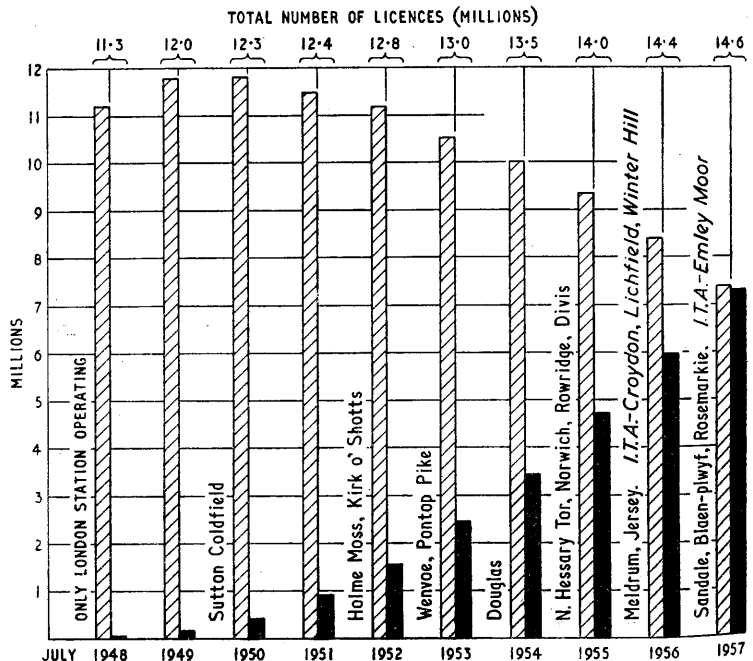
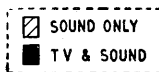
Cabinet Styling

ABOUT 60 manufacturers of cabinet materials, accessories and "embellishments" are exhibiting at a three-day trade show organized by the British Radio Equipment Manufacturers' Association. The exhibition, which is to be international, will be held at the Royal Hotel, Woburn Place, London, W.C.1, from October 1st to 3rd. Admission to the show, which is open from 2.0 to 6.0, is limited to *bona fide* trade visitors, who can obtain invitation tickets from B.R.E.M.A., 59, Russell Square, London, W.C.1.

Receiving Licences

ALTHOUGH the figures for August are not available at the time of going to press it is pretty certain that television licences in the U.K. now exceed the number of sound-only licences. The July figures are, sound-only 7,374,865, television 7,269,748. If, however, the 319,163 licences for car radio current in July are deducted from the sound-only figure the resulting total of 7,055,702 for domestic sound licences was already some 200,000 below the television figure.

The thermometers in this chart show the gradual rise and fall of the two groups of licences during the past ten years. The figures given are those at July each year. The additions to the number of television stations for each twelve months are also indicated on the chart.



What is a Technician?

THE confusion caused in the minds of laymen by the indiscriminate use of the words engineer and technician must have been still further confounded by the recent announcement in the lay press that pay increases averaging £125 were to be given to all "television technicians from the top existing rate of £1,600 a year downwards." The announcement concerned the agreement signed by the I.T.A. programme contractors and the Association of Cinematograph, Television and Allied Technicians on behalf of its members who include supervisory engineers, maintenance and control engineers, camera operators, technical assistants, etc. It is understood the Association will be negotiating for a similar agreement, which covers not only pay increases but overtime rates and conditions of employment, with the B.B.C.

Schools Television

IT has been estimated that scholars in about 1,000 schools will be viewing when the B.B.C.'s schools television service opens to-day, September 24th. All B.B.C. transmitters will radiate the programmes (designed for the 11s to 15s) from 2.5 to 2.30 on school days.

Television transmissions for schools are also being radiated from two I.T.A. stations, Croydon and Lichfield, from September 23rd. They are being organized by Associated-Rediffusion, the programme contractors, and will be transmitted on Mondays to Fridays from 2.45 to 3.10 and repeated from 3.25 to 3.50.

As we mentioned some months ago, the Association of Education Committees (10, Queen Anne Street, London, W.1) has issued a report on television equipment for schools which lists a number of "approved" receivers

Brit.I.R.E. Awards

THE Clerk Maxwell premium, the senior award of the Brit.I.R.E., is to be presented to Dr. K. D. Froome of the N.P.L. Metrology Division. The 20-gn. award is made for his paper "Microwave determinations of the velocity of light."

The Institution's 20-gn. Heinrich Hertz premium, awarded for the most outstanding paper dealing with the mathematical or physical aspect of radio, goes to Dr. A. G. Edwards (A.E.I. Research Laboratories) for his paper "The effects of atmospherics on tuned circuits." K. E. Harris, Cossor Radar's research director, receives the Brabazon 15-gn. premium (awarded for a contribution on radio and electronic devices for aircraft safety) for his paper "Some problems of secondary surveillance radar systems."

Both the Louis Sterling (15gns.) and the Marconi (10gns.) premiums go to overseas engineers. The first to Dr. A. van Weel (Philips, Eindhoven) for "Some remarks on the radio-frequency phase and amplitude characteristics of television receivers," and the second to Professor P. M. Honnell (Washington University, St. Louis) for "Prescribed-function vibration generator."

H. J. Leak receives the 5-gn. Norman Partidge Memorial Award for "High fidelity loudspeakers: the performance of moving-coil and electrostatic transducers."

"Sandwich" and Special Courses

NEARLY 70 colleges in all parts of the country are now offering sandwich courses—consisting of alternate periods of work in industry and college—leading to advanced-level awards such as the Higher National Diploma or Certificate or the recently introduced Diploma in Technology. A list of sandwich courses was published early in September by the Ministry of Education (H.M.S.O., 1s 4d).

In addition to the regular full-time and part-time courses for recognized awards provided by technical colleges and polytechnics, a large number of them are conducting short-term specialized courses. Among those beginning this term are the following:

Transistors and Allied Devices.—Twenty lectures (Tuesday afternoons or evenings beginning October 8th) at Borough Polytechnic, Borough Road, London, S.E.1. (Fee 50s.)

Pulse Techniques.—Twenty-two lectures on the fundamental principles (Monday evenings, beginning October 7th) and a 12-week laboratory course (Monday afternoons or Thursday evenings, beginning October 28th) at Borough Polytechnic. (Fees 50s and 20s respectively.)

Transistor Physics and Applications.—Eight lectures on successive Wednesday evenings from October 23rd at South East London Technical College, Lewisham Way, London, S.E.4. (Fee 20s.)

Operational Calculus.—A course of 20 evening lectures on applications to electric circuit theory begins at South East London Technical College on October 22nd (Fee 26s.)

Control Engineering.—A series of courses covering industrial instrumentation, mathematics of feedback systems and automatic process control are being given at Battersea College of Technology, Battersea Park Road,

London, S.W.11, during the Autumn and Spring terms. They begin in the week commencing September 30th.

Linear Servomechanisms.—A one-year evening course (Mondays) begins at Battersea College of Technology on September 30th. (Fee 20s.)

Pulse Circuit Design.—Twenty-two evening lectures begin on Thursday, October 10th, at Twickenham Technical College, Egerton Road, Twickenham. (Fee 40s.)

Higher technology courses at Southall Technical College, Beaconsfield Road, Southall, Middlesex, include radio telemetry (12 lectures, beginning September 30th), digital computers (12 lectures, October 1st), transistors (12 lectures, October 2nd), and pulse techniques (18 lectures, October 10th).

Essentially for Layman.—A course on elementary theory of electrical and electronic engineering, including some radio and television servicing, on Mondays and Wednesdays at the Wesley Evening Institute, Wesley Road, London, N.W.10. (Fee 30s.)

2,600 miles on 2 metres is the record set up by two amateurs in California and Hawaii in July, according to a note in the *R.S.G.B. Bulletin*. The Californian station, W6NLZ, near Los Angeles, used a 13-element, 24-ft Yagi and the Hawaiian station, KH6UK, at Kahuku, Oahu, employed an array consisting of four 24-ft Yagis in a box formation. Both transmitters had an output of 1kW. With such arrays what were the e.r.p.s?

A fourth channel in Band III has now been cleared. The first station to operate in it will be the I.T.A. Chilterton Down, Isle of Wight, transmitter, which, when opened next summer, will serve central Southern England. The carriers in channel II will be 201.25 Mc/s (sound), and 204.75 Mc/s (vision).

Radio Hobbies Exhibition is the new title given to the annual amateur radio show organized by the Radio Society of Great Britain. The emphasis at the show, which opens at the Royal Horticultural Old Hall, Vincent Square, London, S.W.1, on October 23rd for four days, will be on home construction. Admission to the exhibition, open daily from 11.0 to 9.0, costs 2s.

B.S.I.R.A.—The series of "open days" at the headquarters of the British Scientific Instrument Research Association at Southill, Elmstead Woods, Chislehurst, Kent, originally arranged for October 7th to 11th, has been extended to include the 14th also. Enquiries for invitation tickets should be addressed to the director.

Isle of Man is to have a v.h.f. transmitter on the same site as the permanent Douglas television station now being completed at Carnane. Initially it will transmit only the Home Service.

For R.E.T.M.A. read E.I.A.—The American Radio-Electronics-Television Manufacturers' Association, which through the years has grown from R.M.A. through R.T.M.A. to R.E.T.M.A., has now changed its name to the all-embracing Electronic Industries Association.

Air Communications.—A five-week meeting of the communications division of the International Civil Aviation Organization opened in Montreal on September 10th. It will be concerned primarily with radio-telephone facilities and procedure (especially in relation to the introduction of the selective calling system). It will also consider the formulation of international technical standards for air traffic control radar equipment.

Canada's fourth Decca Navigator chain, covering the Quebec area, will be opened in October. The third chain, centred at Nova Scotia, was opened in August, and two other chains (Newfoundland West and Newfoundland East) are under test by the Canadian Department of Transport. Two of the stations in the Western Newfoundland chain are also used for the North Atlantic Decca long-range navigational system.

Personalities

Lord Brabazon, president of the Radio Industry Council in succession to **Sir Edward Appleton**, is a director of Electric & Musical Industries, Ltd. For some time before the war he was president of the now defunct Radio Manufacturers' Association. Unfortunately sickness prevented him from performing his first public function as R.I.C. president—the opening of the Earls Court Radio Show.

Sir Thomas Spencer, M.I.E.E., on September 9th completed 50 years' service with Standard Telephones and Cables, of which he is chairman and managing director. Sir Thomas, who is also chairman of Standard Telecommunication Laboratories, Kolster-Brandes, and International Marine Radio Company, was founder and first chairman of the Telecommunication Engineering and Manufacturing Association.

Sir Leonard Owen, C.B.E., has been appointed managing director of the Industrial Group of the Atomic Energy Authority in succession to **Sir Christopher Hinton**, K.B.E., F.R.S., who has become chairman of the Central Electricity Generating Board. Sir Leonard, who obtained his degree of Master of Engineering at Liverpool University, has been engaged in the development of Britain's atomic energy programme since 1946 and for the past three years has been director of engineering and deputy managing director of the Industrial Group.

Rear Admiral P. Dawnay, M.V.O., D.S.C., who in January takes up the appointment of Flag Officer Yachts, is a signals specialist and was at one time captain of the naval signal school H.M.S. *Mercury*. From 1941-43 he was signal officer to the Admiralty Delegation in Washington and the combined chiefs of staffs, and in 1945 was signal officer at the Yalta conference of heads of States. In 1946 he was promoted captain and for two years, 1948-50, was deputy director of the Signal Division at the Admiralty.

H. E. Cornish, O.B.E., M.C., B.Sc.(Eng.), A.C.G.I., M.I.E.E., succeeds **Sir Archibald Gill**, K.B., B.Sc.(Eng.), M.I.E.E., as general manager of British Telecommunications Research, Ltd., the research establishment jointly set up by Automatic Telephone & Electric Company and B.I. Callender's Cables, at Taplow, Bucks, some ten years ago. Sir Archibald, who now becomes chairman of B.T.R., which he joined last year, was engineer-in-chief of the Post Office until his retirement in 1951. Mr. Cornish has been Postmaster General of Sarawak since 1951 and previously held telecommunications engineering and administrative posts in Nigeria and Malaya.

C. G. Mayer, M.I.E.E., has relinquished the post of managing director of R.C.A. Great Britain, Ltd., to which he was appointed in July last year, and has become special representative for Europe of the parent company, Radio Corporation of America. His office is in Eagle House, 109, Jermyn Street, London, S.W.1. **P. A. Turnor** resumes the position of managing director, which he relinquished last year.

R. S. Roberts, M.Brit.I.R.E., until recently senior lecturer in the department of radio and musical instrument technology at the Northern Polytechnic, Holloway, London, N.7, which he joined in 1937, has been appointed executive technical director of Wolsey Electronics, Ltd. Prior to entering the teaching profession he was for 14 years with Wright & Weaire, where he was in charge of the technical department. For three years during the war Mr. Roberts, who is 51, was seconded to the Ministry of Aircraft Production for work on the development of radar equipment. During his career as a lecturer he has also worked as a con-

sultant and was for some years an examiner in advanced radio engineering for the Brit.I.R.E. graduate examination.

W. E. Miller, M.A.(Cantab.), becomes assistant managing director of the Trader Publishing Co., publishers of *Wireless & Electrical Trader*, of which he is managing editor. **H. E. Craddock** becomes managing director of the company. Mr. Miller started his journalistic career in 1925 when he joined the staff of *Experimental Wireless*, now *Electronic & Radio Engineer*, and a year later joined the *Trader* as technical editor. He was president of the British Institution of Radio Engineers from 1952-54 and is honorary secretary of the Radio Industries Club.

J. M. Dodds, O.B.E., M.A., B.Sc.(Eng.), Dr. Ing., has succeeded **B. G. Churcher**, M.Sc., as manager of the research department of Metropolitan-Vickers. Dr. Dodds, who joined the company in 1928 and after two years as a college apprentice went into the research department, was one of the first two industrial engineers to be taken fully into the confidence of the Government on radar—the other was **L. H. Bedford**. Dr. Dodds has been assistant manager of the research department since 1953.

L. Roullier, A.M.I.E.E., is appointed head of the recently-formed Electrical Division of Aluminium Laboratories, Ltd., of Banbury, Oxon. He has been transferred from Aluminium Union, Ltd., London, where he was engaged on development engineering associated with the use of aluminium in electrical apparatus. He joined the Aluminium Group of Companies in 1954 after six years with Johnson & Phillips, Ltd., with whom he served a post-graduate apprenticeship course.

R. W. Fane, M.Sc., A.Inst.P., author of the article on thermionic cathodes, graduated from University College, Exeter (now the University of Exeter). Following National Service he returned to Exeter where, after taking a Diploma in Education, he carried out research on thermionic emission and was awarded an M.Sc. by London University in 1951. He joined Marconi's as a lecturer on post-graduate courses at Marconi College, transferring to the Research Laboratories in 1954 to work on problems relating to high current density electron beams.

Thomas W. G. Calvert, B.Sc., who, on page 505, writes on the use of ferrites for f.m., is a graduate of University College, London. For two years prior to coming to London in 1954 he was a student at Portsmouth Municipal College. He is 21 and has now joined the metals division of I.C.I.

R. A. Burberry, of the radio division of Standard Telephones & Cables, was recently awarded a prize by the Royal Aeronautical Society for his paper "Aerial systems for aircraft" published by the Society. He joined S.T.C. in 1947, after five years at the T.R.E. (now R.R.E.), Malvern, and is now head of a group working on aircraft aeriels.

John G. Elting, formerly with Ultra Electric as production engineer, has joined Simon Equipment, Ltd., as works manager.

OBITUARY

Dr. Irving Langmuir, who in 1950 retired from the associate directorship of the physical chemical research laboratories of the American General Electric Company in Schenectady, died on August 16th at the age of 76. Dr. Langmuir, who was awarded the Nobel chemistry prize in 1932, is perhaps best known in our field for his researches on surface chemistry and the emission from hot filaments in gases which led to the invention of the gas-filled lamp and rectifier. He received numerous awards, among them the Hughes Medal of the Royal Society.



Radio Show Review

Trends as Seen by Wireless World Technical Staff

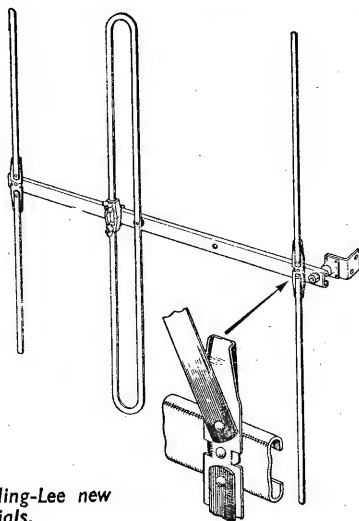
AERIALS

A NEW development with interesting possibilities is the idea of standardizing a limited number of aerial units or "aerial bricks" and using them as the occasion demands to assemble aerials for any location or for any service or combination of services it is possible to envisage. If well planned the "aerial bricks" will enable either single-band or multi-band aerials to be assembled with very little difficulty and the dealer benefits by having fewer parts to stock; the listener benefits as his particular requirements can easily and cheaply be met and the manufacturer benefits as he has to concentrate only on production of a limited number of standard parts. Prices and installation costs should be reduced all round.

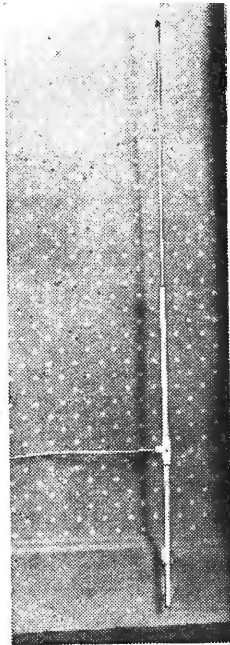
Belling-Lee call this a "Unit Plan" and say it offers the choice of over 200 different outdoor aerial combinations and many more indoor varieties. A similar arrangement is adopted by Burwell for a new range described as "View-Well" aerials. In this case there is a basic unit consisting of a three-element Band-III aerial with a folded dipole adjustable for length, one reflector and one director. The elements are mounted on a cross-arm with swivel fittings at each end for attachment of additional units. These can be either extra Band-III directors or Band-I or Band-II systems, or a combination of all three can be assembled as a unified aerial system.

Provision for adding extra director elements to a basic aerial unit forms part of the J-Beam Aerial's

policy. The main unit is a slot-beam Band-III aerial having a skeleton slot with four directors and two reflectors forming the equivalent of a double four-element broadside aerial. It is supported by a "Y"-shaped fitting attached to the twin cross-arms supporting each end of the slot and the side arrays of parasitic elements. Additional units, in the form of directors, are added when it is necessary to increase the gain and/or directivity of the system and with

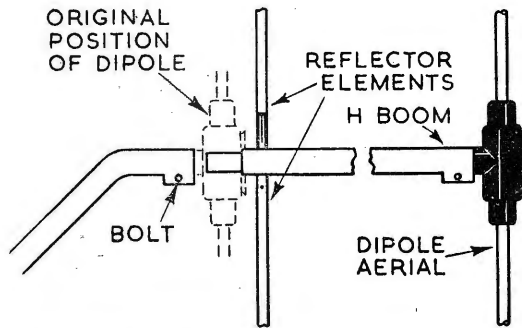
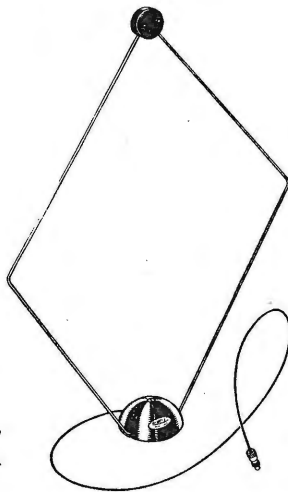


One of the Belling-Lee new Band-III loft aerials.



Wolsey "Twin-Super" indoor television aerial.

Labgear indoor "Diamond" twin-band television aerial.



Meadow-Dale units for converting Band-I dipole to an "H."

these the equivalent of a 16-element aerial can easily be built up. The basic aerial does not have to be disturbed other than for the assembly of the extra director units.

A step towards standardization has also been taken by Wolsey with their "Turret" wall bracket and universal aerial clamp. The latter allows the separate parts of a combined Band-I/Band-III aerial to be oriented through 360° and the wall bracket permits the whole system to be pointed in any direction relative to the wall or joist on which it is fixed. These two fittings were illustrated in our June issue as they made their appearance at this year's R.E.C.M.F. components show, but they are mentioned here in order to complete the picture of the latest trend in the design of v.h.f. aerials and accessories for television and f.m. sound broadcast reception.

Meadow-Dale aerials are designed with an eye to easy conversion from one type to another while utilizing all the parts of the original aerial. For example, if a plain dipole is found inadequate for any particular purpose, reflections causing ghosts for example, it can easily be changed into an "H" by means of the conversion parts. The insulator is removed from the supporting arm, it is replaced by a short boom having identical fittings carrying a reflector element and the insulator with its dipole fitted into the other end of the extension boom. All fittings are interchangeable.

Indoor television aerials have received quite a lot of attention lately and have emerged as two quite distinctive types. There is the "in-the-room" type and the loft or attic type and their principal differences are that the former must be reasonably small, pleasing to the eye and serve for both the high and the low television bands. These often stand on top of the set, like the Belling-Lee "Golden V,"

and the Labgear "Diamond," or alternatively they can be mounted inconspicuously like the Labgear "Spiral" or again be fixed, in one way or another, to the wall like the Wolsey "Twin-Super."

The Belling-Lee "Golden V" consists of two short telescopic rods with provision for swivelling in several directions and can be used as an ordinary dipole mounted on a picture rail if desired. It provides for reception on both television bands and also on the f.m. band, but should favour the 200-Mc/s band as the rods will not extend to a full-length Band-I or Band-II dipole, the total length being adjustable from 20 in to just over 32 in.

Labgear's new contribution, the "Diamond," is virtually a full-wavelength loop on Band III and a tuned loop on Band I, tuning on Band I being effected by a small pre-set capacitor housed in the top insulator, as shown in the drawing, and some loading inductance in the base. The capacitor enables the loop to be adjusted on any of the Band-I channels. It is directional and should be useful in suppressing ghosts due to multi-path reception. It is said to be effective up to about 20 miles from a station.

A novel twin-band aerial is the Wolsey "Twin-Super" designed for mounting on the wainscot or suspended from a picture rail. It consists of a half-wave Band-III dipole and an approximately three-quarter wavelength Band-III element telescoped into one end, as shown in the photographic illustration. These function as two collinear half-wave dipoles on Band III, the quarter-wave telescoped section serving to produce the necessary phasing to bring the currents in both dipole sections into phase for single-lobe response in the horizontal plane. The aerial is mounted vertically, of course, for vertical polarization. The result of this form of construction is that an appreciable gain, it is said to be about 2.7 dB, is obtained on Band III. The aerial is pleasing to the eye, being covered with a cream-coloured plastic material.

Loft, or attic, aerials need not be so tastefully finished as room aerials, also size is not so important, and full-length multi-element Yagis are permissible for Band III. Consequently for Bands II and III they take orthodox forms, but are made of lightweight materials and have simple types of insulators as they are not exposed to the weather. Belling-Lee have a new indoor range of this kind which includes 3-, 6- and 9- element types made of flat strip with channel-section light-alloy supporting arms. All are factory assembled and folded flat for transit, and this renders them very convenient for

passing through small trapdoors and into lofts. For erection the elements are opened out and snap into place. Only one wing nut has to be tightened and this is for fixing the aerial in position after it has been correctly oriented on its support. The short support is fixed to a joist, or rafter, by two screws.

Band-I loft aerials are invariably contracted in one way or another since few lofts will accommodate a 10 ft or more vertical aerial. No notable changes have been effected in this type, however, which, in general, are made the same as formerly. The Labgear "Bi-Square" is an exception, but it was introduced last year and so strictly speaking is not new.

The "Bi-Square" idea, however, has now been extended to Band II and as the aerial for this band measures about 2 ft 6 in cube, and is said to have a power gain of 10 dB relative to a plain half-wave dipole, it should make an excellent loft aerial. It goes together quite easily, all parts being secured by nuts and bolts.

With the exception of the Labgear "Bi-Square" f.m. aerials call for little comment as they are the familiar types, such as plain dipoles, horizontal "Hs" and 3-element models. Folded dipoles are used in some of the last mentioned models.

Combined aerials embracing the two TV bands and the f.m. band were somewhat more numerous this year, an understandable progress perhaps as provision is now made for f.m. sound reception in several of the new television receivers. The extra aerial at present adds very little to the technical

problems involved in multi-band aerial design, as in most cases it takes the form of a simple dipole connected to the common feeder, or a simulation of this effected by adding horizontal quarter-wave elements to an existing Band-I dipole or "H" aerial.

One interesting example is the Telerection range of "Hi-Max" phase-corrected triple-band models. The simplest is a single Band-I dipole broken up into three phase-corrected collinear Band-III dipoles as described last year. To this is now added the Band-II horizontal dipole and this composite three-band unit is used with Bands-I and -III reflectors and directors to build up a variety of types to satisfy different conditions of reception.

Several firms now have adaptor elements which clip on to an existing Band-I television aerial and adapt it for f.m. sound broadcast reception in much the same way as provision was made for Band-III reception in the early days of I.T.A. Meadow-Dale call them "Convertorods." Antiference supply them for attachment to their range of "Hilo" twin-band television aerials and Belling-Lee supply rods easily attached by a wing-nut casting.

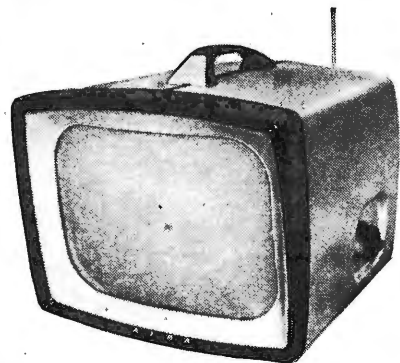
Outstanding among the Band-III only aerials was the "Dale Parabolic" model consisting of a single vertical dipole backed by eight vertical reflector elements arranged on a parabola. It provides a gain of 14 dB relative to a dipole, has a front-to-back ratio better than 36 dB and an acceptance angle of 22° measured from the centre-line of the aerial to the half-power points. Its impedance is 70 Ω so that a good match is achieved with a nominal 75-Ω cable.

TELEVISION

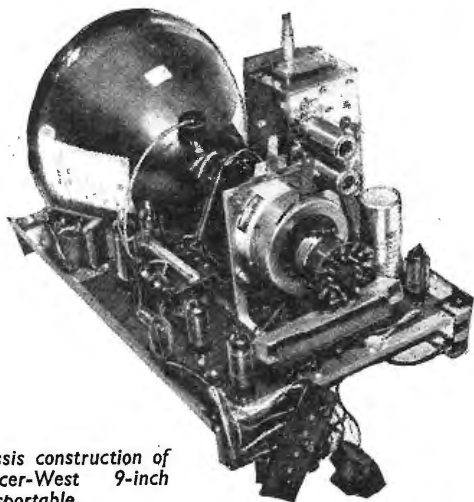
LAST year in our Show Review we gave a general description of a "standard" television receiver circuit which might well have applied to almost any set on view at the exhibition. This year the same circuit description was still valid. We would not like to suggest, however, that only the cabinet designers have been busy while circuit technicians have been taking a rest. The old gibe about the Radio Show being just a "furniture exhibition" has never been entirely justified. On this occasion, for example, one could see that the engineers had been actively engaged on problems arising from such recent techniques as 90° scanning and from the new forms of the television set—the transportable, the receiver incorporating v.h.f. sound, the combined radio-gram/television set. At the same time, there was evidence of quite a number of refinements to the basic circuit and to the overall mechanical design.

Although many more 21-inch sets were on view this year—practically all manufacturers have them now—the sales statistics still show the 17-inch screen to be the most popular size. In the past half year 67% of receivers sold had 17-inch screens, while only 7% had 21-inch screens (the remainder being largely 14-inch receivers). Does this mean that the 21-inch set is too expensive? Or perhaps too big for the average living room?

If one takes the theoretically correct viewing distance of ten times the picture height, one should sit at least 11 ft away from a 21-inch screen—but in how many living rooms is this really convenient or possible? At the more practical viewing distances, the gaps between our 405 lines become



Alfa 14-inch transportable set with single rod aerial.



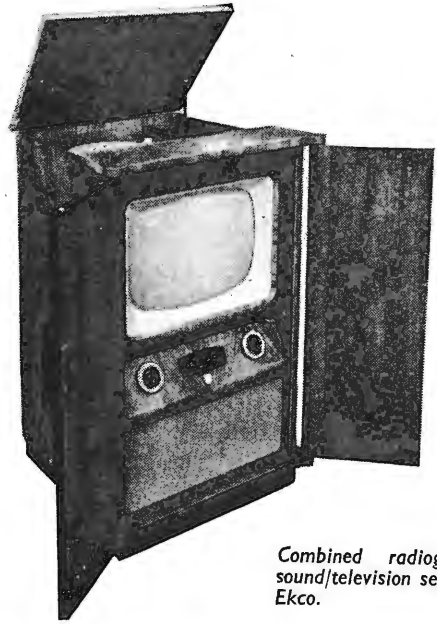
Chassis construction of Spencer-West 9-inch transportable.

painfully obvious on a 21-inch screen. If this size of picture is correct for school classrooms (judging from the schools' models on show) then it is certainly too big for the home.

Nothing daunted, two firms were showing receivers with 24-inch screens this year. Even though there may be very little danger of implosion these days, the idea of sitting directly in front of one of these monsters is somewhat alarming—not to mention the possibility of X-rays generated by the use of 17kV on the final anode!

The 14-inch screen seems to have almost disappeared in the latest ranges of conventional table models, but is obviously coming back as a "standard" size for the new transportables, of which about ten makes were on show. This type of receiver, which is smaller, lighter and less expensive than the equivalent table model, is intended as a "second set" for carrying about to other parts of the home. It may, however, prove attractive as a "first set" to many people, in which case it could become a serious competitor to the conventional type of receiver.

The situation is not quite the same as in the U.S.A., however, where price competition is very fierce and the transportable has been introduced primarily to undercut all other models. To achieve



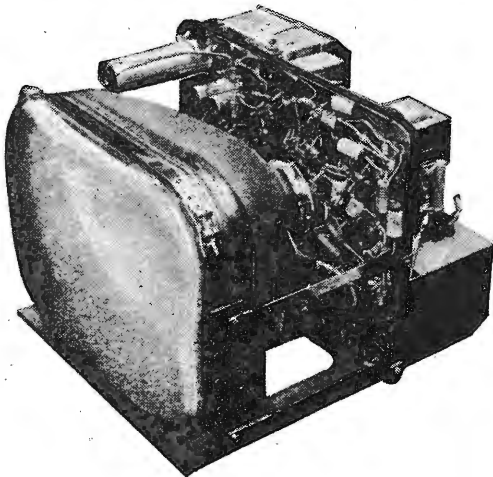
Combined radiogram/v.h.f. sound/television set made by Ekco.

such a low price the circuit performance has had to be reduced, in addition to the economies practised on the external design. In Britain, however, there has been no attempt to economize in size, weight or price, at the expense of the performance. The circuit, in fact, is practically the same as in conventional table models, only packed physically into a much smaller space.

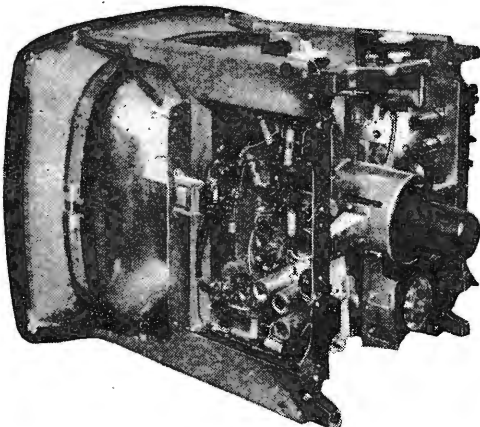
Considerable ingenuity has been shown in chassis design in order to achieve this compression. A vertical type of chassis is common, arranged either as one complete section parallel with the tube face (the tube neck passing through its centre), or in two sections parallel with the sides of the cabinet. Printed circuits are used in some models. The problem of positioning chokes, transformers and loudspeakers to keep their magnetic fields away from the c.r. tube becomes acute, and in one case the loudspeaker has been specially designed from this point of view to allow it to be mounted close to the tube neck. High-permeability cores are used in line output transformers to reduce their size. The aerials are telescopic rod types, fixed at the back of the set. Some models have a pair of these elements to form the dipole, while others use only one and rely on the chassis to provide the lower element. Ball joints allow the rods to be adjusted for optimum pick-up in one receiver.

Vertically mounted chassis were seen also in some of the large 21-inch receivers. Here it is the geometry of the tube, with its sharp 90° flare, which makes this type of construction particularly convenient and allows plenty of room for servicing. A new Bush set had the chassis arranged parallel to the screen, while a Murphy receiver used two vertical chassis parallel with the sides. This style of construction is usually accompanied by a "wrap-around" type of cabinet of very simple design which either slides off, like a matchbox cover, or—notably in the transportables—comes apart in two halves.

There were many more television receivers incorporating v.h.f. sound on show this year. Since the



Vertical chassis in Sobell 14-inch transportable.



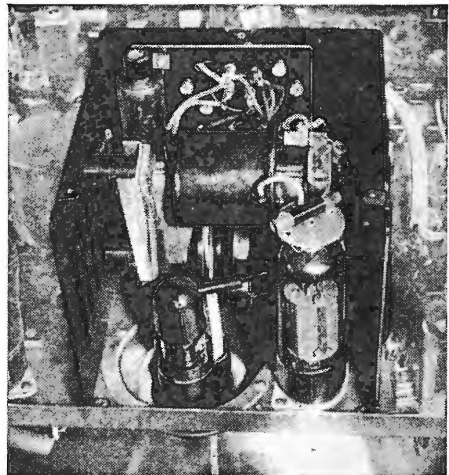
Two vertical chassis in Murphy 21-inch receiver.

Band-II tuning can easily be incorporated in the existing type of television multi-channel tuner, and only a discriminator and perhaps one other valve have to be added in the sound channel, the whole thing can be achieved very conveniently, at an extra cost of only a few guineas. In some models there is just one position on the multi-channel switch for Band II, and the Home, Light and Third programmes are selected by means of the fine-tuning control. This means that the fine tuning must cover a band of about 8 Mc/s instead of the usual 3 or 4 Mc/s required for television. Other models have three separate positions on the tuner for the Home, Light and Third programmes.

The sound take-off point is in the usual place after the common vision-sound i.f. amplifier. Then follow two sound i.f. stages and the f.m. discriminator, one diode of which may also serve as the a.m. sound detector for television. Owing to the loss of gain in the f.m. discriminator, the output of the television a.m. detector normally has to be attenuated to keep the two sound levels balanced when switching between television and v.h.f. programmes. For this reason, some models have to use an extra audio amplifier stage. One maker provides a magic-eye indicator to assist in f.m. tuning.

Having provided a reasonably high quality audio output for these television/f.m. sets, some makers have obviously argued that one might as well make further use of it by adding a gramophone turntable and pickup. Since no separate radio chassis is required, this has resulted in a v.h.f./radiogram/television set which, unlike the combined models of the past, is notable for its compactness and reasonable price. The examples on view were no bigger than an ordinary console television set or radiogram.

Vision a.g.c. circuits are still fairly equally divided between the mean-level system and the gated system (which maintains a constant black level). There have been various refinements, however. Peto Scott have introduced a mean-level system in which the a.g.c. bias voltage is applied to the common i.f. stage and also to the r.f. amplifier. The r.f. voltage, however, is delayed with respect to the i.f. voltage. This prevents an excessive voltage from being applied to the i.f. stage and so causing cross-modulation between vision and sound. Thus in fringe areas the a.g.c. operates only on the i.f. stage, leaving the full r.f. gain available for ampli-



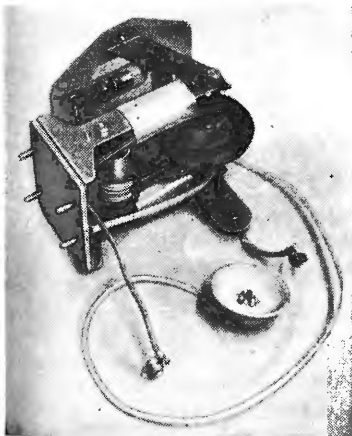
Line output transformer with Bakelite cups in Bush 21-inch receiver.

fying the weak signal, while in strong-signal areas any increase in signal above a certain level is taken care of by the delayed a.g.c. on the r.f. stage, to which it is possible to apply the larger bias voltage without encountering difficulties. Incidentally, the Peto Scott arrangement incorporates separate contrast controls for B.B.C. and I.T.A. which can be pre-set to give correct balance when switching from one programme to the other.

An experimental system of gated a.g.c. shown by Mullard was designed to avoid the situation when the receiver falls out of synchronization and the gating pulse (which is derived from the line timebase) consequently does not sample the black level but some other part of the video waveform. First of all the video waveform is inverted, so that the sync pulses appear on top, then the sync pulses themselves are inverted again. The resultant waveform is passed to a peak detector which gives a steady output voltage corresponding to the black level. Since this black-level voltage is continuous it can be sampled at any time by the gating pulse so that loss of synchronization will not affect the correct operation of the a.g.c. system.

As for synchronization methods themselves, the two principal systems are still the direct-locking technique and the flywheel sync system, which indirectly controls the frequency of the line timebase. There was, however, some evidence of a refinement to direct-locking circuits which the manufacturers describe as a simple form of flywheel sync. The line timebase oscillator incorporates an LC resonant circuit which produces a "flywheel" effect at the line frequency. Thus the timing of the individual line sweeps is not entirely dependent on the incoming sync pulses but is controlled partly by the natural period of the LC circuit. It is said that this considerably improves the performance on weak signals, when the sync pulses are distorted by noise, and generally reduces ragged edges on the picture. One receiver, incidentally, had a switch to allow the sync to be changed from direct-locking to flywheel according to circumstances.

The requirement of higher scanning power for the new 21-inch tubes with their 90° deflection angles has brought with it a number of incidental



Philco plug-in replaceable line output transformer.

difficulties. For example, the geometry of these tubes does not allow the frame coils to be as large as would be desirable. Consequently they tend to run warm and the resulting change of resistance causes an alteration in frame amplitude and picture height. This has been overcome by means of thermostats in series with the frame coils.

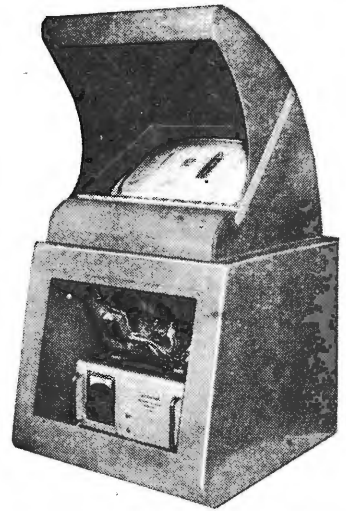
Radiation from line deflection coils is a good deal worse, of course. Most receivers have shielded scanning assemblies to reduce this, but one maker (K-B) has gone further by arranging the line output transformer to drive the line coils in such a way that they are balanced about earth. This reduces the electrostatic field radiated to such an extent that no metal foil screening is required inside the cabinet. As a result it has been possible to build a plate type of internal aerial into the receiver—the chassis forming the lower element of the dipole.

Another safety measure, noted in the line scanning section of a Bush 21-inch set, was the use of Bakelite cups to enclose the windings of the line output transformer. The idea here is to retain the wax impregnation of the coils when they become warm, so that the risk of breakdown is avoided. Line output transformers being notoriously susceptible to breakdowns, it was interesting to see that at least one maker uses a plug-in type which can be very quickly replaced when a fault is suspected.

One of the most interesting television exhibits at the Show was basically nothing to do with domestic reception, though in fact it may eventually enter this sphere. Shown by Decca under the name of Deccafax, it was a facsimile transmission system utilizing the flying-spot principle, by which transparencies (diagrams, patterns, photographs, written messages, etc.) could be sent instantaneously over a video-frequency link. A standard unit is used for both transmitting and receiving, so that a two-way channel can be set up, and the outputs of several units can be mixed to form composite pictures. The system works on 405-line standards and an ordinary television set can, if desired, be used as a receiving unit.

For scanning the transparencies the flying-spot tube has to have a short-afterglow screen phosphor. This gives a bluish light, and a corresponding colour filter is used in front of the photocell mounted in the hood. Since the short-afterglow phosphor by itself produces an unpleasant flicker at the receiving end it is mixed with long-afterglow components giving red and yellow light outputs. These reduce the

Deccafax equipment with Telequipment pattern generator for producing still test pictures.



flicker in reception but do not enter the photocell during transmission because of the blue filter (which incidentally helps to filter out tungsten-lamp room lighting), so that the transmission scanning is done entirely by the short-afterglow component.

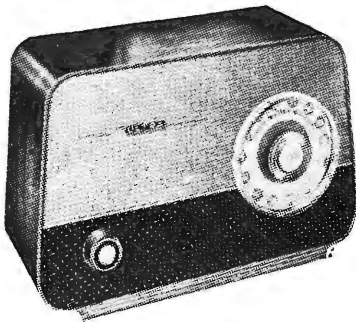
The possible connection with domestic television receivers lies in the fact that Telequipment were demonstrating the use of a single Deccafax unit, in conjunction with one of their own pattern generators, as a means of generating still television pictures for servicing and other purposes. The pattern generator supplies the sync and blanking waveforms to the flying-spot scanner and also accepts back the video signal from the photocell for modulating its own r.f. output. In this way, a complete television picture (which can be a test pattern or any other photographic transparency suitable for the Deccafax) can be generated locally on either Band I or Band III for feeding to the aerial socket of a receiver.

It has also been suggested that television relay companies could use the same equipment for transmitting their own test patterns, or even details of programmes and local advertisements. What the legal position is on this remains to be seen. At any rate, it would probably be quite legitimate for radio dealers to use the equipment to insert their own "commercials" between programmes displayed on receivers in their showrooms—even on Band I!

SOUND RECEIVERS AND REPRODUCERS

MOST of the differences from last year resolve themselves on closer examination as developments of trends already noted at previous shows, for example, the increase in the number of transistor battery portable receivers. The basic design of transistor sets, however, has not yet become stabilized, though to obtain adequate sensitivity a superheterodyne circuit with two i.f. stages is nearly always used. Self-oscillating mixer transistor circuits are generally adopted. As the usable upper frequency limit for commercially available transistors is still only of the order of 1 Mc/s, greater ease of operation and gain can sometimes be obtained by reducing the i.f., and thus reducing the generating frequencies. The i.f.s used this year range from 250 kc/s in the Peto Scott set to the standard 465 kc/s used by K-B and Vidor.

As regards the output, the choice lies between a single-ended stage giving only about 30mW, or a class-B push-pull stage giving about 300mW and corresponding to a small valve battery set. In general, single-ended stages were used in the smallest transistor sets, an exception being the use of a push-pull stage in the small (6in x 3in x 1½in) Peto Scott model. The impedance of transistors being less than that of valves there are better possibilities of avoiding the use of an output transformer with, in this case, the important advantage of saving space and weight. Such an arrangement was seen in the Pam and Pye sets. Two examples of reflexing, with consequent saving in transistors, were noted in the Cossor and Peto Scott models. In the former, the second i.f. transistor also acts as the first i.f. amplifier; and in the latter, detection, i.f. amplification and



Ultra "Troubadour" f.m. only radio.

d.c. amplification (to provide amplified a.g.c.) are all carried out in the same transistor.

Transistor circuits easily lend themselves to extreme miniaturization. An experimental t.r.f. model built by Siemens-Ediswan was contained in an ordinary 20-cigarette box without difficulty. Besides the Peto Scott set already mentioned, very small commercial models were shown by Perdio ($5\frac{3}{4}$ in \times $3\frac{1}{4}$ in \times 1 in) and Cossor ($6\frac{1}{2}$ in \times $3\frac{1}{2}$ in \times $1\frac{1}{2}$ in). A useful accessory supplied with the latter (particularly in view of its 30mW power output) is an insert ear-piece to enable reception to be confined to the hearer.

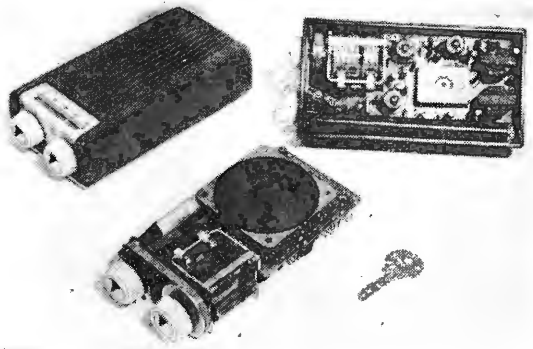
An interesting hybrid battery portable set shown by H.M.V., the 1410 "Mini-sette," uses transistors only in the push-pull output stage. The current consumption is normally greatest in this stage so that it is here that the low consumption of transistors offers the maximum advantage.

Though there were also few changes in a.m./f.m. sets the design of these is not so stabilized as the standard four valves plus rectifier arrangement in a.m. sets. This is due to the somewhat differing amounts of ingenuity thought worth while to enable valves to be used both for a.m. and f.m. reception; and to the occasional adoption of separate pentode r.f. amplification on f.m., instead of using a double-triode to provide both r.f. amplification and mixing. Sets for f.m. only, with which the Ultra "Troubadour" FM950 may now be included, remain rare, perhaps corresponding to the relative scarcity of push-button three-station a.m. sets.

Unlike table record players or radio-grams, not many table receivers offer improvements in the audio specification such as multiple speaker systems, improved speaker loading, or a push-pull output stage. This difference between receivers and record players is somewhat surprising as such improvements can be taken advantage of in v.h.f./f.m. reception as well as in the reproduction of modern gramophone records.

Record Players and Radio-grams.—Like sound receivers, the accentuation of previously noted trends provides most of the change. For example, almost every exhibitor now markets one or more record players. Transistor battery models are also now common, push-pull output stages being invariably used in this case. Multi-speed full-size transistor models were shown by Philco (A3755) and Pye, the latter using a Goldring variable-reluctance pickup. Although a transistor radio-gram is now an obvious possibility, only one, the Cossor 545 (45 r.p.m.) model, was seen.

As we have already mentioned, table record players and radio-grams with improved audio speci-

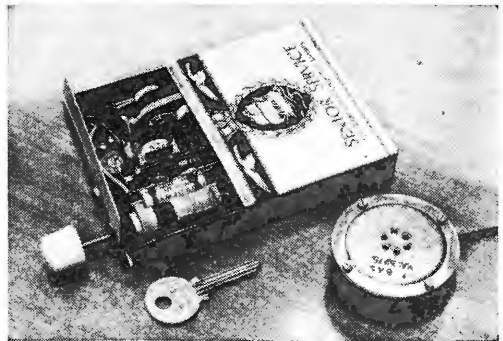


Peto Scott transistor receiver.

H.M.V. valve and transistor "Mini-sette."

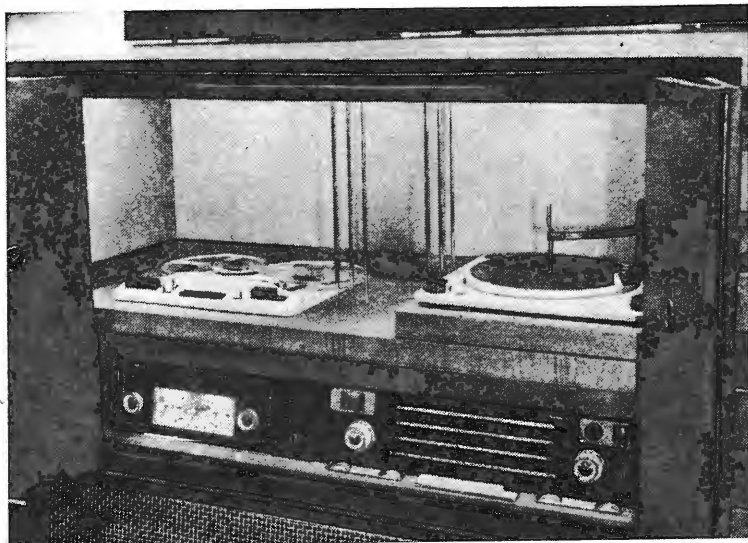


Cossor transistor radio-gram.



Siemens-Ediswan prototype t.r.f. transistor set.

fications can readily be obtained. For example, in the Philco A3764 "Phonorama," when the heavy lid is closed over the record player an airtight seal is formed which completes a resistively loaded reflex cabinet for the 8-in speaker, to give a response down to 60 c/s. The a.m./f.m. tuner and 8-watt



Ferguson radio-gram with tape recorder and clock switch.

"ultra-linear" push-pull amplifier are placed in the (large) port tunnel. A diffuser spreads the radiation from the 4-in tweeter. An economical circuit, noted in the Ferguson 393G "Fortune" record player, uses two triode-pentodes to provide amplification (sufficient to allow useful negative feedback) and phase-splitting from the triodes, and about 5 watts push-pull output from the pentodes.

Multiple speaker systems giving a large apparent sound source (3D) and, it can be claimed, reducing intermodulation distortion, remain very popular. A simple, often used arrangement, is to capacitively couple one or more small (3- or 4-in diameter) moving-coil tweeters to the audio output. Five speakers (one 12-in Goodmans Audiom 60 bass unit, two 8-in x 5-in elliptical mid-frequency units and two 5-in tweeters) are used in the R.G.D. "Victoria" radio-gram, the Audiom 60 being fitted in a resistively loaded bass-reflex enclosure. In this set a 16-watt push-pull amplifier with separate bass and treble controls is also incorporated, and a variable reluctance pickup with diamond stylus is used.

In the loudspeaker used in the H.M.V. 1134 a.m./f.m. table receiver two cones are attached to the same voice-coil. Another way of improving reproduction is to operate two similar speakers in parallel, as in the Sobell RPS77 record player. Since each speaker then handles only half the output, the speaker distortion for a given output is reduced. In addition, if they are placed close together, their mutual interaction will produce a rise in efficiency at low frequencies, leading to a further reduction in distortion (see article "Loudspeakers in Parallel" by J. Moir, in this issue). Irregularities in response will also tend to be smoothed in the overall output. Alternatively, two dissimilar speakers may be operated in parallel to compensate for deficiencies in each other's response as, for example, in the Bush RG66 a.m./f.m. radio-gram (also fitted with a 4-in tweeter).

Tape Recorders and Reproducers.—A number of new models were seen. In the E.A.P. "Elizabethan Essex" (the new name for the "Triple Three" mentioned in our Show Guide) a push-pull bias oscillator offers a reduced d.c. component in the

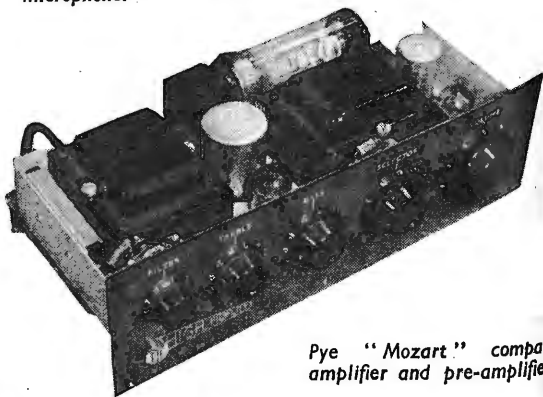
output with consequent decrease in the recording noise level. The 6-watt push-pull "ultra-linear" stage feeds a 9-in x 5-in bass speaker and two 3-in tweeters. A ribbon microphone is provided. In the Winston "Thoroughbred" volume controls on both the low (2mV) and high (200mV) level inputs allow full mixing facilities between these two sources. Two double-electrode small electrostatic tweeters are included (also noted in the Bush VHF64 a.m./f.m. table radio). The Baird recorder is unusual in having a single-ended "ultra-linear" output stage. As has been shown by Leakey (*Jnl. of the B.S.R.A.*, May, 1957) such feeding of a pentode output valve's screen from a tapping on

the output transformer has certain advantages even if the output is not push-pull. The above three recorders used the Collaro 3-speed tape deck.

R.C.A. showed a stereophonic tape reproducer whose external appearance matched that of their "Vice-President" record player, the amplifier and speaker in both units being intended to be used together in stereophonic reproduction. A 3-speed tape deck with two stereophonic heads is used, one for recording and one for monitoring. Single-channel recording and playback facilities are also provided.



E.A.P. "Elizabethan Essex" tape recorder with ribbon microphone.



Pye "Mozart" compact amplifier and pre-amplifier.

Stereophonic reproduction was also demonstrated using versions of the G.E.C. "Periphonic" system. Four "Presence Unit" tweeters in a horizontal line are used in each of the two systems, the input levels to the individual tweeters being differently graded in each case. This produces suitable high-frequency angular responses to give the differential intensity differences required for stereophonic reproduction (see Brittain and Leakey, *Wireless World*, Vol. 62, p. 208, May, 1956).

With increasing activity in tape recording some of the radio-grams shown, such as the Portogram TR100 (f.m.-only model), also included a tape recorder. In the Ferguson 403 tape radio-gram, a clock switch enables recordings from the a.m./f.m. receiver (which is automatically allowed 7 minutes' warming-up time) to be made at any preselected time within a minute, the apparatus being switched off when the tape unthreads from the emptied spool. The Ferguson 403 also includes a 10-watt push-pull amplifier with bass and treble controls, which can be switched out so that an immediate estimate of their effect is possible. The sound level from the three 4-in tweeters, relative to that from the 13-in x 8-in bass speaker, can be varied by a three-position control.

New Units for Sound Reproduction.—A somewhat unusual speaker mounting on a board placed across the corner of a room near the ceiling was seen in the T.S.L. "Concert Sound Corner." Back radiation downwards being blocked by an attached board at right angles, such radiation passes upwards to the corner, and is then reflected downwards into the room. This provides some approximation to horn loading.

A compact (10½ in x 5 in x 3½ in) combined amplifier and pre-amplifier, the "Mozart" HF10, was shown

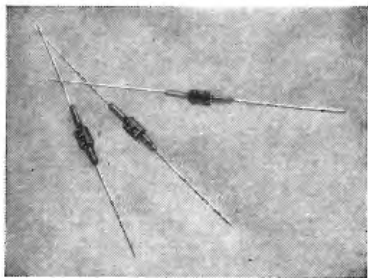
by Pye. For an input of 10mV the output is 9 watts with 0.3% distortion. Bass and treble controls and four treble filter cut-off frequencies are provided. Simple compensation for different pickup sensitivities and impedances is also available. Another new 15-watt amplifier and pre-amplifier, the Lintronic "Wessely HF15," includes controls to give a continuously variable treble cut slope at two alternative frequencies, and to alter the relative levels of treble and lower frequencies (presence control).

The latter amplifier was also used in the "Wessely Symphonette Royale" record reproducer, which also incorporates a Garrard 301 transcription turntable, B.J. "Super 90" pickup arm with Tannoy variable reluctance cartridge and Thermionic Products "Microlift" pickup arm control, and also the "Dust Bug" anti-static dust remover.

A new ceramic pickup cartridge, the E.V. "Power Point," is designed to be very simply replaceable as a whole in the mechanism (turnover, turnunder or fixed alternatives are available). Response is within ±5dB of 250mV output from 50 c/s to 10 kc/s, the compliance being 10⁻⁶ cm/dyne. The needle is connected directly to the ceramic generating element.

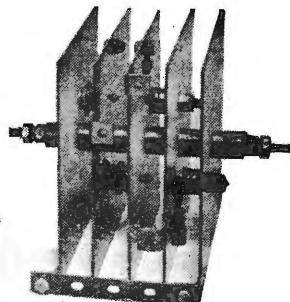
A prototype single-ended transistor audio amplifier using a new type of sliding bias to give almost doubled output was shown by Mullard. A rectified fraction of the output is fed back to shift the working point as the drive increases, this resulting in an increased output for a given dissipation or size of heat sink. If this fraction is fed back to the driver stage, rather than to the output as is usual, the increased gain allows much better d.c. gain stabilization. Moreover, the feedback time constant can be made so short that transient distortion due to this cause is virtually eliminated.

RECTIFIERS, VALVES AND C.R. TUBES



Group of S.T.C. silicon Zener diodes.

G.E.C. germanium diode GEX541 in two arrangements for power rectification.



SEMICONDUCTOR junction diodes, both silicon and germanium, are threatening very seriously the supremacy of the conventional metal rectifier in some power-supply applications. The reasons are their greatly superior rectification efficiency and extremely small size for a given power rating. As a striking example of what can be done, S.T.C. were showing a 17-inch television receiver in operation with its entire h.t. supply of 220mA derived from an experimental silicon diode about the size of a ½-watt resistor. In the same receiver the efficiency diode was made up of four of these units, handling altogether 240mA mean at 4.5kV.

S.T.C. have, in fact, three ranges of these silicon diodes—a ½-amp range, a 1-amp range and a 5-amp (development) range—all being available with peak inverse voltage ratings of 50, 100 and 150 volts. Being silicon, they will operate at ambient temperatures up to 100°C. The ½-amp types do not require "heat sinks," but the larger ones do, and have threaded studs for mounting on to cooling fins.

Germanium power rectifiers were represented by a new junction diode, GEX541, on the G.E.C. stand. This can be used in various series, parallel and series-parallel arrangements to provide d.c. supplies of anything up to about 30kVA, and will operate successfully at ambient temperatures up to 55°C. An example on show was a 3-phase bridge rectifier giving a d.c. output of 74 volts at 7.5 amps from

an a.c. input of 55 volts r.m.s. This firm also had a range of four silicon diodes and a new power transistor, the GET15, suitable for audio output stages. Two of these transistors operated in Class-B push-pull will give an output of 1 watt, using a 6-volt power supply.

Both S.T.C. and G.E.C. were also showing some special semiconductor junction diodes intended for voltage reference purposes. Known as Zener diodes, they have a low breakdown voltage in the reverse direction, with a fairly sudden turnover and a small slope resistance after the turnover point. If the Zener diode is biased in the reverse direction to just beyond the turnover point, any increase in reverse current will result in an almost constant voltage being developed across the device—the actual variation of voltage depending on the slope resistance. This reverse characteristic can therefore be used as a voltage reference or for voltage stabilization.

In receiving valves, the most notable exhibit this year was a new double triode from Mullard, the PCC89, intended for use as a cascode r.f. amplifier in television multi-channel tuners. The valve has a variable- μ frame grid construction to assist in the reduction of cross-modulation effects, and in the normal cascode series connection the mutual conductance is as high as 12.5mA/V for an anode current of 15mA. This permits a considerable increase in r.f. gain. Another new double triode was the Brimar type 5965, intended for use in two-state circuits in digital computers.

The electrostatically focused cathode ray tube is now coming into much wider use in television receivers. It saves the extra weight and cost of magnetic focusing assemblies, and requires no adjustment once it is set because there is practically nothing to cause drift. The focusing is



Mullard low-noise pentode, UF86, for 100 mA a.c./d.c. operation.

achieved by a short cylindrical electrode which surrounds a gap in the long final-anode cylinder. A fairly low potential is applied to this electrode (anything between 0 and 400 volts, according to the c.r. tube) which therefore produces an electrostatic lens action between itself and the two high-voltage ends of the final-anode cylinder. The configuration of equipotential lines is such as to bring the electron rays to a focus at the screen. New c.r.

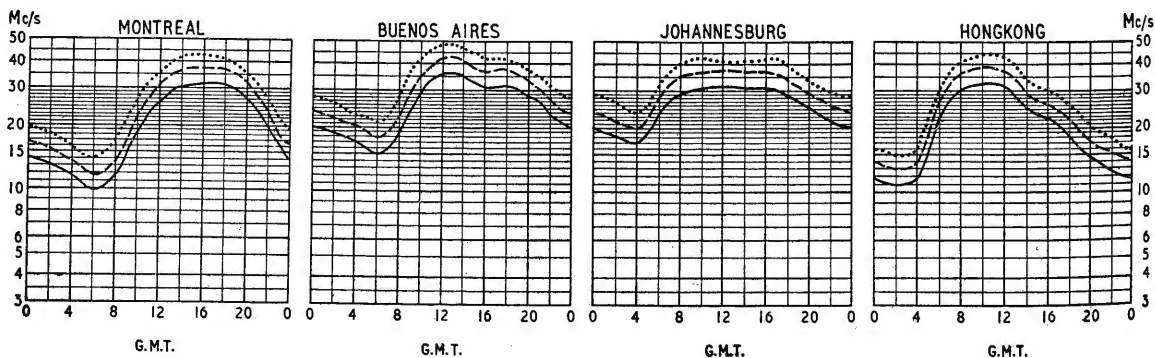
tubes of this kind were shown by both Siemens-Ediswan and Brimar.

The 24-inch tube mentioned earlier under the heading of "Television" is also a Brimar product. Known as the C24KM, it has a pentode electron gun with three anodes—a first anode, a pre-focus anode and a final anode. It does, however, require magnetic focusing as well. The final anode voltage is 17kV. Incidentally this firm has recently introduced a range of c.r. tubes in which a substantial increase in screen brightness is obtained by the use of a phosphor containing a new type of activator.

As an aid to the servicing technician, G.E.C. have produced a 6-inch "setting-up" c.r. tube which can be plugged into any popular television set using a 14-inch, 17-inch or 21-inch tube. Owing to its small size and weight, compared with the normal tubes, it is very convenient to handle, and when plugged in leaves a good deal of extra space, which is useful in gaining access to other components. It is available in two versions, one for magnetic focusing and the other for electrostatic focusing.

SHORT-WAVE CONDITIONS

Prediction for October



THE full curves given here indicate the highest frequencies likely to be usable at any time of the day or night for reliable communications over four long-distance paths from this country during October.

Broken-line curves give the highest frequencies that will sustain a partial service throughout the same period.

- FREQUENCY BELOW WHICH COMMUNICATION SHOULD BE POSSIBLE FOR 25% OF THE TOTAL TIME
- PREDICTED AVERAGE MAXIMUM USABLE FREQUENCY
- FREQUENCY BELOW WHICH COMMUNICATION SHOULD BE POSSIBLE ON ALL UNDISTURBED DAYS

"Nearest Approach" Calculator

Rapid Interpretation of Marine Radar Screen Information

By A. L. P. MILWRIGHT*

If a mariner wishes to determine the closest passing distance of his ship from any other ship by means of radar, it can be done quite simply by plotting the ranges and bearings of the other vessel's echo. The line joining the plotted positions indicates the relative course of the other vessel and by extending the relative course line the closest passing distance can be measured.

With the existing method of measuring bearing by means of a mechanical cursor, with its attendant possible inaccuracies, it is necessary to plot a number of positions and draw the relative course line as a mean through the plotted positions. The time taken to establish the nearest approach is therefore comparatively long (approximately 3 minutes if the "target" vessel is some distance away). If an electronic bearing cursor were to be used the time to determine the nearest approach could be reduced since the accuracy of the measured bearings would be higher, and fewer measurements would be required.

It may however be inconvenient to move from the radar screen to the plotting table and if plotting is done on the face of the p.p.i. or a reflection plotter the accuracy may be poor, particularly if the nearest approach is determined by extending a relative course line formed by two plotted positions close together, using a blunt wax pencil.

In the case of a true motion radar the nearest approach is not so readily available as with the relative display, and the operator will have either to construct a relative plot from his true plot or change the picture to a relative picture and from that construct a relative plot.

A Direct Answer

Various methods have been suggested notably by Topley¹ and Wylie² of determining the nearest approach without having to plot by using two radar ranges and a change of bearing, but both these methods present the information as a percentage of the initial pick-up range of the target. This may require the mariner to do an annoying little sum, e.g., 18% of 4.9 miles. To provide a simple method of determining nearest approach when using a true motion display the Ministry of Transport and Civil Aviation's Research group at the Admiralty Signal and Radar Establishment have developed a simple calculator.

The principle of the calculator is as follows. Suppose an incoming vessel is first observed at range R_1 (Fig. 1) and that after a short period of time the range has changed to R_2 and its bearing has changed by an

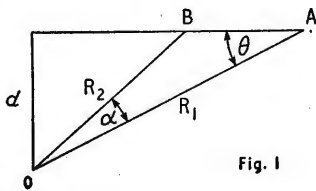


Fig. 1

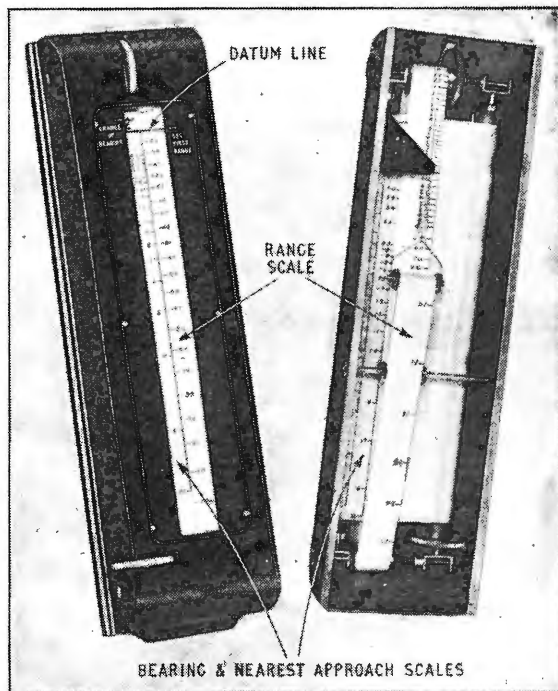


Fig. 2. Front and rear views of the A.S.R.E. "nearest approach" calculator.

angle α . Let the nearest approach distance be d and let θ be the angle BAO.

$$\text{Then } d = R_1 \sin \theta \text{ and } \frac{\sin \theta}{R_2} = \frac{\sin \alpha}{AB}$$

$$\text{also } \cos \theta = \frac{R_1 - R_2 \cos \alpha}{AB}$$

$$\therefore \sin \theta = \frac{R_2 \sin \alpha}{AB} = \frac{(R_2 \sin \alpha)}{(R_1 - R_2 \cos \alpha)} \cos \theta$$

$$\therefore d = \frac{(R_1 R_2 \sin \alpha)}{(R_1 - R_2 \cos \alpha)} \cos \theta$$

For small values of α , $\cos \alpha$ can be taken as unity, and if d is much smaller than R_1 , $\cos \theta$ can be

as unity since $\cos \theta = \sqrt{1 - \frac{d^2}{R_1^2}}$

$$\therefore d \approx \frac{R_1 R_2 \sin \alpha}{R_1 - R_2}$$

$$= \frac{\sin \alpha}{\frac{1}{R_2} - \frac{1}{R_1}}$$

Suppose we plot a scale (A) where the lengths

*Admiralty Signal and Radar Equipment.

(denoted by R_1R_2) from some fixed point (datum) are proportional to $\frac{1}{R_2}, \frac{1}{R_1}$ then the length between R_1 and R_2 will be proportional to $\frac{1}{R_2} - \frac{1}{R_1}$. If this length is now measured from the datum the scale reading obtained would be $\frac{1}{\frac{1}{R_2} - \frac{1}{R_1}}$.

By having a second scale B placed alongside A and calibrated such that the lengths denoted by R_1R_2 , etc., on scale "A" are denoted by $R_1 \sin \alpha, R_2 \sin \alpha$, etc., then the operation $\frac{\sin \alpha}{\frac{1}{R_2} - \frac{1}{R_1}}$ can be carried out as follows:—

1. Set the first range R_1 on scale A, opposite the datum of scale B.
2. Note the reading on scale B opposite the reading R_2 on scale A.

The reading so obtained is equal to $\frac{\sin \alpha}{\frac{1}{R_2} - \frac{1}{R_1}}$ which

as has been shown is a very close approximation to the nearest approach distance. A series of "B" scales would be required for each value of α .

Since the answer provided by the calculator is only an approximation, let us examine the error involved.

Let the actual distance of nearest approach be d and that obtained using the calculator be d_{calc} .

$$\begin{aligned} \text{Then } d &= \frac{R_1R_2 \sin \alpha}{R_1 - R_2 \cos \alpha} \cos \theta \\ d_{calc} &= \frac{R_1R_2 \sin \alpha}{R_1 - R_2} \\ \therefore \frac{d}{d_{calc}} &= \frac{R_1 - R_2}{R_1 - R_2 \cos \alpha} \cos \theta \\ &= \frac{1 - R_2/R_1}{1 - R_2/R_1 \cos \alpha} \cos \theta \\ &= \frac{1 - \frac{\sin \theta}{\sin(\theta + \alpha)}}{1 - \frac{\sin \theta \cos \alpha}{\sin(\theta + \alpha)}} \cos \theta \\ &= \frac{\sin \theta \cos \alpha + \cos \theta \sin \alpha - \sin \theta}{\cos \theta \sin \alpha} \cos \theta \\ &= \left[1 - \tan \theta \left(\frac{1 - \cos \alpha}{\sin \alpha} \right) \right] \cos \theta \end{aligned}$$

Assuming a limiting case when $\alpha = 5^\circ$ then

$$\frac{1 - \cos \alpha}{\sin \alpha} < 0.044.$$

\therefore in the limiting case

$$\begin{aligned} \frac{d}{d_{calc}} &= (1 - 0.044 \tan \theta) \cos \theta \\ &= \cos \theta - 0.044 \sin \theta \end{aligned}$$

Since $\sin \theta = \frac{d}{R_1}$ we have a relation between d , d_{calc} and R_1 . Giving R_1 the values 12, 8 and 4 miles the values of d corresponding to chosen

values of d_{calc} have been calculated and are shown in the table.

$R_1 = 12$ miles		$R_1 = 8$ miles		$R_1 = 4$ miles	
d_{calc}	d	d_{calc}	d	d_{calc}	d
3.0	2.872	2.0	1.914	1.5	1.366
2.0	1.957	1.5	1.461	1.0	0.957
1.0	0.993	1.0	0.987	0.5	0.493
0.5	0.499	0.5	0.498	0.25	0.249

As can be seen from the table the accuracy of the calculator is high, particularly when the nearest approach is small.

The calculator can be constructed in a number of forms and a preferred type is shown in Fig. 2. This consists of two endless belts moving at right angles to each other and operated by the knurled knobs at each end. The range scale on the right (in the front view) is calibrated from 2 to 15 miles. The scale on the left is the nearest approach scale and ten such scales are provided at half-degree intervals for bearing changes of between 1 degree and 5 degrees. The bearing change is shown in the upper left-hand corner of the window.

In order to use the calculator all that is necessary is to proceed as follows:

1. When an echo is seen on the radar screen set the bearing cursor over the echo and measures its range.
2. Rotate the upper knurled knob of the Calculator until this measured range is coincident with the datum line (marked "set first range").
3. Wait until the bearing has changed and then measure the *change* of bearing and the new range.
4. Rotate the lower knurled knob until the bearing change appears in the upper corner of the window.
5. Read off nearest approach distance on the left-hand scale opposite the second range of the target on the right-hand scale.

Provided both ships do not alter course the nearest approach distance can be checked for various bearing changes without having to reset the range scale.

REFERENCES

- Topley, H. "Estimating Nearest Approach by Radar." *Journal of Inst. of Navigation*, Vol. VIII, p. 50 (1955).
 Wylie, F. J. "The Region of Collision." *Journal of Inst. of Navigation*. Vol. IX, p. 161 (1956).

Precision Plug-in Wirewound Resistors

AN unusual type of precision wirewound resistor has been introduced by Alma Components, Ltd., 165, Ossulton Street, London, N.W.1. It has a standard octal-valve plug-in base and can be supplied with up to six tappings which, by suitable external switching or interconnection, provides a wide choice of values with any one component. The plug-in feature enables this whole family of values to be instantly changed.

The resistance wire is non-inductively wound on an eight-slot, ceramic former securely fixed to the base and finally "potted" in a non-hygroscopic resinous compound. Resistors are wound to specific requirements and in values up to 5 M Ω , with tolerances of from $\pm 5\%$ down to $\pm 0.1\%$ as required, normally at 25°C. The rating is $\frac{1}{4}$ W per section.



Alma plug-in, tapped, precision wirewound resistor.

New Radio Telescope

OPENING OF THE MULLARD OBSERVATORY AT CAMBRIDGE

THE new Mullard Radio Astronomy observatory outside Cambridge was opened on July 25th by Sir Edward Appleton. The project has been financed jointly by Mullard, Ltd., the Department of Scientific and Industrial Research, and Cambridge University itself. The Mullard contribution of £100,000 provided more than half of the total sum required.

The methods used for measuring very low-level signals¹ (even below receiver noise) after they have been collected by the aerial remain relatively unchanged. For this reason and also more obviously because of their size and expense, the aerials usually excite the main interest at such observatories. In addition the two aerial systems at this observatory use a new technique known as "aperture synthesis"² to provide the maximum resolving and collecting power for a given structure size and weight.

The output voltage from a normal aerial such as a mirror may be regarded as being obtained by the appropriate combination of the voltages from a number of elementary aerial subdivisions of the mirror. The new technique is to use small movable aerials to take up in turn the positions of the various elements of a much larger aerial. Then, from the measured voltages given by the small aerials, the voltage which would be received by the large aerial can be calculated. The large aerial is then said to have been "synthesized." Since the combined output voltage involves vector products of the elementary voltages, it becomes necessary to use two elementary aerials.

Two additional factors give a considerable reduction in the total number of observations necessary. In the first place, in many of the element pairs the aerial elements are in the same relative position (have the same spacing and orientation), and all such similar pairs will give identical voltages. Thus

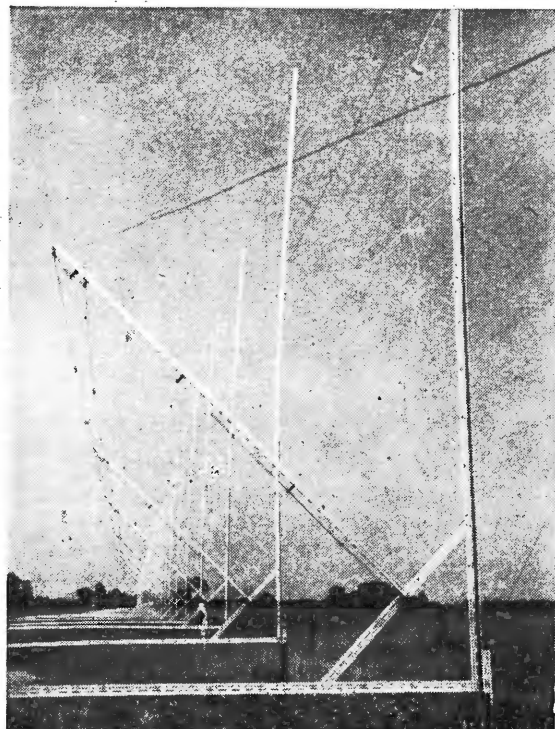


Fig 2. Part of the fixed aerial for use on 7.9m in synthesizing a single aperture.

the voltages need only be measured for each different relative position of the two elements, provided that we multiply the voltages for each different relative position by a factor proportional to the number of times that relative position occurs in all the possible element position pairs. Secondly, by suitably altering the phases of the voltages from the elementary aerials the synthesized aerial lobe may be rotated to give a maximum response anywhere within the lobe of one of the elementary

aerials. Thus, once the elementary aerial voltages have been measured, it is possible to compute the voltage which would be given by the synthesized aerial in a number of different orientations. A similar technique for rotating the lobe of an aerial without physically moving any of its elements is often used in radar communication systems.

There is no need for the two elementary aerials to be the same size. In

¹ See for example *Wireless World*, July 1951, Vol. 47, p. 275.

² Described in "The Mullard Radio Astronomy Observatory, Cambridge," by M. Ryle, F.R.S., *Nature*, July 20, 1957, Vol. 180, p. 110.

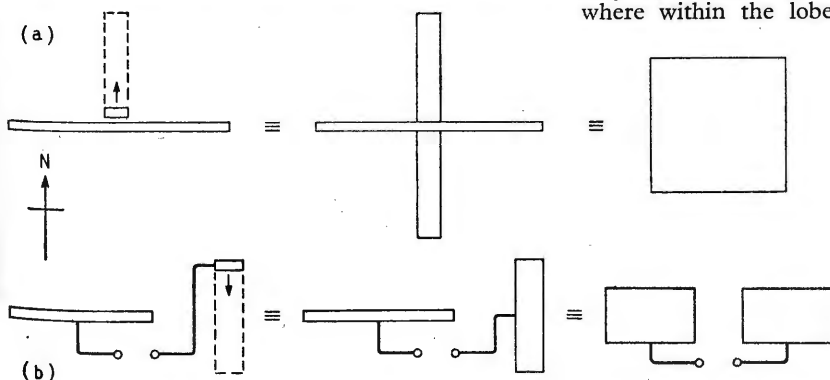


Fig. 1. The synthesis of (a) a single aperture, and (b) an interferometer; using one long fixed and one moving aerial. (Adapted from Fig. 2 of Reference 2).

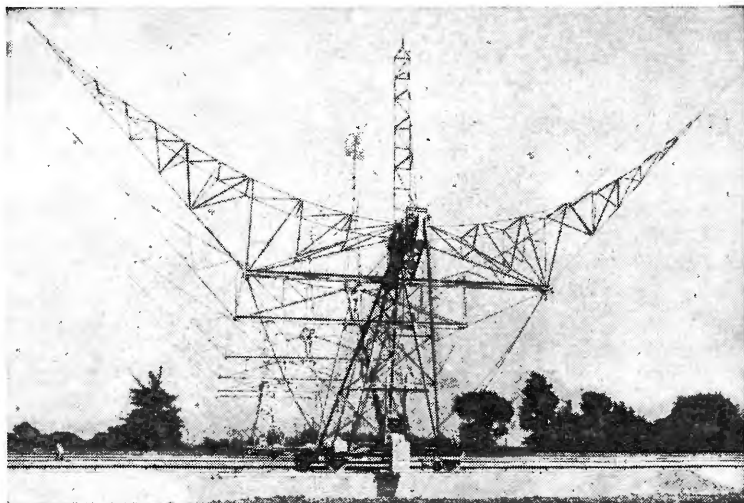


Fig. 3. Moving aerial of the radio star interferometer for 1.7 metres

the new systems one of the aeri-als is made comparable in size with the synthesized aerial so that it need not be moved at all. This also simplifies the measurement and computation process. A large aerial can be most economically built as a long line, since rotation about the long axis can be achieved without the need for a high or sturdy structure. If this aerial is arranged to run east to west, then, as the earth rotates, it also rotates in a plane at right angles to its long axis. All the different relative spacings of the elementary aeri-als can then be obtained if the small aerial moves at right angles to the long fixed one. According as to whether the path of the moving aerial cuts the long fixed aerial or not, the resulting effective synthesized aerial is a single aperture, or two apertures separated by a fixed distance forming an interferometer. These alternatives are shown schematically in Figs. 1a or 1b respectively. The lobe width in the equatorial plane and the earth's rotation rate fix the total time available for observation of any one source, or for "integration" of its signal. This imposes some restriction on the relative size and shapes of the two aeri-als in an optimum design.

Both of these two types of synthesis will be used in the new observatory. The arrangement for synthesizing a single aperture (Fig. 1a) will be used at a wavelength of 7.9 m to measure the galactic background radiation, and thus study galactic structure. The fixed east-west aerial is 3,200 ft long; the other is 110 ft long and can be moved over a distance of 1,700 ft. Each aerial is in the form of a corner reflector with an aperture of 40 ft. Part of the fixed aerial is shown in Fig. 2. For readers who are more used to reflecting surfaces, such as ordinary astronomical mirrors, which "look like" reflectors, it should perhaps be pointed out that the reflecting surfaces for both these aerial systems are formed by conducting wires spaced out on suitable frames. If this spacing is a small fraction of the wavelength used, then, at this wavelength, the wires will give nearly perfect reflection. The synthesized reception lobe on the 7.9 m aerial will be about 1 degree square, and the equivalent collecting area about 2×10^5 sq. ft. The number of elementary positions

of the movable aerial is about 75, so that a complete set of observations in a given rotation position will take at least this number of days. In a plane at right angles to the long axis the lobe width of the individual aeri-als is about 60° so that only three (or perhaps four to allow some overlap) rotation positions about this axis are necessary. The angle of rotation about the long axis is determined simply by the length of guy wires supporting the corner reflectors.

The arrangement for synthesizing an interferometer (Fig. 1b) will be used at a wavelength of 1.7 m to study sources of small angular diameter (radio "stars"). This wavelength was chosen as a compromise between the requirements of sensitivity (both the flux from the source, and the sensitivity of the receivers used, increase with increasing wavelength), allowable

constructional errors (these are proportional to the wavelength), and gain and resolving power (both of which increase with decreasing wavelength for a given aerial). The fixed east-west aerial for 1.7 m is 1,450 ft long; the other is 190 ft long and can move up to 1,000 ft on railway lines. Both aeri-als are cylindrical parabolas with an aperture of 65 ft. The movable aerial is shown in Fig. 3. The synthesized reception lobe will be about 25 by 35 minutes of arc and this will contain an interference pattern in the plane of the equator with a lobe width of about 8 minutes. The equivalent collecting area will be about the same as the other aerial system— 1.9×10^5 sq. ft. The number of elementary positions of the movable aerial is about 20. The lobe width of the individual aeri-als in a plane at right angles to the long axis is only about 4 degrees. Thus many rotation positions about this axis are necessary, and more precise mechanical methods of rotation have been adopted than those used for the other aerial system.

Although the operational wavelengths of the two aerial systems are not essentially fixed, altering these will involve changing the considerable number of full-wave receiving dipoles along the long axes of the aeri-als.

The large amount of computation involved in the synthesis method will be handled on EDSAC.

National Lending Library

WITH the ever-growing volume of scientific and technological journals published throughout the world the task of maintaining a really comprehensive library in an industrial organization is a major problem, and a considerable amount of material is therefore destroyed from time to time. The Department of Scientific and Industrial Research will be glad to receive such material for the recently formed National Lending Library. Offers of journals (not U.K. publications), which should cover at least six years and, if unbound, be 80 per cent complete, should be sent to the D.S.I.R. Lending Library Unit (20 Chester Terrace, London, N.W.1), of which the Technical Information and Documents Unit, which issues the "unpublished reports" referred to in "Technical Notebook," is now a part.

Loudspeakers in Parallel

By J. MOIR,* M.I.E.E.

MANY of the advantages of a stereophonic sound reproducer are due to the impression of source size that is transmitted, and it is natural (though quite wrong) to believe that the use of multiple speakers on a single channel will increase the apparent size of the source and thus have the same advantages. Two loudspeakers are clearly twice the size of a single speaker, and it is easy to fall into the error of thinking that our ears take the same "view" as our eyes. However, this is one of the few instances where plain common sense is quite wrong, for two loudspeakers with their voice coils in parallel (or series) convey the same impression of size as a single speaker, however they are mounted or spaced.

This is not to suggest that two loudspeakers in parallel have no advantages over a single speaker, it is just that the advantage of an increase in the apparent size of the source is not obtained. The merits of paralleled speakers will be discussed after considering this source size anomaly.

If two similar loudspeakers are spaced 8-10 ft apart (as they might be in a domestic stereophonic system, but with their voice cells in parallel), the apparent position of the sound source will depend on the listener's position with respect to the speakers, and on the relative polarity of the voice coil connections. With the voice coils in phase (both cones moving in the same direction) a listener seated on the median line, as in Fig. 1 (a), will always locate the sound source on the same line somewhere behind

INCREASE OF APPARENT
SOURCE SIZE NOT ONE
OF THEIR ADVANTAGES

the loudspeakers. With a single artiste the lateral position is quite sharply defined, and, though the definition is less sharp with a large source such as an orchestra, it is important to note that the apparent size of the orchestra is the same as is given by a single speaker. The reproduced orchestra appears to occupy about two cubic feet of space about the centre line, giving the subjective impression that one is listening to a very small reproduction of a large-sized orchestra.

Effect of Moving Off Centre

If the listener moves off the median line, as shown in Fig. 1 (b), the virtual artiste starts to move with him in the same direction, but after a movement of only a few inches the source moves fairly sharply to just behind the nearer loudspeaker, and the remote loudspeaker apparently ceases to sound.

If the listener moves some way to the right, all the sound appears to come from the right-hand speaker, and the left-hand speaker seems to contribute nothing to the acoustic picture.

Though there is a strong subjective impression that the remote loudspeaker is making no contribution to the total effect, open circuiting its voice coil produces a sharp increase in the acoustic definition of the sound source, and places the virtual artiste at the position of the single speaker. Thus the use of a second speaker only appears to add "vagueness" to the apparent position of the artiste. This is a lesson that the film sound engineer learnt the hard way back in the early 1930's, when several of the film equipment companies endeavoured to obtain complete coverage of a large theatre by the use of a multiplicity of cone speakers mounted on flat baffles round the perimeter of the picture screen. Though superficially attractive, and technically sound from some points of view, the performance is poor, so this solution has been abandoned by all film sound engineers.

The previous discussion began with an indication that the speaker voice coils were connected in phase, for when they are out of phase the effects are quite different. With the listener seated on the centre line, as in Fig. 1 (a), reversal of the connections to one voice coil produces a well-defined impression that the artiste has been bisected and one half moved out to each of the loudspeakers. Further experience leaves the listener quite unable to decide where the artiste is supposed to be, presumably

* Electronics Engineering Dept., British Thomson-Houston Company.

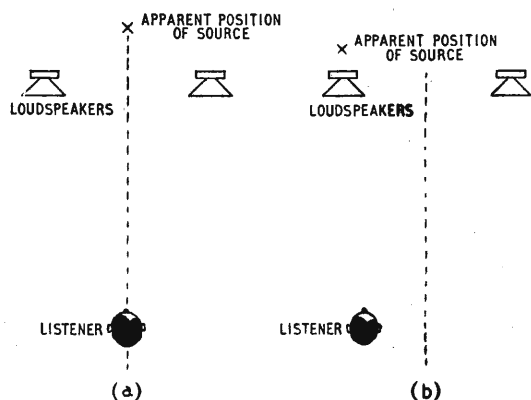


Fig. 1. (a) To a listener on the axis, the source of sound appears to be on this axis, but behind the speakers. (b) To a listener off the axis, the source of sound appears to be slightly behind the nearer speaker.

because the listener is presented with an acoustic experience which never occurs in real life. When listening to an actual performance, all the frequency components below about 1 kc/s must arrive with the same phase, or at least the same polarity, at both ears, irrespective of the position of the sound source. Signals from a reproducer system that arrive with opposite polarity at the two ears serve to confuse the hearing system and render it unable to fix the position of the sound source, though it is easy to bias the brain by presenting it with some clues from the other senses.

The effects of a polarity reversal are less well marked to a listener seated off the speaker system centre line, for all the sound appears to be emitted by the nearer speaker, an illusion that is strengthened as the listener moves further from the centre. Further consideration of the effects of polarity reversal will be deferred as not being germane to the argument. Instead, consideration will be given to the apparent acoustic disappearance of the remote speaker when the listener is off the system centre line.

This is an effect that has been known as a

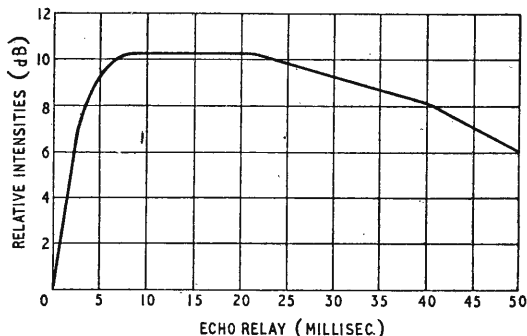


Fig. 2. Relative intensities for equal loudness as a function of the echo delay time.

nuisance by sound engineers for many years though the explanation is only of relatively recent origin. A typical situation where this nuisance occurs is in cinemas and theatres where it is necessary to mount the public address speakers on each side of the proscenium opening. Down the centre of the theatre there is a sharply defined line along which both speakers are heard and any artiste appears to be standing in the centre of the stage irrespective of his actual position. A slight movement of the head to one side of the centre line, often by only a few inches, moves the artiste over to the nearer loudspeaker while the sound from the further one seems to vanish. This is, as one might expect, the exact counterpart of experience in domestic surroundings.

This vanishing loudspeaker phenomenon is a simple example of the so-called "Haas effect," a subjective reaction that is of great importance when considering the influence of the hearing system. Working at Göttingen University, Haas discovered that the apparent position of the sound source in a multiple speaker installation is fixed at the position of the nearest loudspeaker, though all the loudspeakers contribute to the total loudness. This unsuspected result is due to the important part played by time of arrival differences when similar sound

energy spectrum patterns arrive at the ears. A signal arriving at the ears from the nearest loudspeaker reduces the response to any similar signal arriving slightly later in time, the amount of the reduction being a function of the time of arrival difference of the two identical sound patterns. More precise information is given by the data in Fig. 2, which indicates the relative intensities of the two signals for both to sound equally loud when they differ in arrival time. Thus, for time of arrival differences between about 5 and 30 milliseconds, the second signal to arrive at the ears must be about 10 dB higher in intensity before it sounds as loud as the first signal. The velocity of sound in air is sufficiently close to 1,000 ft/sec (actually it is 1,125 ft/sec) to make it possible to substitute "path length difference in feet" for "echo delay in milliseconds" without any serious error. Where similar loudspeakers are connected in parallel the sound outputs will generally have sufficiently similar intensities and responses to make the data in Fig. 2 applicable. Thus the sound from the second speaker will appear to vanish at a path length difference of less than one foot, corresponding to a time interval difference of less than one millisecond. This is in accordance with practical observations.

If the time interval difference increases above about 40-50 milliseconds, the sound from the remote speaker, though not consciously appreciated as a second signal, begins to reduce the intelligibility of the first signal; and with still further increases in the delay time it appears as a separate echo. For all time differences greater than about one millisecond, it makes the apparent position of the nearer loudspeaker increasingly vague without actually moving this apparent position.

Thus the Haas effect is responsible for the fact that two loudspeakers radiating the same signal do not appear to be any larger than a single speaker. Though this is not quite so obvious, it is also the reason for an 18in speaker sounding little larger than an 8in speaker.

In marked contrast, a good stereophonic reproduction of an orchestra using the same two speakers at the same spacing will appear to fill the whole of the space between them. This is achieved because the two signals differ both in timing and in frequency content. Because of these differences reversal of the connections to either voice coil does not, in general, have the same drastic effect on the apparent position of the sound source.

Advantages of Paralleled Speakers

Two speakers in parallel do have appreciable advantages over a single speaker of the same size, and, in fact, have some advantage over a single speaker having the same cone area as the two speakers together. A 12in speaker of the normal type has an efficiency of about 1%, i.e. it converts about 1% of the electrical energy input to the voice coil into sound. This abysmally low figure is in large measure due to the very considerable disparity between the density of air and the density of those materials which are mechanically suitable for speaker cones. It is roughly true to say that if we could double the density of the air we could double the efficiency of our loudspeakers. This seems impossible, but it is in fact easily achieved, for when two speakers are mounted in close

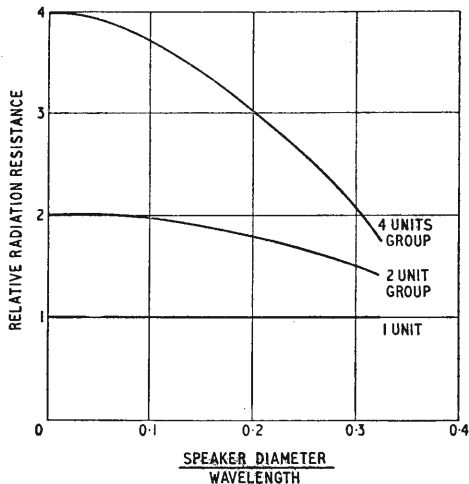


Fig. 3. Relative acoustic radiation resistance "seen" by each speaker of a closely spaced group.

proximity, each speaker benefits from the presence of the other. As the cone of one speaker moves forward it encounters, not free air, but air of a higher density due to the fact that the other cone is also moving forward and compressing the air in front of it.

Quite clearly any advantage due to this mechanism requires that the two cones be near together, for ideally the pressure variations produced by one speaker must be in phase with those produced by the other. This will only be achieved if the spacing between speakers is a fraction of the wavelength of the sound being radiated. Wolfe and Malter, and also Klapman, have made theoretical investigations of this problem and produced the curves shown in Fig. 3, from which it will be seen the radiation resistance seen by each speaker diaphragm is proportional to the number of such diaphragms in use. Thus two loudspeakers in parallel produce twice as much acoustic power when they are close together as they do when they are far apart. As the separation is measured in wavelengths and not in feet, this means that the power advantage is gained only at the low frequency end of the range. It is no mere academic advantage, for the addition of a second speaker produces an increase in the low frequency response that is immediately obvious even to the untrained ear.

Distortion Reduction

Paralleled speakers also have a significant advantage in reducing amplitude distortion. This distortion arises in loudspeakers due to non-uniformity of the field distribution over the depth of the gap in which the coil moves, and to non-linearities in the stiffness of the cone suspension. Both forms of distortion are similar in that the deflection of the voice coil for a given current is constant for small movements, but decreases rapidly, either as the coil moves out of the gap, or as the cone approaches the end of the travel permitted by the surround and centring

Paralleling a second speaker: and adjusting circuit constants to give the same overall acoustic output

as with one speaker means that the cone movement becomes less than that required by a single cone to give this acoustic output. The relative reduction in distortion can be much greater than the factor by which the cone movement is reduced.

Dissimilar speakers may be used in parallel to extend the frequency range. Alternatively, if the units are only slightly dissimilar, they may be used to smooth out the low frequency response, the intention being that dips in the response of one speaker should be filled by peaks in the response of the other. In every instance it is wise to use units having their bass resonances about 10 c/s apart, for when they are connected in parallel the overall impedance curve is significantly smoothed. At the resonant frequency of one cone the impedance of that speaker may rise by a factor of ten or twenty times. The combined impedance of the two speakers cannot do more than double, for the second voice coil appears in parallel and being "off resonance" has a low impedance. There are few better ways of achieving a good damping factor.

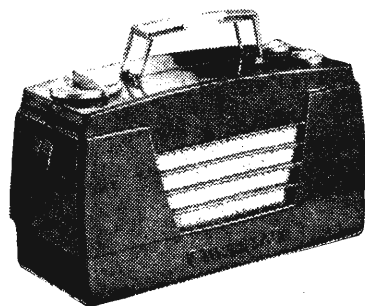
Thus we may summarize by saying that while two speakers in parallel have several advantages, the increase in source size that appears so obvious at first thought is not in fact achieved, two speakers being no larger in the acoustical sense than a single speaker.

My thanks are due to Chapman & Hall for permission to use illustrations from my book "High Quality Sound Reproduction."

REFERENCES

- "Sound Radiation from a System of Vibrating Diaphragms," Wolfe & Malter, *Phys. Rev.* Vol. 33, p. 1061, 1929.
- "Interaction Impedance of a System of Circular Pistons," Klapman, *J. Acous. Soc. Amer.* p. 289, 1939.
- "The Use of Multiple Small Loudspeakers," Langford-Smith, *Radiotronics*, Vol. 19, p. 85, 1954.

PROSPECTOR'S PORTABLE



The idea of combining a geiger counter with a portable radio receiver is one which should have a wide appeal to Canadians who have prospecting in the blood. The "Lode-star", made by Canadian Aviation Electronics of Montreal, weighs only 5lb and is housed in a tough plastics case, for which a polythene shoulder strap is available. In addition to normal wave-band selection, two switch positions give aural indication from the loudspeaker or visual indication in a neon flasher if the set is affected by the emanation from radioactive material of sufficient strength.

Component Developments

Trend of Design of Electronic Components Used by the Services

By G. W. A. DUMMER*, M.B.E., M.I.E.E.

AT present most components used in Service electronic equipment conform to the specifications in the Radio Components Standardisation Committee's (R.C.S.C.) lists¹ of fully tested and approved components which have been effectively standardized in this country for the past eighteen years. Many developments, however, are now in progress both at government Research establishments and in industry which will affect the future standardization of Service electronic components.

It may not generally be realized that Great Britain was the first country in the world to standardize Service radio components. In the 1920s Joint Service "K" specifications were drawn up under the aegis of the Wireless Telegraphy Board for 2½-in and 3½-in ammeters and voltmeters. These specifications laid the foundations for the dimensions of most of the 2½-in and 3½-in flush and projecting type instruments seen in Britain today.

The 1939-1945 war made it essential to produce large quantities of components quickly, the scale of increased production amounting to approximately three times the normal peace-time output. This led to severe rationalization of components by Joint Service Standardization Committees which are now the R.C.S.C. An example of the success of this rationalization is that in 1942 there were 1,500 different plugs and sockets in use in the Ministry of Aircraft Production alone and after rationalization only 200 were retained by the three Services. In addition, some 10,000 resistor types were reduced to 1,300 approved items; 8,000 fixed capacitor types were reduced to 750 preferred items, and 700 types of transformer laminations were reduced to 32 preferred items.

It is worth emphasizing that the situation on electronic components is constantly changing. There is a time delay in introducing new components because of the necessity for thorough approval testing, and it is difficult to withdraw components from Service use because of the world-wide organization of the Navy, Army and Air Force. It would be useful if it could be generally realized that there is a "standardization life" for every component, which may be 10 years or more.

There are many specifications for the Services and industry and, to the user, these may seem confusing. There are at the present time specifications for Service components prepared by the R.C.S.C., R.C.S., etc. (now D.E.F.), in addition to N.A.T.O. specifications, whilst for industry there are the Radio Industry Council (R.I.C.), International Electro-technical Commission (I.E.C.) and British Standards Institution (B.S.I.) specifications. It would seem desirable for some of these specifications eventually to be merged into one Service and one international, or British industry, specification. As a long-term

policy it is conceivable that these specifications may converge into one N.A.T.O. specification with individual country specifications agreeing with the main N.A.T.O. specification (at present concerned mainly with interchangeability) for the Services, and one I.E.C. specification for industry, with the individual countries agreeing with the I.E.C. specification as shown below:—

N.A.T.O.	}	Great Britain	R.C.S.C. and D.E.F. specifications
		France	C.C.T.U. specifications
		United States of America	J.A.N. or M.I.L. specifications
		Canada	J.C.N.A.A.F. specifications
		Belgium	National Defence specifications
		Denmark	
		Netherlands	R.C.S.S. and M.I.L. specifications
Italy	National Defence specifications		

I.E.C.	}	Great Britain	B.S.I. specifications
		France	Industry specifications
		United States of America	R.E.T.M.A. specifications
		Canada	Industry specifications
		Belgium	" "
		Sweden	" "
		Denmark	" "
		Netherlands	" "
		Norway	" "
		Italy	" "
		Austria	" "
		Japan	" "
		Switzerland	" "
		Portugal	" "
		Spain	" "
South Africa	" "		
Yugoslavia	" "		

New Component Developments:—Operational requirements have changed greatly in the post-war years and new developments such as guided missiles, automation techniques, high-speed aircraft, etc., are influencing component development considerably.

The single range of Service-type approved components may diverge in the future into several differing categories, which might be classed as:—

1. The reliable component
2. The transistor circuit component
3. The high temperature component
4. The short life, or guaranteed life, component
5. The very long life component

For some years there may be no clear definition between these types, but it is useful to discuss these developments in more detail.

1. The Reliable Component:—With the increasing complexity of electronic equipment used in the Services the need for increased reliability becomes more essential. It has now become accepted that in war the lives of a complete aircraft crew, tank crew or sea-going vessel crew may become jeopardized if the radio, radar or navigational systems fail at a crucial moment. The success of a complete operational mission, even a major battle, can depend on the electronic equipment.

*Royal Radar Establishment.

It is not easy to assess reliability of equipment under Service conditions, but from many sources of information failures in electronic components appear to occur in the following order²:—

- (1) Valves
- (2) Resistors
- (3) Capacitors
- (4) Transformers
- (5) Switches
- (6) Plugs and Sockets, etc.

This does not necessarily mean that resistors and capacitors have high fault rates, but that they are the main causes of failure because large quantities are used in equipments.

The reliability of an equipment depends also on the environmental operational conditions under which it is used. From analyses, the author would estimate that the fault rates with Service equipments are from ten to twenty times those of home radio and television sets, which use basically similar components.

It is now being suggested by the author that the fault rates of these common components, such as resistors and capacitors, should be of the order of 0.01% per annum under laboratory conditions. In order to attain this low rate of failure it is essential that improved process control in manufacture and a higher standard of inspection of materials should be obtained. In addition, an important point arising directly from this requirement for increased reliability is that of mass testing. In order to evaluate failure rates of this order it is necessary to test very large quantities of components (of the order of 1,000); a machine designed by a British firm is about to go into operation at the Royal Radar Establishment for the automatic testing of 1,000 resistors.

It is possible to feed instructions on coded tape to this machine for any series of tests it is required to make for any length of time up to six months. The coded signals control the sequence of testing and the appropriate climatic conditions in the test chamber. Rotary switches select each resistor in turn. They are measured on an automatic impedance bridge and recorded as change of resistance against the particular test conditions. The accuracy of measurement and recording is of the order of 0.5%. This is one of

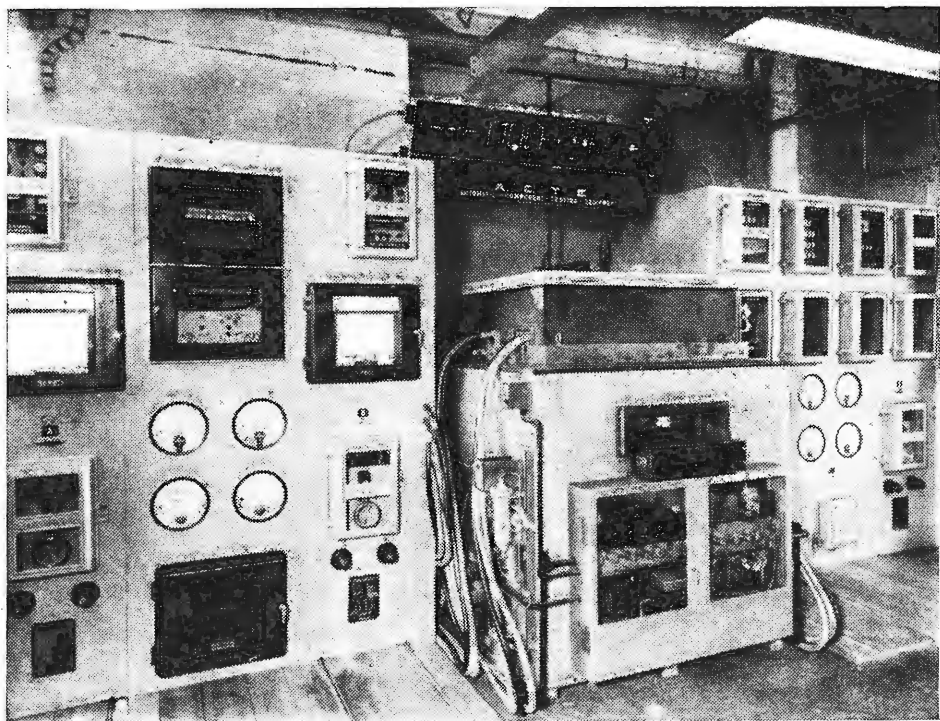
the first examples of automation in testing. Modifications of this machine, or further machines of this type for testing capacitors and other components, may be developed.

2. The Transistor Circuit Component:—In this type of component physical size comparable with that of the transistor is of importance, together with maximum reliability. Life times may well be of the order of 10,000 hours for Service equipment. The reduction in size of the transistor equipment is possible because of the lower voltages and currents used in transistors and many sub-miniature components have already been developed³. The danger to be avoided is extreme miniaturization affecting reliability, particularly for Service requirements.

In the United States of America a maximum voltage of 50 has been chosen for all transistor components and in this country a similar maximum voltage is being discussed by the Joint Service authorities. It is possible that agreed voltage figures may evolve to which all future Service transistor circuit components will be designed. At the moment these figures are 1.5, 3, 6, 9, 15, 30 and 50, but these are not yet finalized and await the outcome of discussions with the component industry. It would, however, be a most useful step to standardize voltages at this stage for all future transistor circuit components.

Considerable development is taking place in America and in this country on the design and development of these miniature components.

3. The High Temperature Component:—This requirement arises mainly in radio and radar equipment installed in high-speed, high-performance aircraft, although it is also required in guided



Modern equipment for the automatic testing of electronic components.

[Crown Copyright Reserved]

missiles and in some of the miniature high-power Army radio transmitters. In recent years considerable advances have been made in miniaturizing components. The use of these extremely small components in sealed assemblies aggravates cooling problems since there are smaller surface areas available to transfer waste heat to the surroundings, coupled with a general increase in power dissipation per unit volume as against conventional designs.

Various methods of cooling miniature equipments have been adopted, notably on airborne equipment. It is obvious that where components are available which can operate at the maximum temperature of, say, 150°C, in a confined space without cooling arrangements, considerable gains can be made.

The problem is particularly acute in airborne radar equipments where it is no longer possible to use the aeroplane itself as a heat sink. With the increased speeds of modern aircraft the temperature due to aerodynamic heating effects, such as friction, etc., becomes high and the rise in temperature in the Fairey D₂ during its record-breaking-speed flight was stated to be 100°C.

Some developments in high temperature components are described in detail in a recent publication⁴, but in general the design of components for use at high ambient temperatures precludes the use of organic materials, such as paper or the currently known plastics, and requires the use of inorganic materials, such as glass or ceramics. Certain plastics, such as p.t.f.e., and materials, such as silicones, can be used with advantage. Some recent developments in resistors and capacitors are described in a series of books currently being published⁵.

Testing components at temperatures of 100° to 150°C may also present difficulties, as handling them may need tongs or asbestos gloves.

4. Short Life Component:—This type of component is required for guided missiles, shell fuses, etc. Components must be extremely reliable and they may have a life of approximately 100 to 1,000 hours. This is not the flight time of the missile but the testing time necessary to set up and check the missile allowing for stand-by periods. Components must withstand high temperatures, vibration and long periods of storage, without deterioration.

They are expendable and whilst at the moment R.C.S.C. type-approved components are being used, because of the need for maximum reliability, in time reliable short life components may be developed which are comparatively inexpensive. It is possible that components with "guaranteed lives" may be produced.

A programme of work is being initiated by the R.R.E. on the relationship between life and ambient temperature of components in an attempt to establish initial data on a typical range of components such as resistors, capacitors, etc. The components will be tested to destruction and the information obtained will be valuable in improving the understanding of the effects of high temperature on the life of components.

It is, for instance, possible that certain types of impregnated paper-dielectric capacitors normally rated at 85°C can have a guaranteed life of 50 hours at a temperature of 150°C, with a slight increase of capacitance at this temperature.

5. The Very Long Life Component:—The

laying of the transatlantic cable and of other long-distance cables has necessitated considerable study of long-term corrosion, electrolytic action, silver migration and general degradation of materials used in components. The life expectancy of the standard components used in the repeater amplifiers of these cables is of the order of 20 years⁶. The lessons learned in these studies will be of great importance in improving the reliability of the R.C.S.C. range of Service components and also of those components used in the Atomic Energy Research Establishments, etc., where a component failure may affect a very long-term experiment and render it useless.

The Influence of Automation Techniques on Components:—Although as yet few automatic assembly machines are available in this country it is probable that the shape of components may be affected when assembly machines of this type are used in increasing quantity.

In the United States of America several automatic component assembly machines are in use which are capable of assembling up to 10,000 sub-units per day⁷.

Some proposals affecting future components are being made by Government authorities to the appropriate component manufacturers' committees such as:—

(a) In order to fit the insertion heads of these machines it is desirable that all future components, wherever possible, should be cylindrical in shape and should have axial leads.

(b) As holes are punched in the printed wiring chassis through which the components are inserted, the diameter of the leads becomes important. It has been suggested that all components should have two standard diameters, i.e., 20 s.w.g. and 26 s.w.g., with the possible introduction of 30 s.w.g. for miniature transistor components.

(c) Most Service components have, at the moment, lead lengths of 1½ to 2 in. In component insertion machines only a fraction of this length is used, the rest being chopped off in the machine. The proposal is now being made for all components to be made with lead lengths of 1¼ in. This is already being standardized in America.

(d) One of the most important points in component design for automation techniques is the ease of soldering of the connecting leads. The success of the dip-soldering operation which accompanies automatic machines depends entirely on this and solder coated or plated component leads are an advantage.

In addition to the tubular, axial-lead type of small component it is possible that a range of larger components, such as transformers, electrolytic capacitors, switches, relays, etc., may be developed which can be inserted by "snap-in" methods prior to dip soldering.

Conclusions:—It would appear that the trend in component development for Service use is away from single standard range into divisions or branches of the standard "reliable" range to suit particular and increasingly severe operational requirements.

With the general trend towards transistor constructions and automatic assembly techniques it may well be that the electronic equipment of the future will need components much smaller in size, extremely reliable for a given life period, and capable

of being automatically inserted in printed-wiring chassis.

With the rapid development of transistors and semi-conductor materials, film resistors, etc., it may even be possible to envisage future electronic equipment as a solid block with no connecting wires. The block may consist of layers of insulating, conducting, resistive, rectifying and amplifying materials, the electrical functions being connected directly by cutting out areas of the various layers.

References

¹ Inter-Service Standards for Radio Components; R.C.S.C.

² G. W. A. Dummer, *et al.*, "Maintainability of Services Equipment," *J. Brit. I.R.E.*, 15, No. 6, June, 1955, p 283.

³ G. W. A. Dummer, "Components for Transistors"—*Wireless World*, May, 1953, p 196.

⁴ G. W. A. Dummer, "High Temperature Components"—*Wireless World*, October, 1956, p 510.

⁵ Radio and Electronic Components; Vol 1, "Fixed Resistors"; Vol 2, "Variable Resistors"; Vol 3, "Fixed Capacitors"; Vol 4, "Variable Capacitors" (Sir Isaac Pitman & Sons Ltd.)

⁶ Halsey, R. J. & Wright, F.C., "Submerged Telephone Repeaters for Shallow Water," *Proc. I.E.E.*, 101, Pt 1, No. 130, July, 1954, p 173.

⁷ Markus, J., "Mechanized Production of Electronic Equipment," *Electronics*, September, 1955, p 138.

More Jobs for Computers

Recent Applications and Installations

Ever since computers came on the market as commercial products and computing time could be bought at so much an hour, the applications of these machines have been multiplying at a very fast rate, sometimes in the most unexpected directions. The following is just a random list of recent uses of both analogue and digital machines, and makes no attempt to present a balanced picture. It may, however, give some idea of the expansion which is likely in this branch of the electronics industry—already recognized by the formation of an Electronic Data Processing Section in the R.C.E.E.A. and the holding of a computer exhibition next year.

Payrolls continue to be the most popular application of digital computers, following the success of Lyons with their LEO I at Cadby Hall, London. Now, LEO I is also handling the payroll for 19,000 employees of the Ford Motor Company, while a LEO II machine is being installed at the Corby offices of Stewarts and Lloyds for their payroll and other work as well. The G.P.O. has ordered a system comprising two National-Elliott "405" computers for a payroll of 112,000 employees, amounting to £70,000,000 per annum.

Road Vehicle Suspension.—The effect of uneven road surfaces on vehicle suspension systems is being simulated by a Short Brothers analogue computer at the Brunswick Technical High School, West Germany.

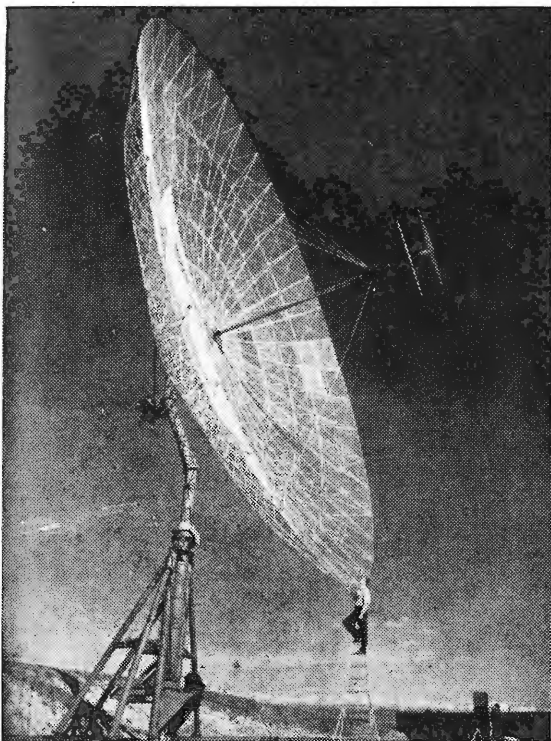
Weather Forecasting.—An entirely new method of forecasting the pressure distribution for 24 hours ahead by calculation has been developed by the Meteorological Office, treating the movement of the atmosphere as a problem in classical hydrodynamics. To handle the heavy computation in less than the three hours it takes at present a Ferranti "Mercury" digital computer is being installed at the Dunstable forecasting office.

Aircraft Design provides an enormous list of applications for both analogue and digital machines, too detailed to be covered completely. For processing wind-tunnel data Armstrong Whitworth are using a Ferranti "Pegasus" digital computer, and other machines of this type have been installed by Hawker's, Vickers-Armstrongs and the Royal Aircraft Establishment. Short Brothers are using one of their own analogue computers for simulating aircraft take-off problems, while Metropolitan-Vickers have a system for simulating kinetic heating in aircraft and missiles which incorporates their "950" transistor digital computer.

Biophysical Research.—The task of calculating the positions of atoms in the complex molecules of living tissue has been undertaken by a biophysics laboratory of London University, using a digital machine at I.B.M.'s London computing centre. Large numbers of alternative structures have been calculated for correlation with the results of observational methods. In this way it is hoped to establish that the atoms are arranged in particular patterns which can be represented mathematically.

Motor Racing Results.—An electronic computing centre using I.B.M. digital machines was set up at Le Mans this year to work out the placings of the cars during every hour of the race. It also provided accurate placings at the end of the contest.

Town and County Councils.—A National-Elliott "405" digital computing system is now calculating and printing rate demands in the City Hall, Norwich, and will also be used for other accounting work. Orders for "Hec" digital machines have been received by the British Tabulating Machine Company from the County Councils of Middlesex, Nottinghamshire and West Riding, from the Brighton and Derby County Borough



Specially designed 61-ft parabolic aerial system erected by the Stanford Research Institute, California, for gathering data on scattering and reflection of radio signals from meteor trails, and ionization associated with the aurora borealis, in the frequency range 100 to 1,000 Mc/s. Pulse transmitters of 50 to 70 kW output will be used initially in the 100 to 400 Mc/s range. A similar aerial has been erected also near Fairbanks, Alaska.

Councils, from Birmingham Corporation and from Durban City Council.

Educational Establishments.—To celebrate the higher technological status of the Northampton College of Technology (formerly Northampton Polytechnic) a Ferranti "Pegasus" digital computer has been installed. One of these machines is due also for Sheffield University (the purchase being shared with the United Steel Company). The Royal Air Force College at Henlow has installed an Elliott G-PAC analogue computer for use in the study of guided missiles.

Rail Distances.—The British Transport Commission has recently used LEO I at Cadby Hall for working out distances between all possible pairs of railway stations and goods depots in Britain for the purposes of their new freight charges scheme. The 7,000 stations and depots gave 50,000,000 permutations, but they were reduced to 4,000 groups to simplify the task.

Fuel Systems and allied problems are being studied by H. M. Hobson, of Wolverhampton, with the aid of an Elliott G-PAC analogue computer, and Dowty Fuel Systems of Cheltenham have ordered a similar machine for the same purpose.

River Water Levels.—A I.B.M. "650" digital computer at the company's London computing centre has been used to calculate water levels at 30 points along the River Nile over a period of 48 years, the object being to study the relative merits of irrigation and hydro-electric power schemes.

Management Information, leading to better managerial control, is said by the Morgan Crucible Company to be one of the chief advantages derived from the "Hec" digital computer (British Tabulating Machine Company) installed at their Battersea headquarters. Accounting and mathematical computation is also being handled.

Insurance Policy Records will be maintained by the South African Mutual Life Assurance Society at Cape Town using a large electronic data processing system called "PERSEUS" which has just been ordered from Ferranti.

Technical Consultancy Service operated by Stenhardt Ingeniörsfirma, a small and specialized engineering company in Stockholm, has recently extended its facilities by the installation of a Short Brothers analogue computer.

Sales Statistics will be handled, among other things, by an Elliott "405" digital computer at Littlewoods Mail Order Stores, and by a Ferranti "Pegasus" at I.C.I., Blackley. Both machines are on order.

Flame Cutting Control.—New developments in oxygen cutting of metal plates by the British Oxygen Company have involved the application of Ferranti's methods of controlling machine tools by digital computers.

Hydromechanical Research.—For processing data from a water tunnel, and other uses, an English Electric DEUCE digital machine has been ordered by the Mechanical Engineering Research Laboratories at East Kilbride, Scotland.

The Dawn Chorus

A New Type of Audio-frequency Atmospheric

INTEREST in audio-frequency "whistler" atmospherics¹ has been considerable since it was realized that observations at various latitudes could give information on the electron density at heights well above the (at present) highest known ionospheric layer (F2). The recent discovery of a high-latitude form of whistler² offers prospects of also determining the strength of the earth's magnetic field at such great heights.

A recent paper³ describes results on another type of audio-frequency atmospheric, which has been called the "dawn chorus" since it consists of many rising (typically from 2 to 4 kc/s) tones, sounding rather like a distant rookery; and it occurs most often in the early morning. This is in contrast to the single falling tone of "whistlers," which occur throughout the day.

Records are obtained as before, simply using an aerial (orientated for minimum local hum pick-up) feeding a band-limited (1 to 7 kc/s), high-gain (80 dB) audio amplifier. The output of this amplifier is for convenience recorded on magnetic tape for four minutes every three hours, two days a week.

Observations at Wellington, New Zealand, show good correlation between the strength of the dawn chorus and the amount of magnetic activity. When data from three American and two New Zealand stations were compared, good correlation was found between dawn chorus activities at stations which, though far apart, lie on approximately the same line of force of the earth's magnetic field. Observations were also made to determine whether the same dawn chorus is heard at different stations. Unfortunately, individual rising tones are weak and difficult to identify, so that occasional sudden bursts

were used instead. These were received apparently simultaneously at Wellington and at Unalaska (Aleutian Islands), which lie on neighbouring magnetic lines of force. These results suggest that dawn chorus signals are propagated along magnetic lines of force, as are whistlers⁴.

No correlation could be observed between dawn chorus and whistler activity. Also, no audible forerunners of dawn chorus signals, like the "clicks" generated by lightning which can often be correlated with whistlers, have been found. Thus it is unlikely that such signals originate in the lower atmosphere.

Results from various stations also show a pronounced daily variation in the strength of dawn chorus signals, the time of greatest signal strength remaining unchanged throughout the year. However, this time of maximum signal does vary with the geomagnetic latitude, and in a manner consistent with the idea that dawn chorus signals are initiated by positively charged particles which approach the earth in its (magnetic) equatorial plane, and are deflected by its magnetic field. Because of the correlation of dawn chorus with magnetic activity, and the daily variations in signal strength which occur at the same time throughout the year, such particles presumably come from the sun.

The rising tone cannot be caused by propagation effects as these are responsible for the falling tone of whistlers (the higher frequencies travel faster than the lower). A possibility is, however, that the frequency of a particular source increases as the incoming particles penetrate to lower heights. Proton plasma oscillations can perhaps produce suitable frequencies, in which case the lowest frequency in the chorus should increase as the observation station approaches the equator.

⁴ Morgan and Allcock, *Nature*, Vol. 177, p. 30 (Jan. 1956).

¹ Storey, *Phil. Trans.* A246, p. 113 (1953). Storey's results are also described in *Wireless World* Vol. 49, p. 338 (July 1953).

² Helliwell et al. *J. Geophys. Res.* Vol. 61, p. 139 (1956).

³ McK. Allcock, *Austral. J. Phys.*, Vol. 10, p. 286 (June 1957).

LETTERS TO THE EDITOR

The Editor does not necessarily endorse the opinions expressed by his correspondents

Colour Television

I WOULD like to point out that your report on the Paris Colour Television Symposium (August issue) when referring to the comparative performances and costs of colour display devices misquotes me to such an extent that it completely reverses the meaning I had intended.

The order of performance that I gave was: (1) three-tube projection with best performance, (2) three-gun shadow-mask tube, (3) beam-indexing tube, (4) three-gun focus-grid tube, and (5) beam-switching tube with lowest performance. The order of increasing cost was: (1) beam-switching tube at the lowest cost, (2) beam-indexing tube, (3) three-gun focus-grid tube, (4) three-gun shadow-mask tube, and (5) three-tube projection with the highest cost.

CHARLES J. HIRSCH,
Hazeltine Research Corporation.

New York.

Projection Television

FROM the remarks of your correspondent O. V. Wadden in the September issue, it is obvious that he has never had the opportunity of seeing a forward projection television receiver in the home. I have been using for two years now a slightly modified Philips 1800 chassis throwing a picture 32 in x 24 in on a screen made from hardboard sprayed with aluminium paint. Far from having to darken the room, I can use 450 watts and still view comfortably.

I think that manufacturers have "missed the bus" by neglecting forward projection and concentrating

on bigger, unwieldy and expensive direct view c.r.t.s. Everyone who has seen my picture says, "Where can I buy one like it?" I am a television engineer and see them all, but I would never go back to direct viewing.

Mr. Wadden's condemnation of forward projection probably arises from the fact that most demonstrators of these receivers are too greedy in screen size, with a consequent serious loss of light. For the same reason "Free Grid's" idea (July issue) of the projector in one wall of a room and the screen in the other is equally absurd unless, of course, he lives in a cupboard!

A. G. TUCKER.

London, N.W.6.

Transistor Oscillator Stability

MR. SCROGGIE'S reference, in his article on "Transistor Oscillator Stability," in your September issue, to a long-term frequency drift surprised me considerably as I have never seen any indication of this effect in an OC45, or for that matter in any other Mullard transistor. I should therefore be most interested to know if Mr. Scroggie did in fact observe this effect on any Mullard transistor.

L. P. MORGAN,
Mullard Research Laboratories.

Salfords, Surrey.

The author comments:

I would assure Mr. Morgan that I, also, did not observe the long-term frequency drift in any Mullard samples. The effect was no doubt an abnormality attaching to one or two experimental samples I used in my tests.

M. G. SCROGGIE.

Standard Chassis

THE improved version of the pre-fabricated chassis described in the September 1955 *Wireless World*, and said in our September issue of this year to be available in commercial form, is supplied as a kit of parts for assembling a chassis measuring 16 in x 7 in x 7 in. As the illustration shows, two such units can be joined together to provide a large chassis and any number, within reason, can be joined together in a similar way.

A single kit consists of 2 end plates (a), 2 runners

(b), 2 brackets (c), 6 small and 3 large valveholder plates (d), 6 potentiometer brackets (e) and 6 blank plates (f). The various parts are made of cadmium-plated steel and the end plates have provision for mounting power-supply connectors, jacks, toggle switches and terminal strip.

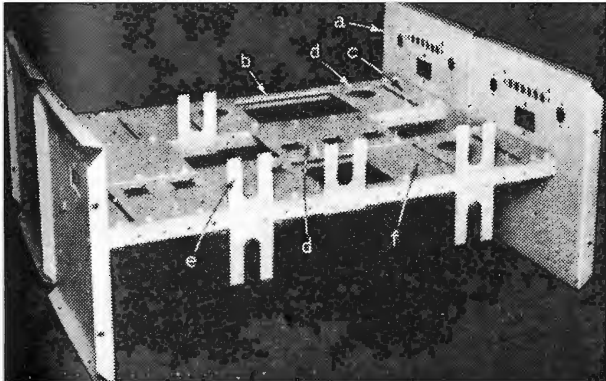
The chassis kit is obtainable from Cowell Developments, 67, Long Drive, East Acton, London, W.3, and a single kit costs 45s complete with all necessary screws.

Transistor Audio Amplifiers

THIS is one of those subjects on which up-to-date information is rather scattered. However, a *Wireless World* book which has just been published covers practical and theoretical aspects of this field from the latest viewpoint. The authors, D. D. Jones and R. A. Hilbourne, are engaged in transistor developments at G.E.C.

The book deals mainly with germanium p-n-p transistors as these are the only type commercially available in Great Britain at present. An introductory chapter on this type of transistor has sections on its various equivalent networks. Small signal amplifier design is then discussed including such points as signal to noise ratio and tone controls. The chapters on power amplifiers evaluate the relative advantages of class A or class B operation, and also deal with mismatching and other causes of distortion. A number of practical small and large signal amplifiers are also discussed.

"Transistor A.F. Amplifiers" is obtainable from our publishers, Iliffe and Sons Ltd., price 21s (postage 8d).



Modern Thermionic Cathodes

Review of the Main Types and Their Relative Merits

By R. W. FANE*, M.Sc., A.Inst.P.

DURING and since the second world war the problem of obtaining thermionic cathodes yielding high current densities with long life has been the subject of intense research and development. The difficulties in the most commonly used oxide coated cathodes have become more and more apparent with the increased interest shown in microwave valves operating under extreme conditions.

Investigations into alternative methods of producing cathodes capable of withstanding ionic bombardment, gas poisoning, mechanical and thermal shock and at the same time yielding a high and stable current density (amperes per square centimetre) have led to some very interesting results. An outline of the most important developments and an assessment of their relative merits is given in the following pages.

The choice of material for use as a thermionic emitter is chiefly governed by considerations of melting point, ease of fabrication and the work function. This latter quantity appears in the well-known Richardson equation relating "saturated" or "temperature limited emission" to the absolute temperature, viz:—

$$I = AT^2 \exp. (-\phi/kT)$$

where I is the saturated emission in amperes per sq cm, A is a constant, amperes/cm²/deg², T is the temperature in °K, k is Boltzmann's constant, 8.6×10^{-5} e.v./deg, and ϕ is the work function measured in electron volts (e.v.), ranging from rather less than 1 to 5 e.v. The value of I is difficult to determine experimentally as the emission, particularly in the case of oxide cathodes, is never truly saturated, an increase in anode-cathode voltage always giving rise to some increase in emission current (Schottky Effect). The value often taken (see Fig. 1) is that at which the current versus voltage curve departs from the space-charge-limited line ($3/2$ power law). Alternatively a logarithmic plot of the portion beyond the "knee" of the characteristic is extrapolated to zero volts to give the required value. The current which may be drawn using microsecond pulses is, in general, considerably higher than the d.c. rating and is considered to be the true emission for work function calculations.

For the purpose of this review all cathodes are considered as belonging to one of the following groups:—

- (i) pure metals,
- (ii) atomic films,
- (iii) oxide emitters.

Pure Metals.—Tungsten has held pride of place in the first group for many years. As it is not readily fabricated into sheet its use is restricted to directly heated filaments and where robustness is of prime importance, giving some 500 mA/cm² at 2300°C with $\phi=4.5$ e.v. and $A=60$ amperes/cm²/deg². The expected life under such conditions is 10,000 hours. For

unipotential cathodes, tantalum ($\phi=4.1$) is preferred. The high temperature required makes radiation heating impracticable and such cathodes have been heated by bombardment with electrons from a subsidiary tungsten filament. Such a system has been used in some high power klystrons.

Atomic Films.—The characteristics of the second group are mainly determined by a thin film, believed to be one atom thick, of barium or thorium on a refractory metal. Some of the most important recent advances belong to this category, their behaviour being analogous to thoriated tungsten. In the first instance about 1% of thorium oxide was added to tungsten wire during manufacture to improve its mechanical properties. Later it was found that metallic thorium, produced by the reduction of the oxide at high temperature, diffused to the surface and formed an electric double layer with positive charge outermost reducing the work function to 2.6 e.v. Owing to the strong forces of adhesion the cathode can be operated at high temperatures without undue evaporation of active material. Further improvement is shown if the outer layer of the tungsten is converted to tungsten carbide. The active life of the filament depends upon the maintenance of the thorium layer and many thousands of hours are obtained at 1600-1800°C drawing 1-5 amperes/cm². While such filaments have been used extensively in medium and high power transmitting valves they cannot be used in microwave valves utilizing an electron gun structure where a planar cathode is necessary.

Similar properties are obtained with monatomic films of barium on tungsten, but in this case the work function is 1.6 e.v. Such a layer is, however, relatively unstable. An adsorbed layer of oxygen between the barium and the tungsten lowers the barium evaporation rate but some method of replenishment is necessary to make such a cathode of practical value. This has been achieved in the "L" type dispenser cathode announced by the Philips Laboratories in 1949*. In this, and other types to be described, porous tungsten is an essential part of the structure. This is produced by pressing tungsten powder at 50-100 tons/in² in a steel die and then sintering the compact at high

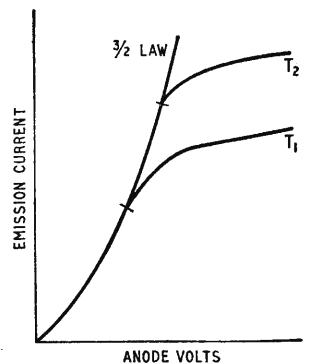


Fig. 1. Diode characteristics for two temperatures, T_1 and T_2 , showing departure from the space-charge-limited line.

*Research Laboratories, Marconi's Wireless Telegraph Co.

temperature in a protective atmosphere. The porosity (ratio of pore volume to total volume) is 20-50%.

Fig. 2 shows the basic construction of a planar "L" cathode. A double-ended molybdenum cylinder is closed at one end by a porous tungsten plug. The cavity so formed contains barium and strontium carbonates. Heating the cathode to 1100°C in vacuum converts the carbonates to oxides. Continued activation at a higher temperature results in the reduction of barium (and strontium) oxide by the tungsten, yielding barium (and strontium) which diffuses to the surface and is continually replenished from the reservoir. Some controversy exists at present as to the exact nature of the emitting surface. At 1100°C the d.c. saturation current density is 2-3 ampere/cm². At 1000°C and a current density of about 1 ampere/cm² lives of 8-10,000 hours are obtained. Good performance has been given by such cathodes in microwave valves, particularly klystrons. Little has been published regarding the use of "L" cathodes in travelling-wave tubes, but the smooth surface should be of advantage in low-noise tubes although this is somewhat offset by the high operating temperature. A further consequence of the high temperature is the difficulty in mounting the cathode in a vacuum tube; for example mica supports have to be replaced by alumina ceramics.

The impregnated cathode², a modification of the above type, has simplified the structure by eliminating the need for a gas-tight weld round the tungsten plug, at the same time improving the temperature distribution and reducing the processing time. In this case the pores of the tungsten are filled with normal and basic barium aluminates, BaAl₂O₄ and Ba₃Al₂O₆, the cavity containing the carbonates being dispensed with. The aluminates gives rise to barium oxide on heating, the behaviour of the cathode then being identical in all respects to the "L" type. A further improvement has been obtained by adding a small quantity of calcium oxide to the aluminates³. At 1100°C a d.c. saturation emission of 4 or 5 amperes/cm² is obtained, the peak microsecond pulsed emission being about 12 amperes/cm². A considerable reduction in the barium evaporation rate is also claimed which should result in considerably longer life.

The latest modification of the impregnated cathode has recently been described by Hughes and Coppola⁴. The improved impregnant, in powder form, is mixed with 50-50% molybdenum-tungsten alloy powder, pressed into a retaining molybdenum cylinder at 70 tons/in² and sintered at 2000°C in a hydrogen atmosphere. In a well processed valve d.c. emissions comparable with pulsed values can be drawn and the authors claim lives of 5,000 hours drawing a current density of 10 amperes/cm² at 1130°C. This simplified technique of producing such cathodes makes them an attractive commercial proposition. As with the types mentioned previously, exposure to atmospheric pressure after activation causes no permanent damage and repeated reactivation can be achieved.

Finally, the cathode described by Beck and his associates⁵ is considered as belonging to the second group. A mixture of about 70% nickel and 30% barium and strontium carbonates is used. As pure nickel will not reduce barium oxide, some reducing agent, in this case zirconium hydride, is used (about

1%). After pressing into a metal retaining cylinder the cathode is mounted in the valve and heated to about 1100°C, causing the carbonates to dissociate and the nickel to sinter into a strong matrix. In general the temperature required for a given emission is about 100°C higher than that of an oxide coated cathode but resistance to poor vacuum conditions enables larger d.c. currents to be drawn. Although no evaporation rate information is available, lives of 5,000 hours at 1000°C and 1 ampere/cm² have been recorded. At this temperature a pulsed emission of 10-30 amperes/cm² could be obtained. Again, use can be made of such cathodes in demountable vacuum systems and the authors claim good results when used in klystrons and television cathode ray tubes.

Oxide Emitters.—The most important and oldest member of the final group is the oxide coated cathode. This consists of a coating of barium and strontium (and often calcium) carbonates on a nickel base. The reduction of the oxides, subsequently formed in vacuum, by impurities in the nickel (in particular silicon, magnesium and titanium) produces an excess of barium (and strontium) in the oxide crystals and is thought to be responsible for the cathode activity.

The low work function, about 1 e.v., and long life (20-50,000 hours) accounts for the very extensive use of such cathodes in all low-power valves requiring some tens of mA/cm². As mentioned previously, however, resistance to ionic bombardment and gas poisoning is poor and the electrical properties of the coating limit the d.c. emission current density to less than 500 mA/cm² (at about 850°C) for a reasonable life. In pulsed operation with low-duty cycle the emission is from five to ten times higher than the d.c. values but a limit is ultimately set by arcing and a disruption of the coating. Some improvement in mechanical properties can be achieved by welding a nickel mesh to the base metal before applying the coating, thereby improving the bonding. The alkaline earth oxides are, however, employed as the basic active material in all modern types of cathodes, thermal efficiency having been somewhat sacrificed in favour of other desirable features.

Using oxide cathode materials in powder form, namely, nickel and alkaline earth carbonates, MacNair, Lynch and Hannay⁶ have briefly described "molded" or nickel matrix cathodes made by the pressing and sintering technique. Although d.c. current densities as high as 10 amperes/cm² at temperatures of about 1000°C are reported, no life-test studies have been made at such high currents. Lives of 5,000 hours with cathodes operating at 850°C and 500 mA/cm² have been obtained using high anode voltages. The pulsed emission is approximately six times the d.c. values. Conditions of ionic bombardment which produced a fivefold decrease in the

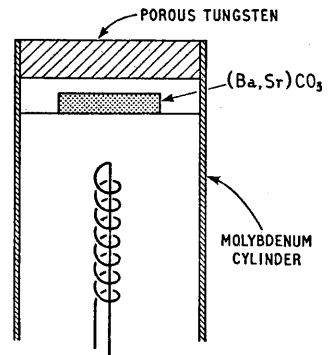


Fig. 2. Construction of the "L" type dispenser cathode.

emission from an oxide cathode caused no significant change in the "molded" cathode.

Cathodes with similar properties but with a slightly different method of preparation have been developed at the Honeywell Research Centre⁷. In this case the carbonates have been chemically precipitated into the pores of a previously formed nickel matrix. The work function is 1-1.25 e.v. No life-test information is recorded. Although the above nickel cathodes appear to behave in a similar manner to oxide cathodes, results are largely empirical and the mechanisms involved are not completely understood. There have been no reports of such cathodes having been used in practical devices but they are likely to find application where a few amperes/cm² d.c. or tens of amperes/cm² pulsed emission are required at operating temperatures little above those of an oxide cathode.

Research into the thermionic properties of materials other than the alkaline earth oxides has yielded little of practical value, with the possible exception of thorium oxide. Coatings of this oxide on tungsten, tantalum or molybdenum have been used, for example, in power tetrodes and magnetrons, where a rugged cathode is required even at the expense of extra heater power. The life at current densities greater than 1 ampere/cm² has, however, been disappointing. A sintered mixture of molybdenum and thoria, called the "Cermet" cathode, has also been used, particularly in magnetrons, where electron bombardment would damage any conventional coating and the higher heat dissipation can be used to advantage.

Conclusion.—Some of the work which has been done on the various types of cathodes has necessarily been omitted but the most important parts of each section have been discussed to indicate the developments round which future valves, particularly those in the microwave field, will be designed. The scanty life-test information at present available and the relatively small number of valves which have been made incorporating the various cathodes make it impossible to give more than a tentative assessment of their relative merits.

Several very important features, such as recovery from gas poisoning, machinability and mechanical strength, smooth surfaces and low electrical resistance are, however, common to the various derivatives of both the atomic film emitter and the oxide cathode. For all ordinary low current applications the oxide cathode is still preferred.

The nickel matrix cathodes follow next as regards thermal efficiency and have many interesting features to commend them, including easy machinability—with tungsten special techniques have to be employed. Emission of 1 or 2 amperes/cm² d.c. at 830-900°C with a good life can be expected. Lives in excess of 5,000 hours have been obtained in these laboratories from cathodes of a similar type operating at 830°C drawing 1 ampere/cm² d.c. at high anode voltages.

The "L" cathode, and particularly the latest pressed type, are likely to find widespread use, although the more expensive mounting techniques and higher heater wattage required will limit their use to the more expensive high-power and microwave valves requiring high continuous current densities.

The utility of all the above-mentioned cathodes in

low-noise travelling-wave tubes is not yet clear. Non-uniformity of emission over the cathode surface still remains a problem. Improved surface coverage by the barium in the case of the atomic film emitters and a finer and more even pore distribution in all cases may do a great deal to improve the noise characteristics.

Operating conditions of the various cathodes with an indication of expected life are summarized in the following table:—

Type	Operating Temp. (°C)	D.C. Emission (amperes/cm ²)	Life (Hours)
Tungsten	2300	0.5	10,000
Tantalum	2100	0.5	10,000
Thoriated tungsten "L" and impregnated	1750	1-3	15,000
Improved impregnated and pressed	1000	1	10,000
Nickel matrix ..	960-1130	0.5-10	>5,000
Oxide coated ..	850-900	1	>5,000
	830	0.5	5,000

REFERENCES

- ¹ Lemmens, H. J., Jansen, M. J., Loosjes, R. "A New Thermionic Cathode for Heavy Loads," *Philips Tech. Rev.*, Vol. II, 1949-50, p. 341.
- ² Levi, R. "New Dispenser Type Thermionic Cathode," *J. App. Phys.*, Vol. 24, 1953, p. 597; *I.R.E. Conv. Rec.*, VI (part 6), 1953, p. 40.
- ³ Levi, R. "Improved Impregnated Cathode," *J. App. Phys.*, Vol. 26, 1955, p. 639.
- ⁴ Coppola, P. P., and Hughes, R. C. "A New Pressed Dispenser Cathode," *Proc. I.R.E.*, Vol. 44, 1956, p. 351.
- ⁵ Beck, A. H., Brisbane, A. D., Cutting, A. B., and King, G. "A New Type Diffusion Cathode," *Le Vide*, Vol. 9, 1954, p. 302.
- ⁶ MacNair, D., Lynch, R. T., and Hannay, N. B. "Molded Thermionic Cathodes," *J. App. Phys.*, Vol. 24, 1953, p. 1335.
- ⁷ Balas, W., Dempsey, J., and Rexer, E. F. "An Oxide Impregnated Nickel Matrix Cathode," *J. App. Phys.*, Vol. 26, 1955, p. 1163.

BIBLIOGRAPHY

- Wright, D. A. "A Survey of Present Knowledge of Thermionic Emitters," *Proc. I.E.E.*, Vol. 100 (part 3), 1953, p. 125.
- Vick, F. A. "Some New Thermionic Cathodes," *Science Progress*, Vol. 44, 1956, p. 65.
- Danforth, W. E. "Thorium Oxide Electronics," *Advances in Electronics*, Vol. 5, p. 169 (Academic Press Inc., 1953).

Electronic Telephone Exchange

ALTHOUGH much development work has been done on electronic telephone exchanges they are not likely to come into widespread use in the public service for some time. There is no reason, however, why they should not be used extensively for private automatic installations in offices, factories, and so on. Here they offer the important advantages of small size and absence of moving parts, which are often a source of trouble. As an example, Pye Telecommunications have just produced a 10-line private automatic exchange which measures only 20in x 19in x 12in. The switching is done by Z50T cold-cathode valves, with two thermionic valves for shaping the incoming dialling pulses. It has an interesting storage feature by which if a wanted extension turns out to be "engaged" it is automatically rung again as soon as the person there replaces his handset.

Stabilization of A.C. Supplies

A Comparative Review of Methods of Voltage Control

By O. E. DZIERZYNSKI

THEORETICAL circuits and commercial apparatus for stabilizing a.c. power supplies are not so well known as those for d.c. supplies. A possible explanation is that a.c. voltage stabilization circuits demand certain special components for the degree of stabilization achieved to be comparable with that obtainable in d.c. systems. The power handling capacity (and consequently size) of a.c. stabilizers is also often greater than that normally required. However, it frequently happens that d.c. stabilization is not good enough owing to a.c. valves heaters being affected by mains voltage variations, with consequent uncertainty in gain.

In this article it is proposed to give a very general survey of possible a.c. stabilizing systems, pointing out their advantages and disadvantages.

Performance Requirements.—There are four main requirements for a mains voltage stabilizer. The first of these is the accuracy of stabilizing action.

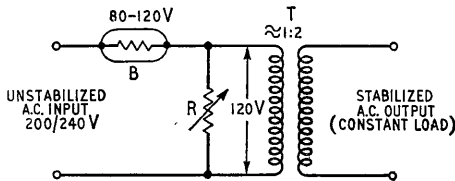


Fig. 1. Barretter stabilizer (constant load).

The requirement for this can be within $\pm 0.05\%$ up to within say $\pm 2\%$, but stabilization to better than $\pm 0.5\%$ can be considered as very good. As an illustration of the meaning of this requirement, if the required mains voltage is 200V to within $\pm 1\%$, the stabilized voltage can be allowed to drift between 198V and 202V, without any action being performed by the stabilizer. As soon as the voltage drops down to say 197.5V, the stabilizer will act to raise the voltage until the level is close to 200V. In an ideal case, the voltage should be set back to exactly 200V. Normally the value reached is somewhat higher—say 201V; but in a well designed stabilizer it should not come too close to the upper limit of 202V as overshooting effects may be experienced. Alternatively, the voltage may not be reset enough, and it would reach only say 198.5V.

The second requirement for a stabilizing system is the speed of response, which is defined as the accuracy of the system divided by the time taken to reset the voltage for a change equal to this accuracy (the regulating time); i.e. in the last example the time taken to reset upwards from 198V, or downwards from 202V. For instance, if this

resetting time is 1 sec., the speed of response would be 1%/sec. The majority of a.c. voltage stabilizers do not act fast enough to deal with sudden mains voltage changes such as those produced by switching electrical apparatus.

It is important to realize that both these factors (speed of response and accuracy) are in practice interdependent. If, for instance, our voltage limits are set closer, say to within $\pm 1V$, with the same speed of response, the regulating time would be only 0.5 sec. Increasing the accuracy in stabilizing systems generally necessitates a slower response speed; otherwise overshooting and hunting effects will be unavoidable. Response speeds can be up to 5%/sec. in motor-driven systems (1/5 sec. for 1% change), but magnetic reactor stabilizers offer much higher figures (1/200 sec. for 1% change).

The third requirement associated with stabilizing systems is the output waveform. In certain applications it is important to have the power supply free from distortions of the original sinusoidal waveform. Unfortunately stabilizing circuits using non-linear elements, as for example saturated inductances, introduce such distortions. They can be removed by using low-pass filters, but this is rather a cumbersome remedy as the mains frequency is comparatively low so that filter elements (condensers, inductances) have to be large, and consequently expensive.

The stabilized power needed is the fourth and last requirement to be discussed. When these powers are large (say over 0.5 kW) motor-driven variable voltage transformers are preferred, as the cost of such regulating equipment rises very slowly with the controlled power, which is not the case for stabilizers with no moving elements.

Simple Stabilizing Circuits.—If we consider the case where a stabilized a.c. source is supplying a constant load, a quite simple stabilizing device can be designed (see Fig. 1). The barretter B is inserted in series with the primary of the step-up transformer T, and this stabilizes the current drawn from

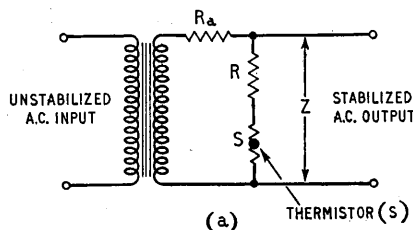
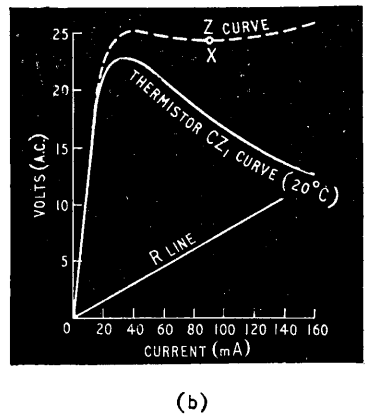


Fig. 2. Circuit of thermistor stabilizer and current/voltage relationships in the branch Z.



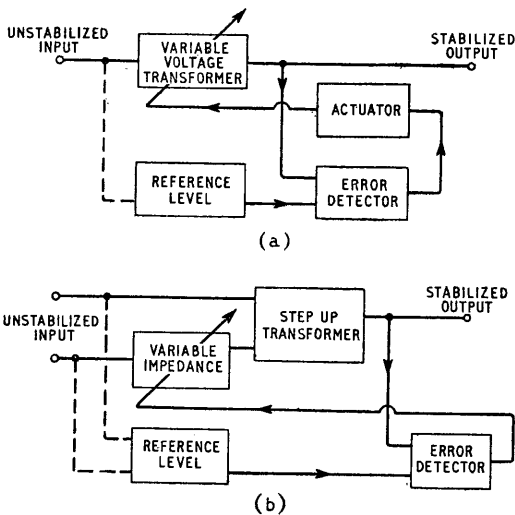


Fig. 3. General block diagrams of complex stabilizers.

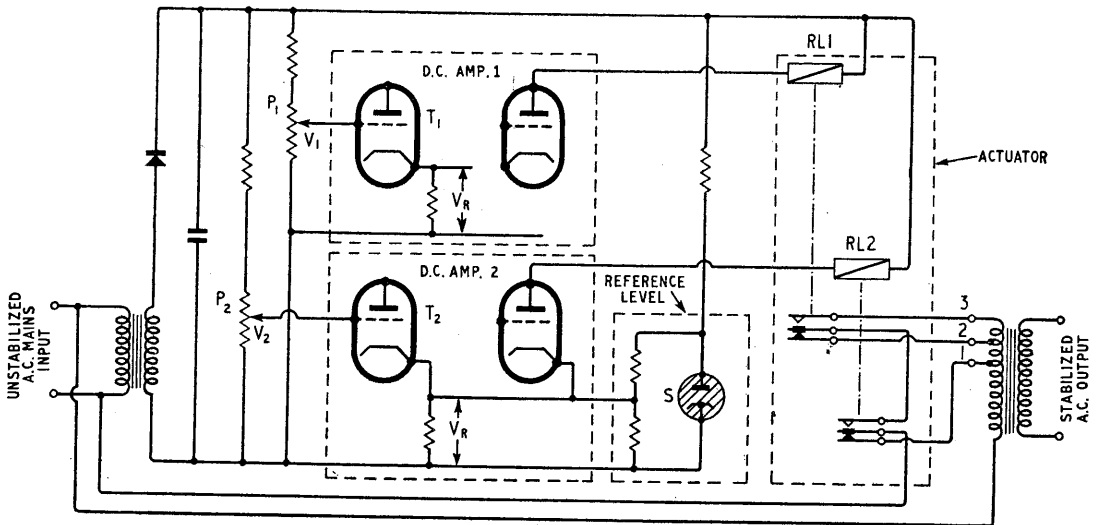


Fig. 4. Stabilization in steps using relays and tapped transformer.

the mains. With a constant load, the primary and secondary voltages will then be stabilized, and any voltage variations will occur across the barretter.

This method works quite successfully providing that the power required is not too large and, as previously stated, that the loading conditions are constant. The maximum available stabilized power can be calculated as follows. Assuming that, for instance, a barretter type 301 (G.E.C.) is employed, the required voltage drop across the latter would be about 100 volts, and the rated current 0.3 amps. Hence there would be about 120V (assuming 220-V mains) on the primary of the transformer, and the power delivered to the load would be given by

$$\text{Power} = 120 \times 0.3 \times \text{efficiency of } T \approx 120 \times 0.3 \times 0.8 = 29 \text{ watts.}$$

The transformer in such a circuit should have a step up ratio of about 1:2. Furthermore, the primary winding should be calculated for the actual barretter current, otherwise it is necessary to shunt

the primary by a resistor R to secure a sufficiently high current through the barretter. In certain applications such a resistor R can be made variable (possibly in steps) to allow for varying loading conditions. It is obvious that, if the load is taken off, the shunting current in R must be made larger to maintain a constant voltage across the primary; so that R has to be set to its minimum value. Conversely with increasing loads, R has to be set to a higher value.

Another simple stabilizing system is the saturated core mains transformer. Even with only a small load on the secondary, the magnetic flux reaches saturation when the a.c. current approaches its maximum, and the output waveform is flattened. With increased loads, the waveform approaches a square wave shape, and consequently the output is rich in odd harmonics; though its r.m.s. value remains practically constant. As stated previously, if a better waveform is required, a filter can be provided. Even so this system still has the disadvantage of the heat developed in the saturated transformer, which results in a rather low efficiency, an important factor if large powers are required.

Fig. 2 (a) shows the use of a thermistor as a non-linear device for stabilizing a low a.c. voltage. An impedance Z connected across the load, consists of an ordinary resistor R and a thermistor S connected in series.

In Fig. 2(b) the voltage/current characteristic of a thermistor type CZ₁ (S.T.C.) is shown. The straight line on this graph represents the voltage/current characteristic of the resistor R. The third curve (dotted line) gives the resulting characteristic of the compound impedance Z. It can be seen from this curve that, by choosing a suitable value for R, the "dynamic resistance" at a point such as X on the impedance Z curve can be made very small.

The stabilizing action of the circuit in Fig. 2(a) then follows, assuming that for an average mains voltage of say 220V the stabilized output voltage corresponds to the point X on the impedance Z curve. Any tendency of the output voltage to vary is nullified by large current changes in Z (due to its

low "dynamic resistance") acting through the resistance R_a in series with the load.

The thermistor CZ_1 combined with a resistor R of 69 ohms will deliver only 25V stabilized a.c. If a normal stabilized a.c. mains supply is required (say 225V) 9 thermistor CZ_1 's and a 620-ohm resistor could be connected in series.

Stabilizing action of this sort is very similar to that of reference tubes in d.c. circuits and gives good results, particularly when only low powers are needed.

Complex Stabilizing Systems.—Fig. 3 represents the basic functional diagrams of two more complex systems. In both of these circuits a reference level and the stabilized output feed the error detector. In the system of Fig. 3(a), the error detector output varies the stabilized output voltage through the variable voltage transformer by mechanical means. In Fig. 3(b) the output voltage is altered using a variable impedance (inserted in series with the primary of the step-up transformer) which is controlled by the error detector output purely by electrical means (no moving parts). The reference level device (voltage or current) is usually fed from

two driving relays, RL1 and RL2. The reference voltage V_R derived from the d.c. reference tube S is connected in opposition with V_1 , a fraction of the unstabilized a.c. voltage (obtained from the potentiometer P_1), in the grid circuit of the first valve T_1 of the d.c. amplifier No. 1. Similarly, in the grid circuit of the input valve T_2 of the second d.c. amplifier voltages V_R and V_2 are connected in opposition. Potentiometers P_1 and P_2 are adjusted so that V_1 is slightly greater than V_2 , and, for mains voltages below 220V, both first valves T_1 and T_2 do not conduct ($V_R > V_1 > V_2$), and thus both the output relays RL1 and RL2 are energized.

As can be seen from the circuit, two sets of contacts on RL1 and RL2 are connected so that when both relays are energized, the mains lead is connected to tap No. 1 on the output transformer. For mains voltages between 220 and 240V, valve T_1 starts conducting, RL1 is de-energized and the mains are switched over to tap No. 2. Finally, for mains voltages higher than 240V, both T_1 and T_2 are conducting, both relays are off, and the mains are connected to tap No. 3. This method of mains stabilization, though rather crude, secures a mains

voltage stable within limits of $\pm 5\%$, providing that the input voltage does not fall below 200V or rise higher than 260V. The d.c. amplifier used in this system could be similar to that described by the author in the September 1956 issue of *Wireless World* (p.441).

Figs. 5 and 6 show two circuits of stabilizers also belonging to the group of Fig. 3(a). In Fig. 5 the reference voltage is V_0 (d.c.) obtained by rectification of the a.c. supply from the transformer T which has a barretter B in series with its primary. The d.c. voltage V is of the same order as V_0 and connected in opposition with it. Consequently, with V_0 equal to say 400V, and V for a mains voltage of 220V also equal to 400V, the potential across

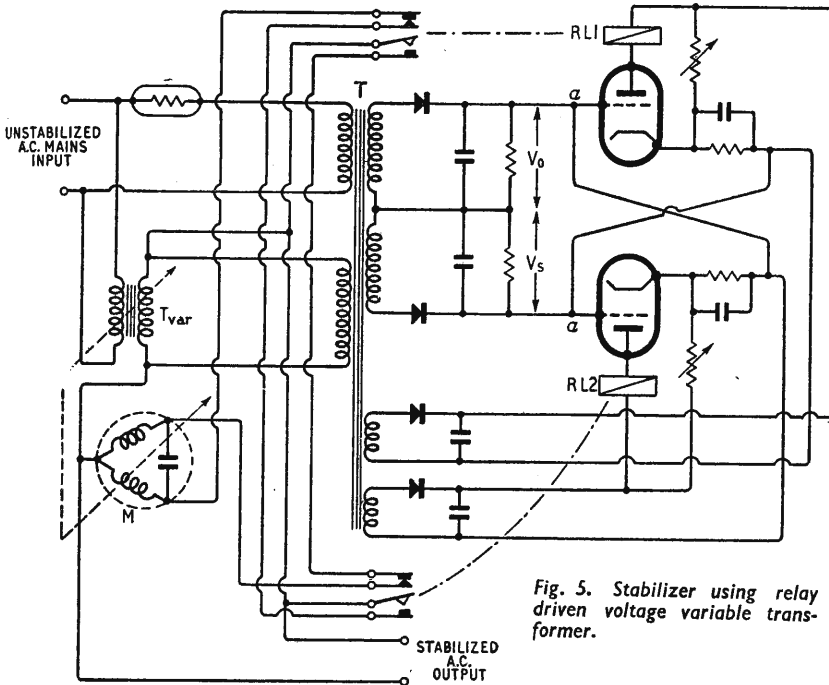


Fig. 5. Stabilizer using relay driven voltage variable transformer.

the a.c. input. However, this is not essential, and in certain cases a dry battery might be employed; and therefore in Figs. 3 connections between the a.c. input and the reference level block are shown by dotted lines.

The "actuator" in Fig. 3(a) could be either a servomotor (including relays energized from the error detector) driving the variable voltage transformer continuously, or two (or more) relay systems switching different tapings on the mains transformer. Obviously, this second system can only regulate in steps. A more detailed treatment of such a circuit is given below.

Stabilizing Systems using Moving Parts.—Fig. 4 represents a stabilizing circuit employing

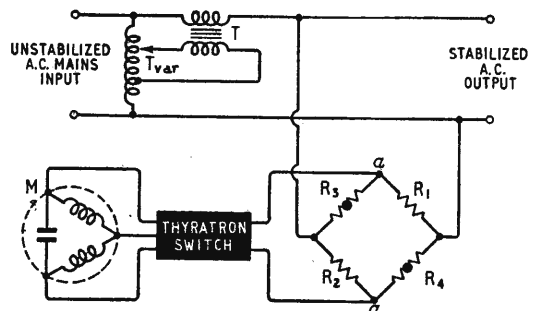


Fig. 6. Stabilizer using thyatron switched voltage variable transformer.

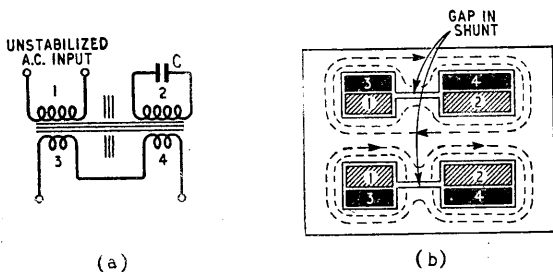


Fig. 7. "Sola" saturated transformer stabilizer.

$a-a$ is zero and valves T_1 and T_2 are balanced. The relays RL1, RL2 are just about to trip, as the initial bias for each valve is set slightly above cut-off. If the mains voltage now changes, a d.c. voltage appears across $a-a$ and, according to its sign increases the anode current in one of the valves and completely cuts off the other. This causes one relay to close its contacts and to switch on the induction motor M, which drives the voltage variable transformer T_{var} until V_s is restored to the value V_o . The relay then opens, and M is switched off.

The most important feature of this system is that, by boosting the voltages V_o , V_s (up to several hundred volts d.c.), it is possible to improve the sensitivity quite considerably, without using a two-stage d.c. amplifier. A certain amount of inconvenience is experienced with the h.t. supplies for the two valves as these have to be completely separate, as is shown in Fig. 5.

Thyratron Circuits.—Instead of a d.c. amplifier, thyratron circuits sensitive to the phase of an a.c. signal are sometimes employed. Fig. 6 shows a basic circuit of this type. Two ordinary resistors R_1 and R_2 and two thermistors R_3 and R_4 form a bridge. When the output voltage alters, owing to the non-linear voltage/current characteristics of the thermistors R_3 and R_4 , an error a.c. voltage appears across the diagonal $a-a$. This voltage is proportional to the mains voltage variation, and its phase obviously changes when the error sign changes. A tapping on the voltage variable transformer T_{var} (driven by a reversible induction motor M actuated by relays in the thyratron switching circuit) supplies an auxiliary transformer T connected in series with the mains, and corrects the final output to the required constant level.

Stabilizing Systems with no Moving Parts.—The block diagram of Fig. 3(b) gives the most general representation of such systems. Its basic principle has already been mentioned, and as varying an inductance through its degree of saturation is the most efficient way of changing a series impedance such systems are usually the best. Very many circuits of this type have been developed, some of them similar to the previously mentioned simple saturated transformer.

For instance, Fig. 7(a) represents the circuit of a magnetic stabilizer made by the American firm Sola. Here the secondary winding No. 2 resonates with a condenser C. The core of the transformer contains a magnetic shunt with a special gap (as shown in Fig. 7(b)), and works close to saturation with a normal transformer load. Under these conditions the voltage across winding No. 2 reaches a high value at resonance. As the flux in the core approaches the saturation point, flux lines linking the primary winding with the secondary tend to be

diverted through the gap, thus decreasing the effective transformer voltage ratio—see lower part of core in Fig. 7(b). Thus an increase in the primary voltage raises the secondary voltage only very slightly. The final stabilized output could be taken from winding No. 4 (windings 2 and 4 are in fact a step-down transformer). Winding No. 3 comprises a few compensating turns connected in the opposite way to those on No. 4, thus finally reducing voltage fluctuations across the output terminals to zero; or even making the output characteristic slightly negative, i.e. causing a decrease of output voltage with increasing mains input.

Fig. 8 illustrates another American stabilizing system comprising two reactors in series, one of which is bypassed by a condenser, which in this case does not resonate. Stabilization is produced by interaction between the non-linear characteristics of reactor R_2 and the linear characteristic of the condenser C (8b), and the consequent changing phases in the circuit. Considering the voltage/current curves in Fig. 8(b) it can be seen that, if the mains voltage drops from E_{o2} to E_{o1} , and causes a voltage drop across R_2 and C from V_2 to V_1 , then the current delivered to R_2 and C becomes more leading as it flows more through the condenser C. As a result, the voltage on the primary of R_1 actually increases from V_{p2} to V_{p1} (see vector diagram Fig. 8(c)). With suitable choice of components, the output voltage E_2 or E_1 which is the sum of V_2 or V_1 and the corresponding secondary voltage V_{s2} or V_{s1} on

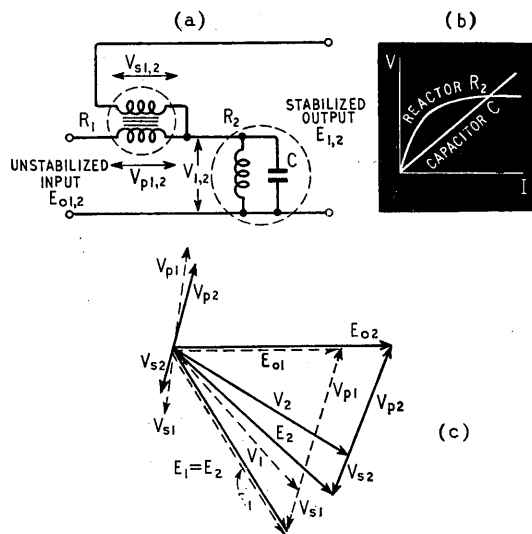


Fig. 8. Stabilization by vector interaction between non-linear reactor and condenser.

transformer R_1 will remain constant, as shown in the vector diagram.

Electronically Controlled Saturable Reactor.—An example of a mains voltage stabilizer using a saturable reactor controlled by an electronic valve is shown in Fig. 9. The auto-transformer T_1 has a series connected variable inductance W_{AC}/W_{AC} forming the a.c. winding of the transducer T_R . The inductance of the windings W_{AC}/W_{AC} can be controlled by varying the anode current of the 6L6 valve, which flows through the winding W_o . Three

(Continued on page 495)

Fig. 9. Stabilizer using saturable reactor controlled by valve anode current.

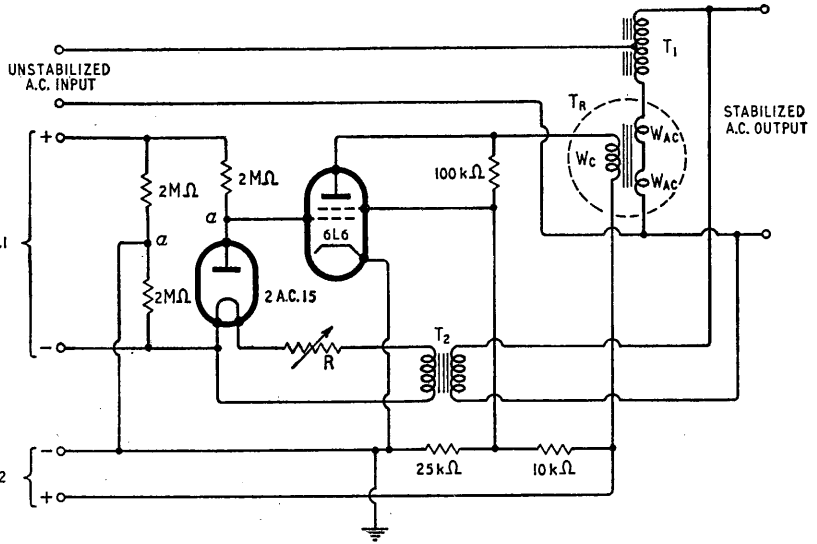
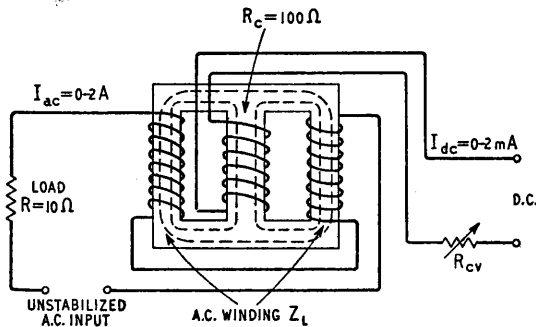
$2M\Omega$ resistors and the anode resistance of the 2AC15 diode are connected in a bridge (supplied by H.T.1). In a state of balance, i.e. when the output voltage has the required value V_2 , the anode resistance of the 2AC15 is $2M\Omega$ so that no voltage appears across the diagonal $a-a$, and consequently the grid voltage of the 6L6 is zero. Now, if the output voltage V_2 rises, the heater of the diode (which is fed by a transformer T_2 from this voltage) increases its emission, and the diode's resistance falls. The bridge then becomes unbalanced, and the grid of the 6L6 is driven negative. This reduces the current in W_c , and the inductance of W_{AC}/W_{AO} increases. As a result, the auto-transformer step-up ratio decreases and the output voltage remains almost unchanged. A similar action, but of course in the opposite sense, happens with a decrease in mains voltage.

This type of stabilization is quite rapid, as the delay with properly designed components is only of the order of 50 to 100 msec. The variable resistor R in the heater circuit of the 2AC15 is for obtaining different output voltages if required.

The Magnetic Amplifier.—The basic difference between a voltage stabilizer using the anode current of an electronic valve as a variable inductance controller, as just described, and systems using magnetic amplifiers, lies in the replacement of the electronic d.c. amplifier by a magnetic amplifier. The chief advantages obtained are the very high power gains possible (up to 10^6), greater robustness and other advantages due to the absence of valves, and high efficiency.

Fig. 10 represents the basic circuit for the magnetic amplifier. The impedance of the a.c. winding Z_L is high for zero (or very small) d.c. currents in the control winding (resistance R_c). The unstabilized

Fig. 10. Elements of a magnetic amplifier.



a.c. input and the output load R are connected in series with Z_L .

Assuming that the initial conditions are with no d.c. current in the control winding (R_{cv} open circuit) the initial output power in the load R will be rather low ($R \ll Z_L$). Now even a small d.c. current I_{dc} in R_c will cause a sudden drop in the value of Z_L by saturating the transductor core (flux lines shown dashed). The current I_{ac} through the load R is thus increased much more than the d.c. control current I_{dc} .

By using a high-permeability, square B/H curve magnetic core a few milliamperes change in I_{dc} can cause a change of up to several amps in I_{ac} . Assuming that the control winding has a d.c. resistance of say 100 ohms and the incremental control current is say 2 mA, the control power will be equal to $400 \mu W$. This power could cause a change in a.c. current of 2 amps with an a.c. winding resistance of say 10 ohms, the a.c. power in R then equalling 40 W. Thus the power gain in this case would be 10^5 .

If the a.c. power delivered to the load is rectified a high-gain d.c. amplifier can be obtained with this circuit.

Circuits Using Magnetic Amplifiers.—Fig. 11 shows the full circuit of a mains stabilizer using a magnetic amplifier.* The secondary voltage of the step-up transformer T is rectified, and the d.c. voltage fed into the error detector network formed by R_1 , R_2 , R_3 and C and the two control windings W_1 and W_2 (wound on the middle leg of the transductor core T_c). The essential feature of this network is that currents in W_1 and W_2 (which have the same number of turns) are arranged to act in opposition; and an increase in the current in W_2 decreases the flux in the core T_c . In a state of balance R_2 and R_3 are equal, so that the currents in W_1 and W_2 are equal. Consequently, there is no control flux in the transductor core, and the inductance of the a.c. winding is maintained fairly high. The word "fairly" is used as there is an additional feedback winding W_b (also located on the central leg of the transductor core) which has some polarizing d.c. current derived

*See "Proceedings of the National Electronic Conference," (Chicago) Vol. 6, Sept., 1950, p. 45.

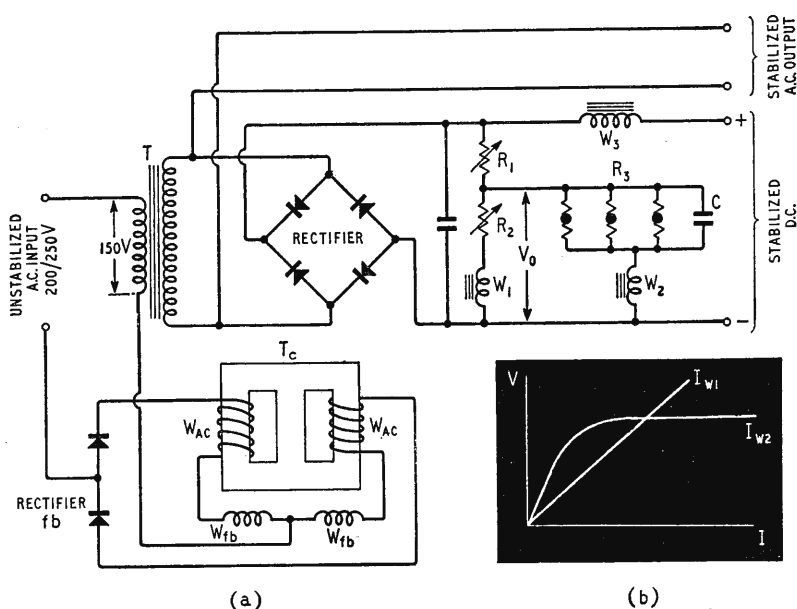


Fig. 11. Stabilizer using a magnetic amplifier.

I_{w1} and I_{w2} respectively, as a function of V_0 and thus of the stabilized voltage. It is obvious that even a small increase in V_0 would cause a much larger increase in the current in W_2 than that in W_1 (owing to the thermistors in series with W_2). Thus, as in a magnetic amplifier, the impedance of W_{AC}/W_{AC} would suddenly rise owing to the decrease in the saturation in the transductor core. As a result, the voltage drop across the primary of T would show only a very small increase, thus maintaining the a.c. output almost constant. A similar but opposite action compensates for a decreasing mains voltage.

The winding W_3 is a small compensating d.c.

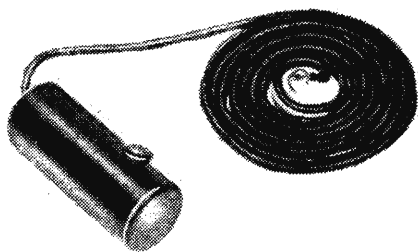
from the rectifiers fb. The result is that, even without a control flux from W_1 and W_2 , the a.c. voltage drop across W_{AC}/W_{AC} is not very large, thus maintaining the required voltage on the primary of T (say 150 V). The second important feature of the error detector is that while R_1 and R_2 are linear, resistors R_3 are non-linear (thermistors).

Fig. 11(b) shows the d.c. currents in W_1 and W_2 ,

winding on the central leg of T_c to prevent fluctuations in the output voltage due to a varying load. In this way the stabilizing action is speeded up, as in this case the transductor is controlled not by the network W_1, W_2, R_1, R_2 and R_3 (which would give a slight delay due to the slowly changing voltage on condenser C), but directly by changing the current in W_3 .

Historic Hearing Aid

The original bone conduction instrument made by C.M.R. Balbi in 1919 while engaged on development work for S. G. Brown has recently been presented to the Science Museum. This was the prototype of the Brown "Ossiphone" which was used in the Marconi "Otophone," believed to be the world's first commercial valve hearing aid. Mr. Balbi who has spent a lifetime in research into the problems of hearing is now living in South Africa where he has been working on direct stimulation of the auditory nervous system.



Commercial Literature

Television Aerials, for Bands I and III, v.h.f. aerials for Band II, and various accessories. A comprehensive illustrated catalogue of all types made by Aerialite, Hargreaves Works, Congleton, Cheshire.

Variacs (continuously adjustable mains auto-transformers). The complete range of types, with load ratings from 0.58 kVA to 7 kVA and input voltages of 115V and 230V, is given in an illustrated catalogue from Claude Lyons, Valley Works, Hoddesdon, Herts. Also included are Variacs with motor drive, ganged assemblies, portable types with carrying handles and types for permanent fixing to walls or benches.

Signal Strength Meter for television frequencies, with three ranges directly calibrated in microvolts and a

decibel scale for comparison purposes. Has a self-contained stabilized power supply and a thermistor temperature compensation system. Leaflet from Radio-Aid, 22, Market Street, Watford, Herts.

Switches and Signal Lamps, a catalogue including new miniature toggle switches for 250V, 10A a.c. with a light snap action similar to that of microswitches. From Arcoelectric (Switches), Central Avenue, West Molesey, Surrey.

Electrolytic Capacitor Bridge, for measuring capacitance between 0.1 μ F and 11,000 μ F. A continuously variable polarizing voltage supply of 0-600V is incorporated. Meters indicate direct-reading capacitance, polarizing voltage, leakage current and bridge balance. Power factor is read from dials. Specification on a leaflet from British Physical Laboratories, Radlett, Herts.

THE GYRATOR

By THOMAS RODDAM

2. A Modern Microwave Device with a Classical Physical Ancestry

IN the first part of this article on the gyrator I adopted a quasi-historical approach and dealt with the way we thought about this problem in the rather short period 1944-46. The previous article showed that a rather abstract concept, a two-terminal pair "black box," could have impedance equation in which the transimpedances Z_{12} and Z_{21} were not equal, but satisfied the equation $Z_{12} = -Z_{21}$.

A device of this sort is passive, linear and constant, but it is not reciprocal. Combined with a reciprocal network it can produce a system which transmits freely in one direction and not at all in the other. This last property is the one which really made people sit up. As you know, one of the great problems of microwave radar systems was the need to use the same aerial for transmitting and receiving. This involves putting the enormous transmitting power, kilowatts or even megawatts, into the feeder or waveguide system which must also include the receiver mixer crystal. The literature is extensive and designs of TR boxes, anti-TR boxes and I don't know what abound. Non-linearity was the key to their design: the transmitted pulse ionized the gas in a special sort of valve and thus switched in some protection for the receiver. But this would only work with pulses and wasn't really too good at that. A completely linear and passive device, with no gas to get absorbed, offered tremendous advantages.

The first thing that any young beginner should do when he has some completely new idea, especially if it is in the field of wave propagation, is turn to the collected papers of Lord Rayleigh. In 1901* Lord Rayleigh described an optical one-way transmission system based on the Faraday effect. We must look back down the arches of the years to our school physics and see if we can recall what we learnt then about polarized light. As a digression, I can't let this opportunity go by without pointing out how important it is that technical education should be broad based rather than devoted to what some people call practical matters. Here we are on a microwave problem, and the basic theory is made up of two parts, why your bicycle stays upright (gyroscopic forces) and what you would see if you wore sun glasses to visit Elsie, Lacie and Tillie, the three sisters in *Alice in Wonderland* who lived in a treacle well in the Dormouse's story (polarized light). The sisters, as it happened, drew everything that begins with an M—such as memory and muchness. Had Lewis Carroll lived in this era he might well have added microwave devices.

Let us return to our polarized light. As you remember, if you pass ordinary light through a sheet of Polaroid it is sorted out and only the radiation of one polarization is allowed to pass. The usual picture shows a man shaking a clothes line vigorously in circles, a grating through which the

line passes and a nice clean, parallel-to-the-grating wave going off beyond the grating. Before Polaroid was invented a device called a Nicol prism was used. This was a special arrangement of two birefringent crystals stuck together in such a way that for one polarization the light just got through the join while for the other it was totally reflected to one side.

Having polarized our light, we now look at it through a second piece of Polaroid and we find that when the axes are parallel the light passes through, but if the axes are at right angles most of the light is stopped. This is the background to the use of polarized glasses for snow and seaside sun glare. When electromagnetic waves (light or radio) are reflected from a plane surface there is one particular angle, the Brewster angle, at which almost all the reflected electromagnetic radiation is of one polarity, and at other angles there is quite a lot more of one than t'other. Polarized sun glasses absorb most of the reflected light and get rid of the glare.

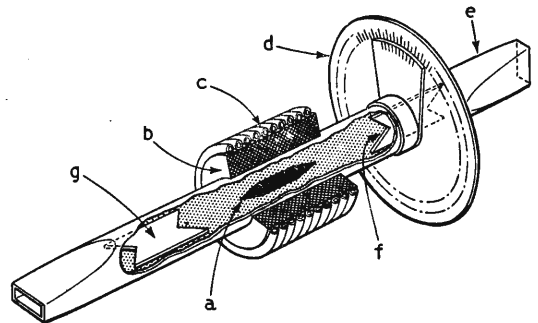


Fig. 1. Experimental arrangement for measuring Faraday rotation. (a) ferrite specimen, (b) winding, (c) cooling coils, (d) stationary protractor, (e) rotatable waveguide section, (f) radial vane to absorb vertically polarized waves, (g) radial vane to absorb horizontally polarized waves.

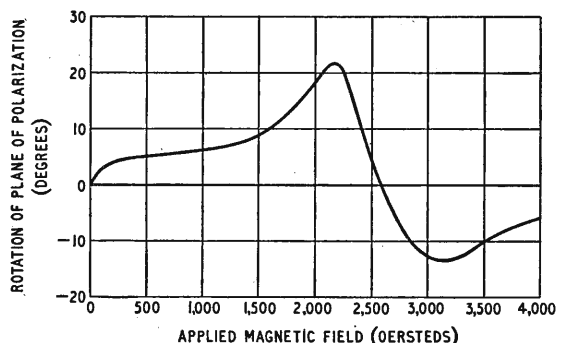


Fig. 2. Faraday rotation in a cylindrical specimen of ferrite. Frequency 8950Mc/s.

*Nature, Vol. 64, page 577.

But to return to our optical bench. We have a light at one end, a polarizer next to it and then, a bit further down, another polarizer and an eyepiece. Usually we put in some lenses, too, so that we have a clean source of parallel light, but these we can regard as frills. The first stage of the experiment is to turn one polarizer until the light reaching the eyepiece is a minimum: the polarizers are now said to be crossed. Now we put between the polarizers a tube filled with a solution of dextrose, which is a sort of sugar, and we find that light is streaming through the eyepiece. To get darkness again we must turn our viewing polarizer. Dextrose, therefore, rotates the plane of polarization and indeed owes its name to the fact that it produces a right-hand rotation. Now obviously a cylinder of liquid will have much the same properties whichever way we look through it and we find, if we care to test it, that our dextrose solution produces a right-hand rotation whether light travels from east to west or west to east. If we reflect the polarized light back, therefore, it will swing back to the original plane of polarization.

The next experiment is to turn out the dextrose, fill the tube with nitrobenzene and wind a solenoid round the tube. When a current flows through the solenoid the plane of polarization is rotated, but if we reverse the current, and thus reverse the magnetic field, the rotation of plane of polarization is in the opposite direction. I imagine that we

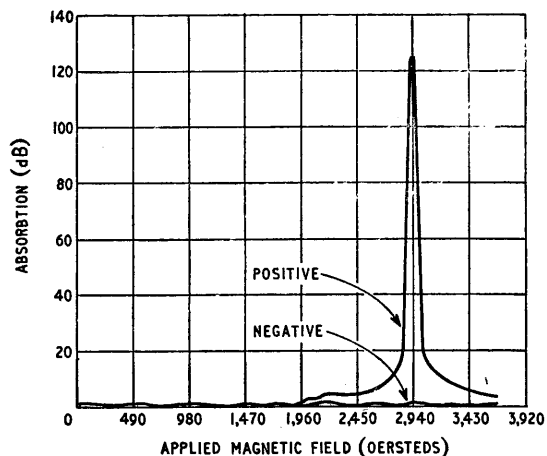


Fig. 3. Selective absorption of the positive and negative circularly polarized components of microwaves (9455 Mc/s) with variation in the magnetic field.

should all have expected this because if a field H produces an effect θ , a field $-H$ will probably produce $-\theta$. Here, of course, I am relying on intuition to tell me that the whole operation is a linear one, but it seems a reasonable expectation, even if you

haven't, as I have, checked it. This magnetically controlled rotation of the plane of polarization is called the Faraday effect, and it was discovered by Faraday in 1845.

In a system showing the Faraday effect a traverse from north to south will produce a rotation of θ° , but a traverse from south to north will produce a rotation of $-\theta^\circ$. A normal polarization rotator will produce a rotation of θ° whichever way the light is going.

Any reader who has turned up the reference to Lord Rayleigh's one-way system and has not started immediately on the construction of a one-way telescope for use at the seaside is invited to look now at Fig. 1 (based on Fig. 17 of "The Elements of Nonreciprocal Microwave Devices," by C. Lester Hogan, *Proc. I.R.E.*, Vol. 44, pp. 1345-1368, Oct., 1956). Here we have most of the optical bench of Fig. 2, apart from the side arms, but now it is something rather nearer home, a microwave guide system. A small cylinder of ferrite with coned-off

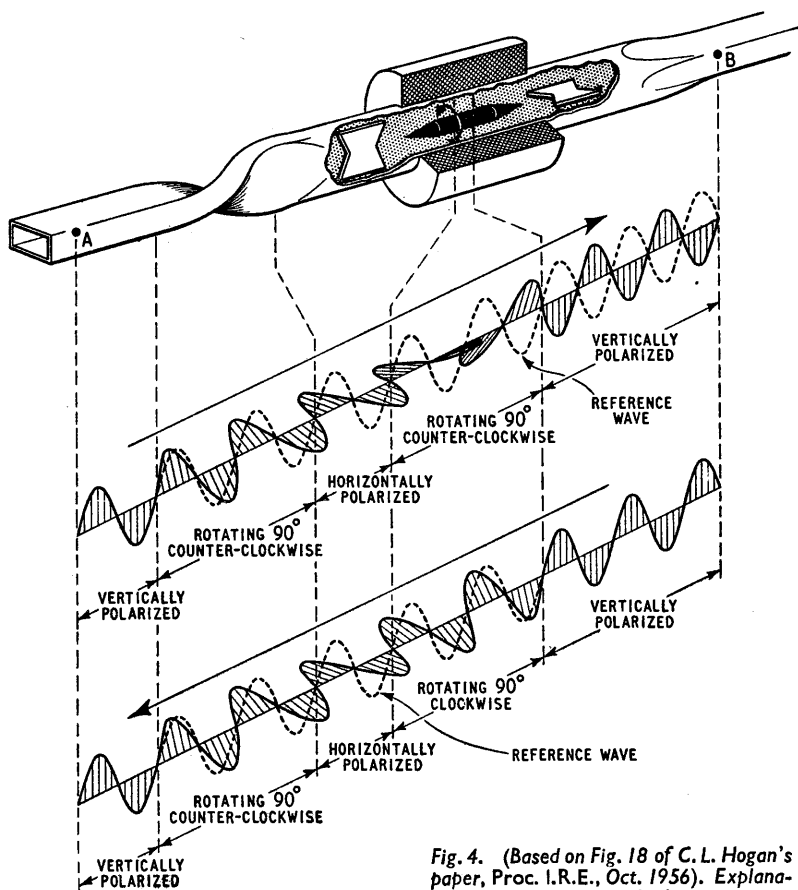


Fig. 4. (Based on Fig. 18 of C. L. Hogan's paper, *Proc. I.R.E.*, Oct. 1956). Explanation of the action of the microwave gyrotator.

ends to reduce reflections produces the Faraday effect and Figs. 2 and 3 (based on Figs. 15, 16, loc. cit.) show the amount of rotation and the cost in attenuation. These curves are for different sample sizes of different materials. In weak fields there is a fair amount of rotation for very little loss. It, therefore, becomes possible to make up devices similar to that shown in Fig. 2, but, of course, using ferrites and operating at, say, 9,000 Mc/s.

A typical system is that shown in Fig. 4 (Fig. 18, loc. cit.) and I don't think I can do better than quote Mr. Hogan's own words:

"The anti-reciprocal property of the Faraday effect affords a means of realizing a microwave circuit element which is analogous to Tellegen's gyrator. Such a gyrator is illustrated (in Fig. 6) along with diagrams which help explain its action. Beneath the gyrator are construction lines which indicate the plane of polarization of a wave as it travels through the gyrator in either direction. On each diagram is a dotted sine wave for reference only which indicates the constant plane of polarization of an unrotated wave. It is noticed that for propagation from left to right, the screw rotation introduced by the twisted rectangular guide adds to the 90° rotation given to the wave by the ferrite element making a total rotation of 180°. For a wave travelling in the reverse direction these two rotations cancel each other, producing a net zero rotation through the complete element. The unique property of the Faraday rotation becomes immediately apparent from this diagram. In the case of the rotation induced by the twisted rectangular guide, the wave rotates in one direction in going from left to right through the twisted section, and rotates in the opposite direction when it traverses the section from right to left. For the case of the rotation induced by the ferrite element, the direction of rotation is (the same) for either direction of propagation. The important characteristic of the element is the time phase relation between two points such as *A* and *B* in the upper diagram. It is seen with the help of the diagrams illustrating the rotating waves that the

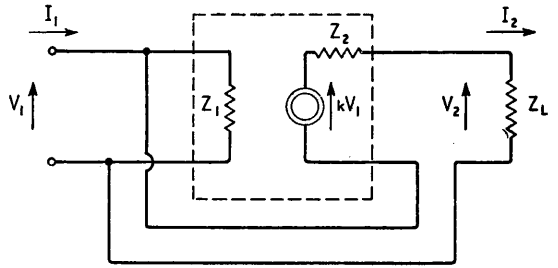


Fig. 5. An amplifier with feedback which can be designed to give impedance inversion. This is the first stage of equivalent gyrator design.

field variations are in phase at points *A* and *B* for propagation from left to right and they are 180° out of phase for propagation from right to left. In other words, the transmission line is an integral number of wavelengths long between *A* and *B* for propagation from left to right and is an odd integral number of half-wavelengths long for propagation from right to left.

"If the rectangular wave guides on each side of the ferrite are rotated about their common axis so as to make an angle of 45° with each other, then a one-way transmission system can be created which is similar to Lord Rayleigh's one-way transmission system of optics. This one-way transmission system can be used, for example, to isolate the generator or detector from the wave guide in microwave systems. In this application it has the great advantage over the attenuators which are presently used for this purpose in that it can be made practically lossless for the direction of propagation which is desired but the reflected wave will be completely absorbed and hence more complete isolation can be effected."

I do not think it would be very profitable to try to explain in words just why ferrites have this particular property. Essentially, however, the reason is that the waves travelling in the ferrite are coupled to the myriads of tiny gyroscopes, the electrons. Small as an

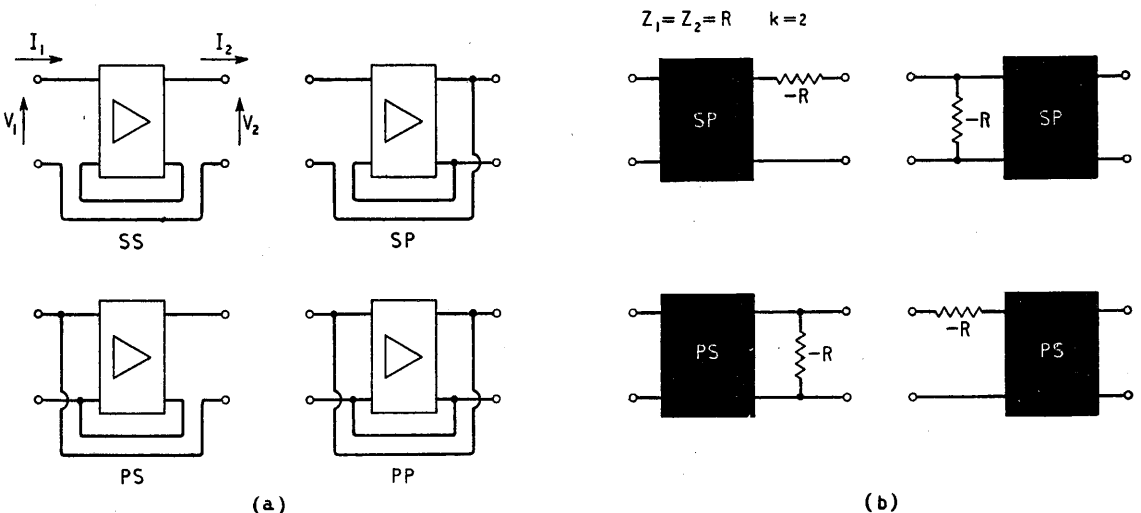


Fig. 6. (a) The four connections of feedback round the amplifier of Fig. 5 (S = series, P = parallel). Putting one of these complete units into circuit we have the four possible gyrator circuits shown at (b).

electron is, it is spinning about a central axis. In a magnetic field the electron axis precesses round the field axis and also pulls in towards it. Now there is a rather odd thing about systems which are kept stable by gyroscopic forces: a little friction may make them unstable. I think it is possible to find examples of this when bicycling. In any event, the direction of the magnetic field due to the signal has a very important effect on the electronic gyroscopes. Remember that the gyro axis is nearly along the axis of the steady magnetic field and that this is the direction of propagation. The signal field is linear, in a plane at right angles to this axis, but it can be split into two circularly polarized components in this plane, one clockwise and one anticlockwise. These two components interact quite differently with the electron and are, in simple language, shifted in phase relative to each other. Combining them again, this phase shift appears as a rotation of the polarization.

The fuller development of devices based on the ferrite gyrator involves much more microwave theory and practice than is appropriate to these columns. Indeed, having passed from "black box" to gyroscope to practical systems using sub-atomic gyroscopes, let us go on, or back, to some more "black boxes."

The circuit we shall consider is that shown in Fig. 5. The dotted box contains an amplifier with input impedance Z_1 , output impedance Z_2 and gain k times. A feedback loop is shown, together with a load Z_L .

The input current is obvious given by:

$$I_1 = V_1/Z_1 + I_2 = V_1/Z_1 + (1 + k)V_1/(Z_2 + Z_L)$$

and the output current

$$I_2 = V_2/Z_L$$

The input impedance is given by V_1/I_1 and is

$$\frac{Z_1(Z_2 + Z_L)}{Z_2 + Z_L + Z_1(1 + k)}$$

We can make k anything we please, within reason. In particular, let us make $k + 1 = -Z_2/Z_1$, which means k must be negative. An odd number of valve stages will do this. Also, let Z_L be small compared with Z_2 so that $(Z_2 + Z_L) \approx Z_2$. The input impedance then becomes

$$\frac{Z_1 Z_2}{Z_L}$$

This means that if $Z_1 Z_2 = S^2$, the input impedance S^2/Z_L is just the inverted form we met with the basic gyrator "black box." It looks, therefore, as though we are offered the possibility of making a gyrator with the aid of valves or transistors.

I must confess that I am not very certain whether there is any point in producing a gyrator system using valves and am almost as doubtful about the value of transistorized gyrators. I do not, therefore, propose to go further with the analysis which shows that a special case of the impedance inverter combined with a negative resistance (another valve), will produce a gyrator. The configurations are summarized in Fig. 6. These circuits are analysed by Bogert*, who gives the conditions required for what we might call "gyration."

It is very difficult at this stage to assess the overall future of the gyrator. We must, at the moment, look at it as a triad of almost completely detached character. The microwave Faraday effect devices are already with us. They will undoubtedly stay with us for some time, growing first of all more complex and then, later, more simple. The purely artificial, contrived gyrator is a less certain bet. It is possible, for example, to sketch out a circuit for an echo suppressor based on the gyrator, but will it be simpler, cheaper, more reliable than the straightforward circuits now in use? At first sight the answer is no. In any event, the echo-suppressor of the long physical telephone line is a device almost certainly doomed to vanish as the improvements brought about by ferrite cores and transistors make it profitable to operate shorter and shorter circuits as carrier systems. Purely passive gyrators may find a home in colour television transmission systems, if anyone can produce gyrators for the appropriate frequencies. Coloured rings and ghosts are obviously more annoying than the familiar black-and-white variety, and echo suppression can do a lot to reduce them. But can we make gyrators below the kilomegacycle range?

On the theoretical side, the gyrator has got rid of an anomaly and has cleared up our theoretical foundations. Although this may seem rather remote, it is ultimately of benefit to us all if we start off with no skeleton in the cupboard, and these oddities of failure of reciprocity certainly were skeletons in the network theorist's cupboard.

It is a wide traverse, from gyroscopes to electromagnetic-electrostatic couplings, to ferrites, to feedback circuits: all are linked together by a common theoretical concept, a common very simple pair of equations.

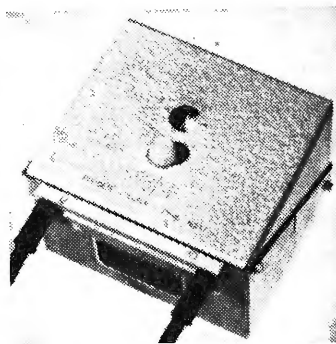
Process Control Timer

TWO ranges of 1 to 10 and 10 to 100 seconds are provided in the new Airmec N237 timer. The "start" signal can be either an open or short circuit, long or short pulse; and resetting is automatic. Two or more timers can be arranged to operate themselves successively, or, by returning the last timer to the first, an indefinitely continuing process is possible.

Scale calibration accuracy is within $\pm 3\%$, the repetition accuracy being considerably higher. A change of mains input voltage of up to 10% affects the interval time by less than 5%. The full resetting time is roughly $1\frac{1}{2}$ seconds, but a reset time of 1 second causes a timing error of less than 5%.

An alternative model to the one illustrated has a sealed screwdriver slot timing adjustment to prevent tampering.

The maker's address is Airmec, Ltd., High Wycombe, Bucks. The timer costs £14.



Airmec N237 process control timer.

* "Some Gyrator and Impedance Inverter Circuits" by B. P. Bogert, Proc. I.R.E., Vol. 43, page 793, July, 1955.

"Tandem" Particle Accelerator being made by Metropolitan-Vickers for the Atomic Energy Research Establishment has the novel feature that acceleration is achieved in two stages. Negative hydrogen ions at earth potential, formed in a high-frequency gas discharge, are extracted by preliminary accelerating electrodes, which produce a 6-MeV focused beam of circular cross-section down the centre of a main accelerating tube. Electrons are "stripped" from the negative ions by passing them through an extremely thin foil. This leaves the ions still moving in a forward direction with a net positive charge but with energy almost unchanged. The second stage of acceleration in the main tube is achieved by bringing the positive ions back to earth potential, so that the total energy communicated to them is 12 MeV. In this way the ions are accelerated to an energy twice as great as could be achieved in a single stage, while the insulation problems remain exactly the same as in a single-stage machine. On emerging from the lower end of the accelerating tube, the beam passes through a magnetic field which deflects the ions through a right angle and brings them to a focus on the target being used. Negative ions are more difficult to form than positive ions, so the beam current is smaller in the tandem machine than in a single-stage type, but this is a small price to pay for the saving in insulation.

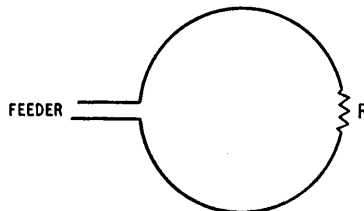
Lenticular Colour Display for frame sequential colour television systems, performing the same sort of function as a rotating colour filter in front of the c.r. tube, has been devised by E. Allard of the French firm Société Telco. It consists of two identical and parallel lenticular plates with a vibrating colour filter in the focal plane between them. This filter is built up of groups of interlaced red, green and blue primary-colour elements corresponding to the lenticular pattern, and is driven by an electric motor and reciprocating mechanism. The arrangement is such that during the filter's cycle of movement the system transmits, over its whole surface, each of the primary-colour components in turn. The light efficiency is said to be the same as that of a rotating disc, but, of course, the arrangement is more compact. It makes possible flat filters for large c.r. tubes and is particularly suitable for projection purposes.

Arbitrary Waveform Generator described by C. B. House in D.S.I.R. unpublished report PB121157, will produce periodic waveforms in which the magnitude, slope, polarity and points of inflection can be controlled at will by simple resistance or

Technical Notebook

voltage changes. It uses standard magnetic cores, diodes and switching transistors. When incorporated in an analogue computing system, the device will provide output transfer functions which can be adjusted to any desired complexity.

Unidirectional Loop Aerial.—The loop aerial, with its bi-directional figure-of-eight radiation pattern, is a familiar object to radio engineers. It is not generally known, however, that the device can be made unidirectional. This can be done in



the case of a single-turn circular loop by breaking the conductor opposite the feed point and inserting a suitable terminating resistor, as shown in the sketch. A mathematical analysis and some practical results are given in the September issue of *Electronic and Radio Engineer*. Measurements were made at 110 Mc/s on loops with circumferences of $\frac{1}{2}\lambda$ and $\frac{3}{4}\lambda$. Front-to-back ratios in excess of 5 to 1 were obtained using terminating resistors of 400-500 ohms.

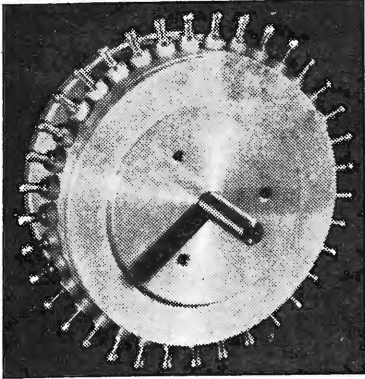
Light Velocity Measurement by means of electron multipliers is suggested as a possibility by R. Gerharz in the *Journal of Electronics* for March, 1957. Use would be made of the extremely short ($\approx 10^{-8}$ sec) light pulses found to be emitted as a side effect of the impact of electrons on the magnesium oxide film on the dynodes of electron multipliers. A single pulse could be reconverted to electrical form by means of a photomultiplier, then amplified and used to initiate a new pulse. Thus a succession of pulses could be produced at a repetition frequency determined by the total electronic and optical delay time. The optical path would be via a mirror forming part of an interferometer. By moving this mirror, the length of the optical path, and hence

the optical delay time, would be altered, and this would change the pulse repetition frequency. From accurate measurements of this frequency change (about 1.5 kc/s), of the original frequency (about 20 Mc/s) and of the mirror displacement (using the interferometer) the velocity of light could be determined.

Millimetre Wavelength Measurement by a new method is described in D.S.I.R. unpublished report PB111909 by M. B. Rapport, E. W. Ward and W. W. Balwarz. The method uses an intermediate medium interposed between a source of waves and a receiving aerial to create an interference phenomenon which provides a measure of the free-space wavelength. The results are independent of the aerial patterns and Fresnel zone effects, and are not appreciably affected by the orientation or position of the interposed medium. Results accurate to approximately 1% can be readily obtained.

New Type of "Maser" using gyromagnetic resonance in ferrites has been operated recently by Dr. M. T. Weiss at Bell Telephone Laboratories in the U.S.A. The ferrite sample is placed in a microwave cavity which can resonate at two frequencies (in one case both near 4,500 Mc/s). A d.c. magnetic field of the correct strength and direction to cause gyromagnetic resonance at the sum of these frequencies (9,000 Mc/s) is applied, and microwave power at this same sum frequency is also fed in. As a result of non-linear coupling in the ferrite, and depending on the amount of r.f. power fed in, both amplification and oscillation at the two resonant frequencies (around 4,500 Mc/s) can occur. Frequency changing between these two resonant frequencies is also possible.

Non-Linear-Function Potmeter recently introduced by Salford Electrical Instruments is basically a linear potentiometer with its element tapped at 10° intervals and the connections brought out to turret-type terminals spaced around the body. Theseappings allow fixed resistors to be shunted across sections of the element so that non-



linear functions can be constructed as desired. The main idea of this design is to avoid the need for the shaped-card type of potentiometers commonly used for producing non-linear functions, which are often difficult to replace when faulty. The new multi-tap potentiometers can be held in stock as standard items and adapted to particular functions as the need arises.

Optical Noise Filter might be a suitable description for an interesting subjective phenomenon mentioned at the recent Paris Colour Television Symposium. A speaker remarked that if television pictures are viewed through a small aperture about the size of a pinhole the noise seems to disappear, and, moreover, there is an apparent improvement in contrast and resolution. Another speaker, commenting on this, suggested that the small aperture might be comparable with a narrow-band filter, and mentioned in passing that the "reality" of television pictures is sometimes heightened by viewing them through a tube.

Inexpensive Digital Plotter for working at medium speeds is described by P. M. Kintner and E. A. White in an unpublished report, PB121056, available from the D.S.I.R. The system is built around a commercially available stencil cutting machine and, actuated by logical circuitry, will plot six points per second on a stencil suitable for reproduction by mimeograph or offset process.

Centimetre-Wave Semiconductor.—A new semiconductor device being tried out experimentally by Raytheon in America is said by *Electronics* for August 1957 to be "leading the way to reliable amplification at frequencies up to 10,000-Mc/s". Known as the "spacistor", it consists of a pellet of semiconductor material with collector and base connections made to opposite ends and with two other intermediate connections called an injector and a modulator. The high-frequency response is obtained

by utilizing a high field strength across a reverse-biased junction to accelerate the current carriers so that their transit time is greatly reduced. The transit time is, of course, the thing which mainly determines the alpha cut-off frequency of conventional transistors. In the "spacistor" the injector, modulator and collector are biased positively with respect to the base. The input signal is applied in series with the modulator bias battery, while the output is obtained across a load in series with the collector battery. At low frequencies the power gain is said to be over 70dB. Earlier discussion of the principles appeared in *Proc. I.R.E.* for March 1957.

Soldering Stainless Steel, normally very difficult with conventional soldering fluxes, is facilitated by a new solder paint called Epatam 3311. It is made by Perdeck Solder Products, who claim that it allows stainless steel to be tinned and soldered as easily as copper or bright mild steel. The paint is merely applied straight from the tin, undiluted, and then heated to the normal soldering temperature. If used on brass or copper it can be slightly diluted with water for greater economy. It can also be used to advantage on surfaces with heavy contaminations such as iron welding scales, rust and grease. A pure-tin variety is available as well as the usual 40/60 and 60/40 tin-lead compositions.

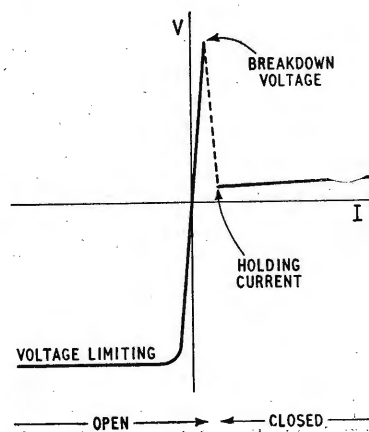
Four-Layer Silicon Diode with bistable properties, suitable for use in waveform generation, switching and computing circuits, is the first product of the Shockley Semiconductor Laboratory of Beckman Instruments, California, U.S.A. It is a two-terminal device made by diffusion techniques. The two states are an "open" or non-conducting state of 10-100M Ω and a "closed" or conducting state of 3-30 Ω , and switching from one to the other is effected by the voltage applied. If this voltage is made to

exceed a certain critical "breakdown" value (see diagram) the diode is switched from the "open" state to the "closed" state, and remains closed provided there is sufficient current to hold it there. If the current is reduced below this "holding" value (see diagram) the diode switches back to the "open" state again. A typical value for the breakdown voltage is 30V, with a current of several hundred microamps, while the voltage required to maintain the minimum holding current is about 1-2V. The physical action of the device is complicated, being explained on the basis of an equivalent structure containing two transistors and an avalanche diode. A full exposition, as well as several circuit applications, appeared in the August 1957 issue of *Electronic Industries*.

Travelling-Wave Frequency Multiplication is described by D. J. Bates and E. L. Ginzton in *Proc. I.R.E.* for July, 1957. Two helices in series are used. After "bunching" at the fundamental frequency in the first helix the electron beam enters the second helix. Here the harmonic components of the r.f. current induce fields on the helix. By making this second helix dispersive a particular harmonic may be selectively amplified by adjusting the helix voltage (with respect to the cathode). The experimental tube was designed to multiply frequencies from 0.5 to 1.0 kMc/s to frequencies from 2 to 4 kMc/s, and conversion gains of the order of 10 dB were obtained. The advantages of this method lie in these two factors of wideband operation and good conversion ratio.

Two-way Damping of the resonances in bass reflex loudspeaker enclosures is described by E. de Boer in *Audio Engineering* for July, 1957. The lower "vent" resonance is damped in the usual way by putting acoustically resistive material (such as layers of porous cloth) in the vent. But in addition, the upper "enclosure" resonance is damped by separating the loudspeaker and vent from the main enclosure volume by further resistive material. By thus controlling the resonances in more than one way, greater flexibility in cabinet design should be possible.

Magnetic-Core Delay Cable described in our August issue (p. 398) is actually made by Hackethal of Germany. In this country it can be obtained from the representatives, W. Wykeham and Company, 17-19, Cockspur Street, Trafalgar Square, London, S.W.1, who can deliver bulk supplies or sample uncalibrated lengths of five available types from stock. Columbia Technical Corporation are the representatives in the U.S.A.



Scientific Theories

By "CATHODE RAY"

" . . . the question is not whether they are true
or false but whether they help or hinder "

DO you find this "second thought" business rather irritating? I don't mean my own efforts, which must be irritating enough, but the habit of scientists never to leave well alone. Having worked out a nice tidy explanation for something, they ought to be contented, one would think; but what do they do? Just when one has satisfactorily learnt their explanation, they come out with a new one which is far more complicated and probably quite incomprehensible. Worse still, several eminent scientists may invent quite different (but all very complicated and incomprehensible) theories, the only thing they have in common being rejection of the nice tidy common-sense explanation one has taken the trouble to learn.

This deplorable habit was well taken off in J. C. Squire's sequel to Pope's couplet:

Nature and Nature's laws lay hid in night
God said, *Let Newton be!* and all was light.

* * *

It did not last: the Devil, howling *Ho!*
Let Einstein be! restored the status quo.

Can you remember when the transmission of radio and light was explained by the existence of an all-pervading aether? Just as the speed of sound waves through air, water or steel depends on the density and elasticity of the air, etc., so it was quite easy to calculate the density (very small) and elasticity (very great) of the aether. It seems obvious that some sort of medium must exist, even though it must needs be such an odd one as aether; otherwise how could radio power be conveyed from one place to another! It would be as absurd as supposing one man could punch another on the nose without coming anywhere near him. But after further consideration the scientists announced that there was no such thing as aether. As if that were not enough, the definite and understandable light waves turned into something unimaginable, behaving sometimes like waves and sometimes like particles.

The younger students will no doubt wonder why their elders shy at present-day theories, which *may* seem just as straightforward to them as the now discarded ideas did to us. But their time will come.

The less sophisticated may wonder why it is that when an explanation has been found and proved by the test of engineering practice to be right there should be any need to upset everybody by looking for another, especially when it turns out to be far-fetched.

These thoughts ran through my mind while I was contemplating a return to the subject of semiconductors. If the account I gave last summer was all right, why make it more complicated? Well, that story, simple though it was compared with what you will find in many of the books, might have seemed complicated to anyone brought up on the simple picture of conduction as a sort of sap flow through the

solid stem of the conductor. But this simple conduction picture fails entirely to account for such things as metal rectifiers.

On a grander scale, Newton's "laws" were satisfactory for a century or two, but the wider range and greater accuracy of modern measurements have shown some discrepancies. That is not to say that they must be scrapped and the newer laws substituted everywhere. It would be a great nuisance always to use a very general and difficult theory when dealing with everyday affairs where a much simpler one is good enough, even though known to be unsound.

While agreeing that it may be expedient to use things known to be wrong, some people perhaps feel slightly conscience-stricken about it. They may feel that one ought really to rely always on the truth, or at least what is believed to be the truth or the nearest known approach to it.

Understanding Natural Processes

I don't want to attempt an answer to Pilate's "What is truth?", or get involved in philosophy, metaphysics or religion; this is meant to be a strictly engineering discussion. Einstein (who, contrary to common impression, could talk and write with crystal clearness) said "It is difficult even to attach a precise meaning to the term 'scientific truth'." He also said "When we say we have succeeded in understanding a group of natural processes, we invariably mean that a constructive theory has been found that covers the processes in question." Quite so, you may say, but having found a theory that covers everything why not let it be?

Someone supplied the answer by remarking that while a billion observations in accord with a theory cannot prove it, a single contrary observation is enough to disprove it. So no theory is final. People can only invent theories on the basis of observations they and others made, and nobody will ever have knowledge of every event in nature. Moreover, all the observations are conveyed indirectly to the mind through sense organs and nerves; there is no direct contact with "reality."

I put the word in inverted commas, because it is doubtful what it means. One is apt to draw a distinction between an analogy, such as the old water pump for an e.m.f., and the real thing itself. But is this distinction clear? In a way, aren't all scientific explanations analogies? To explain crystal structure by talking about valency bonds is pure analogy and metaphor; one might almost say poetry. Words like "bonds" convey ideas that may help us to picture crystal structure, and even to predict quite correctly how it will behave in certain circumstances. So do descriptions of electrons being "knocked out" of atoms by "collisions." But calling them electrons instead of tiny billiard balls doesn't really make the

thing less metaphorical or more scientific. What is an electron? Just a concept. The word "electron" is shorthand for the continually changing collection of theory designed to fit the increasing collection of experimental evidence. Don't imagine we shall ever be able to say that now we know exactly what an electron is!

You see, it is a relatively simple matter to describe or define something complicated. One can specify a house in terms of bricks, boards, pipes, etc., because it is taken for granted that these are familiar things. If we are asked to say what a brick is, we may describe how it is made by baking a particular kind of clay, and if we are well up in chemistry we might give some formulæ. Asked then to say what the silicon in it is, do we consider the enquiry has gone far enough? Even if we happen to remember that the silicon atom has 14 electrons round a nucleus, we suspect we may be pressed to explain what an electron is, and saying it is (or has) a mass of so much and a negative electric charge of so much doesn't really explain it. Our predicament, sooner or later, is summed up by the rule in logic that it is futile to define the obscure in terms of the more obscure. So we can go on explaining only as long as there is something simpler and more easily understood to fall back on.

A Long Drink

But what *isn't* obscure? Do you *really* understand how the water pump works, in the e.m.f. analogy? How would you explain the process of drinking lemonade through a straw? Some would just say the drinker sucks it up. Another would say he produces a partial vacuum in his mouth, which draws it up. Another, perhaps, that the pressure of the atmosphere pushes it up. But what is the pressure of the atmosphere? It is explained as the result of the bombardment of the surface of the lemonade by countless air molecules continually whizzing about in all directions. But what makes them whizz? Here the discussion begins to get highly involved and can go on for a long time.

Even if we take that as read, however, isn't the bombardment story just another analogy? It sounds plausible because we know that intense bombardment of an unlatched door by snowballs would exert pressure on it, probably enough to push it open. But we have no right to assume that air molecules are like snowballs or any other missiles of which we have experience. They do not behave in the same ways as the larger objects we can see. Scientists may use less crude analogies, but I suspect they are still only analogies, for the reasons we have already considered.

That is not to say that analogies, even our crude ones, are to be despised. (If they were, I might as well give up.) The massive technical progress of this century is due to people who are guided by mental pictures or concepts—of such things as electric currents—that for the most part are probably quite crude and remote from reality. Any resemblance between electrons "bombarding" an anode and bullets hitting a target may be purely coincidental, but in practice it is quite helpful, and in my opinion legitimate so long as it isn't allowed to run away with one's intelligence.

The fact that many different explanations can be given of a single phenomenon such as lemonade

flowing up a straw doesn't mean that one of them is right and the rest wrong; it all depends on how much is taken for granted. The delightful simplicity of the first will do if sucking is accepted as one of the basic principles of the universe. Shockley's classic book *Electrons and Holes in Semiconductors* is divided into three parts, which are three different treatments of the same subject, suited to different readers—or the same reader at different stages of progress.

That is an example of several different but legitimate accounts of the same thing. There can also be different accounts as it were side by side rather than one on top of another. Recently we saw that potential could be defined in two very different ways, one depending on the concept of field strength and the other on the concept of work. With regard to field strength, some people rely on lines of force. These lines are only a concept; that is to say, a way the mind has of seeing something. Other people are content to think of just fields. But fields too are a concept; a way of imagining and referring to the supposed causes of certain effects. Others discard fields and consider only the velocities and accelerations of charges. I have no doubt that if there are beings of equal or greater intelligence elsewhere in the universe they will have quite different concepts for electromagnetism. Among concepts the question is not whether they are true or false but whether they help or hinder. The field concept seems to have been a great help; but later might it be seen to hinder, by excluding some more fruitful concept?

Sometimes there have been lengthy scientific arguments about which of two concepts was right. For instance, some scientists held that when a spectroscope produces coloured light when white light is passed into it, this proves that white light is composed of light of all colours. Others contended that white light is entirely random, and the spectroscope creates coloured light from it, almost as a valve oscillator creates a.c. of various frequencies from d.c. As Eddington said about this, "The mistake was . . . in claiming that we could decide experimentally between two equally permissible forms of description."

So far I haven't even mentioned the word "mathematics," which omission some readers may count as grave as "Hamlet" without the Prince of Denmark. The more "advanced" the treatment of a subject, the more mathematical it is likely to be. In fact, there is a tendency to elevate mathematical equations to a supreme status in science, as if they were the language of ultimate reality itself. This seems to be like enthroning electronic computers as the intellectual lords of the universe. Mathematical symbols are just shorthand for concepts, and mathematical operations are shorthand for reasoning about them. The same results could, theoretically, be obtained by the use of words, but this would often be far too laborious and involved to be practicable. Calling a thing "F" instead of "force" doesn't in itself add to what we know about the nature of force, but it may make it practicable, as nothing else would do, to arrive at certain conclusions about it. While on the one hand it would be silly to regard, say, mechanical transport as the answer to everything, it would be equally so to despise it when undertaking a long journey. I hope the analogy is clear!

Ferrites for F.M.

FREQUENCY MODULATION USING FERRITE-CORED COILS

By T. W. G. CALVERT, B.Sc. (Eng.).

UNTIL recently, frequency modulation and control in electronic apparatus has nearly always been effected by means of a reactance valve circuit. Due to the development of new materials, however, there are now several alternatives to this method. For example, the discovery of ferro-electric materials has made it possible to vary the capacity of a condenser by applying a voltage. Another capacity which can be voltage controlled is that of a germanium p-n junction. Ferrites have made it practicable to make use at radio frequencies of the change of inductance which occurs when a magnetic flux is applied to the ferromagnetic core of a coil. In this article the use of ferrite-cored coils for frequency modulation and control is described.

It is well known that the permeability of a ferromagnetic material changes when a magnetic field is applied to it. Also, that if a coil is wound on the material, its inductance changes with the permeability, and thus with the magnetic field. When the coil is part of a resonant circuit, it is possible to change the frequency of oscillation by applying a magnetic field to the core.

A remote tuning unit, which depended for its operation on the change of permeability of a magnetic material subjected to a changing magnetic field, was described by Boucke in 1936, and a similar system was described by Kramolin in 1938¹. These devices made use of an iron-dust, or laminated nickel-iron core to carry the winding. Their use was limited because of uncertain operation, low power sensitivity, and the ability to operate only at low radio frequencies.

The last decade has seen the development of mag-

netic ferrites. These are non-metallic substances which combine good magnetic properties (initial permeabilities between 10 and 3,000), with a very high resistivity (0.1-1,000 ohm-metres). Other magnetic materials, such as laminated nickel-iron or powder-dust cores have resistivities of the order of 0.1-1 microhm-metres, which may be increased only at the expense of the permeability. The high resistivity of ferrites enables them to be used up to very high frequencies as core material for coils.

From the literature on the ferrites made by Mullards under the trade name Ferroxcube, it was decided that grade B4 would be suitable for this application. This grade of Ferroxcube is available in many sizes, but rods 2in long and 0.25in diameter were found to be convenient.

Applying the Field

A varying field in the ferrite core of an r.f. coil may be produced in three main ways, namely:—

- (1) By passing a modulating or control current through the r.f. winding of the core.
- (2) By passing a similar current through a separate winding on the core.
- (3) By producing the field externally and applying it to the core.

The first two methods, (1) and (2), have been investigated by the author, and the third, (3), was fully described by Slater in 1954².

(1) A coil of 46 turns of 28 s.w.g. wire was wound on the 0.25-in diameter ferrite rod and its inductance measured. The change of inductance at 1 Mc/s which was observed when direct current was passed through the coil is shown in Fig. 1. This direct current must be obtained from a high-impedance source if the Q of the coil is not to be appreciably affected. In this case it was found to be convenient to connect the r.f. coil in the anode circuit of a pentode valve.

It is seen from Fig. 1 that a linear change of the order of 1% may be obtained. A series of coils were now wound with 40, 20, 10, 5, 2, and 1 turn respectively of 28 s.w.g. wire, and tests carried out over a range of frequencies from 1 to 50 Mc/s. It was found that up to 14 Mc/s the percentage inductance changes were similar to those obtained at 1 Mc/s, but above 14 Mc/s the amount of change began to decrease, reaching zero at 45 Mc/s. As might be expected, the current required increased as the number of turns was reduced, but the ampere-turns required remained fairly constant up to 14 Mc/s.

The fall in inductance change as the frequency was increased above 14 Mc/s could be due to losses in the core. However, as B4 Ferroxcube can be

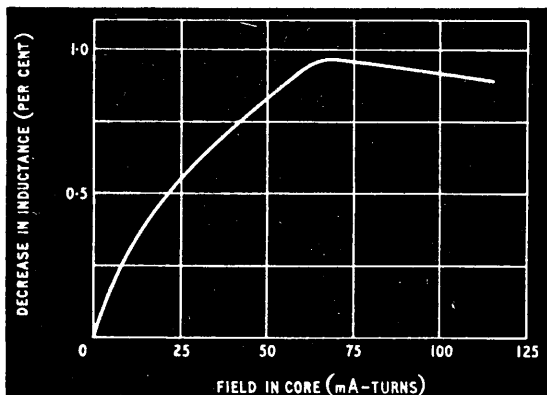


Fig. 1. Change of inductance when the control current is passed through the r.f. coil.

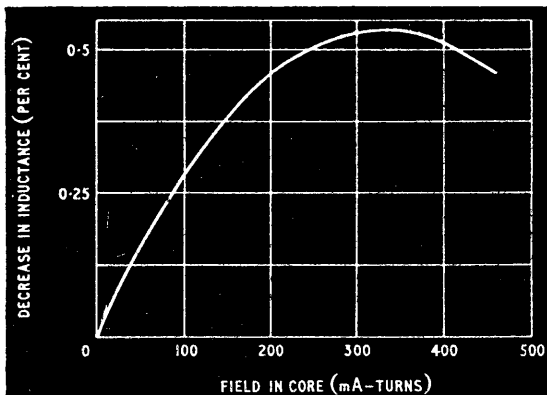


Fig. 2. Change of inductance when the control current is passed through a separate interleaved coil.

used as a core material up to 100 Mc/s, this seems improbable. It is more likely that, since the number of turns falls as the frequency increases, the approximation to a solenoid becomes less valid, and the flux produced by the control current is not in the ferrite core, but in the surrounding air, so that it has no effect on the permeability of the core.

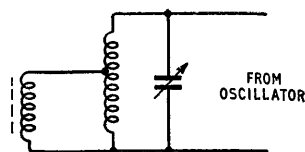
(2) The control flux in the ferrite core may also be produced by passing a current through a separate winding on the core. This is clearly a simplification, since the control current need not be derived from such a high impedance source as with a combined r.f. and control winding. Initially, a control coil of 50 turns was wound on top of the r.f. coil of 46 turns of 28 s.w.g. wire already wound on the ferrite rod. This, however, decreased the Q of the r.f. coil so much that no inductance measurements were possible. With a control coil of 300 turns split into two sections, and wound on either side of the r.f. winding, the inductance of the coil was measured, but no change could be detected when current was passed through the control coil. The only arrangement which did give an appreciable change of inductance was that in which the r.f. and control coils were interleaved bifilarly. The results, which are shown in Fig. 2, are similar to those for (1), shown in Fig. 1, but the maximum inductance change was only 0.6% as compared with 1%, and nearly 10 times as many "control ampere-turns" were required for a given inductance change.

These results suggest that it is necessary to have very close coupling between the r.f. and control windings, so that the control flux passes through the part of the core associated with the r.f. coil. Thus, the best results were obtained when the two windings were combined, as in (1), giving the closest coupling possible; smaller inductance changes were obtained when the two windings were closely coupled by interleaving them; and no inductance changes at all were detectable when the control winding was wound in two sections on either side of the r.f. winding.

(3) An alternative to producing control flux by passing current through windings on the ferrite core, is to place the ferrite, with an r.f. coil wound on it, in the gap of a permanent or electro-magnet.

When a ferrite core carrying an r.f. winding was placed in the gap of a powerful permanent magnet, the inductance of the winding was reduced by 55%. This large change, which is more than 50 times

Fig. 3. A method of producing frequency modulation at v.h.f. The flux in the core may be produced either by passing current through the coil on the core, or by placing the core in the gap of an electromagnet.



greater than the maximum obtained in earlier tests, is consistent with the results of Slater², who recorded inductance changes of more than 60%. Slater used an r.f. coil wound on a small ferrite core, placed in the gap of a stack of U-shaped nickel-iron laminations which carried control windings, thus forming an electromagnet. With such a large change of inductance, there was an appreciable hysteresis effect.

From the results described above, it is seen that when the flux in the core of a coil is produced externally to the core, i.e., the magnetic circuit is complete, then the inductance changes which result are of the order of 50 times greater than those obtained when the flux is produced by a coil on the core itself, and the magnetic circuit is incomplete. The great difference between the two sets of results is thought to be due to the demagnetizing effect of an incomplete magnetic circuit, which causes the flux in the ferrite core to be diluted.

Thus there are three systems, two of which are very simple, in that there is no associated electromagnet, but which give maximum inductance changes of only about 1%, i.e., a frequency change of about 0.5%. The third system, which is more complicated, requires the control winding to be wound on a subsidiary core of nickel-iron laminations, but inductance changes of up to 60% are obtainable, i.e., frequency changes of up to 30%.

All three methods of applying flux to the core become ineffective as the frequency is raised, i.e., as the number of turns on the r.f. coil is decreased. This may be avoided by using the circuit shown in Fig. 3, where the ferrite-cored coil is tapped onto another coil. The total inductance is reduced without reducing the number of turns on the ferrite-cored coil. The disadvantage is that the percentage inductance change of the combination will be less than that of the ferrite-cored coil alone.

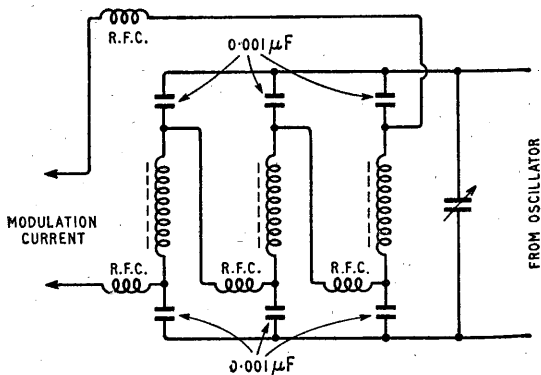


Fig. 4. This circuit provides modulation at v.h.f. without reducing the maximum frequency deviation. More ferrite cored coils must be added as the frequency is increased.

Fig. 4 shows an alternative circuit which enables the inductance to be reduced without reducing the percentage frequency deviation. The essential point of this circuit is that the ferrite-cored coils are connected in series at modulating frequencies and in parallel at radio frequencies. This circuit would function in an oscillator, giving total frequency deviations even at very high frequencies of up to 0.5%.

The first two systems, giving frequency changes of $\pm 0.25\%$ and $\pm 0.15\%$ respectively, are suitable for an f.m. signal generator. (The ± 75 kc/s maximum deviation of the B.B.C. v.h.f./f.m. signals represents a change of less than $\pm 0.1\%$.) They could also be used to apply a.f.c. to a radio receiver. However, as a simple ferrite-cored coil will not give any frequency change above 45 Mc/s, for v.h.f. such as the 90 Mc/s f.m. broadcast band it would be necessary either to use the third or fourth harmonic of the local oscillator, or one of the circuits shown in Figs. 3 and 4. The author has used method (1) to provide frequency sweep in a wobulator. (A wobulator enables the response curves of tuned circuits, e.g. i.f. transformers, to be displayed on a cathode-ray oscilloscope.) The wobulator was built for use with a short wave receiver tuning over the range 4.5-15 Mc/s. Since the receiver had an i.f. of 465 kc/s,

the frequency deviation of ± 25 kc/s, obtainable at a typical input frequency of 10 Mc/s, was quite sufficient to show the whole response curve of the i.f. transformers.

Although the system which produces the control flux in an auxiliary Ni-Fe core is more complicated, and therefore more expensive, there is the advantage that the control current need not be derived from a high impedance source. Scroggie used a method similar to this to provide automatic frequency correction in an f.m. receiver³. With a possible frequency change of 30%, this method is very suitable for control applications, such as the remote tuning of a radio receiver. It also gives linear frequency modulation of up to $\pm 2\%$, which is a much greater deviation than is easily obtainable by other methods.

REFERENCES

- (1). L. De Kramolin. "Magnetic Tuning Devices," *Wireless World*, Vol. 42, p. 160 (Feb. 24th, 1938), Vol. 42, p. 186 (March 3rd, 1938), Vol. 43, p. 5 (July 7th, 1938).
- (2). F. Slater. "A Ferrite Frequency Modulator," *Marconi Instrumentation*, No. 8, p. 186 (1954).
- (3). M. G. Scroggie. "An Unconventional F.M. Receiver," *Wireless World*, Vol. 62, p. 258 (June, 1956).

Books Received

An Introduction to Automatic Digital Computers, by R. K. Livesley. Describes in general terms the sort of facilities available in stored-programme "mathematical" machines and concentrates mostly on principles of programming, with particular emphasis on routine engineering problems. Pp. 53; Figs. 10. Price 8s 6d. In the Cambridge Engineering Series. Cambridge University Press, Bentley House, Euston Road, London, N.W.1.

Modern Computing Methods, by the staff of the N.P.L. Mathematics Division. Numerical methods of solving mathematical problems suitable for computing machines, with worked examples. Covers linear equations and matrices, differential equations, roots of polynomial equations, latent roots of matrices, finite-difference methods and relaxation methods. Pp. 129; Figs. 18. Price 10s. 6d. H.M.S.O., York House, Kingsway, London, W.C.2.

Ceramic Insulators for Telecommunication Purposes. A revised specification defining tolerances on ceramic insulators used as bushings or in radio and electronic components in high- low-voltage and r.f. circuits. An appendix gives guidance to engineers and draftsmen on the design of ceramic insulators for most economical production. Pp. 15; Figs. 4. Price 1s. R.E.C.M.F., 21, Tothill Street, London, S.W.1. Price 1s.

Guide to the Specification and Use of Quartz Oscillator Crystals. Pp. 40; Figs. 11. Price 5s. Radio Communications and Electronic Engineering Association, 11, Green Street, London, W.1.

Propagation des Ondes Electromagnetiques de Haute Fréquence, by J. Ortusi. The first volume in the series "Collection des Annales de Radio-électricité" covers in its first-part general waveguide theory, waveguide junctions and discontinuities; including guides containing ferrites and dielectrics. A second part discusses u.h.f. terrestrial propagation, and has some useful nomograms. Pp. 320; Figs. 110. Price 3,240 fr. (French). Société Française de Documentation Electronique, 12, rue Carducci, Paris 19.

Valve and Television Tube Equivalents, by B. B. Babani, covers British, American, European and Service types of receiving and transmitting valves. Pp. 66. Price 5s. Bernard's, The Grampians, Western Gate, London, W.8.

T.V. Fault Finding, by the staff of the *Radio Constructor*. Revised edition with many illustrations from TV screens gives circuit details of, and correction methods for the various types of fault. Pp. 104; Figs. 112. Price 5s. Data Publications, Ltd., 57, Maida Vale, London, W.9.

Understanding Hi-Fi Circuits, by Norman H. Crowhurst. Deals simply with various amplifier and pre-amplifier stages, overall feedback and damping, and crossover networks and other speaker sound distribution systems. Pp. 224; Figs. 179. Price 2.90 dollars in soft cover edition. Available in Gt. Britain from The Modern Book Co., 19-23, Praed Street, London, W.2. Price 23s.

Transistor Engineering Reference Handbook, by H. E. Marrows, contains a large amount of data on commercial American transistors, components for use with transistors, and transistor circuits, and includes a classified bibliography and manufacturers' directory. Pp. 286; many figs. Price 80s. Chapman and Hall, Ltd., 37, Essex Street, London, W.C.2.

Industrial Rectifying Tubes, by members of Philips Electron Tube division. Vol. 13 in the Philips technical library series on electron tubes deals with construction, operation and applications (battery charging and industrial) of hot-cathode gas-filled rectifiers. Pp. 126; Figs. 100. Price 15s. Cleaver Hume Press, Ltd., 31, Wrights Lane, London, W.8.

Receiving Aerial Systems, by I. A. Davidson, B.A., discusses generally television and radio aerials, including their mechanical design and installation, and also cables and accessories. Pp. 152; Figs. 70. Price 21s. Heywood and Co., Ltd., Tower House, Southampton Street, London, W.C.2.

Subjective Colour for Television?

Experimental Film Based on the Benham's Top Principle

By C. E. M. HANSEL*, M.A.

IT is well known that people watching certain television "commercials" on ITV have observed colour effects on their receiver screens. As the same colours were reported by a number of independent observers there is no reason to doubt that they did experience sensations of colour, and it is of interest to see how these could arise.

It has long been known that colour sensations can be aroused by viewing a black and white top rotating in white light. Benham's top (Fig. 1) is the best known means by which these colours can be produced. If Benham's top is rotated in monochromatic illumination from the middle part of the spectrum it is still possible for an observer to experience a variety of colours.

The effect was demonstrated by Helmholtz. He showed that if a simple top (Fig. 2) in which one half is black and the other white is rotated, there appears to the observer to be a blue fringe behind the black as it leaves the white area and a red fringe extending into the black area as it advances into the white area. These colour fringes were attributed

* Department of Psychology, University of Manchester.

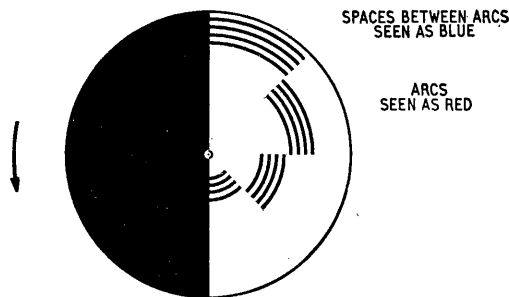


Fig. 1. Structure of the well-known Benham's top

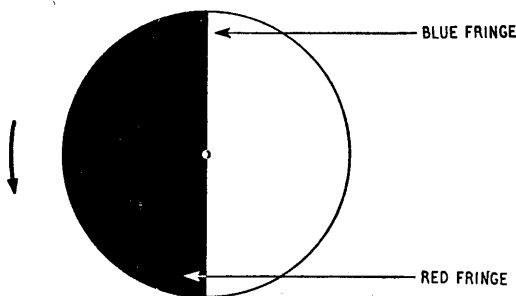


Fig. 2. Simple top used by Helmholtz to demonstrate subjective colours.

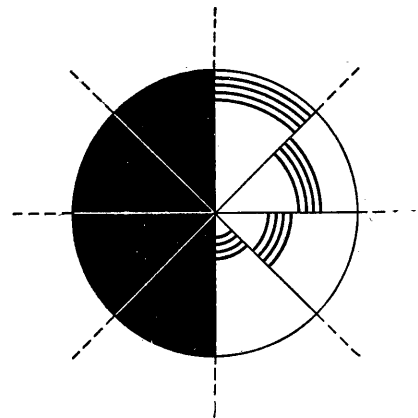


Fig. 3. Benham's top shown divided into eight segments.

to differences in the retinal action times of the photo-receptors bringing about the sensations of blueness and redness, for the time taken for the sensation of blueness to arise after onset of illumination is known to be less than that for redness.

As the white area of the top advances into the black area, light strikes the corresponding part of the retina but as the sensation of blueness is aroused more quickly than that of redness, a blue fringe is seen at the leading edge of the white area. Similarly, a red fringe is seen where the black area advances into the white area.

Benham's top is a modified form of Helmholtz's top in which the area of the edge is increased by means of the arcs and, as we should expect, the blueness extends over the white area between the arcs, whereas the redness is seen in the arcs themselves. These colour effects can be obtained in monochromatic light provided that the photoreceptors which normally evoke the sensations of blueness and redness have sensitivities extending over the wavelength being used.

In 1951 I suggested to the B.B.C. that they might produce colour effects in normal television transmitters by utilising this principle, and for this purpose a black and white film was constructed which, on projection, gave the impression of objects of different colours against a coloured background[†].

A simple technique was developed which utilized the principle of Benham's top but which enabled the colours to be superimposed on drawings. Ben-

[†] The B.B.C. did not follow up this suggestion but demonstrations of subjective colour effects by means of tops were given on American television in 1953.

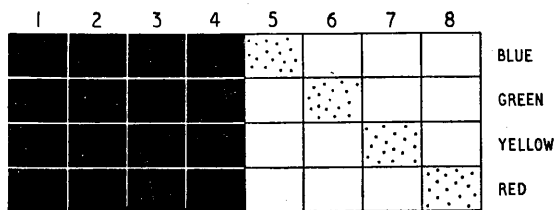
ham's top may be divided into eight segments (Fig. 3). Areas shaded in accordance with these eight segments are projected successively on to a screen, but the segment containing the arcs is replaced by a system of dots, thus increasing the length of the black-white boundary areas, on which the effect is to some extent dependent.

The desired colour effect for a particular area is obtained by shading the area on successive frames to conform with the code shown in Fig. 4(a). Projection at the rate of 24 frames per second† then gives three complete cycles per second and is accompanied with a coarse flicker. In order to decrease the flicker effect the coding may be modified as in Fig. 4(b). A particular area may also be split up into sub-areas, giving further decrease in flicker.

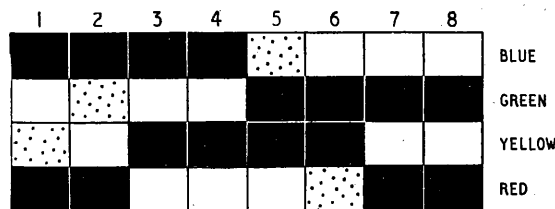
The sequence of 8 frames to a cycle may be modified and 6-, 4- or 3-frame cycles used. With 24 frames per second as used in film projection, a cycle of 8 frames has been found to be too long, and one of 4 frames is more effective, although in this case colour effects are not so pronounced (see Fig. 5).

By using these techniques it is possible to construct cinematograph films which, on projection, will appear coloured. Sets of cards are prepared with the different areas shaded in accordance with the code for the desired colour effect and these are photographed in sequence on successive frames of the film. A similar technique could be used on photographs of natural objects. In this case the dot pattern would be replaced by the actual area of the photograph (which would have to have some lines or shading added if these were not already present).

† For television film scanning, of course, this would have to be increased to 25 frames per second, since the film frame rate has to be related to the television standards.—Ed.



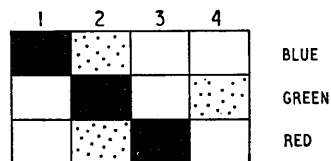
(a)



(b)

Fig. 4. (a) Adaptation of the 8 segments of the top in Fig. 3 to a cycle of 8 successive film frames. A different sequential pattern is used for each colour, and dots replace the arcs of Fig. 3. In (b) are modified code patterns used for reducing flicker.

Fig. 5. Simplified 4-frame coding system for use at a film projection rate of 24 frames per second.



In television, where a single scanning spot is used on a c.r. tube, a particular area of the screen is illuminated for only a small fraction of the total presentation time for each frame. The cumulative action of the eye largely compensates for this, however, and it is possible that more effective means of obtaining colour effects could be devised by utilizing the fact that the image is traced out by a small moving illuminated area. Special techniques could be developed which would utilize the full 50-c/s scanning rate of the interlacing odd and even lines, rather than the 25-c/s scanning rate which would result from using film.

It was reported by the viewers on ITV that a person was seen wearing a blue tie with white spots. Although we should rather expect that a blue tie with black spots should be seen, there is no reason to doubt that the colours were subjective and were produced by characteristics of the film approximating to those described above.

CLUB NEWS

Bexleyheath.—At the October 10th meeting of the North Kent Radio Society, E. Hasted (G3BHF) will speak about filter circuits. The club meets fortnightly at 8.0 in the Congregational Hall, opposite Bexleyheath Clock Tower. Sec.: D. W. Wooderson (G3HKX), 39 Woolwich Road, Bexleyheath, Kent.

Birmingham.—Mullard films "Mirror in the sky" and "The principles of the transistor" are being shown at the October 25th meeting of the Slade Radio Society at 7.30 at the Y.M.C.A. Sec.: C. N. Smart, 110, Woolmore Road, Erdington.

Bury.—The October meeting of the Bury Radio Society will be held at 8.0 on the 8th at the George Hotel, Kay Gardens. "Matching matters" is the title of the talk to be given by R. Hammans (G2IG). Sec.: L. Robinson, 56 Avondale Avenue, Bury, Lancs.

Dorking.—A film show will be given at the next meeting of the Dorking and District Radio Society at 7.45 on October 8th at the Star & Garter Hotel, adjacent to Dorking North station. Sec.: J. Greenwell (G3AEZ), Wigmore Lodge, Beare Green, Near Dorking, Surrey.

Reading.—The next meeting of the newly formed Reading Amateur Radio Club will be held at 7.30 on September 28th at Palmer Hall, West Street, when Roland Page (G5TP) will describe and demonstrate "A table-top 150-watt transmitter." Sec.: L. R. Mitchell (G3BHK), 965 Oxford Road, Reading.

PUBLICATION DATE

Owing to a temporary rearrangement of our printing schedule the publication date of the November issue of *Wireless World* will be advanced to October 15th.

News from the Industry

E.M.I.—With the merging of E.M.I.'s domestic radio interests with those of Thorn Electrical and the recent setting up of a new company (E.M.I. Records, Ltd.) to handle the marketing of records, E.M.I. Sales & Service, Ltd., has been re-organized. R. J. T. Hewitt is appointed general manager and will act as deputy to the recently appointed managing director, H. A. Lewis. There are two main divisions within the company, one handling consumer products (household appliances, reproducers, car radio and components) and the other capital goods (magnetic tape, professional tape-recording equipment and sound and vision distribution equipment). The divisional managers are F. W. Goodman (consumer products) and P. H. Wetherill (capital goods). A. Thorpe is appointed works manager.

H.M.V. and Marconiphone.—Consequent upon the agreement between E.M.I. and Thorn regarding the manufacture and marketing of receivers under the trade names Marconiphone, H.M.V. and Ferguson, the British Radio Corporation, Ltd., was formed to merge these interests. Now two new marketing companies have been formed, "His Master's Voice" Radio and Television Sales, Ltd., and Marconiphone Radio and Television Sales, Ltd., with offices and showrooms at 21, Cavendish Place, London, W.1. The directors of both companies are F. W. Perks (E.M.I.) and S. T. Holmes and G. J. Strowger (Thorn). The marketing of Ferguson receivers will continue through Ferguson Radio Corporation.

English Electric are to supply a DEUCE computer to the Mechanical Engineering Research Laboratories (East Kilbride, Scotland) which is part of the Department of Scientific and Industrial Research. This will be the fifth DEUCE computer in Government service and will be employed mainly in calculations in hydro and thermo-mechanical problems. It will be the first machine of the series to be equipped for high-speed paper tape and punched card inputs.

Texas Instruments, Ltd., the British subsidiary set up nine months ago by the American Texas Instruments, Inc., open a factory at Dallas Road, Bedford, on October 1st. It is initially concentrating on the production of silicon rectifiers and transistors.

Helsinki.—Among the 450 representative United Kingdom products shown on the Council of Industrial Design stand at the British Trade Fair at Helsinki (September 6th-22nd) were two television sets (Ekko portable and Pye console), three sound receivers (Bush MB60 portable, Philco A3655 and R. M. Electric "Minitone" portable), and two record reproducers (E.A.R. "Chairside" and Pilot "Music Master").

Echo sounders, including the new MS30 open-boat type for inshore fishermen, are being shown by Kelvin Hughes at the International Fisheries Trade Fair at Copenhagen (September 27th to October 6th).

Vienna Trade Fair.—Products of the various companies in the Pye group, including domestic television and sound equipment, industrial and underwater television, scientific instruments, communications gear and components, were exhibited at the International Trade Fair held in Vienna from September 8th to 15th.

Netherlands.—Although no British radio manufacturer has an individual stand at the Radio Fair in Amsterdam (September 19th to 26th) U.K. products are on many of the stands. Some of the well-known names quoted in the preview of the show published in our Dutch contemporary *Radio Bulletin* are: Avo, Bakers-Selhurst, Belling-Lee, Colvern, Daly, E.M.I., Egen, Ferguson, Ferranti, Goodmans, Gresham, Leak, Morganite, Muirhead, Pam, Panton, Pamphonic, Pye, Q-Max, Racal, Truvox, W.B., Wharfedale and Wingrove & Rogers.

Angola.—The British Consulate in Luanda has prepared a report on the domestic receiver market in Portuguese East Africa. Whereas in 1949 the U.K. supplied over 1,000 receivers, which was 40% of the country's purchase, last year's figure of 740 was but 6% of the imports. The Netherlands supplied 40% of last year's receivers, U.S.A. 30% and Germany 20%.

Central American agency of U.K. manufacturers of components, accessories and test equipment is being sought by Henrique Stol Representaciones, Frontera 115 Dept. 303, Col. Roma, Mexico D.F. Among the accessories listed are pickups and cartridges, microphones, speaker magnets and cones, car aerials, amplifier and record-changer kits, and recording blanks.

OVERSEAS TRADE

Television film recording equipment (telerecording) has been ordered from Marconi's for the Prague studios of the Czechoslovakian television service. The equipment is similar to that mentioned in our March issue (p. 137), the outstanding feature being the "fast pull-down" film mechanism, which enables each frame of film to be moved into position during the blanking period between television frames—from 1.4 to 1.8 msec. The Prague installation will have a number of additional features, including a waveform monitor and facilities for separate synchronous magnetic sound recording.



EXACTING STANDARDS of cleanliness are observed in this dust-free, air-conditioned zone of the AVO factory, at Douglas Street, London, S.W.1, within which instruments are built, calibrated and tested.

Miniature Soldering Iron.—Oryx Electrical Laboratories, Ltd., of 98, Dominion Road, Worthing, Sussex, manufacturers of the Oryx sub-miniature soldering iron, are making a change in their sales policy and invite inquiries from overseas for exclusive agencies.

NEW ADDRESSES

Minnesota Mining and Manufacturing Co., Ltd., have moved their offices to a new building, to be known as 3M House, in Wigmore Street, London, W.1. (Tel.: Hunter 5522.)

Antiference, Ltd., have opened a new factory on the Bicester Road, Aylesbury, Bucks. (Tel.: Aylesbury 2511), where all sales, service and accounts matters are now being dealt with.

Anders Electronics, Ltd., manufacturers of test and measuring equipment, have transferred their office to 103, Hampstead Road, London, N.W.1. (Tel.: Euston 1639.) The dispatch department and warehouse remain at 91, Hampstead Road.

Marine Aerials, Ltd., manufacturers of the "Marinette" indoor television aerial, have moved from Deptford High Street, to 17a, Clifton Rise, New Cross, London, S.E.14. (Tel.: Tideway 3066.)

Electronic Products, of Ruislip, has been merged with Nesco Products, Ltd., of 149, Stanwell Road, Ashford, Middlesex (Tel.: Ashford 3555). K. B. Hobday is the managing director of the combined company, which will continue to make Nesco public-address loudspeakers and is specializing in the automatic assembly of components on printed circuit boards.

OCTOBER MEETINGS

LONDON

3rd. I.E.E.—Address by T. E. Goldup (president) at 5.30 at Savoy Place, W.C.2.

4th. Television Society.—"Recent investigations into the operation of image orthicon camera tubes" by Dr. R. Theile (Institut für Rundfunktechnik, Nuremberg) at 7.0 at 164 Shaftesbury Avenue, W.C.2.

15th. Institute of Physics (Electronics Group).—"In electronic beams" by Dr. D. Meltzie at 5.30 at 47 Belgrave Square, S.W.1.

15th. Physical Society (Acoustics Group).—"Present state of acoustic theory as applied to small rooms" by J. Moir at 5.30 in the Physics Department, Imperial College.

15th. Institution of Post Office Electrical Engineers.—"Thirty years of radio development in the Post Office" by H. G. Beer at 5.0 at the I.E.E., Savoy Place, W.C.2.

16th. I.E.E.—"Some radio aids for high-speed aircraft" by Dr. J. S. McPetrie at 5.30 at Savoy Place, W.C.2.

16th. Radar Association.—Lecture at 7.30 at the Anatomy Theatre University College, Gower Street, W.C.1.

17th. Television Society.—Discussion on servicing modern television receivers at 7.0 at 164 Shaftesbury Avenue, W.C.2.

18th. B.S.R.A.—"Plastic deformation and wear of gramophone records" by Dr. D. R. Barlow at 7.15 at the Royal Society of Arts, John Adam Street, Adelphi, W.C.2.

23rd. British Kinematograph Society.—"Simple techniques in television film production" by John Lamont, R. Evans and W. H. Cheevers (Associated-Rediffusion) at 7.30 at the Royal Society of Arts, John Adam Street, W.C.2.

28th. I.E.E.—"Domestic high-fidelity reproduction" by J. Moir at 5.30 at Savoy Place, W.C.2.

31st. Television Society.—"Performance of television receiver turret tuners" by K. H. Smith (Siemens Edison Swan) at 7.0 at 164 Shaftesbury Avenue, W.C.2.

CHELTENHAM

4th. Brit.I.R.E.—"Radio engineering" by C. T. Lamping at 7.0 at the North Gloucestershire Technical College.

GLASGOW

10th. Brit.I.R.E.—"Reception problems of Scottish television" by W. Boyd at 7.0 at the Institution of Engineers and Shipbuilders, 39 Elmbank Crescent.

25th. Society of Instrument Technology.—"Computer control of machine tools" by A. A. Lodge at 7.15 at the Scottish Building Centre, 425 Sauchiehall Street.

MANCHESTER

3rd. Brit.I.R.F.—"High-quality sound equipment" by K. Davin and F. C. Gibson at 6.30 at Reynolds Hall, College of Technology, Sackville Street.

9th. I.E.E.—Address by K. J. Butler, chairman of N.W. Radio and Telecommunication Group at 6.45 at the Engineers' Club, Albert Square.

NEWCASTLE

21st. I.E.E.—Address by W. Gray, chairman of N.E. Radio and Measurements Group at 6.15 at King's College.

SHEFFIELD

9th. Society of Instrument Technology.—"Computers in heavy industry" by Dr. C. M. Wilson at 7.0 at the University, St. Georges Square.

WOLVERHAMPTON

9th. Brit.I.R.E.—"Transistors—circuits and applications" by M. D. Cooper at 7.15 at the Wolverhampton and Staffordshire Technical College, Wulfruna Street.

LATE-SEPTEMBER MEETING

27th. R.S.G.B.—"Trends in aerial design for the amateur" by S. Kharbada, G2PU, (Labgear) at 6.30 at the I.E.E., Savoy Place, London, W.C.2.

new

TRIX

DYNAMIC MICROPHONE



THE MICROPHONE ILLUSTRATED is our new type G7850, a dynamic microphone of outstanding contemporary design. It is finished in bronze black, carries a ring-locking plug connector and is suitable for hand and stand use. Owing to its exceptional top response characteristic, it gives particularly good reproduction of speech and thus, allied to its distinguished looks, will make it a welcome and handsome addition to our range of Sound Reproducing Equipment. (Dimensions: Head diam. 1½ in.; Overall length 8¼ in.)

Price: 15 gns.

Please write for full details of our complete range of Sound Reproducing Equipment.

a product of

TRIX ELECTRICAL COMPANY LTD.
1-5 Maple Place, Tottenham Court Road,
London W. 1

Tel: MUSEum 5817 Gram: Trixadio Wesdo London

P277

RANDOM RADIATIONS

By "DIALLIST"

Good Going

WITH five transmitters (Croydon, Lichfield, Winter Hill, Emley Moor and Black Hill) already at work, the Glamorgan station due to come into action before the end of this year, the Isle of Wight transmitter scheduled for completion by next summer and a station in the North East by the end of 1958, the Independent Television Authority can't be said to have let the grass grow under its feet in the comparatively short time that it has been in existence. Over 85% of the population will then be within the I.T.A. service areas. The Authority plans that its programmes should cover almost the whole of the country within the next three years. The task wasn't an easy one when a beginning was made, for little or nothing was known about the propagation of vertically polarized television transmission in Band III and it was expected that there would be reception snags due to such things as blind spots and ghost-producing reflections. Actually, the service areas have mostly proved to be rather larger than was expected. Some of the good beyond-the-fringe reception that has been reported from many places is undoubtedly due to sunspot pranks and is not likely to last indefinitely. But, taking them by and large, all of the Band III stations are putting up a good show.

Polarization Problems

AT the time of writing Black Hill's test transmissions have been playing up in the matter of polarization. Outside the main service area a strong horizontally-polarized signal is found to be coming in some places. I'm not really surprised. When I lived in Hertfordshire some 50 miles from Wrotham I found quite accidentally that its transmissions could be very well received with a vertical dipole. And, if you remember, I gave some account in these notes a month or two ago of the experiences of a Lancashire reader who was regularly receiving Wrotham and found that it didn't seem to matter two hoots whether the apology for a dipole that he had made was arranged horizontally or vertically. I've just heard

from a reader living in Launceston, in Cornwall, that before North Hesyary Tor came into action on full power he used frequently to receive the f.m. transmissions from Wenvoe and Wrotham by means of his vertical channel-5 television aerial, normally used for receiving Wenvoe. Wrotham, as I've remarked before, seems to hold the B.B.C. record for long-distance v.h.f. reception. A kind correspondent tells me that during a recent visit to Germany he had no difficulty in receiving Wrotham with a 3-valve Grundig set using a simple home-made dipole.

Fringe Area TV Sets

I AM glad to see that so many firms this year are producing fringe-area TV receivers as counterparts to their standard sets. A very large number of the inhabitants of these islands live just outside the service areas of both B.B.C. and I.T.A. transmitters. Such people receive a weak signal, and one of their most common complaints is that the line scan won't stay locked. The reason is, of course that the sync pulses received in such areas aren't of sufficient amplitude to hold the ordinary sync separator-differentiating circuit-oscillator line scan to its correct frequency. Various forms of fly-wheel sync have been introduced, and these can be a very great help. The

trouble, though, about many of them is that they mean extra valves and bits and pieces, and so add considerably to the cost of the sets.

The Sychroguide System

One method of keeping the line timebase running at exactly the right speed greatly takes my fancy. This is the sychroguide, which was originally developed in the U.S.A. and is now being used to a considerable extent in this country. Only two triodes are needed, and these can be in the form of a double triode. The first is the control valve, to whose cathode are applied negative-going sync pulses. This valve is biased back so far that only the tips of the pulses make it conductive. Valve number two is a blocking oscillator. The positive-going pips of its grid-voltage waveform are applied to the grid of the control valve. When the timebase speed is correct these pips coincide with the leading edges of the sync pulses. Anode current then flows, and both its amplitude and duration are conditioned by the phase relationship of the sync pulse and the pip. From this current is derived a voltage which is applied to the grid of the blocking oscillator. Should it be running too slowly the pip is late in arriving at the cathode of the control valve; anode current flows for a longer period and the biasing pulse



"WIRELESS WORLD" PUBLICATIONS

	Net Price	By Post
ABACS OR NOMOGRAMS: A. Giet. Translated from the French by H. D. Phippen and J. W. Head	35/-	36/-
TELEVISION RECEIVING EQUIPMENT. W. T. Cocking, M.I.E.E. 4th Edition	30/-	31/9
TRANSISTOR A.F. AMPLIFIERS. D. D. Jones, M.Sc., D.I.C. and R. A. Hilbourne, B.Sc.	21/-	21/10
WIRELESS SERVICING MANUAL. W. T. Cocking, M.I.E.E. 9th Edition	17/6	18/8
SECOND THOUGHTS ON RADIO THEORY. "Cathode Ray" of <i>Wireless World</i>	25/-	26/4
RADIO LABORATORY HANDBOOK. M. G. Scroggie, B.Sc., M.I.E.E. 6th Edition	25/-	26/9
ELECTRONIC COMPUTERS: Principles and Applications Edited by T. E. Ivall	25/-	26/-
GUIDE TO BROADCASTING STATIONS 1957-58. Compiled by <i>Wireless World</i>	2/6	2/5
BASIC MATHEMATICS FOR RADIO AND ELECTRONICS. F. M. Colebrook, B.Sc., D.I.C., A.C.G.I. Revised and enlarged by J. W. Head, M.A.(Cantab.). 3rd Edition	17/6	18/6

A complete list of books is available on application

Obtainable from all leading booksellers or from

ILIFFE & SONS LTD., Dorset House, Stamford Street, London, S.E.1

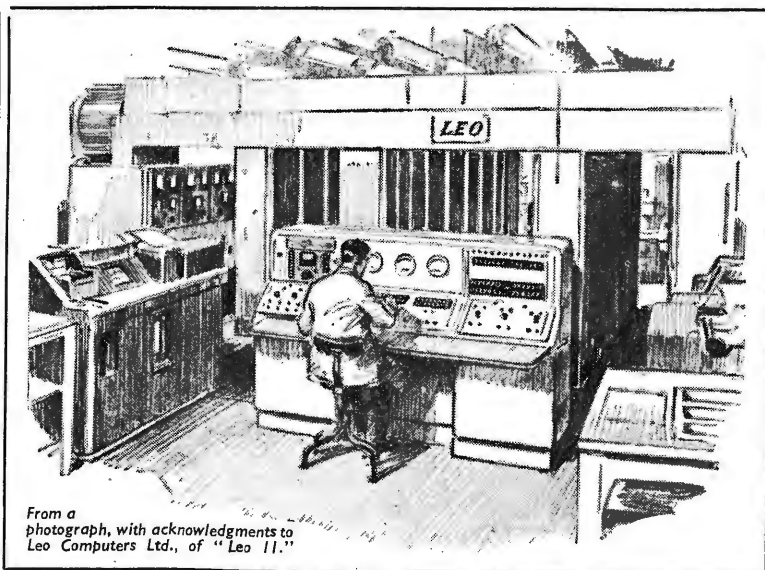
is lengthened, so speeding up the blocking oscillator. If the speed is too high, the resultant biasing pulse is shortened and the oscillator slowed down. Like so many ingenious ideas, it's beautifully simple. And it works well, provided that the TV set has effective a.g.c.

VHF/FM Comes Into Its Own

IT'S good to see that the majority of sound receivers, other than battery portables and the less expensive kind of mains sets, are provided this year with a Band II range for the reception of f.m. transmissions. Only the more expensive sets with high-quality audio stages will be able to do full justice to the excellent quality of the B.B.C.'s now almost country-wide system; but all will confer the advantage of freedom from almost every kind of interference. You get a silent background and, if you have an outdoor dipole, complete freedom from all sorts of interference. Some sets have a built-in ferrite aerial for Band II. That's all right, if you happen to live at the top of a high building (as I do), or in a place where there is little interference from the ignition systems of motor vehicles. But if you try to use the v.h.f. range with a built-in ferrite aerial on the ground floor of a house, or near a road carrying no small volume of motor traffic, you're liable to disbelieve the "no interference" claim made for the service. Give it a fair chance and you'll have no complaints to make.

FM and TV

WRITING from Rawthorpe, near Huddersfield, a reader sends me an interesting account of reception of both f.m. from Holme Moss and the a.m. sound from the Emley Moor television station on his f.m. set. The transmitting aerials of both stations can be seen from windows in the upper part of his house. By detuning from the Holme Moss Home Service frequency (93.7 Mc/s) towards that of the Third Programme (91.5 Mc/s) he can bring in the I.T.A. sound (196.25 Mc/s). His set has a.f.c., which enables him to "drag" the transmission further away from the Home. Then, by reducing the h.f. reproduction by means of the tone control, he can cut down the background noise until it's quite inoffensive. When the set is tuned to the Home Service there is no interference from Emley Moor. Have any other readers had similar experiences?



From a photograph, with acknowledgments to Leo Computers Ltd., of "Leo 11."

Electronic components FOR ALL INDUSTRIES (COMPUTERS)

Used in every form of mechanico-electrical accounting and computing equipment — and we illustrate one famous model — BULGIN Electronic Components are overcoming problems of control, as in all the Scientific and Industrial fields, giving faithful and reliable service. The Bulgin research department and manufacturing units, with their unique skill and experience, build good electronic components on which you can depend.

Over 10,000 different components are now available.

★ For full details of Bulgin Components send for fully illustrated Catalogue No. 197/W.W. (free to trade letterhead or trade order)



THE HOUSE OF **BULGIN**

A. F. BULGIN & CO., LTD.



BARKING ESSEX.

Tel.: RlPpleway 5588

MANUFACTURERS OF RADIO AND ELECTRONIC COMPONENTS

Canned Concerts

I HAVE previously pleaded in these columns for manufacturers to give us a wireless set with a built-in tape recorder and a time switch so that if some programme to which we wish to listen clashes with an important "date" we can arrange for it to be bottled in our absence.

There is obviously no technical difficulty whatever in producing such an instrument, but probably there is a legal snag in connection with recording rights and that is why nothing has been done about it so far. I was glad to see, however, that a start was made in the right direction with a tape recorder at the 1955 Radio Show with space for a v.h.f. radio receiver, and some of the German sets that are on the market in this country approach the problem in a remarkably sensible way.

German manufacturers have obviously realized that a set with a built-in tape recorder would be very expensive and one of them has therefore produced a receiver in which there is provision for adding the tape recorder afterwards, and I understand that others are doing the same thing. This particular manufacturer also makes a tape recorder and he has left a space for housing it. You may say that there is not much to shout about in a mere space and nor is there until you buy a tape recorder to fill it up. It is at any rate a beginning. Maybe in next year's model we shall see a space left for a time switch.

Another point I like about all these "hi-fi" sets from the fatherland is that they all have a special outlet socket for coupling up a tape recorder so that you can feed straight from the diode into the amplifier of the recorder, so by-passing the set's amplifier with its "non-recordingenic" (horrible but apt expression) characteristics.

Telly Nellie

BECAUSE of the intuitive flair women have for diagnosing trouble in bawling babies I have always held the opinion that they would make far better radio service technicians than men. I recollect once spending a convivial evening with a young doctor when his wife was out. Their sleeping baby upstairs suddenly let out a piercing yell. We both went upstairs to see what was the matter and although we, metaphorically, "turned all the knobs" we failed to reduce the howling by a single dB.

Eventually the youthful medico got out his stethoscope and was about to carry out a thorough examination when his wife came home, angrily pushed us aside and without more

ado diagnosed the trouble intuitively. I don't recollect exactly what the trouble was but I know safety pins came into it.

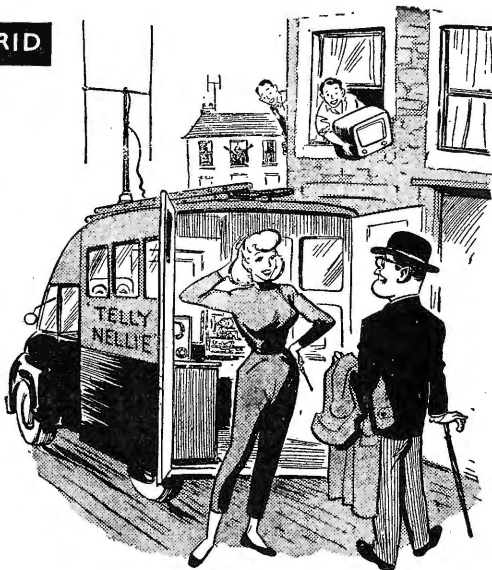
Some time ago I told you of a dealer who employs girls as service technicians, finding their intuitive faculties cheaper and quicker than an oscilloscope but recently I came across a far more remarkable instance of the same sort of thing. I was visiting friends in a small village which lies just within the fringe area of the London TV stations. Each house had a very complex aerial array and I was told that sets have to be kept up to concert pitch in order to get good results. I was also informed that consistently good reception in that and neighbouring villages is only made possible by the activities of a girl who has fitted up a small motor van as a mobile service station.

To obtain her services it is only necessary to telephone her HQ a few miles away and if already out on a job a message is sent to her in the van by a mobile radio link. She is known throughout the countryside as Telly Nellie and uses the slogan "Send for Telly Nellie." When her van arrives at a customer's house she runs a long cable to plug into the mains in the house and removes the set to her mobile test bench for first-aid work. In the case of a serious fault she takes it to her HQ.

I had the good fortune to see her when her van drew up in the village street and had a chat with her. She is not only a competent service technician but also an extremely attractive girl and I was not surprised to learn that many of the lads of the village were having constant trouble with their TV sets. There seems to be much scope for this sort of service in country districts and also for alternative names such as Radio Rita and Video Vera.

Ernie's Innards

I WAS informed by the P.R.O. of the Lead Development Association that Ernie's innards were encased in lead and in reporting this in the August issue I said I wondered if this was because he might be a bit radio-active. A G.P.O. engineer now writes telling me that Ernie is not encased in lead but, like a good civil servant, he is conventional in his attire. He assures me that the only lead in him is the normal lead sheathing of connecting cables.



Competent and comely

Seeing While You Soak

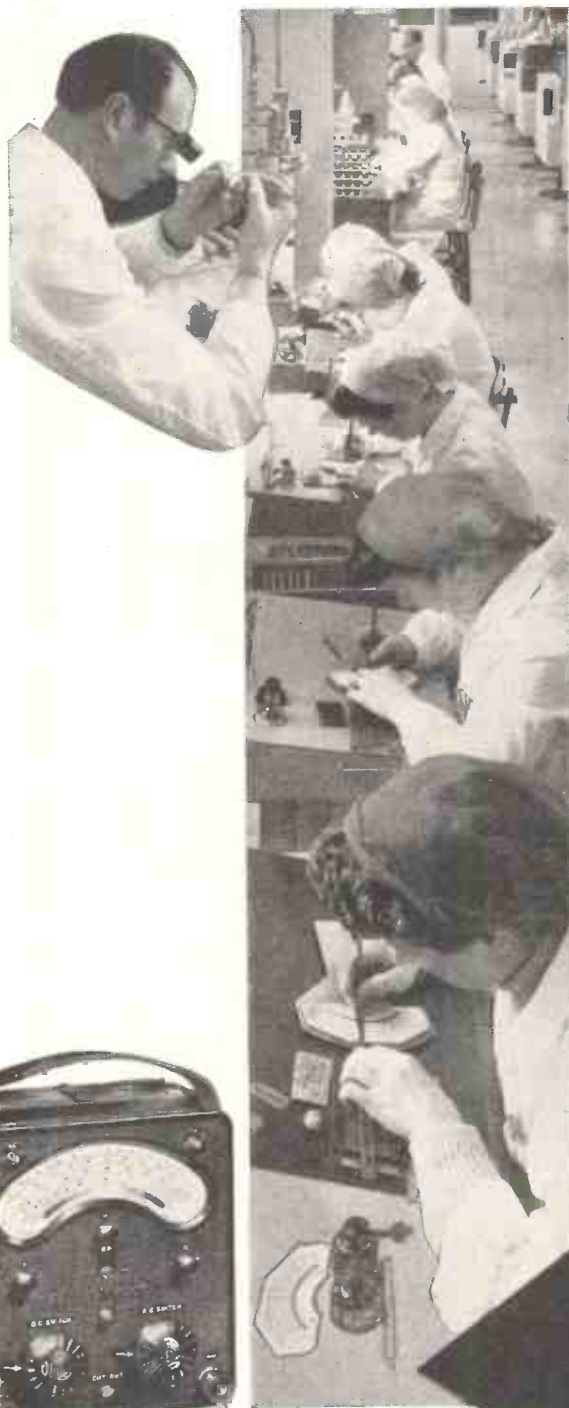
IF any of you are thinking of taking my tip (Oct., 1956, issue) to instal bathroom TV, you will at once be confronted with the problem of steaming up of the screen. However, there is no need to adopt a Spartan regime of cold baths as all you need to do is to instal a car windshield wiper to keep the TV screen clear.

Recently I moved into a new house and asked the local electricity authority, if, whilst installing an immersion heater in the bathroom, they would mount on the skirting board an outlet socket. They were adamant in their refusal.

After much argument, however, they agreed to instal a step-down transformer under the floorboards to provide a six-volt feed to a skirting board socket for my electric shaver which has an optional six-volt input.

Technically speaking there ought to be no difficulty about operating a television set from a six-volt a.c. supply provided that I can find a TV set manufacturer enterprising enough to fit to his product a power transformer with a six-volt input winding. Maybe a set with this special power-input arrangement exists already.

Another great advantage of my six-volt idea is, of course, that you can shave in comfort and cleanliness as one of the greatest objections to certain electric shavers is that they act like a mowing machine without a grass box and tend to bespatter your chest with facial fungus. For those of you who only want to shave in the bath and not to enjoy TV I would point out that all you need is an inexpensive bell-ringing transformer as its voltage output is just right, although quite inadequate, of course, for a TV set.



A Good Sign ...

It is a good sign when such an old-established firm as AVO Ltd. adopt such advanced techniques as those in practice in their new dust-free air-conditioned zone.

It is under these ideal conditions of scrupulous cleanliness and controlled temperature and humidity that the world-famous instruments bearing the "AVO" sign are assembled, calibrated and tested.

To users of instruments, "AVO" is a good sign ... a sign of dependability. To users of electrical appliances, "AVO" is a sign of the competence and discernment they look for in the manufacture of a product and in those who service it.

To the whole world



is a good sign.



AVO Ltd.

AVOCET HOUSE • 92-96 VAUXHALL BRIDGE ROAD • LONDON • S.W.1
Telephone: VIctoria 3404 (9 lines)

'packaged' power

saves design time
and effort

Performance figures unaffected by capacity loading on the H.T. output.

It's so easy to put in a ready-made, self-contained, completely reliable Power Supply sub-unit!

A COMPLETE RANGE OF SELF-CONTAINED UNITS READY TO BUILD INTO YOUR PROJECT	SRS 156	AS 619	AS 516	AS 517	AS 515	AS 615	AS 616
VOLTAGE	±150V	±150V to ±180V	±250V or ±300V	±250V or ±300V	±250V or ±300V	±250V or ±300V	±250V or ±300V
CURRENT	0-40ma	0-200ma	0-50ma	10-100ma	0-150ma or 50-200ma at 250V. 100-200ma at 300V.	0-500ma	0-1A
A.C. OUTPUTS	6.3V 4A C.T. 6.3V 1A	6.3V 4A C.T. 6.3V 4A C.T. 6.3V 1A C.T.	6.3V 4A C.T. 6.3V 1A	6.3V 4A C.T. 6.3V 2A C.T. 6.3V 1A	6.3V 4A C.T. 6.3V 4A C.T. 6.3V 1A	6.3V 5A C.T. 6.3V .5A C.T.	6.3V 10A C.T.
D.C. SOURCE IMPEDANCE	<2Ω	<1Ω	<1Ω	<1Ω	<1Ω	<1Ω	<1Ω
STABILISATION FACTOR BETTER THAN	400:1	400:1	400:1	400:1	300:1	400:1	400:1
A.C. SOURCE IMPEDANCE 40c/s—100kc/s	<2Ω	<2Ω	<0.25Ω	<0.25Ω	<0.5Ω	<0.5Ω	<0.5Ω
RIPPLE AND NOISE CONTENT	<350μV	<300μV	<250μV	<300μV	<1mV	<300μV	<300μV
DIMENSIONS	9½" × 6½" × 6½" high	10" × 10" × 6-7/8" high	9½" × 6½" × 6½" high	9½" × 7½" × 6½" high	9½" × 9½" × 6½" high	19" × 12½" × 10½" high	19" × 19" × 10½" high
WEIGHT	14½ lbs	21½ lbs	14½ lbs	20½ lbs	21½ lbs	80 lbs	approx 150 lbs

From this complete range of regulated power supply sub-units you can choose, ready-made, the right power source for your prototype or production equipments. Why waste design time and effort on a part of the problem which we have already thoroughly covered for you?

These robustly made units are giving excellent service in many forms of electronic equipments, computers, simulators, industrial controls, etc. Educational and servicing establishments find them most useful as bench instruments because of their compactness.



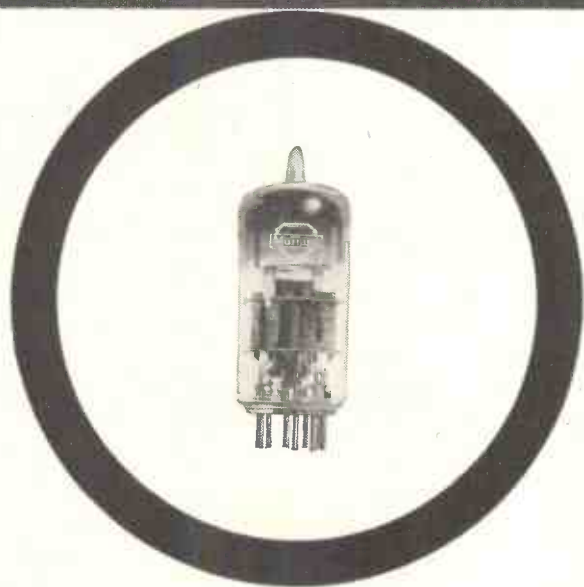
Notable features are

- ★ LONG TERM RELIABILITY
- ★ LOW SOURCE IMPEDANCE
- ★ VERY LOW RIPPLE AND NOISE CONTENT
- ★ GOOD STABILISATION RATIO
- ★ LOW COST. DELIVERY EX STOCK

Power Supply Sub-units

THE SOLARTRON ELECTRONIC GROUP LTD • THAMES DITTON • SURREY • ENGLAND

Telephone: EMBerbrook 5522 • Cables: Solartron, Thames Ditton



Close tolerance characteristics

Close tolerances of standing current, slope, balance and cut-off add to equipment reliability and life.

Low impedance

High anode current at zero bias and low anode voltage provide high speed capabilities.

High slope — controlled cut-off

A high slope of 12.5 mA/V and a short grid base ensure small drive requirements.

Low cross capacitances

Sections are physically screened, thus materially reducing cross capacitances and permitting sections to be used independently.

The employment of a frame grid construction in this valve is largely responsible for its outstanding characteristics. This also enables a good noise factor to be achieved in r.f. or i.f. input applications thus making the E88CC suitable for use in Radar, Communications, Television Studio Equipment, etc.

Further technical information concerning the E88CC is available on request.

E88CC

a new
high speed
Double
Triode for—
computing,
switching
and scaling

ABRIDGED DATA

$V_h = 6.3V$ $I_h = 300mA$

Computer operation

$V_a(b)$	150V
$V_g (I_a = 100\mu A)$	$-7.0 \pm 1.5V$
$V_g (I_a = 5.0\mu A)$	-15V
V_g difference ($V_{g1} - V_{g2}$ at $I_a = 100\mu A$)	$< -2.0V$

Cascode amplifier

V_b	100V
$V_{g(b)}$	+9.0V
R_k	680 ohms.
I_a	$15 \pm 0.8mA$
gm	10.5 to 15 mA/V
Noise factor ($f = 200Mc/s$)	4.6dB
R_{eq} (r.f.)	300 ohms.
Base	B9A

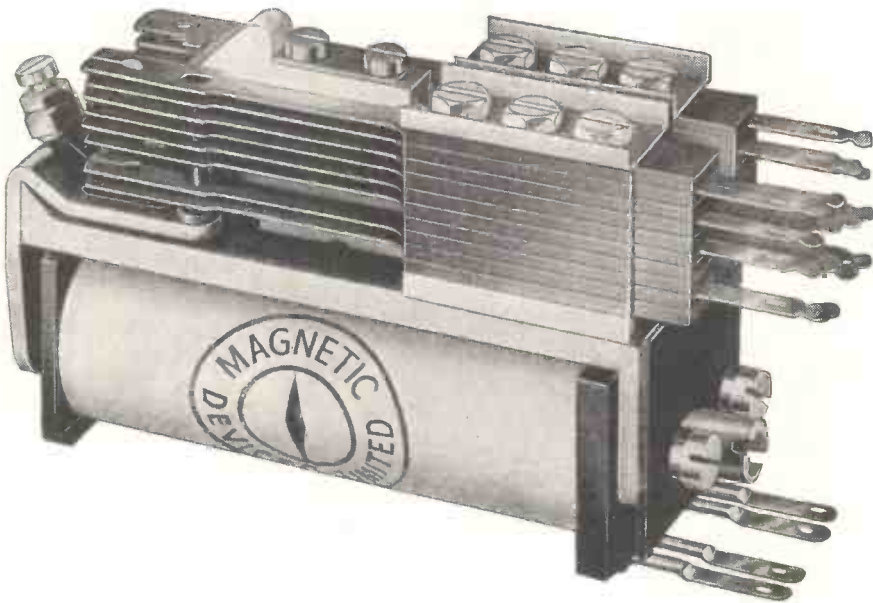
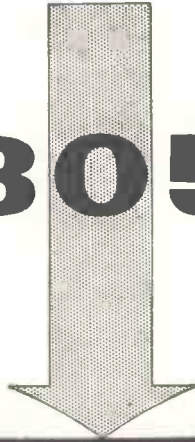
Mullard

COMMUNICATIONS-AND
INDUSTRIAL VALVE DEPARTMENT



Mullard Limited, Mullard House,
Torrington Place, London, W.C.1

series 305 relay



P.O. 3000 RELAY

This Relay is the well known P.O. 3000 Relay and can be supplied with coils wound for standard voltages up to 250 volts D.C.

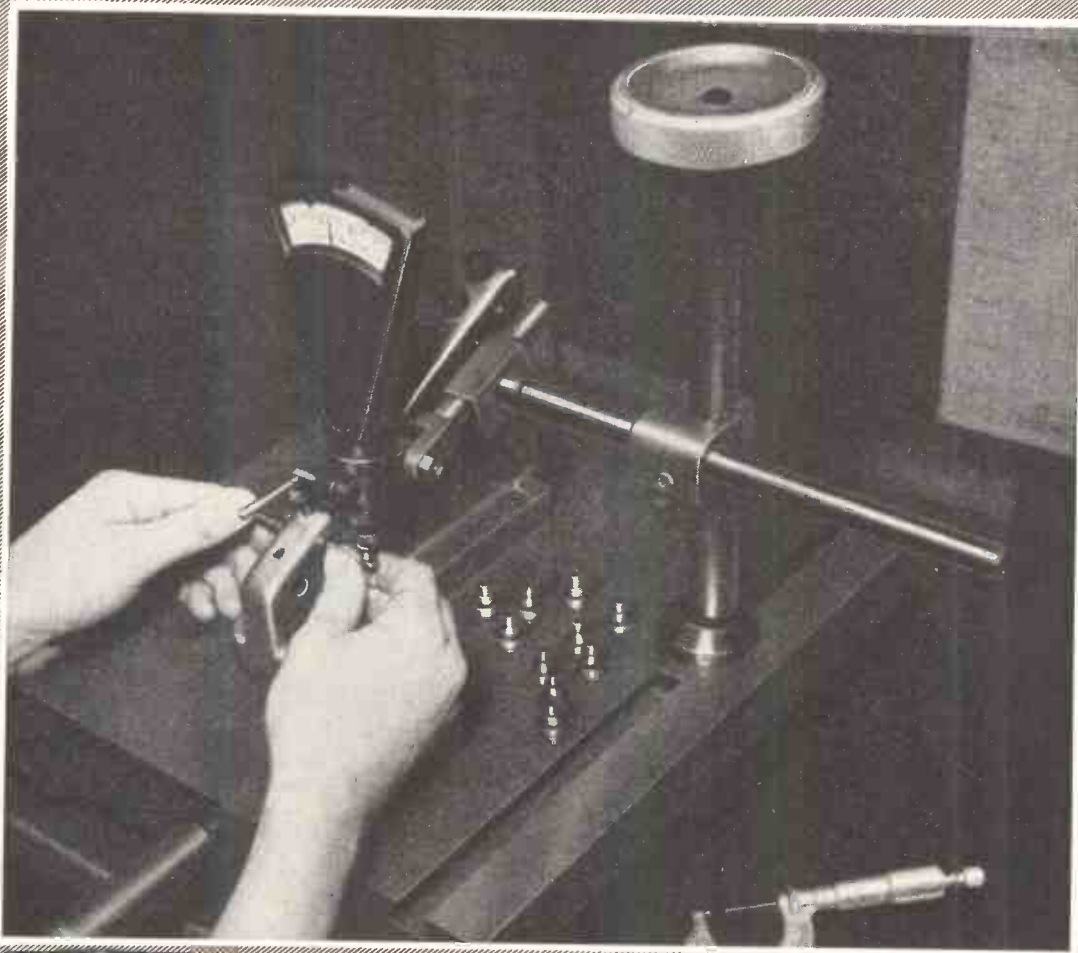
Contact assemblies are available up to six pole changeover and alternative rivets can be supplied to suit varying duties. The Series 305 Relay can be slugged for make or break action and coils can be vacuum impregnated for tropical and humid conditions.

Magnetic Devices
A.I.D. & A.R.B. approved. **LTD**

MAGNETIC DEVICES LTD. EXNING ROAD, NEWMARKET, SUFFOLK

Telephone : Newmarket 3181/2/3

Telegrams : MAGNETIC, Newmarket



Micro Gauging

"Why  is best" series No 7

ACCURACY in the manufacture of components for Garrard record playing equipment is essential, and to ensure that the high standards are maintained, strict inspection is applied at all stages of manufacture. The gauge illustrated above checks the concentricity of motor pulleys to an accuracy of one ten-thousandth of an inch. This is only one of the many inspections carried out on components produced by the Garrard factory. One more reason why Garrard units are the finest in the world.

Garrard AUDIO
PERFECTION

THE GARRARD ENGINEERING AND MANUFACTURING CO. LTD SWINDON · WILTS

Announcing **THE NEW**



L.F. PHASE METER

TYPE 206

THE Airmec L.F. Phase Meter Type 206 has been designed to enable measurements of gain and phase-shift to be made on any four-terminal network operating in the frequency range 20 c/s-100 kc/s.

Phase is indicated directly on a six inch meter having four scales and the gain or loss values are indicated by the difference between two attenuator settings.



- Frequency Range:** 20 c/s to 100 kc/s.
- Accuracy:** $\pm 2^\circ$ from 100 c/s to 20 kc/s.
 $\pm 5^\circ$ at other frequencies.
- Input:** 1 mV to 1 V
- Difference in Input Level:** Up to 60 db.
- Input Impedance:** 12 M ohms.
- Attenuators:** Calibrated 50 db step and 10 db slidewire attenuators with an accuracy of ± 0.2 db for each 10 db.
- Display:** 6 inch meter calibrated in four ranges
 0° to 360° ; -90° to $+90^\circ$
 -180° to $+180^\circ$; $+90^\circ$ to $+270^\circ$.

Full details of this or any other Airmec instrument will be forwarded gladly upon request.

AIRMEC

L I M I T E D

HIGH WYCOMBE

BUCKS.

ENGLAND

Telephone: High Wycombe 2060

Cables: Airmec High Wycombe



V.H.F. radio telephones

A.T.E. single-channel radio telephone equipment takes over where landlines are impracticable or uneconomic. Providing communication services over relatively short distances—normally between points within optical range—V.H.F. Radio telephones have many applications, including fixed point to point communication for industrial, mining and agricultural purposes, and portable equipment for transport.

The equipment may be mains or battery driven, fixed or portable.

A range of equipment is available with the following characteristics.

- ★ Frequency or amplitude modulation
- ★ Frequency bands 156-184 Mc/s or 54-87 Mc/s
- ★ Transmitted power 0.6 W-10 W



AUTOMATIC TELEPHONE AND ELECTRIC COMPANY LIMITED

STROWGER HOUSE . ARUNDEL STREET . LONDON . W.C.2. Telephone: TEMple Bar 4506
Telegrams : Strowger Estrand London. *STROWGER WORKS, LIVERPOOL, 7.]*

AT 1441

EMITAPE

HI-FI MAGNETIC RECORDING TAPE



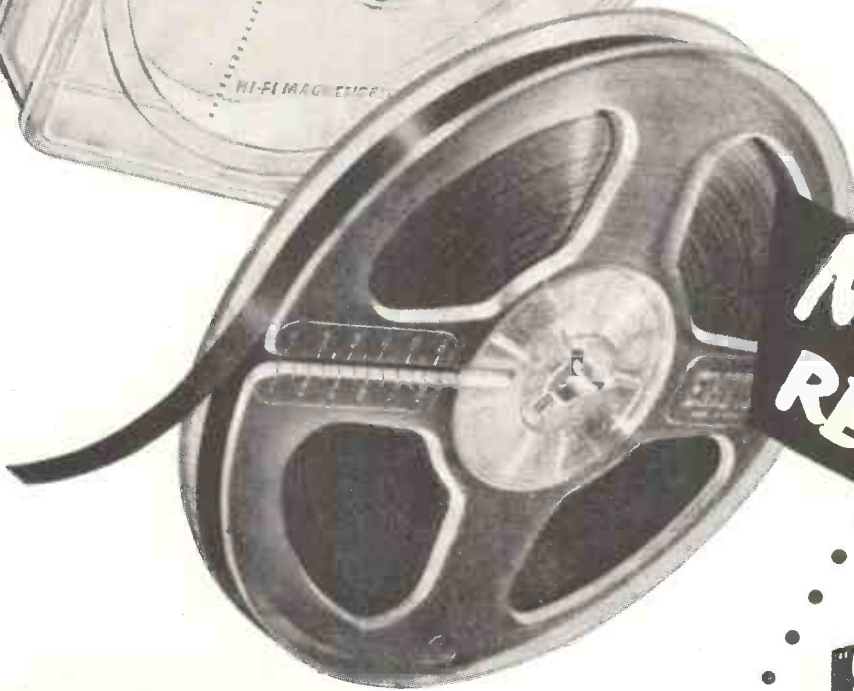
FOR ALL
TAPE RECORDERS

E.M.I. SALES & SERVICE LTD

-with the NEW look!



**New
EMICASE!**



**New
REEL!**

88"

GENERAL
PURPOSE

99"

LONG PLAY
50% increased
playing time

HAYES · MIDDLESEX · ENGLAND

AS SHOWN AT THE RADIO SHOW

ESI47A

F requency & Time Measurement



FREQUENCY MEASURING EQUIPMENT, TYPE TSA3

Transistorized throughout.

TIME measurement from 0.0001 of a second to 11½ days.

FREQUENCY measurement from 0.1 of a cycle to 50 kc/s.

PERIOD measurement from 0.00001 of a cycle to 100 c/s.
5 digit display.

Digital time base.

Accuracy better than $\pm 0.005\%$.

Self checking on 5 frequencies.

Variable display time from 0.5 seconds to 5 seconds or infinite.

Sine, square or pulse inputs.

Standard output frequencies at 0.1 c/s, 1 c/s, 10 c/s, 100 c/s, 1 kc/s, and 10 kc/s.

Portable - weighs only 27½ lbs. and measures 14½" x 7¼" x 11½".

Low power consumption - only 2W at 12V.

Price: £275 0s. 0d.



MILLISECOND STOPCLOCK TYPE TSA4

Transistorized throughout.

TIME measurement from 0.0001 of a second to 27.8 hours.

Digital counting.

Measures virtually any contact or pulse interval time within the range stated from common or independent sources.

Accuracy better than $\pm 0.005\%$.

Indicated time read direct in seconds from the cyclometer counter, four decimal places from the meters.

Portable - weighs only 19 lbs. and measures 13" x 9" x 7½".

Low power consumption - only 1W at 12V.

Removable lid protects front panel and meters when in transit.

Price: £155 0s. 0d.

Both types of equipment are constructed from Venner plug-in stages and are therefore inherently reliable.

Write for descriptive literature

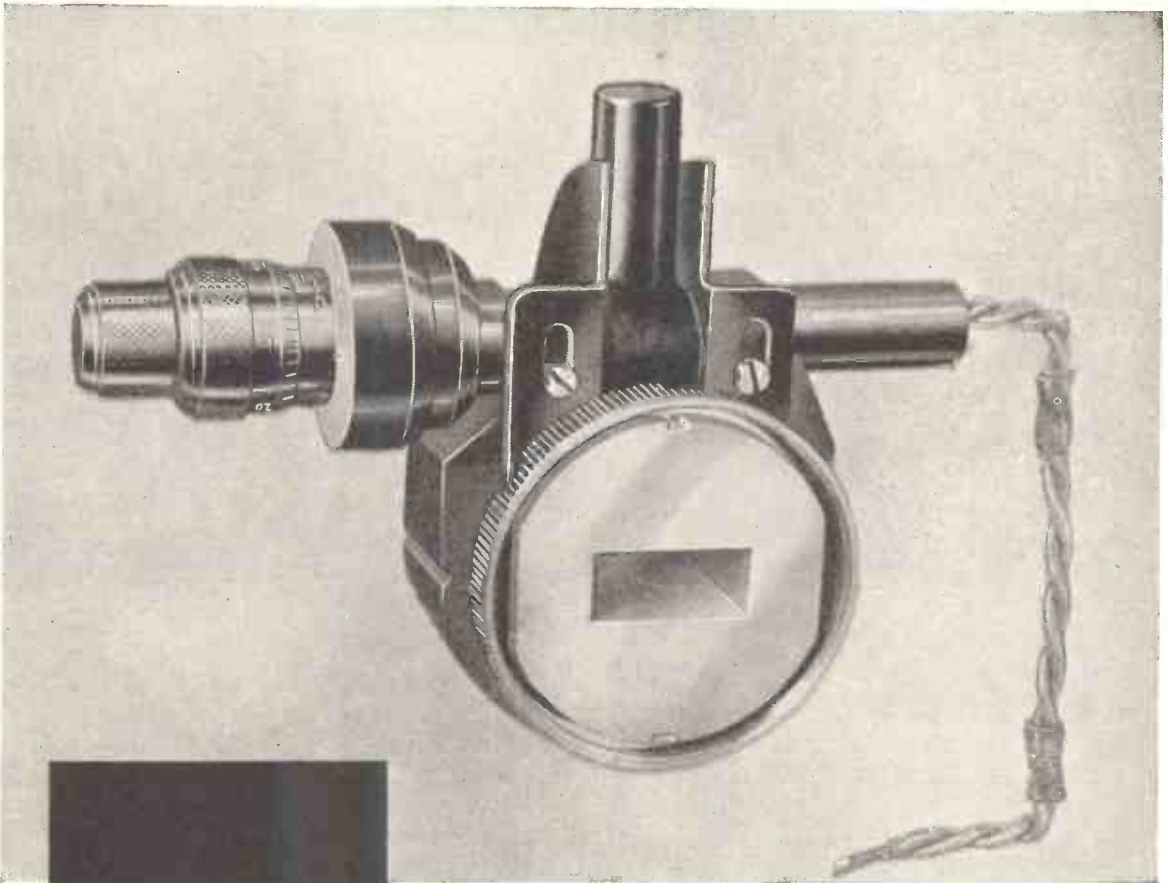
VENNER ELECTRONICS LTD.

Kingston By-Pass, New Malden, Surrey.

Associated Companies: Venner Limited

Telephone: MALden 2442

Venner Accumulators Limited



Mullard

tunable magnetrons

These tunable X-band medium power magnetrons, developed by Mullard and produced in the new microwave valve factory, represent an important contribution to the field of microwave valves. They are particularly suited for use in microwave test equipment where c.w. power levels of a few watts are required.

JPT9-01

Tunable X-band magnetron with waveguide output. The valve delivers a c.w. output of 5 to 10 watts over a 450Mc/s band centred on 9375Mc/s. Tuning is by single-knob control, and has a total range of 800Mc/s, including the 450Mc/s band centred on 9375Mc/s.

JPT9-02

This is a similar valve intended for pulsed applications. It will deliver peak powers in excess of 20 watts over the 450Mc/s band at duty cycles up to 0.05.



MULLARD LIMITED · MULLARD HOUSE · FORRINGTON PLACE · LONDON W.C.1

Experimental samples are available of another c.w. magnetron which gives a power output of several watts over the frequency range 5850 to 7300Mc/s.

Mullard

COMMUNICATIONS AND
INDUSTRIAL VALVE DEPARTMENT

*no rungs missing
of*

in the ladder of our range

QUARTZ CRYSTALS

G.E.C.

For long term stability and unfailing activity, G.E.C. Quartz Crystal Units provide the basis for reliable communications systems.

A complete range of units to meet D.E.F. 5271 and R.C.L. 271 Inter Services styles can be supplied.

From
200 cycles/sec.
to
90 Mc/sec.

SALFORD ELECTRICAL INSTRUMENTS LIMITED

(COMPONENTS GROUP)

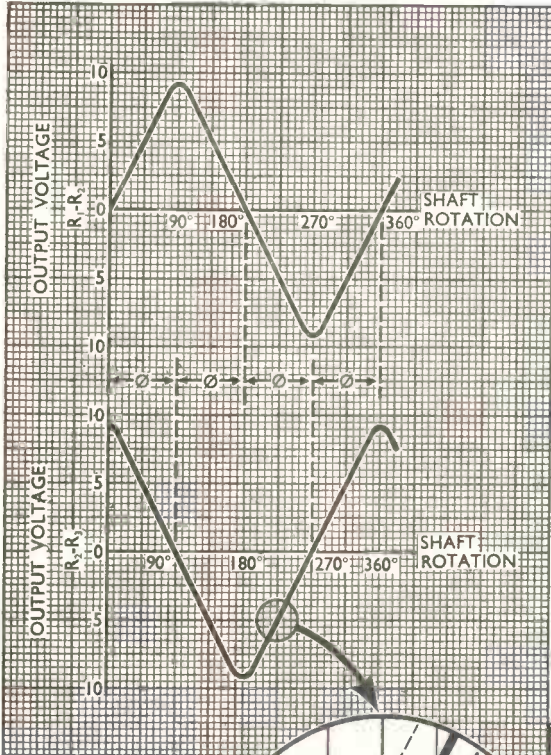
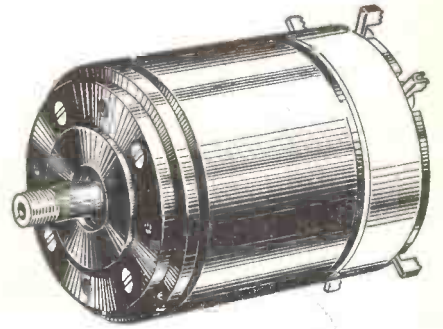
TIMES MILL · HEYWOOD · LANCASHIRE Tel: Heywood 6868

London Sales Office, Tel: Temple Bar 4669

A SUBSIDIARY OF THE GENERAL ELECTRIC CO. LTD. OF ENGLAND

A NEW APPROACH...

The SPERRY 15 VLT Synchro (Variable Linear Transformer)



The Sperry size 15 Variable Linear Transformer gives two output voltages whose amplitudes vary linearly with shaft rotation. It consists of a rotor with two windings at right angles which rotates in a stator having a single winding. If the Synchro is connected as shown, the voltages $V_{R_1-R_2}$ and $V_{R_2-R_1}$ vary linearly as shown in the accompanying graphs.

SUPPLY: — The unit is designed to work with a 1000 c.p.s. 10-volt signal applied to the stator, but will work at other frequencies including 400 and 50 c.p.s. with suitable adjustment of the signal level.

TRANSFORMATION RATIO: — The rotor output voltage, when the stator is excited at 10 volts 1,000 c.p.s., is arranged to rise to 5 volts when the rotor is displaced 45° from a null position. This transformation ratio of 2:1 varies ± 0.2 per cent between the windings in any one model and ± 0.5 per cent between models.

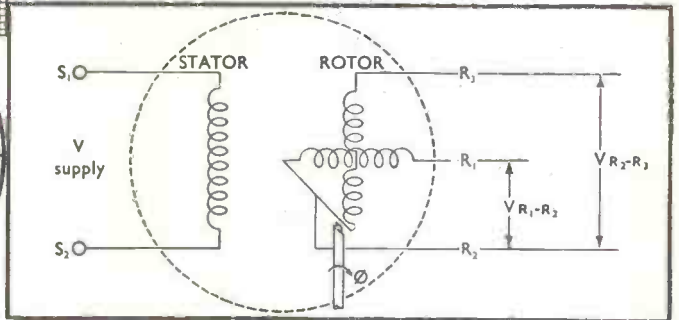
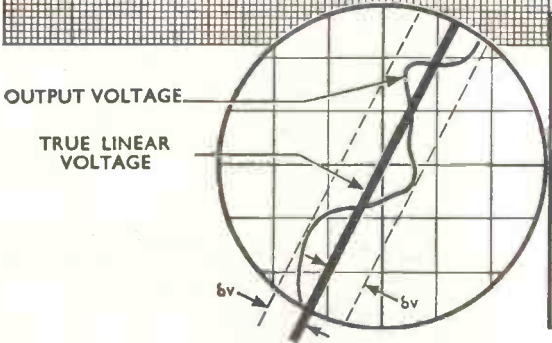
NULL SPACINGS: — $\theta = 90^\circ \pm 4'$

LINEARITY: — The rotor output voltage rises linearly from the null position

$\delta = \pm 0.4\%$ $0^\circ - 60^\circ$ displacement
 $\delta = \pm 0.5\%$ $60^\circ - 75^\circ$ displacement

Expressed as a percentage of the output voltage at 60°.

Linear Synchros offer a new approach to a wide range of computing problems and may also be used for position control and signal modulation.



Advice on their application to your problem is available

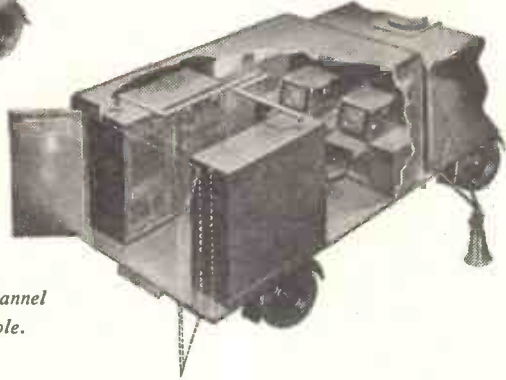
SPERRY SYNCHROS

COSSOR RADAR

CR.21



Either single or twin channel installations are available.



C.R. 21 is a new high-power surveillance radar. It is available either complete and self-contained in mobile form as illustrated above or as a series of units readily installed in a building.

The large reflector provides a narrow beam-width that assists in giving a high definition display. In the vertical plane, coverage is obtained through 45° without beam switching or tilting.

Unwanted permanent echoes can be cancelled by means of the latest type of Moving Target Indication circuits. Rain responses can be eliminated by circular polarisation.

Modern aircraft speeds and heights, together with mounting traffic densities are constantly increasing the demands on radar performance. C.R. 21 is well aligned to the present and future requirements of the jet age.



Accessibility: The magnetron, like all major units, is readily accessible.

Each electronic chassis is serviced from the front—whilst operating if desired.



COSSOR RADAR & ELECTRONICS LIMITED

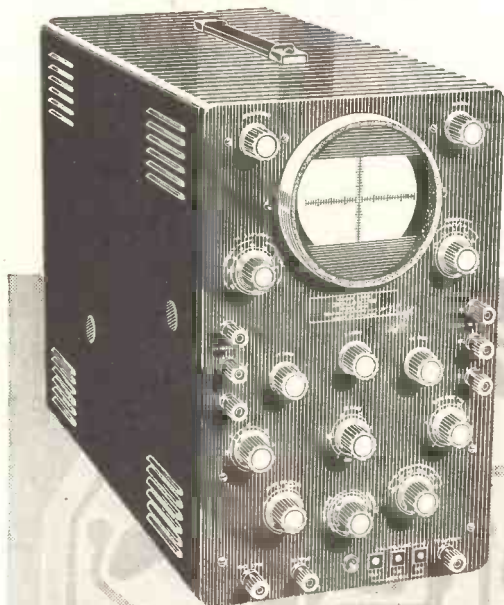
One of the Cossor Group of Companies

COSSOR HOUSE · HIGHBURY GROVE · LONDON, N.5

Telegrams: Cossor, Norphone, London

Telephone: CANonbury 1234 (33 lines)

Cables: Cossor, London

PERFORMANCE ASSURANCE WITH**COSSOR****PRINTED CIRCUITS****AN INSTRUMENT RANGE
IN KIT FORM**

- Q.** *Why has Cossor Instruments decided upon this innovation?*
- A.** To make available a range of first-class measuring instruments at a considerable saving in cost to the Buyer.
- Q.** *Are Kit instruments inferior in performance to their Factory-built equivalents?*
- A.** Certainly not. If assembled and wired exactly in accordance with the Manual of Instructions.
- Q.** *A certain skill must, surely, be required to build these instruments?*
- A.** None beyond the ability to use a small soldering iron.
- Q.** *How can a performance specification be maintained without setting up test equipment?*
- A.** Largely by the use of PRINTED CIRCUITS which allow no interference with the layout of critical parts of the circuit.
- Q.** *How many Kit instruments are at present available?*
- A.** Three. Two Oscilloscopes, a Single-Beam and a Double-Beam, and a Valve Voltmeter. Others will follow shortly.
- Q.** *Could I have more information on these interesting instruments?*
- A.** With the greatest of pleasure. Just write to:

*Model 1071K Double Beam Kit Oscilloscope
List Price £57.10.0*

COSSOR INSTRUMENTS LIMITED

The Instrument Company of the Cossor Group

COSSOR HOUSE · HIGHBURY GROVE · LONDON, N.5

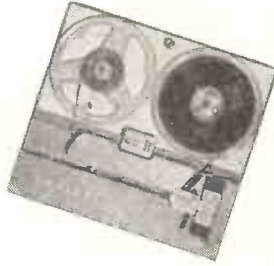
Telephone: CANonbury 1234 (33 lines)

Telegrams: Cossor, Norphone, London

Cables: Cossor, London

The fruits of TRUVOX Development.

TRUVOX R1 Recorder



Tape Deck Mark IV.



Stereophonic Head

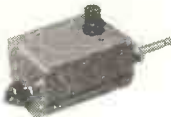


Telephone Attachment



Tape Recording Amplifier

Senior Radio Jack



Standard Radio Jack



Lightweight Headphones



Foot Control



No other manufacturer can boast of so wide a range of components and accessories devoted to the perfect reproduction of taped speech and music. Designed and developed in our own laboratories by a team of highly skilled acoustical engineers, the Truvox range of equipment represents years of patient research which has now reached full fruition by the introduction of the Truvox R1 Recorder. The available accessories provide almost limitless applications for this truly high-fidelity equipment.

Detailed literature available on request from

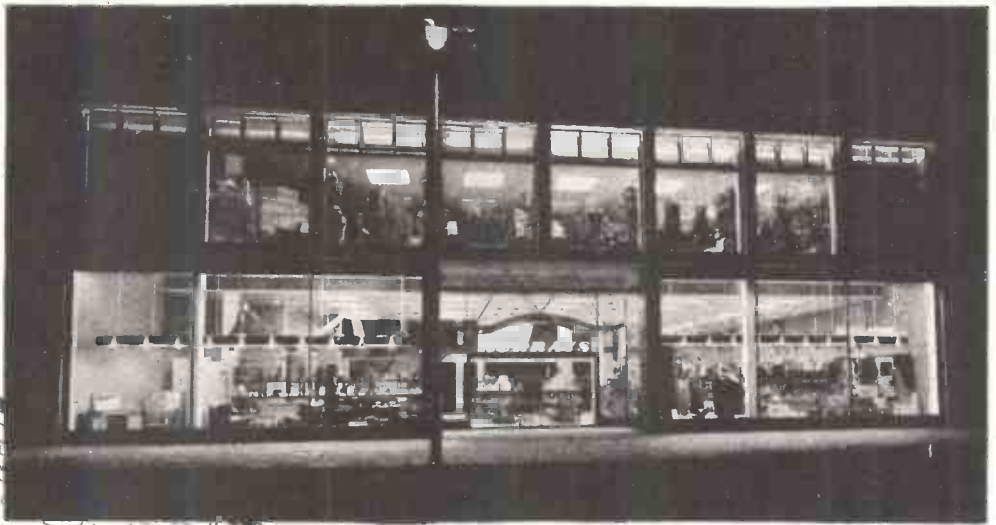


TRUVOX LIMITED

Sales Office: 15, Lyon Road, Harrow, Middlesex. Tel: Harrow 9282

Service & Technical Dept: 328 Station Rd., Harrow, Middlesex. Tel: Harrow 4455

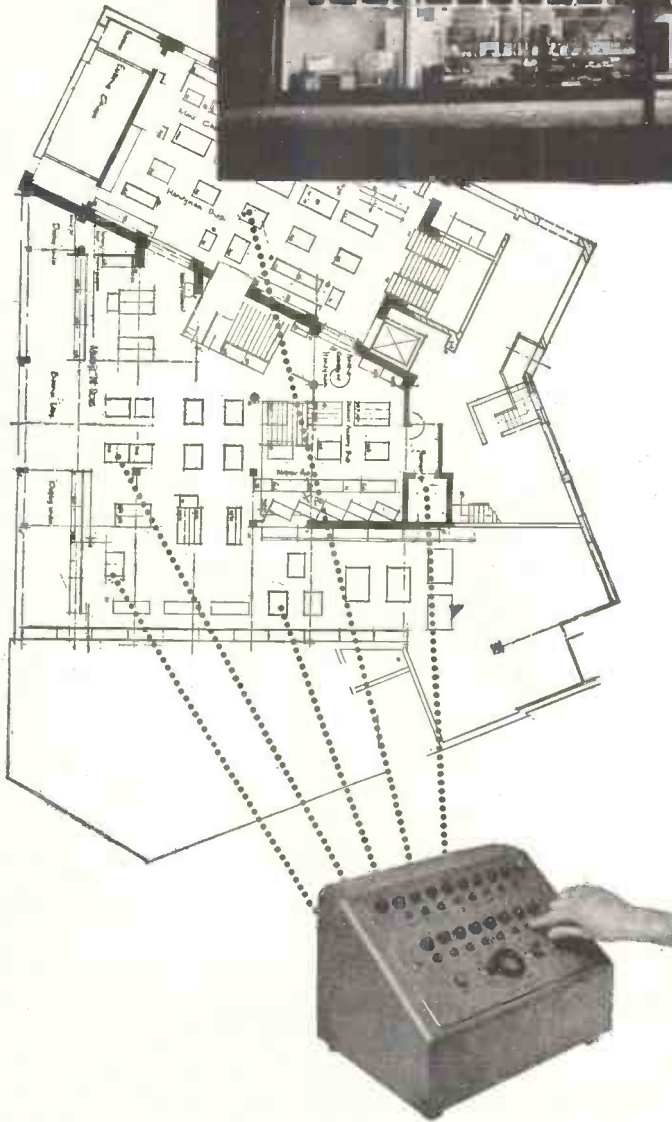
Murray's (High Wycombe) Limited



department store locates staff in seconds

There are no flashing lights, distracting bells, buzzers or loudspeakers in this modern 5 storey department store, opened this year by Murray's, High Wycombe, Ltd. because internal communication is handled by the Multitone Personal Call staff location system. Senior members of the staff carry light pocket receivers, only 5 in. long and 1 in. diameter. To call anyone carrying a receiver, anywhere in the building, the switchboard operator sends out a signal which affects only that particular receiver. A direct spoken message can follow if required.

A complete installation of this type, with up to 50 receivers can be installed on easy rental terms, inclusive of maintenance, or low outright purchase price. This personal call system could save time and trouble in *your* building. Write and we'll send you details.

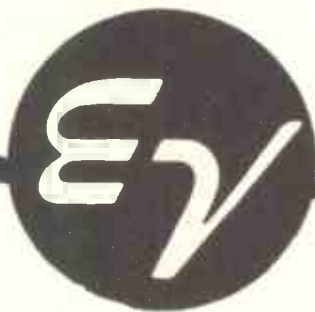


multitone personal call **STAFF LOCATION SYSTEM**

Multitone Electric Company Ltd., 12-20 Underwood Street, London, N.1. Tel: Clerkenwell 8022

CRC13M

Here is the best
selling point!



POWER-POINT

A revolutionary miniature *ceramic* record player cartridge with two sapphire tips.

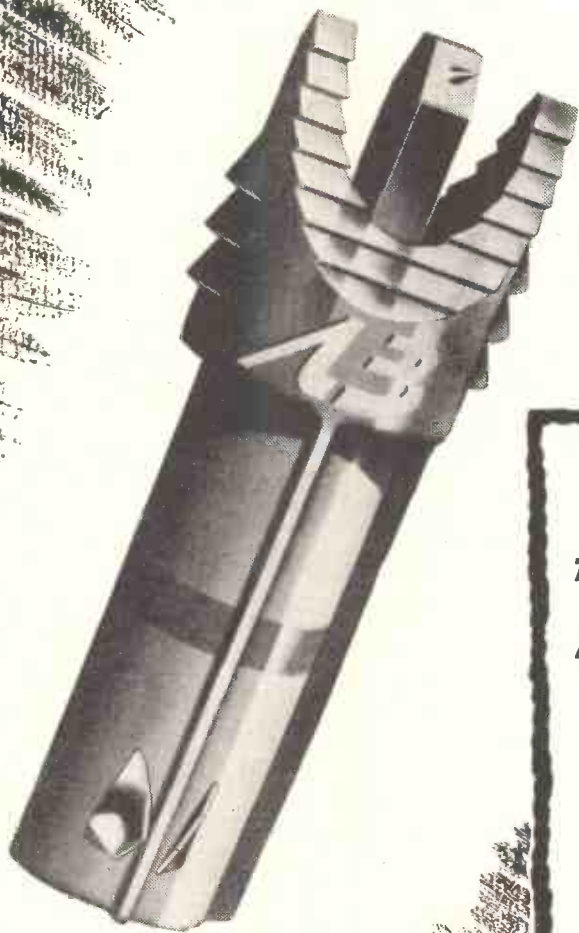
POWER POINT is a proved sales success—over 3,000,000 have already been sold abroad!

POWER POINT can be fitted to all popular pick-up arms.

POWER POINT is so easy to handle and so quick to replace—it solves your stylus replacement problems!

POWER POINT gives higher fidelity, longer life, and reduces record wear to a minimum.

OVER 3,000,000 **POWER-POINTS**



POWER POINT is backed by attractive display material and a carefully planned advertising campaign.

POWER POINT is a "must" for anyone with a record player!

£1,000 IN PRIZES!
A EUROPEAN TOUR
FOR WINNING
Wholesalers and Retailers!
T.V. Sets, Radios and Record Players
for your customers!
You can profit from
POWER POINT!
FOR FULL DETAILS
write to :—**E. V. LIMITED,**
Camp Bird House,
Dover Street, London, W.1.
Telephone: Hyde Park 8292.

ARE ALREADY IN USE ABROAD!

AND NOW — THE COLLARO "CHALLENGER" RECORD CHANGER



An entirely new Record Changer having the unique feature that records of any dimension from 6in. to 12in. can be loaded and automatically played.

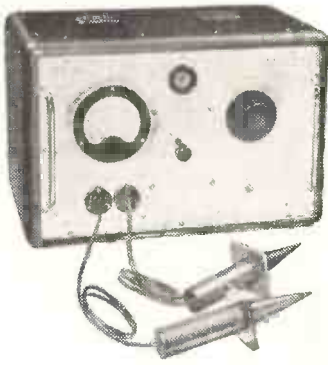
The "Challenger" has four speeds— $16\frac{2}{3}$; $33\frac{1}{3}$; 45 and 78 r.p.m.—and also has manual control. It incorporates all the best features of the previous series of Collaro Record Changers, including the choice of the various "Studio" Crystal and Ceramic Cartridges, and is available in a selection of standard colour finishes.

RC 456 4-SPEED RECORD CHANGER. This well-proven Record Changer, which has sold in countless thousands throughout the world, is also available.

GRAMOPHONE UNITS. The AC 4/564—a reliable and moderately priced 4-speed Gramophone Unit which incorporates an automatic stop and can be fitted with any of the Studio Turnover Crystal Cartridges.

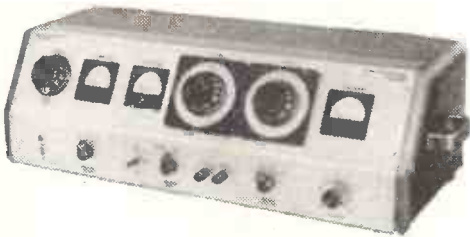


COLLARO LTD., RIPPLE WORKS, BY-PASS ROAD, BARKING, ESSEX.
 Telephone: Ripplaway 5533-Telex 8748. Telegrams: Korllaro-Telex-Barking.
Makers of Record Changers, Gramophone Units, Pick-ups, Electric Motors, etc.



BREAKDOWN TESTER MODEL RM 215E

Output Voltage: 0 to 10,000-V D.C. 5 mA. Max.
and 0 to 5,000 V A.C. 10 mA. Max.



**ELECTROLYTIC & TANTALUM
CONDENSER BRIDGE MODEL CB 154C**

Capacity Range: 0.1 mFd to 11,000 mFd.
Power Factor Range: 0.4% to 30%
Polarising Voltage: 0 to 600 Volts in 5 ranges.
Leakage Current: 0/500 uA, 0/5 mA, 0/50mA.

MODEL CB 154D

Polarising Voltage: 0 to 800 Volts in 5 ranges.
Leakage Current: 0/50 uA, 0/500 uA, 0/5 mA.
Other details as CB 154C.

*Available
for
Immediate
Delivery*



MEG OHMMETER

MODEL RM 175 — uA LZ MK II

Resistance Range: 0.9 Megohm to
10,000,000 Megohms.
Test Pressure: Continuously variable from 10 to
1,000 V D.C.

Ask for demonstration

**BRITISH
PHYSICAL
LABORATORIES**

RADLETT · HERTS

ENGLAND

TELEPHONE · RADLETT 5674

. . . a new battery-operated constant speed miniature motor

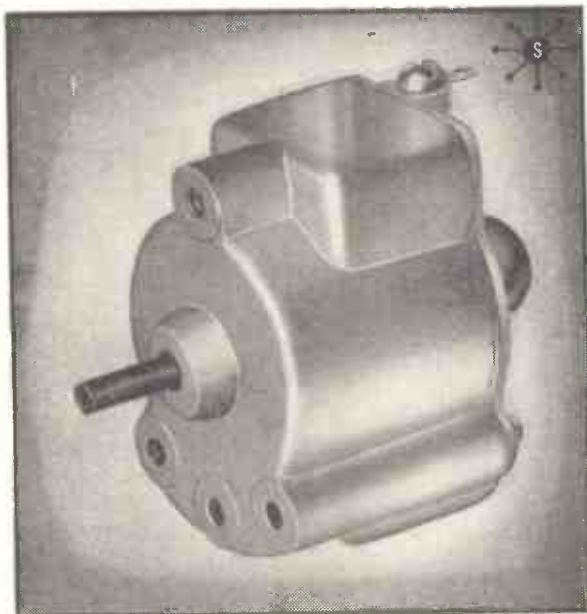
The

Staar-Kinder

Manufacturers are invited to write or telephone for full information on this governor controlled constant speed motor. Only slightly larger than a match-box, the Staar-Kinder Motor presents a noiseless power unit of extremely low current consumption.

The standard unit is for 6v. operation, but the motor can be supplied for usage at other voltages up to 12v.

The Staar-Kinder Motor is available only to manufacturers.



Staar Electronics Ltd.,

Ormond House, 26/27, Boswell Street, London, W.C.1

Telephone: CHAncery 8953-4-5-6

Telegrams: Asterisk, London

The "Little Staar"

. . . battery operated player
for single 45 r.p.m. records

★Size of unit base-board only $7\frac{1}{2}'' \times 6''$.

★Weight only 15½ozs.

★Powered by Staar-Kinder motor. Operating voltage 6v., current consumption as low as 27 mA while playing.

★Ideal as the nucleus of a midget player, and amplifier of extreme portability.

The pickup of the Little Staar is fitted with a robust ceramic element transducer with two 1 mm. radius sapphire styli suitable for use in all climatic conditions. The cartridge can be withdrawn and replaced in a matter of seconds. The Staar-Kinder Motor incorporates a centrifugal governor to ensure constant turntable speed within 2% whatever the applied voltage between 7.5v. and 4.5v.



A dual purpose turntable centre is available which allows for playing small or large centre-hole records.



Staar Electronics Ltd.,

Ormond House, 26/27 Boswell Street, London, W.C.1

Telephones: CHAncery 8953-4-5-6.

Telegrams: Asterisk, London

Available to Manufacturers only—write for full details.

Quality Approval

ONLY STEATITE & PORCELAIN
NICKEL METALLISING HAS THE
FULL JOINT SERVICE
QUALITY APPROVAL

(Cert. No. 980. Issue 2)

Approved:
Humidity class H.I.
Temp. category 40/100

Samples sent
on request



METALLISED BUSHES



Please write for Catalogue No. 47

STEATITE & PORCELAIN PRODUCTS LTD.

STOURPORT ON SEVERN, WORCS • Telephone: Stourport 2271 Telegrams: Steatain, Stourport.



Specifications—Model SV-5

RANGE	12 Channels and IF.
SWEEP WIDTH	Approx. 25 mc. adj.
OUTPUT	1 volt into 75 ohms.
IMPEDANCE	75 ohms.
FLATNESS	5% over each channel. 10% overall.
ATTENTION	Atten. #1 20, 20, 10, 6, 3 db. } Plus vernier
MARKERS	Atten. #2 20, 20, 10, 6, 3 db. } atten. 0-10 db.
SIZE	Pulse type on video and audio carriers.
	10" x 12" x 9½"

(One 75 to 300 ohm balun is supplied—extra baluns are available.)

TELONIC SWEEP and MARKER GENERATORS 0-2400 mc

Hundreds of standard models—send for catalogue

Telonic VHF Sweep Generators—"Standard of the TV Mfg. Industry"

This 13-position sweep generator uses a separate crystal on each channel to produce 2 pulse markers, one on the video and one on the audio carrier frequencies. A special circuit forms pulses with much greater accuracy and stability than the usual multi-vibrator method.

Special features of this compact VHF-TV sweep and marker generator are: electronic sweep, 25 mc. sweep width; hi-level, flat output; special crystal-controlled pulse markers; remable sweep and marker sub-chassis; frequency centring control, sweep width control; and a monitor output for checking performance of the instrument and for making VSWR measurements.

Dual attenuators permit instantaneous comparison of unit under test to a standard unit by use of an electronic switch and also permit production set-ups involving permanent connection to an IF input without disconnecting the RF input.

An extra marker can be supplied on the I.F. channel at extra cost.

SV-5—American standards.

SV-5F—Frequency and power may be specified to meet other requirements.

TELONIC INDUSTRIES INC., Beech Grove, Indiana, U.S.A.

Export Dept., Sylvan Ginsbury Ltd.

8, WEST 40th STREET, NEW YORK 8, N.Y., U.S.A.

2, RUE BARTHOLONI, GENEVA, SWITZERLAND.

PRECISION INSTRUMENTS BY GERTSCH



PT-5 Standard RatioTran*
Precision AC voltage divider available rack-mounted or portable. Terminal linearity 0.001%. Resolution 0.00005%. 12 other models available.



FM-3 Frequency Meter
Portable direct reading meter measures 1 to 1,000 mc., generates 20 to 1,000 mc. Accuracy $\pm 0.001\%$. Also available with external power supply and rack-mounted.



Rotary RatioTran*
Sealed, shaft driven precision AC voltage divider in 100-turn and 1,000-turn units. Terminal linearity as good as 0.005% and resolution as good as 0.0005%.

Gertsch

PRODUCTS, INC.

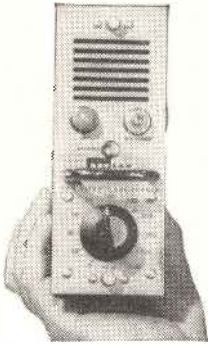
3211 SOUTH LA CIENEGA BLVD.
LOS ANGELES 16, CALIFORNIA

Export Dept.
SYLVAN GINSBURY LTD.
8 West 40th Street, New York 8,
N.Y., U.S.A.
2 rue Bartholoni, Geneva,
Switzerland

Complete specifications are available on request

*Trade mark

DRIFT FREE
DC μ V
AMPLIFIER

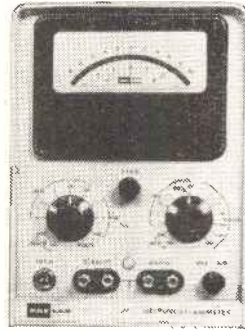


The KIN TEL MODEL III amplifier provides the lowest drift of any commercially available broad-band d-c amplifier. The unique circuit incorporates KIN TEL's proven chopper amplifier system to provide unsurpassed dynamic performance—unaffected by load or gain changes. Available in a single-unit cabinet or as a six-amplifier rack-mountable module only 19in. wide, the Model III is ideal for data reduction facilities, or as a strain gauge amplifier, recorder driven amplifier, or general purpose laboratory amplifier

SPECIFICATIONS

- ± 2 uv equivalent input drift
- Integral power supply
- ± 35 V, ± 40 ma output
- 100,000 Ω input impedance
- 0 to 1,000 gain in ten steps
- $\pm 1\%$ gain accuracy
- 5 uv peak equivalent input noise
- Price (Single) Amplifier \$550.

THE ONE
UNIVERSAL METER
microvolts to kilovolts



This new microvolt-ammeter-amplifier will measure as little as 10 μ v or 10 μ ma with accuracy. It may also be used as a DC amplifier with up to 80 db gain and only 10 μ v drift. A zero-centre mirrored scale provides instant polarity indication. Utilization of KIN TEL'S chopper stabilized circuit provides versatility, accuracy, and stability that is unobtainable with conventional VTVM's. The Model 203 is the ideal general purpose laboratory meter, production test set, or null meter.

SPECIFICATIONS

- 100 μ v to 1,000 v fs.
- 100 μ ma to 100 ma fs.
- 25 ranges.
- 100 megohms input impedance.
- 80 db gain as amplifier.
- 10 μ v equivalent input drift
- 1 volt output into 1k Ω .
- Price \$550.

Write for literature or demonstration.



(KAY LAB)

5725 KEARNY VILLA ROAD, SAN DIEGO 11, CALIFORNIA

EXPORT DEPT., SYLVAN GINSBURY LTD., 8, West 40th Street, New York 8, N.Y., U.S.A. 2, rue Bartholoni, Geneva, Switzerland.

ENERGY FROM THE SUN FOR ONLY 7c PER MILLIWATT OF POWER
WITH THE EXCLUSIVE Hoffman SILICON SOLAR CELLS

Hoffman Silicon Solar Cells will convert sunshine to electrical energy at amazingly low cost. This cheap power creates big sales advantages. When sunshine is not available they may be energized effectively by the light of household type lamps.

Small DC motors may be operated with as few as two Silicon Solar Cells in series. *Our engineers will work with you to insure the success of your projects.*

Solar Cells in various sizes and power outputs can be connected in series or parallel to obtain any combination of voltage and current.

Technical data is available upon request.



Hoffman Semiconductor Division
of
Hoffman Electronics Corporation

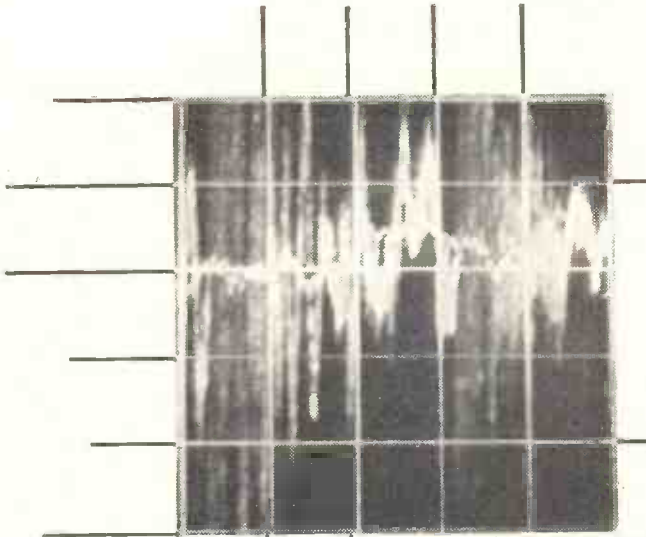
formerly National Semiconductor Products

930 Pitner Avenue, Evanston, Illinois

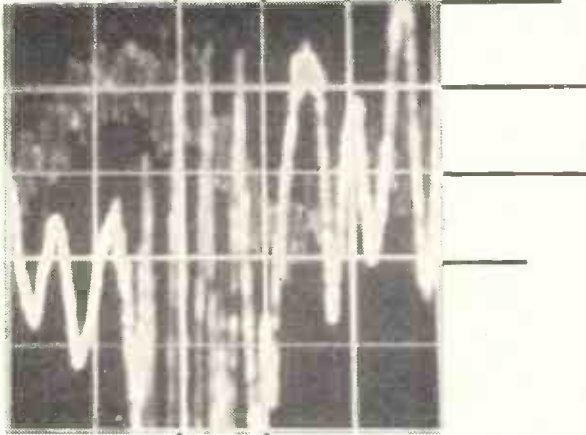
MANUFACTURERS OF:
silicon junction diodes
zener reference elements
medium and high power
rectifiers

EXPORT DEPT., SYLVAN GINSBURY LTD., 8 West 40th Street, New York 8, N.Y., U.S.A. 2 rue Bartholoni, Geneva, Switzerland

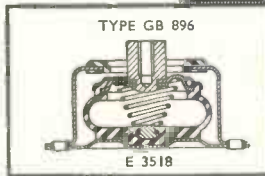
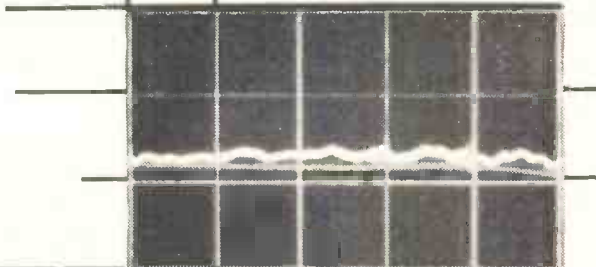
Nett Gain < 1?



Isolator "A" with some damping, but snubbing at resonance (15 c.p.s.). Metal to metal impact. Transmitted acceleration approx. 12 g. for sinusoidal input of ± 0.026 ". Envelope contains transients as high as 10,000 c.p.s.



Isolator "B" with little damping, but with rubber buffers to reduce shock at resonance (15 c.p.s.). High frequency transients reduced but transmitted acceleration still approx. 12 g. for same input.



"BARRYMOUNT" Isolator. Non-linear, air-damped. No snubbing at resonance (8 c.p.s.). Transmitted acceleration for slightly increased input (± 0.030 ") is 0.62 g. Note sinusoidal waveform of equipment.

Where airborne application of instrumentation is concerned, it is all too easy to find "progress" has resulted in the substitution of one element of chance, not necessarily human, for another and the nett gain can actually be well below unity.

The new enemy is vibration. The more complex and sensitive the equipment, the more potent is the enemy, and protection against vibration becomes part of the design problem. Attempts to achieve isolation have often magnified the problem, for it is obvious that if a major component of the offending vibration happens to be at the resonant frequency of the isolator employed, danger is increased by the isolator itself.

To keep the resonant frequency of the isolator low is not a complete answer. In fact there is, as yet, no complete answer. But by far the nearest approach is today provided by "BARRYMOUNT"

Isolators, the principle of which is the complementary performance of non-linear springing and air-damping. Even at resonance "BARRYMOUNT" Isolators offer quite spectacular freedom from vibration, as the accompanying un-retouched oscillographs of transmitted acceleration show.

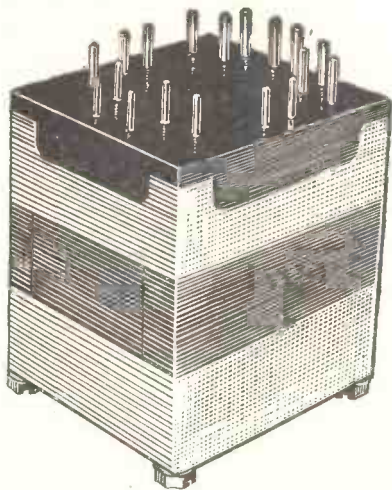
We shall be happy to tell you all you want to know about "BARRYMOUNT" Isolators.

We shall be even happier to mount your "problem unit", in your presence, and give it "the works".

Your equipment rides safely on the



"BARRYMOUNT" and "BARRY B MOUNT" are Registered Trade Marks CEMENTATION (MUFFELITE) LTD. 20 ALBERT EMBANKMENT, LONDON, S.E. 11 TELEPHONE RELIANCE 6556



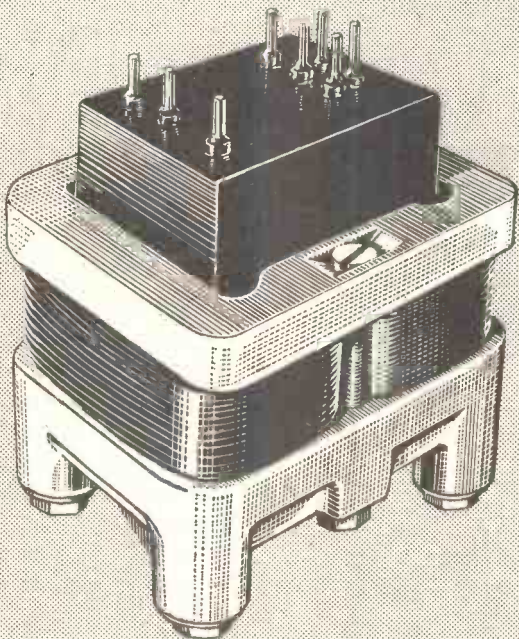
R120 and R130 laminated series.

FORTH SERIES

TRANSFORMERS AND CHOKES

*smaller in size —
lighter in weight*

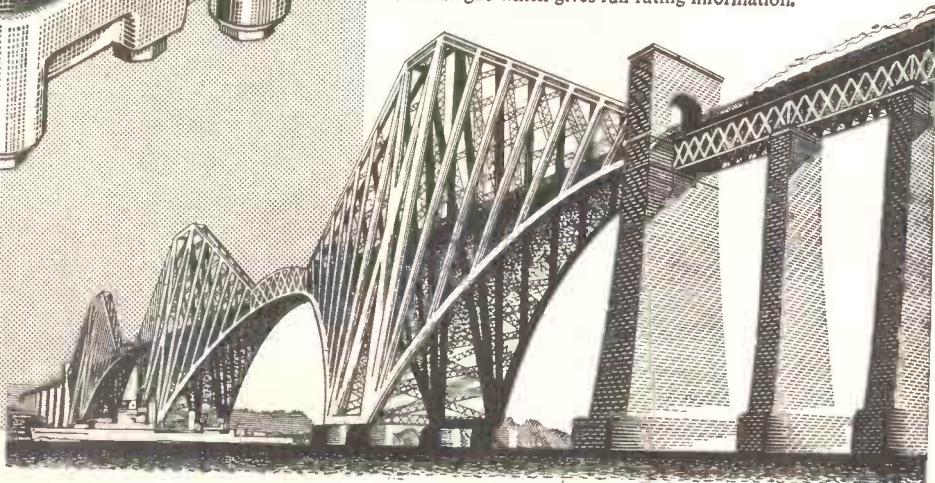
R200 'C' Core series.



FERRANTI

The new range of Ferranti Resin Cast Transformers and Chokes has been named after this famous Scottish landmark which represented a remarkable advance in engineering design when it was constructed over 60 years ago. To-day, the new techniques in manufacture and construction of 'C' Core Transformers have enabled Ferranti Ltd. to make a significant contribution to Electronic Engineering.

The Forth series components will have particular appeal to designers of airborne equipment since savings in weight and volume of up to one-third can be achieved over the resin cast and oil-filled units now available. Moreover, the quality requirements of the Joint Service Specification RCS.214 are met in every respect. Please write for a catalogue which gives full rating information.

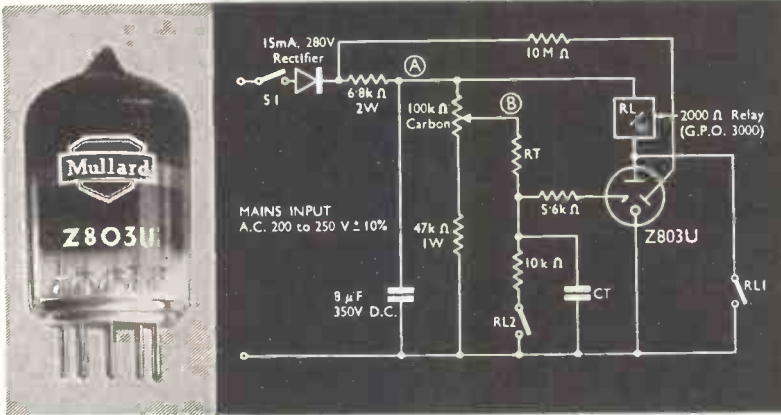


FERRANTI LTD • FERRY ROAD • EDINBURGH 5

FOR TIMER SIMPLICITY
AND ACCURACY

Z803U

TRIGGER TUBE



The Z803U trigger tube can be used for a variety of timer, voltage control and general relay applications. It has an extremely stable trigger voltage over a very long operating life and offers the advantages of all Mullard cold cathode tubes—no heater supply requirements, no waiting for “warming up” and good mechanical strength.



Mullard

COMMUNICATIONS AND
INDUSTRIAL VALVE DEPARTMENT

Typical of the applications of the Z803U is the simple interval timer described here which can cover the range between 5 seconds and 10 minutes. It may be operated direct from any a.c. mains supply between 200 and 250 volts. To start a timing sequence the mains supply is switched on (S1). The d.c. voltage at point A will then rise, in about 100 milliseconds, to between 184 and 282 volts, the actual level depending on the value of the local mains voltage. The timer capacitor CT will start to charge up through RT, the timer resistor. When the voltage on CT reaches the critical trigger voltage of the Z803U the tube will fire, pulling in the relay, partially discharging the 8 microfarad smoothing capacitor, and lowering the voltage at A. The relay will self lock on contact RL1 thus extinguishing the Z803U, and the relay current will then be limited by the 6.8 kΩ series resistor. Contact RL2, which should make after RL1, re-sets the timer capacitor to zero volts.

However, the relay drops out only when S1 is opened. A new sequence can then be started on reclosing S1. The 100 kΩ preset potentiometer allows the timing circuit voltage to be set up so as to compensate both for component tolerances and for the value of the local supply voltage. The pre-firing voltage at point B will be about 170 volts.

The values of RT and CT will be set by the required time interval T' , and can be determined from the fact that $T' = 1.6 RT.CT$.

RT should be a high stability resistor, while CT must be a capacitor, with a small power factor, e.g., a paper or plastic film capacitor. All other components are of $\pm 10\%$ tolerance.

COSSOR

Instruments Ltd

BRIEF DETAILS OF THE COSSOR RANGE OF OSCILLOSCOPES AND OSCILLOGRAPHS TOGETHER WITH ANCILLARY EQUIPMENT

In addition to the oscilloscope and oscillograph equipment shown Cossor Instruments Ltd. manufacture a range of instruments for radio and television servicing and also specialised electronic apparatus for specific industries.



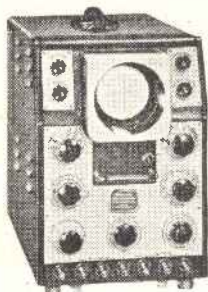
MODEL 1039M MK. II—MINIATURE OSCILLOGRAPH

A miniature instrument weighing only 10 lb. with a new, high sensitivity tube of 2 $\frac{3}{4}$ -in. screen dia. Single stage amplifier covers a frequency range from 25 c/s to 120 kc/s (30% down) at a gain of 75 and 25 c/s to 1.5 Mc/s (30% down) at a gain of 20. The free-running hard-valve time base provides symmetric X-plate deflection with repetition frequencies of 10 c/s to better than 50 kc/s. (Leaflet CL. 127.)



MODEL 1052—DOUBLE BEAM OSCILLOGRAPH

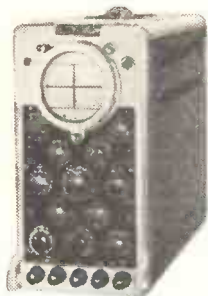
With similar amplifiers having continuously variable gain controls. Sensitivities of 9, 33 and 180 mV peak-to-peak/cm. Frequency response 15 c/s to 5 Mc/s (-6 dB). Time Base for either triggered or repetitive operation. Sweep duration 5 microseconds to 200 milliseconds. 4-in. dia. flat screen tube operates at 1 kV. Power units designed for operation from all Services and domestic supplies. C-core transformer, canned and oil-filled. (Leaflet CL. 137.)



MODEL 1035 MK. II—DOUBLE BEAM OSCILLOGRAPH

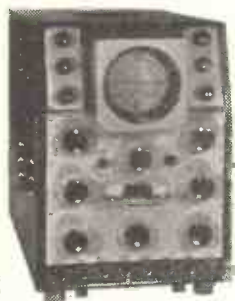
Two independent amplifiers with frequency ranges 20 c/s to 7 Mc/s and 20 c/s to 100 kc/s. The 4-in. dia. flat screen tube operates at 2 kV. Time Intervals and Input Voltages may be measured on either beam by means of the calibrated controls. Time base for repetitive, triggered or single-stroke scan with velocity 150 milliseconds to 15 microseconds. (Leaflet CL. 122.)

C O S S O R I N S T R U M E N T S L T D



MODEL 1058—SINGLE BEAM OSCILLOGRAPH

This Model is fitted with a 4-in. dia. tube with post-deflection acceleration and direct-coupled Y amplifier with a sensitivity of 0.25 V/cm and bandwidth 0—6 Mc/s (— 50%). An X amplifier of gain five times is provided. The time base is repetitive or triggered and a special facility provides synchronisation from either frame or line sync. pulses with a 1 V double amplitude pulse (positive) television signal. (Leaflet CL. 149.)



MODEL 1049 MK. IIIA—DOUBLE BEAM OSCILLOGRAPH

With direct-coupled amplifiers of gains 900 and 30 operating from d.c. to 400 kc/s and 800 kc/s respectively. Stabilised power supplies provide alternative tube operating voltages of 2 kV and 4 kV. Voltages and Time Intervals may be measured on either beam. Direct-coupled time base provides a repetitive, triggered or single-stroke scan with a time range of 1.5 sec. to 150 μ sec. Provision is made internally for Z modulation of the traces. (Leaflet CL. 112.)



MODEL 1063—HYDRAUDYNE

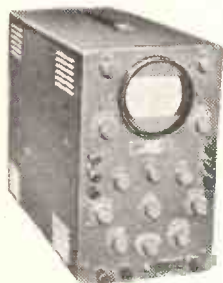
This pressure-testing equipment is compact and portable and permits the display, analysis and measurement of static and dynamic pressure conditions in all pneumatic and hydraulic systems. Complete with Transducer and all necessary ancillary items, the Hydraudyne is normally fed from alternating current mains supplies but may be driven from a rotary converter fed by a 12-volt accumulator. (Leaflet CL. 182.)



MODEL 1045K—KIT OSCILLOSCOPE

This up-to-date single-beam Oscilloscope, utilising printed circuits, is offered in kit form for construction by the purchaser. A marked economy is thus achieved whilst valuable technical experience of this type of instrumentation is automatically gained. (Leaflet CL. 215.)

C O S S O R I N S T R U M E N T S L T D



MODEL 1071K

A double-beam Oscilloscope in kit form providing two identical Y Amplifiers of bandwidth d.c.—3 Mc/s with a sensitivity of 0.5 V/cm. A Pre-amplifier is included to increase sensitivity to 5 mV/cm up to 500 kc/s. The repetitive or triggered time base has a range of velocity from 10 msec./cm to 0.05 μ sec./cm and an X Amplifier providing up to 5 screen diameters is included. Y calibration. (Leaflet CL. 207.)



MODEL 1042A

Model 1042A Oscillograph has been designed especially for the Radar field and provides an amplifier of bandwidth d.c. to 5 Mc/s with a sensitivity of 1 V d.c./cm. The triggered time base provides spot velocities from 0.066 cm/msec. to 2 cm/ μ sec. with direct calibration. Velocities for delayed sweep are provided. A low frequency amplifier of bandwidth 10 c/s to 4 kc/s is provided to increase the sensitivity to 20 mV peak/peak/cm.



MODEL 1065

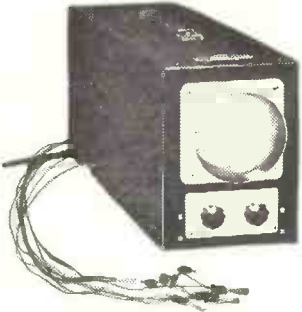
Designed for the display and measurement of pulse phenomena and employing an amplifier of bandwidth 0-14 Mc/s (— 50%) providing a useful deflection up to 20 Mc/s. The sensitivity is better than 250 mV/cm. Time base velocities from 40 cm/sec. to 5 cm/ μ sec. with continuously variable delay of time base start when desired. Calibration of voltage and time by Y and X shifts. A 25 Mc/s oscillator provides intensity modulation pips spaced at 0.04 μ sec. intervals for accurate measurement of pulse rise-times.



MODEL 1050A—OSCILLOGRAPH TROLLEY

Strongly constructed of steel tubing and fitted with rubber-tyred swivel castors, this trolley provides a very convenient mobile stand for Cossor Oscillographs, enabling them to be wheeled easily to any location in laboratory or factory. (Leaflet CL. 121.)

COSSOR INSTRUMENTS LTD



MODEL 1043—OSCILLOGRAPH MONITOR

The Monitor is a light-weight tube unit designed for mounting on the top of a Cossor Oscillograph, Model 1049, to provide an identical and simultaneous display with that presented by the parent instrument. Its purpose is to serve as a visual monitoring channel when the oscillograph tube is obscured by a recording camera. The unit may also be used in conjunction with Models 1035 and 1052. (Leaflet CL. 208.)



MODELS 1428 MK. IIA & 1432—OSCILLOGRAPH CAMERAS

MODEL 1428, Mk. IIA. For use with Oscillograph Models 1035 and 1049, providing single shots of a stationary waveform or continuous records of non-recurrent waveforms on standard perforated 35 mm film or paper. The cassettes hold 25ft. of sensitised material. This model now incorporates new lid with end of film indicator. (Leaflet CL. 231.)
MODEL 1432 is generally similar but has a 3-point fixing for use with Models 1052, 1058 and 1063. (Leaflet CL. 148.)



MODEL 1431—9-SPEED CAMERA DRIVE

For use with Camera Models 1428 and 1432, this unit comprises a powerful capacitor motor worm-coupled to a 9-speed gear box giving film speeds of .05, .1, .25, .5, 1.0, 2.5, 5, 10 and 25 inches/second. Operation on single-phase a.c. 110 to 250 V is through an auto-transformer which is housed with the motor capacitor. (Leaflet CL. 142.)



MODEL 1438, 1438/1— PLASTIC COVERS FOR OSCILLOGRAPHS

These strong plastic oscillograph covers have been designed to effect good protection against dust deposit and abrasion when the instruments are temporarily not in use. Two sizes are available to suit most models in the Cossor range. (Leaflet CL. 210.)

COSSOR INSTRUMENTS LTD

The Instrument Company of the Cossor Group

COSSOR HOUSE · HIGHBURY GROVE · LONDON N.5 · ENGLAND

Telephone: CANonbury 1234 (33 lines)

CABLES: COSSOR, LONDON

Telegrams: COSSOR, NORPHONE, LONDON

CODES: BENTLEY'S SECOND

Advance

CIRCUIT MAGNIFICATION METER



INDUCTANCE CAPACITANCE

The "T1" is an easily operated and convenient instrument for making R.F. measurements of circuit magnification ('Q'), inductance, capacitance and power factor at frequencies between 100 kc/s and 100 Mc/s. Its portability and excellent specification make it a valuable addition to the electronic laboratory as well as for production testing.

Full technical details in Leaflet W31 available on request

The MODEL T/2

A version of the Model T1 providing additional facilities for comparing 'Q', Inductance and Capacitance, and is most suitable for the production testing of coils.

Full technical details in Leaflet W44. £70 Nett Price in U.K.

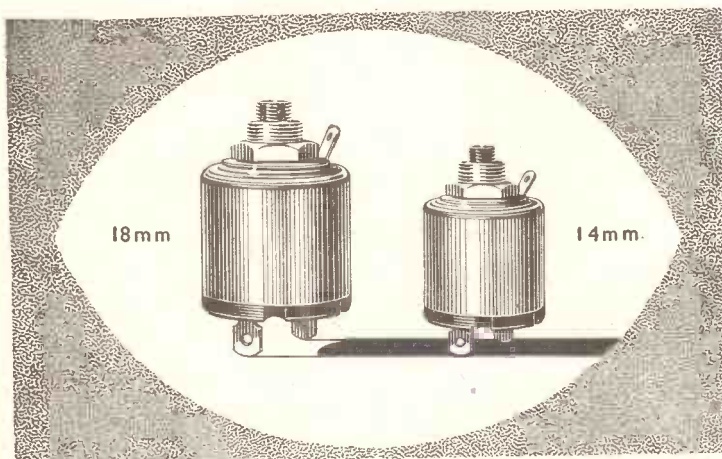
- Direct reading of 'Q' Range 10-400
- 'C' by substitution
- Rapid calculation of 'L' and 'Z'
- No 'Set-Zero' problems
- Small and portable
(15½ x 10¼ x 6½ - 14lb)

MODEL T1 NETT PRICE IN U.K. **£55**

Export inquiries invited.

MULLARD HIGH EFFICIENCY POT CORES

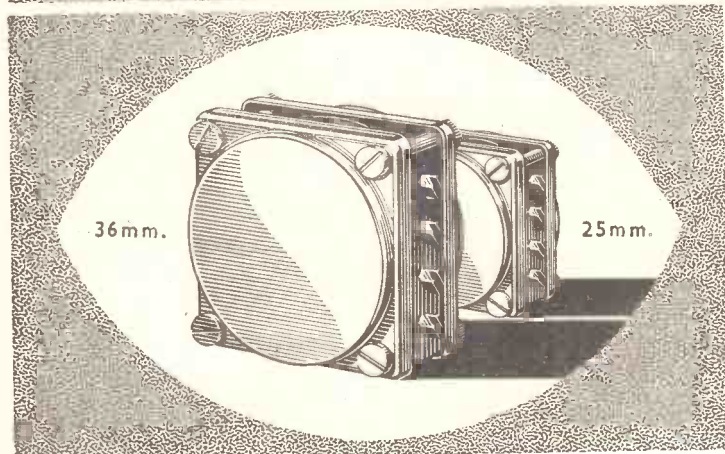
have these outstanding features



- * Pot core design facilitating rapid assembly
- * Small size
- * High value inductance
- * Low losses resulting in high Q values
- * Very fine setting accuracies
- * Operative over a wide frequency range
- * Controllable temperature coefficient

Wherever high quality pot cores are required, there will be a Mullard type available to meet the specification, furthermore, they can be supplied wound to customers individual requirements.

Write now for full details of the comprehensive range currently available.



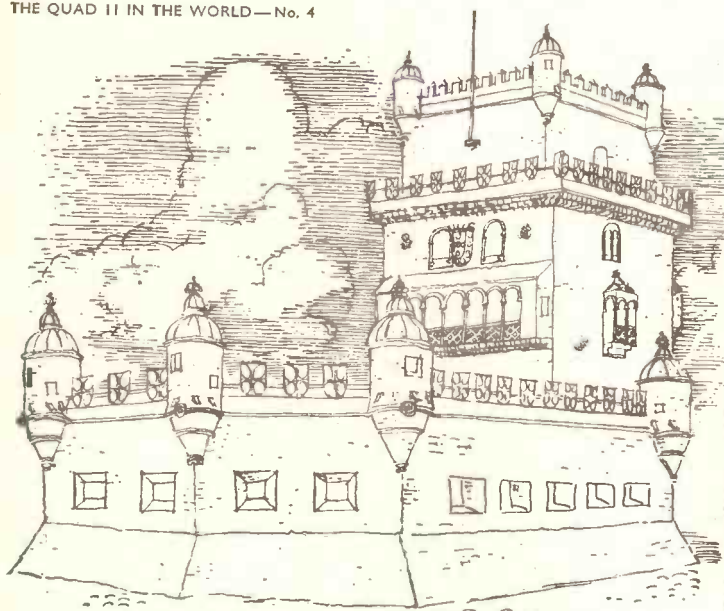
Mullard



'Ticonal' permanent magnets
Magnadur ceramic magnets
Ferroxcube magnetic cores

MULLARD LTD., COMPONENT DIVISION, MULLARD HOUSE, TORRINGTON PLACE W.C.1

THE QUAD II IN THE WORLD—No. 4



The 'TORRE DE BELEM', Portugal.

also in
Portugal

QUAD II AMPLIFIER



In Portugal, too, the QUAD II Amplifier is being used in the homes of those who appreciate music, in the monitor rooms of the Emissora Nacional de Radiodifusão, and, of course, for the recent 'Festival Hall' demonstration in Lisbon by Mr. G. A. Briggs and Acoustical Agent, Valentim de Carvalho, in which live and recorded items were played under conditions of direct comparison. Throughout the world the QUAD II is used for the *closest approach to the original sound.*

Send for full details and Brochure to Dept. WW

ACOUSTICAL
MANUFACTURING CO LTD

HUNTINGDON, HUNTS • Telephone : HUNTINGDON 361

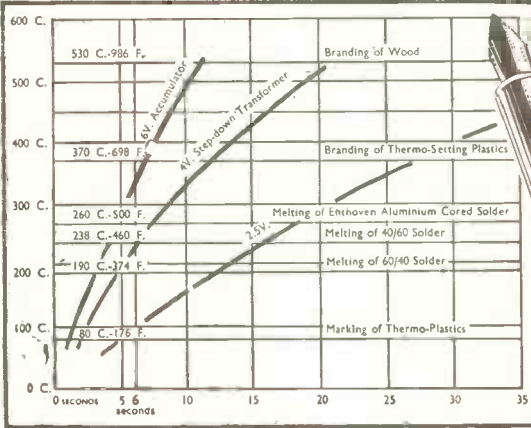
The Superspeed

SOLDERING IRON

heats up from cold
in 6 seconds!

Manufactured for Enthoven Solders Ltd., by Scope Laboratories, Melbourne, Australia.

Designed on an entirely new principle, this light-weight, versatile iron is eminently suitable for soldering operations in the radio, television, electronic and telecommunication industries. For test bench and maintenance work it is by far the most efficient and economical soldering iron ever designed. Ideally suitable for use with Enthoven Aluminium Cored Solder (melting point 260°C. 500°F.).



TIME/TEMPERATURE CURVE CHART from the SUPERSPEED SOLDERING IRON TIP/TEMPERATURE TIME CHECK

The effect of different voltages on initial heating-up time is shown. Whilst 4V is the standard voltage normally employed, 6V will cause no harm, and accumulators are a useful source of current supply.

- * Activated by light thumb pressure on the switch ring. When pressure is released, current is automatically switched off—thus greatly reducing electricity consumption, wear on copper bit and carbon element.
- * Length, 10"; weight, 3½ ozs.; can be used on 2.5 to 6.3 volt supply (4 volt transformer normally supplied) or from a car battery.
- * More powerful than conventional 150-watt irons; equally suitable for light wiring work or heavy soldering on chassis.
- * Simple to operate; ideal for precision work.
- * Requires minimum maintenance—at negligible cost; shows lowest operating costs over a period.

For full particulars, including guarantee terms and free trial facilities, please write to the sole concessionaires in this country:—

ENTHOVEN SOLDERS LTD. (Industrial Equipment Division)
Dominion Buildings, South Place, London, E.C.2. **MONarch 0391**

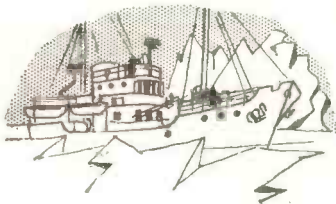
LIST PRICES	
IRON	39/6
TRANSFORMER	35/6
All prices and trade discounts subject to revision	



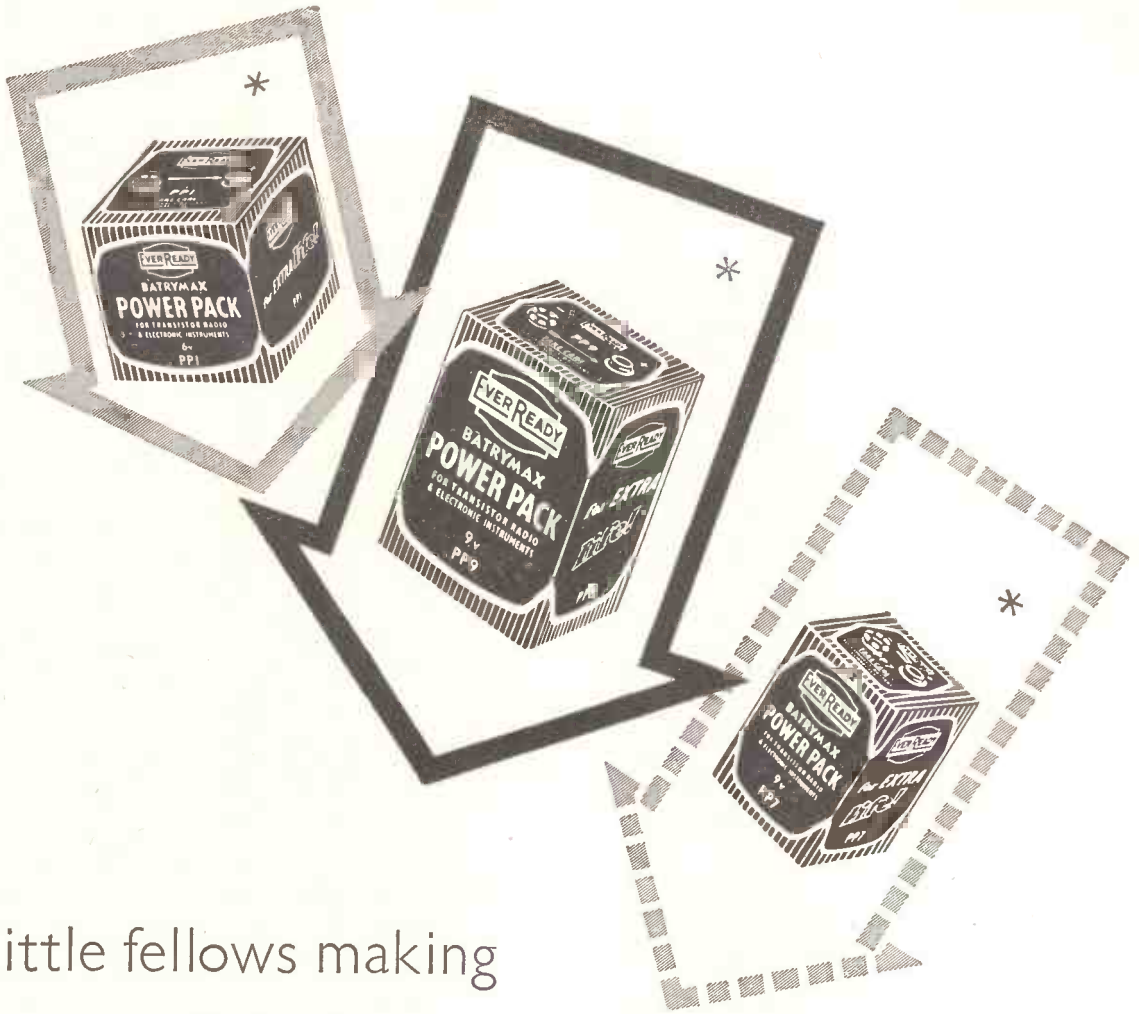
Switch to the

Superspeed

Soldering Iron



as being used by the
Royal Society Antarctic Expedition
for the International Geophysical Year.



Little fellows making

POWERFUL HISTORY

Top manufacturers and designers have been quick to grasp the advantages offered by the recent introduction of the Ever Ready Power Pack range of batteries for transistor duties and are exploiting the enormous potential they offer in the design of portable transistor equipment. **Have you considered how Ever Ready Power Packs might help develop new lines in your business?**

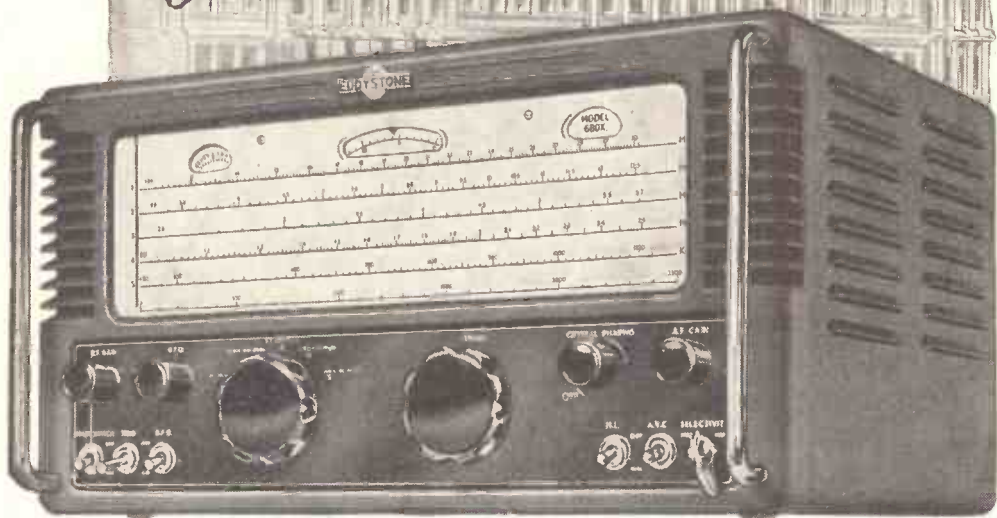
Write or telephone today for comprehensive leaflet which gives full details to: Sales Department (Technical Service) The Ever Ready Company (G.B.) Ltd., London, N.7. Tel: Archway 3030.



POWER PACKS *EXTRA* **for life!**

* The illustrations show only three of the new range of Ever Ready Power Packs.

for the
Professional
User



The **EDDYSTONE**
MODEL 680X
COMMUNICATIONS RECEIVER



Manufactured by **STRATTON & CO LTD** Birmingham, 31.

The controls of the Eddystone "680X" receiver are laid out so conveniently that the Professional operator quickly "takes" to the receiver and is able to make the most of its extremely good performance. All normal communications facilities are provided:— variable pitch BFO; crystal filter; wide range of selectivity; noise limiter; 600 ohm balanced output. There are two RF and two IF stages, all valves being of Service-approved types. Frequency coverage is continuous from 480 kc/s to 30 Mc/s. Available in table and rack-mounting versions. Robust all-metal construction and suitable for use in any climate. The illustrated brochure gives full particulars and you are cordially invited to write for it.

Build your own High Fidelity Loudspeaker System...

by means of GOODMAN'S "Stage-Built" method. This is a system of building up a multiple-unit High Fidelity Reproducer to give a performance of the highest order. There are three distinct stages, so the total outlay for the complete system may be split into three parts to suit individual convenience. The main feature of this "Stage-Built" system is that each stage does comprise a complete full range High Fidelity Reproducer, which can be improved by the addition of the next stage. The user is, therefore, never without a first class High Fidelity loudspeaker. At no stage is there any duplication of components, since all parts used in each stage are automatically used in the successive stage. By this means it is possible to improve the quality of the loudspeaker system most economically, as and when the remainder of the apparatus (pick-up, amplifier, etc.) is improved.

Briefly, the three stages are:—

Stage 1

Comprises one of the 12" twin-cone AXIOM loudspeakers; the AXIOM 150 Mk. II (15 watts) or the AXIOM 22 Mk. II (20 watts), depending upon the power handling capacity required. The enclosure employed has provision for the components of Stages 2 and 3; constructional drawings are available. Alternatively, the SHERWOOD enclosure can be used; this has provision for Stage 2 components; When Stage 3 is added, an extension to the enclosure is constructed.

Stage 2

In this stage the 12" twin-cone AXIOM loudspeaker chosen for Stage 1 is used to cover the bass and mid-frequency ranges only, up to 5,000 c/s., from which point the Trebax pressure driven horn-loaded high frequency unit covers the remainder of the range up to and beyond 16,000 c/s. Crossover network, Type XO/5000, is used to perform the frequency division, and an 8-step 12 db. constant impedance variable attenuator is added to provide adjustment of high frequency output.

Stage 3

This final stage is the conversion of the two-way system of Stage 2 to a three-way system by the addition of the Midax pressure driven horn-loaded mid-range unit. This takes over the reproduction of the mid-range frequencies (750 c/s.—5,000 c/s.) from the 12" twin-cone Axiom, which is now called on to cover the bass range only. A 750 c/s. crossover network, Type XO/750, performs this extra frequency division, and another variable attenuator is added to provide adjustment of the mid-range output. The system is now completed. If all instructions have been correctly followed, the result will be an outstanding reproducer, whose performance will not easily be matched by any other currently available system.



AXIOM 150 Mk. II



TREBAX



MIDAX

GOODMANS

GOODMANS "High Fidelity Loudspeaker Manual" fully describes the "Stage-Built" system, with details of the entire range of Goodman's High Fidelity Loudspeakers and associated equipment. This instructive publication free on request.

STOCKISTS

A. C. Farnell Ltd.
(Midlands)
Hereford House,
Vicar Lane, Leeds, 2.

Harris & Russell Ltd.
(South)
80, Tottenham Court Road,
London, W.1.

Lugton & Co. Ltd.
(South)
209-212, Tottenham Court
Road, London, W.1.

Thompson, Diamond &
Butcher, Ltd. (South)
5-9, University Street
Tottenham Court Road,
London, W. C.1.

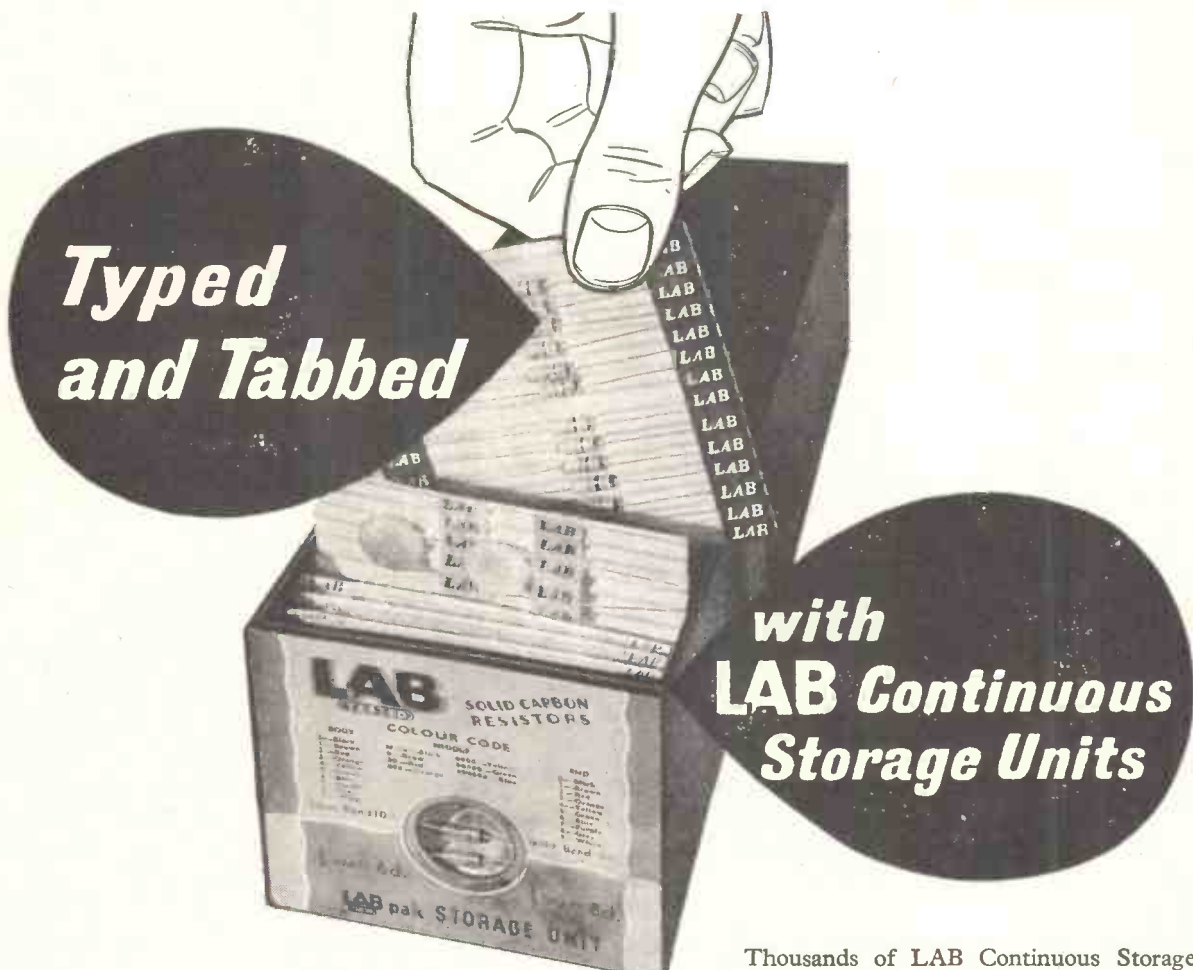


Loudspeakers and

Universally used by
leading manufacturers
of Television and
Radio Sets.

T/V

components



Thousands of LAB Continuous Storage Units are daily solving the problem of control and storage of the great range of resistors. Compact, and capable of storing up to 720 separate resistors, LABpak make selection positive, simple and speedy. Now that Ceramicaps, Histabs and Wirewound resistors have been added to the carded range the usefulness of LABpak storage units is enhanced.

FREE with any purchase of the LABpak range, these units are the complete answer to the storage problems of small production units, laboratories, etc.

MAKE UP YOUR ORDER TODAY — DELIVERY EX-STOCK

All LABpak resistors are carded in ohmic value, rating and tolerance, colour indexed and tabbed for easy selection.

REF.	WATTS	MAX. VOLTS	OHMS	MIN. ORDER FOR FREE UNIT	UNIT STORAGE CAPACITY
------	-------	------------	------	--------------------------	-----------------------

RESISTORS

T	$\frac{1}{2}$	250	10 to 10M	240	720
R	1	500	10 to 10M	180	500

Tolerances available $\pm 20\%$ 10% 5%

HIGH STABILITY RESISTORS

HS3	$\frac{1}{2}$	750	1 to 500M	93	500
-----	---------------	-----	-----------	----	-----

Tolerances available $\pm 5\%$ 2% 1%

WIREWOUND RESISTORS

LM	5 & 10	—	5 to 100K	72	300
LP	5 & 10	—	5 to 100K	72	300

CERAMICAPS

CER	Tubular	500	3 to 470pf	141	500
HK	Tubular	500	470 to 5000pf	141	500
HKD	Disc	500	470 to 5000pf	141	500

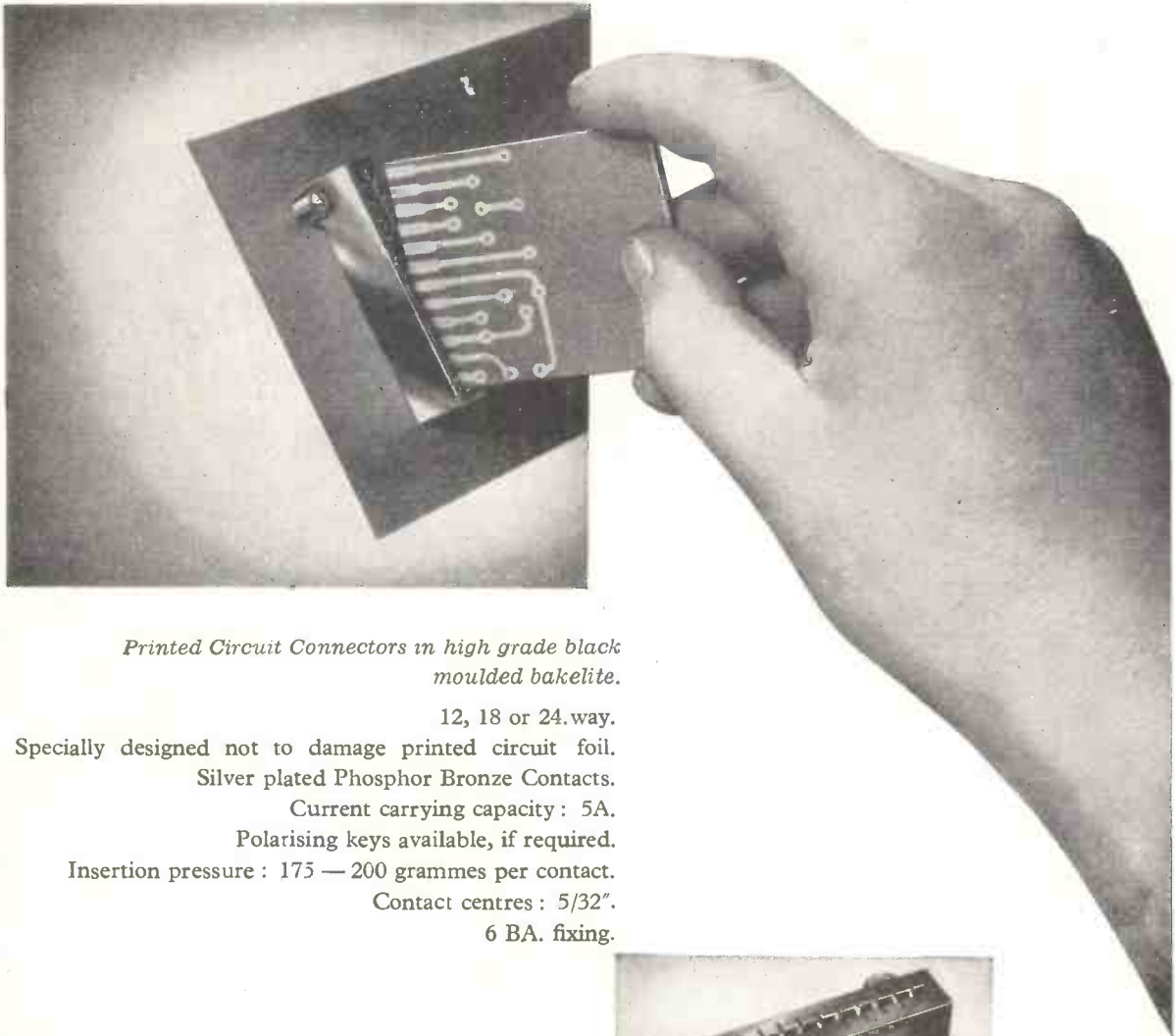
Tolerances available $\pm 2\%$ 10%

The LAB Continuous Storage Units are available from your normal source of supply, but more detailed information and literature can be obtained from

THE RADIO RESISTOR COMPANY LIMITED

50 ABBEY GARDENS, LONDON, N.W.8 • Telephone: Maida Vale 5522

PRINTED CIRCUIT CONNECTORS



Printed Circuit Connectors in high grade black moulded bakelite.

12, 18 or 24. way.

Specially designed not to damage printed circuit foil.

Silver plated Phosphor Bronze Contacts.

Current carrying capacity: 5A.

Polarising keys available, if required.

Insertion pressure: 175 — 200 grammes per contact.

Contact centres: $5/32$ ".

6 BA. fixing.



EXNING ROAD · NEWMARKET · SUFFOLK
TELEPHONE: NEWMARKET 3181-2-3 · TELEGRAMS: POWERCON · NEWMARKET



MINIATURE
RECTIFIERS

for

Electronic Circuitry

Write for full details to Dept. W.W.10,
WESTINGHOUSE BRAKE & SIGNAL CO. LTD.

82, York Way, King's Cross, London, N.1. T E Rminus 6432

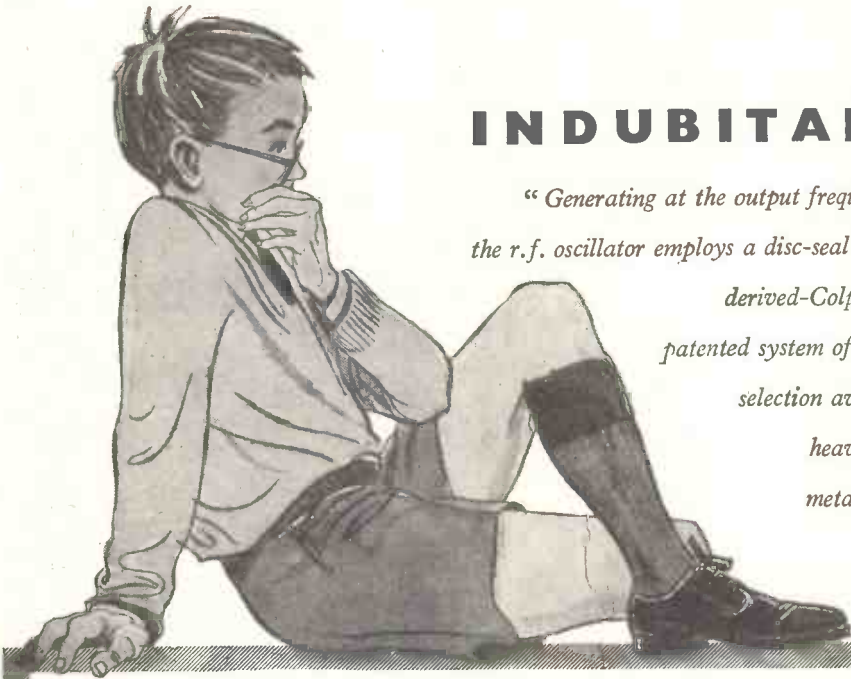
INDUBITABLY . . .

*"Generating at the output frequency without multipliers,
the r.f. oscillator employs a disc-seal triode in a shunt-fed*

*derived-Colpitts circuit in which the Marconi-
patented system of contactless waveband*

selection avoids the necessity for passing

*heavy r.f. circulating currents through
metal-to-metal contacts".*



OUR young friend may ponder the problem of which Marconi instrument is being described but many well-informed electronic engineers will have realised already that the subject under discussion is the Marconi TF 1066 FM/AM Signal Generator—an instrument notable for its stability, its unique incremental tuning system and the complete absence of spurious sub-multiples in its output.

You didn't know Marconi Instruments made such a signal generator? Write out one hundred times "The Marconi TF 1066 is an outstanding instrument capable of the broadest application"—or better still, write to us for leaflet G103



FM/AM SIGNAL GENERATOR

Type TF 1066

10 to 470 Mc/s. Output: 0.2 μ V to 200 mV at 50 ohms. Internal 400-c/s modulation: f.m., variable up to 100 kc/s deviation; a.m. variable up to at least 40% depth. External modulation: 30 c/s to 15 kc/s. Incremental tuning: \pm 100 kc/s max. with direct calibration valid at all carrier frequencies. An exceptionally versatile general-purpose instrument and, in particular, a high-quality f.m. generator.

**MARCONI
INSTRUMENTS**

AM & FM SIGNAL GENERATORS · AUDIO & VIDEO OSCILLATORS
FREQUENCY METERS · VOLTMETERS · POWER METERS
DISTORTION METERS · FIELD STRENGTH METERS
TRANSMISSION MONITORS · DEVIATION METERS
OSCILLOSCOPES, SPECTRUM & RESPONSE ANALYSERS
Q METERS & BRIDGES

MARCONI INSTRUMENTS LTD · ST. ALBANS · HERTFORDSHIRE · TELEPHONE: ST. ALBANS 56161

London and the South: Marconi House, Strand, London, W.C.2. Tel: COVENT Garden 1234

Midlands: Marconi House, 24 The Parade, Leamington Spa. Tel: 1408

North: 30 Albion Street, Kingston-upon-Hull. Tel: Hull Central 16347

WORLD-WIDE REPRESENTATION

It pays
to use

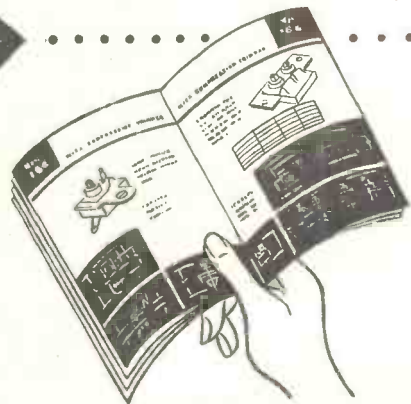
Cyldon

**Inductance
Tuners**
& VARIABLE CAPACITORS
for TELEVISION and AUTO RADIO

for
**Precision,
Stability &
Long Life**

Designers and users of radio and electronic equipment know that they can rely implicitly on the efficiency and dependability of "Cyldon" Capacitors and Tuners. They know too that the exceptionally wide variety of types in the standard "Cyldon" range covers most day-to-day requirements, but that when *special* types are needed the full resources and specialised experience of the manufacturers are entirely at their disposal.

**SYDNEY S. BIRD
& SONS LTD.**



Address for enquiries and sales correspondence :—
LONDON SALES & TECHNICAL LIAISON OFFICE,
3 PALACE MANSIONS, PALACE GARDENS, ENFIELD, MIDDXX.
Telephone : Enfield 8571-3. Telegrams : "Capacity, Enfield."

Head Office: POOLE, DORSET.

Contractors to Ministry of Supply, Post Office,
and other H.M. Govt. Depts.

Equipment manufacturers are invited to write for literature covering Cyldon "Teletuners" and Cyldon Trimmers, together with details of our complete range of Variable Capacitors and list of Agents for Home and Overseas.

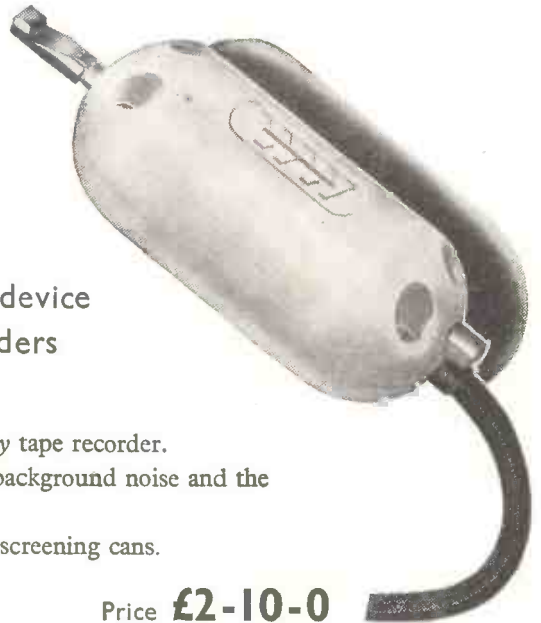
A 'must' for owners of Tape Recorders—

the *NEW* WEARITE **DE-FLUXER**

— a simple, easily operated trouble-free device
for *depolarising* the heads of tape recorders
and players

- ★ It ensures the maximum signal/noise ratio from *any* tape recorder.
- ★ Protects valuable recorded tapes from cumulative background noise and the gradual attenuation of the higher frequencies.
- ★ Is extremely simple to use without removing head screening cans.
- ★ Permits selective tape erasure during editing.

Price **£2-10-0**

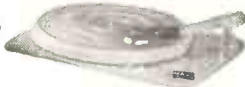


WRIGHT AND WEAIRE LTD

131 SLOANE STREET · LONDON · S.W.1 · Tel: SLO 2214/5 and 1510

LENCO

GL 56



with No. 500 variable-reluctance cartridge and unique location device **£23/7/0**



GARRARD 301

Transcription unit
£26/8/3

HI-FI SPEAKERS

GOODMAN (as illus.)
SOUNDSALES
TANNOY
WHARFEDALE
WB, etc., on
daily demonstration.



TRANSISTOR

SUB-MINIATURE COMPONENTS

Send S.A.E. for full list of Transistors,
Transformers, Earphones, Cords,
Potentiometers, etc.

**FULL RANGE OF
GILSON**

TRANSFORMERS, CHOKES, including
WO1059 for the NEW Mullard 8-
watt amplifier.

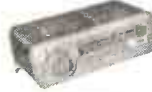
ALL COMPONENTS FOR

Osram 912 plus,
Mullard 3, 8, 10 and 20 watt and William-
son Amplifiers (S.A.E. for special lists).

**ACOUSTICAL
Q. U. A. D**



Mk. II Amplifier and
Control Unit **£42 0 0**
F.M. Tuner **£30 9 0**



LEAK

TL/12 Plus Amplifier **£18 18 0**
Varislope Mk. III **£15 15 0**
F.M. Tuner **£35 10 0**



Pick-up, Head (LP or 78 diam.) and transformer..... **£13 16 6**

CHAPMAN

SSE/FM—4 bands and FM **£34 2 6**
FM.85—Med., Long and FM **£25 4 0**
FM.81 Mk. II—FM only **£22 1 0**

BERRY'S RADIO

25 HIGH HOLBORN, LONDON, W.C.1

Telephone: HOLborn 6231-2
(OPPOSITE CHANCERY LANE)

**"Q-MAX" CHASSIS
CUTTERS**

The easiest and quickest way of
cutting holes in SHEET METAL.



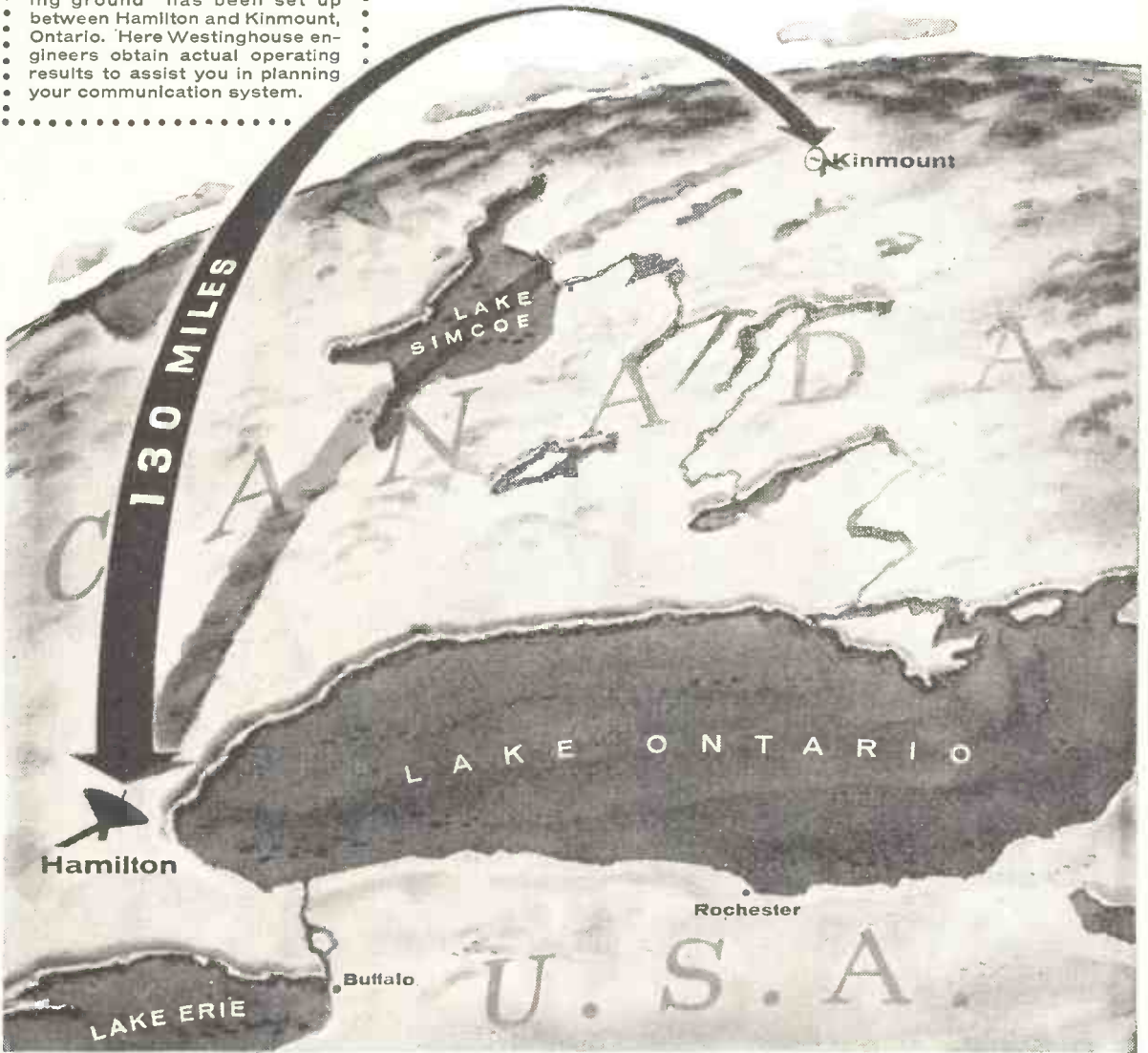
Patent No. 619178

3/8 in.	(a)	12/9
1/2 in. or 5/8 in.	(a)	13/9
1 in. or 1 1/8 in.	(b)	16/-
1 1/8 in.	(b)	16/-
1 1/2 in.	(b)	18/-
1 3/4 in.	(b)	18/-
2 in.	(c)	20/6
2 1/8 in.	(c)	33/6
2 1/4 in.	(c)	38/6
1 in. square	(b)	25/6
Keys (a) 1/- (b) 1/6 (c) 2/3.		



**"Q-MAX" GDO-1A
GRID DIP OSCILLATOR**
with eight coils from 1.5 to
300 Mcs. 15 gns.

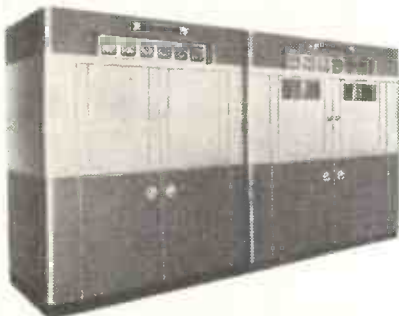
.....
 • A 130-mile Westinghouse "proving ground" has been set up between Hamilton and Kinmount, Ontario. Here Westinghouse engineers obtain actual operating results to assist you in planning your communication system.
 •.....



ANOTHER WESTINGHOUSE FIRST!

57-B-745R

SHF "Scatter" Transmission



New Westinghouse 4400-5000 mc. Transmitting and Receiving Equipment is compactly and durably designed for truck mounting or fixed installation for either commercial or military application.

• ● Now for the first time in the communications field, scatter equipment for super-high frequency transmission for fixed or transportable operation has been introduced by Canadian Westinghouse.

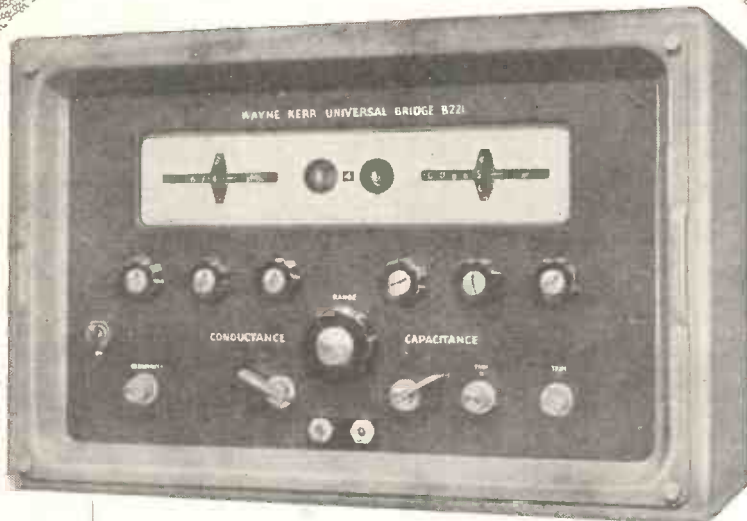
• The new Westinghouse "Scatter" communications equipment is designed for high quality, high reliability transmission of voice, teletype, telemetering, facsimile, television and data signals over hops of 100 to 200 miles. Voice capacity for multi-channel operation extends to 120-150 channels.

• Contact your local Westinghouse Sales Office for Descriptive Bulletin H83-100 or write Canadian Westinghouse Company Limited, Electronics Division, Hamilton, Canada.

WATCH WESTINGHOUSE ELECTRONICS

...WHERE BIG THINGS HAPPEN FIRST

WAYNE KERR UNIVERSAL BRIDGE B.221



Specification

BRIDGE ONLY:
 Capacitance: 0.0002 pF to 10 μ F in 7 ranges. Accuracy $\pm 1\%$.
 Conductance: 0- \pm 100 mmho in 7 ranges. Inductance: 1mH to infinity in 7 ranges. Measuring Frequency: 10,000 radians/sec. (1592 c/s.) Power Supply: 110/115 and 200/250 V 40/60 c/s. Dimensions: 17" x 7" x 11 $\frac{1}{2}$ " high. Weight: 25 lbs. approx.

WITH LOW IMPEDANCE ADAPTOR:

Capacitance: 1 μ F-100,000 μ F in 4 ranges. Resistance: 0-100 Ω in 4 ranges. Discrimination on lowest range 50 μ Ω . Inductance: 0-10 mH in 4 ranges. Discrimination on lowest range 5m μ H.

PRICES:
 Bridge, £175. Low Impedance Adaptor £15

50 MICRO-OHMS TO 10,000 MEGOHMS .0002 PICOFARAD TO 100,000 MICROFARADS, 5 MILLIMICROHENRIES TO INFINITY

- Accuracy to 0.25% is achieved with complete stability.
- Two decades and a continuously variable control indicate independently the resistive and reactive terms to four significant figures.
- Adaptors for measurement of conductivity, dielectric constant and loss factor of solids and liquids.

The B.221 is a highly accurate transformer ratio arm bridge of very advanced design. It provides facilities for the two, three, or four-terminal measurement of impedance or transfer admittance over an extremely wide range at an operating frequency of 10,000 radians/sec. (1592 c/s).

Measurement is unaffected by the impedance of the test leads, which can therefore be of any length. Consequently the instrument is ideally suitable for the determination of temperature coefficient of components under test conditions or, in fact, any remote in

situ measurement. A novel mechanism automatically displays the cyphers, decimals and units of measurement. This gives direct reading and avoids any confusion which might be caused by the large multiplying factors involved.

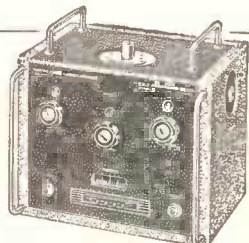
The basic range of the instrument covers impedances from 10,000 megohms to 10 ohms and this is extended to 50 micro-ohms by the use of the Low Impedance Adaptor. Other adaptors have been designed for measurement of conductivity, dielectric constant and loss factor of solids and liquids.

WAYNE KERR



Inductance Meter Type M.149

A small portable instrument designed for the simple and direct measurement of inductance values between 0.05 μ H and 100mH. Price £65.



Admittance Bridge Type B.901

An extremely stable transformer ratio-arm bridge designed for unbalanced measurements on aerials, feeders, cables and components at frequencies between 50 and 250 Mc/s. Price £175

THE AUTUMN

AUDIO FAIR**1957**

... IN THE NORTH

will be the most comprehensive public demonstration of High Fidelity equipment ever staged in the North.

The growing demand by the discriminating public for music in the home akin to what they hear on the concert platform has forced great technical advances in sound reproduction.

Leading manufacturers will be exhibiting and demonstrating, under domestic conditions, the latest developments in audio equipment.

Lovers of music of all types, if they are true to their enthusiasm, should hear for themselves how exactly and faithfully their favourite passages can be played back to them.

COMPLIMENTARY TICKETS AVAILABLE FROM YOUR RADIO, MUSIC OR RECORD DEALER.

IF YOU HAVE ANY DIFFICULTY, SEND STAMPED ADDRESSED ENVELOPE TO:
Exhibition Office, 42 Manchester Street, London, W.1.

The
**AUTUMN
AUDIO FAIR**
will be held at the
GRAND HOTEL

Harrogate

OCTOBER

Friday 25th

Saturday 26th

Sunday 27th

11 a.m. until 9 p.m.

**SPECIAL BUSES WILL RUN
BETWEEN
STATION AND FAIR**



McMURDO
**Multi-Way
Voltage Selector**

MULTI-WAY MAINS VOLTAGE SELECTOR TYPE 279001

14 POSITIONS! 90, 100, 105, 110, 115, 120, 130, 200, 210, 215, 220, 225, 230, 240 VOLTS.

NYLON LOADED P.F. MOULDING.

Send for full details including circuit information to:—

THE McMURDO INSTRUMENT CO. LTD · ASHTEAD · SURREY · Tel: ASHTEAD 3401

JSP MVS9



MAGNETIC SHIELDS

*for all types
of cathode ray tubes*

A few examples from the extensive range of standard shields available in

MUMETAL AND PERMALLOY "C"

The latest edition of the M.E.A. catalogue illustrating our complete range of shields for Cathode Ray Tubes and Transformers is now available on request.

Enquiries for special shields are welcomed and our Technical Sales Staff is always at the service of Customers to assist in the solution of specific problems of magnetic shielding.

MAGNETIC & ELECTRICAL ALLOYS LTD

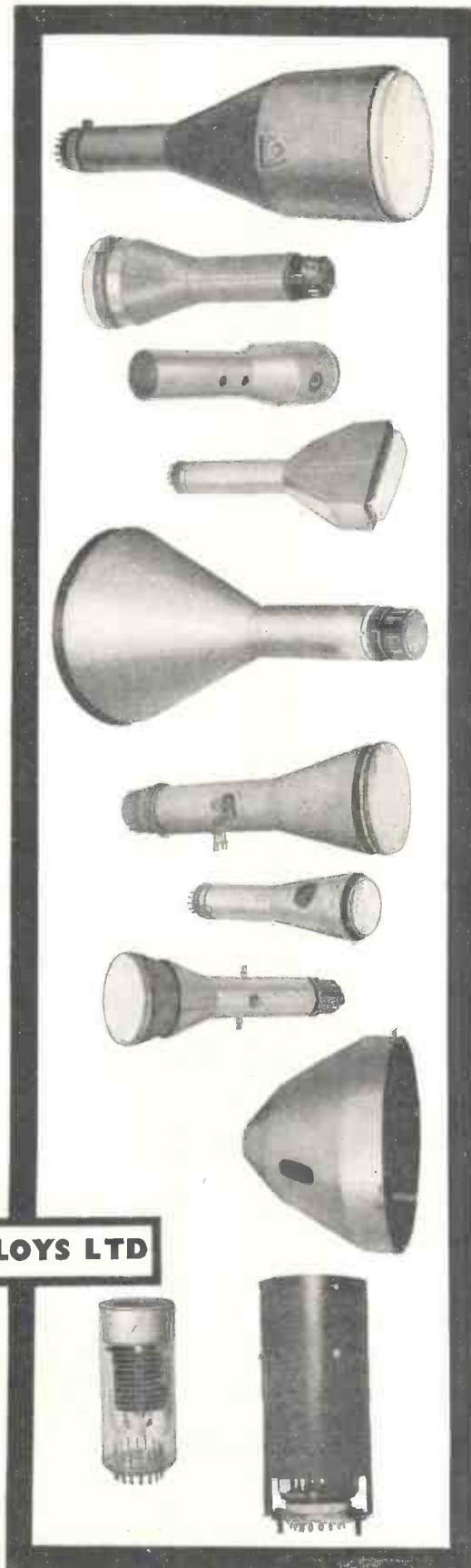
BURNBANK, HAMILTON, LANARKSHIRE

Telephone: Hamilton 932. Grams: Magnetic, Hamilton.

Branches at:

LONDON, BIRMINGHAM, MANCHESTER.

A Member of the Telcon Metals Group.



G.E.C.
6EP Series,
M.E.A. 8.T.25.

G.E.C.
4GP Series,
M.E.A. 8.T.24.

Ediswan
30 E6-7-8-10
Series,
M.E.A. 8.T.29.

Ediswan
30C 3 Series,
M.E.A. 8.T.31.

Mullard
DG.16-22
20th Century
S 6 Rect.
Series,
M.E.A. 8.T.34.

G.E.C.
E 4504 Series
Cintel
6 EO-4
Series,
Service
reference
CV 1097, etc.
M.E.A. 8.T.1.

20th Century
6in. Double
gun tube
D-6 Series,
M.E.A. 8.T.6.

Electronic
Tubes Ltd.
4 EP Series,
M.E.A. 8.T.36.

Radar Tube
Bulb Shield.
Mullard
M.F. 31-55
Cintel 12 to
3A.
M.E.A. 8.T.53.

**PHOTO
MULTIPLIER
Shields for
photo-
multiplier
tubes to suit
ranges made
by E.M.I.,
20th Century,
Mullard,
Du Mont and
R.C.A.**

TAKE YOUR PICK

Our wide range of capacitors, incorporating all the latest developments, are described fully in these new leaflets . . .

SEND NOW for COPIES

DALY has succeeded in maintaining full capacity values and working voltages in more compact designs, specially suited to ultra modern equipment :—

- PHOTO-FLASH EQUIPMENT • DEAF AIDS
- PRIVATE TELEPHONE INSTALLATIONS
- AMPLIFIERS • D.C. POWER UNITS
- TRANSISTOR EQUIPMENT
- MAGNETISATION EQUIPMENT
- TEST GEAR



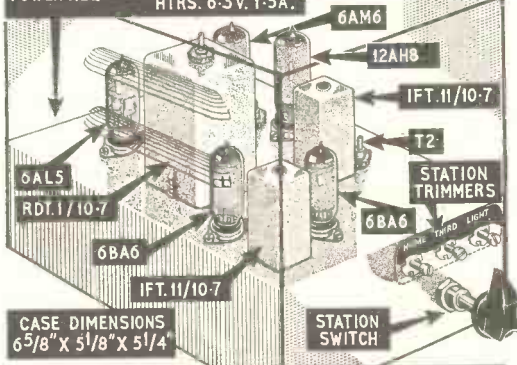
DALY ELECTROLYTIC CAPACITORS

Condenser Specialists for over 20 years.

DALY (Condensers) LTD., WEST LODGE WORKS,
THE GREEN, EALING, LONDON, W.5. Phone: Ealing 3127-8-9. Cables: Dalcyon, London

MAXI-Q

POWER REQUIRED H.T. 250V. 60mA.
HTRS. 6.3V. 1.5A.



PRE-SET F.M. TUNER

V.H.F./F.M. HOME, LIGHT AND THIRD PROGRAMMES INSTANTLY SELECTED AT THE TURN OF A SWITCH

Full constructional details, point-to-point wiring diagrams and alignment instructions for building the "MAXI-Q" PRE-SET F.M. TUNER and also the VARIABLE TUNED version are given in Technical Bulletin DTB.8, 1/6.

Completely punched chassis, screens and bronze finished cover, 19/- Station Indicator Plate, 1/1. 3 position switch, 4/3. Station Condenser Trimmers, 3-9 pF., 2/- each.

RATIO DISCRIMINATOR TRANSFORMER, RDT.1/10.7 Mc/s. Secondary winding of bifilar construction, iron dust core tuning, polystyrene former, silver mica condensers. Can size: 1in. square x 2 1/2 in. high, 12/6.

I.F. TRANSFORMER, IFT.11/10.7 Mc/s. Miniature I.F. Transformer of nominal frequency 10.7 Mc/s. The "Q" of each winding is 90 and the coupling critical. Can size: 1 1/2 in. x 1 1/2 in. square, 6/6.

COILS TYPE L1, T1 and T2. Specially designed for use in this unit are wound on polystyrene formers complete with iron dust core tuning, 3/11 each.

THE "MAXI-Q" PRE-SET F.M. TUNER is available completely wired, assembled, valved and housed in a sturdily made bronze finished cover at £8/11/5, plus £3/8/7 P.T., =£12.

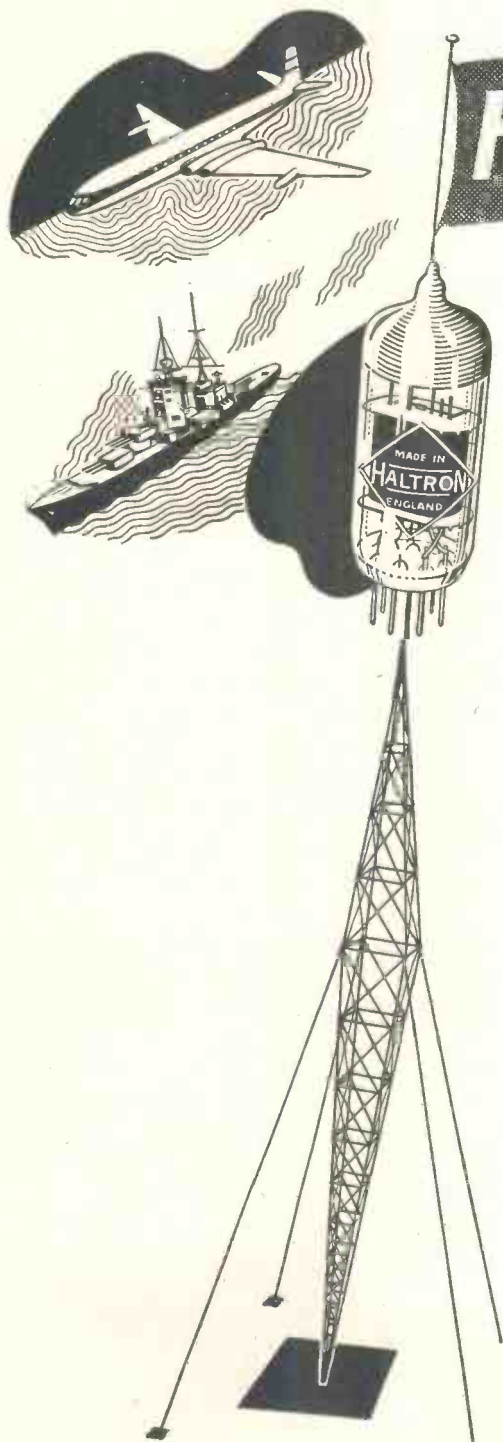
"MAXI-Q" VARIABLE F.M. TUNER is available completely assembled at £7/17/2 plus £3/2/10 Purchase Tax = £11.

GENERAL CATALOGUE covering technical information on full range of components, 1/-, post free.

Trading terms for direct postal orders: c.w.o. plus appropriate postage charge

DENCO (CLACTON) LTD.
(DEPT. W.W.) 357/9 OLD ROAD
CLACTON-ON-SEA, ESSEX

Stop Press: "MAXI-Q" 60 kc/s TAPE DECK OSCILLATOR COILS, TDO.1—for high impedance Erase Heads (Truvox, etc.), 5/- TDO.2—For low impedance Erase Heads (Brenell and Collaro), 5/-.



Here is an organisation which
can solve 99%
of YOUR
Radio Tube Problems.

We have in stock over **2,000** types of Receiving, Transmitting and Special Purpose Tubes, covering most American and European types.

Amongst our customers are the Army, Navy, Air Force, Civil Airlines and Post Office Departments of most European countries, the Near and Far East, Commonwealth, etc.

Tubes can be supplied to C.V., JAN and MIL Specifications. Our organisation is A.R.B. approved.

Price and Stock Lists available on application. Your enquiries for Special Types welcomed.

HALL ELECTRIC LTD

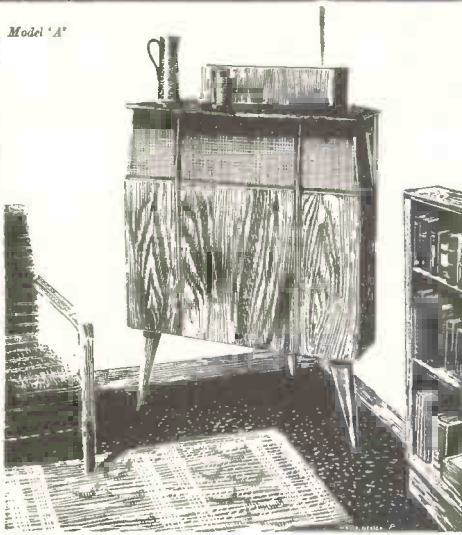
Haltron House, 49/55 Lisson Grove, London, N.W.1

Telephone:
AMBassador 1041 (5 lines)
Cables:
Halllectric, London
TELEX 2-2573

CITY SALE & EXCHANGE LTD

*The High Fidelity
Specialists*

Model "A"



Our Mail Order Service is superb. L.P. Records, Diamond needles and Tape accessories guaranteed by return of post.

LOWTHER T.P.I. CORNER REPRODUCER

This is a very compact speaker and preserves to an amazing degree true relationship between fundamental and harmonics whether it be low or high frequency. Speech is smooth, forward, and gives a feeling of the presence of the artist. Strings, brass and percussion alike have a clarity comparable to a concert hall performance.

Price £95 . 0 . 0

Part Exchange is our speciality. We will give you a fair offer for your present proprietary radio goods against the purchase of either new or secondhand apparatus. This allowance can be used as deposit or part deposit in the event of a credit or hire purchase transaction, for example:

New Acoustical Quad II Amplifier and control unit £42.

Allowance on Present Quad I amplifier and control unit £12.

Balance paid in eight monthly instalments of £4/0/11.

GUARANTEED SECONDHAND APPARATUS

Leak Variable Selectivity AM Tuner.....	£15 0 0
Acoustical Quad Preset AM Tuner.....	£7 10 0
Leak Varislope I Pre-amp.....	£6 0 0
RD Junior Pre-amp.....	£7 10 0
WB HF1012 Speaker in Reflex Cabinet.....	£12 10 0
Wharfedale W15/CS, Super 8, Super 3 in Corner Sand-filled Assembly, back panel and castors, Medium Oak	£60 0 0
E.M.I. Twin Track Tape Recorder, handsomely veneered cabinet, perfect condition. Complete.....	£65 0 0
E.M.I. Tape Player.....	£37 10 0
R.C.A. Orthophonic Amplifier and Control Unit.....	£32 0 0
Tannoy 12in. Direct Radiator Speaker.....	£11 0 0
Goodmans Audiom 70 Base Unit.....	£10 0 0
Garrard RC80 Changer Unit, GE Diamond Cartridge	£12 0 0

93-94 FLEET STREET, LONDON, E.C.4

Phone: *FLE*et St. 9391/2

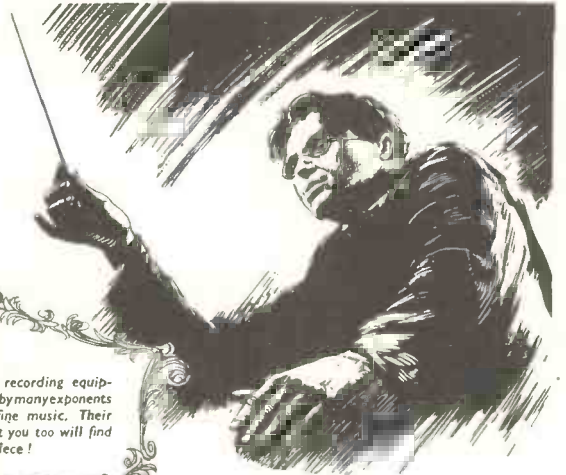
MASTERPIECE...

Exquisite melody on the strings, a poignant undertone of horn and woodwind, pulsing drum, crash of percussion, the decisive overwhelming crescendo of the coda...

Great music and the mastery of brilliant conducting. A masterpiece to be captured for ever, worthy only of the most faithful reproduction.



Master Tape and MSS recording equipment are in regular use by many exponents and connoisseurs of fine music. Their preference proves that you too will find Master Tape a masterpiece!



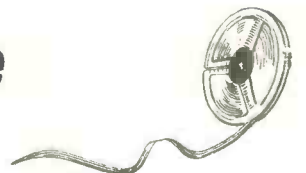
An occasion in fact, for

Master Tape

MAGNETIC RECORDING TAPE BY

MSS RECORDING CO. LTD., Colnbrook, Bucks.

Telephone: Colnbrook 430





You can bank on

Hunts



... for all types and applications

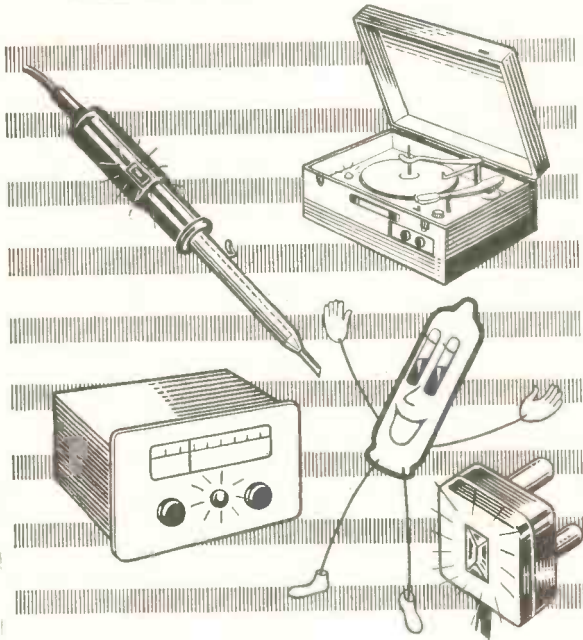
ALL TYPES
 DRY ELECTROLYTIC
 METALLISED PAPER (HUNTS PATENTS)
 METALLISED PLASTIC FILM (HUNTS PATENTS)
 PLASTIC FILM · FOIL & PAPER
 SILVERED MICA · STACKED MICA
 CERAMIC, POWER CERAMIC
 TRANSMITTING TYPES
 SPECIAL R.F. TYPES

ALL APPLICATIONS
 RADIO & TELEVISION EQUIPMENT
 ELECTRONIC EQUIPMENT
 POWER FACTOR IMPROVEMENT
 CAPACITOR MOTORS
 FLUORESCENT LIGHTING
 PHASE SPLITTING · H.F. & R.F. HEATING
 IGNITION AND INTERFERENCE SUPPRESSION
 TELEPHONE INSTALLATIONS

A. H. HUNT (Capacitors) LTD., WANDSWORTH, LONDON, S.W.18. Tel: BA1tersea 1083

Factories also in SURREY and NORTH WALES

For better indication fit a **Hivac** neon



With its distinctive colour indication and almost indefinite life, a Hivac Neon is the best indicator for a wide range of domestic and industrial electrical equipment. Its easily seen light serves as a visual check that an appliance is working as required. Look at the advantages:

- * Extremely long life without sudden failure
- * No filament to break
- * Inexpensive and easy to instal
- * Shock resistant
- * Negligible power consumption
- * Operation on a wide range of A.C. or D.C. voltages

It just glows to show!

*There's a type for every purpose—
write for full details*

Hivac Limited

Stonefield Way, South Ruislip, Middx. Ruislip 3366

REMOTE CONTROL ?

We cannot do the Indian Rope Trick but with

FLEXIBLE SHAFTING

We can operate any element requiring rotation or push-pull movement, or both, no matter if the controlled element is close to or at a distance from the control point.

We can operate from an accessible point, switches, valves and other electrical and mechanical devices located in inaccessible places.

We can, in fact, solve your problems.

Flexible Shaft Handbook available to technicians on request to Dept. W.

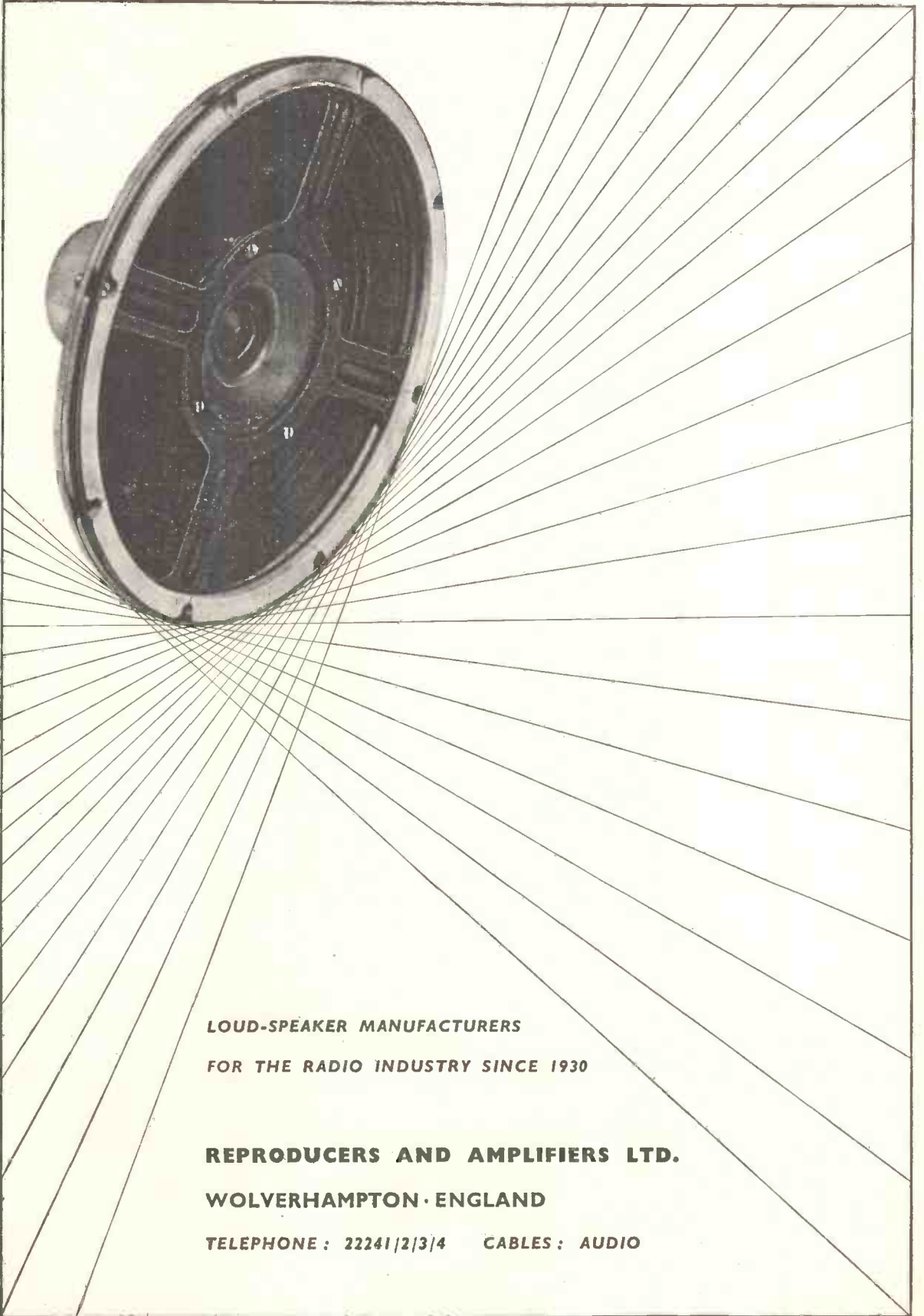
S.S. White

THE S.S. WHITE CO. OF GREAT BRITAIN LTD.
INDUSTRIAL DIVISION

BRITANNIA WORKS,
ST. PANCRAS WAY, LONDON, N.W.1.

Telephone: EUSton 5393

R.C.3



**LOUD-SPEAKER MANUFACTURERS
FOR THE RADIO INDUSTRY SINCE 1930**

**REPRODUCERS AND AMPLIFIERS LTD.
WOLVERHAMPTON · ENGLAND**

TELEPHONE : 22241/2/3/4 CABLES : AUDIO

THE BEST OF BOTH WORLDS

Whether you want a self-contained plug-in-and-play High Fidelity instrument or a complete range of matched High Fidelity units—specify RCA. For over 25 years the world's recording studios have consistently preferred RCA. Now let RCA bring this same studio quality to your home.

New Orthophonic

High Fidelity

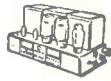
Matched Units



Super-sensitive FM Tuner. £24.3.0 plus £9.8.4 P.T.



Panoramic Multiple Speaker System. £56.11.0



20 watt Power Amplifier. £24.10.0



Transcription Turntable Deck. £22.6.0 plus £8.14.0 P.T.



Versatile Pre-amplifier Control Unit. £16.10.0

High Fidelity

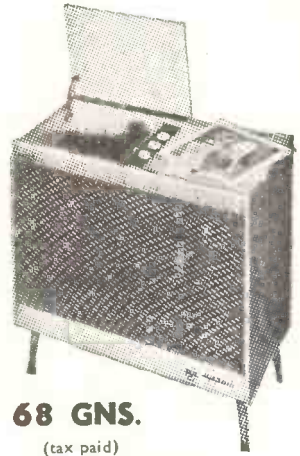
PLUG-IN-AND-PLAY

Record Reproducers

Above is the RCA "PRESIDENT" High Fidelity phonograph, ready-to-play, automatic changing, console record reproducer of outstanding quality. Panoramic multiple speaker system; new triple control with balanced loudness feature; 20 watt peak push-pull power from extended range amplifier; elegantly styled in superb cabinets in walnut, light oak, or dark oak finishes.

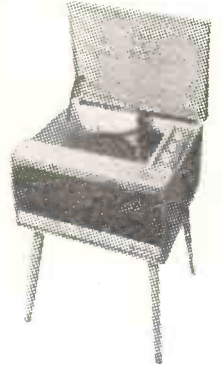
The RCA "VICE PRESIDENT" High Fidelity phonograph (illustrated right) is a beautifully styled record reproducer with a quality of reproduction never before associated with instruments of its size. Panoramic triple speaker system; 10 watts peak power from push-pull amplifier with frequency range 40-20,000 cycles; triple control system; 4-speed changer.

43 GNS. (plus £1.15.0 optional legs) tax paid.



68 GNS.

(tax paid)



RCA GREAT BRITAIN LIMITED, Lincoln Way, Sunbury-on-Thames, Middx.

(An Associate Company of Radio Corporation of America) Telephone: Sunbury-on-Thames 3101.

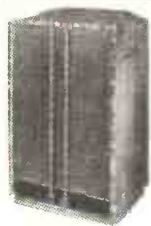
The Radio Centre's

HIGH FIDELITY EXHIBITION

See and hear the best in
HIGH FIDELITY and TAPE RECORDING

Just look at the models illustrated—a few examples taken at random from our large stocks of loudspeakers and enclosures.

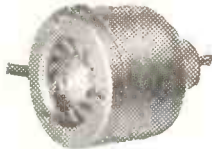
An efficient Mail Order Dept. is available to handle all your requirements. Low Deposit and Easy Repayment Terms if required. Special Export Service.



Goodmans 315 Reproducer



Goodmans Sherwood Enclosure



G.E.C. Presence Unit

G.E.C. Metal Cone Speaker



Goodmans Audiom 80



Goodmans Axiom 150 Mark II



W.B. HF1012



Goodmans Axiom 22 Mark II



Hi-Fi enthusiasts—come and see our huge and varied stock of all the latest equipments by

CHAPMAN CONNOISSEUR
E.A.R.
GOODMANS
LEAK
QUAD
ROGERS
W.B.
WHARFEDALE

Many Special Offers available to callers—come to

MAIL ORDER SUPPLY

E. & G.

The Radio Centre, 33, Tottenham Court Road, London, W.1

Telephone: MUSeum 6667

MINIATURE CERAMIC CAPACITORS

FIXED & VARIABLE

MINIATURE CERAMIC CAPACITORS AND TRIMMERS for Radio, T.V., Electronic Appliances & Interference Suppression. MICRODISC TRIMMERS for printed circuits

Vast range, new designs. Our Capacitors and Trimmers are of unsurpassed quality to build reliability that sets standard of long life and trouble free performance, and are used throughout the world by leading manufacturers.

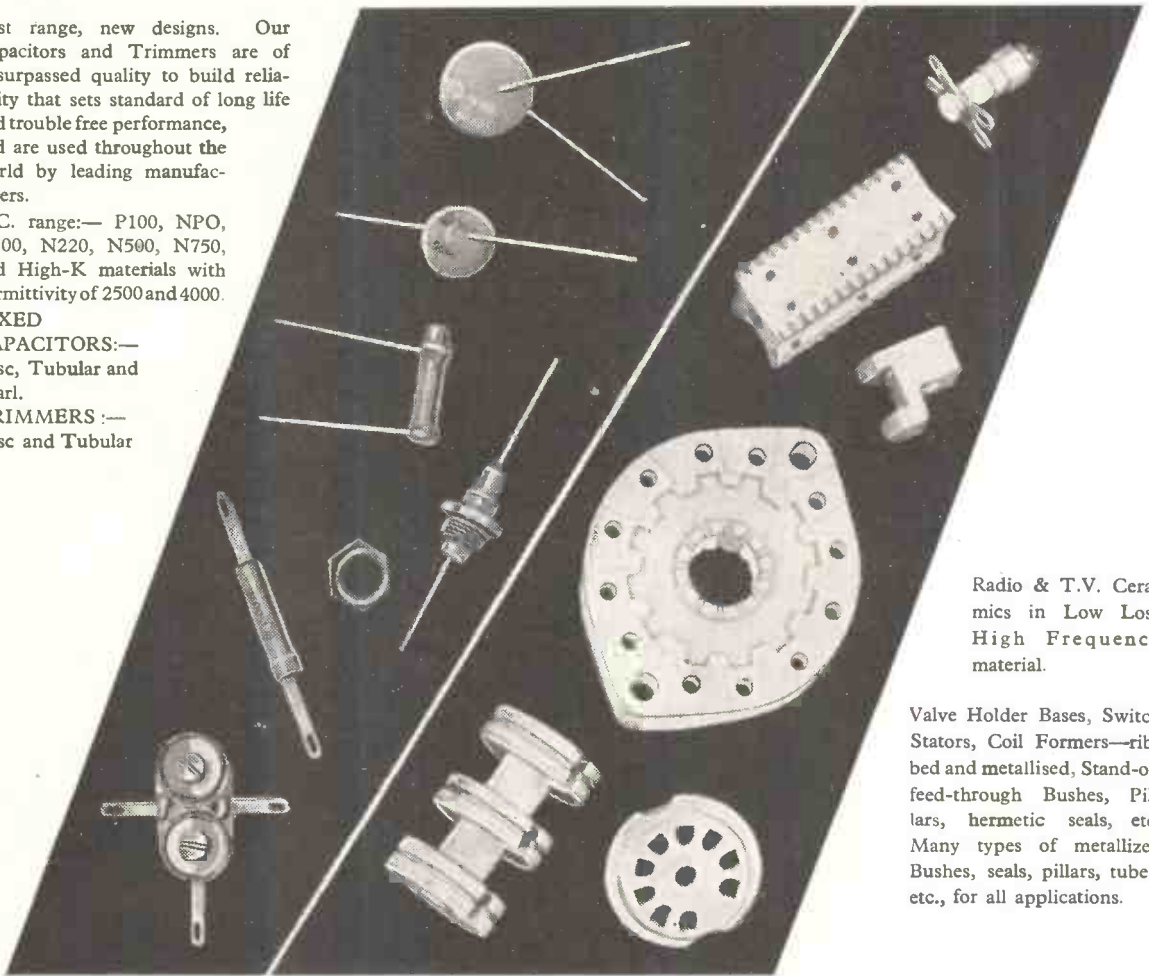
T.C. range:— P100, NPO, N100, N220, N500, N750, and High-K materials with permittivity of 2500 and 4000.

FIXED CAPACITORS:—
Disc, Tubular and Pearl.

TRIMMERS:—
Disc and Tubular

& FINEST QUALITY CERAMIC INSULATORS

LOW LOSS, METALLIZED, GROUND, etc.



Radio & T.V. Ceramics in Low Loss High Frequency material.

Valve Holder Bases, Switch Stators, Coil Formers—ribbed and metallized, Stand-off feed-through Bushes, Pillars, hermetic seals, etc. Many types of metallized Bushes, seals, pillars, tubes, etc., for all applications.

Please apply for further details and Prices.

If you want to improve the quality of your products, send us your enquiries for fixed Capacitors, Trimmers and Ceramic Insulators. Catalogues of a very wide range of standard types are available on request.

STEATITE INSULATIONS LTD.,
25 SOMERSET ROAD, EDGBASTON, BIRMINGHAM, 15.

Telephone: EDGBASTON 5381/2.
Telegraphic Address: "STEATITE-BIRMINGHAM, 15"

I. G. Y.

A 40,000-mile journey to film the world-wide activities of the International Geophysical Year: shooting in extremes of temperature and humidity, from tropical Africa to the polar regions—from Australian desert to Japanese mountains—from the inside of the Vesuvius crater to the blizzards of the Himalayas—even tunneling *inside* an Alpine glacier: this fantastic location job made possible the B.B.C. inaugural programme for I.G.Y., so admirably presented by H.R.H. Prince Philip.

The World Wide Film Unit which secured these amazing sequences relied entirely on a standard LeEVERS-RICH Syncropulse Recorder, and once again proved that



On the Jungfrau—12,000ft.



In the Belgian Congo, temperature 96° F

LEEVEERS-RICH

Syncropulse

RECORDERS

are making TV SOUND BETTER

Photos by courtesy of World Wide Pictures Ltd

LEEVEERS-RICH EQUIPMENT LTD.

78B Hampstead Road, London, N.W. 1

EUSton 1481

THE RD JUNIOR

FM UNIT

Review Extracts ...

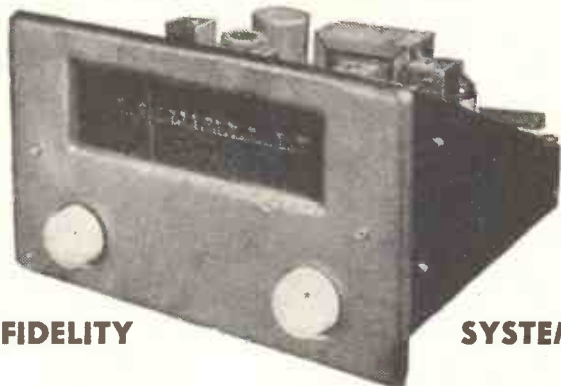
"... the construction and workmanship of this Rogers FM tuner is a delight to behold. The chassis is rigid and the wiring neat."

"... the signal is held like a limpet over a few degrees of the dial then disappears and the inter-station noise increases until the next signal drops in and is held firmly, with no "off-tune" positions of distortion."

"The discriminator is of the Foster-Seeley type and provides first class audio quality."

"... on switching on cold no drift is apparent, as the AFC takes over within plus or minus 500 kc/s of correct tuning point."

(GRR Home Test No. 37 by Donald W. Aldous, M.Inst.E., M.B.K.S., G.R.R. March 1957).



PART OF A COMPLETE HOME HIGH FIDELITY

SYSTEM

- ★ Automatic Frequency Control
- ★ Variable Inductance Tuning
- ★ Built-in Filament Supply

- ★ Foster-Seeley Discriminator
- ★ Low Impedance Output
- ★ Grounded-grid RF Stage

PRICE £24 . 17 . 0 INCLUSIVE

Available from leading High Fidelity dealers throughout the country. Immediate delivery.

A new Illustrated Leaflet giving concise details of the complete range of matched units forming the RD JUNIOR Home High Fidelity System may be had on request.

ROGERS DEVELOPMENTS (ELECTRONICS) LTD

"RODEVCO WORKS"

4-14, BARMESTON ROAD

CATFORD

LONDON, S.E.6

Telegrams: RODEVCO LONDON SE6

Telephone: Hither Green 7424



IT'S GOOD BUSINESS TO INVEST IN RCA BROADCAST EQUIPMENT



RCA engineering combines quality and long-range economy

Because there's more to radio equipment than its initial cost, economy minded broadcasters prefer RCA equipment... their best insurance for safeguarding their investments and building profits. They realize that many RCA broadcast transmitters with more than 25 years of service are operating today because RCA has engineered and manufactured its broadcast equipment to meet the highest standards.

Why RCA Broadcast Equipment Reduces Operational Expenditures

- RCA uses the highest quality circuits and components — gives you a wide safety margin of operations, minimizes costly, time-consuming replacement.
- Superior specifications include superlative wiring — for longer service without re-wiring.
- Long tube life in RCA Broadcast Equipment often saves more money in the long run than the initial cost of less carefully engineered equipment.
- Higher trade-in value for RCA equipment.

FROM THE STATION LOGS

Here are a few of the many station reports from all over the world, describing long tube life in RCA Broadcast Equipment. When these reports were received, the tubes were still going strong:

- 94,613 hours:** RCA final amplifier triode in RCA 10 KW medium wave transmitter, at KPOJ, Portland Oregon.
- 62,000 hours:** RCA final power triode, in RCA 50 KW medium wave transmitter at KDKA, Pittsburgh, Pennsylvania.
- 46,115 hours:** RCA final power triode in RCA 1 KW short wave AM transmitter at DZMB, Manila, Philippines.
- 33,738 hours:** RCA mercury-vapor rectifier, in RCA 50 KW short wave transmitter at Canadian Broadcasting Corporation.

RCA offers a complete line of Broadcast Transmitters ranging from 250 watts to 250 kilowatts. Consult your RCA Distributor or write Dept. BE49-J at the address below for complete information.



**RCA INTERNATIONAL DIVISION
RADIO CORPORATION OF AMERICA**
30 ROCKEFELLER PLAZA, NEW YORK 20, N. Y., U. S. A.

Trademark(s) Registered

**A JOY TO THE EYE
AND EAR**

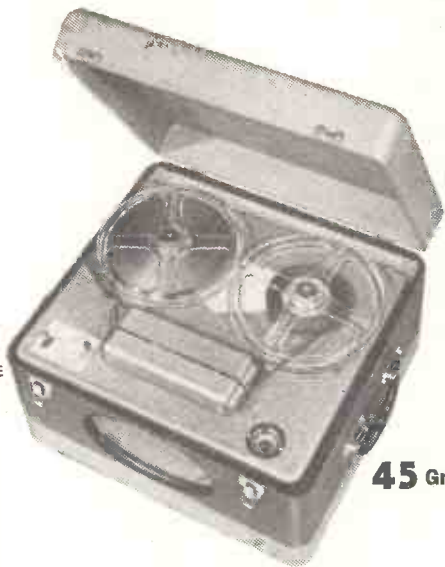
Have you heard the sensational

**QUALITY AMPLIFIER
and PRE-AMPLIFIER**

VERDIK

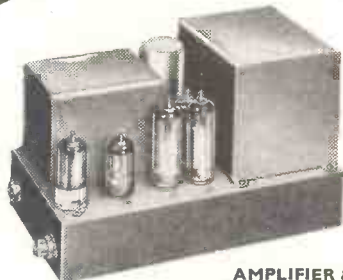
See your dealer
or write direct

to

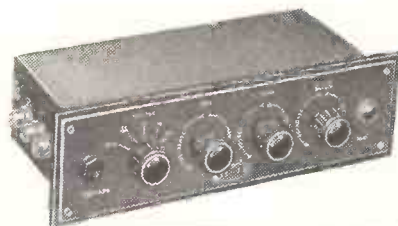


**2-SPEED TAPE
RECORDER**

45 Gns.



**AMPLIFIER &
PRE-AMPLIFIER**
**20 GNS. ONLY
COMPLETE**



**VERDIK SALES LTD., 8, RUPERT COURT
WARDOUR ST., LONDON, W.1 (GERrard 8266)**

OUTSTANDING IN DESIGN

**Exhaustive research, inordinately
fine engineering and individual craftsmanship
have produced this new
standard in amplifier performance**

**AMPLIFIER model 2001
and PRE-AMPLIFIER model 2001A**

25 watts continuous output, total distortion only .05%. Positive and negative feedback to achieve distortion-free reproduction. Pre-amplifier has inputs for Tape, Gram., Mic. and AM/ FM tuner. Compensator for record characteristics and continuous adjustable bass and treble controls. Automatic attenuation control for various cartridge characteristics. Price complete **40 gns.**

**INTEGRATED AUDIO AMPLIFIER
model 1004**

Selector switch gives choice of three correction networks which between them cover the majority of recording characteristics. Separate bass and treble controls. Supplies for Radio and Gram. motor provided. A plug-in pick-up attenuator permits the use of all types of high output pick-ups in addition to the magnetic and moving coil patterns. A rumble filter is automatically switched into circuit. Power output 10 watts. Price **25 gns.**

In High Fidelity

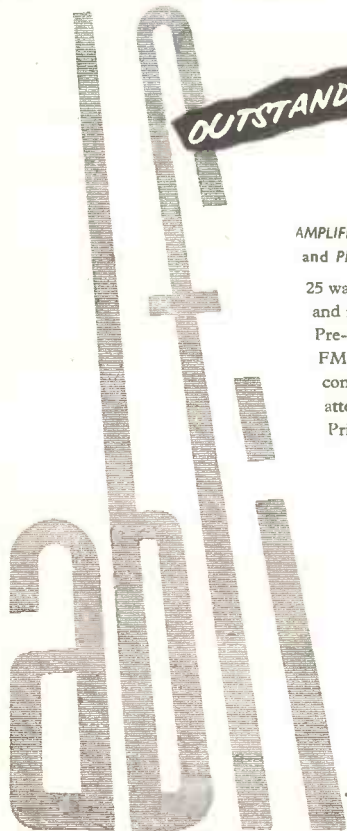
Pamphonic

for sound — **NATURALLY!**

PAMPHONIC REPRODUCERS LTD

17, Stratton Street, London, W.1

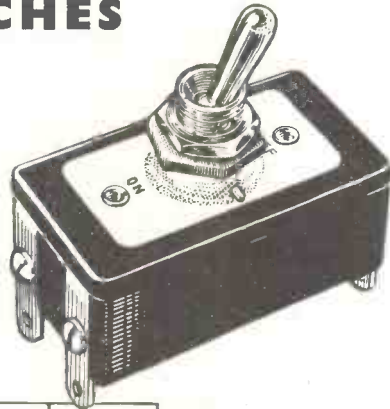
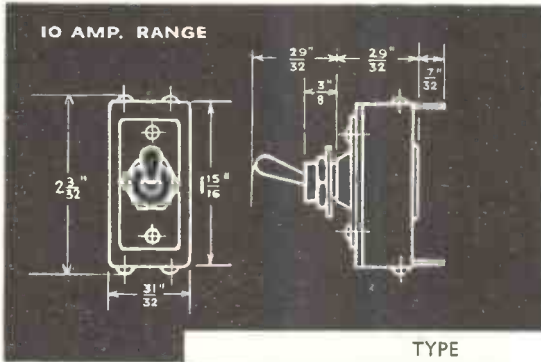
Telephone GROsvenor 1926





By Appointment to the Professional Engineer

TOGGLE SWITCHES



TYPE	CAT. No.
SINGLE POLE CHANGE OVER OPERATION.	501056
DOUBLE POLE ON/OFF OPERATION.	500705
As 500705, but fitted for two-hole mounting by 4 B.A. bushes on 1-7/8" fixing centres. . . .	501089
DOUBLE POLE ON/OFF. Dimensions and finish of bush and lever to conform to current RCL 151.	501402

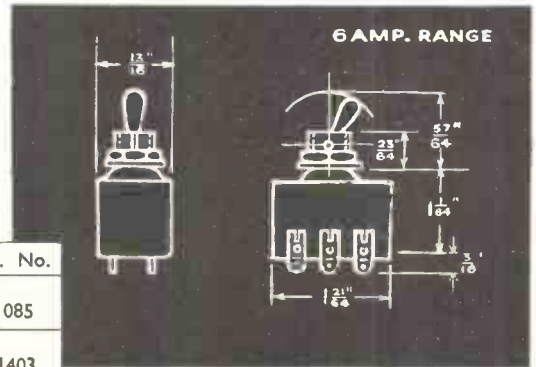
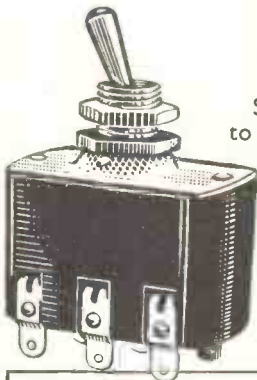
10 AMP

SWITCH RATINGS:
10 amps. at 250 volts AC/DC
AVERAGE INTERNAL RESISTANCE:
Less than .002 ohm.
CONTACTS AND TERMINALS:
Silver clad phosphor bronze.

6 AMP

The Painton 6 Amp. Toggle Switches are designed to conform to the performance requirements of appropriate R.C.S.C. Specification.

SWITCH RATINGS:
6 amps. at 250 volts AC/DC
AVERAGE INTERNAL RESISTANCE:
Less than .002 ohm.
CONTACTS AND TERMINALS:
Silver clad phosphor bronze.



TYPE	CAT. No.
DOUBLE POLE CHANGE OVER. Dimensions shown in line drawing. Heavy duty chrome finish.	501085
DOUBLE POLE CHANGE OVER. Dimensions and finish of Bush and Lever to conform to current RCL 151.	501403
DOUBLE POLE CHANGE OVER. Bush and Lever Dimensions to conform to current RCL 151 but with chrome finish.	501521

PAINTON
Northampton England

A NEW CATALOGUE OF HIGH FIDELITY EQUIPMENT NORTHERN RADIO SERVICES

has just been published by

11 Kings College Road, London, N.W.3. Phone: PRImrose 3314

Send two 2½d. stamps for your copy now.

The new No. 1 "SYMPHONY" AMPLIFIER Mark III is a 3-channel 5-watt Gram/Radio Amplifier with astonishingly flexible tone control. You can lift the treble, the bass, or—and here is the unique feature—the middle-frequencies to suit your own ear characteristics, and the record or radio programme being heard. Independent Scratch-cut is also fitted and special negative feedback circuit employed. The Amplifier can accommodate a wide variety of records from old 78s to new LPs. Input is for all types of pickup of 0.1 v. output or more and there is full provision for Radio Tuner, Tape take-off and Playback. It is available to match 15 ohms or 2-3 ohms speakers. Price 12 gns. (carriage 7/6). Fitted in Portable Steel cabinet 2 gns. extra.

The new No. 2 "SYMPHONY" AMPLIFIER Mark III as No. 1 but with 10-watt Push-Pull triode output and triodes throughout. Woden mains and output transformers and choke. Output tapped 3, 7.5 and 15 ohms. Provision for Tuner and Tape. Competes with the most expensive amplifiers on the market yet costs only 16 gns. (carr. 7/6). Fitted in Portable Steel cabinet 2 gns. extra.

No. 2 "SYMPHONY" AM/FM TUNER. Combining all the specifications of our Long, Medium and Short wave Superhet AM Tuner and our No. 1 FM Tuner. Separate Coil Assemblies and I.F.s. Fully self-powered on one chassis. 26 gns. (carr. and pkg. 7/6).

No. 1 "SYMPHONY" F.M. TUNER. High grade instrument with extremely silent background. Based on the latest type of permeability-tuned Coil Assembly of advanced design housed in anti-radiation shroud giving extreme sensitivity and high music/noise ratio. Suitable for amplifiers in the highest fidelity class. £15/8/-. Power Pack £3/7/6. Magic eye £1 extra if required.

- Amplifiers, Tuners, Cabinets, etc., at Manufacturers' prices.
- Demonstrations: Monday-Saturday inclusive, 10 a.m.-6 p.m. without appointment. Technical Guidance Service by our Chief Engineer personally or by return post free.

Let us have your enquiry now.

- Single items or complete installations from stock. We can supply any regular item advertised in this journal
- Complete satisfaction or goods exchanged. Deferred terms available.



THE "SYMPHONY" DE-LUXE TAPE RECORDER, 2-speed, twin-track, microphone, radio and gramophone inputs. Facilities for playback through high quality internal elliptical speaker, or through external high fidelity speaker or through external high fidelity amplifier. Automatic head demagnetisation. Wide frequency range heads. Housed in handsome polished walnut cabinet. Fantastic value for money at 52 gns., or 9 monthly payments of £6/13/-. Plus carriage £1. Cabinet only £5/19/6. Full details in catalogue.

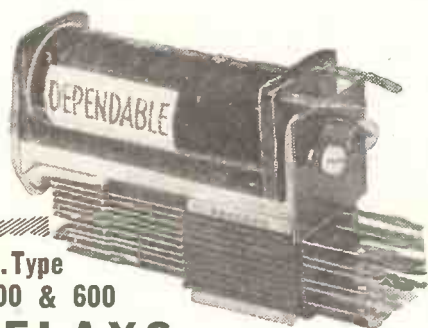
"Symphony" Amplifier, FM Tuner and Lenco Unit in Norydk Cabinet. Size 20in. wide x 17in. high x 17in. deep, at 9 gns.

DEPENDABLE RELAY CO. for DEPENDABLE AUTOMATION

STANDARD SELF-CONTAINED CONTROL UNITS FOR



- PRODUCTION CONTROL
- COUNTING
- BATCH WORK
- PROGRESS
- TIMING
- SWITCHING
- POWER HANDLING
- LIQUID AND GRAIN LEVEL CONTROL
- TEMPERATURE AND FURNACE CONTROL



P.O. Type 3000 & 600 RELAYS

Manufactured to your specification to A.I.D. and I.E.M.E. standards.

COILS up to 80,000Ω. CONTACTS up to 8 amp. INSULATION up to 5kv. Prototypes 7-14 days.

PROMPT DELIVERY — PROMPT QUOTATIONS

SIEMENS high-speed types also supplied.

Specialists in tropicalisation. Transistorised relays.

Contractors to leading manufacturers, P.O. and Govt. Depts.

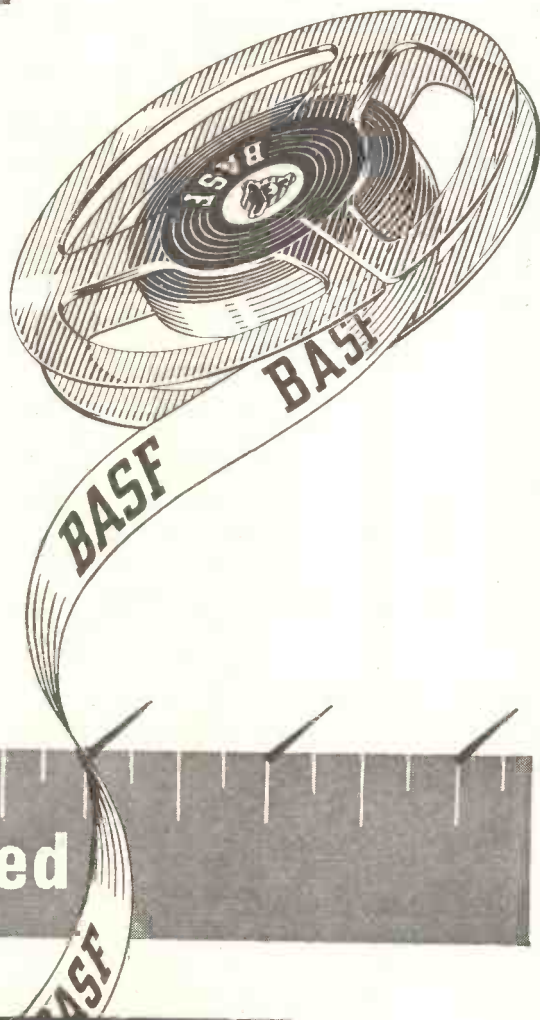
DEPENDABLE ELECTRONIC RECORDER

- Continuous Strip Chart
- Sin. graph
- 3 speeds
- Power driven pen
- Immediate starting torque
- Full-scale drive 3 sec.
- "Plug in" oscillator chassis
- Black ebony finish Instrument Case
- Research
- Industrial and medical applications

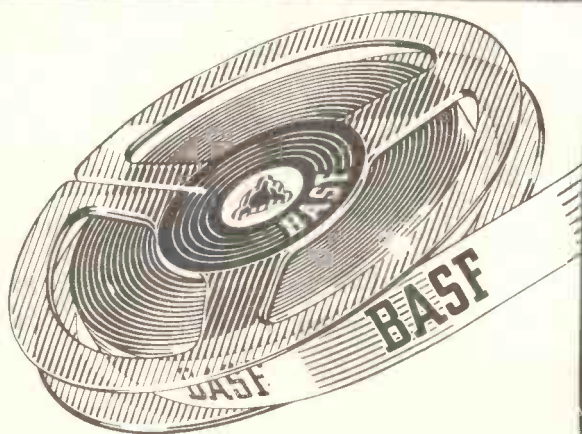
12a, Tottenham Street, LONDON, W.1: 'Phone: LANgham 7391/2 (NEAR GOODGE ST. STATION)

BASF

magnetic
recording
tape



every inch is tested



is **BEST**

F. A. HUGHES & CO. LTD Devonshire House • Piccadilly • London

Mayfair 8867

"YOU CAN RELY ON US"

Stockists of all Radio and Electronic components for manufacturers, laboratories, Educational authorities, and the amateur.

MULLARD 510 AMPLIFIER AND G.E.C. 912 AMPLIFIER—ALL PARTS STOCKED AND AVAILABLE ON H.P.



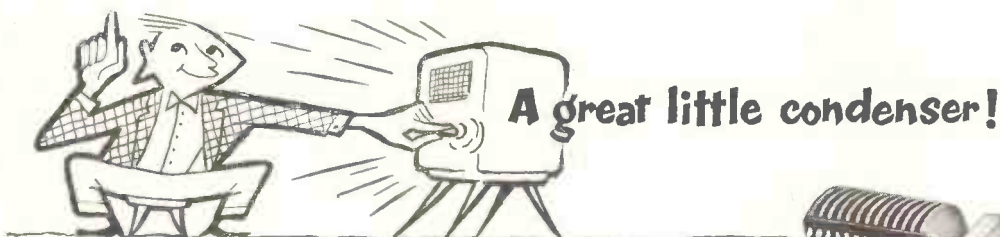
INCLUDING ELCOM, BULGIN, TCC, HUNTS, DENCO, ETC.
DETAILED LISTS ON ABOVE AVAILABLE
ALL AVO, TAYLOR, INSTRUMENTS FROM STOCK

RADIO SERVICING COMPANY

82, SOUTH EALING ROAD, LONDON, W.5.

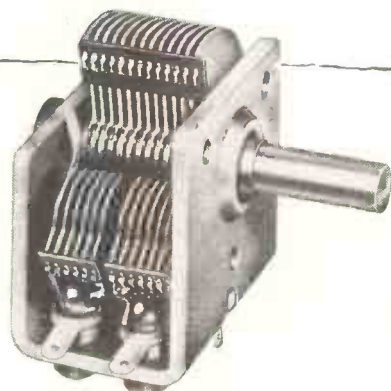
Next to South Ealing Tube (TURN LEFT) 9 to 6 p.m., Wednesday 1 o'clock.

Telephone : EAL. 5737



THE JACKSON "00" TWIN CONDENSER

Designed for use in miniature transistor receivers. The front (aerial) section is 208pf. to provide coverage for medium waves, and the rear section is 176pf. which may be padded to match the oscillator, very robust yet light weight. Front area $1\frac{3}{8}$ in. x $1\frac{1}{2}$ in. x $1\frac{1}{2}$ in. deep, price 9/6d.



*It's reliable
if it's made
by Jackson's*

JACKSON BROS. (London) LTD.

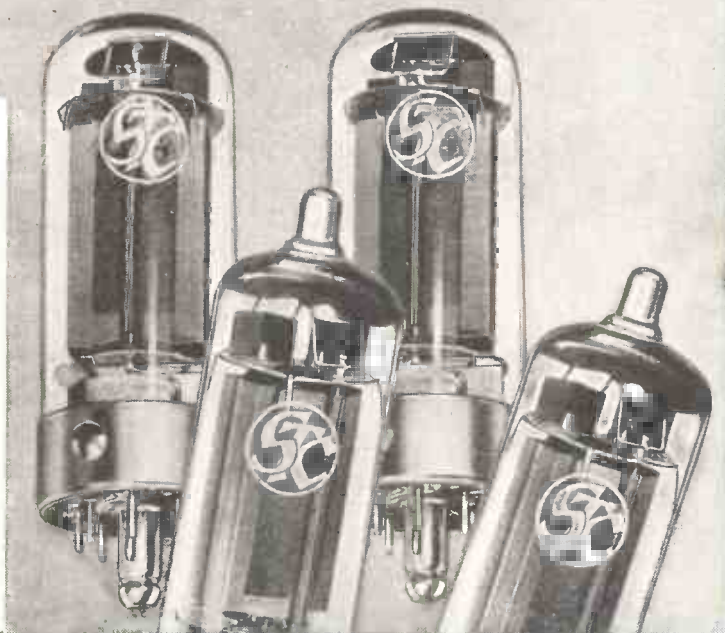
KINGSWAY · WADDON · SURREY

Telephone CROYDON 2754-5

Electrical equivalents

FOR THE

807



plus these **EXTRA** advantages

SMALL SIZE
MORE RIGID
MORE COMPACT



These new STC valves are loctal-based, indirectly-heated, beam-power amplifiers electrically similar to the U.S.A. type 807 but with extra advantages. Little more than half the size of the 807 the electrode assemblies are more compact... stronger and more rigid... and the glass bulbs less vulnerable. Shorter grid and anode leads, and glass base with miniature-type pins reduce inter-electrode capacitance and improve performance at the higher frequencies. Thus, both mechanically and electrically, they offer a new high standard of reliability, which, together with their small size, makes them particularly suitable for use in mobile equipment.

The range of four valves offers a choice of heater voltage:

5B/254M double-ended	5B/255M single-ended	5B/257M single-ended	5B/258M double-ended
6.3V	6.3V	12V	19V
0.9A	0.9A	0.47A	0.33A

Where the overall seated height must be kept as low as possible, the single-ended type 5B/255M may be used under conditions other than those of high altitude or anode modulation. The 5B/254M is available under the code 5B/254G, as a flying lead version.



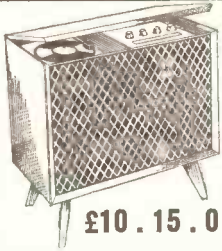
Standard Telephones and Cables Limited

SPECIAL VALVE SALES DEPARTMENT

CONNAUGHT HOUSE

63 ALDWYCH

LONDON W.C.2



£10.15.0

THE SERENADE. Veneered with finest selected walnut, beautifully polished to a medium shade; this attractive cabinet has generous storage space, with board sliding out smoothly on metal rollers.
This cabinet can be fitted with any of the latest Hi Fi Units.



£12.19.6

THE BUREAU. This popular bureau cabinet is veneered with the finest selected Walnut and beautifully polished in a medium shade. Designed to accommodate almost any of the many units we have available and to give generous storage compartments.



£16.16.0

THE NEW 4-SPEED B.S.R. AUTO-CHANGER. Now for the first time since the invention of the gramophone, you can play 78, 45, 33—and the sensational new 16 r.p.m. extra-long-play records—on one instrument! Now, in your own home, you can enjoy the magic of "recording studio" fidelity. This new Monarch can be fitted to any of the cabinets illustrated or purchased separately.

Enthusiasts Choice!

THE CONTEMPORARY. This beautifully made cabinet is oak veneered with mahogany interior and is waxed finished. Available in any shade to order at slightly extra cost.
This cabinet can be fitted with any of the latest Hi Fi Units.

EMPRESS A.M./F.M. RECEIVER CHASSIS. 9-VALVE H/F.

This de Luxe high-fidelity chassis covers the F.M. band and the Short, Medium and Long Wavebands. Miniature cathode-ray indicator is incorporated to facilitate precise and accurate tuning. It has internal ferrite rod aerial which gives perfect station selectivity, extension, speaker and pick-up sockets, 200/250 volts. Including two loudspeakers.

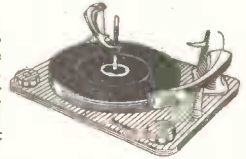


£27.6.0



R.T.C. LOUDSPEAKER. This loudspeaker has been designed to give cone air loading to reduce harmonic and inter-modulation distortion—this unit forms one of the most compact full range systems within its power capacity. Can be fitted to any of the cabinets illustrated or purchased separately.

£3.19.6



£9.15.0

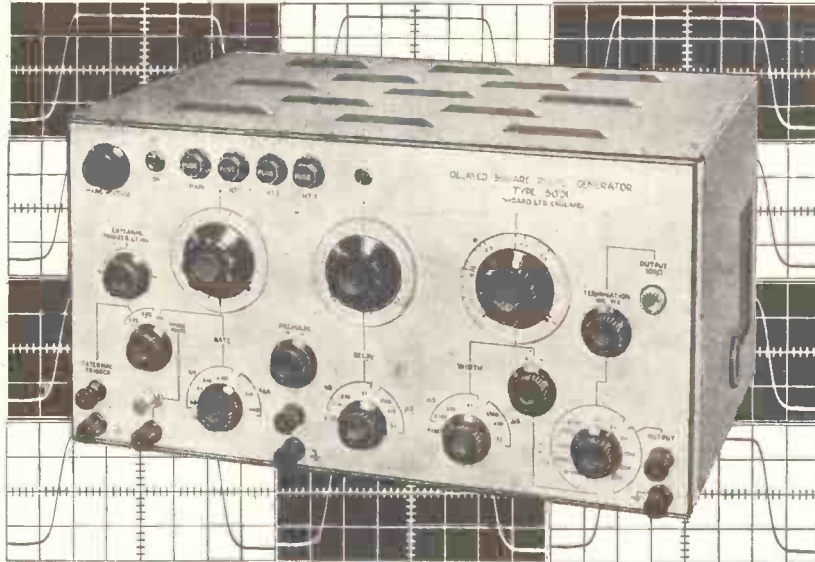
We supply all units and can fit any cabinet with the latest Hi Fi amplifiers, tuners, transcription units, record changers, speakers, etc. Send for comprehensive illustrated catalogue of cabinets, autochangers, speakers, etc., all available on easy H.P. terms.

LEWIS RADIO COMPANY

120 (Dept. WWO) GREEN LANES, PALMERS GREEN, LONDON, N.13.

Telephone: BOWes Park 1155/6

A new wide range DELAYED SQUARE PULSE GENERATOR



Model 5001 with accurate Time & Voltage Calibrations

Rise time 10 μ sec independent of pulse width

Square Wave Output 0.25 c/s to 2.5 Mc/s Waveforms show 0.2 μ sec pulse on 25 cm/ μ sec sweep; 10 million to 1 range of pulse rate, width and delay calibrated by direct reading dials within 5%

Internal Multivibrator of new type gives highly stable frequencies continuously variable from 0.1 c/s to 1 Mc/s

External Trigger from signals of any waveform and polarity at amplitudes down to 0.2V and frequencies up to 2.5 Mc/s

Single Pulses at any range setting by push button

Delay of Pre-Pulse to main pulse — jitter free and continuously variable from 0.2 μ sec to 2 secs; Pre-pulse output 20 volts positive or negative—0.2 μ sec wide

Main Pulse amplitude—20 mV to 50 V positive or negative

★ OUTPUT VOLTAGE CALIBRATED TO WITHIN $\pm 2\%$

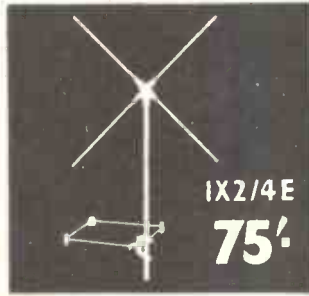
Negligible overshoot on any range—no sag on long pulses. Width continuously variable from 0.2 μ sec to 2 secs. $\pm 5\%$. The most accurate and versatile box of pulses yet made available to electronic engineers.



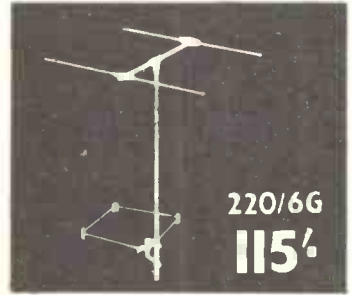
NAGARD LIMITED

18 Avenue Road, Belmont, Surrey
Telephone VIGilant 9161/2

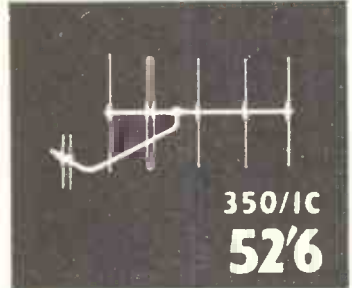
ANTIFERRENCE aerials



BAND I A complete range of Antex (illustrated) Dipole, "H," Fringe and Indoor models is available. Outdoor models can easily be adapted for Band III by adding Band III Grip-on aerials.



BAND II Indoor and outdoor models to suit all conditions and to provide the very best results for VHF/FM equipment. Models for fitting to existing TV masts are available.



BAND III 3, 5, 8, 10 element and Stacked Arrays for outdoor installation and a comprehensive range of indoor models.

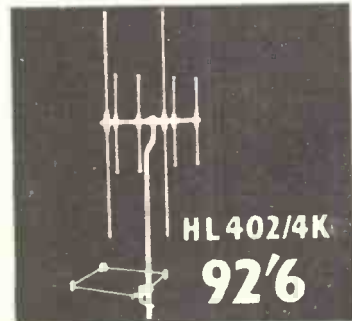
Specially Designed EXPORT RANGE

Antiferrence offer a specially developed range of competitively priced Television and VHF/FM aerials for export including Horizontally or Vertically Polarised Single or Stacked Yagi Arrays, Broad-Band and All-Band types for International Frequencies including Continental (C.C.I.R.) and American channels. Full details of this specially designed Export Range on request from Export Department, ANTIFERRENCE LIMITED, AYLESBURY, BUCKS.

Now BAND III & HIL-O AUTOMATIC WITH Click-Mec

Far in advance of any other form of pre-assembly — "click" and they're fixed!

HIL-O 17 models to provide perfect Band I/Band III reception with only one aerial. All incorporate the patented Electronic Coupling exclusive to Antiferrence.

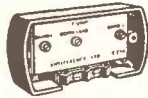


STANDARD
PLUG &
SOCKET

R.E.C.M.F. SPECIFICATION.
Robust and simple to fit.

PLUG TVP/1
SOCKET TVS/1

Both **8^D** each



"Y" BOXES

For combining or dividing Band I and Band III Television Aerial down leads.

Outdoor Model Y.1.— **16' 6**

Indoor Model Y.2.— **12' 6**

ANTIFERRENCE
LIMITED

BICESTER RD.,
AYLESBURY, BUCKS.

THE ANTIFERRENCE GROUP Antiferrence Ltd., Aylesbury & London • Antiferrence (Canada) Ltd. • Antiferrence (Australia) Pty. Ltd. • Antiferrence Installations Ltd.

Antiferrence Aerials are supplied through Appointed Antiferrence Distributors to all leading Radio and Television Dealers. We regret that we cannot supply direct to members of the public.

LIST No. 70 $\frac{1}{8}$ BIT

THE tool for Electronic Circuits
also by

ADCOLA
REGISTERED TRADE MARK
(Regd. Trade Mark)

Soldering Equipment

SHARP HEAT FOR QUICK
soldering of transistors, resistors and
all classes of miniature components.

SUPPLIED IN ALL
VOLT RANGES

ADCOLA
"LONG LIFE" Bits
FROM STOCK

ILLUSTRATED ACTUAL SIZE

Electrical standards approved in all
leading countries

Catalogues of the Adcola patented
and registered design soldering
equipment on request from

Head Office, Sales and Service

ADCOLA
PRODUCTS LTD.
GAUDEN ROAD,
CLAPHAM HIGH ST.,
LONDON, S.W.2

Telephones: —
MACaulay 4272 and 3101

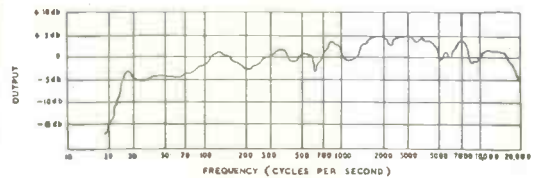


HARTLEY-TURNER

"315"

LOUDSPEAKER

Power Handling Capacity	15 Watts Peak A.C.
Flux Density	14,000 Gauss
Voice Coil Impedance	4 or 15 ohms. (Please state on order)
Fundamental Resonance	30 c/s
Frequency Coverage	25 c/s - 15 Kc/s
Chassis	Die Cast non-magnetic alloy
Overall diameter	12 $\frac{1}{2}$ in.
Overall depth	6 $\frac{1}{2}$ in.
Nett weight	7 lbs. 9 ozs.
Packed weight	9 lbs. 9 ozs.



Retail Price 10 Guineas
(Carriage paid in Great Britain)

H. A. HARTLEY CO. LTD.
66, WOODHILL, WOOLWICH,
LONDON, S.E.18.

Phone: Woolwich 2020. Ext. CB32

(An A.E.I. Company)

RADIATION MONITORS LIMITED

announce their

Utility
GEIGER COUNTER

The first low price radiation monitor for general use

£10.0.0

(Plus batteries)*



Now obtainable from
Initial U.K. Distributors

A self-contained portable instrument made under licence from the U.K. Atomic Energy Authority for the detection and measurement of Beta/Gamma radiation by the technician, experimenter, student, or amateur prospector—with wide application in Industry and Civil Defence.

Circuit

Based on the Integrator Circuit developed at the Atomic Weapons Research Establishment. Current pulses from specially produced, halogen quenched, long-life Geiger-Mueller tube integrate in neon scaler capacitor. Stepped charge-per-pulse gives triple range over voltage cycle. Visible and audible count.

Construction

High grade components throughout. Case specially designed for single-handed operation and field use, moulded in high-impact polystyrene of great insulation resistance. Balanced weight, thumb operated switches, hooded neon, sliding Beta window.

Range

Three switched ranges. Crystal speaker gives precise audible count of each single pulse on lowest range or immediate appreciation of significant flux change on medium range. Calibrated flash cycle on all ranges.

Sensitivity

Average back ground count 90 per minute.

Utility

General laboratory monitoring.
Isotope tracing and contamination detection.
Location and relative assay of Uranium and Thorium ores.
Examination of path or flow in industrial processes.
Qualitative measurement and illustrative experiments in education. Realistic training in nucleonic practice at a harmless radiation level. Geological mapping, and cave and mine exploration.

Facilities

Portable, completely self-contained. High tension from internationally available 30 volt layer-type batteries, potential automatically disconnected as case is opened. Battery life under continuous day and night operation exceeds shelf-life.

Easily cleaned anti-contamination feet on base protect case.

Anti-glare panel and substantial hood simplify count and promote accuracy.

Finger tip audio and range change.

Output socket for miniature earpiece, 'scope, or scaler (insertion of jack mutes speaker for "secret" counting).

Extra long, wide shoulder strap for field survey leaves both hands free.

Size 9in. by 6in. by 3in., weight with batteries, 3lb.

* (Set of miniature batteries supplied with instrument for £2 15s. 3d. extra.)

PROOPS BROS. LIMITED
52, Tottenham Court Road, W.1.
Telephone: LANgham 0141

Modernise Your Radiogram

with an *Armstrong* chassis

The effect of substituting a good quality Receiver/Amplifier for your ordinary commercial unit will astonish and delight you. Only in this way can the full benefits of the improved modern recordings and the superb quality of the VHF/FM transmissions be obtained. Armstrong have been making replacement chassis for nearly 25 years and have concentrated exclusively on the requirements of those who want the best. This is your guarantee of first-class performance and reliability.

MODEL PB 409 (illustrated) 28 GNS.

A High Quality Radiogram replacement Unit

★ 9 valves ★ 6 watts
Push-Pull output ★ Negative Feedback ★ 4 wavebands including VHF

★ Quick action Piano Key selectors ★ Separate Bass and Treble controls ★ Magic Eye

MODEL AF 105 £37

AM and FM Tuners and High Fidelity Amplifier on one compact chassis

★ 10 valves ★ 10 watts
Push-Pull output ★ 20 dB Negative Feedback ★ 5 wavebands including

VHF. ★ Independent wide range Bass and Treble controls with visual indicators ★ Magic Eye



Post this coupon or write for descriptive literature and details of Home Trial facilities, Credit terms and Guarantee to Armstrong Wireless and Television Co. Ltd., Warriners Rd., Holloway, N.7.

Tel: NOR 3213

BLOCK CAPITALS PLEASE

NAME

ADDRESS

Demonstrations at our Holloway Showroom 9—6
Weekdays and Saturdays

WWO



FLEXIBLE REMOTE CONTROL OUTFITS

offering facilities for making prototype flexible remote controls as required, without flexible casing.

The Remote Control Flexible Shafts in these Outfits cover the range of torque loadings required for volume controls, wave change switches and condensers used in electronic, radio and television equipment.

No. 130 (.130 in. dia.) for controls up to 4 inches long
No. 150 (.150 in. dia.) for controls up to 6 inches long

Longer controls with flexible casing made to order.
Detailed Parts and Price List available upon request to Dept. W.

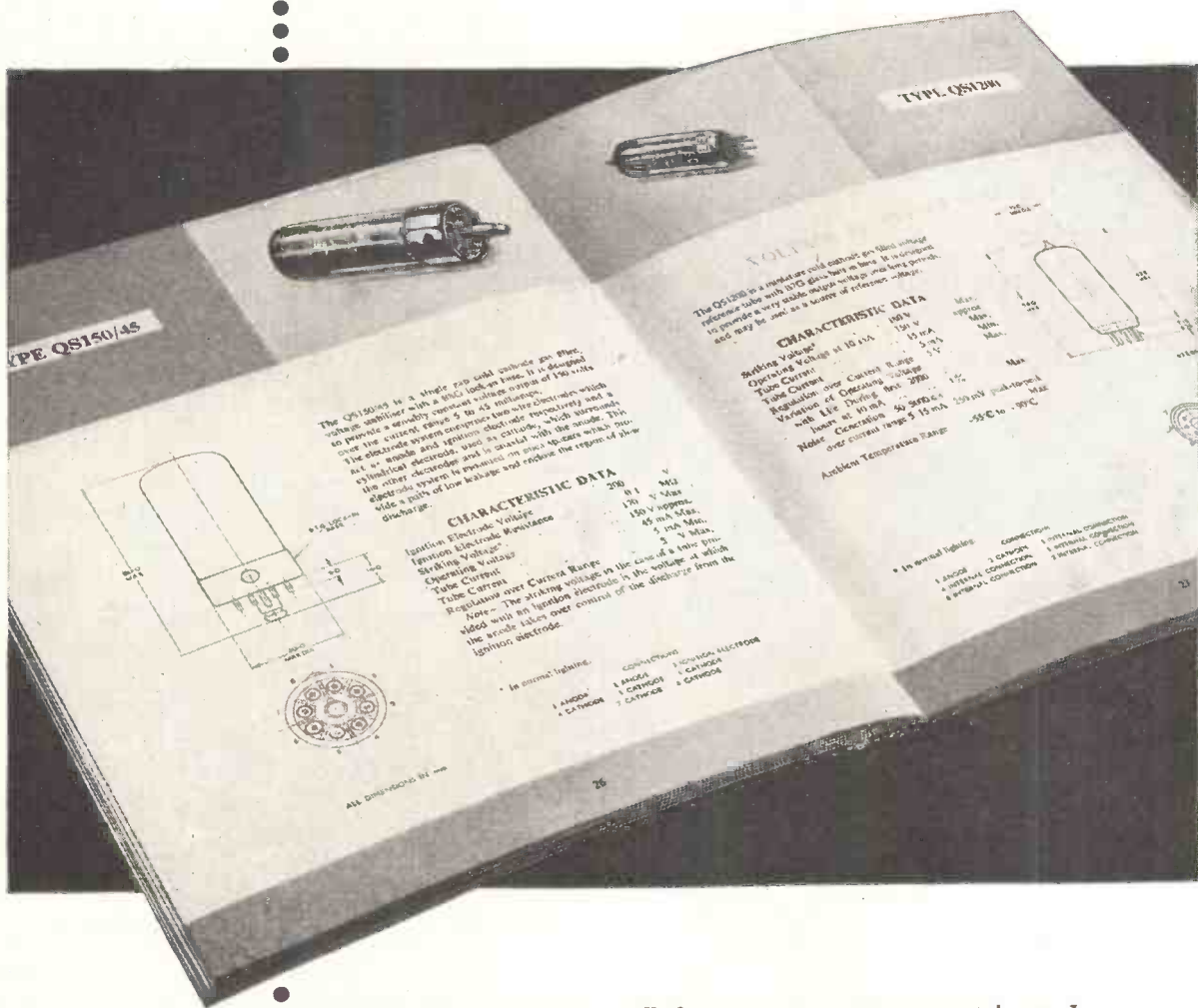
THE S.S. White
CO. OF GREAT BRITAIN LTD.
INDUSTRIAL DIVISION

BRITANNIA WORKS, 25-31, ST. PANCRAS WAY N.W.1

Telephone: EUSTon 5393

R.C.4.

Voltage Stabilisers & Reference Tubes



This brochure, which will gladly be sent to you on request, contains much useful information relating to voltage stabilisers and reference tubes, together with data and characteristics of the wide range produced by English Electric Valve Co. Ltd.

'ENGLISH ELECTRIC'

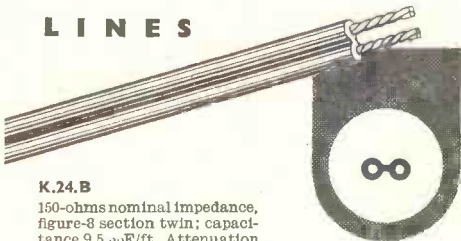
ENGLISH ELECTRIC VALVE CO. LTD.



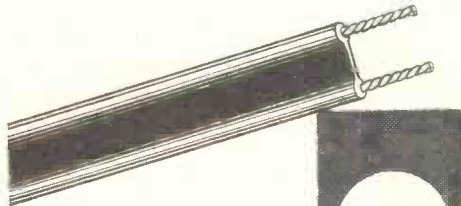
Chelmsford, England
 Telephone: Chelmsford 3491

TELCON

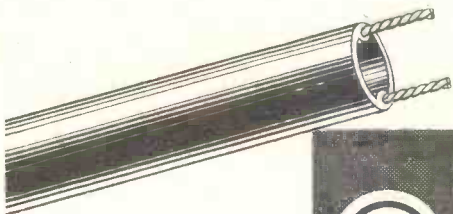
LOW-LOSS
TRANSMISSION
LINES



K.24.B
150-ohms nominal impedance, figure-8 section twin; capacitance 9.5 $\mu\text{pF}/\text{ft}$. Attenuation at 100 Mc/s, 2.5 db/100 ft; power rating at 100 Mc/s, 300 watts.



K.25.B
300-ohms nominal impedance, flat ribbon-type twin; capacitance 4.0 $\mu\text{pF}/\text{ft}$; Attenuation at 100 Mc/s, 1.4 db/100 ft; power rating at 100 Mc/s, 500 watts.



K.35.B
300-ohms tubular twin feeder with stable characteristics in varying weather conditions. Capacitance 4.0 $\mu\text{pF}/\text{ft}$; Attenuation at 100 Mc/s, 1.4 db/100 ft; power rating at 100 Mc/s, 500 watts.



**THE TELEGRAPH
CONSTRUCTION
& MAINTENANCE
CO. LTD.**

Enquiries to: Mercury House, Theobald's Road, London, W.C.1.
Telephone: HOLborn 8711.

Branches at: CARDIFF · DUDLEY · LONDON
MANCHESTER · NEWCASTLE · NOTTINGHAM

RADIOS · DEAF AID
**THESE ARE
ACCUMULATORS**
SIGNALLING



*hermetically
sealed, too!*



DEAF AIDS

from
50mAh
to
23Ah
cap.

DEAC PERMA-SEAL
Hermetically sealed Ni-Cd accumulators have these advantages:

No corrosion — No gassing — unlimited shelf-life.

No maintenance—can be permanently wired-in. Easily re-charged. A range of three types: disc, cylindrical and rectangular from 50 mAh to 23 Ah capacity. Disc cells can be stacked for the higher voltages.

Write for leaflet D13 giving further details.

RADAR · GUIDED



fully patented

G · A · STANLEY PALMER LTD

MAXWELL HOUSE, ARUNDEL ST., LONDON, W.C.2
Telephone: TEMple Bar 3721/3

"... the finest instrument of its kind"



Sir John Barbirolli, the world famous Conductor of the Halle Orchestra has said of these instruments: "... And to think that I can remember the old phonograph cylinder and that we have now arrived at the incredible perfection of the Black Box—surely the finest thing of its kind ever produced."

The Pye Black Box range of Record reproducers offers a choice of models to suit everyone. The original De-Luxe Black Box is magnificently presented in an elegant hand-painted Chinese Lacquer finish, while the Traditional Black Box, finished in a rich natural mahogany, has the same pleasing lines and its own air of distinction. The latest addition to the range—the Super Black Box—features the amazing new 'Infinite Throat' Electrostatic Loudspeaker and is available in 'Contemporary' or 'Traditional' finishes. All models play four speeds of records and can be operated automatically or by hand.



BLACK BOX

The World's Finest Range of Record Reproducers

Pye Limited,
Auckland, C.I.,
New Zealand.
Pye Pty. Ltd.,
Melbourne, Australia.

Pye Corporation of America,
1149 Raritan Avenue,
Highland Park,
New Jersey, U.S.A.

Pye Radio and Television
(Pty.) Ltd.,
Johannesburg, South Africa.
Pye (Ireland) Ltd.,
Dublin, Eire.

Pye Limited,
Tucuman 829, Buenos Aires.
Argentine.
Pye Limited,
Mexico City.

Pye (Canada) Ltd.,
Northline Road, Toronto.
Deutsche Pye G.m.b.H.
Berlin-Zehlendorf-West,
Roonstrasse 2, Germany.

P Y E L I M I T E D . C A M B R I D G E . E N G L A N D

ARCOLECTRIC

SWITCHES & SIGNAL LAMPS



S.936: Normally off
S.938: Normally on



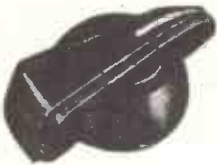
T.600
3-amp., 250v.



S.L.81
Neon Signal Lamp
½" hole fixing



T.622, Toggle Switch
D.P.C.O. 3-amp., 250v.



K.75: Small Pointer Knob



S.L.90/SB
Low Voltage
Signal Lamp
for M.E.S. bulbs

Write for Catalogue No. 131

ARCOLECTRIC
SWITCHES · LTD

CENTRAL AVENUE, WEST MOLESEY, SURREY.

TELEPHONE: MOLESEY 4336 (3 LINES)

Spectone

FIVE-FIFTEEN

AMPLIFIERS

A TRIBUTE FROM
MR. P. WILSON, M.A.

Technical Editor of the "Gramophone"

"All the components used in the Spectone amplifiers are of the highest quality and the workmanship is first class: I give them full marks."

Write for descriptive leaflet with full technical specifications



The
WINDSOR

POWER AMPLIFIER with PRE-AMPLIFIER

Volume Control, Bass and Treble Controls and Input Selector Switch on chassis. Two inputs; one for radio tuner or pre-amplifier and the second for a pick-up. Treble Control continuously variable from + 16 db to - 15 db at 10 Kc/s. Bass Control continuously variable from + 18 db to - 12 db at 20 c/s.

£24/17/6

SPECTO LTD. Vale Rd Windsor

high sensitivity 5 inch cathode ray tube with SPIRAL P.D.A.

THE 5BHP SERIES BY



Electrostatically focused and deflected cathode ray tubes, the 5BHP series has been produced for high performance oscillographic applications. The tubes have a high deflection sensitivity and a helical post-deflection acceleration system to permit the use of high p.d.a. ratios. The screens are aluminised and the tube is available with any of the standard screen phosphors—the phosphor type being denoted by the last number in the tube title. For example, 5BHP1 has a P1 phosphor screen.

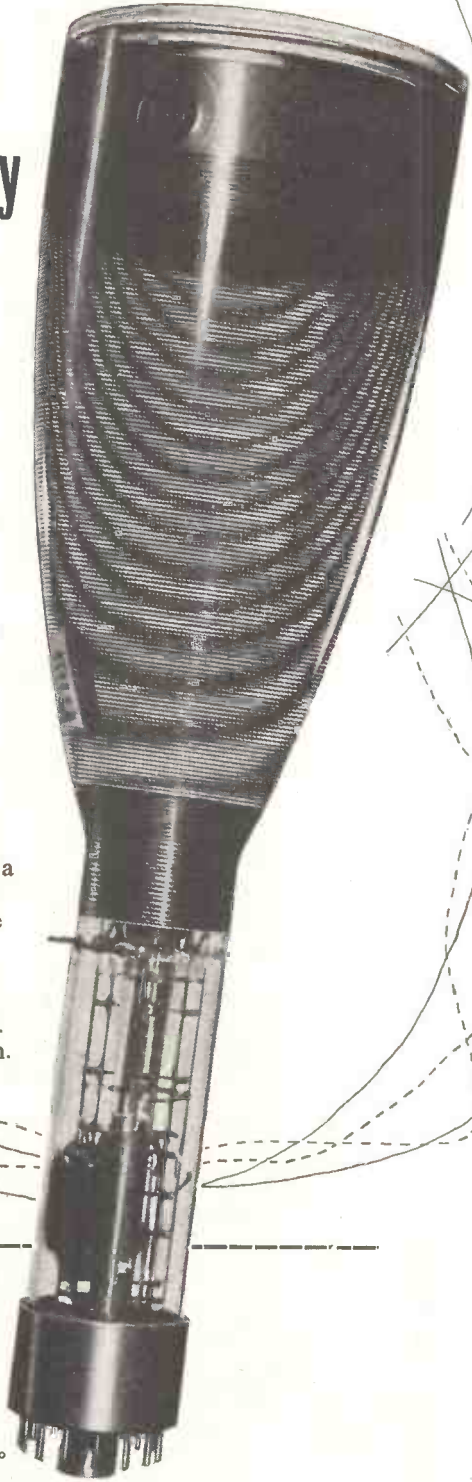


PLATE SENSITIVITIES*

S_x..... 30.5 mean V/cm

S_y..... 6.5 mean V/cm

Useful x scan..... 10 cm

Useful y scan..... 4 cm

Pattern distortion..... 1.5 max. %
(at 100% of useful scan)

Spot position..... within 0.5 cm
(undeflected) radius circle

Orthogonality of deflection axes ±1°

*With a helix potential of 10kV

For further details, write to the G.E.C. Valve and Electronics Department

the DYNATRON v.h.f. tuner unit

PROVIDES TRUE HIGH FIDELITY LISTENING

- 7/8 Valve Tuner
- Pre-tuned 4 stations
- Automatic frequency corrector
- Single switch operated

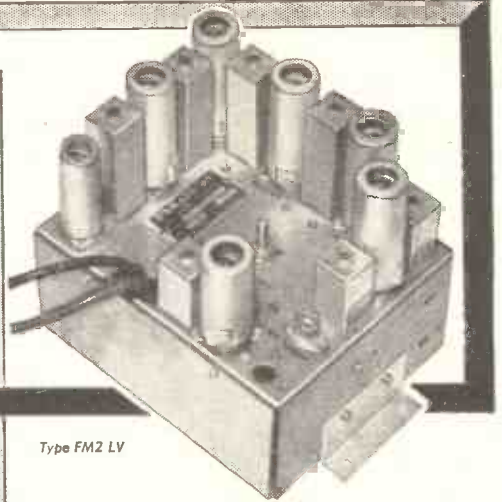
This tuner is the most advanced unit available today. It brings to the discriminating listener true-to-life reception of music and spoken word through the medium of the B.B.C.'s 'Home', 'Light' and 'Third' VHF radio broadcasts.

The F.M.2 employs a Foster-Seeley type of discriminator and covers from 88-100 Mc/s. with four pre-tuned circuits. This unit is used by the B.B.C. and leading relay organisations use it as both a main and monitor receiver. For completing a high fidelity audio installation or converting a radio-gramophone, the Dynatron VHF tuner provides the complete answer.

Two versions are available—one with an output of 0.2V.; the other with an extra valve providing a variable audio output which can be adjusted between 0.3V. and 2.0V. R.M.S. A separate Power Unit, Type P1, is also available for use in installations where suitable voltages are not available.



Power Unit P.1



Type FM2 LV

7-valve FM2LV
£28.0.0

8-valve FM2HV
£33.12.0

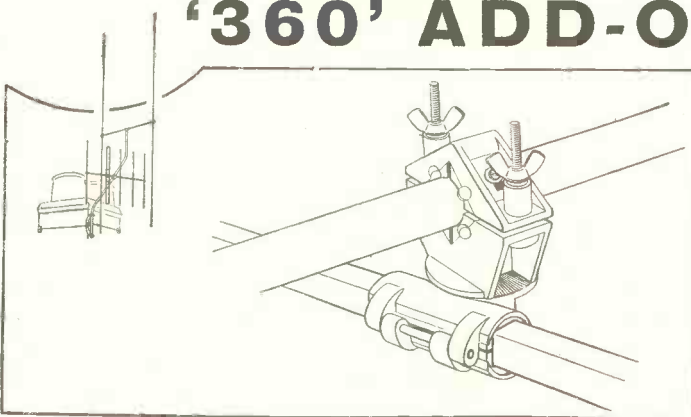
Power Unit P.1
£8.15.0

Write for full details of this Dynatron F.M. Tuner and learn what true high fidelity listening really means.

DYNATRON

Dept. TU 103, DYNATRON RADIO LIMITED
CASTLE HILL · MAIDENHEAD · BERKS

'360' ADD-ON AERIALS WITH FULL ORIENTATION



NOTE THESE PLUS FEATURES

- 1 360 degrees orientation in all 3 planes irrespective of angle of stand-off arm
- 2 Type "A" is adjustable to fit stand-off arms or masts $\frac{7}{8}$ in. to $1\frac{1}{4}$ in. or Type "B" which is adjustable to fit stand-off arms or masts $1\frac{1}{2}$ in. to 2 in. (please specify when ordering).
- 3 Attaches by hinged collar to stand-off arm or mast in seconds (no dismantling necessary).
- 4 Locks positively at any angle, in any situation.

Fitted in seconds for any angle any direction.

The Wolsey "Add-on" aerials, incorporating the new '360' clamp can be mounted in apposition to the stand-off arm and provide unlimited orientation in every direction.

Available in
BAND III aerials, 3, 5 and 8 elements.

AND NOTE THESE RETAIL PRICES

Band III Types	
360/Y3.....	32/6
360/Y5.....	43/6
360/Y8.....	63/6
360/DY5	100/-

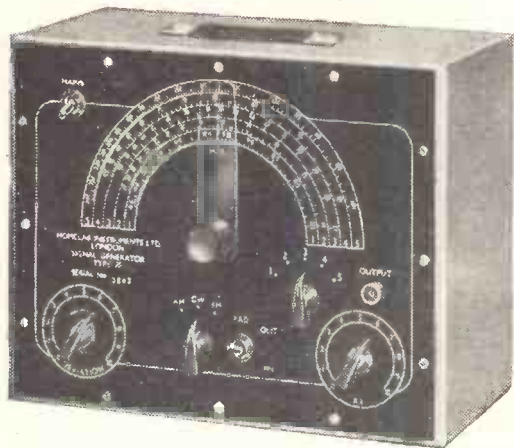
When ordering, please specify for which diameter of stand-off arm required: A = $\frac{7}{8}$ " to $1\frac{1}{4}$ ", B = $1\frac{1}{2}$ " to 2".

FOR ANY JOB YOU'RE SAFE WITH A **WOLSEY**

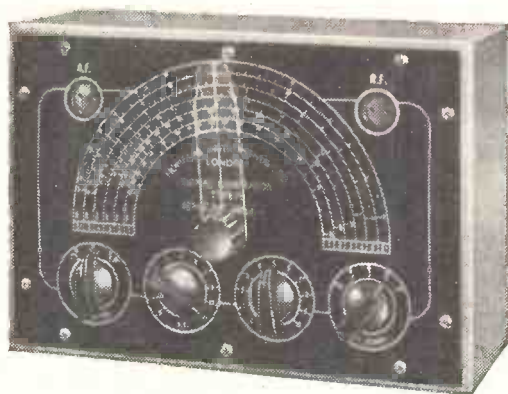
WOLSEY ELECTRONICS LIMITED · CRAY AVENUE, ST. MARY CRAY, ORPINGTON, KENT · Telephone: Orpington 26661/2/3/4

(Electronics Division, Gas Purification & Chemical Co. Ltd.)

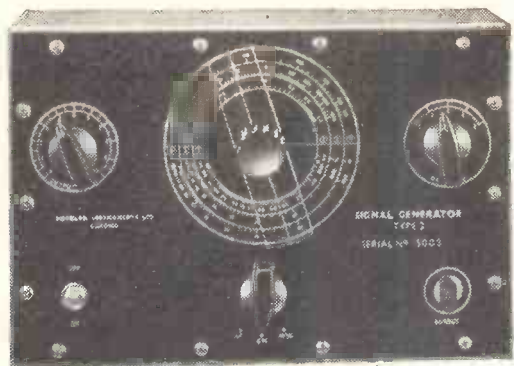
A NEW RANGE OF **HOMELAB** SIGNAL GENERATORS . . .



The Type 20 is an AM/FM Signal Generator covering the frequency range from 7.5 to 240 megacycles on fundamentals. The output RF signal may be unmodulated or modulated with a 1,000 c.p.s. sine-wave for normal AM tests. As an FM generator a reactance-valve modulator is employed to provide deviation up to 250 kc/s throughout its range. PRICE £15/15/-, plus 5/- packing and postage. Send stamp for details.



The Type 12 is a general-purpose Signal Generator covering the frequency range from 100 kc/s to 130 mc/s. The RF output signal may be unmodulated or modulated by 1,000 c.p.s., sine-wave or square-wave. In addition an AF output signal of either sine- or square-wave shape is available for audio testing. PRICE £8/10/-, plus 5/- packing and postage. Send stamp for details.



The Type 2 is an inexpensive Signal Generator covering the frequency range from 100 kc/s to 130 mc/s. The RF output signal may be unmodulated or modulated by a sine-wave of 400 c.p.s. An audio signal of 400 c.p.s. is also available. PRICE £4/10/-, plus 5/- packing and postage. Send stamp for details.

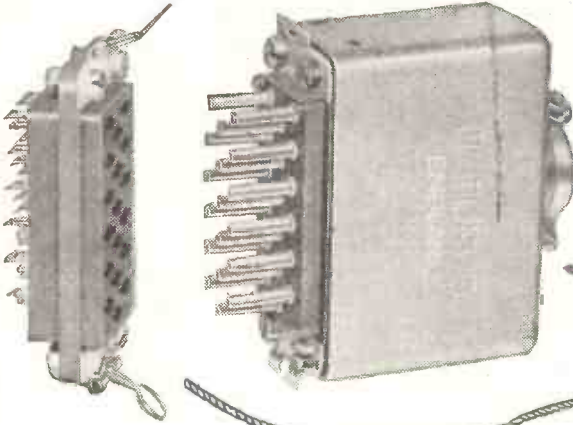
OTHER "HOMELAB" PRODUCTS

- AUDIO OSCILLATOR UNIT. 20 c.p.s. to 20 kc/s.
PRICE £7-10-0. Packing and Postage 5/-.
- MULLARD FM TUNER UNIT, WITH POWER SUPPLY.
PRICE £12-10-0. Packing and Postage 5/-.
- CHECK TEST. 50 pf. to 8 mfd. and 0 — 1 MEG.
PRICE £2-12-6. Packing and Postage 5/-.

HOMELAB INSTRUMENTS LIMITED

615-617, HIGH ROAD, LEYTON, LONDON, E.10

Telephone: LEYtonstone 6851



**McMURDO
STANDARD
CONNECTOR**

8 WAY | **18 WAY**
12 WAY | **25 WAY**

Sturdy, Reliable and Inexpensive
Nylon—PF mouldings. Silver plated contacts. Solid drawn aluminium cans. Positive locking mechanism.
Breakdown voltage 3.5kV.

Send for full details to:—

THE McMURDO INSTRUMENT CO. LTD.
ASHTEAD, SURREY. Telephone: Ashtead 3401

ISP. MSC 6

HETERODYNE FREQUENCY METERS TYPE LM14

Designed and built to United States Navy specification, these Crystal Controlled instruments combine all the advantages of the well known BC.221 Frequency Meter, plus many additional features which increase their usefulness.

- ★ Frequency range 125-20,000 kcs. in 2 bands.
- ★ Accuracy better than .02% in 125-2,000 kcs. band, and better than .01% in 2,000-20,000 kcs. band.
- ★ Voltage stabilisation circuit ensures accuracy not affected by power supply fluctuation.
- ★ Separate power switches allow standby filament operation without HT supply.
- ★ Modulation switch enables instrument to be used as a Signal Generator.
- ★ Has corrector for WWV.
- ★ Supplied with removable shock protection mounting.
- ★ Size only 8½ in. x 8 in. x 8½ in., weight 11½ lbs.
- ★ Brand New and Unused.

Further details on application.



UNIVERSAL ELECTRICAL INSTRUMENTS CORPORATION

138 Gray's Inn Road, London, W.C.1.



Radar

PORTABLE OSCILLOSCOPES

TYPES

301 and 302

SPECIFICATION

Type 301

Y AMPLIFIER 2 Stage Cathode Follower to Y Plates. Bandwidth: 20 c/s-6 Mc/s (3 db) usable to 10 Mc/s. Sensitivity: 100 mv/cm.-300 v/cm. in 8 ranges through frequency compensated attenuator. Input impedance 1 Megohm across 15 pf.

C.R. TUBE Emitron type 3AFPI. Diameter 70 mm. Green trace. Pre-set astigmatism correction. E.H.T. 800 volts. Vertical shift > 10 cm. Horizontal shift > 30 cm.

TIME BASE Entirely new Miller-Multivibrator circuit combining the excellent properties of the multivibrator with the linearity of trace achieved by Miller feedback. Continuously variable expansion to 30 cms. Sweep range $5\mu\text{S/cm.}$ to 50mS/cm. Recurrence frequency (repet.) 5 c/s.-100 kc/s. Flyback suppressed.

SYNCHRONISING Repetitive or Triggered. Internal or External. Positive or Negative. Provision for synchronising from the frame pulse in a television waveform. Input resistance 2 Megohms. Trigger initiates the scan.

MISCELLANEOUS Calibration voltage (sinusoidal) 10 v. pp. at mains frequency available. Detachable viewing hood and transparent lattice with 1 cm. rulings. Adjustable tilting stand for easy viewing. Removable door encloses controls and provides stowage for leads. A.C. mains supply (externally adjustable) 200-250 v. 50 cycles. Power consumption 85 watts. Dimensions $12\frac{1}{4}'' \times 9'' \times 7''$. Weight 19 lbs.

Type 302

As for type 301 with the following exceptions. **Y AMPLIFIER** 2 stage balanced amplifier with cathode followers to Y plates. Single ended input. Bandwidth: D.C. - 3 Mc/s (3 db). Usable to 7 Mc/s.

C.R. TUBE. Emitron type 3AFP7. Blue trace. Long persistence.

TIME BASE Sweep range $5\mu\text{S/cm.}$ to 500mS/cm. Recurrence frequency (repet.) $\frac{1}{2}$ c/s-66 kc/s.

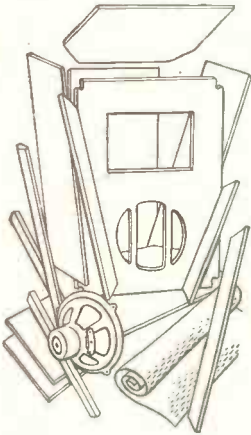
MISCELLANEOUS A.C. mains supply either 200-250 v. 50 cycles or 100-130 v. 400 cycles.

waveforms
LIMITED

Radar Works, Truro Road,
London, N.22.

Telephone: Bowes Park 6641-2-3

So easy!



A simple kit brings true high-fidelity within your means

NO HEADACHES with this kit of parts. Everything you need to build an acoustically perfect loudspeaker is here; including the famous Grampian 1255/15 speaker unit, grille material and working diagrams. All parts are accurately finished, machined and drilled, only assembly and polishing to suit your taste remains to be done. Ingeniously designed for either a corner or flat against the wall, the cabinet will enhance your room—to say nothing of your listening!



PRICE of complete kit including 1255/15 Grampian high-fidelity speaker £20

Deferred terms available if desired on complete kit or speaker and cabinet purchased separately.



The well-known Grampian 1255/15 high-fidelity speaker unit may be purchased separately if required. It is a 12in unit especially designed for use with high quality amplifiers. It has an extended frequency coverage of from 20 to 15,000 c/s with exceptional performance over the useful audio range. Price of 1255/15 unit only, £9.

Write for full details of complete cabinet, copy of the response curve and information about suitable amplifiers today—

GRAMPIAN REPRODUCERS LIMITED

Makers of High-Quality Sound Equipment

17 HANWORTH TRADING ESTATE, FELTHAM, Middx
Telephone: Feltham 2657/8. Telegrams: Reamp Feltham

M. R. SUPPLIES Ltd.

(Established 1935)

Universally recognised as suppliers of UP-TO-DATE ELECTRICAL MATERIAL which does the job properly. Instant delivery. Careful packing. Satisfaction assured. Prices net. Brand new goods.

SYNCHRONOUS TIMER MOTORS (G.E.C.). 200/250 v. 50 c. Compact units, 2½ x 1½ x 1½in. with lin. shaft proj. Self-starting, high torque, 6 r.p.m. Suitable also for display turntables. 57/6 (despatch 1/-).

SHADED POLE INDUCTION MOTORS. 200/250 v. A.C. Very silent running and ideal for many lab. and domestic applications, stirrers, cooling fans, extractors, etc. No interference with radio/T.V. Delco super model, fan-cooled, body 4½ x 3½in. shaft proj. 1½in. Torque 600 grm./cms. and the perfect unit for tape recorders in addition to above duties, 42/6 (des. 2/-). Also open type, small model, body 3 x 2½in. Shaft proj. approx. ½in., torque 150 grm./cms. Also suitable for rim-drive grammo-motor. 18/6 (des. 1/6).

SERIES WOUND MOTORS (Parvalux). 1/30th h.p., 220/250 v. A.C./D.C. Double-ended shaft, 4,000 r.p.m. Body approx. 4 x 3 x 2½in. Right for sewing machines, small tools, cine, etc., very limited supply (we wish we had more) at only 47/6 each (des. 2/-).

F.H.P. GEARED MOTORS. We have an unrivalled reputation for supply of series wound and capacitor/induction units with final speeds ranging from 1 r.p.m. to 840 r.p.m. and final torques up to 75 lb/in. A good choice from stock. **PLEASE WRITE FOR OUR LIST GM/357.** Production and Technical Managers are sure to be interested. **CENTRIFUGAL AIR BLOWERS.** Exceptional offer of brand new £16 units by Leach Electrical, powered with capacitor/induction motor, 230/240 v. 50 c., 1 ph. Rated output 35 c. ft./min. Overall length 8in. Max. dia. 4½in. Intake 2½in. dia., outlet 1½in. dia. Weight 8½lb. An excellent quiet running unit for extraction or blowing. 24/17/6 (des. 2/6).

EXTRACTOR FANS. 220/250 v. A.C. at much below normal price. Induction motor, silent running, no interference. In addition to the 8in. and 10in. impeller models previously advertised (details on request) we now offer a lightweight model with 6in. impeller, with back grille, and mounting frame, ready for easy installation at only 24/12/6 (des. 2/6).

AIR THERMOSTATS (Kieff). Adjustable range, 30/90 deg. F. Differential only 2 deg. F. Capacity 15 amps. A.C. in smart ivory housing 4½ x 2 x 2in. Easily installed—instructions with each. Ideal for greenhouse, rooms, labs., etc. 45/6 (des. 2/-).

SYNCHRONOUS TIME SWITCHES (Sangamo). 200/250 v. 50 c. In compact black plastic housing 4in. dia. by 3½in. deep, providing up to 3 on-off operations per 24 hours, with day-omitting device (use optional). Capacity 20 amps. A.C. 25/8/6 (des. 2/-). Two-circuit model (Smith's Bayon) 26/18/- (des. 2/6).

RUNNING TIME METERS (Sangamo). Indicating up to 9,999 hours, with cyclometer dial indicating every six minutes. 200/250 v. 50 c. (Synch.) 25/5/- (des. 2/-).

SELENIUM RECTIFIERS. Large range now available including a Bank of four units for D.C. delivery up to 30 volts 56 amps. The bank 27/17/6.

A.C. MAINS RELAYS. Londez ML/AC, 220/250 v. A.C. coil, with 2-pole changeover 6 amp. switching. 29/6 (des. 1/-).

POWERFUL SOLENOIDS, rated for 24 volts D.C., but quite suitable for 12 volts D.C. Size of pot. 2½ x 3½in. ½in. 50 lb. pull. 10/6 (des. 2/-).

DELAY RELAYS (Western Electric). 24 volt 120 ohms coll. 2-pole "make" with precision adjustable delay action, max. delay 3 secs. on base 4½ x 2½in. 15/6 (des. 1/-).

WE ARE STOCKISTS OF: Philips Variable Transformers, Stuart Electric Pumps, B.P.L. Measuring Instruments. Lists on request.

M. R. SUPPLIES, Ltd., 68, New Oxford Street, London, W.C.1

(Telephone MUSEum 2958)

EDDYSTONE COMMUNICATION RECEIVERS



Model 840A illustrated
Cash Prices and Statutory Terms

Model	Cash Price	Deposit	8 Monthly Payments of
820	£31 18 0	£3 14 6	£3 14 6
870	£34 16 0	£4 1 6	£4 1 6
840A	£55 0 0	£6 8 4	£6 8 4
750	£78 0 0	£9 2 0	£9 2 0
888	£110 0 0	£12 16 8	£12 16 8
680X	£120 0 0	£14 0 0	£14 0 0

Cash price if paid in 6 months by Bankers' order.

Carriage paid per passenger train

Model 840A is for A.C. or D.C. 110/250 v.; 750 and 680X 110/240 v. A.C. These sets are the choice of the discerning professional and amateur users. Descriptive literature gladly forwarded.

Latest EDDYSTONE Component Catalogue 1/-.



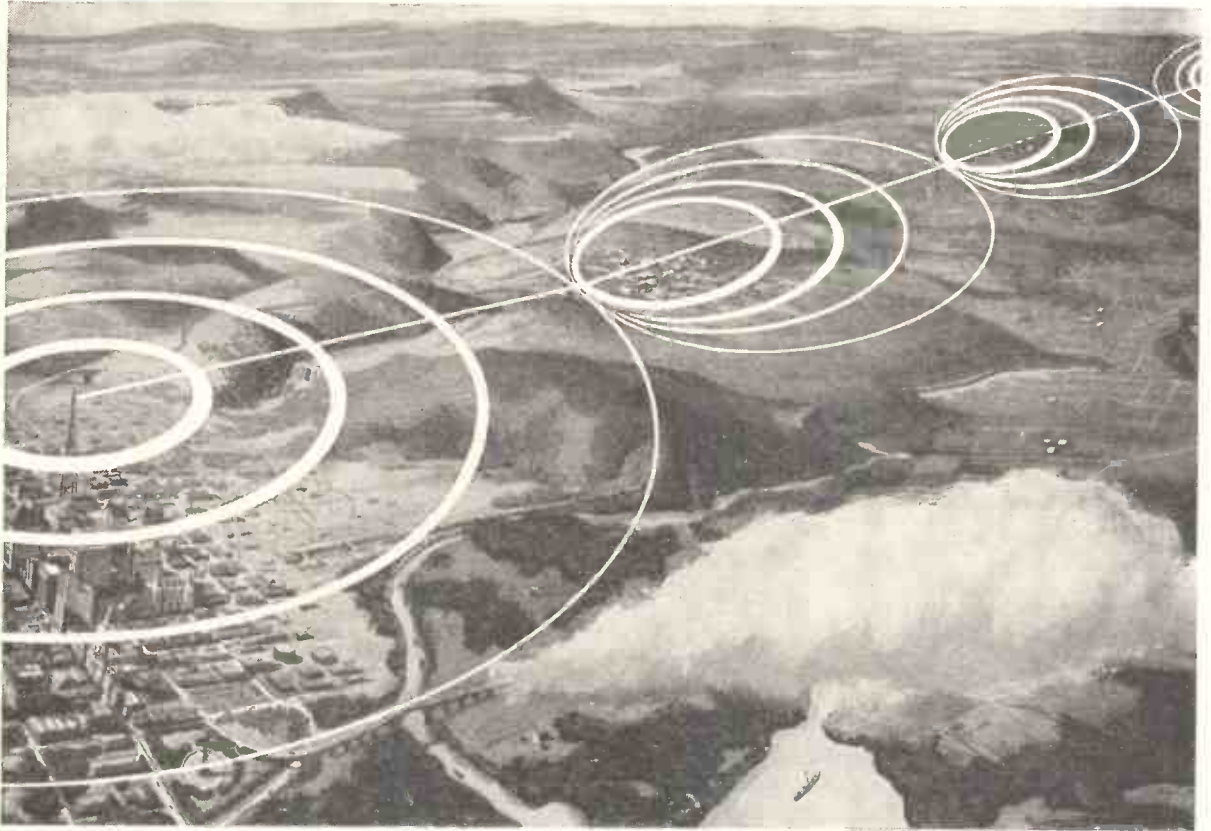
The
Eddystone
Specialists
SERVICES LTD.,

55 COUNTY ROAD, LIVERPOOL, 4
Telephone: AINTREE 1445 ESTAB. 1935

CALL US ON TELEX. 62-244.

RCA's NEW TVR-1 RELAY REBROADCAST SYSTEM

Economically extends VHF TV Station Coverage



Since the TVR-1 relay system uses standard TV frequencies, it enables those in its path to receive your station's broadcasts on their home receiver. Eight repeaters, or more, may be linked in tandem to relay television programs while providing home reception between repeaters.

The RCA TVR-1 offers the TV broadcaster an opportunity to extend economically the coverage of his stations, and provide inter-city television relaying. Communities which may not be receiving a sufficiently strong signal, or those small communities which are outside the station's service area and could not hope to have television, will now receive your broadcasts. Unlike conventional microwave re-

lay systems, the TVR-1 is capable of rebroadcasting at each relay station. Designed for unattended operation, each repeater is in essence an automatic station. Directional or non-directional antennas can be used, depending upon local coverage considerations. For full details on new RCA TVR-1 relay-broadcast system, contact your RCA Distributor or write Dept. TV-49-J at the address below.



Typical TVR-1 repeater antenna installation.



RCA INTERNATIONAL DIVISION

RADIO CORPORATION OF AMERICA

30 ROCKEFELLER PLAZA • NEW YORK 20, N.Y., U.S.A.

Trademark(s) Registered

Mains Voltage Fluctuations ?

Can be overcome with the new

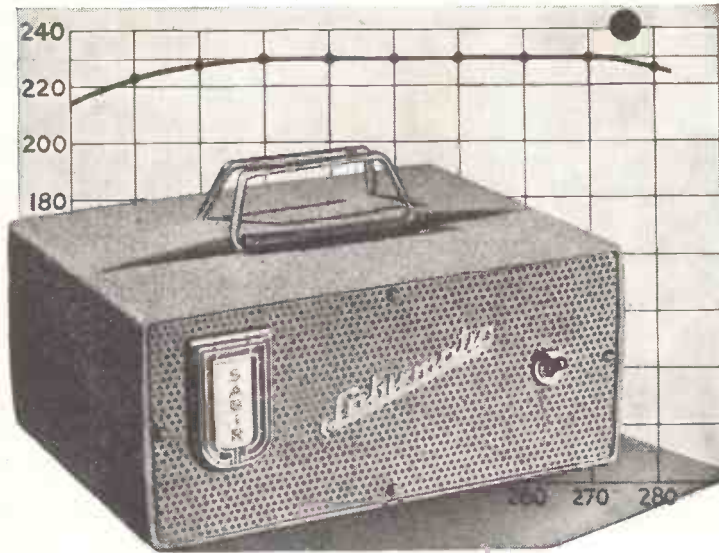
SABIR

**HIGH PERFORMANCE—LOW COST
AUTOMATIC AC VOLTAGE REGULATOR**

VOLTAGES: 110-110V; 110-230V; 230-230V.
REGULATION: $\pm 1\%$ for input variations of $\pm 15\%$.
RATING: 200 VA nominal. (Load limits 25 VA-250 VA.
RESPONSE TIME: .01 sec.
EFFICIENCY: 83% approx. at rated load.
FITTINGS: On-off switch, illuminated escutcheon.

The benefits of complete protection from the disturbing effects of varying mains—available for the first time at a moderate outlay. In a size, presentation and finish that make the SABIR MATIC ideal for:—Instruments, Test Equipment, Television and Broadcast Receivers, Appliances, and Experimental Work.

List Price £11.15.3



Further details and full specifications from:—

MERCIA ENTERPRISES LTD
GODIVA HOUSE, ALLESLEY OLD ROAD, COVENTRY. Telephone: 2279

**THE
BRITISH NATIONAL
RADIO SCHOOL**
ESTD. 1940

**NOW IN OUR SEVENTEENTH YEAR
AND STILL**

**NO B.N.R.S. STUDENT
HAS EVER FAILED**

to pass his examination(s) after completing
our appropriate study course

**A.M.Brit.I.R.E., CITY and GUILDS, and P.M.G.
EXAMINATIONS, and now**

MORSE CODE

New L.P. Records

Can be "played back" at 16, 33, 45 and 78 r.p.m.
to give morse speeds of 4—25 w.p.m. Skilfully
arranged figure and cypher groups.

Agencies available in all overseas English-speaking countries

**PRINCIPAL,
BRITISH NATIONAL RADIO SCHOOL**
65 ADDISCOMBE ROAD, CROYDON, SURREY
Tel. ADDiscombe 3341

HERE'S THE HEART
OF **DULCI**
HIGH FIDELITY!

DULCI MODEL H.II. A combined and self-powered AM/FM Tuner, Control Unit and Audio pre-amplifier in one chassis. Seven channel selector matching to L.P. and 7 r.p.m. Records and Tape replay. FM (VHF) short, medium and long wavebands. Bass and treble controls giving 15dB lift and cut with indicated level response position. Designed in every detail for superb performance.
PRICE (inc. tax) £ 29-3-10

DPA 10 (10-14 watts) Ultra Linear Power Amplifier
£ 12-12-0

DP 4 4 watt high fidelity amplifier, produced with every refinement of technical skill for superb reproduction. 4 watt amplifier for Tuner.
£ 7-10-0

distinctly **DULCI**

... pricewise products

The DULCI COMPANY Limited
97-99 VILLIERS ROAD, LONDON N.W.2

*New addition to the Thorn family of
miniature indicator lampholders designed
to use the Atlas midget panel lamp which
is only 0.575" in length and 0.249"
in diameter*

INTRODUCING THE

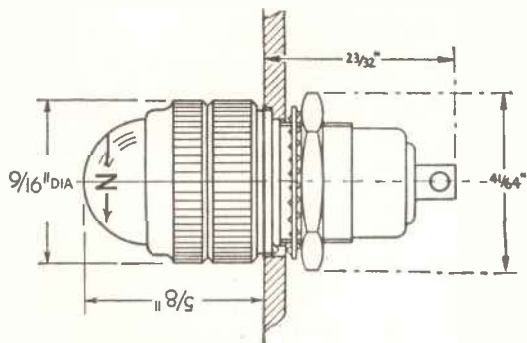
Thorn

ROTARY SHUTTER

LAMPHOLDER

SHORT AND LONG SHANK VERSIONS

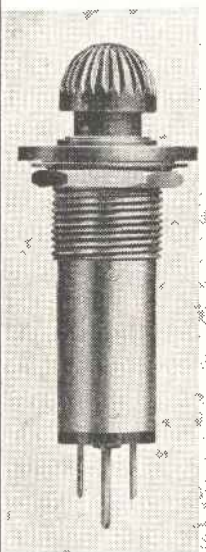
This lampholder represents an outstanding advance in space-saving—the outside diameter of the complete device is only $\frac{9}{16}$ ". Here, then, is the smallest of all dimmer indicator lamps. The cap contains a rotary shutter with built-in stops to restrict rotation between the fully-shuttered and the fully-open positions. When fully shuttered there is sufficient illumination for night vision. Glass lenses are engraved with the direction of rotation and letters indicating night and day conditions. The short shank version is designed for panel fitting where there is no "Plasteck" panel intervening between the indicator cap, and the lampholder. The long shank version is for use where a "Plasteck" panel intervenes and/or where the extended length may be necessary to suit special installations. Both components are designed to screw into the standard lampholder body used for Plasteck lighting L/H body 80/10/0063 earth return. This can be supplied as double pole version if required. Colour of cap: red, green, amber, blue or clear. Can be supplied with 28V, 12V or 6V bulb.



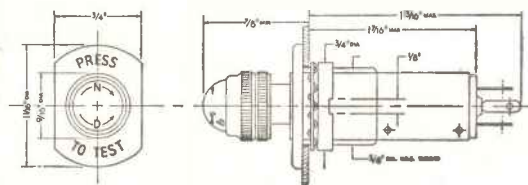
AND THE MINIATURE PRESS-TO-TEST

FITTING

Extreme compactness has been achieved in this new "Press to Test" component. For installation a round hole $\frac{3}{16}$ " diameter is all that is necessary in the mounting panel. The component can be extracted from either the front or from the back of the panel. There are two versions one with 3 terminals (solder or screw 1 terminal common) and the other with 5 tag terminations, solder (1 terminal common). The internal contact assembly are so arranged as to be free from normal aircraft vibration conditions and pre-determined contact pressures are maintained in the design technique. The front indicator plate can be engraved "Press to Test" or for any other engraving to suit operational requirements. The lampholder cap may be either the indicator or rotary shutter type. Colour of cap: red, green, amber, blue or clear. Can be supplied with 28V, 12V or 6V bulb.



other engraving to suit operational requirements. The lampholder cap may be either the indicator or rotary shutter type. Colour of cap: red, green, amber, blue or clear. Can be supplied with 28V, 12V or 6V bulb.



For full information write:

AIRCRAFT COMPONENTS DIVISION
THORN ELECTRICAL INDUSTRIES LTD
GREAT CAMBRIDGE ROAD, ENFIELD
MIDDLESEX. TEL: ENFIELD 5353

And now...the **NEW**
Type V.200A
voltmeter



Giving you—

- ▲ Wider bandwidth (10Mc/s)
- ▲ 100 microVolts r.m.s. sensitivity
- ▲ Enhanced stability

—and no increase in price

**There is no finer voltmeter
for your application**

Write for technical leaflet

*Furzehill
Laboratories Ltd.*

57 CLARENDON ROAD, WATFORD, HERTS
TELEPHONE: CADEBROOK 4686

direct TV REPLACEMENTS

**offer WINDING, ASSEMBLY
CAPACITY, SPECIALIST KNOWLEDGE
ON LINE OUTPUT TRANSFORMERS,
OTHER WAVE WOUND UNITS, AND
ELECTRONIC EQUIPMENT**

*Leading Manufacturers use
our service either for current
production or for small runs
of service replacements*

*Write or 'phone today
for full details of this
valuable service to*

ALFRED ROSE, M.I.R.E., CONTRACTS DEPARTMENT, EXT.10

*Speedy delivery of all windings for Automation Transistor
circuits, Television, Printed circuits and other electronic devices.
You can rely on our delivery dates.*

direct TV REPLACEMENTS
134/136 LEWISHAM WAY, NEW CROSS,
S.E.14. TIDeway 3696-2330
Telegraphic: FLIBAK, London, S.E.14

SONOMAG portable

incorporates the latest Collaro Transcriptor with 3-digit rev. counter in an attractive Maroon and Gold deck with matching bronze control panel. Mullard valves, E.L.A.C. quality speaker, input jacks for microphone and radiogram, output jacks for additional speaker and/or external amplifier, Collaro Studio microphone and 1,200 ft. tape.

Retails at 52 guineas.

Profits are sky-high with . . .

SONOMAG HI-FI RECORDING UNITS

SONOMAG Adaptatape

Ideal low-cost high-fidelity tape system. Latest Collaro 3-speed Transcriptor with 3-digit rev. counter unit-coupled to a high-grade pre-amplifier. Simple to fit into a suitable existing cabinet; the price includes a specially designed power pack.

Retails at 38 guineas.

For full details and leaflets write direct to:

SONOMAG LTD

2 St Michael's Road, Stockwell, S.W.9 Phone No. Brixton 5441



CONTACT COOLED SELENIUM RECTIFIERS



SIEMENS & HALSKE AKTIENGESELLSCHAFT
BERLIN · MÜNCHEN

FULL PARTICULARS FROM
R. H. COLE (OVERSEAS) LTD.
2, Caxton Street · Westminster · London S.W.1

TUNERS

FM85

The FM85 is the answer to so many problems. Combining as it does the highest quality Frequency Modulation reception, and excellent reception on Medium and Long Wavebands, on a small compact easily installed chassis, complete with attractive escutcheon.

With completely stable drift free tuning, the FM band covers 87.5 to 100 Mc/s and has a sensitivity of $< 8\mu\text{V}$ for 20 dB quieting. The circuit includes a tuned low radiation R.F. stage, high level noise limiter, A.V.C. The Medium and Long Wavebands cover from 195m. to 550m. and 800m. to 2,000m., and using special delayed Amplified A.V.C. circuits provide high-quality reception of good Continental broadcasts. The FM85 is fitted with a Cathode Ray tuning indicator which operates on AM and FM, a Volume Control, and is supplied complete with an escutcheon finished in gold or bronze and costs 24 gns. including P.T. or 28 gns. self-powered 200-250 v.

Also available the De Luxe AM/FM series S5/FM and S5E/FM at 32½ gns., including P.T., or 36½ gns., self-powered 200-250 v.

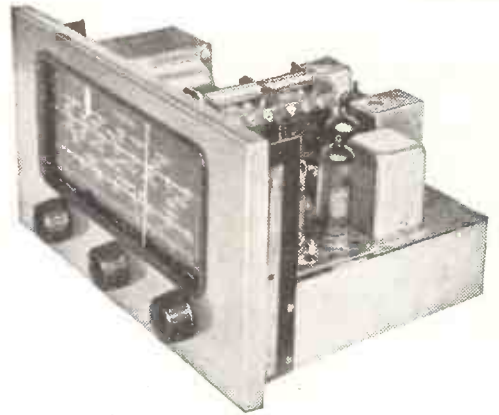
And the FM81 Mk II long range Frequency Modulation only tuner at 21 gns. including P.T.

The 205 Power Amplifier and Control Unit is now being demonstrated with enthusiasm by most High Fidelity specialists. Capable of giving the highest quality of reproduction at "any level" up to 20 watts. The Control Unit may be combined with and powered from some of our tuners and is suitable for feeding any amplifier with an input sensitivity of up to 250 m/v or to special order up to 2 v.

C. T. CHAPMAN (Reproducers) LTD

**WORKS. HIGH WYCOMBE
BUCKS. H. W. 2474.**

**SALES. RILEY STREET, CHELSEA,
S.W.10. FLA. 4577**



PRE-SET CONTROL LOCK

Designed to lock the spindles of pre-set potentiometers or trimmers without rotational or lateral displacement of shaft.



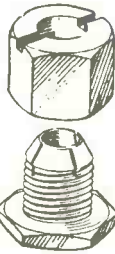
Will accept wide range of panel thicknesses.

TYPE P

Very attractive appearance for panel mounting

TYPE C

Send for leaflet A.1



"KNOB LOCK"

The ideal method of locking panel mounted controls. Positive guard against vibration, etc.

This development of our popular pre-set control lock is finished in black plastic and embodies control knob and instantaneous finger-tip locking knob.

Send for List No. A.6

SUTTON COLDFIELD ELECTRICAL ENGINEERS
Reddicap Trading Estate, Sutton Coldfield. 'phone SUT 3038 & 5666

TRANSFORMERS

for every requirement



Electronics
Transmitters
Radar
Test equipment
M.V. discharge tubes
R.F. heating
L.V. heating

Range 1 volt—35 K.V. 1 M/A—1,000 amps.

STANDARD OR TROPICAL FINISH

We are on Admiralty and Ministry
of Supply lists and A.I.D. approved

Enquiries to:

STEWART TRANSFORMERS Ltd.

75 KILBURN LANE, LONDON, W.10 • LADbroke 2296/7

WORLD

FAME

ASSURED

When we introduced the Goldring "500" Variable Reluctance Cartridge our claim for it was a modest one—simply that it was a very good high fidelity cartridge at a very reasonable price. Amateurs and experts throughout the world have described the "500" in rather more glowing terms, and we have been happy to accept their judgment. But we have not been content to leave matters there.

Development work has proceeded on a new cartridge—the first in Great Britain to be designed specifically around a diamond stylus. Full advantage has been taken of the technical superiority of the diamond and, in addition, its long playing life obviates

the need for compromise between optimum mounting arrangements and extreme simplicity of stylus replacement. This new cartridge—the "600"—will delight both the musically meticulous and the hi-fi "fanatic". Our claims for it are not this time so modest. The reception of the "500" points clearly to the "600" being destined for world fame.

The "600" is similar in shape and size to the latest version of the "500". Replaceable styli—diamond for L.P. and sapphire for 78 r.p.m. Mu-metal shield. Specifications for both cartridges are broadly the same but the "600" has a much-extended frequency response, the effective mass at stylus tip is reduced by almost 100% and compliance is substantially increased. Improved transient response and "presence" are not easily defined mathematically but are very evident aurally.

Price 8 gns plus P.T. £3.5.6



GOLDRING '600'

GOLDRING
MANUFACTURING COMPANY
(GREAT BRITAIN) LIMITED
486-488 High Rd, Leytonstone, London E11
Leytonstone 8343

**A FIRST-CLASS
BOOK EVERY
MONTH FOR**

4/-



Now's the time to join the
**Scientific
Book Club**

Each month, the Scientific Book Club brings to its members the fascinating story of the march of modern science, told in thoroughly dependable books by the front-rank scientific writers of our time—vivid, vital, constructive contributions to Man's unceasing struggle to solve the problems of the Universe. And although the ordinary editions of these books are sold to the general public at 10/6, 12/6 or 15/-, THE PRICE TO MEMBERS OF THE SCIENTIFIC BOOK CLUB IS ONLY 4/-.

Remember, too, that Scientific Book Club selections are full-length and unabridged. They are printed on good quality paper, well bound, with an attractive picture jacket. These are, we say with certainty, books that you will be glad to read, proud to own. The Scientific Book Club brings these great books to you each month; helping you to build up, at remarkably low cost, a first-class collection of scientific books.

Now is the time to join!

LOOK AT THESE TITLES!

Recent and forthcoming selections include:

THE SILENT WORLD by J-Y. Cousteau. (Published at 18s.)

SCIENCE UNFOLDS THE FUTURE, by J. G. Crowther (18s.)

THE MOUNTAINS OF PHARAOH by Leonard Cotterell (16s.)

INSIDE THE ATOM by Isaac Asimon (12s.-6d.)

All full-length, full-size!

The Scientific Book Club is owned and controlled by Foyles, the world-famous booksellers.

In addition to the authors of the selections listed (right), members have received books by these famous authors.

- J. BRONOWSKI**
- FRED HOYLE**
- JULIAN HUXLEY**
- F. SHERWOOD TAYLOR**
- JOHN CROMPTON**
- J. ROBERT OPPENHEIMER**

FILL IN THIS ENROLMENT FORM TODAY!

To The Scientific Book Club, 121 Charing Cross Road, London, W.C.2

I wish to join the Scientific Book Club, and agree to purchase the book issued each month to members at a cost of 4s. (postage 9d.). I agree to continue my membership for a minimum of six books and thereafter until countermanded. *Wireless/World/Oct. '57.*

* I will pay for selections on receipt.
Or if you wish to save time, postage and postal-order costs you may send an advance subscription. 6 months 28s. 6d.; 12 months 57s.

* I enclose 28s. 6d./57s. (strike out amount not applicable).
*Place ✓ in the space above, as required.

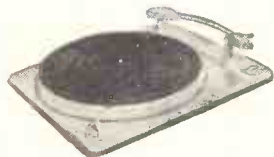
NAME
(Block letters, please)

ADDRESS

Overseas enrolments (prices as for inland) must be accompanied by an advance subscription.

**ONE GOOD
TURNTABLE . . .**

. . . is worth several poor ones. Apart from the fact that the cheaper turntables soon begin to deteriorate, it is fairly obvious that for sustained high fidelity performance, any piece of equipment must be made to very exacting standards. We have many types of high fidelity transcription turntable which we demonstrate at our showrooms. Some of these are listed below and further particulars will be sent on request.



The Collaro 4T200. A four-speed turntable fitted with transcription head as illustrated. £19/10/-.

The Lenco with Goldring 500 cartridge. A popular unit with variable speed. G.L.50/4 with auto brake £21/17/10. G.L.56 without auto brake but with pick-up lifting device £23/7/-.

The Garrard 301. An outstanding model with variable speed adjustment. £26/8/3.

- MICROPHONES . TAPES . TAPE RECORDERS
- SPEAKERS . AMPLIFIERS . F.M. RADIO
- GRAMOPHONES . RECORDS

QUALITY MART

8 Dartmouth Park Ave, London, N.W.5 GULLiver 1131
Tufnell Park Underground (16 mins. Charing X.) 27, 134, 137 bus

-ARMY SIGNALLING LAMPS-

12 volt, in metal container with carrying strap. Contents: 3 spare bulbs, operator's lamp and spare bulbs, morse key, plugs and 3 coloured screens (red, green, amber).

12/6 P. & P. 2/6



**12 VOLT RECEIVERS
type 1125d**

Contents: two 9D2 valves, 3-1 intervalve transformer, one mu-metal multi-ratio transformer, etc.

10/- P. & P. 2/-

CHARTBOARD ANGLE LAMP

With clip-on end. Suitable for Colleges, Offices, Draughtsmen, etc. Bayonet fitting Globe.

£1.0.0 P. & P. 2/-

U.S.A. Dynamotors, Type D/M53A, 24 v. input, 220 v. D.C. output. £1. P. & P. 2/6



A. PRESTON & SONS
186 Sussex Way, London, N.19. Phone: ARCHway 5951



W. BRYAN SAVAGE LIMITED

Vibrators

for fatigue testing

Guided missiles, aircraft and all forms of industrial components . . .

TYPE V1001. This vibrator is of the moving coil type with a wound field magnet energised from an external source of direct current. It is continuously rated and therefore suitable for extended fatigue testing as well as for intermittent use in research, development and production work.

The useful frequency range is up to 5 kc/s.

The design of the vibrator is such that the electrical impedance of the "speech coil" shows only a slight rise at the higher frequencies and this obviates the need for frequent output transformer tap changing as the frequency is varied.

Our Technical Dept. is always available to give assistance on any Vibration problems.

W. BRYAN SAVAGE LTD

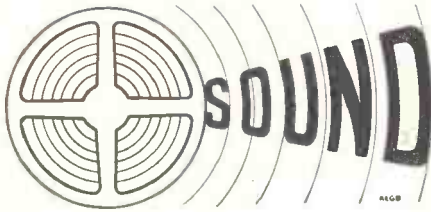
17, Stratton Street, London, W.1

Telephone: GROsvenor 1926

SPECIFICATION

Height	20in.
Dia. of base.....	35in.
Fixing holes, No. and size as required, on a 33½ in. P.C.D.	
Weight.....	1 ton 15 cwt. 10 lb.
Table.....	18in. dia.
Thrust.....	3,000lb. plc.
Excursion	0.500in. max.
Max. permitted acceleration 100 "G"	
Direct current force factor 36lb/amp.	
Max. input.....	64 amps. (r.m.s.)
Moving coil blocked impedance	
	1.5 ohms (est.)
D.C. resistance of moving coil	
	0.875 ohms.
Field coil current.....	4.6 amps.

the first choice in



Recording

55 GNS.

complete with desk mic. and LP tape

- 4 watts output
- 3 hours' playing time



and the new, sensational



The most compact, light weight 3-speed tape recorder with simple, push button automatic control. up to 3 hours' playing time. Playing all types of pre-recorded tapes and providing an output of approximately 3 watts this versatile recorder is at a price all can afford. Complete with spool of standard tape.

40 GNS.

Piezo-electric desk microphone, £2.15.0. optional extra



MICROPHONE

55/- LIST, including special screened plug and lead.

Manufacturers apply for special prices

Write for details to

Tape Recorders (Electronics) Ltd.

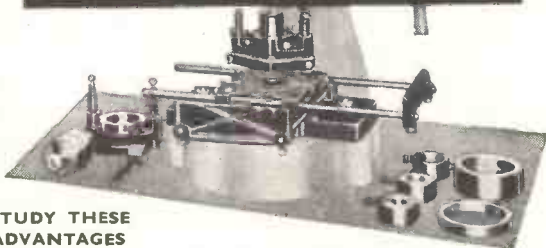
784-788 High Road, Tottenham, London, N.17.

Tel: TOTtenham 0811-3

Cables: Taperec, London

HUNTON will cut your press tool costs for PROTOTYPE and PRE-PRODUCTION RUNS!

THE UNIVERSAL BOLSTER OUTFIT USING STANDARDISED PUNCHES AND DIES FOR SHEET METAL PIERCING AND BLANKING ON FLY PRESSES



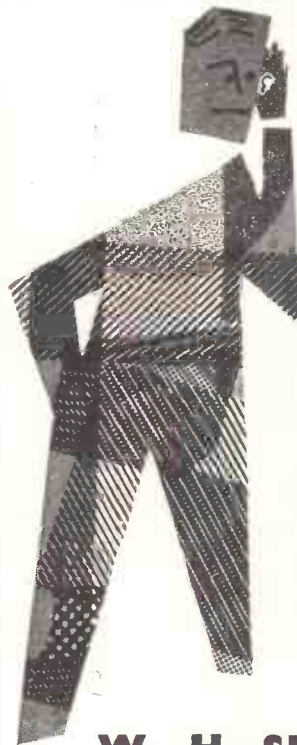
STUDY THESE ADVANTAGES

- Specialised range of Chassis Piercing and Forming Tools for the Radio and Electronics industries.
- To get you started—standardised Punches and Dies 1/4in. to 3 1/2in. dia. in 1/32in. sizes from stock.
- At short notice, Standardised Tools or square, oblong and other shapes.
- Adjustable Gauges for exact location of work. Automatic and Positive Stripping of material from Punch.

in London or Home Counties ask for a practical demonstration in your own works. Alternatively, write for illustrated price list W.W.

HUNTON LIMITED

PHOENIX WORKS, 114-116, EUSTON RD., LONDON, N.W.1.
Tel.: EUSTon 1477 (3 lines). Grams: Untonexh, London.



sound technique

Come to SMITH'S for all the books that you need to increase your technical knowledge and keep up with the latest radio developments.

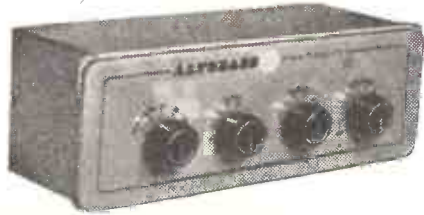
Volumes not in stock can be obtained for you, and we shall be pleased to supply a list of standard works on any subject.

● Our local branch can also supply your business and personal stationery.

W. H. SMITH & SON

HEAD OFFICE: STRAND HOUSE, LONDON, W.C.2

BRANCHES THROUGHOUT ENGLAND AND WALES



inherent noise level DOWN
performance and reliability UP
with PRINTED CIRCUITS

ALTOBASS

HIGH FIDELITY
510 AMPLIFIER

The Altobass High Fidelity 510 is a greatly improved version of the universally popular 5 valve 10 watt Mullard design.

Combining a separate pre-amplifier, which increases the over-all sensitivity and flexibility, with a power unit incorporating an ultra-linear output stage, the Altobass 510 equipment enables a new realism and fidelity to be achieved in all aspects of sound reproduction.

The use of printed circuits as a basis for the design of both units ensures a negligible inherent noise level and gives greater consistency and reliability.

Price: 23 gns.

Sizes: Pre Amplifier 10 ins long x 3½ ins high x 4½ ins deep

Power Amplifier 13½ ins long x 5½ ins high x 5½ ins deep

Both units are finished in gold hammertone stoved enamel. The indelibly engraved perspex escutcheon is also finished in gold, with matching control knobs.

Write for technical specification leaflet ALTOBASS LIMITED · PERCY ROAD · LEICESTER



S.C.R. 399 WHOLE INSTALLATION

INCLUDING SHELTER H.D. 17A & 10 KW. PETROL GENERATOR
P.E. 95G AVAILABLE

Also available separately

TRANSMITTER B610E

Frequency range 2 Mc.-18 Mc. Three pretuned channels selected by switch. Frequency control regulated either by manually tuned MASTER OSCILLATOR or crystal controlled oscillator.

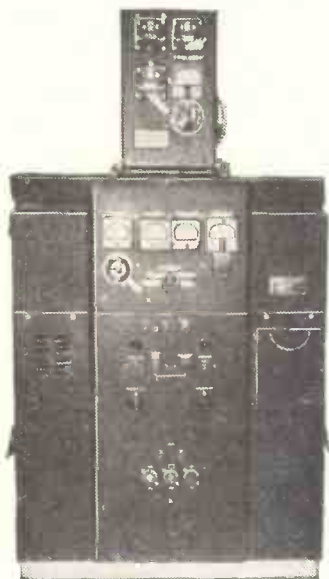
Power output 450 w. telegraph, 350 w. telephone.

Power supply 120 v. A.C. 50/60 cycles special auto-transformer 120/220 v. made by Hallicrafters can be supplied additionally.

Tube complement oscillator 6V6, doubler or buffer 6L6, intermediate amplifier 807(2). Power amplifier 250 TH. HV Rectifier 866A(2). Voltage regulator VT139(3). Audio drive 2A3(2). Modulator 100TH(2). Rectifier 5Z3(2).

Complete with Speech amplifier, aerial tuning unit, tank coils, tuning units, microphone, key, connecting cables.

We guarantee full supply of all replacement parts for a minimum of 5 years after purchase.



P.C.A. RADIO

Offices and Works

BEAVOR LANE, HAMMERSMITH, LONDON, W.6

Telephone: RIV 8006/7

BRAND NEW ORIGINAL SPARE PARTS FOR AR88 RECEIVERS

I.F. TRANSFORMERS 1st, 2nd, 3rd, 4th (for type D) 12/6 each or complete set of 4, 40/-.

I.F. Transformers Crystal Load 12/6 each

Plates escutcheons (for type D and LF) 15/- each

Tuning Dial (for type D) 10/- each

Filter Chokes (for D and LF) 22/6 each

Output Transformers (for LF) 30/- each

Crystal phasing (D) 2/6 each

Antenna trimmers (LF and D) 2/6 each

Condensers 3 x .25 UF (D and LF) 2/6 each

3 x .01 UF (D and LF) 2/6 each

RF Antenna inductors (D and LF) 7/6 each

Mains transformers (LF) £4 each

Small knobs (for LF and D) 4/- each

ROTARY CONVERTER UNITS. Input 11.5-12.5 V. D.C. Output 300 V., 200 m/Amps D.C. Price 30/- . Packing and carriage 15/-.

AMERICAN VALVE TESTER Model 314. Individual lever switches for each tube element, Roll Chart for American type valves. 220/30 V. A.C. Brand new in nice wooden case with leather handles. Full instruction booklet. £10. Carriage 10/-.

HIGH RESISTANCE HEADPHONES. 2,000 ohms. Brand New, Ex W.D. boxed. Type D.H.R., 11/- per pair, post 1/6.

LOW RESISTANCE HEADPHONES. Brand new, Ex W.D. boxed. Type C.L.R. and D.L.R. 5/6 per pair, postage 1/6.

1155L RECEIVERS COVERING TRAWLER BAND. Frequency range, 200 kc/s.-500 kc/s. and 600 kc/s.-18.5 Mc/s. Working and guaranteed £12/19/6. Packing and carriage within U.K. £1.

J. P. ELECTRIC

MAIL ORDER DEPT.

156 ST. JOHN'S HILL · LONDON · S.W.11



HIGH QUALITY TAPE RECORDING EQUIPMENT

OUR RANGE OF TAPE DESKS

Model 5D	(Taking up to 10 1/2 in. reels)	£50. 0. 0
Model 5CL	" " " 9 1/2 in. "	£47. 10. 0
Model 5CS	" " " 9 1/2 in. "	£45. 10. 0
Model 5B	" " " 7 in. "	£42. 0. 0

All with two speeds, 3 1/2 and 7 1/2 i.p.s. Three half track heads. Three heavy duty motors. Desks also available fitted with stereophonic heads suitable for playing back E.M.I. "Stereosonic" tapes.

OUR RANGE OF MAGNETIC HEADS

HALF TRACK

Standard (.970in. dia.)	Type 6RP Super Rec/Play
	Type 5RP Rec/Play
	Type 5R Record
	Type T5E Erase
Miniature (15 mm. dia.)	Type M6RP Super Rec/Play
	Type M5R Record
	Type M5E Erase

FULL TRACK (.970 dia.)

Type 6RPF Super Rec/Play
Type 5RPF Rec/Play
Type 5RF Record
Type 5EF Erase

All the above heads are high impedance but low impedance heads can be wound at extra cost.

Two types of fixing stem available. Screening Cans available.

AMPLIFIERS

Our type 10 Record/play amplifiers have an overall frequency response of 30-15,000 cycles within 4 db. unweighted. Details on application. Send for lists. Private and Trade supplied.

BRADMATIC LIMITED

STATION ROAD ASTON BIRMINGHAM 7

Phone: EAST 2881-2

Grams: Bradmatic, Birmingham

Perth SETS THE HIGHEST STANDARD

COMPLETE RADIOGRAMS
and RECORD PLAYERS



FREQUENCY MODULATED VHF
and STANDARD AM RADIO
RECEIVER and TUNER CHASSIS



CABINETS IN THE LATEST
CONTINENTAL and BUREAU
TYPE STYLING



HIGH FIDELITY and STANDARD
SPEAKER UNITS



AUTOMATIC RECORD CHANGERS



DISC PLAYERS



AMPLIFIERS



LOUDSPEAKERS

... for enthusiasts and those who appreciate the finer qualities of perfect sound reproduction, Perth Radios, manufacturers of electronic equipment, provide the complete answer with their fully guaranteed components at the keenest prices, plus a generous extended credit plan



SEND FOR ILLUSTRATED CATALOGUE AND PRICE LIST

Perth

RADIOS LTD

COMPONENTS DIVISION

MARTEN HOUSE
37-47 EAST ROAD, LONDON, N.1
Telephone : CLERKENWELL 2413/4





Size 30" x 17" x 10½" Weight 35 lb less unit.

£15.15.0

Can be supplied in veneered walnut, oak, mahogany or maple to any finish.

Wharfedale AF 10 REFLEX CABINET

with 10" foam surround unit performs in public. Philharmonic Hall, Liverpool, 2nd July 1957.

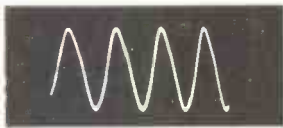
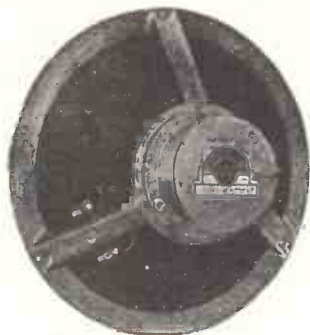
This cabinet is fitted with Wharfedale Acoustic Filter (patent app. 4483/56), and the vent is tuned to 40/45 cycles. Photograph shows G. A. Briggs and R. E. Cooke demonstrating the blowing out of a match at 40 cycles in the Philharmonic Hall, Liverpool, before an audience of some 1600 people.

W10/FSB

£13.2.4

(incl. purchase tax 74s. 10d.)

This is the best 10" speaker in the Wharfedale range and gives excellent results in the AF10.



Waveform of vent output at 40 c/s with 4 watts into 10" Bronze/FSB.

Other suitable units are the **GOLDEN/FSB** at **£8.14.11** and the **10" BRONZE/FSB** at **£5.11.3.** (including purchase tax)

Made and Guaranteed by

WHARFEDALE WIRELESS WORKS LTD · IDLE · BRADFORD · YORKS. Telephone: Idle 1235/6

TRANSFORMERS

COILS LARGE OR SMALL QUANTITIES

CHOKES TRADE ENQUIRIES WELCOMED

SPECIALISTS IN

FINE WIRE WINDINGS

MINIATURE TRANSFORMERS, PICK-UP, CLOCK AND INSTRUMENT COILS, ETC. VACUUM IMPREGNATION TO APPROVED STANDARDS

ELECTRO-WINDS LTD.

CONTRACTORS TO G.P.O., M.O.S., L.E.B., ETC.

123-5-7 PARCHMORE ROAD, THORNTON HEATH, SURREY LIVINGSTONE 2261 EST. 1933

POLYTHENE

PROTECTIVE CAPS & PLUGS FOR STANDARD INTERNAL & EXTERNAL THREADS OR SPECIAL MOULDINGS

AMPLEX APPLIANCES (KENT) LTD.

19 DARTMOUTH ROAD, HAYES, BROMLEY, KENT (RAVensbourne 5531)

All export enquiries to **ANGLO NETHERLAND TECHNICAL EXCHANGE LTD.** 3, TOWER HILL, LONDON, E.C.3.

Hi - Fi

Obtainable from



AMPLIFIERS AND TUNERS

Leak TL.10 and Pre-amp.....	£28 7 0
Osram 912.....From	£21 0 0
Mullard 5/10.....From	£18 10 0
W.B.12	£25 0 0
T.S.L.	£13 13 0
Tripletone Major	£14 10 0
Tripletone de Luxe.....	£9 7 6
Tripletone Junior.....	£6 19 6
Armstrong AM/FM Chassis.....	£29 8 0
T.S.L. AM/FM Chassis.....	£32 11 0
T.S.L. F.M. Tuner.....	£17 10 0
Eddystone F.M. Tuner Model 820.....	£31 18 0

TRANSCRIPTION MOTORS

Garrard 301	£26 8 3
Connoisseur	£28 11 4
Lenco GL55	£17 10 4
Lenco GL56	£23 7 0

SPEAKERS

Tannoy Dual Concentric 15in. with X-over	£35 12 0
Tannoy Dual Concentric 12in. with X-over	£29 5 4
Tannoy Direct Radiator 12in.....	£14 0 0
Goodmans Axiom 150.....	£11 5 9
WB.HF 10/12.....	£4 19 9

Also available Connoisseur, Leak, Goldring and B.J. pick-ups Tannoy varilutance cartridge, Diamond and Sapphire styli, Dust Bugs and accessories. W.B. and Goodmans cabinets. Cabinets custom built or altered to take Hi-Fi equipment.

the amplifier of tomorrow **Audiomaster**

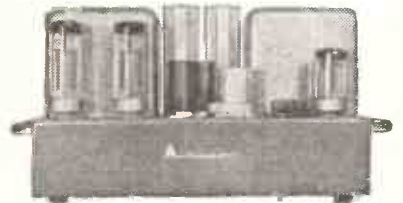
**an amplifier which really does
sound better than any other**

Craftsmanship and component quality control to standards which have never before been approached, together with close inspection in actual production, guarantee that the Audiomaster you buy will give the same phenomenal performance as the original prototypes. This rigid adherence to published specifications ensures a reproduction of the highest fidelity, from records, radio, tape or microphone and the maintenance of this masterly performance over many years of hard work.



The facilities and performance of the Audiomaster Pre-amplifier leave nothing to be desired. For example, any first-class medium impedance tape head can be connected *directly* and the unit will amplify and equalise according to the characteristic required. Max. sensitivity 1 mV.

Block condensers, high stability resistors and craftsmanship of the highest order ensure years of service to the Audiomaster's high standards. Total distortion less than 0.1% at 30 watts output. Harmonic distortion less than 0.5% at 20 watts. Damping Factor of 50. Hum and Noise level better than 85 db relative to 20 watts.



for reproduction that's out of this world ...

the amplifier of tomorrow **Audiomaster**

A.W. & N. Electronics product distributed throughout the U.K. by

Musicraft

Write for full information, or better still,
see it and hear it at Musicraft's showrooms.
Export Trade enquiries welcomed.

20/22, High Street, Southall, Middx. SOUthall 3828
13, King Street, Richmond, Surrey. RICHmond 6798

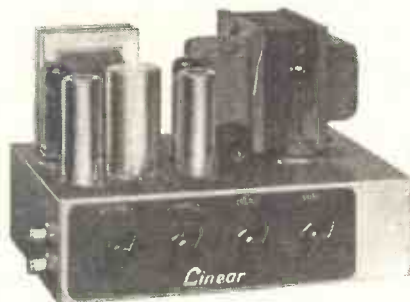
THE LINEAR 'DIATONIC'

A HIGH FIDELITY ULTRA LINEAR AMPLIFIER WITH INTEGRAL PRE-AMP

A special feature is the compactness of the unit. Full advantage has been taken of latest component miniaturisation developments to produce a 10-watt Hi-Fi push-pull amplifier incorporating tone control preamplifier stages within the measurements of 10 x 6 x 6in.

In addition two high impedance input sockets are provided for microphone and gram, etc. Each input has its associated vol. control, five B.V.A. (Mullard) valves are employed ECC83, ECC83, EL84, EL84, EZ81.

H.T. and L.T. power supply point is included for a radio tuner.



FREQUENCY RESPONSE
± 2 d.b., 30-20,000 c.p.s.

MAXIMUM POWER OUTPUT
In excess of 14 watts.

RATED OUTPUT 10 WATTS.

SENSITIVITY
Volume (1) 22 millivolts for rated output.
Volume (2) 220 millivolts for rated output.

TREBLE LIFT CONTROL
Continuously variable + 6 d.b. to -13 d.b. at 12,000 c.p.s.

BASS CONTROL
Continuously variable + 13 d.b. to -18 d.b. at 50 c.p.s.

HUM LEVEL
Referred to maximum output and including integral pre-amp -60 d.b.

HARMONIC DISTORTION
0.19% measured at 6 watts.

NEGATIVE FEEDBACK
Total 32 d.b. including 24 d.b. in main loop.

SIZE ONLY 10-6-6ins.

Weight: 12½lb. Power consumption 90 watts
For 200-230-250v. 50 c.p.s. A.C. mains.
Outputs for 3 and 15 ohm speakers.

Chassis finish stoved Grey
—Blue hammer.

Retail Price **12 GNS.**

From your local stockist or, if in difficulty, direct from us.

Send S.A.E. for descriptive literature.

TRADE AND EXPORT ENQUIRIES

to

L45 MINIATURE 4/5 WATT QUALITY AMPLIFIER
Size only 6 x 5 x 5½in. high. 12 d.b. Negative Feedback. Sensitivity 30 m.v. for full output. 3 Mullard valves, ECC83 Twin Triode, EL84 Power Output, EZ90 Rectifier. Separate Bass and Treble Controls. For 200—250v. 50 c.p.s. A.C. Mains. An ideal unit for use with Gram. or 'Mike.' Output matching for 2—3 ohm speakers. Retail Price **£5.19.6**

LT/45 TAPEDECK AMPLIFIER
A complete unit ready for connection to 200—250v. 50 c.p.s. A.C. Mains, 2—3 ohm speaker and practically any make of Deck. Negative feedback, equalisation adjustment by multi-position switch for 3½, 7½, 15in. per sec. Retail Price **12 Gns.**

LINEAR PRODUCTS LTD.

5-9 MAUDE STREET, LEEDS, 2.
Tel. 26311



Send for our Monthly Bulletin

Size 3ft. 1½in. long, 1ft. 3in. deep, 2ft. 9½in. high including legs which are 10in from the floor. Motor board 12½in. x 17in. Dial aperture 17½in. x 9½in.

Will accommodate an 8in. speaker. Also full storage space is provided. The half-length doors are slid on metal runners and are provided with gold inset finger plates. Send also for our detailed wholesale list for cabinets, wire chassis FM/AM. Complete TV, Radio Aerials, converters & sundry Electrical components. E.G. shavers, etc.

Trade only supplied

V.E.S. WHOLESALE SERVICES Ltd.

Dept. (W.W.), 11, Gunnersbury Lane, Acton, W.3.

Tel. : ACOrn 5027

CABINETS!

Many and varied designs in Bureau Piano, Console & Table Models

THE CONTINA CABINET

This cabinet is of a new revolutionary continental design. A style which has been copied by most of our leading radio and furniture manufacturers. The exterior is finished in high polished dark walnut veneer and panelling picked out with gold metallic strip work. The interior also is complete in its high standard of finish and is veneered throughout in light mahogany, blending but offering an excellent contrast to the exterior.



THE 'ASPDEN' TAPE DECK

Model No. 721 (Assembled). Cash Price £10/10/- plus 6/- P.P. & I. or deposit of £1/5/8. plus 6/- P.P. & I. and 8 monthly payments of £1/3/3 plus 6/- P.P. & I. and 8 monthly payments of £1/3/3. They are also available in Kit form at £9 and £8 respectively, or on easy terms.

Specification: Model 521 7½in. x 11in. 5in. Reels. Model 721 10½in. x 11in. 7in. Reels. High impedance Record/Play heads 2,800 ohms at 1 K Gap. 0004in. at 50 Kc/s 80 v. High Impedance Erase Head 10,000 ohms at 50 K Gap. 0025in. Erase Volts are 50 K/80/90. Both heads are latest type, low capacity moulded with Ferroxcube core. 2 speeds are obtainable: 3½in.—7½in. per sec. Frequency Response at 3½in. per sec. approx. 50/6,000 c.p.s. and at 7½in. per sec. 30/12,000 c.p.s. A detachable handle is supplied for hand rewinding. Model 721 panel is drilled for a rewind motor should the user wish to fit one. Drive: Rubber belt from a constant speed motor to a perfectly balanced flywheel, giving constant tape speed without "wow" and "flutter," throughout the full length of tape. The motor is suitable for 100/250 volts 50 cycles mains. Amplifier and Power Pack Kits are also available on "H.P." Write today for quotation.

DOUGLAS JORDAN LTD., (Dept. W.W. 15),
3 Corbetts Passage, Rotherhithe New Road, S.E.16

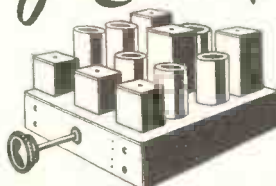
Switch-tuned F.M. (FREQUENCY CONTROLLED)

a Sensitive Unit of Quality

Size 4½" x 4½" x 5½"

Wiring diagram and holed chassis available.

Send S.A.E. for full circuit and constructional information.



Get these **FREE** CIRCUITS & WIRING DIAGRAMS

T.R.F. Circuits
Battery Circuits
Portable Circuits
Sheet Circuits
Mains Circuits
Filter Circuits

T.V. Converter Circuits, etc. etc.

send 10d. in stamps for the lot

OSMOR

(Dept. WW15) 418 Brighton Road, South Croydon, Surrey

Telephone Croydon 5148/9

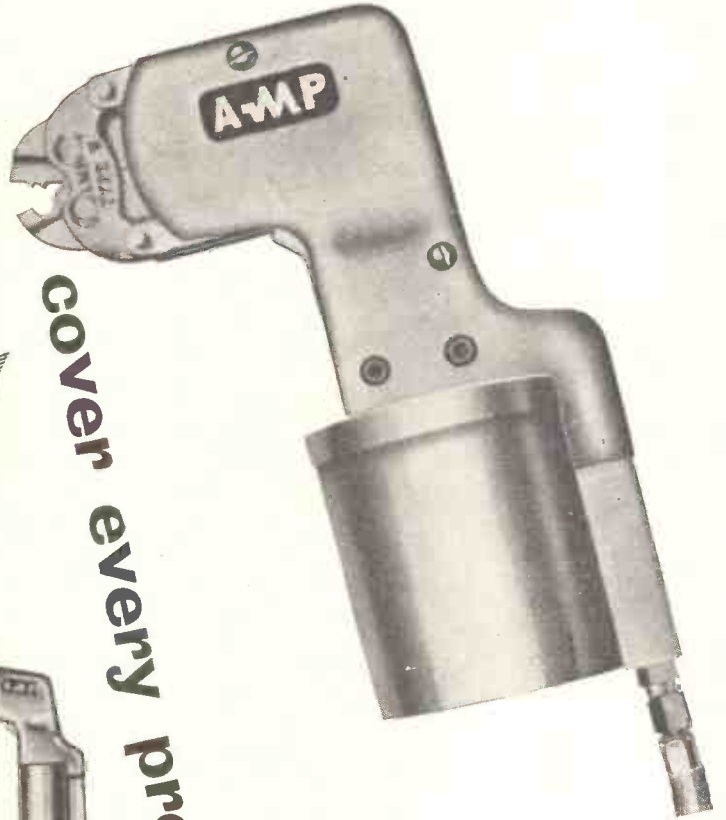
OSMOR



TRADE MARK

* modern solderless terminations

A-MP* TOOLS



cover every production need



Hand Tools



Pneumatic Assisted Hand Tools



Foot-operated Bench Press



Fully Automatic Power Tools

The A-MP solderless termination system is based upon the A-MP Precision Pressure Crimp. Wherever wiring is employed, using termination singly or in complicated "harness", A-MP systems reduce costs, time and labour, with gains in efficiency and reliability.

The A-MP Precision Pressure Crimp is applied by means of hand tools, pneumatically assisted hand tools, foot-operated bench presses or heavy duty automatic power presses.

Each is a triumph of precision engineering, producing strong, completely dependable terminations, each of which is *identical*, a standard of uniformity which endures for the life of the tool.

But we are not just selling tools. Wherever there is wiring to be done, terminations to be made . . . no matter how complicated they may be . . . A-MP engineers can assist you.

A-MP SYSTEMS AID EXPORTS

The A-MP solderless method meets wire termination specifications in foreign countries. Use of the A-MP method will enable you to compete in world markets. It is particularly significant that A-MP systems are standard practice in the U.S.A.

Write or 'phone NOW and learn more about A-MP* Solderless Terminations—the CREATIVE approach to Better Wiring.



TRADE MARK

* AIRCRAFT-MARINE PRODUCTS (GT. BRITAIN) LTD.

London Office: DEPT. 7, 60 KINGLY STREET, LONDON, W.1. Telephone: REGENT 2517-8 and 3681-2-3

Works: SCOTTISH INDUSTRIAL ESTATES, PORT GLASGOW, SCOTLAND.

* Trade Mark of AMP Incorporated, U.S.A.

AP 328/42

For faultless service



operators
everywhere
are using*

S. G. BROWN Headphones

Are you? Even under the most adverse conditions, the weakest signal can be clearly heard with BROWN headphones. Reliable and highly sensitive, yet able to stand the rigours of everyday use, they can be worn for long periods without any discomfort.



For full details of BROWN Headphones and other equipment write to Telephone Dept.

*Type A

Embodying the adjustable reed principle, these instruments are capable of the utmost sensitivity.

The ideal choice when purity of tone and clear reception of weak signals is essential.



Headphones & Handphones
'Automatic Helmsman'
Marine Compasses
Echo Sounders
Navigational Equipment

S. G. BROWN LTD.

SHAKESPEARE STREET · WATFORD · HERTS
Telephone Watford 7241

WAFER SWITCHES TO SPECIFICATION

As we specialise only in the manufacture of small quantities of wafer switches (to individual specification) we guarantee competitive prices and fast delivery.

SWITCHES TO PUBLISHED DESIGNS (FROM STOCK)

G.E.C. 912-PLUS		Mullard Tape Amplifiers
S1 (14061/B1)	} 14/6 pair	Amplifier "A"
S2 (14062/B1)		SS/567/A } SS/567/B } 32/6 the set SS/567/C }
S4 (SS/556/1)	... 11/6	Amplifier "B"
S5 (SS/556/2)	... 10/6	SS/567/A ... 16/6

G.E.C. 88-50 Pre-Amplifier

Input Selector (state number of positions) ... 12/-
Treble Selector ... 7/9

Write for Price List and Design Chart.

SPECIALIST SWITCHES

23 Radnor Mews - Sussex Place
London W2 - AMBassador 2308

Suppliers to the leading electronics, aeronautical and automobile companies and to research institutions, the G.P.O. and Universities.

TELERELAYS LTD.

ENQUIRIES
INVITED



K3000 AND 600 TYPE
RELAYS
SUPPLIED TO YOUR
SPECIFICATION

- ★ LOWEST PRICES
- ★ QUICK DELIVERIES
- ★ BUILT TO A.I.D. STANDARDS
- ★ SAMPLES ON REQUEST
- ★ LARGE OR SMALL ORDERS UNDERTAKEN

PHONE: PAL 1686

TUDOR WORKS, 3, CHASE SIDE, SOUTHGATE, N.14

THE WORLD'S GREATEST BOOKSHOP

FOYLES

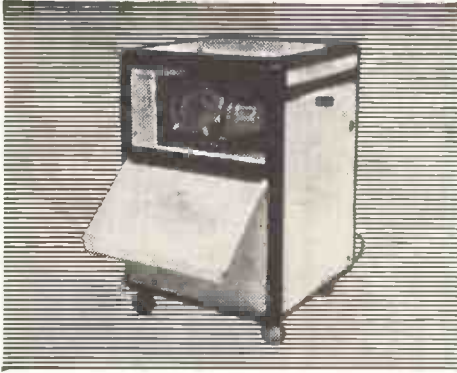
★ ★ FOR BOOKS ★ ★
FOR ALL YOUR
Technical Books

Foyles have departments for Gramophone Records, Stationery, Handicraft Tools and Materials, Music, Magazine Subscriptions, Lending Library.

119-125 CHARING CROSS ROAD, LONDON, W.C.2

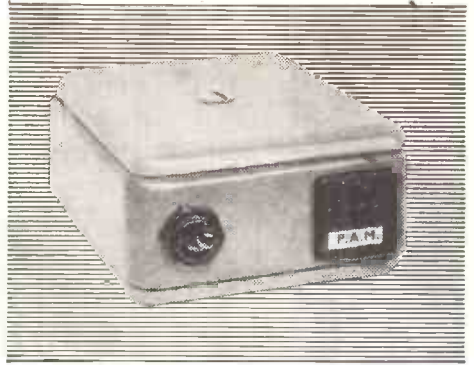
Gerrard 5660 (20 lines) ★ Open 9-6 (Thurs. 9-7)

Nearest Station: Tottenham Court Road

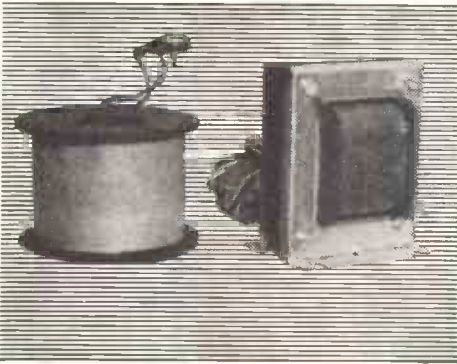


"NERA" MODEL PC. 50, a floor console projection television receiver, designed for industrial use with Closed Circuit Television. Picture sizes — 30" x 22", 40" x 30", and 48" x 36", on special activated aluminium screens.

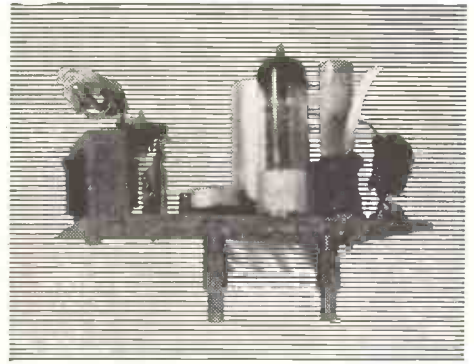
Transistor Battery Portable Counter designed for counting small production quantities. Maximum rate 4 per second, with a built-in photo-electric cell, or alternative remote photo-electric cell probe. Battery life gives 250,000 continuous counting operations. Size 4 1/4" x 3 3/4" x 1 1/4".



Small Audio Amplifier using Printed Circuit technique for use in Record Players.



Typical types of Coil Winding. Focus coil and small mains transformers for Television Receivers.



If you want

IMAGINATION, TECHNIQUE, EXPERIENCE BUILT INTO ELECTRONIC EQUIPMENT
Whether in Design, Development or Manufacture

consult



Whichever type of service you need, you can save time and trouble, maybe money too, if you write or 'phone without delay.

P.A.M. Electronics Department combines the technique and experience of several companies, long-established in the Electronic field, with the extensive modern production resources of P.A.M. Ltd. Examples of recent work are illustrated.

P.A.M. Ltd., Electronics Department
Merrow, Guildford, Surrey. Tel: Guildford 2211.

YOU'LL DO BETTER WITH PREMIER

The NEW De-Luxe
TAPE RECORDER TR3

Case finished in Red and Cream with gilt styling and fittings.
Size 18½in. x 15in. x 9in. for A.C.
Mains 200/250 v. 50 cycles.
TRADE ENQUIRIES WELCOMED

for **£5.18.0**

DEPOSIT & 8 MONTHLY PAYMENTS OF £5.16.3

OR

CASH 45 gns.

plus 2/- post & packing.



THE *"Petite"* PORTABLE

MAY BE BUILT FOR

£7.7.0

plus 3/- post & packing.

Batteries extra.

HT 10/- (Type B126) or equivalent.

LT 1/6 (Type AD 35) or equivalent.

- ★ Size only 8in. x 8in. x 4½in.
- ★ Weight, including batteries, 5½lb.
- ★ 4 valves of the economy type.
- ★ Medium and longwave superhet circuit.
- ★ High Q frame aerials.
- ★ High sensitivity on both wavebands.
- ★ Prealigned IF transformers.
- ★ 5in. speaker of the latest type.
- ★ Automatic on/off switch operated by lid.
- ★ Designed in our own laboratory.
- ★ Backed by an up-to-date Technical Information Dept.
- ★ Components available separately if desired.
- ★ Simple to construct, using normal soldering methods.
- ★ Mains unit will be available later.
- ★ Instruction book 1/6.

Build the NEW "MAYFAIR" TELEVISOR
which gives complete SAFETY
to the constructor !

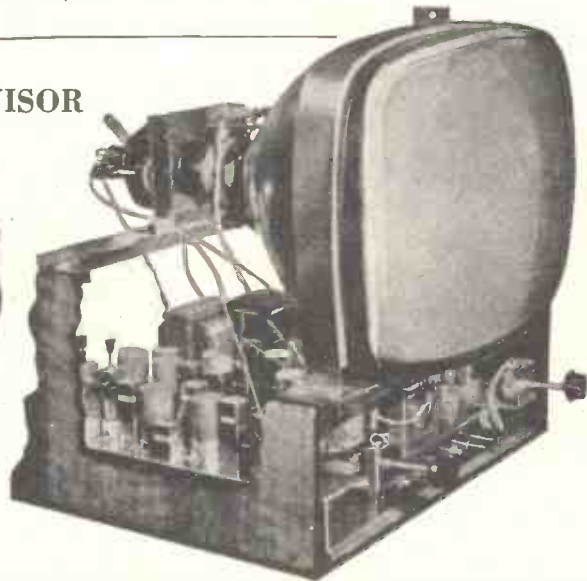
These Televisors use a double wound mains transformer which gives you complete safety from contact with the mains supply when handling the chassis or controls.

★ **B.B.C. & I.T.A. DESIGN**

WITH NEW TURRET TUNER **£33.7.11** PLUS COST OF C.R.T.

Build in 5 Easy Stages. Full Construction details available. Instruction Book 3/6 Post Free.

CONSOLE CABINETS with full length doors for 14in., 16in. and 17in. tubes. PRICE £14/14/-. H.P. Terms: Deposit £7/7/6 and 9 monthly payments of 18/6. CONSOLE CABINETS. Half door £12/12/-. H.P. Terms: Deposit £6/6/- and 8 monthly payments of 18/3. On above cabinets add 2/- for pkg. and carr.



PREMIER RADIO COMPANY,

YOU'LL DO BETTER WITH PREMIER

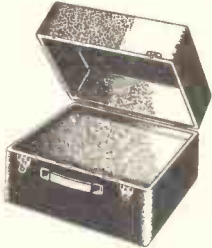
B.S.R. T.U.8 3-speed Record Player £4/12/6 plus 2/6 post and packing.



P.U. complete with arm 36/-.

CABINETS — PORTABLE

MODEL PC/2
Grey Lizard Rexine covered 45/-
Overall dimensions 15 in. x 13½ in. x 6½ in. Clearance under lid when closed 3 in.



MODEL PC/2 DE LUXE
Two colours, wine and grey, with cut-out for speaker and amplifier 55/6
Dimensions 15 in. x 14 in. x 7½ in.

MODEL PC/3
Grey Lizard Rexine covered. 69/6
Overall dimensions 16½ in. x 14½ in. x 11 in. Clearance under lid when closed 3½ in.

MODEL PC/3 DE LUXE
As above but with cutouts for Speaker and Amplifier 79/6
Dimensions as above.

THE ABOVE CABINETS ARE COMPLETE WITH CARRYING HANDLE FASTENERS AND PANEL.

Packing and Postage 3/- each.

Junction Transistors 10/- each
Equivalent of the OC70 Type

CONTINENTAL STYLE CABINET



Dark Piano finished with gold and black styling, overall size 39 in. long, 32½ in. high, 16 in. deep. Two sliding doors, concealing on the left a black panel 18½ in. x 20½ in. finished in medium mahogany, and on the

right a detachable board 12½ in. x 18½ in. and a shelf which may be used for record storage. Cash Price 18 gns., plus 25/- pkg. and carr. Credit Terms: Deposit £2/18/- and 8 monthly payments £2/4/11.

The new Spencer West Band Three converter is now available at £6/5/- plus pkg. and post 3/-.

Spencer West Pattern Unit 25/- plus 1/- pkg. and post. For elimination of B.B.C. interference or I.T.A.



PREMIER BUREAU DE LUXE

A superb cabinet in finely figured walnut veneer. Interior light sycamore with rexine matching lining. Overall dimensions: 33 in. high, 34 in. long, 17½ in. deep. Uncut control panel on right-hand side approximately 16 in. x 10½ in., uncut base-board on left-hand side 15½ in. long, 13½ in. deep. Two full size felt-lined storage cupboards in the lower part of the cabinet. Cash price 16½ gns.

Credit Terms: Deposit £2/3/10 and 8 monthly payments of £2/2/10. Packing and Carriage 25/- extra.

We carry a comprehensive stock of components by all leading manufacturers.

SEND 2½d. STAMP FOR OUR AUTUMN CATALOGUE



Why not make the best!

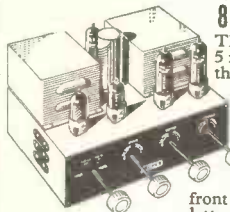
MULLARD

AMPLIFIER KIT

NOW SUPPLIED WITH ULTRALINEAR OUTPUT TRANSFORMER.

All the components for model 510, PLUS pre-amplifier, on one chassis (total six valves), chassis gold hammer finished. May be purchased for £12/12/- plus pkg. and post 7/6. This version complete and tested £15/15/-.

Or pre-amplifier and tone control in a separate unit £14/14/- plus pkg. and post 7/6.



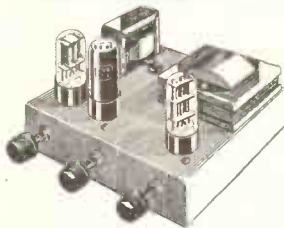
8 WATT AMPLIFIER

This design includes 5 miniature valves of the latest types, an

Ultralinear Output Transformer suitable for Speakers of 3 and 15 ohms, and a very attractive perspex

front panel with gold lettering, complete set

of parts £8/8/- Postage and Packing 5/- extra.



4 WATT AMPLIFIER

£4. 10. 0

MAY BE BUILT FOR Plus 2/6 Pkg. & Postage

Instruction Book 1/- post free.

A steel case is now available, complete with engraved panel, for 15/6 extra. The amplifier may be supplied complete for £5/5/- plus pkg. and post 3/6, or fitted in case at £6 plus pkg. and post 3/6. Engraved panel 3/6. Post Free.



COMPACT GRAM AMPLIFIER

Complete ready to connect to any type of Pick-up and speaker (8 ohms) A.C. Mains 200/250 v. Volume and tone control fitted with knobs. Overall size 7½ in. long x 3½ in. wide x 2½ in. high. £2 : 19 : 6

Suitable speaker 7 x 4 in. Plus packing and postage elliptical £2/10. 2/6.

2-BAND TRF RECEIVER MAY BE BUILT FOR £5.15.0

plus pkg. and post 3/-

3 BAND SUPERHET RECEIVER

£7. 19. 6

MAY BE BUILT FOR Plus 3/- Pkg. & Postage

These two receivers use the latest type circuitry and are fitted into attractive cabinets 12 in. x 6½ in. x 5½ in. in either walnut or ivory bakelite or wood. Individual instruction books 1/- each, post free.

TERMS OF BUSINESS

Cash with order or C.O.D. over £1. Please add 1/- for Post Orders under 10/- 1/6 under 40/-. Unless otherwise stated.

Limited Quantity Only!

COLLARO R.C. 54 CHANGERS

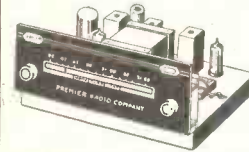
at £7.19.6 plus 5/- post and pkg.

COLLARO R.C. 456 4-Speed AUTOCHANGER
Designed to play 12 in., 10 in. and 7 in. Records intermixed in any order at 16, 33½, 45 or 78 r.p.m. Capacity 10 records. New reversible Dual Stylus Crystal Pick-up for use on 100/250 v. 50 cycle A.C. mains, £9/15/- plus packing and postage 5/-.

Deposit 25/- and 8 monthly payments of 25/-.

NEW FM TUNER

for the Home Constructor



A new design using the latest circuit techniques. Includes 4 valves plus magic eye tuning indicator, permeability tuning and an integral power supply. Two controls only, a gear driven slow motion tuning control and an output volume control with on/off switch. Suitable for fringe area reception.

All components may be purchased for £8/15/- plus packing and postage 3/6.

OR less Mains Transformer and Rectifier £7/12/6 plus packing and postage 3/-.

Power requirements HT 230 v. 50 mA., LT 6.3 v. 1.5A. Dial size 3½ in. x 1½ in., overall size 1½ in. long, 5½ in. deep, 4½ in. high.

★ IT WILL PAY YOU TO VISIT OUR NEW HI-FI DEMONSTRATION ROOM



THE NEW TSL FM TUNER HIGH STABILITY MODEL

6 Valves including Magic Eye and Power Supply using the latest type Gortler permeability Unit complete with first audio stage and preset output volume control. Maximum radiation less than 10 microvolts per metre. Sensitivity better than .5 microvolts. Cash price £17/10/- (inclusive) or Credit Terms: Deposit £2/3/9 and 8 monthly payments of £2/3/4. Postage and packing 5/- extra.

STIRLING VHF/FM TUNER UNIT

A cleverly designed Unit suitable for installation either in existing equipment or as an external Unit. Completely self contained with its own power supply. The latest type permeability tuned circuit is used, tuning drift being negligible. Size 7½ x 7½ x 2½ in. Cash Price £13/13/- Postage and Packing 2/6 extra. Cr. Terms £1/15/- deposit and 8 monthly payments of £1/13/6. Plus postage and packing of 2/6.

WHY BUY SURPLUS OR RE-CONDITIONED TUBES WHEN THESE FULLY GUARANTEED WIDE ANGLE TUBES ARE AVAILABLE? THE LATEST TYPE 17in. RECTANGULAR TUBE AT £17 (INCL. TAX), POST AND PACKING 21/- EXTRA

TUNING CONDENSERS (Miniature type) 2-gang .0005 mfd. 5/-.

THE JASON "ARGONAUT" MW/FM DESIGN

★ All Premier components are designer approved ALL components to build the complete Receiver, including output stage, may be purchased for £15/5/-, or all components less output stage but including Power Supply, for £13/19/6, plus packing and postage 3/6 on each.

WORLD APPROVAL

FOR THE RANGER



and

25 Kc/s Channel Spacing

Pye Ranger V.H.F. equipment has received approval from the British G.P.O. for land, marine and international marine applications employing A.M. or F.M. systems, type approval from the Canadian D.O.T., and type acceptance by the F.C.C. of the United States of America.

No other company holds so many approvals for this type of equipment. Ranger equipment now covers every conceivable requirement, and will continue to do so for many years to come.

Ranger equipment now in full production is designed for all channel spacings including 20 and 25 kc/s. for frequency ranges from 25 to 174 Mc/s., for power ranges up to 1 kilowatt and for A.M. or F.M. modulation. This range has been designed to expand the application of Pye Radio-Telephones already in constant use all over the world.

No matter what your V.H.F. requirements, Pye Telecommunications Ltd., can fulfil them. Your inquiries are invited.



Telecommunications

Pye Telecommunications distributors in 91 countries ensure trouble-free service.

PYE TELECOMMUNICATIONS LIMITED · NEWMARKET ROAD · CAMBRIDGE · ENGLAND

Telephone : Teversham 3131

Cables : Pyetelecom Cambridge

Wireless World

ELECTRONICS, RADIO, TELEVISION

Managing Editor: HUGH S. POCOCK, M.I.E.E.
Editor: F. L. DEVEREUX, B.Sc.
Editorial Consultant: H. F. SMITH

OCTOBER 1957

In This Issue

VOLUME 63 No. 10

PRICE: TWO SHILLINGS

FORTY-SEVENTH YEAR
OF PUBLICATION



Offices: Dorset House,
Stamford Street, London,
S.E.1.

Please address to Editor,
Advertisement Manager or
Publisher, as appropriate.

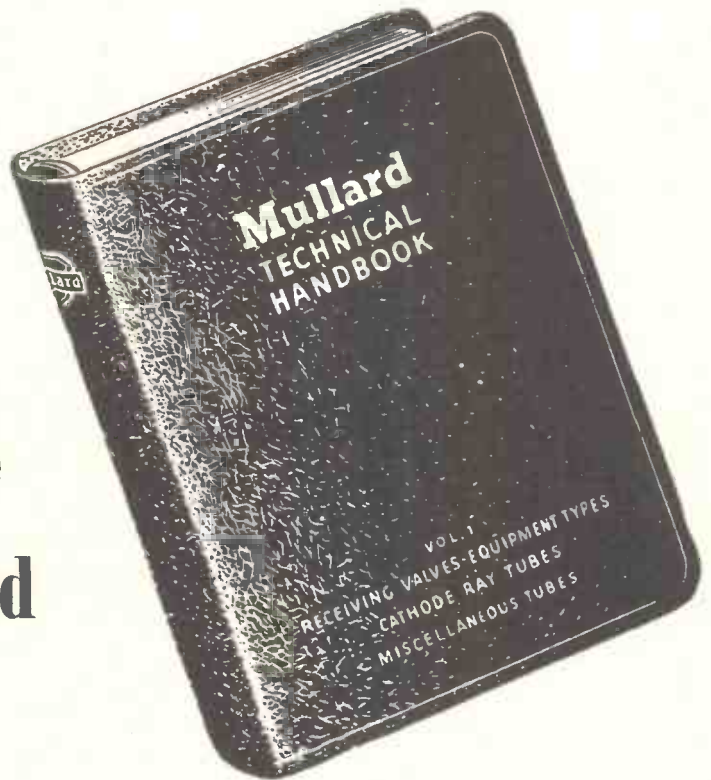
Telephone:
WATERloo 3333 (60 lines)

Telegraphic Address:
"Ethaworld, Sedist, London".

- 459 Editorial Comment
460 Farnborough Air Show
462 World of Wireless
465 Radio Show Review
474 Short-Wave Conditions
475 "Nearest Approach" Calculator *By A.L.P. Milwright*
477 New Radio Telescope
479 Loudspeakers in Parallel *By J. Moir*
482 Component Developments *By G. W. A. Dummer*
485 More Jobs for Computers
487 Letters to the Editor
488 Modern Thermionic Cathodes *By R. W. Fane*
491 Stabilization of A.C. Supplies *By O. E. Dzierzynski*
497 The Gyrator—2 *By Thomas Roddam*
501 Technical Notebook
503 Scientific Theories *By "Cathode Ray"*
505 Ferrites for F.M. *By T. W. G. Calvert*
508 Subjective Colour for Television? *By C. E. M. Hansel*
510 News from the Industry
512 Random Radiations *By "Diallist"*
514 Unbiased *By "Free Grid"*

PUBLISHED MONTHLY (4th Tuesday of preceding month) by ILIFFE & SONS LTD., Dorset House, Stamford Street, London, S.E.1. Telephone: Waterloo 3333 (60 lines). Telegrams: "Iliffepres, Sedist, London." Annual Subscription: Home and Overseas £1 15s. 0d; Canada and U.S.A. \$5.00. Application for second-class mailing pending at Post Office, New York, N.Y. BRANCH OFFICES: BIRMINGHAM: King Edward House, New Street, 2. Telephone: Midland 7191. COVENTRY: 8-10, Corporation Street. Telephone: Coventry 5210. GLASGOW: 26B Renfield Street, C.2. Telephone: Central 1265. MANCHESTER: 260, Deansgate, 3. Telephone: Blackfriars 4412. OVERSEAS OFFICES: U.S.A.: 111, Broadway, New York, 6, N.Y. Telephone: Digby 9-1197. CANADA: 67 Yonge Street, Toronto, 1, Ontario. Telephone: Empire 6-0873.

A service for all who need complete data on Mullard valves, tubes and semiconductor devices



The Mullard Technical Handbook is a loose-leaf publication, issued on a subscription basis and containing data sheets on all Mullard valves, tubes and semiconductor devices in current production.

From one to twenty pages are devoted to each type, data including: standard ratings, recommended operating conditions and performance figures for various applications, limiting values, characteristic and performance curves.

Subscribers receive supplementary or revised sheets automatically as they are issued and thereby have early intimation of new introductions.

At present the Handbook comprises four volumes with the following contents:—

Mullard

Mullard Limited, T.S.D., Data and Publications Section,
Mullard House, Torrington Place, London, W.C.1.

VOLUMES I and IA

Data on current Receiving and Amplifying Valves. Cathode Ray Tubes. Crystal Diodes and Transistors. Photocells. Cold Cathode Tubes. Small Thyratrons. Miscellaneous and Special Tubes.

VOLUME 2

Data on earlier type Receiving and Amplifying Valves and Cathode Ray Tubes still in limited production for the maintenance of existing equipment.

VOLUME 3

Data on Power Valves for Transmitting and Industrial Equipment. Power Rectifiers. Large Thyratrons. Microwave Devices.

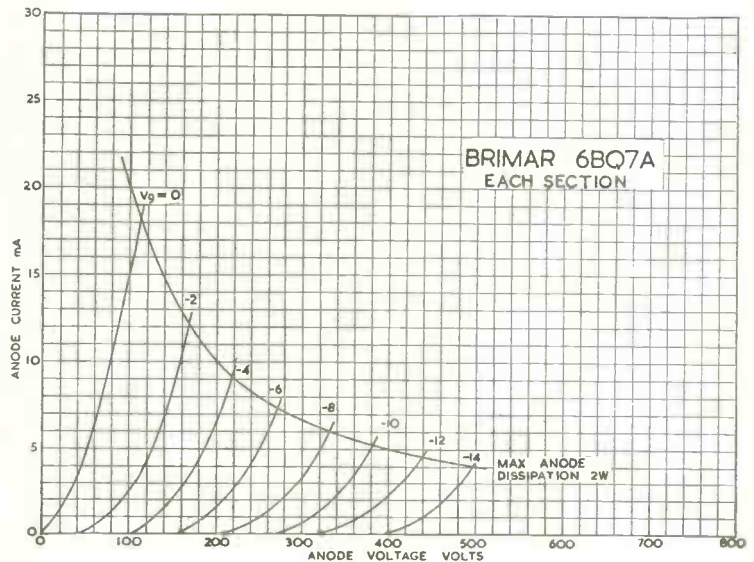
For full details of this service, including subscription rates and application form, write to the address below.





BRIMAR 6BQ7A

The Brimar 6BQ7A is a double triode consisting of two independent high slope sections with similar characteristics. The valve is particularly useful as a cascode R.F. amplifier for television receivers and also as a combined oscillator and mixer for frequency modulation receivers. It can, of course, be used wherever high slope triodes are required, and features low interaction between the sections as an internal screen is provided which is brought out to a separate base pin.



Cut this out for further reference or write to the Publicity Department at Footscray for a data sheet.

Name

Address

W.W.

TYPICAL CHARACTERISTICS

Heater voltage	6.3. volts
Heater current	0.4 amp.
Anode voltage	150 volts
Cathode bias resistor	220 ohms
Anode current	9 mA
Mutual conductance	6.4 mA/V
Amplification factor	39
Anode resistance	6,100 ohms
Grid cut-off voltage (1 — 10 μ A)	-10 volts approx.



Standard Telephones and Cables Limited

Regd. Office: Connaught House, 63, Aldwych, London W.C.2

FOOTSCRAY · SIDCUP · KENT · FOOTscray 3333

'Saw you at
the Radio Show'



'Be seeing you
at home'



Some of us Acos Series 65 turnover cartridges met you at Earls Court. Now we are off in our thousands to your homes. 65-3 Types are going to popular players, where their great output* (and good performance) will do a power of good.

65-1 Types are putting their hi-fi, hi-g, wide-range excellence (and very acceptable output*) at the disposal of some of the best instruments in the land.

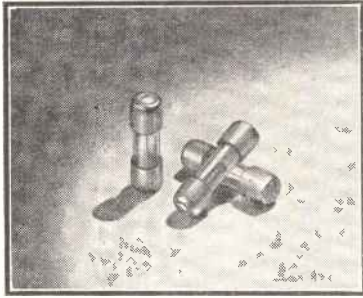
And we'll all of us give you good and long service. (If you have not ordered one of us yet, you will find us at your dealer's.)

*Outputs—Type 65-1: 0.15 V, Type 65-3: 1 V, at 1 cm/sec velocity, 1000 c/s.

acos

ARE DOING THINGS IN STYLE

"BELLING-LEE" FUSE-LINKS

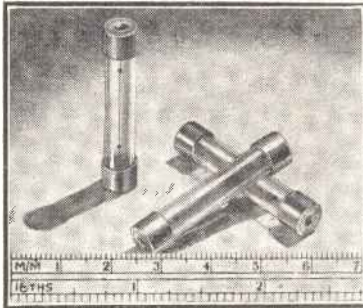


MINIATURE (GLASS)

L.562 ($\frac{5}{8}$ in. \times $\frac{1}{8}$ in.)

50mA to 7A

Designed to blow within $\frac{1}{2}$ second on 100% overload. The glass body is colour coded and the rating is coded on the nickel-plated caps.

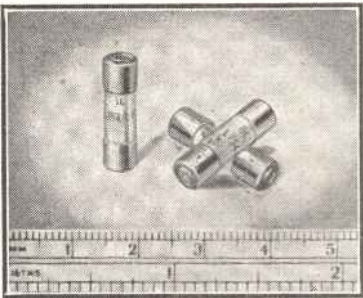


"MAG-NICKEL" delay fuse (glass)

L.338 ($1\frac{1}{2}$ in. \times $\frac{1}{2}$ in.)

250, 500 & 750mA colour coded

Conform to the dimensions and blowing requirements of our standard L.1055 and can withstand a surge current of 10 to 30 times their rated current for a period not exceeding 0.01 second.



"MINIFUSE" miniature (ceramic)

L.754 ($\frac{5}{8}$ in. \times $\frac{1}{8}$ in.)

10, 15 & 25mA

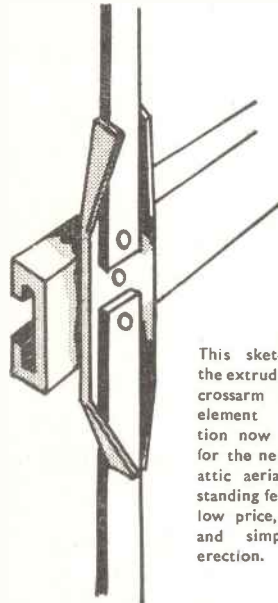
Primarily designed for the protection of small meters, test and laboratory gear, etc., "Minifuses" are designed to carry their rated current indefinitely and blow within 0.01 sec. at $3\frac{1}{2}$ times their rated current.



Telephone: Enfield 3322. Telegrams: Radiobel, Enfield

"BELLING-LEE" NOTES

We sincerely hope that by the time this is being read, the test transmitting aerial made by us for St. Hilary will be sending out a signal that will have been received by a very large number of people during the best part of a month. The signal from the test transmitter cannot be strong, but in general wherever the transmitter has been used, it has covered the area, though weakly. Its purpose is to provide something for the trade to focus on for alignment of aerials.



This sketch shows the extruded channel crossarm and strip element construction now employed for the new band III attic aerials. Outstanding features are low price, lightness and simplicity in erection.

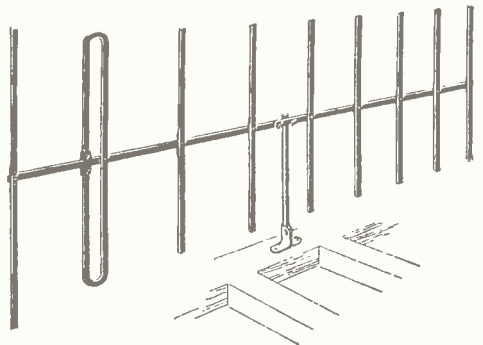
We must emphasise that the transmitter is owned, manned and maintained by the Independent Television Authority to whom all enquiries and reports should be made.

There will be hundreds of thousands of indoor aerials such as the "Golden V" used up to five or eight miles from the transmitter. Further out, other aerials will come into their own. But please don't expect that everywhere within five miles of St. Hilary will manage with an indoor aerial.

By far the greatest number of aerials used will still be the outdoor type although the small length of the elements does allow even a nine-element to be used in the loft, but this would only be as good as a six-element out of doors. North of the Severn, except for the coastal regions, there will be trouble. Reception of Wenvoe up the valleys is bad enough, but the band III signal from St. Hilary will be worse. You can expect more and better "ghosts," calling for careful selection

and siting of multi-element arrays, and please do believe that in a difficult site the movement of the aerial a fraction of a wavelength can make all the difference between entertainment value and no signal at all.

So far as distance is concerned, as long as there is "line of sight" there should be little trouble up to 50 (or many more) miles. For example towards Yeovil there are forty-five miles of flat country, but the fact that there is some rising ground immediately to the north of Yeovil would lead us to expect some difficulty in reception of a band III signal from St. Hilary. This is only quoted as an example. Places very much closer to the transmitter, often with higher ground between, will be much worse off. Parts of Swansea will get a better signal than parts of Neath, but there will be part of both towns where it will be almost impossible to receive a really good signal. During September we will be showing our colour film on band I—band III reception to hundreds of dealers in the area to be served by St. Hilary. Please note that it is not our policy to rush in and be the first firm to give a talk in a new transmitter area, and to book up orders. We deliberately postpone our meetings until a test signal has been "on the air" for a short time, so that a considerable number of the audience will have something definite in their minds. They are not sitting listening to some vague statements. They know more about local conditions than we do, and they are in a position to ask significant questions, which we can generally answer. We certainly consider the questions and answers part as most useful both to our audience and to us.



We now offer a band III attic aerial range with up to 9 elements on a short mast. These are light and simple in construction and practically spring into action.

Advertisement of
BELLING & LEE LTD.
 Great Cambridge Rd., Enfield, Middx.
 Written 15th August, 1957

EMI "HIS MASTER'S VOICE"

MARCONIPHONE · COLUMBIA

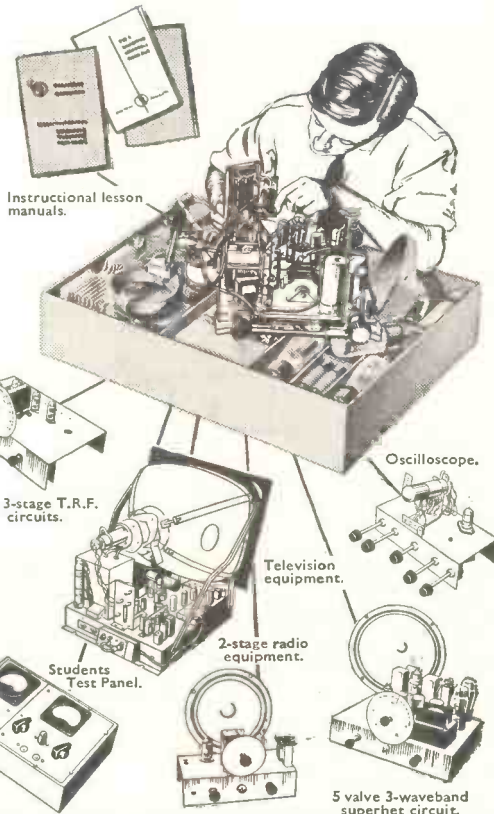
Announce NEW PRACTICAL WAY OF LEARNING AT HOME

NEW — completely up-to-date methods of giving instruction in a wide range of technical subjects specially designed and arranged for self-study at home under the skilled guidance of our teaching staff.

NEW — experimental outfits and lesson manuals are despatched on enrolment and remain the student's property. A tutor is allotted to each student for personal and individual tuition throughout the course.

Radio and television courses, with which specially prepared components are supplied, teach the basic electronic circuits (amplifiers, oscillators, detectors, etc.) and lead, by easy stages, to the complete design and servicing of modern Radio and T/V equipments.

If you are studying for an examination, wanting a new hobby or interest, commencing a career in industry or running your own full-time or part-time business, these practical courses are ideal and may be yours for moderate cost. Send off the coupon to-day for a free Brochure giving full details. There is no obligation whatsoever.



- Courses with Equipment**
- RADIO · SHORT WAVE RADIO**
 - TELEVISION · MECHANICS**
 - CHEMISTRY · PHOTOGRAPHY**
 - ELECTRICITY · CARPENTRY**
 - ELECTRICAL WIRING**
 - DRAUGHTSMANSHIP · ART etc.**

E.M.I. Factories
at Hayes, England



EMI INSTITUTES

Fill in for FREE BROCHURE
E.M.I. INSTITUTES, Dept. 127x, London, W.4.

Name _____

Address _____

Age _____ (If under 21)

I am interested in the following subject(s) with/without equipment _____

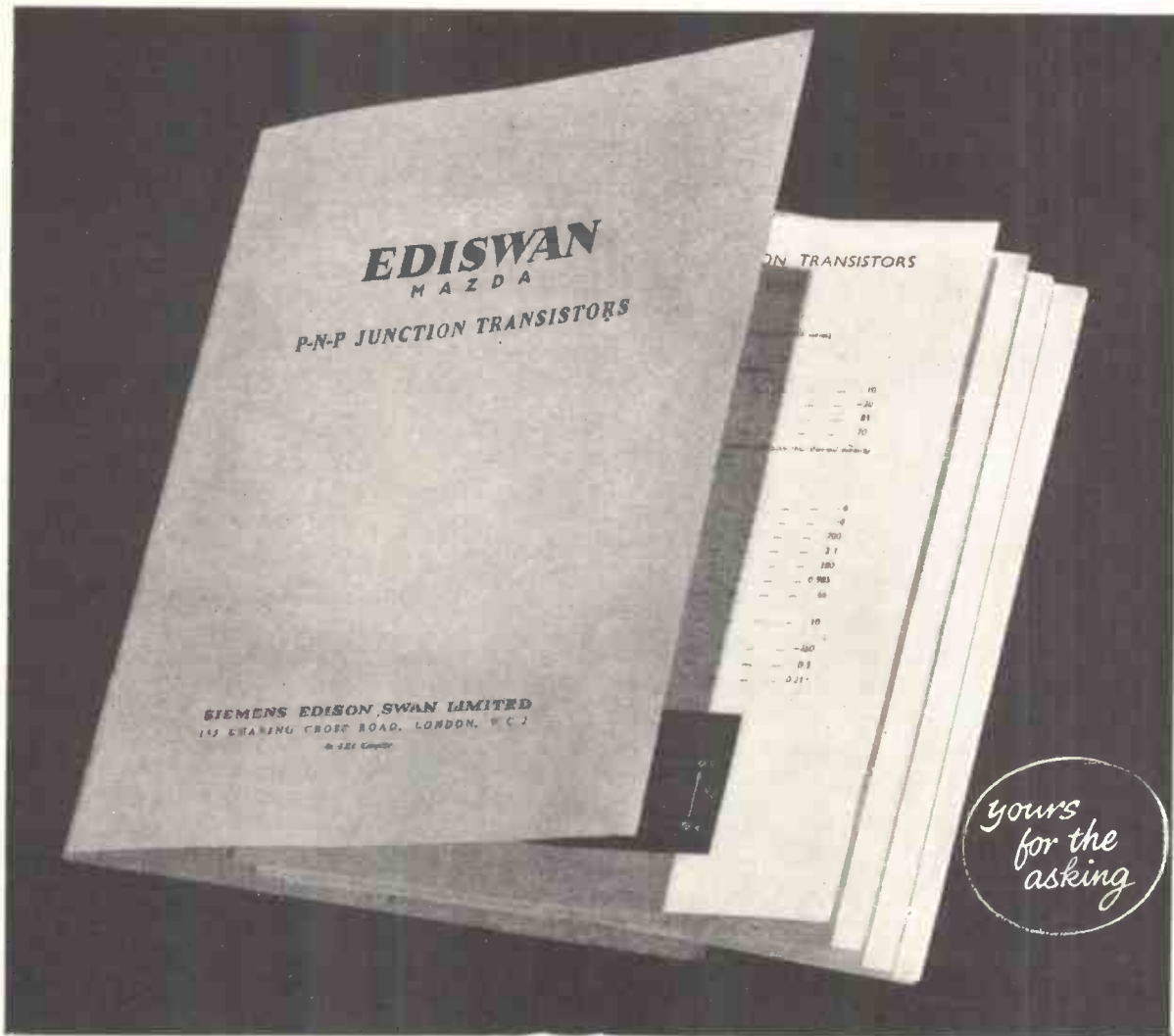
OCT./57 (We shall not worry you with personal visits)

IC107

FREE

BLOCK CAPS PLEASE

The only Home Study College run by a World-wide industrial organisation.



EDISWAN **transistors**

MAZDA

If you are manufacturing or designing electronic equipment you will find this folio of data sheets helpful as a source of reference. It gives you comprehensive information and characteristic curves covering the whole range of EDISWAN Mazda transistors.

Simply ask for the P-N-P Transistor Folio on your business notepaper.

at highly competitive prices

SIEMENS EDISON SWAN LIMITED

155 CHARING CROSS ROAD, LONDON, W.C.2, AND BRANCHES

TELEPHONE: GERRARD 8660. AN A.E.I. COMPANY

TELEGRAMS: SIESWAN WESTCENT, LONDON

CRC 15/4

MARCONI TELEVISION RECORDING EQUIPMENT

TYPE BD679 RECORDING CHANNEL

16mm Film presents a most economical and flexible means of recording Television pictures since film costs are low, developing and printing techniques are advanced and a wide range of fine grain film stocks are readily available. Projection, editing, viewing, dubbing and handling are all easily carried out with standard equipment. The Fast Pull-down technique presents great advantages over other systems of recording on film but the mechanical difficulties of moving the film in the short period of frame blanking have so far prevented the employment of the technique. These problems have now been successfully overcome by Marconi's.



Features

Exceptionally high picture quality.

Specially developed gearbox enables Fast Pull-down technique to be employed. F.P.D. Mechanism has given over 3,000 hours trouble-free operation.

Pull-down time adjustable, normally set at 2 milliseconds permitting recording of fully interlaced picture. Simple single-lens optical system avoids loss of contrast.

Sound can be recorded on optical track,

magnetic stripe or separate synchronous magnetic track.

Conveniently placed input selector switches, monitor and level controls. Sound/Vision cueing device incorporated.

Recording can be made on positive or negative stock of a wide variety, either direct positive, direct negative or reversal. Magazines hold 2,400 ft. (2,000 ft. magnetic stripe) or film may be fed directly into a rapid processor.

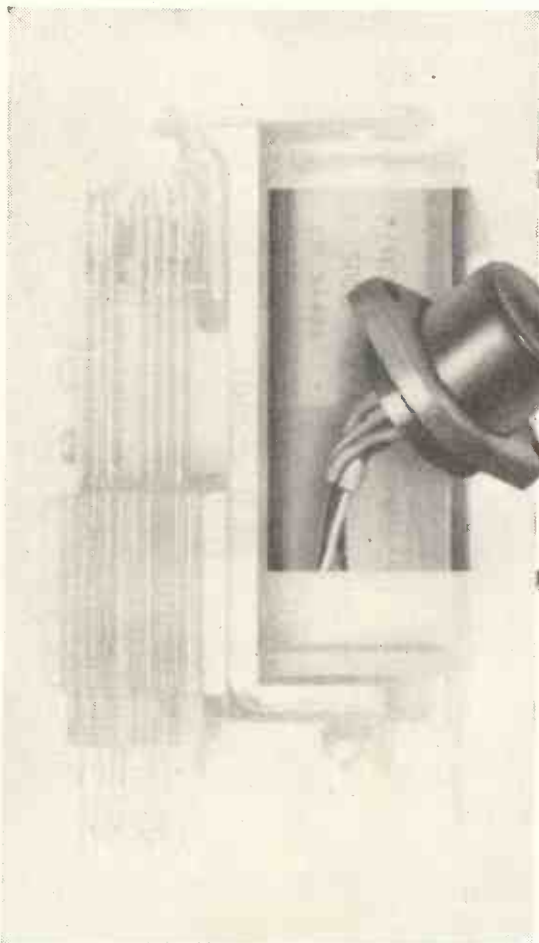
MARCONI

COMPLETE SOUND AND TELEVISION BROADCASTING SYSTEMS

MARCONI'S WIRELESS TELEGRAPH COMPANY LIMITED, CHELMSFORD, ESSEX



SUB-MINIATURE RELAYS



*Designed for
compactness and reliability.*

FEATURES

- * Lightweight
- * High Speed
- * Fully Tropicalised (R.S.C. 165)
- * Long Life

APPLICATIONS

- * Guided Weapons
- * Airborne Radar and Radio
- * Portable Electronic Equipment

MAIN CHARACTERISTICS

- * Weight 0.7 oz. (20 gm)
- * Operating Temperature -40°C to 100°C
- * Operating Power 300 mW
- * Contact Loading 120 mW
- * Single pole balanced armature type
- * Will withstand high accelerations

PRICES

- R1A/6 —for 6 volt operation—£4.10.0
 R1A/12—for 12 volt operation—£4.10.0
 R1A/24—for 24 volt operation—£4.10.0
 Series R1—similar electrically to series R1A
 but different physically—£3.10.0

OTHER E.M.I. EQUIPMENTS

OSCILLOSCOPES · VIBRATORS

MICROWAVE TEST EQUIPMENT

ACCELEROMETERS

STROBOSCOPES · TACHOMETERS

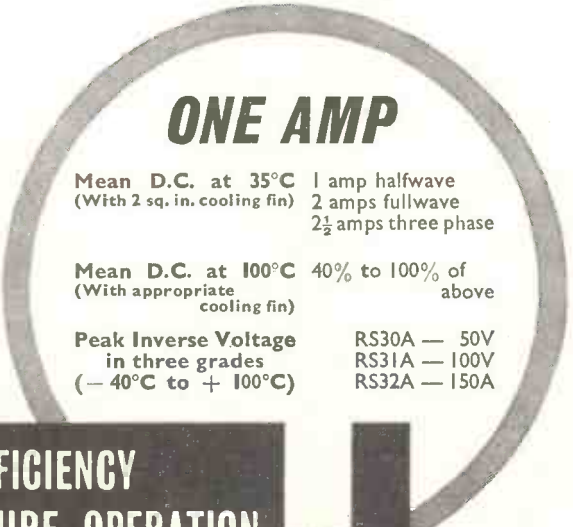


E.M.I. ELECTRONICS LTD

INSTRUMENT DIVISION · HAYES · MIDDLESEX · Tel: SOUthall 2468 (Ext. 1013 & 655)

SenTerCel

LOW POWER SILICON RECTIFIERS



ONE AMP

Mean D.C. at 35°C (With 2 sq. in. cooling fin) 1 amp halfwave
2 amps fullwave
2½ amps three phase

Mean D.C. at 100°C (With appropriate cooling fin) 40% to 100% of above

Peak Inverse Voltage in three grades (-40°C to +100°C) RS30A — 50V
RS31A — 100V
RS32A — 150A

**HIGH EFFICIENCY
HIGH TEMPERATURE OPERATION
SMALL SIZE
HERMETICALLY SEALED**

HALF AMP

Mean D.C. at 35°C ½ amp halfwave
1 amp fullwave
1½ amps three phase

Mean D.C. at 100°C 50% of above

Peak Inverse Voltage in three grades (-40°C to +100°C) RS20A — 50V
RS21A — 100V
RS22A — 150V

WRITE FOR TECHNICAL DATA SHEET F/SIL 101

WRITE FOR TECHNICAL DATA SHEET F/SIL 102

NOW AVAILABLE FROM PRODUCTION

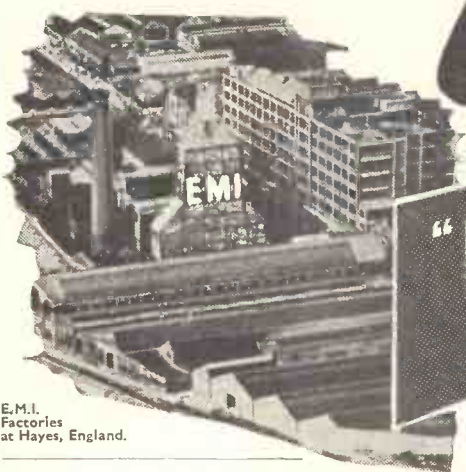


Standard Telephones and Cables Limited

Registered Office: Connaught House, Aldwych, London, W.C.2

RECTIFIER DIVISION: EDINBURGH WAY · HARLOW · ESSEX

ENROL with E.M.I.



E.M.I. Factories at Hayes, England.

"HIS MASTER'S VOICE" MARCONIPHONE · COLUMBIA

*to train
for your
CAREER-HOBBY
OR NEW INTEREST*

PERSONAL & INDIVIDUAL HOME TRAINING IN—

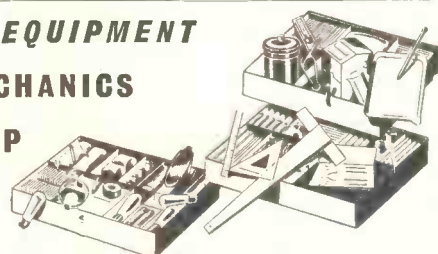
- | | | | | |
|---------------------------------------|----------------------------------|----------------------------|---------------------|----------------------------------|
| Accountancy | Commercial Subjects | Heating & Ventilation Eng. | Photography | Secretaryship |
| Advertising | Commercial Art | High Speed Oil Engines | P.M.G. Cert. | Servo Mechanisms |
| Aeronautical Eng. | Computers | Industrial Admin. | Police | Shorthand & Typing |
| A.R.B. Licences | Customs Officer | Jig & Tool Design | Production Eng. | Short Story Writing |
| Art (Fashion, Illustrating, Humorous) | Draughtsmanship | Journalism | Production Planning | Short Wave Radio |
| Automobile Eng. | Economics | Languages | Radar | Sound Recording |
| Banking | Electrical Eng. | Management | Radio | Telecommunications |
| Book-keeping | Electrical Installations | Maintenance Eng. | Radio Amateurs | Television |
| Building | Electronics | Mathematics | (C & G) Licence | Time & Motion Study |
| Business Management | Electronic | M.C.A. Licences | Radio & Television | Tracing |
| Carpentry | Draughtsmanship | Mechanical Eng. | Servicing | Transistors |
| Chemistry | Eng. Drawing | Metallurgy | Refrigeration | Welding |
| City & Guilds Exams. | Export | Motor Eng. | Sales Management | Workshop Practice |
| Civil Service | General Certificate of Education | Painting & Decorating | Sanitary Eng. | Works Management and many others |

Also courses for GENERAL CERTIFICATE OF EDUCATION, A.M.I.H. & V.E., A.M.S.E., A.M.Brit.I.R.E., A.M.I.Mech.E., A.M.I.E.D., A.M.I.M.I., A.F.R.Ae.S., A.M.I.P.E., A.M.I.I.A., A.C.C.A., A.C.I.S., A.C.C.S., A.C.W.A., City & Guilds Examinations, R.T.E.B. Serv. Certs., R.S.A. Certificates, etc.

NEW!

*Courses with PRACTICAL EQUIPMENT
in RADIO · TELEVISION · MECHANICS*

CHEMISTRY · ELECTRICITY · DRAUGHTSMANSHIP
PHOTOGRAPHY, ETC., ETC.



**COURSE FROM
15/- PER MONTH**

POST THIS COUPON TODAY

To:—E.M.I. INSTITUTES, Dept. 127K, London, W.4.

NAME..... Age.....
(if under 21)

ADDRESS.....

I am interested in the following subject(s) with/without equipment

.....

OCT. 57 (We shall not worry you with personal visits)



BLOCK
CAPS
PLEASE

EMI INSTITUTES

IC 104

The only Home Study College run by a World-wide industrial organisation

Proof from Australia!

Independent test shows Ful-Fi best!

Another large and reputable firm of radio and radiogram manufacturers in Australia carried out evaluation tests between a B.S.R. TC8M cartridge and another make hitherto fitted in their range of high quality record reproducers.



They were particularly impressed with the TC8M's ability to withstand tropical conditions. After over 150 hours exposure in a laboratory atmosphere of 118°F and relative humidity of 98% the output of the BSR cartridge was completely normal—the other cartridge had dropped by 26 d.b.

Their chief Radio Engineer writes: "The new B.S.R. cartridge appears to be superior to the—in ALL IMPORTANT RESPECTS and it is the intention of this company to change over to the TC8M just as soon as this type is available readily."

Send today for full technical details of Ful-Fi cartridges.



Ful-Fi Turnover Crystal Cartridges

Feature Points of Ful-Fi cartridges:

- ★ Strong efficient design.
- ★ Very easily removed from P/U arm for cleaning or replacement of styli.
- ★ The TC8M has a flat response ± 3 db. up to 12,000 cps. Output (at 1,000 cps.) at 1.2 cm/sec. .3 volts.
- ★ Alternative model; TC8H is of identical construction. Flat response ± 3 db. up to 7,000 cps. Output (at 1,000 cps.) at 1.2 cm/sec. .9 volts.

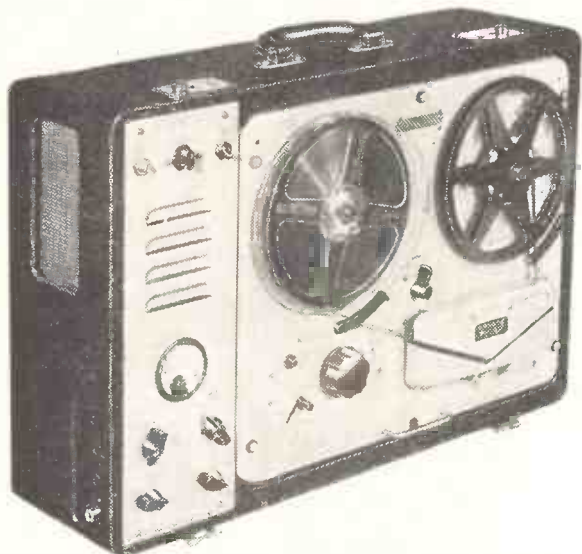


Fitted to the *Monarch*
UA8 4-speed Autochanger

BIRMINGHAM SOUND REPRODUCERS LTD., OLD HILL, STAFFS.

Vortexion

TAPE RECORDERS and AMPLIFIERS



The above recorder uses a synchronous capstan motor and for use on 12 volt car battery a 50 c/s ± 1 cycle 230 v., 120 w. power supply unit is available.

T.R.G.10 MINIATURE AMPLIFIER AND VERSATILE PRE-AMPLIFIER. A modern miniature amplifier, measuring only $4\frac{1}{2}$ x 5 in. over front panel and projecting $10\frac{1}{2}$ in. to the rear. Uses C core transformer material to obtain low external magnetic field and has less than 0.1% harmonic distortion at 10 watts output. The amplifier response is level 15 c/s. to 50,000 c/s. within 0.2 db. The 3-valve pre-amplifier will operate direct from recorder heads with correction networks for difficult tape speeds and switched inputs are provided for radio, microphone and gram. with correction for all recording characteristics.

"SUPER FIFTY WATT" AMPLIFIER. This heavy duty amplifier is available for long life under arduous conditions. The normal life being 5,000 hours without valve change.

★ The total hum and noise at $7\frac{1}{2}$ inches per second 50-12,000 c.p.s. unweighted is better than 50 dbs.

★ The meter fitted for reading signal level will also read bias voltage to enable a level response to be obtained under all circumstances. A control is provided for bias adjustment to compensate low mains or ageing valves.

★ A lower bias lifts the treble response and increases distortion. A high bias attenuates the treble and reduces distortion. The normal setting is inscribed for each instrument.

★ The distortion of the recording amplifier under recording conditions is too low to be accurately measured and is negligible.

★ A heavy mu-metal shielded microphone transformer is built in for 15-30 ohms balanced and screened line, and requires only 7 micro-volts approximately to fully load. This is equivalent to 20ft. from a ribbon microphone and the cable may be extended 440 yds. without appreciable loss.

★ The 0.5 megohm input is fully loaded by 18 millivolts and is suitable for crystal P.U.s, microphone or radio inputs.

★ A power plug is provided for a radio feeder unit, etc. Variable bass and treble controls are fitted for control of the play back signal.

★ The power output is 4 watts heavily damped by negative feedback and an oval internal speaker is built in for monitoring purposes.

★ The play back amplifier may be used as a microphone or gramophone amplifier separately or whilst recording is being made.

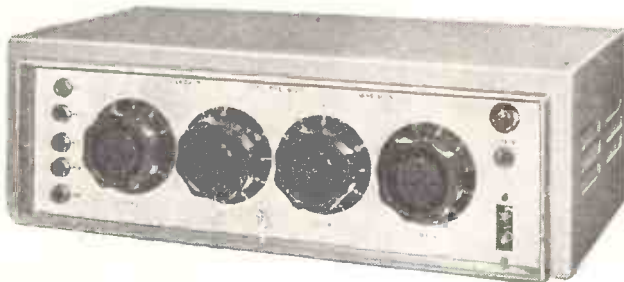
★ The unit may be left running on record or play back, even with 1,750ft. reels, with the lid closed.

CP20A AMPLIFIER. This standard amplifier for extreme tropical use will operate from 230 v. A.C. mains or 12 v. car battery and give 15 w. output for a consumption of 5.5a. Inputs for 30 Ω balanced microphones, M.I. P.U. and Cr. P.U.

THREE AND FOUR CHANNEL ELECTRONIC MIXERS

An Electronic Mixer for four 30-50 Ω balanced line microphones or special to order. Normal output 0.5 v. on 20,000 Ω but 1 mW., 600 Ω balanced or unbalanced is available as an alternative.

The THREE-CHANNEL MIXER and PEAK PROGRAMME METER is similar to the above but is fitted with a meter reading peak signals with 1 second decay time and calibrated in dbs from zero level 1 mW., 600 Ω to +12 and -20 balanced or unbalanced output by means of switch.



Full details and prices of the above on request

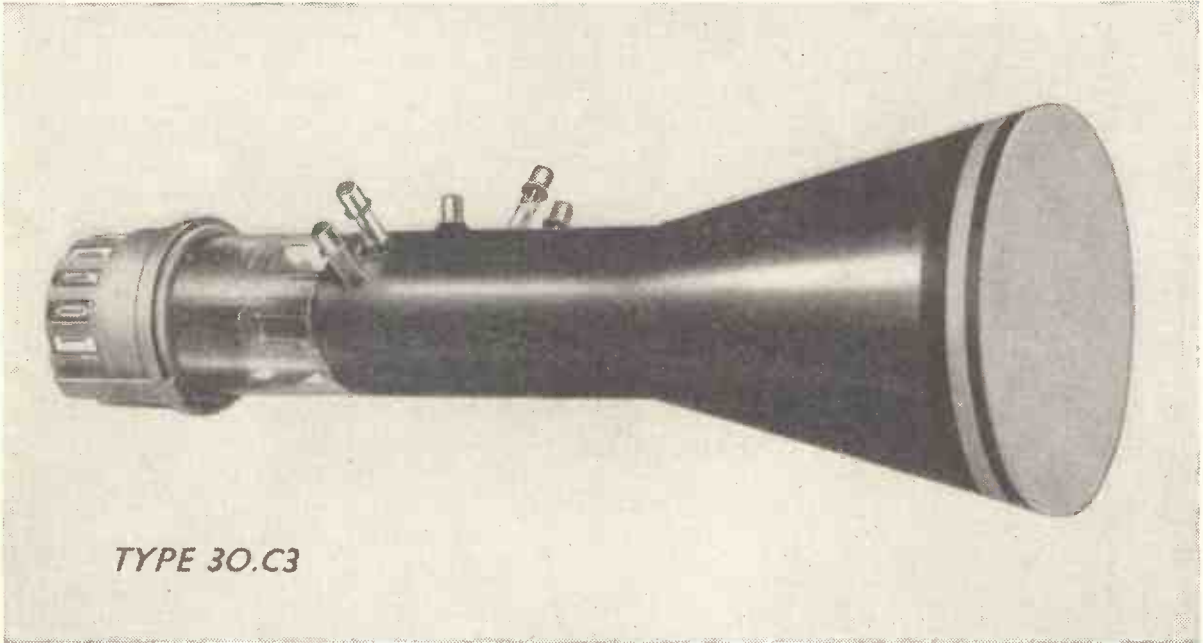
VORTEXION LIMITED, 257-263, The Broadway, Wimbledon, London, S.W.19

Telephones: LIBerty 2814 and 6242-3

Telegrams: "Vortexion. Wimble, London."

Industrial

Cathode ray tubes



TYPE 30.C3

SIEMENS EDISON SWAN make a range of high grade electrostatic cathode ray tubes for use in instrumentation. Three sizes are available, each with a choice of screen phosphors to suit varying requirements.

- 30.B1 3½" diameter polished flat screen.
- 30.C2 5½" diameter polished flat screen.
- 30.C3 As 30.C2 but with all plates brought out at the side.
- 30.E6 12" diameter curved screen.

Each of the tubes listed can be supplied with the following screen phosphors.

- T.1 Green. Medium persistence.
- T.2 Blue-green. Medium-long persistence.
- T.3 Blue actinic. Short persistence.
- T.4 White 'television' type.
- T.5 Blue. Very short persistence.

EDISWAN also have available 9" and 12" dia. Radar P.P.I. Tubes as well as a range of calibrated Compass Tubes.

EDISWAN

Send for further details to:

SIEMENS EDISON SWAN LIMITED (An A.E.I. Company) Industrial Valve Division

Britain's best Hi-Fi Equipment

We have devoted over 22 years entirely to the design and manufacture of audio equipment and we are proud of our position as leaders in this field. We were the first firm in the world to design and market Amplifiers having a total distortion content as low as 0.1%; a claim which was received with incredulity in 1945, but which was subsequently confirmed by the National Physical Laboratory and has become an accepted world-wide standard.

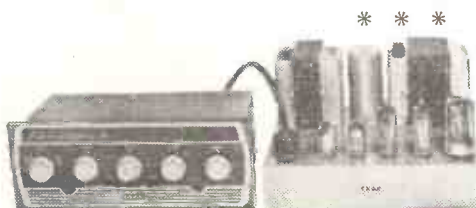
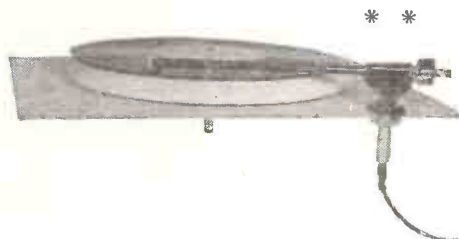
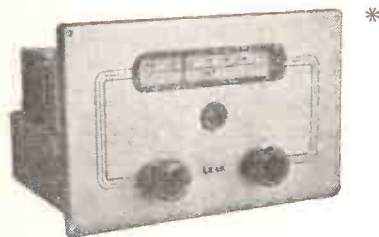
High engineering ideals have guided our efforts, and Leak Amplifiers have been the choice of the B.B.C., Commonwealth and foreign broadcasting authorities and Recording Studios. This acceptance by professional audio engineers has led to a demand for Leak equipment from music lovers throughout the world.

On the important question of prices it is appropriate to mention one of the basic principles of Leak design. From long experience and by extreme attention to design details during development work on the pre-production models, we enable our craftsmen to achieve a high output per man-hour. The labour costs thus saved offset the increased cost incurred for high-grade materials, components and finishes, and this, together with quantity production (made possible only by a world-wide market), explains how quality products may be sold at reasonable prices.

An important Test Report . . .

Independent laboratory tests of the Garrard 301 transcription turntable were recently carried out by Audio Instrument Company Inc., New York, U.S.A., under the direction of Mr. G. J. Lebel (Chairman of one of the groups which prepared the NARTB Standards). It was necessary that the pick-up and amplifier system should conform in response to the RIAA-New AES-new NARTB response curve within ± 1 db, and in the tests of this excellent transcription unit the components selected for use as complying with this requirement were a Leak tone arm fitted with Leak cartridge and a complete Leak pre-amplifier and power amplifier Model TL/10.

The full test report appeared in the February, 1957 issue of "Wireless World," pages 22 and 23.



If you were unable to visit the B.S.R.A. Exhibition, complete the coupon below and post it to us for details of the NEW Range of Leak High Fidelity Equipment.



The First Name
in High Fidelity

H. J. LEAK & CO. LTD., BRUNEL ROAD,
WESTWAY FACTORY ESTATE,
ACTON, W.3, ENGLAND.

Telegrams: Sinusoidal, Ealux, London
Telephone: SHEphers Bush 1173/4/5 Cables: Sinusoidal, London

Please send details of * FM Tuner
 ** Gram. pickup
 *** Amplifiers
 Please send name and address of my nearest Hi-Fi dealer

Name

Address

W W.

4 WAY
BVS/4

6 WAY
XVS/6



BOTH TYPES HAVE 3 PIN SHORTING PLUGS FOR ADJUSTING SIMULTANEOUSLY 2 TRANSFORMERS CONNECTED IN PARALLEL.

MARKINGS TO CUSTOMERS' REQUIREMENTS.

BVS/4 MOULDED IN BLACK P.F. BLACK ESCUTCHEON MARKED IN WHITE.

XVS/6 MOULDED IN NATURAL COLOUR NYLON LOADED P.F. MARKED IN WHITE.

Send for full details to:—

THE McMURDO INSTRUMENT CO LTD. ASHTEAD, SURREY. Tel: Ashtead 3401.

JSP/MV57

Estd. **L·R·S** 1925
EASY TERMS

LEAK QUALITY EQUIPMENT
for the Connoisseur

THE LATEST

"TL/12 PLUS" POWER AMPLIFIER

and the

"VARISLOPE III" PRE-AMPLIFIER

are designed to give the highest possible fidelity from records, radio and tape.

OTHER LEAK PRODUCTS "Trough-Line" F.M. Tuner . TL/10 Amplifier . Point One Pre-amplifier . Dynamic Pickup

TUNERS: Chapman · Lowther
LOUDSPEAKERS: Goodmans · Tannoy · Wharfedale
TRANSCRIPTION MOTORS: Collaro · Connoisseur · Garrard, etc.
All the above—in fact all QUALITY EQUIPMENT is available on EASY TERMS. Immediate delivery on most items.

SMALL DEPOSIT secures, balance plus 5% interest payable in 9 equal monthly instalments or
50% DEPOSIT and balance plus 10% interest payable over 18 months or 24 months if required.

We pay carriage and cratage on all items.

Send us your requirements. We will quote by return.

The L · R · SUPPLY COMPANY, LTD.
BALCOMBE (Tel : 254) SUSSEX.

Introducing "The Tutor"

This new recorder, using the Mark IV Collaro tape deck with digital counter. Produced by the manufacturers of the well known "Tutor-Tapes."



Outside Measurements: 17½ x 15½ x 7½ in. including lid. Output: 5½ watts. Weight: 36 lbs. In dual colours—Black and Grey, Maroon and Grey. Inputs: High impedance microphone and high/low impedance radio/gram. Output: 3 ohm or 15 ohm (as ordered) for extension speaker, earphone monitoring.

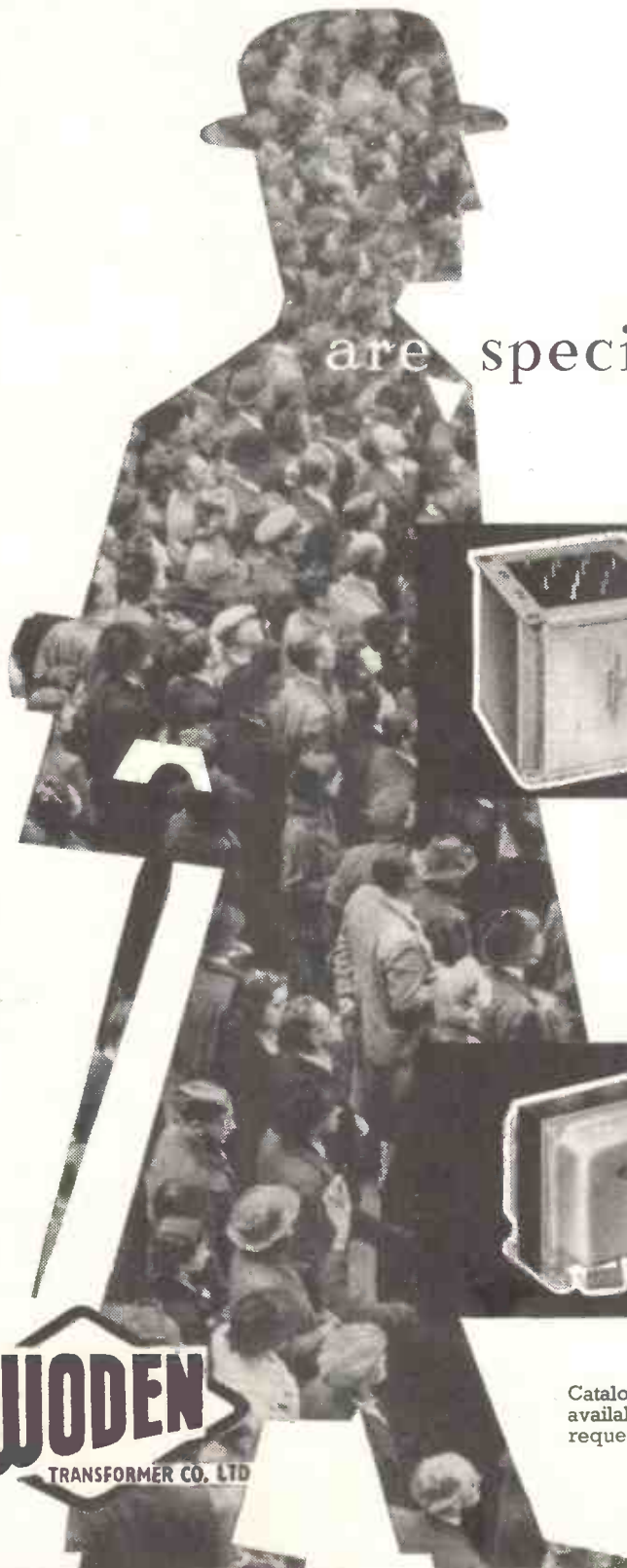
PRICE 63 gns.

complete with Collaro ceramic crystal microphone—and 1,200 ft. reel of tape. A10 watt Push-Pull output model shortly available. Generous Export and Trade Discounts.

Tutor-Tape Company

70, BREWER STREET, LONDON, W.1
CABLES: TUIAPE, LONDON. TELEPHONE: GERRARD 3376



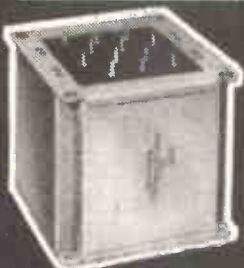


more and more users

are specifying



TRANSFORMERS



Left: Potted Compound Filled Transformers.
 A wide range of capacities for transformers and chokes. Complete reliability. Suitable for exacting industrial and climatic conditions.



Above: Cast Resin Transformers.
 Give complete mechanical and climatic protection for core and windings. Good heat dissipation.



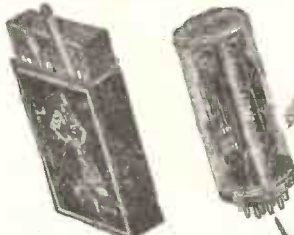
Bottom Left: Shrouded and Open-Type Transformers.
 Combine first-class engineering with a popular highly competitive product. Vacuum impregnated and rigidly tested.

Catalogues available on request.



WODEN TRANSFORMER CO. LTD | MOXLEY ROAD BILSTON STAFFS | Phone: BILSTON 41959

ELECTRO-MAGNETIC RELAYS?..



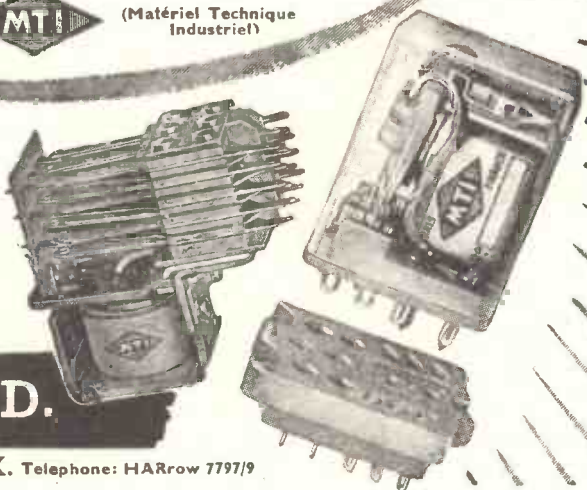
Send to Simmonds!

who have a range
of 1000 NEW TYPES
by  (Matériel Technique
Industriel)

Delivery 14-21 days
for most types

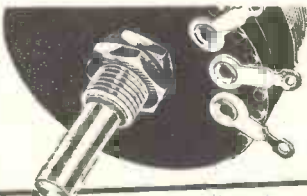
- ★ Operating from 1 Milliwatt to 1 Kilowatt with up to 96 change-overs at 10 amps. per contact.
- ★ Most models can be fitted with dust covers or hermetically sealed.
- ★ Range includes certain models hermetically sealed, all metal gas filled with glass base, and built-in adjustable thermal delay.
- ★ Post Office types 3000 and 600 relays of our own manufacture to specification. Guaranteed to full A.I.D. and I.E.M.E. standards.

Sole concessionaires for U.K. and Dominions on behalf of M.T.I.



L. E. SIMMONDS LTD.

5 BYRON ROAD, HARROW, MIDDLESEX. Telephone: HARrow 7797/9
(Manufacturers and Trade enquiries only)



Potentiometers

Whether wire wound or composition, whether Single, Ganged or Tandem, if the need is Potentiometers then 'RELIANCE' have the answer - from a comprehensive range of types that include linear, log, semi-log and non-inductive characteristics. Linearity or tolerances $\pm 1\%$ P.I.W. types up to 500 K. linear, 250 K. log. From stock or "to specification", a 'RELIANCE' embodies the best in potentiometer design and practice.

RELIANCE

Full details,
on request.

RELIANCE MANUFACTURING CO., (SOUTHWARK) LTD.
Sutherland Road, Higham Hill, Walthamstow. E. 17.
Telephone ; Larkwood 3245

BROOKES Crystals



mean
DEPENDABLE
frequency
control

Illustrated left is a Type S
Crystal unit from a range
covering 100 Kc/s to 15 Mc/s

- Black Bakelite case.
- 1 1/2" high x 1 1/4" wide x 1/8" thick.
- Two 1/8" dia. pins spaced 3/8" centres.

All Brookes Crystals are made to exacting standards and close tolerances. They are available with a variety of bases and in a wide range of frequencies. There is a Brookes Crystal to suit your purpose—let us have your enquiry now.



Brookes Crystals Ltd.

Suppliers to Ministry of Supply, Home Office, B.B.C., etc.
181/3 TRAFALGAR ROAD, LONDON, S.E.10
Phone: GRGreenwich 1828 Grams: Xtals, Green, London



Cadenza

Ribbon Microphone

OVERALL DESIGN: ERIC TOMSON
 ACOUSTICS: STANLEY KELLY
 STYLING: PETER BELL

Designed and Manufactured in England

- True pressure gradient response
- Dual output impedance—30 ohms and 80 k/ohms.
- Microphone assembly fitted with anti-vibration mounting contained in double windshield.
- Available as head only, or with attractive tripod base.

The clean and attractive lines of the dual impedance Cadenza Microphone house an altogether new conception of ribbon and magnet arrangement, giving an output sensibly flat within close limits, 50-12000 c.p.s. The ribbon itself is four times the area usually employed, thus providing increased sensitivity. Because of its extreme thinness (about 1 micron, or .00006 of one inch!) dynamic impedance is actually less. Clever acoustic design gives exceptional freedom from resonant peaks and troughs, particularly the fundamental ribbon resonance, or "bass hump."

Microphone head only, dual impedance.
 Complete with presentation case 8½ gns.



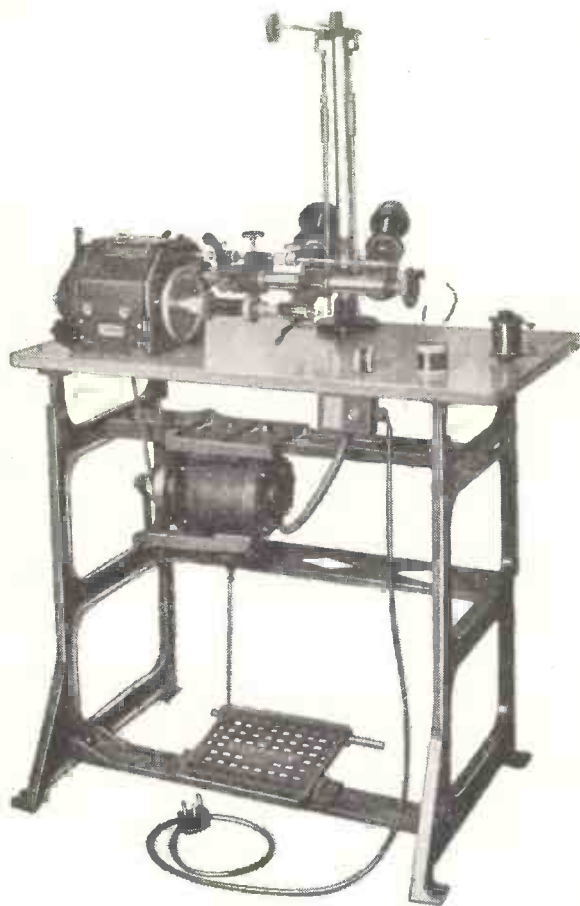
Microphone, tripod desk stand, 11 ft. cable.
 Complete in presentation case 10 gns.

Post the coupon below for illustrated folder and details of range of alternative mountings and accessories.

Distributed by:
SIMON SOUND SERVICE LTD., 46/50 GEORGE STREET, LONDON, W.1.
 Full details of Cadenza please

post this coupon
now

Name _____
 Address _____



AUTOMATIC COIL WINDING MACHINE

Type AII. (25-50 S.W.G.)

Type AIX (19-46 S.W.G.)

COMPLETE WITH

- ★ Cast-iron stand and polished wood table top.
- ★ Dual reel carrier and tensioner.
- ★ ¼ h.p. integral clutch motor with foot control.

THE MOST OUTSTANDING MACHINE ON THE MARKET!

Dustproof construction—up to four coils can be wound simultaneously—micrometer traverse setting—easily adjusted wire gauge setting—cadmium and chromium-plated steel parts—instantaneous re-set counter reads up to 100,000 turns—Wire Tensioning Stand holds two reels.

We will be pleased to send you an illustrated leaflet giving a full technical specification on request.

KOLECTRIC LTD

73 UXBRIDGE ROAD,
EALING, LONDON, W.5.
EALing 8322.

All good 'Labs' use
RadioSpareS

quality components
for design
development and
prototype work

Service Engineers!

Remember—

Radiospares components are delivered absolutely "by return"

EXECUTIVES REQUIRE CRISP, CONCISE REPORTS—DICTATE THOSE DETAILS IN YOUR CAR! VALRADIO DC/AC CONVERTERS MAKE DICTATING MACHINES AND TAPE RECORDERS MOBILE



For use too with Record Changers, Radiograms, Electric Gramophones, Television Receivers, and T.V. from country house lighting plants. (Prices according to instrument.)

INPUTS . ENTREES . ENTRADAS:
6, 12, 24, 32, 50, 110 or 200/250v.
OUTPUTS . SORTIES . SALIDAS
110 v. or 230 v. AC 50 or 60 c/s, 30 to 300 w.

Prices DC/AC Converters:

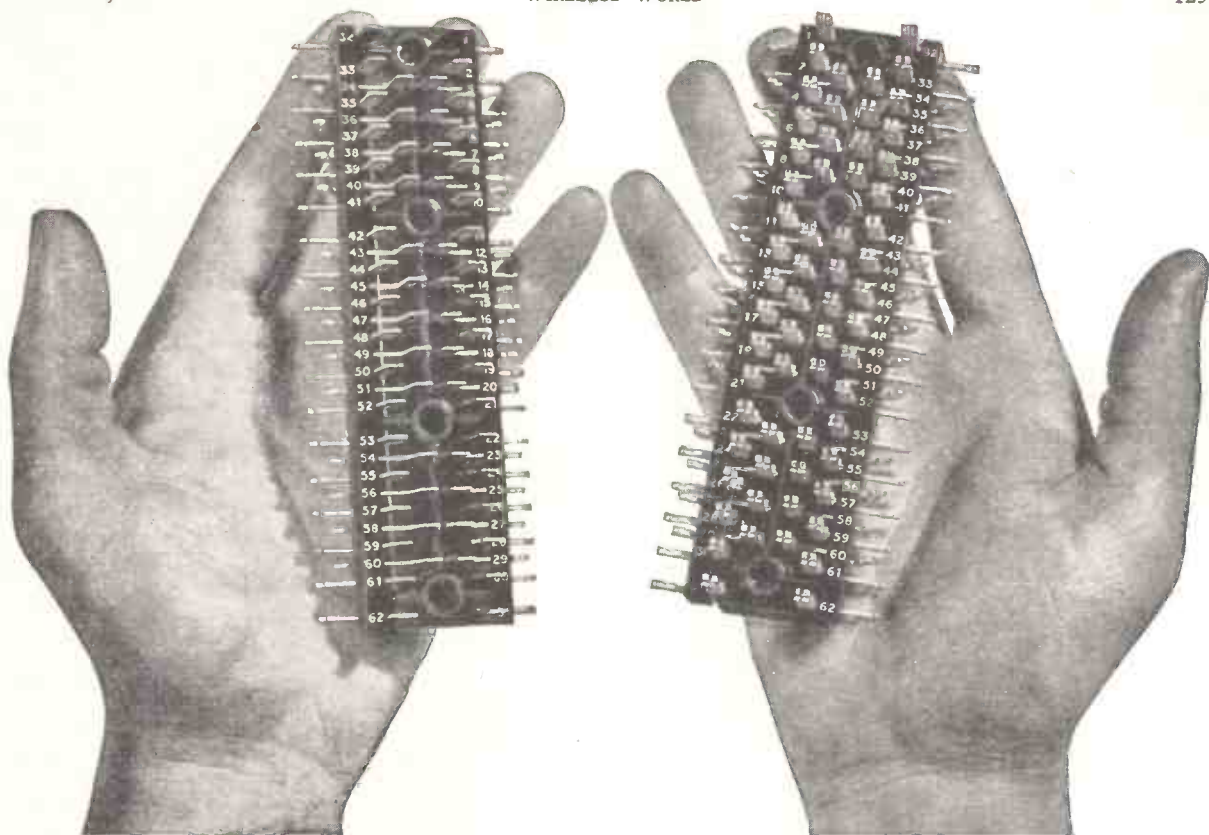
From £3/18/—for Small Motors.
From £12/15/—for Radiograms (including 3-speed Types).

Units complete and ready for use. **VALRADIO.** Write for descriptive folder, WW/C. ACCEPTED AS THE STANDARD by RADIO MANUFACTURERS, the Trade and the Aircraft industry.

Les rapports destinés aux chefs de service doivent être rédigés d'une façon bien concise—ditez-les donc dans votre voiture!
Les convertisseurs C.C./C.A. "VALRADIO" consentent la mobilité aux machines à dicter et aux enregistreurs sur bandes.
Ils peuvent également être utilisés pour changeurs de disques, appareils combinés, électrophones, téléviseurs, etc., partant d'installations d'électricité, particulières.

Las relaciones destinadas a los jefes tienen que redactarse de modo muy conciso—díctenlas en el coche!
Los inversores C.C./C.A. "VALRADIO" les prestan movilidad a las máquinas de dictar y a los grabadores de cinta.
También pueden utilizarse para cambiadores de discos radio-combinados, gramófonos eléctricos aparatos de televisión, etc., aprovechando las instalaciones eléctricas privadas.

Specialists in converters since 1937. **VALRADIO LIMITED.**
BROWELLS LANE . FELTHAM . MIDDX. Phone: Feltham 4242/4837
OVERSEAS ENQUIRIES TO—DEMANDES D'OUTRE-MER A:—
TODA INFORMACION DE EXPORTACION HA DE PELIRSE A:—
E.M.I. SUPPLIES LTD. HAYES MIDDLESEX ENGLAND



Holding out for good connections?

There are almost certainly enough high grade ones in this 62-way connector. It was designed to fulfil an Admiralty requirement that could not be met by any other connector, and you will find it suitable for many rack-mounting applications where low contact resistance, high voltage and current capacity and excellent insulation are major factors.

SPECIFICATION

Contact Resistance:	less than 3 milli-ohms
Insulation:	2kV. between contacts
Voltage rating:	750V. r.m.s. working
Current rating:	10A. max. per single contact
Insertion pressure:	30 lbs.
Withdrawal pressure:	13 lbs.

31-way connector also available with identical specification except insertion and withdrawal pressures are 20 lbs. and 9 lbs. respectively.



POWER CONTROLS LIMITED, EXNING ROAD, NEWMARKET, SUFFOLK
 Telephone: Newmarket 3181/2/3 Telegrams: Powercon Newmarket

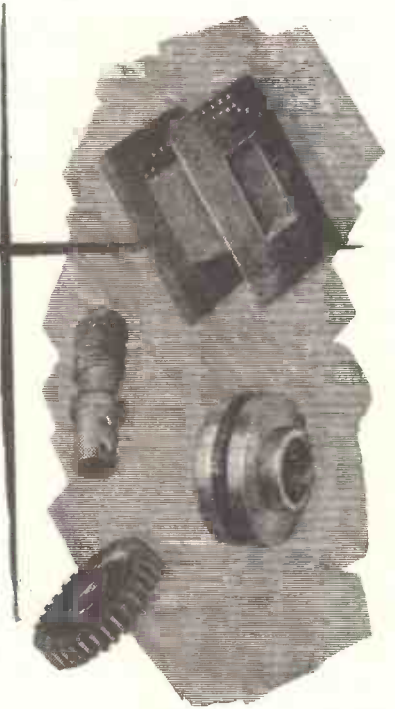
PIRTOID

SYNTHETIC RESIN BONDED LAMINATE

brings you
MATERIAL SOLUTIONS
 to your
CURRENT PROBLEMS



... because the range of PIRTOID Paper and Fabric base laminates affords all the machining qualities needed with consistent uniform dielectric and mechanised strength. Read this booklet, sent gladly on request.



H. CLARKE & CO. (MANCHESTER) LTD

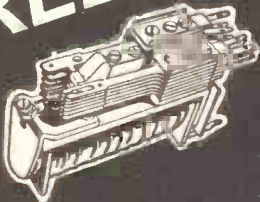
ATLAS WORKS, PATRICROFT, MANCHESTER

Tel. No. ECCLES 5301-2-3-4-5

dmCK4

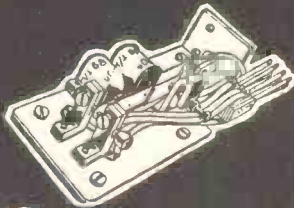
RELAYS

P.O. TYPES
 MANUFACTURED
 TO YOUR
 SPECIFICATION
**PROMPT
 DELIVERY**



3000 TYPES

COILS up to 80,000Ω.
 CONTACTS up to 8 c/o's
 Tropicalizing and impreg-
 nating to order.
 600 and HIGH-SPEED
 TYPES also Supplied.



**LARGE
 STOCKS
 OF
 KEYSWITCHES**

THE KEYSWITCH CO.
 ALL POST OFFICE EQUIPMENT

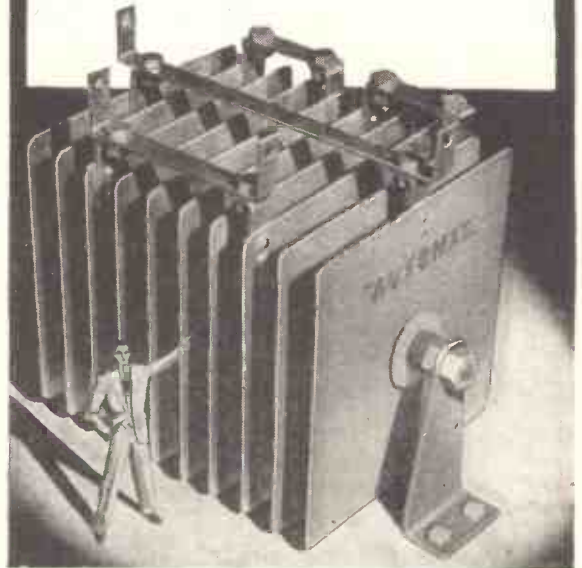
Enquiries to Sales Manager

126 KENSAL ROAD, LONDON, W.10

Telephone: LAD. 0666, 4640 Grams: "Fonequipt", London, W.10

Contractors to Home & Overseas Governments & H.M. Crown Agents

24 HOUR PROTOTYPE SERVICE



EARLY DELIVERY OF HIGH STABILITY
 RECTIFIERS
 to any rating.

AUTOMAT MOORSIDE, SWINTON,
 MANCHESTER. Tel.: SW1 4242
 CW 4325

“Do

you

like

STEREO

?”

Like stereo? We adore it. What other feelings do you expect us to have about a system which uses two speakers where one was enough before? More and more channels—that’s the policy which gets our vote!

Vested interests apart, however, we have found the results to be obtained from the stereo tapes commercially available today most impressive indeed. A good stereo

system demands loudspeakers with a smooth, extended frequency response and a broad, even acoustic distribution. Just the job for the

Vitavox DU120 Duplex Coaxial Loudspeaker in fact.



VITAVOX

DU120 DUPLEX COAXIAL

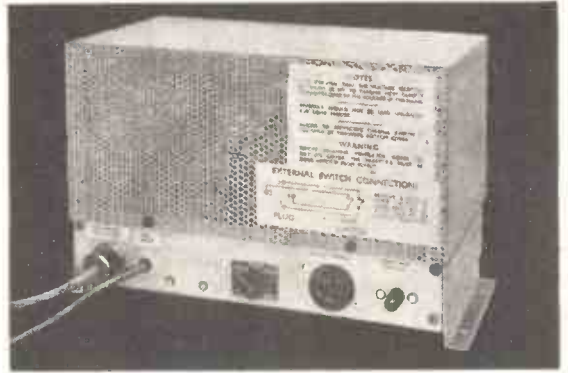


**FULL RANGE
LOUDSPEAKER**

£19.10s.

have you a DC 'bug-bear'?

No longer need D.C. current be a 'bug-bear'. The Felgate ELECTRONIC INVERTER will transform 200/250 volt D.C. current to operate almost any A.C. apparatus needing a power of between 25 and 78 watts. The instrument consists of a hard valve push-pull power amplifier driven by a separate oscillator; there are no moving parts. It is silent in operation and its frequency is very stable. Measuring 9½" x 6½" x 5½" it can be fixed inside a large instrument such as a radiogram, with control switch on the dial. PRICE £13. (no P.T.)



FELGATE electronic inverter

See your dealer today. If any difficulty write to:

FELGATE RADIO LTD. FELGATE HOUSE, STUDLAND STREET, HAMMERSMITH, W.6.

20

Let I.C.S. Train YOU!

Courses on:

Radio and Television Engineering • Radio and Television Servicing • Electronics • Engineering Mathematics • Production Engineering, Management, etc.

Examination Courses for:—

Brit. I.R.E., C. & G. Telecommunications, R.T.E.B. Certificate Society of Engineers, Brit. Inst. of Management.

Whether you plan to have your own business, to become an electronic engineer or to take up a career in industry, an I.C.S. Course will help you to success. You learn at home in your own time, under expert tuition. Moderate fees include all books.

LEARN-AS-YOU-BUILD Practical Radio Course

A basic course in radio, electronic, and electrical theory backed by thorough practical training. You build a T.R.T. and a 5-valve superhet radio receiver, signal generator and multi-tester.

Other Learn-as-you-Build radio courses are available.

POST THIS COUPON TODAY for FREE book on careers in Radio, etc., and full details of I.C.S. Courses.

INTERNATIONAL CORRESPONDENCE SCHOOLS
Dept. 223J, International Buildings, Kingsway, London, W.C.2.

Name..... Age.....
(Block letters, please)

Address

Occupation..... 10 57

INTERNATIONAL CORRESPONDENCE SCHOOLS

1.5 VOLT STABILIZERS



THE A.E. RANGE OF HERMETICALLY SEALED LOW VOLTAGE STABILIZERS

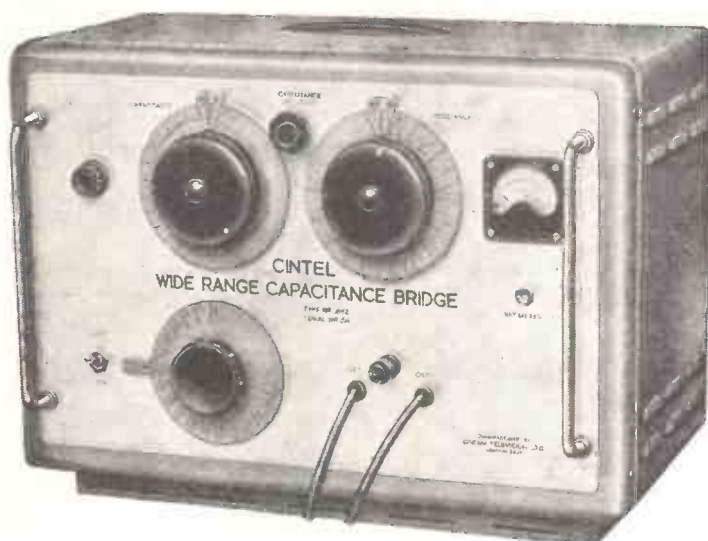
Regulation: .07 V approx.
Max. operating currents: 20 mA to 1 A.
Slope Resistances: 3.5 to .07 Ohms.
Ambient temp. limits: -5° to 70° C.
Useful frequency range: up to 10 Mc/s.

Also available with small "emergency" storage capacity. Suitable for operation in series and parallel. "Filter action" of 400 mA type at 50 c/s equivalent to 60,000µF. Applications include: "Fixed bias" operation, protective ccts., D.C. heater supplies, reference potentials, semi-conductor circuitry, stabilized supplies, etc.

Brochure from Sole Concessionaires:

MERCIA ENTERPRISES LTD. 30 Silver St., Coventry

WIDE RANGE CAPACITANCE BRIDGE



Designed for the accurate measurement of capacitance and resistance in the range 0.002pF to 100 μ F and 1 Ω to 10,000M Ω respectively.

All measurements are made in the form of a three terminal network and components can be measured in situ. Accuracy within $\pm 1\%$ Frequency 1592 c/s ($\omega=10,000$).

Full technical information on this and other 'Cintel' Bridges is available on request.

CINEMA TELEVISION LTD

A COMPANY WITHIN THE RANK ORGANISATION LIMITED
 WORSLEY BRIDGE ROAD • LONDON • S.E.26
 HITHER GREEN 4600

SALES AND SERVICING AGENTS:

Hawnt & Co. Ltd., 59 Moore St., Birmingham, 4

Atkins, Robertson & Whiteford Ltd., Industrial Estate, Thornliebank, Glasgow

F. C. Robinson & Partners Ltd., 122 Seymour Grove, Old Trafford, Manchester 16

Bullers CERAMICS FOR INDUSTRY

High quality material and dimensional precision are attributes of Bullers die-pressed products. Prompt delivery at competitive prices.



We specialise in the manufacture of—**PORCELAIN**
for general insulation
REFRACTORIES
for high-temperature insulation

FREQUELEX
for high-frequency insulation
PERMALEX & TEMPLEX
for capacitors



BULLERS LIMITED

MILTON · STOKE-ON-TRENT · STAFFS

Phone: Stoke-on-Trent 21381 (5 lines) · Telegrams & Cables: Bullers, Stoke-on-Trent

Ironworks: TIPTON, STAFFS London Office: 6 LAURENCE POUNTNEY HILL, E.C.4

Phone: Tipton 1691 Phone: MANsion House 9971

WALMORE ELECTRONICS LIMITED

PHOENIX HOUSE, 19/23 OXFORD STREET,
LONDON, W.1.

Telephone: GERrard 0522 Cables: Valvexpor
For immediate response Telex London 8752

EXPORTERS OF RADIO, TELEVISION AND
INDUSTRIAL TUBES, HAVE PLEASURE IN
INTRODUCING THEIR BRAND



AND INVITE ENQUIRIES FROM BUYING
AND CONFIRMING HOUSES EXCLUSIVELY
FOR EXPORT

SUPPLIERS OF RADIO COMPONENTS
ELECTROLYTICS, AND CATHODE RAY
TUBES

IMPORTANT

ANNOUNCEMENT

A.D.S. RELAYS LTD.

MANUFACTURERS OF 3000 & 600T RELAYS

Wish to make it known that they are

FULLY TYPE APPROVED

TO

INTER SERVICES SPECIFICATION

R.C.S. & R.C.L. 161

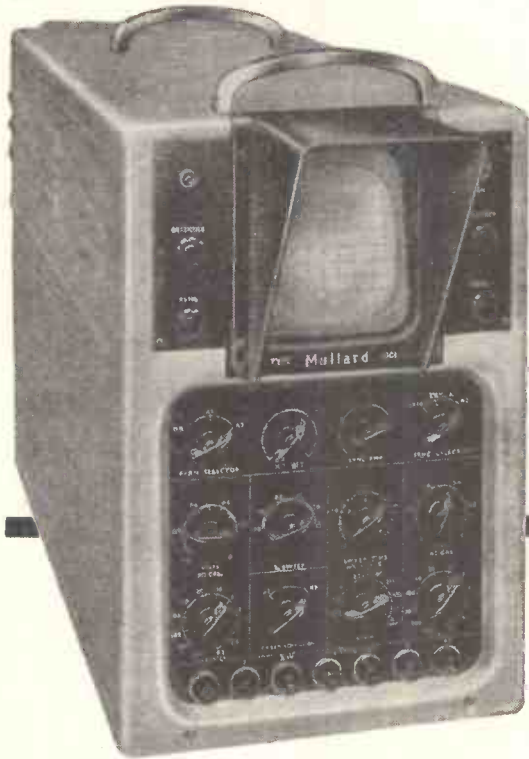
(Certificate Nos. 1000, 1001, 1003 & 1004)

A. I. D.

A.R.B. & ADMIRALTY
APPROVED

A.D.S. RELAYS LTD. Dept. W.W.
12, STORE STREET, LONDON, W.C.1.
Tel.: MUSEum 2453

Internationally accepted...



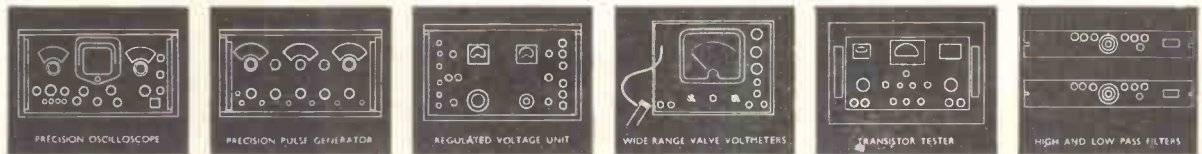
leading technicians
throughout the world
use the
Mullard
Dual Trace Oscilloscope

**The DUAL TRACE OSCILLOSCOPE
TYPE L101 MARK 2 as used by**

- Research Laboratories
- Government Establishments
- Communications and Television
Development Laboratories
- Hospitals
- Universities
- Computer Engineers
- Electricity Supply Authorities
- Audio Engineers
- Nucleonic Engineers
- Instrumentation Engineers
- Aircraft Manufacturers
- Telephone Manufacturers
- Oil Refineries

Scientists and technicians throughout the world recognise that the quick, easy and accurate way to measure and compare waveforms is to use the Mullard Dual Trace Oscilloscope L.101 Mk. 2. Many hundreds of these oscilloscopes are now helping to speed production and research.

Here are some of the advanced design features that have brought this instrument international recognition: Two signals can be locked steady on the graticule for comparison and measurement by the turn of a knob. Two amplifiers preserve their frequency response on all gain settings—each has a 4Mc/s bandwidth (0.1 μ s rise time) irrespective of sensitivity, and a maximum sensitivity of 20mV pk/pk-cm. There is no interaction between channels. Free running or triggered, the time base has sweep speeds from 0.1 μ s/cm to 10ms/cm and the trace may be expanded five times. Both voltage ($\pm 5\%$) and time ($\pm 10\%$) are measured by the null method and calibration accuracy is preserved by a well regulated power supply.



Manufacturers and design engineers are invited to write for full details of the Oscilloscope L.101 Mk. 2 and other instruments in the Mullard range.

MULLARD LIMITED · EQUIPMENT DIVISION · MULLARD HOUSE
TORRINGTON PLACE · W.C.1 · TELEPHONE: LANGHAM 6633



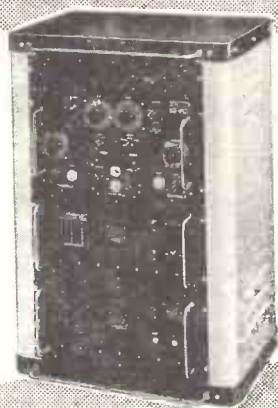
pulse generator

Pulse Generator Type 1298A is designed to produce single and double rectangular positive going D.C. pulses.

The design consists of two independent pulse generators (Channels 'A' and 'B') operated at a common repetition frequency.

A common output (Channel 'C') giving both pulses together is also provided.

Type
1298A



SPECIFICATION

P.R.F.: 50 pulses per sec. to 50,000 pulses per sec.

Pulse Width: 0.1-10µsec. in 20 steps.
'A' and 'B' Pulse Separation: 0-110µsec. dependent on p.r.f. and pulse width.

Amplitude: 'A' and 'B' Channel: 1-100v.
'C' Channel (i.e. 'A' and 'B' pulses):
(a) High output plug 1-50v.
(b) Low output plug 10µv-1v.

Output Impedance: 75 ohms.

Monitor Locking Pulse: Square Wave 40v. pk-pk., positive edge rise time .75µs preceding 'A' pulse by .75µs approx.

Dimensions: 31½" x 19" x 14" (80cm. x 48cm. x 35.5cm).

Weight: 260 lb. (119Kg).

DYNATRON

NUCLEONIC AND
ELECTRONIC DEPARTMENT
Dynatron Radio Ltd.
Maidenhead, Berks.

Scalers · Pulse Generators · Pulse Analysers · Power Units · Probe Units · Pulse Amplifiers · Instrument Racks

METERS

To B.S.89 Calibrated and scaled to your requirements.

COMPREHENSIVE RANGE AVAILABLE
EX-STOCK or TO ORDER

DELIVERY 7-14 DAYS

Stockists of:

ERNEST TURNER, BALDWIN, EAC,
WEIR and LEADING MANUFACTURERS' INSTRUMENTS.

MOVING COIL, MOVING IRON,
THERMO COUPLE, ELECTROSTATIC.

CIRCULAR (Flush or Projecting),
SQUARE, RECTANGULAR, & INDUSTRIAL PATTERNS.

We can supply meters with Non-Standard Current and Voltage Ranges to any specification.

Owing to increased capacity we are now able to accept customers' own Meters for
SCALE DRAWING & LETTERING

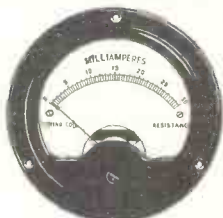
Manufacturers of:
ELECTRONIC TEST EQUIPMENT, NETWORK ANALYSERS, EDUCATIONAL, GEOPHYSICAL and SPECIAL INSTRUMENTS, PORTABLE MULTIRANGE TEST SETS at 1 megohm per Volt.

May we quote for your requirements?

ANDERS ELECTRONICS LTD.

103, HAMPSTEAD RD., LONDON, N.W.1. 'USton 1639

Suppliers to Govt. Depts., B.B.C., Tech. Colleges,
Leading Manufacturers & Research Laboratories



Typical 2½in. & 3½in. Round Flush Pattern.

ASK ARTHURS FIRST

LARGE STOCKS OF VALVES and C.R.T.s. METERS, Avo, Advance, Taylor, and Cossor Oscilloscopes in stock. AMPLIFIERS, Leak, Trix & Quad. GRAM UNITS, Garrard & Collaro. Collaro TRANSCRIPTION UNIT 2010PX.

LOUDSPEAKERS, Goodmans, Wharfedale, WB Tannoy and leading makes. PICK-UPS and STYLII of most makes. TAPE RECORDERS, Grundig, Philips, Truvox, Playtime & Ferrograph.

LATEST VALVE MANUALS

Mullard, 10/6; Osram & Brimar No. 6, 5/- each; Osram Part 2, 10/-.

Postage 9d. each extra.

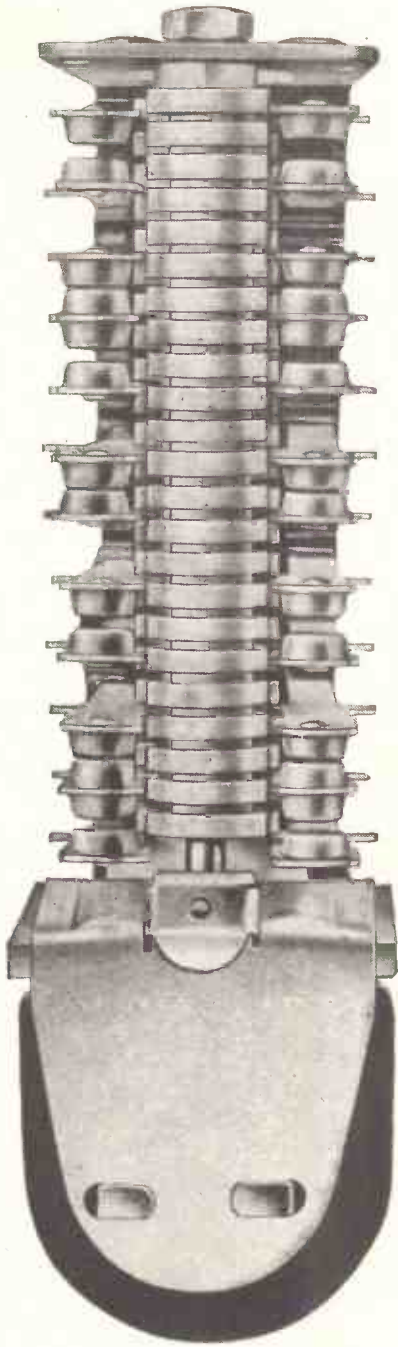
PARTICULARS ON REQUEST

Terms C.O.D. OR CASH with order.

Arthur's
PROPS: ARTHUR GRAY, LTD.

EST.
1919

GRAY HOUSE, 150-152 CHARING CROSS ROAD, LONDON, W.C.2
TE Mable Bar 5833/4 and 4765 Cables TELEGRAY, LONDON



**You don't often see
a relay like this !**

Series 258

- **Fast operating**
- **Negligible bounce**
- **Exceptional life**
- **Exceptional insulation**



Magnetic Devices
A.I.D. AND A.R.B. APPROVED LTD.

MAGNETIC DEVICES LTD., EXNING ROAD, NEWMARKET, SUFFOLK
Telephone: Newmarket 3181/2/3 Telegrams: Magnetic Newmarket

MD 21A



You wouldn't listen to GRAND OPERA in a GREEN HOUSE...

... and you need to listen to Hi-Fi in surroundings that resemble acoustically the room in which you will use the equipment at home.

The place to Judge Hi-Fi is **BARNES BAYSWATER**

Here you can sit at ease and compare the performance of the latest Hi-Fi equipment of the leading makers.

Whether you mean to buy now or later, whether your tastes are classical, jazz or "pop," you are cordially invited to call at our department and listen to Hi-Fi—you'll find it an unforgettable experience.

To Barnes Pianos, 73/77 Queensway, London, W.2.
Please send me literature about Hi-Fi equipment.

NAME _____

ADDRESS _____

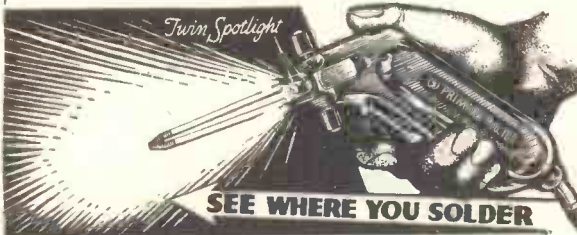
BO182A

It is understood that this places me under no obligation to buy.

BARNES
PIANOS · BAYSWATER

HI-FI DEPARTMENT
73/77 Queensway, London, W.2
Tel : BAYswater 3206

Ready for use in 6 secs.



SOLDERING GUN PRIMAX with Built-in Spotlights Model 100 99/6

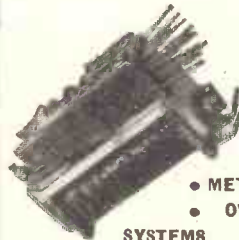
Saves Pounds in Time—See What You Solder
Available 110V, 200/220V, 220/250V. Only weighs 34 oz.
Practically indestructible. Thousands of satisfied users.

PRIMAX Soldering Gun (Model 60)
Save Pounds in Time Similar to above but without Spotlights
Ready for soldering in 6 seconds All Voltages **PRICE 74'6**

PRIMAX Special Model 50
for use off car batteries 6v; 12v; 24 volts **PRICE 74'6**
ONE YEAR'S GUARANTEE (except Bit and lamps)

Sole Distributors : **S. KEMPNER LTD.** 29 PADDINGTON STREET, LONDON W.1. Phone: H U.ter 0755
Dept. 23IK Foreign Made

MAGNETIC RELAYS TYPES



3000 and 600
Supplied to specification
for the following uses:—

- METER PROTECTION • TIME DELAY
- OVERLOAD TRIPS • ALARM SYSTEMS • FLASHING & PULSING
- PROCESS CONTROL • TIMING DEVICES • AERIAL CHANGE-OVER • MAINS FAILURE PROTECTION
- COMPLEX OR SEQUENCE SWITCHING • SELECTION & COUNTING SYSTEMS • HIGH VOLTAGE SWITCHING

(CONTACT INSULATION UP TO 2KV)

Consult us with your problems

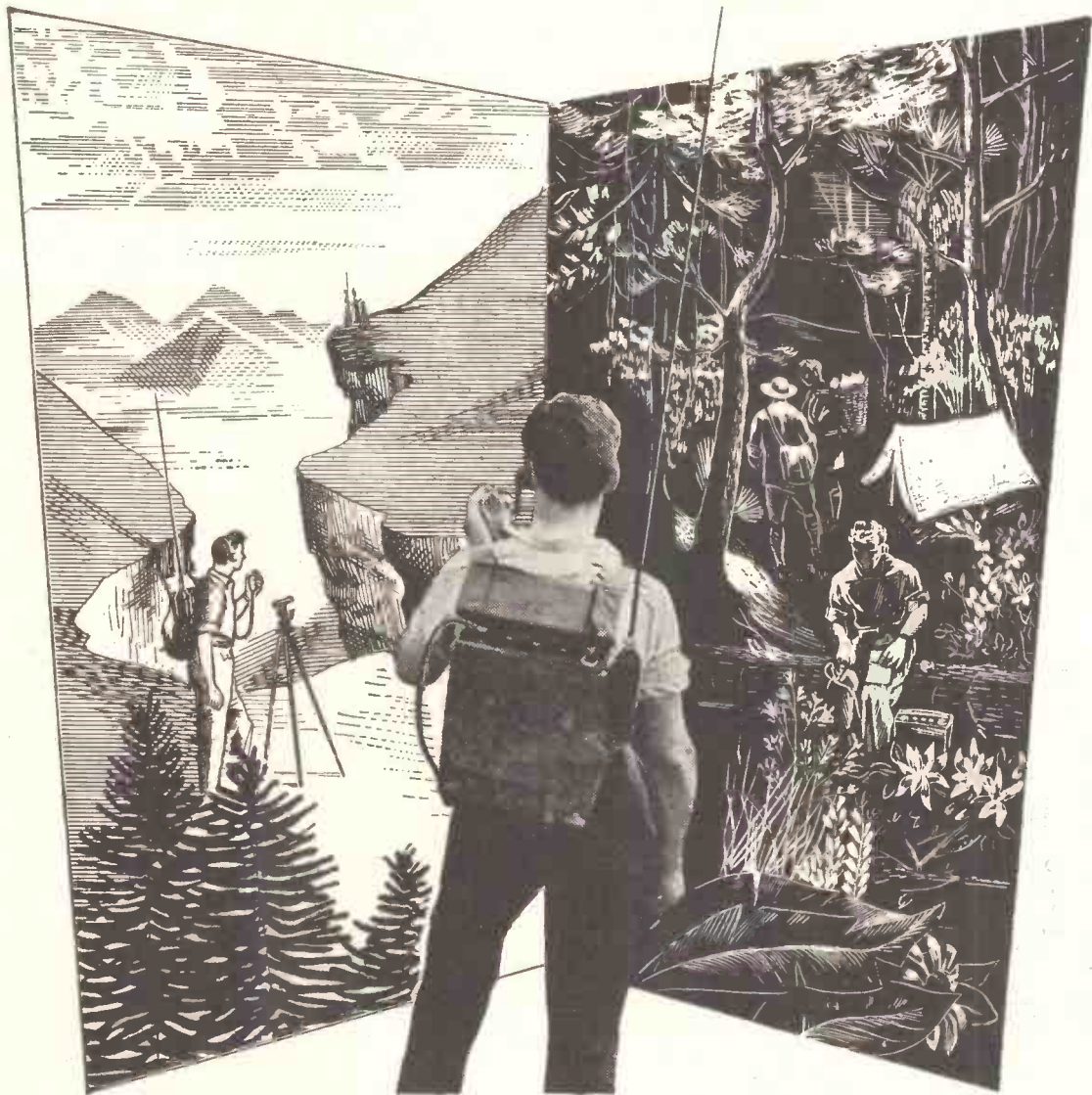
POLARISED, HIGH SPEED, A.C. & TELEGRAPH RELAYS IN STOCK

**ELECTRO MAGNETIC COUNTERS
UNI-SELECTORS**

KEY SWITCHES, P. O. and LOW LOSS

JACK DAVIS (RELAYS) LTD.

(Dept. "W.") TUDOR PLACE, LONDON, W.1
MUSEUM 7960 LANGHAM 4821

BCC**H. F. PACKSET****TWO CHANNELS FOR DAY & NIGHT OPERATION**

SIMPLE TO OPERATE — NO SPECIAL SKILL REQUIRED

PACKSET H.F. 15B TECHNICAL SPECIFICATION

Channel 1: 2.5—4.5 Mc/s.

Channel 2: 4.5—7.5 Mc/s.

Transmitter: C.W. or R.T. Power output 1.5 watts.

Receiver: 3-6 μ V for 12 dB signal/noise ratio R.T.:

20 dB ratio C.W.

Power Supply: Vibratory. Two 2-volt accumulators.

BRITISH COMMUNICATIONS CORPORATION LIMITEDWembley
Telephone: Wembley 1212England
Cables: BeeCeeCe_e



Write for this NEW catalogue of technical information on the design, performance and characteristics of MUREX Sintered Permanent Magnets, including 'Sincomax' magnets. A selection of the range of standard magnets is illustrated and dimensional details given.

MUREX LTD (Powder Metallurgy Division) RAINHAM • ESSEX
 Telephone: Rainham, Essex 3322. Telex 28632. Telegrams: Murex, Rainham-Dagenham Telex
 LONDON SALES OFFICE: CENTRAL HOUSE, UPPER WOBURN PLACE, W.C.1.



8G50 SIGNAL GENERATOR covers 100 kc/s to 80 Mc/s in six continuous ranges on fundamentals (not harmonics) either modulated 400 cps or CW. Frequency accuracy 2%. Uses EF91, 6C4 and RM1 with double wound mains transformer. The scale is directly calibrated on all ranges with total scale length of over 60 inches. Housed in de luxe olive green metal case with carrying handle with scale of engraved Perspex. Size 9in. x 13in. by 4in. deep. Only £5/10/-, plus 6/- carriage and packing.

VV50 VALVE VOLTMETER measures up to 250 volts D.C., R.F., and A.F. with input impedance of 11 Megohms. Complete with probe unit ready for mains operation at £7/19/6, plus 4/6 carr./packing.

CR50 BRIDGE measures from 10 pFd to 100 mFd and from 1 ohm to 10 Megohms in fourteen ranges, having total scale length of over 120 inches. Indication of balance is given by a magic eye fed from a high gain pentode amplifier. Leakage test for condensers. Internal standards are "Constantia" 1% resistors. In case specially designed for bench use with sloping panel. Complete and ready for operation from A.O. mains. ONLY £7/18/- plus 4/6 carr./packing.

Further details sent by return of post on receipt of self addressed, stamped envelope. Trade supplied direct.

RUSH your order now to:-

GRAYSHAW INSTRUMENTS

126 SANDGATE HIGH STREET, FOLKESTONE, KENT

'Phone: Folkestone 78613

BAND III CONVERTOR

for ANY SET in ANY AREA

This unit has been widely used since I.T.A. Transmission began to convert all types of sets, Superhet and T.R.F. to receive on Band III.

Unlike many other convertors this unit is small enough to be fitted inside your cabinet, enabling the job to appear finished and perfectly safe for all to use

The wiring is simple to follow, and alignment is not difficult.

- IT will convert any set, any age, T.R.F. or Superhet.
- IT includes station switching.
- IT provides pre-set contrast balancing.
- IT uses only one aerial input for both bands.
- IT provides manual tuning on Band III.
- IT is totally screened.
- IT completely rejects unwanted signals.
- IT requires no additional power supply where either 6.3 v. or .3 amp. heater line is available.

CONVERTOR wired and aligned with fitting instructions	£3 10 6
KIT complete in every detail, less knobs.....	£2 10 6
KNOBS each	1 0
CIRCUIT and instructions in detail (free with kit)	1 6
KITS made up by customers checked and aligned, including post	12 6

When ordering please state present B.B.C. Station and I.T.A. Orders over £2 post free.

C. & G. KITS

285, LOWER ADDISCOMBE ROAD, ADDISCOMBE, CROYDON, SURREY

Phone : ADDiscombe 5262

NEW RCA AUTOMATIC ELECTRON TUBE TESTER



...RCA WT-110A provides
simplicity, accuracy, and speed
never before possible

...pays for itself in one year—
by saving testing time

Here is tube testing with no wasted motion—no time-consuming searching and setup of old-fashioned roll charts or socket panels, no dial twisting, no fumbling. It's truly *automatic testing* with speed and simplicity that will amaze you!

Here is virtually an obsolescent-proof design—no roll charts to constantly maintain or replace. All data and setup are supplied on the 241 prepunched cards provided with the instrument. These cards cover most of the currently active TV tube types. In addition, accessory cards and punch are available for punching your own cards, enabling you to keep your instrument current as new tube types are released.

See it at your RCA Distributor's, or write to Dept. TE-49-J at address below for complete information.

SIMPLE AS A—B—C!

A. merely insert card in matrix



B. flip power lever to "power-on" position



C. press calibrate lever and adjust calibration control



TUBE IS NOW UNDER TEST!

ACCURATE AUTOMATIC ANALYSIS

- automatically sets up all socket connections and all operating voltages.
- meter protected against burnout.
- checks tubes for transconductance, gas, and shorts between elements.
- provides all combinations of heater voltage, 10 bias voltages, 11 values of cathode resistors, and 50 sensitivity ranges.
- tubes such as rectifiers can be tested under heavy load currents, up to 140 ma per plate.
- leakage test with high and low sensitivity ranges.
- 12-volt plate and screen supply for testing new car radio tubes.
- calibration card for checking instrument.
- 350 active card magazine capacity with storage capacity of 350...a total capacity of 700 cards.

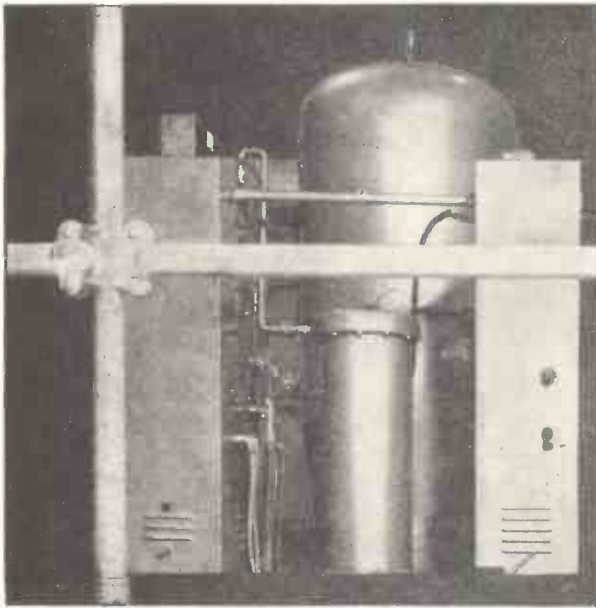


RCA INTERNATIONAL DIVISION

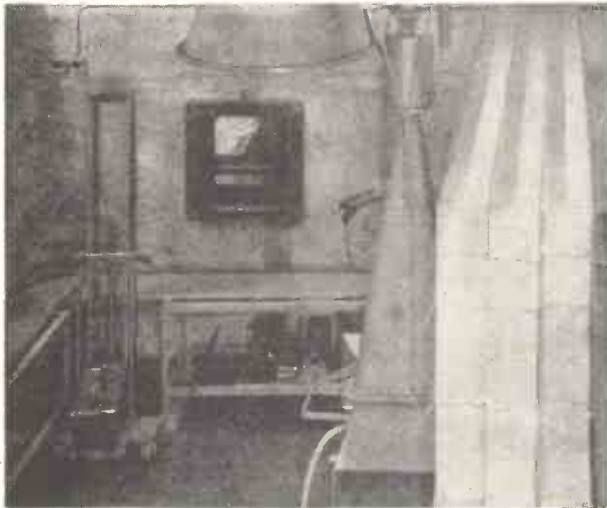
RADIO CORPORATION OF AMERICA

30 ROCKEFELLER PLAZA, NEW YORK 20, N. Y., U. S. A.

Trademark(s) Registered



The first irradiated electrical products



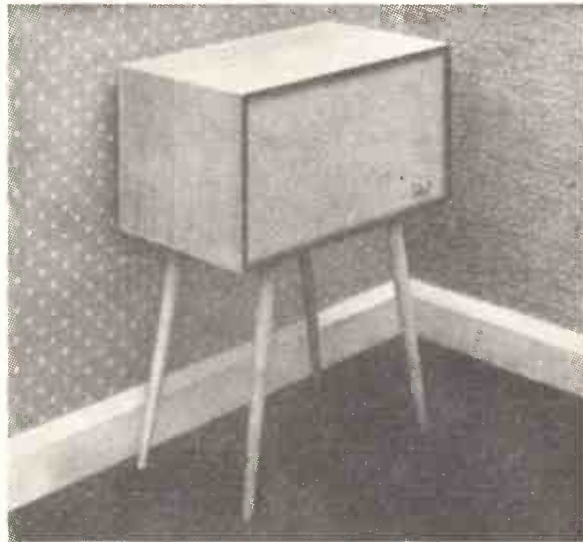
Mersey Cable Works Ltd. takes pride in being the first manufacturer in Europe to offer irradiated equipment wire, insulating sleeving and electrical tapes for improved high temperature performance. As is inevitable where new techniques are employed, production facilities are strictly limited. For the time being at least, it is regretted that supplies of MERAD IRRADIATED EQUIPMENT WIRES are restricted. For further information write for literature.

merad IRRADIATED EQUIPMENT WIRE BY MERSEY CABLES

'MERAD' IS A REGISTERED TRADE MARK
MERSEY CABLE WORKS LTD LIVERPOOL 20

MCW2

A  COMPANY



**Senior CQ
 Reproducer**

A small high fidelity speaker system, the Senior CQ is capable of outstanding performance. It is outwardly identical with the Standard CQ Reproducer but includes a "tweeter" and crossover. The frequency response extends from 35 to 17,000 c/s, and power handling is in excess of 6 watts. Oak £16.16s. Walnut £17.17s. Tax paid. From your local dealer. **R.G.A. Sound Services (Plymouth) Ltd., 2 Sarnesfield Road, Enfield, Middlesex**

**Introducing!!!
 THE "MARINETTE"**



**BAND III
 III
 INDOOR AERIAL
 16'6
 RETAIL**

Complete with 9 ft low-loss cable.

Available in Pastel Colours—Red, Blue and Primrose, with anodised Gold-tinted elements.

"IMPORTANT SELLING POINTS"

The "Marinette" elements are adjustable, giving the highest possible gain in all installations, with minimum ghosts. Variable mounting positions with key holes on base for affixing to wall if desired.

Maximum "eye-appeal". The "Marinette" need not be hidden.

TRADE ONLY

Enquiries Invited

A Product of **MARINE AERIALS LIMITED**
 210 DEPTFORD HIGH ST., LONDON, S.E.6. Tideway 3637.

Connoisseur 3 SPEED MOTOR

The turntable with a 4% variation on all three speeds.

The Connoisseur motor is made for the perfectionist. It is one of the finest turntables in the world.

The speed change is arranged mechanically and gives a 4 per cent variation on all speeds. A synchronous motor, which is virtually vibrationless with low noise level and hum induction, maintains a constant speed at all settings. There is no braking action to obtain speed change.

The 12in. turntable is lathe turned in non-ferrous metal. The main spindle, which is precision ground and lapped to mirror finish, runs in phosphor bronze bearings.

A sound, precision engineering job, the Connoisseur motor provides the foundation for perfect reproduction.

Price £20, plus P. Tax £8/11/-.



Matching Connoisseur Pick-up Mark II with a frequency range from 20-20,000 cycles:

Pick-up complete with I head fitted with Diamond armature £8/19/- plus P. Tax £3/16/6.

A. R. SUGDEN & CO. (ENGINEERS) LTD.

WELL GREEN LANE, BRIGHOUSE, YORKSHIRE.

Phone: Brighouse 2397. Grams: Connoisseur, Brighouse.

OVERSEAS AGENTS:

SOUTH AFRICA: W. L. Proctor (Pty.) Ltd., 63, Strand Street, Cape Town. U.S.A.: Ercona Corporation, 551 Fifth Street, New York, 17, N.Y. CANADA: The Astral Electric Co. Ltd., 44, Danforth Road, Toronto 13, Ontario. NEW ZEALAND: Turnbull & Jones Ltd., Head Office, 12/14, Courtenay Place, Wellington. HONG KONG: The Radio People Ltd., 31, Nathan Road, Hong Kong.

MAIN DISTRIBUTORS:

AUSTRALIA: British Merchandising Pty. Ltd., 183, Pitt Street, Sydney, and J. H. Magrath (Pty.) Ltd., 208, Little Lonsdale Street, Melbourne. EAST AFRICA: International Aeradio (East Africa) Ltd., P.O. Box 3133, Nairobi. MALAYA: Eastland Trading Co., 1, Prince Street, Singapore.

G-V THERMAL RELAYS

A new kind of timing and sensing element, rugged and precise, and having exceptional operational and environmental characteristics.

HERMETICALLY SEALED—AND STILL ADJUSTABLE

TIME DELAY TYPES

Covering 0.1—300 sec. Also instant reset.

VOLTAGE AND CURRENT SENSING TYPES

Covering 15mA—5A and 2—230V. Differential <1%.

Ambient Range: -70° C. to +150° C.

Excellent vibration and shock resistance.

Energization: D.C. or A.C. of any frequency.

Weight: 1-1½ oz. Mountings: B7G, Octal and Flange.

Technical Folder from:

MERCIA ENTERPRISES LTD.

Godiva House • Allesley Old Road • Coventry.

Phone: 2279





Brenell

—for the man who wants
most for his money

THE big feature that attracts everyone to Brenell is its magnificent workmanship and the astonishing simplicity of its mechanism. By clever engineering methods, production costs have been cut and performance standards raised to new levels. This is why Brenell can offer you so much more for your money—a Tape Recorder that will enable you to make recordings from microphone, radio or disc, of excellent quality in your own home. Send for the literature and get the facts about the many Brenell exclusive features without delay. Available from all Hi-Fi and Tape Recording specialists.

BRENELL FEATURES

- Heavy Duralumin Baseplate ● Three independent motors
- Three speeds: 3 $\frac{3}{4}$, 7 $\frac{1}{2}$ and 15 i.p.s. ● Takes 8 $\frac{1}{4}$ inch Reels
- Foolproof drop-in tape loading ● Instant stop without tape spill ● 2-knob interlocked control ● Magic Eye Recording Indicator ● Fast re-wind in 45 seconds ● Azimuth sound-head adjustment ● Digital Rev. Counter (optional extra)

Brenell Mark IV Tape Recorder (including 1,200 ft. of Tape) complete in cabinet as shown 53 gns.

Brenell Tape Deck only 22 gns. Brenell Pre-Amp Unit 16 $\frac{1}{2}$ gns. Brenell Power Pack £4.18.0d. Rev. Counter (if required) 30/-

In case of difficulty write to Sole Manufacturers:

Brenell Engineering Co. Ltd.

1A DOUGHTY ST., LONDON, W.C.1. Phone: HOLborn 7358

CHAS. H. YOUNG, LTD.

SPECIAL OFFERS — DON'T BE TOO LATE

D.104 CRYSTAL HAND MIKES

List £6. Complete with 6ft. of cord and plug. ONLY £3.10.0 each
AMERICAN PRECISION HETERODYNE FREQUENCY METERS. Type L.M.14. 125 kc/s to 20 Mc/s. Crystal checked. Complete with calibration book, etc. Absolutely as new. £25 each.
 VERY LIMITED QUANTITY AVAILABLE

ELECTRON MULTIPLIERS. Type 931A. Only 50/- each, or 2 for £4/10/-. Holders available at 2/- each.

3IN. AERIAL INSULATORS. Ribbed glass. 1/6 each or 6 for 7/6. 12 or more post free.

CONDENSERS. TCC type III, 8 mfd. 1,000 v. List over £3. Only 10/6. Post 1/9. 8 mfd. 750 v. 5/6 each. Post 1/6.

COPPER AERIAL WIRE. 14 g. H/D 140ft. 17/-, 70ft. 8/6. P. & P. 2/-, Stranded 7/25, 140ft. 10/-, 70ft. 5/-. P. & P. 2/-.

RACK MOUNTING PANELS, all 19in. long by 5 $\frac{1}{2}$ in., 7in., 8 $\frac{1}{2}$ in., or 10 $\frac{1}{2}$ in., 5/9, 6/6, 7/6, 9/- respectively. Post 2/-

ABSORPTION WAVEMETERS. 3 to 35 mc/s. in 3 switched bands, complete with indicator bulb. 17/6. Post free.

SEMI MIDGET I.F. TRANSFORMERS (by well known maker). 10.7 mc/s and 465 kc/s. Can be used as 10.7 mc/s or 465 kc/s singly. Only 9/11 per pair, postage 9d.

HEADPHONES. High resistance (4,000 ohms), very sensitive. Bargain price only 12/6 pair. P. & P. 1/6.

AMERICAN BREAST MIKES. Swivel head. Push to talk and lock on switch. Beautiful job. Only 12/6. P. & P. 1/6.

BRITISH BREAST MIKE UNIT, complete with pair of 4,000-ohm phones in strong wooden carrying case, 8 $\frac{1}{2}$ x 4 $\frac{1}{2}$ x 7 $\frac{1}{2}$. Ideal for mobile operators. Only 17/6. P. & P. 2/-.

LOW RESISTANCE HEADPHONES. New ex-W.D. stock. C.L.R. types. Only 8/6 pair. P. & P. 1/6. Special Terms Quantities.

Most comprehensive stock of HiFi equipment in the Midlands, including QUAD, LEAK, W.B., RCA, ROGERS, WHARFEDALE, GOODMAN, etc. Details and demonstrations with pleasure.

NO C.O.D. UNDER £1

All Mail Orders to Dept. "W." Please print your name and address.
CHAS. H. YOUNG LTD., 110 DALE END, BIRMINGHAM 4.

Phone: CENTRAL 1635

KAYE

ELECTRICAL MANUFACTURING CO.

Manufacturers of P.O. types
3000 & 600 Relays.

Contacts

Up to 8 c/o $\frac{1}{2}$ or 1 amp.
 Up to 4 c/o 5 amp.
 Insulation up to 650 v.

Coils

Up to 100,000 Ω , guar.
 + or - 3% on turns.
 + or - 5% on ohms.

All new materials only used. Ordinary or tropical finish to Specification. Fully made and adjusted to A.I.D.—I.E.M.E. or P.O. Standards.

Send for our Free 6 page Relay information folder.

**Havelock Works, Havelock Place,
 Harrow, Middlesex**

Telephone: Harrow 1432

Suppliers also of complete range of relay component parts.

THERE IS MORE THAN HI-FI AT 189 EDGWARE ROAD

There is more than London's largest and most varied ranges of stocks for the constructor. There is **SERVICE** which covers everything possible from same-day service on orders received by post, beautifully equipped demonstration room and unbiased advice to supplying the kind of items you just cannot find anywhere else. You will find the staff helpful and knowledgeable in everything to do with audio-electronics. You will find up-to-date stocks as well as spares and replacements for less modern equipment. In a word, you will most likely find just what you want at 189 first.

AMPLIFIERS, TUNERS, KITS

Tele-Radio Williamson	£25 0 0
Tele-Radio Economy Pre-Amp	£6 16 6
Osram 912 (with pre-amp).....	£24 6 7
Jason F.M. Tuner	£5 5 0
Jason Fringe Area Model.....	£6 0 0
Jason Switched Tuner	£9 0 0
Jason Power Pack	£2 1 9

(Send S.A.E. for Lists on above as required.)

COMPLETE EQUIPMENT

Leak TL.12 Plus	£18 18 0
Leak Varislope Mk. III.....	£15 15 0
Rogers Junior Amplifier	£17 0 0
Rogers Mk. III Control Unit	£12 0 0
Pilot HFA/12 Amplifier	£21 0 0
Pilot HFC/12 Pre-Amp	£16 16 0
Quad II Amplifier	£22 10 0
Quad Control Unit	£19 10 0
Rogers F.M. Tuner	£24 17 0
Leak F.M. Tuner	£35 10 0
Jason Perfect Switched F.M. Tuner	£15 12 9

SPEAKERS, PICKUPS, MOTORS

Westrex complete in cabinet.....	£169 0 0
Acoustilens HF Unit	£69 10 0
Bass 20/80 Unit	£33 15 0
Dividing Network	£13 10 0
Complete Kit of Speakers and drawings.....	£116 2 0
Wharfedale AP/10 Enclosure for 10in. speakers	£15 0 0
Wharfedale SFB/3	£39 10 0
Tannoy Canterbury 12in. DC.....	£57 15 0
Tannoy 12in. Dual Concentric.....	£29 5 0
G.E.C. Metal Cone Speaker.....	£9 5 0
G.E.C. Presence Unit	£3 9 6
TSL LP312-2	£14 19 6
Simon Cabinet Speaker	£31 10 0

Full ranges by Wharfedale, Goodmans, T.S.L., etc.

Leak Pick-Up with one head (diamond)	£13 16 5
Garrard TPA/10 P.U. with Trans.	£14 15 11
Goldring TRI Arm	£11 13 6
Goldring 500 Cartridge (diamonds)	£9 16 0
Connoisseur with diamond head	£12 15 0
Collaro Trans. with PX head.....	£5 7 5
Collaro 4T/200 Trans. Motor.....	£14 18 0
Garrard 301	£26 8 3
Connoisseur	£28 11 0

TAPE

Tele-Radio Masterlink M.2 Record/Pre-amp Unit, powered	£28 7 0
Ferroglyph 3AN	£79 16 0
Wearite 3A Deck	£35 0 0
Wearite 3B Deck	£40 0 0
Vortexion 2A	£92 4 0
Brenell Recorder	£55 13 0
Collaro Mk. III	£22 0 0
Brenell	£23 10 0
Film Industries Ribbon Mic.....	£8 15 0
Lustraphone "Ribbonette" Mic.	£7 17 6
Lustraphone "Lustrette" Mic.	£3 7 6
Reslo RBL/T Mic.	£8 15 0
Wearite De-Fluxer	£2 10 0
Bib Splicer	18 6
Wearite Tape Recording Accessories.	

Tapes by leading makers including Scotch Boy, E.M.I., Ferratope, B.A.S.F., etc.

VALVES, COMPONENTS, ACCESSORIES, MATERIALS, BOOKS AND SERVICE

Our 56-page catalogue with latest additions of value to all who build and listen. 1/3 post paid.

TELE-RADIO (1943) LTD. 189, Edgware Road, London, W.2

Telephone: PADdington 4455-6

BOOKS THAT WILL HELP YOU TO ENJOY PERFECT TELEVISION RECEPTION

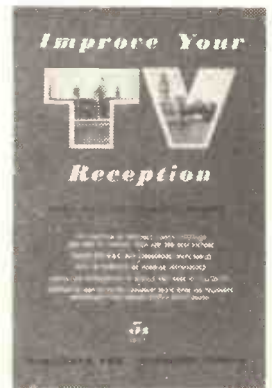
Correcting Television Picture Faults



69 pp. 150 photographs
3s 6d net by post 3s 9d.

This book uses about 150 remarkable photographs of actual faults appearing on the screen of a television receiver, while the accompanying text explains to the ordinary viewer what action can be taken to remedy the faults. Further details of a more technical nature are included for the service engineer, the advanced amateur and the home constructor.

Improve Your Television Reception



112 pp. 134 illustrations
5s net by post 5s 4d.

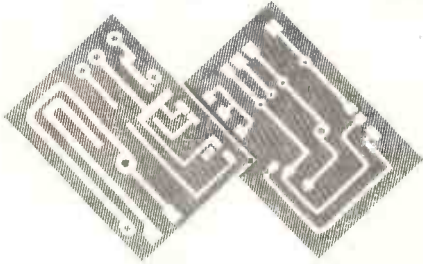
Gives a clear and comprehensive explanation of the functions of the various controls on a television set and precise instructions on how to operate these controls to obtain the best results on the screen. Over 100 telemaps, reproduced from genuine photographs, illustrate the behaviour of the set under various conditions. Also shows how interference may be eliminated or minimised.

By John Cura and Leonard Stanley

from all booksellers

Published for "Wireless World" by Iliffe & Sons Ltd., Dorset House, Stamford Street, London, S.E.1

Great Developments at Bisley in Printed Circuits



P.C.D. LTD.

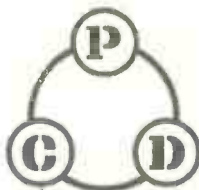
**(PRINTED CIRCUIT DEVELOPMENTS)
AND
PHOTO PRINTED CIRCUITS LTD**

announce that they have joined forces, so that under the vigorous management of P.C.D. Ltd., the production facilities at Bisley will be geared up to give a new and better service to the trade.

THESE FACILITIES INCLUDE :-

- 1 48 hours prototype service from 1:1 transparencies.
- 2 Speedy production follow up.
- 3 Full facilities for blanking, piercing, and assembly—plating in Rhodium, Silver or Gold.
- 4 Consistency, reliability, economy in time, weight, space, material.
- 5 Complete development facilities.

Try us out — AND SEE THE DIFFERENCE



PCD LTD
PRINTED CIRCUIT DEVELOPMENTS
INCORPORATING PHOTO PRINTED CIRCUITS LTD.

GUILDFORD ROAD, BISLEY, SURREY.
TEL: BROOKWOOD 2200

A member of the Camp Bird Industries Group

TELENG SIGNAL LEVEL METER

REGD. TRADE MARK

Type SL 3/B

A battery operated valve voltmeter for measurement of Television and F/M signals as would appear at the down lead end of Aerial Installation or on Cabling of Wired Television or Communal Aerial Systems.

WITH THESE ADVANTAGES

- ★ Turret channel selection.
- ★ Audible signal recognition.
- ★ Free from interference injection via input.
- ★ Probe unit for cable measurements with minimum mismatch.



List M 3 gives full details and will be forwarded on request.

RANGE: 25 μ V to 25 mV in three (attenuator) ranges, or with probe—250 μ V to 250 mV. Frequency Coverage: 40—220 mc/s (Bands 1, 2 & 3).

TELEFUSION ENGINEERING LIMITED
"Teleng Works," Church Road, Harold Wood Romford, Essex.
Ingrebourne 2901

PARALEX ADJUSTABLE HOLE CUTTER

Micro-adjustment to 1/200th inch.
Par. Shanks from $\frac{3}{8}$ " to $\frac{5}{8}$ ".

TEN MODELS

Send for illustrated catalogue to:
LUDFRY LTD.
5 HANWAY PLACE, LONDON, W.1
Telephone: MUSeum 7472

PARKER'S SHEET METAL FOLDING MACHINES. HEAVY VICE MODELS

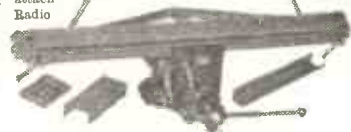
No. 1 (Illustrated). Capacity. 18 gauge mild steel x 3ft. wide. 3ft. model, weight 56lb., £8/5/- Carr. 10/- 2ft. model, weight 22lb., 65/- 18in. model, weight 18lb., 65/-, carr. on small models 4/- If with attachments 5/6.

No. 2. Capacity 18 gauge mild steel x 2ft. wide

No. 3. Capacity. 16 gauge mild steel x 18in. wide

End folding attachments for Radio chassis, Tray or Box making, are supplied if required.

Attachment angle for 3ft. 3/6 per ft. Small models 2/- per foot.



Machines guaranteed Send for details

A. B. PARKER WHEATCROFT WORKS, WELLINGTON STREET, BATLEY, YORKS. Tel: Batley 426
Manchester Office and Showrooms. 2 Sussex Street, off Norfolk Street, Manchester, 2

CATALOGUE FOR 1957 **L/P** & HANDBOOK

**R
E
C
O
R
D
L
I
B
R
A
R
Y**

POST 3/- FREE

Also sections on :—

- The only comprehensive selective catalogue of Classical L/P Records—listing only recordings recommended by the Critics.
- Nearly 4,000 discs listed (as already available to Library members).

- The care of Long Playing Records.
- The Reproduction of Long Playing Records.
- A Basis for a Record Collection (100 Recommended L/Ps).

If (like us) you love good music and find pleasure in good records, you will (we feel certain) be finding it increasingly difficult to choose from among the many fine L/Ps—just which to add to your collection. Now comes the perfect solution—the chance to borrow the pick of the L/Ps to play AT HOME—ON YOUR OWN GRAMOPHONE. FULL DETAILS OF THIS LIBRARY SERVICE (which costs approx. 1/- per week each L/P borrowed) are included in our Catalogue & Handbook—

THE L/P RECORD LIBRARY CLASSICAL CATALOGUE AND HANDBOOK FOR 1957

COSTS ONLY 3/- POST FREE (For Library details without Catalogue, please send large s.a.e. 2d.)

From :— **THE LONG PLAYING RECORD LIBRARY, SQUIRES GATE STATION APPROACH, BLACKPOOL, LANCs.**

- **INSPECTION** before dispatch and only good pressings are chosen.
- **ADVICE** is given when needed and we can supply the best available recording if asked.
- **PACKING** is unique and specially designed. All records are polythene sleeved. No charge for postage and packing on any L/P, M/P or two E/Ps sent within the British Isles (except Eire). (No charge on export orders of £10 or over).
- **SPEED OF DISPATCH** 24 hour service for discs currently and immediately available from the factory.



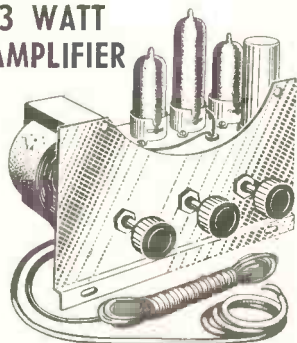
FFSS STANDS FACTORY FRESH FOR SALES SERVICE

FFSS announces a new, eight point, high quality, Sales Service operated exclusively by The L/P Record Library. We have long realised that such a service was badly needed by the audio engineer and high fidelity enthusiast.

- **FFSS** indicates that the record purchased is not only a brand new, guaranteed unplayed, factory copy but that it has been obtained from the makers by special order for the purchaser. Besides being unblemished, the disc is also as up-to-date a pressing as is currently available in this country. This is tremendously important when it is realised that many of the older L/Ps (especially Decca) are currently being re-cut from the master-tapes by the manufacturers with marked improvement in reproduction.
- **FFSS** covers all record labels available in this country except H.M.V.
- **GUARANTEE** on all records providing that any fault was inherent in the disc when it left us and has NOT subsequently been induced by faulty equipment or careless handling. Our decision on this is final.
- **STYLUS REPLACEMENT** Diamond or Sapphire—by return of post in most cases.
- **EQUIPMENT AND ACCESSORIES.** Our Reproduction Specialist Mr. C. T. Salisbury will be only too happy to advise personally on the best available within YOUR price range.

WHY NOT MAKE A TRIAL ORDER NOW... (or send for more details enclosing large s.a.e. 2d.)

2-3 WATT AMPLIFIER



THREE VALVE TYPE (ECC83, EL84, EZ80). A high quality amplifier designed to satisfy the requirements of the more discriminating record enthusiast. Three controls give a very wide variation of tone. Output approx. 2 watts. Fully isolated chassis. Overall size approx 6½in. x 5in. x 2½in.

PRICE 79/6 Plus 2/6 P.P.

THE SUPEREX "55" BATTERY PORTABLE



BUILDING COST £7-15-0
Plus 4/- P.P.

Cabinet size 10½in. x 8½in. x 4½in.

- ★ 4-VALVE SUPERHET.
 - ★ LONG/MEDIUM WAVES:
 - ★ 7in. x 4in. SPEAKER.
 - ★ B7G 1.4 v. VALVES.
 - ★ SIMPLE CONSTRUCTION.
- SEND 1/6 FOR BOOKLET

SUPERIOR BUREAU



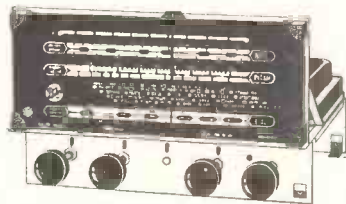
An elegant cabinet in richly figured walnut veneer, internal panels in polished sycamore. A drop front lid covers a sloping, uncut control panel (16in. long x 10½in. high) alongside which is an uncut base-board (15½in. long x 13½in. back to front). The inside of the drop front lid is panelled in beige leatherette. In the lower part of the cabinet are two large storage cupboards (13½in. high, 7½in. wide, 16½in. deep). The lid and cupboard handles are in chased Florentine bronze. Overall dimensions (33in. high, 34in. long, 16½in. deep).

PRICE 16½ GNS. Plus 25/- carriage.

CHASSIS ASSEMBLY CONTAINING

- ★ Punched chassis, Backplate, etc. Size : 12in. x 7in. x 8in.
- ★ Multi-colour Glass Dial L.M.S.G.
- ★ Drive Drum and Spindle.
- ★ Continental Control Knobs.

PRICE 22/6 Plus 2/6 P.P.




SUPERIOR RADIO SUPPLIES, 37, HILLSIDE, STONEBRIDGE, N.W.10.

Phone : ELGar 3644


SHOP OPEN : 9 a.m. to 6 p.m. Monday to Saturday ; 1 p.m. Thursday.

TERMS : Cash with order or C.O.D. (U.K. and N. Ireland only)

CHOKES



SUPPRESSORS



CARBONYL IRON DUST CORES

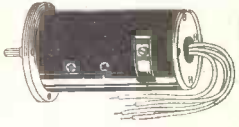
for frequency coils and frequency chokes, made by the latest and up-to-date production equipment. Samples and prices from

BASILDON METAL POWDER PARTS LTD
 CHURCH ROAD · THUNDERSLEY · ESSEX
 TEL : SOUTH BENFLEET 2752

MIDLAND INSTRUMENT CO.

CHASSIS, U.S. mfr., all aluminium, size 12½in. x 8in. x 6½in., complete with top cover some items have been removed, remaining are:— 25 Amphenol midget ceramic v-holders B7G type, complete with cans, over 70 resistors, all 5% colour-coded, also many ceramicons and other conds., trimmers, padders, fixed and variable inductances, transformer v-control, etc., etc, new unused, bargain 10/-, post 3/-.

HUGHES 12-VOLT D.C. SHUNT MOTORS, taking 1.25 amps., up to 2-amps. on load, speed 5,000 r.p.m., external reversing terminations; size 2½in. long, 1½in. dia., ½in. shaft, weight 20 oz., oil impregnated bearings, balanced armature, a very superior powerful motor, original cost over £7, our price new unused 10/-, post 1/3, 2 for 20/-, post paid. Ditto, fitted reduction gears, giving final drive of either 320 or 160 r.p.m. (state which required), 12/6, post 1/6, 2 for 25/-, post paid.



MAINS BLOWER, 200/250 v. A.C./D.C., ½ amp., 5,000 r.p.m., consists of the motor with attached enclosed fan, and funnel intake 1½in. dia., side outlet 1in. x ½in., plinth base 5in. x 4½in., finish black crackle and die cast aluminium, size overall 9in. long, 4½in. wide, 5in. high, weight 7½lb., a very superior blower, offered at a fraction of original cost, new, unused, 25/-, Post 3/-.

TELEPHONE SETS, consists of 2 combined microphones and receivers, which when wired up with ordinary twin flex, provide perfect 2-way communication, excellent results up to 1 mile have been reported, self-energised, no battery required, price 2 instruments new unused, 7/6, post 1/3. Twin P.V.C. 14/36 flex up to 300ft. lengths at 1d. per ft

LOUDSPEAKERS by Pre. Phillips and other makers, 10in. P.M. less transformer, 8-ohm speech coil, fitted in a smart brown finish wood case with carrying handle, size 17in. x 17in. x 6½in. deep, front metal grill with four rear smaller ones, rear compartment houses 50ft. superior twin lead fitted jackplug, ideal for amplifier public address extension speakers, etc., new in sealed cartons, 45/-, carriage (Inland) 3/6.

TRANSMITTER RECEIVERS No. 17 Mk. II, complete with valves high res. headphones, hand microphones and instruction booklet, frequency 44 to 61 Mc/s., range with simple aerial 5-8 miles, requires ordinary 2-v. accumulator and 120-v. battery. These are brand new, in sealed cartons, our price 50/-, carriage 5/-, Inland only.

RECEIVERS, No. 19 Mk. II, complete with 15 valves, 6K7G (6), 6K8G (2), 6V8G (2), 6B8G, 807, EF90, EB34, CV6, condition very good, note our price 60/-, carriage 7/6 Inland only.

SLYDLOK FUSES, 15-amp. type, these are new unused, 6 mounted on a common bar, fraction of original cost 5/-, post 1/4.

ROSS ACHROMATS, all 40 mm. dia., in 5 values, f/1.7, f/2, f/2.3, f/2.7, f/3, focal lengths, are 2½in., 3in., 3½in., 4in. and 4½in., respectively, new and perfect, 10/- each, post 6d.

WESTON MICROAMMETERS, Eng. Temp., black bakelite 2½in. square, flush panel mounting, fitted zero reset and damping short, graduated 0-50-100-150-200-250-300-350 with 1/5th sub-divisions, new boxed, 10/-, post 1/4.

Many other Bargains; send stamped addressed envelope for lists.
MIDLAND INSTRUMENT CO., MOORPOOL CIRCLE, BIRMINGHAM, 17
 Tel.: HAR 1308

A. C. SOLENOID type SAM.



Increased Performance
 Continuous 14 ozs. at ¾"
 Instantaneous to 5½ lbs.
 Same dimensions as Type SA.

Larger and smaller sizes available. Greatly increased discounts for quantities. Also Transformers to 7kVA 3 Phase.

R. A. WEBBER LTD.

18, FOREST ROAD, KINGSWOOD, BRISTOL. Phone: 74065

INSULATING SLEEVINGS

P.V.C. and POLYTHENE
 SLEEVINGS
 INSULATED WIRES
 and FLEXIBLES
 A.I.D. AND A.R.B. APPROVED.

PLASTICABLE LIMITED
 HAWLEY LANE - FARNBOROUGH - HANTS
 PHONE: FARNBOROUGH, HANTS 85

TELEVISION AERIAL COMPONENTS

DESIGNED FOR CONSTRUCTING BAND I & BAND III T.V. AERIALS
 ELEMENT DIMENSIONS SUPPLIED FOR ALL CHANNELS

Selecting at random from our new multi-page catalogue :

- ★ Band III Folded Dipoles (As illustrated)
- ★ Mast Coupling units for 2" Masts
- ★ Reflector and director rod holders
- ★ Insulators, both Rubber and Plastic (As illustrated)
- ★ Masthead Fittings for ¾", 1", 1½" and 2" Masts
- ★ Alloy Tubing for Elements, Cross boom and masting

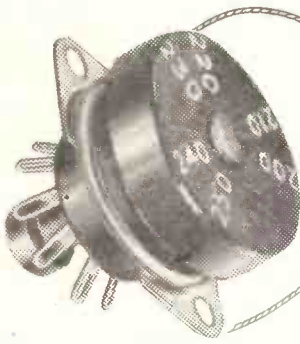
Send 1/- P.O. for the revised, fully illustrated catalogue to :

FRINGEVISION LTD., Marlborough, Wilts. Phone: 657/8



6 WAY

miniature mains
voltage selector
Type BMVS/6



McMURDO Miniature Voltage Selector

STANDARD B9A (NOVAL) VALVEHOLDER WITH 2 - PIN
CAPTIVE PLUG.

UP TO 6 TAPPING POSITIONS.

MARKING TO CUSTOMERS' REQUIREMENTS.

Send for full details to:—

THE McMURDO INSTRUMENT COMPANY LIMITED, ASHTEAD, SURREY.

Tel : ASHTEAD 3401

JSP. MVS 11

DEPENDABLE RADIO SUPPLIES LTD.

12a TOTTENHAM STREET, LONDON, W.1. (2 minutes Goodge Street Station. Opp. Heals in Tottenham Court Road)
Phone: LANgham 7391/2. Hours of Business 9-6.

BLOWER MOTORS
(6-12 or 27 volt)
17/6.
Complete with
blower 22/6.
P. & P. 2/6.



COMPLETE P.A. SYSTEM

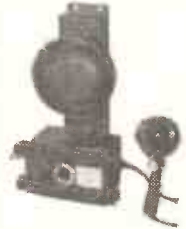
Canadian Telephone loudspeaking Amplifier Unit with 4 loud hailer, powered microphone, headphones and spares. Works off 12 v. D.C. New and boxed, ready for export. **WONDERFUL OPPORTUNITY — CANNOT BE REPEATED.**

£10-10-0 complete.
Carriage extra.

OR SPECIAL OFFER TO
CLEAR THE LOT

High voltage mains transformers
Input 200, 210, 220, 230, 240, 250. Output
1760, 1500, 0, 1500, 1760, 62KVA. Brand
New £10/10/0. Carr. 10/-

Complete Portable
Vehicle Loudhailer
operates on 12 v. or
24 v. supply, out-
put 6 watts. Can be
fixed easily.
Comprising Power
Pack, Loudhailer
Hand Powered Micro-
phone. Weather-
proof. Very heavy
metal case.
PRICE EACH £7/10/-.
Carr. & Packing 10/-



DYNAMOTOR ROTARY TRANS- FORMER



D.C. Output 285 volts, .075 amps. D.C. Input
27 volts, 1.75 amps. Price 37/6 ea. P. & P. 3/-.
Can be supplied in 12 volt.

LOUDHAILER SPEAKER UNIT

Impedance 7Ω. 6-8
watts output. Weight
10lb. Size 7 1/2 in. Depth.
10 in. Diam. Easy
Fixing.
Weatherproof. Spun
solid steel. Hammered
finish.

PRICE £3/15/-.
Carriage & Packing 7/6.

BOTH ITEMS IDEAL FOR
SPORTS EVENTS, ELEC-
TIONEERING AND SOCIAL FUNCTIONS.



UNREPEATABLE OFFER LESS THAN HALF MANUFACTURER'S COST



Brand new single
phase motors
suitable for tape
recorders, radio-
grams, work-
shops, etc., etc.
Has many uses.
Reversible 200-
230 v. 5 in. oz.
torque. 1,400
r.p.m. Capacitor
start. Weight
4 1/2 lb. Length
overall 5 in.,
5 in. x 1/2 in.
spindle both ends. 1/2 in. x 1/2 in., 1/2 in. x 1/2 in.
Price, inc. P.P. and capacitor, 55/-.

ROTARY TRANSFORMERS

Delivery Ex Stock. Quotations on application.



H.T.31
Input 11.5 v.
Output 250
v. at 125 mA.

H.T.32
Input 11.5 v.
Output 490
v. at 65 mA.

Both can be supplied tropicalised.

**AS SUPPLIED TO GOVT. DEPARTMENTS &
LEADING MANUFACTURERS**
Quantity & Export enquiries invited. Callers
welcome. Terms: Cash with order or C.O.D

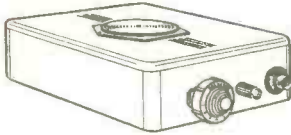


HEAVY DUTY SLIDING RESISTORS

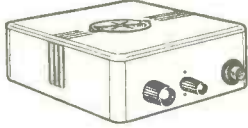
Supplied in two types

250 watts to carry 25 amps. Resistance 0.4 ohms,
worm drive, also 125 watts, 12 amps. Resistance
1 ohm. slider. Suitable for charging board, etc.
Size 9 x 4 x 6 in. high. Brand new Price 12/6.
Post 3/-.

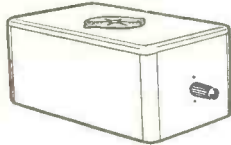
TRANSISTOR WISE



"Reco Special" 3 transistor portable receives home and continental stations. Uses specially designed high gain frame aerial, mounted on metal chassis. Months of operation from 3 volt battery. Complete kit with balanced armature output unit and attractive plastic case. Only 65/- including battery. Wiring circuit diagram parts list 9d.



The "Reco" 2 transistor portable receives home and continental stations, uses high gain ferrite tuned aerial. Complete kit with balanced armature output unit and neat plastic pocket case. Only 55/- including battery. Wiring circuit diagram parts list 9d.



"Reco" 1 transistor receiver, uses tuned inductance coil and super sensitive Bell phone for quality private listening. Plastic case. Complete kit 29/6 including battery. Wiring circuit diagram parts list 9d.



H.M.V. low impedance matching transformers including balancing network, 10/6. P.P. 2/-.

Moving Coil Headphones with earpads and 6ft. lead 12/6.
ELECTROLYTICS: 8 x 8 350 v. 20 mfd. 150 v. working, 1/6 each. Discount for quantity. Top prices paid for tape recorders, etc.

RADIO EXCHANGE CO.

NEWPORT PLACE, LEICESTER SQUARE, W.G.2.
CLOSED SATURDAYS. Telephone: Ger. 2613.

Be your own Sound Engineer

If you own a Tape Recorder you'll be interested to know about the GRUNDIG MIXER UNIT, the GMU.3. With it you can achieve sparkling professional realism; three independently controlled microphone inputs, plus one for your pick-up, enable you to produce plays, dialogue over music, special effects, monitoring—it's like owning a recording studio.

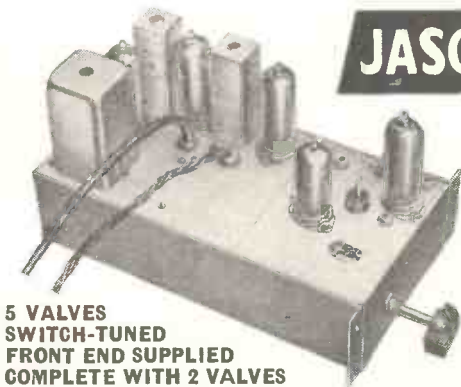
GRUNDIG (Great Britain) LTD.
Advertising & Showrooms:
39/41 NEW OXFORD STREET,
LONDON, W.C.1
Trade Enquiries to:
KIDBROOKE PARK ROAD,
LONDON, S.E.3

(Electronics Division, Gas Purification & Chemical Company Ltd.) G.S.22

Write for fully descriptive leaflet or ask your dealer for a demonstration of the

GMU.3

PRICE 16 GUINEAS
you'll be glad you did



5 VALVES
SWITCH-TUNED
FRONT END SUPPLIED
COMPLETE WITH 2 VALVES

JASON SWITCHED F.M. TUNER

KIT

When built, this new Jason F.M. Tuner provides choice of the three B.B.C. programmes at the turn of a switch, with a fourth position for "OFF". The Switch Tuned Front End is supplied wired, tested and aligned, complete with 2 valves and station-indicating plate. Chassis ready punched. In conformity with all Jason F.M. Units, this model is completely stable and offers the highest possible standards of reproduction

FROM LEADING STOCKISTS or in case of difficulty
JASON MOTOR & ELECTRONIC CO.

328. CRICKLEWOOD LANE, LONDON, N.W.2
Phone: SPEedwell 7050

CONSTRUCTOR'S SWITCH-TUNED KIT including assembled Front End with two valves and all parts as specified and approved. **£9.0.0**

SWITCH-TUNED FRONT END with two valves, complete **£6.5.0**

(incl. £1/15/0 P/Tax)
Data Publication Book of the Tuner (Post Paid 2/3) **2.0**

JASON POWER PACK KIT **£2.1.0**

TECHNICAL TRADING CO.

MARCONI CR150 RECEIVERS. A more comprehensive version of the CR100 covering 5-150 metres continuous 5 Bands, 12 valves, power pack 200/250 V.A.C. checked and tested, £19. COSSOR GANGING OSCILLATORS (Wobblers), all wave, 200/250 V.A.C. checked and tested, £9/10/- 3 1/2 in. SPEAKERS, ex new equipment, 15 Ohm, smallish magnet, 9/6. MARCONI TF517F SIGNAL GENERATORS, 150-300 Mc/s., £15.

TRANSISTORS!	L.F. JUNCTION P.N.P. Type, GUARANTEED	6/-
TRANSISTORS!	R.F. JUNCTION P.N.P. Type, GUARANTEED	11/-

MARCONI VALVE VOLTMETERS, complete with spares and probe in transit cases—5 ranges from 1.5 v. to 150 v. for 200/250 V.A.C. mains, £9/10/- 250 v. 250 mA RECTIFIERS, Selenium $\frac{1}{2}$ wave, square fins, 11/- 100 + 200 mfd. 275 vw. Cans, 5/6 $\frac{1}{2}$ MEG. POT., D.P. sw., 3 1/2 in., sp., small, 3/6 32 + 32 250 v. 2/6 16 + 16 350 v. 3/6 GOODMANS P.M. SPEAKERS, 5 in., 17/- 6 1/2 in., 18/- 7 x 4, 17/6 8 in. (F.M. Quality), 22/6 10 x 6, 26/- 10 in., 25/- 10 INCH CABINET SPEAKERS. Anti-boom lined, size 14 x 18 x 7, 29/- ARDENNE 12 VOLT AMPLIFIERS, 10/15 w., ECC81, ECC81, p.p. EL35's. Very compact, ideal Street Broadcasts, complete, untested, £4/10/- MAINS DITTO, by Parmeno, untested, £4/15/-.

MARCONI TF390G SIGNAL GENERATORS. In original transit cases. Special opportunity at only £15.

SPECIAL BARGAIN! 12 v. 4 amp. rect., 9/6 ea., £5 doz. full wave iron selenium heavy compact type.

13 CHANNEL COVERTERS, famous make, complete PCC84, PCF80, beaut. bakelite cabinet, adjustable all I.F. freqs., tunable all channels, no extra coils required, £3/15/- GERMANIUM CRYSTAL DIODES, famous make, tested, general purpose, polarity marked, 10d., p. & p. 3d., 8/6 doz.

GUARANTEED BOXED RADIO VALVES. 24 HOUR SERVICE.									
5U4G	6/6	6J6	5/-	12AU7	7/-	ECC81	9/-	EF91	7/-
6BA6	6/6	6L6	8/-	12SK7	5/6	ECC82	7/-	EY51	10/-
6BE6	6/6	6SN7GT	5/9	25L6GT	8/6	ECL90	8/6	N78	11/-
6C4	4/9	6V6GT	6/-	EB34	1/6	EP50	2/6	8P41	2/6
6J5G	3/-	6X4	6/-	EBC33	7/-	EP80	8/-	8P61	2/6

FOR FULL VALVE LIST AND CLEARANCE BARGAIN DETAILS
SEND S.A.E. FOR SPECIAL LIST
Postage 1/- in £1 (1/9 in £1 Speakers/Trans.). Min. 6d. No C.O.D.
10,000 OTHER BARGAINS TO CALLERS AT:—
350/352 FRATTON ROAD, PORTSMOUTH

MULLARD TAPE AMPLIFIERS

We stock all parts for the Mullard Tape Amplifiers Type A and B as described in the Mullard Publication. Our fully detailed parts list is available free upon request. All items available separately.

COMPLETE KITS

These contain first grade components and valves with a fully drilled chassis.

AMPLIFIER TYPE A. With Gilson Output Transformer £14.0.0

AMPLIFIER TYPE B. With Partridge Output Transformer £15.15.0

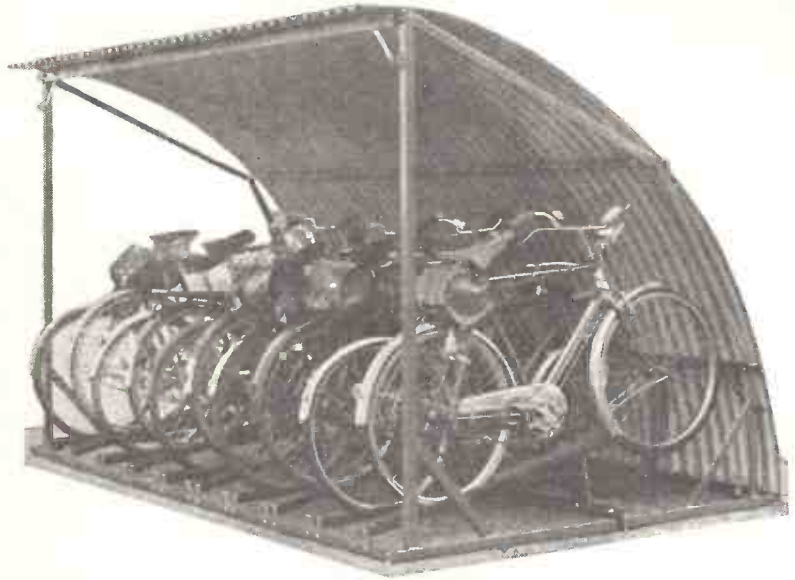
Credit terms available.

WATTS RADIO (Mail Order) LTD.

54 CHURCH STREET, WEYBRIDGE, SURREY.
Telephone: Weybridge 4556.

PLEASE NOTE. Post orders only to this address.

A NEW CYCLE STAND



- ★ We present Type J/C/S as another Cycle Stand to add to the 26 different Types we already manufacture, and feel that there are advantages to offer, apart from economy in cost.
- ★ The CURVED ROOF which gives rear and roof shelter in one section, is far superior to other forms of rear and roof sheeting which have to be fixed separately.
- ★ An outstanding point is that no guttering is required, rain being conducted to the rear, thus giving a neater appearance on the finished product.
- ★ IBIX Cycle Stands are finished Stove Enamelled Olive Green.
- ★ ABIX Cycle Stands are despatched in component parts for easy erection on site. Assembly drawing supplied on receipt of your order.
- ★ Lamp Brackets, Chain and Number plates can be supplied, should they be required.

PLEASE WRITE FOR ILLUSTRATED CATALOGUE TO:

(METAL INDUSTRIES) LIMITED

Steel Equipment for Office & Factory

TAYBRIDGE HOUSE, TAYBRIDGE ROAD, BATTERSEA, LONDON, S.W.11.
Phone: BA Ttersea 8666/7. Grams: ABIX, Batt, London.



Also Manufacturers of: Steel Partitioning (Industrial and Executive), Clothes Lockers, Slotted Angle and Adjustable Steel Shelving.

THE WEYRAD AM/FM RECEIVER

THIS RECEIVER WHICH HAS BEEN SPECIALLY DEVELOPED FOR THE AMATEUR CONSTRUCTOR PROVIDES COMPLETE COVERAGE OF THE SOUND BROADCAST BANDS—LONG, MEDIUM AND SHORT WAVE AM. WITH 87.5-100 Mc/s. V.H.F. FOR FM. WE HAVE PRODUCED A FULLY ILLUSTRATED BOOKLET WHICH GIVES INFORMATION ON THE ASSEMBLY AND ALIGNMENT OF THE 4-BAND SEVEN-VALVE RECEIVER, INCLUDING CHASSIS LAYOUT, CIRCUITS AND POINT-TO-POINT WIRING DIAGRAM.

- ★ "WEYRAD" B.61 COIL PACK, P.23 I.F. TRANSFORMERS, T.S.61 TUNING SCALE, Q2 I.F. FILTER, E.822 MAINS TRANSFORMER AND E.823 OUTPUT TRANSFORMER.
- ★ ALUMINIUM CHASSIS WITH ALL PUNCHING AND BENDING COMPLETE.
- ★ DESIGNED FOR LATEST TYPE MULLARD VALVES.
- ★ RECEIVER OUTPUT CAN BE MODIFIED FOR USE AS A RADIO FEEDER FOR QUALITY AMPLIFIERS.

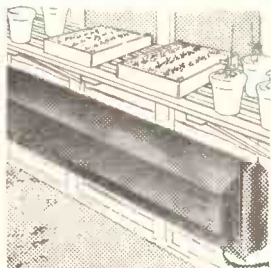
THE BOOKLET & PRICE LIST2/6d.

ILLUSTRATED FOLDER OF AM. COMPONENTS3d.

WEYMOUTH RADIO MANUFACTURING CO., LTD.

CRESCENT STREET, WEYMOUTH, DORSET.

INSTANTUS HEATER



Convecter heater, 1 kW. rating, 4ft. long, made from heavy gauge sheet steel (galvanised). Can be used for greenhouse, workshop, Avlary, etc., etc. Price £2/10/-, or with thermostat, £2/5/-, carriage 6/- GUARANTEED 5 YEARS. 2 KW MODEL. Free standing thermostatically controlled, £5/17/6.

DON'T BE CAUGHT LIKE THIS



CAR STARTER CHARGER KIT

All parts to build 6- and 12-volt charger which can be connected to a "fix" battery and will enable the car to be started instantly. Kit comprising the following.

Mains transformer	22/6
5-amp. rectifier	17/6
Regulator Stud Switch	3/6
Resistance Wire	2/-
Resistance Former	2/6
Mains on/off Switch	2/6
0.5 amp. Moving Coil Meter	12/6
Construction Data	1/6
or if bought all together price is	52/6

plus 2/6 post and packing.

FLUORESCENT LIGHTS



These are complete fluorescent lighting fittings. Built-in ballast and starter—stove enamelled white and ready to work. Ideal for the kitchen, over the workbench and in similar locations.

Single 40. 4ft. 3in. long, uses a 40 watt tube.
Twin 20. Uses 2 20-watt standard tubes. Price 39/6 each, with tubes.
Carriage and ins. up to 150 miles 5/6, up to 250 miles 7/6.

POCKET TRANSISTOR RECEIVER

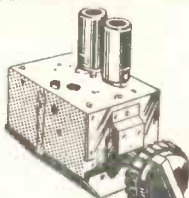
All the parts to build cigarette box receiver, £2/17/6. Includes Ferrite aerials but not the earpiece, battery or case.



WESTINGHOUSE (U.S.A.) METERS

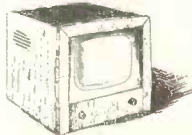
All moving coil flush mounting type, outside diameter of face 3 1/2 in.

0-500 v. D.C.	20/-
0-1.5 kV D.C. external multiplier	25/-
0-2.5 kV D.C. external multiplier	25/-
0-15 v. A.C.	15/-
0-1 mA	25/-
0-50 mA	15/-
0-100 mA	15/-
0-150 mA	15/-
0-250 mA	15/-
0-500 mA	15/-



TURRET TUNER

Brand new stock, not surplus, with coils for Band I and III, complete with valves PCC84 and PCF80—I.F. Output 33/38 Mc/s with instructions and circuit diagram 79/6. With knobs 3/6 extra, post and ins. 2/6.



14" T.V. CABINET

14in. T.V. cabinet of the latest styling made for one of our most famous firms—beautifully veneered and polished—limited quantity—19/6 each. Carriage and packing 3/6 extra.

CABINETS FOR ALL



The CONTINA

Another addition to our range of cabinets. This is of new revolutionary design, styled after the best of Continental radios. Externally, it is finished in highly polished dark walnut veneer, with panelling picked out in gold. Interior is of same very high standard, its veneer being light mahogany which contrasts nicely with the dark walnut and generally gives a very pleasing appearance. The doors slide on metal runners and are fitted with gold insert finger plates. A really excellent cabinet for any home—size 3ft. 1 1/2 in. long, 1ft. 3 in. deep, 2ft. 1 1/2 in. high, including legs which are 10in. from floor. Motor board 12 1/2 in. x 17 in., equipment aperture 17 1/2 x 9 1/2 in. gives ample space for 8in. speaker. Ample storage space for recordings. Price £19/10/-, carriage and insurance, 20/-.

F.M. TUNER

This is a high fidelity unit which although moderately priced has a performance equal to the highest priced. Its stability is very good and extremely good results have been received with the simplest of aerials as far away as Eastbourne. The unit is made up ready to work and has its own power supply for A.C. mains. Demonstration at all our branches. Price 12 gns. or £1/12/- down and 6 payments of £2. Post plus insurance 5/.



THIS MONTH'S SNIP

TAPE DECK—Made by the famous Truvox Company. This contains exactly the same essentials as the current model. Only the styling is different. It also takes the stereophonic head.

Specification: 3 B.T.H. shaded pole motors with silent friction drive eliminating wow and flutter. Push-button controls, electrically and mechanically interlocked. Patented electric type push-button controlled brake. Tape loading on the drop-in principle, accommodation for reels of 7in. diameter. Tracking sense to British and American standards. Playing times: up to 3 hours with L.P. Tape or 2 hours with L.P. Tape or 2 hours with Standard Tapes. Two tracks side by side with safety gap. Positive Azimuth adjustment of Record/Player head. High Impedance Leads. Overall size 14 1/2 in. x 12 1/2 in. x 5 in. approx. 120 only of these fine decks offered at non-repeatable price of £17/10/- or £3/10/- down and eight monthly payments of £3. Non-callers add 10/- carriage and insurance.

EX-ROYAL NAVY SOUND POWERED TELEPHONE



These require no batteries and will go for long periods without attention. Complete with generator and sounder which gives a high pitched note easily heard above any other noise. Also fitted with an indicator lamp which in quiet situations can be used instead of the sounder, or where several telephones are used together, will indicate which one is being called. Size 7 1/2 x 9 x 7 1/2 in., wall mounting, designed for ships' use but equally suitable for home, office, warehouse, factory, garage, etc. Price 57/6 each, plus 4/6 carriage.

UNITS FOR CONTROLLED AUTOMATIC ROTATION

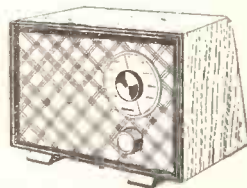


We have two items of equipment which form part of the radar system RC84. These two units work together to form a Tower rotating device, with remote control.

Item 1, known as Tower 24A, is in fact the geared driving motor which rotates the mast. This is quite a heavy construction and would rotate a heavy scanner, reflector, beam array, etc., etc.
Item 2, known as Indicator 1-221-A is the remote controller which enables the azimuth position of Tower 24A to be controlled from a remote point. Conversely, it enables the azimuth position of the tower to be known at any time. Both the Tower and the Indicator contain selsyn transmitter/receivers and it is these that provide the impulses which cause

the aerial to rotate backwards or forwards.
Prices 1-221-A £25 plus carriage. TR24A £35 plus carriage.
Special discount of 25 for cash with order or C.O.D. if both units purchased together.

OUR 19/6 COLUMN



THE SKYSEARCHER

This is a 2-valve plus-metal receiver set useful as an educational set for beginners, also makes a fine second set for the bedroom, workshop etc. All parts, less cabinet, chassis and speaker, 12/6. Post & ins. 2/6. Data free with parts or available separately 1/6. 3 valve battery version also available at the same price.

ALL-MAINS AMPLIFIER



Powerful three-valve Mains amplifier ideal for dances, parties, etc. Complete less chassis cabinet and speaker (available if required)—data 1/6 (free with parts) Price 19/6, plus 2/6 post and insurance.

'CHIMELITE' 19/6



It is a hail light, as well as a double chime and you can make it in a couple of evenings for the total cost of only 19/6 including instructions postage 2/- data available separately price 2/6.

SIMPLEX TRANSISTOR KIT



Makes ideal bedroom radio, uses one transistor and one crystal diode. Complete less case 5/6, case 5/6, extra, post and ins. 1/6.

A.C./D.C. MULTIMETER KIT



Measures A.C./D.C. volts and ohms. All the essential parts including 2in. moving coil meter, selected resistors, wire for shunts, range selector, switches, calibrated scale and full instructions, price 19/6 plus 1/9 post and insurance.

BAND III CONVERTER

Suitable London, Midlands, North, Scotland etc. All the parts including 2 valves, coil, fine tuner, contrast control, condensers and resistors. (Metal case available as an extra plus 2/6 post and insurance. Data free with parts or available separately 1/6.

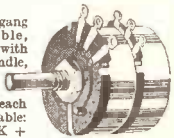
ANOTHER SNIP

Heavy duty castors—Ideal for fitting to T.V. instrument trolley. Current value 12/6—special snip price 7/6 set of four, plus 1/- post.



MORGANITE POTENTIOMETERS

Single and 2 gang types available, standard size with good length spindle, all new and boxed.
Gang type 3/- each —values available: 5K + 5K, 100K + 100K, 1 meg. + 1 meg. Single types 1/- each, values available: 10K, 25K, 50K, 100K, 250K, 1 meg., 2 meg.



CRYSTAL MICROPHONE

Miniature crystal type has high gain and is suitable for all purposes—tape recorders—amplifiers. Price 4/9, post and ins. 9d.



VARIABLE RHEOSTAT TRANSISTORS

A good range of transistor parts, miniature transformers, electrolytics, etc., available at all branches.
Red Spot and audio.. 10/-
Blue Spot 1.6 Mc/s.. 15/-
White Spot 2.5 Mc/s.. 20/-



W.D. CIRCUIT DETAILS

Diagrams and other information extracted from official manuals. All 1/6 per copy, 12 for 15/-.

- | | |
|---------------------------|---------------------|
| American Service Sheets | R.109 |
| A.1134 | 75 receiver |
| BC.348 | R28/ABC5 |
| BC.312 | B1118/A |
| R.103A | RA-1B |
| B.C.342 | A/RSD |
| RA-1B | AN/APA-1 |
| R-208 | 78 |
| R-1155 | 76 |
| R-1124A | R.T.18 |
| E-1132A/R-1481 | CAY-46-AAM- |
| R-1147 | RADAB |
| R-1224A | A.S.B.-3. |
| R-1082 | Indicator 62A |
| R-1355 | Indicator A.S.B.3 |
| B.C.1206-A/B | Indicator 62 |
| R-455-A (or -B) | Indicator 6K |
| B-454-A (or -B) | R.F. unit 24 |
| B-453-A (or -B) | R.F. unit 26 |
| Transmitter T1154/ | R.F. unit 25 |
| B.D.J.N. | R.F. unit 27 |
| Fifty-eight walkie-talkie | Wireless set No. 19 |
| Frequency meter | Demobbed valves |
| B.C.221. | |

CHASSIS ASSEMBLY

Three-colour 3-waveband scale covering Standard, Long, Medium and Short wavebands, scale pan, chassis, punched for standard 5-valve superhet, pulley driving head, springs, etc., to suit. Scale size 14 1/2 x 3 1/2 in. Chassis size 15 x 6 x 2 1/2 in. deep. Price 15/- plus 1/6 post. Note: We can supply cabinet for this 39/6 and 5/- p. and p.

Complete T.V. Commercialising Outfit Sent for 14/6

Hundreds of people have already fitted our T.V. converter and now enjoy BBC and ITA programmes—you can do the same. Our outfit contains: ITA Converter—ITA Aerial—36ft. Co-ax Down Lead—Interference Suppressor—illustrated detailed instructions—nothing else to buy, all for £8/10/-, carr. and ins. 4/6 or 10/- deposit and 9 monthly payments of £1.



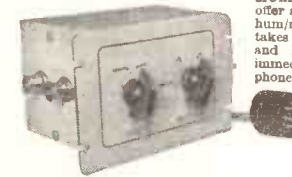
FREE THIS MONTH
To all "Wireless World" readers who send S.A.E. we will present free a copy of our booklet—
"THE VACUUM DELAY THERMAL RELAY"

MULLARD AMPLIFIER

A Quality Amplifier designed by Mullard. Power output exceeds 10 watts. Frequency response almost flat from 10 to 20,000 C.P.S. For use with the Acos "Hi G" and other good pick-ups. Made up and ready to work is £12/10/- or £1/10/- down and 8 payments of £1/10/-, plus 10/- carriage and insurance.



MULLARD PRE-AMP. We are pleased to offer as a ready-made unit. It uses the low hum/noise high gain pentode type EF86. It takes its power supply from the amplifier and incorporates 2 switches to provide immediate compensation, for radio, microphone, L.P. and 78 records. The price of this unit is £4 post and insurance 3/6 extra.
Or 10/- down and 9 payments of 10/-. If purchased with above, combined price is £18 or 30/- down and 8 payments of £2.



AUTO-CHANGER 30/- DEPOSIT

3-SPEED & 4-SPEED

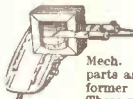
GRAMOPHONE AUTO-CHANGER

Latest types by all famous makers are invariably in stock at competitive prices. BSR Monarch, Garrard, etc. Latest models from £8/10/-, or deposit £1/10/- and 8 payments of £1 plus 5/- carriage and insurance.



MAKING A SOLDER GUN

A 7-second solder gun of the type costing £3-£4 was described in Prac. Mech. Only two essential parts are required—(a) transformer and (b) push switch. These we can supply at 13/6, plus 2/- post. The rest of the parts you will have in your own "junk" box. Copy of the article concerned given free with the kit.



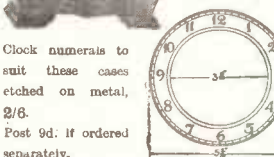
BABY ALARM

Unlike most baby alarms, this not only enables you to hear baby but also to talk to him. Price complete with one microphone and 100ft. twin flex £8/19/6, carriage 3/6, additional microphone, 19/6.



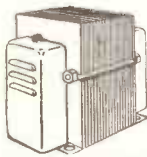
CLOCK CASE

Also suitable for barometer or other instrument. Nicely polished. Price 4/6, post and packing 1/6.



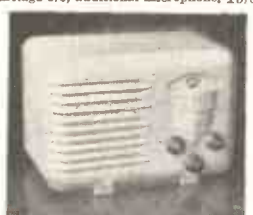
TRANSFORMERS SNIP

Standard tapped mains input. Output 6.3 at 3 amp. 5 v. at 2 amp. and 350-0-350 at 80 millamps. Equipment but guaranteed perfect. 9/6 plus 2/6 post and packing. (Note this transformer is a half shrouded drop-through type.) Similar voltage but 250 m/a. 27/6. Similar 3/6.



MINI-RADIO

Uses high-efficiency coils—covers long and medium wavebands and fits into the neat white or brown Bakelite cabinet—limited quantity only. All the parts, including cabinet, valves, in fact, everything, £4/10/-, plus 8/6 post. Constructional data free with the parts, or available separately. 1/6.



BARGAINS TO CLEAR

4 watt 3 valve Amplifier. Built to Hi-Fi standards with a control panel which can be used separately or fixed to chassis. Separate bass and treble controls. A.C. mains operated. £4/19/6 plus 5/- post and insurance.

AC Superhet 5 Valve Chassis, Medium and Two Short, unused but less valves and mains transformer. Uses standard octal range, 27/6 (again coil pack worth much more), non-callers add 6/6. AC Superhet 7v 5 Waveband Chassis, H.F. stage. Unused, less valves and power pack. Slightly soiled. Coil pack worth twice as much, circuit diagram supplied, £2/15/-, carriage and insurance 7/6.

AC 4 Valve Superhet, complete with valves but less scale and pointer, unused. Circuit diagram supplied, 39/6 plus.

Note that the above three chassis although unused will need checking. On account of low price no guarantee is given. Nor, we regret, can technical assistance be given.

.1mfd. 350 v. small tubular metal. Made by Dublier. 2/6 per dozen. Germanium Diodes. B.T.H. with wire ends. 10d. each or 9/- dozen.

Midget I.F. Coils, dust cored, size 1 1/2 x 1 in. 465 Kc/s, 4/6 pair. Standard size I.F. Coil, dust cored, 465 Mc/s, 4/6 pair.

Coil Pack for Superhet, 465 Kc/s I.F. Medium and 2 short waves, 9/6.

Cathode Ray Tube. VCR 97. Instrument type, new 7/6 each carriage 3/6.

Bakelite 5 amp. electric wall switch. "Hicraft," 9d. each or 8/- per dozen.

Series, parallel and off-electric wall switch, made by Crabtree. Price 1/3 each or 13/6 per dozen.

Amplifier, ex-Government unit 1134, contains one double triode and one triode, 6/6, post and insurance 2/6.

Connecting wire, PVC covered 24 swg. copper, 2/6 per 100ft. or 5 coils different colours for 10/- Scanning coils, by very good maker, new and unused, 4/6 complete.

Choke, 200 m.a., first-class. Made for Services—new, 6/6, post 1/6.

10v. Superhet 1 1/2 metre, ex-Govt., but unused. Complete with valves. Easily converted for Band III. 39/6, carriage and packing 7/6.

Mains Transformer, 250-0-250, 60-80 m.a. 6.3v. Standard mains input. Half shrouded 12/6, post and insurance 2/6.

R.F. 25 Tuning Unit. New, unused and complete with valves, 9/6, post 2/6.

Cathode Ray Tube, VCR 517, 8/6 each, carriage 2/6.

Mains Lead, metal screened to stop interference, 9d. yard.

Thermo-couple, mounted on valve base, useful for experiments and schools. 6/6 each.

Midget push-pull input transformer and push-pull output transformer, to match, 8/- the pair.

Note: Orders for small components over £2 are post free, otherwise please add sufficient.

ELECTRONIC PRECISION EQUIPMENT LTD.

266 London Road, Croydon. Phone: CRO 6558. Half-day Wednesday.

42-46 Windmill Hill, Ruislip, Middlesex. Phone: RUISLIP 5780. Half-day Wednesday.

152-153 Fleet St., E.C.4. Phone: FLEET 2833. Half-day Saturday.

29 Stroud Green Road, Finsbury Park, N.4. Phone: ARCHWAY 1049. Half-day Thursday.

Post orders should be addressed to E.P.E. LTD., Dept. 2, 66, GROVE ROAD, EASTBOURNE. All enquiries to Eastbourne address and please enclose S.A.E., terms are cash with order.



FOR VALVES—GUARANTEED NEW AND BOXED

OZ4	5/6	6AG5	5/6
1A3	3/6	6AK5	6/6
1A6GT	6/-	6AK7	6/6
1A7	12/6	6AG7	9/-
1C9	9/6	6AL5	6/6
1H5GT	10/6	6AM6	9/-
1L4	9/6	6AQ5	7/6
1LL5	3/6	6AT6	8/6
1N5	10/6	6AU6	10/6
1B5	8/-	6B4	5/-
1B4	10/6	6B9G	4/-
1S5	7/6	6BA6	8/6
1T4	7/6	6BE6	8/-
2X2	4/6	6BJ6	9/-
3A4	7/-	6BR7	11/6
3D6	5/-	6BR7	13/-
3Q4	9/6	6BW6	8/6
3Q5	8/6	6BW7	10/-
3S4	8/6	6C4	7/-
3V4	9/-	6CSGT	6/6
4D1	3/-	6C6	5/-
42	8/-	6CH6	7/6
5R4GY	9/6	6D6	5/-
5U4G	8/-	6FL	13/6
5Y3G	8/-	6FG	7/6
5Y3GT	8/-	6FM	7/6
5Z4G	10/6	6FL3	14/-
6A7	13/-	6F33	5/6
6AR6	10/6	6F15	14/-
6AC7	6/6	6GG	4/6

6HG	2/6	7B7	8/6	12Q7	9/6	DL96	10/6	EY86	12/-	PL82	10/-	V856	6/-
6J5G	5/-	7C5	8/6	12R7	2/6	DM70	8/6	EY91	6/-	PL83	12/-	VF57	6/-
6J5GT	5/6	7C6	8/-	12SQT	7/6	EABC80	10/-	EZ40	10/-	PP225	3/11	VF57	8/-
6J5M	6/6	7HT	9/-	12SH7	8/6	EAC81	7/6	EZ30	10/-	PX25	12/6	VB85	3/6
6J6	6/-	7J7	9/-	12SH7	8/6	EAP42	12/6	EZ90	9/-	PY80	10/-	VB85	3/6
6J7G	6/-	7S7	9/6	12SK7	6/-	EB41	9/-	E1148	2/-	PY81	10/-	VR65A	3/6
6K6GT	7/-	7Y4	8/6	12SL7	8/-	EB41	10/-	GZ32	12/6	PY81	10/-	VR65A	3/6
6K7GT	7/-	75	11/6	12SQ7	8/6	EBF80	11/-	H30	5/-	PY82	8/-	VR65A	3/6
6K7G	5/9	77	8/-	12SR7	7/6	EC91	9/6	HL23DD	8/6	PY83	12/-	VR66 (P61)	3/9
6K7M	6/9	80	8/6	12S7	13/6	EC88	10/6	HN309	12/6	U10	10/-	VR91	4/-
6K9G	8/9	807	6/6	20D1	10/6	ECC85	10/-	K40N	9/-	U2	10/-	VR91	4/-
6K8GT	8/6	8D2	2/9	20L1	13/6	ECC91	6/-	KBC32	8/-	U2	10/-	VR92	4/-
6L6G	9/-	9D2	3/9	20P3	13/6	ECC80	14/6	KT24	4/6	U3	13/6	VR92	4/-
6L7	7/6	901	5/6	20P5	11/6	ECC82	15/-	KT24	4/6	U4	12/6	VR92	4/-
6L8	11/6	9002	5/6	25L6GT	9/6	ECH35	11/6	K72	5/-	U5	13/6	VR105/30	6/-
6L8	11/6	9003	5/6	25Y5G	9/9	ECH42	10/6	KT38C	10/-	U5	13/6	VR116	4/6
6M7	13/6	9004	5/6	25Z4G	9/-	ECH31	11/-	KT38C	15/-	U191	12/6	VR136	6/-
6P25	4/-	9006	5/6	25Z5	9/-	ECL50	10/6	KTW61	8/-	UAF42	11/6	VR137	5/6
6Q7GT	8/-	954	2/-	25Z6GT	9/6	ECL82	13/6	KTW62	8/-	UB41	9/6	VR150/30	5/-
6R47GT	8/-	954	2/-	30P5	12/6	EF80	10/-	KTW63	8/6	UBC41	10/-	VR23	6/6
6S7	7/6	956	3/6	30P11	12/6	EF22	8/6	KTZ41	6/-	UBC42	11/-	VS70	3/-
6S7	7/6	10P1	12/6	30P4	15/-	EF40	12/6	LP220	5/-	UBF90	12/6	VS92	6/6
6S7	7/6	12A6	5/6	35L6GT	9/6	EP41	11/-	M14	7/6	UCH49	12/6	VS92	6/6
6S7	7/6	12A8H	11/6	35V4	9/-	EP85	12/6	MH41	7/6	UCH81	12/6	VS92	6/6
6S7	7/6	12A7E	10/6	35Z4GT	8/6	EP86	12/6	N78	12/6	UP41	10/-	VS92	6/6
6S7	7/6	12A7	9/-	35Z5	9/-	EP89	12/6	P61	3/9	UP41	10/-	VS92	6/6
6S7	7/6	12A7	9/6	60L6GT	8/6	EP92	8/6	P215	3/11	UL84	12/6	VS92	6/6
6S7	7/6	12A7	10/-	14ZBT	3/6	EL32	6/6	PEN4A	15/-	UY41	10/-	VS92	6/6
6S7	7/6	12A8	9/-	210DDT	9/6	EL33	6/6	PEN25	5/-	UY85	10/6	VS92	6/6
6S7	7/6	12B6	8/6	210VPT	4/6	EL41	10/6	PEN46	7/-	VR21	2/9	VS92	6/6
6S7	7/6	12C8	7/-	AC6/PEN	6/6	EL42	11/6	PEN220A	4/-	VR53	3/6	VS92	6/6
6S7	7/6	12E16	3/-	ATP4	3/6	EL84	11/-	PC84	10/-	VR53	3/6	VS92	6/6
6S7	7/6	12E16	3/6	DAF96	10/6	EM34	10/-	PCF80	11/-	VR54	2/9	VS92	6/6
6S7	7/6	12E17	10/-	DF96	10/6	EM80	11/-	PCF82	12/6	VR54	2/9	VS92	6/6
6S7	7/6	12E17	9/-	DH33M	11/6	EM81	11/6	PCF83	12/6	VR55	3/6	VS92	6/6
6S7	7/6	12E18	13/-	DK98	10/6	EY31	11/6	PL81	13/6	VR55	3/6	VS92	6/6

Transistors Red Spot 10/- ea. White Spot 15/- ea. P. & P. 6d. per valve. Same Day Service.

RECORD PLAYER UNITS



B-S-R. MONARCH

Four speed automatic record change unit. Plays 7in., 10in. and 12in. records automatically with "MAGDISK" Selector Turn-over Pick-up. Unit plate 12 1/2 x 10 1/2in. £8/15/-.



COLLARO

Model 3/544. Three speed single player. Automatic stop, fitted with "Studio T" pick-up. Cream finish £9/19/6. Carriage on above units 4/6.



COLLARO

Four speed automatic record change unit. A fully mixing automatic changer with many advanced features. Unit plate 12in. x 13 1/2in. £9/15/-.

TRANSISTORS
Suitable for audio work yellow and green spot ea. 10/-
red spot ea. 10/-
R.F. for use up to 1.6 mc/s. blue spot ea. 15/-
R.F. for use up to 1.5 mc/s. to 8 mc/s. yellow and red spot ea. 21/-
JB gang condensers for transistor working "0" gang 1 or 2 gang 365 PF swing, aluminium vanes, steel chassis.
1 gang 7/6 each, 2 gang 11/6 each.
JB "90" twin gang condenser 208 PF front section 17/6 PF rear section price 9/6 each.

TELETRON transistor superhet coils set of IF and oscillator coils with Ferrite rod 36/- per set (circuit included). Long Wave Louvering Coil to match 4/6 each.

METERS

Instrument Meter
Moving Coil, ex-Military 0-3 kv. Round Panel mounting.
Brand new 7/6 each.
Instrument Meter 0-100 mA. Square type. Panel Mounting. Ex-R.A.F. Equipment 7/6 each.
2 Range Pocket Voltmeter. Ex-Military Brand New. 0-15 volts, 0-250 volts, moving coil 345 ohms per volt, complete with leads 16/- each.



MAINS TRANSFORMERS

3 Way Mounting Type.
MT1
Primary: 200-220-240 v. Secondary: 250-0-250 v. 80 mA 0-6.3 v. 4 amp. 0-4 v. 2 amp. Both tapped at 4 v., 19/6 each.
MT2
Primary: 200-220-240 v. Secondary: 350-0-350 v. 80 mA 0-6.3 v. 4 amp. 0-5 v. 2 amp. Both tapped at 4 v. 19/6 each.
MT3
Primary: 200-220-240 v. Secondary: 30 v. 2 amps. Taps at 3 v., 4 v., 6 v., 8 v., 9 v., 10 v., 15 v., 20 v., 24 v., 19/6 each.
Postage and Packing, please add 2/- per transformer.

OUR 1957-1958 CATALOGUE

is now available to all readers of this magazine. 48 pages of components and equipment of interest to all radio enthusiasts. Send for your copy now.

LOUDSPEAKER CABINETS
This attractive walnut finished cabinet is available for 6in. or 8in. speaker units. Metal speaker fret, complete with back and rubber feet.
6in. type: Measures 8 1/2in. x 8 1/2in. x 4in. at base 17/6 ea.
8in. type: Measures 10 1/2in. x 10 1/2in. x 5in. at base 21/6 ea.
5in. type: Very similar design 16/6 ea.
Postage any type 2/- each.

BUILDING A "SECOND" SET
This is The Cabinet To Give Your Receiver The Commercial Look. Walnut Finished Cabinet. Size 11 1/2in. x 7in. x 6in. Supplied with chassis (cut out ready). Price 27/6 complete. Post 8/-, Dial, Back Plate Cord, Dial Drum, Pointer.

LOUDSPEAKER UNITS

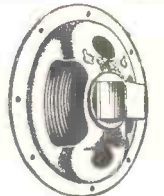
Make	Type	Size	Price
Elac	Square	3 1/2in.	19/6 each
Electrona, Plessey	Round	5in.	17/6 each
Goodmans, Plessey	Round	6in.	18/6 each
Goodmans, R. & A.	Round	8in.	19/6 each
Plessey, R. & A., Elac	Round	10in.	25/6 each
Plessey	Round	12in.	35/- each
Rola	Elliptical	6in. x 4in.	19/6 each
Elac	Elliptical	10in. x 6in.	25/6 each

All the above are PM units with 2 to 3 ohm speech coils.

RTC 12in. heavy duty 20 watts model 15in. ohms
Speech Coil £5 5 0
5in. Mains Energised Speaker £1 0 0

6in. Mains Energised Speaker 17 6
8in. Mains Energised Speaker £1 1 0
All have field coils of approx. 600 ohms.

SPECIAL OFFER
Just a few 8in. units by Goodmans and Lectrona fitted with standard output transformer £1 1 6 each



HEADPHONES—MICROPHONES

EX-GOVERNMENT HEADPHONES AND MICROPHONES
CLR low resistance type 120 ohms 7/6 pair
Throat Microphones, American surplus. Complete with strap, lead and plug type T30B 3/- set
High Resistance Phones, 4,000 ohms 13/6 pair
High Resistance DLE Phones 16/- pair
Ex-R.A.F. Microphone, Type 48 with switch 3/6 each



WESTINGHOUSE RECTIFIERS

16RC.1-1.16-1	9/- each
16RA.1-1.16-1	6/6 each
16BA.1-1.8-1	4/- each
14RA.1-2.8-3	25/- each
14A.86	13/6 each
14A.97	13/6 each
14A.100	15/- each
14A.124	27/6 each
14B.130	31/6 each
14W.7	23/9 each
WX6	3/6 each

COSMOCORD TYPE MIC.22
High sensitivity with good fidelity response; substantially flat from 40-6,000 c.p.s.; vibration and shock proof. Not affected by low frequency wind noises.
MIC 22-1 with adaptor for flood stand 34/- each
MIC 22-2 complete desk unit 34/- each

COSMOCORD TYPE MIC.33-1
A crystal hand or desk microphone designed for the high-quality public address and tape recording field, incorporating a specially designed acoustic filter giving a response flat from 30 to 7,000 c.p.s. The microphone is omni-directional and is housed in an attractive plastic case 50/- each

COSMOCORD TYPE MIC.35-1
A general purpose hand microphone of robust construction with substantially flat response from 50 to 5,000 c.p.s. Suitable for use in recording apparatus, public address equipment, etc. 25/- each

COSMOCORD TYPE MIC.36 (Series)
This microphone will be of particular interest to home recording enthusiasts as well as professional engineers, since the diaphragm microphone insert has a high sensitivity with a pick-up field that may be considered as omni-directional. Substantially flat response from 30 to 7,000 c.p.s.
MIC.36-3. Microphone without switch and with table stand 63/- each
MIC.36-4. Microphone with switch and table stand 68/- each
MIC.36-5. Microphone without switch and with floor stand adaptor. 63/- each
MIC.36-6. Microphone with switch and floor stand adaptor 65/- each
*The floor stand adaptor has internal threads of both 1in. and 1 1/2in. 25 T.P.I., 3/6 each.

TELEDIATOR TRANSFORMERS. TYPE TES
Small Mains Transformers suitable for Television Converters, etc.
Specification:—
Primary: 230 v. 50 c/s.
Secondary 1. 250 v. 40 mA.
Secondary 2. 6.3 v. 1.5 A.
Overall Size:
Clamp construction. 3.9in. x 2.4in. x 2in. over windings. Fixed centres. 3.3in.

15/-



Stern's "fidelity" TAPE RECORDER

IT HAS EVERYTHING — EXCEPT A HIGH PRICE

TESTED AND APPROVED AT THE TRUVOX LABORATORIES

IT INCORPORATES: The NEW TRUVOX Mk. IV TAPE DECK together with the "fidelity" MODEL HF/TR2 TAPE AMPLIFIER (both fully described on this page), and a Rola 10 x 6in. P.M. speaker.

● BEFORE CHOOSING YOUR TAPE RECORDER YOU SHOULD HEAR THIS MODEL—TRULY "Hi-Fi" RECORDINGS ARE OBTAINABLE and it is comparable to much higher-priced Recorders.

Alternatively send S.A.E. for ILLUSTRATED LEAFLET.

PRICE . . . Including CRYSTAL MIKE and 1,200ft. reel of PLASTIC TAPE.

£49.10.0. (OR £3 EXTRA WITH REV. COUNTER.)

(Plus £1/10/- carriage and insurance, of which £1 is refunded on return of Packing Case.)

CREDIT SALE: Deposit £12/8/- and 9 monthly payments of £4/10/8.

HIRE PURCHASE: Deposit £24/15/- and 12 monthly payments of £2/5/11.

A COMPLETE KIT OF PARTS TO BUILD THE "fidelity" TAPE AMPLIFIER Model HF/TR2 including POWER SUPPLY UNIT

FOR ONLY **£12.0.0** (Plus 5/- carr. and ins.)

This amplifier has been expressly designed to meet the requirements of the enthusiasts for High Fidelity reproduction. It is based on a new design, completed by the Mullard Technicians and only really high-grade components are incorporated; truly HIGH FIDELITY Recordings are obtainable whilst "Hi-Fi" reproduction is assured by use of a high-quality Output Transformer by Gilsen. It incorporates a "magic eye" Recording Level indicator, a two-position equaliser for 3½in. and 7½in. speeds, and an effective Tone Control arrangement. Monitoring and Extension Speaker Socket are incorporated and in addition a position is provided to enable it to be used as an independent Amplifier for Gramophone Records or Radio Tuning Unit. Overall size: 11in. x 6in. x 6in. high. Suitable for nearly all makes of Tape Decks. When ordering, please advise make of deck in use. THE ASSEMBLY MANUAL, PRACTICAL DIAGRAMS, etc., are available for 2/9 or send S.A.E. brief details.



WE ALSO SUPPLY THE HF/TR2 ASSEMBLED AND READY FOR USE FOR £16.0.0. (Plus 6/- carr. & ins.). H.P. TERMS: Deposit £8 and 9 monthly payments of £1. CREDIT TERMS: Deposit £4 and 9 monthly payments of £1/9/4.

STERN'S TAPE PRE-AMPLIFIER and ERASE UNIT

Provides the "Link" between the HIGH-QUALITY AMPLIFIER and TAPE DECK.

STERN'S MODEL HF/TR1P . . . A completely assembled Pre-Amplifier with own Power Supply. Can be supplied correctly matched for use with Truvox, Brenell or Collaro Decks, and incorporates Recording Level Indicator and Monitoring facilities (plus 5/- carr. & ins.). Please send S.A.E. with any inquiry. PRICE **£11.10.0** (and insurance)



Home Constructors!

YOU CAN BUILD A COMBINED TAPE RECORDER-RADIOGRAM AT HALF THE NORMAL COST.

As will be seen from this advert, there are several combinations with or without a Record Player. This is a very popular and successful combination and we will supply ALL ITEMS FOR . . .

- WE SUGGEST . . .
- (a) THE TRUVOX MK IV DECK (with Counter £3.0.0 extra).
 - (b) THE HF/TR1P TAPE PRE-AMPLIFIER.
 - (c) THE MULLARD 5-10 with "fidelity" Pre-amplifier.
 - (d) STERN'S P.M. TUNER UNIT.
 - (e) COLLARO R.C.456 AUTOCHANGER.
 - (f) TAPE and MICROPHONE.

£79.0.0

OTHER TAPE EQUIPMENT

PORTABLE CASE as illustrated above	£5 0 0
ACOS CRYSTAL MICROPHONE	£2 10 0
ROLA 10in. x 6in. P.M. SPEAKER (7in. x 4in. 19/6)	£1 10 0
PLASTIC TAPE of all lengths—L.P. and Standard. IN STOCK	
WE WILL SUPPLY ALL ABOVE including a 1,200 ft. reel Plastic Tape for	£9 5 0

THE NEW TRUVOX MkIV TAPE DECK

UNDOUBTEDLY ONE OF THE BEST TAPE DECKS ON THE MARKET.

PRICE **£27.6.0** (Plus 10/- carr. and ins.)

CREDIT TERMS: Deposit £8/17/- and 9 monthly payments of £2/10/-.

H.P. TERMS: Deposit £13/13/- and 12 monthly payments of £1/5/4.

SPECIFICATION:—● 3 B.T.H. shaded pole motors with silent friction drive eliminating wow and flutter. ● Push-button controls, electrically and mechanically interlocked (patented). ● Patented electro-type push-button controlled brake. ● Inching to assist editing; tape loading on the drop-in principal accommodation for reels of 7in. diameter. ● Tracking sense. To British and American standards. ● Playing times: Up to 3 hours with L.P. Tape or 2 hours with Standard Tapes. ● Two tracks side by side, with safety gap. ● Playing time indication by precision revolution counter or large visual type indicator plate, according to choice. Positive Azimuth adjustment of Record/Player Head. ● High Impedance Heads. ● The metal work is Gold Hammered finish. ● Overall size 14½in. x 12½in. from top of face of panel, overall depth 5in.

The Mk. IV DECK CAN ALSO BE SUPPLIED INCORPORATING PRECISION REV COUNTER for £30/9/-. H.P. TERMS: Deposit £15/4/6 and 12 months of £1/8/3. CREDIT SALE: Deposit £7/12/3 and 9 months of £2/15/10.



WE MAKE SPECIAL PRICES FOR COMBINED ORDERS WE WILL SUPPLY

- (a) The model HF/TR2 AMPLIFIER and POWER UNIT, both fully assembled, together with the TRUVOX MK IV TAPE DECK for . . . **£38/10 0**
ALTERNATIVELY as above but the HF/TR3 Amplifier and P/Unit as a COMPLETE KIT OF PARTS **£35 0 0**
- (b) The model HF/TR2 AMPLIFIER and POWER UNIT both fully assembled, together with the TRUVOX TAPE DECK incorporating PRECISION REV COUNTER **£41 10 0**
ALTERNATIVELY as above but the HF/TR2 Amplifier and P/Unit as a COMPLETE KIT OF PARTS **£38 0 0**
- (c) The model HF/TR2 AMPLIFIER and POWER UNIT, both fully assembled, together with the COLLARO TRANSCRIPTOR **£35 0 0**
ALTERNATIVELY as above but the HF/TR2 Amplifier and P/Unit as a COMPLETE KIT OF PARTS **£31 10 0**
- (d) The Model HF/TR1P TAPE PRE-AMPLIFIER together with the TRUVOX MK IV TAPE DECK **£35 0 0**
- (e) ALTERNATIVELY as in (d) above but Truvox Deck incorporating PRECISION REV COUNTER **£38 0 0**
- (f) The model HF/TR1P TAPE PRE-AMPLIFIER together with the COLLARO TRANSCRIPTOR **£31 10 0**

PLEASE INCLUDE 12/8 to cover cost of Carriage and Insurance.

HIRE PURCHASE and CREDIT SALE TERMS are available on all above (excluding Kits of Parts). Send S.A.E. for details.

NOTE . . . The Collaro Transcripator is in short supply and there may be a delay in delivery. We will however book an order.

The Deck switches of the Transcripator must be "wired-up." We will complete this wiring, for use with either the HF/TR2 or the HF/TR1P, for an extra charge of £1.0.0.

Open Monday to Friday 9 a.m.—6 p.m. Saturday 9 a.m.—1 p.m.

STERN RADIO LTD.

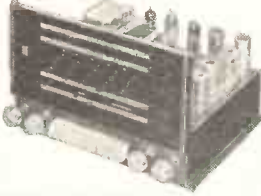
(DEPT 109/W)

109 & 115, FLEET ST., LONDON, E.C.4

Telephone: FL Eet St. 5812/3/4

IT'S MUCH BETTER

THE NEW ARMSTRONG P.B. 409 AM/FM RADIOGRAM CHASSIS

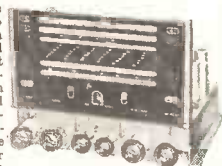


PRICE £29.8.0
(Plus 7/6 carr. and ins.).
TERMS: Credit Deposit £7/7/- and 9 monthly payments of £12/14/- H.P. Dep. £14/14/- and 12 monthly payments of £17/3.

BRIEF SPECIFICATION:—
A 9 valve line up employing the latest MULLARD preferred-type valves. ● Provides complete coverage of the VHF/FM Transmissions, plus the SHORT, MEDIUM and LONG waves. ● Has Push-Pull output, with negative feedback, for 6 watts Peak output. ● Quick action "Plano Key" Selectors and separate Bass and Treble Controls. ● Has "Magic Eye" Tuning Indicator. ● Dimensions 13in. x 9 1/2in. x 6in. high. Dial size 11 1/2in. x 5 1/2in.

THE ARMSTRONG MODEL A.F. 105 AM/FM RADIOGRAM CHASSIS

A Genuinely Hand Made Chassis
Developed to meet the needs of those who require really high quality radio and record reproduction but who, for reasons of expense or lack of room in existing or proposed cabinets, cannot consider the normal high-fidelity system. The A.F. 105 is as good as, or better than, many of the high quality amplifiers, and Associated units. Independent and continuously variable Bass and Treble controls give a wide range of control. **SEND S.A.E. FOR DETAILS.**



PRICE £37 (Plus 7/6 carr. and ins.).
CREDIT SALE TERMS: Deposit £9/5/- and 9 monthly payments of £37/10.
HIRE PURCHASE TERMS: Deposit £18/10/- and 12 monthly payments of £11/4/.

IT'S MUCH CHEAPER

THE DULCI MODEL H.4



COMBINED AM/FM RADIOGRAM CHASSIS
A 4 Waveband Receiver designed for first-rate reproduction of Radio and Gram. **PRICE £24.6.6**
(Plus 7/6 carr. & ins.).

CREDIT TERMS: Deposit £8/2/- and 9 monthly payments of £24/7. H.P. TERMS: Deposit £12/3/3 and 12 monthly payments of £12/7.
BRIEF SPECIFICATION:—
● Covers Short, Medium, Long and F.M. Wavebands. ● Employs full A.V.C. ● The Latest 7-valve line-up. ● For 3 or 15 ohm P.M. Speakers. ● "Magic Eye" Tuning Indicator. ● Excellent Tone range up to 4 watts output. ● Internal aerial for local stations. ● Overall size 12in. x 9 1/2in. x 7 1/2in. high. A Good Quality Chassis and Well Recommended.

THE FOLLOWING DULCI TUNER UNITS ARE IN STOCK

MODEL H.4T. This model is the "TUNER UNIT VERSION" of the H.4 Radiogram Chassis illustrated and described above. It has the same coverage of A.M. and F.M. Wavebands (4 altogether) and precisely the same in size and appearance, except that it has three Controls only, being: TUNING, WAVECHANGE and Volume On/Off, mounted centrally on the chassis. A self-contained Tuner incorporating own Power Supply.

PRICE £20.17.0
(plus 7/6 carr. & ins.).
CREDIT TERMS: Deposit £5/4/3 and 9 monthly payments of £11/8/4. H.P. TERMS: Deposit £10/8/6 and 12 monthly payments of 19/4.

THE DULCI MODEL H.11



"The Heart of High Fidelity"
A COMBINED and SELF-POWERED AM/FM TUNER "HI-FI" CONTROL UNIT

and **AUDIO PRE-AMPLIFIER**
Incorporating switching and connections for direct use with TAPE EQUIPMENT.

PRICE £29.3.10
(Plus 7/6 carr. and ins.).
CREDIT TERMS: Deposit £27/6/- and 9 monthly payments of £29/13/6. H.P. TERMS: Deposit £14/12/6 and 12 monthly payments of £17/1-.
A truly High Fidelity Unit containing the functions of an A.M./F.M. Tuner—Pre-amplifier Tone Control Unit, all on one chassis, designed for use with any High Quality Main Amplifier (i.e., the Mullard 5-10 at £29/10/-, or Williamson, etc.).

BRIEF DESCRIPTION:—
● Covers 4 wavebands being Short—Long—Medium and the V.H.F./F.M. Band.
● Separate Bass and Treble Controls.
● Gram Equalising.
● Magic Eye Tuning.
● Latest BVA 7-valve line-up, plus two matched Diodes.
● Overall size 12in. x 9in. x 7 1/2in. high.

THE DULCI VHF/FM TUNER



PRICE £17.10.0
(Plus 5/- carr. & ins.).

CREDIT TERMS: Deposit £4/7/6 and 9 monthly payments of £11/12/1. H.P. TERMS: Deposit £8/15/- and 11 monthly payments of 17/8.
BRIEF DETAILS:—
(a) Designed to operate with any make of Amplifier and most Radio Receivers.
(b) Incorporates its own Power Supply.
(c) Has the highly efficient GERLER INDUCTANCE TUNING HEART.
(d) A "Magic-Eye" TUNING INDICATOR is incorporated.
(e) Employs the latest valve line-up—EABC80, EOC85, two EF89's 6 x 4 (Rectifier) and EM80 Indicator.

(f) A very attractive Dial (size 10 1/2in. wide x 6in. high) is incorporated and the overall size of Chassis is 6in. deep x 6in. wide x 9 1/2in. high.
The V.H.F. V.H.F./F.M. TUNER is also in stock. It is very similar to the above Dulci F.M. Unit both in general appearance and performance.
PRICE—PRECISELY the same as the Dulci V.H.F./F.M. Unit.

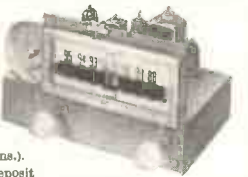
THE MODEL A.F.O.—3 Waveband A.M. only RADIOGRAM CHASSIS

PRICE £11.16.4
(plus 7/6 carr. & ins.).
H.P. TERMS: Deposit £5/18/4 & 8 monthly payments of 17/3.
This is a standard 4-valve A.C. Main Superhet Receiver Chassis covering Long—Medium—Short Wavebands, having Gram and Extension Speaker Sockets. Reproduction from both Radio and Gram is really good and it makes an ideal Chassis for a simple domestic installation. Overall size is 12in. x 7in. x 7 1/2in. high. Really Modern Demonstration Rooms are now available for the convenience of callers.



Stern's "fidelity" F.M. TUNING UNIT

UNIT
A 5-Valve Tuner incorporating the latest Mullard Permeability Tuned Unit. Price assembled less Power Supply.
£14.10.0
(Plus 7/6 carr. and ins.).
TERMS: (a) H.P. Deposit £7/5/- and 9 monthly payments of 18/4; (b) Credit Deposit £31/2/6 and 9 monthly payments of £16/7. Provides "HI-FI" reproduction with any make of Amplifier and many Radio Receivers. It incorporates:
● The latest Valve line-up—EOC85, 2 type EF85, EF91 and EM80. ● A "Magic Eye" Indicator. ● Power consumption is 1.7 amps at 6.3 volts and 26 m/a at 250 volts.

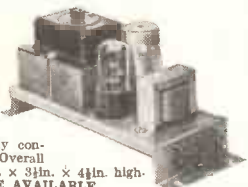


STERN'S "fidelity" COMBINED A.M. and F.M. TUNING UNIT

This is IDENTICAL to the Stern's F.M. Tuner illustrated above, but in addition incorporates the MEDIUM WAVEBAND and thereby also provides a selection of foreign stations. **PRICE £18.18.0** (Plus 7/6 carr. and ins.).
TERMS:—(a) H.P. Deposit £9/9/- and 10 monthly payments of £11/1/-; (b) Credit Deposit £4/15/- and 9 monthly payments of £11/4/7. Send S.A.E. if further data required.

STERN'S POWER SUPPLY UNITS

Fully smoothed with all output connections terminated to Compact 5 Pin Blocks, thereby enabling ease of connecting to a Radio Tuner Unit or Amplifier, etc. (the Compact 5 Amplifiers are immediately connected in this way). Overall size of Units is 9 1/2in. x 3 1/2in. x 4 1/2in. high.
TWO MODELS ARE AVAILABLE
Type "A" Unit provides 250-300 volts at up to 70 m/a and 6.3 volts at 3 1/2 amps.
PRICE £2.17.6 (Plus 5/- carr. and ins.).
Type "B" Unit provides 250-300 volts at up to 100 m/a and 6.3 volts at 3 1/2 amps.
PRICE £3.3.0 (Plus 5/- carr. and ins.).



WE ALSO SUPPLY THESE UNITS AS COMPLETE KITS OF PARTS

A detailed wiring-up leaflet is supplied (this is available separately for 9d.), and they are very quickly and easily assembled.
Type "A" Unit Complete Kit. **PRICE £2/9/6.**
Type "B" Unit Complete Kit. **PRICE £2/15/-.**
(Carriage and Insurance is 2/- extra.)

THE DULCI MODEL H.3 COMBINED AM/FM RADIOGRAM CHASSIS



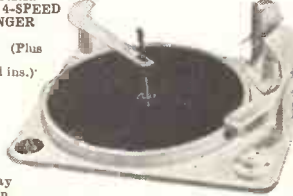
This model is very similar to the Model H.4 described above but covers 3 WAVEBANDS instead of 4 (omitting the Short Band) and is for 3 ohm Speakers only. Overall size is as for the H.4.
PRICE £20.17.0 (Plus 7/6 carr. and ins.).
CREDIT TERMS: Deposit £5/4/3 and 9 monthly payments of £11/8/4. H.P. TERMS: Deposit £10/8/6 and 12 monthly payments of 19/4.

RECORD PLAYERS THE VERY LATEST MODELS ARE IN STOCK

MANY AT REDUCED PRICES !!!
TRANSCRIPTION UNITS—AUTOCHANGERS SINGLE RECORD PLAYERS
Send S.A.E. for ILLUSTRATED STOCK LIST

CASH ONLY OFFER !!!

This latest B.S.R. MONARCH 4-SPEED AUTOCHANGER
£8.7.6 (Plus 5/- carr. and ins.)
● They play MIXED 7in. 10in. and 12in. records of same speed.
● Minimum baseboard size required 14in. x 19 1/2in., with height above 5 1/2in., and height below baseboard 2 1/2in. A bulk purchase enables us to offer these BRAND NEW UNITS at this exceptional price.



WE ALSO HAVE A FEW ONLY

COLLARO MODEL 456 4-Speed "Mixer" Autochangers. The Units are BRAND NEW and incorporate the STUDIO "O" Pick-up.
PRICE £9.10.0 (Plus 5/- carr. and ins.).

FOR CALLERS ONLY We have in stock various **KITS OF PARTS** including F.M. Tuners, AM/FM Tuners, Midget Battery Portable and Mains Units, etc., etc. . . We also have the most comprehensive stock of WIRELESS and ELECTRICAL COMPONENTS.

Open Monday to Friday 9 a.m.—6 p.m.
Saturday 9 a.m.—1 p.m.

STERN RADIO LTD.

AMPLIFIERS
PRE-AMPLIFIERS
HIGH FIDELITY
FOR THE
HOME CONSTRUCTOR
TUNING UNITS
RADIORECEIVERS

—COMPLETE KITS OF PARTS FOR THE "Hi-Fi" ENTHUSIAST—

QUALITY OF THIS NATURE HAS NEVER BEFORE BEEN OFFERED AT SUCH LOW COST

STERN'S REMOTE CONTROL UNIT
Designed in particular for use with the MULLARD 5-10 Main Amplifier.

Ideally suited for simple domestic installation as an alternative to the more elaborate Pre-amplifier (shown opposite). Tone Control facilities are really excellent and in conjunction with the "5-10" Main Amplifier reproduction is of very high quality. Perfectly suitable for use with all the popular Record Players (H.S.R., Collaro, Garrard) and the modern Radio Tuner Units. Front Panel contains: (a) Coloured Indicator; (b) Separate BASS and TREBLE CONTROLS; (c) 3 position Selector Switch; (d) Volume Control. Inputs on back for Radio and Gram, and Gram equalising is incorporated. FULL DATA is contained in the 5-10 MAIN AMPLIFIER MANUAL at 1/6.



The MULLARD "5-10" MAIN AMPLIFIER



Probably the most popular and successful Amplifier yet designed and certainly needs no recommendation from us. Our kit is complete to MULLARD'S specification including the latest ULTRA LINEAR OUTPUT TRANSFORMER and the recommended Mullard Valve line-up. All specified Components are supplied and Power Supply is available to drive a Radio Tuner Unit.
PRICE OF COMPLETE KIT OF PARTS £9.10.0
(plus 5/- carr. & ins.)
or alternatively we supply—
FULLY ASSEMBLED AND TESTED for £11.10.0
(plus 5/- carr. & ins.)
THE ASSEMBLY MANUAL containing FULL SPECIFICATION is available for 1/6. It also includes full data on the REMOTE CONTROL UNIT.

STERN'S "fidelity" PRE-AMPLIFIER-TONE CONTROL UNIT

"A design for the Music Lover"



This unit can be used with any Main Amplifier. Briefly it has inputs for all types of MICROPHONES, HIGH and LOW GAIN PICK-UPS and a RADIO TUNING UNIT. It incorporates (a) GRAM EQUALISING CONTROL (b) STEEPCUT FILTER. (c) Continuously variable BASS and TREBLE CONTROLS, a variable OUTPUT CONTROL which enables its use with any type of Amplifier, and Jack Sockets are incorporated for TAPE RECORD and TAPE PLAYBACK. Used with the "5-10" the reproduction is comparable to that normally associated only with the very expensive commercially made High Fidelity Amplifiers. £6.6.0
PRICE OF COMPLETE KIT OF PARTS £6.6.0
WE ALSO OFFER IT ASSEMBLED READY FOR USE £8 (plus 5/- carr. & ins.)
THE ASSEMBLY MANUAL contains full specification, and is available for 1/6.

THE MULLARD "3-3" QUALITY AMPLIFIER



A small Compact Amplifier capable of VERY HIGH QUALITY REPRODUCTION on both RADIO and GRAM.
PRICE for Complete KIT OF PARTS.... £6.19.6
(plus 5/- carr. & ins.)
Alternatively supplied ASSEMBLED and READY for USE £8.12.6
(plus 5/- carr. & ins.)
The complete SPECIFICATION and ASSEMBLY DIAGRAMS are available for 1/6.
Developed from the very popular 3 valve 3 watt. Amplifier designed in the Mullard Laboratories. We strictly adhere to their specification but in addition we have added switched equalising for L.F. and 78 records and a position for Radio Inputs, plus additional power to feed a Radio Tuning Unit. Extremely simple to assemble and ideally suitable to incorporate with an F.M. Tuner and Record Player in a small installation.

BRITAIN'S FINEST "HI-FI" AMPLIFIER



The GENUINE WILLIAMSON
"Still sets the standard for all amplifiers."
Many versions of the Williamson have been offered to the public at various low prices, but the only Williamson's in the Amplifier built to the designer's specification and employing the very highest grade Components that he specifies, i.e. PART-RIDGE TRANSFORMERS, CHOKES, etc. It is only in doing this that the exceptionally high standard that has made this Amplifier so famous, particularly in America, is obtained... WE HAVE DONE THIS!!!... and we offer these KITS OF PARTS, including Partridge and other high grade Components, as follows—
(a) To build the MAIN AMPLIFIER ONLY £14.10.0
(Illustrated above).
(b) To build the TWIN POWER SUPPLY UNIT only £13.10.0
(Insufficient space to illustrate this.)
(c) COMPLETE KIT to build both above £27.0.0
We will also supply COMPLETELY ASSEMBLED and will be pleased to quote. Credit and H.F. Terms are available. The complete SPECIFICATION and general ASSEMBLY INSTRUCTIONS are available for 3/6.
Our "fidelity" PRE-AMPLIFIER, illustrated and described above, or alternatively the RCA Pre-Amplifier at £10/5/-, is recommended for use with the Williamson.

DEPT. 109/W

109-115 FLEET ST.
LONDON, E.C.4

Phone: FLEet Street 5812-3-4.

**SPECIAL PRICE
REDUCTIONS FOR PURCHASERS OF A COMPLETE
"Hi-Fi" AMPLIFIER WE WILL SUPPLY...**

- (a) The COMPLETE KIT of PARTS to build both the MULLARD 5-10 and the REMOTE CONTROL UNIT for..... £11.11.0
- (b) The COMPLETE KIT of PARTS to build both the MULLARD 5-10 and the "Fidelity" PRE-AMPLIFIER-TONE CONTROL UNIT for..... £15.15.0
- ALTERNATIVELY WE WILL SUPPLY ASSEMBLED and FULLY TESTED, as follows—
- (a) THE MULLARD 5-10 and the REMOTE CONTROL UNIT for..... £14.0.0
- CREDIT SALE TERMS, £3.10.0 Deposit and 9 monthly payments of £1.5.8. H.P. TERMS, £7 Deposit and 9 monthly payments of 17/8.
- (b) The MULLARD 5-10 and the "Fidelity" PRE-AMPLIFIER-TONE CONTROL UNIT for..... £18.18.0
- CREDIT SALE TERMS £4.15.0 Deposit and 9 monthly payments of £1.14.7. H.P. TERMS, £9.9 Deposit and 12 monthly payments of 17/8.

WHEN ORDERING PLEASE INCLUDE 7/6 to cover cost of Carriage and Insurance.

A COMPLETE KIT OF PARTS, STERN'S "HIGH QUALITY" 8-10 WATT AMPLIFIER



Has power supply available for Radio Tuning Unit.
Price of COMPLETE KIT OF PARTS £7.10.0
(plus 5/- carr. & ins.)
WE ALSO OFFER IT ASSEMBLED AND READY FOR USE for £9.10.0
(plus 5/- carr. & ins.)
This amplifier has proved one of the most popular models yet offered to the HOME CONSTRUCTOR. It provides really excellent reproduction up to 8 watts, employing 6V6's in push-pull and incorporating negative feedback. Provides for the use of both 3 and 15 ohm Speakers. The complete SPECIFICATION and BUILDING INSTRUCTIONS are available for 1/6.
"Wire-to-Wire" Diagrams are included and all Components are available separately

THE FOLLOWING HIGH FIDELITY AMPLIFIERS ARE IN STOCK

- STERN'S COMPACT 5 AMPLIFIERS. Expressly developed for very high quality reproduction of Gram Records and particularly FM Transmission. Available in 2 models as follows.
- COMPACT "6-2". A two-stage high sensitivity amplifier having separate Bass and Treble Controls. Price £6.6.0
 - COMPACT "5-3". A three-stage version of the "5-2", but having an additional stage incorporating negative feedback. Price £6.16.0
- Power supply is obtainable from a small separate unit. Price (additional to above), £2.10.0.
- THE DULCI MODEL D.P.A.10. A 10 watt. "Ultra Linear" High Fidelity Amplifier with £19.19.0 separate PREAM-TONE Control Unit
 - THE LEAK MODEL TL10 and "POINTONE" PRE-AMPLIFIER. A universally known Amplifier and now quite accepted as one of the best in production. £28.7.0
 - THE ARMSTRONG MODEL A.10 Mk. II. With associate PREAMP-TONE CONTROL UNIT, that model is perfectly consistent with Armstrong's very high reputation. £32.0.0
 - THE ROGERS "JUNIOR". With associate PREAMP-TONE CONTROL UNIT. £26.0.0
 - THE RCA "ORTHOEPHONIC". 12-20 watt. high Fidelity Amplifier and associate PREAMP-TONE CONTROL UNIT £41.0.0
- HIRE PURCHASE and CREDIT TERMS are available on all models.
Illustrated and Descriptive leaflets are available. Send S.A.E.

SPECIAL CASH ONLY OFFER!!

This very attractive PORTABLE AMPLIFIER CASE together with a 2 Stage GRAM AMPLIFIER and a matched 6 1/2in. P.M. SPEAKER. ALL FOR £8.7.6
(plus 7/6 carr. & ins.)
The Amplifier consists of a 2 Stage design incorporating the modern B.V.A. valves types ECC83, EL84 plus E280 Rectifier and has separate BASS and TREBLE CONTROLS. The Portable Case will also accommodate almost any make of Autochanger, and is attractively finished in Maroon and Grey colour Rexine WE ALSO SUPPLY SEPARATELY—



- (a) The 2-Stage (Rectifier) AMPLIFIER... £4.2.6
 - (b) The PORTABLE CARRYING CASE £3.17.6
 - (c) 6 1/2in. P.M. SPEAKER 16/9
- We also have a smaller PORTABLE CASE Ideal for Record Players. PRICE ONLY £3/3/- (plus 3/- carr. & ins.). Attractively finished in high grade Rexine and robustly constructed with initial measurements at 13 1/2 x 15 1/2 in. high. It will therefore accommodate all makes of Record Players including Autochangers. An uncut baseboard is also supplied.

LASKY'S RADIO

SAVE POUNDS! ORDER BY POST IF YOU CANNOT CALL

TRANSISTORS AT A REASONABLE PRICE

R.F. P.N.P. Junction type, suitable for medium and low frequency oscillators, frequency changers and I.F. amplifiers, 1.5 to 8Mc/s (double spot—yellow & red) **21/-**
AUDIO P.N.P. Junction type, suitable for high gain and low frequency amplifiers, and for output stages up to 250 milliwatts. (double spot—yellow and green). **10/-**
 Post Free.



SPECIAL PRICES FOR 6 AND OVER.

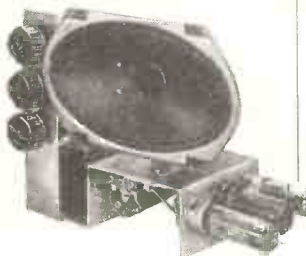
★ TESTED AND GUARANTEED EFFICIENT

★ HERMETICALLY SEALED and unaffected by temperature variations.

Full operating data and circuit diagrams for a simple receiver superhet, T.R.F., multi-vibrator, relaxation oscillator, audio amplifier, oscillators signal tracers, etc., supplied with each Transistor.

MULLARD TRANSISTORS
 OC70 or OC71 21/- | OC72 30/- | OC16 60/-

BRIMAR TRANSISTORS
 TS1 15/-, TS2 21/-, TS3 24/-, TP1 or TP2 40/-, TJ1 30/-, TJ2 35/-, TJ3 40/-.



LASKY'S 4-WATT PORTABLE GRAM AMPLIFIER

Will suit any type of crystal or magnetic pick-up. Uses 3 valves: EL84 output, L63 and EZ80 rect. Speaker and controls are completely separate and can be mounted as shown or on anywhere in cabinet where most suitable.

COMPLETE with 3 valves and knobs, less Speaker. **79/6**
 Carr. 5/-.

7x4in. Elliptical Speaker, if required, 19/6 extra.

Details and circuit diagram post free on request.

INTRODUCING LASKY'S TRANSISTORISED SUPERHET FRONT END TUNER ON PRINTED CIRCUIT

Uses three R.F. Transistors and one Germanium Diode, three I.F. transformers, Ferrite rod aerial. Operates on one 6 v. battery and one 1.5 v. cell.

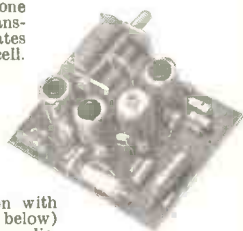
Size of printed circuit, 3 1/2in. x 3 1/2in.

CAN BE BUILT FOR **£5.12.9**

Full details and illustrations post free on request.

Demonstrations at both addresses.

NOTE.—This Tuner in conjunction with our Transistor Amplifier (see below) makes an excellent Transistorised radio. Cabinets available.



THE TELETRON "COMPANION"

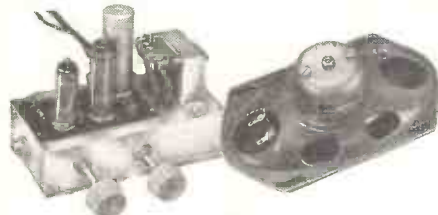
3-TRANSISTOR POCKET RADIO. T.R.F. circuit covering and long waves, with balanced armature output, Ferrite aerial. Note small size of case: 4 1/2 x 3 x 1 1/2in. You can build this novel transistorised pocket receiver for only **89/6**

Full instructions and price list, 6d. post free. All components available separately. Teletraon Coil FX25, 15/-, Ardenite Trans. D240, D239, 10/- each. Case and Fret, 8/6.

ALL TRANSISTOR COMPONENTS stocked. Trans., midget, min. and sub-min. Coils, Ferrite Rods, sub-min. Condensers, etc.

SUB-MIN. TRANSISTOR INTER-STAGE TRANSFORMERS. 4-1 ratio each **6/6**
 Post 1/-.

TRANSISTOR TURNTABLES. 45 r.p.m., 6 volt, complete with pick-up **£5.19/6**
 Post 5/-.



LASKY'S PORTABLE GRAM AMPLIFIER KIT

2 watts. Note small dimensions: approx. 6 1/2 x 3 1/2in., max. height 5in. Uses EL84 output and 6X4 rectifier, double-wound transformer, tone control, output transformer, etc. Built on a T.C.C. PRINTED CIRCUIT which greatly simplifies construction and eliminates wiring errors.

COMPLETE KIT, including valves, printed circuit, full instructions, less Speaker **58/-**
 Carr. 2/6.

7x4in. Elliptical Speaker, if required, 19/6 extra.

LASKY'S NEW MINIATURE 200 milliwatt TRANSISTOR AMPLIFIER KIT

FOR CONSTRUCTION ON A PRINTED CIRCUIT

Size: 3 1/2 x 3 1/2in. Height can be under 1in.

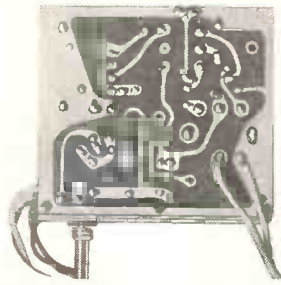
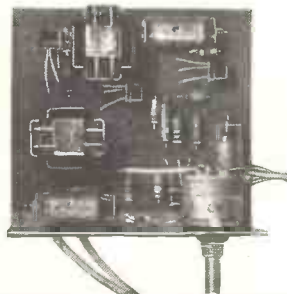
Uses our new hermetically sealed Transistors and operates from 6 volt battery. The great popularity of this new kit has enabled us to substantially reduce our price.

SEND FOR FULL DETAILS, CIRCUIT DIAGRAM AND SHOPPING LIST, 1/-
 Post free.

LASKY'S PRICE FOR THE COMPLETE KIT including 4 Transistors, all brand new components, latest T.C.C. Miniature condensers printed circuit and full instructions. **79/6**
 Post 2/6.

You can have a demonstration at either of our addresses and you will be amazed at the results!

All components available separately.



AUTO-CHANGERS

Our stocks are constantly changing. See us for your requirements or send for our latest list



COLLARO 4-SPEED MIXER AUTO-CHANGER

Latest model RC.456 incorporating auto and manual control enabling records to be played singly or automatically. Complete with Studio crystal pick-up and sapphire stylus. List £13.17.0. **LASKY'S PRICE £9.15.0**

B.S.R. 4-speed with t.o. crystal pick-up. £8/15/-, post 5/-.

SINGLE PLAYERS



Collaro 3/554 3-speed Single Player with Studio 1 p.u., crystal cartridge and styli. **LASKY'S PRICE £6.19.6**
 Carr. 3/6.

Collaro 4/456 4-speed Single Player £7/19/6.

CABINETS AND CASES

Large selection for TV sets, radiograms, record players, tape recorders etc. at attractive prices.

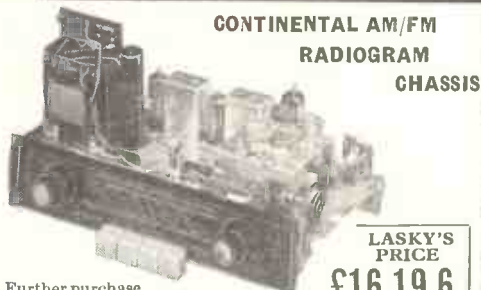
PICK-UP BARGAIN "RONETTE" Lightweight Crystal Pick-up with 2 cartridges. **LASKY'S PRICE 45/-**
 Post 2/6.

P.U. CARTRIDGES

ACOS HGP37 p.u. cartridges, i.p. and standard, complete with styli. List 41/7. **LASKY'S PRICE 18/-**
 Post 1/-.

MORE MONEY-SAVING LASKY BARGAINS ON NEXT PAGE

RADIO · TELEVISION · HI-FI · ELECTRONICS · RECORDERS



**CONTINENTAL AM/FM
RADIOGRAM
CHASSIS**

**LASKY'S
PRICE
£16.19.6**
Carr. 12/6.

Further purchase enables us to re-offer this wonderful bargain! Built throughout of latest high grade components. 5 valve plus metal rect., gram socket and switch, piano key wavechange, tone control, independent AM/FM tuning. Covers med., long and V.H.F. wavebands. Valve line-up: ECC85, ECH81, EF89, EABC80, EL81. For A.C. mains 100-250 v. Also available: the **IMPERIAL DE LUXE AM/FM Radiogram chassis** with every up-to-date refinement and 3 speakers, **£25.** Post and packing 15/-.



**WONDERFUL OFFER OF
THE FAMOUS 'CHAMPION'
BAND III CONVERTERS**

A high grade model covering all channels, Bands I and III, B.B.C. and ITV. Uses valves PCC84, EF80 and U78 rectifier. Incorporates own power supply. In attractive cream plastic case. Listed at **£10.10.0.**

**LASKY'S PRICE
79/6**
Post 5/-.

**LASKY'S
RADIO**

**STILL FURTHER
REDUCED!**

BAND I-III TUNERS. Covers channels 8-4 pr. 1-9 with provision for 10 more coil sets. Output 16-19 Mc/s, easily modified to other outputs. Complete with power supply for 200-250 v. A.C., 2 Mazda valves, knob and circuit diagram. **LASKY'S PRICE 97/6** Post 3/6.

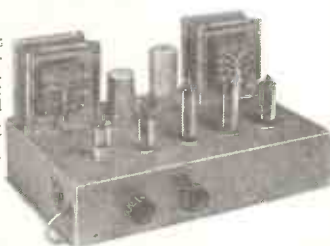


HI-FI AMPLIFIER BARGAIN OFFER!

LIMITED QUANTITY ONLY

Complete with Mullard valves. Famous 5/10 circuit. Push-pull, 12 watts output. Separate bass and treble controls. Remote control for volume. Valves: Mullard, 2 EL84, 1 ECC83, 1 EF86 and rect. EZ80. Chassis: 12 1/2 in. wide, 8 1/2 in. deep, maximum height 7 in. Grey hammered enamel finish. For A.C. mains 200-250 v.

LASKY'S PRICE £8.19.6
Carr. and pkg. 7/6.



**BUILD YOURSELF
A HIGH GRADE
RECORD PLAYER!**

We can supply the Units, Amplifiers and Cases for building either the Auto-Changer or Single Player illustrated.



Take this opportunity to build yourself an Auto or Single Player of high performance and handsome appearance. Any of these Units demonstrated at either of our addresses.

MULLARD 510 AMPLIFIER KIT WITH T.C.G. PRINTED CIRCUIT

All specified components are used and you have your choice of transformers and chokes by Partridge, Haddon, W/B, Ellison or Gilson. Demonstrations given at any time.



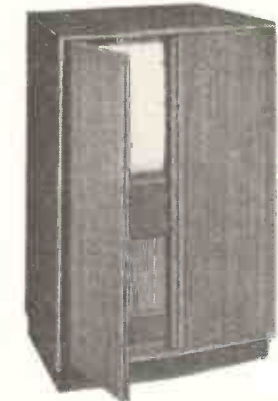
COMPLETE KIT of parts and Printed Circuit for building the Mullard 510, from **10 Gns.** Details on request. Book, 3/6 post free. Printed Circuit separately, 22/6.

We can also supply this built ready for use. Price according to transformers used.

OSRAM 912 AMPLIFIER. Everything in stock for this fine quality hi-fi Amplifier. Can be built conventionally or on printed circuit. **BOOK** and full details, 4/-, post free.

All components for either above Amplifiers supplied separately. Price List on request.

BAND III AERIALS. All types, outdoor or indoor, also Dplexers, Crossover Boxes, Co-axial Plugs, Socket and Cable.



**SUPERB TV CABINET
ALMOST HALF PRICE**

Dimensions: 36in. high, 19in. deep, max. width 26in. Constructed of finest laminated wood with straight grain walnut veneer, inlaid maple. Fitted two full-length doors. Has cut-out for 21in. projection TV but can easily be adapted for any size c.r. tube. Also can be adapted to house hi-fi equipment or a radiogram. A really handsome cabinet which cost £20 to manufacture.

**LASKY'S PRICE
£10.19.6**

Carr. 21/- extra. Strictly limited number.

AMPLIFIER. 4 watt, 3 valve (EL84 output, L63 and EZ80 rect.), 7in. x 4in. elliptical speaker, separate bass and treble controls. Will suit any type of auto-changer or single player. Price, complete with 3 valves, knobs and speaker. **Post 5/-.** **£59/6.**

CASE FOR AUTO-CHANGER, as illustrated, size 18in. x 15in. x 9in., fawn/brown finish. **79/6.** Post 5/- (Others from 69/6.)

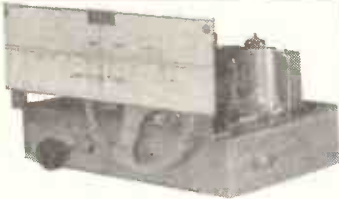
CASE FOR SINGLE PLAYER, as illustrated, size 15 1/2 in. x 13in. x 7 1/2 in., grey, with black/silver bands. **Post 5/-.** **69/6.**

(Others from 49/6.)

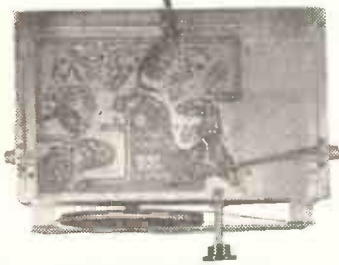
PLAYER UNITS. We recommend the following Collaro units with Studio turnover crystal pick-up:—
4-speed **AUTO-CHANGER RC4/456** **£9 15 0**
3-speed **SINGLE PLAYER, 3/554** **£6 19 6**
4-speed **SINGLE PLAYER, 4/456** **£7 19 6**
(Other types of Auto-Changers and Single Players in stock.)
All the above are available separately.

MORE MONEY-SAVING LASKY BARGAINS ON NEXT PAGE

LASKY'S RADIO



LASKY'S F.M. TUNER
PRINTED CIRCUIT VERSION
OF G.E.C. 912 F.M. TUNER
FOR HOME CONSTRUCTION



Note these star features:—

- ★ HIGH SENSITIVITY.
- ★ ALL BRAND NEW T.C.C. CONDENSERS.
- ★ AERIAL COIL AND R.F. COUPLING COIL PRINTED ON CIRCUIT.
- ★ 5 VALVES AND 2 GERMANIUM DIODES.

By the use of a printed circuit the I.F. and R.F. amplifiers are extremely stable at maximum gain and results are consistent on all tuners.

Valve line-up—
R.F. Amplifier, Z719 or EF80.
Mixer and Osc. B719 or ECC85.
1st I.F. amp., W719 or EF85.
2nd I.F. amp., W719 or EF85.
2 Germanium Diodes GEX.34.
Driver Limiter, Z719 or EF80.

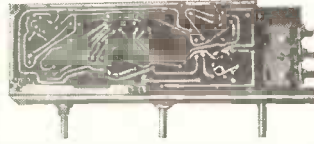
CAN BE BUILT FOR 8 gns.
(Including Valves)
Post and pkg. 2/6.

G.E.C. F.M. Tuner Book plus our full data and shopping list 2/6 post free. All parts available separately. ALIGNMENT SERVICE available.

SAVE POUNDS! ORDER BY POST IF YOU CANNOT CALL

BUILD THIS GRAND BATTERY PORTABLE FOR ONLY 7 GUINEAS

OR AS A MAINS/BATTERY FOR ONLY 9 GNS.



PRINTED CIRCUIT makes construction amazingly easy and accurate. You can build this fine 4-valve superhet portable in an hour or so, and performance equals ready-built sets costing pounds more!

FOR ONLY £7/7/- plus 3/6 carr. and pkg., you can build this Portable using all brand new components and valves, only batteries extra. Printed circuit, circuit diagram, and full instructions supplied.

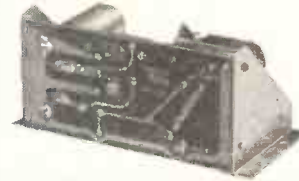
If you would first like to study the layout of this portable send 1/6 for Circuit Diagram, illustrations and full data.

SPECIAL COMBINED OFFER

FOR ONLY £9/9/- plus 3/6 carr. and pkg., you can build this job as a mains and battery Portable using the Power Unit illustrated and described below.

DEMONSTRATIONS GLADLY GIVEN AT EITHER OF OUR ADDRESSES.

POWER SUPPLY UNIT



for the above 4-valve portable. For 200-250 v. A.C. Latest design using PRINTED CIRCUIT, brand new TCC condensers, latest S.T.C. metal rectifiers, etc. Made for the new low consumption valves; constant voltage h.t. and l.t. guaranteed, valves cannot be over-run. COMPLETE KIT, including Printed Circuit and full instructions. 45/-.

Note: The above Power Unit is also suitable for most other battery portables.



10 STAR FEATURES

- ★ PRINTED CIRCUIT, size 7 1/2 x 2 1/2 in.
- ★ 4-valve Superhet, med. and long waves.
- ★ Low consumption Valves. Double Battery Life.
- ★ Ferrite Rod Internal Aerial.
- ★ 5in. P.M. Moving Coil Speaker.
- ★ Brand New T.C.C. Capacitors.
- ★ Automatic Volume Control.
- ★ New Style Contemporary Case
- ★ Lightweight and Handsome Appearance.
- ★ Every Component available separately.

JASON F.M. TUNER

Special parcel containing data book, chassis, front panel, dial, drive, tuning condenser, full sets of coils, I.F.'s ratio detector, etc. Post 2/6. DATA BOOK with price list 2/- Note: This tuner uses 4-6AM6 and 2 crystals and can be built for £6/15/-, plus 3/6 post.

JASON "ARGONAUT"

Super-sensitive Tuner for F.M. and medium waves. Complete parcel with power supply. Post 3/6. £13.19.6 DATA BOOK 2/- post free. Chassis Assembly 57/9 post 2/6. I.F. and Coil Set 78/- post 1/6.

All components available separately.

OTHER F.M. TUNERS

TSL, £17/10/- . DULCI, £17/10/- . Also Quad, Leak, R.C.A., Rogers, Pamphonic, etc. DULCI H4/T 4-wave AM/FM Tuner, £20/17/-.

HI-FI SPECIALISTS!

Selective Demonstrations of all the latest and best Hi-Fi equipment are given at our Tottenham Court Road showrooms. Call and see our large and comprehensive stocks.

PICK - UPS. Garrard, Leak, Connoisseur, Orthophone B/J., etc., etc.

SPEAKERS. Wharfedale, Goodmans, G.E.C., Lothar, Lorenz, etc., etc.

NOTE. We can still supply Goodmans Speakers at pre-increase prices. Why wait and pay more?

AUDION 60 ...	£9 2 6	TREBAX	£6 4 0
AXIOM 150, Mk. II	£10 15 9	AXIOM 22, Mk. II	£14 14 0

TRANSCRIPTION TURNTABLES. 3 and 4 speed Garrard, Connoisseur, Collaro, Lenco, etc.

AMPLIFIERS. Quad, Rogers, Leak, R.C.A., Pamphonic, Unitelex, W.B., etc.

CABINETS. Wide selection and bargain value in Cabinets and cases to house your speakers and hi-fi equipment.

NEW BRENELL MARK IV DECK

Now available! Entirely redesigned to permit of conversion to stereophonic sound with 4 heads for dual channel operation when required.

DECK only 22 gns.

DECK WITH PRE-AMP. UNIT and magic eye indicator ready for use with any standard amplifier 38 1/2 gns.

COMPLETE MARK IV TAPE RECORDER, as illustrated. Counter 30/- extra. 53 gns.

Come and inspect the new Brenell Mark IV and have a demonstration. Full details post free on request.

HIRE PURCHASE TERMS AVAILABLE on certain items. Write stating requirements.



TAPE DECKS

Collaro "Tape Transcrip." Mk. IV, £22. With fitted Pre-Amp. £21 extra.

Truvox Deck, Mk. III, 23 gns.

Truvox Deck, Mk. IV, £27/6/-.

Lane Deck, £18/10/-.

Wearite Decks, £35 and £40.

TAPE RECORDERS

Leading makes — Grundig, Elizabethan, Truvox, Sound, Vortexion, etc.

ALL LEADING MAKES OF RECORDING TAPE IN STOCK.

COLLARO TAPE DESK

MOTORS, set of 3, clockwise, anti-clock, capstan. List £5/15/-.

LASKY'S PRICE **95/-**
Post 5/-.

MAGNETIC RECORDING TAPE, kraft base, on Cydon metal spool, 1.200ft. 10/6. Post 1/-.

HI-FI ELECTROSTATIC SPEAKERS ("TWEETERS")

Easy to fit to any radio, TV receiver or amplifier. Full data and circuit diagram supplied.

LSH75. For outputs up to 6 watts, 8/-.

LSH518. For outputs of 10-12 watts, 12/6.

LSH100. For outputs up to 20 watts, 14/-.

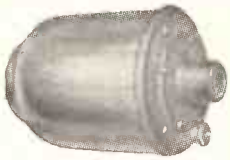
Post free.

LPH65. MOVING COIL TWEETER.

Imp. 5.5 ohms, freq. range 2,000-2,200 50 c/s. For outputs up to 6 watts. 2 1/2 in. diameter. All post free. 39/6

MORE MONEY-SAVING LASKY BARGAINS ON NEXT PAGE

EVERYTHING FOR HOME CONSTRUCTOR & SERVICEMAN



TRUVOX 'SENIOR' SPEAKER DRIVING UNIT (pressure type)
Power handling cap. 15 watts peak. With 12ft. cinema horn reproduces down to 17cps.
List £7/15/- Lasky's Price **59/6**
Carr. 5/-

MOVING COIL P.M. SPEAKERS

2 1/2 in.	17/6
3 in.	19/6
5 in. 19/6. 6 1/2 in. 17/6. 8 in. 21/-	
10 in. 29/6. 12 in. 29/6	
6 1/2 in. with transformer	21/-
7 x 4 in. Elliptical	19/6
10 x 7 in. Elliptical	32/6



SAVE POUNDS ON THIS 6-VALVE RADIOGRAM CHASSIS COMPLETE WITH VALVES

Famous Manufacturer's Surplus. 6-valve 3-wave Superhet. 13-50 m. short. 200-550 m. medium. 1,000-2,000 m. long. Brand new Mullard valves: ECH42, EF41, L63, EB41, 6V6, g.t., E240 and finest quality components. Gram. switch. 455 Kc/s I.F. tone control, three-colour dial. Overall size 18 1/2 x 5 1/2 in. height 12 1/2 in. Aperture required for dial and controls 11 x 3 1/2 in. Complete with valves, output trans., knobs, etc.

LASKY'S PRICE £10/19/6
Carriage and packing 7/6 extra.

5-VALVE RADIOGRAM CHASSIS COMPLETE WITH VALVES

3-wave superhet, 16-50 m. 200-550 m. 1,000-2,000 m. Brand new Mullard and Mazda valves—6C9, 6P16, 6LD20, N108, U107. Overall dim. 13 in. long, 6 in. deep, 7 in. high approx. for A.C. mains 200/250 v

LASKY'S PRICE 7 GNS.
Carr. and Pkg. 7/6 extra.
Price without valves, £5/4/-.

SPEAKER COVERINGS. Large stocks of Tygan and "Somewave" Speaker Coverings. Any size piece cut. Send for samples and prices.

MAKERS' SURPLUS TV COMPONENT BARGAINS

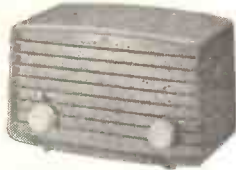
WIDE ANGLE 38 mm.

Line E.H.T. trans., ferro-cube core, 9-10kV.	25/-
Scanning Coils, low imp. line and frame	25/-
Ferro-cube cored Scanning Coils and Line Output Trans., 10-15 kV., EY51 winding, Line Trans. Complete with circuit diagram, the pair	50/-
Frame Output Transformer	6/6
Scanning Coils, low imp. line and frame	17/6
Frame or line blocking osc. transformer	4/6
Focus Magnets Ferro-dure	19/6
P.M. Focus Magnets, Iron Cored	19/6
Duomaz Focallisers	22/6
300 m/a. Smoothing Chokes	15/-
Electromagnetic focus coil with combined scan coils	25/-

STANDARD 35 mm.

Line Output Transformers 6.9 kV. E.H.T. and 6.3 v. winding. Ferro-cube	19/6
Scanning coils. Low imp. line and frame	12/6
Diito by Igranic	14/6
Frame or line blocking oscillator transformer	4/6
Frame output transformer	7/6
Focus Magnets	
Without Vernier	12/6
With Vernier	17/6
Focus Coils, Electro-magnetic	12/6
200 m/a. Smoothing Chokes	10/6

LASKY'S NEW MIDGET T.R.F. CONSTRUCTOR PARCEL



CAN BE BUILT FOR ONLY 99/6

Post & Pkg. 5/-.

Handsome contemporary design case, overall size 8 1/2 in. wide, 4 1/2 in. deep, 5 in. high. 2 latest double-purpose valves EBF9 and ECL80, contact cooled rectifier. For A.C. mains 200-250 v. Med. and long wave. 5 in. P.M. speaker. Plastic cabinet in cream, pastel green, pink, blue.

FULL DATA, instructions, circuit diagram and shopping list, 1/6 post free.

All components available separately.

CABINET only, as illus., 12/6 plus 4/6 post and pkg.

NOTE: This new parcel will not be ready until 21st September approx. Orders will be dealt with in strict rotation, therefore order early.

★ **LASKY'S fully transistorised portable for home constructors on printed circuit. Watch for full details.**



NEW AND PERFECT 16" METAL CONE C.R.T.

Type T901. Note. Not "seconds" but perfect tubes in original cartons. Gives large 11 x 14 1/2 in. picture. Guaranteed by us for 3 months. See our previous adverts in "W. World" or send for details.

LISTED AT £23.9.10

LASKY'S PRICE £8.9.6

Carr. and Insur. 22/6 extra.

Masks, Anti-Corona, Bases and Ion Traps available.

FEW ONLY 17 in. C.R. TUBES

Rectangular, aluminised or ion trap 0.3 heater. Brand new and unused. **£12.19.6**
Carr. and Insur. 22/6.

LASKY'S RADIO CONSTRUCTOR PARCELS



PARCEL No. 1
Contains everything to build a 4-valve 3-wave superhet for 200/250 A.C. mains. Uses 6K8, 6K7, 6Q7, 6V6 valves. Attractive wood cabinet, walnut veneer, or plastic Cabinet as illustrated. Size 12 x 6 1/2 x 5 1/2 in. deep. **CAN BE BUILT FOR £7.19.6**
Carr. and packing 2/6.

PARCEL No. 2
Contains everything to build a T.R.F. 3-valve set for 200/250 A.C. mains, medium and long waves. Uses 6K7G, 6J7, 6V6 and metal rectifiers. Neat plastic cabinet, walnut or ivory finish, or wood cabinet. Size 12 x 6 1/2 x 5 1/2 in. deep. **CAN BE BUILT FOR £5.10.0**
Carriage and packing 2/6

INSTRUCTION BOOK for either above sets 1/- post free.

CABINETS ONLY, plastic or wood, 17/6. Post 2/6.

All parts/omono available separately.

ALL-DRY POWER UNITS

Further purchase enables us to again reduce price

By Decca. Suitable for any battery radio using 1R5, 1T4, etc., 67 1/2 volts H.T., 1 1/2 volts L.T. Mains input 200-250 adjustable. In metal chassis with rubber feet and black plastic cover. Size: 7 in. x 5 in. x 1 1/2 in. Mains lead and on/off switch. Complete with two metal rectifiers, ready for use. Listed at £14/15/-.

LASKY'S PRICE 29/6
Post 3/6.

If too large to fit into your portable, stand it on or by it.

MAINS TRANSFORMERS

All 200-250 v. 50 c.p.s. primary, finest quality, fully guaranteed.	
MEA/3. 350-0-350 v. 80 m.a. 6.3 v. 4 a., 5 v. 2 a. Both filament tapped at 4 volts.	19/6
MEA/7. 250-0-250 v. 80 m.a. 6.3 v. 3 a., 5 v. 2 a. Both filaments tapped at 4 volts.	19/6
AT/3. Auto trans. 0-10-120, 200-230-230 v. 100 watts	19/6
MT/34L. Tapped input 250-0-250, 120 m.a. 6.3 v. 5 amps., fully shrouded	27/3

FILAMENT TRANSFORMERS

All 200-250 v. 50 c.p.s. primary, finest quality, fully guaranteed.	
6.3 v. 1.5 amp.	5/11
6.3 v. 3 amp.	9/6
0-30 v. 2 amp. tapped voltages	19/6.

GERMANIUM CRYSTAL DIODES

GEX.00 1/6 GEX.34 3/6. WG5 3/6. GEX 54 and OAT4 5/- GD3 3/6. GD4 3/6. CG12E 5/-.

SPECIAL PURCHASE RECORDING TAPE

Famous manufacturers' surplus. P.V.C. base, 1,200 ft. on 7 in. plastic Spool. **21/-**
Post 1/-.

SPECIAL SPOOL OFFERS

7 in., Plastic, 2/6. Metal, 1/6. All other types and sizes of Spools in stock.

VALVES

20,000 IN STOCK

Here are a few examples of brand new surplus and imported valves:

EB91	7/6	EV41	10/6	EY86	14/6
EB41	7/6	EF80	10/6	EZ40	8/6
EAB080	10/-	EF85	10/6	EZ80	8/3
EAF42	10/-	EF86	12/6	PCF32	12/6
EA41	10/-	EF89	10/-	PC34	12/6
ECC85	10/-	6K8	10/6	PL81	13/8
ECC84	15/-	6V6	8/6	PL82	10/6
ECC83	9/-	6K7	5/6	PL83	11/5
ECC82	9/-	6Q7	10/6	PY80	10/3
ECC81	9/-	6B7	6/6	PY81	10/6
12AT7	8/6	5Z4	9/6	PY82	10/6
12AU7	9/6	DAP96	10/-	PY83	10/8
12AX7	9/6	DL98	10/-	6AT8	7/6
EB89	10/6	DK96	10/-	6AT7	7/6
ECP92	15/-	DP96	10/-	1B5	7/8
ECH43	11/6	DM70	9/-	8B4	9/-
ECH81	11/6	EY51	12/6	1T4	9/-
ECL80	10/6	EC84	11/6	1B5	7/8

Also full stocks of B.V.A. Valves and C.R. Tubes at the new lower list prices.

WRITE FOR COMPLETE LIST

LASKY'S RADIO

LASKY'S (HARROW RD.) LTD.

TWO ADDRESSES FOR PERSONAL CALLERS
OPEN ALL DAY SATURDAY. EARLY CLOSING: THURSDAY

42 TOTTENHAM COURT ROAD, W.1
Between T.C.R. and Gooch St. Stns. MUSEUM 2605

370 HARROW ROAD PADDINGTON, W.9
(Opposite Paddington Hospital) LAD 4075 and CUN 1979

ALL MAIL ORDERS TO HARROW ROAD PLEASE

SELENIUM BATTERY CHARGING EQUIPMENT

L.T. Types

2/6 v. 1/2 a.h.w.	1/9
6/12 v. 1/2 a.h.w.	2/9
F.W. Bridge	
6/12 v. 1 a.	4/11
6/12 v. 2 a.	8/9
6/12 v. 3 a.	11/9
6/12 v. 4 a.	14/9
6/12 v. 6 a.	19/9
6/12 v. 10 a.	25/9
H.T. Type H.W.	
120 v. 40 mA.	3/9
250 v. 50 mA.	5/9
250 v. 80 mA.	7/9
250 v. 150 mA.	9/9
300 v. 250 mA.	12/11

ASSEMBLED CHARGERS

6 v. 1 a.	19/9
6/12 v. 1 a.	27/9
6 v. 2 a.	29/9
6/12v. 2 a.	38/9
6/12 v. 4 a.	56/9

Above ready for use with mains and output leads. Cases well ventilated and finished in stoved blue hammer. Carr. and packing 3/6.

BATTERY CHARGER KITS

Consisting of Mains Transformer F.W. Bridge. Metal Rectifier, well ventilated steel case, Fuses, Fuse-holders, Grommets, panels and circuit. Carr. 2/6 extra.

6 v. or 12 v. 1 amp. 25/9
 6 v. 2 amps. 25/9
 6 v. or 12 v. 2 amps. 31/6
 6 v. or 12 v. 4 amps. 53/9

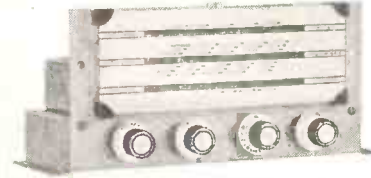
ASSEMBLED CHARGER

6 v. or 12 v. 2 amps.
 Fitted Ammeter and selector plug for 6 v. or 12 v. Louvred metal case, finished attractive hammer blue. Ready for use with mains and output leads. Double Fused. Only Carr. 3/6. **47/9**

All for A.C. MAINS 200-250v., 50 c/s. Guaranteed 12 months. Assembled 6v. or 12v. 4 amps.



Fitted Ammeter and variable charge selector. Also selector plug for 6 v. or 12 v. charging. Double fused. Well ventilated steel case with blue hammer finish. Ready for use with mains and output leads. Carr. 3/9. Or Deposit 13/9 and five monthly payments 13/9.



AM/FM RADIOGRAM CHASSIS PUSH PULL 6-8 WATTS OUTPUT
 Current manufacture. For 200-250 v. mains. Covers L. and M. Wavebands plus F.M. Valve line up: 12AT7, 6BJ6, 12AH8, HABC30, 19A85, 19AQ5, 19AQ5, 35W5. Only 22 gns. plus 7/6 carr. Or deposit £2/12/- and 9 monthly payments of £2/12/-. Guaranteed 12 months.

CO-AXIAL CABLE. 75 ohms. 1/2 in., 8d. yard
 Twin screened feeder 11d. yard.

DIAL BULBS. M.E.S., 8 v. 0.2 a., 6/9 doz.
 6.5 v. 0.3 a., 5/9 doz. 2.5 v. 0.3 a. 3/9 doz.

ELECTROLYTICS (current production). NOT Ex Govt.

Tabular Types	Can Types	
8 mfd. 450 v.	16µF 450 v.	2/9
8 mfd. 500 v.	16 mfd. 500 v.	3/9
16µF 350 v.	32µF 350 v.	2/11
16µF 450 v.	32 mfd. 450 v.	4/9
16µF 500 v.	100 mfd. 450 v.	4/9
8-16µF 500 v.	8-8µF 450 v.	2/11
25µF 25 v.	8-16µF 450 v.	3/11
50µF 12 v.	16-16µF 450 v.	3/11
50 mfd. 25 v.	32-32µF 350 v.	4/9
50µF 50 v.	32-32µF 450 v.	5/9
100 mfd. 12 v.	100-100 mfd. 350 v.	5/9
100 mfd. 25 v.	64-120 mfd. 350 v.	7/6
3,000 mfd. 6 v.	100-200 mfd.	3/9
6,000 mfd. 6 v.	275 v.	6/11

Many others in stock.

VOLUME CONTROLS with long spindles, all values, less switch, 2/9; with S.P. switch, 3/9.

EX GOVT. STEP UP/STEP DOWN TRANSFORMERS. Double wound 80/100 watts. 10-0-100-200-220-240 v. to 5-0-75-115-125-135 v. or Reverse. Only 11/9, plus 2/9 post. 10-0-100-200-220-240 v. to 9-0-110-122-136-148 v. or Reverse. 200 watts, 35/9 plus 7/6 carr.

EX GOVT. METAL BLOCK PAPER CONDENSERS

4 mfd. 500 v.	2/3	8 mfd. 500 v.	4/6
4 mfd. 1,000 v.	3/9	10 mfd. 500 v.	3/9

OIL FILLED BLOCK CONDENSERS
 Bryce 11-7 mfd. 500 v. New unused Govt. surplus, only 5/9 each.

THE SKY FOUR T.R.F. RECEIVER



A design of a 3 valve 200-250 v. A.C. Mains L. & M. wave T.R.F. receiver with selenium rectifier. For inclusion in cabinet illustrated or walnut veneered type.

It employs valves 6K7, SP61, 6F6G, and is specially designed for simplicity in wiring. Sensitivity and quality is well up to standard. Point-to-Point wiring diagrams, instructions and parts list, 1/9. This receiver can be built for a maximum of £4/19/6 including cabinet. Available in brown or cream bakelite, or veneered walnut.

5 CORE FLEX. Henleys circular rubber 14/36. Each lead colour coded. 1/6 yard.

EX GOVT. MAINS TRANSFORMERS
 230 v. 50 c/s. input
 120-0-120 v. 40 mA. 5/9
 Pri. 0/110/200/230/250 v. 275-0-275 v. 100m/a., 6.3v. 7 a., 5 v. 3 a. 18/9

HEAVY DUTY OIL FILLED MAINS TRANSFORMERS
 Suitable welding or soil heating. With input of 200-250 v. 50 c/s., output is 12 v. 80-100 amps. Only £6/19/6, carr. 7/6.

EX-GOVT. VIBRATOR UNITS. 12 v. input 280v. output. Suitable for car radio, etc. 16/6.

MANUFACTURERS SURPLUS TRANSFORMERS. Primary 200-240-250 v. Drop through type 250-0-250 v. 70 mA. 6.3 v. 3 a., 11/9. Postage 2/9.

R.S.C. BATTERY TO MAINS CONVERSION UNITS

Type BM1. An all dry battery eliminator. Size 5 1/2 x 4 1/2 x 2 in. approx. Completely replaces batteries supplying 1.4 v. and 90 v. where A.C. mains 200-250 v. 50 c/s. is available. Suitable for all battery portable receivers requiring 1.4 v. and 90 v. This includes latest low consumption types. Complete kit with diagrams, 39/9, or ready for use, 46/9.



Type BM2. Size 8 x 5 1/2 x 2 1/2 in. Supplies 120 v., 90 v., and 60 v., 40 mA. and 2 v. 0.4 a. to 1 amp. fully smoothed. THEREBY COMPLETELY REPLACING BOTH H.T. BATTERIES AND L.T. 2V. ACCUMULATORS when connected to A.C. mains supply 200-250 v. 50 c/s. SUITABLE FOR ALL BATTERY RECEIVERS normally using 2 v. accumulator. Complete kit with diagrams and instructions 49/9 or ready for use 59/6.

JUNCTION TRANSISTORS for Audio stages. Only 7/6.
MINIATURE MOTORS. 24/28 v. D.C. or A.C. Size only 2 1/2 x 1 1/2 in. Spindle 1 1/2 in. long, 1/2 in. diam. Made by Hoover Ltd., Canada. Price only 9/9.
M.E. SPEAKERS. 2-3 ohms R.A. 8 in. Field 600 ohms, 11/9.

T.V. CABINETS. For 15 16 or 17 in. tube. Table model with doors. 79/6 carr. 7/6.

R.S.C. TRANSFORMERS

FULLY GUARANTEED. INTERLEAVED AND IMPREGNATED.

MAIN TRANSFORMERS
 Primaries 200-230-250 v. 50 c/s.

FULLY SHROUDED UPRIGHT MOUNTING

250-0-250 v. 60 mA., 6.3 v. 2 a., 5 v. 2 a.	17/6
350-0-350 v. 70 mA., 6.3 v. 2 a., 5 v. 2 a.	19/9
250-0-250 v. 100 mA., 6.3 v. 4 a., 5 a., c.t., 0-4-5 v. 3 a.	25/9
250-0-250 v. 100 mA., 6.3 v. 4 a., 5 v. 3 a.	23/9
250-0-250 v. 100 mA., 6.3 v. 6 a., 5 v. 3 a., for R1355 conversion	31/-
300-0-300 v. 100 mA., 6.3 v. 4 a., 5 v. 3 a.	25/9
300-0-300 v. 100 mA., 6.3 v. 4 v. 4 a. c.t., 0-4-5 v. 3 a.	26/9
300-0-350 v. 100 mA., 6.3 v. 4 a., 5 v. 3 a.	23/9
350-0-300v. 130 mA., 6.3v. 4 a., c.t., 6.3v. 1 a., suitable for Mullard 510 Amplifier	33/9
350-0-350 v. 100 mA., 6.3 v. 4 v. 4 a., c.t., 0-4-5 v. 3 a.	26/9
350-0-350 v. 150 mA., 6.3 v. 4 a., 5 v. 3 a.	33/9
350-0-350 v. 150 mA., 6.3 v. 2 a., 6.3 v. 2 a., 5 v. 3 a.	33/9
425-0-425 v. 200 mA., 6.3 v. 4 a., c.t., 6.3 v. 4 a., c.t., 5 v. 3 a., suitable Williamson Amplifier, etc.	49/9
450-0-450 v. 250 mA., 6.3 v. 6 a., 6.3 v. 6 a., 5 v. 3 a.	69/6

FILAMENT TRANSFORMERS
 Primaries 200-250 v. 50 c/s.

6.3 v. 1.5 a.	5/9	6.3 v. 3 a.	8/11
6.3 v. 2 a.	7/6	6.3 v. 6 a.	17/6
0-4-6.3 v. 2 a.	7/9	12 v. 3 a. or 12 v. 1 a.	7/9
		25 v. 1.5 a.	17/6

CHARGER TRANSFORMERS
 All with 200-230-250 v. 50 c/s. Primaries: 0-9-15 v. 1 1/2 a., 11/9; 0-9-15 v. 3 a., 16/9; 0-3.5-9-17 v. 3 a., 17/9; 0-9-15 v. 5 a., 19/9; 0-9-15 v. 6 a., 23/9.

ELIMINATOR TRANSFORMERS
 Primaries 200-250 v. 50 c/s.
 120 v. 40 mA., 5-0-5 v. 1 a. 14/9
 90 v. 15 mA., 6-0-6 v. 250 mA. 9/11

OUTPUT TRANSFORMERS

Midget Battery Pentode 66:1 for 3S4, etc.	3/6
Small Pentode 5,000Ω to 3Ω	3/9
Standard Pentode, 5,000Ω to 3Ω	4/9
Standard Pentode, 8,000Ω to 3Ω	4/9
Push-Pull 8 Watts 6V6 to 5 ohms.	8/9
Push-Pull 10-12 Watts 6V6 to 3Ω or 15Ω	15/9
Push-Pull 10-12 Watts to match 6V6 to 3-5-8 or 15Ω	16/9
Push Pull EL84 to 3 or 15 ohms.	16/9
Push Pull 15-18 Watts, sectionally wound, 6L6, KT66, etc., to 3 or 15 ohms.	21/9
Push-Pull 20 Watt high-quality, sectionally wound, 6L6, KT66, etc., to 3 or 15Ω	47/9

SMOOTHING CHOKES

250 mA., 5 H., 100 ohms.	11/9
150 mA., 7-10 H., 250 ohms.	11/9
100 mA., 10 H., 200 ohms	8/9
80 mA., 10 H., 350 ohms.	5/6
60 mA., 10 H., 400 ohms.	4/11
1 amp. 0.5 ohm. L.T. type	6/6

TOP SHROUDED DROP-THROUGH TYPE

200-0-260 v. 70 mA., 6.3 v. 2 a., 5 v. 2 a.	16/9
350-0-350 v. 80 mA., 6.3 v. 2 a., 5 v. 2 a.	18/9
250-0-250 v. 100 mA., 6.3 v. 4 a., 5 v. 3 a.	22/9
300-0-300 v. 100 mA., 6.3 v. 4 v. 4 a., c.t., 0-4-5 v. 3 a.	23/9
350-0-350 v. 100 mA., 6.3 v. 4 a., c.t., 5 v. 3 a.	22/9
350-0-350 v. 100 mA., 6.3 v. 4 a. 4 a. c.t., 0-4-5 v. 3 a.	23/9
350-0-350 v. 150 mA., 6.3 v. 4 a., 5 v. 3 a.	29/9

VIBRATORS. Oak and Wearite Synchronous 7 pin 2 v., 7/9, 6 v. 8/9.

R.S.C. A10 ULTRA LINEAR 30 WATT AMPLIFIER

NEW 1957 DESIGN. HIGH FIDELITY PUSH-PULL UNIT EMPLOYING SIX VALVES. EF86, EF86, ECC83, 807, 807, GZ34. Tone Control Pre-amp stages are incorporated. Sensitivity is extremely high. Only 12 millivolts minimum input is required for full output. THIS ENSURES THE SUITABILITY OF ANY TYPE OR MAKE OF MICROPHONE OR PICK-UP. Separate Bass and Treble controls give both "lift" and "cut" with ample tone correction for long playing records. An extra input with associated vol. control is provided so that two separate inputs such as "mike" and gram, etc., etc., can be simultaneously applied for mixing purposes. AN OUTPUT SOCKET WITH PLUG IS INCLUDED FOR SUPPLY OF 300 v. 20 mA. and 6.3 v. 1.5 a. FOR A RADIO FEEDER UNIT. Price in kit form with easy to-follow wiring diagrams.



Cover as illustrated 17/6 extra. Only **10 GNS.** car. 10/-
 Or Factory built with 12 months' guarantee £12/19/6. TERMS ON ASSEMBLED UNITS. DEPOSIT 35/9 and 9 monthly payments of 28/11.

Type 807 output valves are used with High Quality Sectionally wound output transformer specially designed for Ultra Linear operation. Negative feedback of 20 D.B. in main loop. **CERTIFIED PERFORMANCE FIGURES ARE EQUAL TO MOST EXPENSIVE UNITS AVAILABLE.** Frequency response ± 3 D.B. 30-20,000 c/cs., Tone Controls ± 12 D.B. at 50 c/cs., $+ 12$ D.B. to $- 6$ D.B. at 12,000 c/cs., Hum and noise 70 D.B. down. Good quality reliable components used. Chassis finish blue hammer. Overall size 12 x 9 x 9in. approx. Power consumption 150 watts. For A.C. mains 200-230-250 v. 50 c/cs. Outputs for 3 and 15 ohm speakers. **EQUALLY SUITABLE FOR THE CONNOISSEUR OR FOR LARGE HALLS, CLUBS, or OUTSIDE FUNCTIONS. IDEAL FOR USE WITH MUSICAL INSTRUMENTS SUCH AS STRING BASS, ELECTRONIC ORGAN, GUITAR, etc. FOR DANCE BANDS, GARRISON THEATRES, etc.,** Microphones, Speakers, 12 v. Rotary Converter, etc., at keen cash prices or on terms with amplifiers.

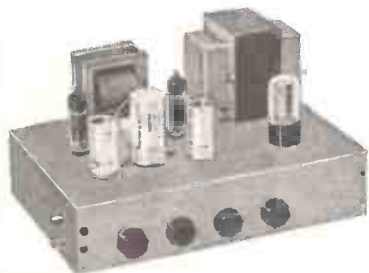
LT/45 HIGH QUALITY TAPE DECK AMPLIFIER

COMPLETE with POWER PACK and OSC. STAGE. Suitable for Collaro, Lane, Truvox, Aspiden, Brennel, etc., etc. State make of Deck when ordering. Chassis size 12-7-3in Overall size 12-7-4in. For 200-250 v. 50 c/cs. A.C. mains. Output for standard 2-3 ohm speaker. Only 15 millivolts input required for full recording. Only 2 millivolts minimum input required from recording head. Magic Eye recording level indicator. Provision for feeding F.A. amplifier. Negative feed-back equalisation. Linear frequency response ± 3 D.B. 50-11,000 c/cs. Facilities for recordings at 15in., 7in. or 3in. per second. Automatic equalisation at the turn of a knob. When switching from record to playback position automatic demagnetisation of heads is assured. Separate gain and output controls. Valves type ECC83, ECC83, EL84, E280, EM34. Output 4 watts. Unit supplied with makers' 12 months' guarantee. We know of no other make which represents the same exceptional value. We can supply Decks and microphones with above at a special inclusive price. Leaflet 6d.

12 GNS. Carr. 7/6

etc. We can supply
 verter, etc., at keen
 EXPORT ENQUIRIES INVITED

R.S.C. ULTRA LINEAR 12-14WATT AMPLIFIER



LINEAR LG3 MINIATURE 3 WATT GRAM. AMPLIFIER

For 200-250 v. 50 c.p.s. A.C. Mains. Overall size only 6 1/2 x 4 1/2 in. Fitted vol. (with mains switch) and Tone Control. Designed for use with any kind of single player or record changing unit. Output for 2-3 ohms speaker. Guaranteed 12 months - Only 49/9 carr. 3/9.

R.S.C. 4-5 WATT HIGH GAIN AMPLIFIER TYPE A5

A highly sensitive 4-valve quality amplifier for the home, small club, etc. Only 50 millivolts input is required for full output so that it is suitable for use with the latest high-fidelity pick-up heads in addition to all other types of pick-ups and practically all mikes. Separate Bass and Treble controls are provided. These give full long playing record equalisation. Hum level is negligible being 71 D.B. down 15 D.B. of negative feedback is used. H.T. of 300 v. 28 mA. and L.T. of 6.3 v. 1.5 a. is available for the supply of a Radio Feeder Unit or Tape Deck pre-amplifier. For A.C. mains input of 200-230-250 v. 50 c/s. Output for 2-3 ohm speaker. Chassis is not alive. Kit is complete in every detail and includes fully punched chassis (with baseplate) with the blue hammer finish, and point-to-point wiring diagrams and instructions. Exceptional value at only £24/15/-, or assembled ready for use 25/- extra, plus 3/6 carriage. Or Deposit 22/- and five monthly payments of 22/- for assembled unit.

R.S.C. A7 3-4 WATT QUALITY AMPLIFIER

A highly sensitive 4-valve amplifier using negative feedback and having an excellent frequency response. Pre-amplifier and Tone Control stages are incorporated with separate Bass and Treble controls giving full tone compensation for Long Playing records. Suitable for any kind of pick-up including latest high fidelity types. H.T. of 250 v. 20 mA. and L.T. 6.3 v. 1 a. available for supply of Radio Feeder Unit, etc. ONLY 40 millivolts input required for full output. Fully isolated chassis with baseplate. For A.C. mains 200-250 v. 50 cycles. Output for 2-3 ohm speaker. Complete kit of parts with point-to-point wiring diagrams and instructions. Only £31/5/-, carr. 3/6 or factory built 22/6 extra. Or Deposit 18/6 and five monthly payments of 18/6 for assembled unit.

P.M. Speakers 3 ohm recommended for use with AT, A5, LG3 or L45 amplifiers. Plessey 12in. 25/11. 6in. Celestion and Goodmans with high flux emily magnet 19/9. 10 x 6in Goodmans Elliptical 27/9.

COLLARO RC457 4 SPEED AUTO-CHANGERS

With studio pick-up with turnover head. BRAND NEW. Cartoned, latest model. For 200-250 v. 50 c.p.s. A.C. mains. Very limited number at only £8/19/6. Carr. 5/6.

COLLARO RC54 3 SPEED AUTO-CHANGER

As above unit but for normal 3-speed requirements. Brand new cartoned but for 110 v. 50 c.p.s. A.C. mains. So that the unit can be operated from normal 200-250 v. A.C. mains we are supplying free with every changer a suitable auto-transformer with input and output voltages clearly marked. Limited number only. 7 gns. Carr. 5/6.

PORTABLE CABINETS. Exceptionally attractive design. Finished in 2 tone varnish. Provision for speaker and amplifier. Inside dimensions 17 1/2 x 12 1/2 in. 59/6

Depth 7in. plus lid 1 1/2 in. Carriage 5/-
 SPECIAL OFFER. Above cabinet, LG3 Amplifier 6in. speaker, and RC457 changer 14 GNS. Carr. 8/6.

LINEAR L45 MINIATURE 4/5 W. QUALITY AMPLIFIER.

Suitable for use with Garrard, B.S.B. or any other record playing unit and most microphones. Total negative feedback 12 db. Separate Bass and Treble Controls. For A.C. mains input of 200-250 v. 50 c.p.s. Output for 2/3 ohm speaker. Three miniature Mullard valves used. Size only 6 x 5 x 5 1/2 in. high. Chassis fully isolated from mains. Guaranteed 12 months. Only £5/19/6. Or Deposit 22/- and five monthly payments of 22/- Send S.A.E. for leaflet.



PLESSEY DUAL CONCENTRIC 12in. P.M. SPEAKERS

(15 ohms), consisting of a high quality 12in. speaker of orthodox design, supporting a small elliptical speaker ready wired with choke and condensers to act as tweeter. This high fidelity unit is highly recommended for use with our A11 or any similar amplifier. Rating is 10 watts. Price only £5/17/6. Or Deposit 13/- and nine monthly payments of 13/-.

NEW 1957 MODEL A11 HIGH-FIDELITY PUSH-PULL AMPLIFIER WITH "BUILT-IN" TONE CONTROL, PRE-AMP. STAGES

Two input sockets with associated controls allow mixing of "mike" and gram, as in A10. High sensitivity. Includes 5 valves, ECC83, ECC83, EL84, EL84, 6Y3. High Quality sectionally wound output transformer specially designed for Ultra Linear operation, and reliable small condensers of current manufacture. **INDIVIDUAL CONTROLS FOR BASS AND TREBLE "Lift" and "Cut"** Frequency response ± 3 dB. 30-30,000 c/cs. Six negative feedback loops. Hum level 60 dB. down. ONLY 23 millivolts IN PUT required for FULL OUTPUT. Suitable for use with all makes and types of pick-ups and microphones. Comparable with the very best designs. For STANDARD or LONG PLAYING RECORDS. FOR MUSICAL INSTRUMENTS such as STRING BASS, GUITARS, etc. OUTPUT SOCKET with plug provides 300 v. 30 mA. and 6.3 v. 1.5 a. For supply of RADIO FEEDER UNIT. Size approx. 12-9-7in. For A.C. mains 200-230-250 v. 50 c/cs. Output for 3 and 15 ohms speakers. Kit is complete to last nut. Chassis is fully punched. Full instructions and point-to-point wiring diagrams included. Despite improved performance due to use of latest miniature valves price remains as previous model but extra input now standard.

Only 8 GNS. or factory built 45/- extra.
 Carr. 10/-. If required leather mat cover with 2 carrying handles can be supplied for 17/6. TERMS ON ASSEMBLED UNITS. DEPOSIT 25/6 and nine monthly payments of 25/6.

LINEAR "DIATONIC" 10-WATT HIGH FIDELITY AMPLIFIER.

Incorporating pre-amp. For A.C. mains input 200-230-250 v. 50 c.p.s. A compact attractively finished unit with two separately controlled inputs, and outputs for 3 and 15 ohm speakers. Separate Bass and Treble control. Five latest type miniature Mullard valves. Only 12 Gns. Send S.A.E. for leaflet and credit terms.

W.B. "STENTORIAN" HIGH FIDELITY P.M. SPEAKERS. EF1012, 10 watts, 15 ohm (or 3 ohm) speech coil. Where a really good quality speaker at a low price is required, we highly recommend this unit with an amazing performance. £4/10/9. Please state whether 3 ohm or 15 ohm required.

P.M. SPEAKERS. 2-3 ohm 5in. Goodmans 17/9. 7 x 4in. Elliptical, 19/9. 6in. Rola, 19/9. 8in. Rola, 19/9. 10in. R.A., 25/9. 12in. Plessey 3 ohms, 10 watts, 59/6.

SUPERHET RADIO FEEDER UNIT

Design of a high quality Radio Tuner Unit (specially suitable for use with any of our Amplifiers). A Triode Heptode Feedback is used. Pentode I.F. and double Diode Second Detector. Delayed A.V.C. is arranged so that A.V.C. distortion is avoided. The V. Ch. Sw. incorporates Gram position. Controls are Tuning W., Ch., and Vol. Output will load most Amplifiers requiring 500 m.v. input depending on Ae. location. Only 250 v. 15 mA. H.T. and L.T. of 8.3 v. 1 amp. required from amplifier. Size of unit approx. 9-8-7in. high. Send S.A.E. for illustrated leaflet. Total building cost is £4/15/-. Point-to-point wiring diagrams and instructions, 2/6.

RECORDING TAPE. 1,200 ft. Reels Parfume, Medium Coercitivity, 15/9.

Radio Supply Co. (LEEDS) LTD.

32 THE CALLS. — LEEDS, 2.

Terms: C.W.O. or C.O.D. No C.O.D. under £1. Postage 1/9 extra on all orders under £2, 2/9 extra under £5 unless carriage charge stated. Full Price List 6d. Trade List 5s. Open to Callers: 9 a.m. to 5.30 p.m. Saturday until 1 p.m., S.A.E. please with all enquiries.

CLYNE RADIO LTD.



18, TOTTENHAM COURT ROAD, LONDON, W.1

MUSEum 5929/0095

(50 yards only from Tottenham Court Road Tube)

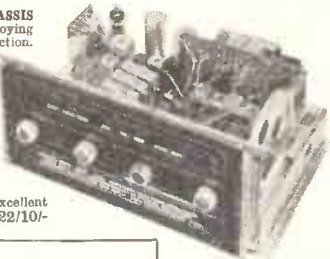
All post orders please to:—162, HOLLOWAY ROAD. LONDON, N.7.

NORth 6295/67

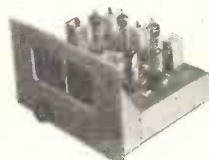
TRANSISTORS!!!

SURPLUS—P.N.P.	
RED SPOT (Audio/Experimental Applications)	10/- ea.
BLUE SPOT, R.F. up to 1.6 Mc/s.	15/- ea.
WHITE SPOT, R.F. up to 2.5 Mc/s.	20/- ea.
STANDARD—	
BBIMAR	
T.S.1	18/- ea.
MULLARD	
OC70	21/- ea.
OC71	24/- ea.
OC72	30/- ea.
(ALL POST FREE)	

RC4 F.M. AM/FM RADIOGRAM CHASSIS
A new style AM/FM Chassis employing a printed circuit F.M. Tuner section. Valve line-up: 8 valves: ECC85, 6BA6, 12A6S, 6BA6, 6AL5, 6AT6, EL84, 6Y3. Most attractive dial 12 x 6 in. fully illuminated with figures in green, red and white on black background. Four controls: Tuning, Volume, Wavechange and Tone/On/Off. Dimensions (overall): 13 x 9 x 6 in. Frequency coverage (four wavebands): 1,000-2,000 m., 200-550 m., 15-50 m., 88-100 mc/s. This is an excellent and very efficient chassis. Price £22/10/- plus 5/- P. & P.



ANNOUNCING OUR NEW F.M. TUNER KIT! (printed circuit). This is our printed circuit version of the Osram 912 F.M. Tuner—using T.C.C. printed circuit and condensers, incorporating 6 valves and two germanium diodes. Attractive black and gold dial, with gold escutcheon plate. Dial aperture only 5 x 2 in. Osram F.M. booklet plus our additional instructions and individually priced components list—2/6 post free or the Kit absolutely complete at £5/8/- plus 3/6 P. & P. Alignment service available if required. We are demonstrating at 18 Tottenham Court Road.



THE JASON FM TUNER

Based on the booklet by Data Publications Ltd., 2/- post free, including our individually priced Parts List. Highly sensitive, free from drift. Incorporates 4 valves 6AM6 and 2 specially graded G.E.C. Crystals. The kit supplied includes drilled chassis with tuning condenser, scale calibrated in mc/s. and attractive bronze stove-enamelled front plate already mounted (illustrated). Front plate size 9 in. x 5 in. Chassis 7 in. x 4 in. x 1 in. Complete standard kit £8/15/- plus 3/6 P. & P. Fringe area: kit £7/15/- plus P. & P.



SWITCH TUNED FOUR STATION RECEIVER CHASSIS (Manufacturers' Surplus). A most attractive unit covering 4 pre-set stations in the medium waveband. A complete receiver (less cabinet) including built-in good quality 5 in. loudspeaker, and frame aerial. Employs Universal Superbet circuit and miniature valves—UCH42, UAF42, UL41, UY41. Dimensions (overall)—5 x 9 x 5 in. For use on AC/DC mains 200/250 v. Absolutely brand new. Few only at £5/5/- plus 2/6 P. & P.

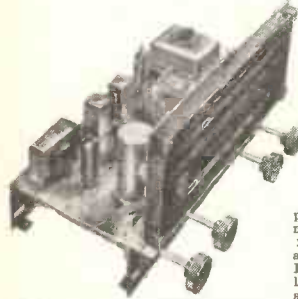
DULCI
DULCI H.3 AM/FM Chassis (7 valve). Covering Long, Medium and F.M. bands. Most attractive dial in RED and GOLD on BLACK background. £20/17/- plus 5/- p. & p.
All Dulci products available ex stock. Illustrated leaflets and H.P. terms available.
Demonstrating at Tottenham Court Road!

SPEAKERS & ENCLOSURES
Full range in stock by WHARFEDALE, W.B., T.S.L., etc. Your enquiries welcomed.

★ **OUR NEW BRANCH IS NOW OPEN AT** ★
★ **162, HOLLOWAY ROAD, LONDON, N.7.** ★
★ **Telephone: NORTH 6295/67.** ★
★ Situated approximately half-way between "Nags Head" and High-bury Corner. One minute from HOLLOWAY ROAD and DRAYTON PARK Tube Stations. Two doors from the NORTHERN POLYTECHNIC.
★ Early closing Thursday at 1 p.m. Open all day Saturday until 5.30 p.m.
★ The service that we are noted for at Tottenham Court Road is available! Old and new friends welcome!
★ **ALL MAIL ORDERS and CORRESPONDENCE in future to HOLLOWAY ROAD please.** ★

FM POWER PACK KIT. We can now supply complete kit for power pack suitable for the above F.M. tuner or any other similar type. Price for the complete kit is 37/6 only or 52/6 for ready assembled unit. This pack is extremely small, incorporating valve rectifier type 6X4 and built on chassis size only 6 x 4 x 1 in. Optional extra for power pack. Bulgin Octal Plug 2/3.

BY LEADING MANUFACTURER !!!
(limited quantity)
6 1/2" Dual Concentric Cone Loudspeakers. 3-8 ohm speech coil. This is a quality unit at only 35/- each brand new



DULCI F.3 AM. RADIOGRAM CHASSIS
We are very fortunate in being able to offer a further limited quantity of this very popular and efficient chassis at a greatly reduced price.
Specification: Three wavebands, Long, Medium and Short. Valve line-up: X79, 6BA6, 6AT6, EL84, 6X4 (or equiv.). Four controls: Tone, ON/OFF, Volume, Wavechange, Tuning. Output 4 watts matched to 3-5 ohms. Incorporates latest Ferrite Rod Aerial. Input sockets for crystal or magnetic pick-up. Provision for mains supply to gram motor. Overall dimensions 12 in. L. x 7 in. D. x 7 in. H. Attractive dial with Red, Gold and Green lettering on Black background. Dial size: 11 in. x 4 in. Price, whilst stocks last, only £10/5/-, plus 3/6 P. & P. Terms available.

JUST RELEASED!!!
THE NEW R.C. TRANSISTOR/RECEIVER KIT
This receiver, covering medium waveband, which can be assembled in about 1 hour, will give amazing volume and tonal quality when used in conjunction with a good aerial and earth. Incorporating PNP Transistor and Germanium Diode. For headphone reception.
Included with the kit of parts is a handsome plastic case in black and white, measuring 4 1/2 x 2 1/2 x 1 1/2 in. This case accommodates the complete receiver, including battery.
PRICE OF COMPLETE KIT: 25/- plus 1/3 P. & P.
Lightweight high resistance headphones can be supplied separately at 15/- pair. If, however, the kit is purchased complete with headphones this will be supplied at a **SPECIAL INCLUSIVE PRICE OF 37/6 plus 1/6 P. & P.** Optional extra. 100ft. coil single 7/36 coloured P.V.C. covered wire, suitable for both aerial and earth. 2/6 only.



THE TELETRON COMPANION
At last we are able to offer an efficient pocket portable TRANSISTOR receiver. This is a regenerative three transistor unit covering Medium and Long Wavebands. Dimensions only: 4 in. x 3 in. x 1 in. Completely self contained in a smart plastic cabinet. Employs highly efficient Teletron coils and circuitry. Complete set of components with full assembly instructions only 89/6 plus 1/3 p. & p. or all parts sold separately if required.
Instruction leaflet and price list 6d post free!



STOP PRESS!!! By leading manufacturer. AM/FM chassis. Seven valves—ECC85, ECH81, EF85, EAC80, EL84, EZ80, EM81. Covers long, medium, and F.M. bands. Separate bass and treble controls, illuminated volume control on extended lead. Attractive easily read edge lit dial. Incorporates Mullard F.M. tuner section. Overall dimensions: 12" L. x 10" W. x 10" D. Brand new and fully guaranteed. Whilst stocks last only £18/19/6 plus 5/- P. & P. H.P. or Credit Sale Terms available.

CONSTRUCTORS NOTE !!
RADIO DATA BOOKS AVAILABLE, i.e. Valve guide, Colour code, etc.
Send stamp for list.

Have YOU had a copy of our 109 page comprehensive CATALOGUE? This invaluable publication is only 2/-, post free.

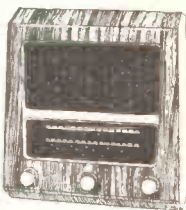
AM/FM KIT

Introducing the JASON AM/FM KIT for medium waves and F.M. This is a very high quality chassis incorporating 8 of the latest miniature valves, plus DM70 magic eye. Kits are available for chassis complete with output stage at £15/5/-. Also less output stage but with own built-in power pack at £13/19/6 only. These are high fidelity units and exceptional value at these prices which include all required components and full constructional details. Fully illustrated Data Booklet with full construction details, plus individually priced component list, available per return of post 2/- post free. Both plus 3/6 P. & P.

Our advantageous H.P. and Credit Sale terms are available on any single item under £5. Your enquiries invited. If not stated, please add postage on orders under £1. Cash with order or C.O.D. (charges extra). Open: Tottenham Court Road: 9 a.m. to 6 p.m. Mon. to Fri., Sat. 1 p.m. Holloway Road: 9 a.m. to 6 p.m. daily except Thurs., when we close at 1 p.m.

THE "SUPERIOR FOUR" KIT

Our superior four-valve receiver A.C. mains, 200/250 v. M. and Long waves. As with our very successful "Economy Four" all required components are supplied. Valve line-up: 2 6SG7, 6 XGT and 6 V6GT. Chassis ready drilled. Cabinet size 10 1/2 in. x 12 in. wide. Maximum depth at base 5 in. tapering to 3 1/2 in. at top. Sloping front. Very attractively finished in light walnut and peach. Each component brand new and tested prior to packing. Complete instruction booklet with practical and theoretical diagrams is provided. Booklet available at 1/6 post free. Our price for complete kit, £8/9/6. Please add 2/6 P. & C. If preferred, we can supply Cabinet Assembly only, comprising Cabinet and bracket wave-change switch, dial, pointer, drum pulleys drive spindle, drive spring and knobs, at 4/5/-, plus 2/6 P. & C. N.B.—Our kits are even supplied with sufficient solder for the job.



THE R.E.P. 1-Valve RECEIVER. All dry battery operation, for use with bead phones, the complete kit is available at 4/5/-, plus batteries plus 2/- P. & P. or full instructions at 9d. post free.

VALVES. We have perhaps the most up-to-date valve stocks in the trade. A stamp will bring complete list of brand new imported valve types, fully guaranteed. P.T. paid. Also all usual surplus types available such as 6V6GT, etc.

THE R.C. RAMBLER ALL-DRY PORTABLE KIT

Full assembly details with practical and theoretical diagrams, 1/6 post free. This is a truly professional 4-valve superhet—all dry—for medium and long waves. Cream plastic top panel, with dial engraved in red and green adds to the very imposing appearance of this model which is housed in attractive cream and grey leatherette covered attaché-case type cabinet, measuring only 9 in. x 7 in. x 8 1/2 in. Weight less batteries 4 1/2 lb., with batteries 6 1/2 lb. This set really has everything. Built-in frame aerial, high quality, extremely sensitive, and very adequate volume from the 5 in. speaker. Valve line-up 3V4, 1R5, 1S5, 1T4. The required components, exactly as specified, including cabinet can be supplied from stock at the special inclusive price of £7/7/- plus 2/6 p. (less batteries) Uses Ever-Ready 90 v. H.T. type B120 at 10/-, Also L.T. 1.5 v. A.D. 35 at 1/6. RAMBLER MAINS UNIT. For using our popular all-dry "Rambler" on A.C. Mains. Complete kit, when assembled fits snugly into battery compartment, supplied at 4/7/6 plus 1/6 packing and postage. Includes all required components, and full assembly instructions. N.B.—This unit is completely self-contained in a metal box measuring 7 in. x 2 1/2 in. x 1 1/2 in. and is ideally suitable for many all-dry battery portables requiring 90 v. H.T. and 1.5 L.T.



IMPORTANT ANNOUNCEMENT. IT HAS BEEN BROUGHT TO OUR ATTENTION THAT THE WORDING OF OUR ADVERTISEMENT ON THE RAMBLER MAINS UNIT IS INCORRECT. THIS UNINTENTIONAL ERROR HAS NOW BEEN CORRECTED AND WE TRUST OUR APOLOGIES WILL BE ACCEPTED FOR ANY MISUNDERSTANDING CAUSED.

N.B.—All our T.R.F. Kit circuits include specially wound Denco "Max Q" coils on polystyrene formers, improved performance. Price remains the same.

THE R.C. 2 AMP. BATTERY CHARGER KIT. Includes handsome well-ventilated black stove-enamelled steel box, size: 7 1/2 in. x 3 1/2 in. x 3 1/2 in. Fully shrouded first quality transformer, brand new G.E.C. rectifier, Mains fuse, etc., for charging 6 or 12 v. batteries at 2 amp. Absolutely complete kit with full practical and theoretical instructions. Price 36/6 plus 2/6 P. & P. Can be supplied assembled and tested at 4/5/- plus P. & P. Heavy duty crocodile clips suitable for car battery lugs, optional extra at 1/6 per pair.

RCE.A. Small Portable Gram Amplifier. This little Amplifier is built around a Printed Circuit and employs the very latest highly efficient valve type ECL82. It is ideal for use where space is limited! Although of such small size 7 in. x 5 1/2 in. x 2 in. (overall) with a control panel 2 1/2 in. x 1 1/2 in., reproduction is excellent. A wide range tone control is provided. Output approx. 3 watts max. For use on A.C. Mains 200/250 v. NOTE THE PRICE 59/6, plus 2/- P. & P.

RCL.A. AMPLIFIER. A small high quality gramophone amplifier employing the latest circuitry and highly efficient miniature valves. Very neat chassis finished in bronze stove enamel. Size (overall) 5 1/2 x 4 x 5 in. Valves 6X4, ECL82. Output 3 watts max. Controls: Volume, Tone/On/Off.



Price £3/19/6 plus 2/- P. & P.

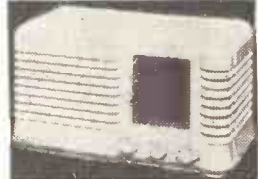
RCS.A. Small 3-Valve Portable Gram Amplifier. An excellent little amplifier for portable gram, giving high quality output. Separate Bass and Treble controls. 2-3 watts output. Valve line-up: E280, EL84, ECC83. Provision for mounting 6 in. loudspeaker. Fully isolated from mains 200/250 v. A.C. Overall size: 6 1/2 in. L. x 5 1/2 in. H. x 2 1/2 in. D. PRICE £3/19/6 (less Speaker and Output Transformers), plus 2/6 P. & P.

RC4.A. (STALLION). This is supplied complete with high flux 8 in. P.M. Speaker and Baffle. Incorporating three metal type valves 6Q7, 6V6 and 6X5, this robust and well-made unit is ideal for use in the larger type of record player and is equally suitable for use in conjunction with a radio feeder unit. Separate bass and treble controls are provided; also provision is made for an extension speaker and mains supplies to gram. motor. Output approx. 4 watts. Size overall 18 in. x 4 in. x 9 in. high. For use on A.C. Mains 100/200/250 v. PRICE £5/19/6, plus 2/6 P. & P. H.P. terms £2/19/6 deposit and four monthly payments of 16/6 per month. Fits our portable cabinet "G" at 85/- without modification.

RECORD PLAYER CABINETS—to suit all types of single record and auto-changer units. Priced from 45/- and stamp for fully illustrated list.

THE "ECONOMY FOUR" T.R.F. KIT.

A three-valve plus metal rectifier receiver. A.C. mains 200/250 v. Medium and Long waves. We can supply all required components right down to the last nut and bolt. Valve line-up 6K7, 6J7 and 3V6 Chassis ready drilled. Cabinet size 13 in. long by 6 in. high by 4 in. deep—Choice of ivory or brown Bakelite or wooden walnut finish cabinet. Complete instruction booklet with practical and theoretical diagrams. Each component brand new and tested prior to packing. Our price £5/10/- complete—Remember this set is being demonstrated at our shop premises! We proudly claim that our fully illustrated instruction booklet is the most comprehensive available for this type of receiver—Booklet available at 1/5 post free. This is allowed if kit is purchased later. Plus 2/6 packing and carriage for complete kit.



GRAMOPHONE MOTORS are in SHORT SUPPLY!

COLLARO AC 3/554: Three speed, single player for A.C. mains 200/250 v. cream finish, complete with turn-over crystal pick-up incorporating the well-known high output "T" type head. Strictly limited quantity at £6/19/6 plus 3/6 p. and p.

FOUR-SPEED CHANGERS

Collarc RC456 Mixer Auto-Changer in cream with Studio "Q" insert. £9/15/- B.S.R. Monarch Mixer Auto-Changer, in cream and gold. £8/15/- Both plus 3/6 p. and p. B.P. Terms available. Stocks rapidly diminishing.

THE STAAR "GALAXY"

Four speed Mixer Auto-Changer. Fingerprint stop, start and speed change control. Modern duo-tone finish. Beautifully made and moderately sized to fit almost any cabinet. For A.C. mains operation 110-250 v. Price: £12/16/3 inc. plus 3/6 C. & P. Also available ready mounted on playing desk. For A.C. mains operation 200-250 v. Price: £14/3/11 inc. plus 3/6 C. & P. Both brand new, boxed and fully guaranteed.

RECORDER AMPLIFIER

(Well known manufacturer's surplus). This is a brand new amplifier designed for use with a famous wire recorder. A simple modification is all that is required to make this unit ideal for use with any Tape Deck. Specifications: Valve line-up 7C5, 2A7U, 6BB7, 6BB1. 6X4. Neon Record Level Indicator. Controls: Volume/Record Level, Tone Control, Record/Play/Switch. High and Low level inputs for Mike and Radio. External Speaker Socket. Built-in 5 in. Loudspeaker with High Flux magnet; Separate Power Pack. Dimensions: Amplifier 6 1/2 in. H. x 1 1/2 in. W. x 2 1/2 in. D. Power Pack 6 1/2 in. x 8 in. x 5 in. High (overall). Full modification details are supplied. Price £3/19/6. P. & P. 3/6. 10 in. CABINET SPEAKER. Ideal for P.A. etc. Comprises solid wood cabinet complete with carrying handle. Painted dark brown, with built-in good quality 10 in. P.M. speaker, 3 ohm speech coil, complete with lead and Lignac Jack plug. Brand new. Price only 45/-, plus 3/6 P. & P.



SURPLUS BARGAINS—METERS

F.S.D.	Size	Type	Fitting	Price
50 microamp	D.O. 4 in.	M.C.	Rectangular	110/-
50 microamp	D.O. 3 1/2 in.	M.G.	P.R.	95/-
100 microamp	D.O. 2 1/2 in.	M.C.	P.R.	45/-
200 microamp	D.C. 3 1/2 in.	M.C.	P.R.	18/6
500 microamp	D.C. 2 in.	M.C.	P.R.	65/-
750 microamp	D.C. 2 1/2 in.	M.C.	P.R. (scaled 0-100)	15/-
1 mA.	D.C. 2 in.	M.C.	P.R.	17/6
1 mA.	D.O. 2 in.	M.C.	F.Sq.	22/8
1 mA.	D.C. 2 in.	M.C.	F.Sq. (1954 by Elliott)	25/-
1 mA.	D.C. 2 1/2 in.	M.C.	Desk Type	30/-
50 mA.	D.C. 2 in.	M.C.	P.R.	8/6
100 mA.	D.C. 2 1/2 in.	M.C.	P.R.	10/6
.5 amp.	R.F. 2 in.	Thermo	F.Sq.	6/6
1 amp.	R.F. 2 1/2 in.	M.C.	F.E.	10/-
120-0-120 amp.	D.C. 2 in.	M.C.	F.Sq. (shunt required)	15/-
150 amp.	A.C. 4 in.	M.I.	R.F.	45/-
1 amp.	R.F. 2 1/2 in.	Thermo	F.Sq.	7/6
3 amp.	R.F. 2 in.	Thermo	R.P. (with shunt)	10/6
20 amp.	D.C. 2 in.	—	M.I.	12/6
30 amp.	D.O. 2 1/2 in.	M.I.	P.R.	10/-
15 volt	A.C. 2 1/2 in.	M.C.	P.R.	17/6
15-0-15 volt	D.C. 2 1/2 in.	M.C.	P.R.	35/-
200 volt	D.C. 3 1/2 in.	M.C.	P.E.	35/-
300 volt	A.C. 2 1/2 in.	M.C.	F.R.	35/-
300 volt	A.C. 3 1/2 in.	M.I.	F.R.	30/-

SPECIAL U.S. 0-1 mA. 2 1/2 in. taken from equipment but perfect, 22/6 each. R.P. = Round Projection. M.C. = Moving Coil. Thermo = Thermo-coupled. F.Sq. = Flush Square. P.R. = Flush Round. M.I. = Moving Iron.

METER RECTIFIERS. 1 mA. by G.E.C. at 6/6, also 5 mA. by G.E.C. at 6/6.

THE R.C. 3/4 WATT AMPLIFIER KIT. Compare the advantages. Treble, bass AND middle controls. For crystal or magnetic pick-up. A.C. Mains 200/250 v. Valve line-up: 6V6GT, 6SG7 metal 6X5GT. Negative feedback. Built on stove enamelled steel chassis, measuring only 8 in. x 4 in. x 1 1/2 in. Four engraved brass knobs are included in the price of the complete kit with all necessary practical and theoretical diagrams at 24/5/- only, plus 2/6 packing and post or Instruction Book fully illustrated for 1/-, Post free. This amplifier can be supplied assembled, tested, and ready for use at 25/5/- plus P. & P. Hearing is believing.



VALERADIO T.V. TUNER. Limited stocks of this well-known unit available at much reduced price. An ideal prefabricated front end for any superhet T.V. receiver with 16 mc/s 12F. Continuously variable tuning covering ALL bands from 40-100 mc/s and 170-225 mc/s. Valve line-up: POC84, POF80 (series heaters). Whilst stocks last only £3/19/6 plus 2/- P. & P.

RETURN OF A WINNER!!! (Exclusive)

We have been most fortunate in obtaining further limited supply of this fine and popular cabinet. Instantly recognised as being of leading High Quality manufacturers stock, this trolley-type cabinet is finished in polished dark solid walnut. Can easily be adapted to accommodate tape recorder, amplifier, radio-gram etc., etc. External measurements: 24 1/2 in. x 16 in. x 39 in. The whole is mounted upon "easy run" castors. Unrepeatable at this price £5/19/6, plus 15/- C. & P.



CLYNE RADIO LTD.

18, Tottenham Court Road, London, W.1
And at
162, Holloway Road, London, N.7.

G.W. SMITH & CO (RADIO) LIMITED

Phone: GERRARD 8204/9155
Cables: SMITHEX LESQUARE
3-34 LISLE STREET, LONDON, W.C.2

MIDGET RECORDER MOTORS
Size only 1½ x 1 x 2½ in. Will operate from 4.5 to 24 volt D.C. Fitted with reduction gear. Supplied brand new, 12/6 each. P.P. 1/-.

H.D. AUTO TRANSFORMER. 110/230 volts, 1,000 watts, 79/6 each. P.P. 5/-.
Also 150 watts, 21/- P.P. 2/-.
L.T. TRANSFORMER BARGAIN. Input 200/250 volts. Output 12 volts 5 amps. Brand new, 12/6 each. P.P. 2/6.

SURPLUS TRANSISTORS
Junction type, P.N.P. Red spot, for audio, 10/- Blue spot, R.F. 1.6 mc/s., 15/- R.F. Transistors, 8 mc/s., 21/- each.

MINIATURE TRANSFORMERS.
½ in. sq. 4.5 : 1 or 10 : 1, 4/6 each.

SUB MINIATURE CAPACITORS.
Size only ¼ x ¾ in., .6, 8, 16 or 30 mfd. 3 or 6 volt. 2/9 each. .001, .002, .005, .01, .02, or .04 mfd., 9d. Miniature 2 gang 365 pf., 8/6 each.

6FT. POST OFFICE RACKS. Standard 19 in. "U" channel type, 79/6 each. P.P. 12/6.



CRYSTAL MICROPHONE INSERTS

Sensitive, ideal for tape recorders, amplifiers, etc., 4/6 each. P.P. 6d.

POST OFFICE JACK LEADS. 4ft. screened lead fitted with 2 standard jack plugs, brand new, 3/- each. P.P. 6d. Standard socket. 9d.

WESTON DUAL RANGE OHMMETER
Incorporates a 2½ in. moving coil meter, ranges, 2,000 and 200,000 ohms. Supplied brand new with leads and leather carrying case, 39/6 each. P.P. 2/6.

HEAVY DUTY L.T. TRANSFORMERS. Input 230 volts. Output 17.5 volts, 35 amps. (service rating, OK 50 amps.). Brand new, 72/6 each, P.P. 5/-.

HOOVER ROTARY TRANSFORMERS. Latest type, small. 24 volt D.C. input, 210 v. 140 ma. output. New, 15/6 each. P.P. 2/-.

HEAVY DUTY SLIDER. 1 ohm, 12 amps, brand new, 6/6. P.P. 1/9.

R.C.A. OUTPUT TRANSFORMERS
Completely potted. Centre tapped primary, 8,000 ohms. Secondary tapped, 3, 7.5, 15, 500 or 600 ohms. Separate feedback winding. 15 watts rating. Ideal for 6L6, KT66, EL84's etc., brand new, 27/6 each. P.P. 2/-.

ROTARY CONVERTORS. Input 24 v. D.C. Output 230 volts A.C. 50, cycles 100 watts. Supplied unused, 92/6 each. P.P. 5/-.

A.R.88 WAVECHANGE SWITCHES
Ceramic, 8 bank, 6 position, complete with screens. Brand new, 17/6 each. P.P. 2/6.

MODULATOR 67
These bargain instruments contain a COMPLETE A.C. MAINS POWER PACK. Input 230 volts 50 cycles. Output 350 volts. 120 mA. and 6.3 volts 5 amps. Choke and condenser smoothed and uses 5Z4 rectifier. (Transformer actually 200 mA.). Also included in the unit are 11 other valves, 5 SP61, 1 VR116, 2 EB34 and 3 EA50, and many other useful components, pots, resistors, switches, etc. Size of case 18 x 9 x 7 in., which is finished in grey. Supplied brand new, 49/6 each. P.P. 7/6.

HALLIGRAFTER S. 36A. V.H.F. COMMUNICATION RECEIVERS. Improved version of S.27. Specification: Completely self contained except for headset or speaker. Operation 110/230 volt A.C. Superhet receiver, for A.M. or F.M., incorporating R.F. and 3 I.F. stages, A.V.C., noise limiter, and S meter. Frequency coverage 27.8 to 143 mc/s. Supplied brand new, £45 each. P.P. 15/-.

COSSOR DOUBLE BEAM OSCILLOSCOPE
TYPE 339A. Standard model. Operation 110/200/250 volt A.C. Ten time base positions, 6 cps. to 250,000 cps. Input frequency range, 10 cps. to 2 mc/s. Offered in perfect operational condition, fully tested, £27/10/- each. P.P. £1.

MARCONI SIGNAL GENERATORS. Laboratory instruments at a fraction of original cost. Operation of all types, 200/250 volt A.C. Type TF-390G. Frequency coverage 16 to 150 mc/s. Brand new with leads and charts, £25 each. P.P. £1. Ditto 4 to 100 mc/s., £22/10/-. Type TF-517G. Frequency coverage 16 to 58 mc/s. and 150 to 300 mc/s. Brand new £35 each. Ditto complete with TF-675 pulse generator, £42/10/-. P.P. £1.

Type TF-144G. Standard model. Frequency coverage 85 kc/s. to 25 mc/s. Completely overhauled, £75. P.P. £1.

AMERICAN BEACON TRANSMITTER/RECEIVERS
RT 37/PPN-2. Brand new and boxed, complete with instruction book. Equipment comprises transmitter/receiver with 9 valves (5 3A5, 3 1S5 and 1 IR5), with built-in 2 v. vibrator power pack, spare vibrator, head-set connector leads and 10ft. collapsible aerial. Frequency coverage 214/238 Mc/s. Price 72/6 each. P.P. 6/-.

AMERICAN ROTARY TRANSFORMERS
Models available for either 6 or 12 volt D.C. input. Output 250 volts D.C. 80 mA. Ideal for car radios or razors, etc., brand new 22/6 each. P.P. 3/-.

HEAVY DUTY MAINS ISOLATING TRANSFORMERS. Specification:—Primary 230 volts 3 amps. Secondary 230 volts 3 amps. (service rating, OK 5 amps.). Ideal for laboratory or workshop use. Supplied brand new in original transit cases, £6/10/- each. P.P. 10/-.

R.I155 SUPER SLOW MOTION DRIVES. Improved version as fitted to Model L and N. Supplied brand new and boxed, 12/6 each. P.P. 1/6.

AMERICAN GEARED MOTORS
American 24 volt D.C. motor with built-in precision gearbox giving twin outputs 20 r.p.m. and 6 r.p.m. Will also operate on 12 v. giving reduced outputs. Size 7 in. x 1½ in. Shaft dia. ½ in. Supplied brand new only 19/6 each. P.P. 3/-.



ADMIRALTY REFLEX RE-ENTRANT P.A. LOUDSPEAKERS
Twin units. Impedance 3 ohms. Extremely sensitive and directional. Ideal for all outside work. Complete with 600 ohm line transformer. Price 32/6 each. P.P. 5/-.

PARMEKO PRESSURE UNITS. Heavy duty, 3 ohm coil. Not new but all tested, 39/6 each. P.P. 3/-.
L.T. TRANSFORMER BARGAIN. Input 200/250 volts. Output tapped, 3, 6, 9, 12, 24 or 36 volts 5 amps. 35/- P.P. 3/-.

A.C. MAINS BLOWER MOTORS
220/230 volt 300 watts. 1½ in. dia. outlet. Housed in metal box and fitted with dust filter pads. Supplied complete with 4 spare filters, 2 way outlet adaptor and 2 lengths of hose. Brand new only, £4/19/6 each. P.P. 7/6.

COPPER AERIAL WIRE. Ex-U.S.A. 300ft. reels, 3/6. P.P. 1/-.
ALUMINIUM CHASSIS. Best quality, 18 swg. Four sided, reinforced corners. 6 x 4 x 2½ in., 3/6 10 x 7½ x 2½ in., 5/3 7½ x 5½ x 2½ in., 4/6 13½ x 9 x 2½ in., 6/9 11½ x 7½ x 2½ in., 6/- Postage 1/- all sizes.

BARGAIN 6.3 VOLT FILAMENT TRANSFORMERS
Potted, hermetically sealed, ceramic terminations, all brand new. Made by famous manufacturer.
Type 1. 200/250 volt input. Outputs: 6.3 v. C.T. 5.6 amp., tapped 5 v.; 6.3 v. C.T. 4.8 amp., tapped 4 v.; 6.3 v. C.T. 1 amp., tapped 4 v., 19/6 each.
Type 2. 200/250 v. input. Output: 6.3 v. C.T. 3.3 amp., tapped 5 v.; 6.3 v. C.T. 1 amp., tapped 4 v.; 6.3 v. C.T. .9 amp.; 6.3 v. C.T. .6 amp., 15/6 each. Postage both types, 2/-.

BENDIX COMMAND TRANSMITTERS 2.1 to 3 mc/s. Complete with all valves and crystal, 22/6 each. P.P. 3/-.
460 KC/S B.F.O. UNITS. Brand new and complete with I55 valve. Fully screened in aluminium case, only 8/6 each. P.P. 1/-.

AMERICAN SUPER LIGHT-WEIGHT HEADPHONES
Magnetic type, res. 50 ohms. Fitted with rubber earmoulds to fit inside the ear. Extremely good quality, ideal for communication receivers etc., supplied brand new, 15/- pair. P.P. 1/-.

TRANSFORMER BARGAIN. Input 200/250 volts. Output 250/0/250 volts 200 mA. 6.3 volt 4 amp., 5 volt 2 amp. Brand new, 27/6 each.

6 VOLT VIBRATOR PACKS
Output 120 volts 30 mA. Fully smoothed, uses standard Mallory 4 pin vibrator. Supplied brand new and boxed, 12/6 each. P.P. 2/6.

MAINS NEON PANEL INDICATORS. Chroma escutcheon. 200/250 v. Red, amber, green or clear, 3/9 each. P.P. 6d.
HEATER TRANSFORMER. Brand new. Input 230 volts. 6.3 volt 1.5 amp. output 5/9 each. P.P. 1/-.

50 MICROAMP METERS
2½ in. flush mounting meter housed in grey instrument case, complete with a chrome handle. Resistance 800 ohms. Supplied brand new and tested, 59/6 each. P.P. 2/6.

LOOK! THOUSANDS OF BARGAINS AVAILABLE WHICH WE ARE UNABLE TO ADVERTISE. IT IS WORTH YOUR WHILE TO PAY US A VISIT

SMOOTHING CHOKE BARGAINS

4H. 22.5 mA. 4/6 10H. 120 mA. 8/6
 8H. 50 mA. 5/6 15H. 60 mA. 5/6
 8H. 250 mA. 10/6 15H. 300 mA. 10/6
 9H. 100 mA. 7/6 20H. 120 mA. 10/6
 10H. 60 mA. 4/6 30H. 30 mA. 3/6
 Collins potted choke 8H. 100 mA. 8/6
 Bargain Parmeko choke 5H. 200 mA. 5/6
 Rich and Bundy choke 50H. 120 mA. 15/6
 Swinging choke 8/40H. 30/300 mA. 10/6
 Swinging choke 3/6/4. 2H. 250 mA. 10/6
 P.P. under 10/- 1/3, over 10/-, 2/-.

8 MFD. PAPER CONDENSERS. Brand new T.C.C. visconol type. 750 volts working 5/6 each. P.P. 1/-.

CONVERTOR TRANSFORMERS. Midget. Input 220/240 volts. Output 220 volts 25 mA., 6.3 volts 1 amp. New, 10/6. P.P. 1/- Midget contact rectifier to suit, 7/6. P.P. 6d.

DYNAMO EXPLODER UNITS

Used for detonating explosive charges. Operation is by hand generator, giving 1,800 volts D.C. across output terminals. Ideal also for use as photo flash generator. Brand new only £3/19/6 each. P.P. 5/-.

CHARGING AND MODEL TRANSFORMERS.

1. Pri. 200/250 v. Sec. 3.5, 9 or 17 v. 1 amp., 9/9
 2. Pri. 200/250 v. Sec. 3.5, 9 or 17 v. 2 amp., 14/3
 3. Pri. 200/250 v. Sec. 3.5, 9 or 17 v. 4 amp., 16/6
 4. Pri. 200/250 v. Sec. 6.3 v. 3 amp., 8 v. 1.5 amp. 9/6.

5. Pri. 200/250 v. Sec. tapped, 3, 4, 5, 6, 8, 10, 12, 15, 18, 20, 24 or 30 volt 2 amp., 18/6. Postage 1/6 all types.

L.T. METAL RECTIFIERS. Full wave and bridged. 12 v. 1 amp., 6/3; 12 v. 2 amp., 9/3; 12 v. 4 amp., 13/9; 24 v. 1 amp., 12/6; 24 v. 4 amp., 22/6. P.P. 1/- all types.

0-1 MA. METERS



Brand new moving coil meters, round finish mounting with 2 1/2 in. scale, calibrated 0/300 volts. Resistance 100 ohms. Supplied complete with rectifier. 25/- each. P.P. 1/-.

AMERICAN BD-91 SWITCHBOARDS. 25 line, complete with automatic ringer and seat, etc., brand new, £50. P.P. £2.

INSTRUMENT POTENTIOMETERS. Brand new Colvren type, 100,000 ohms, 10 watts, 3 1/2 in. dia. Ideal for bridges, etc., 10/6. Ditto twin gang 5,000 ohms, 10/6. P.P. 1/-.

INSTRUMENT TRANSFORMERS. Parmeko. Input 230 volts. Output H.T. 195 volts 85 mA. tapped 130 v. and 65 v. L.T. 6.3 v. 5 amp., 6.3 v. .3 amp. Brand new, 4/6. P.P. 1/6.

ADMIRALTY 12 VOLT D.C. MOBILE AMPLIFIERS

Separate mic. or gram. inputs. Output 10 watts, matched, 3, 15 or 600 ohms. Not new, but all tested, £8/19/6 each. P.P. 5/-.

SOUND POWERED BALANCED ARMATURE EARPIECES. Brand new, 3/6 each. P.P. 9d. inserts only, 1/9. Brand new sound powered handsets, 19/6 each. P.P. 1/-.

G.P.O. BELL UNITS. Supplied brand new complete with 2 bells, induction coil, etc., 7/6 each. P.P. 2/6.

BARGAIN GRAM MOTORS

Garrard centre drive motors complete with turntables. 200/250 volt A.C. Adjustable mechanically from 0 to 45 r.p.m. Only 22/6 each. P.P. 3/-.

TRANSMITTER/RECEIVER No. 19 MK. II COMPLETE KITS



Brand new in original transit cases. Equipment comprises TX/RX, 12 volt rotary power pack, vario-meter, control boxes, all necessary connecting leads, aerial base and mounting platform. For R.T. or C.W. frequency coverage A set, 2 to 8 mc/s. B set, 229 to 241 mc/s and intercom system. Complete with 15 valves and tuning meter. Only £11/19/6 each. P.P. £2.
 Also available transmitter/receiver complete with power pack only, in very good condition, £5/10/- each. P.P. 15/-.

CHEAP "G" CORE TRANSFORMERS

Wonderful offer. Made to highest specification, fully potted, hermetically sealed, ceramic terminations, fully tropicalized. **ALL BRAND NEW.**

- 1. 230 v. primary. Sec. 510/0/510 v. 300 mA. 375/0/375 v. 100 mA. 6.3 v. 9 a. 2 x 6.3 v. 2 a. 2 x 6.3 v. 1 a. 6.3 v. 1.5 a. 6.3 v. .5 a. 5 v. 3 a. 82/6. P.P. 5/-.
- 2. 230 v. primary. Sec. 360/0/360 v. 200 mA. 360/0/360 v. 65 mA. 6.3 v. CT. 5 a. 6.3 v. CT. 2 a. 6.3 v. 5 a. 5 v. 4 a. 5 v. 3 a. 65/- P.P. 4/6.
- 3. 230 v. primary. Sec. 350/0/350 v. 400 mA. 25 v. 1 a. 21 v. 5 a. 6.3 v. 5 a. 6.3 v. 1 a. 5 v. 4 a. 75/- P.P. 5/-.
- 4. 230 v. primary. Sec. 665/0/665 v. 50 mA. 800 v. 5 mA. 4 v. 4 a. 2 v. 1.5 a. 42/6. P.P. 2/6.
- 5. 200/250 v. primary. Sec. 350/0/350 v. 180 mA. tapped 250 v. 6.3 v. 1.5 a. 5 v. 3 a. 32/6. P.P. 2/6.
- 6. 115/230 v. primary. Sec. 430/0/430 v. 200 mA. common tapping 950 v. 5 mA. 35/- P.P. 2/6.
- 7. 200/250 v. primary. Sec. 250/0/250 v. 50 mA. 6.3 v. 1 a. 19/6. P.P. 1/6.
- 8. 230 v. primary. Sec. 3,850 v. 5 mA. 4 v. 2.5 a. 4 v. 1 a. 52/6. P.P. 3/-.
- 9. 230 v. primary. Sec. 1,250/0/1,250 v. 5.5 mA. 6.3 v. 1 a. 6.3 v. 1 a. 4 v. 1 a. 42/6. P.P. 2/6.
- 10. 230 v. primary. Sec. 2 x 6.3 v. 5a. 2 x 6.3v. 1a. 35/- P.P. 2/6.
- 11. 230 v. primary. Sec. 2 x 6.3 v. 0.75 a. 2 kv., 12/6. P.P. 1/3.
- 12. 230 v. primary. Sec. 6.3 v. 5 a. 6.3 v. 4 a. 2 x 6.3 v. 3 a. 6.3 v. 2 a. 6.3 v. 1.5 a. 6.3 v. 1 a., 45/- P.P. 3/-.
- 13. 230 v. primary. Sec. 3 x 6.3 v. 3 a. 6.3 v. 1.5 a., 32/6. P.P. 2/6.

Many other types in stock. As above specification but not C core.
 1. 200/250 v. primary. Sec. 330/0/330 v. 180 mA. 2 x 6.3 v. 2 a. 5 v. 3 a., 42/6. P.P. 3/-.
 2. 230/250 v. primary. Sec. 2 x 350/0/350 v. 52 mA. 4 x 55 v. 30 mA. 2 x 5 v. CT. 3 a., 39/6. P.P. 3/-.

AMERICAN MINE DETECTORS. Model SCR-625C. Completely portable, battery operated and complete with instructions. Can be used to detect any hidden metals. Supplied in perfect condition. £12/10/- each. P.P. 10/-.

EDDYSTONE POWER UNITS. S441B. 200/250 watt A.C. input. Output 300 volts 200 m/a. and 12 volts 3 amps. Double choke and condenser smoothed. Uses 5U4 rectifier. Housed in compact grey metal case. Supplied in perfect condition. 49/6. each. P.P. 7/6.

EX-NAVY SOUND POWERED TELEPHONES



This type requires no batteries to operate and can be fitted in moments. Uses hand generator for calling, giving an extremely loud buzzing note, and also a neon indicator. Ideal for field activities, factories, office, etc. Only 45/- each. P.P. 4/6.

METER BARGAINS

50 microamp 2 1/2 in. Pj. M.C.	49/6
100 microamp 2 1/2 in. FM. M.C.	39/6
200 m/amps. 2 1/2 in. FM. M.C.	9/6
1 amp. RF. 2 1/2 in. Pj. T.C.	5/-
300 volt A.C. 2 1/2 in. FM. M.I.	25/-
1.5 amp. A.C./D.C. 2 in. FM. M.I.	6/6
500/0/500 microamp 2 1/2 in. FM. M.C.	25/-
20/0/20 amp. Lucas car type	8/6
2ma. meter rectifiers, STC	5/6

MAINS VOLTAGE REGULATOR TRANSFORMERS. Will give variable output from 185 watts to 250 watts at maximum current of 25 amps. Supplied in good condition. £15 each. P.P. 10/-.

UNISELECTOR SWITCHES. Standard P.O. type. Double wipers, 25 positions. 4 bank, 35/-; 8 bank, 52/6. Postage 1/-.

CHEAP MAINS TRANSFORMERS. Standard replacement type. Pri. 200/250 v. Sec. 250/0/250 v. 80 mA. 6.3 v. 4a. tapped 4 v. 5 v. 2 a. Tapped 4 v. Brand new, 18/6, Ditto 350 v. 18/6. P.P. 1/6.

CHEAP P.M. SPEAKERS. All new and unused. 3 ohm coils.
 Plessey 2 1/2 in. Elac. 10 in. 27/6
 Goodmans 3 1/2 in. Plessey 12 in. 32/6
 Elac 5 in. Elac 7 x 4 in. 18/6
 Elac 6 1/2 in. 17/6 Plessey 10 x 6 in 27/6
 Elac Bin. 19/6 Std. O/P tr. 3/9
 Postage under £1 1/3 over 2/-.

MINIATURE SLOW MOTION DRIVES

Dia. 1 1/2 in. Scale 0-100, for 1/2 in. spindle. Complete with locking device. Brand new, 7/6. P.P. 1/- Large type available as above 7/6.



VOLTAGE REGULATOR TRANSFORMER. Input 220 volts. Output variable from 200 to 240 volts 7.5 amps., 87/6 each. P.P. 5/-.

A.C. MAINS POWER PACKS. Input 230 v. Output 250 v. 50 mA. 6.3 v. 2 a. fully smoothed, 5Z4 rectifier. Housed in metal box with other useful gear including, 2XEFS0, VR137, EA50, and Y65. 32/6 each. P.P. 3/-.

4 SPEED RECORD CHANGERS

Brand new B.S.R. 4 speed changers, UA8 £8/12/6.
 Brand new COLLARO RC546. 4 speed changers, £8/15/- P.P. 3/6.

EDDYSTONE POWER UNITS. Input 200/250 volts A.C. Output 175 watts 60 m/a. and 6.3 watts 3 amps. Fully smoothed, uses 5Z4 rectifier. Supplied in good condition. 32/6 each. P.P. 3/-.

VALVE BARGAINS

50,000 valves in stock. All new and guaranteed. Many obsolete types. Send for lists.
 EF86, 12/6 EY51 10/6 EF80 9/6
 EL84 12/6 ECL80 11/6 PX25 15/6
 ECC81 9/6 EZ81 10/6 616 3/6
 ECC82 9/6 6SN7 5/11 VU111 1/9
 ECC83 9/6 EF37a 10/6 807 6/- etc.

G.W. SMITH & CO (RADIO) LIMITED
 Phone: GERRARD 8204/9155
 Cables: SMITHEX LESQUARE
 3-34 LISLE STREET, LONDON, W.C.2

There is always a fine selection of equipment at

TRANSFORMERS

HEAT TRANSFORMERS

6.3 volt, 1½ amps.; brand new, 6/6. plus 1/- p.p.

SMALL MAINS TRANSFORMERS

Input 230 v. 50 cycles, output 250 v. 40 mA., 6.3 v. 1.5 a. Size 3.9in. × 2.4in. × 2in. Ideal for TV converters. Price 12/6 each, plus 1/- p.p.

CHARGER TRANSFORMERS

For 6 or 12 volt; 230 volt 50 cycles input, 9 and 17 volt 3 amp. output. Price 15/6 each, plus 1/- p.p.

BENDIX COMMUNICATION RECEIVER M.N.26C

A superb 12 valve receiver covering 150-1500 kc/s in 3 bands, 150-325, 325-695, 695-1500 kc/s. I.F. frequency 112.6 kc/s.

Valve line-up: 6K7 1st and 2nd R.F. 6L7 Mixer. 6I5 Oscillator. 6K7 I.F. Amplifier, 6B8 1st and 2nd Det. and A.V.C. 6J5 B.F.O. 6F6 Audio Output. Also Radio Compass output stage: 6N7 Compass Modulator. 6N7 Audio Oscillator. 6K7 Loop Amplifier, 6K7 Compass Output.

Power Supply 28 volt D.C. 1.6 amps to internal Motor Generator, which can be easily changed for 12 volt Generator as unit was designed for both supplies (Details available). THE PERFECT CAR RADIO. Size 15½in. × 6in. For A.C. mains operation supply required: 6.3 v. and 230 v. 100 mA. Circuit diagram and connection chart free with each unit. Price £3/10/-, plus 10/- carriage. 12 v. Dynamotors available (U.S.A.) at 30/- each.



DESYNN TYPE ANTENNA

or Beam position indication system

This comprises a transmitter unit and Indicator which will operate on 12 or 24 volts D.C. and will indicate with instantaneous and smooth pointer movement. The Transmitter is a specially designed potentiometer and will operate the Receiver on a simple three-wire system and the receiver in this instance is calibrated in Gallons but dial could be easily altered to indicate a 360 deg. sweep. Transmitter and Receiver with full instructions. Price 12/6, plus 2/- p.p.

WATERPROOF PLUGS & SOCKETS

3-pin 5 amp., non-reversible. Suitable for caravan and trailers, etc. 1/6 per pair, post paid.

STUD SWITCHES

20 segment 5/16in. studs, base 5in. square with handle and housing. New and boxed, 5/- each, plus 1/6 p.p.



MAINS CHANGING TRANSFORMER



(Admiralty Pattern) 230/100-110-130 v. Separate primary and secondary with earthed screen winding between. Totally enclosed in 7in. × 6in. × 8in. black steel case with detachable lid exposing terminal block and tapping link. Secondary very conservatively rated at 0.44 amps. (core size 3 sq. in.), tested to 2,000 v. Weight 19½lb. Price £1 each, including packing and postage.

RECEIVER UNIT Ex 1143A

Suitable for conversion to 2 metres or F.M. Wrotham transmissions. Valve line-up: (4) EF50. (1) EL32. (2) EF39. (1) EBC33. (1) EA50. Supplied with circuit diagrams. Fully valved. 25/- each, plus 3/- p.p.



AZIMUTH INDICATOR

Bendix Radio Compass

Azimuth indicator, for use with D.F. loop on manual operation. Flexible cable entries on both sides of unit. Dial face calibrated in degrees and adjustable for corrections. Small dial lamps are fitted for night use and unit is supplied with plug for input. Size 6in. dia., 2½in deep Grey crackle finish Brand new and boxed. Price 15/-, plus 2/6 p.p.



ASTRO COMPASSES

New and Boxed £1 each, plus 3/- postage and packing.

BENDIX INVERTER

Type 12123-1-A. 24 volt D.C. input. 115 volt 3 phase 400 cycle .5 amp. Size: 9in. long, 4in. dia., 6in. high including connector box and voltage regulator. Price £4 each, plus 5/- p.p.

24 VOLT D.C. CONVERTERS

50 V. 50 cycles A/C 4 amps. Size 9in. long × 6in. diameter. 25/- each plus 7/6 carriage.

STANDARDISE YOUR RIG!

With British-to-American, or American-to-British. Co-axial Adaptors, plug or socket fitting. 1/6 each post paid.

Please state which type required

SMALL HEARING AID 3-VALVE AMPLIFIER

Containing crystal Microphone. 2-505AX, 1-507AX Valves. This unit can be converted into a miniature receiver with aid of the following components:—

Ferrite Rod 5/-, 250 pf Trimmer Condenser 1/6, 100 pf Condenser 6d. 2 megohm Resistor 4d. Balanced Armature Earphone 3/6.

Voltage required is 30 to 45 Volts H.T. and 1.5 Volts L.T. Circuit and conversion diagrams sent free with each Amplifier. Price of Unit, less outer case, £1. Components for conversion 10/6 extra, or sold separately.

A.F. Amplifier. For audio frequency amplifier on sub-standard chassis 5in × 3in. × 3½in. R/C coupled, using 2-12SH7 and 1-12SJ7 valves, and can be used for telephone intercommunication pre-amps etc. at 10/-, post paid.

Inspection Lamp. 2 pole S.B.C. Holder with 6ft spring loaded lead, in case 3in. × 3in. × 4in. with on/off Switch on front panel at 6/-, post paid.

4 Aircraft Instruments for 10/- post paid

1. Speed of Sound (MACH) Meter. 1. Rate of Climb. 1. Air speed Indicator. 1. Altimeter. The lot 10/- post paid.

Plastic Handles. 9in. long 1in at centre tapered. In three attractive pastel shades, i.e. Pink, Blue and Grey. 2/6 pair, post paid.

Slow Motion Drive. With dial scaled 0-100 over 180 deg. 5 to 1 ratio. Complete with lock and ceramic coupler. These have been removed from T.U.5 Tuning Units, 5/-, post paid.

Solenoid C4C 12 v. D.C. ½in. Travel. Quick and powerful action, Size 2½in. diameter 5in. long 7in. overall. Gun firing actuator. 7/6. post paid.

Indicator Unit CPR-55ABB. Chassis containing 4 6AC7 and 3 6H6 valves. Tube holder and screen for 5 B.P.I. New less C.R.T. 17/6, plus 8/6 postage and packing.

Auto Selector Switch. 12 v. D.C. or manual operation 5 contact. At present wired for 4 position. Housed in Watertight cast case, 10 way terminal block and cord grip cable entries. Price 3/-, plus 2/- postage and packing.

Two 400 microamps Meter Movements. American Beam Approach Indicator containing two separate movements, one 200-0-200 microamp; the other 400 microamps F.S.D. with shunt removed, two S.B.C. Neon Holders. New and boxed 10/-, post paid.

110 Volt Motors. A.C./D.C. 1/30 h.p. 400 r.p.m. Size 4in. long, 2in. wide, 2½in. high. ½in. spindle protruding 1in. from either end. Diecast body 230 v. 60 watt bulb in series. Motor will run off 230 v. mains. New condition. Price 15/-, plus 2/- postage and packing.

BC.461. Reel Control Boxes, containing 1 re-settable 3 figure counter and drive. 1 Pilot lamp and bulb (red), 3 pole 3-way wafer switch, housed in diecast aluminium box 4½in. × 3in. × 1½in., 8/6, plus 2/- postage and packing.

All these fine offers PROOPS

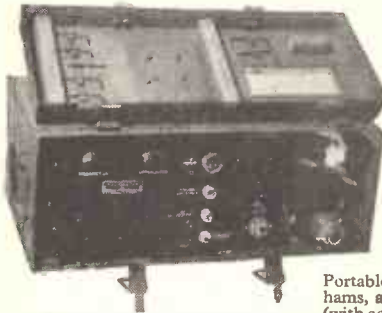
Head Office: Telephone: LANGham 0141

Mail order enquiries: Telephone: EUSton 8812

Carriage prices quoted apply only to England and Wales.

PROOFS BROS. LTD. — The Walk-around Shop

THE MOST SIGNIFICANT RELEASE THIS YEAR—



The TS184 A/AP

Real 70 cm Test Gear, brand new in carrying case for only

£5.10.0

plus packing & carriage

Portable precision for mobile hams, amateur T.V. telearchics, (with acknowledgements to Free Grid) and those monitoring the latest U.H.F. allocations.

Resonant Cavity Wavemeter, calibrated 400-430 Mc/s. Tuning stops adjustable to any 30 Mc/s band within 400-470 Mc/s coverage. Calibrated scale rack and pinion drive piston input attenuator—and alternative fixed coupling loop input provide facilities for use as signal generator. Plug-in "Telescopic Probe Antenna" 6J6 detector and monitor amplifier, 2-600 ohm phone jacks for modulated signals. Panel output terminals for metering 6J6 output current. Power required: 6v at 300mA and 30v at 1/2 mA. Circuit diagram and instructions for adjusting tuning stops supplied.

Circuit diagram and instructions for adjusting tuning stops supplied. Details of suggested free oscillator to plug in front panel. Socket for signal generator operation (or built-in oscillator for those who prefer) and comprehensive circuit description available shortly; automatically sent to every purchaser as soon as ready.

TEST SET TS.61

10 CENTIMETRE ECHO BOX With 20-0-20 Microamp Meter Indication. £7/10/- each, carriage paid.

Spirit Levels. XI. Overall length 3 1/2 in. Chromium Plated 1/2 in. Hex. Metal Body. Beautifully made by well-known manufacturer. New and boxed 3/6 each plus 6d. postage. Limited quantity.

Spirit Levels V.5 1 in. long x 1/2 in., 2-hole fixing, ground base suitable for Tripod and Camera work, etc. New and boxed 1/6 each post paid.

Lamp Bulbs 6.8 Volt. Miniature B.C., American manufacture. Box of 10 3/6 post paid.

Crystal Microphone Inserts Suitable for connection directly into pick-up sockets of Radio or Gramophone Amplifier. No transformer required. Very sensitive. Guaranteed. 4/6 each post paid.

Neon Lamps S.B.C. Mains voltage. 1/9 each post paid.

Neon Lamps M.B.C. 100 volt. 1/6 each post paid.

Colour Filters 4 1/2 in. dia. 4 colours: Amber, Red, Green and Purple. These filters have three equidistant clips and should be suitable for Photographic Safelights, etc. Supplied in fibre carrying case. Price 3/6 post paid.

Meters (Oil Temperature Indicator). 2 1/2 in. sq. Panel mounting. Basic movement 1 mA. or better. New and boxed. 5/- each post paid.

12 Volt Horns. American manufacture, used condition, but in working order. 5 in. dia. with fixing plate. Price 5/- each plus 2/- postage and packing.

B.29 Marconi Communication Receiver 15-560 Kc/s, 4 Bands, mains AC/DC internal power supply. Brand new and fully valved. £7/10/- plus 10/- postage and packing. Limited quantity.

Ground Position Indicators This unit contains beautifully made gears. Three "M" motors, 24 v D.C. motor, switches, lamps, lenses, drives, bearings, variable ball and plate assembly. Perfect for the model maker. Price 30/- plus 7/6 carriage.

Control Box BC.938A. Seven push buttons, miniature toggle switch, 3-position cam operated switch, two jack sockets. American, brand new and boxed. Size 4 x 3 x 3 in. 7/6 post paid.

70 C.M. Antenna system used with APS-13. New and boxed. 3/6 post paid.

Hellograph Mirrors. Two 5 in. dia. mirrors. One duplex, one signalling. Packed in metal transit case. 3/6 post paid.

Reflector in bakelite case. Fitted with small bayonet cap holder. Size 5 in. dia. x 3 in. deep. 2/6 post paid.

are on display at

BROS Ltd. DEPT. 'W'

52 TOTTENHAM COURT ROAD, LONDON, W.1.

Shop hours 9 a.m. to 6 p.m.—Thurs.: 9 a.m. to 1 p.m.

OPEN ALL DAY SATURDAY.

GYRO UNIT AND INVERTER

Inverter: 12 volt D.C. input, 3 phase 190 cycle output. (These inverters can be used successfully as 12 v. D.C. Motors for Models.)
Gyro Unit: operates on 3 phase output from Inverter. Peak speed 11,400 r.p.m. Caged. Precision made equipment.
 These units are ideal for experimenting and demonstration purposes. Size: Inverter 4 x 3 x 3 in.; Gyro 4 in. dia. incl. cage. Price 12/6 per pair, plus 3/- p.p.



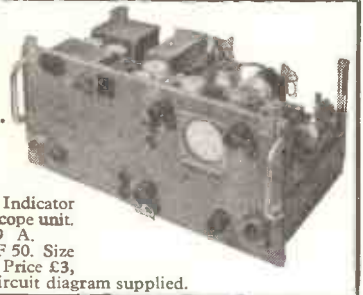
AN/APN.1 TRANSDUCER

This Unit consists of Magnet and Coil which is attached to an aluminium diaphragm suspended freely and perforated to prevent air damping. Mounted on a Ceramic cover which sits over the diaphragm is a form of 2-gang capacitor which has a swing from 10-50 pF.

The above unit is used as part of Wobbulator described on page 252 of the June 1956 "Wireless World." Price 7/6 p.p.

OSCILLOSCOPE UNIT

With internal 12v. Vibrator Power Pack



Suitable for Modulator Indicator or conversion to Oscilloscope unit. Containing V.C.R. 139 A. 2-VR.56, 1-VR.54, 2-EF 50. Size 1ft. 6in. x 9 1/2 in. x 8 in. Price £3, plus 10/- carriage. Circuit diagram supplied.

SELENIUM RECTIFIERS

300 volt 60 mA. 4/- each post paid.

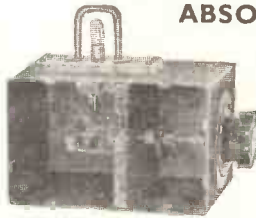
I.N.21.A. CRYSTALS

New and Boxed 1/6 each, post paid.

R.F. UNITS

RF.25 9/6 each. RF.26 25/- plus 3/- postage and packing.

ABSORPTION WAVEMETER



Easily converted to 2 metres or 70 cm. In Copper-plated metal case 3 1/2 x 4 1/2 x 5 1/2 in. with dial calibrated 0-100 and 80 v. Neon tube. Coverage approx. 190-210 Mc/s. New 6/6 each, post paid.

COMPRESSOR AND VACUUM PUMP

(Edwards Type 4) A beautifully constructed pump, coupled with a 24 v. D.C. Motor mounted on rigid steel base, cover and complete with hose coupling Vacuum 10 cm. mercury. Pressure 10lb per sq. in. 2.6 cu. ft. per min. Unit in case size: 16 in. x 7 in. x 8 in. New and boxed £4, plus 10/- postage and packing.

'S' BAND PRECISION WAVEMETER

2,900 to 3,150 Mc/s. TEST SET 288 A.M. Ref. 10SB/6161.

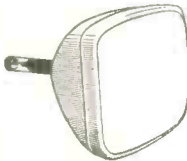
Comprising exceptionally rugged silver-plated Wavemeter Type 1665, resiliently mounted and directly tuned by 1 1/2 in. dia. calibrated micrometer with 6 1/2 in. thimble scale. Temperature correction for micrometer attached. Resonance indicated on 100 microamp meter. Equally suitable for laboratory using milliwatt power or, with loose coupling, for high powers. UR21 connecting cable and coupling probe supplied. Brand new in robust moisture-proof case with jacking-off screws and tool. Price £15, plus £1 packing and carriage.



RECTANGULAR T.V. TUBES

used with 12 MONTHS' GUARANTEE
17" £7-10-0 14" £5-10-0

6 months' full replacement, 6 months' progressive. Made possible by the high quality of our tubes. Ins., carr. 15/6.



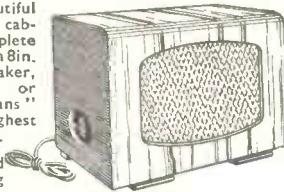
SPECIAL OFFER OF 14in.—15in.—16in. T.V. TUBES at £5.—
CONVERT YOUR 9in.—10in.—12in. to the above sizes. Details of how to "Do-it-Yourself" in our FREE catalogue. 12in. T.V. TUBES £6. Guaranteed. 15/6 Ins., carr. on all tubes.

ELECTROSTATIC T.V. TUBES

All at 10/- each. 8 1/2in.—09D, 4 1/2in.—E4205/B/7, 2 1/2in.—E4103/B/4, 1 1/2in.—DG7-5, 2 1/2in.—VCR131, 1 1/2in. Not guaranteed free from defects. Removed from working sets. Ins., carr. 5/-.

EXTENSION SPEAKERS. 29/9

In beautiful polished cabinet. Complete fitted with 8in. P.M. speaker, "W.B." or "Goodmans" of the highest quality.

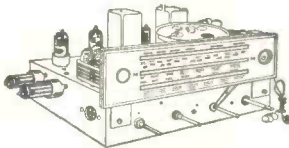


Standard matching to any receiver. 2.5 ohms. Flex and switch included. Unrepeatable at this price. Money back guarantee if not completely satisfied. Ins., carr. 3/6.

8in. P.M. SPEAKERS. 8/9. Let the lady of the house listen to that T.V. or radio programme. At this price you can have one in every room. Complete with O.P. trans. 10/- P. & P. 2/9.

SPEAKERS. 12/9. Goodmans or Elac. High quality 8in. P.M. Money back guaranteed. With O.P. trans. 14/- P. & P. 2/9.

ARGOSY PUSH-PULL RADIO-GRAM CHASSIS. £6.19.6



8 valve, uses 2-EL42, 2-EBF80, ECH81, EBC41, EZ80, EM34. Latest models, 3 wave band and gram. Switched. Over 10 watts output. Full tone range. 4 knob control. Size 12in. x 7 1/2in. x 7 1/2in. Less valves. Ins., carr. 5/6.

SIMULATOR UNITS. 29/6

Complete with valves. Telescopic aerial. Instruction booklet FREE with each order. Ideal for Walkie-Talkie conversion. Test set 172A. Ex-W.D. P. & P. 4/6.

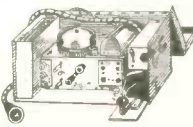


HEADPHONES. 1/9

Single earphone and headband. C.L.R. Ideal for crystal sets, extension on radio, etc. P. & P. 1/3.

TELEPHONE SETS. 7/9

Ex-W.D. Wireless remote control unit. E.M.K.11. New condition. Morse tapper, switched, jack plugs etc., less phone. P. & P. 3/6.



R.F. EHT COIL. 30/-. 6-10 kV. Drawing and data FREE with each order. Post Free.

ELECTRIC CONVECTOR HEATER. 99/6

Cheaper than paraffin, Hotter, no smells, AC/DC. Switched for 1 or 2 kilowatts. Illuminated grille. Ins., carr. 10/6.

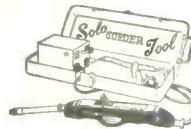


ELECTRIC FIRES. 17/6. Hammered finish. 200/250 volt 750 watts. P. & P. 3/6.

ELECTRIC FIRES 29/6. Pencil element with reflector and carrying handle. Beautiful finish. Amazing heat. 1 kilowatt. 200/250 volt. P. & P. 3/6.

SELF FEED SOLDERING. 29/6

6-12 volt, 100-125 volt. Made for the American market. Car battery or mains. Export quality. Complete in light carrying case. Reel of solder and spare parts. P. & P. 2/9. A few of the above in 6-12 volt, 200-240 volt. 45/-.



T.V. CHASSIS TO CLEAR, 59/6

Complete chassis by famous manufacturer. R.F. EHT unit included. Drawing 2/6 or FREE with order. Chassis in 3 separate units (Power, s/vision, time base interconnected). These chassis can easily be fitted into existing console cabinets. Less valves and tube. Channels 1-2, 3-5. Easily converted to I.T.A. Ins., carr. 10/6.

TERMS AVAILABLE

17" T.V. CHASSIS. £19.19.6

Latest improved circuits. Higher E.H.T. (brilliant picture). Improved sensitivity (for greater range). Chassis easily adapted to any cabinet. As supplied to many well known Rental and Hire Cos. 17in. RECTANGULAR tube on adapted chassis. All channels. Valve line up (5 valves) 6SN7, 6V6, EY51, two 6D2s.



17" T.V. CHASSIS

Others 6L18, EL38, seven 6F1. TURRET TUNER 50/- extra. 12 months' guarantee on tube, 3 months' on chassis, valves and speaker. Complete and working on any channel 1-5. Less valves. With 5 valves, £21/19/6. With all valves £25/19/6. Ins., Carr. 25/- (incl. tube). State B.B.C. channel (and I.T.A. channel if Turret required).

14" T.V. CHASSIS, TUBE, SPEAKER. £13/19/6

As above with 14in. round tube. Less valves. Guaranteed 3 months. With 5 valves, £15/19/6. With all valves, £19/19/6. TURRET TUNER 50/- extra. Ins., carr. 25/- incl. tube.

CO-AX. CABLE. 6d. yard. Good quality. Cut to any length. Post on 20 yds. 1/6. 45/- per 100 yards. Post 3/6.

T.V. MASKS. 3/9. New 12in. white rubber. Post 1/3.

T.V. MASKS. 1/9. Soiled, require washing, rubber. Post 1/3.

RECTIFIERS. 2/9. 250 volt, 100 mA. Full or half wave. Salvage guaranteed. Post 1/3.

COIL PACK SETS. 3/9. This bargain includes 3 band coil pack, pair 465 I.F.s and std. 2 gang condenser. Printed dial. Post 2/3.

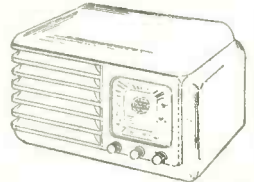
INSULATING TAPE. 1/6. 75ft. x 1/2in. wide. Finest quality. Large roll in sealed metal container. P. & P. 9d. (post on 6 tins 2/-).

SUCCESS T.Vs. RADIOS. TUBES. SPEAKERS.

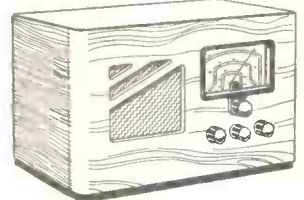
Your response to our last month's advert in this magazine has given our staff great satisfaction. They send their thanks, and hope that with your increased demands they will continue to give SATISFACTORY SERVICE.

A.C./D.C. MIDGET RADIO. 99/6

5 valve, CCH35, E F 3 9, E B C 3 3, CL33, 35Z4 or metal rec; 3 control knobs. Switched for gram. In attractive brown plastic cabinet. 15 x 7 1/2 x 9in. Ins., carr. 4/6.



HOME RADIO. 79/6



5 valve (octal) s/het, 3 w/band receiver. A.C. Gram, P.U. sockets. In wooden cabinet, 18 1/2 x 11 1/2 x 8 1/2in. Ins., carr. 7/6.

RADIOGRAM CHASSIS. 39/9

3 w/band and gram, s/het, 5 valve (octal). Ideal for table gram, giving high quality output, 4 knob control. 8in. P.M. speaker, 7/9 with order. Set of knobs 2/- Chassis 12 x 6 x 7 1/2in. Ins., carr. 4/6.

MAINS TRANSFORMERS

- 350-0-350 v. 80 m.a. 4 v., 4 v. heaters. 200-250 v. prim. 3/9
- 350-0-350 v. 80 m.a. 4 v., 12 v. heaters. 200-250 v. prim. 2/9
- 280-0-280 v. 80 m.a. 6 v. 2 a., 4 v. 2 a., 4 v. 2 a. 200-250 v. prim. Drop through, half shrouded 5/9
- (All above 2/3 post.)
- 425-0-425 v. 5 v. at 6 a., 6.3 v. at 12 a., 6.3 v. at 6 a. 200-250 v. screened primary. (P. & P. 2/6) 17/6
- 0-200-250 v. heater transformer. 4 v. at 2 1/2 amp. (P. & P. 1/9) 8/9
- 0-200-250 v. heater transformer. 12 v. at 1 1/2 amp. (P. & P. 1/9) 8/9

O.P. TRANSFORMERS, 1/3. Standard size 2-5 ohms. Post 1/- 20 for £1. P. & P. on 20, 5/6.

CANDELABRUM. 19/9

3 Light Lounge Fitting, with flex and lamp holders and 3 shades in glass or plastic. Special purchase makes us able to sell at this very cheap price. P & P. 2/9.

Boxed VALVES		3 months' guarantee	
185	4/9 77	3/9	ECH42 8/9 PEN4612/6
6A66	7/9 210LF	3/9	EP41 8/9 PEN220 3/9
6H8M	1/9 210VPT	3/9	EP50 2/9 PP225 3/9
6N7GT	4/9 7193	3/9	EL32 6/9 BL37 1/9
6B8G	3/9 AR6	1/9	KTW61 5/9 VR21 1/9
68G7	3/9 CV189	3/9	L410 1/9 VW48 9d
8D2	3/9 EB34	1/9	LP220 1/9 EF37 4/9
12BE6	6/9 ECC81	8/9	ML4 1/9 EF37A 4/9

Send for FREE CATALOGUE
Liverpool Street to Manor
Park Stn. — 10 mins.

DUKE & CO.

621/3, ROMFORD ROAD,
MANOR PARK, LONDON, E.12

ILF. 6001-3 (Note new Phone Nos.)

Best Buy at Britain's

MARCONI NOISE GENERATORS

Type TF 987/1.

- ★ Frequency range 100 Kc/s-200 Mc/s.
- ★ Accuracy plus or minus .5 decibel.
- ★ Determines noise factor of AM AND FM receivers.
- ★ Noise output ranges 0-5, 0-10, 0-15, and 0-30.
- ★ Directly calibrated 3½ in. m/coil meter.
- ★ Output impedance 71 ohms nominal.
- ★ Fully stabilised HT supply.
- ★ For A.C. mains operation, 200-250 v., 45-65 c/s.
- ★ Size 15½ x 11 x 8½ in. deep. Weight 28 lb.
- ★ Finished in grey enamel and chrome.
- ★ Brand new, unused, and in original boxes.
- ★ Complete with mains socket, co-ax plug, and lead.



PRICE — ONLY £25.

TRANSFORMER BARGAINS

Input 0-230/250 v. Output 240-0-240 v., 1.5 amps RMS, 5 v. 1.75 amps, and 5 v. 12.5 amps. 7 x 7½ x 10½ in. high. Wt. 50 lb. Potted, oil-filled, by Gresham. Gives 2.1 amp. D.C. when rectified, OR, as ISOLATING TRANSFORMER, to obtain two 240 v. 360 w. lines. Brand new. £3/10/-. Carr. 10/-.

Input 0-110/120-200/250 v. Output 275-0-275 v. 100 mA., 6.5 v. 7 amps, 5 v. 3 amps (Govt. ratings). 4 x 4½ x 4 in. high. Upright mounting. Brand new. 32/6. Postage 2/6.

U.S.A. potted type. Input 210/220/230 v. 5 secondaries, 7.5 v. 4 a., 7.5 v. 4 a., 7.5 v. 8 a. and 2.5 v. 5 a. ALL centre tapped, and 6.3 v. 4 a. These can be connected to give many useful voltages up to 31 v. 4 a. Size 6 in. x 5 in. x 4 in. Wt. 16 lb. price 35/-.

HEAVY DUTY SLIDER RESISTORS. 0.4 ohm, 25 amps, 250 watts, worm drive, 7/6. 10 ohms, 3.5 amps, worm drive, 10/6. 1 ohm, 12 amps, 150 watts, 7/6.

MINIATURE STC RELAYS. 250 ohm coil. DP C/O (double-contacts). 1½ x 1½ x 2½ in. 7/6.

OUTPUT POWER METERS. Ex-W.D. No. 3, Mk. 2 (Windsor 150 A.). Impedance ranges: 2.5 to 20,000 ohms in 40 steps. Power ranges 0-5, 50, 500 milliwatts, and 0-5 watts. Also scaled in dB, 3½ in. M/C meter. In oak case, 10½ in. x 8 in. x 5½ in. In good condition. Tested. £15.

INSULATION TESTERS by Record Electric, 0-50 Megohms. Test voltage 500. In perfect working order. Complete in leather carrying case. £9/19/6.

AVO VALVE TESTERS. Roller panel type, with cut-out. New purchase enables us to offer these in very good condition, in transit case and full working order for ONLY £7/19/6 carriage paid.

JACK BOXES. A small metal box fitted with 9 miniature insulated Igranic jack sockets. Brand new. SNIP, 12/6.

HEAVY DUTY BLOWERS. For 200-250 v. A.C./D.C. mains, 300 watts. With 1½ inch diam. twin "V" shape outlets, 2 lengths of hose. 4 spare filters and brushes. Suitable for industrial use, forges, etc. Brand new, £4/19/6.

VIBRATOR PACKS. Input 6 v. D.C., Output approx. 100 v. D.C. at 30 m/Amps, fully smoothed and R.F. filtered. Size 6½ x 5 x 2 in. Fitted with Mallory 629C vibrator. Brand new. Boxed. 12/6.

MOTOR ALTERNATORS. Input 80 volt D.C. at 16 amps. Output 80 volt A.C. 2,000 c/s, at 8 amps (650 V.A.). Built-in voltage regulator. Brand new. Crated. 79/6. Carriage 15/-.

METAL RECTIFIERS. 250 volt, 100 mA 5/-, 230 volt, 60 mA 3/6. Many other types.

METER BARGAINS

RANGE	TYPE	SIZE	PRICE
50 Microamp.	D.C. M/C	2½ in.	59/6
100 Microamp.	D.C. M/C	2½ in.	59/6
500 Microamp.	D.C. M/C	2 in.	17/6
500-0-500 Micro-	D.C. M/C	2½ in.	
amp.			25/-
1 Millamp.	D.C. M/C	2 in.	22/8
150 Millamp.	D.C. M/C	2 in.	7/8
200 Millamp.	D.C. M/C	2½ in.	10/8
1 Amp. Thermo-couple	2 in.	Projecting circular	6/9
4 Amp. Thermo-couple	2 in.	Flush square	8/9
30-0-30 Amp.	D.C. M/I	2 in.	Prof. circ., ear type
15 Volta	A.C. M/I	2½ in.	Flush circular
METER RECTIFIERS. Full wave bridge. Brand new, Salford 1/mA.			
6/8.	6 mA/A.	6/8.	8/0
		8/0.	5/8.

WIRELESS SET No. 19, Mk. 2.

Two transmitter-receivers and an intercom. amplifier in one case. "A" set covers 2-8 Mc/s R/T and CW, and "B" set 240 Mc/s R/T only. Complete with dynamotor for 12 v. D.C. operation, 6 K7G, 2 6K8G, 2 6V6G, 6B8G, 807, EF50, EB34, and 500 microamp check and tuning meter. S.A.E. full specification. Technical data supplied. Made in U.S.A. First-class condition. AIR TESTED £5/10/- plus 15/- carr. and pkg. Or less dynamotor, £4/19/6.



RCA AMPLIFIER MI-11220. Employs 2 6L6G, 4 6J7, 1 5U4G. Output 12 watts at 5, 7.5, 15, or 600 ohms. For 190-250 v. A.C. mains. In amber-grey crackled case, 17 x 11 x 9 in. Wt. 38 lb. Brand new, boxed, less valves, £9/19/6. Circuit supplied. Set of new valves, 59/6. Converted for use with pick-up or microphone, with tone control, £2 extra. Spare O/P transformer for above, with NFB tertiary winding. BRAND NEW, 27/6, including amplifier circuit.

HIGH VOLTAGE POWER UNITS
Input 200-250 v. A.C. mains. Output 1200v. D.C., 200 milliamps. Fully smoothed, Metal rectifiers, £5/10/-, plus 15/- carriage.

R109A RECEIVERS. 8 valve superhet using 5 x ARP12's and 3 x AR8's covering 2-12 Mc/s. Contains vibrator pack and 3½ in. speaker and operates from 6 volt battery, consumption 1½ amps. Housed in metal case 13 x 12 x 11 in. Complete with valves and circuit. Very good condition. Tested. £4/7/6, carr. pd.

SCR522 TRANSMITTER/RECEIVERS. 100-150 Mc/s. Comprises BC624A rec., and BC625 trans. All complete with valves, and in first-class condition. BC624A, less relay, 39/6. With relay, 49/6. BC625, 49/6.

RT37/PN2 BEACON TRANSMITTER-RECEIVER. 214-234 Mc/s. Size 13 in. x 10 in. x 5 in. Contains 5 3A5, 3 1S5, 1 1R5 and 2 2 v. synchronous vibrators. Operates from 2 v. accumulator via 2 built-in vibrators. Complete with telescopic mast antenna system (9½ ft.), lightweight headphones. Technical Manual, super quality carrying haversack, cords, co-ax cables, plugs, etc. Total wt. 28 lb. BRAND NEW, boxed. American equipment, 72/6.

PYE 45 Mc/s. IF STRIPS. Complete with 7 valves and CIRCUIT. New, ONLY 39/6. **RF UNITS. ALL BRAND NEW AND BOXED.** RF24 7/6, RF26 25/-, Post 2/6.

Two-Way MORSE TRAINING SETS, W/T Mk. 3. Consists of 2 valve oscillators (ARP12's) (one with pitch control), for 1 or 2 operators. Has provision for creating "atmospherics." In polished oak case 12½ in. x 10 in. x 8 in., wt. 16 lb. Complete with valves leads, 2 keys, 7-way terminal board, circuit and instructions, but less batteries and phones. Ideal for Cadets, Scouts, etc. SNIP, 19/6, carr. 7/6.

VARIAC TRANSFORMERS (Zenith). 200-230 v. input. Output voltage variable from 200-250 v. at 8 amps. Wt. 14 lb. Brand New 87/6. Carr. 5/-.

MAINS DIMMERS. 300 ohms, 1 amp, 300 watts, twin ceramic formers, 15/-.

FIELD TELEPHONES. Army type D, Mk. 5. Buzzer calling. Ideal for building sites, farms, workshops, etc. Complete with handset and batteries. Tested, 39/6 each.

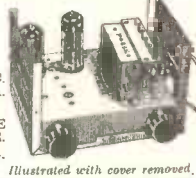
CRYSTALS. 200 Kc/s American GEC, 10/- each. 100 Kc/s RCA bars, 19/6 each.

PLEASE ADD POSTAGE OR CARRIAGE ON ALL ITEMS

CHARLES BRITAIN (Radio) Ltd.
11 UPPER SAINT MARTIN'S LANE,
LONDON, W.C.2. TEMple Bar 0545
One minute from Leicester Square Station (up Cranbourn Street)
Shop Hours: 9-6 p.m. (9-1 p.m. Thursday) Open all Saturday

COMMERCIAL TELEVISION CONVERTER

SUITABLE ANY T.V. using lower side band NO ALTERATIONS TO SET



Complete with built-in power supply, 230-250 v. A.C. mains. Case 5 1/2 in. long, 3 1/2 in. wide, 4 1/2 in. high. Incorporating gain control and band switch.

£3/19/6 Plus Post & Packing 2/6. HIRE PURCHASE TERMS AVAILABLE.

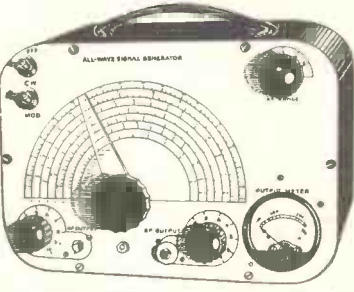
3 element folded dipole I.T.A. loft AERIAL, 15/- P. & P. 2/-.

Illustrated with cover removed.

Coverage 120 Kc/s.-230 Kc/s., 300 Kc/s.-900 Kc/s., 900 Kc/s.-2.75 Mc/s., 2.75 Mc/s.-8.5 Mc/s., 8 Mc/s.-28 Mc/s., 16 Mc/s.-66 Mc/s., 24 Mc/s.-84 Mc/s. Metal case 10 1/2 x 8 1/2 in. x 4 1/2 in. Size of scale, 6 1/2 in. x 3 1/2 in. 2 valves and rectifier. A.C. mains 230-250 v. Internal modulation of 400 c.p.s. to a depth of 30 per cent., modulated or unmodulated R.F. output continuously variable 100 milli-volts, C.W. and mod-switch, variable A.F. output and moving coil output meter. Grey hammer finish case and white panel. Accuracy plus or minus 2%.

£4/19/6 or 24/- deposit and 3 monthly payments 25/- P. & P. 4/6 extra.

SIGNAL GENERATOR

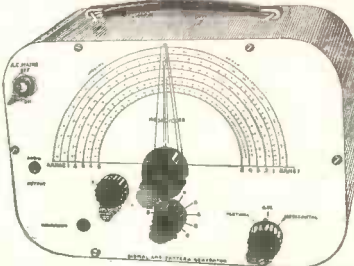


SIGNAL & PATTERN GENERATOR

Coverage 7.6 Mc/s.-210 Mc/s. in five bands, all on fundamentals, slow motion tuning, audio output, 8 vertical and horizontal bars, logging scale. In grey hammer finished case with carrying handle. Accuracy $\pm 1\%$. A.C. mains 200-250 v.

£6/19/6 P. & P. 5/6

Or £2 deposit, P. & P. 5/6 and 4 monthly payments of 2/7/6.



COMPLETELY BUILT PORTABLE AMPLIFIER

Approx. size 6 1/2 x 2 1/2 Incorporating 2 valves, contact-cooled metal rectifier, bass and treble lift controls and double wound mains transformer 39/6 Plus P. & P. 230-250 v. 3/6.

5" P.M. SPEAKER AND O.P. TRANSFORMER

if purchased with the above 18/6. Plus P. & P. 1/6.

COLLARO 4-SPEED AUTOMATIC CHANGER

Model 456. A.C. Mains 200/250v. Turnover crystal head. Brand new. **£8.19.6** Fully guaranteed. (Suitable for use with above amplifier.) P. & P. 5/-.

AC/DC MULTI-METER KIT

Comprising 2 in. moving coil meter, scale calibrated in A.C./D.C. volts, ohms and milliamps. Voltage range A.C./D.C. 0-10 and 0-500. Milliamps 0-10, 0-100; ohms 0-10,000.

Front panel, range switch, wire wound pot (for ohms zero setting), two toggle switches, resistors and meter rectifier.

Complete in case, grey hammer finish. **19/6** P. & P. 1/6.

Point to point wiring diagram 1/-, free with kit.

4 VALVE ALL-DRY SUPERHET PORTABLE KIT

incorporating ferrite rod aerial

Medium and long waves. In grey leatherette

Size 9 in. x 7 in. x 6 in. Valve line up IT4, IR5, IS5, 3V4. Complete kit of parts (less batteries)

£5/19/6 Plus 3/6 Post and Packing.



RADIO AND T.V. COMPONENTS (ACTON) LTD.
23, ACTON HIGH STREET, LONDON, W.3
GOODS NOT DISPATCHED OUTSIDE U.K.

MULLARD "3-3" QUALITY AMPLIFIER



An ideal companion unit to the JASON Tuner. A really first-class 3-valve 3-watt Amplifier giving Hi-Fi quality at a reasonable cost. Mullard's latest circuit. Valve line up: EF86, EL84, E280. Extra HT and LT available for Tuner Unit addition.

Variable treble cut and bass boost controls, sensitivity 100 MV for 3-watt output. Frequency response - or - 1db, 40 c/s to 25 kc/s.

Complete amplifier wired and tested with quality sectioned output transformer to Mullard specification (less speaker) **£8.8.0** Carr. and ins. 4/6.

JASON F.M. TUNER UNIT 87-105 m/cs

F.M. TUNER-UNIT (87 mc/s.-105 mc/s.) by Jason. As described in Radio Constructor. Designer Approved Kit of parts to build this modern highly successful unit, drilled chassis and superior type dial as illustrated, coils, cans and all quality components, etc., for only 5 Gns., post free. Set of 4 spec. EF91 or equiv. valves 30/-, post free. Illustrated handbook with full details, 2/-, post free. Free with Kit. 48-hr. Alignment Service, 7/6 and 2/- p. & p.



ELECTROLYTICS ALL TYPES NEW STOCK

TUBULAR	CAN TYPES
25/25 v. 50/12 v. 1/9	8 + 8/450 v. ... 4/6
50/50 v. 4/500 v. 2/-	8 + 16/450 v. ... 5/-
100/250 v. ... 1/9	8 + 16/500 v. ... 5/6
5/450 v. ... 2/3	16 + 16/450 v. ... 5/6
8/500 v. ... 2/9	16 + 16/500 v. ... 6/-
8 + 8/500 v. ... 4/6	16 + 16 + 8/350 v. 5/6
8 + 16/450 v. ... 5/-	32 + 32/350 v. ... 5/6
16/450 v. ... 3/6	32 + 32/275 v. ... 4/6
16 + 16/450 v. ... 5/6	50 + 50/350 v. ... 6/6
32/350 v. ... 4/-	60/350 v. ... 6/6
32/500 v. ... 5/-	60 + 250/275 v. 12/6
32 + 32/350 v. ... 5/6	64 + 120/275 v. 11/6
32 + 32/450 v. ... 6/6	100 + 200/275 v. 12/6
	100/270 v. ... 6/6

MIDGET TRANSFORMER TYPES. 2 1/2 F, 4 1/2 F, 8 1/2 F, 6V, 3/9; 6 1/2 F, 10 1/2 F, 16 1/2 F, 3V, 3/9; 32 1/2 F, 11V, 3/9

CONDENSERS.—Mica, Silver Mica. All prof. values, 3 pf. to 1,000. pf. 6d. each. Ditto ceramic 9d. each. Tubulars, 450 v. Hants and T.C.C. .001 mid-.01 and 1/350 v., 9d. each. .02-1/500 v., 1/- each. 25 Hants, 1/6. 5 Hants, 1/9. .001 mid. 6kv. 5/6. .001 mid. 20kv. 9/6.

CLOSE TOLERANCE CONDENSERS S/MICA. 10% Type, 5 pf.—500 pf., each 1/-; 600 pf.—5,000 pf., each 1/3. 15% Type, 1.5 pf.—50 pf. (Tot. 1 pf.), 1/9; 56 pf.—500 pf., each 1/3; 575 pf.—5,000 pf., each 2/-.

RESISTORS.—Prof. values 10 ohms to meg-ohms.

CARBON	WIRE-WOUND
20% Type, 1 w., 3d.; 1 w., 5d.; 1 w., 6d.; 2 w., 9d.	5 w. } 25 ohms—1/3
10% Type, 1 w., 9d.; 5% Type, 1 w., 1/-; 1% Hi-Stab., 1 w., 2/-	10 w. } 10,000 1/6
	5 w. } 15,000—1/9
	10 w. } 33,000
	10 w. } ohms 2/3

WIRE-WOUND
3 W. LAB. COLVERN
Etc. Standard Size Pots
2 1/2 in. Spindle. High Grade. All Values.
10 ohms to 50 K.
5/6; 100 K., 6/6
W/W EXT. SPEAKER
CONTROL, 10 0 3/-

SENERCEL RECTIFIERS. E.H.T. Type, Fly-Back Voltages. K3/25 2 kV., 5/-; K3/40 3.2 kV., 6/6; K3/45 3.6 kV., 7/3; K3/50 4 kV., 7/9; K3/100 8 kV., 13/6, etc. MAINS TYPES.—RM1 125 v. 60 mA., 4/9; RM2 125 v. 100 mA., 5/6; RM3 125 v. 120 mA., 7/6; RM4 250 v. 250 mA., 16/-; RM4B type 270 mA., 17/6.

SPEAKER FRET—Expanded Bronze anodised metal 8 x 8 in., 2/3; 12 x 8 in., 3/-; 12 x 12 in., 4/3; 12 x 16 in., 6/-; 24 x 12 in., 8/6, etc. Any preferred size cut.

TYGAN FRET (Murphy pattern) 12 in. x 12 in., 2/-; 12 x 18 in., 3/-; 12 x 24 in., 4/-, etc

NEW BOXED VALVES	ALL GUARANTEED
1R5, 1T4, 7F6	EABC80 9/6
185, 184 7/6	EB91 6/6
384, 3V4 8/-	EB33 8/6
3Z4 9/6	EB34 10/6
6AT6 8/6	EC84 12/6
6K7 8/6	ECF80 12/6
6K8 8/6	ECF82 12/6
6Q7 8/6	ECH42 10/6
6SN7 8/6	ECH41 10/6
6V6 7/6	ECH10 6/6
6X4 7/6	EF41 10/6
6X5 7/6	EF80 10/6
7C5 9/-	EF86 12/6
7Y4 8/6	EF91 8/6
DAF96 9/-	EM85 11/6
DF96 9/-	EL41 10/6
DE96 9/-	EL84 11/6
DL96 9/-	EX31 10/6
3SL6 10/6	EZ40 8/6
	UZ2 8/6
	UBC41 9/6
	UCH42 10/6
	UF41 10/-
	UL41 10/6
	UY1 8/6

SPECIAL PRICE PER SET
1R5, 1T4, 185, 184, or 384, or 3V4 27/6
DK96, DF96, DAF96, DL96 ... 35/-
6K8, 6K7, 6Q7, 6V6, 5Z4 or 6X5 ... 35/-

TRANSISTORS. Mrs. surplus PNP Junction type. Audio Type, 800 kc/s 250mV, 9/6; R.F. and L.O. Mixer Type, 2.5 Mc/s, 18/6. All tested and guaranteed.

Vol. Controls 80 ohm COAX

Log. ratios, 10,000 ohms—2 Megohms. Standard ins. diam., Polythene insulated. GRADE "A" ONLY.

8d. yd. SPECIAL—Semi-air spaced polythene, 50 ohm Coax ins. diam. Standard core. Losses cut, 9d. yd. 50%. IDEAL BAND 2/3. TRIMMERS, Ceramic, 4 pf.—70 pf., 9d.; 100 pf., 150 pf., 1/3; 250 pf., 1/6; 500 pf., 1/9. PHILIPS Beeline Type—2 to 8 pf. or 3 to 30 pf., 1/- each.

LOUDSPEAKER.—FM. 3 ohm. 2 1/2 in. Elec., 17/6; 3 1/2 in. Goodmans, 18/6; 5 in. R. and A. 16/6; 8 in. Cetes, 18/6; 7 x 4 in. Goodmans Elliptical 18/6; 8 in. Elec., 20/-; 10 in. R. and A., 25/-; 10 in. WB-EF102, 99/9; 12 in. Plessey 15 ohm with 6 x 4 in. Tweeter and Cross Over Filter, 97/6.

TRS RADIO COMPONENT SPECIALISTS

70 BRIGSTOCK RD., THORNTON HEATH, SURREY
Phone: THO 2188. Hours 9 a.m.—6 p.m., 1 p.m. Wed. Open all day Saturday. By THORNTON HEATH STATION.

TRANSFORMER & COIL/WINDING CAPACITY AVAILABLE FOR PROTOTYPES & SMALL RUNS.

Terms: C.W.O. or C.O.D. Kinaly make cheques, P.O.s., etc., payable to TR.S. Post and Packing up to 7d., 1lb. 1/1, 3lb. 1/8, 5lb. 2/-, 10lb. 2/9. Bargain Lists, 3d.

Hours of Business:

9-6 Weekdays
9-1 Saturday

GEE ros RADIO Ltd.

ADJOINING
LEICESTER SQ
TUBE STATION

15, LITTLE NEWPORT STREET, LONDON, W.C.2. Telephone: GERrard 6794/1453

For QUALITY—CIVILITY—RELIABILITY and VALUE!

VITAVOX PRESSURE UNITS. Heavy duty. P.M. 20 watt. Brand new, £4/9/6. Also ditto, second-hand, in good working order, 40/-, carr. 7/6.

50-WATT EX-GOVT. AMPLIFIER. Type III with 4-KT66/s in paralleled push-pull. Standard 200-250 v. A.C. input. Output imp. 600 ohms Line. High imp. gram. and mike input. Bass boost control fitted. Quality amplifier housed in strong metal case, ready for use. Terrific performance, £28, carriage paid.

BAKER SELHURST 12in. P.M. 15 ohms. 15 watts loudspeakers, 30-14,000 c.p.s. Brand new, £4/10.

MINE DETECTOR No. 4. Complete in carrying case with all accessories. Good working order. £8.19.6, Carr. Paid.

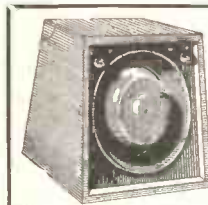
RE-ENTRANT LOUD-HAILERS. Heavy duty 20 watts all-metal. 15 ohms. Diameter 18in., length 12in. (approx.). By Parmeko, £6/10/-, carr. 10/-.

ROTARY CONVERTERS. 24 v. D.C. to 230 v. A.C. 50 cycles. 100 watts. Fully tested, £4/12/6, carr. 7/6.

SELENIUM METAL RECTIFIERS. FULL BRIDGE

6 or 12 v. 1 amp.	7/6	24 v. 1 amp.	13/6
12 v. 2 amp.	10/-	24 v. 2 amp.	20/-
12 v. 2½ amp.	15/-	24 v. 2½ amp.	25/-
12 v. 4 amp.	16/6	24 v. 4 amp.	30/-
12 v. 6 amp.	23/6	24 v. 6 amp.	35/-
12 v. 10 amp.	40/-	24 v. 10 amp.	80/-

SPEEDY DELIVERY OF L.T. RECTIFIERS TO ORDER, FULLY GUARANTEED



TANNOY LOUDHAILERS (EX GOVT.)
New and Boxed Impedance 7½ ohms. Handling capacity 8 watts. Price 25/- Post 3/6. 2 sent for 50/-, Carr. 5/-.

COMMAND TRANSMITTERS. 4 to 5.3 megs. Complete with valves and crystal. New and boxed 35/-, P. & P. 3/-.

APQ9 TRANSMITTER. Containing 931a Photo Electric cell (complete with network). 2-6AC7s, 1-6AG7, 2-807s and 2 blower-cooled 8012s. With rev. counter. Brand new, 89/6, carr. 12/6.

TEST METER. Model 420 S.P. (by Radio City Products, U.S.A.). 3in. sq. meter in polished wood carrying case, covering a wide range of volts at a sensitivity of 1,000 ohms per volt for both A.C. and D.C. tests. In addition to this, the instrument will measure resistances up to 1 meg. and D.C. current up to 1 amp. Complete with full instruction data and test prods. Tested before despatched, £5/19/6 only, carr. etc. 7/6.

VALVE TESTER (by Radio City Products, U.S.A.), model 314, Brand new, unused with instruction manual. 110-220 v. A.C. 50 c/s. Will test most American valves from 1.1 v. to 200 v., £10, carr. 5/-.

AVO TEST BRIDGE. No. 1 M.K. I for 230 v. A.C. mains operation. Will test all condensers from .0001 to 50 mfd., also resistances from 5 ohms to 50 megohms. A very useful instrument, tested before despatched, £8/19/6, carriage, etc. 7/6.

PARMEKO MOVING COIL HAND MICROPHONE. 200 ohm imp. Fitted on/off switch, complete with 12yds. flex 30V., P.P. 2/6.

AVO VALVE TESTER. Complete with Rotary Panel in good order, £7/19/6, carriage and Packing 7/6.

WAVEMETER TYPE W 1310 (Marconi Ex-Govt.) coverage 155-230 Mc/s continuous. Complete with chart and test prods. As new for 200-250 v. A.C. mains operation, £4/15/-, carr. 10/-.

20-WAY TELEPHONE PLUG and INDICATOR BOARDS. Standard G.P.O. fitting. New and unused in sealed cartons. 15/- each, either type.



RCA OUTPUT TRANSFORMER. 30 watts, for 5, 7.5, 15 and 500-600 ohms impedance. Primary for a pair of 6L6's in push-pull. (Connection details supplied.) This specially designed first quality output transformer is the best that money can buy! **OUR PRICE 27/6 each.** P. & P. 2/- Special terms for quantities.

L.T. TRANSFORMERS. Pri. 200-250 v. 50 cycles A.C. Sec. 17.5 v. at 35 amps., £4/15/-, carr. 10/-.

TRANSFORMER (FERRANTI). Potted for 0-250 v. 50 cycles tapped primary, sec. 1,250 v., 15 mA. Ideal for oscilloscopes, etc. Size 3½ x 3½ x 4½in. ONLY 35/-, P. & P. 2/6.

TRANSFORMERS. 110-230 v. Pri. Sec. 26 v. tapped to 41 v. at 14 amps. New and boxed. £3/10/-, carr. 5/-.

VARIABLE VOLTAGE REGULATOR TRANSFORMERS. Input 230 v. A.C. at 21 amps. Output 57.5 volts in 16 equal steps to 230 v. at 21 amps. Ex-Govt. in perfect condition, £12/10/-, carr. 15/-.

CAR RADIO VIB. TRANSFORMERS. 6 v. Input 280 v. at 80 mA. H.T. (Ex-Philco). New in perfect condition, 12/6. P.P. 2/-, Ditto 12 v., same price.

E.H.T. TRANSFORMER. 20 kV. at 140 mA. 230 v. 50 cycles primary. New and unused. Ex-Govt. Built to the highest specification. £22, carr. 30/-.

TRANSFORMER. 2.8 kV. E.H.T. at 5 mA., with additional 4 v. heater supply for 230 v. input. A sound job built to the highest specifications. Tested before despatched. 47/6. Carriage, etc. 5/-.

TRANSFORMER. 1,800-0-1,800 at 1 kVA, 230 v. 50 cycles, primary. Fully tropicalised. New and boxed. £8/15/-, Carr. 10/-.

E.H.T. TRANSFORMER. 3,850 v. at 50 mA. with two additional 4 v. L.T. windings, for 230 v. 50 cycles primary. New and boxed. £3/15/-, Carr. 5/-.

RCA AR-88 L.F. RECEIVER (C.R.91). In very good condition. Freq. range: 550 kc/s. to 31.9 Mc/s. continuous on 6 wavebands, £45, carr. £2 U.K. only.

AIRCRAFT RADIO RECEIVER BY RCA (Model No. CRV 46151). Freq. 195 kc/s to 9,050 kc/s. (33-1,500 metres) continuous. For 28 v. D.C. input with built-in dynamotor. This 6 valve receiver with 2 R.F. stages and 2 I.F. stages with B.F.O. and C.W. £10, or complete with A.C. mains power-unit for loudspeaker or phones. Ready for use £15/10/- Carriage 10/-.

R.109A RECEIVERS. Freq. range 2-12.0 megs. In good working order. £4/7/6, carr. 10/-, A.C. mains 200/250 v. power packs available, £4, carr. 5/6.

TRANSMITTER-RECEIVER No. 19. Mk. II complete with 15 valves. Frequency range A set 2-8 meg., B set 230-240 Mc/s. in good condition, £3/19/6, carr. 10/6. 12-V. ROTARY POWER UNIT for above, £1, carr. 5/-, All Leads, Headsets, variometers, etc. available.

RECEIVER RI132A. In good condition. Freq. range 100-124 Mc/s., £3/15/-, carr. 10/-.

COMMAND RECEIVERS. B.C. 454, 13-6 Mc/s. Brand New, 39/6. 455, 6-9 Mc/s., 39/6. P. P. 3/- each.

RECEIVER RI392 P 104. 15 valve sup-het set 95-150 Mc/s. (2 to 3 metres) slow motion tuning, normally crystal controlled or tunable over 95-150 Mc/s. Receiver front panels made to fit 19in. Rack Mounting. External Power supply req., good order. £5/19/6, carr. 15/-

METERS

0-50 microamps. D.C. m/c., projecting 2½in. round, 49/6 each.
0-10 mA. A.C. m/c., rectifier, flush 3½in. round, 49/6 each.
0-300 v. A.C. 2½in. Flush mounting, 25/- each
0-200 v. A.C. 3½in. Flush mounting, 25/- each
0-300 v. A.C. 3½in. Flush mounting, 25/- each
S. METERS. 2in. circular calibrated in decibels 5 mA. FSD, 25/- each.
All brand new and boxed, P. & P. 1/- each.

SWINGING CHOKE 8/40 henrys—3/03. m/a. 110 ohms D.C. resistance. 15/-, post 3/6.
BENDIX DYNAMOTORS. 28 v. D.C. input, 230 v. D.C. output at 100 mA. New and boxed. 19/6. P.P. 2/6.
18/24v. 10-AMP. BATTERY CHARGERS, for 200-250 v. 50 cycles input, metered, switched and fused. As new, £12/10/-, carr. 20/-.
AC-DC RECTIFIER POWER SUPPLY UNIT, 230 v. A.C. 50 cycles input 100 v. D.C. output max. 10 amps., £12/10/-, carr. 20/-.
Ditto at 2½ amp., £4/10/-, carr. 7/6.
MICROPHONE STANDS 3 sections of 18½in. per section. Extends to 56in. Stands securely on 3 legs which fold together for carrying. A robust job, only 21/-, P.P. 2/6.

ACCUMULATORS.

Bakelite cased 2 v. 100 ampere, 75 actual. Ex-Govt. New and unused. Complete with carrying handle. Ideal for coupling 6 or 12 v. storage batteries. Size 6½in. x 6½in. x 3½in., 15/- each. Carr. 3/6. 3 sent for 50/- or 6 for £5 carr. paid.
Ditto, 14 A.H. less handle 5/6, post 1/3.

MARCONI CRYSTAL CALIBRATOR. Frequency coverage 170-240 Mc/s. Directly calibrated, accuracy .001%. Operation 200/250 volts A.C. Supplied complete with 5 Mc/s crystal and spare set of 5 valves, in original transit case, brand new with instructions. £4/15/6 each, carr. 10/-.

C.M.G. 25 PHOTO CELLS (OSRAM). Brand new. 15/-, P.P. 1/-.

B.C. 929ACRT INDICATOR UNIT. Containing 1-3PB1 3in. C.R.T., 3-6SN7s, 2-6HG6s, 1-6G6, 1-6X5, 1-2X2; 8 valves in all. Ideal for 'scope conversion. New, in original sealed cartons. 70/-, carr. 5/-.

KLYSTRONS. 723/AB. 50/-, post paid.
TELEPHONE SETS (TELE "F"). Housed in bakelite cases, complete with built-in ringing generators and batteries. Ideal between two or more positions up to practically any distance. Tested before despatched. ONLY 59/6. P. & P. 3/6. 2 sent for £6, carr. paid.

813 CERAMIC VALVE HOLDER. NEW AND UNUSED. 12/6 post paid.

CATHODE RAY TUBES. VCR 139A 2½in., 30/-; 3BP1 3in., 30/-; 5FP7 5in., 35/-; VCR57, 6in., 20/-, All new and unused. P. & P. 3/- each.
GRAMOPHONE PLAYER AND AMPLIFIER CABINET. Finished in blue rexine. Complete with hinges and handle which are unassembled. New and unused. Overall size 12½in. x 19½in. x 7½in. SPECIAL PRICE 32/6. P. & P. 3/6.

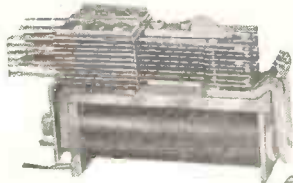
T.U.B. AMERICAN TRANSMITTER TUNING UNITS. Numbers available: 6, 7, 8, 9 & 10. In good condition with outer cases, 19/6 each type. P.P. 3/6.

WAVEMETER CLASS D. Freq. range 1,900 kc/s. to 8,000 kc/s. (158-37.5 metres) in two ranges. Supply 6 v. D.C. input. New with instruction manual, spare vibrator and frequency changer. Complete in maker's transit case. £5/19/6. Carr. 5/-.

DON "8" TWIN TELEPHONE CABLE on 1 mile drums, £5 per mile, ½ size drums 25/-, carr. extra.

SPECIAL TERMS FOR QUANTITIES—EXPORT ORDERS PROMPTLY EXECUTED

RELAYS P.O. TYPE 3000.



BUILT TO YOUR SPECIFICATION
QUICK DELIVERY
KEEN PRICES
CONTACTS UP TO 8 CHANGE OVER

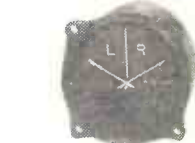
KEY SWITCHES

PROMPT DELIVERY ALL TYPES UP TO 4co/6co



METERS GUARANTEED

F.S.D.	Size	Type	Price
100 Microamp	2 1/2 in.	MC/FR	50/-
250 Microamp			
Multi-Sc.	3 1/2 in.	MC/FR	55/-
500 Microamp			
Sc. 15Kv.	2 in.	MC/FR	18/6
1 Milliamp	2 in.	MC/FS	27/6
5 "	2 in.	MC/FR	17/6
30 "	2 1/2 in.	MC/FR	12/6
100 "	2 1/2 in.	MC/FR	12/6
20 Amp.	2 1/2 in.	MI/FR	25/-
25 "	2 1/2 in.	MI/FR	7/6
50 "	5 in.	MI/FR	60/-
50-0-50 Amp.	2 in.	MC/FS	12/6
20 Volt	2 in.	MC/FS	10/6
250	2 1/2 in.	MCR/P	30/-
300 Volt A.C.	2 1/2 in.	MI/FR	25/-
300 " A.C.	5 in.	MI/FR	60/-



GROSS POINTER METERS. With 2 separate 100 microamp movements. Brand new. 22/6, post 2/-.

METER RECTIFIERS. Full wave bridge 1 ma or 5 ma. 7/6 each. 50 ma 5/- each, post 6d.

CIRCUIT TESTER in wood case 9in. X 6in. X 4in. 2 1/2 in. Flush Round meter, 50 milliamps, basic movement 10 MA with leads, 10Ω pot. provision for 1.5 v. batt. Ideal for conversion, 17/6, post 2/6.

TELEPHONES—SOUND POWERED—NO BATTERIES REQUIRED. Just connect with twin flex for clear speech. Transmitter/receiver units 4/6 ea. Twin flex 4 1/2 yard. Post 1/-.

If 2 units are connected in series and one used for speaking and one for listening, perfect 2-way conversation can be made.

TELEPHONE SETS. For perfect communication between 2 or more positions. Wall Type, one pair of units, £5. Batteries 5/6. Twin wire 5d. yard. Desk Type, now available, latest modern style. Two complete units ready for use, £8/17/6. Wire 5d. per yard. Post 3/-.

ROOM THERMOSTAT. Adjustable between 45 and 75 deg. Far. 250 v. 10 amp. A.C. Ideal for greenhouses, etc., 35/-. Post 2/-.

CONDENSERS METALMITE. 350 vt. wkg., .001, .002, miniature, 12/- doz. .005, .01, .02 10/- doz. .05 12/- doz. 1 13/6 doz. 25 Metalpack 12/- doz. 1.0 Metalpack 24/- doz. Post 1/-.



BATTERY CHARGERS Ideal for charging 24 volt batteries on electrically propelled vehicles. Rating 22 v. 10 amps., controlled by two 4-position rotary switches for fine and coarse control which enables 6/24 vt. Batts. to be charged. Input 200/250 v. A.C. 50 cy., fused for A.C. and D.C. Brand new £17/10/-. Carr. 15/-.

CHARGING RECTIFIERS. Full wave Bridge 12 volts 2 amps., 13/6, 4 amps., 22/6, suitable transformers 2 amp., 24/-, 4 amp., 27/3, post 2/-.

JACK PLUGS. Cylindrical bakelite screw on cover. 2 Contact. Ideal for amplifiers etc., 2/6 each, 24/- doz., £3 per 100.

AIR BLOWERS. 230 vt. A.C. 57 hp. 15in. fan, 6in. outlet. Brand new £25. Carriage in England 20/-.

PORTABLE BLOWERS. 200/250 v. AC/DC 300 watts with switch and leads, 1 1/2 in. outlet, £5, carr. 7/6.

VOLTAGE REGULATORS. Input 230 v. A.C., 21 amp. Outputs 7.5 v. to 228 in 18 steps with current limiting reactor. These variable transformers are brand new and not removed from equipment. £12/10/- each, carriage 10/-.

ROTARY CONVERTERS. Input 24 volt D.C. Output 230 volt A.C., 50 cy., conservatively rated at 100 watts, 92/6. Also available in a strong ventilated metal case with switch, input plug and output socket. 105/-, carr. 7/6.

RACKS—POST OFFICE STANDARD. 6ft. high with U-channel sides drilled for 19in. panels, heavy angle base, 4ft. 10in. also in stock.

PHOTOMULTIPLIER NO. 931A. Ideal for film scanning, spectography. Alpha counting, colorimetric measurement, etc., supplied complete in light proof chamber with lamp, wired with the resistor network. 70/-.

VERNIER DRIVES. Muirhead scaled 0/180 deg. Ratio 38 to 1. Diam. 3in. 10/6. Post 1/6.

RADIO ACTIVITY MEASURING INSTRUMENTS. Philips Type 1002c. A portable self-contained unit in haversack. Scaled 0 to 10 millirontgens per hour, using Mullard Geiger Counter MX115. £25.

HEADPHONES. Balanced Armature Type DHR. 17/6 per pair, post 1/6.

HEADPHONES. High resistance 4,000Ω Type CHR, new. 12/6 pair, post 1/6.

VENT-AXIA FANS—EXTRACTION OR INTAKE. 230/250 volts A.C. 6in. diam. blades 130/-, 12 v. D.C. 90/-, post 2/0.

RATIO ARM UNITS. Sullivan. 600 ohms + 600 ohms. 50/-, post 2/-.

WHEATSTONE RESISTANCE BRIDGE. 1 to 10,000 ohms. Plug type, £5.

SWITCHES. 1 hole fixing, 3 amp. 250 vt. Single Pole change over. 1/6 each, 12/- doz. £37/10/- per 1,000.

L. WILKINSON (CROYDON) LTD.

19, LANSDOWN ROAD, CROYDON

Phone: CRO. 0839 Telegrams: "WILCO", CROYDON

RADIO TRADERS LTD.

23 WARDOUR ST., LONDON, W.1 (Coventry Street end)
 Phone No. GERrard 3977/8 Grams: "Radiotrade"

SPECIAL OFFER OF CURRENT MANUFACTURE ELECTROLYTIC CONDENSERS
 8 mfd. 450 v. 2/6 each; 16 mfd. 450 v. 3/-; 32 mfd. 450 v. 4/-; 8 x 8 mfd. 450 v. 3/9; 8 x 16 mfd. 450 v. 4/-; 16 x 16 mfd. 450 v. 4/6; 32 x 32 mfd. 350 v. 5/-; Bias Condensers: 25 mfd. 25 v. 1/6; 50 mfd. 50 v. 1/9. Please note we can offer special discounts for quantities.

W.W. RESISTORS. 5 watt 1/6; 10 watt 2/6; 15 watt 3/-; 20 watt 3/6. We carry stocks of resistors from 2 watt to 150 watt W.W. Your enquiries invited.

HIGH STABILITY RESISTORS. 1/2 watt 5% 6d.; 1/2 watt 5% 9d.; 1 watt 5% 1/- . A few values in 1% and 2% still available. ALL ORDERS FOR RESISTORS C.O.D. PLEASE, AS WE CANNOT GUARANTEE TO STOCK ALL VALUES.

W.W. V/CONTROLS. ALL WELL-KNOWN MAKES. Pre-set types 2/6; Spindle types 3/-; Carbon type, less switch spindle and pre-set 2/- With switch 3/6 each.

CRYSTAL DIODES. Westinghouse WG5B 1/6 each, B.T.H. 1/3 each. Special price for large quantities.

SEMI-MIDGET 2-GANG. .0005 Condenser, size 2 1/2 x 2 x 1 1/2 in. 6/9 each.

AM/FM GANG CONDENSER. Double 500 pf, double 27 pf size 3 1/2 x 1 1/2 x 1 1/2 in. 9/6 each.

ELECTROLYTIC CONDENSERS. Manufacturers' Surplus, in perfect condition. 100 mfd. x 200 mfd. 350 v. surge 5/6 each; 100 mfd. x 100 mfd. 425 v. surge 5/6 each; 150 mfd. 450 v. wkg. 5/6 each.

BIAS CONDENSERS. 3,000 mfd. 6 v. 3/6 each; 2,500 mfd. 3v. 3/6 each; 1,000 mfd. 12 v. 1/6; 25 mfd. 25 v. 1/3; 50 mfd. 12 v. 1/-.

MANUFACTURERS PLEASE NOTE. We hold large stocks of Nitrogol, Visconol and other block-type Condensers, your enquiries are invited.

MIDGET MICA CONDENSERS. .0001, .0002, .0003, .0004, .0005 5/- per dozen.

200 Assorted Moulded Mica Condensers, popular values £2 10 0
 200 Assorted Silver Mica Condensers, popular values £2 10 0
 200 Assorted Carbon Resistors, 1/2, 1 and 1 watt. Good selection £1 10 0

PAXOLIN SHEET. 18 x 4 1/2 x 7 1/2 in. 1/6; 10 x 10 x 1/2 in. 1/6; 20 x 10 x 1/2 in. 3/-; 10 x 10 x 1/2 in. 2/-; 20 x 10 x 1/2 in. 4/-. Minimum P. & Pkg. 1/6.

BARGAIN OFFER OF BATTERIES
 4 1/2 v. Heavy Duty Bell Battery. Size 6 1/2 x 4 1/2 x 2 1/2 in. 2/6
 72 v. H.T. 1.5 v. L.T. Size 6 x 5 x 1 1/2 in. 2/6
 150 v. H.T. Size 2 1/2 x 5 1/2 x 1 1/2 in. 5/6
 67 1/2 v. Size 2 1/2 x 3 1/2 x 2 1/2 in. 6/6
 60 v. H.T. 1.5 v. L.T. 3 1/2 x 3 1/2 x 1 1/2 in. 4/6
 All batteries sealed and unused. All plus 1/6 post and pkg. Special reduction for quantities.

4-way Push Button Units 2/6 each. Knobs for same 3/- per doz.

WEARITE COILS. PA4, PO4, PA5, POS, 1/3 each doz. 12/-

VALVE HOLDERS. Moulded B9A 7/6; B7G 6/-; Int. Oct. 9/-; Eng. Oct. doz. 4/6

VALVE HOLDER FITTED WITH LOWER CAN 1/6 per doz. extra. Screening cans for B7G and B9A doz. 6/-

Paxolin V/H Int. Oct. B9A, B7G, 5/- per doz.; Eng. Oct., 5-pin 7-pin doz. 3/-

BELLING-LEE PLUGS AND SOCKETS, 5 pin 1/9; 7 pin 2/-; 10in. each 2/6

Transistors. Junction type red spot by well-known manufacturers, 10/- each.

AIR-SPACED TRIMMERS. 5, 10, 15, 20, 25, 50; and 75 of pre-set and spindle types 2/- each doz. 21/-

PYE PLUGS AND SOCKETS 1/6 per pair, "T" pieced...each 1/9

GROMMETS, 1 grs. assorted grommets, 1/2 in. to lin.....gross 8/6

POST OFFICE LAMP JACKS No. 10 1/- each.....doz. 9/-
 Lamp Covers for same doz. 3/-

OUTPUT TRANSFORMERS. Multi-ratio 5/- each.

WESTECTORS. WX6, WX12, W4 1/- eachdoz. 9/-

SIGNAL LAMP HOLDERS. Panel mounting, complete with adjusting lampholder 2/- eachdoz. 21/-

Special offer Westinghouse Rectifier 14A1116 1/2 wave 300 ma. 10/6 each.

POINTER KNOBS. Small black with white line, standard 1/2 in. spindledoz. 7/6

WANDER PLUGS. Red and blackdoz. 2/-

PHILIPS TRIMMER TOOLS 1/- eachdoz. 10/6

CASH WITH ORDER OR C.O.D. ALL ORDERS DEPT. W.1. ALL ORDERS FOR LESS THAN £2 ADD POSTAGE

We invite your enquiries for items not listed

Trade Counter open 9 to 6 Monday to Friday

Also 9 to 1 Saturdays. Callers welcomed

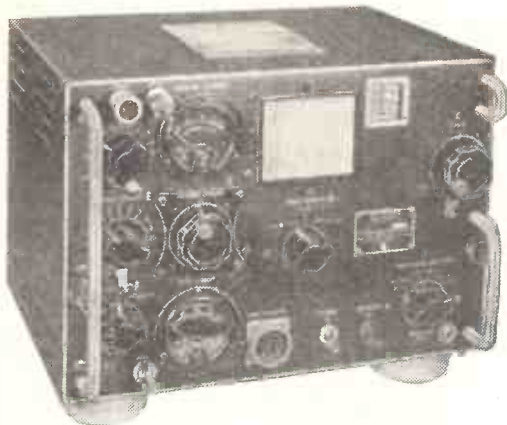
WHOLESALE MANUFACTURERS AND EXPORT ENQUIRIES INVITED

TCS TRANSMITTERS

The renowned American TCS Model designed by the Collins Company for static or mobile use. Covers 1.5-12.0 mc/s. in 3 bands, and is complete with 7 valves, employing 2 of 1625 in P.A. Stage, 1 each of 1625 in Buffer and Modulator Stages, and 3 of 12A6 in Oscillator Stage. Provision for VFO or Crystal Control. 4 Crystal positions. Radio Telephone or Radio Telegraph. Has Plate and Aerial Current Meters. Power Requirements 12v LT & 400v HT. In black crackle case, size 11 x 13 x 11in., condition BRAND NEW AND UNUSED. ONLY £12/10/- (carriage, etc., 15/-).

We can also supply the TCS RECEIVER, which matches the Transmitter in size and appearance, and covers similar frequencies. Complete with 7 valves, 1 each of 12SA7 and 12SQ7, 2 of 12A6 and 3 of 12SK7. Power Requirements 12v LT & 225v HT. IN BRAND NEW CONDITION. ONLY £8/10/- (carriage, etc., 15/-), OR THE TRANSMITTER AND RECEIVER TOGETHER £20 (carriage, etc., 30/-).

The double Dynamotor Power Unit, Type 21881B for 12 volts operation, delivering 400v for Transmitter and 225v for Receiver, is available at £12/10/- (carriage, etc., 15/-).



R1155 SUPER SLOW-MOTION TUNING ASSEMBLY. As used on all late model 1155s. Easily fitted to "A" sets, etc. ONLY 12/6.

RF UNITS TYPE 26: For use with the R.1355 or any receiver with a 6.3 v. supply. This is the variable tuning unit which uses 2 valves EF54 and 1 of EC52. Covers 65-50 Mc/s. (5-6 metres). Complete with valves, and BRAND NEW IN MAKER'S CARTONS... ONLY 25/- each. Brand New Type RF 24, 5 positions covering 15-30 Mc/s., ONLY 7/6 (postage 2/6).

A.C./D.C. BLOWERS. 220/250 volts, 300 watts. 1 1/2 in. diam. outlet. Complete with filter pads. BRAND NEW. ONLY £4/19/6.

INSULATION TESTERS (MEG- GERS). Read up to 20 megs. at 500 volts pressure. Overhauled, and in perfect order. With leather carrying case. ONLY £9/19/6, OR less case £8/10/-.

POWER UNIT TYPE 3. Primary 200/250 v. 50 cycles. Outputs of 250 v., 100 mA. and 6.3 v. 4 amps. Fitted with H.T. current meter, and voltmeter. For normal rack mounting and has grey front panel size 19in. x 7in. ONLY 70/- (carriage, etc., 7/6).

EHT TRANSFORMERS. 5.5 kV. (Rect.) with 2 v. 1 a., 79/6, 7 kV. (Rect.) with 2 v. 1 a., 79/6, 7 kV. (Rect.) with 2 v. 1 a., 89/6, 2.5 kV. (Rect.) with 2-0-2 v. 1.1 a., 2-0-2 v. 2 a. (for VCR 97 tube, etc.), 42/6 (postage 2/- per trans.).

6 v. VIBRATOR PACKS. Output approx. 130 v. at 30 mA., fully filtered and smoothed. Complete. ONLY 12/6.

100-0-100 VOLTS METERS by Sangamo Weston. 2 1/2 in. circular, basic movement being 500-0-500 microamps. A really first-class centre zero meter for hundreds of uses. BRAND NEW IN MAKER'S CARTONS. ONLY 27/6.

500 MICROAMPS METER. 2in. circular as used on British No. 19 Wireless Sets. Calibrated 0-15 and 0-600 volts, resistance 500 ohms. A very fine instrument, and A SNIP AT ONLY 15/-.

MARCONI SIGNAL GENERATOR TF144G

Frequency coverage 85 kc/s. to 25 Mc/s., and known as a Laboratory Standard. For normal A.C. mains, and complete with all leads. Reconditioned. AS NEW ONLY £75.

MARCONI SIGNAL GENERATORS TF-390G

Frequency coverage 16-150 Mc/s. BRAND NEW IN MAKER'S ORIGINAL TRANSIT CASES, with instruction manual. For normal A.C. mains operation. A unique opportunity to acquire Laboratory Equipment at a fraction of original cost. ONLY £27/10/-.

MARCONI BAND III CRYSTAL CALIBRATORS

Frequency range 170-240 Mc/s. Incorporates 5 Mc/s. crystal for better than .001 per cent. accuracy. Directly calibrated dial, internal A.C. mains pack. Complete with spare set of valves and instruction manual in maker's transit cases. BRAND NEW. ONLY £4/19/6.

CLASS D WAVEMETER

Another purchase of this famous crystal-controlled wavemeter which has been repeatedly reviewed and recommended in the "R.S.G.B." Bulletin as being suitable for amateur transmitters. Covers 1.9-8.0 Mc/s., and is complete with 100/1,000 kc/s. crystal, 2 valves ECH35, two 6-volt vibrators and instruction manual. Designed for 6 v. D.C. operation, but simple mod. data for A.C. supplied. BRAND NEW IN MAKER'S TRANSIT CASES. ONLY £5/19/6. Transformer for A.C. modification, 7/6. OR a few instruments less Crystal £3/10/0.

METERS

F.S.D.	SIZE AND TYPE	PRICE
50 microamps D.C.	2 1/2 in. Flush circular	59/6
100 microamps D.C.	2 1/2 in. Flush circular	39/6
250 microamps D.C.	2 in. Proj. circular	30/-
500 microamps D.C.	2 in. Flush square	27/6
1 mA D.C.	2 in. Flush square	22/6
10 mA D.C.	2 1/2 in. Flush circular (blank scale)	10/6
150 mA D.C.	2 in. Flush square	7/6
200 mA D.C.	2 in. Flush square	12/6
10 amps D.C.	3 1/2 in. Proj. circular	20/-
20 amps D.C.	2 in. Proj. circular	7/6
40 amps D.C.	2 in. Proj. circular	7/6
15-0-15 amps D.C.	3 1/2 in. Flush square	25/-
30-0-30 amps D.C.	Car type moving iron	5/-
15 volts A.C.	2 1/2 in. Flush circular moving iron	8/6
300 volts D.C.	2 in. Flush square	10/6

WIRELESS SET NO. 19 MK. II

The famous Army Tank Transmitter-Receiver Incorporates "A" set (TX/RX covering 2.0-8.0 mc/s., i.e. 37.5-150 metres); "B" set (VHF TX/RX covering 230-240 mc/s., i.e. 1.2-1.3 metres), and Intercomm. Amplifier. Complete with 15 valves as follows: 6 of 6K7G, 2 of 6K8G, 2 of 6V6G, and 1 ea. 6BBG, 6H6, E1148, EF50, 807, and booklet giving circuits, notes, etc.

Size 17 1/2 in. x 8 1/2 in. x 12 1/2 in. Magnificently made by famous American firms.

IN BRAND NEW CONDITION. ONLY £4/19/6 (carriage, etc., 10/6).

AMERICAN COMMAND RECEIVERS. A few still available. Top band model (1.5-3.0 Mc/s.). Used, good condition, 65/-, OR BRAND NEW IN CARTONS, 75/-.

L.T. HEAVY DUTY TRANSFORMERS. Ex-Admiralty, with 230 v. 50 cycles primary. Secondaries 5, 10, 15, 20, 25, 30 volts at 5 amps. ONLY 29/6. (Postage 2/9).

12-WAY SCREENED CABLE. In 10ft. lengths, fitted with plugs, originally made for use with the 19 Set. UNUSED. ONLY 17/6 per lead.

POCKET VOLTMETERS. Not ex-Govt. Read 0-15 v and 0-300 v. A.C. or D.C. BRAND NEW AND UNUSED ONLY 18/6.

WALKIE TALKIE TYPE 18. Covers 6.0-9.0 Mc/s. Transmitting and receiving units in metal case, complete with valves. In excellent condition. ONLY 79/6.

CRYSTALS. British Standard 2-pin 500 kc/s. 15/-. Miniature 200 kc/s. and 465 kc/s. 10/- each.

AMERICAN 14 v. DYNAMOTORS. Output 225 v. 60 mA. Ideal for car radio or running electric shaver from car battery. ONLY 45/-.

Cash with order please, and print name and address clearly

PLEASE ADD POSTAGE OR CARRIAGE COSTS ON ALL ITEMS

U.E.I. CORPORATION

Radio Corner, 138 Gray's Inn Road, London, W.C.1. Phone: TERMINUS 7937

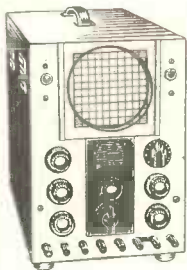
Open until 1 p.m. Saturdays

We are 2 mins. from High Holborn (Chancery Lane Station) and 5 mins. by bus from King's Cross

— UNIVERSAL ELECTRONICS —

Whether new or used, all equipment is guaranteed to be in perfect condition

COSSOR Double Beam Oscilloscope



Type 339. **IMPROVED VERSION** of the OBSOLETE Type 3339.

Time Base Frequency. 6 to 250,000 c.p.s.
 Amplifier. 43 mV RMS/mm. 10 to 100,000 c.p.s., 3dB. 1.3 mV RMS/mm. 10 to 100,000 c.p.s., 3dB (2 stage).
 10 mV RMS/mm. 10 to 2,000,000 c.p.s., 3dB (2 stage).
 Deflector Coils. 2 mm/mA RMS.
 Power Supply. 110-250V A.C. 120 watts.
 Sensitivity. Y1, Y2, 3.1V D.C. 1.1V RMS (volt/mm.) X2.25V D.C. 0.8V RMS (volt/mm).
 Screen Diameter. 114 mm. **£30**

In good working condition. PRICE **£30**
 Also supplied Rebuilt to Laboratory standard and guaranteed for 3 months. Prices on request.

TEST EQUIPMENT

AVO

Model 7 meter £14 0 0
 Model 40 meter £12 0 0

G.E.C.

Type BW232, Signal Generator
 500-1,000 Mc/s £65 0 0

MARCONI

Type TF144G range 85 kc/s-25
 Mc/s £85 0 0
 TF390G range 16-150 Mc/s.
 £25 0 0
 TF517 range 150-300 Mc/s.
 £35 0 0

'Q' Meter type 329F £85 0 0
 Output meter, type TF340.
 £35 0 0

GENERAL RADIO

Type 804 Signal Generator,
 30-300 Mc/s. £65 0 0

SULLIVAN Mutual Capacitance Bridge £175 0 0
 AVO Valve Testers Roller Panel Types £9 15 0
 Resistance Capacity Bridges £7 10 0
 British and U.S.A. V.H.F./U.H.F. 10cm., 3cm., 1.5cm. Test Equipment available from stock, see our advert. "Wireless World" Feb.

EVERSHED

500V Wee Megger .. £12 10 0
 250V Wee Megger .. £10 0 0
 Bridge Meggers available 250V-500V and 1,000V.

RCA.

Signal Generator type 710A, 370-550 Mc/s, price £35 0 0

U.S.A. BRAND NEW

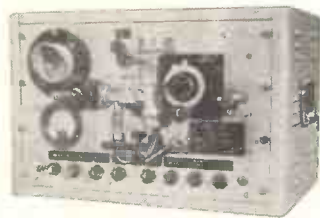
HICKOCK

Valve Voltmeters; unused, ranges 2.5-250 A.C.V. 2.5 1,000 D.C.V. 2.5-1,000 mA. D.C. Resistance 0-1,000 megohms. Frequency up to 100 Mc/s. Voltage 110 A.C. Price, each £30 0 0

M.I.T. Radiation Laboratories

Spectrum Analyser Type TSX-4SE

(3 centimetre)



The TSX-4SE Spectrum Analyser

is an ultra-high frequency receiver with an oscilloscope indicator, in which the local oscillator is frequency-modulated by a sawtooth voltage proportional to the sawtooth sweep on the oscilloscope tube. It is used for observing the spectra of the pulsed oscillators, tuning receiver local oscillators, adjusting defective r.f. components, measuring large standing-wave ratios, and measuring the Q of resonant cavities.

ENQUIRIES AND INSPECTION INVITED
SPECIFICATION: Tuning range—8,630 Mc/s-9,550 Mc/s (723/AB klystron). Frequency calibration by means of a pip provided by a reaction type cavity wavemeter. I.F. frequency 20 Mc/s. Receiver band width 50 kc/s. Receiver gain 130 db, 4 I.F. stages, 3 video stages. Sweep frequency variable from 10 to 20 cps. Attenuation graduated from 0-100 with calibration factor of 1.0 db/div. above 10.

FREQUENCY METERS

BC221 Range 125 kc/s—20 Mc/s

In perfect condition

Also in stock: **U.S.A. BENDIX LM SERIES**
 Aircraft version of BC221.

TS174 40—250 M/cs.

TS175/U 85—1000 M/cs.

Prices upon written request.

MANUALS

for Communication Receivers **£1.7.6** each. AR88D-LF, AR77E, HQ120, HQ129X, R107, S20R, SX24, SX28, B2, TX/RX HRO's, etc.

RECEIVERS in stock—

COLLINS . G.E.C. . HALLICRAFTER . HAMMARLUND NATIONAL MARCONI CR100 & CR150 . RCA., etc.

Please note: the above prices do not include postage and carriage.

22/27 Lisle Street, Leicester Square, London, W.C.2

Write, Call or Telephone GERrard 8410

Shop hours, 9.30 a.m. to 6 p.m. Thursday 9.30 a.m. to 1 p.m. OPEN ALL DAY SATURDAY

RADIO HAM SHACK LIMITED

The new LEAK TL/12 PLUS POWER AMPLIFIER and VARISLOPE III PRE-AMPLIFIER. 33 guineas, carriage paid.
 COLLARO 4T200, 4 speed Transcription Player. With Studio "O" Turnover Head, £19/3/-. With Studio Transcription Head, £19/10/-. Carriage paid.
 TRUVOX Model TR7U TAPE DECK. Fitted with latest type Record/Replay and Erase Heads, the panel size is 14 1/2 in. x 12 13/16 in. the overall depth is 5 in. £24/3/-. carriage paid.
 TRUVOX Mk. IV TAPE DECK, Type TR2102. Similar in performance to above, but with completely enclosed heads and other modifications. £26/6/-. carriage paid.
 TRUVOX MODEL C TAPE AMPLIFIER. A correctly designed amplifier for use with Truvox Tape Decks. Output 4 watts, £17/17/-. carriage paid.
 W.B. HF1012 High Fidelity 10in. Speaker, £4/19/-.
 W.B. HF1214. High Fidelity 12in. Speaker, £9/15/6.
 W.B. T.10 TWEETER UNIT and Cross-over Network. £5/14/-. All speakers carriage paid.
 W.B. SPEAKER AND CONSOLE CABINETS. Leaflets on req. Send 6d. for our list of components and books for the amateur and engineer.

155, SWAN ARCADE, BRADFORD 1, YORKS.

LYONS RADIO LTD.

RECEPTION SETS R.109B. Ex-Army superhet receivers employing 8 valves (1-ARP36, 4-ARP12's and 3-AR's). Fitted with a miniature loudspeaker, B.F.O., vibrator type power pack for operation from a 6-volt motor cycle or car battery (no other power supply required). Frequency range 3 to 12 Mc/s. (25 to 100 metres) in 2 switched bands. Housed in waterproof metal cases with canvas cover over front panel. Overall size 13 x 11 x 1 1/2 in. deep. Front panel fitted with all controls including 2 jack sockets for alternative headphone reception. In good condition and working order, supplied with circuit diagram and input plug. PRICE ONLY, with valves, 85/-, or less valves, 45/-. Carriage 8/6.

HEADPHONES. Low impedance type with headband and cord which terminates with the appropriate jack plug to fit above Rx. PRICE 6/9, post free with Rx or 1/- separately.

TWIN FLEX P.V.C. insulated (Transparent) conductor 14/36 tuned copper, for radio and electrical work, extension speakers, bells, telephones, etc. PRICE ONLY: 25 yards 6/9. 50 yards 12/-. 100 yards 21/-. Post paid.

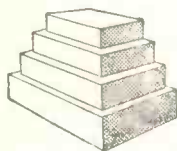
L.T. TRANSFORMERS. Primary 200/250 v. 50 cps. Secondary—30 v. at 2 A. tapped at 3, 4, 6, 8, 9, 10, 12, 15, 16, 20 and 24 v. Brand new and guaranteed. All connections clearly marked. PRICE 21/-, post 1/6.

THROAT MICROPHONES. American made, carbon type with neck band. As new in maker's carton. PRICE 2/9, post 6d.

3 GOLDHAWK ROAD (Dept M.W.), SHEPHERD'S BUSH, LONDON, W.12

Telephone: Shepherd's Bush 1729

CHASSIS



Aluminium Undrilled with Reinforced Corner. Available in the following sizes:	12 x 8 x 2 1/2in. 8/6 each
	14 x 3 x 2 1/2in. 6/- each
	14 x 9 x 2 1/2in. 12/- each
6 x 4 x 2 1/2in. 4/6 each	16 x 6 x 2 1/2in. 8/6 each
8 x 6 x 2 1/2in. 6/3 each	16 x 10 x 2 1/2in. 14/- each
10 x 7 x 2 1/2in. 7/3 each	
12 x 3 x 2 1/2in. 5/9 each	
12 x 5 x 2 1/2in. 6/9 each	

All are four-sided—ideal for radio receivers, amplifiers, power packs, etc.

SPECIAL OFFER BAND I-III TUNERS

Covering Channels 8-4 with provision for 10 more coil sets. 2 valves: Mazda 30J1 cascode r.f. amp., Mazda, 30C1 triode pentode f.c. Complete with power supplies for 200-250 v. A.C.I.F. output 16-19 Mc/s, easily modified to other outputs. Full circuit diagram supplied **£5.17.6**

THE NEW APEX MARK II BAND III CONVERTOR

- B.B.C. or Commercial Programmes at the touch of a switch.
- Built in power supply for 200/250 v. A.C.
- Variable fine tuner and gain control. Separate mains on/off switch.
- Robust construction for mounting on top or side of cabinet.
- Size only 5 1/2in. x 4 1/2in. x 2 1/2in.

Retail Price £5.15/- complete.

EXPLOSION GUARDS. For 17in. tube. Outside dimensions 17 1/2in. x 12 1/2in. Brown/Fawn Escutcheon Price 7/6 each Post 2/6

EX-GOVERNMENT HEATER TRANSFORMER. Universal Input. 2 x 6.3 volts windings at 1 1/2 amps each. Price 7/6 each.

MAINS DROPPING RESISTORS

Manufacturers Surplus Types.	each
946 ohms Zenith with taps	1/-
725 ohms Erie tap at 600 ohms	1/6
650 ohms tap at 275 ohms, 500 ohms 5 ohms, 30 ohms	2/6
Green Vitreous Mains Dropper 1,328 ohms, 2 taps, Midget Type	1/3
Zenith Mains Dropper 910 ohms	2/-
Dublier Type HY, tapped 200-210 220-230, 240-250 ohms	1/9
Erie Two Section Dropper, 150 ohms and 1,340 ohms, with two taps	1/9
Bulgin Dropper with voltage taps	3/9

Co-axial Cable 75 ohms, top quality, 9d. yard. Aerialite Co-axial plug, Part 166. 1/4 each. Aerialite Back to Back Socket, Part 203, 1/6 each

Aerialite Car Radio Aerial, Model 12, Mud-guard or Valsance fitting, 35/- each.

Cydon Turret Tele-Tuner, suitable for all Channels and most Receivers. Send for descriptive leaflet, 27/7/-.

Osmor Band I Filter, stops patterning 10/-.

Wearite P Coils, Aerial, Oscillator and H.F. Coils. All types in stock, 3/- each.

J.B. Solid Dielectric Condensers 100pf, 200pf, 300pf and 500pf, 3/10 each. Do not miss this Bargain, 12/6 pkt.

Television Electrolytics—100 mfd. T.C.C. 450 v., 2/- each. 60-120 mfd. B.E.C. 300 v., 5/- each. 100-200 mfd. 275 v., 5/- each. 60-100 mfd. 275 v. B.E.C., 5/- each. 60-100 mfd. 275 v. B.E.C., 5/- each.

Vibrators—4 pin U.X. types. Available for 12 or 6 volts by Oak, Mallory Plessey, etc., 8/6 each.

Pre-Set Controls. Available wire wound 1K and 10K ohms, 2K ohms, 30K ohms, available, carbon track 50K, 100K, 1 meg., 1 meg., 2 Meg. 20K ohms, 1/2 Meg. ohms. Various makes and types. 150K ohms. 1/9 each.

*Control Knobs in Modern Styling. Tastefully and clearly engraved in gold. These Mouldings are available in two colours: Walnut and Ivory.

They are suitable for use with 1/4in. spindles and are simply and firmly held by means of a grub screw and locking nut.

Prices: Type "A" 1/6 each. Type "B", 1/2 each.

Line Cord, 3 amp., 3 core 1/9 yard

Line Cord 2 amp., 3 core 1/9 yard

Electric Buzzers in Bakelite

(Case, Loud tone) 2/6 each

Epicyle Friction Drive with Brass Drum. For use with steel Dial Drive Wire 1/6 each

MISCELLANEOUS COMPONENTS

ROTARY SWITCH. 4 position, 30 amp., 3/- each.

SPINDLE COPLERS. Brass, for 1/4in. spindles with two Grub Screws, 6/4 each.

IRON ELEMENTS. H.M.V. Replacement Element, 3/- each. Standard Elements will fit most makes, 1/8 each.

MISCELLANEOUS COMPONENTS—Cont.

RUBBER GROMMETS. Mixed Sizes. 6d. doz.

GRID CAPS. 1 Octal Push-on type, 6d. doz. British screened type, 3d. each.

ARMOUR PLATED GLASS. Size 1 1/2in x 1 1/2in., rounded corners, 3/6 each. 2 Pin Mains Plug and Socket. 2/6 each. Pliers Side Cutters, 2/9 pair. Line Cord, 3 amp., 3 core, 1/9 yard. Line Cord, 2 amp., 3 core, 1/9 yard. Electric Buzzers in Bakelite case. Loud tone, 2/6 each. Epicyle Friction Drive with Brass Drum. For use with Steel Dial Drive Wire, 1/6 each.

AMERICAN RELAY. 45 ohms Impedance with lead, No. AZ0545, 1/9 each.

IRON LEADS. Black and white flat iron leads, bonded ends, 1/3 each.

POTENTIOMETER PANEL. Four Potentiometers on Panel. 50K ohms SP5; 750 ohms W/W; 25K ohms Carbon; 5K ohms W/W. All with long spindle, with leads of different colours terminating in an 11 pin plug, 7/6 each. Wavox choke, max. current 100 mA D.C., resistance 125 ohms, 6/- each. Westinghouse 1 m/a Rectifier, wire ends, 9d. each. 6 volt Vibrator Pack, complete with 4-pin Vibrator, 17/6 each. Morphy Richards Type Replacement Iron Elements, 3/9 each.

INDICATOR LAMPS. Spring fixing type, 9d. each. "Aerovox" Condenser Clips. 1d. each. Pencl Rectifiers, Type 110, 2/- each. Amplion Volume Controls, 2 meg. B.P.S., 3/6 each. Extension Speaker Volume Controls, 1/3 each. Vibrator Clips (Standard), 5d. each.

NINE-INCH TUBE MASKS. White (Sooled Condition), 4/9 each. Tri-Sol 3-Core Solder. Net weight 1lb. 16 S.W.G., 60 4/4in. carton, 6/6. 0-100 mA Meter Panel Mounting, 7/6 each.

SURPLUS GEAR PARCELS. We have found, from time to time, stocks of components stripped from ex-Government equipment, along with discontinued lines, etc. These are in small quantities and therefore unprofitable to advertise. To make room for new items we offer at less than cost parcels of these components at 10/- each.

JUNCTION BOXES. Type 5X/2234, 20 way 1/6 each.

RECORDING TAPE, 1,200 feet. "Pure-tone", 12/6 each.

NEEDLE CUPS. For Gram. Needles (Bakelite), 1d. each.

CRYSTAL DIODES. Wire Ends, plastic case, 1/- each. Bulgin 7-pin Plug and Socket, 7/6 each. Insulated Coupler, 2in. dia. for standard 1/4in. spindles, ceramic insulation, 9d. each. Pairs of Instrument Handles, 5/4in. between centres, 1/4in. back to front, 1/3 pair. Speaker Cones, 6ASP in 5in. cone with 1in. cone piece, 4/6 each. 6ASP in cone with 1in. pole piece, 4/6 each. A Low-High Impedance Matching Unit for Headphones to be inserted in the cord, 8/9 each. Mains Transformer, Standard Type Primary Windings with a Secondary 225-0-225 20 mA. 6.3 v. 3 amp., 11/6 each. Bulgin Indicator Lamp, single bolt fixing for standard MES bulb, red lens, 3/3 each. Tubular Condenser (Metal Boss) Sprague 4 mfd. 600 v., 4/- each. Sprague Block Condenser, 2 x 1 mfd. 2,000 volts, 3/- each. Paper Block Condenser, 2 mfd. 250 volts, 9d. each. Kettle Elements, 1,000 watts for 200/210 volts or 230/250 volts, 17/6 each. Relay Valve 0V271, in Holder, 3/9 each.

BELL TRANSFORMER "CONCORDIA," 3 v., 5 v., 8 v., 1 amp. fused. In bakelite case, 8/6 each.

SELF TAPPING SCREWS (PK). No. 4, 3/4in. long, 3/4d. doz.

"GLEM" TRAVELLING IRON with ASBESTOS STAND. Size: 4in. x 2in. x 2 1/2in., including handle, complete with lead and switch to enable it to be used on any voltage between 110 and 250 v. A.B.C. adaptor is fitted on the lead. (Colour as available: Blue, Green, etc.), 21/- each.

FUSES, 1, 1 1/2, 2, 3, 5 amp. 1 1/4in. Standard Cartridge Fuses, 3d. each.

CARRYING CASE. Suitable for use as a projector or recording case, size 15in. x 9 1/2in. x 1 1/2in. Internal dimensions: 14in. long, 1 1/2in. deep, 5 1/2in. front. E.T. Case B.T. With black rexine finish. Weight 9 1/2lb., 13/6 each. Post and Packing 2/6.

B70 MINIATURE VALVE PIN STRAIGHTENER. This is an American manufactured tool at a price everyone can afford. Complete with plug, 2/6 each.

10 WATT WIRE WOUND RESISTORS BY DAGOLE. Special purchase of following sizes at 1/- each. 250 ohms, 700 ohms, 600 ohms, 225 ohms, 750 ohms, 500 ohms, 350 ohms, 175 ohms, 150 ohms, 200 ohms, 850 ohms, 400 ohms.

TV SLIDER PANEL. Welwyn panel of 3 resistors, values 1 Meg. ohms, 150K ohms, 250K ohms, with black screw type locking knobs. Total size: 3 1/2in. x 3in. Price 1/9 each.

ALL DRY BATTERY PLUGS AND SOCKETS. All types available. Two popular types of plug, 2-pin and 3-pin, 4d. each part. Bulgin Type P322 Anode Cap. Insulated for high voltage, 6d. each. Terminal Block, Ref. No. 5X/2234, 20-way, 5 yards Top Quality Maroon Flex, 2in. core, twisted with 2in. pin plug, 2/9. Marconi Dropper, resistance 1,000 ohms, 3 voltage taps 195/215, 216/235, 236/255, 1/- each. Crocodile Clips, plated, strong jaws, 3d. each. Toggle Switches, various assort. 12/- doz. 4B.A. Terminals, red and black. Suitable for Battery Chargers, etc., 1/6 each.

PUBLICATIONS. Please include 4d. postage with single copies.

No. 134—E.M. TUNER CONSTRUCTION BY W. J. May.

* Easy to build, Point to Point Wiring. * Super High Fidelity Response * 32 Pages * All Components for this circuit available ex stock. 2/6 each

No. 138—HOW TO MAKE AERIALS FOR T.V. (Bands 1 and 3) and V.H.F. (Band 2).

Data for all Channels. Ten different designs for local and fringe areas. 2/6 each

No. 100—A COMPREHENSIVE VALVE GUIDE, Book No. 1. 5/- each

No. 121—A COMPREHENSIVE VALVE GUIDE, Book No. 2 (Characteristics and Base Connections). 5/- each

No. 103—RADIOFOLDER "A" The Master Colour Code Index for Radio and Television. 1/6 each

No. 128—PRACTICAL TRANSISTORS & TRANSISTOR CIRCUITS * How to make your own transistors. * 48 pages. 3/6 each

No. 143—A COMPREHENSIVE VALVE GUIDE, Book No. 3. * International Edition * 1,200 valves not previously listed are presented. 5/- each

No. 144—VALVE AND TELEVISION TUBE EQUIVALENTS. * Receiving * Transmitting * Industrial. 5/- each

No. 140—TELEVISION SERVICING FOR BEGINNERS. * 40 pages of information. 4/6 each

No. 142—A MODERN T.V. CIRCUITS AND FAULT FINDING GUIDE. * Many interesting circuits included. 4/6 each

No. 133—RADIO CONTROLLED MODELS FOR AMATEURS. * Boats * Aircraft * Circuits, etc. 5/- each

HIGH QUALITY SOUND REPRODUCTION. Includes 20 watt amplifier, P.M. Tuner, Pre-Amplifiers, etc. 3/6 each

G.B.T. ISOLATION TRANSFORMERS. Type NR20. New "Competition" transformers. Input has one tap which increases output by 25%. Three types available to cover 2, 4 and 6.3 volt CR Tubes. NR20/A. Input 200/250 volts. Output: 2 volts. NR20/B. Input 200/250 volts. Output 4 volts. NR20/C. Input 200/250 volts. Output 6.3 volts. (All with optional 25% boost). With tag board primary. Flying lead secondary. All types. All 10/6 each.

2 pin Mains Plug and Socket 2/6 each. Pliers Side Cutters 2/9 pair.

HEATER TRANSFORMERS	Each
230 v. Input 2 volt 5 amp.	5/6
230 v. Input 2 volt 3.0 amp.	9/3
230 v. Input 4 volt 1.5 amp.	5/6
230 v. Input 4 volt 3.0 amp.	10/-
230 v. Input 5 volt 2.0 amp.	5/6
230 v. Input 6.3 volt 1.5 amp.	6/9
230 v. Input 6.3 volt 3.0 amp.	10/-
230 v. Input 12 volt .75 amp.	5/9

TERMS: Cash with order or C.O.D. Postage and Packing charges extra, as follows: Orders value 10/- add 1/-; 20/- add 1/6; 40/- add 2/-; £5 add 3/-; unless otherwise stated. Minimum C.O.D. fee and postage 3/-. For full terms of business see inside cover of our catalogue. Personal Shoppers 9 a.m. to 5 p.m. Mon. to Friday. Also Saturday 10 a.m. to 1 p.m.

ALPHA
RADIO SUPPLY CO.

103, LEEDS TERRACE,
WINTON STREET,
LEEDS, 7.

EDDY'S (Nottm.) LTD.

(DEPT. W.W.)

172 ALFRETON ROAD, NOTTINGHAM

THIS MONTH'S SPECIAL OFFERS

MIDGET BATTERY ELIMINATORS, 220/240 volt A.C. Mains input, 85 v. 10 m/A. H.T. output, 1-3 v. 125 m/A. L.T. output. Suitable for converting all modern low consumption valve battery portables for mains operation. Size only 3.7in. x 2.5in. x 1.8in. Smaller than H.T. battery alone! New and guaranteed 55/- only. Post extra 2/6.

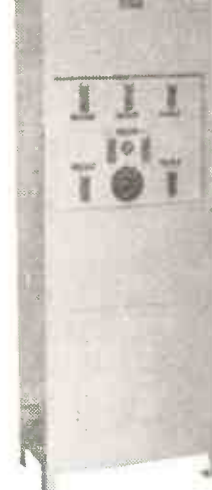
GERMANIUM DIODES 1/- each. Post 3d. All new, guaranteed.
RECORDING TAPE. 1,200ft. reels 9/11 each. Postage etc. 1/- each extra.

5-inch SPEAKERS. New and guaranteed 16/11 each, 2/- extra postage etc.

Any parcel insured against damage in transit 6d. EXTRA.		NEW & GUARANTEED VALVES		All tested before despatch.		Post etc. 6d. per valve. OVER £2 free.	
DM70	7/11	EF80	8/3	VU11	2/6	6K8G	8/6
EABC80	7/6	EF89	9/6	UF41	8/11	6Q7G	8/3
EB91	6/11	EF91	7/11	UF42	13/6	6C7GT	8/11
EBC41	9/11	EL84	9/11	1S5	7/6	6V6GT	5/11
ECC83	8/6	EY51	9/11	1S5	7/3	10F9	11/9
ECC84	10/11	EZ80	8/3	1T4	7/3	12K8GT	13/11
ECC85	9/-	GZ32	12/6	3V4	8/6	1457	13/6
ECF80	12/6	PL82	8/11	5Y3GT	7/6	25Z4GT	8/11
ECF82	12/6	PL83	11/6	6BA6	6/11	35W4	8/11
ECH42	9/11	PY80	8/11	6BBG	3/6	35A5	10/6
ECH81	8/11	PY81	8/3	6B16	7/11	35L6GT	9/11
ECL80	8/11	PY82	8/3	6F1	13/6	954	1/6
ECL82	13/6	U25	13/6	6J5M	2/11	955	3/11
EF40	10/11	UBF80	9/6	6F15	14/-	956	2/6
EF41	9/6	UBC41	8/11	6K7G	2/11	958	3/11

NO LISTS. TRADE ENQUIRIES INVITED

SAMSON'S SURPLUS STORES Exclusive Purchase!!



S.T.C. RECTIFIER SUPPLY UNIT No. 11 TYPE ZB 10235

Specification:—A.C. input 100-260 volts, 45-65 cycles. D.C. output 24 volts 11 amps. and 130 volts 600 m.a. very conservatively rated. L.T. and H.T. completely smoothed. All circuits fused. Mains on/off switch. Built in grey metal cabinet as illustrated. Height 5ft. 0in., width 1ft. 7½in., depth 1ft. 1½in. Weight 200lb.

These units were originally designed to supply L.T. and H.T. power in conjunction with Bay Power No. 3 to S.O.S./T 3 channel telephone system, but are ideal for the electronic industry, research laboratories, schools, etc., etc. Complete with instruction book and circuit. Supplied brand new at a fraction of the maker's price.

£17.10.0 ex-warehouse

If further technical details are required, Instruction Book will be forwarded against a deposit of One Pound. Export enquiries are welcomed. We have a limited number of these units ready packed in original transit cases at a small extra charge.

169/171 Edgware Road, London, W.2. Tel.: PAD 7851
125 Tottenham Court Road, W.1. Tel.: EUS 4982

All orders and enquiries to our Edgware Road branch, please. This is open all day Saturday.

CONDENSERS

Large Quantities Available

TUBULAR BAKELITE CONDENSERS (Jelly filled). 0.1µF. 4 kV. wkg. 4/6 each. 0.1µF. 2.5 kV. wkg. 3/6 each. 0.01µF. 5 kV. wkg. 5.05 3.5 kV. wkg., and 0.002µF. 5 kV. wkg. 2/6 each. 0.1µF. 1200 v. wkg. 0.01µF. 4 kV. wkg., 0.02µF. 3 kV. wkg., 0.05µF. 2 kV. wkg., 0.001µF. 5 kV. wkg. and 0.25 µF. 800 v. wkg. and 0.001µF. 2 kV. wkg. All at 2/- each.

BLOCK PAPER TYPES. 55 + 55 mfd., 300 volts A.C. 8 x 7 x 7 in., each 30/-, 0.1µF. 4 kV. wkg., 2 x 2 x 4 in., each 3/6.

BLOWER MOTORS (Snail type) 12 or 24 volts AC/DC. 15/- each.

VARIABLE RESISTORS with right angle drive to fix behind panel 29.5 ohms, 5 amps. at the lower end, 1.4 amps. at the higher end. Each 12/6.

METALMITE CONDENSERS. 0.005 µF. 600 volts D.C. 8d. each or 32/6 per 100.

COLVERN W/W pots, 25 k. and 50 k. (preset), 1/6 each, or 15/- doz.

PRECISION RESISTORS. 3,000 ohms. + - 0.5%, 2/- each, or 20/- doz.

BALANCED ARMATURES. (Inserts), 3/- each, or 30/- doz. These are very useful as a small speaker, etc.

RECEIVERS, U.S.A. CW46048 (part of R.T.19). Valves, 3 type 78, 2 type 77, and 1 type 1624. One coll set with each Freq., 1330-2040 Kcs., price 19/6 each. Post 3/6.

COMMAND TRANSMITTERS. B.C.457-A. Freq. 4-6.3 Mcs. Valves 2, 1625, 1, 1626, 1, 1629 and Xial 4609 Kcs. 15/- each. Post 3/6.

PARMEKO RE-ENTRANT SPEAKERS (Heavy duty), 10 ohms. 15 watts, as new, 11/0/- each, 4 for £20.

MAGSLIPS. 2in. type A.P.6550 and A.P.6549 and 6649A. 22/6 each.

RADIAL STUD SELECTOR SWITCHES, 20 stud tap, 5/- each.

RESISTORS (insulated type $\frac{1}{2}$ and $\frac{1}{4}$ watt), 15/- per 100.

SPIRIT LEVELS, small for Instruments etc. 1in. long. $\frac{1}{2}$ in. wide 1/- each, or 9/- doz.

SLYDLOCK FUSE HOLDERS. 5 amp. and 15 amp., 2/- each.

TRANSFORMERS, 110 v. to 230 v. input, 12 v. 4 amps. output, 12/6 each.

YOUR ENQUIRIES FOR ANYTHING NOT LISTED PLEASE.

All goods offered are ex-W.D.

Please include postage on all orders under £1.

TERMS C.W.O. WRITE OR CALL
W. MILLS
3B TRULOCK RD., TOTTENHAM, N.17
Phone: Tottenham 9213 & 9330

M. & J. PEARSON

Radio, Television & Radar Equipment

OFFER THE FOLLOWING AMAZING BARGAINS

- 1.—Marconi Test Sets. Type 87, A.C. mains 50~150-300 Mc/s. 27" x 10½" x 10½". Complete with mains lead, co-ax. cables and instruction book. Brand New. Only £3/10/0 each.
 - 2.—Receiver/Transmitter. New Zealand Set. Z.C.1, 12-volt. 2.5-6.5 Mc/s. New, but condensers need replacing owing to long storage. Special Price to clear £5/0/0 ea.
 - 3.—R.1156 Receivers 'B' model in nice condition tested before dispatch. A few left. £5/19/6.
 - 4.—American Type Aldis Lamps. Grimes Signal Light. Model K3, 24-volt. 5.3 amp. Sealed beam. With small swivel stand and four coloured filters all new in neat fibre cases. 17/6 each.
 - 5.—Mirror Galvanometers Mark**11. 45 cents by Cambridge Instruments Co. Sensitivity. 2,400 mms. Brand new in cases. £4/0/0 each.
 - 6.—Redspot Transistors. With circuits. 7/6 ea.
 - 7.—Hand Microphones. Moving Coil. To suit loud hailers, complete with switch and 10 yds. screened cable. All new. 22/6.
 - 8.—Hailer Speaker Diaphragms. V/Vox, Parmeko, etc. Ref. No. W.3506. 792, 2060, etc. 2/6 each.
 - 9.—Special Offer. $\frac{1}{2}$ in. x 4BA. bolts with nuts, round slotted head, hex. nuts, cad. plated. 5/- gross.
- All prices include Post and Packing Scotland and England.

**263 GALLOWGATE
GLASGOW, C.4**
Telephone: BELL 0729.

SOUTHERN RADIO'S WIRELESS BARGAINS

TRANSRECEIVERS. Type "38" Mark II. Just arrived. New purchase. New condition—5 valves—in case—Less attachments. 37/6 each.

ATTACHMENTS for Type "38" Transreceivers. ALL BRAND NEW: Headphones 15/6; Throat Microphones 4/6; Junction Boxes 2/6; Aerials, No. 1 2/6, No. 2 5/-; Webbing 4/-; Haversacks 5/-; Valves—A.R.P.12 4/6, A.T.P.4, 3/6; Set of FIVE VALVES 19/- the set.

TRANSRECEIVERS. Type "18" Mark III. Two Units (Receiver and Sender). Six Valves, Microammeter etc. in Metal Case. Untested, without guarantee but COMPLETE £2/18/6

ATTACHMENTS for "18" Transreceivers. ALL BRAND NEW. Headphones 15/6; Hand Microphone 12/6; Aerials 5/-; Set of 6 Valves 30/-.

RECEIVERS R.109. S.W. Receiver in Case, eight valves. Speaker and 6-v. vib. Pack. Untested, no guarantee but COMPLETE £2/18/6.

RESISTANCES. 100 Assorted useful values. New wire end 12/6.

CONDENSERS. 100A.D. Mica; Tubular; etc. 15/.

BOMBSIGHT COMPUTERS. Ex-R.A.F. NEW. Hundreds of Components, Gears, etc. Ideal for Experimenters £3.

LUFBRA HOLE CUTTERS. Adjustable $\frac{1}{2}$ in. to 3½ in. For Metal, Plastic, etc. 7/-.

QUARTZ CRYSTALS. Types F.T.241 and F.T.243. 2-Pin. $\frac{1}{2}$ in. Spacing. Frequencies between 5,675 kcs. and 8,650 Kcs. (F.T.243). 20Mcs. and 38.8 Mcs. (F.T.241. 54th Harmonic) 4/- each. ALL BRAND NEW. TWELVE ASSORTED CRYSTALS 45/-.

HOLDERS for both types 1/- each. Customers ordering 12 crystals can be supplied with lists of Frequencies available for their choice.

MORSE TAPPERS. Standard type 3/6; Extra Heavy on Base 5/6; Midget 2/9.

TRANSPARENT MAP CASES. Plastic 14in. x 10½in. Ideal for Maps, Display, etc. 5/6.

DINGHY AERIALS. Ex-U.S.A. Reflector Type 4/6.

STAR IDENTIFIERS. Type I A-N Covers both Hemispheres 5/6.

CONTACTOR TIME SWITCHES. 2 Impulses per sec. in case 11/6.

Post or carr. extra. Full list Radio Books, etc., 3d.

SOUTHERN RADIO SUPPLY LTD
11 LITTLE NEWPORT STREET,
LONDON, W.C.2. GERARD 6633.



(RADIO) LTD.

5, Harrow Road, Paddington, W.2

Opposite Edgware Road Station
Paddington 1008/9

OPEN MONDAY to SAT. 9-6. THURS. 1 o'clock
SEND 3d. FOR 28-PAGE CATALOGUE

Over 300 different types B.V.A. & American valves in stock. Send for Lists.



TRANSISTORS

JUNCTION TYPE P-N-P
(British Manufacture)

RED-SPOT 800 kc/s Audio Frequency	10/-
BLUE-SPOT 1.6 Mc/s Mixer and Frequency Changer	15/-
WHITE-SPOT 2.5 Mc/s R.F. and I.F. Amp.	20/-

All Transistors are Tested and Guaranteed
N.B. The Red-Spot is similar to Mullard OC71

"EAVESDROPPER"

THREE-TRANSISTOR POCKET RADIO

(No Aerial or Earth required)

Variable Tuning. Total cost, as specified, including Transistors, Transformers, Coils, Condensers and Battery, etc., with circuit and plastic case.

All items sold separately
With single 'phone, 82/6. **77'6** POST FREE
With Min. Hearing Aid, 90/-

The New "TRANSISTOR-8"

Push-pull Portable Superhet

Can be built for £11/10/-

This Portable 8 Transistor Superhet is tunable for both Medium and Long Waves and is comparable in performance to any equivalent Commercial Transistor Set. Simplified construction enables this set to be built easily and quickly into an attractive lightweight cabinet supplied.

TEN STAR FEATURES

- 8 Specially selected Transistors
- 250 Milliwatts Output Push-Pull
- Medium and Long Waves
- Internal Ferrite Rod Aerial
- 7 x 4 Elliptical High Resistance Speaker
- Drilled Plastic Chassis 8½ x 2½ in.
- Point to Point wiring and practical layout
- Economical. Powered by 7½ v. battery
- Highly sensitive
- Attractive lightweight contemporary case

We can supply all these items including Cabinet for £11/10/-
All parts sold separately

Send for circuit diagrams, assembly data, illustrations and instructions, and full shopping list 1/6.

N.B. Pair of OC72's supplied at additional cost of 40/-
Call and hear demonstration model.
Further details in the August issue of "Radio Constructor."

QUARTZ CRYSTALS

FT243—FUNDAMENTALS

80 Types 5706.667 Kc/s to 8340 Kc/s (in steps of 33.333 Kc/s).

120 Types 5675 Kc/s to 8650 Kc/s (in steps of 25 Kc/s).
(Excluding Types 7000/7300 & 8000/8300)

5'— EACH

Complete Sets of 80 Crystals, £7/10/-.
Complete Sets 120 Crystals, £10.

7000 Kc/s to 7300 Kc/s in steps of 25 Kc/s } **7'6d**
8000 Kc/s to 8300 Kc/s in steps of 25 Kc/s } **EACH**

FT241A—54th HARMONIC

80 Types 20 Mc/s to 27.9 Mc/s (in steps of 100 Kc/s)
(Excluding 27 Mc/s)

27 MC/S 10/-

5'— EACH

COMPLETE SET OF 80 CRYSTALS £6.0.0

100 Kc/s Standard 10X	15/-	200 Kc/s FT241A	10/-
100 Kc/s Gold Plated D.T. Cut	22/6	500 Kc/s FT241A	10/-
150 Kc/s Two Pin Round	12/6	500 Kc/s Brook's Special Holder	15/-
160 Kc/s " " 10X	12/6	5000 Kc/s Piezo 2-Pin Holder	12/6

P.O. TYPE 4B CERAMIC

100 Kc/s 819.6 Kc/s **15/- EACH**
163.9 Kc/s 1000 Kc/s

DC 11A 2-PIN

1740 Kc/s 1780 Kc/s **7/6**
1764.5 Kc/s

MINI-TWO

TWO-TRANSISTOR MINIATURE POCKET RADIO (No Aerial or Earth)

The smallest Transistor set offered on the market. Variable Tuning, Drilled Chassis, Plastic Case size 3in. x 2in. x ¾in., Miniature Hearing Aid, 2 Transistors and all components including 1½ volt Battery, Circuits and full practical layout diagrams.

Total Cost **55'—** Complete.



COLLARO RC456

4-speed auto-changer. Latest type with crystal turnover pick-up. £9/15/-.

TRANSISTOR SIGNAL TRACER

Complete Kit with 2 Transistors, Components Phones with Circuit and plastic case. **42/6**

TRANSISTOR SQUARE WAVE GENERATOR

Complete Kit with 2 Transistors. Components, Circuit and plastic case. **25/-**

R.F. 24. 10/- E.F. 25 12/6. R.F. 26 25/-
Brand new with valves, carr. 2/6.

"HOMELIGHT" 2-TRANSISTOR PERSONAL PORTABLE

No Aerial or Earth Required Variable Tuning

We can supply all components including 2 Transistors, Diode, Resistors, Condensers and Miniature Hearing Aid and Plastic Case size 4½x2½x1½ and 1½ v. Battery FOR 55/-
All items sold separately.

COLLARO RC/3/554

3-speed single player with crystal turnover pick-up type "T." £6/19/6, carr. 3/6.
Brand new in original carton.

MANY OTHER TYPES AVAILABLE

NEW S.T.C. AND "WESTALITE" SELENIUM RECTIFIERS. Largest L.T. range in Great Britain. Latest Current Products. NOT Surplus.

REVISED PRICES (3rd JUNE)

S.T. & C. E.H.T. K3/15, 5/-; K3/45, 9/4; K3/50, 9/10; K3/100, 16/8; all post 4d. extra.
BRIDGE CONNECTED FULLWAVE.
 17v. 1a., 13/4; 1.5a. 26/6; 2.5a. 32/6; 3a. 30/6; 4a. 38/-; 5a. 38/6; all post free. 33v. 0.6a. 22/3; 1a. 22/9; 1.5a. 45/-; 2a. 54/-; 3a. 54/-; 4a. 64/-; 5a. 68/-, all post 1/6. 54v. 1a. 33/-; 1.5a. 62/-; 2a. 74/-; 3a. 74/-; 5a. 97/-; 72v. 1a. 42/-; 1.5a. 78/-; 2a. 95/-; 3a. 95/-; 5a. 124/-; 100v. 1a. 61/-; 1.5a. 112/-; 2a. 134/-; 3a. 134/-; 5a. 180/-, all post 1/10.
BRIDGE CONNECTED WITH 7 $\frac{1}{2}$ in. SQUARE COOLING FINS 17 v. 6 a. 53/7; 10a. 61/-; post 2/3.
BRIDGE CONNECTED HEAVY DUTY FUNNEL COOLED or 7 $\frac{1}{2}$ in. SQUARE COOLING FINS. Both types, same price.
 17v. 12a. 95/-; 20a. 120/-; 30a. 172/-; 50a. 280/-; 33v. 6a. 89/-; 10a. 102/-; 12a. 176/-; 20a. 202/6; 54v. 6a. 124/-; 10a. 144/-; 72v. 6a. 160/-; 10a. 186/-; 100v. 6a. 227/6; 10a. 270/-, all post 3/-.

REVISED PRICES (7th FEB.)

"WESTALITE" (BRIDGE). 12-15v. D.C. 0.6a., 12/-; 1.2a., 30/-; 2a., 32/6; 2.5a., 49/-; 5a., 37/6; 10a., 64/6; 20a., 117/6; 30a., 171/-; 50a., 278/-; 24v. 1.2a., 30/-; 2.5a., 49/-; 5a., 60/-; 10a., 109/6; 20a., 208/-; 36v. 1.2a., 47/6; 2.5a., 84/-; 5a., 82/6; 10a., 154/6; 100v. 1.2a., 82/6; 2.5a., 154/6; 5a., 195/6; 10a., 391/-.
 All post extra from 1/6-3/-. E.H.T. Rects., 14D134, 25/-; 36EHT60, 35/10, post 4d. 1 m.a. A.C./D.C. meter-rects., 14/6.

Wholesale and Retail

Special Price for Export and Quantity

T. W. PEARCE

66 Great Percy Street, London, W.C.1
 Off Pentonville Road. Between King's Cross and Angel

THERMOSTATIC SOLDERING IRON

CECO — 70 watt

Instrument size



HEATS UP QUICKLY— $1\frac{1}{2}$ mins. — STAYS HOT — but NEVER OVERHEATS — BIT DOES NOT CORRODE OR NEED CLEANING

WEIGHT—4 $\frac{1}{2}$ ozs.

(Excluding Flex)

ALL PARTS INTER-CHANGEABLE

The Thermostat is easily adjusted to suit the grade of solder and keeps the temperature to within 15°C. It incorporates a micro-switch giving snap action on-off with minimum electrical interference. Eliminates dry joints and damage to insulation. Element and bit last much longer

LIST PRICE 85/- each

BRITISH PATENT No. 663214

Available from Manufacturer:—

CARDROSS ENGINEERING CO. LTD.

LEVENFORD WORKS, DUMBARTON

Phone: Dumbarton 655

BARGAIN OFFERS

HETERODYNE FREQUENCY METERS, type L.M.14, new U.S.A. surplus. 12kc/s to 20 Mc/s accuracy 0.01%. Offered complete with crystal, valves, connecting cable, calibration book and instruction Booklet.

FIELD STRENGTH ABSORPTION WAVEMETER, type TS-509/UR. Brand new American surplus in original packing. Direct calibration 90/400 Mc/s. No battery or mains required. Complete with crystal and built-in $\frac{1}{4}$ -wave telescopic aerial, sealed microammeter reading 0-50 fitted on panel. The instrument, ready for use and with instruction booklet, is housed in neat grey portable case with lid.

SIGNAL GENERATORS. Standard Telephone Precision Micro-wave type 9. Signal Generator, 6 cms. to 7.2 cms., complete with calibration charts.

Type T.F. 144G current model, not war surplus, 85 kc/s to 25 Mc/s.

VARIACS type 50 B, in new condition. Input 230 volts, Output 0-270 volts 5 KVA. Type 100L. 230 volts input, 0-230 volts 2 KVA output.

TEMPERATURE CONTROL OVENS, 230 volts A.C. Admiralty pattern, give stability of 2 parts in a million with suitable crystals. Fitted thermostat and thermometer, temperature adjustable 40/60 degrees C. Ideal for quartz crystals. As new, lab. tested and guaranteed.

MINIATURE I.F. STRIPS 10 $\frac{1}{2}$ " x 2 $\frac{1}{2}$ " x 3", frequency 9.72 Mc/s, supplied with circuit dia. 8/-, post 3/6.

A.C. CONTACTORS by Allen Bradley. 110 volts 50/60 cycles 3-pole 25 amps. Overload Relays 56/117 amps. A.C. Relays D.P.C.O. 115 volts, 15 amps., new General Electric. Hand reset. Overload Relays 230 volt D.C., coil 0.3 to 0.6 amps.

A.C. MOTORS, $\frac{1}{4}$ H.P. 230 volts 2.3 amp., 1,435 r.p.m. 4-foot mounting Crompton or Hoover, tested and guaranteed, £4/12/6, carr. 5/-.

Leslie Dixon & Co.

Dept. A, 214 Queenstown Road, London, S.W.8

Telephone: MACaulay 2159

POST RADIO SUPPLIES FOR HEADPHONES

DLR5, DLR2, BA5, HEADPHONE CORDS

EXPORT ENQUIRIES INVITED

33 Bourne Gardens, London, E.4

METERS

All types Any make



Single and Multi-range repaired and recalibrated

We convert or supply meters to your requirements.

10/14 days

E.I.R. INSTRUMENTS LTD.

329 Kilburn Lane, London, W.9.

Tel.: LADbroke 4168

RESISTANCE WIRES EUREKA - CONSTANTAN

MOST GAUGES AVAILABLE NICKEL-CHROME - MANGANIN

POST RADIO SUPPLIES

33 Bourne Gardens, London, E.4

Phones: CLIssold 4688/2021

METERS

WE CAN SUPPLY WITHIN 7-14 DAYS

a complete range of moving coil—moving iron—electrostatic—thermo-couple—also multirange meters—meggers—pyrometer and laboratory test instruments etc.

All to B.S.89.

REPAIRS

Delivery 7-14 days.

Our skilled craftsmen carry out repairs or convert any types and makes of single and multirange meters.

Where desired, repairs are accepted on contract.

THE V.Z. ELECTRICAL SERVICE

4, LISLE STREET, LONDON, W.C.2.

Telephone: GERrard 4861.

ENGINEERS!

Whatever your age or experience, you must read "ENGINEERING OPPORTUNITIES." Full details of the easiest way to pass A.M.I.Mech.E., A.M.I.O.E., C. & G. (Electrical, etc.), General Cert., etc., on "NO PASS—NO FEE" terms and details of Courses in all branches of Engineering—Mechanical, Electrical, Civil, Auto, Aero, Radio, etc., Building, etc. If you're earning less than £10 a week, tell us what interests you and write for your copy of "ENGINEERING OPPORTUNITIES" today—FREE.



B.I.E.T.
 387 College House, 29-31, Wright's Lane London, W.8.

BRITISH INSTITUTE OF ENGINEERING TECHNOLOGY

build your own TAPE RECORDER

with the 'ASPDEN'

tape deck kits

Two models, 5in. or 7in. spools, two speed, twin track, ferroxcube heads, finest motor, and complete assembly instructions.

Compact model 521 kit..... £8 5 0
 Standard model 721 kit..... £9 5 0
 Assembled and tested 30/- extra

And the RECORD/REPLAY AMPLIFIER KIT, 2 $\frac{1}{2}$ watt, neon indicator, without valves £5/18/-.

POWER PACK KIT for above, less valve £2/18/6 Carr. extra.

Mr. E. D. S., of Notts, writes:—
 "Can truly say that I have never had such good value for my money—performance—equal to many of the more expensive recorders." This deck and amplifier is being used in the Antarctic by an expedition member.

Send stamp for full particulars to:—
W. S. ASPDEN
 Stanley Works, back Clevedon Road, Blackpool, Lancs.

C.R.T. ISOLATION TRANSFORMERS

For Cathode Ray Tubes having Heater/Cathode short circuit for C.R. Tubes with falling emission. Type A Low leakage windings. Ratio 1:1.25 giving a 25% boost on Secondary. 2 volt 10/6 each 4 volt 10/6 each with Tag 6.3 volt 10/6 each Panel and 10.8 volt 10/6 each Solder Tags 13.2 volt 10/6 each Ditto with mains primaries 12/6 each Type B. Mains input 220/240 volts. Low Capacity. Multi Output 2, 4, 6.3, 7.3, 10 and 13 volts. Input has two taps which increase output volts by 25% and 50% respectively. This transformer is suitable for all Cathode Ray Tubes. With Tag Panel 2 1/2 each. Type C. Low capacity wound transformer for use with 2 volt Tubes with falling emission. Input 220/240 volts. Output 2-2 1/2-21-3 volts at 2 amps. With Tag Panel 17/6 each. All Isolation Transformers are individually boxed, labelled and clearly marked with relevant data. NOTE.—It is essential to use mains primary types with T.V. receivers having series connected heaters.

RESISTORS. All values. 10 ohms to 10 meg., 1/2 w. 4d.; 1 w. 6d.; 1 1/2 w. 8d.; 2 w. 1/-. HIGH STABILITY. 1/2 w. 1/-. All preferred values 100 ohms to 10 meg. WIRE-WOUND RESISTORS. 1/3 10 watt 25-ohms-10,000 ohms 1/6 15 watt 2-15,000 ohms-50,000 ohms, 5 w., 1/9; 10 w. 2/3 WIRE-WOUND POTS. 3 WATT LAB. COLVERN, ETC. Front Min. 7 V. Type Standard size Pots, 2 1/2in. Knurled Slotted Knob. Spindle High Grad. All All values 25 ohms to 30 Values, 100 ohms to 50 K., K. 3/- ea. 50 K., 4/- 5/6; 100 K., 6/6. Ditto Carbon Track 60 K. W/W EXT. SPEAKER 2 Meg., 3/- CONTROL 10 1/2, 3/- TRANSFORMERS. Heavy Duty 50 mA., 4/6. Multi-ratio push-pull, 6/6. Min. 3 v. 4 duty 4/6. Hygrade Push-Pull 7 watts, 15/6. L.F. COILS 15/10 H. 60/65 mA., 5/-; 25/20 H. 100/120 mA., 11/6; 20/15 H., 120/150 mA., 12/6; 5 H. 250 mA., 15/- MAINS TRANS. 350-0-350, 80 mA., 6.3 v. tapped 4 v. 4, 2 v. 5 v. tapped 4 v. 2 a., ditto 250-0-250 80 mA., etc., 21/- Bargain 300-0-300 v. 65 mA., 6 v. 4 n., 4 v. 2 a., 15/-

I.F. TRANSFORMERS 7/6 pair 465 Kcs Slug tuning Miniature Can 2 1/2 x 1 1/2 in. High Q and good band width. By Pye Radio. Data sheet supplied. Weatrite M800 IF Transformers 465 Kcs. 12/6 pair.

HEATER TRANS. Tapped 200/250 v. 6.3 v. 1 1/2 amp. 7/6 ALADDIN FORMERS and cores. 4in. 9d.; 5in. 10d. 3in. FORMERS 587/8 and Cans TV1/2. 4in. sq. x 2 1/2 in. and 4in. sq. x 1 1/2 in. 2/- complete with cores. SLOW MOTION DRIVES. Epicyclic ratio 6:1, 2/3. TYANA. Midge Soldering Iron, 200/220 v. or 230/250 v., 1/6. SOLDER INSTRUMENT IRON. 25 w., 24/- MAINS DROPPERS. 3 x 1 1/2 in. Three 4 1/2 Sliders, 3 amp. 750 ohms, 4/3. 2 amp., 1,000 ohms, 4/3. LINE COORD. 3 amp., 60 ohms, per foot, 2 amp., 100 ohms, per foot, 2 way, 6d. per foot, 3 way, 7d. per foot.

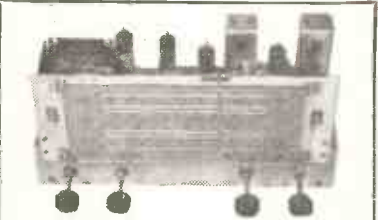
CRYSTAL MIKE INSERT by Acos Precision engineered. Size only 1 1/4 x 1/16 in. Bargain. Price 6/6. No transformer required.

MIKE TRANSF. Ratio 50:1, 3/9 ea.; 1:0:1, 10/6. LOUDSPEAKERS P.M. 3 OHM. 2 1/2 in. square 17/6 3in. R.A. 17/6 7in. x 4in. Goodmans 21/- 3 1/2 in. square 18/6 8in. Plesey 19/6 6in. Goodmans, 18/6 10in. R.A. 30/- 4in. ELAC TWEETER, 25/- 12in. Plesey 30/- 8in. M.E. 2.5 k. field tapped O.P. transformer, 24/6 CRYSTAL DIODE. G.E.C. 2/-, GEX34, 4/-, 40 Circuits, 3/- CRYSTAL SET CONSTRUCTION. Kit 12/6. Book 1/- H.R. HEADPHONES. 4,000 ohms, best new. 16/6 pair. SWITCH CLEANER Fluid, squirt sprout, 4/3 tin. TWIN GANG CONDENSERS. 365 pt. Miniature, 1 1/2 in. x 1 1/2 in., 10/- .0005 Standard with trimmers. 9/-; less trimmers, 8/- Midget, 7/6; 3-gang 500 pt., 7/6.

SUPERHOT COIL PACK 27/6 Miniature size 2 1/2 x 1 1/2 in. High Q dust coated coils. SHORT, MED., LONG. GRAM switching with connection diagram and 5 valve circuit. 465 Kcs/EF.

VALVE HOLDERS. Pax Int. Oct., 4d. EF50, EA50, 6d. H2A, CRT, 1/3. Eng. and Amer. 4, 5, 6, 7 and 9 pin. 1/- MOULDED Mads and Int. Oct., 6d., B7G, B8A, B8G, B9A, 9d. B7G with can, 1/6, VCR97, 2/6. B9A with can, 2/6. CERAMIC, EF50, B7G, Int. Oct., 1/- B7G with can, 1/9 SPEAKER FEET. Gold Cloth 18in. x 25in., 5/- 25in. x 30in., 10/- Expanded metal, Silver 13 1/2 x 9 1/2 in., 2/- each. 14in. x 12in., 3/- each. Tyan 4ft. 6in. wide, 10/- 1/2. 2ft. 3in. wide, 5/- 1/2. WAVECHANGE SWITCHES. 2 p. 2-way 3 p. 2-way, short spindle 2/6 5 p. 4-way 2 water, long spindle 6/6 2 p. 6-way, 4 p. 2-way, 4 p. 3-way, long spindle 3/6 3 p. 4-way, 1 p. 12-way, long spindle 3/6 Wave change "MAKITS", 1 w. 8/6; 2 w. 12/6; 3 w. 16/-; 4 w. 19/6; 5 w. 23/6; 6 w. 26/6 TOGGLE SWITCHES. S.P. 2/-; D.P. 3/6; D.P.D.T. 4/- MORSE KEYS, good quality 2/6

KNOBBS GOLD ENGRAVED. Walnut or Ivory. 1 1/2 in. diam., 1/6 each. "Focus", "Contrast", "Brilliance", "Brilliance-On/Off", "On-Off", "Volume", "Voice-On-Off", "Tone", "Tuning", "Treble", "Bass", "Wavechange", "Radio Gram", "S.M.L. Gram", "Record-Play", "Brightness", ditto, not engraved, 1/-.



1957 RADIOGRAM CHASSIS THREE WAVEBANDS S.W. 18 m.—30 m. M.W. 200 m.—550 m. L.W. 800 m.—2,000 m. FIVE VALVES LATEST MULLARD EHZ42, EF41, EBC41, EL41, ELZ40 12 month Guarantee. A.C. 200/250 v., 4-way switch. Short-Medium-Long-Gram. A.V.C. and Negative feedback. 4.2 watts. Chassis 13 1/2 in. x 5 1/2 in. x 2 1/2 in. Glass Dial 10 x 4 1/2 in. horizontal or vertical available. 2 Pilot Lamps. Four Knobs, Walnut or Ivory, signed and calibrated. Chassis isolated from mains.

BRAND NEW £10.10 Carr. 4/6. TERMS: Deposit £5/5/- and 6 monthly payments of £1. MATCHED SPEAKERS FOR ABOVE CHASSIS: 9in., 17/6; 10in., 25/-; 12in., 30/-.

RECOMMENDED FOR ABOVE CHASSIS

R.C.S. SCOOP HIGH FIDELITY AUTOCHANGER 1957 MODEL RC456 For 7", 10", 12" Records 16, 33, 45, 78 r.p.m.

4 SPEEDS — 10 RECORDS WITH STUDIO "O" PICK-UP BRAND NEW IN MAKER'S BOXES OUR PRICE £9.15.0 Post free. TERMS: Deposit £5/5/- and 6 monthly payments of £1. SUITABLE PLAYER CABINETS 49/6 AMPLIFIER PLAYER CABINETS 63/-

B.S.R. MONARCH 4-SPEED AUTOMATIC RECORD CHANGERS 1957 MODELS Brand new and fully guaranteed 12 months.

NOT JOB LINE REJECT STOCK Designed to play 16, 33, 45, 78 r.p.m. Records 7in., 10in., 12in. Lightweight Xial pick-up, turnover head, two separate sapphire styli, for Standard and L.P. Each plays 2,000 records. Voltage 200/250 A.C. OUR PRICE £8.15.0 each. Post free. Terms: Deposit £5 and 5 monthly payments of £1. Space required 14in. x 12 1/2 in. 5in. above and 3in. below. SUITABLE PLAYER CABINETS 49/6 AMPLIFIER PLAYER CABINETS 63/-

GARRARD. 4-speed Single Record Player with GC2 Turnover Head for 78 r.p.m. and L.P. Space required 14in. x 12 1/2 in., 2 1/2 in. below 2 1/2 in. below Mode 4 SP — BARGAIN £8. Post Free.

FAMOUS MAKE 4-speed Motor and Turntable with selecting switch for 16, 33, 45 and 78 r.p.m. records 200/250 v. A.C. 50 c.p.s. Also Lightweight pick-up with Xial turnover head, separate Sapphire styli for L.P. and standard records. SPECIAL OFFER. THE TWO 24/12/6, post 2/6. 14 x 12 1/2 in. Cut out board 6/-.

AMPLIFIER/PORTABLE RECORD PLAYER CABINET Size 17 1/2 x 13 1/2 x 7 in. Motor Board 16 1/2 x 12 1/2" SPACE FOR ANY SINGLE RECORD PLAYER, TWIN SPEAKERS and AMPLIFIER etc. BARGAIN PRICE 45/-

4-WATT GRAM. AMPLIFIER. For 200-250 v. 50 c.p.s. A.C. mains. Chassis fully isolated. Fitted vol. (with mains switch) and Tone Control. Designed for use with any kind of single player or record changing unit. With 6 1/2 in. loudspeaker and output transformer. Fits our portable cabinet without modification. Post 3/-. £4-15-0

CHAMPION VHF (FM) TUNER B8 to 96 mc. 5 Mullard Valves and Superhet Tuning Heart. Maroon and Cream Receiver styled cabinet 6 x 12 x 6 in. Features: This is a self powered 200/250 v. A.C. VHF (FM) Adapter with operating and servicing data and a screened lead for connection to pick-up sockets of Any Radio, Radiogram or Amplifier. Brand new with 12 months guarantee. List price 16 gs. Our Price 10 gs., carr. 4/6.

TELETRON BAND III CONVERTER For London, Midland and Northern I.T.A. Suitable all T.V. makes, T.R.F. or Superhet. Coils, valves, components, chassis, wiring plans. COMPLETE KIT for mains operation 200-250 v. A.C. £3/10/- As ABOVE less POWER PACK. Requires 20 mA. H.T. 6.3 v. 6 a. L.T. £2/5/-. Mark II cascade £1 extra each Kit.

Volume Controls 80 ohm Coaxial

Midget size Long spindles. Guaranteed 1 year. All values 10,000 ohms to 2 Meg. No. Sw. S.P.S.W. D.P.S.W. 3/- 4/- 4/6 Lin or Log Tracks Semi-air spaced Polythene insulated fin. dia. Stranded core. Ideal Band III. 9d. vd. Losses out 60%. STANDARD QUALITY fin. Coaxial 8d. vd.

COAXIAL PLUGS 1/- DOUBLE SOCKET 1/3 SOCKETS 1/- OUTLET BOXES 4/6 BALANCED TWIN FEEDER per vd. 6d. 80 U or 300 U TWIN SCREENED BALANCED FEEDER 1/- vd. 80 ohms. TRIMMERS, Ceramic, 30, 50, 70 pt., 9d. 100 pt., 150 pt., 1/3. 250 pt., 1/6. 600 pt., 750 pt., 1/9. Philips 1/- ea.

ALUMINIUM CHASSIS. 18 s.w.t. Plan, undrilled, with 4 sides, riveted corners and lattice fixing holes, with 2 1/2 in. sides. 7 x 4 in., 4 in., 9 x 6 in., 5/9; 11 x 7 in., 6/9; 13 x 9 in., 8/6; 14 x 11 in., 10/3; 15 x 14 in., 12/6; and 18 x 16 x 3 in., 16/6.

12/6 PURETONE RECORDING TAPE 1,200 ft. on standard fitting 7" Plastic reels. Brand new, boxed, 12/6. Spare Spools 5" metal, 1/6, 7" Metal 2/3 FERROVOILE 1,200ft. Plastic Tape 25/-

SENTERCEL RECTIFIERS. E.H.T. TYPE FLY-BACK. VOLTAGES. K3/25 2 kV., 5/-; K3/40 3 kV., 7/-; K3/45 3.6 kV., 7/6; K3/50 v. 4 kV., 8/-; K3/100 8 kV., 14/6. MAINS TYPE, RM1, 125 v., 60 mA., 5/-; RM2, 100 mA., 6/-; RM3, 120 mA., 5/-; RM4, 260 v., 275 mA., 16/- MINIMATURE CONTACT COOLED RECTIFIERS. 250 v. 60 mA., 8/6; 250 v. 85 mA., 9/6. COILS. Wreathe "P" type, 3/- each. Osmor Midget "Q" type adj. dust. core, from 4/- each. All ranges. TELETRON. L. & Med. T.R.F. with reaction, 3/6. FERRITE ROD AERIALS. M.W., 8/9; M. & L. 12/6. T.R.F. COILS 4/HF, 7/- pair. H.F. COILS, 2/6.

JASON F.M. TUNER COIL SET. 26/- H.F. coil, aerial coil, Oscillator coil, two I.P. Transformers 10.7 Mc/s., Detector transformer and heater choke. Circuit and Dial, 19/6. Complete Kit, £5/15/6. With Jason superior calibrated dial. £6/15/-

CONDENSERS. New stock. .001 mfd. 7 kv. T.C.C., 5/6. 0.025 20 kv., 9/6; 100 pt. to 500 pt. Meas, 6d.; Tubular 500 v., .001 to .01 mfd., 9d.; .05, 1, 1/-; .25, 1/6; 5, 1/9; 1,350 v., 9d.; 0.1 mfd., 2,000 v., 1 mfd., 2,000 v., 4/- CERAMIC CONDENS. 600 v., 3 pt. to .01 mfd., 10d. SILVER MICA CONDENSERS. 10% 5 pt. to 500 pt., 1/-; 600 pt. to 3,000 pt., 1/3. DITTO 1% 1.5 pt. to 500 pt. 1/9; 615 pt. to 3,000 pt., 2/-.

NEW ELECTROLYTICS. FAMOUS MAKES.

TUBULAR TUBULAR CAN TYPES 1/374 v. 2/3 100/25 v. 3/- 8+10/450 v. 5/- 2/450 v. 2/3 8+8/600 v. 4/6 16+16/1000 v. 6/6 4/450 v. 2/3 18+18/500 v. 4/6 6,000 mfd. 6 v. 6/3 8/450 v. 2/3 CAN TYPES 32+32/350 v. 4/6 8/500 v. 2/6 Clps 32+32/450 v. 6/6 16/450 v. 3/6 16/450 v. 3/6 64+32/275 v. 7/6 16/500 v. 4/6 32/350 v. 3/6 100+100/250 v. 11/6 25/25 v. 5/6 64/350 v. 5/6 60+200/257 v. 5/6 50/25 v. 1/9 50+50/360 v. 7/- 1,000+1,000/6 v. 6/6 50/50 v. 2/3 500/12 v. 3/- FULL WAVE BRIDGE SELENIUM RECTIFIERS. 2, 6 or 12 v. 1 1/2 amp., 8/9; 2 a., 11/3; 4 a., 17/6. CHARGER TRANSFORMERS. Tappan input 200/250 v. for charging at 2, 6 or 12 v. 1 1/2 amp. 13/6; 4 amp., 21/-

Table with columns: All Boxed, VALVES, New & Guaranteed. Rows list various valve types and their prices, such as 1E5 8/6, 6K9 8/6, EABC80 8/6, etc.

NEW AND ENLARGED SHOWROOMS NOW OPEN. Our written guarantee with every purchase. Please address all Mail Orders correctly as below.

RADIO COMPONENT SPECIALISTS 337 WHITEHORSE RD., WEST CROYDON OPEN ALL DAY—(Wed. 1 p.m.) CATALOGUE 6d.

Tel. THO 1665. Buses 133 or 68 pass door. S.R. Stn. Selhurst. 48-hour postal Service. P. & P. 1/-, £2 orders post free (Export extra). C.O.D. Service 1/6

Solder with



LITE SOLDER
REGD. TRADE MARK

**"PERMATIP"
AND
"PERMABIT"**

**INSTRUMENTS
FOR
GREATER
SOLDERING
EFFICIENCY**

The soldering bit which maintains its face indefinitely without attention. 25 models available for mains or low voltage supply. Bit sizes 3/32 to 3/8 inch. Full details in booklet S.P.5 from sole manufacturers:—

LIGHT SOLDERING DEVELOPMENTS LTD.
106, GEORGE ST., CROYDON, SURREY
Tel.: CROydon 8589

The NEW
EDDYSTONE '870'
RECEIVER

PRICE — £34.16.0 (inc. P.Tax)

Efficient broadcast reception on short, medium and long waves. A Semi-Portable AC/DC set equally suitable for cabin or home use, offering Eddystone design and workmanship at a Reasonable Price.

In stock at:—
WEBB'S RADIO
14 SOHO STREET, LONDON, W.1
Telephone GERRard 2089

QUARTZ CRYSTAL UNITS



Type
B7



The type B7 unit is mounted in the standard B7G valve envelope and is hermetically sealed and fully evacuated.

Available for the frequency ranges from 100 kc/s to 500 kc/s and from 3 Mc/s to 16 Mc/s. Gold electrodes applied by cathodic sputtering give permanence of calibration. Normal adjustment accuracy 0.01%, Max. adjustment accuracy 0.003%.

Early delivery can be given of some frequencies, and we will be pleased to quote for your specific requirements.

THE QUARTZ CRYSTAL Co. Ltd.

63-71, Kingston Road,
NEW MALDEN, SURREY.
Telephone: MALden 0334
Cables, etc. QUARTZCO NEW MALDEN

**RADIO & ELECTRONIC
ENGINEERS . . .**

The MORSE CODE is still, and always will be, the basic Code for individual Signalling, whether on visual or telecommunication circuits.

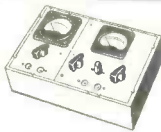
So add this simple and interesting subject to your qualifications. Apart from the pleasure derived from this extra knowledge, it counts for much when a step up the ladder is under consideration.

Write for the **CANDLER BOOK OF FACTS** and see for yourself how fascinating 'the Candler method of teaching the Morse Code will prove.

CANDLER SYSTEM CO.
(56W) 52b ABINGDON ROAD, LONDON, W.8
Candler System Co., Denver, Colorado, U.S.A.

**PORTABLE
TEST PANEL**

for workshop
or students' use



Two separate moving coil meters for voltage, current and resistance measurement. In wooden case with metal front and test prods.

Ranges (AC & DC)
0-30mA
0-10v, 0-25v
0-500v
0-10,000 ohms
Size 8½" x 5½" x 2½"

Cash £6 (inc. post/pkg.) or 30/- down
and 5 monthly payments of £1
(Total Price £6.10.0.)

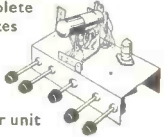
Order now from:—
E.M.I. INSTITUTES, Dept. T.P.127, London, W.4

IC.87

OSCILLOSCOPE

(MINIATURE TYPE—1" C.R.T.)

Supplied in kit form complete with full instructional notes for radio & T.V servicing. Operates from power supply of most AC domestic radio receiver equipment or from power unit supplied as an extra.



Cash £10 (inc. post/pkg.) or 30/- down
and 9 monthly payments of £1
(Total Price £10.10.0.)
(Power unit, if required, £3 extra)

Order now or send for further details to:—
E.M.I. INSTITUTES, Dept. S.G.127, London, W.4

IC.82

TELETRON SUPER INDUCTOR COILS



Ferrite Rod Aerials. Wound on high permeability Ferroxcube rod. Medium wave 8/9, Dual wave 12/9.



Type HAX. Selective crystal diode coil for tape and quality amplifiers, MW 3/-, LW 3/6. Dual wave TRF Coils, matched pairs (as illustrated) 7/- pair. Type S.S.O. Supersonic Tape Osc. coil, provides 6.3 v. 3 a. RF for pre-amp heater. Eliminates induced 50 c/s hum, 40/100 kc, 15/- ea. Transistor coils, etc. Available from leading stockists. Stamp for complete data and circuits.

THE TELETRON CO. LTD.
266, Nightingale Rd., London, N.9. How 2527

COPPER WIRE

ENAMELLED, TINNED, LITZ,
COTTON AND SILK COVERED
RESISTANCE WIRES,

1 oz., 2 oz, and 4 oz. REELS.

All gauges available.

B.A. SCREWS, NUTS, WASHERS,
soldering tags, eyelets and rivets.

EBONITE and BAKELITE PANELS,

TUFNOL ROD, PAXOLIN TYPE COIL
FORMERS AND TUBES, ALL DIAMETERS.

Latest Radio Publications.

SEND STAMP FOR LIST. TRADE SUPPLIED.

**G.E.C., B.T.H. &
WESTINGHOUSE
GERMANIUM CRYSTAL
DIODES**

1/- each. Postage 3d.

Diagrams and three Crystal Set Circuits Free with each diode.

A large purchase of these fully GUARANTEED diodes from the manufacturers enables us to make this attractive offer.

POST RADIO SUPPLIES
33, Bourne Gardens, London, E.4

**TELEVISION
TUBES**

USED BUT

RELIABLE AND FAULT FREE

14 in. £5-10-0 RECTANGULAR
17 in. £7-10-0 TYPES.

6 MONTHS GUARANTEE

12 in. ALL TYPES GUARANTEED
FROM 3—3 MONTHS

C.W.O. £6 CARR. INS. 15/6

FELMARC LTD.
15, KINGSWAY
NUNEATON · WARWICKSHIRE

"AMPI"

LENGTH 6", WIDTH 4", DEPTH 2½"
Really Versatile 2 Stage Audio Amplifier designed specially for instant fitting to any portable Record-Player!

Brief Specification:— OVER 3W OUTPUT for 2-4 ohm Spkr; Mains Transformer having isolated HT winding, plus Output Transformer all on one-piece chassis; easily & quickly fitted inside any cabinet which will hold a turntable & motor; Neg feedback, Tone and Volume controls. Ready to operate, and PLAYING TESTED.

£3.19.6 & 3/6 p.p. Photos & further details 6d. Stamps to

E.K.E. 47, Arksey Lane, Bentley, Doncaster

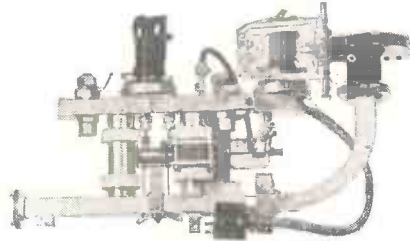
SPECIAL 'HAM' OFFER!!!!



TEST SET 102

Consists of impregnated mains transformer 200-250 v 50 cycles, 12 v 2 amp, 6 v 3 amp, output 280 v at 80 ma. S.T.C. metal rectifier 80 ma. 1-DET19, 1-6J5. Bulgin plugs, sockets and pilot lights. Mains leads. Circuit is a multi vibrator locked mains type, with a cathode follower. Can be modified for:
 ① Audio Amplifier
 ② Audio Oscillator
 ③ V.F.O.
 ④ External Synchronizer
 ⑤ Stabilized Power Unit
 ⑥ Modulator Etc.
 Brand new including circuit only 40/-, Carr. 5/-.

3 CM MAGNETRON/KLYSTRONS ASSEMBLY



Includes:—

- 1 725A Magnetron
- 2 723A/B Klystrons
- 2 CV253 Crystal Diodes
- 1 1B24 TR Tube
- 1 CV115 ATR Tube

ASSOCIATED WAVEGUIDE ASSEMBLY PRICE £7 10 0 each. P. & P. 7/6.

PULSE TRANSFORMER and MAGNET FOR ABOVE £3.

373 MINIATURE 9.72 I.F. STRIPS. Supplied complete with 3 EF91, 2 EF92, 1 EB91. Ideal for modification to FM Tuner as described on page 107 of the April Practical Wireless. Price 45/- each.

WESTINGHOUSE PENCIL RECTIFIER. Type J.50, output 500 v. at 5 mA. 5/- post paid.

BENDIX RECEIVER MN26.C. Covering 150-1500 kc/s in 3 bands. Valves used 5-6K7, 2-6N7, 2-6J5, 1-6F6, 1-6L7. Complete with switching motor and dynamotor. This superb unit has been modified for 12 v. operation. Only 80/-, carriage 8/6.

AMERICAN GEARED MOTOR. 24 v. D.C. with built-in precision gearbox. No. 1 drive 24 R.P.M. No. 2 drive 6 R.P.M. On 12 v. No. 1 drive 16 R.P.M. No. 2 drive 4 R.P.M. Overall size of motor and gearbox 7½ in. x 3½ in. x 3 in., weight 1 lb. 14 ozs. Brand New. Only 29/6. P. & P. 2/-.

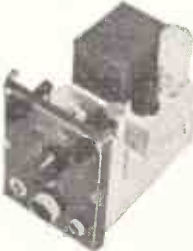
DIPOLE AERIAL No. 4A. 52ft. hard drawn 7/22 copper wire with centre insulator, fitted with feeder sockets. Both ends have 3-link insulators and slotted wire adaptors. Brand new. Price 9/- P. and P. 2/-.

HIGH RESISTANCE HEADPHONES. Type Mk. IV 4,000 ohms, with cord and plug, Brand new. 11/- each. P. & P. 1/6.

INDICATOR UNIT TYPE 1B2A. Unit contains VCR 517 6in. cathode ray tube with mumetal screen, 1 5U4G, 3 EF50, and 4 SP61, 9 wire-wound volume controls, H.T. transformer, numerous resistors, condensers and other components. Fully smoothed. Brand new, 65/-. Plus carriage 7/6.

HOOVER ROTARY TRANSFORMERS. 11.5 v. input, 490 v. output at 65 mA, and 6 v. input, 300 v. output at 75 mA. Guaranteed and tested, only 27/6. P. & P. 2/6.

RCAF AMPLIFIER UNIT
 12 v. input. Vibrator. Pack 250 v. out. QZ4. Microphone Transformer into a 6K6 GT output valve with negative feed back. Size 8in x 5½in x 8½in. Brand new, 35/- each. P. & P. 3/-.

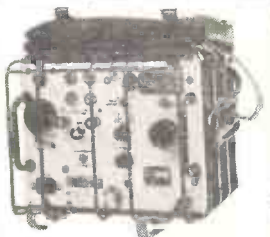


ORIGINAL AR88 MAINS TRANSFORMERS

Input 110 volts—240 v. Output 345-0-345 at 150 ma. 5 v. at 2 amps and 6.4 v. at 4.5 amps. Brand new fully. Shrouded. 50/- P. & P. 3/-.

R109A RECEIVER

8 valves 5 ARP 12's, 3 AR 8's covering 2-12 Mc/s on two frequency bands. Contains 6 v. Vibrator Pack and built-in 8½in. Goodman speaker, operates from 6 v. battery, consumption 2 amps. Housed in metal case 13 x 12 x 11in. Designed for Mobile or Ground station. Operates with any normal aerial. Complete, guaranteed and tested including circuit. Very good condition. Only 85/-, carr. paid.



TANNOY PUBLIC ADDRESS EQUIPMENT

6 valve speech amplifiers with 4 6L6's in parallel push pull handling from 30 to 60 watts. Mains input 200-250 volts. COMPLETE WITH ALL LEADS IN T.R.S. Cable, Hand microphones, plugs and spares. Housed in wooden transit case size 17½ in. x 15½ in. x 21½ in. with full operating instructions and circuit.

FULLY TESTED AND OFFERED OUR **£20** AT 1/3rd OF ORIGINAL COST. PRICE

SPEAKERS FOR ABOVE 25/- each.

COMMAND TRANSMITTERS

3-4 Mc/s	valved with crystal	25/-
4-5.3 Mc/s	valved less crystal	17/-
5.3-7 Mc/s	valved less crystal	17/-

COMMAND RECEIVERS

1.5-3 Mc/s	Fully valved	65/-
3-6 Mc/s	Fully valved	35/-

62A INDICATOR UNIT

Complete with VCR97 with mu-metal screen, 12 EF50, 4 SP61, 3 EA50, 2 EB34. Plus pots., switches, H.V. Cond., Resistors, Double deck chassis and crystal. Less drive 50/- carr. 7/6.

FM WOBLULATOR CAPACITOR Excellent for Sweep Generator. Frequency modulation unit permanent magnetic field and a moving mechanism driving a metal diaphragm supported at its rim. This diaphragm acts as a moving plate of the frequency modulator capacitor. Tested. Price 7/- each.

R.F. UNITS

- R.F. 24, 20-30 Mc/s, 8/6 each
- R.F. 25, 40-50 Mc/s, 8/6 each
- R.F. 26, 50-65 Mc/s, 25/- each

All valved. Postage 3/- on each.

WESTERN ELECTRIC SHUNT MOTORS. 27 v. 1½ amps giving 3,000 R.P.M. Continuous duty, rated 1/50 H.P. works off 12 v. and 6 v. at reduced R.P.M. length of shaft 1½in. Motor 3½in x 2½in. Brand new and boxed. Only 17/6. P. & P. 1/6.

24 v. giving 5,000 R.P.M. continuous duty. Shaft ½in. x ½in. Motor 1½in. x 2½in. works off 12 v. at reduced R.P.M. Brand new. Only 12/6. P. & P. 1/6.

TUNING UNITS

- TU-7-B 4500-6200 KC
- TU-8-B 6200-7700 KC
- TU-10-B 10,000-12,500 KC

These well known units have Micro Meter dials with 2,500 divisions over 180 degrees rotation. Giving plenty of mechanical bandspread. Velvet vernier drive, high Q tank circuit and heavy duty 6-way ceramic switch and variable transmitting condensers. Price 14/- each. P. & P. 4/-.

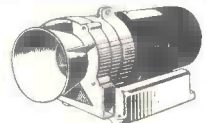
LOW IMPEDANCE PADDED HEADPHONES TYPE D.L.R. 3. Complete with cord and plug. Brand new. Price 9/- P. & P. 1/6.

U.S.A. INDICATOR BC929A. Complete with 3 BPI, shield and holder. Aerial switching unit. 7 valves: 2-6H6GT, 1-6X5GT, 1-2X2, 1-6G6, 2-6N7. Brand new. Original cartons. With modification circuit 60/-, Carr. 7/6.

PARMEKO C CORE TRANSFORMER. Inter-valve Transformer. Ratio 4/1 600 ohms CT. 1½in. x 1½in. x 2in. Original cartons. 6/- post paid.

AMERICAN ROTARY CONVERTORS

With cooling Fan. Input 12 v. D.C. Output 300 v. at 90 mA.



Completely suppressed. Brand new 19/- each. Plus P. & P. 3/-.

Hours of business:
 8.30 a.m. to 6 p.m.
 Monday to Saturday.

OPPOSITE
 BRITISH MUSEUM

Relda Radio Ltd.
 (Dept. "W") 32A, Coptic Street, London, W.C.1. Phone: MUSeum 9607

Carriage charges apply to England and Wales only.

Terms: Cash with order

All orders despatched same day.

EXPERT ENQUIRIES INVITED.

TELEVISION INSTRUMENTATION DEVELOPMENT ENGINEERS

DUTIES: To undertake the design and development of test equipment for television, including work on special television camera applications. Considerable personal responsibility and freedom is given, and there are no set rules regarding the number of people engaged on a project, the allocation of project leaders, etc.

QUALIFICATIONS: The ability to design and develop equipment and aggressively progress a project through to the stage where a model is made and the information is available for a production drawing office. Candidates should preferably be of degree standard, or Corporate Members of one of the Professional Institutions, but consideration will be given to others who have considerable practical experience in the field. The ability to progress the project through to a satisfactory conclusion is the prime requirement. Due to expanding activities men with drive and initiative can be sure of progressive advancement.

Comprehensive pension and assurance schemes are in operation, and Canteen and Social Club facilities are provided.

HOLIDAY ARRANGEMENTS CAN BE MAINTAINED

Call any day including Saturday mornings at:

**MARCONI INSTRUMENTS LTD.,
LONGACRES, HATFIELD ROAD,
ST. ALBANS, HERTS.**

or write giving full details to Dept.: C.P.S. Marconi House
336/7, Strand, London, W.C.2, quoting reference WW
2970V.

DIPLOMATIC WIRELESS SERVICE

(FOREIGN OFFICE)

Applications are invited from Qualified Candidates to fill, by competitive interview, the following posts, in the North Buckinghamshire area:

**ONE SENIOR SCIENTIFIC OFFICER
TWO SCIENTIFIC OFFICERS**

Candidates must be British subjects or Citizens of the Irish Republic born within the Commonwealth, or in the Irish Republic of parents born within those territories.

The Senior Scientific Officer should possess Honours Degree in Physics or Engineering, or equivalent qualifications, and have at least three years' experience of working on Radio or Electronic Equipment. Scientific Officers should possess similar qualifications.

Salary Senior Scientific Officer £1,078 rising to £1,265 p.a.

Salary Scientific Officers £565 rising to £995 p.a.
Closing date for applications 10 days from the appearance of this advertisement.

Write, giving age, qualifications and experience to:—

**Chief Establishment Officer,
Diplomatic Wireless Service,
Foreign Office, London, S.W.1.**

HANDLEY PAGE LTD.

(Cricklewood, London, N.W.2)

seek a limited number of

ELECTRICAL ENGINEERS

Positions of wide scope and interest can be offered to qualified Engineers wishing to specialise in the

**Design and Development of
Aircraft Electrical Installations**

including Radio, Radar and Instrumentation of services, e.g. fuel, pressurisation, etc.

Applicants having qualifications of not less than G.I.E.E. or H.N.C. (elec.) standard and fair drawing board experience are invited to write to:

**Staff Officer,
Handley Page Limited,
Cricklewood,
London, N.W.2.**

**ASSISTANCE WITH HOUSING AND
REMOVAL EXPENSES WILL BE
GIVEN IN APPROPRIATE CASES.**

CINEMA - TELEVISION LTD

The following Staff are required to assist in an increasing programme of engineering and manufacture of high-grade television equipment for Broadcast and Laboratory Application.

Excellent opportunities exist for men with the right ability and experience.

PROJECT ENGINEERS

to be responsible for the engineering development and production of television and allied equipment which would include some progressing and the supervision of some technical staff. Applicants required to possess qualifications to H.N.C. or equivalent standard (suitable practical experience considered in lieu).

TECHNICAL ASSISTANTS

preferably with test experience, conversant with the use of Laboratory Test Equipment, required to work with minimum supervision.

PROGRESS ENGINEER

to assist in the administration of department manufacturing television equipment.

PROTOTYPE WIREMEN

for the production of highest grade television transmission and allied equipment. Applicants to possess sound knowledge of both radio and television together with some experience of layout and wiring of video equipment. Wiring to be of instrument standard and capable of producing own component layouts. (One candidate may be selected as assistant to foreman.)

COPY WIREMEN

required with good practical knowledge of television and radio technique and capable of copy wiring to a high standard.

**5-DAY WEEK · PENSION SCHEME · GOOD
CANTEEN · 1 MIN. BUS AND RAIL SERVICES**

Write, giving particulars of age, experience and salary required to
**CINEMA-TELEVISION LIMITED, Worsley Bridge Road,
Lower Sydenham, S.E.26.**

CINEMA - TELEVISION LTD

BRITISH TELECOMMUNICATIONS RESEARCH LIMITED

Associated with

AUTOMATIC TELEPHONE & ELECTRIC CO. LTD.

and

BRITISH INSULATED CALLENDER'S CABLES LTD.

Reg. Office & Laboratories

TAPLOW COURT, TAPLOW, Nr. MAIDENHEAD, BERKS.

invite applications for permanent appointments

ENGINEERS, DRAUGHTSMEN, TECHNICAL ASSISTANTS

for Research and Development of

- | | |
|-----------------------------------|------------------------------------|
| (a) Wide-band feedback amplifiers | (c) Inductors and Transformers |
| (b) Networks and Filters | (d) Electronic Switching Circuits. |

These posts are permanent and carry attractive salaries. Working conditions and staff facilities are exceptionally good, and assistance with house, and/or an allowance towards removal expenses will be given in approved cases after the applicant has joined the Company.

Applications and enquiries will be treated in strictest confidence and should be addressed to The General Manager, British Telecommunications Research Limited, Taplow Court, Nr. Maidenhead, Berks, quoting reference A/33.

ELECTRONIC & ELECTRICAL ENGINEERS

required for various projects of an interesting nature and offering full scope for advancement. A range of vacancies exists from Senior to Junior for those with qualifications and experience.

Engineers with extensive experience and without qualifications will also be considered for various worthwhile positions. Applications from ex Services Technical Personnel are invited.

Good salaries paid according to age and experience. Generous sick and superannuation arrangements.

Write stating age, qualifications and experience to

Personnel Manager (Ref. R.G.),

**THE GENERAL ELECTRIC CO., LTD.,
Applied Electronics Laboratories, Allesley, Coventry**

DIGITAL DATA PROCESSING

The SHAPE Air Defense Technical Center is increasing its activity in the field of high-speed digital data-processing.

Applications are invited from suitably qualified persons with interest in one or more of the following fields:

- Digital computation.**
- High-speed analog-digital conversion.**
- Computer input and output devices.**
- Transistor and magnetic-core techniques, applied to computers.**
- Cathode-ray tube displays.**

The basic salaries will be based on the European average for corresponding background and experience. Successful applicants from foreign countries will benefit by a number of privileges including a foreign allowance of the order of 70% of the basic salary, and reimbursement of the cost of moving their families and household effects to The Hague and back to their country of origin on termination of contract. The total income is tax free in the Netherlands.

Applications, containing detailed information on training and past experience, should be sent as soon as possible to:

**The Director,
SADTC, P.O. Box 174,
The Hague, Netherlands.**

NEW ZEALAND

Radio Mechanics

Applications for posts with the New Zealand Post and Telegraph Department are invited from fully experienced single men between 21 and 30.

Excellent pay and conditions. Free passages are granted to successful applicants. For full information apply to New Zealand Migration Office, Adelphi Building, John Adam Street, London, W.C.2, quoting this advertisement.

TEST ROOM PERSONNEL REQUIRED

Duties: Testing and calibrating a wide range of telecommunication and industrial electronic instruments.

Qualifications: We shall be pleased to receive applications from any man with or without academic qualifications, who is able to demonstrate suitable experience and training.

Call any day including Saturday mornings at

**MARCONI INSTRUMENTS LIMITED
LONGACRES, HATFIELD ROAD
ST. ALBANS, HERTS.**

or write giving full details to Dept. C.P.S., Marconi House, 336/7, Strand, London, W.C.2, quoting reference WW 2970X.

Television Development and Test Equipment Engineers

A well known West London manufacturer requires Engineers for the development of black and white and colour television receivers and associated test equipment.

Vacancies exist for both Senior and Junior Engineers in the Television Development Department and for Junior Engineers in the Test Equipment Department.

Senior Engineers should have academic qualifications and several years' development experience. Junior Engineers require either academic qualifications or experience in development or equipment calibration and maintenance.

Progressive salary policy ensures rapid advancement for Engineers who show exceptional initiative and responsibility. All posts are permanent and carry the benefit of the Firm's Pension Scheme.

Please write fully, in confidence, stating age, qualifications and experience to Box No. 7441.

R. B. PULLIN & CO. LTD., GREAT WEST ROAD, BRENTFORD MIDDLESEX

invite applications for the following appointments in their progressive and steadily expanding organisation.

(1) CHIEF TEST ENGINEER

to take charge of a department concerned with the production testing of electronic equipment of considerable variety and technical interest. Substantial experience is essential, preferably in a similar capacity, and familiarity with A.I.D. requirements would be an advantage. Technical qualifications to H.N.C. standard or the equivalent are desirable.

(2) SENIOR DEVELOPMENT ENGINEER (ELECTRO-MEDICAL)

to undertake a responsible part in the design of a wide range of Electro-Medical Instruments. An honours degree or the equivalent would be an advantage but is by no means essential.

(3) DEVELOPMENT ENGINEERS (ELECTRONIC)

to be concerned with the design of a variety of SPECIALISED INSTRUMENTS and TELE-COMMUNICATIONS EQUIPMENT. Qualifications ranging from O.N.C. to degree standard are acceptable.

For the development posts applicants should have had appreciable previous experience of valve or transistor circuit design preferably (although not necessarily) in one of the above fields.

All appointments are permanent, pensionable and carry attractive salaries; they offer excellent prospects and the opportunity to work on a variety of interesting projects.

Applications will be treated in strict confidence. They should include details of qualifications and experience, an approximate indication of the salary required, and should be addressed to the Superintendent, Electronic Development Division (posts 1 and 3 above), or the Superintendent, Medical Development Division (post 2).

CENTRAL ELECTRICITY AUTHORITY HEADQUARTERS

Second Assistant Engineer (Electronics)

Applications are invited for the appointment of a Second Assistant Engineer in the Plant Design Branch at Headquarters in London.

Duties will primarily be to assist in the investigation of problems associated with the application of electronic equipment to power station control and instrumentation, an important part of the work being the critical assessment from the points of view of both reliability and performance of equipments which are commercially available. The successful applicant may also be required to give assistance in connection with problems of control and instrumentation generally.

Candidates should have a degree in electronic engineering, or comparable technical qualifications, and practical experience in the design or manufacture of electronic equipment. Some knowledge of power station control and instrumentation would be an advantage.

Salary within the scale £1,210—£1,570 p.a.

Application forms obtainable from Secretary's Office (Establishments), Central Electricity Authority, Applications Section, Winsley Street, London, W.1. Quote Ref. W.W./340.

RADIO TECHNICIANS IN CIVIL AVIATION

A number of appointments are available for interesting work providing and maintaining aeronautical telecommunications and electronic navigational aids at aerodromes and radio stations in various parts of the United Kingdom.

Applications are invited from men aged 19 or over who have a fundamental knowledge of radio or radar with some practical experience. Training courses are provided to give familiarity with the types of equipment used.

Salary £561 10s. at age 25 rising (subject to a practical test) to £671. The rates are somewhat lower in the Provinces and for those below age 25. Prospects for permanent pensionable posts for those who qualify.

Opportunities for promotion to Telecommunications Technical Officer are good for those who obtain the Ordinary National Certificate in Electrical Engineering or certain City and Guilds Certificates. The maximum salaries of Telecommunications Technical Officers are Grade III £790, Grade II £925, Grade I £1,160.

Apply to the Ministry of Transport and Civil Aviation (ESB1/RT), Berkeley Square House, London, W.1, or to any Employment Exchange (quoting Order No. Westminster 2109)

MURPHY RADIO ELECTRONICS DIVISION

ENGINEERS are required in the design laboratories to work in the following fields:—

SPECIAL PURPOSE TELEVISION EQUIPMENT

**MOBILE COMMUNICATION SYSTEMS
POINT TO POINT TELEPHONE RELAY**

TELEMETER DEVICES

RADAR NAVIGATIONAL AIDS

AIRCRAFT AND GROUND AERIALS

Both Senior and Junior engineers are required and there is ample opportunity for advancement to staff with energy and initiative who are willing to accept responsibility.

Location of laboratories allow easy access to both London and open country and Sports Club and other recreational facilities are available locally. Good conditions of employment including a Pension and Life Assurance Scheme.

Apply in writing initially giving full details of age, experience and qualifications to:—

Personnel Department (E38),
Murphy Radio Limited,
Welwyn Garden City,
Herts.



A. V. ROE & CO. LIMITED WEAPONS RESEARCH DIVISION

(GUIDED MISSILES)

WOODFORD, CHESHIRE

have vacancies in their

TRIALS DEPARTMENT

for the following

1 SENIOR ENGINEERS

to be responsible for design and development of instrumentation and monitoring systems.

2 SENIOR ENGINEERS

to develop service test equipment.

3 MECHANICAL AND ELECTRONIC TECHNICIANS

to operate in Trials Teams both in U.K. and Australia.

4 TECHNICIANS

for environmental testing.

5 DRAUGHTSMEN

to form part of development teams.

The work is concerned with the development of a guided weapon project and for Post 3 willingness to travel to and from Australia is essential.

QUALIFICATIONS: Posts 1 & 2 - H.N.C. Standard
Posts 3 - 5 - Preferably O.N.C. Standard.

Previous experience is not necessary providing that initiative is shown and that candidates are willing to work with a minimum of supervision.

The Division is situated within easy access of Manchester and the Derbyshire Hills, and the company provides excellent canteen facilities and a superannuation scheme.

Applications should be addressed as follows:—

POSTS 1 & 2

THE CHIEF ENGINEER,
WEAPONS RESEARCH,
A. V. ROE & CO. LIMITED,
WOODFORD, CHESHIRE.

POSTS 3, 4 & 5

THE PERSONNEL
MANAGER,
A. V. ROE & CO. LIMITED,
GREENGATE,
MIDDLETON, M'CHESTER.

Quoting Reference WRD/HWL/RI4/W

VACANCIES FOR SKILLED CRAFTSMEN IN GOVERNMENT SERVICE AT CHELTENHAM

Experience in one or more of the following:—

1. Maintenance of radio communication receivers.
2. Sub-assembly lay-out, wiring and testing of radio type chassis.
3. Cabling, wiring and adjustment of telephone type of equipment.
4. Fault finding in, and maintenance of, electronic apparatus.
5. Maintenance of Teleprinters or Cypher Machines and associated telegraph equipment.

BASIC PAY: £9/2/4 plus merit pay, assessed at interview and based on ability and experience as under:

ORDINARY RATE: 10/- to 40/-

SPECIAL RATE: 38/- to 70/-

Opportunities for permanent and pensionable posts.

Five-day week, good working conditions, single accommodation available.

Apply to: Personnel Officer, G.C.H.Q. (FOREIGN OFFICE), 53, Clarence Street, Cheltenham.

PHYSICISTS AND ELECTRICAL ENGINEERS

Progressive positions are open to qualified people of degree standard for work on development and manufacture of special radio valve and microwave devices.

Initial training at the Research Laboratories of the G.E.C. will be available for certain selected candidates.

Canteen, pension fund and social club.

Apply quoting T/1 to:—

Personnel Officer, THE
M.O. VALVE CO. LTD.,
Brook Green,
Hammersmith, W.6.

MANUFACTURERS of VALVES for G.E.C.

DEVELOPMENT ENGINEER

INTERESTING U.H.F. PROJECT

Degree or equivalent. U.H.F./
V.H.F. experience essential

Apply Box No. 0059 c/o W. World.

Venner Electronics Limited

require

several development engineers for a new laboratory carrying out interesting work on transistor circuit design.

Previous experience with transistors is not essential. Initial salary and prospects are attractive and holiday arrangements will be honoured. Applications should be sent in complete confidence to:

The PERSONNEL MANAGER
Kingston By-Pass, New Malden,
SURREY.

TROUBLE SHOOTERS TESTERS TRAINEE TESTERS

FOR AM/FM RECEIVERS

GOOD RATES AND
CONDITIONS

APPLY: ACE RADIO LTD.
WILLESDEN 3902.

MULTITONE ELECTRIC CO. LTD.

invite applications from
Intermediate and Junior

ELECTRONIC ENGINEERS

for work on the development and testing of an interesting range of new electronic projects. There are vacancies for engineers with a wide range of qualifications and experience up to and including H.N.C. standard. Experience of development work or fault-finding advantageous. Preferred age range 20/30 years but applications will also be considered from young men who have recently left school with Higher School Certificate in Science. Apply stating age and giving particulars of education, training and experience to 12/20, Underwood Street, London, N.1.

MARINE RADAR

Never before have the opportunities been so great for experienced engineers to achieve satisfaction with their design work.

Join a world famous Company and see your ideas take shape in prototype and production form.

Decca Radar offer unique facilities for capable men to put new ideas into quick production.

There are Senior and Junior vacancies for:

MICROWAVE ENGINEERS

Write or telephone the Chief Development Engineer, DECCA RADAR LTD., 9, Davis Road, Chessington, Surrey. Telephone: ELMbridge 5281.

VACANCIES IN GOVERNMENT SERVICE

A number of vacancies, offering good career prospects, exist for:—

Radio Operators — Male

Cypher Operators — Male & Female

Apply, giving details of education, qualifications and experience, to:—

Personnel Officer, G.C.H.Q. (FOREIGN OFFICE),
53 Clarence Street, Cheltenham.

ASSISTANT CHIEF ENGINEERS with prospects of early promotion to **CHIEF ENGINEERS** required for modern laboratory of a progressive engineering company situated in the eastern suburbs of London. The selected candidates will be responsible for the control of design and engineering aspects of the manufacture of products in the following fields:

T.V. Component Design and Circuit Application Work

or

R.F./I.F. & Tuner Applications in Radio & T.V. Fields.

These vacancies are caused by normal expansion of company business and present excellent opportunities. A good and progressive salary, commensurate with qualifications and experience, will be paid to the successful applicants. Please reply, giving full details to Box No. 1125 c/o Wireless World.

THE MANCHESTER COLLEGE OF SCIENCE AND TECHNOLOGY

Advanced Engineering Studies

Part-time day courses of post-graduate level are available in the following four branches of Electrical Engineering:

Electrical Machinery
Electric Power Systems
Radio Communication
Control Systems

The courses are largely analytical and are primarily intended for university graduates in the final year of their practical training; they will demand attendance on one day (Thursday) each week. Further details may be obtained from The Registrar, The Manchester College of Science and Technology, Manchester, 1

MARCONI INSTRUMENTS LTD., TECHNICAL PERSONNEL REQUIRED Senior & Junior Electrical Design Engineers SENIOR & JUNIOR MECHANICAL DESIGN ENGINEERS

DUTIES: To undertake the design of Test Equipment covering practically the whole electronic field, including Telecommunication, Guided Weapons, and Nuclonics. Considerable personal responsibility and freedom is given, and there are no set rules regarding the number of people engaged on a project, the allocation of project leaders, etc.

QUALIFICATIONS: The ability to design equipment and aggressively progress a project through to the stage where a model is made and the information is available for a production drawing office. Senior engineers are usually of B.Sc. standard with practical experience in measuring techniques, while Junior engineers are often Graduate Members of one of the Professional Institutions, or have similar qualifications, but this is in no way mandatory. The ability to progress the project through to a satisfactory conclusion is the prime requirement. Due to expanding activities, men with drive and initiative can be sure of progressive advancement.

Comprehensive pension and assurance schemes are in operation, and Canteen and Social Club facilities are provided.

HOLIDAY ARRANGEMENTS CAN BE MAINTAINED

Call any day including Saturday mornings at

**MARCONI INSTRUMENTS LTD., LONGACRES,
HATFIELD ROAD, ST. ALBANS, HERTS.**

or write giving full details to Dept. C.P.S., Marconi House, 336/7, Strand, London, W.C.2, quoting reference WW 2970W.

ELECTRONIC ENGINEERING CAREERS

A well established organisation of world repute offers progressive posts to ENGINEERS, PHYSICISTS, DRAUGHTSMEN AND TECHNICIANS OF ALL GRADES for a planned expansion of a branch of their Research and Development Division. The projects include Marine and Airborne Radar, Guided Weapon Systems, Microwave Links and Electro Mechanical Devices. All the posts are pensionable and offer outstanding scope for advancement to candidates possessing initiative, originality of thought, and an aptitude for hard work.

The establishment is in pleasant country surroundings within 30 miles of London and housing assistance is available to selected applicants after a probationary period. In some cases, a subsistence allowance is payable during the probationary period.

Opportunities to participate in trials at sea or in the air, or to travel overseas for short periods, frequently occur in some positions.

Examples of specific vacancies are given below. Four figure salaries are envisaged for the senior positions with corresponding scales for other grades.

SENIOR ENGINEERS. Qualifications required are, Graduate of a University or Corporate Member of an Engineering Institution together with at least 5 years' experience in a responsible position in one of the above fields; exceptional, proved ability and extensive experience in a responsible position will be accepted in lieu of academic qualifications. Successful candidates will be members of the Senior Design Staff leading a team of engineers, with full technical responsibility for a project. Ability to conduct technical negotiations at senior levels with Government and other organisations, and possession of the vision and drive necessary to control a project from inception to completion are essential.

ENGINEERS (Electronic). Successful candidates will work under the general direction only of a Senior Engineer and will have ample scope to exercise initiative and originality of thought. The minimum qualifications required are, H.N.C. or equivalent together with 3 years' experience in the Industry, but not necessarily in the fields mentioned. Applications are also invited from graduates without experience who, after a suitable period, would qualify for the senior posts above.

ENGINEERS (Electrical). The successful candidates will be required to undertake the design of small motors, generators, transformers etc. as used in electronic and electro-mechanical equipment. Qualifications required are, H.N.C. or equivalent and at least 3 years' experience in this field.

ENGINEER/DRAUGHTSMAN. The successful candidate will be required to control and direct work of the design drawing office, and must be thoroughly conversant with Government and Commercial drawing procedure. The minimum qualifications are, H.N.C. or equivalent, with at least 10 years' drawing office experience of which a minimum of 5 years have been in a responsible senior position.

DESIGN DRAUGHTSMEN. Candidates for these posts should possess H.N.C. or equivalent and have had at least 5 years' experience in the Industry, with an accent on mechanical design. They must be capable of interpreting the design engineers' requirements and translating these into production drawings.

Those interested in any of the above posts are invited to write, in confidence, giving details of qualifications, experience and salary required to Box 0453 c/o "Wireless World."

TEXAS INSTRUMENTS LIMITED A new British Company TRANSISTOR APPLICATIONS ENGINEERS

required for the Engineering Division of this United Kingdom Manufacturing Subsidiary of Texas Instruments Incorporated, the world's leading transistor manufacturer.

This is a unique opportunity for qualified engineers or physicists with experience in circuit applications. Previous knowledge of Semiconductors is not essential providing good experience has been obtained in any of the following:—

Control Systems. L.F. amplifications, servo-mechanism associated with aircraft and guided weapons.

Telephony. Carrier telephony, automatic exchanges, digital computers, telemetry.

High Frequency Applications. V.H.F. radio, I.F. and video amplifier design.

Rectifiers. Power rectifiers, signal and reference diodes.

Salaries commensurate with age, ability and experience.

The Company operates a non-contributory Pension Scheme and Life Insurance and Family Medical Benefits.

Reply to:—General Manager (Technical), Texas Instruments Limited, Dallas Road, Bedford.

Z & I AERO SERVICES LTD.

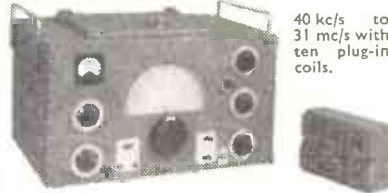
SPARES FOR AR-88D RECEIVERS

I.F. Transformers, 1st, 2nd, 3rd and 4th	12/6 each
Set of four	£2 0 0
I.F. Crystal Load Transformers	12/6 each
Knobs, small or medium	4/- each
Tuning Dial Assy.	10/- each
Dial Window Plate	15/- each
Flexible Coupling	2/- each

Bakelite Back Cases for Avo Model 40	7/6 each
Front Panels for Avomitor Universal	7/6 each

Marconi CR-150 Communication Receivers, range 2 to 60 mc/s, dual superhet, fully overhauled and guaranteed **£50 0 0**
Power Supply Unit for the above **£10 0 0**

EDDYSTONE 358X COMMUNICATION RECEIVERS



40 kc/s to 31 mc/s with ten plug-in coils.

PRICE: Aerial Tested, complete with ten coils **£12 10 0**
 Fully overhauled and guaranteed, complete with mains power pack **£25 0 0**

ALSO, for the first time we have available separately coils in sets of ten or individually, at 17/6 each or £6/10/- per set of ten.

MARCONI TF428B/I VALVE VOLT-METERS, .10 to 150 v. in five switched ranges; resonant frequency 400 mc/s; complete with diode probe, brand new, in original transit case, with spare valves, **£35**.

INSULATION TESTERS

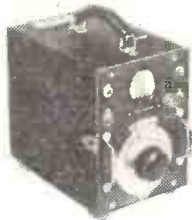
Record "Minor" 500 v. Insulation Tester, in leather case	£10 0 0
Evershed "Wee" Meggers, in leather cases: 500 volts	£12 10 0
250 volts	£11 10 0
Evershed 500 v. Meggers, 40 megohms	£22 10 0
Evershed 1,000 v. Meggers, 100 megohms	£27 10 0
Evershed 1,000 v. 200 megohms Bridge Megger	£55 0 0

Marconi CR-100 Communication Receivers, range 60 kc/s to 30 mc/s, mains operated, in good operating condition **£20 0 0**

These can also be supplied fully rebuilt and guaranteed, price on application.

ATTENTION RADIO AMATEURS AND MODEL MAKERS

Brand new American Test Kits, comprising the following:



Frequency Meter (Absorption) BC-906-D, range 150-235 mc/s.



Test Oscillator I-196, portable, battery operated; frequency range 150-235 mc/s.



Test Receiver BC-1065, 150 to 235 mc/s, battery operated; contains one valve 1D8GT and two Valves 957.



Range Calibrator BC-949; contains a resonating circuit that can be switched to produce signals from 8 to 81 kc/s. Valves: one each 6SL7GT and 6H6.



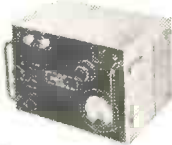
Indicator BC-936; contains a diode rectifier circuit (957) to rectify received pulsed RF signals. The output can be supplied to a C.R. Oscilloscope.

PRICE: £5 . 10 . 0 per set.

CARRIAGE: £1 . 0 . 0 extra.

ECHO BOX TS-61/AP

Hand Tuned Echo Box, having a frequency range of 3140 to 3360 mc/s. Accuracy ± 10 mc/s; Microammeter for measuring relative power and resonance indication. PRICE, each ... **£7 10 0**



AMPLIFIER ALIGNMENT UNIT TS-92/AP.

Superhet Receiver having a range of 15 to 500 mc/s, accurate to $\pm .125$ mc; Low pass filter adjustable from .5 to 7 mc bandwidth. Selectivity 3 db down at 50 kc from resonance Sensitivity 100 mA for $\frac{1}{2}$ -scale deflection of the meter.

PRICE, each **£12 10 0**

FREQUENCY METERS

BC-221 Frequency Meter, 125 kc-20 mc/s. LM Series Frequency Meters, Naval Version of the above. MARCONI TF-643 Absorption Frequency Meters.

SIGNAL GENERATORS

Marconi TF-144G, 85 kc to 25 mc. Marconi TF-390G, 16 to 150 mc/s and other ranges. Marconi TF-517F, 18-58 and 150-300 mc/s or 130-260 mc. R.C.A. type 710 UHF Signal Generator 370-560 mc.

KLYSTRONS AND MAGNETRONS AT SPECIAL PRICES: QK59, QK-60, QK-61, QK-62, 417A, 5J29, 5J30. All brand new and guaranteed at **£2** each.

HALLICRAFTER S-27C UHF RECEIVER,

130 to 210 mc/s, FM/AM Detectors, for 115 V. A.C. operation, fully overhauled and guaranteed **£50**.

MARCONI TF-340 OUTPUT METERS. Fully overhauled and guaranteed **£32/10/-**.

We buy good American Communication, Test and Aircraft Equipment such as: BC-312, BC-342, BC-348, ARC-1, ARC-3, ART-13, ARN-6, ARN-7, etc.

Z & I AERO SERVICES LTD.

14, South Wharf Road, Paddington, London, W.2

Telephone: AMBassador 0151/2.

Telegrams: ZAERO W2 London.

SOLDERING ?



for 25 years
the best

25 watt Instrument Model

A model for
every purpose

Leaflets on request from :

W. T. HENLEY'S TELEGRAPH
WORKS CO. LTD.
51-53 Hatton Garden,
London, E.C.1

Tel: CHAncery 6822

NEW GRAMOPHONE AND SOUND EQUIPMENT

GLASGOW.—Recorders bought, sold, exchanged, cameras, etc. exchanged for recorders or vice versa.—Victor Morris, 406, Argyle St., Glasgow, C.2. [0201

TRUE HI-fidelity: have you heard Vortexion tape recording equipment in use with the latest Wharfedale and Goodman's Hi-Fi speakers? Why not arrange a personal demonstration, when we can give you our undivided attention and help you with your Hi-Fi problems? Write or phone for appointment.
GRIFFITHS HANSEN (RECORDINGS), Ltd., 32-3 Gosfield St., Langham St., W.1. [0293 2771/0642

TAPE Recorders, Ferrograph, 76gns; Reflectograph, £27; Brenell 49 gns tape decks. Weatite, Collaro, Truvox; microphones, Reslo, S.T.C., Acos; amplifiers, Leak, 27gns; Quad, £42; hire purchase facilities available; high fidelity tape to disc service.—**Lambda Record Co.,** 4, Kimberley Ave., Liverpool, 23. [6884

OLD-ESTABLISHED studio offers you benefit of years of experience recording for broadcasting, TV, films, theatre, etc., in choosing your professional or domestic T.R. Leavers-Rich, Ferrograph, M.S.S. Brenell Mk. IV, mics., tapes, speakers, etc., special tape bargains, tape/disc service, mobile and studio recording.
"EROICA" Recording Studios (1949), Peel St., Eccles, M/C, Eccles 1624. Director, Thurston Smith, A.R.M.C.M. [0122

ATTENTION! The famous Sonomag "Adaptatape" pre-amplifier is now fitted to the Collaro Mk. IV tape deck and now incorporates push-pull oscillator, complete with power pack; 38gns. Easy terms and full specification on request.—**Sound Tape Vision,** the tape recorder and Hi-Fi specialists, 71, Praed St., London, W.2. Pad. 2807. [7555

CINE-VOX disc recording equipments, type CTJ, for high-quality recordings from existing microphone equipment; price from 28gns; also available as a complete channel inclusive of mic., amplifier and playback equipment, at 70gns; type C7 for highest quality professional requirements.—recorder mechanism at 48gns, or complete channel at 110gns; demonstrations arranged in London.
PLEASE write for details to K.T.S., Ltd., "Coplow," Park Rd., Braunton N. Devon, Tel. Braunton 224. Callers by appointment only.

GRAMOPHONE AND SOUND EQUIPMENT—SURPLUS AND SECONDHAND

FERROGRAPH 3 A/N as new, also accessories, tapes available: £74.—Box 892 [0199

BIB tape splicers, with base, 13/6, without, fix direct to tape-recorder, 11/- including post.—44, Shipman Rd., Forest Hill, S.E.23. [7314

LEEVERS-RICH recorder, 11 1/2in spools, 15 ips, timing clock, variable spooling, etc., £300, perfect condition; Vortexion 4-channel mixer, £15; Sugden Connoisseur m/c cutter head, £15.—Box 1089. [7297

CABINETS

LEWIS RADIO have the best selection and finest finish.—See page 68. [0224

CABINETS, radiogram and television, 25 models.—157, Bromsgrove St., B'ham, Mid. 1054. [7140

VALVES WANTED

ALL types of valves British or American, transmitting and receiving, keenest cash prices paid. Write or call for offer.—Write or call Lowe Bros., 9a, Diana Place, Euston Rd., N.W.1. [6985

WANTED, EXCHANGE, ETC.

WANTED Mullard valve tester, cheap.—44, Shipman Rd., Forest Hill, S.E.23. For. 5513. [7313

WANTED Voigt Corner Horn with or without drive unit.—Parker, 17, Kingsley Park Ave., Sheffield, 7. [7309

WANTED, HRO coils, Rxs., etc., A.R.88s, BS548s, S27s, etc.—Details to R. T. & I. Service, 254, Grove Green Rd., London, [0163 Ley. 4986.

VALVES (new), tape recorders, test equipment, any quantity.—Stan Willett, 43, Spon Lane, West Bromwich, Staffs. Tel. Wes. 2392. [7079

LEE ELECTRONICS.—For all leading makes of high-fidelity equipment, tape recorders, tuners, amplifiers, speaker enclosures; bought, sold, exchanged.—400, Edgware Rd., Pad. 5521. [7283

URGENTLY required, scrap platinum wire, contacts, etc.; spot cash for any quantity; £27 per oz troy.—The Scientific Metal Co., 50, Old Brompton Rd., London, S.W.7. Tel. Knt. 2534. [7235

CASH on the spot for second-hand tape recorders, amplifiers and Hi-Fi equipment, top prices paid.—**Sound Tape Vision** (Dept. W.W.), 71, Praed St., London, W.2. Paddington 2807.

WANTED, BC610 Hallcrafters, E.T.4336 transmitters, BC312 receivers, BC221 frequency meters and spare parts for all above; best cash prices.—P.C.A. Radio, Beaver Lane, Hammersmith, W.6. [0079

BENSON'S BETTER BARGAINS

CAR RADIO (Command Receiver, Medium wave), circuit and modification data, 1/6. **COMMAND RECEIVERS,** brand new, with 6 valves, BC454, 3-6 mcs., 45/-, Med. wave, 0.52-1.5 mcs., 97/6, used 82/6 (post 3/-). **HRO** Vibrapacks, 6 v., D.C. to 180 v. 50 mA., smoothed, cased, 22/6 (post 3/-). **Accumulators,** Varley Dry 2 v., 15 AH, 12/6, wet, 15 AH, 7/6. **Indicator Units,** new, with VCR97, 3/VRS1, 2/CV18, 2/VRS4, 24/- (carr. 6/-). **Responder** ZCR931, 190/220 mcs., with valves, 17/6 (carr. 7/6). **VIBRATORS,** Mallory G629C 12 v., 4 pin, 7/6. **THROAT MICS.,** new, 2/6. **SMALL MIC. TRANS.,** 3/6. **BRAND NEW** RE.28, 27, 25/- (post 2/6); RF25, 10/6. **RF26/27** damaged dial, 15/-, **CONTROL UNITS** with 6 P.P.O. Key switches, 15/- (p.p. 3/-). **DYNAMOTORS** (post 3/-): 12 v. to 250 v., 65 mA., and 6.3 v., 2.5 A., 11/6; 6 v. to 250 v., 80 mA., 12/6. **SMALL** 26 v. to 210 v. 140 mA., 15/-, **EDDYSTONE,** 12 v. to 190 v., 75 mA., cased, 15/-, Input 24 v., outputs 475 v., 210 mA., 22/6. **METAL RECTIFIERS:** 240 v., 100 mA., 4/-; 500 v., 300 mA., 10/-; 240 v., 30 mA., 3/6. 1,000 v., 30 mA., 7/6. 6 v., 13 A., 25/-; 120 v., 2 A., Bridge, 30/-, **RL155** Coil packs, used, 9/6. **RL155 8.M. Tuning DRIVES "N"** type, brand new, 10/6. **CHOSES, L.P.,** 10H, 120 mA., Screened, 7/6. 10H, 200 mA., 3/6; 10H, 400 mA., 17/6. 5H, 200 mA., 4/6. **SWITCHES,** wafer: 1 pole 6 way, 1 bank, 1 p 11 w 1 b, 1 p 8 w 1 b, 1 p 3 w 3b, 2p 3w 2b, 4p 2w 1b, 1p 6w 5b, 1p 6w 2b, 2/6; 1p 11w 2b, 6p 2w 4b, 3/6. **Stud type,** 1p 9w 2b, 4/6. **Muirhead type** IP24W2B, 7/6. **TRANSFORMERS:** "C" core: 220 v. in, outputs: 315-0-315 v., 60 mA., 5 v., 2 A., 6.3 v., 1.5 A., 25/- (p.p. 3/-). 215/315 v., 350 mA., 790/850 v., 480 mA., 40/- (carr. 7/6). **Potentiometers,** w. wound 20 k., 3 1/2in. dia., ceramic, 4/6. **Transmitter/Receivers** No. 18, with valves, 50/- (less attachments, carr. 7/6); **POWER UNITS:** input A.C. 200/250 v., Outputs: 300 v., 80 mA. D.C. and 6.3 v., 3 A. A.C., smoothed, filtered, fused, new, 35/-; **METERS:** ex-equt. 500 mA. 2in. Rd. Fr. 12/6. **FILTER UNITS,** 8 way, rated 600 v. D.C. diecast case, 7/6. **RECTIFIER UNITS,** Input 230 v. A.C. Output 12 v., 2 A., D.C. Grey metal cased, 22/6. **Receivers** BC1068 with valves, 9/5F, 1/1D8GT. **VIEW** new, 15/-, **TRANSFORMERS,** Auto 600VA 240/180 v. and tapped, 45/- (carr. 5/-). **TEST SETS 74A,** Suitable oscilloscope basis; 10 valves, VCR139A and 50c. power pack. Fair cond., 50/- (carr. 7/6).
S.A.E. please! Terms, C.W.O. Postage extra. Immediate despatch.

Callers and post: W. A. BENSON (W/W)
186, Bathhouse Road, Liverpool, 15. SEF 6853.
Callers: SUPERADIO (W'chapel) LTD.,
116, Whitechapel, Liverpool, 2. ROY 1130

HANNEY offers Components for

- OSRAM 912 PLUS AMPLIFIER
- OSRAM 912 PASSIVE UNIT
- OSRAM 912 PRE-AMPLIFIER
- OSRAM F.M. PLUS TUNER
- MULLARD "TAPE" AMPLIFIERS
- MULLARD 510 AMPLIFIER
- MULLARD 510 "A" PRE-AMPLIFIER
- MULLARD 510 "B" PRE-AMPLIFIER
- MULLARD 3/3 AMPLIFIER
- MULLARD F.M. TUNER UNIT
- "WIRELESS WORLD" BAXAND-ALL PRE-AMP.
- "WIRELESS WORLD" F.M. TUNER UNIT
- DENCO MAXI-Q F.M. TUNER UNIT

Manuals available:
912 PLUS AMPLIFIER—4/-; OSRAM F.M. PLUS TUNER—2/6; MULLARD HIGH QUALITY AMPLIFIER MANUAL (contains F.M. details)—3/6; DENCO F.M. TUNER—1/6.
Send 23d. postage, stating lists required. General Components list also available.

L. F. HANNEY

77, Lower Bristol Road
Bath

- **AERIAL EQUIPMENT.** Poles, Masts, Dipoles, Yagi, Microwave arrays. Whips. 12in. Whips to 90ft. Masts.
 - **CABINETS AND RACKS.** 36in. to 95in. high, standard 19in. wide.
 - **CONDENSERS** up to 10,000 mfd. and 50 kV.
 - **FUSES.** Cartridge and E.S. 1/2 amp. to 600 amps.
 - **INSULATORS** 80 different patterns.
 - **LOUDSPEAKERS** 3in. dia. to 50 watt Theatre Systems.
 - **METERS.** 2in. to 12in. dia. 120 different types.
 - **POWER SUPPLIES.** Generators, Rectifiers, Vibrators, Inverters, Dynamotors from 2 volts 100 amps. to 36,000 v. 1/2 amp.
 - **RECEIVERS.** 80 types available from 15 Kcs. to 600 mc/s. including portable, D.F., Table Rack and Pedestal.
 - **TEST GEAR,** American over 100 different types, Meters, Calibrators, Signal Generators, etc.
 - **TELEPHONE AND TELEGRAPH EQUIPMENT.** Single and multi channel apparatus, filters, switchboards, power supplies, perforators, printers.
 - **TRANSFORMERS** Audio and Power, 200 types from 2 volts to 18,000 volts and up to 15 kVA.
 - **TRANSMITTERS,** 60 different types from UF-1 Handie Talkie to G-50, 2,500 watts.
- FULL LISTS AVAILABLE

Send your requirements. All packing and shipping facilities.

P. HARRIS,

ORGANFORD, DORSET

Telephone: LYCHETT MINSTER 212

Armstrong

High Quality VHF Radiograms
Incorporating

- AF 105 10 watt push-pull amplifier
- 5 Wave bands including VHF
- Independent Bass & Treble boost and cut controls
- High Flux Speakers
- Wide range Pick-up



THE TWIN £74.16.6

The TWIN has been designed to suit the smaller type of room without sacrificing quality of reproduction. This has been achieved with a compact cabinet (31 1/2 in. high, 27 1/2 in. wide and 14 1/2 in. deep) soundly constructed, and finished in elegant Walnut veneer. Twin 10 in. P.M. Speakers give faithful reproduction, free from distortion and resonance, and the latest 4 speed COLLARO autochanger is fitted. The radio chassis is housed in a unique "hopper" arrangement permitting armchair control over all operations.



THE STANDARD £88.4.6

The STANDARD is a full size Radiogram (35 in. high, 4 1/2 in. wide and 19 in. deep) constructed to give the best possible tonal quality, and fitted with an Adjustable Bass Reflex Chamber. It is beautifully finished in two tone Walnut, and has exceptionally generous record storage capacity (200 records).

The other components have been selected to maintain this high standard. The Record Player is the latest COLLARO 4 speed fully mixing autochanger fitted with the Studio Turnover Crystal Pickup head. The Speaker is a 10 in. GOODMANS P.M. having a very high flux density (12,000 lines)

DEMONSTRATIONS at our Holloway showrooms every weekday (inc. Saturday) 9-6 p.m.

HIRE PURCHASE facilities are available.

ARMSTRONG WIRELESS & TELEVISION CO. LTD.

Warlters Road, London N.7.

Telephone: NORth 3213

WANTED, EXCHANGE, ETC.

URGENTLY wanted, manuals or instructor books, data, etc., on American or British Army, Navy or Air Force radio and electrical equipment.—Harris. 93, Wardour St., W.1. Gerrard 2504. [6995]

WANTED, good quality communication RYS tape recorders, test equipment, domestic radios, record players, amplifiers, valves, components, etc., estd. 18 years.—Call, send or phone Ger. 4638, Miller's Radio, 38a, Newport Court, Leicester Sq., W.C.2. [7074]

ALL U.S.A. V.H.F. test and communication equipment; TS174, TS175, TS47, E.C.221 freq. meters; receivers 1294, 1359; Hallicrafters S.27, S27CA U.S.A.; APR4 and tuning units TN16, 17, 18 and 19, RCA AR88D-LP, Hallicrafters SX28; valves 707A-707B, 2K28, 2K39, 2K33, 2K41; highest offers given by return.—Ger. 8410 and 4447.—Universal Electronics, 22, Lisle St., Leicester Sq., London, W.C.2. [0229]

REPAIRS AND SERVICE

MAINS transformers rewound, new transformers to any specification. MOTOR rewinds and complete overhauls; first-class workmanship; fully guaranteed. F.M. ELECTRIC Co., Ltd., Potters Bldgs., Warser Gate, Nottingham, Est. 1917. Tel. 47898. [0113]

TRANSFORMERS rewound or built to specification, up to 8KVA, singly or in quantities; 12 months' guarantee. NOTTINGHAM TRANSFORMER SERVICE, 179, Wollaton St., Nottm. Tel. 41992. [7260]

USE Jefco coil winder, cheapest machine on the market.—Details, 170, London Rd., Southend-on-Sea. [0174]

MAINS transformers, E.H.T.s, chokes, field coils, etc., promptly and efficiently rewound or manufactured to any specification. LADBROKE REWIND SERVICE, Ltd., 320a, Harrow Rd., London, N.W.10. [0222]

WE have in stock 1,000s and 1,000s of service sheets for sale or hire; these are the actual ones used by the trade; please send s.a.e. with enquiries.—M. Foy, 6, Wykebeck Gardens, Leeds, 9. [7208]

D. C. BOULTON for repairs to any loud-speaker: specialists on heavy and P.A. types; cone assemblies, field coils, repair accessories, pressure units, microphones; transformers rewound and to specifications; motor rewinds.—134, Thornton Rd., Bradford, 1. Tel. 22838. [0171]

PAINTS, CELLULOSE, ETC.

PANL, recognised for many years as the unique one-coat black crackle finish, brush applied, no baking; available by post in 1/8th pint cans at 3/6 from: G. A. Miller, 244, Nether St., London, N.3. [0260]

MISCELLANEOUS

TAPE to disc; 12/6.—Mobile Recording Services, 5, New Brown St., Manchester. [6555]

COIL winding machines, as new, and small stock of wire; Birmingham area.—Box 1516. [7347]

REWINDS, all types of transformers rewound as original or new types supplied to your specification.

MANUFACTURERS of the "Meltronic Series" of quality transformers and chokes. MELTON ELECTRONICS LTD., 42, Towngate St., Poole, Dorset. Tel. Poole 2044-5. [7343]

FOR sale 50 chimney brackets; brand new with corner plates/hooks. £12 10s. carriage forward.—Box 1184. [7312]

REFRIGERATOR spares of every description.—Farron Refrigeration, Station Approach, Sanderstead, Tel. 3655. [7221]

TAPE to disc, Queensway Recording Studios, 123, Queensway, W.2, Bay. 4992. Recorders serviced and for hire. [6994]

TAPESPONDING—Exchange your recorded messages with tape pals home/overseas.—Ewart, 87, Terrace, Torquay. [7320]

HAVE your tape recordings transferred to LP discs; quick service.—Supertone Radio, 29, King St., W.3. Acorn 2594. [0195]

RENDEZVOUS RECORDS offer comprehensive size 78/LP tape to disc recording facilities. Leaflet from: 19, Blackfriars St., Manchester 5. [7249]

PLAIN white valve cartons, best quality board. 4 sizes available from miniature to large G; list on request.—R.H.S., Ltd., 155, Swan Arcade, Bradford. [0195]

TOROIDAL inductors, considerable stocks held of wound coils up to 1H.; Toroidal winding to order.—Bel Sound Products Co., Marlborough Yard, London, N.19. [0182]

METALWORK, all types cabinets, chassis, racks, etc., to your own specification; capacity available for small milling and caption work up to 1in bar. PHILPOTT'S METAL WORKS, Ltd., Chapman St., Loughborough. [0208]

TAPE to disc recording—LP (30 mins.), 25/-; 78's 12/-; 48-hour service; s.a.e. leaflet.—Marsh, Little Place, Moss Delph Lane, Aughton Ormskirk, Lancs. Aug. 3102. [6907]

CABINETS by STAMFORD

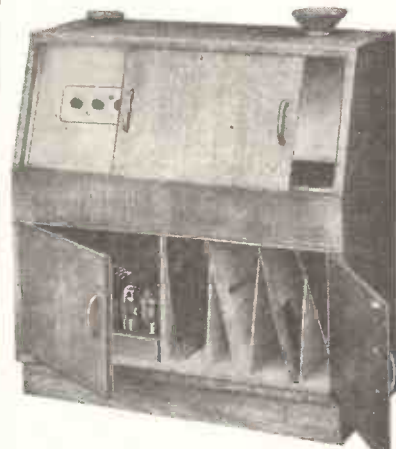
GP 41/301

21in. wide, 16 1/2 in. high, 17in. deep. Motor Board 20in. x 16in. with 4in. clearance above. Control panel 20in. x 9 1/2 in. Area under Motor Board 20in. wide, 16in. deep, 9 1/2 in. high. Price £9/15/- or 20/- deposit and 9 payments of 19/10 monthly.



THE VENTNOR

26in. wide, 35in. high, with choice of Motor Boards either (A) 35in. x 14in. (as shown), or (B) 17in. x 14in., and control panel 16 1/2 in. x 12 1/2 in. Amplifier compartment and LP record storage in lower section. Price £15/15/- or 47/- deposit and 9 payments of 32/- monthly. Bottom section can be supplied with loudspeaker baffle or full length control panel.



GP 39

31 1/2 in. wide, 35in. high, 16in. deep, with choice of Motor Boards: (A) 35in. x 14 1/2 in., or (B) as shown, 16in. x 14 1/2 in., having 4 1/2 in. clearance below the top of the motor board and 1 1/2 in. above. Control compartment: Deck area 18 1/2 in. x 13 1/2 in. Front panel 16 1/2 in. x 12 1/2 in. with 1in. clearance. Lower section 13in. high, amplifier compartment 16 1/2 in. wide, 14 1/2 in. deep. Record capacity 125 LP. 2 sliding doors to top section. Hinged or sliding doors at bottom. Price £18/18/- or 56/- deposit and 9 monthly payments of 38/6.

All Cabinets are veneered in Oak, Walnut or Mahogany, finished to shade required. Delivery 12/6 in England and Wales (Scotland & N. Ireland 25/-). Write for Catalogue of cabinets for EQUIPMENT, RECORDS, SPEAKERS, and P.YE BLACK BOX. Satisfaction guaranteed or money refunded.

A. L. STAMFORD (Dept. Q4)

20 College Parade, Salisbury Road, London, N.W.6

LONDON CENTRAL RADIO STORES

G.E.C. (Reconditioned) Model BC4010 10-VALVE OVERSEAS RECEIVER

100 v. to 250 v. A.C. mains, twin speakers, 5 wavebands, covering 25 Mc/s, 10 Mc/s, 3 Mc/s, 1,500 Kc/s, 300 Kc/s (equivalent to 11-2,000 metres). P.P. output, separate Bass and Treble Controls, full vision tuning scale, etc. Walnut cabinet 24x19 1/2 in. high x 12 1/2 in. deep.

For Callers only 18 gns. METAL RECTIFIERS. Ex-Govt., made by S.T.C., 250 v. 60 mA, size 5 1/2 x 1 in. dia. Unused. 7/6. **WIREWOUND RESISTANCES.** 160Ω 1 A. Overall size 10 x 1 1/2 in. dia. Unused. 5/6.

ELECTRO MAGNETIC COUNTERS. Ex-G.P.O., every one perfect, 500 ohm coil, counting to 9,999, operated from 25 v.-50 v. D.C., 4 1/2 in. long x 1 1/2 x 1 in., many industrial and domestic applications. 5/6.

PUSH-BUTTON HAND CONTROLS. Complete with indicator lamp, heavy duty H.F. on/off switch, 3 yds. 15 amp. 6-core cable and 6-pin Jones plug. 27/6.

3 OHM SPEAKERS. In good working order. 10 in., 25/-, 8 in., P.M., 11/6.

MOVING COIL HAND MIKE. Type No. 7, 8/6. **VIBRATORS.** Synchronous 6 v. 7-pin and 2 v. 7-pin, 7/6 each.

MEGGER CIRCUIT TESTING OHMMETER in leather carrying case, as new, 53/5/-.

AYO UNIVERSAL TEST METERS. Reconditioned as new. In perfect working order. Model 40 £11/10/-, Model Z £10/10/-.

VENNER 8-DAY CLOCKWORK TIME SWITCHES 230 volt, 1 amp., 3 1/2 x 2 1/2 x 2 1/2 in., 25/-, 230 v. 25 amp. in iron-clad case. Size 9 x 7 x 4 in., weight 12 lb., 45/-.

UNISELECTOR SWITCHES. Have many applications including automatic tuning, circuit selection, etc. Operates on 25-40 v. Full wipe 4-bank, double coils. 32/6. Half wipe 6-bank. 12/6.

2-VOLT VIBRATOR POWER PACKS. Output 200 volt 60 mA. Size 9 x 5 x 3 1/2 in. £11/7/6.

5-INCH ALDIS LAMP REFLECTORS. Glass parabolic. 6/-.

All prices include carriage.

23 LISLE ST. (GER. 2969) LONDON, W.C.2
Closed Thursday 1 p.m. Open all day Saturday

COAXIAL CONNECTORS UG TYPE

21-B/U, 58/U, 290/U, etc.
According to JAN & MIL Specifications for Aircraft, etc.

Full list available. Send your requirements. Overseas Enquiries Invited

N.A.R. Agencies Ltd.

40 King's Road, London, S.W.3

RECORD PLAYERS



GRAM MOTORS & AUTOCHANGERS CABINETS

COLLARO AC.3/554. Three-speed, single player for A.C. mains 200/250 v., cream finish, complete with turnover crystal pick-up. "T" type head. Strictly limited quantity at £619/6, plus 5/6 carr.

CRYSTAL PICK-UPS fitted Acos HGP37 cartridge. Ultra lightweight. Our price 37/6, plus 2/6 carr.

3-SPEED RECORD PLAYERS. Fitted with Acos turnover HGP99 pick-ups with twin sapphire styl, revolve case with lid, fitted clips and handle. Worth 10 gns. Our price £71/5/6, plus 5/6 carr.

3-SPEED GRAM. MOTORS! by well-known maker. Our price 59/6, plus 5/6 carr.

REXINE COVERED CABINETS. single player size, suitable most non-auto units, including transcription mixers. (Motor board units). Our Price 46/-.

PORTABLE RECORD PLAYER CABINETS to house Monitor, Collaro, or Garrard 120 Changers, with spare for Amplifier and Speaker. Rexine finish in attractive colours. Fitted catches and handles. Our Price £3/5/-.

Send stamp for complete bargain list.

RONALD WILSON & CO.
(DEPT. W.W.) 12 BRIDGE STREET, WORCESTER

MISCELLANEOUS

USE Britain's oldest full-time tape/disc transfer service for LPs and Mark 78s (still 1952 rates).—Sound News Productions, 59, Bryanston St., London, W.1. Amb. 0031. [0192]

HEAVY duty auto-transformers (ZA22917) input and output 100/120v, 150/170v, 200/250v, 40/60 cycles, 500 watts approx. all brand new in makers' boxes 49/6. part cost packing and carriage 7/6. Brand new electric motors. 1/6th h.p., standard 1/2 in shaft, continuous 1,400rpm rating, made by Hoover, Compton Parkinson, etc., 120-125 volt a.c. 50-cycle single-phase, or 110-120v a.c. 50-cycle single-phase, 59/6; 220-230v d.c., 55/-; 200-220v a.c. single-phase 79/6; part cost packing and carriage 7/6 in each case. **WALTON'S WIRELESS STORES, 48, Stafford St., Wolverhampton.** [0145]

NOTICES

BRITISH SOUND RECORDING ASSOCIATION. Details of membership, open to the professional sound recording engineer and all others interested in recording high quality reproduction and other branches of audio engineering, together with details of the London lecture programme and the Manchester, Portsmouth and Cardiff Centres, may be obtained from the Hon. Membership Secretary, H. J. Houlgate, A.M.I.E.E., 12, Strongbow Rd., Eltham, S.E.9. [0031]

AGENTS WANTED

ADVERTISERS wish to enter into a mutual arrangement for representation by gentleman at present calling upon manufacturers of equipment employing electronic units or devices: please write in strictest confidence.—Box 0750. [7245]

BUSINESS AND PROPERTY

DRURY Lane, W.C.—Light workshop available, suitable TV servicing, light and phone.—Holborn 8622. [7284]

BUSINESS AND PROPERTY WANTED

PREMISES central London sought by small private recording service, sharing partnership consid.—Box 8828. [0194]

BUSINESS OPPORTUNITIES

ANGLO-AMERICAN house in New York seeks exclusive franchise for U.S.A., Latin America or Canada for British tape recorder mechanisms, record changers or Hi-Fi speaking units; also interested in manufacturing licenses.—Box 1340. [7340]

WELL-KNOWN firm of precision engineers and instrument makers (London area) are desirous of entering into a licence agreement or purchasing outright, patents relating to electrical and/or mechanical devices of a precision instrument character, or of a consumer goods nature; adequate capital and production facilities are available to develop, produce and market suitable devices.—Communications should be addressed, in the first instance, to Box 7247. [7146]

CAPACITY AVAILABLE

CHASSIS work, instrument cases, embossed panels, in all usual metals. Special groundboards in S.R.B.P., etc. Long or short runs. Precision work at low prices. Extensive range of stock tools for radio and electronics industry; special tooling at favourable rates.—Metalwork Dept., Unitelex (London), Ltd., Parnell St. London, S.E.14. Tideway 5842. [0200]

WORK WANTED

ELECTRONIC apparatus wiring and sub-assembly work wanted.—Please write E. G. C. Rawson, 47, Morley Crescent West, Stanmore, Middlesex. [7220]

SUB-ASSEMBLY work invited by specialising company; excellent capacity for longish runs; increased output for you at reduced costs.—Box 1016. [7295]

SITUATIONS VACANT

HER Majesty's Overseas Civil Service.

A VACANCY exists for an Assistant Superintendent of Police (Signals Officer) in Tanganyika.

CANDIDATES, preferably under 30 years, must have sound knowledge and practical experience of the installation and maintenance of all types of H/F and V.H.F. equipment including erection of masts used in Police, fixed and mobile radio communication or similar services and should have good knowledge of the maintenance and repair of petrol and diesel generating sets.

APPOINTMENT is permanent and pensionable with salary including inducement pay in the scale £379-£1,422 per annum. Other allowance £15 on first appointment. Free initial issue of uniform and an annual allowance of £25 towards its upkeep. Free passages for officer, wife and children up to cost of three adult passages. Government quarters when available at low rent. Taxation at low local rates. Generous leave.

SUMMARY of personal particulars, qualifications and experience to the Director of Recruitment, Colonial Office, London, S.W.1, quoting BCD55/8/09. [7354]

SERVICE technician with experience of television and V.H.F. required; Dublin firm; state qualifications, experience, salary expected.—Box 1468. [7544]

SELENIUM RECTIFIERS

40 ma. to 10 amp., 6 v. to 100 v. Bridge, H.Wave or P.P.

WITH OR WITHOUT HIGH-GRADE TRANSFORMER TO SUIT. These are new goods, best makes, not reconstructed Government surplus. Popular types, 6 v. 1 a., 4/-, 2 a., 7/6, 12 v. 2 a., 8/6, 12 v. 1 a., 7/6, 12 v. 3 a., 15/-, 6 a. alloy-finned type, 27/6, 24 v. 0.3 a., 9/-, 0.6 a., 12/6, 24 v. 1 a., 13/6, 2 a., 15/6, 24 v. 3 a., 21/-, 50 v. 1 a., 24/-, 50 v. 2 a., 42/-, 130 v. 300 ma. h. wave, 38/-, 250 v. 300 ma. do., 65/-, 110 v. 1 a. bidge., 48/-, 130 v. 80 ma. bidge., 21/-.

CHARGER KITS

No. 1, a kit for 2 v., 6 v., 12 v., 3 amp. transformer, rectifier, ammeter, all high-grade new parts, not rubbish, 52/6, unique convactor housing for same, as illust., 12/6, p.p. 3/-, ditto, but 2 amp., 43/-, case 12/6, p.p. 3/-.

Economy 12 v. 3 amp. kit, no ammeter needed, 34/6, p.p. 2/6, all with 12 months' guarantee.

CHAMPION PRODUCTS,

43 UPLANDS WAY, LONDON, N.21.

Telephone: LAB 4457

JAMES H. MARTIN & CO.,
CADENZA dual Impedance Microphone & table stand £10.10.0. **TRIX T43** Amplifier £19.19.0. **APEX** band III Converter £5.15.0. **TSL LORENZ** Concert Soundcorner, £13.16.3. **Richard Allen** 'Golden unit' speaker 10" diam. £7.5.6. **AM/FM** Radiogram chassis from £24. Stamp (only) for Lists. **James H. Martin & Co.,** Finsthaite, Newby Bridge, Ulverston, Lancashire.

NEW BOOKS

ON RADIO & TELEVISION

The G.E.C. Valve Manual, new edition.	7/6
Transistor A.F. Amplifiers, by Jones and Hibbourne. Postage 1/-	21/-
Receiving Aerial Systems, by Davidson. Postage 9d	21/-
Principles of Telecommunication, by Harbottle and Hannam. Postage 1/-	17/6
Understanding Hi-Fi Circuits, by Crowhurst. Postage 1/-	23/-
Electro-Technology for Nat. Cert. Courses, by Buckingham and Price.	
Postage 1/-	12/6
Radio Valve Data, by "Wireless World"	
Postage 6d	5/-
Transistors Theory and Practice, by Turner Gernsbach Library. Postage 9d	16/-
Television Explained, by Miller, new edition. Postage 1/-	12/6
Radio Vol. 3 for City and Guilds Radio 3 exam., by Tucker. Postage 9d.	12/6
Transistors, by Bettridge. Postage 4d.	2/6

UNIVERSAL BOOK CO.

12 LITTLE NEWPORT STREET, LONDON, W.C.2 (adjoining Lisle Street).

Smith's of EDGWARE ROAD

ELECTRONIC COMPONENTS DISTRIBUTORS FOR OVER 25 YEARS

Some popular lines:

FOUR-SIDED BLANK CHASSIS

Made in our own works from commercial quality half-hard aluminium of 16 s.w.g. thickness, these chassis will carry components of considerable weight and normally require no corner strengthening.

Standard stock sizes (in inches) are as follows:—

6 x 4 x 2	5/-	12 x 5 x 3	7/11	13 x 10 x 2 1/2	9/8
7 x 5 x 2	5/6	12 x 7 x 2 1/2	8/-	14 x 10 x 2 1/2	10/-
10 x 4 x 2	6/4	11 x 8 x 2 1/2	8/3	12 x 10 x 3	10/3
9 x 7 x 2	6/6	10 x 8 x 3	8/6	16 x 10 x 2 1/2	10/6
12 x 4 x 2	6/10	15 x 8 x 2 1/2	8/10	17 x 10 x 2 1/2	11/3
9 x 8 x 2 1/2	7/6	12 x 9 x 2 1/2	8/11	17 x 9 x 3	11/6
10 x 8 x 2 1/2	7/10	14 x 7 x 3	9/6	17 x 10 x 3	12/3

Special sizes to order. The same material cut to any size up to 3ft. at 4/- per square foot.

Close Tolerance Wax-protected Silver Mica

CAPACITORS

Values stocked (pF):

5	22	47	75	130	180	270	370	515	635	815	3000
10	25	50	80	135	200	290	385	535	670	820	3300
11	27	56	82	140	220	320	440	600	760	1000	3500
13	28	60	100	145	225	316	410	558	703	1500	4000
15	30	65	110	160	230	330	450	600	710	2000	4700
18	33	68	120	180	245	340	470	600	750	2200	5000
20	40	70	125	175	250	350	500	603	800	2500	

Tol. up to 33pF, 1pF over 33pF, 1 per cent.
 PRICES: 5-300 pF 6d.; 316-300pF 10d.; 1,000-2,500 pF 1/3; 3,000-5,000pF 1/6.
 Special (limited number only), 0.1 mfd. 1%, 12%.
 *Surplus stocks of mica, paper and ceramic capacitors from 6d. each.

*DAILY GUARANTEED ELECTROLYTICS

Full range from 1/6 each.
***HIGH STABILITY RESISTORS.** "T.S.L." 1/4-watt 10% tol. 5-year guarantee. Full "preferred value" range, 12Ω to 10MΩ, 6d. each. 1% tol., 2/6 each.
 *Surplus stocks, various makes:

1/4 watt	6%	2%	1%
1/2 watt	7d.	10d.	1/3
1 watt	9d.	1/-	1/6
1 watt	10d.	1/3	1/9

***"ELECTROVOICE"** guaranteed TRANSFORMERS AND CHOKES. Individually tested. Fully shrouded. Used by leading laboratories. 66 types in stock. **WAFER SWITCHES** made to order. Quotations on request.

The COOPER-SMITH HIGH FIDELITY AMPLIFIER

Model BPI Main Amplifier, £16. Build-it-yourself, £14. Mk. II Pre-amp. and Control Unit, £10. Build-it-yourself, £7/10/-.

DIRECT FROM MAKER TO USER

A better 10 watt amplifier at lower cost. Send for illustrated details of this remarkable outfit or hear it in our demonstration room.
 Other HI-FI equipment includes Acoustical, Leak, Rogers, Lowther, Goodmans, Wharfedale, Lorenz, Philips, Connoisseur Collaro, Garrard, Goldring.

AMERICAN RELAYS, brand new:—
 8-make, 60Ω coil, small, 2/3; 2-make, 50Ω coil, 3,000 size, 2/6; 4-make, 50Ω coil, 3,000 size, 3/6.
 2-make, 2-brak, 50Ω coil, large, 2/6.
VISUAL INDICATORS, type 3 (100/4) containing two micro-amp movements. Brand new, 6/6 each. With neon lamps (two), 9/6.
 200 V. D.C. wkg **MANSBRIDGE CAPACITORS.** Suitable for crossover units, etc. 5 mF, 4d. each; 1 mF, 6d. each; 2mF, 6d. each; 4 mF, 9d. each.
POWERFUL 24 V. D.C. MOTORS. 2in. square, 4 mm. spindle. Will work on A.C. 6/6.
LIGHTWEIGHT HEADPHONES: "Ivalek," 2,000Ω, 12/6 pr. "Stein" 4,000Ω, 17/6 pr.
AMERICAN 21-way PLUGS AND SOCKETS, with cover, 7/6 pr. **AMPHENOL 4Pin.** one hole fitting (13/16in.), retaining screw, chromium plated. 5/6.
 Chromium plated **INSTRUMENT HANDLES,** 7 1/2 x 1 1/2in. 3/6 pr.

High-Grade METERS

By LEADING MANUFACTURER

Flush mounting, 3 1/2in. dia. (less flange) 3in. scale.
 DC Moving Coil:—100 microamps FSD, resistance 750. Calibrations:—0-20mA. 0-3kV. 0-5kV. 0-2 mA./0-250V. 5-0-5/0-10. 0-50mA./0-1kV. 85/-
 0-100 milliamperes, res. 0.75. 50/-
 0-500 volts, res. 500k. 65/-
 0-1,000 volts, res. 20k. (20k. PV). 95/-
 AC Moving Iron:—0-300 volts, with external res. 50/-
 5 amps, FSD, scale 0-50. 50/-
 All the above are brand new and tested.

*Lists available

H. L. SMITH & CO. LTD

287/289 EDGWARE ROAD LONDON W2
 Telephone Paddington 5891

SITUATIONS VACANT TV TECHNICAL SALES.

A VACANCY has arisen in the TV Technical Sales Department of Pye, Ltd., for an Assistant, whose duties include the preparation of quotations and the handling of orders, correspondence and enquiries relating to the sale of television transmission equipment at home and overseas.

PREVIOUS experience in this work is not essential although a knowledge of television equipment would be an asset. Important qualifications are ability to deal with customers at all levels and to work on own initiative. APPLICATIONS should be addressed to the Chief Engineer, Pye, Ltd., Cambridge, quoting "ATS" [7351]

INSTRUCTOR, Grade I, required by

POSTS and Telegraphs Department, Nigeria Federal Government for one tour of 12-24 months in first instance. Salary scale (including inducement addition) £1,536 rising to £1,674 a year. Disturbance allowance £200-£250. Gratuity at rate of £150 a year. Commencing salary according to experience. Free passage for officer and wife. Assistance towards children's passages and grant up to £150 annually towards maintenance in U.K. Liberal leave on full salary. Candidates, preferably under 40 years of age, should have had experience in the installation or maintenance of Multi-channel radio telephone systems and be conversant with V.H.F. and F.M. techniques. They must have had not less than three years' teaching experience and should possess C. & G. Certs. in Telecomms. Principles III and Radio III or equivalent.—Write to the Crown Agents, 1, Millbank, London, S.W.1. State age, name in block letters, full qualifications and experience and quote M2C/42120/WF. [7330]

SENIOR Electronic and Mechanical Engineers.

ARE required by Pye, Ltd., of Cambridge, for an expanding TELEVISION programme for home and export markets.

OPPORTUNITIES exist for suitably qualified and experienced engineers to join the design and development teams of one of the country's leading T/V manufacturers in the following fields:

1. T/V Receivers.
2. T/V Transmitters, medium and high power.
3. T/V Terminal equipment, including studio and O.B. equipment.
4. INDUSTRIAL T/V.
5. T/V Flats Distribution Systems.

ALTHOUGH desirable, previous T/V experience is not essential, and applications will be welcomed from engineers with several years' design and development experience in other branches of the electronics industry. APPLICATIONS should be addressed to the Chief Engineer, Pye, Ltd., St. Andrew's Rd., Cambridge, quoting "STE." [7318]

APPLICATIONS are invited for pensionable posts as

EXAMINERS in the

PATENT Office.
 TO undertake the official scientific, technical and legal work in connection with Patent applications.

AGE at least 21 and under 35 years on 1st January, 1957, with extension for regular Forces' service.

CANDIDATES must have (or obtain in 1957) 1st or 2nd Class Honours in Physics, Organic or Inorganic Chemistry, Mechanical or Electrical Engineering or in Mathematics, or an equivalent qualification, or have achieved a professional qualification, e.g. A.M., C.E., A.M., Mech.E., A.M.I.E.E., A.I.C. For limited number of vacancies candidates with 1st or 2nd Class Honours degrees in other subjects—scientific or otherwise—will be considered. Exceptionally candidates otherwise qualified by high professional attainments will be considered.

STARTING pay for 5-day week of 42 hours in London between £605 and £1,120 (men), according to post-graduate (or equivalent) experience and National Service. Maximum of scale £1,345. This salary scale is being increased by approximately 5%. Women's pay above £605 slightly lower but is being raised to reach equality with men's in 1961. Good prospects of promotion to Senior Examiner (rising to £2,000 (under review) and reasonable expectation of further promotion to Principal Examiner.

APPLICATION form and further particulars from Civil Service Commission, Scientific Branch, 50, Old Burlington St., London, W.1. quoting S 128/57 and stating date of birth. INTERVIEW Boards will sit at intervals, as required. Early application is advised. [7300]

BRITISH COMMUNICATIONS CORPORATION, Ltd., Exhibition Grounds, Wembley, have vacancies for the following:—

- (1) PROCESS planning engineer with experience of methods to produce electronic telephone and similar equipment.
 - (2) DRAWING office clerk to prepare material schedules from drawings.
 - (3) DESIGNER draughtsman.
- ALL progressive, pensionable appointments. APPLY, with details of qualifications and experience, to Personnel Officer. [7352]

HI-FI—Vacancy for sales assistant with good technical and practical knowledge of all modern HI-FI equipment.—Berry's Radio, 25, High Holborn, W.C.1. [7223]

BAKERS 'Selhurst' RADIO



The Full-Range ULTRA TWELVE
 Tone resonance 20 c/s.

20-25,000 c/s
 £17. 10. 0

The BRADFORD PERFECT BAFFLE

(Patent Pending)



A COMPACT enclosure ensuring realism and clarity of reproduction with NO BOOM.

A comprehensive range for single- and multi-speaker systems is available.

From £8/15/0 for 17in. x 17in. x 1 1/2in.

We are demonstrating the GOODSELL "Golden Range," the ORTOFON Pick-Ups and the WOOLLETT Transcription Gramophone Turntable.

Daily: 9 a.m. to 6 p.m.
 Saturdays: 9 a.m. to Noon.



17, Charing Cross Rd., London, W.C.2

Tel.: TRAFalgar 5575
 (opp. Garrick Theatre)

LIMITED

Trade & Export enquiries to:—
JOHN LIONNET & COMPANY
 (at above address)

I HAVE HEARD MY FRIEND'S DUODE I WANT ONE FOR MYSELF

This letter from an overseas enthusiast says much the same as many others which come along during the year. Hear a Duode at home under proper conditions, and if you are a good judge of natural sound there's only one result—you will want a Duode Sound Unit for yourself.

Ever since Mr. A. C. Barker's invention of the famous dual drive with built-in cross-over and feed-back, which gives so wide a frequency range, such smoothness, such crystal clear, natural sound with no boom, no fizzes, no peaky noises, Duode quality has been giving great joy to an ever-increasing band of critical people who know what's right in sound.

INSIST on hearing a DUODE

Write today for details of the two latest Units.

DUODE LTD.

3, Newman Yard, London, W.1



CABINETS

for
Goodmans, G.E.C.,
Wharfedale,
Jensen.

HI-FI
Equipment and
Records supplied

Open till 5.30
Saturdays.

A. DAVIES & CO. (Cabinet Makers)
3 Parkhill Place, off Parkhill Road, London
N.W.3. GULLIVER 5775

YOUR METER DAMAGED?



Leading
Electrical
Instrument
Repairers
to the
Industry

Contractors to the Ministry of Supply and General Post Office. Repairs by skilled craftsmen of all makes and types of Voltmeters, Ammeters, Microammeters, Multirange Test meters, Electrical Thermometers, Recording Instruments, etc. Quik deliveries—for speedy estimate send defective instruments by registered post to:—

L. GLASER & CO. LTD.

Electrical Instrument Repairers
97-100 ALDERSGATE STREET, E.C.1
(Tel.: MONarch 6822).

SITUATIONS VACANT

CHIEF engineer, telecommunications department, Mauritius. Responsible for the engineering branch, particularly for the installation and maintenance of C.B. and automatic exchanges, training of technical staff and as necessary to take charge of the department.

PERMANENT and pensionable appointment or contract appointment for 3 years. Salary £1,327/10 p.a., plus cost-of-living allowance. Contract gratuity—£50 for each 3 months' resident service. Free passages for officer, wife and up to 3 children. Quarters, if available. Generous leave.

CANDIDATES must be A.M.I.E.E. or be exempted from the Institution's examinations, and have considerable practical experience in maintenance and installation of telecommunications equipment, particularly automatic exchanges.

WRITE Director of Recruitment, Colonial Office, London, S.W.1, giving age, qualifications and experience, quoting BCD 135/52/01. [7293]

THE MANCHESTER COLLEGE OF SCIENCE AND TECHNOLOGY

RESEARCH Assistant required to work on a project concerned with electronic equipment for the control of machine tools. The project is sponsored by the National Research Development Corporation.

THE successful applicant will be expected to lay out, construct and test such equipment according to the requirements and specifications supplied by research engineers. Experience of similar work is essential. Salary according to experience.

APPLICATIONS in writing, stating experience, qualifications, salary requirements, etc., should be addressed to the Registrar, The Manchester College of Science and Technology, Sackville Street, Manchester, within fourteen days of the appearance of this advertisement. [7346]

PETO SCOTT ELECTRICAL INSTRUMENTS, Ltd., Addlestone Rd., Weybridge, Surrey.

SENIOR and Junior Development Engineers are required for the design of domestic television equipment, employing printed circuit techniques.

DEVELOPMENT Engineers are also required for application and design of transistorised equipment of various types.

LABORATORY Technicians and Wires for employment on television transmission equipment and electronic instruments.

EXCELLENT rates of pay, and ideal working conditions in modern, well-equipped laboratory will be available to successful applicants.

THERE are new housing estates in the vicinity and the area is well served by train and bus services to most parts of London.—Apply: Chief Engineer. [7305]

ASSISTANTS (Scientific)—The Civil Service Commissioners invite applications for pensionable posts.

AGE at least 17½ and under 26 years of age on January 1st, 1957, with extension for regular service in H.M. Forces, but candidates over 26 with specialised experience may be admitted.

CANDIDATES must produce evidence of having reached a prescribed standard of education, particularly in a science or mathematical subject. At least two years' experience in the duties of the class gained by service in a Government Department or other civilian scientific establishment or in technical branches of the Forces is essential in one of the following groups of scientific subjects:—

(i) **ENGINEERING** and physical sciences.
(ii) **CHEMISTRY**, bio-chemistry and metallurgy.

(iii) **BIOLOGICAL** Sciences.
(iv) **GENERAL** (including geology, meteorology, general work ranging over two or more groups (i) to (iii) and highly skilled work in laboratory crafts such as glass-blowing).

STARTING pay £355 (at 18) up to £485 (women £450) at 25. Men's scale maximum £665; women's scale being raised to reach equality with men's by 1961; somewhat less in provinces; opportunities for promotion and for further education; 5-day week, generally.

FURTHER particulars, from Civil Service Commission, Scientific Branch, 30, Old Burlington Street, London, W.1, quoting No. S59/57.

INTERVIEW Boards sit at intervals, as required; early application is advised. [7319]

REQUIRED for interesting research development work on electro-acoustic devices, an Engineer up to B.Sc. standard.—Apply Box 8275, [0099]

ENGINEER required, experienced in television and radio, able to drive; good salary.—Ritz Radio & Electrical Co., 506, Neasden Lane, N.W.10. Gladstone 4983. [7299]

SEVERAL attractive and senior positions are offered in the development and industrial application of modern non-destructive testing techniques; the positions will be in the following fields:—

(1) **ELECTRONIC** Circuit Development.
(2) **PROPERTIES** of Materials.

(3) **PHYSICAL** Investigation and Measurement. They offer good scope to men of initiative and experience in the above fields; salaries will be commensurate with the candidate's qualifications and experience.

Applications should be made in writing in the first instance, giving full details of qualifications, previous experience, age and salary required and be addressed to:—

PERSONNEL Department,
KELVIN & HUGHES, Ltd., New North Rd., Barking, Essex. [7209]

OPPORTUNITIES IN RADIO



Get this FREE Book!

'ENGINEERING OPPORTUNITIES' reveals how you can become technically qualified at home for a highly paid key-appointment in the vast Radio and Television Industry. In 148 pages of intensely interesting matter, it includes full details of our up-to-the-minute home study courses in all branches of **TELEVISION and RADIO, A.M. Brit. I. R. E. City & Guilds, Special Television, Servicing, Sound Film Projection, Short Wave, High Frequency and General Wireless Courses.**

We definitely Guarantee
"NO PASS—NO FEE"

If you're earning less than £18 a week this enlightening book is for you. Write for your copy today. It will be sent FREE and without obligation.

**BRITISH INSTITUTE OF
ENGINEERING TECHNOLOGY**

388b COLLEGE HOUSE,
29-31, WRIGHT'S LANE,
LONDON, W.8.

B.I.E.T.

Tape Recorders ONLY

We specialise solely in Tape recorders, stocking every good make—Grundig—Simon—M.S.S.—Ferrograph—Wyndor—Elizabethan—Philips—Editor Sound—etc., etc. Call and hear them all in comfort, or write

Dixon's Electronics
227 OXFORD ROAD,
MANCHESTER

Telephone: Ardwick 4269

Official Grundig repair agents. Parts for most machines in stock. H.P. and credit terms.

COVENTRY RADIO COMPONENT SPECIALISTS SINCE 1925

We have now trebled the size of our premises in order to supply a larger range of Components, Amplifiers and HI-FI Equipment.

Send your enquiries to:

**189-191, DUNSTABLE ROAD,
LUTON, BEDS.**

New Telephone No.:—LUTON 7388-9

TELEPHONE SETS

IN ATTRACTIVE BAKELITE CASE
BRAND NEW EX-GOV'T. "F" TYPE

Ideal between 2 or more positions up to five miles. STORE FACTORY AND OFFICE; BUILDINGS; GARDEN SHED and HOUSE. 2 sets in individual carrying cases, complete with long life batteries, bells, ringer and 100ft. telephone cable.

£7.10.0 per pair Carr. (G.B.) 9/6



DON 3 telephone cable NEW 1 mile drum £5/10/-, carr. extra.

SPECIAL OFFER OF AERIAL MASTS
R.A.F. TYPE 50

36ft. HIGH

Kits comprise—9 2in. dia. Tubular Steel (Copper Plated) Sections of 4ft. length, top-section and base, Pickets, Guys and Fittings.

YOU can purchase this normally expensive MAST for a fraction of its cost, i.e.,

£7.10.0 ONLY
(Carr. 15/6)

Please add £1 for (returnable) wooden carrying case.

The MAST is particularly suitable to take aerials for Tx., Rx., F.M. and T.V. (especially COMMERCIAL), and has many other uses. Extra 4ft. sections can be supplied at 11/6 per section.



U.S.A. 45ft. AERIAL MAST (10 sections 4ft. 6in. x 2in., guys, etc.). This entirely new and complete set in canvas carrying bag £12/10/- each, carr. 17/6 or 2 sets with additional low and high frequency antenna £25 pair. Carr. extra.

ARMY TYPE 32FT. MASTS similar to above but 10 lin. screw-sections, suitable for permanent lightweight installation. Kit in canvas bag, £5/10/-, carriage 12/6.



TRUVOX and TANNOY LOUD HAILERS EX-GOV.

Impedance 7½ Ω Handling cap. 8 watts price 25/-, post 3/6. 45/- pair carr. paid.

Brand New TELEPRINTER EQUIPMENT CREED AUTOMATIC TRANSMITTER

No. 654/N for telegraph working, in original cases. RECTIFIER UNITS 26B. Input 110/230 v. A.C. Output 80+80 volts. In original cases. TELEGRAPH RELAYS 299 AN. Also other equipment.

TELEPHONE SWITCHBOARDS



A.D. 1240 and others—spares etc.

G.P.O. SWITCHBOARD IL.1806 10 lines, thru' connexion, £12/10/-, carriage 15/-.

Complete intercom telephone system for £50 Comprising (1) switchboard, (10) Tele-F extensions (as above), and 1 mile drum of Don 3 telephone cable. Carriage extra.

Quantity and Export enquiries are invited for all above items, also other Electronic Component parts.

HATTER & DAVIS (RELAYS) LTD.
128, KENBAL ROAD, LONDON, W.10. LADbroke 0866

SITUATIONS VACANT

AUDIO and television engineer required by leading manufacturer, applicants to submit full details of qualifications and experience; all applications treated as strictly confidential.—Box 0303. [7187]

RADIO Mechanics wanted immediately, workshop and aircraft experience essential; pay according to ability.—Apply: Chief Radio Engineer, Dan-Air Engineering, Lasham Airfield, Nr. Alton, Hants [7257]

RADIO/TELEVISION—Service engineer, capable man required, ability to drive an advantage, permanent and progressive position, half-day Saturday.—Apply, Staff Manager, Gamages of Holborn. [7321]

RADIO repairs required to repair navigational radio equipment, applicants should have good basic knowledge of radio.—Please apply: Ref. RFB, Decca Radar, Ltd., Brixton Rd., S.W.9. [7306]

TELEVISION service engineer: good position and prospects for keen man with high standards of service; able to drive; write, stating age and details of experience.—Draizin, Ltd., 59, Heath St., Hampstead, N.W.3. [7349]

AUDIO engineers required for progressive positions in expanding organisation; men with experience of development test and service work apply to Personnel Manager, E.A.R., Ltd., The Square, Isleworth. Tel. Hou. 6256. [7359]

SUPERVISOR required by leading manufacturer of high quality loudspeakers and microphones, experience in this field and ability to control female staff essential; full particulars and wages required.—Box 1413. [7328]

PERSONAL assistant required by owner of London retail radio and electrical business of good standing; congenial position and good prospects for capable and conscientious person; state age and full details of career.—Box 1517. [7348]

SUPERVISOR is required for department associated with assembly and test of high-grade transformers; considerable experience of this class of work is necessary, and electrical qualifications are desirable; ability to control female labour is essential.

GOOD salary and prospects; pension scheme, sports club, etc. APPLY by letter; setting out qualifications and experience, to Personnel Manager, R. B. Pullin & Co., Ltd., Phenix Works, Great West Road, Brentford, Middx. [7326]

TELEVISION Engineer—Large Cardiff house require experienced engineer, must have experience on all leading makes, good comfortable permanent job with excellent wages and prospects; new flat available if required.—Full particulars to Box 1100. [7302]

EXPERIENCED electrical engineer required for development laboratory to work on electro mechanical and electronic instruments; degree or similar qualification essential; housing available.—K.D.G. Instruments, Ltd., Manor Royal, Crawley. [7350]

TECHNICAL writers required for writing radar technical manuals, applicants should have previous experience in writing and good knowledge of radio and radar techniques.—Please apply: Ref. RFB, Decca Radar, Ltd., 1-3, Brixton Rd., S.W.9. [7307]

ELECTRONIC engineer required for development work on saturable reactor devices and power transformers; H.N.C. or equivalent standard, with design experience in this field.—Apply in writing to Hirst Electronic, Ltd., Gatwick Rd., Crawley, Sussex. [7294]

INSTALLATION and service engineers required by Decca Radar Ltd., applicants must have sound knowledge of both radio and radar, marine experience an advantage but not essential.—Applicants please apply in writing: Ref. RFB, 1-3, Brixton Rd., S.W.9. [7308]

FARADAY ELECTRONIC INSTRUMENTS, Ltd., 245, Brixton Rd., S.W.9, have vacancies for young men in the test and inspection department which could lead to development work for the right type of man; further education is encouraged.—Apply in writing to the Chief Engineer. [7296]

MICHAEL RADIO, Ltd., Slough, require a radio development engineer with experience in F.M./A.M. design and progressive ideas; good pay and prospects with an expanding and progressive company; pension scheme.—Apply to Personnel Officer, McMichael Radio, Ltd., Wexham Rd., Slough. [7325]

TESTER-Inspector. A leading firm in audio equipment require several young men with electronic test experience and technical knowledge, 44-hour week and overtime, career, good rate and prospects. West London region. Please state age, details of training and experience.—Box 1457. [7342]

LABORATORY technician required for development of prototype electronic equipment. City and Guilds or National Certificate qualification desirable, but practical experience essential; salary in accordance with qualifications and experience.—Apply in writing to the Director of Research, Research Laboratories, The British Aluminium Co., Ltd., Chalfont Park, Gerrards Cross, Bucks [7353]

for use with KT 88



TRANSFORMER TYPE 4N1

Capable of full output of 50 watts from 25~ to 35,000~

PRIMARY

6,000Ω C.T. tapped 43% and 25%.

SECONDARY

0.45Ω, 1.8Ω, 4Ω, 7Ω, 11Ω, 16Ω, 22Ω and 30Ω to handle 50 watts.

Approximate characteristics:

Primary resistance: 50Ω+50Ω.
Primary inductance: 50 hys.

Leakage Reactance:

Primary to secondary: 6 m/Hys.
Half primary to secondary: 3 m/Hys.
Half primary to half primary: 6 m/Hys.

Open type:

5½in. x 4½in. x 5½in. high.
Fixing Centres: 4¾in. x 3¾in.
Weight: 14½lbs.

Potted type: (Hammer Grey finish):

5in. x 5½in. x 6½in. high.
Fixing Centres: 3¾in. x 5in.
Weight: 15lbs.

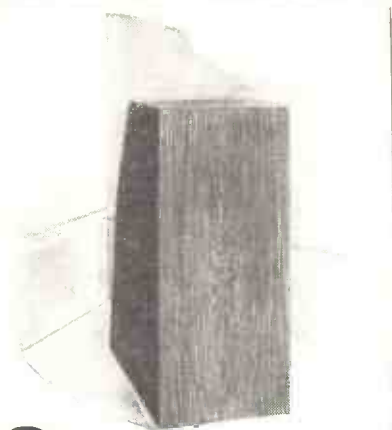
Transformer type 4N1 is designed to handle 50 watts in the Ultra Linear Circuit where cathode bias is employed.

A 100w. model is available if required.

SAVAGE TRANSFORMERS LTD.

DEVIZES, WILTS.

Tel.: Devizes 932



Davey

CORNER REFLECTOR Loudspeakers

At once the most civilised and the most natural way of listening. No ugly speaker apertures or grilles to be seen from any part of the room. Source of music widely diffused and well up in the air, with a strong sense of perspective, just as it comes from the concert platform. Six types of cabinet made to order to house every good multiple or single speaker system. **EMG HANDMADE GRAMOPHONES LTD**
6 Newman Street London W1 MUSEum 9971

FM and HI-FI COMPONENTS

- In stock for the*
- WIRELESS WORLD FM TUNER UNIT circuits 1s. 6d.
 - DENCO FM TUNER " " 2s. 0d.
 - RADIO CONSTRUCTOR FM " 3s. 6d.
 - MULLARD AMPLIFIERS " 4s. 0d.
 - G.E.C. 912 PLUS AMPLIFIERS " 2s. 6d.
 - G.E.C. FM PLUS TUNER " 2s. 6d.
- Separate price lists on request to*
J. T. FILMER 82, DARTFORD ROAD, DARTFORD, KENT.
Tel.: Dartford 4057

—OF COURSE—
FOR THE
Cyldon
"TELETUNER"
units available for
all known channels
UNCLES, BLISS AND CO. LTD
NEW PARADE · CHERRY ORCHARD RD · EAST CROYDON
SURREY · TELEPHONE: CROYDON 3379/6390

SITUATIONS VACANT

INSPECTOR required for electronic equipment and components, good remuneration and excellent prospects for advancement in expanding company.—Rivlin Instruments, Ltd., Doman Rd., Yorktown Industrial Estate, Camberley, Surrey. Telephone Camberley 2507-8. [7354]

VACANCY exists for electrical engineer or physicist, interested in the design of selenium metal rectifiers; applicant would be expected to work in close liaison with design and sales sections and be prepared to undertake original work; good salary for competent person. Automat, Moorside Rd., Swinton. Tel. Swinton 4242. [7322]

THE Medical Research Council have a vacancy for an operator to be trained in the running of their 45in cyclotron at Hammer-smith Hospital; duties will include supervision of the production of radioactive isotopes on the cyclotron and co-operation with workers using the machine for medical and biological research. **CANDIDATES** must be adaptable and willing to learn cyclotron techniques; some knowledge of electronics, including R.F. is essential. **SALARY** according to age, experience and qualifications.—Write, stating age and give full personal details, to the Senior Cyclotron Engineer, Medical Research Council, Hammer-smith Hospital, Duane Rd., W.12. [7335]

RADAR Technician, experience in Third Line Maintenance and servicing of Ground and Air Radar equipment preferred. Would suit ex-R.A.F. radar fitter or mechanic. Staff appointment.—Write, giving details of experience, qualifications, age, etc., to Personnel Department (E44), Murphy Radio, Ltd., Welwyn Garden City, Herts. [7345]

OVERSEAS. Electronic technicians to maintain & operate equipment on seismic field crews; Academic qualifications to H.N.C. or equivalent or genuine practical experience to this standard. Liberal home leave. Permanent career for men prepared to accept responsibility & work in camp conditions in all parts of the world.—Box 1239. [0188]

ABLE electronic engineers required for varied and interesting work in rapidly expanding research department, experience of pulse techniques, ultrasonic desirable but not as essential as initiative and capability.—Write giving details of qualifications, experience, age and salary required to Ultrasonoscope Co. (London), Ltd., Sudbourne Rd., London, S.W.2. [7248]

SKILLED radio mechanics. A large organisation has vacancies for men who are prepared to travel and work anywhere in the world. Periods abroad from 6-24 months. Salary £75 per month plus all found; candidates must be single, medically fit and have a good knowledge of radio theory and practice. Write Box WD.360 c/o 191, Gresham House, E.C.2. [7311]

RADIO mechanics. Skyways Limited require the following experienced radio mechanics at Stansted Airport for employment in workshops and on maintenance of equipment in aircraft. Applicants must be fully experienced particularly in workshop practice; good rates of pay and conditions of service; apply with full details to Personnel Manager, Skyways Limited, Stansted Airport, Essex. [7333]

TEST engineer required for testing prototype aircraft and allied instruments by light engineering company in south-west Essex locality; applicants should have a sound knowledge of electronics and some experience of aircraft instrumentation; experience of radio interference suppression an advantage; the work is of an interesting and varied nature requiring a methodical approach to the testing and subsequent reports of the best results.—Write, giving full details, to Box 1425. [7333]

A VACANCY exists in the Electronics Laboratory in a section engaged upon the design of special purpose television receiving equipment. Several design projects are currently in hand offering interesting work in the industrial and other fields. Applications are invited from candidates possessing experience in the design of domestic television receivers, giving details of experience and qualifications, and should be addressed to Personnel Department (E43), Murphy Radio, Ltd., Welwyn Garden City, Herts. [7338]

MEDICAL RESEARCH COUNCIL Experimental Radiopathology Research Unit, Hammer-smith Hospital, Duane Road, London, W.12. require an electronics technician to work in a laboratory engaged in construction and maintenance of a wide variety of apparatus; previous electronic experience necessary; adv. level G.C.E., O.N.C. or equivalent preferable; age limit 25; salary in scale £515-£630 plus London weighting; prospects of promotion.—Apply in writing, giving two referees, to the Director. [7327]

AMBASSADOR RADIO & TELEVISION, Ltd. have vacancies for development engineers in their television and radio laboratories. Men of degree standard or its equivalent are preferred, but lack of recognised qualifications will not exclude, providing the applicant has a keen technical interest and possesses initiative; previous experience of this class of work is an advantage, but is not essential.—Write, in first instance, giving details and salary required to Technical Director, Princess Works, Brighouse, Yorkshire. [7332]

HOME RADIO LTD. FOR THE TELETRON "COMPANION"



2 waveband 3 transistor pocket portable. Weighs only 9 ozs. Measures 4½ x 3 x 1½. Full constructional data and price list 6d. All parts available separately including neat plastic case as illustrated. Uses new type of ferrite rod tuning and sensitive reaction circuit for high gain. **COMPLETE KIT AVAILABLE £4/5/-** (plus 1/6 post). **REPANCO "TRANSEVEN" TRANSISTOR PORTABLE.** Full data, 1/9 post paid. **SPECIAL OFFERS.** 5130P voltage stabiliser valves new and boxed. Limited number only. 3/- each plus 9d. postage. Single Screened Mic. Cable, best quality, 6d. yard. Black PVC covering. Add postage.

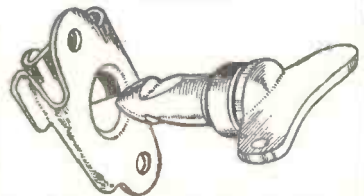
HOME RADIO (MITCHAM) LTD.

187 LONDON ROAD, MITCHAM, SURREY.
MIT 3282

T.V. Engineers required for Branches in London and the Provinces. Fully experienced. Able to drive. Top wages and prospects. Pension scheme. Write or Call **J. & F. Stone Lighting & Radio Ltd.,** Edgware Road, The Hyde, N.W.9. Tel.: COL 7061.

ODDIE FASTENERS

Pac. 507249



THIS FASTENER WITH ENDLESS APPLICATIONS—SIMPLE—POSITIVE SELF-LOCKING. MADE IN A VARIETY OF TYPES AND SIZES. SPECIAL FASTENERS TO SUIT CUSTOMERS' REQUIREMENTS. WIDELY USED IN THE RADIO INDUSTRY.

Illustrated brochure and other information will be gladly sent on request.
DEPT. "W.W."
Oddie, Bradbury & Cull Ltd., Southampton
Tel.: 55883 Cables: Fasteners, Southampton

JUST PUBLISHED

TRANSISTOR A.F. AMPLIFIERS

Price 21s. Postage 8d.
By D. D. Jones and R. A. Hilbourne.

Principles of Telecommunications Engineering, Vol. 1, by H. R. Harbottle and B. L. G. Hanman. 17/6. Postage 1/-.

Understanding Hi-Fi Circuits, by N. H. Crowhurst. 23/-. Postage 1/-.

Receiving Aerial Systems, by I. A. Davidson. 21/-. Postage 6d.

Basic Mathematics for Radio and Electronics, by F. M. Colebrook and J. W. Head. 17/6. Postage 8d.

Magnetic-Amplifier Circuits, by W. A. Geyger. 52/6. Postage 1/3.

Dry-Battery Receivers, by E. Rodenhuis. 32/6. Postage 1/-.

Radio Valve Data, Compiled by "W.W.". 5/-. Postage 6d.

The Radio Amateur's Handbook, by A.R.R.L. 1957 ed. 32/6. Postage 1/6.

THE MODERN BOOK CO.
19-23 PRAED STREET
LONDON, W.2

BRITAIN'S LARGEST STOCKISTS OF
BRITISH AND AMERICAN
TECHNICAL BOOKS

Please write or call for our catalogue.
PADDINGTON 4185. Open 6 days 9-6 p.m.

SITUATIONS VACANT

TEST-Engineers.—Vacancies exist for experienced engineers, applications are invited from test engineers with previous industrial experience of testing radio communication or similar electronic equipment; the work of the test laboratory of this expanding company is varied and includes the testing to specification of prototype and small batch production of the following types of equipment:—

- (a) COMMUNICATION and broadcast transmitters (50w to 10kw).
 - (b) COMMUNICATION receivers.
 - (c) MARINE installations including automatic alarms and d.f. equipment.
 - (d) INDUSTRIAL r.f. heaters up to 125kw.
 - (e) AUDIO amplifiers (2w-2kw).
- THE positions are permanent and progressive and the salaries offered will be commensurate with qualifications and experience.—Apply. Giving full details to Personnel Officer, Rediffon Ltd., Broomhill Rd., S.W.18. [7336]

ENGINEER required to assist on sales and demonstration of VHF radio-telephone equipment; this is an interesting appointment for a young engineer with some general experience of VHF systems and with a presentable manner. Please write giving details of past experience, qualifications, age and salary required, to Personnel Department (E41), Murphy Radio, Ltd., Welwyn Garden City, Herts. [7303]

RADIO technicians of all grades are invited to apply for interesting and varied positions in car radio servicing, installation and development. Vacancies occur from time to time for our dealers at all parts of the country; a high standard of practical and theoretical knowledge of radio technology is required.—Apply in the first instance to: Personnel Officer, S. Smith & Sons (Radiomobile), Ltd., North Circular Rd., London, N.W.2. [10270]

INSTRUCTOR in marine radio required by the College of I.M.R. Comms., Overseas House, Brooks' Bar, Manchester, 16; technical standard equal to C. & G. Radio III with Telecommunications. Principles II desirable; P.M.G. 1st class certificate and lecturing experience in radio an advantage; salary based on Burnham Scale with pension scheme for man of proved ability.—Write Principal (Ref. "Staff"), giving full particulars in confidence. [7316]

RADIO technicians required by International Aeradio, Ltd. for overseas service; permanent pensionable positions; inclusive salary from £845 per annum to £1,616 per annum, tax free, according to marital status; child allowances; free accommodation, free insurance, kit allowances, free air passages, generous P.M.G. leave; qualified candidates to whom replies only will be sent please write, quoting R.T. to Personnel Officer, 40, Park St., W.1. [10262]

NUCLEONIC and Electronic Development Engineer required by manufacturers who have pioneered development and production in this field; the successful applicant will be responsible for complete electrical development of instruments; there are first-class facilities available in new laboratories; the salary offered will be in the region of £350-£1,100 p.a. and there is an attractive pension scheme in operation.—Apply, stating qualifications and experience, to Chief Engineer, Dynatron Radio, Ltd., St. Peters Rd., Furze Platt, Maidenhead, Berks. [7325]

SECTION leader is required by A. V. Roe & Co., Ltd., for the environmental test laboratory of the Weapons Research Division (Guided Weapons) at Woodford, Cheshire. This laboratory is equipped to carry out a wide range of vibration and climatic tests on electronic and electro-mechanical components. Applicants should be of degree standard and possess experience of electronic development work and light engineering practice. Replies should be addressed to The Chief Engineer, A. V. Roe & Co., Ltd., Weapons Research Division Woodford, Cheshire, quoting Ref. No. SL/R-23/W. [7339]

STANDARD TELEPHONES & CABLES, Ltd., North Woolwich, London, require qualified electronic engineers for test apparatus laboratory. The work covers the development of a wide range of high-frequency testing equipment associated with the design of telephone and television cables. Practical experience in electronics is essential, with qualifications to H.N.C. level. Applicants will work in a well-equipped laboratory with access to all facilities of a large organization. Non-contributory pension, life insurance and many other facilities.—Please write experience and career to date to Personnel Manager, North Woolwich, London, E.16. [7337]

ELECTRONIC Engineer required for Technical Advisory Laboratory of Design Department; the work involves research into suitability of all components and materials for inclusion in new designs of radio and television, and affords a practical graduate engineer a fine opportunity of broadening experience in an interesting branch of work; a further vacancy exists in the same type of work suitable for an applicant of H.N.C. standard; Welwyn Garden City is well situated in pleasant countryside within easy reach of London, and applicants from the London area would become eligible for housing; applications giving full details of experience, age, qualifications and materials for inclusion should be forwarded initially to Personnel Department (R.10), Murphy Radio, Ltd., Welwyn Garden City, Herts. [7227]

GALPIN'S ELECTRICAL STORES

408, HIGH STREET, LEWISHAM, S.E.13
Tel.: Lee Green 0309 Nr. Lewisham Hospita

TERMS: CASH WITH ORDER
(No C.O.D.)

All Goods sent on 7 days' approval against cash

P.M. EXTENSION SPEAKERS. 8in. 3 ohm speech coil, in good condition, 10/-. p/p. 1/6.

SMALL ROTARY REOSTATS, point nine ohms at 3 amps., high quality, 6/-, p/f.

EX-GOVT ROTARY CONVERTORS. 24 volts D.C. Input 50 volts 50 cycles, 1 phase at 450 watts. OTTUP (complete with Step-Up Transformers) from 50 volts to 230 volts, £13/10/- each or CONVERTOR only £9/10/- each.

EX-NAVAL ROTARY CONVERTORS, 110 volts D.C. Input. Output 230 volts 50 cycles 1 phase 250 watts, capable of 50 per cent. overload, in good condition, guaranteed, weight approx. 110 lb., £13/10/- each.

HIGH FREQUENCY 2 VALVE AMPLIFIERS. New. two EF37A, 25/-, c/p.

‡ H.P. D.C. MOTORS, 110 volts, 3,000 r.p.m., new 35/-; starters to suit N.V.R., 25/-.

LARGE METER Movements, fairly low F.S.D., average 6 inch deflection, very high quality, 7/6, p/p. 1/6 each.

MOVING COIL Meters, all 2 to 3 inches dia., damaged cases or glasses, 3 for 10/- guaranteed one sound meter. 6 for 18/-, two sound meters, no junk.

3 PHASE TRANSFORMER, Double wound, New, 110-220 and 440 V., 2,000 watts, can be used on any combination at full wattage. £25.

MAINS TRANSFORMERS, all 200/250 volts primaries (New). Heavy duty. Output combination of 0/6/12/18/24/30/36 volts 4/8 amps. 35/6 each. Ditto 6/8 amps, 51/6 each. Ditto 15 amps. output, 75/- each. Another combination of 0/6/12/18/24 volts 6/8 amps. 51/6 each. Ditto 10/12 amps. 58/6 each. Ditto 25/30 amps. output, 85/- each.

MEDIUM SPOT WELDER TRANSFORMERS. Input 200/250 volts. OUTPUT combination of 0/2/4/6/8/10/12 volts at 50/70 amps. 25/7/6 each. Ditto 120/150 amps output. £8/10/- each.

GOOD AMPLIFIERS, complete with valves in working order. 12 watt £10; 30 watt £20; 50 watt with NO valves, £10.

ELECTRIC LIGHT OR POWER CREDIT METERS, 10 amp. load 25/-; 20 amp. load, 47/6; 30 amp. load, 57/6. Fully guaranteed, carriage paid.

PREPAYMENT METERS, 1/- slot, set at 2d. per unit. 10 amp. load, 24/2/6; 20 amp. load, 25/2/6.

6d. SLOT ONLY PREPAYMENT METERS. 5 amp. load only, set at 4d. per unit, 52/6 each.

AUTO WOUND Voltage changer TRANSFORMERS. Tapped 0/10/200/230/250 volts, 230 watts, 45/6 each; 350 watts, 57/6 each; 500 watts, 78/6 each; 1,000 watts, 88/5/- each; 2,000 watts, £10 each; 3,000 watts, £15 each.

Any TRANSFORMERS made to order within 7 days from date of order. Please ask for quote. Numerous other items.

MAINS TRANSFORMERS. 110/250 volt input 300/0/300 volt 70/80 M/amps., 12 volt 1 A. 0-4 volt 2 A. Useful for Wireless, Model Trains, Chargers, etc., or as an 80-watt Auto Transformer 110/250 volts, 10/9 each. Guaranteed.

HIGH QUALITY INDUCTION MOTORS. New, 1-80 H.P. 230 v.-50-1, 1,500 r.p.m., 50/-, p/f.

EYE BALL TELEPHONE CALL INDICATORS, 1,000 ohms, new, 6/- each p/f, rack of ten mounted in frame, 50/-, p/f.

GOOD FILM for cutting into plate size, etc., guaranteed sound, very fast. Special reduction for clearance. Spools 5 1/2 in. by 47 feet, 7/6; and 5 1/2 in. by 24 feet, 5/-, p/f. Large reduction for quantities.

SELENIUM RECTIFIERS. Full wave, bridge connected, 6 or 12 v. output, 24 amps., 15/6; 4 amps., 25/- Trans-formers to suit, 25/-, all p/p.

DITTO RECTIFIERS. 6 amps., 37/6; 8 amps., 50/- Trans-formers to suit, 51/-, all p/p.

ASSORTED RESISTANCES. All new, Assorted wattage and ratings, plain, gold and silver tipped. Our choice. 10/- per 100, p/f.

TELEPHONE HAND GENERATORS for Phone calling small size, as new, 7/6, p/p. 1/6.

P.O. COUNTERS TO 9999, Resistance 400 ohms, 6/-.

Clients in Eire and Northern Ireland please ask for quotations as to carriage charges. The above charges apply only to England.

SPLENDID ODD BARGAINS FOR VISITORS

OPEN ALL DAY SATURDAY

PLEASE PRINT YOUR NAME AND ADDRESS

Excellence in design..

Specialists in Sub-miniature Telecommunication Components.



STAND OFF INSULATOR

For 1500 volt working. Overall height 1.1". Over chassis .86". Silver plated spill .35" 6BA hexagon stud chromium plated.

(Illustrations approximately actual size)

MINITRIMMER



Standard maximum capacities up to 13pF. Voltage 500 DC. Base 1/4" square with fixing centres for 10BA 1/4" apart.

Details from:—

OXLEY

DEVELOPMENTS CO. LTD.
ULVERSTON, NORTH LANCs
Tel.: ULVERSTON 3306

Fidelia

HAND BUILT



The Fidelia Imperial gives V.H.F. reception plus all the facilities of a fine audio amplifier. The gramophone pre-amplifier suits all types of pick-ups and has recording correction for L.P., R.I.A.A. and 78 curves. Independent Bass and Treble Controls are fitted with approx. 24db total range. Tape jacks can be fitted. Hand built throughout and available with either our Major power amplifier at £38 or our Junior power amplifier at £34.

Other models in our range include: Fidelia AM/FM Major. 12 valves. Tuned R.F. stage on all wavebands. VHF, S. M. and L wavebands. Gram pre-amplifier and input corrector for all pick-ups. Separate 9 watt power amplifier £44.

Fidelia De-Luxe. VHF reception plus normal wavebands, 7 watt push-pull output. Separate bass and treble controls, 9 Kc filter, variable selectivity on M and L wavebands. £34/10/-



Full details willingly on request (6d. in stamps is appreciated).

ELECTRO
Acoustic
DEVELOPMENTS

2 AMHURST ROAD
TELSCOMBE CLIFFS
Nr. Brighton,
SUSSEX

Tel: Penchaven 8156

PURCHASE, HIRE OR HIRE - PURCHASE

VORTEXION

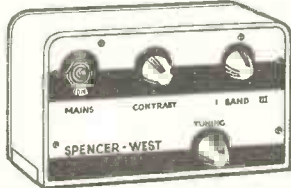
Tape Recorders and
P.A. Equipment, etc.

also Recordings—Tape to Tape/Disc Service

GRIFFITHS HANSEN (Recordings) LTD.

32-33, COSFIELD STREET, LONDON, W.1
Phones: MUSEum 2771/0642

A SPENCER-WEST BAND III CONVERTOR FOR £6 . 5 . 0



The Type 80 with printed circuits, panel controls for Band switch and fine tuning and a performance which ensures enthusiastic satisfaction. Handsomely designed and finished to stand on your receiver with its self-contained power supply it just plugs straight in.

Full descriptive leaflet on request.

SPENCER-WEST LTD.

QUAY WORKS, GREAT YARMOUTH,
NORFOLK

Phones: Works 4794; Sales 3009
Grams: Spencer-West, Gt. Yarmouth

SITUATIONS VACANT

THE General Post Office has vacancies for radio operators at its coast radio stations and applications are invited from men between 21 and 35 years of age who hold the Postmaster-General's first-class certificate of proficiency in radiotelegraphy or an equivalent certificate issued by an administration of the Commonwealth or of the Irish Republic: selected candidates will be considered later for permanent pensionable posts. Application should be made to the Inspector of Wireless Telegraphy, Radio Services Department, Wireless Telegraphy Section, Union House, St. Martins-le-Grand, London, E.C.1. [7317]

HIGH DUTY ALLOYS, Ltd., Research Division, Slough, Bucks, invite applications for an appointment in the Physics Laboratory; candidates should preferably be either physicists with a good degree and have some knowledge of electronics, or electronic engineers to the standard Grad. I.E.E. with an interest in applied physics; the successful candidate will have an opportunity of developing a knowledge of special applications of X-ray diffraction and non-destructive methods of determining the condition of metals and alloys; the salary will be in accordance with qualifications and experience and there is a pension scheme in operation; applications, giving full details, should be sent to—The Staff Manager, address as above. [7221]

TELECOMMUNICATIONS Inspector required by British Railways at York; applicant must have wide practical experience including theoretical knowledge of electronic equipment including V.H.F. radio, line transmission overhead line and cable construction, carrier telephone and automatic telephone exchange systems. Applicant will be required to test all types of telecommunication apparatus and instruct personnel in the maintenance of equipment throughout the North Eastern Region. A technical standard of Higher National Certificate or equivalent is desirable, but consideration will be given to an otherwise suitable applicant. Pension scheme, free travel facilities, salary £775 to £932 per annum; apply in writing to Signal Engineer, British Railways, York, giving full details of experience, qualifications and age etc. [7500]

SITUATIONS WANTED

RADIO electronics technician, 36, wide experience, seeks post in Australia.—Box 1431. [7329]

PORTUGUESE ex-officer, 27, single, experienced assembly and repairs, radar and other electronic equipment, fairly fluent English, some knowledge French; suggestions welcomed.—M. Soares Rodrigues, Rua Nova da Trindade, 1-3-D, Lisbon, Portugal. [7304]

EXPERIENCED sales representative aged 29, with basic knowledge of electronics, wishes to contact manufacturer of electronic equipment desirous of appointing an agent or full-time representative in the Midlands; workshop and office facilities, telephone, etc., available.—Box 1088. [7298]

TECHNICAL TRAINING

LEARN it as you do it—we provide practical equipment combined with instruction in radio, television, electricity, mechanics, chemistry, photography, etc.—Write for full details to E.M.I. Institutes, Dept. WW47, London, W.4. [0006]

CITY and Guilds (Electrical, etc.) on "No Pass—No Fee" terms, over 95% successes. For full details of modern courses in all branches of Electrical Technology send for our 144-page handbook, free and post free. B. I. E.T. (Dept. 388A), 29, Wright's Lane, London, W.8. [0117]

TUITION

NOTHING succeeds like success! What we have done a thousand times we can do again for you—see the B.N.R.S. advt. page 84. [C172]

WIRELESS operating; attendance and postal courses.—Stamp for reply to Manager, The Wireless School, Manor Gdns., London, N.7. [0104]

FULL-TIME courses for P.M.G. Certs.—C.G.L.I. Telecommunications, Radar Maintenance Cert. and B.Sc. (Eng.); prospectus free.—Technical College, Hull. [0111]

T.V. & Radio—A.M. Brit.I.R.E.E., City & Guilds, R.T.E.B. Cert., etc., on "No Pass—No Fee" terms, over 95% successes—Details of Exams and Home Training Courses in all branches of Radio and T.V. write for 144-page Handbook—Free. B.I.E.T. (Dept. 397A), 29, Wright's Lane, London, W.8. [0116]

A.M.I.Mech.E., A.M. Brit.I.R.E.E., City and Guilds, etc., on "No Pass—No Fee" terms, over 95% successes—or details of Exams and courses in all branches of Engineering, Building, etc. write for 144-page Handbook—Free. B.I.E.T. (Dept. 397B), 29, Wright's Lane, London, W.8. [0118]

FREE! Brochure giving details of Home Study Training in radio, television and all branches of electronics. Courses for the hobby enthusiast, or for those aiming at the A.M. Brit.I.R.E.E., City and Guilds, R.T.E.B., and other professional examinations. Train with the College operated by Britain's largest electronics organization; moderate fees.—Write to E.M.I. Institutes, Dept. WW28, London, W.4. [0179]

TELEGRAPH AND TELEPHONE EQUIPMENT

12-Channel Carrier Telephone Terminals. Carrier Link S.R. Equipment. Apparatus Selective Carrier—28 Channels.
1 - 4 Carrier Telephone Terminals, Repeaters and Spares.
1+1 Carrier Telephone Terminals, Repeaters and Spares.
VF Telegraph 3-channel Group Units and Repeaters.
VF Telegraph Speech + Duplex Terminals and Filter Assemblies.
VF Telegraph Speech + Simplex No. 3.
Racked Bays for multi-channel telegraph and telephone equipment.
Filter Units, 600 ohms, various cut-off frequencies.
Retardation Coils and Repeating Coils.
Input and Output Transformers.
Teleprinters Tape and Paper and Power Supply Rectifier Units for Teleprinter.
Telephone Switchboards, 10 Line and 40 Line.
Field Telephone Sets. Types D, F and L.
Polarized Relays 299 AN and 320 AN.
Attenuator Assemblies Wiper Types "T" Networks.
Vibrators 7-pin Synchronous.

LOW POWER RADIO STATIONS

Wireless Set 19. Freq. 2—3 Mc/s and 2 3/4 Mc/s Systems A1, A2 and A3 AM.
Wireless Set X32D. Freq. 2—8 Mc/s Systems A1, A2 and A3 AM and FM.
Wireless Set 31.
Wireless Set 58. Canadian Walkie-Talkie. Complete with all accessories.
Wireless Set 69T. Tropicalized Man-Pack set 3.0 to 5.2 Mc/s.
Wireless Set 88. Walkie-Talkie. 40 Mc/s 4-channel pre-set.
Collins 18Q Stations. Complete 1.5 Mc/s to 12 Mc/s. T.C.S. Stations with choice of Power Supply Units 12 v., 24 v., 115 v. or 230 v.
Wireless Set 62. 14-10 Mc/s, fully tropicalized.
Flexible Conduit, 3/8 in. I.D. tinned, Copper, braided in 50ft. lengths, 9d. per foot.

AIRBORNE EQUIPMENT

AN/ARC 1 VHF Stations. 100-156 Mc/s 10-channel, 20-channel or 50-channel.
SCR 269R Radio Compasses. Complete with all parts including Inverter Supply Units.
SCR 622 VHF Stations. 100-156 Mc/s. Complete with all spares.

R. GILFILLAN & CO. LTD.
7, HIGH ST., WORTHING, SUSSEX
Tel.: Worthing 8719 and 30181.

Cables: Codes:
"GIL WORTHING" BENTLEY'S 2nd.

TANNOY SOUND EQUIPMENT

Tells you what's going on clearly

WEST NORWOOD · S.E.27
Telephone: GIPsY Hill 1131 (7 lines)

"DIPLOMA" HEADPHONES



Lightweight High Resistance (4,000 ohms). Complete with cord.

17/6

Ideal for CRYSTAL SETS
The "TYANA" Standard Soldering Iron



- Adjustable Bit.
 - Weight approx. 4 oz.
 - Heating time 3 min.
 - 40 Watt economy Consumption.
 - Standard Voltage Ranges.
- 16/9

Replacement Elements and Bits always available

KENROY LIMITED
152/297 UPPER ST., ISLINGTON,
LONDON, N.1

Telephone: CANonbury 4905-4663

**UNIVERSITY OF BELFAST
POST-GRADUATE
CERTIFICATE
IN
RADIO ENGINEERING**

A full-time day course leading to the above certificate will be held in the coming session. Subjects: radio theory, radio technics, circuit theory, servo-mechanisms, mathematics and physics. The course is open to men or women graduates in either electrical engineering or physics.

The session begins on Tuesday, 8th October, 1957, and applications or enquiries should be made as soon as possible to the Secretary, Queen's University, Belfast.

PROVED The finest method for cleaning records
Already over 20,000 enthusiastic users

THE "Dust Bug"
AUTOMATIC GRAMOPHONE RECORD CLEANER
PATENT APPLIED FOR

Price reduced to 17/6 (plus 7/- purchase tax) from your local dealer or
Cecil E. Watts
Consultant and Engineer (Sound Recording and Reproduction)
Darby House, SUNBURY-on-THAMES, MIDDXX

**FOR PROMPT DELIVERY
WAFER SWITCH
ASSEMBLIES, CUSTOM BUILT**

Banks	PAXOLIN	CERAMIC
1	s. d. 7 4	s. d. 11 10
2	10 9	23 1
3	14 2	34 8
4	17 0	47 5
5	19 9	58 11
6	22 1	71 6
7	24 2	—
8	28 4	—

When A.B. 11 and 12 way Wafers are required, please add 1/- per bank to above prices. SPECIALS at time and material plus 50%.

● N.S.F. TYPE "G" SWITCHES.

1 Bank	£1 5 2	Control Plate etc., each
2 Banks	£1 14 7	
3 Banks	£2 4 1	15/-
4 Banks	£2 13 6	Wafers, each
5 Banks	£3 3 0	
6 Banks	£3 12 5	

Quotations gladly given for small as well as large quantities, also for special assemblies.

TELE-RADIO (1943) LTD.
189, EDGWARE ROAD, LONDON, W.2.
Paddington 4455/6.

TUITION

BEGINNERS' morse records (LP 33 $\frac{1}{2}$), complete course with booklet, designed to pass G.P.O. test at 12wpm easily; only 45/-; send P.O. now, course by return.—45, Green Lane, Furley, Surrey. Dpl. 2896. [7301]

ALL EXAMINATIONS easier to pass by I.C.S. home study methods, A.M.Brit., I.R.E., C & G. Telecoms., P.M.G. Cert. in Wireless Telegraphy, radio and TV servicing, etc.—Write for free prospectus: International Correspondence Schools, Dept. CL.42A, Kingsway, London, W.C.2. [0033]

LEARN-AS-YOU-BUILD Course in basic radio, electronic and electrical theory with practical training, building a 4-valve receiver and superhet signal generator and multi-tester.—Write for free book International Correspondence Schools, Dept. CL.42, Kingsway, London, W.C.2. [0350]

TRAIN at home for a better position or a new hobby.—We offer comprehensive modern home tuition courses covering over 100 careers and hobbies, practical equipment supplied with many courses.—Write for free brochure stating subject of interest, to: E.M.I. Institutes, Dept. WW 39, London, W.4. (Associated with H.M.V.) [0180]

INCORPORATED Practical Radio Engineers' home study courses of radio and TV engineering are recognized by the trade as outstanding and authoritative. Moderate fees to a limited number of students only. Syllabus of Instructional Text is free. "The Practical Radio Engineer" journal, sample copy, 2/-; 6,000 Alignment Peaks for Superhets, 5/9—Membership and entry conditions booklet, 1/- all post free from the Secretary, I.P.K.E., 20, Fairfield Rd., London, N.8. [0088]

PERSONAL

MORBEY—If Robert Morbey who formerly resided in the Welwyn Garden City area and who at one time worked for Murphy Radio, Ltd., will communicate with Messrs. Wild & Hewitson, Solicitors, 4, Market Hill, Saffron Walden, Essex, he may hear something to his advantage. [7324]

AUCTIONS

SALES every Thursday at 11 a.m.
EASTERN Auction Mart, Ltd.
TELEVISIONS, radios, fridges, wash/machines, etc., etc.
ENTRIES accepted working or not.
15% commission on lots sold (min. 10/-). No sale, no charge.
WE collect in Greater London area.
WHITEHORSE Lane, Mile End Rd., Stepney, E.1.
STEPNEY Green 3993, 3296, 1033. [0125]

BOOKS, INSTRUCTIONS, ETC.

TELECOMMUNICATIONS (Principles) I and II in m.k.s. Units "covers everything for these C. and G. exams., numerous worked examples, price 10/6; also "Radio Reference" covers everything from basic principles to VHF transmitters, aerial arrays, FM, etc., 180,000 words, 598 figs, price 25/-.—Riddiford, 394, Tlehurst Rd., Reading, Berks. [7232]

INTRODUCTION to Valves By R. W. Hallows, M.A. Cantab., M.I.E.E. and H. K. Milward, B.Sc. Lond. A.M.I.E.E. Describes the principles, construction, characteristics and uses of most types of radio valves. The approach is simple and, as far as possible, non-mathematical, but the book provides the student with a thorough understanding of valves and how they work, 8/6 net from all booksellers. By post 9/2 from Iliffe & Sons Ltd., Dorset House, Stamford St., London S.E.1.

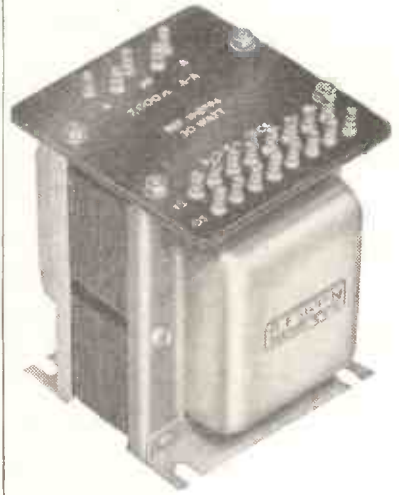
"ADVANCED Theory of Waveguides." By L. Lewin. Sets out various methods of treating problems arising in work on this complex subject. The author has selected for discussion a number of topics as representative of the field in which the centimetre-wave engineer is engaged, many of the examples being concerned with the rectangular waveguide, 30/- net from all booksellers 30/10 by post from Iliffe & Sons Ltd., Dorset House, Stamford St., London, S.E.1

I.T.A.

THE INDEPENDENT TELEVISION AUTHORITY has a number of vacancies for Technical Assistants and Shift Engineers for the maintenance and operation of Television Transmitting Stations. Qualifications for Technical Assistants include education to G.C.E. standard with passes in English, Mathematics and Physics and some knowledge of electrical and high frequency transmitter engineering. Shift Engineers should also have had practical high frequency experience. Salary scales are: Technical Assistants £515-£25-£565-£35-£670-£40-£750. Shift Engineers £655-£50-£905. There is a Contributory Pension Scheme. Applications in writing, giving details of experience and qualifications, including Course study undertake, to Personnel Officer, Independent Television Authority, 13/14 Princes Gate, London, S.W.7.

**FOR THE PROFESSIONAL
STUDIO AMPLIFIER**

The
GILSON
Type WO866 30W OUTPUT
TRANSFORMER



This was used in performance measurements of the KT88 HIGH QUALITY AMPLIFIER

Primary inductance > 250 H.
Leakage inductance < 4 in H.
Wide Frequency range at full power.
H.F. response level to > 80K~.
7,000/3.7/15 ohms, 43% pri. taps for E.L. 34's KT66's or 807's.
List Price **£5.12.6**

TRANSISTOR TRANSFORMERS

for the
MULLARD 4.5V. 200mW AMPLIFIER
Types WO929/4 and WO930/4 £1 each
For the 6 and 9 VOLT VERSIONS
Types WO929/6 and WO930/6 £1 each or
Types WO1072/6 and WO1073/6 miniature 6V. List Price 19/- per pair.
Types WO1072/9 and WO1073/9 miniature 9V. List Price 19/- per pair
Also a good range of 5, 10 and 20 watt P.A. Transistor Amplifier Transformers of advanced design and moderate cost.

Prices on application.

R. F. GILSON LTD.

11a ST GEORGE'S RD. WIMBLEDON, S.W.19
Phone: WIMbledon 5695
Makers of a comprehensive range of
HEAVY DUTY MAINS, NEON and
FLUORESCENT LIGHTING TRANSFORMERS



HIGH VOLTAGE TRANSFORMER

Input 230 v., 50 cycles.
Output 3,000 v. at 3 milliamperes and 2 v. at 2 amps. Oil filled. Adm. Patt. 58689. Weight 15 lbs. 6 1/2 in. x 6 1/2 in. x 10 in. Unused, in wooden boxes. 36/- Carr. 3/6.

3,500 VOLT METER

D.C. Moving Coil. 3 1/2 in. dial. Built-in, non-inductive resistance. New and boxed. 19/- P. & P. 2/6.



TRANSFORMERS

All 4 types below for £20/24c v. Input. £4/5/- each. Carr. average 6/- after delivery. Double Wound. (1) 3, 5, 9 & 12 v. at 55 amps. (2) 6, 12, 18, 24 & 30 v. at 12 amps. (3) 5 v. at 300 a.

Auto-Wound. (4) 110/120 v. at 6.5 amps. We have a large selection of Transformers, specially with Low Volt/High Amps. output.

NEST OF DRAWERS

6 1/2 in. x 5 in. x 10 in. high. With 12 drawers 3 in. x 4 1/2 in. x 1 1/2 in. high. For radio components, nuts, bolts, small parts. Made from sheet steel, green enamelled. 20/- P. & P. 3/-.



WIRE MESH

Rustless, 14 mesh per inch. Illustration is life size. For P.A. speakers, screening, ventilating. 12 in. x 12 in., 1/2, post 10d. 23 in. x 23 in., 3/9 post 1/6. 8 1/2 in. x 23 in., 7/6, post 2/6.

HARMSWORTH, TOWNLEY & CO.,
2 JORDAN STREET, MANCHESTER, 15

We manufacture all types of **SMALL TRANSFORMERS** and **CHOKES** with **MUMETAL** and **RADIOMETAL** CORES either with or without **MUMETAL** SCREENS.

Microphone, Pickup, Line input, Output, Computer, Rectifier, High Fidelity, Midget, Transistor, Vibration, Seismic, Instrument, Photocell, Recorder, Bridge and Experimental Transformers of all kinds. Frequency bands in the range 1 c/s to 150 kc/s. Designs produced against Clients' electrical requirements.

Quick delivery. Large or small quantities. Contractors to G.E.C., Rolls-Royce, Decca, H. J. Leak, R.C.A., M.O.S., Admiralty, etc.

E. A. SOWTER LTD.,

7 Dedham Place, Fore Street, Ipswich, Suffolk. Tel.: Ipswich 52794.

LOCKWOOD
makers of
Fine Cabinets

and woodwork of every description for the Radio and allied trades

LOCKWOOD & COMPANY
(WOODWORKERS) LTD.
Lowlands Rd., Harrow, Middlesex. Byron 3704

C.R.T. TECHNICIAN
TUBE RECONDITIONING—Gen. type required to design and create small plant—must be fully conversant with C.R.T. processing from start to finish. Salary commensurate with knowledge and ability. Write giving full details of career in confidence.
Box No. 1188.

FOR SALE
SCR 584
RADAR SET and TRAILER
As new condition—Fully equipped. 10 CM. Search and Track. Ideal for Guided Missile Tracking. Trailer Van, Tools, some Spares, etc.
CONTACT OWNER
P. J. PLISHNER, 550 5th AVE., NEW YORK

"DRAUGHTING & TRACING"
CAPACITY AVAILABLE
(ELECTRONIC & MECHANICAL)
'ELMAC' 23, MELROSE AVE.,
BOREHAMWOOD, HERTS.

Hi Fi Tape Record/Playback Amplifiers, suitable for Collaro, Reflectograph, and other Decks. 6 watts U/L. 'Lodestar' model 25 gns. 4 watts U/L. model 23 gns. The new 'Mitecamp' 2 1/2 watts U/L. 18 gns. 1 watt TRANSISTOR Amplifiers for TAPE (playback only) 6 volt, 16 gns.
HARDING ELECTRONICS
120a Mora Rd., Cricklewood, London, N.W.2
Phone: GLA 1770

SIFAM
SIFAM ELECTRICAL INSTRUMENT CO. LTD.
LEIGH COURT - TORQUAY - Telephone 4547/8

TELECOMMUNICATIONS CONSULTING ENGINEER
D. R. GAMLEN, A.M.I.Mech.E., A.M.I.E.E., has retired under the new Constitution for Ghana after serving for seven years, during a period of rapid development, in the Radio Division of the Posts & Telecommunications Department. He is now in practice as Consulting Engineer specialising in Telecommunications at
38, Highfield Road, Southampton.
Telephone: Southampton 56535

FINSBURY TRADING CO.
EX U.S. AERIAL, 9ft. spring loaded and fully collapsible complete with cords and guys, ideal as aerial or fishing rod, brand new, 10/6, p. & p. 2/-.
TELEPHONE SETS "F," ideal for communication between two or more positions, considerable range, complete in carrying case and ready for use. £3 per unit or £5/15/- per pair, p. & p. 5/-.
HIGH SPEED RELAY, 2 bobbins 1,000 ohms each, 5/6, p. & p. 9d.
U.S. HIGH SPEED RELAY, 300 ohms coil 2.05 v. adjustable contacts, 5/- p. & p. 9d.
HEADPHONES M/C, complete, 9/6 per set, p. & p. 1/6.
HEADPHONES CLR, complete, 7/- per set, p. & p. 1/6.
HEADPHONES BAL. ARMATURE 9/- per set, p. & p. 1/6.
EX G.P.O. ELECTRO MAGNETIC COUNTERS, 5 x 1 1/4 x 1 1/4 in. 4 figures, various voltages D.C. 3/6 v. 18/24 v. 100/110 v. 200/230 v. D.C. 5/- each, p. & p. 1/6.
TERMS: C.W.O.
FOR CALLERS ONLY: A selection of VHF, FM/AM and Ultra Short Wave Signal Generators, various frequencies; also valve voltmeters, etc., at real bargain prices.
We specialise in Telephone and ZA Equipment and spares as used by Govt. Depts. and the Services. Trade and manufacturers enquiries invited.
12, STOKE NEWINGTON HIGH STREET, LONDON, N.16.
Tel.: CLIssold 7342.

S.T.S. TRANSFORMERS

Fully Shrouded Up-right Mounting, Mains Trans. for Mullard 510 Amplifier, 300-0-300v. 100 mA., 6.3v. 2a. ct., 6.3v. 1a. 27/-
Mains Trans. for 510 Amp. and Tuner 300-0-300v. 120mA. 6.3v. 2.5a. ct., 6.3v. 2.5a., 6.3v. 1a. 32/-
Primaries for above 200-230-250v. 50 c/s. Output Transformer, Ultra-Linear, 8000 ohm. with 43% tapping, for Mullard 510 Amp. 30/-
All carefully made to conform to specifications
Postage 1/9 extra on all items
SOUTHERN TECHNICAL SUPPLIES
13 NORTH STREET, PORTSLADE, SUSSEX
Tel. HOVE 47223

BRASS, COPPER, DURAL, ALUMINIUM, BRONZE
ROD, BAR, SHEET, TUBE, STRIP, WIRE
3,000 STANDARD STOCK SIZES
No Quantity too Small. List on Application
H. ROLLET & Co. Ltd.
6 Chesham Place, S.W.1. SLOane 3463
ALSO AT LIVERPOOL, BIRMINGHAM, MANCHESTER, LEEDS

A MAST PROBLEM? **Skymasts** WRITE TO

BEADON GARAGE BEADON ROAD LONDON W6 Telephone RIVerside 1124 and 7878

RADIO SOCIETY OF GREAT BRITAIN



RADIO HOBBIES EXHIBITION

ROYAL HORTICULTURAL OLD HALL
VINCENT SQUARE, LONDON, S.W.1.

Wed. Oct. 23rd to Sat. 26th

11 a.m. till 9 p.m. — Admission 2/-

HOME CONSTRUCTION—DO IT YOURSELF FEATURES

Kits of Parts to Build:—RECEIVERS,
TRANSMITTERS, TELEVISION, HI-FI AMPLIFIERS,
TAPE RECORDERS, TRANSISTOR EQUIPMENT

Demonstrations of
HOME-BUILT LIVE AMATEUR TELEVISION STATION &
HOME-BUILT LIVE AMATEUR TRANSMITTER
TALKING TO THE WORLD

WIN AN EDDYSTONE COMMUNICATIONS RECEIVER

Hand this Advert. in at the door for Entry Form

INDEX TO ADVERTISERS

	Page		Page		Page
Ablx (Metal Industries), Ltd.	147	Galpins	195	Quality Mart	90
Acoustical Mfg. Co., Ltd.	35	Garnien, D. R.	198	Quartz Crystal Co., Ltd.	173
Adcola Products, Ltd.	70	Garrard Eng. & Mfg. Co., Ltd., The	199	Queen's University, Belfast	197
A.D.S. Relays, Ltd.	130	Geo Bros. Radio, Ltd.	169		
Advance Components, Ltd.	33	General Electric Co., Ltd.	77	Radiation Monitors, Ltd.	71
Aircraft Marine Products (Great Britain), Ltd.	99	Giffilian, R. & Co., Ltd.	196	Radio Component Specialists	177
Airmec, Ltd.	150	Gilson, R. F., Ltd.	197	Radio Corporation of America	61, 83, 137
Alpha Radio Supply Co., The	173	Glaser, L., & Co.	192	Radio Exchange Co., The	146
Altabass, Ltd.	132	Goldring Manufacturing (Gt. Britain), Ltd.	89	Radio Ham Shack, Ltd.	193
Amplex Appliances (Kent), Ltd.	96	Goodmans Industries, Ltd.	39	Radio Hobbies Exhibition	196
Andec, Ltd.	124	Gramplan Reproducers, Ltd.	62	Radio Resistor, Ltd.	41
Anders Electronics, Ltd.	132	Gray, Arthur, Ltd.	152	Radio Servicing Co.	66
Antiference, Ltd.	69	Grayshaw Instruments	196	Radiospares, Ltd.	124
Appointments Vacant	180, 181, 182, 183, 184, 185, 194, 197	Griffiths Hansen (Recordings), Ltd.	196	Radio Supply Co. (Leeds), Ltd.	158, 159
Arcoelectric Switches, Ltd.	76	Grundig (Gt. Britain), Ltd.	146	Radio Traders, Ltd.	170
Armstrong Wireless & Television Co., Ltd.	72, 189			Radio & T.V. Components (Acton), Ltd.	168
Aspden, W.	176	Hall Electric, Ltd.	53	RCA, Great Britain, Ltd.	58
Automat, Ltd.	126	Hanney, L. F.	188	Relda Radio, Ltd.	179
Automatic Telephone & Electric Co., Ltd.	7	Harding Electronics	198	Reliance Manufacturing Co., Ltd.	122
Avo, Ltd.	1	Harmsworth, Townley & Co.	198	Reproducers & Amplifiers, Ltd.	67
		Harris, F.	188	R.G.A. Services (Plymouth), Ltd.	186
Barnes Planos	134	Harrogate Audio Fair	50	Rogers Development (Electronics), Ltd.	198
Basildon Metal Powder Parts, Ltd.	144	Hartley, H. A., Co., Ltd.	70	Rollett, H., & Co., Ltd.	198
Belling & Lee, Ltd.	109	Hatter & Davis, Ltd.	193		
Benson, W. A.	188	Henley's, W. T., Telegraph Works Co., Ltd.	188	Salford Electrical Instruments Ltd.	12
Berry's (Short Wave), Ltd.	46	Henry's (Radio), Ltd.	175	Samsons Surplus Stores	174
Bird, S. S. & Sons, Ltd.	45	Hivac, Ltd.	56	Savage Transformers, Ltd.	193
Birmingham Sound Reproducers, Ltd.	16	Homelab Instruments, Ltd.	79	Savage, W. Bryan, Ltd.	91
Bradmatic, Ltd.	96	Home Radio, Ltd.	194	Servo Electronics	87
Brenell Engineering, Ltd.	140	H.P. Radio Services, Ltd.	82	Siemens & Halske	111, 118
Britain, Chas. (Radio), Ltd.	167	Hughes, F. A., & Co., Ltd.	65	Siemens Edison-Swan, Ltd.	198
British Communications Corporation, Ltd.	135	Hunt, A. H. (Capacitors), Ltd.	92	Siem Electrical Instruments Co., Ltd.	122
British Institute of Engineering Technology	176, 192	Hunton, Ltd.	52	Simmons, L. E., Ltd.	123
British Insulated Callender's Cables, Ltd.	Cover 11			Simon Sound Service, Ltd.	198
British National Radio School	84	Iliffe & Sons, Ltd.	141	Skymasts	162, 163
British Physical Laboratories	21	International Correspondence Schools	128	Smith, G. W. (Radio), Ltd.	190
Brookes Crystals, Ltd.	122	Jackson Bros. (London), Ltd.	66	Smith, H. L., & Co., Ltd.	92
Brown, S. G., Ltd.	100	Jason Motor & Electronic Co.	146	Smith, W. H. & Sons, Ltd.	92
Bulgin, A. F. & Co., Ltd.	Edit. 513	Jordan, D., Ltd.	94	Solartron Electronic Group, Ltd.	2
Bullers, Ltd.	130	J.P. Electric, Ltd.	94	Sonomag, Ltd.	86
Burne Jones & Co., Ltd.	48	Kaye Electrical Mfg. Co. Ltd.	146	Southern Radio Supply, Ltd.	198
		Kempner, S., Ltd.	196	Southern Technical Supplies	198
C. & G. Kits	136	Kenroy Ltd.	126	Sowler, E. A.	100
Canadian Westinghouse Co., Ltd.	47	Keyswitch Co., The	126	Specialist Switches	100
Candler System Co.	178	Kolectric, Ltd.	124	Specto, Ltd.	76
Cardross Engineering Co., Ltd.	176	Lasky's Radio, Ltd.	154, 155, 156	Spencer-West, Ltd.	196
Cementation (Muffelite), Ltd.	26	Leak, H. J. & Co., Ltd.	119	Sperry Gyroscope Co., Ltd.	13
Champion Products	190	Leavers-Rich Equipment, Ltd.	68	Staar Electronics, Ltd.	25
Chapman, C. T. (Reproducers), Ltd.	123	Lewis Radio Co.	60	Standard Telephone & Cables, Ltd.	67, 107, 114
Cinema Television, Ltd.	123	Light Soldering Developments, Ltd.	178	Steatite & Porcelain Products, Ltd.	23
City Sale & Exchange, Ltd.	54	Linear Products, Ltd.	38	Steatite Insulations, Ltd.	59
Clarke, H. & Co. (Manchester), Ltd.	126	Lionnet, J., & Co.	191	Stern Radio, Ltd.	151, 152, 153
Clyne Radio, Ltd.	160, 161	Lockwood & Co. (Woodworkers), Ltd.	198	Stewart Transformers, Ltd.	89
Collaro, Ltd.	20	Lockwood Central Radio Stores	190	Stretlys, Co., Ltd.	38
Cosmocord, Ltd.	103	Long Playing Record Library	143	Sugden, A. R. & Co. (Engineers), Ltd.	139
Cosmo Instruments, Ltd.	15, 29, 30, 31, 32	L.R. Supply Co., Ltd.	120	Superior Radio Supplies	143
Cossor Radar & Electronics, Ltd.	14	Ludfry, Ltd.	142	Sutton Coldfield Electrical Engineers	88
Coventry Radio	192	Lyons Radio, Ltd.	172	Sylvan-Ginsbury, Ltd.	24, 25
		Magnetic & Electrical Alloys, Ltd.	142		
Daly (Condensers), Ltd.	52	Magnetic Devices, Ltd.	4, 53	Tannoy Products, Ltd.	196
Davies, A., & Co.	192	Mail Order Supply Co.	58	Tapo Recorders (Electronics), Ltd.	14
Davis, Jack (Relays), Ltd.	134	Marconi Instruments, Ltd.	44	Technic Trading Co.	141-147
Denco (Clacton), Ltd.	52	Marconi Wireless Telegraph Co., Ltd.	112	Television Eng., Ltd.	142
Dependable Radio Supplies	145	Marine Aerials, Ltd.	138	Telegraph Condenser Co., Ltd.	Cover 111
Dependable Relay Co.	64	Martin, J. H.	190	Telegraph Construction & Maintenance Co., Ltd.	74
Direct T.V. Replacements	176	Mercia Enterprises, Ltd.	84, 128, 139	Tele-Radio (1945), Ltd.	141-147
Dixon, J. & Co.	192	McMurdo Instruments Co., Ltd.	50, 80, 120, 145	Teletels, Ltd.	100
Dixons Electronics	166	Mersey Cable Works	138	Teleton Co., The	178
Duke & Co.	84	Midland Instrument Co.	144	Thorn Electrical Industries, Ltd.	85
Dulci Co., Ltd., The	192	Mills, W.	174	Trix Electrical Co., Ltd.	Edit. 511
Duode Natural Reproducers	84	Modern Book Co.	195	T.R.S.	168
Dynatron Radio, Ltd.	73, 132	Modern Electrics, Ltd.	46	Truvox, Ltd.	16
		M.R. Supplies, Ltd.	82	Tutor Tape Co., Ltd.	120
		M.S.S. Recordings Co., Ltd.	54		
		Mullard, Ltd.	3, 11, 34, 38, 106, 131	Uncles, Bliss & Co.	194
		Multicore Solders, Ltd.	Cover 14	Underlay Book Co.	190
		Multitone Electric Co., Ltd.	17	Universal Electrical Instruments Corpn.	80, 171
		Murex, Ltd.	97	Universal Electronics	172
		Muscraft	97		
		Nagard, Ltd.	68	Valradio, Ltd.	124
		N.A.R. Agencies, Ltd.	190	Venmer Electronics, Ltd.	10
		Northern Radio Services	64	Verdik Sales, Ltd. Co.	62
				V.S. Wholesale Services, Ltd.	98
		Oddie, Bradbury & Cull, Ltd.	194	Vitavox, Ltd.	127
		Osmor Radio Products, Ltd.	98	Vortexion, Ltd.	117
		Oxley Developments Co.	195	V.Z. Electrical Service	176
		Painton & Co., Ltd.	63	Walmore Electronics, Ltd.	130
		Palmer, G. A. Stanley, Ltd.	74	Watts, Cecil E.	197
		P.A.M., Ltd.	101	Waymors, Ltd.	81
		Pamphonic Reproducers, Ltd.	62	Wayne Kerr Laboratories, Ltd., The	49
		Parker, A. B.	142	Webber, R. A., Ltd.	144
		Partridge Transformers, Ltd.	187	Webb's Radio	178
		P.C.A. Radio	94	Westinghouse Brake & Signal Co., Ltd.	43
		Pearce, T. W.	176	Westwood, L.	96
		Pearson, M. & J.	174	Weymouth Radio Mfg. Co., Ltd., The	147
		Perth Radios, Ltd.	95	Whitefalede Wireless Works	96
		Photo Printed Circuits, Ltd.	142	White, S. S., Co. of Gt. Britain, Ltd.	56, 72
		Plasticable, Ltd.	144	Wilkinson, L. (Croydon), Ltd.	170
		Plishner, P. J.	195	Wilson, Ronald, & Co.	190
		Post Radio Supplies	176, 178	Woden Transformer Co., Ltd.	121
		Power Controls, Ltd.	42, 125	Wolsley Television, Ltd.	78
		Premier Radio Co.	102, 103	Wright & Weaire, Ltd.	46
		Preston, A. & Sons	90		
		Proops Bros., Ltd.	164, 165	Young, C. H.	140
		Eye Telecommunications, Ltd.	104		
		Pye, Ltd.	75	Z. & I. Aero Services Ltd.	186

Printed in Great Britain for the Publishers, LITTON & SONS LTD., Dorset House, Stamford St., London, S.E.1, by CORNWALL PRESS LTD., Paris Garden, London, S.E.1. *Wireless World* can be obtained abroad from the following: AUSTRALIA: Gordon & Gotch, Ltd. SYDNEY; A. H. Wheeler & Co. CANADA: The Wm. Dawson Subscription Service, Ltd.; Gordon & Gotch, Ltd. SOUTH AFRICA: Central News Agency, Ltd. WILLIAM DAWSON & SONS (S.A.), LTD. UNITED STATES: Eastern News Co. 308 West 11th Street, New York 14.

Yes!

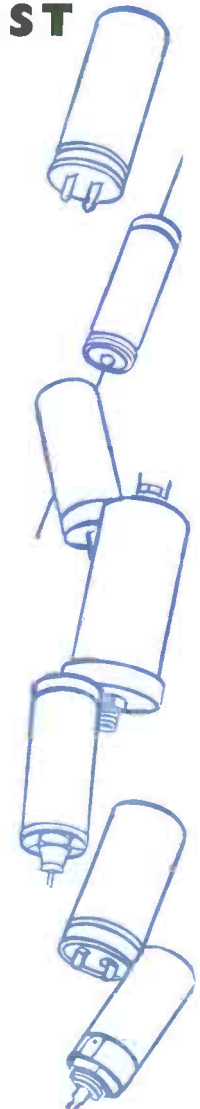
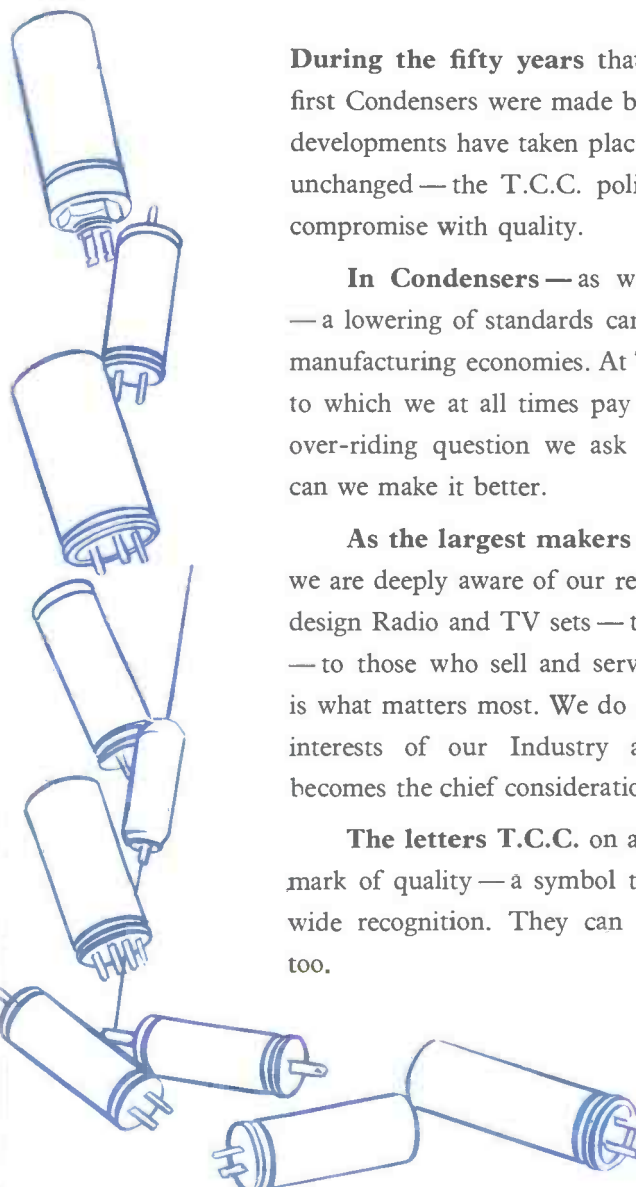
T.C.C. CONDENSERS SOMETIMES COST — A LITTLE MORE

During the fifty years that have passed since the first Condensers were made by T.C.C., vast technical developments have taken place. But one thing remains unchanged — the T.C.C. policy that there can be no compromise with quality.

In Condensers — as with most other products — a lowering of standards can often effect substantial manufacturing economies. At T.C.C. these are matters to which we at all times pay great attention. But the over-riding question we ask ourselves continually is can we make it better.

As the largest makers of Condensers in Europe we are deeply aware of our responsibility to those who design Radio and TV sets — to those who make them — to those who sell and service them. To us quality is what matters most. We do not believe that the best interests of our Industry are served when price becomes the chief consideration.

The letters T.C.C. on a Condenser are its hallmark of quality — a symbol that has achieved world-wide recognition. They can protect your reputation too.



THE TELEGRAPH CONDENSER CO. LTD.

RADIO DIVISION · NORTH ACTON · LONDON W3 · TEL: ACORN 0061



RECEIVES

Ministry Approval

**MAY NOW BE USED FOR SOLDERING EQUIPMENT
FOR THE SERVICES. APPROVAL NUMBER DTD/900/4535**

INCREASES THE USEFUL LIFE OF SOLDERING BITS 10 TIMES

During the past two years many of the leading manufacturers of electronic equipment have undertaken production tests with SAVBIT alloy which have confirmed the claim that its use increases the life of soldering bits by 10 times. Apart from the saving in maintenance costs SAVBIT provides better joints because the irons are in first-class condition for so long a time.

The secret of the success of SAVBIT alloy is the inclusion of a small percentage of copper which prevents absorption of copper from the soldering iron bit into the solder alloy.

B.S. 219 the standard for solder alloys does not permit the incorporation of copper, as for solder seaming purposes this metal has been considered to be undesirable. For wire-to-tag

joints and other soldering purposes in the electronic industry, the incorporation of copper is desirable as the strength and creep properties of the joints will be increased.

The Ministry of Supply have now confirmed these claims and under Approval Number DTD/900/4535 have given approval for SAVBIT Type 1 Alloy containing Type 362 Ersin Flux to be used for circuit bit soldering on equipment for Service use in lieu of the solders in B.S. 219.

Ersin Multicore SAVBIT Type 1 Alloy costs slightly less than 60/40 alloy. Engineers are invited to write on their Company's notepaper for full technical information.

SAVBIT is a registered trademark of Multicore Solders Ltd. and is manufactured under an Exclusive British licence of Patent No. 721,881.



SAVBIT FOR FACTORIES

SAVBIT Type 1 Alloy is supplied to factories at bulk prices on 7 lb. reels. 16 and 18 s.w.g. are the diameters most suitable for the majority of soldering processes.

Supplies are also available on 1 lb. reels in all gauges.



SAVBIT FOR THE SERVICE ENGINEER

Approx. 170 ft. of 18 s.w.g. SAVBIT is supplied on a 1 lb. reel individually packed in a carton and is available from trade stockists under reference R18SAV. Price 15/- each (subject).



SAVBIT FOR THE SMALL USER

The size 1 carton contains approximately 53 ft. of 18 s.w.g. SAVBIT. Obtainable from radio and electrical stores. Reference CrSAV18. Price 5/- each (subject).

MULTICORE SOLDERS LIMITED, MULTICORE WORKS, HEMEL HEMPSTEAD, HERTS. (BOXMOOR 3636)