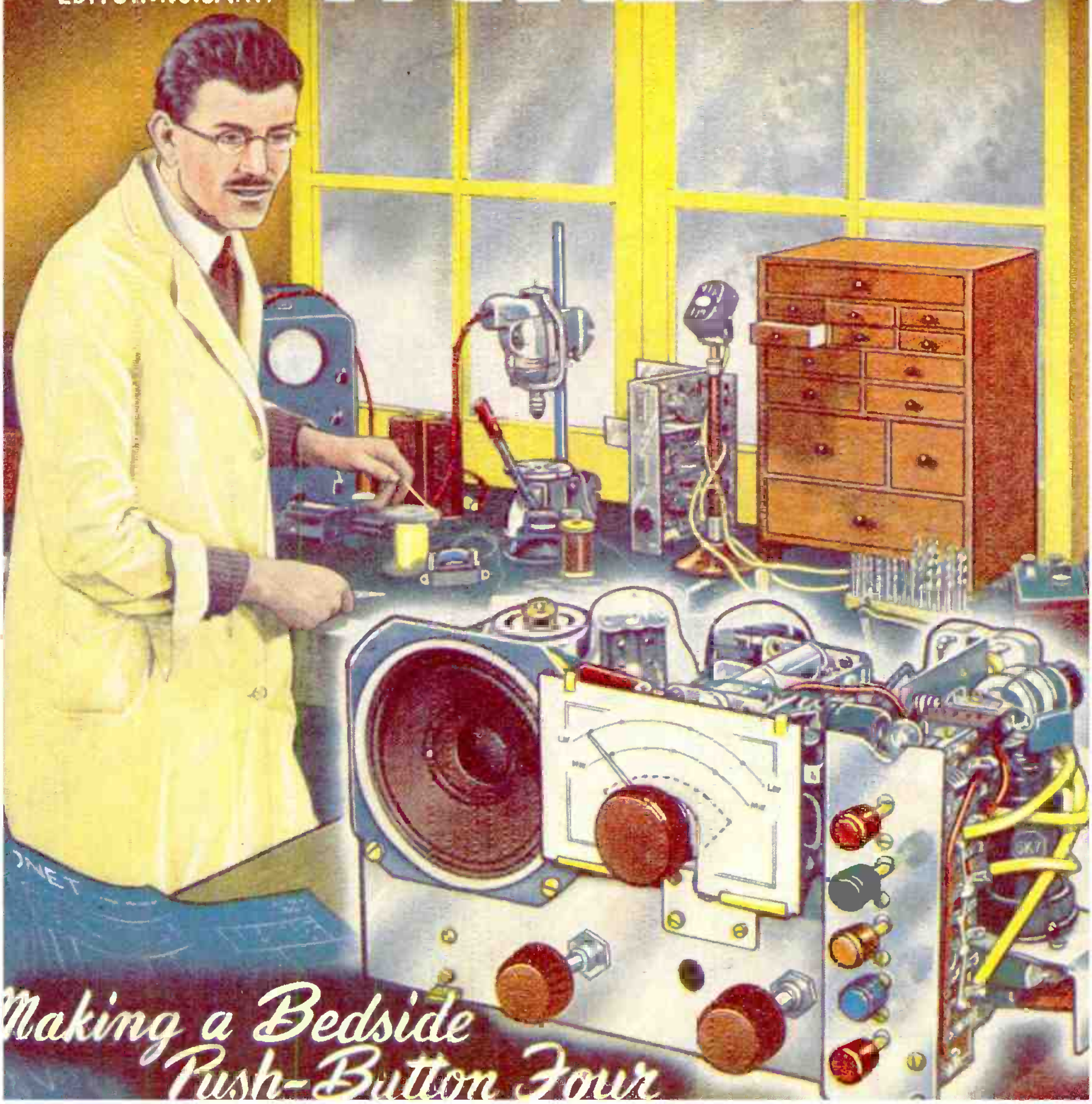
The Leading MAGAZINE FOR THE RADIO CONSTRUCTOR

PRACTICAL WIRELESS

1/-

APRIL 1955

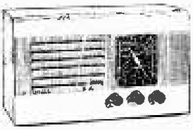
EDITOR: F. J. CAMM

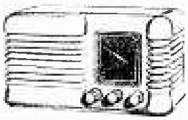


Making a Bedside Push-Button Four

BARTON'S (Radio)

BUILD YOUR OWN RADIO!





We can supply all the parts (including valves, 5in. moving coil speaker, cabinet, chassis, and everything down to the last nut and bolt) to enable YOU to build a professional-looking radio. The chassis is punched and drilled ready to mount the components. There is a choice of any of three attractive cabinets 12in. long, 5in. wide by 6in. high, as follows: either ivory or brown bakelite, or wooden, finished in walnut. Complete, and easy-to-follow point-to-point and circuit wiring diagrams supplied.

MODEL I. T.R.F. RECEIVER
This is a 3 valve plus metal rectifier T.R.F. receiver with a valve line-up as follows: **6K7 (HF), 6J7 (Det) and 6V6 (Output).** The dial is illuminated. Coverage is for the Medium and Long Wave bands. Operates on 200/250 volts A.C. Mains. A.C./D.C. Model now available.
Plus 2/6 Packing, Carriage, Insur. **£5.10.0**

T.R.F. RECEIVER We can supply this Receiver ready built at **£6 15s. 6d.** plus 3/6 packing, carriage.

MODEL 2. SUPERHET RECEIVER
This is a powerful midget 4 valve plus metal rectifier Superhet Receiver with a valve line-up as follows: **6K8, 6K7, 6Q7, 6V6.** The dial is illuminated and coverage is for the Short Wave bands between 16-50 metres, the Medium Wave bands between 190-450 metres, and the Long Wave bands between 1,000-2,000 metres. Operates on 200/250 volts A.C. mains.
Plus 2/6 Packing, Carriage, Insur. **£7.19.6**

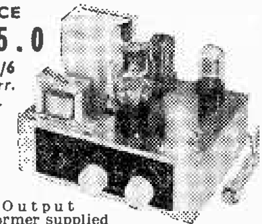
THE NEW T.R.F. MODEL I PLUS.
THE RECEIVER WITH THE SENSATIONAL PERFORMANCE!
This is a completely new design 4 VALVE, 2 Wave Band radio, incorporating the LATEST MINIATURE HIGH GAIN VALVES and the most modern design HIGH "Q" IRON CORED COILS, ensuring greatly increased sensitivity and selectivity over the whole of the Medium Band and providing outstanding performance on the Long Wave band. 4 VALVES. 6BJ6 R.F. Amp., 6BH6 Anode Bend Det., 6AQ5 Output. 6X4 Rect. Operates on 200/250 volt A/C Mains.
Plus 2/6 packing, carriage, & Insur. **£6.19.6**

This Receiver can be supplied Ready Built at **£8 5s. 0d.**, plus 3/6 packing, carriage and insurance.

Instruction Booklet and priced Parts List for any of the above available separately at 1/-. This money will be refunded if circuit diagram is returned as NEW within 7 days. *When ordering please state Model No.*

4-watt AMPLIFIER KIT
This is a 3 valve 3 stage Amplifier for use with Gramophone, Microphone or Radio. *Valve line-up is as follows:* **6SL7, 6V6, 5Z4.** Negative feed-back. Tone Control. Voltage adjustment panel incorporated. 4 watts output. For operation on A.C. Mains 200/250 volts.
The complete Kit includes every item down to the last nut and bolt, drilled and punched chassis, and comprehensive point-to-point wiring circuit diagram. Chassis dimens.: 8in. x 6in. x 2½in.

PRICE £4.5.0
Plus 2/6 Pkg., Carr. & Ins.



The Output Transformer supplied is for use with a loudspeaker of 3 ohms. *Circuit Diagram only, available separately at 1/-.* To those who require this Amplifier ready-built we can supply it at **£5.1.0**, plus 3/6 pkg., carr., ins.

RADIO TUNER UNIT
A new T.R.F. Tuner Unit designed for High Quality local station reception. 2 Valves—6K7 and 6J7. Controls—Volume, Tuning and Wavechange. Waveband coverage—Medium and Long. Dimensions—L. 6in. H. 5½in. D. 4½in. Power requirements—6.3 volts at 0.6 Amps. 250-300 volts 15 mA. (This supply is already available in the Amplifier illustrated above.) All the parts to build this Unit can be supplied at **£2 15s. 0d.**, plus 2/6 p. & c. Ready Built **£3 15s. 0d.**, plus 2/6 p. & c.

Office: (Dept. P.W.). 34, Montpelier Rise, London. N.W.11. Telephone: Meadway 1736.
Works and Despatch Dept.: 44. Tottenham Street, London, W.1. Tel.: Langham 1151. Open 9 to 6 p.m. Daily, Saturdays 1 p.m.
TERMS OF BUSINESS: Cash with order (or C.O.D. Post items). All orders over £2 post free unless otherwise stated.

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/- extra under 10/-. 1/6 extra under £1. 2/- extra under £2. 2/6 extra under £3. Open 9 to 5.30. Sats. until 1 p.m. Catalogue 6d. Trade List 5d. S.A.E. please with enquiries.

CHASSIS (Undrilled Aluminium)
18 s.w.g. amplifier (4-sided).
14in. × 10in. × 3in. **7/11** 14in. × 9in × 2½in. **6/11**
16in. × 10in. × 3in. **8/3**
18 s.w.g. receiver type.
6in. × 3¾in. × 1½in. **1/11** 10in. × 5½in. × 2in. **3/3**
7½in. × 4½in. × 2in. **2/9** 11in. × 6in. × 2½in. **3/11**
16 s.w.g. receiver type.
12in. × 8in. × 2½in.... **5/3** 16in. × 8in. × 2½in. **7/6**
20in. × 8in. × 2½in.... ... ... **8/11**
16 s.w.g. amplifier type, 4-sided.
12in. × 8in. × 2½in.... ... ... **7/11**
16in. × 8in. × 2½in.... ... ... **10/11**
20in. × 8in. × 2½in.... ... ... **13/6**
14in. × 10in. × 3in.... ... ... **13/6**

EX-GOVT. TRANSFS. 230 v. 50 c/cs. Following suitable for chargers, etc., 8.8 v. 4 a., **9/9**; 0-11-22 v. 30 a., **72/6**; 0-16-18-20 v. 35 a., **79/6**; 7.7 v. 7 a. C.T. 4 times, **25/9**. Carr. 5/-.

Misc. Types
4 v. 2.5 a., **4/9**; 4 v. 6 a. High Ins., **7/9**; 48 v. 1 a., **9/9**. Carr. 5/- extra on following types: 460 v. 200 mA. 6.3 v. 5 a., **27/9**; 400 v. C.T. 150 mA, 4 v. 6 a., 6.3 v. 6 a., 6.3 v. 0.6 a., 4 v. 6 a., 4 v. 3 a., 4 v. 3 a., 4 v. 3 a., 5 v. 2 a., **22/9**; 1,220 v. 350 mA, 610-0-610 v. 150 mA, 300-0-300 v. 150 mA, **29/9**; 865-775-690-0-690-775-865 v. 500 mA, **29/6**; 250-0-250 v. 200 mA., 6.3 v. 8 a., 5 v. 3 a., **22/9**; 300-0-300 v. 150 mA, 6.3 v. 4 a., 5 v. 3 a., **22/9**.

AMMETERS Moving Coil (EX-GOVT.) G.E.C. 0-5 amps, 2in. scale, **11/9**.

SILVER MICA CONDENSERS. 5, 10, 15, 20, 25, 30, 35, 40, 50, 100, 120, 150, 200, 230, 300, 400, 500, 1,000 (.001 mfd.), 2,000 pfd. (.002 mfd.), **6d.** each; **3/9** doz. One type.

MIDGET MAINS TRANSFORMER. Manufacturer's Surplus. Primary 220 240 v. Secs. 230-0-230 v. 70 mA., 6.3 v. 2 a. Only **11/9**.

EX-GOVT. AUTO TRANSFORMERS Double Wound, 50 c/cs.
10-0-200-220-240 v. to 10-0-275-295-315 v. 1,000 watts, **69/6**; 0-230 v. to 0-230 v. tapped every 11 volts; from 57.5 v. 5,000 watts (21 amps.), **£6/15/-**. Carriage on above 5/- extra.
15-10-5-0-195-215-235 v. 500 w., **27/9**.

EX-GOVT. SMOOTHING CHOKES.
250 mA. 10 H 50 ohms **14/9**
250 mA. 10 H 100 ohms **14/9**
150 mA. 10 H 100 ohms **11/9**
150 mA, 6-10 H 150 ohms Trop. ... **6/9**
100 mA. 10 H 150 ohms Trop. **5/11**
50 mA, 5-10 H 200 ohms... ... ... **2/9**
L.T. type 1 amp. 2 ohms **2/9**

EX-GOVT. METAL BLOCK (PAPER) CONDENSERS
4 mfd. 500 v., **2/9**; 4 mfd. 1,500 v., **4/9**; 4 mfd. 2,000 v., **7/9**; 6-6 mfd. 400 v., **5/11**; 8-8 mfd. 500 v., **6/11**; 4 mfd. 400 v., plus 2 mfd. 250 v., **1/11**; 8 mfd. 500 v., **5/9**; 15 mfd. 500 v., **6/9**.

EX-GOVT. E.H.T. SMOOTHERS
.02 mfd. 8,000 v. cans, **1/11**; .25 mfd. 4,000 v. Blocks, **4/9**; .5 mfd. 2,500 v. Blocks, **3/9**; .5 mfd. 3,500 v. cans, **3/3**; 1.5 mfd. 4,000 v. Blocks, **5/9**; .1 mfd., plus .1 mfd. large Blocks, 8,000 v., **9/6**.

EX-GOVT. ACCUMULATORS
With Non-Spill Vents. Unused and guaranteed 2 v. 16 A.H., **5/9**.

H.T. ELIMINATOR AND TRICKLE CHARGER KIT. Input 200-250 v. A.C. Output 120 v. 40 mA, fully smoothed, and rectified supply to charge 2 v. acc. Price with steel case and circuit, **29/6**. Or ready for use, **8/9** extra.

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. 25 mA. and L.T. of 6.3 v. 1.5 a. is available for the supply of a Radio Feeder Unit, or Tape Deck preamplifier. For A.C. mains input of 200-230-250 v. 50 c/cs. Chassis is not alive. Kit is complete in every detail and includes fully punched chassis (with baseplate), with green crackle finish, and point-to-point wiring diagrams and instructions. Exceptional value at only £4/15/-, or assembled ready for use 25/- extra, plus 3/6 carr.

TV. PREAMPLIFIER (Plessey) For Fringe Areas. Brand New. Complete with 6F13 valve. Only **22/6**.

RF26 UNITS BRAND NEW, CARTONED. Only **39/6**. Carr. 2/6.

EX-GOVT. VALVES (NEW)

	Each		Each		Each
IT4	7/9	6SN7GT	8/11	AC5PenDD	9/9
IR5	7/9	6V6G	8/9	EF36	5/9
IS5	7/9	6V6GT	7/9	EB91	8/9
3S4	7/9	6X5GT	8/9	EF91	7/9
5Y3G	8/9	8D2	2/11	EL33	9/6
5U4G	10/6	807	7/11	MU14	8/9
5Z4G	9/6	12A6	7/9	MS/Pen	5/9
6F6G	7/9	12K7GT	10/6	SP4	5/9
6J7G	6/6	15D2	4/9	SP41	1/11
6K7G	5/11	25Z4G	9/6	SP61	2/9
6K8G	8/11	35Z4GT	10/6	VU120	2/11
6SK7Met	7/9	EBC33	7/9		

SPECIAL OFFER. Ex-Equip. Goodmans 3½in. P.M. Speaker with Battery pentode trans., **12/9**.

PRACTICAL WIRELESS

EVERY MONTH
VOL. XXXI, No. 582, APRIL, 1955

EDITOR : F. J. CAMM

23rd YEAR OF ISSUE

COMMENTS OF THE MONTH

BY THE EDITOR

ADVANCES IN TAPE RECORDING

THE advance of interest in tape recording in this country is shown by the fact that nearly 40 manufacturers are now marketing complete apparatus. In addition, one well-known recorder is available in kit form.

It is impossible to assess how many amateurs are interested in this subject to-day, but the number is large enough to sustain an association whose only interest is in sound recording, and it is a number which is growing week by week.

Radio, television and recording have allied interests, and it is understandable that large numbers of our readers are interested in all three. This journal and our companion journal, *Practical Television*, cover the three subjects very fully, from the amateur point of view, and our associated journal, *Practical Mechanics*, has also described the construction of an efficient tape recorder. These instructions have been reprinted in the *Practical Mechanics How-To-Make-It Book* (12s. 6d., or 13s. by post from the publishers of this journal).

At present, however, tape recorders are costly, whether purchased ready made or home built. The tape deck is the costly item, for it must be purchased as a unit, being outside the skill and workshop facilities of the average amateur. We refer to this matter now because we have received requests for a greater amount of space to be devoted to this subject. We, therefore, invite readers who are interested in the subject to submit their views so that the matter may be given consideration. As a footnote, in addition to firms supplying complete recorders, nearly 30 others supply tape and accessories. There can be little doubt that recording has given rise to another absorbing hobby.

ABOUT CLUBS

A CONTRIBUTOR has, in recent issues, dealt with the subject of clubs and the way in which they are run. His remarks have evoked a large amount of correspondence, mostly from members of particular clubs, some expressing satisfaction with their organisations and the way they are run, whilst others state that they had not given the matter a thought until the spotlight was turned on to the subject in this journal.

We have always encouraged the formation of local radio clubs, which are purely domestic affairs whose finances are within the knowledge of every member. The membership of such clubs is always comparatively small, the subscription low, and in every case annual general meetings are held at which the officers are elected for the following year. When, however, a club is launched on a national basis the position is vastly different. The members are widespread and for many of them the only contact they have with headquarters and other members is through the club magazine, usually a duplicated affair.

In such cases it is even more important that the club, association or league should be run on accepted lines and account to its members each year for its activities, revenue and expenditure. Also, it is vital that annual general meetings be held to afford members an opportunity, if necessary, of criticism and of appointing fresh officers. If such clubs were run on the lines of the R.S.G.B. no criticism could arise.

When, however, a group of people form a club and become the proprietors of it, it ceases to be a club and becomes an ordinary business undertaking. Some correspondents suggest that an independent audit is unnecessary. Why? It allays any possibility of suspicion that the club is being run for private gain.

A member of a club should have a right to a say in the conduct of its affairs, since every member *jointly and severally* is responsible in law for any costs and damages awarded against it.

Legal advice should always be sought before founding any club which appeals for subscriptions or donations. Our only interest in this matter is to protect our readers against possible exploitation, and without wishing to impugn any particular organisation.

It is for this reason that we have to reassure ourselves as to the standing of any particular club, and the manner in which it conducts its affairs before we can publish any notices concerning them in this journal.

Readers who join particular clubs as a result of notices we publish are entitled to presume that all clubs are *bona fide*, and we therefore have a duty to protect them.

We have already published in this journal the details we require before we can publish any club notices herein. We are not, of course, referring to long-established organisations.

—F. J. C.

Round the World of WIRELESS

By "QUESTOR"

300 Members

THE Mobile Radio Users' Association now has a membership of about 300, this number being 75 per cent. of land users of mobile radio.

Broadcast Receiving Licences

THE following statement shows the approximate number of broadcast receiving licences issued during the year ended December, 1954. The grand total of sound and television licences was 13,872,633.

Region	*Number*
London Postal ...	1,502,332
Home Counties ...	1,436,842
Midland	1,180,153
North Eastern... ...	1,553,937
North Western ...	1,202,591
South Western ...	974,028
Wales and Border Counties	608,216
Total England and Wales	8,458,099
Scotland	1.039,152
Northern Ireland ...	219,393
Grand Total ...	9,716,644

Talks Producer

MR. WALTER TAPLIN joined the temporary staff of the BBC on January 17th as a Talks Producer in Home sound programmes.

BBC Commissions Concerto

DR. EDMUND RUBBRA has accepted a commission from the BBC to write a concerto for piano and orchestra for performance in the BBC Symphony Orchestra's 1955-56 Winter Season of Symphony Concerts.

Export Record

PROVISIONAL figures issued by the Radio Industry Council reveal that radio equipment exports in 1954 reached a new high level.

The total value of exports last year was £29,100,000, 12 per cent. more than the value for 1953. Britain's best customer was Holland—it was Sweden the previous year—and Canada was second best. Sales to the United States were worth more than £580,000, an increase of £140,000.

Obituary

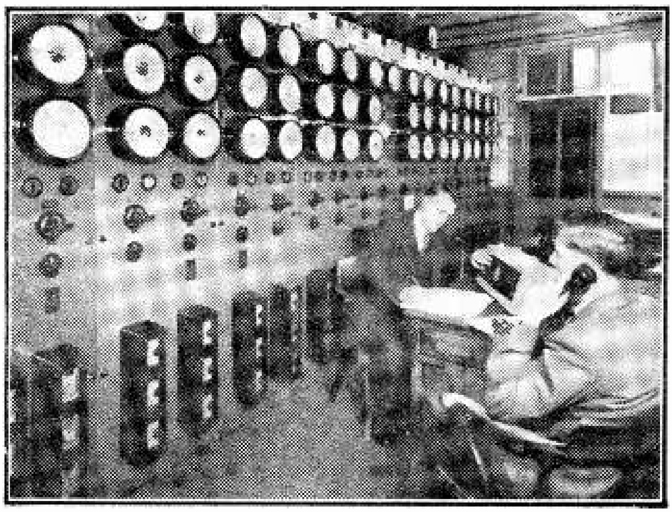
IT is with regret that we announce the death of Mr. Eric Dare, general manager of Mullard Australia Proprietary, Ltd. He died suddenly at the end of December, at the age of 56.

Mr. Dare was a well known and popular figure in Australian radio circles. His active interest in radio dates back as far as 1924 when he started a daily wireless newspaper.

Gee System Lectures

A SHORT series of three lectures on the Gee system of navigation was delivered recently to the Derby and District Amateur Radio Society by Mr. G. M. C. Stone, of A. C. Cossor, Ltd.

The lectures covered both ground and airborne Gee and were supplemented by films. Mr. Stone also described its use in wartime.



The electrical control room in the Newcastle Corporation headquarters. Any electrical faults that occur in the city streets are telephoned to this office. The engineer-in-charge then calls one of the tower wagons by V.H.F. radio and directs it to the fault.

V.H.F. Radio for Newcastle Corporation

FIVE tower wagons and a maintenance van belonging to the Newcastle Corporation have been equipped with mobile V.H.F. two-way radio and a main control station set up at the Corporation headquarters.

The tower wagons are responsible for the maintenance of the street-lighting installations and trolley-bus overhead lines throughout 40 miles of streets in Newcastle.

The radio equipment, which was supplied by The General Electric Co. Ltd., was introduced to facilitate repair work.

Princess Royal to Open Show

H.R.H. THE PRINCESS ROYAL has consented to open the North Radio Show, City Hall, Manchester, on Wednesday, May 4th.

All space in the exhibition has been taken and the exhibitors include the leading manufacturers of radio and television receivers. The organisers, the Radio Industry Council, are to build a studio within the exhibition from which the BBC will broadcast sound and television programmes. The show closes on Saturday, May 14th.

Change of Address

BRITISH INSULATED CALLENDER'S CABLES, LTD., announce that the new address of their London sales office is 10-14, White Lion Street, London, N.1. The telephone numbers are TERminus 8696 and 0372.

The company's central administrative offices remain at 21, Bloomsbury Street, London, W.C.1.

British Institution of Radio Engineers

THE following meetings of the Institution will be held during March :

London Section. — Wednesday, March 30th, 6.30 p.m., at the London School of Hygiene and Tropical Medicine, Keppel Street, Gower Street, W.C.1. Discussion meeting on "The Maintainability of Service Equipment."

North-eastern Section.—Wednesday, March 9th, 6 p.m., at Neville Hall, Westgate Road, Newcastle-upon-Tyne. "The Application of Negative Feedback to Electrical Measuring Instruments"—F. J. U. Ritson.

West Midlands Section. — Wednesday, March 9th, 7.15 p.m., at Wolverhampton and Staffordshire Technical College, Wulfruna Street, Wolverhampton. "Electrical Standards in Electronics"—P. M. Clifford.

Scottish Section. — Thursday, March 10th, 7 p.m., at the Institution of Engineers and Shipbuilders, Elmbank Crescent, Glasgow. "Computing Circuits in Flight Simulators"—R. A. Marvin, B.A.

North-western Section.—Thursday, March 31st, 7 p.m., at the Reynolds Hall, College of Technology, Sackville Street, Manchester. "Electronic Control of Industrial Production Processes"—J. A. Sargrove. To be followed by the A.G.M.

Singapore's First Radio-taxis

SINGAPORE'S first radio-controlled taxicabs have recently appeared on its busy streets. A local firm, Radio Taxis Ltd., is installing Marconi mobile V.H.F. sets in its large fleet of vehicles.

About 25 of these taxis have been fitted with two-way radio so far, and the operating company has already found that the system results in a great saving of time and expense.

E.M.I. Purchase Shares

THE directors of E.M.I., Ltd., have entered into a contract to purchase the majority of the 476,230 common shares of Capitol Records, Inc., of California, at the price of 17.50 dollars per share, and are offering to purchase the balance of the common shares at the same price.

Treasury consent to the provision of the necessary dollars has been obtained.

Mr. Bernard Moore

MR. BERNARD MOORE has been appointed head of the BBC Colonial Service, the position which was formerly held by the late Mr. Grenfell Williams.

The appointment took effect from January 24th.

ITMA Writer Opens Shop

MR. TED KAVANAGH, who used to write the scripts for "ITMA," opened a radio shop in Southampton recently.

Ambulance Economy

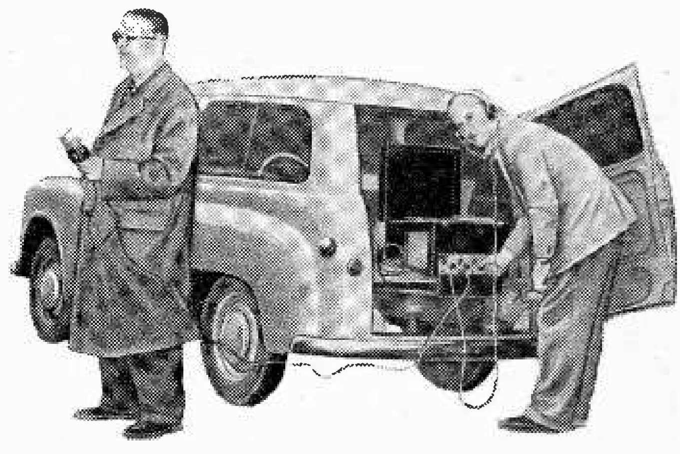
A TRIAL period of thirteen weeks in Bedfordshire showed that the fitting of two-way radio to ambulances and hospital cars enabled 1,039 more patients to be carried to and from hospitals and that, in doing so, 2,428 fewer miles were covered compared with the same period in 1953.

Now mobile radio is to be adopted by hospitals in the northern part of Bedfordshire at an approximate cost of £4,011.

Concern Over Welsh Reception

IN reply to questions put to him in the House of Commons recently, Mr. L. D. Gammans, Assistant Postmaster-General, has stated that the BBC is well aware of the bad reception of the Home Service by Welsh listeners and is doing its best to find an answer to the problem.

Most of the interference is caused by a station in the Soviet zone of Germany that operates on the same wavelength and efforts to stop this have had negative results. Welsh Members of Parliament have asked whether Welsh listeners need pay the full licence fee in view of the poor service received.

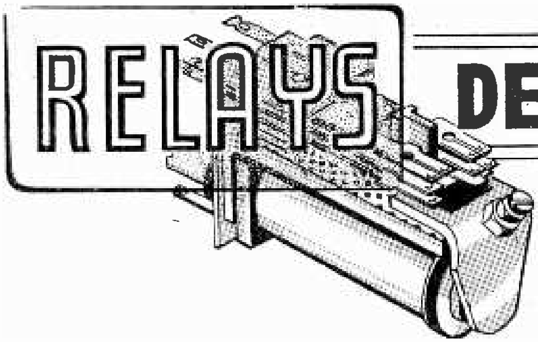


For covering outside assignments, J. R. (sound) Reproductions of South Croydon, Surrey, have converted this Hillman Husky into a compact mobile recording unit.

"Housewives' Choice" Anniversary

ON March 4th, "Housewives' Choice" celebrated its ninth birthday. When the first programme went out in 1946 it was presented by Robert MacDermot and organised by Pat Osborne.

After some years on other programmes, Pat Osborne is once more working on "Housewives' Choice." Before the first edition was broadcast, she wondered whether there would be enough requests from housewives to keep the series going, but the announcement of the special programme brought in a flood of requests that has shown no sign of drying up.



RELAYS DESIGN & USES

THE SECOND ARTICLE IN A NEW SERIES DEALING WITH A MOST USEFUL TYPE OF RADIO ACCESSORY

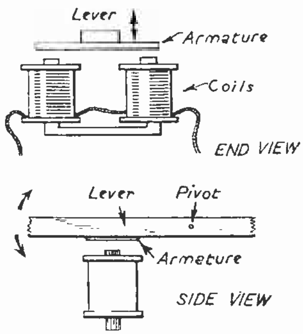
By J. R. Davies

ALTHOUGH the relay works at relatively high speed (up to approximately 20 words a minute), its contacts travel through a distance of nearly half-an-inch each time it energises. This large degree of movement enables aerial switching to the transmitter and its associated receiver to be carried out each time the key is pressed or released.

Fig. 7 (a) shows the armature and coils of the relay. It will be noticed that the armature consists of two "leaves" these being inclined to each other. The "leaves" are pivoted at their junction.

The energising circuit of the relay is shown in Fig. 7(b) which illustrates also the position of the armature when the key is raised. This diagram includes one of the relay contacts as well, this contact making when the relay is in the "key-up" position (as it is in Fig. 7(b)). It will be seen also from this diagram that, until an energising voltage is applied to one of the coils, the armature and the contact bar are free to move on their common pivot. When the relay is used, as in the T1154, no energising voltage appears until the transmitter L.T. (6 volts D.C.) is switched on, whereupon coil A becomes energised and the armature takes up the position shown in the diagram. On pressing the key, coil B becomes energised. So also does coil C, the voltage appearing across this coil via the contact of the relay. Coil C is so wound that it sets up a magnetic field opposite in polarity and stronger than that of coil A. This new field causes that leaf of the armature adjacent to coil A immediately to be repulsed; this repulsion is due to the fact that the polarity of the core around which coil C is wound is now the same as that presented to it by the residual magnetism remaining in the armature. This repulsion then assists and speeds the armature in swinging over to the already energised coil B. After the armature has swung sufficiently far, the relay contact breaks and coil C becomes de-energised. The armature, however, completes its movement and takes up the position shown in Fig. 7(c). It is, of course, necessary to de-energise coil C as soon as it has completed its task of starting the armature moving, since otherwise it would prevent or delay coil A from pulling the armature back again when the key is raised.

Fig. 6—A simplified diagram showing the armature and coil arrangement of a non-polarised relay capable of working at fairly high speeds. The lever to which the armature is attached may be made of any material. Contacts and springs, etc., may be fitted to the lever on either side of the pivot.



To prevent too much sparking at the key, resistors are connected in series with coils B and C. These resistors have been omitted from Figs. 7(b) and (c) for purposes of simplicity.

A.C. Relays

It occasionally happens that it is necessary to use relays which must be energised from a source of A.C.

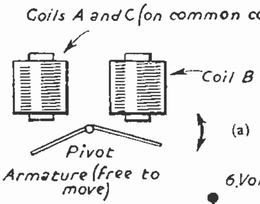
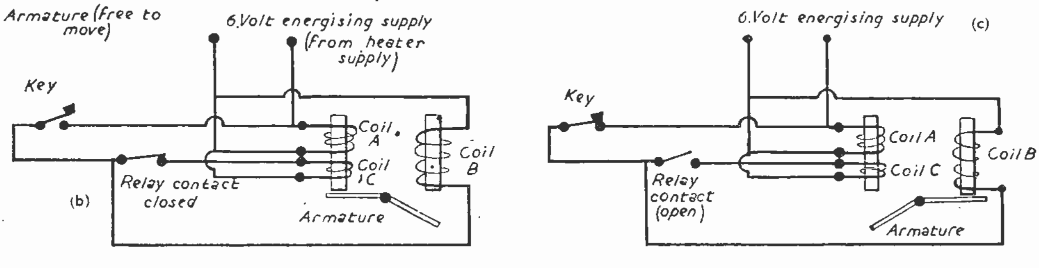
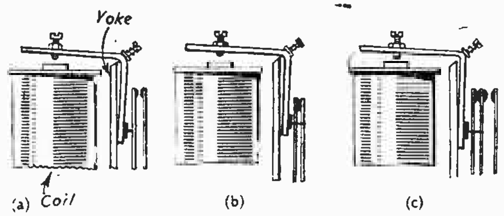


Fig. 7.—(a) A simplified diagram showing the armature and coil construction of the keying relay fitted to the T1154. The moving contacts (not shown here) are fitted to a bar which turns with the armature. (b) The relay energising circuit, illustrating the state of affairs when the key is raised. (c) The circuit obtaining when the key is pressed.





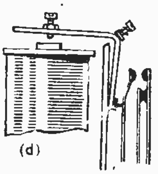


Fig. 9.—(a) A pair of make contacts. (b) Break contacts. The extension of the second contact bearing against the armature lever passes through a hole in the first contact. (c) Change-over contacts. (d) Make-before-break contacts.

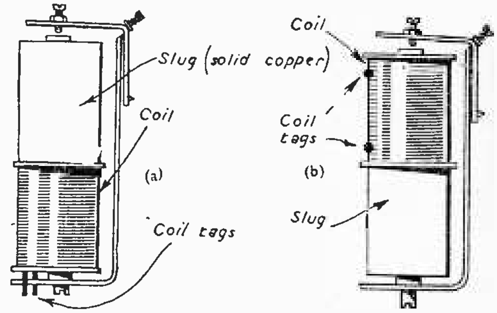


Fig. 10.—(a) A relay fitted with a heavy slug at the armature end of the coil. (b) A relay with the slug fitted to the heel end of the core.

As may be appreciated, this gives rise to certain difficulties, since the magnetic attraction holding the armature to the core of such a relay would be continually altering.

A common method of overcoming this trouble is shown in Fig. 8. This diagram illustrates the end of the core which is nearest to the armature, the latter having been omitted for purposes of clarity. What is known as a " shading coil " is fitted to half of the face of the core. The shading coil is simply a single short-circuited turn of heavy copper.

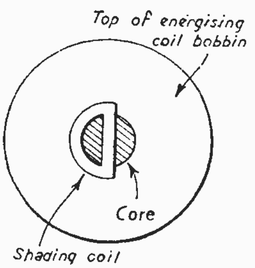


Fig. 8.—Top view showing how the shading-coil is inset into the core of an A.C. relay.

When the energising A.C. voltage applied to the relay core drops to zero at every half-cycle, the shading coil opposes the cessation of the field within the shaded area of the core. This shaded area, therefore, holds the armature down during the time when the rest of the core affords no magnetic attraction. Thus the armature is continually held against the core over the entire A.C. cycle and does not " chatter " or vibrate in sympathy with the energising A.C. as would otherwise be the case.

A.C. relays usually employ a laminated, instead of a solid, core.

Contacts

Up to now we have discussed in some detail the construction and design of the more common relays likely to be encountered in radio work. Our next step consists of considering the various types of contact unit which may be used with these relays. (The term contact unit refers to a group, or set of two or three contacts, one of which is moved by the armature. Each unit is similar to a single-pole switch. A single relay may operate as many contact units as can reasonably be fitted to it.)

Fig. 9 shows four contact units, these being the most representative types likely to be met. For convenience, they are illustrated as though they were fitted to the conventional type of relay which was illustrated in Fig. 1.

Fig. 9(a) shows two contacts which are pushed together when the relay energises. These are known as " make " contacts.

Those of Fig. 9(b) carry out the reverse process and are called " break " contacts. Fig. 9(c) shows a set of " change-over " contacts, while Fig. 9(d) illustrates a set of " make-before-break " contacts. Make-before-break contacts are not so common as

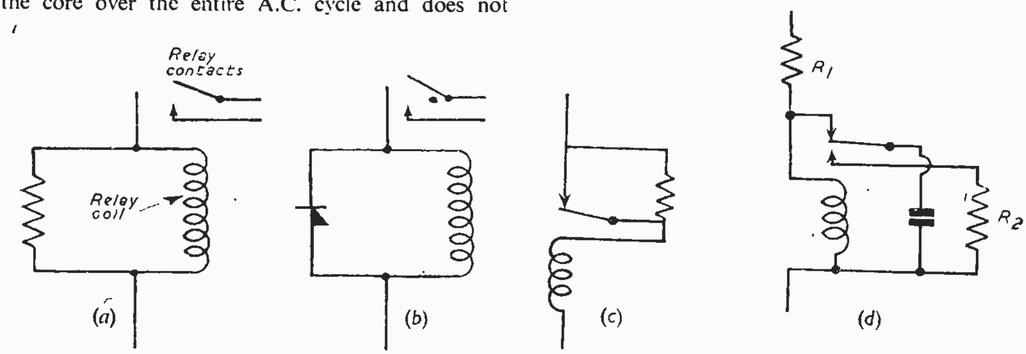


Fig. 11—(a) Connecting a resistor across the coil of a relay to make it exhibit a slow to release characteristic. The resistor should have approximately the same value of resistance as that of the coil. (b) Another relay circuit which gives a slow to release effect. (c) A relay that is quick to operate and release. (d) A relay which is made slow to operate only

are the other three types, but they are very useful in certain circuits where changeover contacts could not be used. The nomenclature and functions of the various types are simple enough to remember: each

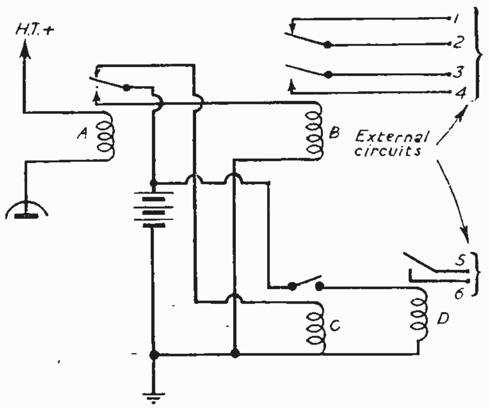


Fig. 12.—A relay circuit illustrating the attached method of presentation. Relay A is operated by anode current and its change-over contacts cause either relay B or relay C to be energised. Relay C, on energising, energises relay D. The contacts of relays B and D are used to switch external circuits via the terminals 1 to 6.

name describes the action carried out by the contact unit when the relay energises.

Slugging

When we described the action of the shading coil of an A.C. relay above, we pointed out that this coil tended to oppose the change in magnetic flux given by the alternating energising voltage. This principle is often used with D.C. relays as well, its purpose being to slow down the speed with which the relay operates.

This slowing-down process is known as slugging, and instead of a small shading coil relatively large pieces of solid copper are used instead. These pieces of copper, called "slugs," are fitted around the core of the relay.

Fig. 10(a) shows a relay which is fitted with a heavy slug at the armature end of the coil. If desired, this slug could take up as much as half the winding space on the core, the remainder being left for the coil.

To understand the action of the slug let us imagine that a source of supply is about to be connected to the coil of the relay. As soon as this source becomes connected the coil immediately sets up a magnetic field. This field is opposed by the slug (by reason of the induced currents and consequent opposing field set up in it) and some time elapses before sufficient magnetic force can be built up to move the armature. When the energising voltage is removed from the coil the slug acts once more, this time opposing the collapse of the magnetic field. Thus, the slug causes the release of the armature to be delayed as well.

A relay constructed in this manner is described as being "slow to operate and release."

The relay of Fig. 10(b) operates in a slightly different manner. This time the slug is fitted to the heel end of the core. It will be found that, in this case, the slug does not delay the process of energising. This is due to the fact that, when the relay becomes energised, there is sufficient attraction between the top of the core and the armature for the latter to move to the energised position. When the relay is de-energised, however, the slug opposes the breakdown of the field existing in the magnetic circuit formed when the armature moved over to the core. The de-energising of the relay is, therefore, delayed.

A relay of this type is described as being "slow to release." One occasionally hears the terms "slow to make-and-break" and "slow to break" used for the relays just described. These terms are incorrect and are liable to lead to confusion.

Alterations in the speed of working of normal relays can often be obtained by using external components, instead of relying on slugs fitted to the core.

Fig. 11(a), for instance, shows a relay which will exhibit a "slow to release" characteristic. On connecting the energising voltage, the relay energises normally, the resistor serving only to draw an additional current from the source of supply. When the energising voltage is broken, however, the resistor tends to short-circuit the coil, giving it something of the action of a slug. The main disadvantage with this circuit is the extra current needed when the relay is energised.

Fig. 11(b) shows a more efficient method. The rectifier across the coil is so connected that it does not conduct when the energising voltage is applied. When this voltage is removed, however, the collapsing magnetic field induces in the coil a voltage which is opposite in polarity, causing the rectifier to conduct and apply a partial short-circuit. This relay, therefore, exhibits a "slow to release" action also, without the disadvantage of requiring extra energising current.

By using the contacts of the relay itself, further alterations in performance may be obtained. Fig. 11(c) shows a typical example, this illustrating a relay which is made "quick to operate and release." At the instant of applying the energising voltage to the relay its break contacts are short-circuiting the resistor. Thus the full voltage appears across the coil and the relay energises quickly. However, as soon as it energises, the series resistor is brought into circuit and the voltage across the coil drops to a value that is just sufficient to hold the armature against the core. Thus, on removing the energising voltage, it is necessary for only a small magnetic field to collapse, and the armature releases more quickly than it would otherwise have done. Incidentally, this circuit allows the initial energising voltage to have a much higher value than would normally be required by the relay, thereby speeding up the process of operating still more.

Circuit Diagrams

An interesting and unconventional circuit is shown in Fig. 11(d). This time the relay is "slow to operate." When the energising voltage is originally applied the relay is shunted, via its change-over contact, by a capacitor. Due to the series resistor, R1, the capacitor takes some time to charge up, and the energising of the relay is correspondingly delayed. Once energised, the change-over contacts are actuated, causing the capacitor to be disconnected from the relay coil and connected to another resistor, R2, through which it discharges. When the energising voltage is removed, the armature releases normally.

A relay circuit diagram is usually drawn in one of two ways, the choice being made according to the complexity of the circuit and, to a small extent, with a view to the person who will be using it.

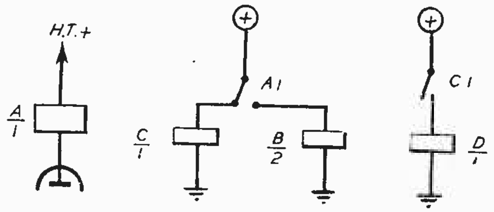
The method chosen for simple relay diagrams uses what is known as the "attached" circuit. An example of the "attached" circuit diagram is given in Fig. 12. As may be seen, this diagram shows all relay contacts as being in line with their energising coil. This type of circuit diagram is often used for simple arrangements, in which form it presents a circuit that is easy to visualise. It is often used in radio diagrams which include only one or two relays.

The other system is known as the "detached" circuit diagram. Using this interpretation, relay coils are represented as solid blocks, and their contact units are inserted in any convenient position in the diagram. In a complicated circuit, a relay contact unit may appear at the opposite end of the diagram from its coil. The detached circuit diagram is, perhaps, a little disconcerting at first to the uninitiated, but one soon gets used to it.

An example of a detached circuit diagram is shown in Fig. 13. It will be seen that each coil is designated with a letter and a figure, such as, for example, $\frac{B}{2}$. The letter identifies the relay, whilst the figure indicates the number of contact units on that relay. The contact units spread around the diagram are then labelled with the letter of the relay, and their number. Thus $\frac{B}{2}$ relay has two contact units—B1 and B2, these appearing in their appropriate places in the diagram. The contact units are usually numbered in the order in which they are mounted on the relay itself, No. 1 contact unit being that nearest the yoke. When two banks of contacts are fitted, contact unit No. 1 is that nearest the yoke on the left, No. 2 that nearest the yoke on the right, No. 3 the next out on the left, and so on. The left and right directions are obtained when looking at the underside of the relay with the core below the contacts.

It is important to remember that contacts illustrated in detached circuit diagrams are always shown in their de-energised positions. In the very occasional cases where this rule is not observed, the energised relays are named in a prominent place in the diagram.

A further simplification shown in Fig. 13 consists of the use of separate "sources of supply" and earth



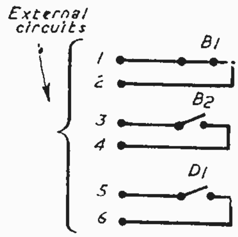


Fig. 13. — Another relay circuit using the detached interpretation. (This circuit is the same as that of Fig. 11.)

symbols. Fig. 13 shows two positive sources of supply ("plus" signs enclosed by a circle), and three earth symbols, these being used for two separate relay circuits. In practice, the positive sources of supply are obtained from the same point. Negative sources of supply may also be used.

It helps considerably, when studying a complex relay circuit, to try to visualise the action of each particular circuit by starting at its "source of supply" end and carrying through to the earth connection.

Up till now we have used the attached method of representation in these articles. Next month, when we show some circuits which are particularly applicable to radio, we shall commence to use detached circuit diagrams. *(To be continued)*

G.E.C. Radio Compass

THE G.E.C. radio compass, developed in close collaboration with the Royal Aircraft Establishment to a Ministry of Supply specification, is now available for civil aircraft. Designed especially for modern high speed aircraft and widely used in Service machines, it operates in conjunction with any ground transmitting station of known location operating in the frequency band 150-1,500 kc/s. It is used to determine the aircraft's position and course, and also for homing an aircraft on a transmitting station, the bearings being supplied by the instrument. The instrument also provides normal radio reception facilities in the medium waveband.

The complete equipment comprises a receiver, a loop assembly, a desiccator, two control boxes, a junction box, two indicators and a cathode follower unit, the total weight being about 74lb. One of the indicators incorporates a compass and is driven by a repeater from the gyro compass, enabling bearings to be related direct to North.

There are four facilities, all controlled from a service switch on the control boxes:

When the switch is tuned to "Nav.," A.V.C. is replaced by full-range manual control on both R.F. and I.F. amplifiers. This arrangement with the note filter switched in is provided specially for use with medium frequency ranges or track guides which are tone-modulated at approximately 1,000 c/s with polar diagram keying to give an equi-signal track with interlocking A—N off-course signals.

Turning the service switch to "A.D.F." brings into use the electronic loop switching circuits and servo mechanisms for automatic loop positioning, there being no ambiguity as to the sense of the bearings indicated. A.V.C. operates on this facility and a separate A.V.C. line is provided for the loop amplifier while manual volume control operates on the A.F. amplifier only. The compass provides reliable bearings on field strengths of 50 microvolt/metre, though in taking bearings on weak signals the receiver should always be carefully monitored by the telephones. A "No Signal" indicator is provided which confirms to the user that the signal on which he is homing is still being transmitted.

When the service switch is turned to "Loop" the sense aerial is eliminated and reception is on loop with full range R.F. manual volume control. Loop rotation is by variable speed reversible manual control and both note filter and heterodyne oscillator will be in use on weak signals.

AMPLIFIER DESIGN

13.—TUNED AMPLIFIERS

By R. Hindle

(Concluded from page 146, March issue)

The Conclusion of A Series of Articles Dealing with the Theoretical Considerations of Amplifier Design, both R.F. and A.F.

Selectivity

IN addition to increasing the gain an increase in Q of a tuned circuit improves the selectivity as is shown in Fig. 52. The simplest way in which Q can be increased to take advantage of the increased gain and selectivity is by introducing positive feedback deliberately up to very near to the instability level. This is exactly what reaction is, and it is a very useful arrangement for a simple receiver giving quite appreciable R.F. gain, in effect. It will be seen, however, that bandwidth is severely restricted thereby, and it is hardly the measure to adopt for a quality receiver.

Similar results are achieved by using a number of tuned circuits in cascade, i.e., one after the other, and Fig. 53 gives curves for from one to four such circuits. It is assumed that the coupling used between successive circuits is in one direction only, such as is the case if there is a valve between circuits. Where circuits are coupled together inductively or by capacitance the operation is modified.

Transformer with Tuned Primary and Secondary

The transformer as dealt with above was tuned at the secondary only, but a transformer can also be tuned both primary and secondary and on the face of it this could be looked upon as two separate tuned circuits in cascade (i.e. one following the other) but a moment's reflection will show that the coupling in the case of a transformer is not unidirectional as is required for circuits to be considered as working in cascade. It is necessary for cascaded tuned circuits that the energy be transferred from the first to the second circuits, but not in reverse from the second to the first, and the common method of coupling visualised for this method is via a valve. Inductive coupling in the transformer, however, is just as effective from second to first tuned circuit as in the forward direction and the cumulative effect shown in Fig. 53 cannot necessarily be applied.

The exact effect achieved by the tuning of both primary and secondary depends on the degree of coupling and where this is of a low order the shape of the secondary response curve is, in fact, very similar to that obtaining with one-way coupling between two such circuits, i.e. the selectivity is increased and the peak of the response narrowed and sharpened. The primary response, on the other hand, is much as though the secondary did not exist and the response is almost identical with that given by a single tuned circuit with similar Q. Curve 1 of Fig. 54 indicates the secondary circuit response for a low coefficient of coupling. As the coupling is increased the secondary current grows in amplitude and takes on a flattened peak and the degree of coupling at which the amplitude of current reaches its maximum and exhibits a maximum width of flat top is called the "critical coupling." This condition is given at curve 2 in Fig. 54. A further increase in coupling has no effect on the peak amplitude of the secondary current but is seen to result in the breaking up of the response into two separate peaks, and the greater the coupling above the critical value the wider apart are the peaks and the more pronounced the trough between. Curve 3 of Fig. 54 indicates the condition where k slightly exceeds the critical value and curve 4 where k is three times the critical coupling and it will be seen that the claim that peak amplitude does not change for over-coupling is verified.

Reason for Double-peaking

This break-up into double peaks is due to the

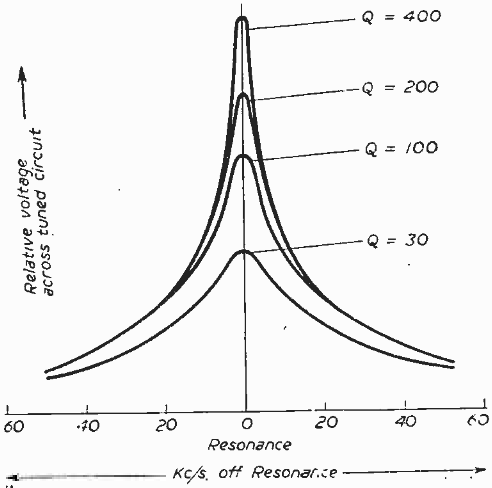


Fig. 52.—Effect of Q on selectivity.

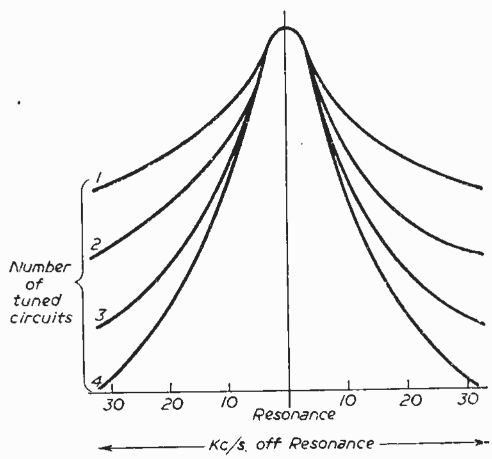


Fig. 53.—Effect of tuned circuits in cascade.

nature of the impedance coupled into the primary from the secondary. At resonance the reflected impedance is a pure resistance and this, being effectively in series with the primary impedance, reduces the Q of the primary and so reduces the response

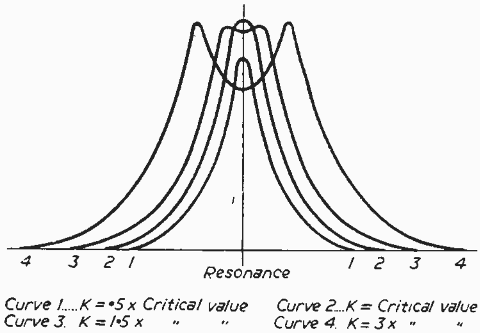


Fig. 54.—Secondary response curve for various degrees of coupling ($Qp = Qs$).

of the circuit at the exact frequency of resonance. This results also in a reduction in the voltage induced into the secondary at this frequency. The tighter the coupling the more effective is this damping of the primary by the secondary, and consequently the reduction of the secondary voltage at resonance is greater; hence the trough. To a frequency slightly above resonance, however, the secondary circuit capacitance has a reactance lower than that of the secondary inductance and therefore it draws the greater current. The secondary circuit as a whole, therefore, now exhibits the net characteristics of a capacitance, and it is a partially capacitive load that is reflected into the primary. Now in the primary the reflected secondary load appears as though it were in series with the primary components, and so the reflected capacitance appears there in series with the primary capacitance, effectively reducing it (two capacitances in series, the reader will remember, are less than either capacitance alone). This produces in the secondary a resonance effect to a frequency higher than that to which the primary alone is tuned. Where the shift in frequency of response in this way is equal to the displacement off natural resonance (of the primary alone) of the frequency causing the effect, the primary response is greater, and the signal passed to the secondary is greater, than at the natural resonance of the individual circuits. This accounts for the displaced peak at a frequency above that to which the circuits are tuned.

By a similar argument the fed-back impedance at a frequency slightly lower than resonance is inductive and this, in series with the primary inductance, increases the effective inductance and lowers the primary frequency of response, causing a peak at the lower frequency.

The above discussion has been in terms of primary current whereas generally a voltage is required to drive the next stage but, of course, the current produces a voltage across the capacitance of the secondary, Ohm's Law determining the amplitude, and this voltage is thus proportional to the current flowing.

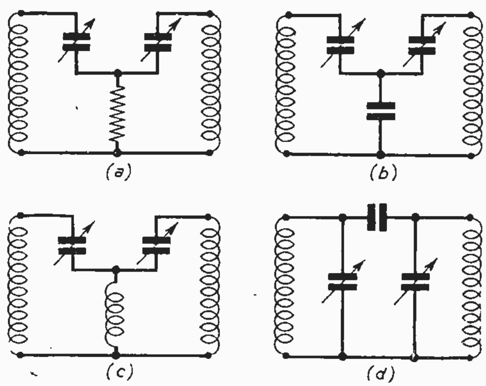


Fig. 55.—Alternative coupling methods.

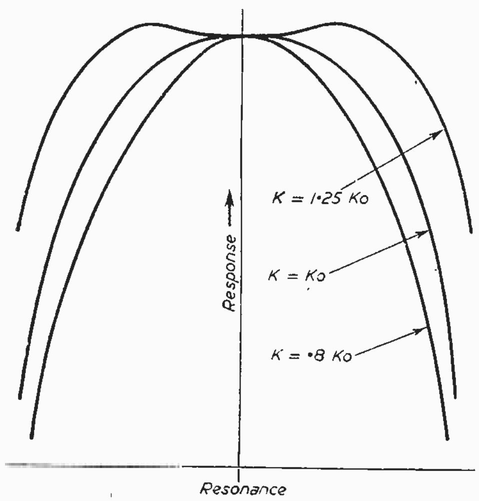


Fig. 56.—Response for K values centred round the critical valve (Ko).

Critical Coupling

The degree of coupling permissible without the break-up into double humps, i.e. the critical coupling, depends on the quality of the tuned circuits and is given by

$$\text{Critical coupling (ko)} = \frac{1}{\sqrt{QpQs}}$$

where Qp is the Q of the primary circuit, Qs is the Q of the secondary circuit; when the two circuits have the same Q Ko becomes $\frac{1}{Q}$. The similarity of tuned circuits used in the transformer is assumed when stating that double-humping occurs when the coupling exceeds the critical value as previously defined; if the Q's are different a somewhat greater degree of coupling is required to give the double hump.

Staggered Tuning

The frequency band passed by a transformer tuned at both primary and secondary can be increased by staggering the tuning so that one is tuned slightly above and the other slightly below the centre frequency required. The effect of this is, in practice, equivalent to an increase in the coefficient of coupling and is (assuming equal Q's) as though k had been increased to a value equal to

$$\sqrt{k^2+\left(\frac{\Delta}{f}\right)^2}$$

where k is the coefficient of coupling actually used:

f is the wanted middle frequency of the pass-band and so the frequency midway between the frequencies to which the tuned circuits are tuned.

and Δ is the difference between the resonant frequencies of the two tuned circuits.

Generally, transformers used by the constructor have fixed coupling and so it is useful to know that the effect of tighter coupling can be simulated by staggering.

Methods of Coupling

Throughout the above discussion mutual inductance has been considered as the medium coupling the two circuits, but other methods are practicable. Fig. 55 gives various alternatives, indicating that any impedance common to the two circuits will serve as a coupling impedance. The larger the impedance (i.e., the larger the resistance or inductance but the smaller the capacitance) the greater is the coupling. An alternative is "top-end" coupling by virtue of a capacitance connected from one circuit to another as shown in Fig. 55(d). Here, the larger the capacitance the greater the coupling.

Bandpass Filter

A circuit set up so as to give a reasonably level response over a range of frequencies whilst discriminating against frequencies outside that range is called a band-pass filter, and it has been shown that this condition is not fulfilled in all mutually coupled tuned circuits (which are often quite erroneously styled as band-pass circuits), but only in those cases where a suitable degree of coupling is found between circuits of suitable Q. In general, the band-pass characteristic is obtained with two circuits of equal Q coupled together when the Q of each circuit is within the range $\frac{1}{k}$ to $\frac{1.5}{k}$. The amount of coupling that is permissible to give a suitably flat characteristic also depends on the associated circuits.

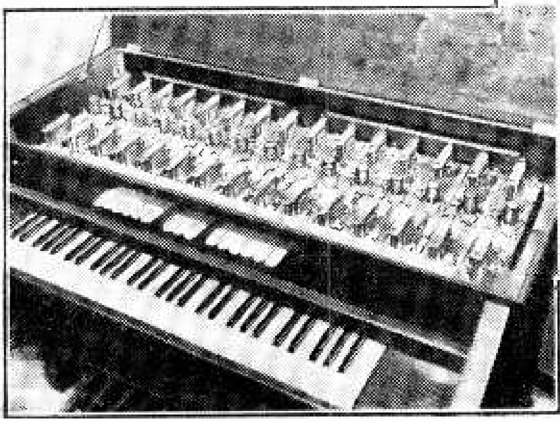
New Electronic Organ Employs Osram Valves

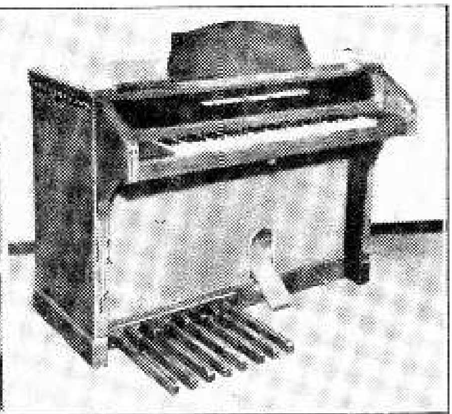
THE organ, which has been described as the most complex of all musical instruments, has tended in the past to be limited in its scope by the attendant expense. Henri Selmer, Ltd., of 114-116, Charing Cross Road, London, W.C.2, have recently, however, introduced a new electronically operated organ which markets at a much reduced price.

The Lincoln organ, as it is called, is the latest in a line of electronic musical instruments made by Henri Selmer, Ltd., and the experience derived from these is evident in the new instrument. It is silent in action, more responsive in speech than many pipe organs and free from mechanical complexities. Its performance is claimed to be acceptable even to the pipe organ purist and it measures only 4ft. by 2ft. 6in. by 3ft.

Each note can be tuned individually merely by rotating a knurled knob which varies the inductance in the oscillatory circuit, in which 15 Osram B65 valves are employed. Another B65 valve, in conjunction with an Osram L63 valve, forms the tremulant arrangement. A B309 valve acts as a shunt resonator, an L63 as a bass oscillator. Two KT66 valves are used together with a Z729, a B65 and an L63 in the amplifier. Altogether 24 Osram valves supplied by the General Electric Co., Ltd., are employed in the organ circuit.

The organ has 15 stops in all, controlled by rocking-tablets. Six of these provide the main tone colours of the pipe organ which can be mixed to produce further tones. Three select the usual 4ft., 8ft. and 16ft. pitches, thus providing sub- and super-octave coupling. The remaining tablets control the bass and tremulant. Where extra volume is required the tremulant can be varied in both speed and depth. A solo stop is also provided which reduces the accompaniment and brings out the melody.

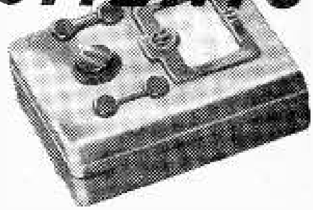




Two views of the Lincoln Organ.

Provision has been made for the addition of a tone chamber with its own booster amplifier (incorporating two Osram KT66 valves).

Using TEST INSTRUMENTS



Part 4 of a New Series of Articles Dealing with the Practical Application of Standard Test Equipment

By Gordon J. King, A.M.I.P.R.E.

(*Continued from page* 186 *March issue*)

Form Factor (8)

CURIOUSLY, although our multi-range meter READS in R.M.S. values when it is used on A.C., it is not actually measuring R.M.S. voltages! We must remember, of course, that since a rectifier is used between the A.C. source and the meter, the meter will measure proportionally to the MEAN or average value of the RECTIFIED waveform, and not to the R.M.S. value of the source voltage.

Essentially, all universal multimeters employ a full-wave rectifier for A.C. measurements, which means that a sine waveform as in Fig. 12(a) will appear to the meter in the form of Fig. 12(b). It follows, then, that the meter needle will receive a push from zero to maximum when the A.C. is going positive, and a similar push when the A.C. is going negative—this is because the negative half-cycle appears to the meter as a positive pulse due to the action of the full-wave rectifier. Precisely the same effect occurs during the proceeding A.C. cycles; so that for each full cycle of A.C., two positive half-cycles are applied to the meter.

Because each needle deflection due to the rectified A.C. begins gradually, builds up to a maximum, and then diminishes gradually, the meter will measure the mean value of the rectified waveform. Now it can be shown that the mean value of half a sine wave is $2/\pi$, or 0.6366 times its peak value. Therefore, a meter connected through a full-wave rectifier to a sinusoidal A.C. source will measure 0.6366 times the peak value of the A.C., and not the R.M.S. value of the A.C., which, as we have already seen, is 0.707 times the peak value. Provided we are dealing with sine waves this discrepancy is of little consequence, for the meter is calibrated to READ the R.M.S. value, even though it is actually MEASURING in proportion to the mean value.

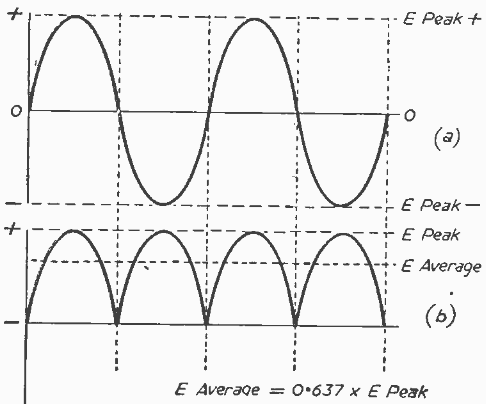


Fig. 12.—By reason of the full-wave rectifier in a universal multimeter the sine waveform at (a) will appear to the meter as in form (b). The meter will thus measure the average value of the rectified waveform.

The ratio of the R.M.S. value to the mean value is termed the "form factor," and for SINE waveforms it is 1.11 (0.707/0.637). From this reasoning we can realise that a D.C. voltmeter connected through a full-wave rectifier to an A.C. supply would read 11 per cent. less than the R.M.S. value of the supply. This error is automatically catered for in universal multimeters by internal alteration of the circuitry on A.C. ranges—the switch does more than just bring in a full-wave rectifier, it adjusts the meter to READ 11 per cent. higher than the mean value, thereby corresponding to the R.M.S. value.

Although one may feel that all this theory is superfluous to the "Practical Application of Test Instruments," it is really necessary to understand as much as possible of it if we desire to interpret A.C. meter readings correctly, and if we expect our instruments to yield their utmost assistance.

The most important point to bear in mind is that on their A.C. ranges multi-range meters depend for their accuracy not only upon their initial calibration but also upon the maintenance of a sinusoidal waveform. They, therefore, READ R.M.S. values only on the assumption that the normal sine wave will be encountered. One should always recognise the possibility of some error when using distorted or non-sinusoidal waveforms where the form factor might deviate considerably from 1.11. For instance, squarish wave shapes incite high readings, and peaky ones low readings; a square wave, for example, has a form factor of 1, whilst a half-wave rectified triangular wave corresponds to a form factor of 1.63.

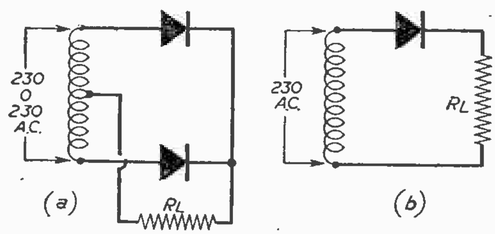


Fig. 13.—Simple full- and half-wave rectifier circuits at (a) and (b) respectively.

Recognise the Effect of Unidirectional A.C. (9)

If we use a D.C. METER to measure the voltage existing across the output of a full-wave rectifier circuit (Fig. 13a), it is clear now, that the meter will measure the average value of the rectified waveform (Fig. 12b). Therefore, provided the rectifier is 100 per cent. efficient, and assuming the 230 volts R.M.S. is being applied to the rectifier, our D.C. meter connected across the rectifier load resistor RL will measure something like 207 volts—($230 \times 1.414 \times 0.637$).

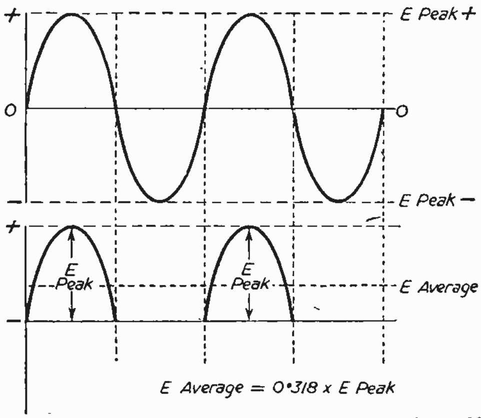


Fig. 14.—Showing that the average value of a half-cycle over the time of a whole cycle is half that of a full cycle.

Now let us consider a half-wave rectifier circuit (Fig. 13b). From this we know that the positive half-cycles of sine waveform drive current through the rectifier with little opposition, and thus give rise to half-cycle pulses of voltage across RL. On the negative half-cycles, however, the rectifier appears as a complete open circuit (assuming a perfect rectifier), so during these periods no output at all appears across RL; this effect is shown in Fig. 14.

We should have a good idea now that if we connect our D.C. voltmeter across RL of Fig. 13b, the rectifier of which also has a 230 volt R.M.S. input, our reading will deviate from that obtained across RL of Fig. 13a. Our meter is still going to measure the average value of the rectified waveform, but the average value of half a cycle over the time of a whole cycle is clearly half of 0.637, or 0.318. Thus, as compared with the 207 volts across RL of Fig. 13a, across RL of Fig. 13b will obtain a reading of something like 103.5 volts.

This explains, of course, why we get a remarkably low D.C. reading from the output of a power pack when the electrolytic reservoir capacitor becomes open-circuit.

The Action of the Reservoir Capacitor (10)

As an example, let us consider a full-wave rectifier circuit complete with reservoir capacitor C (Fig. 15a). Reference to Fig. 15b shows that the voltage at C follows the line ABCD, the capacitor charging between A and B but discharging between B and C. The mean level of ABCD is, therefore, the effective direct voltage across C.

It is not here intended to explore deeply into the theory of rectification, though it is desirable to bear in mind that as the current taken by the rectifier circuit is reduced (as the value of RL is increased), BC becomes more nearly horizontal and its level rises towards the peak value of the waveform until in the extreme case when RL is infinite the direct voltage across C will be is equal to the peak voltage of the waveform.

We shall most likely correctly conclude that the actual value of the reservoir capacitor has a bearing on the output voltage when the rectifier is passing current. Also, with half-wave circuits, since the

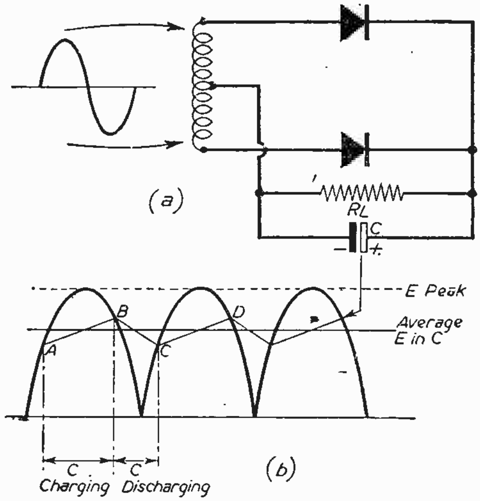


Fig. 15.—(a) A full-wave rectifier circuit complete with reservoir capacitor C. Diagram (b) illustrates how C charges during period AB and discharges during period BC. The average level of ABCD is, therefore, the effective direct voltage across C.

capacitor discharge time is greater and thus a longer time elapses before the capacitor is subjected to a recharging pulse, a larger value reservoir capacitor is demanded in order to maintain the required direct voltage output.

It is also interesting to note that the ripple voltage across C is determined by analysis of the shape of ABCD. Clearly, the greater the rate of change of voltage across C during the periods AB and BC, the greater will be the magnitude of ripple voltage. It follows, then, that as the circuit loading is increased the magnitude of the ripple voltage will also be increased.

Resistance Measurement (11)

Now that we have successfully (we hope!) broken down the barrier so far as A.C. and our multimeter is

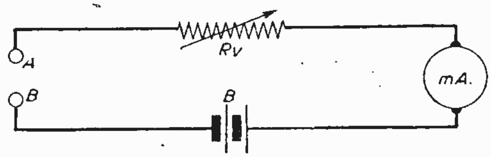


Fig. 16.—A simple ohmmeter circuit.

concerned, let us consider in some detail a feature of our instrument which is considerably less brain-taxing, namely the Ohms range.

(To be continued)

On Your Wavelength

BY THERMION

New Electronic Devices

THE Radio Corporation of America recently demonstrated some startling new electronic devices, including a music "synthesiser," a light amplifier (formerly considered impossible) and a magnetic tape recorder for television and motion pictures.

Brigadier-General Sarnoff, chairman of the R.C.A., who described the devices, declared that they opened up great promise for the future and explained that they were being revealed now in their experimental stage before they were ready commercially because he believed competition could be as stimulating in research as in manufacturing and merchandising.

Among the devices the magnetic tape recorder (first demonstrated in December, 1953, at the R.C.A. laboratories at Princeton, New Jersey) was of particular interest. According to General Sarnoff this can produce quickly and economically without any photographic developing or processing motion pictures in colour as well as in black and white, and an unlimited number of these tape recordings can be made.

The R.A.I.B.C.

I HAVE received the following letter from Mr. J. Comber (E.I.S.L.), hon. treasurer of R.A.I.B.C.:

"With reference to correspondence between the secretary of the above club and yourself re balance sheet and your desire to have certified accounts, arrangements have been made for the accounts to be audited by Messrs. Ormsby & Rhodes, chartered accountants, 12, College Green, Dublin.

"The W.F.S.R.A. had a club from about the middle of 1951 to November, 1952, when it ceased to operate. On February 21st, 1953, the council of the society decided to close down that club. In May of that year I was asked to become treasurer.

"Owing to the differences that have arisen in W.F.S.R.A., I was not able to negotiate with the members now on our panel. R.A.I.B.C. was eventually formed on February 8th, 1954, and the balance in hand, as published in 'Skywire' (Jan.-Feb., 1954), is £6 4s. 1d., which may only be expended on the purposes for which it was donated."

The I.S.W.L.

MY comments on the International Short Wave League have brought forth a number of letters from members who state that they are entirely satisfied with the way in which the league is conducted. The following extracts from one received from Mr. J. D. Pearson, of Barrow-on-Humber, summarise the points made in many of the letters:

"'It is said by some members that all they receive is a membership card and copies of a duplicated journal. That is all that the member of any radio society receives. The usefulness of any society is in the services it renders to members. The I.S.W.L. operates a Q.S.L. bureau. This service is genuine, as I have only to-day received a Q.S.L. card from CKCS, Sackville, Canada, for a report which I forwarded through the I.S.W.L. broadcast bureau some time ago. There are also departments dealing with radio astronomy, broadcast, commercial and amateur station identification (this, too, is a very useful service), translation of foreign signal reception, and several others which I cannot remember without reference to membership data which are not to hand."

And here is another letter from Mr. J. E. Alban (G3JEA), of Bayswater:

"I was given to understand by the past organisers that the production of balance sheets was unnecessary. However, I lost no time in informing the present committee of the points you mentioned, and feel sure they will do something to rectify this error as soon as they are able.

"Annual general meetings have never been held. I agree with you that members should be notified even if the attendance is nil. If our national society can muster only 89 members out of some 10,000 odd at their A.G.M. it seems extremely doubtful that the I.S.W.L. could muster more than 10!

"The production of an annual balance sheet has also been the subject of discussion at many committee meetings, but, as stated above, was always waived by the secretary on the information quoted above. Having been a member of the R.S.G.B. for the past 10 years and received an annual balance sheet, I thought such a sheet was a necessity.

"Committee members, treasurer and secretary have never been put up for re-election each year. The secretary has always accepted the task of collecting membership fees, keeping the books, countersigning the cheques, and the complete running of the Q.S.L. bureau. He also handles most of the league's expenditure."

And, finally, here is a letter from Mr. J. H. Burrows, of Data Publications:

"The I.S.W.L. was formed in October, 1946, and sponsored by our short-wave journal. The founder members were: A. C. Gee (G2UK), C. W. C. Overland (G2ATV), and W. N. Stevens (G3AKA). In 1950 a committee of interested members was appointed by Amalgamated Short Wave Press, Ltd., to assist in the conduct and running of the League. The committee expressed the desire to run the League independently of any commercial organisation, and the League affairs were handed over to this committee as from December 1st, 1951. (There was no question of A.S.W.P., Ltd., being unable to afford to carry it on.) Announcements of all the above facts were prominently made in the sponsoring journal, no complaints were received, and the arrangements appeared to be popular with the League members. At no time up to December 1st, 1951, was there any association with the British Short Wave League. The British Short Wave League, a pre-war organisation, subsequent to the formation of the I.S.W.L., became associated with another periodical. We have not heard of any B.S.W.L. activity since the journal ceased publication.

TRANSMITTING TOPICS

TOPBAND AERIAL SYSTEMS

By O. J. Russell, B.Sc.(Hons.), G3BHJ

WHILE Topband activity is popular, and while many start their transmitting career on this band, it must not be thought that it is an "easy" band. While simple equipment may give first-class results, and while technical problems of the kind encountered upon higher frequencies, or the V.H.F. bands are not met with, yet the Topband has its own technical problems. These technical problems are not unconnected with obtaining excellent results, for DX upon 160 metres is definitely a very difficult feat. However, for some people obtaining other than purely local contacts, it may be difficult.

The question of aerial radiation is the secret of Topband operation, and it is not generally realised that the technical aspects are not as straightforward as might at first be supposed. Some of these aspects are well worth study, as it will be revealed that they give the clue to obtaining greatly improved efficiency.

Naturally, the fortunate few who are able to erect half-wave aerials at a height of 60 or more feet have little to worry about. However, only a few can erect a clear 250 odd feet span of wire, so that the majority are faced with the erection of the best possible compromise in the space at their disposal. City dwellers are, of course, particularly badly placed in this respect. Before considering aerial variations, however, there is one aspect generally overlooked in Topband working, and that is the great importance of the earth system. The earth system is important in all cases where a "Marconi against ground" aerial system is used. Naturally, the Marconi system is popular, as it enables short aerials to be loaded up for Topband use. One such system is shown in Fig. 1.

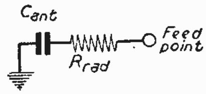
An Example

In such systems, due to the relatively low impedance when series-tuned against ground, the aerial current is high. The ability to produce a given current in the aerial is not a very good indication by itself of efficiency. In fact, a high-impedance radiator drawing a much lower current would be considerably more efficient. To determine how various factors influence efficiency, Fig. 2 shows the "equivalent circuit" of a Marconi system aerial, that is, a length of wire shorter than a quarter wavelength. It is a capacity in series with a resistance. The resistance represents the radiation resistance, that is the value of resistance necessary to account for the power radiated. If the radiation resistance is 5 ohms, then an aerial current of 1 amp. corresponds to the radiation of 5 watts of R.F. The current is that measured at the base of the aerial, so the radiation resistance Rrad is referred to as the "base radiation resistance." It should be noted that in the Marconi tuning system, the aerial loading coil and condenser merely resonate the aerial capacity, so that the effective impedance becomes that of the aerial base resistance as shown in Fig. 3. This state of affairs would apply *only* if the earth return were of zero resistance, and if the loading coil were of zero resistance. In practice, therefore, the radiation resistance has to compete with the earth resistance and with the coil resistance, so that efficiency is lowered. The real state of affairs is shown in Fig. 4, where only the radiation resistance does any useful work. Here, again, if the resistance representing coil losses were low, and if the earth resistance were low, no serious loss would result.

Unfortunately, this is generally not the case, as earth and coil losses may be much larger than the aerial resistance. Fig. 5 gives the Base Resistance curves for vertical wire aerials operated on Topband, and it will be seen that short wires have very low resistances. Thus the "8ft. whip" aerial employed for mobile Topband work has a radiation resistance of around one-tenth of an ohm! When it is considered that earth losses, even with a good earth, may be 10 ohms or more, it is clear that only 1 per cent. of the R.F. fed into such a system will be radiated. A loading coil to load up such a short aerial, even if of high Q construction, will itself have a resistance of over 10 ohms, so that as against the tenth of an ohm of the aerial we have some 20 ohms minimum loss in the earth and coil circuits. Accordingly, less than a half per cent. of the R.F. supplied to the aerial circuit will be radiated. Under these conditions it seems pointless to consume 10 watts in the transmitter to produce the radiation that would be given by a transistor coupled to a fully efficient aerial system!

Fig. 1 (left).—The Marconi aerial. A vertical wire is resonated against ground by the aerial loading coil L, and the variable capacitor C. Aerial current is shown by the R.F. ammeter A.

Fig. 2 (right).—The equivalent circuit of a short vertical aerial. R_{rad} is the radiation resistance, while C_{ant} represents the capacity to ground of the vertical wire. The feed point represents the lower end of the aerial.



Earth Efficiency

This example serves to illustrate the extreme importance of the earth and loading coil efficiency. While an 8ft. vertical whip aerial is generally only used for mobile working, many amateurs in restricted locations are forced to use a short aerial for Topband. The curve of Fig. 5 shows that with short aerials even a few extra feet are worth having. Thus, a 16ft. vertical aerial has some four times the radiation efficiency under the same conditions as the 8ft. whip. Practically, the 16ft. aerial is even more efficient, as a smaller coil is needed to resonate it as its capacity is higher. Consequently, coil resistance is lowered, and coil losses will be less. It is clear, however, that every foot of height counts on Topband, so that any possible extension in height is to be secured.

The "L" Aerial

In this connection the so-called "L" aerial as in Fig. 6, is used in order to get "as much wire" out as possible. Here again height is important. The effective height of the horizontal top portion is the deciding factor. In the general case, where a resonant overall length of wire is not possible, the "L" aerial is actually operating as a "capacity top-loaded vertical." That is to say, the aerial is to be regarded as a vertical, loaded at the top by the effective capacity of the horizontal top portion. It will be found that a 30ft. high "L" aerial with only a short length of top is actually of higher base resistance than a 20ft. high "L" with a long top. This again illustrates the vital importance of height in securing an efficient radiator on the Topband. In fact, "top capacity loading" is one way of improving aerial efficiency, so that after attaching the aerial to the highest possible point, an additional horizontal length adds to the attainable efficiency. In commercial practice, capacity top loading may be effected by flat metallic or mesh discs at the top of the radiator. This is generally beyond the possibility of amateur practice, as discs of some feet diameter are necessary. However, a fan top of several wires may be used where feasible. The practice of using the feeders and top of a centre-fed dipole cut for an H.F. band, as in Fig. 7, is one method of achieving a capacity-top-loaded aerial. In fact, a two-metre beam array, propped at the top of a high mast, could be used in the same way by tying the feeders together and using it as a "capacity-loaded vertical" for Topband use!

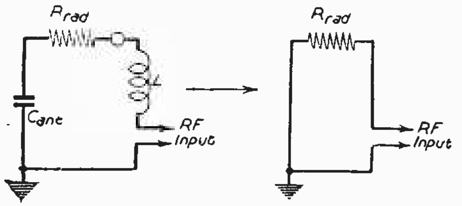


Fig. 3.—The effect of the usual Marconi series tuning circuit is to cancel the capacity of the aerial, so that the effective aerial resistance can be fed with R.F.

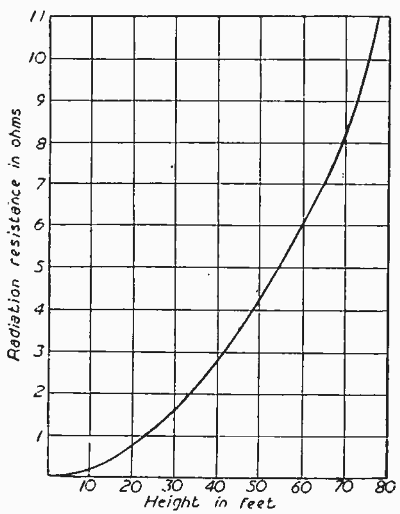
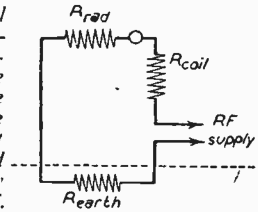


Fig. 5.—Radiation resistance of short vertical aerials on Topband.

In this respect, one rather unusual family of centre-fed aerials may be employed for Topband use. These are operated like conventional dipole systems, although the top lengths may be considerably shorter than an 80-metre dipole. It should be noted that the feeders are tapped on to either side of the centre of a parallel-tuned circuit for Topband use. The advantage of these aerials is that the top is symmetrical and does not have to rely upon a ground system. Thus the difficulty of providing a low-resistance ground is avoided. While the effect of the earth below the aerial will still have some bearing on efficiency, this will not be as marked as when a physical earth is part of the R.F. circulating system. As will be seen, the shorter the top is made the longer become the feeders, as the feeders are an integral part of the system. This feature enables the use of an earth to be replaced by a feeder of low resistance. It may be regarded either as an abbreviated dipole, or as a radiator with an elevated counterpoise. It should be noted that these aerials may be used on higher frequency bands as well as on Topband, so that a single aerial gives an efficient "all-band" aerial system. It should be noted that height is still important, even though the effect of earth losses are reduced.

Fig. 4.—In a practical Marconi system, the radiation resistance has to compete with the effective earth resistance and the resistance losses in the tuning coil. Unless great care is taken, earth and coil losses may very greatly reduce the radiated R.F.



Aerial Radiation

One important effect of aerial height lies in the radiation from the aerial. The vertical Marconi systems radiated a vertically polarised wave at low angle, as shown in Fig. 8. If the ground were of perfect conductivity, the maximum radiation would be at zero angle. However, the effect of ground resistance is to reduce the radiation at extreme low angles, so that Fig. 8 gives a good idea of the radiation pattern at average locations. In effect the vertical aerial radiates a strong "ground wave," with very little radiation at the higher angles. The practical result of this is that a strong local signal up to some hundred miles or so will be radiated.

In contrast to this type of radiation pattern, the horizontal aerial will radiate most of its energy upwards, unless extreme height, say two hundred feet or so, is available for supporting the aerial wire. In most amateur cases the aerial is supported much nearer the earth, so that the available radiation is largely skywards. In fact, the coverage on Topband is almost all due to the skywave being reflected downwards again, and so covering all distances by single or multiple hops. Except under extreme conditions enough ionisation exists for the reflection of Topband frequencies, so that generally night working over all distances is possible by skywave. In daylight ranges may be greatly restricted under some conditions.

In practice therefore, the user of a *vertically* polarised aerial system therefore can expect consistent operation without marked fading over perhaps one hundred miles, and perhaps good results on extreme DX, but with rather inconsistent results on ranges of a few hundred miles on Topband. The user of a *horizontally* polarised system will similarly obtain results perhaps a little worse over the first hundred miles than with a vertical aerial. Over longer distances of up to three hundred miles or so, considerable night fading will often be experienced, but signal strengths will often be higher than with a vertical aerial system.

Needless to say, unless losses have been reduced by attention to aerial efficiency, long ranges will not be achieved easily, despite the fact that even low-power transistor transmitters have achieved considerable ranges, well over the hundred mile mark. As pointed out earlier, the losses of a makeshift aerial system may be so large as to put the 10-watt station on a par with a transistor station as regards actual radiated R.F. power. In this case the power limit upon Topband operation does not enable the

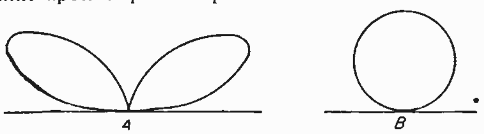


Fig. 8.—With the usual heights obtainable on Topband, the vertical aerial will radiate mainly horizontally, while the horizontal aerials will radiate mainly upwards.

operator to step-up power in order to overcome the limitations of the aerial system. Conversely, where results have been disappointing on Topband operation, the attention to both aerial and earth system efficiency may make a startling improvement in results. While an illegal increase of power to, say, 100 watts would seem an extreme step, it is possible than an *equivalent* increase in signal strength might arise by retaining 10 watts input and improving the aerial efficiency.

Aerial Loading Coil

While a tenfold increase in radiation efficiency may seem exaggerated, this can be seen to be quite a feasible state of affairs when Marconi systems are used. A glance at Fig. 5 will show that unless a very high aerial is in use, and unless a very efficient low-loss earth system and a low-loss aerial loading coil are in use, the aerial efficiency may be only a few per cent. Thus, for example, a single earth driven into the garden soil will seldom be below some 20 ohms resistance, even if a 10ft. earth rod is driven down into the soil. In fact, for the user of a Marconi tuned aerial, one earth connection should never be relied upon. At least three earth rods should be driven into the soil at widely spaced intervals, and the three rods paralleled with heavy cable brought to the shack. It should be noted that the effect of adding extra earth connections in the Marconi system can be observed as an increase in the aerial current meter, and also by a corresponding increase in signal strength as reported by local stations. Therefore, if additional earth connections can be arranged, their efficiency can be gauged by checks on aerial current and on signal strength reports. In all cases where a single earth or a makeshift earth has been employed, an improvement will be noted by using efficient earths, and multiple earth connections.

Finally, it is useless to improve aerial and earth efficiency if the aerial loading coil is inefficient. While a Topband loading coil may need a sizeable

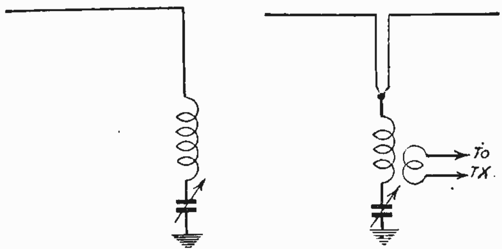


Fig. 6 (left).—Adding a horizontal top section increases the efficiency of a vertical radiator. The effect is to increase the radiation resistance so that a greater fraction of R.F. is radiated. However, length of the top portion is not a substitute for height, so that a high aerial with a short top is better than a low aerial with a long top. Fig. 7 (right).—A dipole aerial used for the higher frequency bands may be used as a capacity top-loaded Marconi system by paralleling the feeders and loading against ground in the usual Marconi fashion.

amount of inductance, it is a poor policy to wind many turns of thin wire on a cardboard former and expect good results. Such a coil may be useful in deciding the size of coil required, but is not suitable for efficient operation. The permanent loading coil should be wound with thick wire on low-loss ceramic formers, or air-spaced. An efficient low-loss aerial tuning coil will make a further contribution to overall aerial system efficiency for topband operation.

While the above features apply with special force to Topband operation, they also apply to other bands as well. Whilst, generally, it is possible to obtain efficient radiation on the higher frequency bands without difficulty, many people are in such restricted spaces, that even 80-metre or 40-metre operation presents a problem. Where only short aerials are possible, therefore, application of Marconi or similar loaded systems may enable efficient operation to be carried out.

Table of feeder lengths and top lengths for centre-fed Topband aerials, using spaced twin feeders. For every 2ft. reduction in overall top length, increase feeders by 1ft.

Full top, length in feet.	*Feeder, length in feet.*
100	38
98	39
96	40
94	41
92	42
90	43
88	44
86	45

Relay-controlled Directional Aerial

A SIMPLE INDOOR SHORT-WAVE IDEA FOR ALL-ROUND USE

By A. W. Mann

ONE hears but little nowadays concerning the transposed doublet type of receiving aerial once so popular with the short-wave fraternity. No doubt quite a number are still in use throughout the world, but on the whole it may be regarded as out of favour so far as the majority are concerned.

To erect an aerial of this type to textbook recommendations requires a considerable amount of space. That in many instances entirely rules out this type of aerial, especially in industrial areas.

Like other types the transposed doublet possesses certain advantages, but also certain disadvantages.

When one cannot follow conventional methods outdoors, it is sometimes possible to adopt unconventional ones indoors, and use roof space to full advantage in order to achieve the desired results.

In this instance the result is an efficient aerial system which will prove to be an asset to the DX enthusiast.

The design of a relay-controlled doublet aerial, using twisted wire feeders to be described, if carefully matched to the receiver which is to be used in conjunction with it, will provide world-wide coverage, with a really good signal-to-noise ratio.

The author is fully aware as to the functioning of this type of aerial, in relation to resonant frequency and theoretical considerations.

Early Tests

The first tests were carried out with two 10-ft. flat tops, separated with a two-terminal spacing insulator. Plastic-covered lighting flex was used as the feeders. Candidly this was only a test to gauge the possibilities. Not much was expected, but the results even when the feeders were directly coupled to the aerial and earth terminals of a R1116A were sufficiently promising to warrant going ahead.

In order to increase aerial signal pick up, 10ft. of wire was added to each flat top section, and the run of wiring arranged as shown at Fig. 1, which we will discuss in detail later. The second test proved even more satisfactory, and the second aerial was made up in a like manner and the feeders run down to the receiver position.

A six-terminal strip was screwed into position along the edge of a shelf about 3ft. above the receiver. The twisted feeders were fitted to the two outside pairs of terminals, and the common feeder pair to the centre pair of terminals. Thus, in order to use the N-S aerial the bridging wires were switched over from the E-W terminals. A double-pole double-throw switch would have been better, but we had other ideas, and the arrangement outlined served during the test period which covered some weeks.

General Arrangement

Fig. 1 shows the general arrangement. Here we have two divided aerials. For example, the N-S aerial from L to K to J is one continuous wire, G to H to I being likewise. The same applies exactly to the E-W aerial. Thus, our bent, flat tops are each 20ft. long. The dividing insulators can be cut from spare insulating material, plastic or the like, and the terminals should be 2in. apart. If desired they could be made in one piece. Separate insulators, however, enable the height of the aerials to be adjusted to suit local circumstances. In my case the E-W one is 1ft. higher than the other. This enables the bent arms A-B, etc., to be arranged one above the other, 1ft. apart.

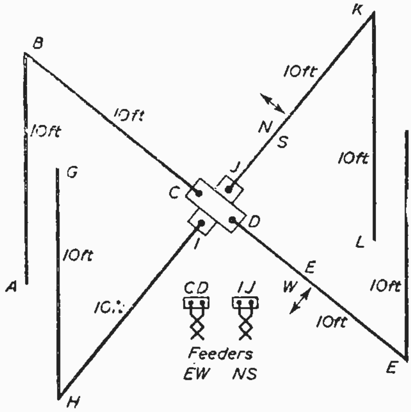
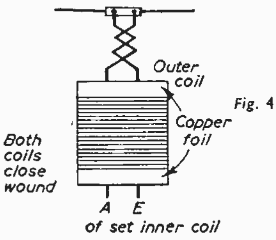
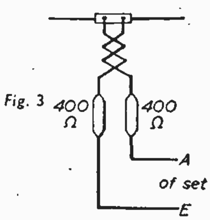


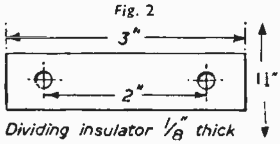
Fig. 1.—General arrangement of indoor doublet aerials :
A to B=10ft. B to C=10ft. Total length, 20ft.
D to E=10ft. E to F=10ft. Total length, 20ft.
G to H=10ft. H to I=10ft. Total length, 20ft.
J to K=10ft. K to L=10ft. Total length, 20ft.

Materials

Fig. 2 shows the dimensions of the dividing insulator, two of which are required. The total length of wire required is 80ft. Any good make of insulated aerial wire will be suitable. The twin feeder used for the original aerials is plastic-covered, twin-lighting flex, at 4½d. per yard. The lengths required will







Figs. 2, 3 and 4.—Details of construction and connections.

depend on the distance between the aerial spans and the receiver location. Providing that insulated aerial wire is used the reader may use other methods than stand-off insulators to support the spans.

Matching

Assuming the receiver to be an R1116 double superhet, a 400 ohms resistor in series with each feeder

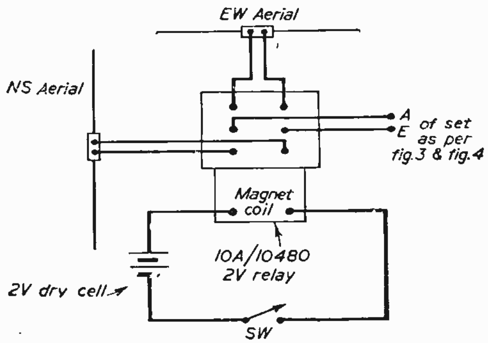


Fig. 5.—Wiring of the complete aerial arrangement.

and the aerial and earth terminals of the set will provide a good match. A resistance of the same value placed in series with the feeder going to the earth terminal of the set will, in certain instances, give a better match and a little extra gain.

An alternative method is to wind a coupler on an inch diameter paxolin former, consisting of 14 turns copper enamelled wire, cover with a strip of copper foil, leaving a ¼in. space between foil ends, and then cover the foil with a paper strip. Follow this by very carefully winding another 14 turns coil over the insulating paper. The latter is a precaution against shorted turns to foil in case of wire insulation defects.

Note: an earth connection (i.e., earthing of chassis) should not be used. The coupler may be used with the foil screen earthed or without. Try both. This electrostatic form of coupler provides a very good match and a good signal-to-noise ratio. See Fig. 3 and Fig. 4. This coupler is somewhat different from anti-electrical-interference types, and is simply a matching device. Use 26 s.w.g. enamelled wire.

Changeover Relay

Fig. 5 shows how by the use of a magnetic relay which require but two volts to operate it, the doublets can be switched. This is the type 10A/10480 as used in the ex-R.A.F. TR9 transmitters and obtainable from advertisers in this journal. The switch used should be of the push-pull type, which allows an almost instantaneous comparison by a fractional movement. Once checked, the switch should be fully engaged or disengaged. A QMB switch can, of course, be used if preferred. At the end of listening periods always leave the switch in open position with no current flowing in relay coil.

Always check that relay is working correctly at the start of a listening period, and that both spring contacts are engaging properly with their opposite numbers. Relays sometimes stick and in this case the result is apt to be misleading.

Directional Properties

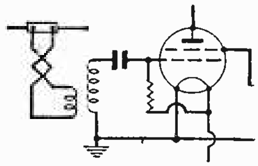
While the writer has been able to cover the world with a rotary aerial, and thus obtain maximum signal strength on all signals according to prevailing reception conditions, the blind spot with other aerials has always been South Africa. This does not mean that South African transmissions were not receivable on end-fed aerials, but that due to location difficulties, such aerials could not be erected so that full advantage could be taken of their directional properties.

The broadside directivity of N-S aerial main span, plus the SE-SW directivity of the legs, resulted in the reception of VQ7DT on twenty metres phone at 6.30 p.m. B.S.T. The broadside directivity of the E-W aerial is equally effective in those directions.

This aerial system is not effective so far as the reduction of electrical interference is concerned, because the flat top sections must perforce come within the interference zone at my location.

Details have been given in this article concerning the use of this aerial system in conjunction with the R1116A double superhet receiver. It can, of course, be used with T.R.F. receivers as shown at Fig. 6, and with straight regenerative types in which six-pin plug-in coils are used, by coupling the feeders directly to the aperiodic coil. I would be most interested to hear of the results obtained by users of modern

Fig. 6.—Details of the aerial input arrangement for T.R.F. receivers.



communication receivers in which provision is made for doublet coupling.

The sole idea behind these experiments was to utilise doublet principles to the best advantage indoors and within a very limited space. Due to the fact that the R1116A has a most excellent AVC system the signal strength and noise ratio compare more than favourably with other aerials which have been used with this receiver. The coupler, like the aerial system, may appear unusual, but the results have been such that they will remain in constant use for some time to come.

To obtain full advantage of relay change-over. the relay switch should be mounted on the table edge as close to the receiver as possible.

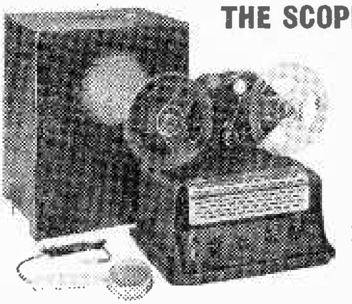
Operating Procedure

It sometimes happens, and especially on the 20 metre amateur band, that nothing is to be heard. I have found this so when tuning for American amateur phones using the E-W aerial. Changing over to the N-S aerial, however, has brought in transmissions from other parts of the world when the band appeared to be entirely closed.

To me this is not surprising, as when using the rotary aerial one only needs to rotate the full circle to hear some amateur, somewhere, unless receiving conditions are extremely bad. Therefore, when tuning, make full use of the change-over switch, always making sure that the relay is working, and enter in the log which aerial was in use against each entry. Within a few months you will have a good idea as to coverage, and in all probability log quite a number of countries from which you had never received either amateur or broadcast transmissions before, and a greater interest in DX.

LASKY'S PAGE OF MONEY-SAVING OFFERS

THE SCOPHONY-BAIRD CINE "SOUNDMASTER" New & Unused



LIST PRICE 72 GNS.

A COMPLETE TAPE RECORDER WITH THE EXCEPTION OF THE MOTOR DRIVE. CAN ALSO BE USED AS A STRAIGHT AMPLIFIER

Originally designed for connecting to a cine projector for synchronising sound to silent films, this superb equipment with the addition of a motor becomes a Complete Tape Recorder of 5 watts undistorted output. Can also be used as a straight Amplifier. Two Inputs for use with Crystal Mike and radio or gram. P.M. Erase. Amplifier uses five valves: 2—6SN7, 2—6V6, 1—5Z4. For 200/240 A.C. Mains. Full instructions and circuit with each Recorder.

LASKY'S PRICE £17.13.0
(Carriage 7/6 extra)

Comprising the "SOUNDMASTER" complete with 5 valves, Cover incorporating 8in. Loud Speaker with 24ft. of cable, Spare Input Plug, One empty Tape Spool, Mains Lead. Dimensions: 13½ x 16 x 11in. Nett weight 32lbs.

ROTHERMAL CRYSTAL MIKE complete with lead and plug. 25/- extra (Listed at 5 gns.).

FLEXIBLE DRIVE NOW AVAILABLE. Price on request.

METAL RECTIFIERS

6 or 12 v. F.W. Bridge.
1 amp. 6/6. 2 amp. 11/3. 4 amp. 15/-
6 amp. 23/6. 10 amp. 32/6.
½ amp., 6 v. 2/6. ½ amp., 12 v. 3/11
3 amp., 12 v. 12/6

I.F. TRANSFORMERS

MINIATURE. ¾ x ¾ x 1⅜ins. PRICE 9/6 pair.
WEARITE TYPE 550. 445-520 kc/s. 8/6 per pair.
WEARITE TYPE 500. 450-470 kc/s. 8/6 per pair.

CRYSTAL DIODES

Wire ends. Glass 1/6
Type WX.6. Wire ends........1/6

"TELETRON" SUPER INDUCTOR COILS

Full range, including the new "Ferrite" rod frame aerials. 5/16in. diam.
4in., medium wave........ 8/9
8in., med. & long wave........12/9
Post extra.

SPECIAL PURCHASE! 16in. C.R. TUBES

Famous make offered at nearly Half Price. Metal cone. .3 amp. heater. e.h.t. required 10-14 kv. LASKY'S PRICE, £12.19.6. Carr. & ins., 22/6 extra.

18in. FILTER MASK ESCUTCHEON to suit above C.R.T., 15/-. Post extra.

PLASTIC ESCUTCHEON MASKS

With dark screen filter.
12in........12/6 16in........25/-

SUPERHET COIL PACKS

With Circuit.
No. 1. L.M.S.G. Size: 4½ x 5 x 2½ins. With ¼in. spindle........19/6
No. 2. M.S.S. Size: 4 x 4 x 3ins. With ¼in. spindle........16/-
Both for use with 465 kc/s. I.F.

LOUDSPEAKERS

First Quality. All 3 ohms speech coil. Less output trans.
3in........9/11 8in........19/11
5in........14/6 10in........19/6
6½in........15/-

BRIMISTORS

Type CZ.1. 1/6 each.
Type CZ.3. 6d. each or 5/- doz.

COMPLETE 5 VALVE RADIO CHASSIS

69/6

Brand New and Unused. A.C. D.C. Mains. 200/250 volts.
* I.F. 465 kc/s. * A.V.C.
* 4 Watts output.
* 3 Station Pre Set.
* Frame aerial.
* Fully aligned.
* Chassis size only 10ins. x 5½ins. Max. height 5½ins.

Completely wired and ready for use, with the addition of a speaker and output transformer. Two controls—Volume and Station switch. Valves used: 10C1, 10F9 or UF41, 10LD11, 10P14, U404 or UY41.

LASKY'S PRICE, 69/6, less Valves. Postage 3/3 extra.
PRICE COMPLETE, £5.19.6.

LASKY'S RADIO CONSTRUCTOR PARCELS

NO. 1. A.C. SUPERHET.—4 valves plus metal rectifier. Long, medium and short wavebands. In very attractive cabinet, either walnut veneer or ivory or walnut plastic. For 200/250 v. 50 c.p.s. All components, valves, mains transformer, cabinet, dial and metalwork. LASKY'S PRICE, £7.19.6. Post & pkg. 2/6 extra.

NO. 2. A.C. T.R.F.—3 valves plus metal rectifier. L. & M. wavebands. For construction in attractive wood or plastic cabinet, walnut or ivory finish. For 200/250 v. 50 c.p.s. All components, mains transformer, cabinet, dial and metalwork.
LASKY'S PRICE, £5.10.0. Post & pkg. 2/6 extra.

NO. 3. 4-WATT A.C. AMPLIFIER.—Uses 1 each 6SL7, 6V6 and 5Z4. All components, chassis, valves, output trans., mains trans.
LASKY'S PRICE, £4.5.0. Post & pkg. 2/6 extra.
Instruction Books for the above, price 1/- each. All components available separately.

3-WATT MIDGET AC/DC AMPLIFIERS 65/-

PUSH PULL. VERY HIGH GAIN

4 valves: 2 UL41 in push pull. 1 UCH42 and 1 UAF42. Input voltage 100/110 A.C./D.C. Very easily converted to 230 volts. Supplied with circuit diagram and full details. Size: 9 x 4 x 4ins. Uses 2 metal rectifiers, 1 each RM1 and RM2. Ideal for ships' record players, tape recorders, home record players, baby alarms, etc., etc. Supplied complete, fully assembled and wired, with 4 valves, 65/-. POST FREE

"SENTERCEL" METAL RECTIFIERS

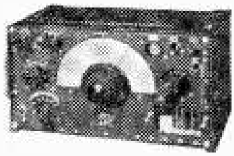
RM1, 125v., 60 m/A........3/10
RM2, 125v., 100 m/A........4/3
RM3, 125v., 125 m/A........5/-
RM4, 250v., 250 m/A........16/-

GANGED TUNING CONDENSERS

.0005 Mfd. ¼in. spindle. Standard 2-gang. 2½ x 1½ x 2¼in., 5/-. Standard 3-gang. 2½ x 1½ x 3¼in., 7/6. Midget 2-gang with trimmers, 1½ x 1½ x 2¼in., 7/6.

RESIN CORED SOLDER........7/6 per 1-lb. reel

EX-A.M. RECEIVER TYPE R.1155



5 Frequency ranges: 18.5-7.5 Mc/s; 7.5-3.0 Mc/s; 1,500-600 kc/s; 500-200 kc/s; 200-75 kc/s. Supplied in maker's original wood transit case.

LASKY'S PRICE
BRAND NEW. £11.19.6.
Secondhand. Grade 1, £9.19.6
Secondhand. Grade 2, £7.19.6
Carriage 17/6 extra, including 10/- returnable on packing case.

ASSEMBLED POWER PACK/OUPUT STAGE FOR R.1155 RECEIVER

For use on 200-250 v. A.C. mains. Complete with 2 valves. In metal case size: 12 x 7 x 5½ins.
LASKY'S PRICE, 79/6
Carr. 5/- extra.

Power Pack as above. Fitted with 6½in. p.m. speaker.
LASKY'S PRICE, £5.5.0
Carriage 5/- extra.

L. & M. WAVE T.R.F. COILS. With Circuit. 4/11 pair

L. & M. DUAL WAVE Superhet Coils. Aerial and oscillator 5/11 pair

AERIAL ROD SECTIONS

Steel, heavily copper plated. 12ins. long, ⅜in. diameter. Any number may be fitted together. PRICE 2/6 per doz. Post free.

RECORDING TAPE

1,200ft. reels, kraft base on Cyldon metal spools. Each 12/11. Post 1/- extra.

TELEVISION SELENIUM RECTIFIERS

"Sentercel" S.T.C. range.
K8/40, 3.2 kV........6/-
K3/45, 3.6 kV........8/2
K3/50, 4.0 kV........8/8
K3/100, 8.0 kV........14/8
K3/160, 12.8 kV........21/6
K3/200, 16 kV........26/-

LASKY'S RADIO

NOTE—Open all day Saturday, early closing Thursday.

42 TOTTENHAM COURT ROAD, LONDON, W.1.
Between Tottenham Court Rd. and Goodge St. Stns. Tel.: MUS 2605

370 HARROW ROAD, PADDINGTON, LONDON, W.9.
Opposite Paddington Hospital. Tel.: CUNningham 1979-7214
Please add reasonable amount for postage unless specified.

HIRE PURCHASE TERMS ON CERTAIN ITEMS
Send us details of your requirements.

LASKY'S, (HARROW ROAD) LTD.

ALL MAIL ORDERS TO HARROW ROAD PLEASE

OSCILLATORS FOR VIBRATO

THE USE OF OSCILLATORS FOR VARYING THE PITCH IN ELECTRONIC MUSICAL INSTRUMENTS

By W. J. Delaney

THE recent series of articles on oscillators dealt with the subject in a general way as applicable to ordinary radio receivers, but there is a further branch of electronics in which the oscillator plays a very important part, and in which circuits different from those which have been described are used.

Most experimenters will be aware of the types of oscillator used in modern television equipment—thyratrons, blocking oscillator, multi-vibrators, etc., and certain of these are used also in some musical instruments, notably the electronic organ. In these instruments the note which is produced is made to vary slightly to give what is familiarly known as the vibrato or tremolo, an effect produced on ordinary wind-blown organs under the more familiar term of "vox humana." It is an effect which is often overdone by the immature singer and, in fact, by the popular type of cinema organist, but it is a valuable effect exemplified in the better playing of some violin pieces.

In the electronic organ the vibrato is obtained by means of an oscillator operating at an extremely low frequency—usually from 5 to 10 cycles per second, and there are several suitable circuits for this low periodicity, as well as the means of applying it to the remainder of the circuitry.

Circuits

The most popular type of low-frequency oscillator is the multi-vibrator or variations of it (Fig. 1), the ordinary feed-back triode (Fig. 2) and the phase-shift (Fig. 3). These are perfectly standard circuits, the values of certain components being selected to provide the low periodicity.

In the multi-vibrator a double-triode is usually employed although separate triodes may be used. The cathodes are strapped and a common biasing resistor is used for both sections, and one anode has a slightly lower value load resistor than the other. In one form, one grid is strapped to earth, and the anode of this section is coupled to the following grid in the usual manner with R.C. coupling. The second grid is taken to earth through an R.C. combination, and the value chosen for the R.C. components controls the speed of oscillation. Those indicated on the diagram will produce a speed of about 6 or 7 c.p.s. the 1 MΩ variable enabling the speed to be adjusted over quite a wide range. As is usual with this type of oscillator, either the capacitor or the resistor may be varied to produce variations in speed. In this particular circuit the anode current of each section rises and falls alternately. This feature is made use of in one application of the oscillations to the remainder of the circuit, as will be described later. The ordinary feed-back by means of a low-frequency transformer is shown in Fig. 2. Here the transformer must be connected the right way round, and almost any triode (or one half of a double-triode) may be used. There is the usual anode resistor in series with the transformer, and to this is also connected a resistor to earth. As a result the anode current causes a voltage drop through the resistor and again this is employed to regulate the intensity of the oscillation—not the pitch or frequency. The latter is controlled by the grid components, and in this particular circuit the vibrato oscillations are taken out from the grid connection as shown. The remaining circuit to be described is the phase-shift oscillator, and although this also calls for a double-triode it is an extremely reliable oscillator and has many points of similarity with the arrangement shown in Fig. 1. Here again either the capacitors or the resistors in the first grid circuit may be modified for the purposes of controlling the frequency of oscillation.

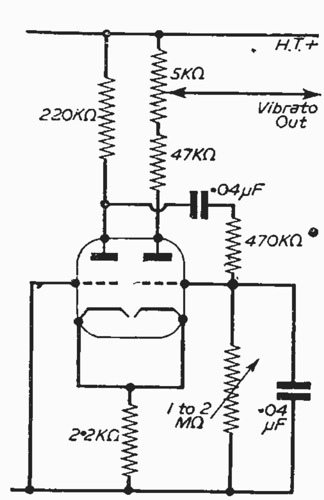


Fig. 1.—Multi-vibrator circuit, utilising variation in anode current as control.

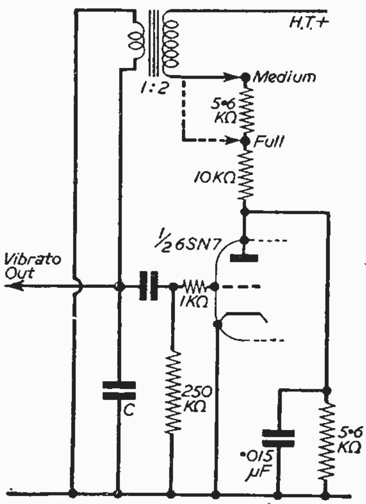


Fig. 2.—Transformer-coupled oscillator with variation of anode load.

Applying the Oscillation

Those readers who remember the circuit of the PRACTICAL WIRELESS Electronic Organ will recognise in Fig. 1 and Fig. 3 the two main oscillators which were used, the former for the purpose of applying vibrato, and the latter as the standard note generators. In the latter circuit, however, it is essential to use the type of triode having high gain such as the ECC83 or 12AX7—6SN7's or similar triodes not functioning satisfactorily—even if oscillation can be obtained. The important feature in the

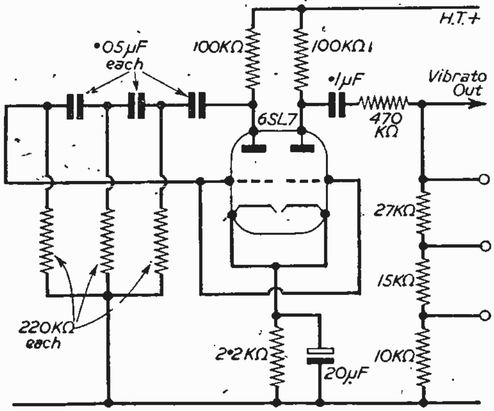


Fig. 3.—The phase-shift oscillator.

oscillatory circuit is the H.T. applied to the anode, and as a rule if this varies the frequency of oscillation will also vary. Advantage is taken of this feature to use the oscillator in Fig. 1 to apply the vibrato to the oscillator used to generate the notes as in the PRACTICAL WIRELESS Organ. The anode resistor of the first triode in Fig. 3 is then joined to the slider of the 5 kΩ potentiometer of Fig. 1 and as already mentioned, the fluctuating anode current will result in the H.T. at the slider varying—the amount of variation being dependent upon the value of resistance between H.T. and the slider point. With the oscillator described this will result in several volts variation in the H.T applied to the note generator or oscillator, and as a result the frequency of the latter will vary, resulting in a nice smooth vibrato effect. In the arrangement of Fig. 2 the oscillation is not quite so strong and it may be amplified with a standard triode amplifier and the variation in anode current of the latter may be employed in a similar manner to that already described, or alternatively the oscillations may be injected into the grid circuit of any other form of note generator.

Separate Vibrato

In the circuits so far described, and, in fact, in the majority of vibrato or tremolo arrangements, the oscillations vary those produced by a note generator and thus are not applicable to straightforward amplifiers such as may be used to amplify guitars or other musical instruments in which a microphone or pick-up is used to pick up the sounds and feed them into an ordinary amplifier. Here, a novel circuit is available for adding a tremolo effect, and is depicted in broad outline in Fig. 4. The signals from the pick-up are fed into a pre-amplifier as shown at (a), and this is arranged as a normal phase-splitter, outputs being taken from anode and cathode. These are applied to the two grids of a standard double-triode. The two parts of the signal are out of phase and re-united at the anodes and taken to the remainder of the amplifier in the usual way. Two separate stages are employed to provide the vibrato effect, one being a standard low-frequency oscillator such as the phase shift arrangement already mentioned or any other arrangement, and the oscillations are fed into a further phase-splitter. The anode and cathode of this latter stage are joined to the two grids of the double-valve previously mentioned, as shown at A and B, and the effect of these out-of-phase signals is to give the signal in its passage through the amplifier a fluctuating effect which forms a very pleasing vibrato. It is essential to use certain filters, etc., in the circuits

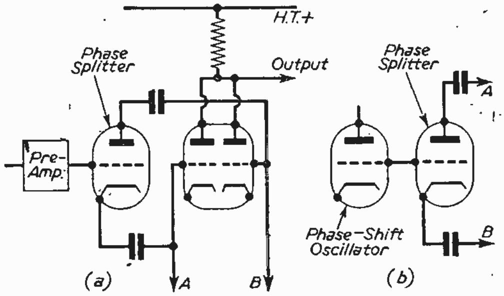


Fig. 4.—Injecting an oscillator into a normal amplifier arrangement.

according to the particular frequencies which are likely to be covered by the apparatus, and the arrangement calls for a certain amount of experiment in order to obtain the maximum vibrato effect, with a minimum of distortion of the actual signal passing through.

Portuguese Radio Lighthouses

FOR some years past the lighthouse service along the rocky and precipitous coast of Portugal has been augmented by the use of Marconi Radio Beacons, which have proved of particular value in foggy weather.

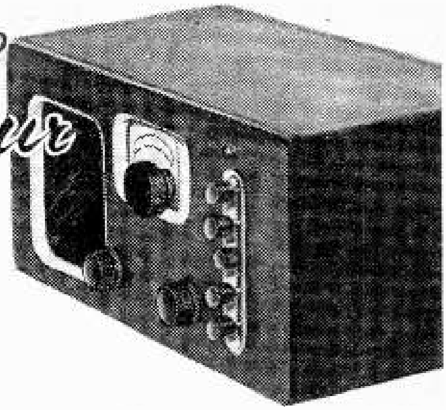
In compliance with regulations laid down at the 1951 Conference for the Re-organisation of Maritime Radio Beacons, the Portuguese Lighthouse Department are to duplicate their existing radio beacons. To this end they have now placed an order with Marconi's Wireless Telegraph Company, Ltd., for four duplicate equipments of the latest design.

The equipments on order are 20-watt M.F. beacon transmitters, Type RB.109. They will be installed at the lighthouses at Montedor, on the northern part of the Portuguese coast, Cabo Espichel near Lisbon, Cabo Sines, and Vila Real de Santo Antonio, which lies in the extreme south close to the Spanish frontier. The single Marconi beacons at these points are being moved to other lighthouses along the Portuguese coast to provide duplicate equipments there also.

The Type RB.109 Radio Beacon is designed for automatic working, and has a normal range of about 50 to 75 miles. The entirely automatic nature of the equipment means that the installation requires no attention other than for normal periodic servicing and for the adjustment of the time period to meet local conditions.

Radio beacons are in many respects equivalent to lighthouses, but instead of a beam of light they transmit wireless signals (generally consisting of a repetitive call sign for station identification followed by a long dash for direction finding purposes).

Making a Bedside Push-Button Four



A SIMPLE THREE-VALVE PLUS RECTIFIER T.R.F. RECEIVER FOR A.C./D.C. MAINS OPERATION, WITH PRE-SET OR MANUAL TUNING

THE use of forms of automatic station-selection seems to be regaining popularity, and such arrangements do have a convenience not found with manual tuning alone, as a number of stations can be selected instantly and accurately. In order that other stations need not be missed, the receiver described here also has a manual tuning control, used to select stations not provided for by the push-buttons. As a five-button unit is used, four pre-set or "button selected" stations are arranged for, one being on long waves. The unit also acts as wavechange switch, allowing manual tuning on both medium and long waves when required.

Dimensions have been kept down as far as is practicable without using midget components, and the receiver is very compact. The popular series of .3 amp. octal valves has been employed because these are efficient, robust and readily obtainable, both new and ex-service, from almost any valve supplier.

The circuit is shown in Fig. 1, and the method of operation will become apparent from this. When the top button is depressed, the coils are tuned by the 2-gang condenser in the usual way. As all other buttons are out, none of the pre-set condensers is in circuit, and the coils are both switched to medium waves. For manual tuning on long waves, both top and bottom buttons are depressed. If the second button from the top is depressed, C1 and C2 are brought into circuit, the coils switched to medium waves, and the gang condenser disconnected. This provides for one pre-set medium-wave station. The centre button, with C3 and C4, is for the second M.W. station, and the fourth button, with C5 and C6, for the third M.W. station. When the lower button alone is depressed, C7 and C8 are brought into circuit, the coils switched to long waves. This allows one L.W. station (e.g., Light Programme) to be selected.

The remainder of the circuit is quite straightforward. Volume control is provided by the 100 K. cathode potentiometer. A further potentiometer of 25 K. acts in a simple tone-control circuit. A valve rectifier is employed in preference to the metal type since hum is usually at a much lower level,

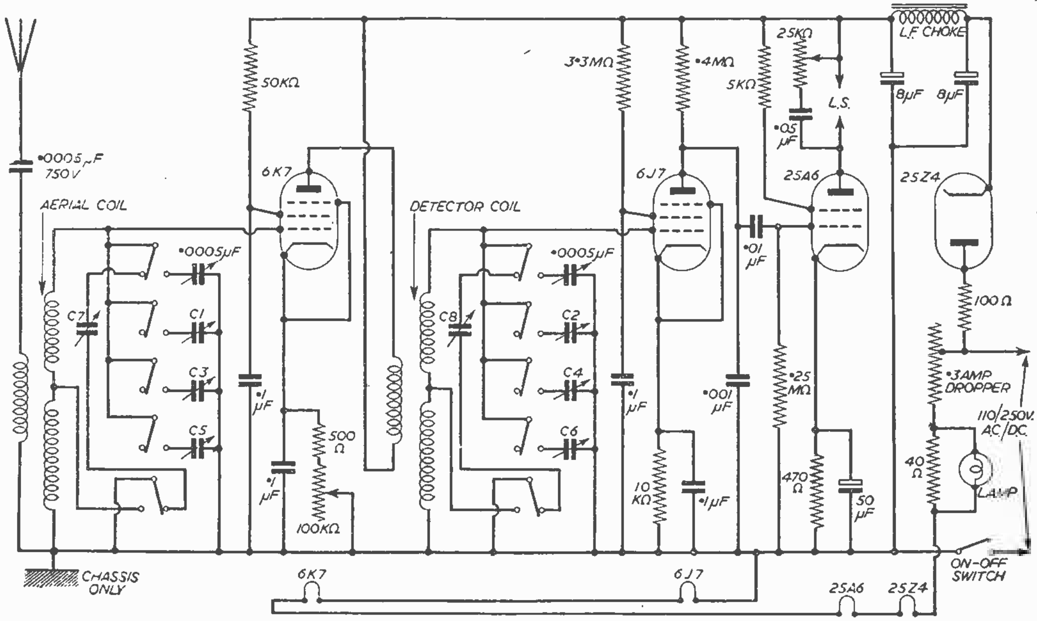
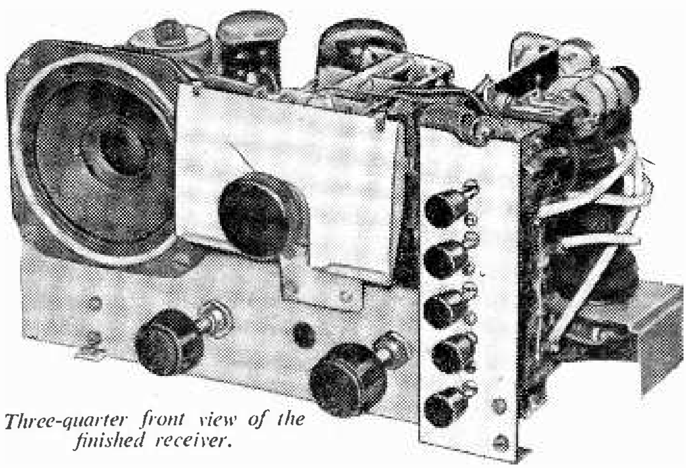


Fig. 1.—Theoretical circuit of the receiver.

with a given capacitance of smoothing condenser, with a valve in this position.

Constructional Points

The chassis is "stepped" at the back to reduce the overall height of the cabinet; except for reducing height, this is not essential, and there is no reason why the usual flat chassis should not be used. The chassis is 4in. wide, 7½in. long, and 2in. deep, descending to 1¼in. deep at the back, where the valveholders are fitted. A screen supporting the push-button switch is bolted to the right of the chassis. This screen is 5in. high, 4½in. from back to front, and has a flange 1½in. wide, turned, as shown, to support the switch. Fairly stout metal, such as 16 s.w.g. aluminium, is desirable here. Finally, a small box-shaped extension, 2in. by 2in. by 1¼in. deep, is bolted against the screen to hold the 6K7 valveholder. This will become apparent from the diagrams. Three double pre-set condensers are bolted to the back edge of the vertical screen. For long waves these may be .0005 μF. This capacity is also suitable for stations above about 350 metres in the M.W. band. For stations of lower wavelength, .0002 μF pre-sets may be used, with small postage-stamp 50 or 100 pF pre-sets, supported directly in the wiring, for stations of very low wavelength. (The large-capacity pre-sets cannot be used to tune low in either waveband, because their *minimum* capacity is very much greater than the minimum capacity of the usual gang condenser.)

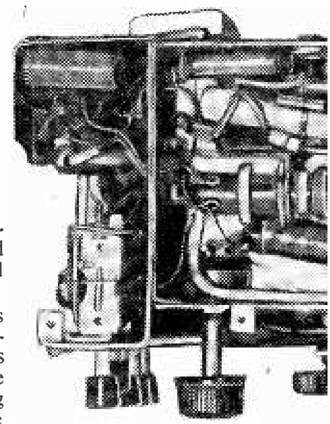


Three-quarter front view of the finished receiver.

The layout of the larger parts is clear from the illustrations, and they should be positioned carefully before drilling mounting holes, as there is not a great deal of free space.

Wiring Details

Wiring under the chassis is shown in Fig. 5, the four .1 μF condensers being lifted out of position to show valveholder wiring. When wiring is complete, these condensers are pushed over the 6K7 and 6J7 holders.



All connections should be well insulated, and points marked "M.C." are taken to soldering tags bolted to the chassis. Work will be simplified if the coils and push-button switch are left off until all other wiring has been completed. Insulated sleeving should be slipped over the wire ends of condensers and resistors, to avoid possible short circuits.

Connections to the push-button unit are shown in Fig. 2.

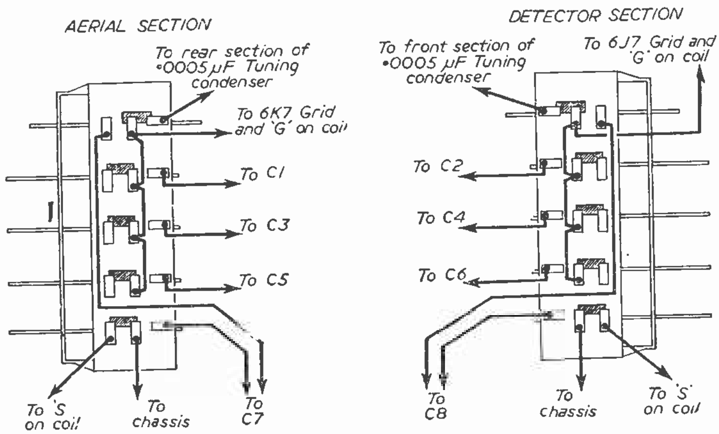


Fig. 2.—Details of the push-button connections.

RESISTORS :—

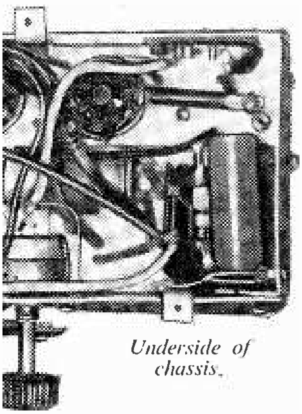
500 ohm	½ watt.
5 KΩ	½ watt.
10 KΩ	½ watt.
50 KΩ	½ watt.
.25 megohm	½ watt.
.4 megohm	½ watt.
3.3 megohm	½ watt.
470 ohm	1 watt.
100 ohm	1 watt.
40 ohm, 2 watts.	
.3 amp, 600 ohm mains dropper.	
100 KΩ pot. with switch.	
25 KΩ pot.	

When the switch is mounted, the aerial section lies outside, and is fully visible. The detector section, however, is adjacent to the vertical screen. Leads should therefore be soldered to this side of the switch before the latter is bolted into place. If desired, these leads may be identified by using coloured sleeving. Wires which are required to go to the detector (6J7) or associated circuits pass directly through the vertical screen. They must not be brought round near connections in the R.F. stage, or instability may arise, expecially when the volume control is turned to maximum.

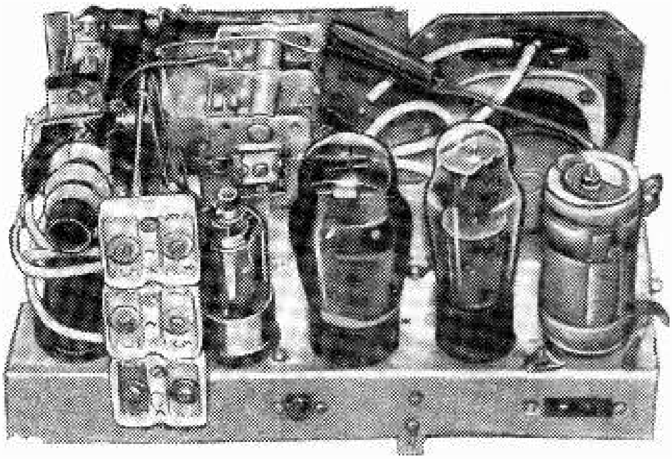
It will be seen that both sides of the switch are wired up in exactly the same way. Leads to the outer, or aerial section, can be put on after the switch is mounted.

Coils

Coil connections are given in Fig. 3, but only apply to the specified coils. If other coils are used, then the maker's instructions must be followed as the tags may be placed differently, or connections from windings to tags, inside the coil, may not be the same. The coils specified have a thick projecting loop, for earth and mounting, and this is bolted to the vertical screen near the top, in the case of the aerial coil, which lies above the 6K7 valve. The Astral coils which were used in the original version of this receiver were made by Astral Radio Products of 138, The Ridgeway, Woodingdean, Brighton 7.



Underside of chassis.



A rear view which shows the compact layout.

Adjustments

The mains dropper should be adjusted so that the valves receive the correct heater voltage—6.3 volts for 6K7 and 6J7, and 25 volts for 25A6 and 25Z4. An A.C. meter is best for assuring this is so. If no meter is available, the dropper clip should be so placed that the valves gain full operating temperature in about 45 secs., when switching on from cold. Both excessive and insufficient heater voltage can cause premature deterioration of the valves.

The anode and screen grid voltages of the 25A6 should not exceed 160 and 135 volts respectively. The exact voltage will depend on the resistance of the speaker transformer and choke, the condition of the rectifier, and the mains voltage, and will usually be around these figures. But with 250 volts mains, the voltages may be a trifle high. If so, the value of the 100 ohm resistor should be increased, or this resistor taken to a tapping clip on the dropper, instead of directly to the one main lead.

The receiver should perform in the usual way when the manual control is operated, the top button being depressed. If the gang condenser does not have

IPONENT LIST

y 2-pole 2-throw push-tton switch.
ycle drive. 3 knobs.
tal valveholders.
A smoothing choke.
) ohm/2-3 ohm mains out-t valve transformer, ratio prox. 45 : 1.
ohm, 3½in. P.M. speaker
al lamp and holder, etc.
es—6K7, 6J7/GT, 25A6G, Z4G.

CONDENSERS
4 of .1 μF, 350 volts.
.001 μF, 350 volts.
.05 μF, 350 volts.
.01 μF, mica.
.0005 μF, 500-750 volts.
8 plus 8 μF, 350 volts.
50 μF, 50 volts.
2-gang .0005 μF tuning condenser.
Trimmers and pre-sets, see text.
Pair "Astral" dual-range coils.

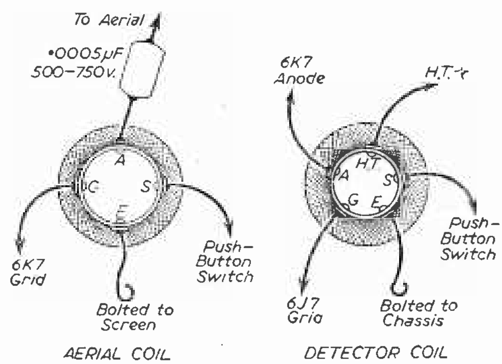
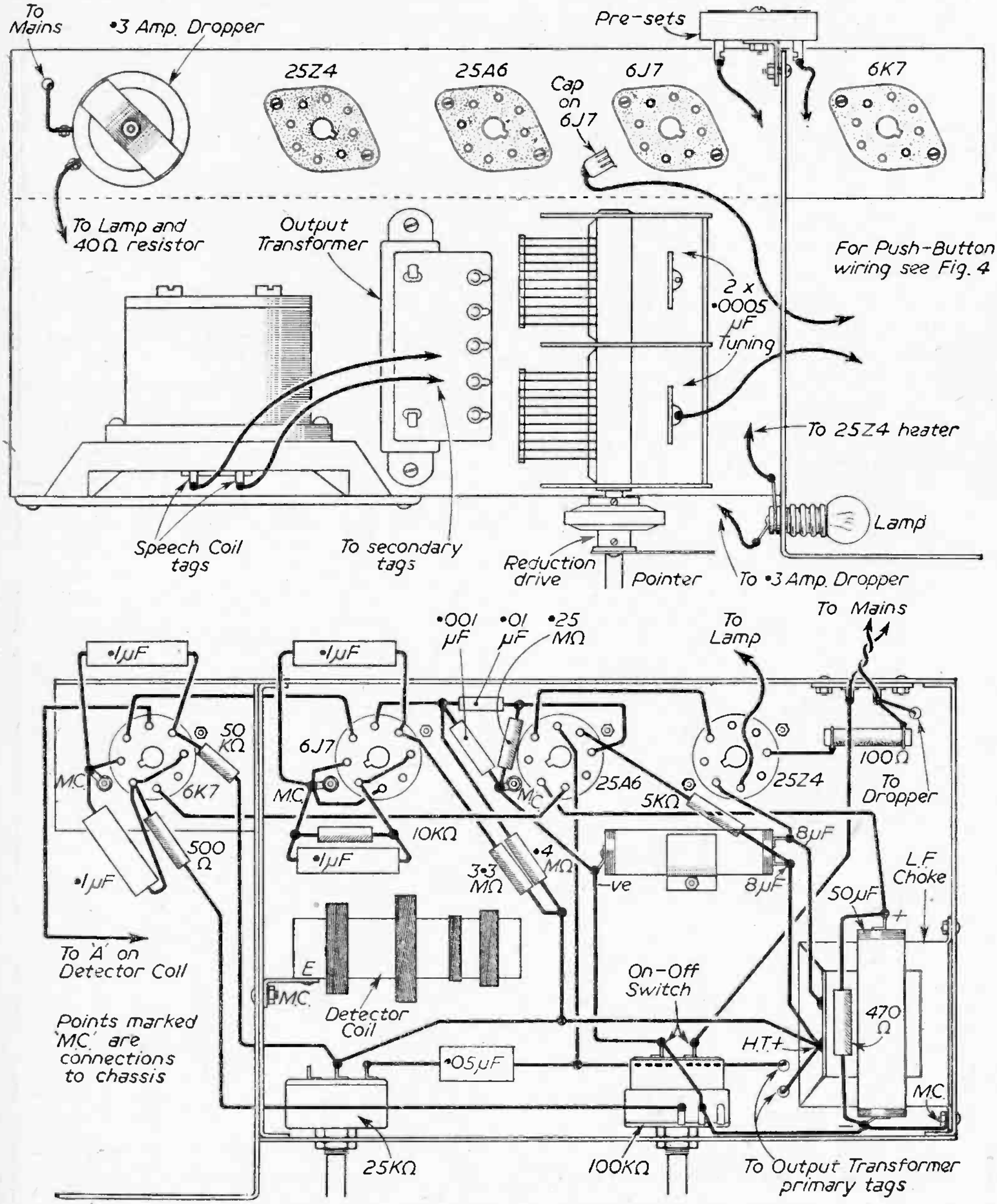


Fig. 3.—Coil connections.

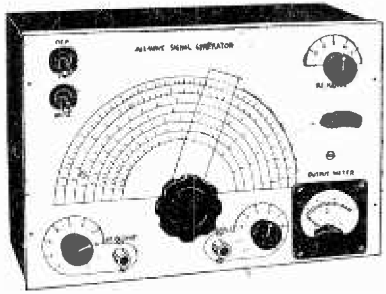
trimmers, two 50 pF trimmers should be wired from the valve grids to chassis. These should be adjusted for maximum sensitivity, at a point fairly low in the medium wave band. No further trimming is required for manual tuning of the long wave band (top and bottom buttons depressed).

To adjust the pre-sets, each button should be depressed in turn, and the required station accurately tuned in by using a *fully insulated* screwdriver. The aerial tuning pre-sets are situated with their tags on the 6K7 side of the vertical screen, and the detector stage pre-sets with tags at the 6J7 side of the screen. This reduces stray coupling between connecting leads.

The receiver should be inserted in an insulated cabinet, as with all A.C./D.C. equipment, since the chassis, and everything in contact with it is "alive" to the mains. No direct earth can be employed, for this reason. If an earth *is* used, the lead should be taken to the chassis via a .05 μF condenser of 500-750 volts working.



Figs. 4 and 5.—Top and bottom chassis wiring details.



COMPLETELY BUILT SIGNAL GENERATOR

Coverage 120 Kc/s-320 Kc/s. 300 Kc/s-900 Kc/s. 900 Kc/s—2.75 Mc/s. 2.75 Mc/s-8.5 Mc/s. 8.5 Mc/s-25 Mc/s. 17 Mc/s-50 Mc/s. 25.5 Mc/s-75 Mc/s. Metal case 10 x 6¾ x 4½in. Size of scale 6½ x 3½in., 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. Black crackle finished case and white panel. Accuracy plus or minus 2%. **£4/19/6.** or **34/-** deposit and 3 monthly payments **25/-.** P. & P. 4/- extra.

Drop thro' 280-0-280, 200 mA., 6 v. 5 amps., 5 v. 3 amps., **27/6.**

Heater Transformer. Pri. 230-250 v. 6 v. 1½ amp., **6/-** ; 2 v. 2½ amp., **5/-.**

R.I. MAINS TRANSFORMERS, chassis mounting, feet and voltage panel. Primaries 200/250.
350-0-350 75 mA. 6.3 v. 3 a. tap 4 v. 6.3 v. 1 a., **13/6.**
350-0-350 70 mA. 4 v. 5 a., 4 v. 2.5 a., C.T., **18/6.** P. & P. on above transformers 2/-.
500-0-500 120 mA. 4 v. C.T. 4 a. 4 v. C.T. 4 a. 4 v. C.T. 2.5 a., **27/6.**
500-0-500 250 mA. 4 v. C.T. 5 a. 4 v. C.T. 5 a. 4 v. C.T. 4 a., **39/6.**
P. & P. on the above transformers 3/-.

PATTERN GENERATOR 40-70 Mc/s. direct calibration. checks frame and line time base. frequency and linearity. vision channel alignment, sound channel and sound rejection circuits, and vision channel band width. Silver plated coils, black crackle finished case, 10 x 6¾ x 4½in. and white front panel. A.C. mains 200-250 volts. This instrument will align any TV. receiver. Cash price, **£3.19.6** or **£1.9.0** deposit and 3 monthly payments of **£1.** Post and packing 4/- extra.

TV. CONVERTER for the new commercial stations, complete with 2 valves. Frequency :—can be set to any channel within the 186-196 Mc/s. band. I.F. :—will work into any existing TV. receiver, designed to work between 42-68 Mc/s. Sensitivity 10 Mu/v. with any normal TV. set. Input :—arranged for 300 ohm feeder. 80 ohm feeder can be used with slight reduction in R.F. gain. Circuit EF80 as local oscillator, ECC81 as R.F. amplifier and mixer. The gain of the first stage, grounded grid R.F. amplifier, 10 db. Requires power supply of 200 v. D.C. at 25 mA., 6.3 v. A.C. at 0.6 amp. Input filter ensuring complete freedom from unwanted signals. 2 simple adjustments only. **£2.10.0.** Post and packing 2/6.

Volume Controls. Long spindle less switch, 50 K., 500 K., 1 meg. 2/6 each. P. & P. 3d. each.

CONSTRUCTOR'S PARCEL
MEDIUM & LONG-WAVE A.C. MAINS 230/250 2-VALVE PLUS METAL RECTIFIER, 22/6.

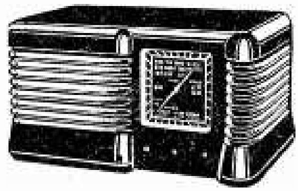
Comprising chassis 10½ x 4½ x 1¾in., 2 waveband scale. tuning condenser, wavechange switch. volume-control, heater trans., metal rectifier, 2 valves and v/holders, smoothing and bias condensers, resistors and small condensers, and medium- and long-wave coil, litz wound. Circuit and point-to-point, **1/3.** Post and packing, 2/6 extra.

Volume Controls. Long spindle and switch. ¼, ½, 1 and 2 meg., **4/-** each ; 10 K. and 50 K., **3/6** each. ½ and 1 meg., long spindle, double pole switch, miniature, **5/-.**

Standard Wave-change Switches. 4-pole 3-way, **1/9** ; 5-pole 3-way, **1/9.** Miniature 3-pole 4-way, 4-pole 3-way, **2/6.** 2-pole 11-way twin wafer, **5/-.** 1-pole 12-way single wafer, **5/-.**

RADIOGRAM CHASSIS.—5-valve A.C./D.C. 3-way band superhet. 195/255 volts 19-49, 200-550 and 1,000-2,000 metres, flywheel tuning frequency, 470 Kc/s iron-cored coils and IFs. Size of chassis, 13 x 6½ x 2½. Complete with valves and 8in. P.W. speaker, P. & P. 5/-, **£8.17.6.**

Constructor's parcel, comprising chassis 12½ x 8 x 2½in., cad. plated, 18 gauge, v/h, IF and trans. cut-outs, back-plate, 2 supporting brackets, 3-waveband scale, new wavelength stations names. Size of scale 11½ x 4½in., drive sp., drum, 2 pulleys, pointer, 2 bulb holders, 5 pax I.O. v/h. 4 knobs and pair of 465 IFs. twin gang, 16 x 16 mfd. 350 wkg., mains trans. 250-0-250 60 mA. 6.3 v. 2 amp., 5 v. 2 amp. and 6½in. M.E. speaker with O.P. trans. P. & P. 3/6. **39/6.**



PLASTIC CABINET as illustrated, 11½ x 6½ x 5½in., in walnut or cream. ALSO IN POLISHED WALNUT, complete with T.R.F. chassis, 2 waveband scale, station names, new waveband, back-plate, drum, pointer, spring, drive spindle, 3 knobs and back, **22/6.** P. & P., 3/6.
As above with Superhet Chassis, **23/6.** P. & P., 3/6.
As above complete with new 5in. speaker to fit and O.P. trans., **37/6.** P. & P. 3/6. With Superhet Chassis, **39/6.** P. & P. 3/6.

Used metal rectifier. 230 v. 50mA., **3/6** ; gang with trimmers, **6/6** ; M. & L. T.R.F. coils, **5/-** ; 3 Govt. valves, 3 v/h and circuit, **4/6** ; heater trans., **6/-** ; volume control with switch, **3/6** ; wave-change switch, **2/-** ; 32 x 32 mfd., **4/-** ; bias condenser, **1/-** ; resistor kit, **2/-** ; condenser kit, **4/-.**
Complete A.C. Mains 3 Valve plus metal rectifier T.R.S. kit. In the above cabinet. **£3.15.0.** plus 3/6 P. & P.
Used A.C. Mains. 5 valve, 3 wavebands. Superhet chassis, 11½in. x 8½in. x 3in. Complete with 3 waveband scale, 10½in. x 5½in. Pair 465, K.C.I.F., tuning condenser, main transformer, volume control with switch, Tone Control, 3 waveband coil pack. (This is a completely detachable unit on small chassis.) Various small condensers and resistors biasing condensers. **19/6.** P. & P. 3/6. As above 2 wavebands **15/-.** P. & P. 3/6.

Valveholders. Paxolin octal, **4d.** Moulded octal, **7d.** EF50, **7d.** Moulded B7G, **7d.** Loctal amphenol, **7d.** Loctal pax., **4d.** Mazda Amph., **7d.** Mazda pax., **4d.** B8A, B9A amphenol, **7d.** B7G with screening can, **1/6.** Duodecal paxolin, **9d.**
Twin-gang .0005 Tuning Condensers, 5/-. With trimmers, **6/6.**
Midget .00037 dust cover and trimmers, **8/6.**
R. & A. M.E. 6½in. speaker with O.P. trans., field coil 175 ohms, **9/6.** P. & P. 2/6.
R. & A. 6½in. M.E. speaker with O.P. trans., field 440 ohms. **10/6.** P. & P. 2/6.
Battery Charger, input 230/250 v., output 6 and 12 v. **1** amp. Black crackle finished case size 10 x 6 x 4in. P. & P. 3/-. **21/-.**
Potato & Vegetable Peeler, by famous manufacturer, capacity 4½lbs., complete with water pump. All aluminium construction, white stove-enamel finish. Originally intended for adaption on an electric food-mixer, can be easily converted for hand operation. **39/6.** P. & P. 3/-.
Primary, 200-250 v. P. & P. 2/-.
300-0-300 100 mA., 6 v. 3 amp., 5 v. 2 amp., **22/6.**
Drop thro' 350-0-350 v. 70 mA., 6 v. 2.5 amp., 5 v. 2 amp., **14/6.**
Drop thro' 250-0-250 v. 80 mA., 6 v. 3 amp., 5 v. 2 amp., **14/6.**
280-0-280, drop through, 80 mA., 6 v. 3 amp., 5 v. 2 amp., **14/6.**
250-0-250, 80 mA., 6 v. 4 amp., **14/-.**
Drop thro' 270-0-270, 80 mA., 6 v. 3 amp., 4 v. 1.5 amp., **13/6.**
Drop thro' 270-0-270 60 mA., 6 v. 3 amp., **11/6.**
Auto Trans. Input 200/250, H.T. 350 v. 350 mA. Separate L.T. 6.3 v. 7 a., 6.3 v. 1½ amp., 5 v. 3 amp., **25/-.** P. & P. 3/-.
Pri. 200/250. Secondary 9 v. 3.5 amp., 6.3 v. 3 amp., **12/6.**
Pri. 230 v. Sec. 500-0-500 and 500-0-500 250 mA. both windings, 4 v. 3 amp., 4 v. 3 amp., **39/6.** P. & P. 5/-.
Mains Transformer, fully impregnated, input 200, 220, 230 and 240. Sec. 600-0-600 275 mA., and 200 v. at 30 mA., complete with separate heater transformer. Input 210, 220, 230, 240. Sec. 6.3 v. 2 amp. three times, 0, 4, 6.3 v. at 3 amp. and 5 v. 3 amp., **45/-.** P. & P. 5/-.
Mains Transformer, fully impregnated. Input 210, 220, 230, 240. Sec. 350-0-350, 100 mA., with separate heater transformer. Pri. 210, 220, 230, 240. Sec. 6.3 v. 2 amp., 6.3 v. 3 amp., 4 v. 6 amp., and 5 v. 2 amp. **30/-.** P. & P. 5/-.

32 mfd., 350 wkg.	2/-	Ex Govt. 8 mfd. 500 v. wkg., size 3½ x 1½, 2 for ...	2/6
16 x 24 350 wkg.	4/-	60+100 mfd., 280 v. wkg.	7/-
4 mfd. 200 wkg.	1/3	16+32 mfd., 350 wkg. ...	6/-
40 mfd., 450 wkg.	3/6	50 mfd., 180 wkg.	1/9
16 x 8 mfd., 500 wkg. ...	4/6	65 mfd., 220 wkg.	1/6
16 x 16 mfd., 500 wkg. ...	5/9	8 mfd., 150 wkg.	1/6
8 x 16 mfd., 450 wkg. ...	3/9	60+100 mfd., 280 wkg. ...	8/6
32 x 23 mfd., 350 wkg. ...	4/-	50 mfd., 12 wkg.	11d.
32 x 32 mfd., 350 wkg. and 25 mfd. 25 wkg.	6/6	32+32mfd., min. 275 wkg.	4/-
25 mfd., 25 wkg.	11d.	50 mfd., 50 wkg. 8 mfd., wkg., wire ends	1/9
250 mfd., 12 v. wkg. ...	1/-	Miniature wire ends moulded 100 pf., 500 pf., and .001 ea.	7d.
16 mfd., 500 wkg., wire ends...	3/3	280-0-280 80 mA. 4 v. 4 a., 4 v. 2 a.	14/6
8 mfd., 500 v. wkg., wire ends...	2/6	250 v. 350 mA. 6.3 v. 4 a. twice 2 v. 2 a.	19/6
8 mfd., 350 v. wkg., tag ends...	1/6	Auto-trans., input 200/250 HT 500 v. 250 mA, 6 v. 4 a. twice 2 v. 2 a. ...	19/6
50 mfd., 25 v. wkg., wire ends...	1/9	250-0-250 60 mA. 6.3 v. 1.5 a. 0-5-6.3 v. 1.5 a.	10/6
100 mfd., 350 wkg. ...	4/-		
100+200 mfd., 350 wkg. ...	9/6		
16+16 mfd., 350 wkg. ...	3/3		

Terms of business : Cash with order. Despatch of goods within three days from receipt of order. Where post and packing charge is not stated, please add 1/6 up to 10/-, 2/- up to £1 and 2/6 up to £2. All enquiries S.A.E. Lists 5d. each.

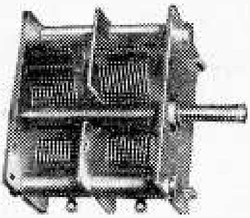
R. AND T.V. COMPONENTS (ACTON) LTD.

(Late D. COHEN)

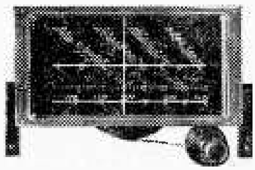
23, HIGH STREET, ACTON, W.3
(Opposite Granada Cinema)

Hours of Business : Saturdays 9-5 p.m. Wednesdays 9-1 p.m. Other days 9-4.30 p.m.

PRECISION BUILT MATCHED COMPONENTS



M.G. GANG CONDENSER



S.L.8 SPIN WHEEL DRIVE

M.G. GANG CONDENSER

Available as 1, 2 or 3 gang, 490 p.F. nominal capacity, matched and standardised to close limits. Supplied with trimmers if required.

Other capacities available—details on request.

Cadmium plated steel frame.
Aluminium Vanes.
Low loss non-hygroscopic. insulation.
Spindle $\frac{1}{4}$in. dia. projects $1\frac{1}{16}$in. from front plate.
Front area $2\frac{3}{4}$in. x $2\frac{5}{16}$in. including sweep of vanes.

Length excluding spindle :	Price
1 gang — $1\frac{7}{16}$in.	**9/3d.**
2 gang — $2\frac{9}{16}$in.	**14/-d.**
3 gang — $3\frac{5}{8}$in.	**18/3d.**

S.L.8 SPIN WHEEL DRIVE

A precision slide rule drive. Complete with 3-band glass scale, 9in. x $4\frac{3}{4}$in.

Printed—short, medium and long wave bands with station names.

Scale length 7in.

The spin wheel drive gives easy control through a ratio of 24-1. Fitted with constant velocity coupling, eliminating strain on the Condenser, and providing mechanical and electrical isolation from vibration and noise.

Supplied with florentine bronze escutcheon.
Price — **27/6d.** complete.

Write for fully illustrated catalogue.

JACKSON

BROS. (LONDON) LTD.
KINGSWAY . WADDON
SURREY

Telegrams :
WALFILCO, SOUPHONE, LONDON
Telephone : CROYDON 2754-5

REGISTERED TRADE MARK

L 4679 A

THE OSRAM NINE-ONE-TWO

AMPLIFIER INSTRUCTION BOOK AND HIGHEST QUALITY COMPONENTS

Available from

COVENTRY RADIO

189, Dunstable Road, Luton. *'Phone :* 2677

Price, 3/6, plus 3d. postage
also
Our 1954/5 COMPONENT CATALOGUE at 1/-

TAPE RECORDERS
P.W. and SOUND MASTER

We can supply complete kits or separate components for both the P.W. and Sound Master Tape Recorders.

Sound Master Instructions, **6/6.**

FULL HIRE PURCHASE FACILITIES
Only 2/- in the £ deposit.

WATTS RADIO,

8, Apple Market, Kingston-on-Thames, Surrey. *Phone : KINgston 4099.*

- **T/V TECHNOLOGY**
- **RADIO ENGINEERING**
- **ELECTRONICS**
- **RADIO SERVICING**

There's a big future in T/V and Radio. Act now ! Increase your knowledge. Back up experience with a sound theoretical background. I.C.S. offer courses of instruction in—

T/V TECHNOLOGY
ADVANCED SHORT-WAVE RADIO
RADIO ENGINEERING
RADIO SERVICE ENGINEERING
RADAR
ELEMENTARY ELECTRONICS
FREQUENCY MODULATION

I.C.S. will also coach you for the following examinations :—

B.I.R.E. ; P.M.G. Certificate for Wireless Operators ; Radio Servicing Certificate (R.T.E.B.) ; C. & G. Telecommunications, etc., etc.

DON'T DELAY—WRITE TO-DAY for free descriptive booklet, stating which subject or examination interests you. Fees include all books needed. Examination students coached until successful. **Reduced terms for H.M. Forces.**

Dept. 170D, I.C.S., 71, Kingsway, W.C.2.

INTERNATIONAL CORRESPONDENCE SCHOOLS,
(Dept. 170D), International Buildings, Kingsway, London, W.C.2.

Please send booklet on ....

Name .... Age ....
(Block letters, please)

Address ....

....

ICS

Building an 8 Valve Super-Het Radiogram

FURTHER DETAILS OF THE NEW RECEIVER

By S. A. Knight

(*Continued from page* 162 *March issue*)

DETAILS of the inter-screens are given in Fig. 6. These screens are also bent up from 16 s.w.g. aluminium and should be made exactly as detailed. The switch hole marked " A " should be at a height (shown as " X ") which exactly coincides with the centre control hole "A" on Fig. 4 when the screens are resting on the underchassis floor ; proper alignment of the switch spindle which passes right through the screening is then ensured. The hole marked " A1 " should coincide similarly with the hole marked " A1 " on Fig. 4, as this allows the volume-control spindle to penetrate across the screening compartments, the actual control being mounted on the rear screen. The screen positions are shown in Fig. 4, only the rear screen being fixed to the chassis by the two feet provided. The other two screens are clamped between the switch spacers ; fuller details of this arrangement will be given later.

Fixing feet and dial supports are fitted when the set is completed ; these can be seen in the respective photographs.

The specified J.B. scale can be obtained with either a vertically or horizontally marked glass dial. As is seen from the front view photograph of the receiver, the vertical markings are used, the set being finally housed in a radiogram cabinet with the controls in a line from back to front across the motor board. For an ordinary table type of cabinet, of course, the horizontal scale would be preferable, and the choice is left entirely to individual taste. No dimensional changes are involved in any way.

Construction

The main receiver unit calls for the most care in construction and wiring, the power chassis being very simple in comparison and calling for no special precautions regarding layout. Most of these constructional notes will therefore be about the main chassis and its assembly.

Referring to Fig. 3, this shows the under-chassis view of the receiver with most parts mounted in position. This diagram is not a wiring layout as such, but is prepared to indicate the proper positions and spacings of the more important parts, the disposition of the various tag strips, and the correct orientations of the valveholders and I.F. transformers. A complete wiring diagram would tend to become complicated and would probably prove a hindrance rather than a help ; with the use of the receiver theoretical circuit (Fig. 1) and the present layout figure used in conjunction, no difficulty should be experienced.

We will deal first with the best manner of setting about the assembly of the set, assuming that the chassis has been drilled and bent as shown in

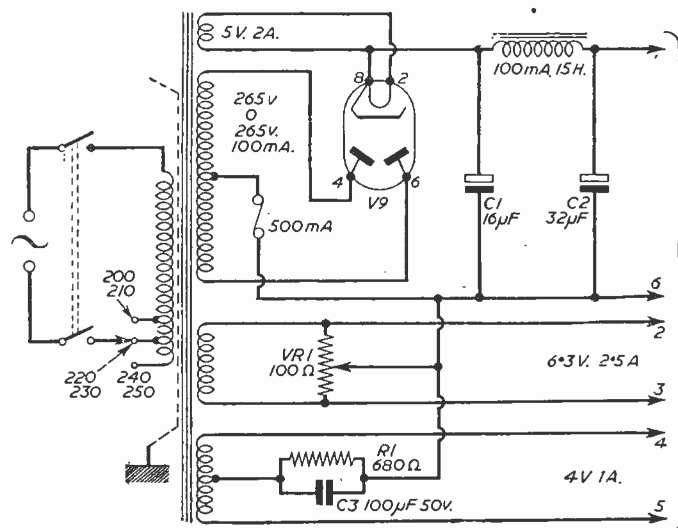


Fig 2.—Circuit of the power pack

Fig. 4, and that the cross-screens have been made in accordance with Fig. 5 and the notes given in the text. A system of assembly is called for, especially in regard to the coils and screens and the tuning condenser, otherwise it will be difficult to mount certain parts.

Switch and Screens

Assemble first of all the switch and the cross-screens as a separate unit. The spacing pieces which fit over the side struts of the Oak switch should be cut to provide two ¾in., eight ¼in., and six 1½in. After ensuring that the positions of the stops in the front plate allow the wafers to move over their ranges of positions correctly, assemble the switch and cross-screens as shown in Fig. 6. The main switch spindle passes through the screen ⅜in. holes, and the screens are clamped in position finally by the pressure of the spacing pieces biting against them. When the assembly is tightly bolted up, check that the whole line is straight and that there is no twist in either the switch struts or the screens. The latter should now sit squarely on the chassis when placed in position with the front bush locked through the front chassis hole. Now mark out the fixing feet positions on the rear screen so that the assembly can be firmly bolted down to the chassis.

The padders can now be fixed to their bracket and bolted on the end of the back screen in the position shown.

When the switch and screens are properly positioned and turning properly, the tuning condenser and J.B. drive assembly should be marked out. The drive is two-hole fixing to the front side of the chassis, but the exact height must be decided by the height at which the tuning condenser spindle comes when this is resting on its feet on the chassis top, centrally placed. Allow the spindle to enter the coupling on the dial drive, therefore, and then mark off the two necessary fixing holes for the dial, ensuring that the flywheel position coincides approximately with the 1in. hole in the chassis front. The flywheel is, of course, removed during this operation, being finally replaced behind the chassis front. The oblong cut-out permits its rotation when it comes a little high.

With the drive assembly fitted, mark off the four fixing holes for the gang condenser. Bolt this down temporarily, and then lock the spindle to the dial coupling by means of the grub screws provided. Check that the drive runs freely and that the gang opens and closes smoothly.

Now remove the gang and solder three flexible leads to its lowermost tags. These should be left fairly long, and they will later pass through the three holes in the chassis into their respective coil compart-

(*Continued on page* 233)

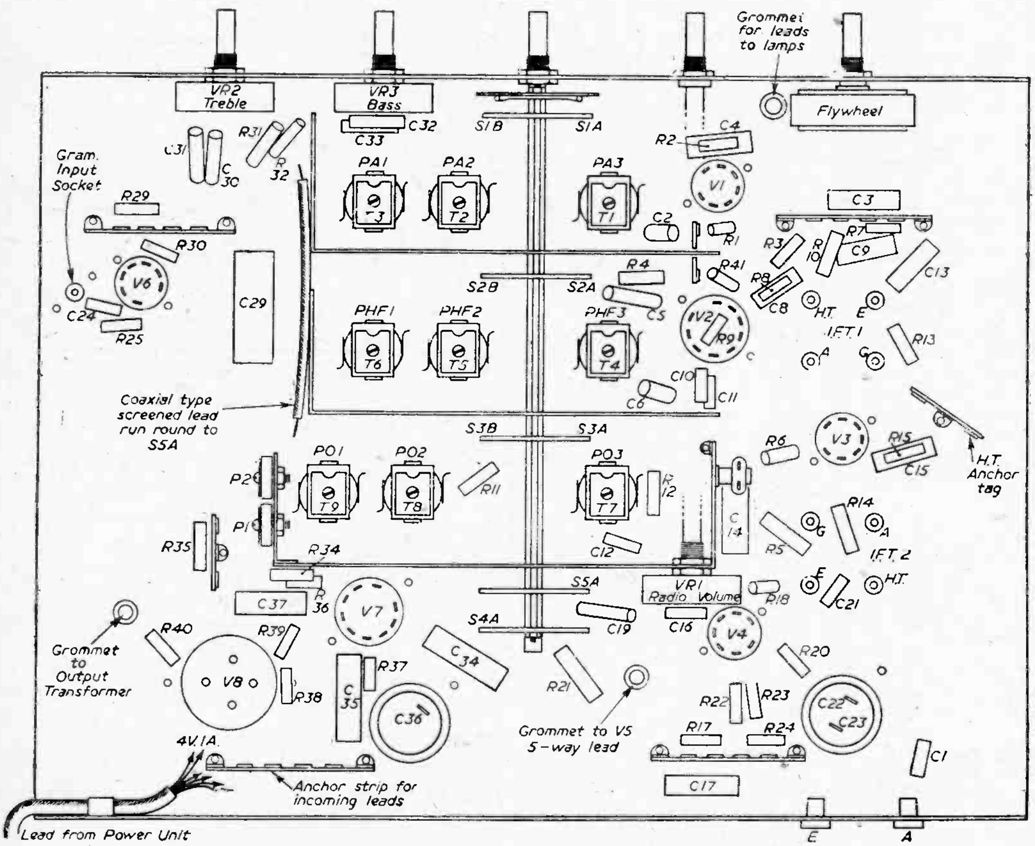


Fig. 3.—Details of principal components below chassis.

Volume Controls

Midget Ediswan type. Long spindles. Guaranteed 1 year. All values 10,000 ohms to 2 Megohms.

No Sw.	S.P.Sw.	D.P.Sw.
3/-	4/-	4/9

COAX PLUGS ... 1/2
SOCKETS 1/-
LINE CONNECTOR 1/2
OUTLET BOXES ... 4/6

80 ohm CABLE COAX

STANDARD ¼in. diam. Polythene insulated. GRADE "A" ONLY **8d. yd.**

SPECIAL. — Semi-air spaced polythene. 80 ohm **Coax** ¼in. diam. Stranded core. Losses cut 50% (just released) **9d. yd.**

BALANCED TWIN FEEDER per yd. 6d. } 80
TWIN SCREENED FEEDER per yd. 1/- } ohms

50 OHM COAX CABLE. 8d. per yd. ¼in. dia.

TRIMMERS, Ceramic, 30, 70 pf., **9d.** 100 pf., 150 pf., **1/3**; 250 pf., **1/6**; 600 pf., **1/9.**

RESISTORS.—All values: 10 ohms to 10 meg., ¼ w., **4d.**; ½ w., **6d.**; 1 w., **8d.**; 2 w., **1/-**; High Stability, ½ w. 1%, **2/-**. Preferred values 100 ohms to 10 Meg.

WIRE-WOUND RESISTORS.—Best Makes Miniature Ceramic Type—5 w., 15 ohm to 4 K., **1/9**; 10 w., 20 ohm to 6 K., **2/3**; 15 w., 30 ohm to 10 K., **2/9**; 5 w. Vitreous, 12 K. to 25 K., **3/-**.

WIRE-WOUND POTS. 3 WATT. FAMOUS MAKE.

Pre-Set Min. T.V. Type. Knurled Slotted Knob. All values 25 ohms to 30 K., **3/-** ea. 50 K., **4/-** Ditto Carbon Track 50 K. to 2 Meg., **3/-**.

Standard Size Pots, 2¼in. Spindle. High Grade. All Values. 100 ohms to 50 K., **5/6**; 100 K., **6/6.** **W/W EXT SPEAKER CONTROL** 10Ω, **3/-**.

O/P TRANSFORMERS.—Heavy duty 70 ma., **4/6.** Small Tapped pentode, **3/9.**

L.F. CHOKES 10 h. 65 ma., **5/-**. 20/25 h. 100/150 ma., **12/6.** 5 h. 250 ma., **15/-**. 15 h. 100 ma., **10/6.** **LYNX,** 3h. 250 ma., **13/6.** **SIMPLEX,** 10 h. 150 ma., **10/6.** **MAINS TRANS.**—Made in our own workshops to high grade specification. Fully inter-leaved and impregnated. Tapped prim. 200 v./250 v., Heater Trans., 6.3 v., 1½ amp., **7/6**; ditto 6.3 v., 3 amp., **10/6**; ditto, 12 v., .75 amp., **7/6**; 350-0-350, 80 ma., 6.3 v., 4 a., 5 v., 2 a., ditto 300-0-300, ditto 250-0-250, **21/-**. **AMPLIFIER TRANS.** 250 v. 50 ma. ½ wave. 6.3 v. 2 a. Fully Shrouded, **17/6.** Viewmaster Auto Type, **35/-**. Teleking, **30/-**. Lynx, **30/-**. Coronet, **30/-**. Simplex, **35/-**. Rewinds and Specials to requirements.

SOUNDMASTER SPECIALS.—Mains Trans., **35/-**. L.F. Choke, **10/6.** O/P Trans., **5/6.** Envelope, **6/6.** Specified Wafer Switches, **22/6** per set of 3.

WOODEN WALNUT CABINET.—12in. x 7in. x 5in. TRF or superhet., comp. punched chassis, dial, back-plate, drive, pointer, etc., **28/6.** plus post 2/-.

TYANA.—Midget Soldering Iron. 200/250 v. or 230/250 v., **14/11.** **TYANA TRIPLE THREE.**—Complete with detachable bench stand, **19/6.**

NEW SOLON MIDGET IRON.—25 w., **19/6.** IDEAL FOR RADIO CONSTRUCTORS.

C.R.T. HEATER ISOLATION TRANSFORMER.—Low leakage winding with 25% sec. boost. Ratio 1 : 1.25, 2 v., **10/6**; 4 v., **10/6**; 6.3 v., **10/6**; 12 v., **10/6.** **MAINS PRIMARIES** and Specials to Order, from **10/6** each.

CRYSTAL DIODE.—Very sensitive, G.E.C., **3/6.**

V'HOLDERS.—**Pax:** Int. Oct., **4d.**; EF50, EA50, **6d.**; B12A CRT, **1/3.** **Moulded:** Int. Oct. **6d.**; B7G, **9d.**; with screening can, **1/6**; B8A, B8G, B9A, **1/-**; VCR97, **2/6.** **Ceramic:** EF50, B7G, **1/-**. **ENG.** and **AMER.** 5-, 7- and 9-pin, etc., **1/-**.

TAG STRIPS.—2- or 3-way, **2d.**; 4- or 5-way, **3d.**; 6-way, **4d.**; 9- or 10-way, **6d.**, etc.

T/V PRE-AMP.—Channel 1. Easily modified for other Channels or Converter use. Midget Chassis, 4¾ x 2½ x 1¾. Complete with EF42 valve, coax. lead and plug. Ready for use. Brand New Mfrs. Surplus. Listed £3 15s. Special Clearance Price, **27/6**; p. & p., 1/6.

TOGGLE SWITCHES EX-GOVT.—"On-off." **9d.** Ersin M'core solder 60/40, 16 g. or 18 g., **5/6** ½ lb., **4d.** yd. T.C. wire, 18 to 22 s.w.g., per yd., **2d.** PVC Connecting wire, 10 colours. Single or Stranded, **2d.** yd. 2 K. 5 w. H.D. w/w Pots, **6/6.** 10 K., 25 K., Colvern w/w Pot. 1in. spindle, **3/6.** **SCREENED GRID CAPS** I. Oct., or **Mazda, 6d.** ea.

FUSES.—1¼in. all values 60 ma. to 10 a., **6d.**

ALADDIN FORMERS and cores, ¼in., **8d.**; ⅜in., **10d.**

SLOW MOTION DRIVES.—Epicyclic ratio 4 : 1, **2/3.**

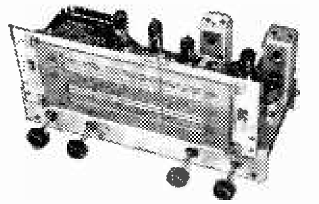
INT. OCTAL CABLE PLUG (8-pin), with cover, **1/3.**

200-250 Volt SELECTOR SOCKET (2in. x 1in.) with Plug, **1/-**. **PILOT LAMPS.**—6.3 v. .3 a., **8d.**

SPEAKER FRET.—Expanded anodised metal, 14in. by 9in., **3/-**. **EXT. L.S.**—Switched Socket, on-off and parallel switching, complete with plug, **2/-**.

MAINS DROPPERS. 3in. x 1¼in. Adj. Sliders. .3 amp, 750 ohms, **4/9.** .2 amp, 1,000 ohms, **4/3.**

LINE CORD. .3 amp, 60 ohms per foot, .2 amp, 100 ohms per foot, 2 way, **1/6** a yard; 3-way, **1/9** a yard.



ALL WAVE RADIOGRAM CHASSIS

THREE WAVEBANDS — **FIVE VALVES**

S.W. 16 m.—50 m. LATEST OSRAM
M.W. 200 m.—550 m. X79, W77, DH77,
L.W. 800 m.—2,000 m. N78, U78.

Brand New and Guaranteed, with 10in. P.M. Speaker. A.C. 200/250 v. Four position Wave-change Switch. Short-Medium-Long-Gram. Slow Motion Tuning. Speaker and Pick-up connections. High Q iron-dust cored coils, 465 kc/s I.F. Latest circuit technique delayed. A.V.C. and Negative feedback. Output 4.2 watts. 3 ohms output transformer on chassis. Chassis size 13½ x 5½ x 2¼in. Glass Dial—10in. x 4½in., horizontal or vertical type available, lit by 2 Pilot Lamps. Colour Black Station names, L.W. Green, M.W. Red, S.W. White. Four Knobs supplied. Walnut or Ivory to choice aligned and calibrated. Chassis isolated from mains. **PRICE £10/15/0.** Carriage and Insurance, 4/6. (Without 10in. Speaker, **£9/15/0.** Carr. & Ins., 4/6)

BARGAIN OFFERS

RECOMMENDED FOR ABOVE CHASSIS GREAT REDUCTIONS

Brand New Plessey 3-speed Autochanger Mixer Unit for 7, 10 and 12in. Records. Twin Hi-Fi Xtal Head with Duopoint sapphire stylus. Plays 4,000 records. Sprung mounting. Superb Quality. Bargain Price 9½ gns., post free.

VALVES

NEW BOXED — ALL GUARANTEED

1R5	8/-	6K7G	6/6	12SH7	5/6	EC91	7/6
1S5	8/-	6K8	9/-	35L6	10/6	EF36	7/6
1S4	8/-	VT127 }	9/-	OZ4	8/6	EF39	9/-
1R5	8/-	Pen46 }		807	10/6	EF50 Equip	
3S4	9/-	EF80	10/6	ECH42	12/6		5/6
3V4	8/-	6L6	10/6	6K6	7/6	British	7/6
3D6	2/6	6P25	15/-	6C9	12/6	Sylvania	
5U4	10/6	6Q7	9/6	6BG6	12/6	Red	10/6
5Z4	9/-	6SA7	8/6	UF41	11/6	EF91	8/-
6X4	7/6	6SH7	6/6	EF41	11/6	EF92	9/6
6AC7	8/6	6SK7	8/6	8D3	9/-	7C6	9/6
6AG5	7/6	6SL7	9/-	CV6	3/6	EY51	12/6
6AM6	9/-	6SN7	11/-	DK91	8/-	HVR2a	7/6
6AT6	10/6	6U5(Y63)	8/-	DF91	8/-	PY80	11/6
6B8	7/6	6V6	8/-	DAF91	8/-	PY82	10/6
6BA6	8/6	6X5	9/-	DL92	9/-	PEN25	8/6
6BE6	10/6	6AK5	10/6	DL94	8/-	SP61	8/6
6BW6	10/6	7S7	9/6	EI148	4/6	U22	9/6
6C4	7/6	9D2	5/6	EA50	2/-	U25	12/6
6F6	9/6	12A6	7/6	6AL5	7/6	MU14	9/6
6H6M	3/6	12AX7	10/6	EB34	2/6	ECL80	12/6
6J5	7/6	12AT7	10/6	EF55	12/6	12AH8	10/6
6J7	8/6	12BA6	8/6	EB91	7/6	PL81	12/6
6K7M	8/6	12Q7	10/6	EBC33	9/6	80	9/-

Huge Stock B.V.A. Valves at 1951 low tax prices.

SPECIAL PRICE PER SET

1R5, 1T4, 1S5 and 3S4 or 3V4 ... ... 30/-
6K8, 6K7, 6Q7, 6V6, 5Z4 or 6X5 ... ... 37/6

SUB MINIATURE VALVES
WIRE ENDS

★ R.F. Pent. .625 v. Fil.
● L.F. Pent. 1.25 v. Fil.

Brand New. Ex Deaf Aid Apparatus, by Mullard, Hivac and American. Types:—

★ XFW 10 ● XFY11
★ XFW 20 ● XFY32
★ 507 AX ● DL66
★ DF66 ● DL72
★ DF70 ● 503AX
● 505AX

all at **7/6** each post free

VCR97 £2
TESTED FULL PICTURE
P. & P. 2/-

5in. RADIO SCREWDRIVERS.—Sheffield made blade. 2¼in. x ⅛in. Ins. handle, 5,000 v., **4½d.** each.

COMBINED NEON TESTER AND SCREWDRIVER, with pocket clip and shield. Tests 100/500 v. **Price 5/6,** plus 6d., postage.

CONDENSERS.—New Stock .001 mfd. 6 kV. T.C.C., **5/6.** Ditto, 12.5 kV., **9/6**; 2 pf. to 500 pf. Mica, **6d.**; .001, Mica or Tub. T.C.C. 500 v., .01 Sprague 500 v., .02 N.S.F. 500 v., .1 mfd. 350 v. Micamould Tub., **9d.**; Hunts Moldseal 500 v. .005, .01 mfd., **9d.**; .05 mfd. and .1 mfd., **1/-**. .25 mfd., **1/6**; .1 mfd., 600 v., **1/3**; Tubular .5 mfd. 350 v., **1/9.**

SILVER MICA CONDENSERS.—10%. 5 pf. to 500 pf., **1/-**. 600 pf. to 3,000 pf., **1/3.**
DITTO 1% (ex stock). 1.5 pf. to 500 pf., **1/9.** 515 pf. to 1,000 pf., **2/-**.

ELECTROLYTICS ALL TYPES NEW STOCK.

Tubular Wire ends		50/25 v. Plessey	1/9
8+16/500 v. Dubilier	5/6	50/50 v. Plessey	2/-
16+16/500 v. Dub.	6/-	**Can Types, Clips, 3d. ea.**	
32+32/500 v. Dub.	7/6	32+32/350 v. B.E.C.	4/6
1/275 v. B.E.C.	2/-	32+32/275 v. B.E.C.	4/6
2/450 v. B.E.C.	2/3	16/450 v. T.C.C.	3/6
4/350 v. Dub.	1/6	32/350 v. Dubilier	4/-
4/500 v. Hunts	2/-	60/350 v. T.C.C.	6/6
8/450 v. B.E.C.	2/3	250/350 v. B.E.C.	8/6
8/450 v. T.C.C.	2/9	8+16/450 v. B.E.C.	5/-
8/500 v. Dubilier	2/9	8+16/500 v. Dubilier	5/6
10/500 v. Dubilier	2/6	16+16/450 v. B.E.C.	5/6
16/500 v. Dubilier	4/-	16+16/500 v. Dub.	6/-
8+8/500 v. Dubilier	4/6	16+32/350 v. T.C.C.	4/6
16/350 v. B.E.C.	3/-	32+32/450 v. B.E.C.	6/6
32/350 v. Dubilier	4/-	32+32/350 v.+25/25 v	
32/500 v. Dubilier	5/-	in same can B.E.C.	6/6
32+32/350 v. Dub.	5/6	60+100/350v. Hunts	11/6
32+32/500 v. Dub.	7/6	100+200/275 v. B.E.C.	
25/50 v. Dubilier	1/9		12/6

SPECIALS.—Can Types. 500 mfd. 12 v., **3/-**; 1,000 mfd.+1,000 mfd., 6 v., **6/6**; 6,000 mfd. 6 v. **5/6**; 1,500 mfd. 6 v., **4/6.**; .1 mfd. 1.5 kV., **3/6.**

SENTERCEL RECTIFIERS. E.H.T. TYPE FLY-BACK VOLTAGES.—K3/25 2 kV., **4/3**; K3/40 3.2 kV., **6/-**; K3/45, 3.6 kV., **6/6**; K3/50 4 kV., **7/3**; K3/100 8 kV., **12/6**; K3/160 14 kV., **18/-**. **MAINS TYPE.**—RM1, 125 v., 60 ma., **4/-**; RM2, 100 ma., **4/9**; RM3, 120 ma., **5/9**; RM4 250 v. 275 ma., **16/-**.

KNOBS, GOLD ENGRAVED.—Walnut or Ivory. 1¼ in. diam., **1/6** each. "Focus," "Contrast," "Brilliant," "Brilliance—On-Off," "On-Off," "Volume," "Vol.—On-Off," "Tone," "Tuning," "Treble," "Bass," "Wavechange," "Radio-Gram," "S., M., L., Gram.," "Record-Play," "Brightness." Ditto not engraved, **1/-** each.

H.R. PHONES.—(Hi-grade Amer.). **15/6** pr. **S. G. BROWN'S,** 4,000 ohms, **15/6** pr.

COILS.—Wearite "P" type, **2/6** each. Osmor "Q" Type, adj. dust core, **3/6** each. All ranges.

REACTION COND.—.0001, .0003, .0005 mfd., **3/6** ea.

I.F. TRANSFORMERS

465 Kc/s Slug tuning Miniature Circular Can, 2¼in. by 1¼in. diam. Fits octal V-holder cut out. High Q and good bandwidth. By Pye Radio. Two mounting feet.

BRAND NEW, 6/9 PAIR

ALUMINIUM CHASSIS.—18 s.w.g. Plain, undrilled, folded 4 sides and riveted corners lattice fixing holes. Strong and soundly constructed with 2½in. sides. 7in. x 4in., 4/6; 11in. x 7in., 6/9; 13in. x 9in., 8/6; 14in. x 11in., 10/6; and 18in. x 16in. x 3in., 16/6.

CHARGER TRANS. PRIM.—0-200/250 v., Sec. 0-9 v.-15 v. (for charging 6 v. and 12 v.) 1.5a., **12/6**; 2a., **16/-**; 3 a., **18/6**; 4 a., **21/-**; 6 a., **26/-**.

FULL WAVE BRIDGE SELENIUM RECTIFIERS.—, 6 or 12 v. 1½ amp., **8/9**; 2 a., **11/3**; 3 a., **12/6**; 4 a. **15/-**; 6 a., **23/6.** Ditto F.W. only 6 v., 1 a. (9 v.-0-9 v. A.C.), **5/6.**

ACID HYDROMETER.—New ex-Govt. Unbreakable. Packed in metal case. 7in. x 1½in. dia., **4/6.**

H.F. MIDGET CHOKES.—14 M.H., **2/6** each.

BRIMISTORS.—CZ1 for 3 a. heater chains, **3/6.** CZ2 for .15 a., or .2 a., **2/6.** CZ3 (Pilot Lamp), **1/6.**

COPPER ENAMEL WIRE.—¼ lb. 14 to 20 s.w.g., **2/-**; 22 to 28 s.w.g., **2/6**; 30 to 40 s.w.g., **3/6.**

SWITCH CLEANER Fluid, squirt spout, **3/9** tin.

TWIN GANG TUNING CONDENSERS.—.0005 mfd. midget with trimmers, **8/6**; 375 pf. midget less trimmers, **6/6**; .0005 Standard size with trimmers and feet, **9/-**; less trimmers, **8/-**; ditto, soiled, **2/6.**

LOUDSPEAKERS P.M., 3 OHM.
3in. Plessey, **12/6.** Goodmans 4in. square, **15/6**; 5in. **14/6**; 6½in., **16/-**. 7in. Elliptical, **18/6.** 8in. R. & A **17/6.** 10in. Plessey, **25/-**. 6½in. with trans., 7,000 ohms to 3, **19/6.**

T.R.S. RADIO COMPONENT SPECIALISTS (THO. 2188)

Now at 70 BRIGSTOCK ROAD, THORNTON HEATH, SURREY

PLEASE NOTE OUR NEW AND ONLY ADDRESS

BIGGER PREMISES ● BETTER BARGAINS

Buses 130A, 133, 159, 166 pass door.

Hours: 9 a.m.—6 p.m. 1 p.m. Wednesday. OPEN ALL DAY SATURDAY.

P. & P., 6d. £1 orders post free. Lists 3d. ALL MAINS TRANS.—1/- extra postage.

(*Continued from page* 230)

ments. Grommets are not necessary provided the hole edges are not ragged.

The Wearite coils should now be prepared for mounting. These coils are one-hole fixing and present no difficulty from this point of view, their fixing holes being already drilled in the chassis compartments.

The trimmers are wired directly across the long tags of these coils, these being bent down for the purpose. A side view of a coil will be shown later to illustrate the best way of doing this. The tag with a red marker is the hot end of the main (secondary) winding, and the fixed plates of the trimmers should be wired to this tag. All the coils have 60 pF trimmers except the long-wave set (PA1, PHF1 and PO1) which have 100 pF.

Before bolting the coils down in the positions indicated in Fig. 3, several other things have to be

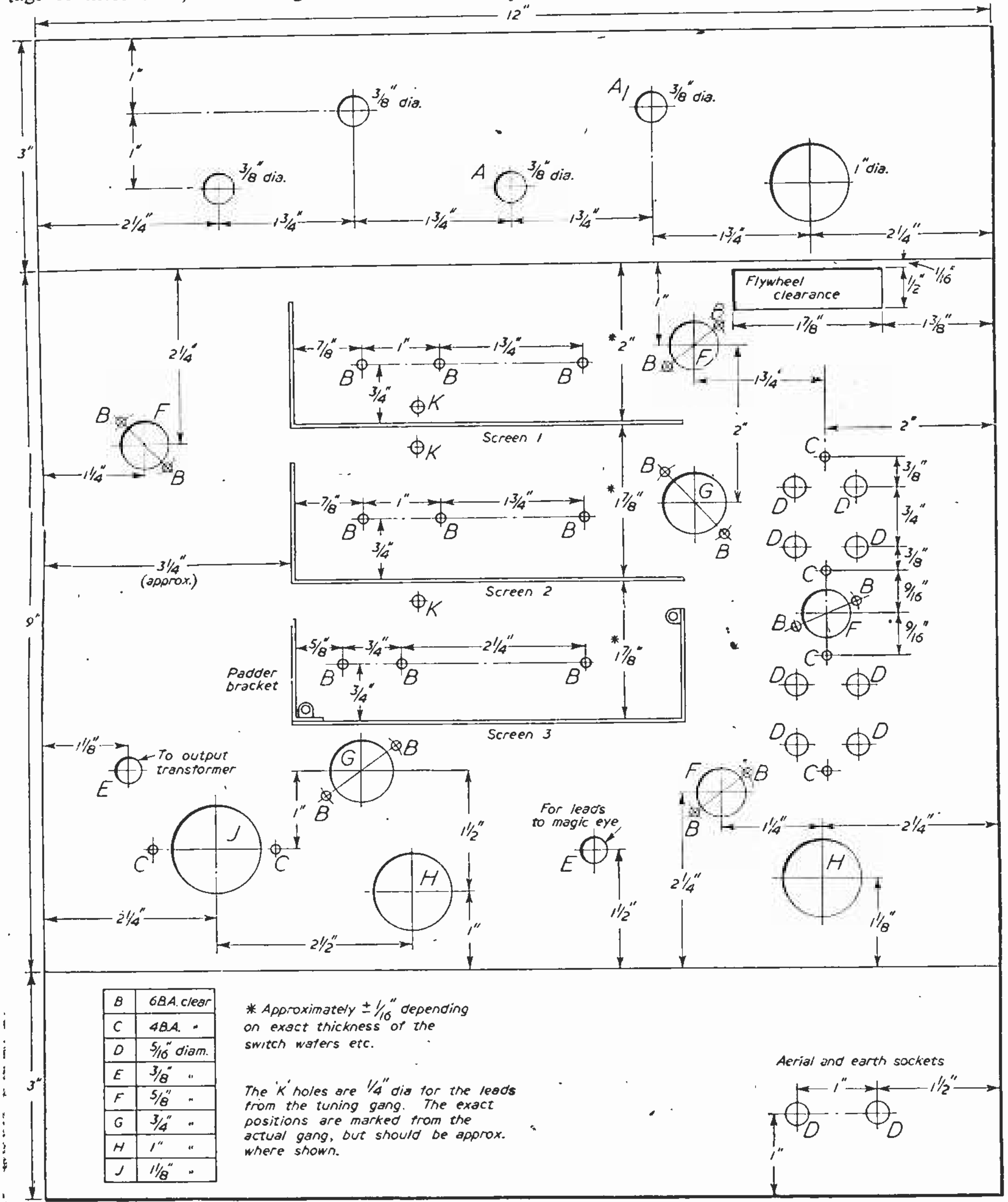


Fig. 4.—Details of chassis drilling and bending.

done. The lowermost tags of the switch banks inside the cross-screens should have leads soldered to them, as it is difficult to get to these once the coils are mounted. Then it should be checked to see whether any coil fixing screw head comes under the position of the three-gang condenser ; this coil or coils should be fixed before the gang, using countersunk screws.

Remaining Assembly

The remainder of the assembly is quite simple and there is no particular order in which it need be carried out. The valveholders should be fitted with the pin orientation as shown in Fig. 3, tags being bolted under each fixing nut for earthing points, though all of these may not be used. The tag strip mountings are clearly shown on the diagram, as are the I.F. transformer orientations. In these latter the tag with the red marker is " Grid," and the other tags are then disposed, as shown. A piece of sleeving may be slipped over each tag outlet of these transformers to avoid possible contact with the chassis where they pass through the holes provided.

The first transformer is supplied with a flying lead at the top of the can. This lead is not required in this set as the I.F. amplifier valve is single-ended. The lead should therefore be removed or snipped off very close to the can itself. It is necessary to ensure that the bare end does not short-circuit to the can if it is cut off in this way.

The volume-control (radio) VR1 is mounted on the rear cross-screen so as to be as close to the second detector V4 as possible. A long extension spindle passes through the other two screens and a bush (which can be obtained from an old volume-control) bolted to the front of the chassis. An 8in. length of ¼in. brass or steel rod may be used for this spindle, and it is joined to the control by a normal coupling unit.

The output transformer is mounted above chassis between V6 and V8, 4 B.A. bolts passing through the four holes provided. The tag strip supporting R35 uses one of these bolts for its fixing, as does the fixing of C29 which, being a large condenser, is clipped down to the chassis.

A pair of one-way tags are fixed to the first cross-screen to act as anchors for R1C2 and R4R41 respectively as shown, and a further single tag is fixed to the rear screen as anchor for the junction of R5, R6 and C7.

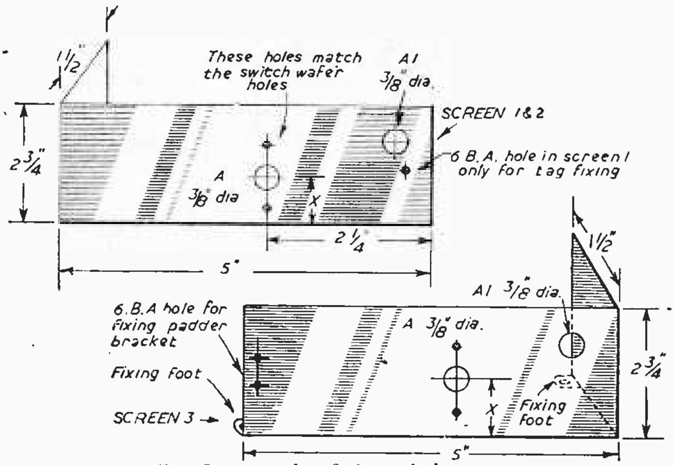


Fig. 5.—Details of the switch screens.

R16 is mounted on the base of the magic-eye indicator itself, not on the chassis.

Wiring

It is best to wire up in 22 s.w.g. tinned copper wire and 1 mm. PVC sleeving, the colour code used being

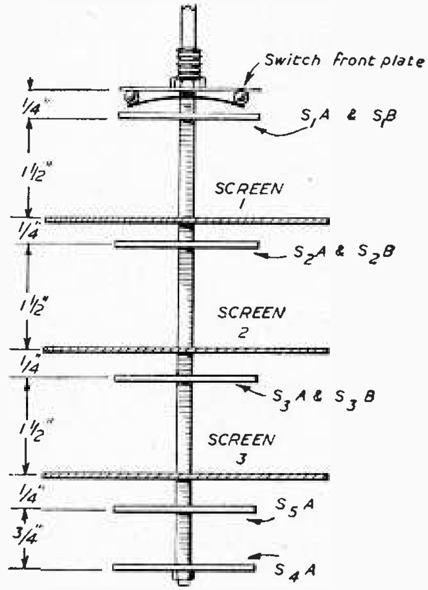


Fig. 6.—Details of the switch assembly.

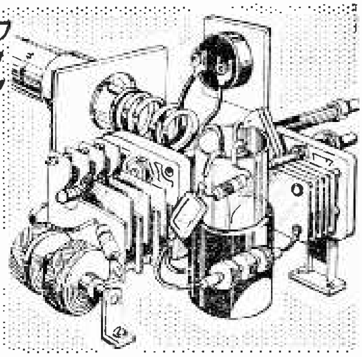
left to the individual. The heater run (all valves excepting V8) is best wired first, this being carried out in twisted pair ; the order from the anchor strip input is : V7, then to V6 and V4, from V4 to V3, to V2, to V1, then through the grommet to the dial lamps on the scale. Note very carefully that both poles of these lamps *must* be insulated from the frame of the dial assembly (chassis), otherwise half the heater winding will be shorted out.

The " trickiest " part of the wiring (if it may be called that) is associated with the coil and switch bank connections inside the screened departments. Basically, each compartment is a duplicate of the other, and a diagram showing in more detail the layout of the R.F. section will be given later. To match the " S.M.L. Gram." markings on the specified knob, the wafers should be wired as drawn here, the " Gram." position being most anti-clockwise looking from the front of the set. It is necessary to ensure that the oscillator coils are properly wired, otherwise there may be no oscillation ; the " hot " tags go to the switch contacts in all cases.

The adjustable padders are wired in the earthy ends of the main windings of the medium- and long-wave oscillator coils, the short-wave having a fixed 0.005 μF padder. P1 (600 pF) is the medium-wave padder, with P2 (250 pF) for long-waves.

(To be continued)

SHORT-WAVE SECTION



BUILDING COMMUNICATIONS RECEIVERS

5.—THE A.V.C. SYSTEM

(*Continued from page* 153 *March issue*)

THOUGH the A.V.C. circuit of a communications receiver may in several respects be similar to that of a standard broadcast band superhet, modifications and improvements are frequently present, especially in equipment of advanced type. In general, the highest possible efficiency will be required from the A.V.C. system, so that weak signals of considerably varying strength may be dealt with, and provide a reasonably stable A.F. output.

The efficiency of the A.V.C. system depends largely on the number of controlled stages. In the usual four-valve superhet circuit, only two controlled stages will be present—the F.C. and I.F. valves. In a communications receiver, four controlled stages are quite usual, due to the addition of one valve in the R.F. position, and a further as 2nd I.F. amplifier. In larger receivers even more stages will be present, and A.V.C. may be introduced into the A.F. amplifier. The degree of A.V.C. action obtained from such arrangements is very great, compared with that achieved with the simple broadcast band superhet.

Typical A.V.C. Circuit

The circuit in Fig. 1 is the basis of more complex arrangements, and one largely used. One diode of the double-diode or D.D.T. valve acts as detector, 100 pF condensers and 50 K resistor providing R.F. filtering for the A.F. output circuit. The A.V.C. diode is fed from the final I.F. anode, or from the secondary of the transformer, as indicated by the dotted line. The I.F. stage receives a minimum amount of bias from the voltage drop across R1, which will usually be from 250 to 500 ohms.

With no signal present, the stage is operating at minimum bias, or maximum gain. When a signal becomes apparent, rectification at the A.V.C. diode results in the A.V.C. line becoming negative, the negative voltage increasing as the signal strength rises. This negative voltage is applied to the control grids of the controlled valves (e.g., R.F., F.C. and I.F. stages), thereby reducing gain. As a result amplification is reduced when signal strength is good, and at maximum with low signal strengths, thereby maintaining a more stable output level from the detector.

With several controlled stages, this circuit can be very satisfactory. It is apparent, however, that the signal reaching the A.V.C. diode cannot be maintained exactly the same in all circumstances, since it is by changes in signal strength here that the A.V.C. operates. The circuit will hold powerful stations down to reasonable volume, however.

A further disadvantage arises from the fact that *any* signal will cause some A.V.C. voltage to be developed, so that the receiver can never be at maximum gain when a station, however weak, is tuned in. This may be overcome by using a delay voltage.

Single Diode

In compact equipment, or battery-operated receivers, only one diode may be available. This is particularly so in battery equipment where the type

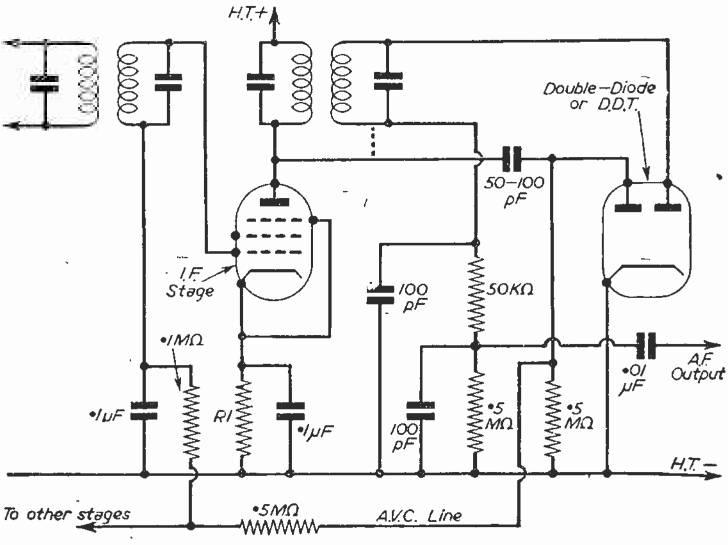


Fig. 1.—A typical A.V.C. circuit.

of valve used has only a single diode. In mains equipment, the second diode normally present may serve some other purpose, such as noise suppression.

When a single diode is available, the circuit in Fig. 2 will provide detection and A.V.C. Here, a battery type valve is shown, but the circuit is the

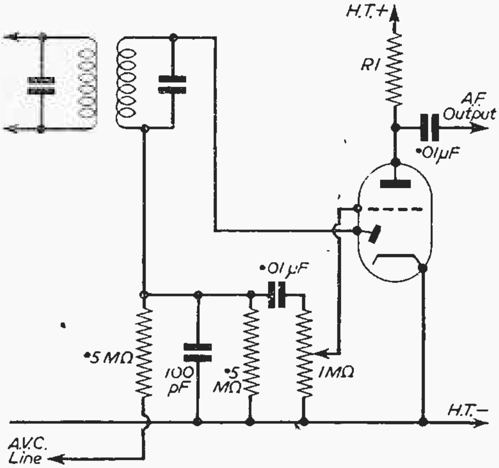


Fig. 2.—Circuit for single diode.

same for mains types. One .5 megohm resistor serves to decouple the A.V.C. line, while the second is the diode load. The potentiometer is for A.F. gain or volume control purposes. The operation of this circuit is basically the same as that in Fig. 1.

Delay Voltage Circuits

When the double diode cathode is at the same potential as the H.T. negative circuit, as in Fig. 1, an A.V.C. voltage will appear when any signal is present, however weak. This may be avoided by applying a positive voltage to the cathode. No A.V.C. action will then commence until the signal strength exceeds the delay voltage.

Fig. 3 shows a circuit of this kind. R1 will be the bias resistor for the triode section of the valve, allowing the triode grid to be negative, with respect to the cathode, to the required extent. The diode detector circuit is returned to the cathode, so that no otential difference exists between the cathode and this diode. The A.V.C. diode, however, is returned to the H.T. negative line, and the cathode will thus be positive, relative to it, by the extent of the combined voltage drop across R1 and R2. R1 and R2 will usually be in the neighbourhood of 1 K to 3 K each, according to the type of valve and amount of pre-detector gain.

It will be observed that some delay voltage will always be obtained with a double-diode-triode, when the cathode circuit has a bias resistor to permit proper operation of the triode section. Such a delay voltage will not be present when a diode alone is used, or when the cathode is returned directly to the H.T. negative line.

When the A.V.C. action of a receiver is insufficiently sensitive to deal with very weak signals, due to a small number of A.V.C. operated stages, it is most satisfactory to delay the operation of the A.V.C. in this manner. The receiver will thus be at maximum gain with all signal levels below that provided for, though no A.V.C. action will be obtained with such signals. Only when ample gain, with three or four controlled stages is available does the successful control of very low signal levels become feasible.

Effect of Other Circuits

With a given A.V.C. system, maximum efficiency will only be obtained when each A.V.C. operated stage is suitably arranged. An example of the effects of changes in circuit design will become apparent from Fig. 4. At "A" the screen grid voltage is obtained by means of a dropper resistor. As the valve control grid becomes more negative, due to the A.V.C. action on tuning in a station, the anode and S.G. currents will fall. The voltage drop in R1 will thus fall, increasing the S.G. voltage. This will, to some extent, oppose the reduction in gain brought about by the A.V.C. system, thereby reducing its efficiency.

At "B" the S.G. is supplied from a divider network R1 and R2. These resistors are of comparatively low value (10 K to 25 K) and the current passing through them is relatively large, compared with the valve S.G. current. As a result, the S.G. voltage will remain reasonably stable, irrespective of the S.G. current. The A.V.C. system can thus work at full efficiency.

A similar effect arises with cathode resistors, but is small when their value is low. If, however, a variable cathode control is used for manual purposes, the A.V.C. action on the valve will be much reduced especially as gain is diminished by means of the manual control. This is a defect largely inherent in such circuits, but can be somewhat offset by adding a resistor from cathode to H.T. positive so that the voltage drop across the control potentiometer is stabilised. (*Continued on page* 241)

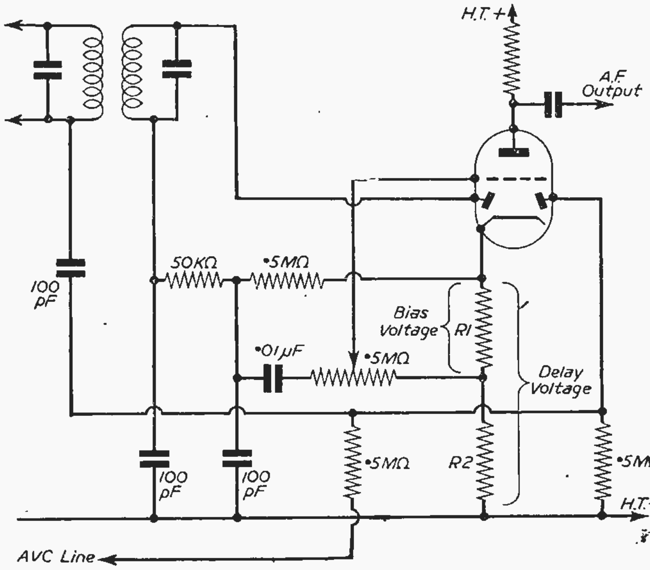


Fig. 3.—Delay voltage circuit.

ALPHA FOR VALVES

GUARANTEED NEW AND BOXED

AC/P4	8/-	PM2B	5/6	5Z3	8/6	6U5G	8/6
AC/P	6/9	PM22B	5/6	5Z4G	8/6	6V6G	7/6
AC6/PEN	5/6	PY80	11/-	6A7	10/6	6V6GT	7/6
ATP4	6/6	PY81	11/6	6A8G	10/6	6W2	15/-
DDL4	4/-	PX25	15/-	6AC7	6/6	6X4	8/-
DH73M	10/-	S130	8/6	6AG5	7/6	6X5GT	7/9
EA50	2/-	SP220	6/9	6AJ5	9/-	7B6	9/6
EB34	2/-	SP61	3/9	6AK5	9/-	7B7	8/6
EB41	11/-	SP41	3/6	6AL5	7/-	7C6	8/6
EBC33	7/6	TP26	9/-	6AM5	7/6	7H7	8/-
EBC41	11/-	U10	9/-	6AM6	7/6	7Q7	8/-
EBF80	11/6	U22	8/-	6AQ5	8/6	7R7	8/6
EC52	6/3	U25	14/6	6AT6	8/-	7S7	8/6
EC91	9/-	U81	10/-	6B4	6/-	7Y4	8/6
ECH35	13/-	U281	10/6	6B8G	4/-	75	10/-
ECH42	10/6	U404	10/-	6BA6	8/-	77	8/-
ECL80	14/6	UAF42	12/-	6BE6	8/-	80	8/6
EF8	6/6	UB41	9/-	6BR7	9/6	807	7/6
EF36	6/-	UBC41	11/-	6BW6	8/6	8D2	2/9
EF39	6/6	UCH42	13/6	6BX6	14/6	9001	5/6
EF41	10/-	UF41	11/-	6C4	8/-	9002	5/6
EF50Syl	8/-	UL41	11/6	6C5GT	7/6	9003	5/6
EF50	6/-	UY41	10/6	6C6	6/6	9004	5/6
EF54	7/-	VP23	8/-	6C9	8/-	9006	6/-
EF55	10/-	VR105/30	5/6	6CD6G	13/6	954	2/-
EF80	11/6	VR116	4/-	6D3	7/6	955	4/9
EK32	8/-	VR150/30	9/-	6D6	7/3	956	3/6
EL2	12/6	VT52 (EL32)	8/-	6F6G	7/6	10C2	13/6
EL33	13/-	VT75 (KT44)	7/6	6F6M	8/6	10F1	10/-
EL41	11/6	VT501 (TT11)	6/-	6F8G	7/-	10F9	13/-
EL42	13/6	VU39 (MU12/14)	8/6	6F13	13/6	10LD11	11/-
EL84	12/3	VU111	3/6	6F14	12/6	10P13	11/6
EM31	9/-	VU120A	3/-	6F15	11/6	10P14	11/6
EY51	14/6	W61	9/-	6G6G	6/6	12A6	6/9
EZ40	10/-	W77	8/6	6H6	3/6	12AH8	11/6
EZ41	11/-	W81	10/-	6J5G	5/-	12AT7	9/-
E1148	2/-	OZ4	6/-	6J6GT	5/6	12AU7	9/-
H30	5/-	1A3	9/-	6J5M	6/6	12AX7	10/-
H63	7/9	1A5GT	6/6	6J6	8/-	12C8	8/-
HL23DD	7/6	1A7	11/6	6J7G	6/6	12H6	5/-
HP210	6/9	1C5GT	8/-	6K6GT	6/6	12J5	6/-
HP211C	7/6	1L4	7/6	6K7G	6/-	12K7	9/-
HR210	6/9	1LD5	6/9	6K7GT	6/6	12K8GT	9/-
KT2	5/-	1R5	7/6	6K7M	6/9	12Q7GT	9/-
KT33C	11/6	1S4	7/6	6K8G	8/-	12SC7	7/6
KT66	11/6	1S5	7/6	6K8GT	9/6	12SH7	5/6
KT74	8/-	1T4	7/6	6L1	11/6	12SJ7	8/6
KTW61	7/9	1U5	8/-	6L19	12/6	12SK7	6/6
KTW63	7/9	220VSG	6/9	6L6G	9/-	12SL7	9/-
KTZ41	6/9	2A3	6/9	6L7M	7/6	12SQ7	8/6
LD210	6/9	2X2	5/-	6N7	7/6	12SR7	7/6
LP220	6/9	3A4	8/-	6Q7G	9/-	20D1	10/6
MH4	5/6	3D6	5/-	6Q7GT	9/-	20F2	12/6
MS/PEN	5/-	3Q4	9/-	6R7G	8/-	20L1	10/-
P61	3/9	3Q5	10/-	6SA7GT	8/-	20P4	11/-
PCC84	12/6	3S4	8/6	6SG7	7/6	25A6G	9/-
PCF80	12/6	3V4	8/-	6SH7	6/-	25L6GT	8/6
PCF82	12/6	4D1	3/-	6SJ7GT	8/-	25U4GT	12/-
PEN25	8/-	42	8/-	6SK7	6/3	25Z4G	9/-
PEN46	8/6	5U4 (U52)	8/6	6SL7	8/-	25Z6GT	8/6
PL81	14/6	5Y3GT	8/6	6SN7GT	9/-	35L6GT	8/9
PL82	11/6			6P25	11/6	35W4	10/-
PL83	13/-			6SQ7	9/-	35Z4GT	8/6
PM12M	10/-			6SS7	8/-	50L6GT	8/6
				6ST7	7/6		

TERMS : Cash with order or C.O.D. Postage and Packing charges extra, as follows : Orders value 10/- add 9d. ; 20/- add 1/- ; 40/- add 1/6 ; £5 add 2/- unless otherwise stated. Minimum C.O.D. fee and postage 2/3.

MAIL ORDER ONLY

WHEN ORDERING PLEASE QUOTE "DEPT. P.W."

CONDENSERS

The following is a selection of our stocks of manufacturers' surplus condensers, all by well-known makers.

ALUMINIUM CAN TYPES, CLIP FIXING

8 × 8 mfd. 450 v. .... 4/- ea.
8 × 16 mfd. 450 v. ..... 4/- ea.
8 × 24 mfd. 350 v. ..... 3/- ea.
8 × 32 mfd. 475 v. ..... 3/9 ea.
12 × 4 mfd. 450 v. ..... 2/- ea.
16 mfd. 450 v. .... 3/- ea.
16 × 8 mfd. 350 v. ..... 4/- ea.
16 × 16 mfd. 350 v. ..... 3/3 ea.
16 × 16 × 8 mfd. 350 v. 3/6 ea.
20 × 20 mfd. 500 v. ..... 4/9 ea.
24 mfd. 450 v. .... 2/9 ea.
24 × 16 mfd. 350 v. ..... 3/6 ea.
32 mfd. 450 v. .... 3/- ea.
32 × 8 mfd. 350 v. ..... 3/6 ea.
32 × 16 mfd. 350 v. ..... 4/6 ea.
32 × 32 mfd. 450 v. ..... 6/11 ea.
32 × 32 × 8 mfd. 350 v. 5/6 ea.
32 × 32 mfd. 350 v. 25 mfd. 25 v. .... 5/9 ea.
60 mfd. 450 v. .... 2/9 ea.
64 mfd. 350 v. .... 2/- ea.

B.R. RANGE

B.R.850, 8 mfd. 500 v. 2/9 ea.
B.R.1650, 16 mfd. 500 v. .... 3/3 ea.
B.R.2050, 20 mfd. 500 v. .... 3/6 ea.
8 × 8 mfd. 500 v. .... 4/- ea.
B.R.501 50 mfd. 12 v... 1/9 ea.
16 × 16 mfd. 500 v. ..... 5/- ea.
16 × 8 mfd. 500 v. ..... 4/9 ea.

MIDGET METAL TYPES

2 mfd. 350 v. .... 1/9 ea.
8 mfd. 350 v. .... 1/1 ea.
8 × 8 mfd. 350 v. .... 3/- ea.
8 × 8 mfd. 450 v. .... 4/- ea.
16 mfd. 350 v. .... 2/9 ea.
16 × 8 mfd. 450 v. ..... 4/- ea.
16 × 16 mfd. 450 v. ..... 4/6 ea.
16 × 24 mfd. 350 v. ..... 4/9 ea.
24 mfd. 350 v. .... 2/9 ea.
32 mfd. 350 v. .... 1/9 ea.
32 × 32 mfd. 350 v. ..... 4/9 ea.
250 mfd. 12 v. .... 1/9 ea.

WIRE ENDED TYPES

8 mfd. 450 v. cardboard covered .... 1/11 ea.
30 mfd. 450 v. .... 3/9 ea.

BIAS CONDENSERS

Tag ended metal types

12 mfd. 50 v. .... 1/- ea.
25 mfd. 25 v. .... 1/3 ea.
50 mfd. 12 v. .... 1/- ea.
50 mfd. 50 v. .... 2/6 ea.
100 mfd. 12 v. .... 1/9 ea.
100 mfd. 25 v. .... 1/9 ea.

WIRE ENDED TYPES CARDBOARD COVERED

25 mfd. 25 v. .... 1/9 ea.
50 mfd. 12 v. .... 1/9 ea.
50 mfd. 50 v. .... 2/3 ea.

SILICONE COATED WIRE-WOUND RESISTORS

Tolerance plus or minus 10%. Each resistor clearly marked with resistance value and wattage. Available in the following values: 25, 50, 68, 100, 150, 200, 250, 350, 500, 680, 1,000, 1,500, 2,000, 2,500, 3,500, 5,000, 6,800, 10,000 ohms.

5 watt .... 1/- ea.
10 watt .... 1/3 ea.
15 watt .... 1/9 ea.

DOUBLE TRIMMERS

250/250 pf.; 100/100; 100/50. All 6d. ea.

THE COMPACT TELEVISION AERIAL BY ANTIFERENCE LTD.

Supplied complete with universal mounting and backplate in neutral brown finish. Overall length 5ft. 6in. Packed in carton 3ft. 4in. long. Complete with full instructions. Cat. No. CD4. Original price 50/-. Our price 12/6 each.

CONDENSERS MOULDED MICA

.0001, .0002, .0003, .0004, .0008, .00027, .0005, .001, .002, .003, .005, .01, 50 PF, 20 PF.
All 4½d. each.

★ ★ ★ ★ ★ ★

LOUDSPEAKER UNITS

5in. Rola with output transformer 17/-
6½in. Rola Standard Type...... 17/6
6½in. Plessey 17/-
6½in. Truvox wafer speaker ... 20/-
8in. Plessey 18/-
10in. Plessey 20/6
6 × 4 Eliptical 19/10
6½in. Mains energised 600 field 17/6
8in. Mains energised 1,000 & 2,000 field 21/-

★ ★ ★ ★ ★ ★

SPRAGUE CONDENSERS

.05 mfd. 500 v.; .01 mfd. 1,000 v.; .1 mfd. 350 v.; .02 mfd. 750 v. All 9/- doz.

CHASSIS

Aluminium Undrilled with Reinforced Corners. Available in the following sizes:

6in. × 4in. × 2½in.......... 4/6 ea.
8in. × 6in. × 2½in.......... 6/3 ea.
10in. × 7in. × 2½in.......... 7/3 ea.
12in. × 8in. × 2½in.......... 8/6 ea.
14in. × 8in. × 2½in.......... 9/6 ea.
16in. × 9in. × 2½in.......... 12/- ea.

All are four sided—ideal for radio receivers — amplifiers — powerpacks, etc.

CRYSTAL DIODES

Plastic case, wire ends, 2 for 2/1.

IRON ELEMENTS

Standard adaptable type 230 v.. 450 v.......... 1/8 ea.
Morphy-Richards replacement type .... 3/9 ea.
H.M.V. replacement type... 3/- ea.

CRT ISOLATION TRANSFORMERS

TYPE NR 9

Ratio 1-1.25 giving a 25 per cent. boost on Secondary. Particularly suitable for High Definition Receivers. 4 types available to cover most tube heaters.

NR 9 A, 2 v., NR 9 B, 4 v., NR 9 C, 6.3 v., NR 9 D, 10.8 v., NR 9 E, 13.3 v., 11/3 each. With Tag Panel and Solder Tags.

TYPE NR 12

Mains Input, 220-240 v. Multi Output, 0-2-4-6.3-7.3-10 and 13 v. Input has two taps which increase output volts by 25% and 50% respectively. This transformer is suitable for most Cathode Ray Tubes in Medium Definition Receivers. The MOST versatile Low Capacity C.R. Transformer with Universal Output. With Tag Panel and Solder Tags. 22/6 each.

TYPE NR 14

A most useful transformer for use with 2 v. Tubes with falling emission. Input, 230-240 v. Output, 2-2¼-2½-2¾-3 v. at 2 amps. There is a constant demand for this popular low capacity transformer. With Tag Panel and Solder Tags, 13/9 each.

ALPHA RADIO SUPPLY CO.

5/6 VINCES CHAMBERS, VICTORIA SQUARE, LEEDS 1.

In home-built equipment the bias resistors recommended by the valve makers should not be omitted, and will usually be of 250 to 500 ohms. Gain will usually be at maximum with the correct value, as the control grid will then not become positive with

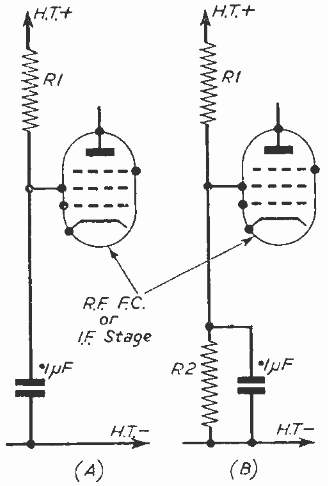


Fig. 4.—These two diagrams show the feeding of voltage to the screen grid through a series resistor and by means of a potential divider.

respect to the cathode under normal circuit conditions, as can arise when no bias is applied. Valve life will also be increased. If such resistors are omitted, the gain of the stage may be increased when a low A.V.C. voltage arises, which is exactly the reverse of the effect desired.

Controlling the A.F. Amplifier

Since a variation in signal strength must always be present at the A.V.C. diode, to control the A.V.C. system itself, complete control by means of pre-detector stages alone is impossible. To overcome this, one or more valves in the A.F. amplifier may be controlled by the A.V.C. system, a circuit such as that shown in Fig. 5 being employed.

Here, R1 provides the normal operating bias for the valve, while additional negative bias is applied to the control grid, via the .5 megohm resistors, under conditions of increasing signal strength. The gain of the stage is thus reduced when volume is high.

A suitable valve for this application is the 6B8G, which is an I.F./A.F. pentode with two diodes. The latter may be used for detector and A.V.C. purposes, with the pentode section as A.F. amplifier. With a H.T. voltage of 180 to 300 this valve requires an anode load of .25 megohm, with the S.G. retained at 75 to 125 volts, or fed through a 1.2 megohm series resistor. For this valve R1 would be 1,800 ohms.

Because of the manner of operation some distortion arises when large A.V.C. voltages are applied to an A.F. stage. In equipment of the type in view this is not such a disadvantage as in broadcast band receivers where high quality is required. If the A.V.C. circuit gives a large A.V.C. voltage on maximum signal it may be necessary to feed the A.F. stage from a potential divider so that excessive voltage (with resultant distortion) is avoided here. This may be done by dividing the normal diode load resistor into two components, feeding the A.F. circuit from the junction of the resistors thus used.

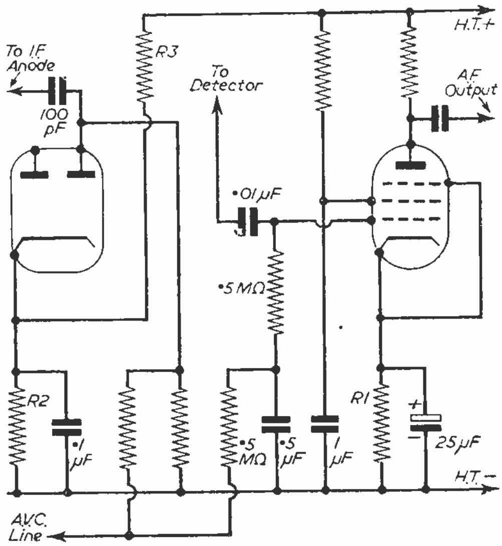


Fig. 5.—An A.V.C. operated A.F. stage.

Variable-Mu type valves are required for A.V.C. circuits, and this should not be overlooked when choosing a type for an A.F. amplifier. Low anode voltages should be avoided with such a stage, as increasing the possibility of distortion or overloading.

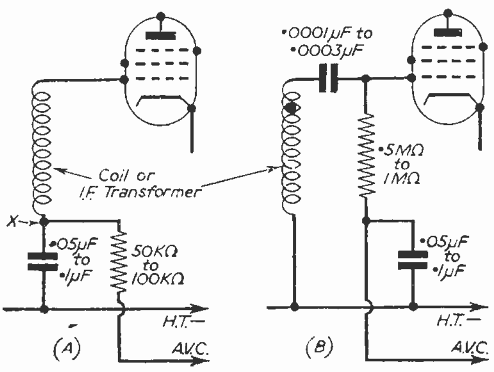


Fig. 6.—Controlled valve grid circuits.

Grid Circuits

The A.V.C. voltage may be applied to the control grids of R.F., F.C. or I.F. stages by means of the coil or I.F. transformer winding, as shown at "A," in Fig. 6. The by-pass condenser is required to complete the R.F. path to earth and, in conjunction with the resistor, prevents coupling through the A.V.C. line, which could otherwise cause instability. The condenser and resistor should be wired near the coil or transformer.

With some coil designs bottom-end coupling is used, the aerial being connected to the point marked "X." With such circuits the condenser for[illegible] of the coupling circuit, and the value sp[illegible] coil maker must be used. This conder[illegible] be much smaller than that shown, an[illegible] .1 μF component coupling would be [illegible] signal strength much reduced.

With some types of switching or coils it is impossible or inconvenient to use the winding in this way, and the circuit at " B " can then be employed. The condenser and leak should be near the grid of the valve in question. If bottom-end or tuned anode coupling is used between R.F. and F.C. stages, the tuning

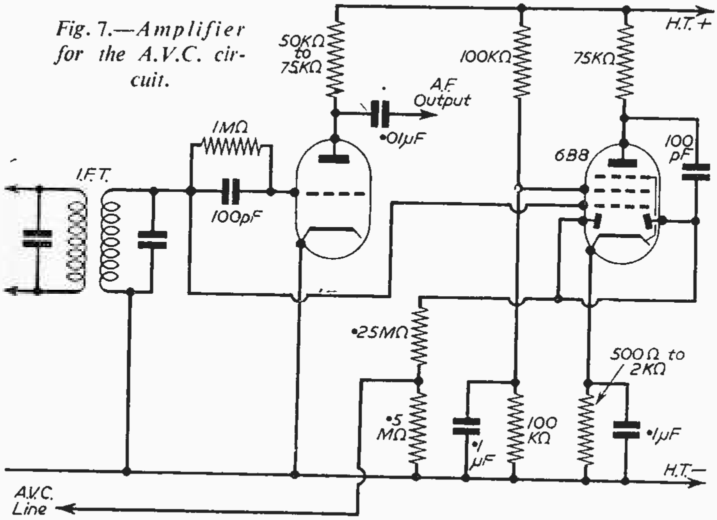


Fig. 7.—Amplifier for the A.V.C. circuit.

coil is at the same potential as H.T. positive, and the grid circuit at " B " then becomes essential. In such cases the insulation of the coupling condenser (.0001 to .0003 μF) must be of high quality, or positive voltages will reach the control grid.

Amplified Circuit

The effectiveness of the A.V.C. system may be further increased by employing a valve to amplify the carrier available from the final I.F. stage. A circuit of this type is shown in Fig. 7. The carrier is applied to the control grid, the pentode section of the valve acting as a straight amplifier, so that the amplitude of the signal applied to the diodes is much increased. A.V.C. is taken from the diodes in the normal way.

When a grid detector is used, in the interests of high sensitivity, an A.V.C. stage of this type is very suitable, as no means of obtaining A.V.C. from the detector exists. With the grid leak type of detector, efficient pre-detector gain control, either by means of the A.V.C. system or a manual control (or both) is essential, as the advantage of high sensitivity to weak signals is offset by the ease with which such a detector may be overloaded. It is, of course, possible to use a separate valve for amplification, with this circuit.

R.T./I.C.W. Switching

With speech or music, the carrier level does not depend on the audio component, but upon the power of the station, and conditions such as distance and fading, which influence the signal strength at the receiver. It is to obtain a stable output under widely varying signal strengths that A.V.C. is employed.

But with I.C.W. Morse, no carrier is radiated during " silent " periods. To prevent erratic operation it is thus necessary to render the A.V.C. system inoperative. This can be done by wiring an on/off switch between the A.V.C. line and H.T. negative. When open, the switch will be set for R.T. reception, with the A.V.C. operating. When closed, it will be in the position for I.C.W. reception, with receiver at maximum gain. It is sometimes necessary to use such a switch with R.T. signals, when the proximity of a powerful I.C.W. station renders the A.V.C. system erratic.

To avoid undue time delay in the operation of the A.V.C. system, the time constant of the whole circuit should be kept low. This requires the use of by-pass condensers of moderate value, and the avoidance of extremely high values of load or decoupling resistors. Without attention to this, the A.V.C. system may become very sluggish and unable to deal with fading of a rapid nature.

Finally, Fig. 5 also shows how a delay voltage may be introduced with a double diode, the cathode voltage here depending upon the relative values of R2 and R3.

"Radio" Earphones

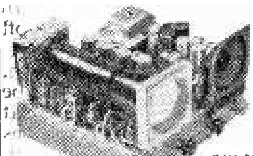
"RADIO" earphones which have no trailing wires and are not plugged into a point are manufactured by the Magnetic Broadcasting Co., Ltd., of Suffolk Hall, 1, Upper Richmond Road, S.W.15. Known as Stethophones—since they resemble doctors' stethoscopes—they give the wearer complete freedom of movement.

The 'phones are of purely mechanical construction. They have no valves, batteries, wire or cords. There is a volume control at each earpiece. Each pair weighs less than two ounces.

Hospital-type Stethophones have short extensions which are made to revolve so that the pole pieces may always remain in a vertical position even when the wearer is lying down. This also controls the power of each earpiece. Standard Stethophones have instead a knurled wheel on the back of each earpiece to control the volume.

When they are used in conjunction with a domestic radio the output of the set is fed into a step-down transformer to match a loop of wire (approximately 14 s.w.g.). The wire is laid round a skirting board, picture rail or outside wall. The loudspeaker can then be fitted with a potentiometer to control the volume without affecting the loop.

This induction radio system was invented by Victor A. Foot, F.Inst.P.I., A.M.Inst.B.E., who for many years has been a manufacturer of hearing aids. Retail price of Stethophones (both standard and hospital types) is £2 2s. a pair, and of lorgnette-type 'phones £3 3s. each. Matching auto-transformers for domestic radios are 12s. 6d. each. Instructions for fitting the 'phones are provided with each pair.

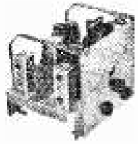


MINIATURE PORTABLE T.V.

The Elpreq Miniature Televisor, 13 valves and 2 crystal diodes. The cathode-ray tube used is 2½in. The layout is extremely clean, straightforward and professional. The total cost comes to **£16-£17.** Its size will be approximately 9½in. x 8in. x 6in.

Full construction data, layouts, diagrams, templates, etc., running into some 50 sheets, is available, price 5/-, post free.

GENUINE HALF-PRICE OFFER
BEETHOVEN CHASSIS

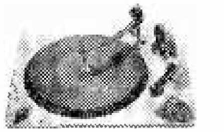


Extremely well built on chassis size approx. 9½ x 7½ x 8½, using only first-class components, fully aligned and tested, 110-240-volt A.C. mains operation. Three wave bands covering medium and two shorts. Complete with five valves, frequency changer, double diode triode, pentode output and full wave rectifier. Special cash-with-order price this month, **£5/19/6,** carriage and insurance 7/6.

MULLARD AMPLIFIER "510"

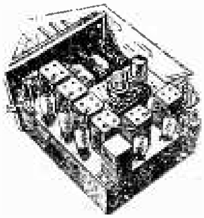
A high Quality Amplifier designed by Mullard engineers. Power output exceeds 10 watts, harmonic distortion less than .4%. Frequency response almost flat from 10 to 20,000 C.P.S. —very suitable for use with the Acos "Hi G" and other good pick-ups. Completely made up and ready to work, is **£12/10/-** or **25/-** deposit, plus 10/- carr. and insurance.

GRAMOPHONE AUTO-CHANGER



The latest model by very famous manufacturers. 3-speed with crystal turnover pick-up, brand new and perfect, in original cartons. Price **£11/10/-,** carriage, etc., 12/6.

RESPONSER UNIT



Ideal for Commercial T.V. These contain 6 valves type SP61, and one each RL7, RL16, and EA50. Six IF transformers 12 Mc/s band, and hundreds of other useful components. Price **39/6,** plus carriage and packing 7/6. These receivers are unused.

THIS MONTH'S SNIP

3-speed record player with pick-up using the famous Acos "Hi G" turnover crystal —motor also by very famous maker—speed selection is by bakelite knob. All on unit board ready for installation. A wonderful bargain at **£6/10/-** plus 5/- carriage. Hire Purchase 15/- deposit.

COST UNDER £4
MINI MAINS

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, **£3/19/6** plus 2/- post. Constructional data free with the parts, or available separately **1/6.**

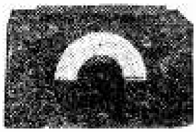
BATTERY 3-VALVER

Good reception on both medium and long waves. All parts including three valves, resistors, tuning condensers, in fact, everything except loudspeaker, cabinet and chassis (available if you haven't something suitable) costs only **19/6**: data available separately, price **1/6**

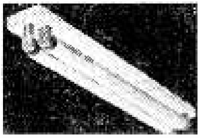
NOW A.C./D.C. MULTI-METER KIT

Parts suitable for making a multi-meter to measure A.C. volts as well as D.C. volts, milliamps and ohms. Price for kit containing all the essential items including moving-coil meter, metal rectifier, resistors, range selector, calibrated scale, etc., etc., is **19/6,** plus 1/- post and packing. The D.C. only version is **15/-,** plus 9d. post and packing.

COMMUNICATIONS RECEIVER R1155 YOURS FOR £1



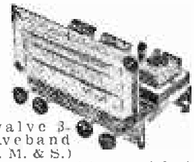
The R1155 is considered to be one of the finest communication receivers available to-day. Its frequency range is 75 kc/s to 18 Mc/s. It is complete with 10 valves and is fitted in a black metal case. Made for the R.A.F. so obviously a robust receiver which will give years of service. Completely overhauled and guaranteed in perfect working order. Price Grade 2 **£7/19/6,** Grade 1 **£9/19/6,** or new and unused **£11/19/6,** or will be sent on receipt of deposit of **£1.** Balance by 12 monthly payments. Carriage and Transit Case 15/- extra. Guaranteed for 12 months.



THE TWIN 20

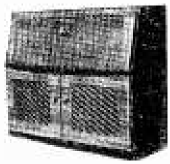
Complete fluorescent fitting. Has built-in ballast and starters —stove enamelled white and ready to work. Ideal for the kitchen, over the work-bench, and in similar location. It uses two 20-watt lamps. Price complete, less tubes, 29/6, or with two tubes, 39/3. Post and insurance 3/6. Extra 20-watt tubes 7/6 each.

THE FINE MODERN RADIO
CLEVELAND ORGANTONE

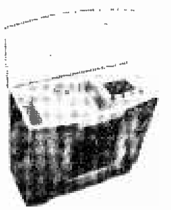


5-valve 3-waveband (L. M. & S.) superhet with special high fidelity 4-watts output—modern B.V.A. miniature valves and parts—gram. position with plugs for extension speaker—ideal for modernising existing equipment. Price **£11/10/-,** or **£3/16/-** deposit, carriage 7/6.

CABINETS FOR ALL



We undoubtedly hold the largest stock of cabinets in the country. All are made of the finest plywood, veneered and polished, and all radio and motor boards are left uncut to suit your own equipment. The top one is The Bureau, walnut finished and highly polished, size approximately 30in. high, 32in. wide, and 16in. deep. Price **16 guineas** or **32/-** deposit, carriage 12/6. The centre one is The Empress, our most popular cabinet, size 32in. high, 36in. wide, and 16½in. deep, walnut finished, lined sycamore. Price **15 guineas,** or H.P. deposit 32/-, carriage 12/6. The lower one is The Contemporary, size 29in. high, 30in. wide and 15½in. deep. Oak finished with contrasting mouldings. Price **£8 15/-,** H.P. deposit 19/-, carriage 12/6.



ELECTRONIC PRECISION EQUIPMENT, LTD.

Post orders should be addressed to Dept. 7, RUISLIP.

Personal shoppers, however, can call at :

42-46, Windmill Hill, Ruislip, Middx.	**152-3, Fleet Street, E.C.4.**	**29, Stroud Green Rd., Finsbury Park, N.4.**	**249, Kilburn High Road, Kilburn.**
Phone: RUISLIP 5780	Phone: CENtral 2833	Phone: ARChway 1049	*(Now Open)*
Half day, Wednesday.	Half day, Saturday.	Half day, Thursday.	

News from the Trade

Potted Iron-dust Aerial Coils

SOME newly introduced Osmor iron-core coils are available in two types: type P.M. for the medium waveband and P.L. for the long waveband. They are for use unscreened in normal superhet circuits where high gain is required with standard oscillator coils. The pots or cups provide efficient magnetic inductive screen. A range of these aerial coils is available and these standard production coils give the following "Q" readings at the frequency stated (Marconi "Q" meter).

Frequency (Kc/s)	Capacity	"Q"
1,200	100	160
980	150	185
852	200	198
695	300	205
600	400	205
545	475	200

Price 6s. each (retail). Osmor Radio Products, Ltd., 418, Brighton Road, South Croydon.

15in. Permanent Magnet Loudspeakers

A RECENT addition to the Plessey range of loudspeakers is a general purpose 15in. permanent magnet unit suitable for use in cinema and public address installations, or as the bass reproducer in dual loudspeaker systems, in which full use can be made of its low fundamental resonance and smooth response.

This loudspeaker is notable for its robust construction and the elaborate precautions which have been taken to ensure consistent results under the most adverse climatic conditions.

The chassis, which is cast in aluminium to give great mechanical stability and is finished in an attractive crackle black enamel, holds a felted cone driven by a 2in. speech coil. This is wound on an aluminium former and protected against atmospheric action by a baked varnish impregnation. Additional protection is given by the outside suspension and moulded speech-coil dome, which excludes all dust.

The coil moves in a gap having a field strength of 15,000 gauss, energised by a permanent magnet giving a total flux of 228,000 lines. The bass resonance can be arranged to occur at any frequency between 30 and 60 c.p.s. to suit individual requirements, while the useful high frequency response extends to 8 Kc/s.

The speaker can also be supplied, at slight extra cost, with a velour surround to the cone in place of the paper corrugations. This results in reducing the resonance to 25 c.p.s. and a somewhat smoother response characteristic.—Plessey Co., Ltd., Ilford, Essex.

Heathkits

FOR some time now enquiries have been made concerning the special kits of parts for various types of equipment which are advertised in American publications under the trade name "Heathkit." These are test instruments, amplifiers and similar apparatus which have been supplied in complete sets of parts with blueprints, etc., for home construction, and they have hitherto not been available in this country.

With the easing of the dollar restrictions these kits are now being imported against specific orders, and may be obtained from Rocke International, Ltd., of 59, Union Street, S.E.1.

It should be pointed out that the mains apparatus is for 110/120 volt operation, but a 220 volt step-down transformer may be used, and a supply of these at various wattage ratings is supplied by the same firm. In some cases the apparatus may be obtained without the American transformer, and thus a standard English transformer may be fitted. Full details of the apparatus available may be obtained on application to the above firm.

Permabit Soldering Iron

AFTER spending a considerable amount of time on research and tests, Light Soldering Developments, Ltd., have evolved a permanent bit for soldering irons which is registered under the trade mark "Permabit." It is claimed that this bit lasts indefinitely, does not become pitted or lose its face, and requires no re-shaping, filing or maintenance. They are available in a fixed bit range of instruments and also as bits for replaceable types in all sizes.

	Complete			Spare Bit-Element Unit	
	£	s.	d.	s.	d.
1/8in. Fixed Permatip Iron ...	1	1	6	13	0
3/16in. ,, ,, ,, ...	1	4	0	15	0
1/4in. ,, ,, ,, ...	1	5	6	16	6
3/8in. ,, ,, ,, ...	1	8	6	18	0

Replaceable Permatip Bits

Bit Diameter	Shank Diameter	Price each s. d.
1/8in.	3/32in.	2 10
3/16in.	9/64in.	3 3
3/16in.	3/16in.	3 6
1/4in.	3/16in.	3 9
5/16in.	5/16in.	4 6
3/8in.	5/16in.	4 10

Light Soldering Developments, Ltd., 106, George Street, Croydon, Surrey.

The Philips "Recordergram"

PHILIPS ELECTRICAL LIMITED announce the introduction of their new, lightweight, portable tape recorder Model AG.8105—to be known as the "Recordergram"—at the attractive price of 35 gns.

The accessories included in this price are a Philips crystal microphone, a 600ft. reel of high quality tape and a spare 5in. diameter take-up reel. The instrument is, therefore, completely ready for service without the purchase of additional equipment.

The "Recordergram" is housed in a neat grey case, measuring 13¾in. by 10in. by 7in.; the total weight is only 21 lb. All the accessories are finished in cream and can conveniently be stowed away in the lid of the case when not in use. This compact tape recorder can also be used, in conjunction with the Philips "Disc-Jockey" or other record player, as an ordinary gramophone amplifier.

There is only one main control knob which can be turned to different positions—marked by clear symbols—to perform the following operations:—Recorder off: Amplifier on: Fast Wind: Fast Re-Wind (80 seconds for 600ft. tape): Playback: Record.

Philips Electrical Ltd., Century House, Shaftesbury Avenue, W.C.2.

Programme Pointers

Our Critic, Maurice Reeve, Reviews Some Recent Programmes

This London of Ours

TRIPS round and about London are always pleasant to follow and listen to. There is so much we know and with which we have grown up. They recall some of our happiest memories and there is often much to be proud of, and feel affection for, the scenes visited and described. A well-conducted tour, as with the "Scrapbooks," is always a welcome item.

"Greenwich Palace" was no exception. Although it is a little off the "beaten track" of most of us, we have nevertheless been there. The historical details given us must either have renewed our interest in this very lovely building and its imperishable story or, if strangers to it, made us resolve to take that trip down the river and see it for ourselves at an early opportunity.

"In All Directions"

A new series of Peter Ustinov's and Peter Jones's "In All Directions" has started. This very witty and sophisticated commentary on manners and customs, rather than on men and things, is often subtle to a degree. It makes fascinating listening as it chatters along, often skating over thin ice and occasionally running up against a boulder. That its quality varies from time to time is perhaps understandable and excusable. It is none the less a brilliant contribution to recent broadcasting.

"Programme Parade" has long seemed to me a superfluous intrusion into the otherwise even flow of programmes. Apart from being a concession to this very repetitious age we live in, it takes tunes, jokes, opinions, sentiments, etc., right out of their context and presents them to us in their least attractive light. Have we not *all* got our *Radio Times*, or our daily paper, at our elbow? Can a snippet from the "Goon Show" or the "Tschaikovsky Concerto" at 8.10 a.m. possibly whet anybody's appetite for the whole thing 12 hours later? It seems hardly possible, even if we remember it all that while.

"Ghastly" Music

Mentioning "The Goon Show," compels me to say it is usually extremely funny if easily the noisiest and most obstreperous show on the air. Its signing-off tune is the second most horrible one in present-day radio. The "musical figure" half way through "What Do You Know?" is an easy winner. Ghastly and quite inexcusable.

Three interesting and worthwhile programmes were "A Cup To Be Filled," "Gold in the Street" and "The Tragic Clown." The first, written and produced by Eileen Capel and narrated by Duncan McIntyre, was all about those over sixty. "Gold in the Street," written and produced by Robert Pocock and narrated by Felix Felton and Frank Duncan, was the story of Hatton Garden, whilst "The Tragic Clown" that ubiquitous and lovable character, speaks for itself. This was an anthology, excellently compiled and delivered by Richard Findlaker, assisted by James Langham, Eric Philipps and Harold Scott.

Drama

There have been more interesting and entertaining plays. I liked "Waiting for Julia," which was not a play really, but a dramatisation by Peggy Wells of Nigel Balchin's novel "A Way through the Wood." Googie Withers is such a fascinating person that even to only hear her is good enough return for staying home on a Saturday evening. When you can see her as well, then you have had your money's worth. (I essayed a film the other day and saw her for a fleeting moment in an advertisement for a washing soap. I shall always use that soap in future.) John McCallum, Hubert Gregg and others helped to vivify the story of what not to do if you knock someone over when driving your car, especially if that someone is "the other guy."

Sonia Dresdel chose Rattigan's "Love in Idleness" for her contribution to the *Stars in their Choices* series. This charming actress played the rôle of the woman who chose her son in preference to a stepfather for him—whom he hated for various reasons—with the greatest sympathy and conviction. Whether the subsequent marriage and happy ending make it one of Mr. Rattigan's best plays leaves me in some doubt. For myself, I rather fancy that either the renunciation of the son for a second husband or the sacrifice of him and all his wealth and luxury for the boy should have been the answer, not a hashed-up situation which removes insuperable barriers and makes the harmonious existence of all three under the same roof possible.

Christopher Marlowe's massive portrayal of that sinister period in our history, Edward the Second, was strong meat, and made excellent listening. The story of the ineffective King and his infatuation for the impostor and adventurer Gaveston, with consequences so grievious to the nation, was one which no Elizabethan dramatist would be expected to overlook. The adaptation and production of R. D. Smith were admirable, as were Richard Hurndall as Gaveston, Paul Schofield as Edward and a long and radio-ly distinguished cast.

"The Duke in Darkness" and "Marie Lafarge" were fair to average. "The Warberg Wire Job" eloquently recounted the amazing wartime escape. Suitably glowing tributes were paid to that very great Nobel Prize winner, Albert Schweitzer.

Open to Discussion

Economy Quality Receiver

SIR,—I don't think much of Mr. Stevens's idea of connecting the screen directly to the oscillator anode in his "Economical Quality Receiver." The screen is floating at R.F. and at the oscillator frequency, and it is unlikely that the circuit will perform at its best under these conditions.

I should think it would be better to feed the oscillator anode in series with the coupling L3, taking the screen from the earthy and decoupled end of this coil. This simply means the use of a 0.1 μF condenser (or thereabouts), and with C13 not now required, no change in the number of components is necessary.—S. A. KNIGHT (Chelmsford).

Ex-R.A.F. Receivers

SIR,—Here is some data about certain ex-R.A.F. receivers which may be of interest to readers:

R1132A.—I.F. 12 Mc/s (about), not 22 Mc/s as is popularly believed. The 6J5 output valve will operate a 5in. speaker connected to the 'phone jack. In many sets the 25 μF electrolytic capacitor is dry and useless.

The A.G.C. delay voltage is large and a very strong signal is necessary to make the needle of the tuning meter move back.

If the set be converted for "144" or some frequency higher than about 130 Mc/s, the mica 0.001 μF condensers in the R.F. unit should be replaced by ceramics.

R1147A & B.—The 1147A has acorn valves both in the R.F. unit and the two I.F. stages. They are four of 954 and one of 955. The 1147B has in the R.F. unit two EF54's (VR136) and one EC52 (VR137) as in the R.F. 26 and 27 units. The I.F. valves are EF50's. The I.F. is about 70 Mc/s. The BFO is an audio-oscillator because a stable 70 Mc/s single-valve oscillator is extremely difficult to construct.

Both sets tune around 200 Mc/s and will therefore convert to Band III if required (170 Mc/s to 216 Mc/s). The fibre insulation in the R.F. unit is very fragile in most sets due to age.

Type 25/73 set (from TR1196).—I.F. 460 kc/s. The two 2 K resistors in the I.F. cans are R13 and R16, and are anode stoppers. On conversion these resistors need not be removed. The socket board on the R.F. unit is for crystals (quartz, not germanium).

The BFO is permanently "on," and cannot be disconnected unless the A.G.C. coupling to the second diode of the EBC33 is reconnected to the anode of the EF39 I.F. amplifier. This may, however, give too low an A.G.C. voltage (about 25 volts is required) and some other means must then be devised. R18 is very useful as an R.F. gain control. The EBC33 will not work a loudspeaker satisfactorily.—T. WOODGATE (Chislehurst).

Whilst we are always pleased to assist readers with their technical difficulties, we regret that we are unable to supply diagrams or provide instructions for modifying surplus equipment. We cannot supply alternative details for receivers described in these pages. WE CANNOT UNDERTAKE TO ANSWER QUERIES OVER THE TELEPHONE. If a postal reply is required a stamped and addressed envelope must be enclosed with the coupon from page iii of cover.

I.F. Adjustment

SIR,—I was recently informed that the latest practice is to "peak" I.F. at 470 kc/s instead of the more usual 465 kc/s, this being done to help overcome the increasing interference on the M.W. I would be interested to hear any PRACTICAL WIRELESS readers' comments on this. —R. BAYLY (Edgware).

Universal Push-button 4

SIR,—I was very interested in the design published in the August issue as it appeared to offer scope for what I had in mind. At the risk of boring you, I would like to say that I studied the circuit and then proceeded to adapt it to my needs. At once you will say that I did wrong and that one should never try and make a new design from an old one, but what I thought was that I did not need to buy a push-button unit, and I had four valves on hand. In place of the buttons I used three on/off switches, a line cord which I had available, and with trimmers and other parts from my spares box I built the set. Total cost was 5s. for two resistors and a new valveholder, plus a small sheet of plywood. When I switched on the set was perfectly stable and the local was soon tuned in. I have a job to know what setting to use for the selector switches as I get so many stations, but have settled on three to give me adequate reception.

I might mention that I am over sixty and that this was the first set I have constructed since pre-war days.

Thanks again for a good design.—G. FRANKS (Edgware).

Licence Legality

SIR,—In "Comments of the Month" in your February issue, you state that "thousands of people have been fined and their convictions recorded for the non-payment of wireless licence fees which, as it now turns out, were illegally demanded. The proposed retrospective legislation should contain a clause ordering these convictions to be expunged from the records and the fines refunded."

In fact, the people to whom you refer were convicted and fined for operating a wireless receiver without a licence. The Attorney General stated in the House of Commons on December 10th, 1954 (Hansard Col. 1256), that "the (Validation of Charges) Bill relates to *charges* for licences. It does not relate to the necessity to hold a licence for a wireless receiving set. No question arises as to convictions of those who have had wireless sets without licences." —T. A. O'BRIEN, Public Relations Officer, G.P.O., E.C.1.

"A New Formula?"

SIR,—I was interested in H. Dobson's letter on a new formula he had discovered (March issue).

Although I have never seen it written in a text book, I have used it a lot at the technical college. In actual fact, it is just the numerical part of the standard equation : $x_c = \frac{10^6}{\omega c}$ after it has been equated.

From $x_c = \frac{10^6}{\omega c}$ where C is in μF we get

$$x_c = \frac{10^6}{2\pi} \times \frac{1}{FC}$$

Equating $\frac{10^6}{2\pi} = 159{,}200 \simeq 160{,}000$

$\therefore$ it can be said that

$$\frac{160{,}000}{CF} \simeq x_c$$

which Mr. H. Dobson says is well within 1 per cent.

As a matter of fact, when using this equation to solve various problems I usually set my slide rule to just below 160,000, which cuts down errors later on in the problems.—MICHAEL J. S. PEAK (Willerby).

SIR,—In reply to Mr. Dobson's query in connection with the equation $X^c = \frac{160{,}000}{fC}$ for calculating capacitative reactance, the explanation relies upon assuming a value of 6.25 or $\frac{25}{4}$ for 2π in place of the more accurate value of 6.28.

The normal equation for determining the reactance of a capacitor is written $X^c = \frac{10^6}{2\pi fC}$ where X^c is expressed in ohms, f in c/s and C in microfarads. This equation can be rewritten $X^c = \frac{10^2}{2\pi} \times \frac{10^4}{fC}$

Substituting $\frac{25}{4}$ for 2π we immediately reach the form $X^c = \frac{4 \times 100}{25} \times \frac{10^4}{fC} = \frac{16 \times 10^4}{fC} = \frac{160{,}000}{fC}$ ohms.

The percentage error incurred in approximating 2π as 6.25 in place of 6.28 is calculated as follows : $\frac{6.28 - 6.25}{6.28} \times 100 = \frac{.03 \times 100}{6.28} = \frac{3}{6.28}$ or less than .5 per cent.

It is indeed a useful mathematical "dodge."—N. CRAIG (West Cumberland).

News from the Clubs

AMATEUR TAPE RECORDING SOCIETY

Hon. Sec. : P. N. Hollis, 143, Lymington Avenue, Leigh-on-Sea, Essex.

ALL correspondence concerning membership of the above Society should be addressed to the assistant secretary, Mr. G. A. Widdup, 92, Halifax Road, Rochdale.

The Society was founded in 1952, the idea being to personally contact other members through the medium of recording tape. Members usually use the small 600ft. reels, double track, and at a speed of 7½in. per second ; this gives a half-hour's recording. This type of reel usually costs 4d. or 5d. through the post and, as one can realise, all manner of subjects can be recorded to each other, musical items, etc. There is no subscription, the only rules being as follows :

1. Members are requested to handle with particular care other members' tape and to *return* same, with recorded reply, *within 10 days*.
2. Members are asked to carefully pack tape reels and always secure parcel with string.
3. Members should first contact other members by letter, advising tape speed, size of reel to be used, and whether single or double track recording contemplated.

We have at the moment only 12 active members, but, as many more people are either constructing recorders or purchasing commercial ones, no doubt membership will increase.

SOUTHEND & DISTRICT RADIO SOCIETY

Hon. Sec. : J. H. Barrance, M.B.E., 49, Swanage Road, Southend-on-Sea, Essex.

INSTEAD of the ordinary meeting on Friday, February 4th, a visit to the power station at Barking was arranged for members of the Society through the good offices of Mr. E. V. C. Habgood, a committee member, and organised by the newly appointed social secretary, Mr. C. G. Collop.

The party was met at the entrance by Mr. R. M. Sephton, one of the station engineers. After signing the visitors book, the party was conducted over this gigantic steam generating station, the largest in Europe.

HAWICK RADIO SOCIETY

Hon. Sec. : Geo. Shankie, 17, Ettrick Terrace, Hawick.

AT the last two fortnightly meetings Mr. Vinnicombe, GM8RV, gave a talk on "Ohms Law in Radio" and Mr. Horne a talk on "Capacitance and Inductance in Radio."

The Club paid a visit to the meeting of Berwick Radio Society on 6th February. On 27th March Berwick Radio Society are visiting the above Society and any visitors will be made very welcome.

READING RADIO SOCIETY

Hon. Sec. : L. A. Hensford (G2BHS), 30, Boston Avenue, Reading, Berks.

ON Saturday, 26th March, a representative from the Engineer-in-Chief's department of the G.P.O. will give a lecture on radio interference. The Society's Annual General Meeting is taking place on 12th March and their annual dinner is being held at the White Hart Hotel on the previous evening.

ROMFORD AND DISTRICT AMATEUR RADIO SOCIETY (G4KF-P)

Hon Sec. : N. Miller, 55, Kingston Road, Romford.

AT the recent A.G.M. the officers elected were : Chairman, F. Simmons (G2FWJ) ; Treasurer, E. Boxcer (G3AUG) ; Hon. Sec., N. Miller ; and a committee consisting of G3EBF, G2BVN and G. Creevy.

Future lectures include : "Transistors," by J. Missen, B.Sc., of the G.E.C. Research Laboratories, on March 22nd ; and "TVI Suppression," by Louis Varney, A.M.I.E.E. (G5RV) on April 12th.

Work has commenced on NFD gear and a workshop is being fitted up at the Club H.Q.

New members and visitors will be welcomed at the weekly meetings held on Tuesdays at 8.15 p.m. at R.A.F.A. House, 18, Carlton Road, Romford.

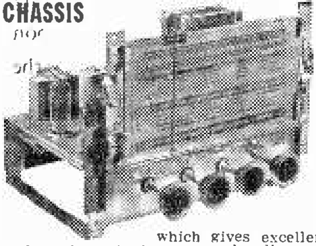
COVENTRY AMATEUR RADIO SOCIETY

Hon. Sec. : J. H. Whitby, 11, St. Patrick's Road, Coventry.

FORTHCOMING programme at 9, Queen's Road : 14th March, "Radio Aids to Navigation—Part I" by G3RF : 28th March, "Radio Aids to Navigation—Part II," by G3RF ; 11th April, no meeting ; 7th April, Night on the Air ; 25th April, "Civil Communications," by G5BJ ; 5th May, Night on the Air ; 9th May, "Receiver Servicing" by G3HDP ; 23rd May, "Frequency Modulation," by G6WH ; 2nd June, Night on the Air ; 6th June, Junk Sale ; 20th June, "V.H.F." by G3BAK ; 4th July, Lecture ; 7th July, Night on the Air.

Editorial and Advertisement Offices :
"Practical Wireless," George Newnes, Ltd., Tower House, Southampton Street, Strand, W.C.2. 'Phone : Temple Bar 4363.
Telegrams : Newnes, Rand, London.
Registered at the G.P.O. for transmission by Canadian Magazine Post.

THREE COMPLETELY ASSEMBLED
"ALL-WAVE" SUPERHET CHASSIS



Modernise your old Radiogram

The three receivers are for operation on A.C. mains, and employ the very latest miniature valves. They are designed to the most modern specification, great attention having been given to the quality of reproduction which gives excellent clarity of speech and music on both gram. and radio, making them the ideal replacement chassis for that "old Radiogram," etc.

- **Model B3.** A 5-valve 3 waveband receiver, £12.12.0. (Plus 7/6 carr. and ins.) H.P. Terms £3.4.0 Dep. and 12 Months at 17/8.
- **Model B.3.P.P.** A 6-valve 3 waveband Receiver with PUSH-PULL OUTPUT, £15.15.0. (Plus 7/6 carr. and ins.) H.P. Terms £3.19.0 Dep. 12 Months at £1.2.2.
- **Model B.3.P.P./R.F.** A 7-valve 3 waveband Receiver, incorporating an R.F. stage with PUSH-PULL OUTPUT. £18.18.0 (Plus 7/6 carr. and ins.) H.P. Terms £4.13.0 Dep. 12 Months at £1.6.9.

We have other NEW 3 SPEED Auto-Changers IN STOCK

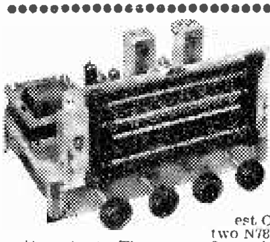
A GENUINE SPECIAL OFFER!

This THREE SPEED AUTOCHANGER is by a famous manufacturer and is offered for £11.10.0. (Plus 7/6 carr. and ins.) Normal price £16.10.0. H.P. Terms £2.17.6. Dep. and 12 months at 16/4.

- Complete with High Fidelity Crystal "Turnover" Head which incorporates separate stylus for L.P. and 78 r.p.m. records.
- A "MIXER" Unit that will autochange on 7in., 10in. and 12in. records.
- Brand New in Maker's Cartons, complete with mounting instructions.

A BULK PURCHASE ENABLES US TO OFFER THIS "PUSH-PULL" 7-VALVE

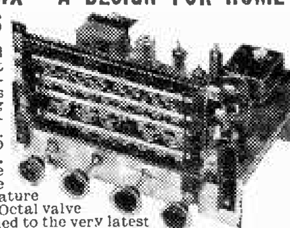
SUPERHET RECEIVER



for only £12.19.6. (Plus 7/6 carr. and ins.) H.P. Terms £3.4.6 Dep. 12 Months at 18/4. Model AW3-7 Receivers are made by a well-known manufacturer and incorporate the latest Osram Valve line-up, having two N78s in Push-Pull for approx. 7 watts output. They cover 3 wavebands and are for operation on A.C. mains. They make an excellent replacement radiogram chassis.

THEY ARE BRAND NEW AND FULLY GUARANTEED.

The "SUPER-SIX" A DESIGN FOR HOME CONSTRUCTORS



A compact and highly efficient superhet Radio-Radiogram chassis of outstanding quality for operation on A.C. mains. YOU CAN BUILD IT FOR £10.7.6. This receiver can be made to incorporate the new B.V.A. miniature valve line-up or the Octal valve line-up, and is designed to the very latest specification. Great attention has been paid to the quality of the reproduction of both Radio reception and Record playing, and excellent clarity of speech and music is obtained. ● Covers 3 wavebands. ● Employs 6 valves having PUSH-PULL for 5-6 watts output. ● A 4 position Tone Control operates on both Radio and Gram. THE INSTRUCTION & ASSEMBLY MANUAL is available for 2/-.

Send S.A.E. for our illustrated and descriptive leaflet; it includes details of various KITS and ASSEMBLED MODELS as follows: AMPLIFIERS AND TONE CONTROL UNITS

(a) WILLIAMSON, models G.W.18 and G.W.12, together with Tone Control Units, etc.
(b) LEAK model T.L./10, together with Pre-Amplifier Tone Control Unit.
(c) OSRAM "912" AMPLIFIER available as an assembled amplifier.
(d) MULLARD AMPLIFIER, also available completely assembled.
(e) STERN'S PRE-AMP./TONE CONTROL UNIT. Can be used with any amplifier.

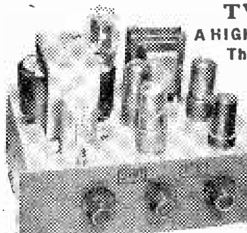
STERN'S TAPE RECORDER. A Twin Track 2 speed recorder . . . will play the new pre-recorded tapes and will take all standard reels up to 1,200 ft. Constructors can build it for £40 including the NEW TRUVOX TAPE DECK, an assembled AMPLIFIER, MICROPHONE, 1,200 ft. REEL OF TAPE, and an attractive PORTABLE CARRY CASE.

RADIO SETS
(a) THE NEW ARMSTRONG F.C.48 CHASSIS . . . an 8 valve 4 waveband chassis having provision for the attachment of an F.M. UNIT.
(b) 4 VALVE SUPERHET PORTABLE in small Attache Case . . . for Battery or Mains operation.
(c) 2 or 3 VALVE BATTERY PORTABLE all dry T.R.F. design.
(d) CAR RADIO. A Superhet design for 6 or 12 volt supplies.
(e) 4 VALVE T.R.F. CHASSIS. Completely assembled for £6.9.6. Bakelite Case 16/6 extra if required.
(f) DENCO F.M. Unit. Consisting of 5 Valve Superhet design incorporating R.F. and F/C Stages followed by two I.F.s and Ratio Discriminator.

STERN'S MAINS UNIT KITS. Two types available: (a) For 69 volts and 1.4 volts 42/6; (b) For 90 volts and 1.4 volts 47/6.

TWO COMPLETE Hi-Fi AMPLIFIER KITS

A HIGH QUALITY 8-10 watt AMPLIFIER
The Ideal Amplifier for General Home Use and for Small Halls, etc.



PRICE OF COMPLETE KIT, INCLUDING VALVES and DRILLED CHASSIS £7.10.0. (Plus 2/6 carr. and ins.) WE WILL SUPPLY IT COMPLETELY BUILT FOR £9.10.0. (Plus 5/- carr. and ins.) Designed for high quality reproduction up to an output level of 10 watts, having 6V6s in Push-Pull and incorporating negative feed-back. Suitable for use with all types of Pick-ups and most types of microphones and the output transformer provides for use of 3 and 15 ohm speakers. BRIEF FEATURES: ● Valve line-up 6J5, 6SN7, 5Z4, with 6V6s in push-pull. ● First class reproduction of radio (where a tuning unit is used) and record playing. ● Separate Bass Boost and Treble controls provide an excellent range of frequency control.
The ASSEMBLY MANUAL is available for 1/- and includes detailed layouts and component Price List.

A 12-Watt "HIGH FIDELITY" Push-Pull AMPLIFIER

Comprising a Main Amplifier Chassis and a Remote Control Pre-Amplifier Tone Control Unit. The remote control unit measures only 7in. x 4in. x 2in. and contains four controls, being: Bass-Treble-Volume and a Radio, Gram, Microphone Switch control. It incorporates its own feed-back circuit on the Bass Channel. Loop negative feed-back is employed on the Main Amplifier which has a valve line up of 6J5-6N7-5U4 with two PX25s in push-pull and 6J5 and 6SN7 are used in the remote control unit. THE COMPLETE UNIT ASSEMBLED AND READY FOR USE £17.0.0. (Carr. and ins. 5/- extra.) H.P. Terms £4.5.0 Dep., 12 Months at £1.3.11. **This Amplifier compares well with the Williamson and similar designs at a fraction of their cost. The complete set of assembly instructions are available for 2/-.**

THE COMPLETE KIT IS AVAILABLE FOR £14.0.0. (Carr. and ins. 3/- extra.)

STERN RADIO LTD. 109 & 115 FLEET ST., E.C.4. *Telephone CENtral 5812/3/4*

RECEIVERS & COMPONENTS

RADIO COMPONENT SPECIALISTS. New boxed Valves, all guaranteed. 1R5, **8/-**, 1S5, **8/-**; 1T4, **8/-**; 1S4, **8/-**; 3S4, **9/-**; 3V4, **8/-**; 5U4, **10/6**; 5Z4, **9/-**; 6AM6, **9/-**; 6AT6, **10/6**; 6J5, **7/6**; 6K8, **9/-**; 6BG6, **12/6**; 6P25, **15/-**; 6Q7, **9/6**; 6SL7, **9/-**; 6SN7, **11/-**; 6U5(Y63), **8/-**; 6V6, **8/-**; 6X5, **9/-**; 12AT7, **10/6**; U25, **12/6**; 6AC7, **8/6**; 6C9, **12/6**; 35L6, **10/6**; 80, **9/-**; EA50, **2/-**; EB91, **7/6**; EBC33, **9/6**; EF39, **9/-**; EF50 Equip., **5/6**; Syl. Red, **10/6**; EF91, **9/-**; EY51, **12/6**; PY82, **10/6**; SP61, **8/6**; U22, **9/6**; ECL80, **12/6**; EF80, **10/6**; 12AX7, **10/6**; ECH42, **12/6**; MU14, **9/6**; EF55, **12/6**; huge stock B.V.A. Valves at 1951 low tax prices. Brand new Plessey 3-speed Autochanger Mixer Unit for 7, 10 and 12in. records. Twin Hi-Fi Xtal Head with Duopoint sapphire stylus; plays 4,000 records; sprung mounting; superb quality; bargain price 9½ gns., post free. VCR97 Tube, tested full picture, **£2.** Coax Cable, 80 ohm standard ¼in. diam., **8d.** yd.; semi-air spaced, **9d.** yd. Vol. Controls, Midget, long spindle, all values, 12 m. guar. less sw. **3/-**, S.P. sw. **4/-**, D.P. sw. **4/9**; 10 ohm w/w pot. **3/-**. Electrolytics, new, best makes, 8/450v B.E.C. **2/3**, 16/450v B.E.C. **3/6**, 16+16/450v B.E.C. **5/6**, 8+8/500v Dub. **4/6**, 8+16 B.E.C. **5/-**, 25/25v Hunts **1/9**. Resistors, ¼ w. **4d.**, ½ w. **6d.**, 1 w. **8d.**, 2 w. **1/-**, 5 w. **1/9**, 10 w. **2/6**. Solder, M'core, 60/40 grade, 16 g., **4d.** yd. All-wave Radiogram Chassis, 3 wavebands, 5 valves, ECH42, EF41, EBC41, EL41, EZ40, brand new and guaranteed, with 10in. P.M. Speaker, A.C. 200/250v, short-medium-long-gram., output 4.2 watts, chassis 13½ x 5½ x 2½in., dial 10in. x 4½in., horizontal or vertical, aligned and calibrated. Chassis isolated from mains. Price **£10/15/-**; carriage and insurance, 4/6 (without 10in. speaker, **£9/15/-**; carr. and ins., 4/6). 307, Whitehorse Rd., West Croydon. (THO 1665.) Buses 133 or 68 pass door. Post free. Open all day Saturday. Lists free.

MIDDLESBROUGH. Largest stocks on N.-East coast. Radio/TV components. FM Kits. Gram. Cabinets. Tape Decks. Leak Amplifiers. Valves, etc. Callers only. PALMERS, 106, Newport Road. (Phone: 3095.)

SPEAKERS, 8in., **12/9;** P.M. Standard, 3-5 ohms or with O.P. Transformer, **15/9;** used, but guaranteed, tested perfect; most makes; post 1/9; Baffle Board **9d.** extra. Extension Speaker Cabinets, 9/9, to fit 8in. speakers, repolished, baffle board fitted, post 1/9. DUKE & CO., 621, Romford Road, London, E.12. (GRA 6677.)

R.F. UNITS Types 26 at **27/6**, 25 at **15/-**, 24 at **11/-**; brand new in original cartons, with valves. Postage 2/6. E.W.S. CO., 69, Church Rd., Moseley, Birmingham.

RADIO UNLIMITED, offer, new, boxed Valve Sets. 6V6, 6K7, EBC33, 6K8, 5Z4, **31/-** set, post free; 1T4, 1S5, 1R5, 3S4, **28/-** set. Special this month: 6SL7, 6SN7, 5U4, 6AL5, 6BE6, 6V6, 6F6, **7/3** each. EF36, EL32, EF36, EBC33, 1T4, 1S5, all at **6/6** each; full list available. Coilpacks, 3-wave, L. M. and S. **23/6**; T.r.f. Coils, Med. and L., **4/11** pair; all R.E.P. and Teletron Coils in stock. Fresh stock, Condensers, 450vw., 8 mf. **1/8**; 16 mf. **2/6**; 8 x 8 mf. **2/9**; 16 x 16 mf. **4/6**; 32 mf. **4/6**; 32 x 32 mf. **5/-**; 0.1-500v. **8/-** doz.; 3-stage Amplifier, AC or AC/DC, c/plete kit, incl. valves, **59/6**; Wired/tested, **75/-**. RADIO UNLIMITED, Elm Rd., London, E.17. (KEY 4813.)

EVERYTHING for Radio Constructors. List from SMITH, 98, West End Road, Morecambe.

RATES: 5/- per line or part thereof, average five words to line, minimum 2 lines. Box No. 1/- extra. Advertisements must be prepaid and addressed to Advertisement Manager, "Practical Wireless," Tower House, Southampton St., Strand, London, W.C.2.

SERVICE SHEETS, T.V. and Radio, over 2,000 models, sale or hire; Valves and Components. S.A.E. with enquiries. W. J. GILBERT, 24, Frithville Gardens, London, W.12.

OSMOR for really efficient Coils, Coilpacks and all Radio Components as specified for many "Practical Wireless" circuits. See advert. on page 235 for free circuits offer or send 5d. (stamps) to OSMOR RADIO PRODUCTS LTD. (Dept. PC4 P134), 418, Brighton Road, South Croydon. (Tel.: Croydon 5148/9.)

WINWOOD FOR VALUE.—Baker 12in. P.M., list 5 gns., **82/6;** Elac 8in. P.M., list 29/-, **23/6;** Coilpacks, L. M. and S. **23/6;** Fil/trans, 200-240v, 6.3v at 1.5A, **5/9;** O/trans, Midget, **4/3;** Miniature, **4/6;** Stnd Pent. **4/9;** M/ratio-P/pull, **6/-;** Card/tub. 8 mf-500v, **2/3;** 500K V/Cntrls, **1/-;** X/tal Diodes, **1/6;** Circuit and data for 3-stage Amplifier, AC or AC/DC, **1/3;** 5-valve P/pull Amplifier, **1/6.** 1½d. stamp for full list. WINWOOD, 12, Carnarvon Rd., Leyton, E.10. (Mail only.)

SEND FOR LIST Auto-record Changers, brand new, now available; Metal-cased Power Supply, 200 vdc. 30 ma and 6.3v 1 amp, fully smoothed with metal rectifier, **25/-;** Battery Charger, 6v 1 amp., **25/-** or ditto 6v and 12v, **30/-;** Filament Trans., 6.3v 1½ amp., **6/3.**—GLADSTONE RADIO, Gladstone Place, Newton Abbot, Devon.

LOUDSPEAKERS repaired promptly. MODEL LOUDSPEAKER SERVICE, Bullingdon Rd., Oxford.

SITUATIONS VACANT

The engagement of persons answering these advertisements must be made through a Local Office of the Ministry of Labour or a Scheduled Employment Agency if the applicant is a man aged 18-64, inclusive, or a woman aged 18-59, inclusive, unless he or she, or the employment, is excepted from the provisions of the Notification of Vacancies Order, 1952.

BERRY'S (SHORT WAVE) LTD. have vacancies for Sales Assistants with good general radio knowledge; interesting work; permanency. Write, giving details of experience, age and salary required, to 25, High Holborn, London, W.C.1.

T/V AND RADIO.—A.M.Brit.I.R.E., City and 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. 242G), 29, Wright's Lane London, W.8.

SKILLED CRAFTSMEN required by Government Department (Eastcote area) for construction or wiring in electronics laboratory; interest in, and some experience of, radio or audio frequency equipment essential. Opportunities exist for permanent and pensionable posts. Basic pay: £7/10/4 plus merit pay up to £2/10/- per week, according to skill and experience. Write: Government Communications Headquarters, Room 2/0805, Eastcote Road, Ruislip, Middlesex.

A.M.I.Mech.E., A.M.Brit.I.R.E., City and Guilds, etc. on "no pass—no fee" terms; over 95% successes. For details of exams. and courses in all branches of engineering, building, etc., write for 144-page handbook, free. B.I.E.T. (Dept. 242B), 29, Wright's Lane, London, W.8.

BUILD A DENCO F.M. Feeder Unit. Full point to point wiring diagrams available separately, price **1/6.** All components can be had separately, price of a complete set of components, less valves, **£4/10/-.** SERVIO RADIO, 156/8, Merton Rd., Wimbledon, S.W.19. (LIBerty 6525.)

ELECTROLYTICS, capacity, voltage, size, type of mounting, price, post paid. 8, 450v, 1 x 2, clip, **2/-;** 50, 12v, ¾ x 1⅝, tag, **1/6;** 150, 25v, ¾ x 1¾, clip, **2/-;** 250, 12v, ¾ x 1¾, wire, **2/3;** 40 + 40, 275v, 1⅜ x 2, clip, **3/3;** 24 + 24 + 16, 350/425v, 1⅜ x 2, clip, **4/9;** 4, 150v, ⅝ x 1¾, clip, **1/1;** 500, 12v, ¾ x 1⅝, tag, **2/3;** 150, 25v, ¾ x 2, clip, **1/9;** 32 + 32, 350/425v, 1⅜ x 2, clip, **5/-;** 8 + 16, 450/525v, 1 x 2, clip, **4/-;** 2, 450/525, ¾ x 1¾, tag, **1/6;** 8, 450v, ¾ x 2, v-clip, **1/9;** 32 + 32, 450/525v, 1¼ x 3, W/E, **5/6;** 1,000 + 1,000, 6v, 1 x 3, Lug, **3/3;** all alicans. Some with sleeves all voltages, wkg., surge where marked, new stock, guaranteed. Set of 3 Components comprising line output trans, with E.H.T. winding to give 7Kv, using EY51 (heater winding for EY51 also included), and fitted with width control. Scanning coils, low impedance line and frame, focus coil high (10,000 ohms). Set of 3, **42/-** plus 2/- postage. Diagram of line trans. supplied. Mains Trans. PRI 0-210-240, SEC. 250-0-250v, 80ma; 6.3v, 2.5a; 6.3v, 0.6a, **12/-.** Loudspeakers 6½in. P.M., New, boxed, **14/6** post paid. RADIO CLEARANCE LIMITED, 27, Tottenham Court Road, London, W.1. (Telephone: Museum 9188.)

EDUCATIONAL

MERCHANT NAVY Wireless School. Overseas House, Brooks' Bar, M/cr 16.

THE INSTITUTE of Practical Radio Engineers Home Study Courses are suitable coaching text for I.P.R.E. and other qualifying examinations. Fees are moderate. Syllabus of seven modern courses post free from SECRETARY, I.P.R.E., 20, Fairfield Road, London, N.8.

SCHOOL OF MARINE Radio and Radar (A.S.T.), Hamble, Southampton, approved by Ministry of Education, offers courses for Merchant Navy Radio Officers, M.O.T. Radar certs. Marconi Scholarships available. Apply COMMANDANT, quoting A12.

SEE THE WORLD as a Radio Officer. Short training; low fees; scholarships; boarding/day students. Stamp for prospectus. WIRELESS COLLEGE, Colwyn Bay.

WIRELESS.—Day and Evening Class instruction for P.M.G. Certificate of Proficiency and Amateur Wireless Licence. Morse instruction only if required, also postal courses. Apply B.S.T. LTD., 179, Clapham Rd., London, S.W.9.

MERCHANT NAVY and Air Radio.—Here is an opportunity to train as Radio Officer. The big liners are open to you, but you must qualify for the P.M.G. Certificate. Day, Evening and "Radiocerts" postal courses. Estd. 30 years; s.a.e. for prospectus from Director, THE WIRELESS SCHOOL, 21, Manor Gardens, London, N.7. (Tel.: ARC. 3694.)

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., City and Guilds R.T.E.B., and other Professional examinations. Train with the college operated by Britain's largest Electronics organisation; moderate fees. Write to E.M.I. INSTITUTES, Dept. PW.28, London, W.4.

MULLARD & OSRAM Amplifiers; "Soundmaster" Tape Recorder; all specified components stocked. Stamp details. FRANKLIN & HALL, 371, Havant Road, Farlington, Portsmouth.

THE MULLARD AMPLIFIER, ready built and tested, **£12** plus 10/- p. and p.; R1155 Receivers, as new, aerial tested, **£10** plus 10/- p. and p. D. P. MILLEN, 95, Kingsway, Luton, Beds.

ALUMINIUM CHASSIS made to your requirements; 16 & 18 gauge; any quantity, large or small. We will be pleased to quote. MACHINE CONTACTS, Building 336, Hurn Airport, Christchurch, Hants.

BOOKS

I.P.R.E. TECHNICAL PUBLICATIONS. 6,500 Alignment Peaks for Superheterodynes, **5/9**, post free. Data for constructing TV Aerial Strength Meter, **7/6**. Sample copy, The Practical Radio Engineer, quarterly publication of the Institute, **2/-**; membership and examination data, **1/-**; Secretary, I.P.R.E., 20, Fairfield Rd., London, N.8.

MAKING YOUR OWN? Telescopes, Enlargers, Binoculars, Microscopes, Projectors, or, in fact, anything that needs lenses. Then get our booklets, "How to use Ex-Gov. Lenses & Prisms." Nos. 1 & 2, price **2/6** each; also our stereo book, "3-D Without Viewers," price **7/6**. Comprehensive lists of lenses, optical, radio and scientific gear, free for s.a.e. H. W. ENGLISH, Rayleigh Road, Hutton, Brentwood, Essex.

HIGH FIDELITY—Bel FM VHF receivers, from **£8**, complete and guaranteed. Full constructional kits, **£7/5/-**, coilsets and separate parts. Lists, **1/-**. New "Mullard" point four per cent. amplifier, **£19**. BEL SOUND PRODUCTS CO., Marlborough Yard, Archway, London, N.19. (Nr. Archway Northern Line, 25 mins. West End.) Tel. ARC. 5078.

VALVES

ALL TYPES of Valves required for cash. State quantity and condition. RADIO FACILITIES LTD., 38, Chalcot Road, N.W.1. (PRImrose 9090.)

WANTED, Valves 5Z4, ECL80, EY51, EF80, KT66, 6U4GT, KT61, and all T.V. types; also P.M. Speaker Units, 3½in., 5in., 6½in., 8in., 10in.; prompt cash. WM CARVIS LTD., 103, North St., Leeds, 7.

VALVES, New, Tested and Guaranteed. Matched Pairs, KT66, **25/-**; 6V6G and GT, **17/-** per pair; 6K8G, 6Q7G, 6SN7GT, 6SL7GT, 6AT6, 6BE6, 6BR7, 6BS7, 6SA7, 6SJ7GT, 6SK7, 6X4, 6X5GT, **8/-**; 1R5, 1T4, 1S5, 3V4, 6AM6, 5763, Y63, 6U5, **7/6**; EBC33, 5U4G, KT33C, 12AT7, **8/6**; PL81, PL82, ECL80, 1H5, 1N5, **10/6**; EF92, W77, **4/6**; UL41, EBC41, **9/6**; 5U4G, **7/9**; p./p., 6d. Coax cable, stranded, 75 ohms ¼in., **6d.** yd. R. J. COOPER, 32, South End, Croydon, Surrey. (CRO 9186.)

VALVES WANTED, EB91, EF80, ECL80, PL81, EY51, and all TV. types, 5Z4G, 6Q7, etc., etc. Brand new only, prompt cash. Send us your offers. RADIO HAM SHACK LTD., 155, Swan Arcade, Bradford, 1.

ONE OF THE CHEAPEST Signal Generators available, covers 170Kc/s to 1,600Kc/s, in 2 ranges. Internally modulated, powered by internal battery; suitable for aligning all I.F. ccts. and trimming and tracking; complete with instruction leaflet, in maker's box, **75/-**, post 1/6. SERVIO RADIO, 156/8, Merton Rd., Wimbledon, S.W.19.

T.V. 12in. CHASSIS, 97/6. Complete Chassis by famous manufacturer, easily adapted to Channel 3; R.F. E.H.T. unit included; drawing free; easily fitted to table or console model. Owing to this Chassis being in three separate units (power—sound and vision—timebase) inter-connected, this Chassis is less valves and tube, but see our catalogue for cheap valves. Our **£5** Tube fits this Chassis. List of valves by request; carr. 5/-. Personal shoppers can see a demonstration model working. DUKE & CO., 621, Romford Rd., London, E.12.

HOME LAB. Signal Generator, **£8**, unused. 22, Spring Gds., Woodford, Essex.

WALNUT Radiogram Cabinets of distinction; stamp details. R. SHAW, 69, Fairlop Rd., E.11.

EX-W.D. unused Fluorescent Lighting Sets for 12 and 24v D.C. input, 230v A.C. output; Rotary Converter, Choke, P.F. Condenser, Leak Transformer, for 85 watt Sodium Lamps; the whole, enclosed in metal box, £5 to clear. PHILPOTT'S, Fountain Sq., Fenton, Stoke-on-Trent.

PUBLIC ADDRESS SYSTEM, Control Panel, 21 Speakers, Auto Starter, 5 Microphones, Record Player and spares, etc. Offers invited. Ex-"Queen Mary," large Electric Fans, **15/-**. LEWIS, 44, High St., Whitechapel, E.1.

ALFRED PADGETT

40 MEADOW LANE, LEEDS, 11

Established 21 years

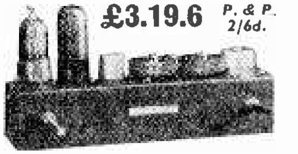
600 1154.TX.—Brand new, complete with valves and meters. **17/6,** carriage 8/-.
200 R.A.F. RACK TYPE AMPLIFIERS, —For PX25 valves in push-pull in Class A. Less valves and meter, otherwise complete. With 200-230 v. power supply. Bargain Price, **32/-**, carriage 8/-.
1125 SETS complete with two 8D2 valves, **6/6**, carriage 2/4.
BRAND NEW 62A TUBE UNIT.—Complete with EF50s and picture-tester VCR97 tube. **£4.5.0**, carriage 8/-.
500 SMALL U.S.A. ELECTRO-MAG. TYPE MIKE.—Complete with on/off switch, 1¼in. diameter. **2/6**, post 8d.
2,000 8D2 VALVES.—**1/-** each, **10/-** per doz. Post 6d. - Dozen lots post free.
2,000 954 VALVES.—**1/3** each, **12/-** per doz. Post 4d. Dozen lots post free.
WAR SURPLUS 15 mfd. 750 volt working condenser, **1/6**, post 1/3.
G.P.O. MULTI-CONTACT KEY SWITCHES.—New. Removed from units. **2/6**, post 8d.
SMALL 5-1 INTER-VALVE TRANSFORMERS.—**9d.** each, post 6d.
Small Wirewound **PRE-SET POTS.** Ideal for extension speaker, etc. **1/-** each, post 2½d.
SMALL BAKELITE TOGGLE-SWITCHES.—**6d.**, post 2½d. **5/-** doz., post free.

ASTRAL RADIO PRODUCTS

TRF coils as used in original Models ALL DRY 3, PUSH BUTTON 4, etc. **6/6** pr., post 6d. **DUAL WAVE** HF Coil as used in Summer All Dry Portable, Modern 1-valver, Modern 2-valver, etc., etc. **4/3** each, post 3d. "**K**" coils for AC BAND PASS 3, **3/3** each, 6d. postage on set. FRAME Aerials M.W. litz wound, **5/-** each, post 4d. "**HOME RADIO**" fully illustrated 32 page booklet, crystal set, 1, 2, & 3-valvers, simple wiring instructions, etc. All Dry Receivers, price **2/-**, post 3d. List 1½d. stamp.
82, Centurion Road, Brighton, Sussex.

GRAM-PAK AMPLIFIERS

£3.19.6 *P. & P. 2/6d.*



Fits neatly inside your record player, leaving room for speaker. Dimensions 10in. x 3½in. x 2in. 4 watts quality output. Suitable for all speakers and with standard or L.P. pickups. Built-in power pack, 200-250 v. A.C. De-luxe model has separate bass and treble controls.

6d. stamp brings illustrated details.

GETTING POOR T/V RECEPTION?

If so you must read our display advert in "Practical Television." Our new Mark III cascode signal booster will clear your trouble. Available for all channels complete with built-in power pack 200-250 v. A.C., in crackled steel case.

Price £5.5.0 Complete

6d. stamp brings illustrated details.

ELECTRO-ACOUSTIC LABS

TAIN—ROSS-SHIRE, SCOTLAND

UNIVERSAL SHUNTS 1% accuracy for any 1 mA. or 500 µA meter. Only one simple adjustment to make, no calibrating meter being required. With instructions. Guaranteed one year. S505 (½ mA.) covers 1, 5, 25, 100 and 500 mA. S51 (1 mA.) covers 2, 10, 50, 200, mA and 1 amp. Price **15/-**.
Shunts for all meters with ranges to your specification. Reasonable prices. Please give meter details, ranges required and accuracy.

D.C. MULTIMETER KIT for 500µA meter. Complete kit of six 1% High Stability Resistors, three other resistors, Shunt S505, Potentiometer and instructions. **26/-**.

A.C./D.C. MULTIMETER KIT.—As above, but with 4 extra 1% High Stability Resistors and Westinghouse Meter Rectifier to give 4 A.C. volts ranges. **45/6.**

18-way, Single Pole, Switch, **7/-**.

Westinghouse Meter Rectifiers, with 1% multipliers for four A.C. volts ranges and circuit. For 500 µA or 1 mA meter, **19/6.**

RESISTANCE BOX STANDARDS.—Twelve 0.5% Wirewound Resistors, 1, 2, 2, 5, 10, 20, 20, 50, 100, 200, 200, and 500 ohms, giving 1 to 1,110 ohms in 1 ohm steps, **30/-**.

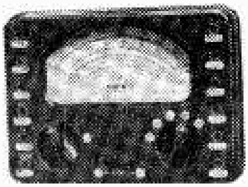
BRIDGE RATIO ARMS.—Nominal 100 ohms. Ratio 1 to 1. Ratio accuracy 0.01% 5/6; 0.1%, 4/6; 1%, 3/6.

PRECISION RESISTORS.—Any value 1 to 1,000 ohms, accuracy 0.5%. Eureka wound on strip, **2/9.**

CALIBRATION SERVICE FOR RESISTANCE CAPACITY BRIDGES and SIGNAL GENERATORS.—Reasonable Charges.

MASSEY

58, Wakefield Ave., Hull.



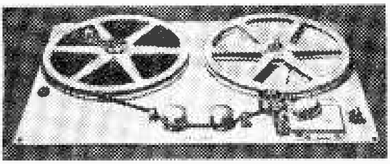
THE "METRIX" MULTIMETER 460

with 28 ranges. Internal resistance 10,000 ohms per volt A.C. *and* D.C. Volts: 3-7.5-30-75-150-300-750 v. A.C. *and* D.C. Resistance from 0 to 2 megohms in two ranges. Dimensions: 5⅛in. x 4in. x 1¼in. Weight: 1 lb. 5 ozs. Cash Price £14.6.4 or 35/- deposit and 8 monthly payments of 35/-.

METRIX MODEL 410.—19 ranges with a sensitivity of 100 ohms per volt from 75-750 volts. A.C. *and* D.C. Volts 15-75-150-300-750. Resistance 0-100 ohms. Weight: 1 lb. 2 ozs. Cash Price £9.2.11 or 22/5 deposit and 8 monthly payments of 22/5. *Send stamp for leaflets of the Metrix range, all of which are available on easy terms.*

***LAFCO COMPOUNDS, LTD.* (Desk 139)**
3, Corbetts Passage, Rotherhithe New Road, London. S.E.16. *Telephone: BERmondsey 4341 Ext. 1*

TAPE THE VESPA DECK



2-SPEED— 3¾in. & 7½in. TWIN TRACK

MODEL 521. Compact Deck. 7½in.x11in., 5in. reels. Kit, £7.10.0.
MODEL 721. Standard Deck. 10¾in.x11in. 7in. reels. Kit, £8.10.0.
Easy to assemble. precision-machined parts, latest high-fidelity heads, first-class motors, full assembly instructions. Either model fully built and tested, 27/6 extra. *Send stamp for full details:*

E.W.A., 266, WARBRECK DRIVE, BLACKPOOL.

FREE

POST THE COUPON TODAY FOR OUR BROCHURE ON THE LATEST METHODS OF HOME TRAINING FOR OVER 150 CAREERS & HOBBIES

NEW!
EXPERIMENTAL OUTFITS INCLUDE: Radio, Television, Mechanics, Electricity, etc.

P.M.G. Certificates, City and Guilds Grouped Certificates in Telecommunications; A.M.Brit.I.R.E. Examination, Radio Amateur's Licence, Radio and Television Servicing Certificates, General Radio and Television Courses, Radar, Sound Recording, etc. Also Courses in all other branches of Engineering.

COURSES FROM £1 PER MONTH

E.M.I. INSTITUTES

The only Postal College which is part of a world-wide Industrial Organisation.

POST THIS COUPON TODAY

Send without obligation your FREE book
E.M.I. INSTITUTES, Dept. 32k,
43 Grove Park Road, London, W.4.

NAME ....

ADDRESS ....

....

Subject(s) of interest ....

APRIL IC18

---

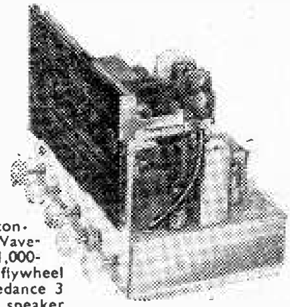
2 YEARS' GUARANTEE

with the

BURGOYNE

8 VALVE *Radiogram Chassis*

With a push-pull output giving 8 watts of undistorted quality reproduction and using negative feedback, this fine chassis is supplied for those connoisseurs wanting only the best, at a price within their means!



SPECIFICATION

★ Illuminated full vision coloured tuning scale ★ Separate bass and treble controls for cut and lift ★ Wavebands 16-50; 190-550; 1,000-2,000 metres ★ Precision flywheel tuning ★ Speech coil impedance 3 or 15 ohms ★ Extension speaker sockets ★ Size 9½ins. high x 13 ins. wide x 8ins. deep—chassis height 2½ins.

200-250 v. A.C. **22 GNS.**
Carriage and packing 7/6.

Buy on the M.O.S. PERSONAL CREDIT PLAN

Any proprietary brands of equipment advertised in this journal are available from us under this plan. 10% deposit. with balance over any period up to 18 months.

E. & G. MAIL ORDER SUPPLY CO. *The Radio Centre.*
33, Tottenham Court Road, London, W.1. MUSeum 6667.

SUPERIOR RADIO SUPPLIES

37 HILLSIDE STONEBRIDGE LONDON, N.W.10
Tel.: ELGar 3644

A really outstanding portable!

The SUPEREX 55 ATTACHE

BUILDING COST £7.15.0
Plus P. & P.

★ 4 valve superhet L.M. wave.
★ 7in. x 4in. eliptical speaker.
★ Latest miniature valves.
★ Very attractive cabinet.
★ A.B.C. Construction booklet.

This is a first-class receiver which we guarantee will give the very best of reception in all parts of the country. No trouble has been spared to ensure simplicity of construction, combined with equality in appearance and performance to any commercial models. All parts available separately. Send 1/6 for "Superex 55" construction booklet.

TERMS: Cash with order or C.O.D. Extra charge for C.O.D.

PERSONAL SHOPPERS WELCOME
Shop open 9 a.m. to 6 p.m. Monday to Saturday. 1 p.m. Thursday.

Practical Wireless BLUEPRINT SERVICE

PRACTICAL WIRELESS

No. of Blueprint

CRYSTAL SETS

1/6d. each

1937 Crystal Receiver ... PW71*
The "Junior" Crystal Set PW94*

2s. each

Dual - Wave "Crystal Diode" PW95*

STRAIGHT SETS

Battery Operated

One - valve : 2s. each

The "Pyramid" One-valver (HF Pen) ... PW93*
The Modern One-valver PW96*

Two-valve : 2s. each.

The Signet Two (D & LF) PW76*

3s. each.

Modern Two-valver (two band receiver) ... PW98*

Three-valve : 2s. each.

Summit Three (HF Pen, D, Pen) PW37*
The "Rapide" Straight 3 (D, 2 LF (RC & Trans)) PW82*
F. J. Camm's "Sprite" Three (HF, Pen, D, Tet) PW87*

3s. each.

The All-dry Three ... PW97*

Four-valve : 2s. each.

Fury Four Super (SG, SG, D, Pen) PW34C*

Mains Operated

Two-valve : 2s. each.

Selectone A.C. Radio-gram Two (D, Pow) ... PW19*

Three-valve : 3s. 6d. each.

A.C. Band-Pass 3 ... PW99*

Four-valve : 2s. each.

A.C. Fury Four (SG, SG, D, Pen) PW20*
A.C. Hall-Mark (HF Pen, D, Push Pull) ... PW45*

SUPERHETS

Battery Sets : 2s. each.

F. J. Camm's 2-valve Superhet PW52*

Mains Operated : 3s. 6d. each.

"Coronet" A.C.4 ... PW100*
AC/DC "Coronet" Four PW101*

No. of Blueprint

SHORT-WAVE SETS

Battery Operated

One-valve : 2s. each.

Simple S.W. One-valver PW88*

Two-valve : 2s. each.

Midget Short-wave Two (D, Pen) PW38A*

Three-valve : 2s. each.

Experimenter's Short-wave Three (SG, D, Pow) PW30A*
The Prefect 3 (D, 2 LF (RC and Trans)) ... PW63*
The Band-spread S.W. Three (HF, Pen, D, (Pen), Pen) PW68*

PORTABLES

1s. 6d.

The "Mini-Four" All-dry (4-valve superhet) *

MISCELLANEOUS

2s. each.

S.W. Convertor-Adapter (1 valve) PW48A*

(2 sheets), 7s. 6d.

The P.W. 3-speed Auto-gram ... ... *
The P.W. Electronic Organ * (2 sheets), 7s. 6d.

TELEVISION

The Practical Television Receiver, (3 sheets), 10/6
The "Argus" (6in. C.R. Tube), 2/6*
The "Super-Visor" (3 Sheets) 7/6*
The "Simplex" 3/-*

All the following blueprints, as well as the PRACTICAL WIRELESS numbers below 94 are pre-war designs, kept in circulation for those amateurs who wish to utilise old components which they may have in their spares box. The majority of the components for these receivers are no longer stocked by retailers.

AMATEUR WIRELESS AND WIRELESS MAGAZINE

STRAIGHT SETS

Battery Operated

One-valve : 2s.

B.B.C. Special One-valver AW387*

Mains Operated

Two-valve : 2s. each.

Consoelectric Two (D, Pen), A.C. AW403

SPECIAL NOTE

THESE blueprints are drawn full size. The issues containing descriptions of these sets are now out of print, but an asterisk denotes that constructional details are available, free with the blueprint.

The index letters which precede the Blueprint Number indicate the periodical in which the description appears. Thus P.W. refers to PRACTICAL WIRELESS, A.W. to *Amateur Wireless*, W.M. to *Wireless Magazine*.

Send (preferably) a postal order to cover the cost of the Blueprint (stamps over 6d. unacceptable) to PRACTICAL WIRELESS, Blueprint Dept., George Newnes, Ltd., Tower House, Southampton Street, Strand, W.C.2.

No. of Blueprint

SHORT-WAVE SETS

Battery Operated

One-valve : 2s. each.

S.W. One-valver for American AW429*

Two-valve : 2s. each.

Ultra-short Battery Two (SG, det Pen) ... WM402*

Four-valve : 3s. each.

A.W. Short Wave World-beater (HF Pen D, RC Trans) AW436*
Standard Four - valv Short-waver (SG, D, LF, P) WM383*

Mains Operated

Four-valve : 3s.

Standard Four-valve A.C. Short-waver (SG, D, RC, Trans) WM391*

MISCELLANEOUS

Enthusiast's Power Amplifier (10 Watts) (3/-) WM387*
Listener's 5-watt A.C. Amplifier (3/-) ... WM392*
De Luxe Concert A.C. Electrogram (2/-) ... WM403*

QUERY COUPON

This coupon is available until April 4th, 1955, and must accompany all Queries, sent in accord with the notice on page 249.
PRACTICAL WIRELESS, April, 1955.

Published on the 7th of each month by GEORGE NEWNES, LIMITED, Tower House, Southampton Street, Strand, London, W.C.2, and printed in England by W. SPEAIGHT & SONS, Exmoor Street, London, W.10. Sole Agents for Australia and New Zealand: GORDON & GOTCH (A'sia), LTD. South Africa: CENTRAL NEWS AGENCY, LTD. Subscription rate including postage, for one year: Inland and Abroad 13s. 6d. (Canada 13s.) Registered at the General Post Office for the Canadian Magazine Post.