Practical Wireless

9D EVERY MONTH

AND PRACTICAL TELEVISION

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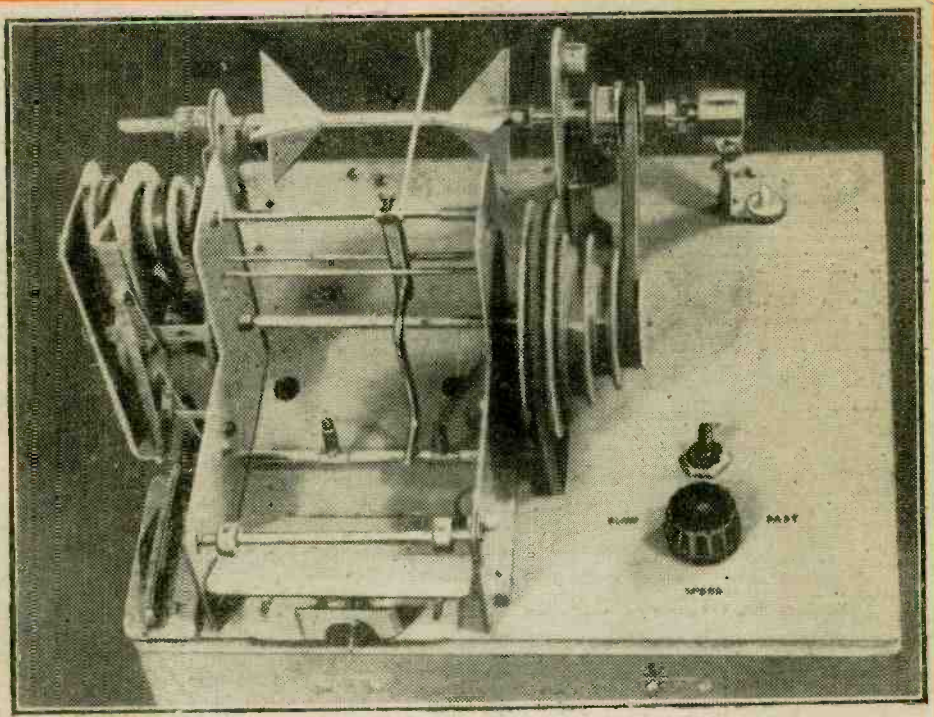


See Page 221

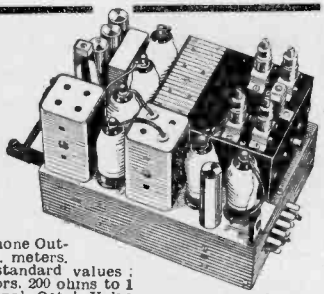
PRINCIPAL CONTENTS

An Electric Coil Winder
Building a Television Receiver
Aerial Coupling Circuits
Using the C-R Comparator

An A.C. Battery Charger
A 12-watt Amplifier
Push-button Unit
Aerials for Television

EDX.17.G.

6 VALVE SUPERHET



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The receiver is, of course, designed for reception from the Alexandra Palace but for use in the Birmingham area when transmissions start. It will only be necessary to utilise coils having slightly less turns, as the Midland Station is of a higher frequency. Midland Constructors are advised to purchase now, even if they do not intend to build immediately. Supplies of the Radar Units at the moment are ample, but the demand is very great. Please bear with us if there is a few days delay in delivery, as all orders are dealt with in strict rotation.

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Practical Wireless and PRACTICAL TELEVISION
17th YEAR OF ISSUE
EVERY MONTH
VOL. XXV. No. 515 JUNE, 1949
Editor F. J. CAMM

COMMENTS OF THE MONTH

BY THE EDITOR

The Durability of Components

CONSTRUCTORS, more than manufacturers, will welcome the efforts of the R.I.C. Technical Specification Committee, working in consultation with the British Radio Equipment & Radio Manufacturers' Association, in endeavouring to evolve climatic and durability tests for radio components.

The Radio Industry Council has just published a specification outlining the general conditions and procedure for durability testing of components for radio and other electronic equipment. The specification is No. R.I.C./11. The Radio Communications and Electronic Engineering Association and the Radio Components Federation have co-operated and this is the first specification issued by the committee.

Whilst it covers similar ground to that of the Inter-services Specification No. R.C.S./11, the new specification includes the industry's own requirements as well. At present the specification has not been considered by the British Standards Institution. The object of the Technical Specification Committee's work is to produce a series of radio component specifications designed to ensure a high degree of reliability and performance for British components during use, transit, and storage. Thus, the specification provides a datum for manufacturers. Unfortunately specifications are not compulsory. They may exercise a guiding influence, but from our own experience of other industries there is always the odd manufacturer who will sell sub-standard stock rather than scrap it.

At present wireless components are sold without any guarantee and some of them have a very poor shelf-life. An electrolytic condenser, for example, may have been in stock for a year or more before an unsuspecting constructor purchases it. Little wonder, therefore, that so many components, such as condensers, transformers, resistors, and other parts break down so soon after they have been installed.

Like foodstuffs, certain radio components should have the dates of manufacture marked on them. Purely mechanical parts, such as variable condensers, cannot deteriorate with age, and so a durability specification for them is unnecessary.

Whilst, therefore, the specification is intended to ensure a high standard of reliability and performance for British components during use, transit, and storage, it is no use relying on the pious hope that manufacturers will adhere to the recommendation. Every member of the associated bodies should be compelled as a condition of membership to adopt the recommendations of their own unified committee.

If manufacturers do adopt the specification, components will be examined and their properties measured before and after they are subjected to the tests, and their performance under test will be laid down in the relevant component specifications. Components will be classified according to their ability to withstand extremes of temperature and humidity. Supplementary tests for vibration, salt, atmospheric corrosion, and mould growth may also be called for.

It is desirable that components should be so designed that their performance is not impaired by dust and grit which accumulates during a few years of normal use. Equipment used in normal conditions in the atmosphere of house, factory or laboratory, or used occasionally out of doors, is exposed to the corrosive effects of the atmosphere and these are especially severe near the sea and in the tropics. Special components may be necessary for use in corrosive atmospheres such as, for example, factories where plating plants are in use.

During transit and sometimes in use components are subject to mechanical shock and vibration, and to acceleration as great as 90g. Quite commonly they are subject to acceleration of from 10g. to 12g. and from low-frequency vibration of 10 to 100 cycles per second. Hence there will be bumping and vibration tests designed to determine the ability of the component to withstand shocks.

Moreover, components may be kept under normal storage conditions for periods of at least six months and all connection tags, wires, etc., intended for electrical connection should be so finished as to be capable of being soldered. These component terminations may have to withstand stresses, and sharp bends, so this finish is important. F. J. C.

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The Editor will be pleased to consider articles of a practical nature suitable for publication in "Practical Wireless." Such articles should be written on one side of the paper only, and should contain the name and address of the sender. Whilst the Editor does not hold himself responsible for manuscripts, every effort will be made to return them if a stamped and addressed envelope is enclosed. All correspondence intended for the Editor should be addressed: The Editor, "Practical Wireless," George Newnes, Ltd., Tower House, Southampton Street, Strand, W.C.2.

Owing to the rapid progress in the design of wireless apparatus and to our efforts to keep our readers in touch with the latest developments, we give no warranty that apparatus described in our columns is not the subject of letters patent.

ROUND THE WORLD OF WIRELESS

Broadcast Receiving Licences

THE following statement shows the approximate numbers of licences issued during the year ended February 28th, 1949.

Region	*Number*
London Postal	2,153,000
Home Counties	1,559,000
Midland	1,653,000
North Eastern	1,799,000
North Western	1,504,000
South Western	1,012,000
Welsh and Border Counties	684,000
Total England and Wales	10,364,000
Scotland	1,088,000
Northern Ireland ..	188,000
Grand Total	11,640,000

The total includes 120,100 television licences—an increase of 8,250.

Prosecutions for licence offences totalling 1,214 were authorised during February, including a number for operating television receivers without licences.

The public are reminded that a special comprehensive licence costing £2, covering both sound and television broadcast programmes, is needed immediately a television receiver is installed. If the viewer holds an ordinary 20s. sound licence, a refund of 1s. 8d. for every unexpired month of this licence can be obtained at any Head Post Office.

British Television in Australia

COMPLETE television transmission station equipment, together with receivers, was recently flown to Australia by B.O.A.C. for the British company Pye, Ltd., of Cambridge, who, in conjunction with Electronic Industries, Ltd., of Australia, have successfully demonstrated television for the first time in Australia at Melbourne.

Pressmen and officials saw yachting scenes, the definition of which was a strong argument in favour of the British 405-line system. In view of the powerful competition of American companies, the demonstration is regarded as a tribute to the enterprise of the British television industry.

West African Radiotelephone Services Extended

THE radiotelephone services provided by Cable and Wireless, Ltd., in West Africa has been extended to provide links between Bathurst and Freetown, between Bathurst and Accra, and Bathurst and Lagos.

Service between Bathurst (C. & W.) and London (Post Office) via Accra (C. & W.) has also been opened.

These extensions complete the inter-connection by radiotelephone of the four British West African colonies—Gambia, Sierra Leone, Gold Coast and Nigeria—and their linking, through Accra, with London.

H.Q.-to-Ambulance Radio

THE first ambulances in the United Kingdom to be fitted with radio for emergency calls and general control are being used in Guernsey. Since the radio apparatus was installed in five St. John ambulances on the island many lives have been saved. Radio calls to ambulances near the spot enable seriously ill patients to be rushed to hospital or doctor in a matter of minutes. Each of the five ambulances is able to keep in touch with the others or with headquarters, and in the twelve months that the radio ambulances have been operating over 4,000 calls have been dealt with.

Electric current to work the radio apparatus on the ambulances comes from Exide-Ironclad or heavy duty, large capacity Exide batteries. The discharge for the radio apparatus is 25 amps, and in addition to this the batteries feed headlights, interior lighting and heating, and a brass warning bell, as well as the starting and other electrical equipment.

The drivers say that the radio system functions perfectly. It is loud, clear and instantaneous, with the precision and efficiency of a brigade of Guards.

Mullard Presentation

MR. G. L. DRIVER, Valve Division representative of Mullard Electronic Products, Ltd., received a presentation on March 31st of a canteen of cutlery and a cheque, following 25 years' service with the firm.

Mr. Driver designed the first Mullard Stand at a Wembley exhibition over 20 years ago. He has been calling on radio set manufacturers for the past 15 years and is therefore well known in the radio trade. In addition, he has achieved fame as an amateur conjurer and is a member of the Magic Circle.

A section of the automatic record-changer production line in the Plessey Co.'s works at Ilford.

Alleged Patent Infringement

ELECTRIC & MUSICAL INDUSTRIES, LTD., Hayes, Middlesex, advise that they have issued a writ against Pye, Ltd., of Cambridge, for alleged infringement of letters patent No. 442666. This patent relates to television cameras and it protects the Super-Emitron camera invented and manufactured by E.M.I. Research Laboratories, Ltd., a wholly owned subsidiary company of Electric & Musical Industries, Ltd.

European Interest in British Television

LATEST distinguished visitors to E.M.I. Research Laboratories at Hayes, Middlesex, were members of the combined Belgian and Dutch television delegation which recently paid a visit to this country as the guests of His Majesty's Government.

The party, which included famous scientists and Government officials, was received by Sir Ernest Fisk, the managing director of Electric and Musical Industries, Ltd. They spent several hours in the research laboratories inspecting E.M.I.'s latest television secrets and described themselves as "very impressed" with the Emitron Television System, using 637-line standards, which was demonstrated on a specially staged "live" broadcast with C.P.S. Emitron cameras.

The delegation had previously visited Alexandra Palace to see the equipment installed by E.M.I. in 1936 (and still in use to-day) and to examine B.B.C. methods of television programme production.

R.C.E.E.A. Chairman

MR. F. STANLEY MOCKFORD, commercial manager, Marconi Wireless Telegraph Co., Ltd., has been elected chairman of the Radio Communication and Electronic Engineering Association in succession to Mr. L. T. Hinton. Mr. V. M. Roberts, British Thomson-Houston Co., Ltd., Rugby, is the new vice-chairman.

Mr. Mockford brings long and varied experience to the chairmanship of R.C.E.E.A., which is concerned with all types of wireless communications, navigational aids, sound and television broadcasting, and industrial electronic equipment. He began his wireless career in the Royal Flying Corps in 1915 and afterwards played an important part as an Air Ministry official in the early development of wireless services for civil aviation. He joined the Marconi Company 19 years ago.

Radio Components on Show

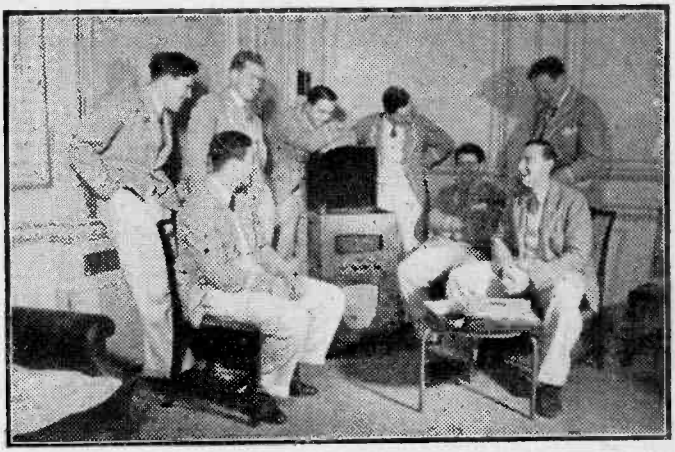
BRITAIN'S skill in the design and manufacture of components for the radio and electrical industries, which led to a 40 per cent. increase in exports last year, was demonstrated at a private exhibition held by the Radio Component Manufacturers' Federation in the Great Hall, Grosvenor House, Park Lane, recently.

"Almost every advance in radio, radar, television and electronics generally, depends on the ability of the component manufacturer to meet some new exacting requirement," an industry spokesman said. "The Exhibition showed what has been done to bring about smaller radio sets, brighter television pictures, more reliable navigational aids for ships and aircraft, and communications and broadcasting equipment for use in every climate from the tropics to the Arctic."

The Exhibition included test gear and, for the first time, valves, including new miniatures for television and frequency modulation. There were 106 exhibitors.

Television and the Film Industry

AFTER an adjournment since December, discussions between representatives of the Renters', Exhibitors' and Producers' Committee of film industry and the B.B.C., under Post Office chairmanship, were resumed recently. It was found that difficulties on the side of the industry had arisen in regard to putting into effect the agreement in principle previously reached for co-operative experimental arrangements for the showing of selected B.B.C. television items in cinemas and for television showing by the B.B.C. of selected films. The industry require further information before proceeding under either head. The discussions will be resumed after further consultation within the industry.



The Cambridge boat-race crew take a rest and are entertained by a radiogram loaned by Marconiphone Co. Ltd., who also supplied a television set for use by the crew at their training headquarters at Epsom.

Shooting Stars and Radar

IT is reported from the U.S.A. that a further use has been found for radar equipment. In this case specially-built apparatus was used to follow the course of shooting stars after daybreak, when they became too faint to be seen. The equipment was built by C. A. Little, Jr., of the Carnegie Institute of Washington department of Terrestrial Magnetism.

Building a Television Receiver—5

The Power Unit, Described Below, Concludes the Constructional Work

By S. A. KNIGHT

THE power unit which is now to be described completes the actual constructional work on the television receiver, and after it has been built nothing remains to do but to connect the various sections together and align the vision and sound receivers.

Basically, the power unit is perfectly conventional as the circuit diagram of Fig. 1 reveals, but in construction it is a comparatively heavy and unwieldy piece of equipment demanding a solid chassis construction coupled with care in wiring and insulation requirements. It consists of two mains transformers, three smoothing chokes, five smoothing electrolytic condensers, and various bleeder resistances, dropping resistances, etc. Such a large number of chokes and condensers may seem unusual when judged by ordinary power unit standards, but this is true of the whole of a television receiver, and in the present instance every component is absolutely necessary. Mains hum and power unit coupling must be avoided at all costs if worthwhile pictures are to be obtained, pictures, that is, which are free of wavy edges and dark hum bands. It is true that the frame locks in at the mains frequency when the set is operating, but a wavy edge and a black band across the picture are still possibilities even if they are stationary.

There are several important points to be dealt with first with regard to the circuit shown in Fig. 1. First, the mains transformer supplying H.T. and heaters to the vision, sound and time-base units already described; it is unlikely that a mains transformer will be available giving exactly the output voltages specified, namely, 350-0-350 volts at 250 mA., 6v. at 8a., 6v. at 3a., 4v. at 4a., 2v. at 2a., and 5v. at 3a. Certain changes are, however, possible. The specified rectifier valve V22 is a 5U4G operating at 5v. 3a. heater; a 4v. valve may be used instead if the 5v. winding is not available, and suitable valves are the Cossor

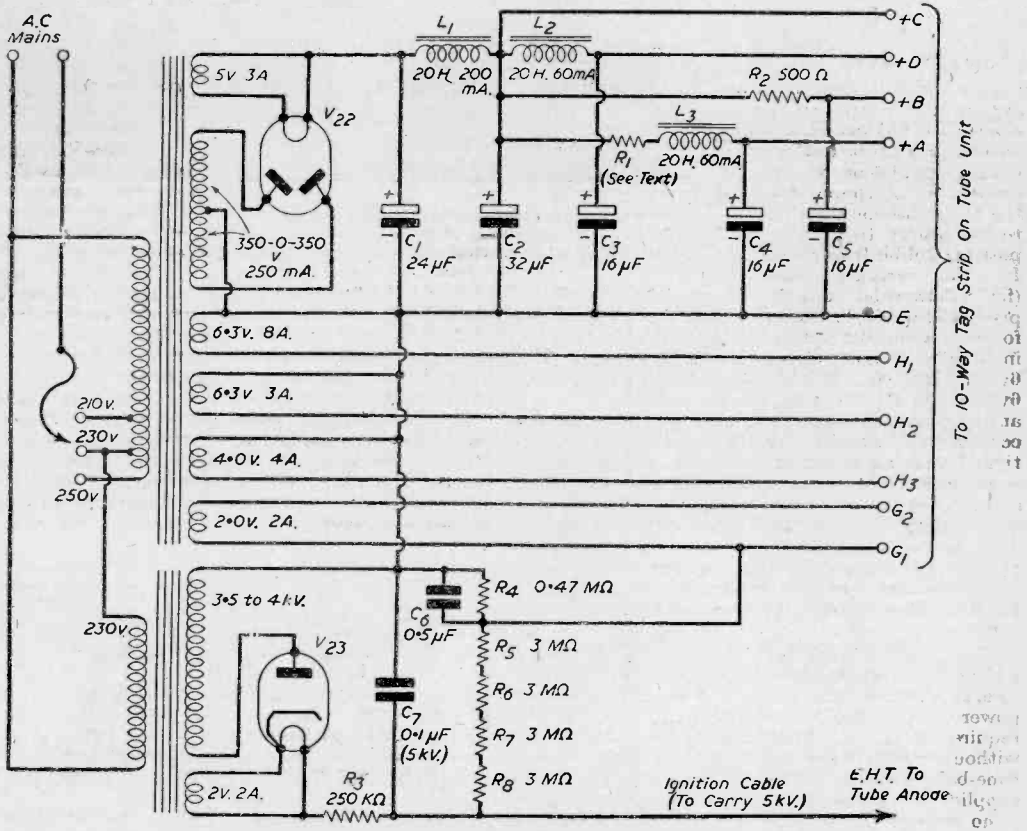


Fig. 1.—Theoretical circuit of the power pack, with terminal references.

45IU or Mazda UU8. Alternately again, two ordinary 120 mA. rectifiers may be wired in parallel. Second changes that are practicable are combination of the two 6v. windings into one winding of 6v. 10a., or failing this, a separate heater transformer may be used for one or more of the required heaters. The two-volt tube winding should, in any case, be isolated as shown, not taken from a tap on one of the earthed windings. The reason for this is not connected so much with tube heater-cathode insulation as the desirability of connecting the tube cathode directly to its heater to prevent possible trouble from hum. In the writer's case (for information and to prevent enquiries) a transformer having the following heaters was used: 6v. at 6a., 4v. at 8a., 6v. (tapped at 2v.) at 2a., and 4v. at 3a. Such transformers having the correct H.T. winding are plentiful at the present time. The writer stripped his transformer of iron—which did not prove so troublesome as the size of the thing indicated—and wound on an additional 2v. winding for the tube, and increased the 4v. winding to 5v. for the available rectifier. Turns per volt are very low on these transformers and can be determined from the windings already wound; there is also plenty of room for the additional turns of wire.

The specified amperages of the windings shown in Fig. 1 are the theoretically correct ones therefore, and are *not* those actually in use in the writer's power unit. The 6v. 6a. winding supplies the required 7 to 8a. demanded by the vision unit without trouble; the tapped 6v. 2a. supplies the time-base chassis. The 4v. 8a. winding easily supplies the two gas valves with their 2a. and there is no voltage rise because of this. This matter of heaters is one for the individual ingenuity of the constructor, but it is not a serious point and is easily overcome with a little thought and attention.

Turning now to the Extra H.T. transformer, this is an easily obtainable component, and is a transformer rated at 3.5 to 4 kV. H.T. with a 2v. heater for the rectifier valve. This latter is a Cossor SU2130 (the Service equivalent is the VU120), or alternately a Mazda U22 is suitable. Great care must be taken with the insulation of the heater winding and wiring of this valve, and a long-leakage path type valve-holder should be used.

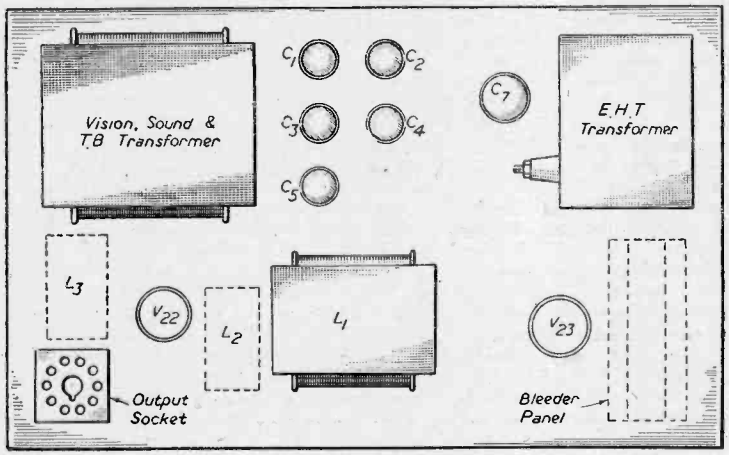


Fig. 2.—Layout for the principal components.

The smoothing chokes and condensers are normal components and can be readily obtained. Heavy duty ex-Government chokes can be obtained cheaply for L1: for L2 and L3 normal type smoothing chokes as used in radio receivers are suitable, although "midget" components must be avoided. All the electrolytics are rated at 450v. working, and the larger values such as 24 μF. and 32 μF. may be made up out of paralleled components. C1 may be raised to 32 μF. if desired.

C7 is the smoothing condenser for the E.H.T. and must be chosen with regard to its working voltage accordingly. 0.1 μF rated at 5 kV. working is suitable, and ex-Govt. components may be used. A larger capacity, provided the working voltage is not below 5 kV. may, of course, be used. C6 is simply a decoupling component and has the usual 350v. rating.

LIST OF COMPONENTS

Mains transformers (see text).
1 20 H. 200 mA. smoothing choke (low D.C. res.).
2 20 H. 60 mA. smoothing chokes.
1 32 μF. 500v. wkg. electrolytic condenser.
1 24 μF. 500v. wkg. electrolytic condenser.
3 16 μF. 500v. wkg. electrolytic condensers.
1 0.1 μF. (or larger) 5 kV. working condenser.
1 0.5 μF. 350v. wkg. paper condenser.
1 Belling-Lee 10-pin plug and socket.
Resistances, etc., as specified in the text.

Construction

Fig. 2 shows the layout, from above chassis, of the writer's power unit, but some modification may be necessary to suit the components actually used. However, no drastic changes need be necessary even if a separate heater transformer is used, for this can be accommodated below the chassis. The chokes

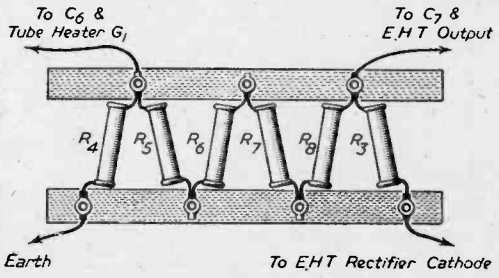


Fig. 3.—How to arrange the EHT bleeder to provide a long leakage path.

L2, L3 and all the resistances are below chassis, their positions being indicated by the broken lines.

A 10-pin socket (heavy type) is used to bring the outputs to a point, and the 10-way lead from the tag-strip on the tube unit is terminated by a 10-pin plug. The order of connections is left to the constructor and is not important, but it is *absolutely essential* to ensure that the plug wiring mates with the socket wiring. Very careful checking is necessary at this point as a mistake is so easily made. The lettered points on the right of Fig. 1 correspond to the lettered points on the circuit of the tube unit previously described, and these particular letters are used throughout the circuit. There should, therefore, be no error with regard to them, and although the number of interconnections seems alarming on paper, in practice a few neat cable forms can be made up to connect together the various units.

The E.H.T. output is *not* brought through any plug or socket, but is led directly from the smoothing condenser C7 to the tube anode through a length of ignition cable. It is essential to take care over the wiring of the whole of this part of the power unit. The heater leads to the rectifier should be heavily insulated and, if possible, kept clear of the chassis by ¼in. or so. The smoothing resistance R3 should be mounted on a tag panel with the bleeder chain R4 to R8, the whole panel then being mounted well clear of the chassis and all other parts and leads. The bleeders should be mounted, as shown in Fig. 3, so as to give as long a path for leakage as possible. R3 is half-watt rating, R4 to R8 each 1 watt. The bias for the tube is obtained from R4, and the brightness control is actually wired in parallel with it, as a check through to the tube-unit circuit diagram will show.

There is nothing of great importance to be said about the wiring of the remainder of the circuit, and it may be carried out as the individual constructor desires. The rating of R2 is 5 watts, as is R1. The value of this latter resistance is chosen to make the total resistance of both L3 and itself in series up to 500 ohms, and is not critical.

The chassis size is, in the writer's case, 14in. × 9in. × 3in., but this is not a hard and fast affair, and the constructor may buy one to suit his components. Nothing much smaller than the above, however, is recommended. Make all earth returns of very heavy wire, especially those associated with heater wiring, and the earth pin on the 10-pin socket must be very heavily anchored.

Radio Industry at the B.I.F.

A Description of Some of the Unusual Exhibits

THE most up-to-date equipment used in television transmitting and receiving, radio communications, aids to navigation, sound reproducing and other branches of the radio and electronic engineering industries will be shown at the British Industries Fair in London and Birmingham from May 2 to May 13.

Television Receivers

At Olympia, London, there will be several combined television and radio receivers. E. K. Cole, Ltd., will show a combined console model with a high-definition picture, 10ins. by 8 ins., viewed indirectly on a specially processed mirror in the lid set at the correct viewing angle. The viewing surface is shielded from conflicting light or reflections. The radio has instantaneous tuning to five chosen stations obviating the need for a tuning scale.

R. N. Fitton, Ltd., will feature an 18-valve console model designed to fit into the corner of a room, and believed to be the only one of its type manufactured in this country.

Television Aerials

Television aerials are being re-designed by Belling and Lee, Ltd., who will show at Birmingham complete aerial systems in three individual kits, comprising dipole, reflector and cross-arm for different frequencies, 8ft. or 12ft. masts, and different lashing kits and chimney brackets for the masts. A new high-tensile light alloy is now being used in the manufacture of the elements and masts, reducing the weight of the aerial system by roughly one-third.

Also to be shown is a new communal amplifier, developed to cover the television frequencies, for use in blocks of flats or similar buildings, enabling up to 20 television receivers to be fed from one normal aerial. The total power consumption is approximately 50 watts.

Radio Receivers

A new radio receiver to be shown at Olympia by Mullard Electronic Products, Ltd., claimed to be the first radio to incorporate the special double superheterodyne circuit, has band-spread tuning on the eight important short-wave bands. The design of the magic-eye enables tuning to be carried out with the volume control at the minimum setting.

A new type of nine-valve receiver by R. N. Fitton, Ltd., has been designed exclusively for export based on refinements requested by overseas agents. By employing an advanced technique and using miniature valves it has been possible to build a nine-valve receiver in a cabinet of the size normally used for five-valve types.

An all-wave superhet by A. J. Balcombe, Ltd., is claimed to be the smallest in the world.

Radar

The cloud and collision warning radar equipment, to be shown at Olympia by E. K. Cole, Ltd., is designed to enable pilots of aircraft to detect certain types of clouds associated with storm areas at a distance of 40 miles. Other uses for the equipment include map pointing facilities, detecting other aircraft in the vicinity, and for selecting a route through dangerous cloud formations.

Aerial Coupling Circuits—2

The Theory of the Coupled Circuit and Some Medium-wave Arrangements Described

By "EXPERIMENTER"

WE deal first with tapped-coil aerial coupling (Fig. 2) because this is the simplest method of coupling an aerial-earth system to a tuned circuit and is most convenient for amateur constructors to use because it involves no additional components; one end of the tuning inductor is earthed and the aerial is connected to a tapping point on the coil.

The position of the tapping point determines the degree of coupling between aerial and tuned circuit and thus determines the performance of the coupling circuit with respect to voltage gain and selectivity. Some numerical examples will illustrate this. Suppose the tuning coil has an inductance of 157 μH and a Q of 100 (assumed constant). If the aerial impedance is made up of 40 Ω and 200 pF in series (values typical of a medium-wave outdoor aerial) optimum coupling and maximum voltage gain is obtained at 1,000 kc/s by a tapping point two-fifths the way from the earthy end of the coil. Thus, if the coil has 80 turns the aerial should be connected to the 32nd turn. Half-optimum coupling is obtained with a tapping one-fifth the way from the earthy end; this gives the best possible compromise between gain and selectivity and should be used if the circuit is to work permanently at 1,000 kc/s and if high gain and high selectivity are equally desirable.

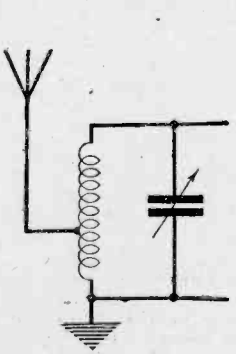


Fig. 2.—Circuit of a tapped-coil aerial coupling.

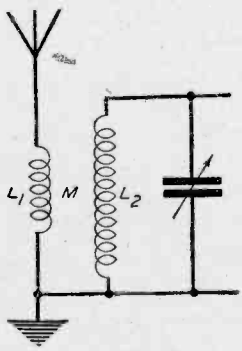


Fig. 5. — Mutual-inductance aerial coupling circuit.

Unfortunately, if the frequency is varied the position of the tapping point should also be changed to maintain a given performance. This is illustrated by the following table, which shows the position of the tapping point for optimum and half-optimum coupling for the coil and aerial-earth system mentioned above.

Frequency	*Optimum coupling*	*Half-optimum coupling*
550 kc/s	top	$\frac{1}{2}$
800 kc/s	$\frac{3}{5}$	$\frac{3}{10}$
1,000 kc/s	$\frac{2}{5}$	$\frac{1}{5}$
1,200 kc/s	$\frac{1}{3}$	$\frac{1}{6}$
1,400 kc/s	$\frac{1}{4}$	$\frac{1}{8}$

This table shows clearly that no one tapping point can be found that will give a particular compromise between gain and selectivity over the entire medium waveband. If, as is usual, one tapping point must be used over the waveband, the performance of the coupling circuit must necessarily vary with frequency. This is borne out by Fig. 3, which shows how voltage gain and selectivity factors vary for a tapping point a quarter of the way from the earthy end. (This tapping point gives half-optimum coupling at 900 kc/s, the geometric centre of the medium waveband.) The voltage gain factor varies from 48 per cent. at 550 kc/s to 100 per cent. at 1,500 kc/s, and the selectivity factor from 93 per cent. at 550 kc/s to 48 per cent. at 1,500 kc/s; this represents the best performance it is possible to get from this type of coupling circuit.

The capacitance reflected into the tuning circuit by an aerial connected to a tapping point is positive and its value depends on the position of the tapping point increasing as the point is moved away from the earthy end of the coil. With normal tuning components the reflected capacitance must not exceed about 60 pF (for any type of coupling circuit), or it becomes impossible to tune to the high-frequency end of the band. This requirement prevents the use of tapping points appreciably higher than the centre of the coil. The reflected capacitance is not constant with change in frequency but increases with increase in frequency as shown in Fig. 4. The increase is not appreciable, however, until the high-frequency end of the band is approached: this shows that there should be little difficulty in ensuring good ganging over most of the band and that the trimmer of aerial circuits of this type should not be adjusted at too high a frequency.

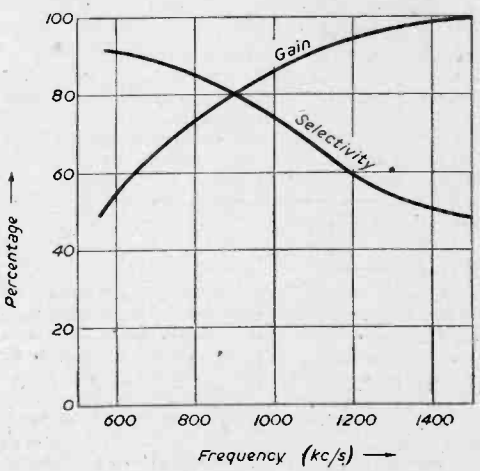


Fig. 3.—Variation of gain and selectivity with frequency for a tapped-coil aerial coupling.

Mutual-inductance Aerial Coupling

This type of coupling circuit (Fig. 5) is probably the most widely employed of all. The aerial and earth are connected to the two ends of an inductor L1 which is inductively coupled to the tuning inductor L2. The performance of the circuit is determined by the value of the inductance L1 and the coefficient of coupling between L1 and L2. As there is no simple way of calculating this

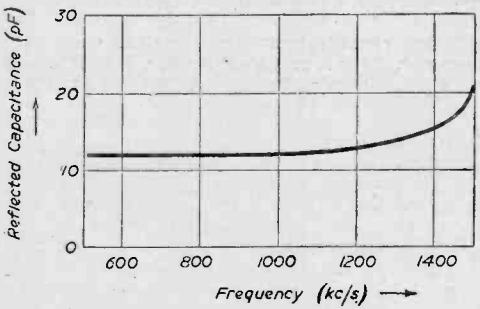


Fig. 4.—Variation of reflected capacitance with frequency for tapped-coil aerial coupling.

coupling coefficient, Fig. 5 is not so convenient a circuit as Fig. 2 for amateur constructors.

The inductance L1 should not resonate with the aerial capacitance at a frequency within the waveband to be covered: if it does the selectivity of the circuit passes through a minimum at the resonant frequency, and there is a rapid change in the value and sign of the reflected capacitance as the tuning passes through this frequency, these variations preventing accurate ganging. Thus L1 should be small (less than 50 μH) to make the aerial circuit resonant above 1,500 kc/s or large (greater than 500 μH) to give a resonant frequency less than 550 kc/s. Commonly used values for L1 are 30 μH and 2,000 μH (2 mH), the former being typical of low-inductance primary windings and the latter of high-inductance windings. These two inductance values give quite different performances and will be treated separately.

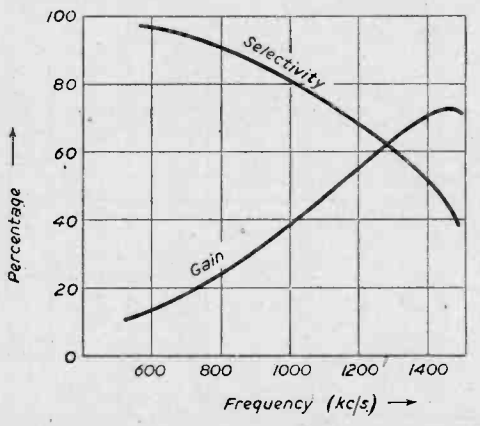


Fig. 6.—Variation of voltage gain and selectivity factors for R.F. transformer with low inductance primary winding.

R.F. Transformer with Low-inductance Primary Winding

The performance of this type of aerial-coupling circuit is very similar to that of the tapped-coil circuit, and the effect on voltage gain and selectivity factors of varying the coupling between L1 and L2 is similar to that of varying the position of the tapping point. Fig. 6 illustrates this: it was calculated for L1=30μH, M=21μH, the values of L2 and the aerial generator constants being the same as quoted earlier. The voltage gain factor varies from 12 per cent. at 550 kc/s to 70 per cent. at 1,500 kc/s, and the selectivity factor from 98 per cent. at 550 kc/s to 38 per cent. at 1,500 kc/s. The voltage gain is roughly directly proportional to the square of the frequency, this being the chief disadvantage of this type of coupling circuit.

For the values quoted the reflected capacitance is positive and varies from 3.5 pF to 6.5 pF over the waveband according to a curve similar to Fig. 4. The reflected capacitance and the variation of it with frequency are smaller than with tapped coil aerial coupling and little difficulty should be experienced in obtaining reasonably accurate ganging over the whole waveband.

R.F. Transformer with High-inductance Primary Winding

With this type of aerial coupling the primary circuit resonates at a low frequency and is inductive over the entire waveband. Thus the impedance of the aerial circuit is roughly directly proportional to frequency and obeys the same law as the dynamic impedance of the tuned circuit to which it is connected. This means that the degree of coupling between aerial and tuned circuit does not vary very much with frequency and there is little change in the voltage gain and the selectivity

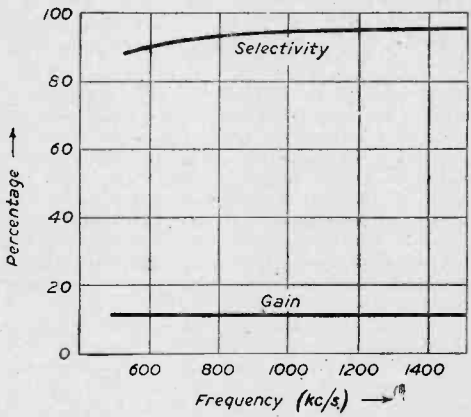


Fig. 7.—Variation of voltage gain and selectivity factors for R.F. transformer with high inductance primary winding.

as tuning is varied. In this respect this coupling circuit has a distinct advantage over the first two circuits described.

(To be continued)

ON YOUR WAVELENGTH

By THERMION

A Committee of Investigation

CRITICISM of the B.B.C. has been going on since the B.B.C. started. A lot of it is unjustified and unjustifiable opprobrium, coming from those with axes to grind. The disgruntled musician who cannot get a broadcast, the hordes of concert artistes, not all of whom are capable of entertaining anyone but a small audience after a dinner when audiences are less critical, out-of-work actors and actresses, producers, and Grub Street playwrights—these are some who are most vitriolic in their attacks upon the B.B.C.

But ignoring all this, there is undoubtedly a case for investigation into the workings of this mysterious body, which consists of a number of water-tight departments, uncorrelated, uncoordinated, yet wielding a power which transcends that of Parliament.

It has grown from small beginnings, and as a result of the original mistake of employing an executive without business experience, without any background of success in any other industry, and without any real ability, the tangled mess has developed into a vast morass which in my view can never be cleared, unless a fresh start is made.

The two books about the B.B.C. which I recently reviewed in this column indicate in some measure the causes, the effects, and the remedy. Whether any Government will have the courage to adopt the remedies suggested I very much doubt. The suggestion that a Committee of Investigation into the workings of the B.B.C. should be appointed is a good one, only if its recommendations are adopted. But the appointment of Select Committees is only a Government method of disarming too shrewd and effective criticism. Such Committees take a year or more to issue their findings, and by that time the critics have cooled off somewhat and lost interest. It is not the first time that the B.B.C. has been under the spotlight of public enquiry. During Reith's time he was ordered to the House of Commons to answer criticisms.

In the words of the reporter of the time, "he came away smiling"! It is my view that the staff of the B.B.C. could be considerably reduced with advantages to the taxpayer and the efficiency of the service.

Interference Suppression

LORD CHERWELL, in the House of Lords, proposed an amendment to the Wireless Telegraphy Bill, imposing a 2s. limit on the cost of suppressing domestic appliances, the object of which was to protect domestic users from being compelled at considerable expense to render appliances interference-free. Viscount Addison objected that it was a new principle that, because one person had something which interfered with another, the State should step in to pay the cost of the adjustment.

He said that if this principle were accepted there was no inducement on anybody to attach a suppressor to the apparatus which was causing interference because the Post Office would pay the piper. The amendment was, however, carried by 42 votes to 23.

625-line Television

THE first public demonstration of a 625-line television transmission system will be given at the B.I.F. (Birmingham Section) this year. The intention of the demonstration is to impress the view that British manufacturers can provide television for any required standard of definition, and are not confined to the 405-line system.

The Marconi Co. has constructed the television receiver for the demonstration.

Old Crocks

THE suggestion has been made that old receivers should be forced off the market by dealers refusing to repair sets more than 12 years old. If this suggestion is given practical effect it would mean that some millions of receivers would be placed on the junk heap. There are far more old receivers in use than is generally supposed.

The sales of new receivers related to the number of receiving licences is not an indication of the total number of receivers in use. When a new receiver is purchased the old receiver may be used in the kitchen, in the bedroom, or even, as I have seen, in the garage. It would be a matter of hardship and contrary to Government policy for old receivers to be scrapped. We are urged not to purchase and to save money.

The Purchase Tax is designed to make the purchase price prohibitive. If listeners are not to purchase new receivers and are to be prevented from having their old one repaired, an impossible position would result. Nor in my view would it work. If the trade refused to repair old receivers this journal would immediately organise a panel of approved repairers who would undertake to repair old receivers, and I for one would throw myself into the fray with great energy and enthusiasm. I do not like restrictive practices, and would remind the trade of certain Acts of Parliament which make the proposed procedure under certain circumstances actionable.

Fortunately, there is little likelihood of the suggestion being adopted. The radio trade is having a thin time, and to repair even old receivers can provide the wherewithal to pay salaries and overheads and still leave a good margin of profit.

A Cathode-ray Comparator

Using the Modified Type 48A R.A.F. Unit as a Dual Tester for the Workshop or Laboratory

TO reduce the interaction of the brilliance controls to a minimum, separate feeds from the fly-back suppression diode are effected by feeding one of the C.R.T. grids through a second condenser, C26, of 1 μF. It is intended to alter the layout at a later date to provide a 0.5 μF. condenser direct to the diode anode from this grid, dispensing with the 1 μF. at present in use, but the method does reduce the interaction to negligible proportions.

Focusing of one tube is found to affect the other very slightly, but again not to any appreciable extent, and there is no difficulty in getting really individual focus and brilliance after a few minutes' tryout.

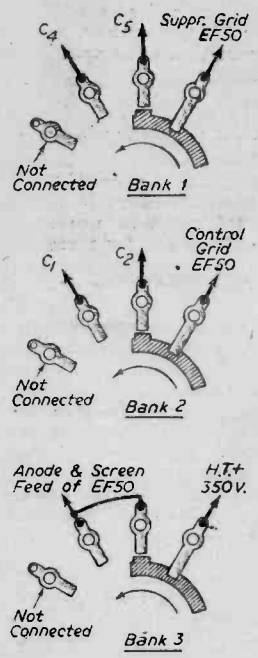


Fig. 4.—Details of Time-box frequency switch and cut-off circuit.

Flyback suppression seems fairly critical as regards the size of C6. Anything less than 0.5 μF. causes a diminution of sweep width, it was found, but the value quoted was quite satisfactory, and on a 50 c/s. sine wave very little of the "tail" is lost.

Several values of resistor were tried as R40, and the tube brilliance seemed quite happy even when values as high as 100,000 ohms were used. 50,000 ohms was the figure finally adopted, but it should be remembered that the lower the supply volts at the C.R.T. anodes can be kept, the greater the sensitivity of the equipment. The amplifiers, by the way, give a gain of about 25 times.

Finally, a word on using the "Comparator." To get a good, locked trace use the lower tube (B) for input measurement and the upper tube for the output from the equipment under observation. This will give a higher input voltage to the autosync for controlling the time-base. For a nonsync observation on one tube, use the lower tube and earth the Y lead from the upper, also turning down the brilliance control on this tube to the extinction point (to avoid damage from the steady trace).

Unequal Sensitivities

It may be found that the sensitivities of the two tubes are not equal. Slight alteration of the anode load resistors of either Y amplifier should compensate for this, and a scale fitted behind the potentiometers, themselves accurately matched, will then show directly the amplification difference between input and output traces of, say, an amplifier under test, by bringing the output trace to the same dimensions as the input. This type of measurement is made easier by cutting off the time-base, when the traces then become simple vertical lines easy to read against the ruled perspex.

Component Values

The values of components specified were in many cases adopted because of the availability of the items, and may be varied experimentally should components of other values be handy, but the changes must be small.

Television By-products

THE rapid growth of television has led in the U.S.A. to a number of interesting side-lines, many of which could, no doubt, be emulated by set-manufacturers in this country. One of the most interesting which has so far come to our notice is a free gift made by a breakfast cereal company. The packages containing this product carry a coupon which has to be forwarded with quite a small remittance to the makers of the cereal. In return you receive a miniature "television receiver." This is a plastic reproduction of a standard R.A.C. television receiver, measuring $\frac{7}{8}$in. by 1$\frac{3}{8}$in. and carrying at the front, where the screen is normally found, a small lens. A removable metal back to the cabinet permits of the insertion of a set of small circular films, their size being such that there is a small projection above the top of the "cabinet." The model is held up to the light and the lens applied to the eye whilst the finger revolves the film disc. This novelty is claimed to increase sales as users become familiar with the particular design of the set.

Intercom.

Another firm is marketing a miniature type of television receiver with a 3in. tube which is intended to replace the normal intercommunicating 'phone. This enables the "master" to see callers at the slave positions. A modification of this idea was reported in this country recently, where bank books which had been stored in a remote strong-room were inspected at headquarters by means of a television transmitter and receiver.

An Electric Coil-winding Machine—1

A Layer- or Wave-winding Device with Turns Counter. By STANLEY BRASIER

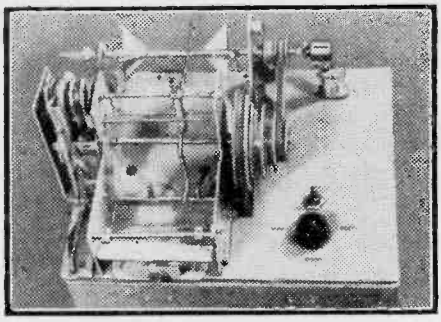
THE keen radio enthusiast feels the need sooner or later for a machine that will wind wire evenly and quickly and so relieve the tedium of hand winding, with its accompanying hand cramp, slipping bobbins, and so on.

Economy is not the only reason why one wants to wind coils at home, although it is almost invariably cheaper to do so. The main reason is usually that one can produce anything in the way of an inductance to an individual specification, whether it be a simple tuning coil, a choke or a mains transformer. But the thought of spending an hour or two feverishly winding thousands of turns with aching fingers undoubtedly detracts from the initial incentive. With a winding machine, however, most jobs may be done in a matter of minutes and in a very professional manner.

These were the feelings of the writer, and since a commercial product was out of reach financially, a search was made for a good basic design for home construction.

The main features of the machine to be described are:

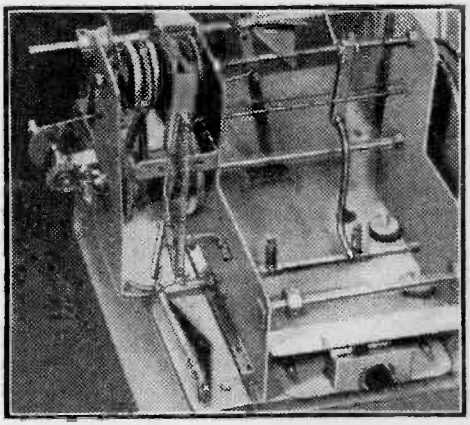
(1) A variable speed control.
(2) An automatic reversing clutch for the wire guide.
(3) A turns counter.
(4) A wire tensioning device.
(5) An attachment for wave winding.
(6) Facilities for winding back on to a wire spool.



A general view of the machine, set up for wave winding.

Operation

For layer winding the winder works as follows: The motive power from the main driving shaft is conveyed to the bobbin shaft by belt drive so that the bobbin or former to be wound is rotated at the desired speed. At the same time the driving shaft is turning the main clutch pulley which in turn drives the forward pulley or the reverse pulley according to the position of the clutch, the action of which will be described later. These pulleys rotate the 4 B.A. screwed rod in a forward or backward direction, moving the wire guide and thus the wire to the right or left. When the wire approaches the end of the bobbin being wound, the clutch reverses and the wire is wound back in the opposite direction. This action is repeated indefinitely and so even layer-wound turns may be built up.



A close-up of the clutch mechanism.

For wave winding, the clutch mechanism is rendered inoperative by loosening the screw which secures the main clutch pulley to its shaft. It is then a simple matter to fix the wave-winding attachment in place, the action of which is self-explanatory from the illustrations. A large pulley is fitted to the bobbin shaft in order that a uniform wave-wound pattern may be produced.

Clutch Action

The action of the clutch mechanism is as follows: After switching on the motor, assume that the wire guide is travelling from left to right. The cranked rod on the wire guide is approaching the reversing stop, finally makes contact with it and gradually pushes the clutch operating rod to the right. This in turn slowly pulls the first toggle until, at dead centre, the toggle clicks over and, by means of the fork at its end, pulls the second toggle over instantaneously to its opposite position. This action slides the moving clutch plate to the left and so pushes the reverse clutch pulley against its plate. This engages the catch pin and turns the reverse plate and the screwed rod in the opposite direction. At the precise moment when the reverse pulley is engaging, the forward pulley disengages itself from its forward drive plate due to the spring interposed between the two. The wire guide then traverses from right to left until the cranked rod engages the left-hand reversing stop and again operates the

clutch, and so on. The reversing stops are adjustable and may be set to any desired length of winding. For construction see Fig. 3 and Fig. 1.

One may imagine that a single toggle would be sufficient to operate the clutch mechanism, but what is needed is an instantaneous changeover. Due to the gradual movement of the first toggle (before it gets to dead centre) one would find that the engaged pulley would disengage itself but the other pulley would not engage until the toggle is finally pulled over. Consequently both pulleys would be running free on the spindle for a while and the wire guide would remain stationary whilst the bobbin would be piling up turns in one place.

This unwanted time-lag is overcome by means of the fork at the end of the first toggle engaging the lower arm of the second toggle at the moment when it (the first toggle) clicks over.

Construction

Although at first sight the machine appears to be somewhat complicated, construction is not really difficult and in actual fact all the materials were collected from odds and ends that happened to be available. Naturally, a little care and patience are required in the construction of the various parts but this is amply repaid in the finished product. A plan view of the machine is shown in Fig. 1.

For convenience, and in order to keep it out of harm's way and free from dust, the motor and its associated components are mounted below the base plate upon which the winder is built. The plate is hinged at its back edge to a wooden box measuring 3¾in. deep. This was actually part of an old portable gramophone case that was available. The base plate measures 12in. by 11in. and is of any suitable metal about 3/64in. thick. It is essential that the plate provides ample rigidity. The side plates are of similar metal 1/16in. thick. Their size and shape is shown in Fig. 2. These form the main supports for all the rods and shafts except the bobbin shaft. This is held by separate supports, which may be designed according to material at hand. Those shown in the photographs happened to be available. The bearing centres are approximately 2½in. from the base plate.

At this point is may be mentioned that although in most cases sizes of the various parts are given it should be realised that quite a large amount of freedom is permissible in this direction. It is advisable, however, to adhere to the specification of the main pulley bank, the bobbin shaft pulley and the toggles, as the dimensions of these items have proved suitable.

The three shafts may be rod of any suitable metal such as German silver, steel, brass, etc.,

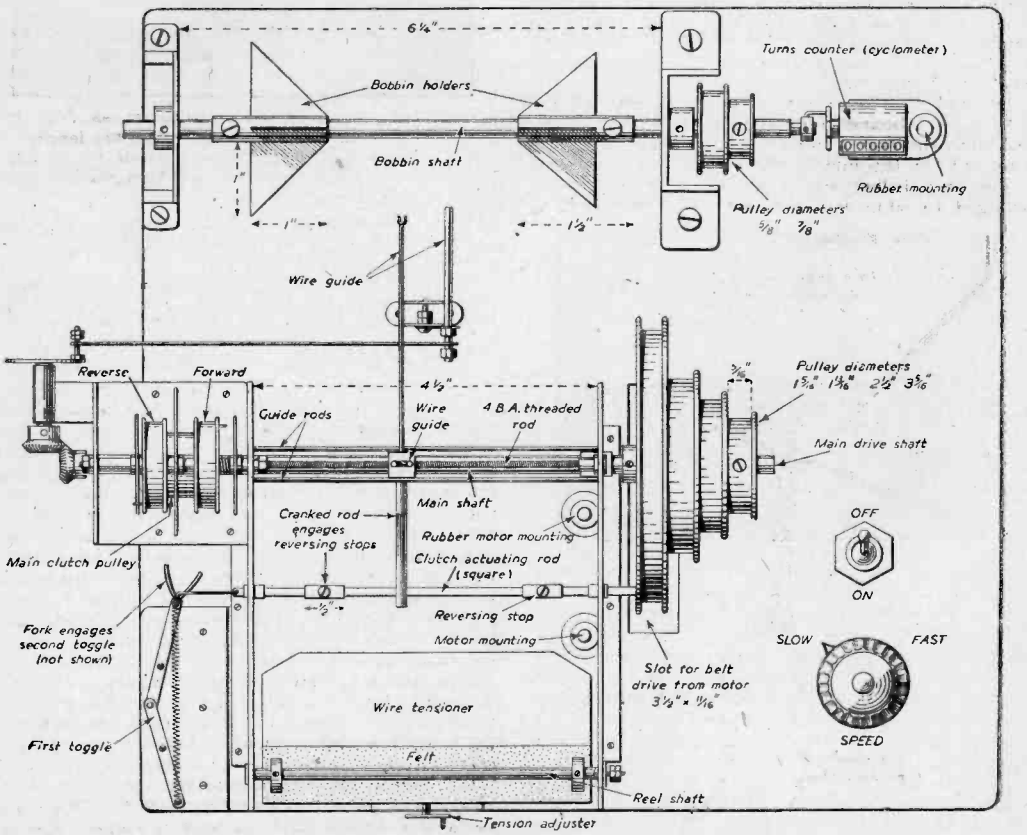


Fig. 1.—A plan of the machine with all parts identified.

and those shown are approximately 3/16in. dia. Bearings for these, except the reel shaft, are made from tubing to fit the rod, and ¼in. lengths soldered into the side plates and bobbin shaft supports is sufficient. A simple method of ensuring that the bearings are true is first to drill the side plates and supports and mount them firmly on the base plate. Slip the bearings (longer than required) on the shafts and fit them all in their relative positions. The bearings may now be soldered, after which the

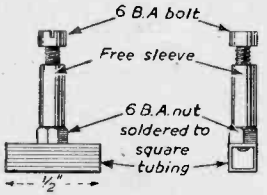


Fig. 3.—Details of construction of the reversing stops.

shafts are removed and the bearings trimmed to the desired length. By this means it is impossible for them to be out of alignment. The same applies to the clutch-actuating rod which is square (so that it cannot rotate around its own axis) and has square tubing to fit, as bearings. This rod *must* have a relatively easy action and should, of course, be lined up with the end of the first toggle. The rod is connected to it by a stout wire link, one end of which is bent accurately around the spacer on the end of the toggle, the other end being bent down to a right angle and inserted into a small hole in the end of the rod.

The reel shaft has a type of quick release method of fixing. A bearing hole is drilled in the left-hand side plate and then a little plate is soldered over the outer side of the hole. The right-hand side plate is similarly drilled and a small swinging plate is arranged to slide over the outside. The shaft is cut to the length of the distance between the outer edges of the side plates and is thus firmly held in position when the moving plate covers the hole. A fixing collar each side of the reel prevents any sideway movement.

The construction of the wire guide is shown in Fig. 4 and is self-explanatory. The 4 B.A. threaded rod upon which the wire guide travels must be long enough to pass through the tubing which forms the shaft for the forward and reverse clutch pulleys, etc. A nut at each end of the shaft serves to lock it to the threaded rod. A short length of tubing is soldered to the other end of the 4 B.A. rod so that it may revolve freely in a suitable hole or bearing in the side plate.

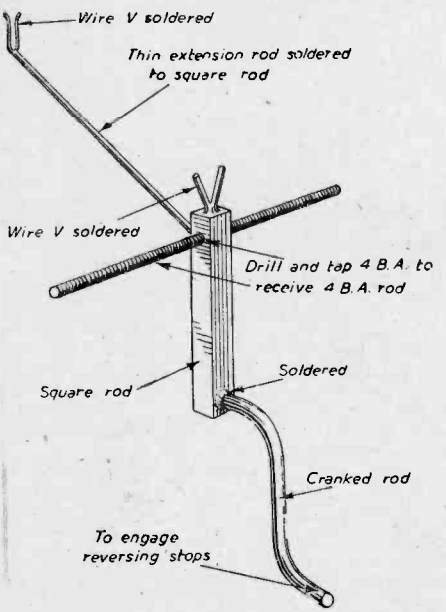


Fig. 4.—Make-up details of the wire guide.

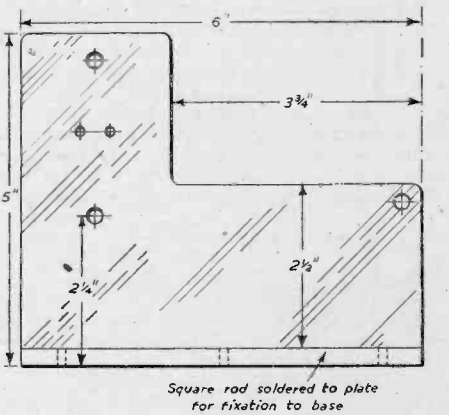


Fig. 2.—Shape and size of the sideplates. Two are needed.

The two guide rods serve to keep the wire guide running in a perpendicular plane and may be of small diameter.

The bobbin holders (see Fig. 1) are made by soldering four triangular pieces of metal equidistantly around the axis of a length of tubing which will fit over the bobbin shaft. Fixing to the shaft is provided for by drilling a 4 B.A. clearance hole, soldering a nut over it, and fitting a 4 B.A. bolt. In use the holders are more or less universal and a round or square bobbin is easily centred and securely held.

The 4-bank pulley on the main shaft and the 2-bank pulley on the bobbin shaft are both made from sheet Perspex. Diameters are shown in Fig. 1. Material 5/16in. thick was used to form the actual pulleys and ⅛in. for the flanges. The procedure is to mark out all the discs required and run a pilot hole through each centre. Then cut out the discs with the aid of a hacksaw or keyhole saw and file the edges true. If facilities are available, the discs may be fastened to the chuck of an electric grinder or polisher and trued up with file and sandpaper. In any case great accuracy is not essential. The discs which form the flanges should have rounded edges. Next drill each disc centre to the diameter of the main drive shaft. *Note.*—Unless care is exercised in the drilling of Perspex the drill is inclined to wander. For this reason the pilot hole is suggested before cutting out. Next, line up the discs on a length of rod and

fix each together with Perspex cement, or if preferred, countersunk machine screws—although this will entail drilling and tapping. When set, drill the centre of the whole pulley bank to a diameter *very* slightly smaller than the diameter of tubing which fits the main shaft. Then taper the end of a

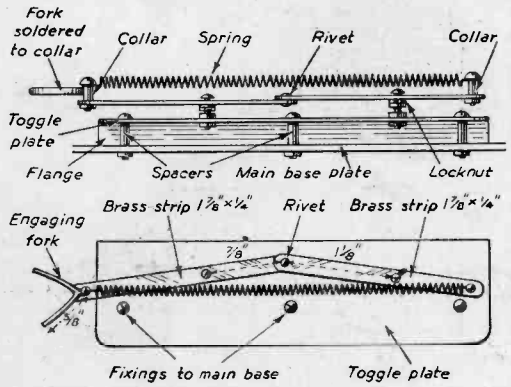


Fig. 5.—The first toggle seen in plan and elevation.

length of tubing and, after heating, push the tube slowly and accurately right through. This will "fuse" the bearing nicely in position. A little experimenting is advisable when heating the tubing, for if too cool it will not slide through and if too hot it will burn and enlarge the hole in the Perspex. Finally, a shaft fixing is provided for by drilling and tapping through the radius of the smallest pulley and on through the bearing tube.

The construction of the toggles is shown in Fig. 5 and 6 and if made up accordingly will operate satisfactorily. It should be realised, however, that the holes around which each strip swivels should be slightly elongated in order to allow of a free action through dead centre. In addition, all moving joints should have a free action. With regard to the second toggle it will be seen from Fig. 6 that it is held by brackets A and B fixed to the side plate. The object of this toggle is to slide the moving clutch plate to the right or left. This is achieved by the one-piece metal tongue attached to the top of the toggle arm and has a swivel joint. The tongue may be bent up from light aluminium and is arranged so that the prongs or tongues engage the outer diameter of the moving clutch plate but do not obstruct the pulleys.

The main clutch pulley which is driven by the main shaft is 1in. diameter, 1⅝in. long and has a flange of some ½in. The size of this pulley, however, is not important and something approaching this size will suffice. The one shown was a wooden wire spool or reel which was available. A bearing, made from tubing to fit the shaft was pressed through the centre and fixing to the shaft provided, for as previously explained.

Figure 8 (which will be given next month) shows the arrangement of forward and reverse pulleys, their associated drive plates and the moving clutch plate. They are shown spaced for clarity and are mounted on a shaft of tubing of a size that is a good fit over 4 B.A. rod. The drive plates are identical in size and shape but one is mounted in reverse in respect to the other.

They are both fixed to the spindle either by means of a driving fit or by soldering. The pulleys measure 1 1/16in. dia. with small flanges and are ¼in. thick. Those shown are small wooden wire spools. Here again the actual diameter is relatively unimportant so long as something approaching these sizes are used. The pulleys are bushed with tubing to fit the spindle, *but not carried right through* so that a recess of a little over ¼in. is formed (see Fig. 8). Into this recess fits the spring (when compressed) so that the pulley, when engaged, may lie flush against its drive plate. A catch pin to engage the drive plate is fitted to the outer edge of both forward and reverse pulleys and may be achieved by driving a little brass pin into the pulley and removing the head. The edge should be slightly rounded so that it disengages freely. These pulleys run free on the spindle.

The moving clutch plate is merely a disc of stoutish gauge metal 2½in. dia. It is free running on the spindle and bushed so that it may slide either way in a true perpendicular plane.

Rubber bands or belts are fitted between the main clutch pulley and forward and reverse pulleys, that to the latter being twisted to effect reversal of direction. Due to the pull of these belts it was found necessary to provide a bearing plate

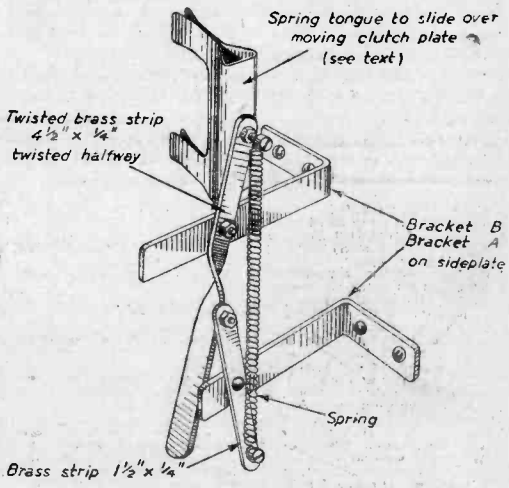


Fig. 6.—Details of the second toggle.

for the two spindle ends. This is shown in Fig. 7. It is just a stout right-angle bracket bolted to the main base plate. The wire tensioning device consists of two pieces of metal 4in. x 2½in. hinged along the 4in. edge. The upper plate has a piece of felt stuck to the area that engages the flanges of the wire-reel. The lower plate lies flat on the base plate and is secured to it by two 4 B.A. bolts screwing into tapped holes. The holes in the wire tensioning plate are elongated to the extent of about an inch so that it may be moved forward or backward, depending on the size of the reel being used. This is the coarse adjustment. The fine adjustment consists of a small three-sided metal flange of] section made to move inside the angle formed by the two plates.

(To be continued)

A.C. Mains Accumulator Charger—2

A Unit Using a Number of ex-W.D. Parts and Capable of Charging Thirty 2-volt Batteries.

By S. BRASIER

VARIOUS methods of connection are illustrated diagrammatically at Figs. 7 and 8.

Where it is required to charge, say, a 2-volt and a 6-volt in series, which would provide an added voltage of 8, set voltage control to 6. If required current cannot be obtained, return current control to minimum and switch voltage control to 12. Then adjust current to desired figure.

It should be realised that voltage and current are interdependent so that the voltage control and current control could be termed respectively,

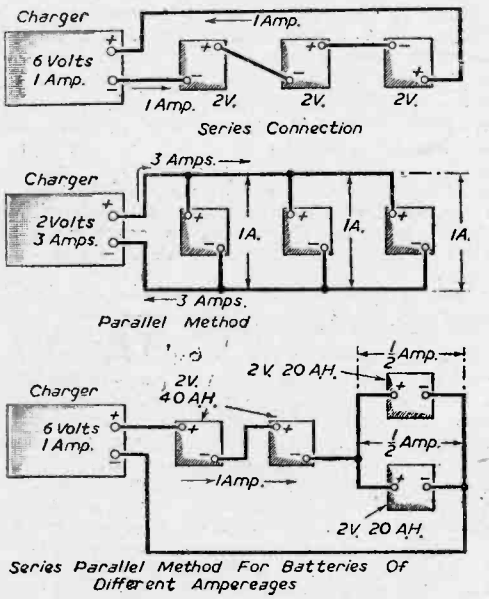


Fig. 7.—Various methods of connecting batteries.

coarse and fine current control. From this it will be appreciated that, under certain conditions, the voltage may be used to increase the charge if insufficient current is available when current control is at maximum. Similarly, if a very low charging rate is required on a certain battery this may be achieved by switching to a voltage lower than the battery. Under all conditions output voltage to battery is more or less self compensated.

For 6- and 12-volt car batteries a maximum current of 5 amps. is available if desired. Two 6-volt batteries in series could be charged at 5 amps. or two 12-volt in parallel at 2½ amps. each.

From the above notes it will be seen that, with a little judicious arranging of connections, practically any combination of batteries may be charged at the correct rate. One final point on this matter. Where batteries of different amperages are connected in series it is important to note that the maximum charging rate of the *smallest* must not be exceeded. In this respect a series-parallel arrangement will often prove helpful, as further reference to Fig. 7 will show.

Modifying Meters

If, as mentioned before, the specified meters are not readily available, most meters may be adapted as follows:—

The Voltmeter.—Select a meter having a basic movement of 5 to about 15 milliamps. The ohms per volt resistance is not of great importance in this case, as the voltage to be measured is low whilst the current is extremely high. In other words, 10 to 15 milliamps is not likely to have any effect across 1-5 amps. For this reason also it is rather an extravagance to use, for example, a 0-1 mA meter, as this range could be put to a more useful purpose. Assume, therefore, that we are dealing with a 0-10 mA meter. We can find

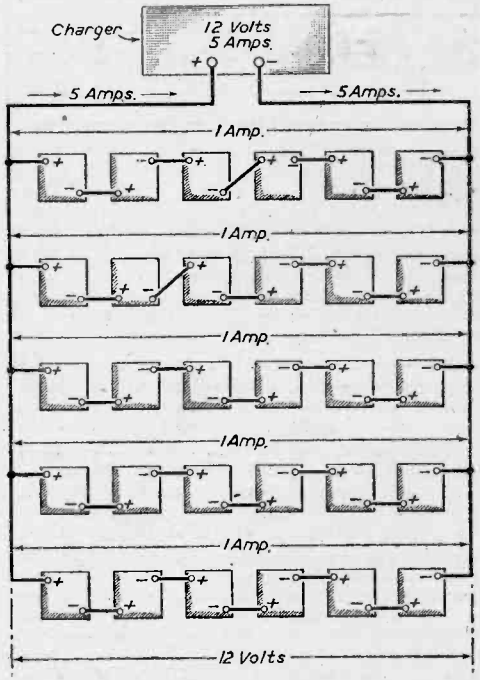


Fig. 8.—One method of connecting thirty two-volt cells.

the ohms per volt required by dividing 10 into 1,000 which is 100. Our series resistor for 7.5 volts will then be $7.5 \times 100 = 750$ ohms, and for the 15 volt range $15 \times 100 = 1{,}500$ ohms.

It is unlikely that resistors of these values will give just the deflection required due to the percentage tolerance so they have to be calibrated to the exact values given above. This is quite easy, but it will first be necessary to divide the meter scale into 7.5 equal parts. This is usually fairly simple by counting the subdivisions and marking off with Indian ink. If it is more convenient the scale could be marked into eight parts provided the appropriate resistors are used for 0-8 and 0-16 volts range.

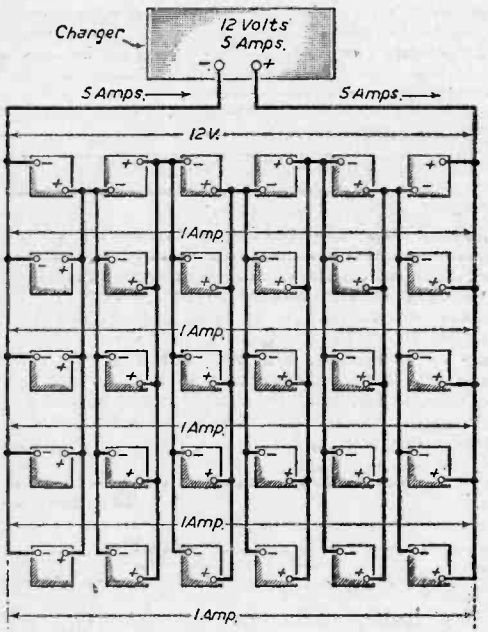


Fig. 9.—Another method of connecting thirty two-volt cells.

Having done this, obtain carbon resistances of rather *lower* values than those given above, say about 700 and 1,250 ohms. Obtain a new 9-volt grid-bias battery and connect the 700 ohms resistor in series with the meter across 4.5 volts of the battery. The reading should be something above 4.5 volts. Next disconnect the resistor and with a small rough file remove a portion of the insulation until the carbon is exposed. Continue filing a little of this also, then reconnect resistor to meter and battery. The reading will be seen to be nearer the 4.5 volt mark. Further discriminate filing will make the reading exact, and this will remain so throughout the whole scale. Treat the 15-volt range resistor in the same manner, checking at 7.5 or 9 volts. Both resistors should be given a coat of enamel, then mounted on a paxolin strip and wired according to the diagram. If another voltmeter is available to check the grid battery, so much the better, but otherwise one can rely on the voltages of a new battery being accurate enough for the purpose.

The Ammeter.—The meter used here may have a much higher basic range, and anything from milliamps up to the required number of amps. may be used. In order to give the full scale deflection of 5 amps. a shunt must be used across the terminals, and in view of the fact that readers may use meters having varying basic movements one can only help in this respect by giving the formula for shunts. This is, Resistance of shunt equals $\frac{\text{Res. of meter}}{\text{N. minus 1}}$ where N = the number of times the range of the meter is to be extended. It will be found that the result, in most cases, will come out to a fraction of an ohm. This means that unless one has a very accurate low-reading ohmmeter available, trial and error has to be resorted to and the following procedure may be adopted.

From the above formula find the resistance of the shunt in ohms. Then from a Resistance Wire Data Table ascertain a gauge that will carry the required current of 5 amps., less the current taken by the meter. From the tables one can also find what length of wire will give the required resistance for the shunt. Use a length of wire slightly in excess of this and connect it across the meter. Next mark off the scale into five equal parts.

Calibrating the Ammeter

For calibration it is essential, for accuracy, to make use of another ammeter for checking purposes. The range need be only 1 or 2 amps., and this meter is connected in circuit on the charger according to the diagram. Connect up a battery and adjust charge to about 1.5 amps. Having made sure that the shunt is firmly connected across the other meter, join this in series with the checkmeter and note the reading. This should eventually be the same as the check meter, so the shunt has to be adjusted by very gradually shortening the wire until both readings are identical. It is of the utmost importance that the instrument be switched off before disconnecting the shunt for adjustment. Equally important is the fact that when checking the shunt it must be really well joined under tightened terminals, for an imperfect or light connection will give entirely erroneous readings due to the extremely small resistance being dealt with. And if the shunt breaks circuit completely the meter will, in all probability, be ruined.

Another method of shunting, and the one adopted by the writer, is to use a German Silver shunt from, say, a 15-amp. meter and file it all around its length until the desired reading is obtained.

Finally, when buying ex-Government meters, it is as well to bear in mind the scale markings required, so that they may be easily modified to the purpose in view. For this ammeter, for example, which requires a 0-5 scale marking, one could easily use a 0-5 milliamp or volts scale or a 0-0.5 amp. by erasing the decimal point.

Britain's First Ultrasonic Generator

A New Mullard Product with Wide Applications

THE Mullard Ultrasonic Generator (type E. 7562), now on the market, is the first commercial generator to be produced in this country. It is designed to fulfil the need for an experimental unit of wide flexibility.

The generator, comprising a control panel with meters, power oscillator, output voltmeter, relay panel and power supply, is mounted in a tubular frame. Trolley wheels are provided for ease of transport and the cover is adequately ventilated. Four pull-out handles simplify lifting the generator and are movable panel—with quick-release fasteners at the rear of the cover—gives access for fuse and valve replacements.

The R.F. output is generated directly by a silica triode capable of producing one kilowatt of R.F. power. Four plug-in coil assemblies, which are rapidly interchangeable, are provided for operation around nominal frequencies of ¼, ½, 1 and 2 Mc/s.

The valve is matched to the crystal impedance by tapping the anode down the coil in the output circuit. Fine tuning of the output circuit and adjustment of grid coupling are effected by means of variometers.

The oscillator is housed in the upper portion of the frame with the control panel immediately above. On the lower deck is the power supply comprising two grid-controlled mercury vapour rectifiers, the filament transformer and the H.T. transformer.

The quartz crystal is contained in a metal case. It is connected to the generator by means of a co-axial cable. The crystal has silver electrodes fired on both sides to which the driving voltages are applied.

To give the maximum ultrasonic output in the forward direction the generating crystal is air backed. The limitations on the temperature at which the transducer can work are set by the polythene of the cable and the rubber sealing rings. If silastic rubber is used and the back of the holder is adequately cooled, the crystal can safely be immersed in liquids at temperatures up to at least 150 deg. C.

Cradle of Wireless

FIFTY years ago Marconi bridged the Channel by wireless for the first time. Much of the experimental work for this and his later triumphs was carried out in the sitting-room of the Haven Hotel, Sandbanks, where, protected from would-be interviewers by the French proprietor, he resided from 1898 to 1926. Outside the hotel the 100-feet high aerial mast dominating the entrance to the vast expanse of Poole Harbour became the focal point of charabanc tours from Bournemouth and the surrounding district. The crowds who came to stare in idle curiosity remained to gaze with envy at Marconi's famous yacht the *Electra* lying at anchor off nearby Brownsea Island, the birthplace of the Boy Scout Movement.

The sitting-room which was Marconi's laboratory was some eighteen feet square with long windows looking across to the Purbeck hills and the Dorset lake country so beloved by Thomas Hardy. Under these windows stood a long line of small tables containing transmitting and receiving equipment, the simple apparatus with which he and his assistants had to work and the primitive coils, transformers and condensers from which wireless and radar have evolved.

In 1926 the small cream-painted building was pulled down to make way for the new Haven Hotel, a palatial building which stands on the extreme tip of Northaven point with the sea on three sides. Marconi took a great interest in the successor to the old building which true to its name had offered him a haven at a crucial period in his experiments.

A special commemorative plaque was struck for the lounge, the site of the room where he had wrestled so long and tirelessly to solve the most difficult of all scientific riddles—the characteristics and behaviours of radio waves. The inscription which Marconi provided reads:

In This Room Which May
Truly be Called the
Cradle of Wireless
GUGLIELMO MARCONI
During the Years from 1898 Until
1926 Conducted some of His Most
Important Experiments in Wireless
Telegraphy and Telephony and Laid
The Secure Foundations of a Science
of Inestimable Value to Humanity.

In 1940 the Haven Hotel was requisitioned by the Army and the plaque was removed to a place of safety, the Haven was turned into a fortress to guard the entrance to Poole Harbour, the jetty was blown up, gun emplacements built and tank traps sown over the sea defences as counter invasion measures. It suffered badly at the hands of the enemy since a direct hit in a low level attack demolished one wing. Eventually the building was derequisitioned. Reconstruction has taken a long time but now the historic Haven Hotel has been completely restored and opened at Easter to play its part in attracting overseas visitors to this country.

WATCH YOUR DUSTBIN

Waste Paper, Cartons, Cardboard should be kept separate, dry and clean for salvage.

A 12-wa

Details of an A.C. Unit with Built-in

By

THIS amplifier was designed to give really first-rate quality in conjunction with pick-up or tuner of comparable performance. If the reproduction system is thought of as a chain, then its ultimate performance cannot be any better than the quality of the poorest link. Therefore, each link must be as near to perfection as time, skill, knowledge and pocket will allow.

On radio, the first links are in the hands of the B.B.C. The result is sometimes unfortunate, sometimes very good; it behoves the "quality" enthusiast to ensure that *his* links are above reproach. The writer uses a single H.F. stage (SP41), followed by an "infinite impedance" detector (MHL4), with tone correction circuits.

On gramophone, the writer uses a moving-coil pick-up and miniature sapphire.

The loudspeaker end is a triple-cone 12in. speaker, in an infinite baffle of optimum dimensions working on to large reflecting surfaces.

Circuit Requirements

Low input requirements were considered essential. It was also decided that triodes in Class A push-pull should be used in the output stage and so the ubiquitous PX4s were chosen. With an anode voltage of 300 and 6,000 ohms anode-to-anode load, an output of 12 watts can be obtained at a nominal 1 per cent. harmonic distortion. This figure assumes perfect balance and bias conditions. It was, therefore, decided that balance should be adjustable and that a built-in meter would be essential. The drivers should also be properly balanced. These four valves could be metered individually at the turn of a switch.

The drivers were to be medium impedance triodes with fairly low anode loads. By using the "floating paraphase" circuit, the drivers could also act as a phase-reverser, thus saving the use of an additional valve as a phase-splitter. A note on the operation of this circuit may be a help to some. (Fig. 2.)

With the system working, the two anodes are always 180 degrees out of phase, or nearly so. Therefore, when point A is going more positive, point B is going less positive. Some point O between the two is therefore at zero A.C. potential and the slider is adjusted to tap off the right phase and proportion of voltage to drive V_4. A large degree of self-balance is achieved since, if the amplification of V_3 falls, point O moves nearer to the slider and so the voltage driving V_4 decreases. On the other hand, if the gain of V_3 rises, point O moves farther to the right and the voltage to the grid of V_4 increases. Similarly for V_4. *Perfect* self-balance is impossible owing to the presence of Rg.

Two high-gain stages would be necessary preceding the drivers to make up the loss due to bass-compensation and negative feedback.

Negative feedback gives us a great many advantages—reduced distortion, reduced hum and noise, improved frequency response and also better damping of the loudspeaker, which reduces its resonances and improves its transient reponse. Its only real disadvantage is reduced gain.

SP41s are available cheaply as ex. W.D VR65A and so these were used for V_1 and V_2.

Controls

The volume control and "Gram-Radio" switch were to be in the grid circuit of V_2. The tone controls would not then operate on "Radio" since the tuner should have its own tone controls as its requirements are so different from those on "Gram."

Feedback would be taken to V_2, since tone-controls would be in the V_1 circuits.

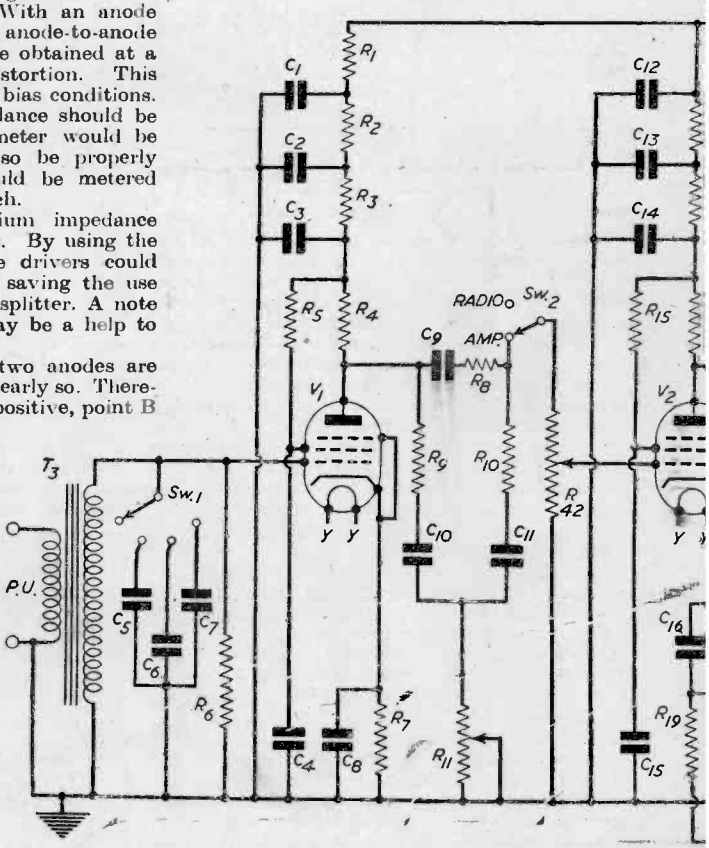
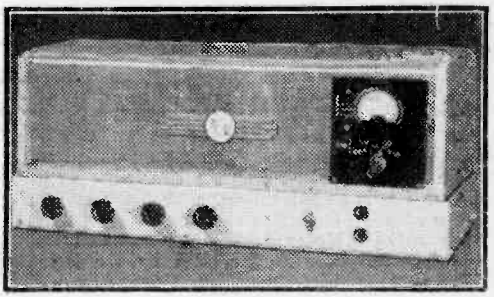


Fig. 1. Theoretical circuit

Amplifier

r, and Bass Compensation for Records

COCK



The finished amplifier in its case.

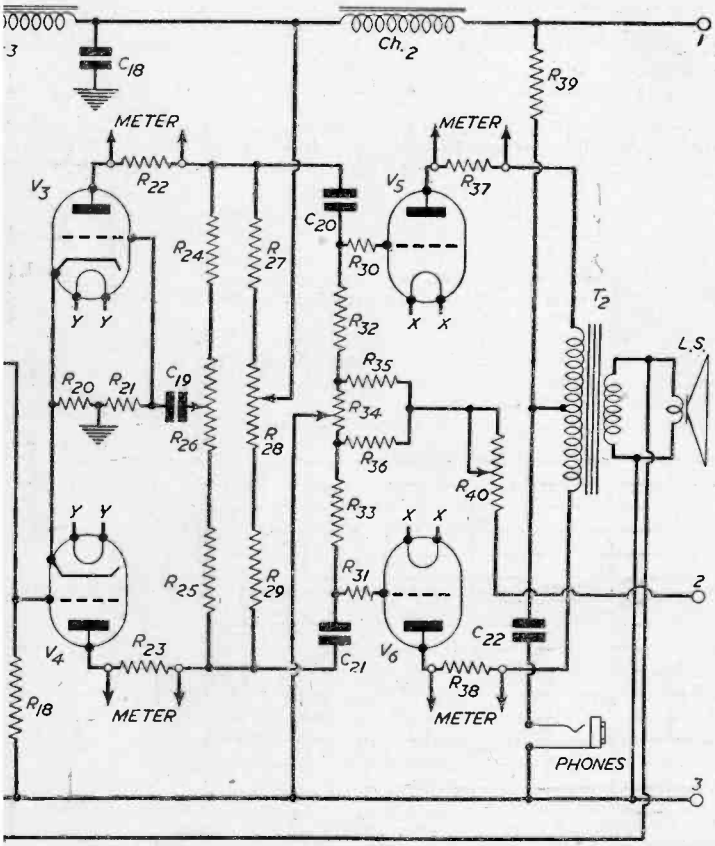
About 14 db. of *current* feedback could be used on V_1, if desired, by the simple device of omitting the cathode decoupling condenser. The gain of this stage would then be reduced to one-fifth of its normal gain.

The bass-compensation circuit would be a two-stage affair, which gives adequate compensation at low frequencies.

Referring to the final circuit, R9 and C10 are in series across the load of V_1, the gain of which, therefore, varies with frequency. Additional lift at very low frequencies is given by R8, R10 and C11. R11 is the bass control. When R11 is shorted out, boost is at a maximum—more than the standard 6 db. per octave from 300 c/s downwards. With the whole of R11 in circuit, boost is negligible and also the gain of V_1 is very much greater so that sufficient gain is available to use a microphone in the grid circuit of V_1.

For top cut, a condenser across the secondary of the pick-up transformer gives the effect of a half-section of a "T" low-pass filter. The condenser values given produce the effect shown Fig. 3 in conjunction with the "straight" transformer for the Wilkins and Wright "Coil" pick-up. For other transformers experiment will show what values are needed.

This type of top-cut circuit has a greater effect on scratch with less detriment to music than the usu variable condenser from grid to earth.



e 12-watt A.C. amplifier.

Power Pack

This is quite conventional. A directly-heated, full-wave rectifier (FW4/500) is used, although a 500 v. 120 mA valve, such as the DW4/500, could be used. This would be running close to its maximum, however, so the FW4/500 is probably the better choice.

The reservoir condenser is 4 μF as it is kinder to the rectifier. However, if the H.T. voltage across C24 is less than 350 volts, due to a high-resistance choke or other cause, an 8 μF condenser will have to be used.

To prevent hum due to heater-cathode emission, the centre-tap on the heater winding for V_1, V_2, V_3 and V_4 is not taken directly to earth, but is connected to a point about 10 volts positive to earth. This is the junction of R40 and R41. It is de-coupled by C26.

Final Specification

Maximum Output = 12 watts.

Mains consumption = 100 watts approx. (230 v. A.C.).

R.M.S. inputs for full output.

To grid of V_1 (max. bass boost) = 20 mV.

To grid of V_1 (min. bass boost) = 1.5 mV.
To grid of V_2 = 200 mV.
Negative feedback = 22 db over 3 stages.
Damping factor $\frac{(RL)}{(2RA)} = 63$.

Construction

In the amplifier built by the writer it was required that all input and output jacks and sockets should be at the back, items on the front panel being Gram/Radio switch; Top cut; Bass boost; Volume control; On/off switch; Fuses (panel mounting type); Meter and Meter switch. V_1 was therefore mounted at the back by the input jack. To avoid long leads from V_1 to the front panel, potentiometers and switches were mounted at the back and operated by extension spindles from the knobs on the front panel. If inputs can be mounted on the front panel the use of extension spindles can be avoided.

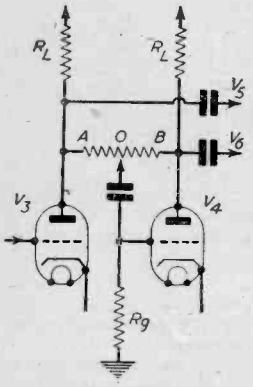


Fig. 2.—Circuit of the "floating" paraphase inverter used in this amplifier.

The amplifier chassis was of 18 s.w.g. aluminium 22in. x 10in. x 2½in., with sub-chassis screens dividing the underside into seven compartments (Fig. 4).

The last compartment, No. 7, is formed by the other six and holds CH3 and some decoupling components. All heater wiring is run into this compartment from the power pack, and does not leave it until close to the appropriate valveholders.

From the input jack the signal goes to the pick-up transformer, which is right up in one corner of compartment No. 1 with the holder for V_1 next to it. From the secondary, a screened lead passes to switch No. 1, which is in compartment No. 6, and also to the screened top cap of V_1. All screened wire should be covered with insulated sleeving and earthed *at one point only* in its appropriate compartment. Screen decoupling condenser is mounted close to the valveholder. Anode decoupling is mounted in compartment No. 7. The output is taken via the bass-boost network to switch No. 2, which is mounted on the screen dividing compartments 1 and 2, and from there to V_2, in compartment No. 2, via the volume control.

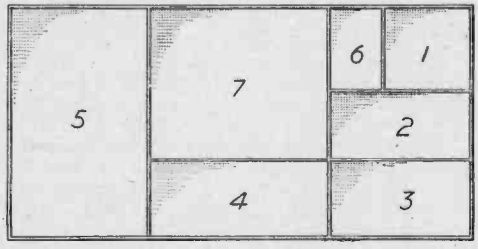


Fig. 4.—Details of the sub-chassis compartments.

V_2 is similar to V_1, but without the tone network. The cathode decoupling condenser is connected with the positive tag to cathode and the negative tag to the junction of R16 and R17. With some types it may be necessary to insulate the metal can from chassis.

The output from V_2 is fed to V_3, which is mounted in compartment No. 3, together with V_4 and their associated potentiometers R26 and R28 and the meter sockets carrying the resistances, R22 and R23. The odd size (1,330Ω) will be explained later.

V_5 and V_6 are in compartment No. 4 with the balance potentiometers R34 and R40, and their meter sockets.

(To be continued.)

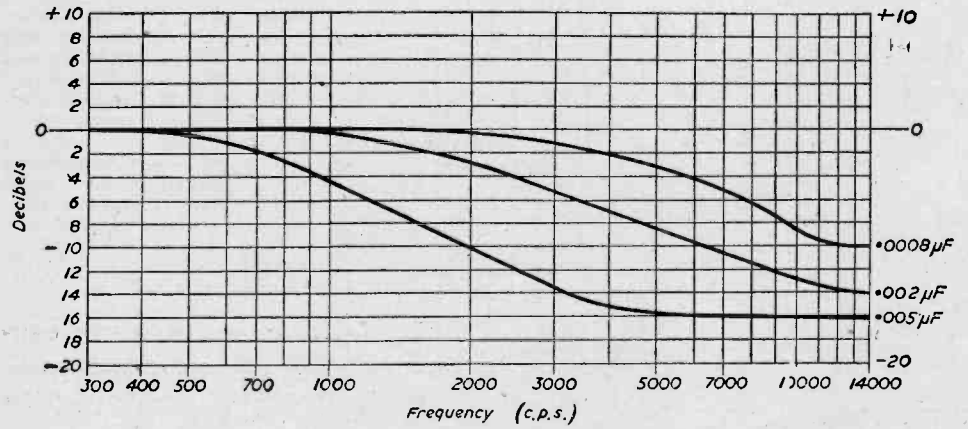


Fig. 3.—The top-cut response curve.

A Push-button Band and Station Selector

How to Wire a Standard 5-button Unit for Multi-circuit Switching

By F. G. RAYER

THIS unit functions as wavechange switch and station selector with preset tuning for two medium-wave and one long-wave transmitters. It also allows ordinary manual tuning to be carried out on either the long or medium waveband, and provides a short-wave range with manual tuning only. Five coloured leads (plus earth return), are the only external connections, so it should be possible to incorporate the unit in many of the simpler types of receiver, where it would replace the wavechange switch. Alternatively, a receiver may be built up round the unit, and a three-valve mains circuit which has been found to give good results is described later.

How the Unit Operates

Reference to Fig. 2 will enable the method of operation to be understood without much difficulty. The unit itself consists of the five two-way switches and the preset condensers C1, C2 and C3. The tuning coils and tuning condenser are external to the unit, and may be those already used in the receiver. Any screened or unscreened dual-range coil is satisfactory, but the S.W. coil must have an aerial coupling winding, as will be described.

In Fig. 2 no aerial or reaction windings are shown because the circuit is so arranged that these do not require to be switched. This saves complication and extra switch contacts, and works well.

In Fig. 2 all the switches are shown as contacting the left-hand contacts and with all the push-buttons released this is the form the circuit takes. When any button is depressed contact is transferred to the right-hand tags and the button only springs back to the position shown when any other button is depressed.

When the top button is depressed the other four will be as shown. The valve grid is, therefore, connected to the L. and M.W. coil, and to the three

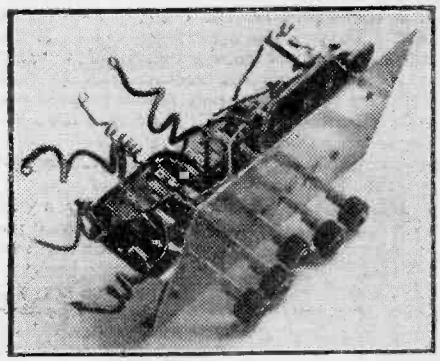


Fig. 1.—The unit ready for use.

preset condensers. The centre button has switched the coil to medium waves, so C1 may be adjusted to receive a desired M.W. station.

Upon depressing the second button, C2 is connected and C1 disconnected, other connections being as before. This provides for a second M.W. station.

If the centre button is depressed C1 and C2 are disconnected and C3 brought into circuit. At the same time the dual-range coil is made to operate on long waves, thus providing one L.W. station.

When the button "Manual Tuning" is depressed the three preset condensers are disconnected and the tuning condenser connected. This provides ordinary manual tuning on medium waves. If manual tuning on long waves is required the centre button is depressed as well. If manual tuning on short waves is required, the bottom button is depressed with the manual tuning button.

It is suggested the Third Programme and one of the Home Service stations be selected on M.W., and the Light Programme on L.W. though naturally other stations can be chosen. As any station to which the tuning condenser is set will be received when the fourth button is depressed, this really means the unit provides for four selected stations, besides manual tuning on long, medium and short waves.

Supposing the stations men-

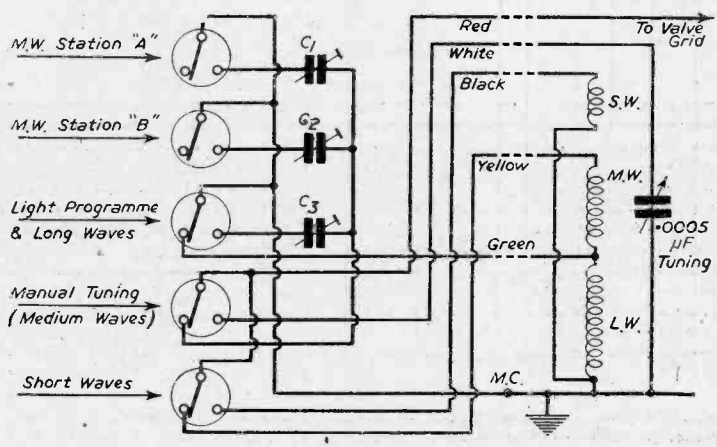


Fig. 2.—Theoretical circuit with coils and tuning condenser.

tioned have been selected, then the method of operating will be as follows:

Depress top button to receive Home Service. Depress second button to receive the Third Programme. Depress centre button to receive the Light Programme. Depress fourth button for manual tuning on medium waves. Depress centre and fourth buttons for manual tuning on long waves. Depress fourth and bottom buttons for manual tuning on short waves.

Wiring the Switch

Fig. 3 illustrates all the connections. To provide screening and allow the preset condensers to be fixed securely, a metal panel 3in. by 6in. is cut, and the switch is mounted on this. The two larger preset condensers are bolted to the panel so as to occupy the free space at the right. (Not shown in Fig. 2 to clarify wiring.)

Wiring is very straightforward but one point should be remembered. This is, that the leads from the valve grid (or grid condenser), tuning condenser, and S.W. coil should not be longer than necessary, especially if a fairly low minimum wavelength (say one enabling the 13 metre band to be tuned) is aimed at. Losses in the push-switch itself are probably no greater than in the usual low-loss rotary wavechange switch.

If coloured leads are used, as indicated, this will facilitate wiring the unit to the other parts in the receiver. The terminal "M.C." is in contact with the switch frame and panel, and should be connected directly to the moving plates tag of the tuning condenser.

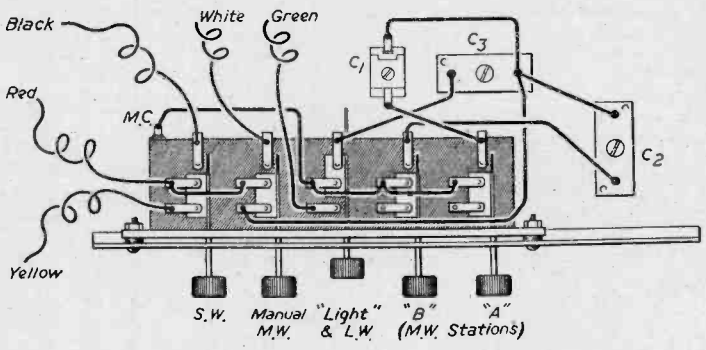


Fig. 3.—Wiring diagram of the unit (condensers not mounted).

Preset Capacitances

These are not shown because the average preset condenser does not have a particularly large range, with the result that if .0005 μF. components were used throughout (the usual tuning capacity) it might be impossible to reach stations of low wavelength.

For the Light Programme (on long waves) a capacity of about .00025 μF. is normally required, and any .0003 μF. or .0005 μF. preset should prove suitable.

A .0005 μF. preset will be required for the Third Programme on 514.6 metres, though if the alternative wavelength of 203.5 metres provides better reception, then a small postage-stamp condenser of .00005 μF. maximum will normally prove sufficient.

A condenser of .0003 μF. maximum will normally enable any of the Home Service stations to be received, excluding the North on 449.1 metres, which will require a slightly higher value.

Some idea of the capacity required can be obtained by noticing the extent to which the plates of the tuning condenser interleave, when receiving the station under manual tuning control. Normally little or no difficulty should arise in selecting a suitable preset for each station, provided what is mentioned above be remembered. If the

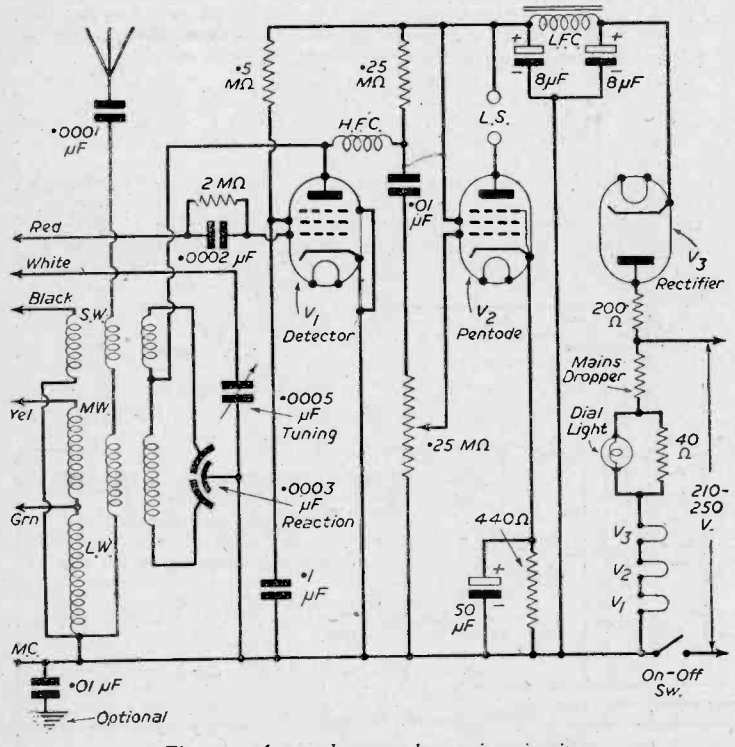


Fig. 4.—A complete 2-valve mains circuit.

capacity of a condenser proves too high, then a plate or two may be removed or bent back.

When adjusting the preset condensers, it is merely necessary to depress the appropriate button (marked "A," "B," and "Light." in Fig. 3) and set the condenser screw so that the desired station is accurately tuned in. This preset tuning position will then be selected in future when the button is depressed.

Complete Receiver Circuit

Any standard battery or mains-operated circuit of the detector-L.F. type can be used, and a mains circuit which was found to give good results is shown in Fig. 4. (The switch itself is not shown, connections being marked to agree with Fig. 3.)

The coil part of the circuit requires a few notes. To avoid switching the reaction windings (and no extra contacts are available on push-button switch of the type used) a differential condenser is employed. The S.W. and L. and M.W. reaction windings are each connected to a different set of fixed plates on this condenser and this provides perfect and smooth control of reaction over all ranges, though, of course, the control knob has to be turned in the reverse direction for L. and M. waves, to that necessary on S.W. In practice, this proves straightforward and satisfactory.

Though a dual-range coil with aerial coupling is shown, a coil with an aerial tapping on the tuning winding can be used. But the S.W. coil must have a separate aerial coupling winding, and this should be interwound with the lower turns of the grid winding. If a S.W. coil is to be made up, then twelve turns of 20 s.w.g. tinned copper wire on a 1in. diameter former (preferably ribbed) will enable the more popular frequencies to be covered with a .0005 μF. tuning condenser. The turns should be spaced by about the diameter of the wire. For aerial coupling, five turns of 36 s.w.g. double silk covered wire are interwound between the turns of the grid winding, at its earthed end. For reaction, nine or ten turns of 32 s.w.g. wire are used. Fig. 5 illustrates this coil.

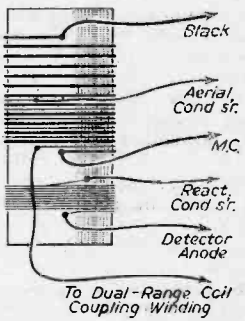


Fig. 5.—Details of a suitable short-wave coil.

The tuning condenser should be a good quality component with an efficient reduction drive, otherwise S.W. tuning will be troublesome.

Circuits other than that shown in Fig. 4 may be used, and component values will require to be adjusted accordingly. Here, an output pentode such as the 25A6G or 43 (same type with U.X. base) is suitable. For detection, a 6K7 is intended, and the rectifier can be a 25Z4G, 25Z6G, 25Y5, or any of its equivalents. But it should be repeated there is a wide range of battery and mains types to choose from, and any of these should function satisfactorily in an appropriate circuit.

B.R. Now Radio Telephone Users

FOR some months now British Railways have been testing out the Radio Telephone as a means of helping them in the business of sorting out goods trains. At the marshalling yards at Whitemoor, near March, in Cambridgeshire, goods wagons from all over the country are sorted out by the simple process of pushing them up a slope, and as they run "free" down the other side switching them on to various sidings where trains for different parts of the country are made up. This is a simple enough process, but one which is severely handicapped by bad weather and particularly by fog.

Pye on the Engine

Now a main station Pye Telecoms set has been installed at the control tower, and each of the diesel shunting engines is equipped with a "mobile" set. A party of Press representatives was taken to the yards a few days ago to see how successful the new system is. Instead of the hand to hand signalling which was formerly used, the control tower talks directly to each loco and tells it when more or less speed is required, and receives from it the destination particulars of every truck. When the locos are required in distant parts of the yard the control tower is able to direct the engine there directly and without trouble. Veteran railway men who talked to the reporters declared themselves wholly in favour of the new system, and high ranking officials of British Railways Executive proudly announced that other marshalling yards would be similarly radio controlled in the future. It is only fair to say that the nationalised railway is carrying on the good work which was started by the private companies before nationalisation started, but let us hope that "our" railway (since we are all part owners of it) will extend this useful system and show the rest of the world that Britain can still lead the way.

News from the Trade

A New Double Triode

THE new double triode Type ECC33 recently introduced by Mullard Electronic Products, Ltd., should prove of immense interest to all designers of industrial electronic equipment. In this valve the combination of medium/low anode resistance, high working current, high slope and low heater current make it ideal for an unusually large number of functions. This means that in a great number of circuits the Mullard ECC33 may be used throughout any equipment. The problem of maintenance and valve replacement is thus simplified.

In practically all cases this valve can be used to replace existing 6SNGTs and then confers the advantage of a 33⅓ per cent. saving in heater current.

The characteristics of the valve are specially targeted upon such varied applications as counting, scaling, multi-vibrators and in flip-flop applications, relay operation, timing, photo-cell amplifiers, etc.

Scophony-Baird Appointments

J. D. PERCY, Rank's head of large-screen engineering, has joined Scophony-Baird, Ltd., as Director of Television Development.

Mr. Percy is son of the late Sir James C. Percy, one of the original directors of the first Baird Co. Mr. Percy has been in television since 1928, with the exception of the war period when he was a naval officer in the submarine service.

A. J. Gale, late engineer-in-charge of the Radio-Tel Groups Television Development, becomes Television Production Manager for Scophony-Baird.

It is interesting to note that both Mr. Percy and Mr. Gale in 1937 demonstrated next door to each other in the West End the rival Baird and Scophony large-screen television system. They now combine under the united banner of Scophony-Baird, Ltd.

Additions to Plessey Range of Loudspeakers

THE new range of loudspeakers recently announced by Plessey has been extended. All permanent-magnet speakers, with the exception of the 3in. model, are now available with a voice coil impedance of 3 ohms.

It has also been found practicable to make the 6½in. and 8in. models available with alternative magnet assemblies in both the 3- and 5-ohm range.

These will provide, where it is particularly required, an even higher degree of sensitivity, better damping, and increased frequency response than the standard models.

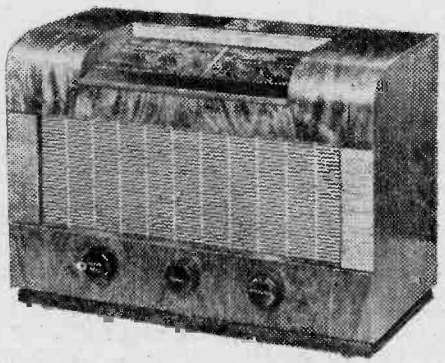
E. K. Cole Appointment

E. K. COLE, LTD., announce the creation of a new post in their Electronics Division by the appointment of the Rt. Hon. Lord Waleran as commercial manager. Since joining the company some 12 months ago Lord Waleran has been engaged on the commercial development of Ekco V.H.F. equipment and other specialised products.

New H.M.V. Receiver

THE new moderately priced receiver (Model 1120), which costs 21 guineas plus £4 15s. 7d. Purchase Tax, incorporates such features as five wavebands, flywheel tuning, extension loudspeaker and pick-up sockets, and a very handsome walnut cabinet.

This new model provides long-, medium- and short-wave reception with equal facility. Semi-



The new H.M.V. Model 1120.

bandspread short-wave tuning, by "stretching out" the waveband scale, greatly simplifies station selection, whilst the large, clearly calibrated horizontal scale enables stations to be readily identified.

"Excell" Intercom. System

THIS new system by Charles Amplifiers, Ltd., has especially interesting features. Complete secrecy is ensured in both directions, and a unique feature is an automatic "engaged light" on the staff stations. This is a light which comes into operation whenever the master is engaged. Also interesting is the fact that all inter-connections are by twin screened wire, the twin leads fulfilling the functions of loudspeaker and microphone lines, and "call light" and "engaged light" return lines. To prevent the current for the engaged light (which returns through the loudspeaker) causing an obtrusive hum the supply for this is taken from a D.C. rectifier.

The Master Unit (for up to six stations) costs £25, and each sub-unit, £4 10s. Current consumption is about 40 watts.

Taylor Price Reductions

FOLLOWING the increased efficiency of production methods, Taylor Electrical Instruments announce a series of price reductions of some of the most popular models in their range of radio test equipment, the instruments affected being as set out below:

Model	Old Price £ s. d.	New Price £ s. d.
70A	11 11 0	10 10 0
75A	14 14 0	14 0 0
85A/P.. ..	19 19 0	18 10 0
85A/S.. ..	18 18 0	17 10 0
110B	12 12 0	11 0 0

The above reductions came into force on April 1st.

Programme Pointers

This Month Our Music Critic, MAURICE REEVE, Reviews Some Recent Programmes

THE B.B.C.'s programmes, on the entertainment side, can be roughly divided into the single performances, such as radio plays, symphony concerts, sporting commentaries, etc., and the special features, like "Much-Binding-in-the-Marsh," etc., given weekly almost throughout the year. Of the two kinds, there can be few disputants to the statement the former are, by and large, far the superior. Perhaps it is because of the freshness and keenness which imbue both artists and listeners that give most single performances their enhanced quality. The knowledge that it is only going to be done once, not counting a couple of repeats in other programmes, is evidently stimulating to all concerned, whilst many of the chief contributors to these single shows are distinguished visitors to the microphone rather than professional broadcasters, in the usually accepted meaning of the term. In fact, the lowest levels reached are usually in such things as the oft-repeated standard items in the concert repertory, where boredom and ennui are not infrequently very obvious.

But most of the regular weekly turn-ups have got into frightful grooves and one-way tracks, and, like another well-known form of turn-up, need a good brushing. I have heard "In Town To-night" two or three times recently, and found it boring and stereotyped to a degree. We can expect a song or two and either an accordion or banjo solo, usually all very amateur, and which can only be considered "interesting," in the programme announcement's meaning, on a very long stretch of the imagination. The signature tunes, both coming on and signing off, together with those between interviews, are worn threadbare, though for the most part pleasant. Whilst as to the item, "Let's Go Somewhere," perhaps we are meant to go as far away from the microphone as possible. One Saturday Brian Johnston interviewed a taxi-driver and on another a waiter in a well-known restaurant. Whilst the last programme I heard Mr. Johnston interviewed himself having a turkish bath! I ask you! The term "interesting people who are in town to-night" is meant to imply, if it doesn't specifically state, that they are interesting people who are *passing through* London on their way to or from the provinces or abroad, and who have been snapped up for a short interview by virtue of this fact and their differences from the ordinary people we have to meet with in the course of the daily pursuit of our lawful occasions. How such permanent fixtures to the London scene as I have mentioned can, with all due respect to the pleasant and entertaining Mr. Johnston, qualify for this feature, I quite fail to see.

Tutankhamen's Tomb

"The Tomb of Tutankhamen," on March 3rd, was a splendid broadcast. Few events have created in our time such a thrill as the discovery, in 1924, of this famous tomb intact, and the vista it opened up of a civilisation 4,000 or more years gone. The papers and illustrated magazines were full of it for weeks. Leonard Cottrell's programme brought it all before us again, and many of us must have realised how colourful, dramatic and romantic the past could be compared to our too-often dull, drab and commonplace present. Now for a Stonehenge programme, not to mention Montezuma or Trevelyan's Social History.

Welcome to the return of "Hi! Gang," the bright and peppy little show made famous in the early days of the war and the blitz by Vic Oliver, Ben Lyon and his charming wife Bebe Daniels. This show should prove most popular, and the vitality and charm of the leading protagonists well able to keep it imbued with the *joie de vivre* that most weekly regulars lose as time passes—"Much-Binding-in-the-Marsh" always excepted. Mentioning which reminds me that I thought Sam Costa's "unwonted" indiscipline and butting-in on the "Music Hall" most amusing; it quite put a breath of life, and certainly of laughter, into this long-toothed and jaded item.

A Refresher Course

"Music Magazine," on Sunday mornings, makes a very useful, and pleasant, way of picking up tips about new music; it also serves as a short "refresher" course in the classics. Combining, as it does, first-class speakers with interesting records and first-class artists to illustrate the talks, it makes, with "The Critics," excellent and stimulating Sunday morning entertainment.

I have been very surprised, and shocked, recently, to notice that London theatre audiences are bringing to the theatre the wireless studio audiences' habit of applauding every joke or remark that registers with them. In the studio, handclapping as well as laughter seems to be a necessary underlining, as if were, of the listeners' appreciation of the fare being provided for them. To me this is always distressing, handclapping having always been recognised as a vulgar, though, at the end of a work, unavoidable, method of registering one's approval, just as shouting and bravo-ing shows one's super approval and demand for an encore, and hissing and booing one's disapproval. At the end of a show it has become a precedent to demonstrate our feelings and opinions in this way.

But to break into and hold up the dialogue of a play, even to the extent of forcing the actors to hold their positions in the meantime, seems to me disgraceful and reprehensible to the last degree. Up to a hundred years ago this was common practice even in the concert hall, and Beethoven symphonies, etc., were broken into with handclapping when melodies and rhythms exercised a sufficiently compelling appeal on audiences unacquainted with either critical faculties or manners. And much the same happened in the theatre with the famous passages from Shakespeare, etc. But it all passed away, and not even during the days of the great actor-managers, who thought nothing of letting the whole play be held up whilst they received their due meed of homage on their first entries, was further interruption of such a kind tolerated. That, too; has gone the way that all bad things should go, and we can only hope

the B.B.C. will put its restraining hand on the practice, even in its lightest shows, before it begins to spread itself again. Let audiences laugh their heads off by all means; it is good to listen-to as well as take part in. But I was criticising something quite different.

Unwanted Lectures

Another point which requires immediate attention is the little lectures which precede almost every one of the multitudinous repetitions which take place every year of the masterpieces of classical music. Every time we hear Schubert's ninth symphony somebody tells us that it was really his eighth, whilst every time we are given Beethoven's first and second concertos, a charming voice must inform us that the first is really the second and the second the first. And so on with scores of other works. And it is the same with operatic scenas, especially Wagner's, which are performed just as often as the symphonies and concertos: the same little synopsis of the opera up to the point of the excerpt being performed is given. Mozart's 40th symphony was written in six weeks six months before he died, and Beethoven's 3rd was dedicated originally to Napoleon, etc., etc.

The argument that there is always someone tuning in who doesn't know these facts should not be allowed to outweigh the far greater one that tens of thousands do know them, many by the B.B.C.'s own teaching, and that their everlasting repetition and reiteration is a first-class bore, even to the point of being a deterrent to listening itself. It is quite unnecessary.

News from the Clubs

THE GRAVESEND AMATEUR RADIO SOCIETY

Hon. Sec.: R. E. Appleton, 23, Laurel Avenue, Gravesend.

THE Mayor of Gravesend (Councillor E. E. Osborne, J.P., C.C.) visited the clubroom on Wednesday, March 2nd, and was installed as first patron of the society. Mr. E. Parker (G3EJK) gave a talk on the SX-28 receiver, Mr. C. Paull on the B2 receiver and Mr. P. Jobson on the multimeter.

Lectures on receiver design and elementary principles of radio and the morse session are continuing each Wednesday when the club meets at 7.30 p.m.

SOUTH MANCHESTER RADIO CLUB

Hon. Sec.: M. I. Wilks, 57, Longley Lane, Northenden, Manchester.

AT long last it seems as though the club has been able to get a Tx on the air at meetings, and recently were permitted to erect a suitable antenna at the schools and for the time being have been fortunate in that one of the members, Mr. M. A. Pyle (G2BLA), has kindly loaned the club his B2. Plans are now going forward to construct the club's own station and it is hoped shortly to have a 'phone station in operation.

Further visits have been planned, including one to Manchester Fire Station, where 10 vehicles are fitted for radio control and another six are to be fitted shortly. The main Tx there is a 100 watt unit and the club is looking forward to seeing it.

Membership is still on the increase and is now around the 50 mark.

DERBY AND DISTRICT AMATEUR RADIO SOCIETY

Hon. Sec. and Treas.: F. C. Ward (G2CVV), 5, Uplands Avenue, Littleover, Derby.

THE next meeting of the society will be on May 11th, 1949. In view of the success of the society's dinner and social evening it has been decided to include a social evening once a month in the society's programme.

EXETER AND DISTRICT RADIO SOCIETY

Hon. Sec.: E. G. Wheatcroft, 34, Lethbridge Road, St. Loyes, Exeter.

GREAT progress has been made by this society during the winter session. Lectures and demonstrations have been given by Avo, Marconi Instruments, Belling and Lee, Mullards, Stratton and Co., and Antiference. Mr. Donald Thomasson has given talks on TV and hopes in the very near future, to give a practical demonstration. Membership has shown a steady increase and a welcome is extended to all visitors to Exeter to spend a Thursday evening at the Y.M.C.A., 41, St. Davids Hill. When the Birmingham TV starts, the society's experimenters will be right in the field, as several have already started on the construction of receivers, in anticipation of favourable results.

READING AND DISTRICT AMATEUR RADIO SOCIETY

Hon. Sec.: Mr. F. Hill, G2FZI, 997, Oxford Road, Reading.

The annual general meeting of the society was held on Saturday, March 26th, when the following officers were elected for the coming year: president, Dr. Lemon, G2CL; chairman, Mr. Guy, G8TH; vice-chairman, Mr. Lewis, G2BTY; hon. secretary, Mr. Hill, G2FZI; hon. treasurer, Mr. Bingham.

When the normal business of the A.G.M. had been completed Dr. Lemon gave a demonstration of pulse transmission equipment in operation.

THE SOLIHULL AMATEUR RADIO SOCIETY

Hon. Sec.: G. Haring, 121, Bradbury Road, Olton, Birmingham.

AT a well-attended gathering of the club recently, the members greatly enjoyed a lecture on U.H.F., by Mr. G. Brown (G5BJ), of Birmingham City Police.

At the next meeting the society will be addressed by one of its own members, Mr. J. Smethurst, describing and demonstrating his home-built oscilloscope.

A forthcoming attraction is a lecture on crystals, to which other local clubs have been invited, and to cope with the enhanced attendance expected, the "Assembly Room," at the Council House, has been secured for that night.

Meetings are held fortnightly at 7.30 p.m., at "The Old Manor House," where new members and visitors are welcome.

THE SLADE RADIO SOCIETY

Hon. Sec.: Mr. C. N. Smart, 110, Woolmore Road, Birmingham, 23.

FORTHCOMING meetings are as follows: May 13th. Wave Interaction, Mr. F. J. Hyde. Otherwise known as the Luxembourg Effect, this phenomenon still offers great scope for original research by amateurs. Mr. Hyde is a member of a team of workers who are studying the subject under Dr. Huxley, at Birmingham University, and he will tell us what is known about it so far, and what we ourselves can do.

May 27th. The president of the society, Dr. W. Wilson, will talk on "Electronic Music."

June 10th. Electro-medical Instruments. Dr. W. Summer. X-rays, Electro-cardiographs, Electro-encephalographs and others. Electronic apparatus is finding continual use in the sphere of medicine.

June 24th. "The First Six Months." Three members, Messrs. W. E. Lewis (G3ESZ), D. J. Pye (G3EVC) and E. W. Merrill (G3EQT), will describe their apparatus and the difficulties and snags they have overcome or failed to overcome in their first six months on the air.

THE RADIO SOCIETY OF GUERNSEY

Hon. Sec.: W. E. Butt, GC2FZC, Meo Voto, Green Lanes, St. Peter Port, Guernsey, C.I.

A meeting of the above society was held in St. John's Schoolroom on Wednesday, April 6th.

Following general business a very fine lecture, illustrated by lantern slides, and entitled "Negative Look Back," was given by the president, Mr. P. Dennison, GC8OK, who was given a hearty vote of thanks for an excellent lecture. Meetings are held on the first Wednesday of every month, at 7.30 p.m.

Visitors to the island and new members will be welcomed.

RADIO CONTROLLED MODELS SOCIETY—LONDON GROUP

Hon. Group Sec.: Lieut. (L) G. C. Chapman, R.N., Pine Corner, Heathfield, Sussex.

The Radio Controlled Models Society, London Group, is starting in May a series of monthly lectures, designed primarily for beginners to radio and electrics, commencing with fundamental electrical principles, and working up over the year to cover the whole field of radio control. Notes and references will be provided to assist members in their private reading. Visitors will be welcome at the lectures, which start at St. Ermin's Hotel, Caxton Street, S.W.1, at 2 p.m., on Sunday, May 8th, when Mr. J. C. Hogg, general secretary of the R.C.M.S. will give the first of two talks on "Fundamentals."

Open to Discussion

The Editor does not necessarily agree with the opinions expressed by his correspondents. All letters must be accompanied by the name and address of the sender (not necessarily for publication).

Home-recording

SIR,—Both Mr. W. Mackintosh and Mr. H. Woodward may be interested in my experiments with home recording.

I first became interested whilst serving in the Army, and my first discs were five-inchers made on the radiogram, the motor being assisted by my finger! A 12in. record underneath was used for tracking.

I, too, soon realised what an expensive hobby this was going to be, but even if I had had the money I would not have paid the fancy prices asked for tracking mechanisms, turntables, etc. With the help of my brother, a wooden console was built in one corner of my bedroom and on this I have installed my gear, consisting of amplifier with radio, recording and ordinary turntable (for dubbing and general use).

The recording turntable is 16in., of the type used by cinemas for a brief period in the early '30s and which was given to me by the chief engineer of a London cinema. It had lain in his store-room since sound-on-film started and I think he was glad to see it out of his way.

The tracking mechanism is an Edison cylinder phonograph bought in a Brixton junk shop for £1 and in perfect condition. With its variable speed I can have any pitch of tracking I require—a feature which I have yet to see on professional equipment at 10 times the price. The arm and its various supports and stays to make it rigid are made of Meccano and brass curtain rail. The counter-balancing weight consists of scrap metal, a horse-shoe magnet, and an adjustable spanner! The weight of the cutter-head is varied by a length of clock-spring.

The cutter-head cost £7 10s., and this, together with steel cutters and discs are the only commercially-made recording parts I use.

The power for the turntable is supplied by a 1/6th h.p. refrigerator motor mounted on Sorbo on the floor.

I can record up to a 12in. disc and my present accuracy of tracking allows of up to five minutes' playing time. It has taken me three years to get this far and I've had trouble a-plenty, but it's been worth it for the experience and knowledge gained. —J. LAW (S.W.2).

Phase Splitting

SIR,—Reference is made to the edition of PRACTICAL WIRELESS for the month of April, 1949.

I was rather surprised whilst looking through a copy to see on page 140 that the G.P. P.A. amplifier circuit was truly unique.

I would be pleased to hear from Mr. K. Kemsey-Bourne how he manages to get a phase reversal of 180 degrees in a valve when taking the output from the cathode. I refer, of course, to the paragraph "Phase Splitter" in which he quotes, "the second half of V2 (Fig. 1) receives *via its cathode circuit a signal 180 degrees out of phase with the original.*"

I would suggest that if a double beam oscilloscope be applied—one half to the grid, the other half to the cathode—he may be astounded to find they *are in phase.*

I do *not* suggest the amplifier does not work—in fact, I have seen much stranger things occur—but this seems to rather upset the theory of valve technique.—"PHASE CHANGE" (Norfolk).

[*The author says: I am surprised to see that our friend thinks that the circuit described "upsets the theory of valve technique," especially since this type of phase-splitter is quite a conventional one. No proprietary rights are claimed in the design, and his remark that "I have seen much stranger things occur" suggests that his experience may be greater than his powers of analysis. The anode of the second half of V2 does in fact receive via the V2 cathode circuit a signal 180 degrees out of phase with that at the anode of V1, which can be checked, as he suggests, oscillographically. . . . Perhaps "Phase Change" has overlooked the phase properties of the feedback inherent in the action of the circuit. Might we suggest that he tries it out to convince himself?*]

Radio Model Control

SIR,—I am very interested in model speedboats, etc. This is my pastime during the summer months and, of course, in winter I have my radio.

I am wondering if any of my fellow PRACTICAL WIRELESS readers can give me any "gen" on radio control of these models. I have, of course, seen two commercial jobs for this purpose, but I feel that there is not the thrill of achievement when one buys a ready-made article. At present I have no data at all on this subject, so if any readers can give me a "leg up" I shall be most grateful. —W. KENNETH JONES (Birmingham).

Another Confirmation

SIR,—Here is another confirmation of television from ex-Government parts. I am aged 24 and have had no training whatsoever other than years of radio experimenting (saying this to encourage other young friends). I am using a Navy 1½-metre superhet which I converted to a four-stage straight, with first stage flatly tuned by condenser (all unwanted stuff removed); synchronised separator and T.-B. oscillator circuits similar to "Electronics," and feeding T41s into cathodes of 6SN7s for push-pull to deflector plates of VCR97 (wonderful tube). Using 2.5 k.volts and bias on all plates, focus is fairly even, interlace is equal to my commercial "Pye," and linearity on line is very good. I have chosen 6SN7s for push-pull because of the good results obtained from such simple circuits with so few components.

Everyone has his own ideas and methods and this is how I have achieved my results. Now to those

who are still struggling: Press on, keep an eye on PRACTICAL WIRELESS, which has been a great help to me, and don't miss a copy.—R. G. HOWE (Ashford.)

Old Receiver Performance

SIR,—Have just read the March issue of PRACTICAL WIRELESS, and read with interest the letter of T. R. Laidlaw (Rugby). I endorse his remarks 100 per cent.

I am employed by one of the biggest radio concerns in the country, and there is no doubt about it that the product turned out to-day doesn't compare with the product turned out in 1938-1940. At the moment we are producing a 1949 set which utilises Octal-base valves, but two stages of this particular receiver have two special valveholders with two special valves, which can only be replaced by the manufacturer. Why on earth don't manufacturers start to build something on a quality basis? There are millions of people who listen only to the so-called "Light" and "Home" and are not interested in range.—B. V. WILLIAMS (Rhondda).

Measuring Meter Resistance

SIR,—The method advocated by your correspondent R. G. Thomas for finding the resistance of a milliammeter is quite accurate, subject to certain precautions being observed.

(1) The variable series resistance must be at least 20 times the expected resistance of the meter; hence a grid-bias or H.T. battery may be required to give a reasonable deflection.

(2) The value of the shunting resistance (the accuracy of which determines the accuracy of the measurement) should be approximately equal to the resistance of the meter, i.e., it should reduce the reading by about one half.

It is, of course, necessary to repeat the measurement at least once to determine whether these precautions have been observed.—M. C. BUMSTEAD (Hythe).

"Surplus" Components

SIR,—I should like to pass on a warning to other constructors who may run into trouble as I did through using certain old ex-Service components. I have used many of these parts without difficulty, but recently, after building a unit, I could not get satisfactory results (in spite of all parts being first checked on suitable meters for open- or short-circuits). I was preparing to make tests when the mains rectifier suddenly flashed and before I could switch off it had turned blue and was finished. A final check on the unit showed that a tubular fixed condenser, rated at 500 volts working, used in a part of the circuit where the applied voltage could not exceed 300 (it was a 350-volt rectifier), had developed a complete internal short-circuit, resulting in overloading the rectifier and in an expensive replacement. Although it appeared unused, the condenser may, of course, have been used in some faulty equipment which had resulted in internal damage leading to the breakdown.—R. WATTS (Hendon).

Television Aerials

SIR,—I wonder if other readers could give us up north their experiences with home-made aerials for the forthcoming television station. I understand that there is a lot in the aerial and that reflectors are not always advisable. I also believe that they require fairly accurate matching, and as I wish to get ready for the new station I should like to have some information on the subject.—H. BENTLEY (Birmingham).

*(An article on the outside aerial for television will be found in the Television Section of this issue.—*ED.)

5-metre Converter

SIR,—As a regular reader of PRACTICAL WIRELESS (since the days of Pract. and Amateur) I was very interested in the 5-metre converter converted from R.F. unit type 26, as described in the April issue. I have one of these units and am going to use it in front of an R1155 which I have adapted for mains.

I am very interested in receiving "2-way" police transmissions, which are shortly to be adopted by the Lincolnshire Constabulary. I wondered if Messrs. Robertson and Wheeler could give me advice as to how to convert an R.F.27 unit to receive these frequencies?—HAROLD MORRIS (Sleaford).

"R1355 and Television"

SIR,—Apropos recent articles regarding the use of R1355 for T.V. I should like other readers to know what reception is like in Gloucester.

I am using a R1355 for vision and another for sound, and a normal Miller Time Base with push-pull output. The aerial is a half-wave dipole with reflector, the bottom of which is approximately 16ft. from the ground.

Results are very variable, but over a period of about three months, the evening transmissions were received as follows:

Good solid picture	15%
Fairly good	25%
Moderate	35%
Poor to nil	25%

I may add that the aerial is not more than 40ft. above sea-level and the Cotswolds are about five miles distant, and London 105 miles away.

To anyone who contemplates using the R1355 I should have no hesitation in recommending it as something to make a start with, as it needs very little modification. I am well aware of the high background noise, and the instability of the oscillator stage, but, after all, if it produces a reasonably good picture that's something!—K. R. YARNOLD (Gloucester).

Impressions on the Wax

Review of the Latest Gramophone Records

THE Boston Promenade Orchestra under the able baton of Arthur Fiedler continues its attractive series of records of light classical music with two splendid minuets on *H.M.V. B*9745. The Boccherini minuet is known to many; but it is only one of many tuneful movements scattered throughout this composer's enormous catalogue of works. The coupling is the Bolzoni Minuet.

Beethoven's Sonata in C, Op. 2, was probably written at the beginning of 1796. It was published in March of that year, together with two others belonging to the same opus number. All three are dedicated to Haydn, with whom Beethoven had taken a few lessons. If you like early Beethoven this is a work you should hear. Solomon gives a performance of impressive accomplishment and power on *H.M.V. C*3847-9.

Gregor Piatigorsky is an enthusiastic and clever arranger of pieces for his own instrument, the 'cello. This month he has taken four specimens of Schubert and arranged them with great taste. The three minuets are Schubert's tribute to an earlier age. Piatigorsky conveys the sentiment of the G minor movement on *Columbia LX*1169.

Delibes is a composer dear to Lily Pons. One of her most famous rôles is that of Lakmé, and in this less well-known song The Maids of Cadiz she proves that she is in the star class of coloratura sopranos. The Blue Danube as a vocal piece always gives fine opportunities to a singer, opportunities here seized by Miss Pons to great effect. The voice, in some passages, adds an attractive counterpoint to the main line of the familiar tune, and the words emphasise the unique place occupied by the great river in the hearts of the Viennese. The orchestra conducted by Andre Kostelanetz adds a musicianly background to the soloist's magnificent performance in both pieces on *Columbia LX*1170.

The return of Paul Robeson to Britain gives London and the provinces a welcome opportunity of seeing and hearing this great singer in person. He has signed a contract to record for Columbia exclusively and this month he has recorded John Henry and Water Boy on *Columbia DB*2506. Robeson's deep, resonant bass is one of the finest instruments for conveying the sad, nostalgic emotion of Negro folk-songs.

Light Music

Peter Yorke's concert orchestra is a full-bodied ensemble which can be relied upon to give stylish interpretations of the many and varied arrangements put before it. In the past the orchestra has given us several selections of film tunes, each being presented in the most tasteful and attractive settings. Now he offers a selection of songs from a new film musical from Hollywood entitled "It's Magic," which is full of catchy tunes, some of which have already become nationally popular through their broadcasts. Fine string playing is a feature of these Peter Yorke recordings on *Columbia DB*2510 and Steve Conway supplies the vocals.

The Wayfarer's Song was written for the picture "The Glass Mountain" by Vivian Lambelet and Elizabeth Anthony, and it has now been recorded by the Queen's Hall Light Orchestra conducted by Sidney Torch on *Columbia DB*2498. "Wellington Barracks" from Haydn Wood's colourful suite Snapshots of London, which is on the other side, is a vivid picture of the great military establishment near Buckingham Palace.

There is always a high quality of string playing to be expected from George Melachrino's renowned ensemble, and his latest performances reveal the impeccable musicianship to which we have become accustomed. For his latest record George Melachrino has arranged two pieces from America. One is Diane, a tuneful song written by Pollack and Rappe in 1927, which has maintained its popularity in the States; and the other is Sigmund Romberg's Faithfully Yours. Both are given colourful treatment on *H.M.V. B*9753.

Variety

The latest recording by Bill Johnson shows how well he handles popular ballads. Lonely Shepherd is the latest tune to come from the pen of the British song writer Michael Carr, whilst Suvla Bay is a nostalgic song telling how the singer "left his heart in Suvla Bay"—*H.M.V. DB*2509.

The revue "Latin Quarter," which has already become a great success in France, has been launched at the London Casino. Two of the songs from the show are sung this month on *Columbia DB*2513 by the star of the revue, Georges Guetary. They are Clopin Clopant and La Bas.

The lavish film musical "Easter Parade" released at Easter features no fewer than 17 songs by prolific composer Irving Berlin. Opening and closing with the film's title piece, the popular Easter Parade, Reginald Dixon presents four of Berlin's new tunes as well as a selection of some of the older tunes on *Columbia FB*3471.

"Jungle Fantasy," featuring Philip Goody on the flute and Sid Bright on the piano, and "Maria from Bahia," featuring the Tophatters, are the latest tunes chosen by Geraldo and his Orchestra on *Parlophone F*2347.

Harry Roy and his band make a welcome return to the musical limelight with two old favourites, "Twelfth Street Rag" and "Temptation Rag," on *Parlophone F*2350.

Other popular numbers are played by Joe Loss and His Band with "Rosewood Spinet" and "Beautiful Eyes" on *H.M.V. BD*6041, and Oscar Rabin and his Band with "You're Still the Only Girl in the World" and "Far Away Places" on *Parlophone F*2348.

Second Sale.

G. R.

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FRITH RADIOCRAFT LTD., Leicester, offer: Super value in bargain parcels, only 5/- each. See April issue for details of parcels 1-14, all still available, also 15, 4 each Rotary Switch Wafers, 3 p. 3 w., 2 p. 4 w., 1 p. 10 w., 3 spare 6in. Locators, nuts, bolts, spacers, etc.; 16, 144 asstd. 2, 4 and 6 B.A. Nuts and Bolts; 17, 72 yds. asstd. colours single P.V.C. Hook-up Wire; 18, 24 asstd. Carbon Brushes, sizes ¼ - ⅜ thick; 19, 4 Ruby Indicators, single, ¾in. hole fixing, complete unit with bulb holder; 20, Air-spaced Tuning Condensers, 12 asstd. 5pf. to 100pf.; 21, 12 yds. Twin Screened Flex, silk covered, suitable for pick-ups, etc.; 22, 12 asstd. Screened Socket Connectors for popular A.M. and U.S.A. equipments; 23, 2 Control Panels, each containing 100 and 350 ohm 25 w. w/wound Rheostats, on/off toggle switch and connectors; 24, 24 yds. Twin Twisted P.V.C. two-colour 22 G. Conductors; 25, 36 yds. Lightweight Twin Twisted Telephone Wire, rubber covered, 7/36 steel conductors; 26, 4 15-yd. coils 7/36 Lacquered D.C.C. Instrument Wire, asstd. colours, total 60 yds. Any parcel above 5/- plus 6d. postage. All items brand new. Satisfaction guaranteed or cash refunded without question.—Frith Radiocraft Ltd., 69/71, Church Gate, Leicester.

BARGAINS: .0003 slow motion with knob and dial, **2/6**; Assorted Nuts, Bolts, etc., **6d.** box, **2/-** lb.; Rotary Switches, most types, **1/6**; Headphones, 3,000 ohms, 3/6 pr.; Volume Controls from **1/6**; Dial-light Holders, **4d.**; Midget Components. List 2½d.—Carter's, 67, Bell Lane, Marston Green, Birmingham.

I.F.Ts, 465 **6/-** pr.; 3 W.B. Coil Pack Kit, L.M.S. or M.S.S. **9/6**; 8 med 450 v. **2/-**; 100 PF/100 PF 2d.; Eyelets, etc., **1/-** gross; .2 amp. 717 ohms Tapped Droppers **1/-**; Mains Transformers **16/6**; 50 PF Trimmers **4d.**; Knobs **4d.** Send for cheapest list in England.—Sussex Electronics, Ltd. (P), Riley Road, Brighton. (Tel.: 4446.)

DISC RECORDERS for amateur or professional. All accessories available. Write:—Sigmaphon, 50, Millvale, Bromley, Kent.

ELECTRIC CABLE.—Plastic covered and others, 250 volts: wholesale only. Samples on request.—A. N. Russell, 30, Scott Road, Olton, Birmingham.

P.W. Jan. 1943 - Dec. 1948; offers. Quantity Radio Books, S.A.E. list.—15, Church Road, Shirley, B'ham.

VALVE Query Service.—Full data of thousands of British, Continental and ex-Service Valves, C.R.T.'s, etc., available by return post. Send **1/-** with each query to V.Q.S., 5, Sciennes Gardens, Edinburgh, 9.

CLEARANCE. Test equipment Valves, Speakers, etc., etc. Prices drastically reduced. List stamped envelope.—Young, 134, Old Shoreham Road, Southwick, Sussex.

SALE.—Radios, A.C./D.C., Valves, Coil Packs, Cabinets, etc., etc. For full list send S.A.E.—Wilson, Balbegno, Crieff, Scotland.

AC/2PEN, AC HL/DD, AC/P1, TH233, HL133DD, 7/6; EF9, APP4E, 6/-; W21, KTW62, MHr, 6X5G, 5/-. List offers. Box No. 180.

MCRI Communications Receiver for sale, complete, coils, phones, power pack, £5/5/-. Box No. 181.

EXPERIMENTERS surplus, Hartley Turner Speaker 215 **£5/-**, 5in. Tweeter, **15/-**; Wharfdale Separator, **£2/10/-**. Box No. 182.

EDCC CONVERT. D.C. 110-230 A.C. 170 watts 50 cs. Sil. Cab., £5. Not ex-Gov. Box No. 183.

NEW Canadian "58" Trans-Receiver, complete, power pack, aerials, phones, spare valves, instruction book, £15. Box No. 184.

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MERCHANT NAVY AND AIR RADIO. Here is an opportunity to train as Radio Officer for merchant ships and the air. The big liners are open to you, but you must first qualify for the P.M.G. Certificate. Established 30 years. We can put you through in the minimum time. Day, evening and postal instruction. Prospectus from Director. The Wireless School, 21, Manor Gardens, Holloway, London, N.7. ARC. 3694.

WIRELESS (sea and air) TELEVISION. Broadcasting, Radar, etc., offer tremendous opportunities. Students, both sexes, age 14 upwards, trained for appointments in all branches of Radio. Low fees, boarders accepted. 2d. stamp for pros.—Wireless College, Colwyn Bay.

RADIO OR RADAR.—Full-time training for career in Air or Marine Services as Radio Officer (M.C.A. or P.M.G. Licences), Radio Mechanic, or Radio Engineer. Residential and non-residential courses at Radio and Radar School, Britain's Air University. Enquiries to the Commandant, Air Service Training, Hamble, Southampton.

WIRELESS, Television. Postal Courses for Amateur Radio Transmitting Licence also Television for Radio Trades diploma. Apply British School of Telegraphy, Ltd., 179, Clapham Road, London, S.W.9. (Forty years' experience in training students in Wireless and allied subjects.)

THE INSTITUTE of Practical Radio Engineers have available Home Study Courses covering elementary, theoretical, mathematical, practical and laboratory tuition in radio and television engineering; the text is suitable coaching matter for I.P.R.E., Service entry and progressive exams.; tuitionary fees at pre-war rates are moderate. The Syllabus of Instructional Text may be obtained, post free, from the Secretary, Fairfield Road, Crouch End, N.8.

Practical Television

Vol. 1. No. 4 NEW SERIES JUNE, 1949

Televiews

AT Radiolympia this year, which takes place from September 28th to October 8th, television will be the *leitmotiv*. There is time to stage such a television show as will convince the critics that we have maintained our pre-eminent position. It is not lip service which is required but a more generous expenditure of money. Television cannot be "done on the cheap," and the money must be spent before revenue commences to flow. The revenue last year was small—only £90,000 to offset against an expenditure of £700,000. Much of the profits earned by the B.B.C. should be ploughed back into television during the next five years. There should also be a purge of the Augean Stables and the right type of technicians and producers introduced.

* * *

THE Budget failed to give any relief to the Radio Industry or to the public. The former must continue to collect Purchase Tax and the public to pay it, and unless the result of the recent Borough Elections causes the Chancellor to modify his views, to the extent of presenting an Autumn Budget, those who intend to purchase a television receiver will for a year or two have to meet this iniquitous deodand. The Purchase Tax was originally imposed during the war to limit the demand so that labour could be diverted to munitions. After the war it was continued as a revenue producer to stop inflation. It has certainly succeeded in doing this, and produced something which is far worse, namely, deflation, where too little money is chasing too many goods.

Manufacturers, however, had prepared for the unrelenting attitude of Sir Stafford Cripps, and have produced cheaper television receivers giving satisfactory results. It is true that most of them are table models, and that the tubes are not so large as may be desired. But to-day, it is possible to buy an excellent television receiver with the hallmark of prominent manufacturers for between £40 and £50, and we learn that there is a steady demand for them—a demand which is bound to increase when the Sutton Coldfield Station opens towards the end of the year.

* * *

ONE critic has stated that within two years television in America will have killed ordinary radio. Whilst this expression of view does not come from one technically qualified to give it, we are of the opinion that several million television receivers will be in operation in the U.S.A. by the end of 1952.

* * *

BRITISH manufacturers are not yet exporting television receivers, but all of them are anxious to. It is thought that America and Canada will be two of our biggest markets. Both Australia and Canada have planned television chains.

Because of the proximity of Canada to the United States and the eventual necessity for exchanging programmes between the two countries, the Canadian authorities have wisely decided to establish their television services with the same technical standards as are used in the United States. Although Canada will not use the standards employed by the B.B.C. in this country, they are quite prepared to place orders in this country for any television stations they may require.

But most of the television equipment produced in this country is not tied down to the standards used in England by the B.B.C. Those who do not understand this have recently been indulging in misguided propaganda intended to force B.B.C. standards of 405 lines and 25 frames down the throats of other countries. These campaigns are bound to do us harm abroad, since it may lead foreign technicians to believe that our standard of technical qualifications is below their own.

* * *

RADIO and television sales for the month of February were the lowest since the index figure for radio sales was started last September. No doubt this was due to the public awaiting Budget concessions. F. J. C.

Telenews

Multiscope

BY means of a device known as the "Multiscope" the time, weather and news are shown simultaneously by station WBKB of Chicago, superimposed on the station call-sign. It is used in place of the usual test pattern.

Honourable Award

PHILCO recently received an award issued annually in U.S.A. for the "organisation or individual who has done most for the radio service technician during the year." It was made in recognition of the work done by them in establishing training courses in television repair and maintenance.

Pye Dealers' Luncheon

AT a recent luncheon given in London by Pye, a demonstration of Pye closed-circuit television was given. A camera was set up at the main entrance so that pictures of all dealers arriving were transmitted to receivers in the main reception room.

Wired Television

IT is now understood that a "laid-on" television service, plus a four-programme broadcast relay, are available in certain L.C.C. flats. The inclusive charge for the service is 3s. 6d. per week, plus the television licence fee of £2.

Aerials for Television

Theoretical and Practical Details for the London and Birmingham Stations

By W. J. DELANEY (G2FMY)

A LARGE number of readers have written for details of aerial construction for the new Birmingham station, as they wish to get ready for the opening. We must remind them, as we have those in the London area, that the aerial used for the

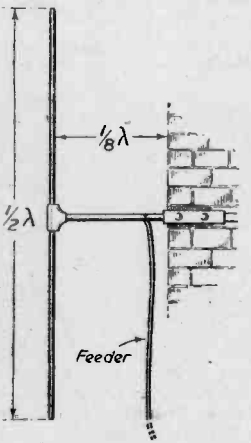

Fig. 1.—A standard dipole showing main details.

reception of television transmissions is not such a simple arrangement as the normal broadcast or even the normal short-wave aerial. In fact, the aerial used for television plays such an important part in the majority of cases, that it is recommended that a properly-designed and properly-made commercial aerial—made by a firm such as Belling-Lee, who specialise in this type of equipment—be used.

In the case of the ordinary aerial the main requirement is that some form of "energy collector" be erected which will be responsive to all the frequencies that it is desired to receive on the usual multi-station receiver. In television, however, we are concerned solely with *one* station, and there are two very important considerations which have to be borne in mind. Firstly, a very wide band-width must be received if full justice is to be done to the picture detail. Secondly, a high signal-to-noise ratio must be obtained if the picture is to be free from blemishes.

The ear can tolerate a somewhat noisy background to speech and music, but the eye is offended if the picture is accompanied by flashes or even break-up in scanning due to heavy noise backgrounds. The aerial must also be responsive to the speech wavelength and thus has to cover a band of about 6 or 8 Mc/s. Actually, of course, it will not be possible to restrict it to such a narrow band.

A Tuned Circuit

The dipole or half-wave aerial is found most efficient for the narrow band-width required, and this is theoretically one-half of the wavelength at which resonance is required. It will be found that the standard television aerial is really a tuned circuit, actual lengths differing among various manufacturers for the following reasons. For the London transmission, vision is transmitted on 45 Mc/s. (6.66 metres) and sound on 41.5 Mc/s. (7.2 metres). The aerial may thus be made to resonate at 45 Mc/s. or at a point between that and the sound frequency, and this will make a difference of a few inches. The Birmingham station frequencies are 61.75 Mc/s. for vision and 58.25 Mc/s. for sound. Here, therefore, one may take 60 Mc/s. (5 metres) as a suitable mid-point, and for London we may take 7 metres or 44 Mc/s. (approx.). There are certain peculiar effects which affect exact calculations in aerial length, one of which is known as "end effect," which is an increased capacitance towards the ends of the aerial, and these effects result in a slight shortening of the actual aerial. However, all these facts are taken care of in a simple formula which gives the length of the desired dipole aerial as 1.56 times the wavelength in metres, or to put it mathematically, 1 (in feet) = 1.56 (in metres). Therefore, for London we have 10.4ft. and for Birmingham 7.8ft.

Materials Required

To obtain the widest band-width the aerial must be of large diameter, but obviously here one

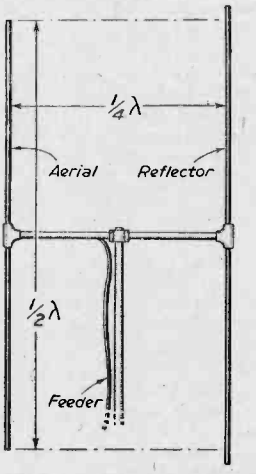

Fig. 2.—A dipole with reflector. Spacing may be reduced to one-eighth wavelength.

is concerned with convenience as well as other factors. Ideally, one would use a "cage-type" aerial made up from about 8 or 10 lengths of wire supported by large insulated rings, but in practice it is found that ordinary aluminium tubing between ¼in. and 1¼in. diameter is perfectly satisfactory, and as the high-frequency currents travel only on the outside of the tubing, it should be painted or treated with

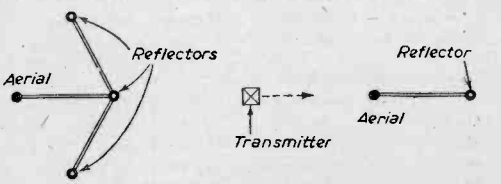

Fig. 3.—(Left) Multiple reflector for bad reception areas, and Fig 4 (right) theoretical relationship between aerial, transmitter and reflector.

some anti-corrosive paint. As the feeder for this type of aerial must be taken from the centre point, the total length is cut in half and the two sections must be clamped with some weather-resisting material at the centre, at which point a suitable feeder is attached to each section.

For an aerial of the type mentioned I prefer standard 70 ohm coaxial, but twin-feeder may be used if desired. As it is necessary to avoid modification of the equivalent length of the lower section of the aerial due to the proximity of any outside materials, the feeder must be taken away from the centre point at right-angles, and it should travel for about ¼ wavelength before coming down to the house. This means that a right-angle support can be used at the centre and this may take the form of the mast or chimney support. The feeder should, of course, be nailed or otherwise fixed to the wall to avoid movement in the wind which might have the effect of introducing a fading effect on the received picture.

As the aerial will be unprotected from the winds it must be held very firmly and it may be found that it "hums" when a strong wind is blowing. The noise may be reduced by filling the tubing with sawdust, or even fine sand if the supports are strong enough, and plugging the ends.

Reflectors

The details so far given are for a simple aerial such as would be used within a reasonable range of the transmitter. Where, however, the transmitter is situated some distance away, or serious local interference is experienced (such, for instance, as may arise from a main road carrying a heavy volume of motor traffic), it may be desirable to employ a reflector. This is merely a rod, similar to the actual aerial, but slightly longer, supported either a quarter or half-wavelength behind the aerial. In the case of road-traffic or similar interference, it may be found that the aerial assembly may be rotated to give improved signal-noise ratio, so some time should be spent in finding the best position for the reflector. In extreme cases, such as very long-distance reception, or very heavy interference, it may even be found desirable to use two or three reflectors arranged round the aerial—again, experiments should be carried out to find the best form the "screen" should take.

Earth Connection

At the receiver end the coaxial or feeder should be terminated in a plug just inside the window so that the receiver may be easily disconnected when desired. A three-point plug and socket arrangement is recommended, the third point being taken to a properly-buried earth rod, and a separate earth connection taken from the receiver to this third point. If there is a thunderstorm and you are nervous of the exposed aerial system, you can earth it at the plug, but there is no evidence to show that there is any added danger from this type of aerial, and indeed it is held by some that it forms a protection to the premises to which it is fitted—certain insurance companies giving a reduced premium where a properly-fitted aerial of this type is in use.

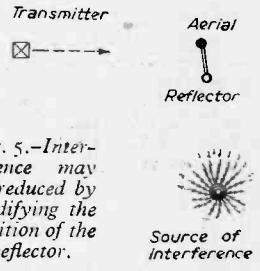

Fig. 5.—Interference may be reduced by modifying the position of the reflector.

Next month we will deal with indoor types of aerial for television.

Underneath the Dipole

Television Pick-ups and Reflections. By "THE SCANNER"

THIS year's Oxford and Cambridge Boat Race was won by the B.B.C. There was a ding-dong battle between the two crews for the whole distance of the course, but long before the race ended it was obvious to television viewers that they had witnessed the B.B.C.'s greatest technical triumph to date.

Sunshine on the Boat Race

It is true that the quality of the picture relayed by ultra-short wave from the B.B.C.'s motor launch, *Consuta*, varied a little. Three receiving stations were used at different points at the river side, and there were occasions when interference or reflections marred the picture slightly. But the combination of several land view-points, together with that of a multi-lens camera in the launch following the boats during the whole race, resulted in an unforgettable news-picture narrative. The weather and light were favourable for television, and though the new cameras are capable of giving good definition in poor light, good light enabled the lenses to be "stopped down" considerably, thus obtaining a sharpness, definition and depth of focus which it is rarely possible to obtain. The film recording of the event, largely photographed from the end of a cathode-ray tube, was put on with the newsreel in the evening. Good though this was it did not do justice to the original transmission.

Latest from U.S.A.

It is events of this class which are the mainstay of American television. A friend who has recently returned from Hollywood and New York has just given me the "low-down" on the present position of television in the U.S.A.

"Quantity rather than quality is the rule at the moment," he said. "There is already an ample choice of programmes in most populated areas, and in both Hollywood and New York five or six transmissions always seemed to be on the air at the same time."

It seems that the programmes are largely provided by advertisers, in the same way as for sound radio programmes. But the money which sponsors are willing to pay is related to the

probable number of viewers. They are not yet convinced that the number of viewers at the moment justifies the outlay of much money. Consequently, amateur talent, old cinema films and not-too-expensive vaudeville acts, form a large part of the programmes, with sporting events as the high spots. The development of the technique of presentation, particularly of radio plays, lags behind the B.B.C.

TV QRM in U.S.

Asked about car and electrical interference with television reception in U.S.A., my much-travelled friend said that in many situations this was bad. The steadiness of the picture seemed to be upset when interference reached a certain level, and sometimes the picture broke up entirely. He said that the 525-line quality and definition was quite good, but not noticeably better than the B.B.C.'s 405 lines. I must say that his remarks reassured me completely both as regards the positive modulation system and the vertically polarised radiation which have been standardised here. The number of lines is not the be-all and end-all; a great deal more can be obtained out of 405 lines, and the B.B.C. are now making their contribution with the improved cameras, tele-cine and other equipment.

Shortage of Programme Material in U.S.A.

The demand for programme material at the American television stations is colossal. It is far greater than the present studio accommodation can provide. International hook-ups, and the extensive use of co-axial cables linking the great cities and their television stations, enable large groups of transmitters to radiate programmes simultaneously, and the photographing of all the more important programmes is regularly carried out, so that stations not on a "hook-up" are enabled to send them out later. All kinds of films, old and new, are transmitted, and a new lease of life has been given to what Hollywood calls "horse operas"—"Westerns" to you—and their cowboy and Indian stars. Attendances at cinemas have dropped from 20 to 30 per cent. in cities which have good television service. A new type of film is being made: a kind of "super quickie," specially designed for television, with a preponderance of close-ups and long dialogue sequences. The demand for film material is insatiable. Old British films, good and bad, have been extensively shown on U.S. television, and at least one of our smaller film studios has received enquiries regarding the making of films specially for American television. As a means of relieving the crises in our film studios this might be a good thing. The picture I was given of the humming activity in some of the American television studios seemed even more chaotic than the daily rush-and-tumble of our Alexandra Palace stages. Many Americans feel that there is a lot to be said for the slower and more considered approach of the B.B.C., unspurred by competition and retarded with red-tape. After all, we now have the experience of as many years television service behind us as the Americans have had—in months!

Ballet on Television

It is not often I mention ballet in these notes. Ballet has been televised many times, without very much success, and in most of the viewers' popularity lists it comes somewhere near the bottom.

The B.B.C.'s transmissions of ballet have suffered largely by the choice of "advanced material," of new-art choreography and ugly modern music, of self-conscious surrealistic production and settings. The first really satisfying exception has been the recent production of the Metropolitan Ballet, a company previously unknown to me. "Swan Lake" is well known and well liked by the ardent balletomanes, but I think even those who weren't ballet fanatics must have been charmed by the smooth performance and excellent presentation. Inevitably, the Metropolitan programme included modern items, and I feared the worst. But my fears were dispelled by an amusing "football" interlude, and an exquisite allegory. The producer, Christian Simpson, is a new name to me, but he must immediately be put into the "top bracket" for his handling of the production, his clever use of close-ups and dissolves, of spoken titles, of effect lighting and of general polish.

Television at the B.I.F.

THE world's first public demonstration of a television transmission on the 625-line system will be given at the Birmingham section of the Fair. The exhibit will be practical backing for the recent statement that British manufacturers can provide television for any required standard of definition and are not confined to the British 405-line system, although the latter is considered here to be the most efficient in relation to cost and to other space occupied.

The 625-line equipment, manufactured by Marconi Wireless Telegraph Co., Ltd., was among developments demonstrated early in March to the official Belgo-Dutch television delegation who visited England on the invitation of the Government.

Included in the B.I.F. demonstration will be two new Marconi Image Orthicon cameras which can be used for either mobile or studio televising. One will be on the stand and the other mounted in a special tower in the grounds, so that scenes inside and outside the building can be televised.

Visitors to the Fair will see the result on the stand in a line-monitor with a 15in. screen. The outside camera will also televise aeroplanes landing and taking-off from the nearby aerodrome.

The pick-up tube is extremely sensitive, allowing the camera to be used in a very poor light and, owing to its small size, lenses of small physical dimensions can be used. The four-lens turret can take telescopic as well as normal lenses, selection being made by a handle at the rear.

An incorporated electronic viewfinder gives a bright, clear display of the scene actually being transmitted on a cathode-ray tube.

Practical Wireless
BLUEPRINT SERVICE

PRACTICAL WIRELESS	*No. of Blueprint.*	
CRYSTAL SETS		
Blueprints, 1s. each.		
1937 Crystal Receiver	—	PW71*
The "Junior" Crystal Set	—	PW94*
STRAIGHT SETS. Battery Operated		
One-Valve: Blueprints, 2s. each.		
All-Wave Unipen (Pentode)	—	PW31A
Beginners' One-valver	—	PW85
The "Pyramid" One-valver (HF Pen)	—	PW93*
Two-valve: Blueprints, 2s.		
The Signet Two (D & L F)	—	PW76*
Three-valve: Blueprints, 2s. each.		
Selectone Battery Three (D, 2 LF (Trans))	—	PW10
Summit Three (HF Pen, D, Pen)	—	PW37*
Hall-Mark Cadet (D, LF, Pen (RC))	—	PW48*
F. J. Camm's Silver Souvenir (HF Pen, D (Pen), Pen) (All-Wave Three)	—	PW49*
Cameo Midget Three (D, 2 LF (Trans))	—	PW51*
1936 Sonotone Three-Four (HF Pen, HF Pen, Westector, Pen)	—	PW53*
Battery All-Wave Three (D, 2 LF (RC))	—	PW55*
The Monitor (HF Pen, D, Pen)	—	PW61*
The "Colt" All-Wave Three (D, 2 LF (RC & Trans))	—	PW72*
The "Rapide" Straight 3 (D, 2 LF (RC & Trans))	—	PW82*
F. J. Camm's Oracle All-Wave Three (HF, Det, Pen	—	PW78
1938 "Triband" All-Wave Three (HF Pen, D, Pen)	—	PW84*
F. J. Camm's "Sprite" Three (HF, Pen, D, Tet)	—	PW87*
The "Hurricane" All-Wave Three (SG, D, Pen, Pen)	—	PW89*
F. J. Camm's "Push-Button" Three (HF Pen, D (Pen), Tet)	—	PW92*
Four-valve: Blueprints, 2s. each		
Beta Universal Four (SG, D, LF Cl. B)	—	PW17*
Nucleon Class B Four (SG, D (SG), LF, Cl. B)	—	PW34B
Fury Four Super (SG, SG, D, Pen)	—	PW34C*
Battery Hall-Mark 4 (HF, Pen, D, Push-Pull)	—	PW46*
"Acme" All-Wave 4 (HF Pen, D (Pen), LF, Cl. B)	—	PW83*
The "Admiral" Four (HF Pen HF Pen, D, Pen (RC))	—	PW90*
Mains Operated		
Two-valve: Blueprints, 2s. each.		
Selectone A.C. Radiogram Two (D, Pow)	—	PW19*
Three-valve: Blueprints, 2s. each.		
Double-Diode-Triode Three (HF Pen, DDT, Pen)	—	PW23*
D.C. Ace (SG, D, Pen)	—	PW25*
A.C. Three (SG, D, Pen)	—	PW29
A.C. Leader (HF Pen, D, Pow)	—	PW35C*
D.C. Premier (HF Pen, D, Pen)	—	PW35B*
Ubique (HF Pen, D (Pen), Pen)	—	PW36A*
F. J. Camm's A.C. All-Wave Silver Souvenir Three (HF Pen, D, Pen)	—	PW60
"All-Wave" A.C. Three (D, 2 LF (RC))	—	PW54*
A.C. 1936 Sonotone (HF Pen, HF Pen, Westector, Pen)	—	PW56*
Mains Record All-Wave 3 (HF Pen, D, Pen)	—	PW70*
Four-valve: Blueprints, 2s. each.		
A.C. Fury Four (SG, SG, D, Pen)	—	PW20*
A.C. Fury Four Super (SG, SG, D, Pen)	—	PW34D
A.C. Hall-Mark (HF Pen, D, Push-Pull)	—	PW45*
Universal Hall-Mark (HF Pen, D, Push-Pull)	—	PW47
SUPERHETS		
Battery Sets: Blueprints, 2s. each.		
£5 Superhet (Three-valve)	—	PW40
F. J. Camm's 2-valve Superhet	—	PW52*
Mains Sets: Blueprints, 2s. each.		
A.C. £5 Superhet (Three-valve)	—	PW43
D.C. £5 Superhet (Three-valve)	—	PW42*
F. J. Camm's A.C. Superhet 4	—	PW59
F. J. Camm's Universal £4 Superhet 4	—	PW60
"Qualitone" Universal Four	—	PW73
SHORT-WAVE SETS. Battery Operated		
One-valve: Blueprint, 2s.		
Simple S.W. One-valver	—	PW88*
Two-valve: Blueprints, 2s. each.		
Midget Short-wave Two (D, Pen)	—	PW38A*
The "Fleet" Short-wave Two (D (HF Pen), Pen)	—	PW91*
Three-valve: Blueprints, 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		
Three-valve: Blueprints, 2s. each.		
F. J. Camm's ELF Three-valve Portable (HF Pen, D, Pen)	—	PW65
Parvo Flyweight Midget Portable (SG, D, Pen)	—	PW77
Four-valve: Blueprint, 2s.		
"Imp" Portable 4 (D, LF, LF, Pen)	—	PW86*
MISCELLANEOUS		
Blueprint, 2s.		
S.W. Converter-Adapter (1 valve)	—	PW48A*
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Blueprints, 1s. each.		
Four-station Crystal Set	—	AW427
Lucerne Tuning Coil for AW427	**1s.**	
1934 Crystal Set	—	AW444
150-mile Crystal Set	—	AW450
STRAIGHT SETS. Battery Operated.		
One-valve: Blueprint, 2s.		
B.B.C. Special One-valver	—	AW387*
Two-valve: Blueprints, 2s. each.		
Full-volume Two (SG det, Pen)	—	AW392
A modern Two-valver	—	WM409*
Three-valve: Blueprints, 2s. each.		
£5 5s. S.G. 3 (SG, D, Trans)	—	AW412*
Lucerne Ranger (SG, D, Trans)	—	AW422*
£5 5s. Three De Luxe Version (SG, D, Trans)	—	AW436
Transportable Three (SG, D, Pen)	—	WM271
Economy Pentode Three (SG, D, Pen)	—	WM337
"W.M." 1934 Standard Three (SG, D, Pen)	—	WM351
£3 3s. Three (SG, D, Trans)	—	WM354
1935 £6 6s. Battery Three (SG, D, Pen)	—	WM371
PTP Three (Pen, D, Pen)	—	WM389
Certainty Three (SG, D, Pen)	—	WM393
All-wave Winning Three (SG, D, Pen)	—	WM400
Four-valve: Blueprints, 2s. each.		
£5 5s. Four (SG, D, RC, Trans)	—	AW370
Self-contained Four (SG, D, LF, Cl. B)	—	WM331
Lucerne Straight Four (SG, D, LF, Trans)	—	WM350
£5 5s. Battery Four (HF, D, 2LF)	—	WM381*
The H.K. Four (SG, SG, D, Pen)	—	WM384
The Auto Straight Four (HF Pen, HF Pen, DDT, Pen)	—	WM404*
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Super-quality Five (2 HF, D, RC, Trans)	—	WM320
Class B Quadradyne (2 SG, D, LF, Class B)	—	WM344
New Class B Five (2 SG, D, LF, Class B)	—	WM340
Mains Operated		
Two-valve: Blueprints, 2s. each.		
Consoelectric Two (D, Pen), A.C.	—	AW402
Economy A.C. Two (D, Trans), A.C.	—	WM286
Three-valve: Blueprints, 2s. each.		
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All-Metal Four (2 SG, D, Pen)	—	WM329
Harris Jubilee Radiogram (HF, Pen, D, LF, P)	—	WM386
SUPERHETS		
Battery Sets: Blueprints, 2s. each.		
"Varsity Four	—	WM395*
The Request All-Waver	—	WM407
Mains Sets: Blueprints, 2s. each.		
Heptode Super Three A.C.	—	WM359*
PORTABLES		
Four-valve: Blueprints, 2s. each.		
Holiday Portable (SG, D, LF, Class B)	—	AW393*
Family Portable (HF, D, RC, Trans)	—	AW447*
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One-valve: Blueprints, 2s. each.		
S.W. One-valver for America	—	AW429*
Roma Short-waver	—	AW452*
Two-valve: Blueprints, 2s. each.		
Ultra-short Battery Two (SG, det Pen)	—	WM402*
Home-made Coil Two (D, Pen)	—	AW440
Three-valve: Blueprints, 2s. each.		
Experimenter's 5-metre Set (D, Trans, Super-regen)	—	AW434
The Carrier Short-waver (SG, D, P)	—	WM390
Four-valve: Blueprints, 2s. each.		
A.W. Short-wave World-beater (HF Pen, D, RC, Trans)	—	AW436*
Standard Four-valver Short-waver (SG, D, LF, P)	—	WM383*
Superhet: Blueprint, 2s.		
Simplified Short-wave Super	—	WM397*
Mains Operated		
Two-valve: Blueprints, 2s. each.		
Two-valve Mains Short-waver (D, Pen), A.C.	—	AW453
Four-valve: Blueprints, 2s.		
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MISCELLANEOUS		
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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*.

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