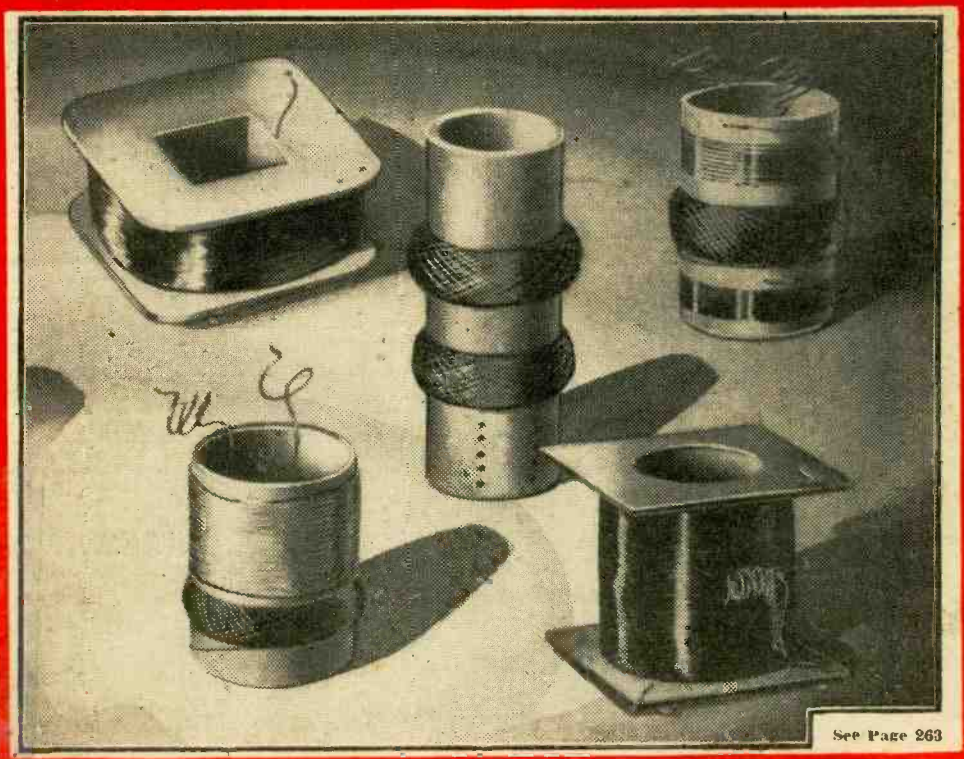
Practical Wireless

9D EVERY MONTH

AND PRACTICAL TELEVISION

Vol. 25. No. 516. || Editor: F. J. CAMM || JULY, 1949



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PRINCIPAL CONTENTS

Practical Wireless and PRACTICAL TELEVISION
17th YEAR OF ISSUE
EVERY MONTH
VOL. XXV. No. 516 JULY, 1949
Editor F. J. CAMM

COMMENTS OF THE MONTH — BY THE EDITOR

Good News

WE are pleased to be able to announce that as a result of the increase of paper allocation which operates as from the August issue readers will now be able to obtain in freer supply copies of this journal.

For many years now, nearly 10 to be precise, paper and hence the circulation of this journal has been severely restricted. We have had a long waiting list for many years. We know the disappointment many would-be readers have felt when they have endeavoured to place orders for the delivery of this journal either through newsagents or with us, only to be told that the best that could be done would be to place their name on a waiting list—a waiting list of many thousands of names.

Elsewhere in this issue you will read an important announcement concerning the future supply of this journal. You who are readers of this journal are among the fortunate, but you will help us and your friends if you will convey the news to them that they may now place orders with their newsagents for the regular delivery of this journal.

Radiolympia

THE ballots for stand sites at Radiolympia have been held and applications have been received for over 90 per cent. of the available space. This year there will not be any gallery stands and this means that with the reduced number of exhibitors the Ground Floor will be well filled. It is our opinion that this is not a move in the right direction. The last Radiolympia was uncomfortable, and it was impossible to examine the exhibits with care and interest whilst jostling cheek-by-jowl with a struggling crowd.

Demands for demonstration rooms have been greater this year and so six more will be provided. Most of the well-known firms will exhibit, and this journal, as in every radio show, will be there. Further details will appear herein as they are disclosed.

Russian Jamming

WE are glad to know that counter-measures are to be employed to stop the Russians jamming our programmes in English. These methods were employed by Hitler, and the Russians are exhibiting tactics which are tendentious and can hardly be associated with a one-time ally. The proposal to broadcast from 100 stations should teach the Russians that their methods provide a two-edged sword.

Training Institutes

THE opening of the Midland Television Transmitter towards the end of this year will create a demand for qualified service engineers, and one well-known manufacturer has undertaken to provide dealers in the service area with first-hand technical information. A meeting was recently held in Birmingham, by Prof. H. F. Truman, at which dealers learned something of the special knowledge and techniques necessary for the successful installation and servicing of any type of television receiver. He gave details of the E.M.I. Institute's postal course on television servicing, which has now been extended at a substantially reduced fee.

Some American Statistics

DURING 1949 over 1,580,000 television receivers will be purchased in America. This makes our own sales seem quite small. It seems deplorable that the Chancellor of the Exchequer did not see fit, as the Americans have done, to reduce the tax on television. It is a new industry needing all the encouragement and the fillip which sales can provide. It seems that the industry will have to wait at least until 1950 even for a hope of tax reduction.

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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.

Our Television Lead

SIR WILLIAM HALEY, Director-General of the B.B.C., told the Radio Wholesalers at Scarborough that B.B.C. television productions are more ambitious and diversified than those of any other country. We now have new cameras, new outside equipment for televising sport, and other public events, and new radio transmitters. New tele-cine apparatus is giving improved transmission of news reels and other films. For latest television news and views see the Practical Television Supplement at the back of each issue of this journal.

ROUND THE WORLD OF WIRELESS

Broadcast Receiving Licences

BROADCAST receiving licences totalling 11,753,150 were current in Great Britain and Northern Ireland at the end of March, 1949; this was an increase of 113,650 over the February figure. This figure includes 126,500 television licences—an increase of 6,400.

It is an offence to instal or use a set without a licence, and those doing so run the risk of prosecution. During March, 1949, the number of prosecutions authorised reached the record figure of 1,659, and the fines imposed ranged up to £10.

Sir Ernest Fisk and the Phonographic Industry

AT a general meeting of the International Federation of the Phonographic Industry recently concluded in Amsterdam, Holland, Sir Ernest Fisk was unanimously re-elected president of the Federation. Representatives of 12 different countries participated in the meetings as members. In addition to members, the meetings were attended and addressed by official representatives of U.N.E.S.C.O., the International Broadcasting Organisation and the International Federation of Musicians, also by representatives of the Netherlands Government.

Radio for Drainage Scheme

THE General Electric Co., Ltd., has been awarded a contract to supply V.H.F. radio equipment to the West Middlesex Drainage Department.

The purification plant, operated by the Middlesex County Council, is the largest in the world, with the exception of one in the U.S.A., and it is believed that radio will be of considerable use in maintaining contact between headquarters and mobile maintenance parties.

Sound Equipment for Churches

THE use of electrical sound reproducing equipment in churches is a branch of electro-acoustics to which the General Electric Company, Ltd., has given special attention, and two interesting installations from those entrusted to the company are those at St. Paul's Church, Portman Square, London, and the Baptist Church at Muswell Hill, London.

The equipment at the Baptist Church, Muswell Hill, centres around a 60-watt amplifier and record-player which can be used to provide music for loudspeakers in the belfry, church or church hall, or the amplifier can be connected to a microphone suspended near a rack of tubular bells on which peals and hymn tunes can be played and amplified and arranged to amplify them for broadcasting from loudspeakers on the roof of the tower. The beautiful tone of these bells has been widely commented on in the district.

High-quality Sound Demonstrations

FOR the first time at Radiolympia special arrangements are to be made for the demonstration of high-quality sound reception and reproduction in the demonstration rooms which, as already announced, are to be provided for the demonstration of television.

This will be in addition to the normal radio input as received on the Olympia aerial.

At regular intervals throughout each day there will be piped into the demonstration rooms a standard high-quality programme on the medium-wave, each programme lasting approximately a quarter of an hour.

This will make possible at Radiolympia for the first time a satisfactory practical demonstration of radio receivers, loudspeakers, radiograms, pick-ups, tape and disc recorders and reproducers of all types.

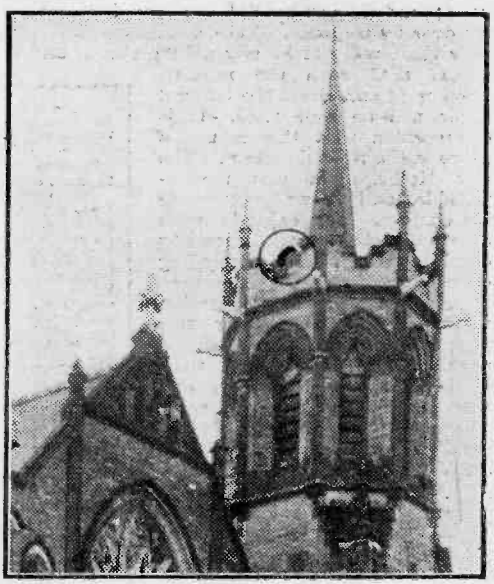
Details are to be announced by the Radio Industry Council immediately direct to prospective exhibitors.

Opportunities for Radio Retailers

THE importance of sound basic training for the service engineer was emphasised by Mr. C. H. Gardner, of the valve division of Mullard Electronic Products, Ltd., at the inaugural meeting of the Nottingham branch of the Institute of Practical Radio Engineers. Mr. A. E. Smith, a prominent Nottingham retailer, was elected chairman, and Mr. L. B. Taylor, who has for some time been active in the Institute's interests, was elected secretary.

The B.I.R.E.

A MEETING was recently held at the London School of Hygiene and Tropical Medicine, London, when a paper was read by W. Wilson, D.Sc., B.Eng. (Member), on "Electronics in Heavy Industry."



A loudspeaker on Muswell Hill Baptist Church, which relays Tubular Bells in place of normal peals.

The paper considered a large variety of applications of electronics to industry, including rectification, oscillation, amplification, cathode-ray applications and motor control. A section was devoted to electronic instruments used in industry.

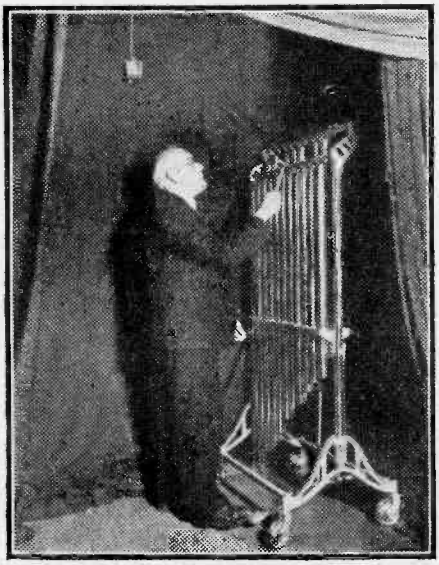
200ft. Tower at G.E.C.

THE research laboratories of The General Electric Co., Ltd., are actively engaged on research and development in connection with long-distance point-to-point communications on very short radio waves.

A tower, 200ft. high, is being erected at Wembley which will be suitable as the Wembley terminal of experimental radio links, enabling a large amount of apparatus there to form an essential part of such schemes. It will also be suitable for work on many other projects at very short radio wavelengths.

The tower is being designed and installed by Pirelli-General Cable Works, Ltd., to the requirements of the research laboratories. It is a lattice steel tower standing on a base 45ft. square, each corner leg being set in a reinforced concrete foundation 10ft. square and 11ft. deep.

A passenger lift will give access to two cabins situated one above the other at the top of the tower. Each cabin will be octagonal, about 11ft. wide, and will have an external balcony on which the very directional short-wave aerials will be mounted. The cavity walls of the cabins will be thermally insulated and electrically screened. The external surfaces of the cabin walls will be galvanised and the windows in them will be of the ships side-light type.



The tubular bells and microphone used at Muswell Hill.

Important Home and Overseas Contracts

TWO orders of particular interest are amongst the many public address installations recently undertaken by the Sound Amplification Division of E.M.I. Sales & Service, Ltd.

At home, the Rugby Football Union ground at Twickenham, Middlesex, is to be fully equipped with P.A. gear including 53 loudspeakers and amplifying equipment giving an undistorted output of 400 watts. Microphone and twin turntable gramophone inputs will enable announcements—of general interest or for crowd control—to be made or musical items played as desired.

The Madura Mill Co., Ltd., Madura, Southern India, have placed an order through their London agents for a complete P.A. installation for their mills. Over 55 cases full of equipment have just been sent from Hayes and are being shipped from Tilbury Docks: another vital contribution from E.M.I. to the export drive.

Hospitals Install Radio for Patients

THE Sound Amplification Division of E.M.I. Sales & Service, Ltd., have just secured a contract for equipping the Elizabeth Garratt Anderson Group of hospitals at Euston, Hampstead and Barnet with double-channel radio systems for disseminating radio programmes by both loudspeaker and headphones. Also to be supplied by the same division is a radio installation at Cardiff Royal Infirmary for paging by microphone and distribution of radio programmes.

Ekco-Ensign Electric, Ltd.

EKCO-ENSIGN ELECTRIC, LTD., announce the conclusion of an important agreement with African Incandescent Lamps (Pty.), Ltd., of Johannesburg, which is designed to strengthen still further the company's position in the South African market.

The agreement provides for E. K. Cole, Ltd., to become a substantial shareholder in the South African company, and Ekco-Ensign Electric, Ltd., will contribute plant and technical information required for the manufacture of tungsten and fluorescent lamps, fittings and control gear.

A new factory has recently been acquired at Industria, on the outskirts of Johannesburg, and is already in production.

The agreement became operative from April 1st, 1949, following a recent visit to the Union by Mr. D. W. Pritchard, commercial director of E. K. Cole, Ltd., and vice-chairman of Ekco-Ensign Electric, Ltd.

A 12-watt Amplifier—2

Concluding Details of an A.C. Unit with Built-in Meter, and Bass Compensation for Records.

By J. ALCOCK

THE meter resistances are actually the anode stoppers R37 and R38. These should be mounted as close as possible to the tag on the valveholder and should not be wirewound. Similarly with the grid stoppers R30 and R31.

Compartment No. 5 houses condensers C24 and C25 and V_7. C25 should be a paper condenser rated at least 600 volts. The writer used a paper condenser also for C24.

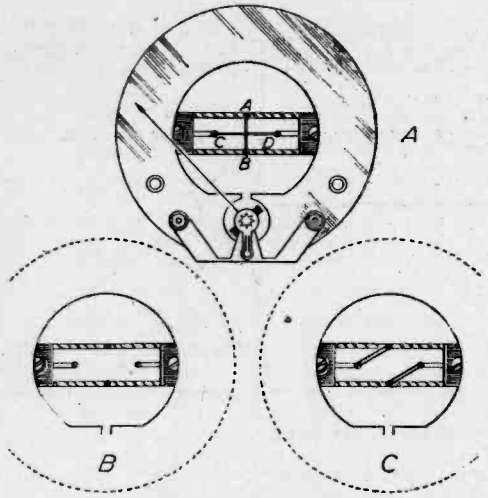


Fig. 6.—The meter with dial removed.

Above chassis are the valves themselves.

The mains transformer and chokes 1 and 2 are over compartment No. 5. The windings on these should be in different planes from each other.

Above compartment 7 is the output transformer, its windings in the same plane as those of Choke 2, since the field of this choke is weaker than that of Choke 1 or the mains transformer.

The output transformer must be a good quality job, or trouble will be encountered due to excessive phase shift at high and/or low frequencies turning the *negative* feedback into *positive* feedback. The resulting noise is hardly "high-fidelity"!

One end of the secondary is earthed and feedback is taken from the other end. There is a right and a wrong way of making these connections and the only way of finding the right way is to try it. If it is the wrong way, positive feedback will result.

The output transformer used had a tapped secondary, and a 2-pole Yaxley switch at the back, near the loudspeaker socket, was used to connect the appropriate tapping to the loudspeaker socket and also to select the correct feedback resistor.

For a given *power* the output *voltage* will depend upon the load, since $W = \frac{E^2}{R}$. Since we have to feed back a certain voltage at a certain power

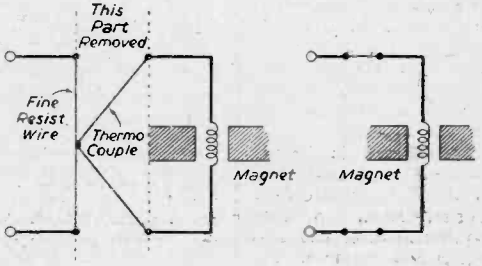


Fig. 5.—The meter before conversion (left) and after conversion (right).

the feedback resistor, R19, will depend upon the speech coil impedance of the loudspeaker used. In this amplifier, the value of the resistor is given by the formula—

$$R = 170\sqrt{\text{Speech coil impedance}}$$

Suitable resistance values for the usual impedances are :—

Impedance (ohms)	*Feedback Resistor (ohms)*
2	240
3	295
4	340
5	380
7.5	470
15	660
30	930

Cover

The framework of the cover was built of brass curtain strip drilled and tapped 4 BA. Front, top and back were made from one piece of perforated zinc of the meat-safe type. The ends were of 20 s.w.g. aluminium. A strengthening, internal, aluminium panel about half way between the two ends is arranged to separate chokes 1 and 2 and the mains transformer from the rest of the amplifier. The whole affair gives adequate protection with good ventilation.

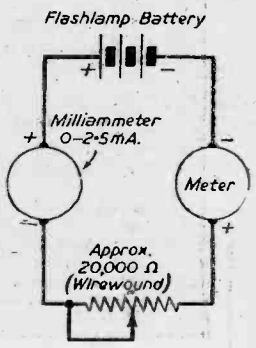


Fig. 7.—Circuit for meter calibration.

Meter

The meter used was converted from an R.F. thermocouple milliammeter, bought new and boxed for 2s. 6d. ex-W.D.

When converted, the meter is calibrated in mA of anode current, but is actually used as a voltmeter.

If 50 mA is passing through V_5, this current flows through the anode stopper, R37. By Ohm's Law, Current × Resistance = Volts. Since R37 is 100 ohms the voltage across it will be 5 volts. If the current drops to 40 mA the voltage will be 4 volts. The meter is converted to a voltmeter, with a full-scale deflection of 10 volts, and can be connected across either anode stopper to measure the voltage across it, which is read off the scale directly in terms of mA of anode current.

In the case of V_3 and V_4, the currents are much lower—in fact, just over 1/10 of V_5 and V_6. The meter resistances are therefore multiplied by 10, to 1,000 ohms, so that 5 mA gives a volts drop of 5 volts (I × R = E). Unfortunately, when we switch our meter across 1,000 ohms, the effect of the resistance of the meter in parallel is to reduce the effective resistance to below 1,000 ohms and so give us a false reading. To allow for this, the meter resistances are increased to 1,330 ohms each. A 4,000-ohm meter across this makes the effective resistance 1,000 ohms, which is what we want. 1,330 ohms can be made up of 1,000 ohms and 330 ohms in series, or, 2,200 ohms and 3,300 ohms in parallel, all standard values.

4,000 ohms has little shunting effect across the 100-ohm resistances R37 and R38.

A 10-volt meter with a resistance of 4,000 ohms is obviously 400 ohms per volt. This means a basic movement of 2.5 mA F.S.D. These figures, therefore, apply only to the meter about to be described, and should be suitably modified if a meter having a different full-scale deflection is used.

There seems no shortage of this particular meter.

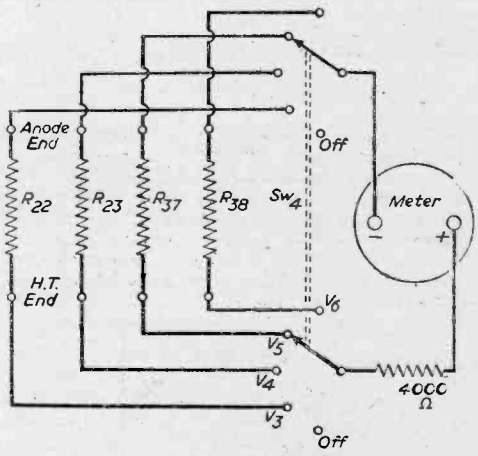


Fig. 8.—Details of meter switching.

It has a 2in. dial, and the scale reads from 0 to 350 mA. Markings are as follows :—

Top :—Sangamo Weston, Ltd., Enfield, Middx., Eng.
AMMETER H.F.
Scale is marked at 100, 200, 300 and 350.
Below Scale 350 mA No. 1.
F. G.
Thermo Couple Resist 1.6 ohms.

LIST OF COMPONENTS

R 1—22kΩ. ½w.
R 2—22kΩ. ½w.
R 3—22kΩ. ½w.
R 4—100kΩ. 1w.
R 5—250kΩ. ½w.
R 6—100kΩ. (see text) ½w.
R 7—1.5kΩ. ½w.
R 8—150kΩ. ½w.
R 9—6.8kΩ. ½w.
R10—150kΩ. ½w.
R11—100kΩ. (var.) ½w.
R12—33kΩ. ½w.
R13—33kΩ. ½w.
R14—100kΩ. 1w.
R15—250kΩ. ½w.
R16—1.5kΩ. ½w.
R17—10 ohms. ½w.
R18—500kΩ. ½w.
R19—170 √Speech coil impedance (see text).
R20—500 ohms. 1w.
R21—500kΩ.
R22—1,330 ohms. } (see text) ½w.
R23—1,330 ohms. } ½w.
R24—100kΩ. ½w.
R25—100kΩ. ½w.
R26—250kΩ var. ½w.
R27—22kΩ. 1w.
R28—25kΩ. (wire-wound).
R29—22kΩ. 1w.
R30—4.7kΩ. ½w.
R31—4.7kΩ. ½w.
R32—250kΩ. ½w.
R33—250kΩ. ½w.
R34—200 ohms. var. (w-w). 1w.
R35—100 ohms ½w.
R36—100 ohms. ½w.
R37—100 ohms. ½w.
R38—100 ohms. ½w.
R39—200 ohms. 3w.
R40—200 ohms. var. (w-w). 3w.
R41—350 ohms. 5w.
R42—1mΩ var. ½w.

SW1—Single pole ; 4 way.
SW2—Single pole ; 2 way.
SW3—Double pole ; Single way.
SW4—Double pole ; 5 way.

C 1—32μF. 350v.
C 2—32μF. 350v.
C 3— 8μF. 250v.
C 4—0.1μF. 250v.
C 5—.0008μF. } (see text).
C 6—.002μF. }
C 7—.005μF. }
C 8—25μF. 12v.
C 9—0.1μF. 250v.
C10—0.1μF. 250v.
C11—.01μF. 250v.
C12—8μF. 500v.
C13—8μF. 350v.
C14—8μF 250v.
C15—0.1μF. 250v.
C16—25μF. 12v.
C17—0.1μF. 250v.
C18—8μF. 500v.
C19—0.1μF. 250v.
C20—0.1μF. 250v.
C21—0.1μF. 250v.
C22—.01μF. 500v.
C24—8μF. 500v.
C25—4μF. 600v. (paper).
C26—50μF. 50v.

CH1—20H @ 150mA.
CH2—20H @ 50 mA.
CH3—40H @ 10 mA.

T1—350-0-350 @ 150mA.
4v. 3a. C.T.
4v. 2a. C.T.
4v. 4a. C.T. (min.).
(If tuner operated from amp. power pack, this last should be 4v. 6A.)
T2—15-watt output transformer, 6,000Ω A-A C.T.
T3—Pick-up transformer (see text).

V1 and V2=SP41 ; V3 and V4=MHL4 ; V5 and V6=PX4 ; V7=FW4/500.

The disposition of these markings sometimes varies slightly. The main points are a F.S.D. of 350 mA and a resistance of 1.6 ohms. There are no screw terminals on the back, plugs being found in their place.

Inside the case a short length of fine resistance wire is connected across the plugs. A current through this wire causes it to get hot, the temperature

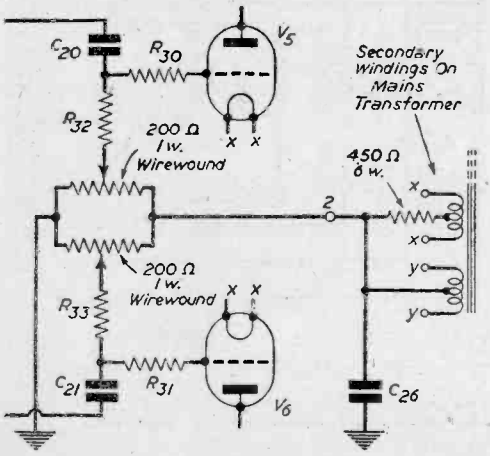


Fig. 9.—An alternative bias arrangement for V5 and V6.

depending on the current. The "hot junction" of a thermocouple touches this wire.

If two lengths of dissimilar metals are connected at both their ends, and a difference in temperature exists between these ends, a minute current flows which is proportional to the temperature difference. Some combinations of metals exhibit this property more strongly than others, a common combination being iron and copper.

The two ends of the thermocouple in this instrument are (i) at the resistance wire ("hot junction") and (ii) connected to the meter movement which thus registers the current flowing in the thermocouple, this being dependent upon the temperature of the resistance wire. This, in turn, depends upon the current flowing through the resistance wire.

Conversion consists of removing the resistance wire and thermocouple, and connecting the movement direct to the terminal plugs. (Fig. 5.)

First remove seals from the three screws round the side and take these screws out. Hold the plugs in one hand and pull the sides with the other to take off the case. The meter is now unprotected and care should be exercised. The two screws on the front of the dial are taken out and the dial can be removed by sliding it upwards, care being taken not to bend the pointer.

Stubs C and D Fig. 6(a) are each connected to the terminal plugs and the fine resistance wire can be seen between them. A and B are crimped copper strips connected to the movement and the thermocouple goes from A to B, touching the fine resistance wire halfway across.

Using tweezers, remove both resistance wire and thermocouple so that the meter looks as in Fig. 6(b).

The trickiest job of all is now to connect stub C to copper strip at A and stub D to strip B by short lengths of tinned copper wire. This calls for tweezers, a soldering iron which is not too large, and a lot of patience and care! See Fig. 6(c).

Then glue white paper over the calibrations on the dial.

Now replace the dial, but not the case.

Calibration

The first thing to do is to determine the polarity of the meter. A 3-volt cell and a resistance of about 50,000 ohms should be momentarily connected in series across the instrument and, if necessary, changed over so that the flick of the needle is "up-scale." The terminal connected to the positive pole (brass stud) on the battery should be marked with a red cross or similar mark.

Next, the circuit shown in Fig. 7 should be hooked up. Adjustment of the variable resistance will control the current flowing through the circuit and the meter can be calibrated as follows:

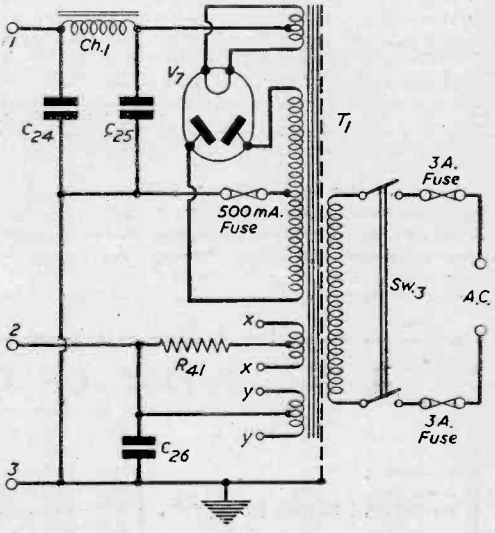


Fig. 10.—Circuit of the power pack.

Milliammeter reading	Meter scale marked
0	0
0.25 mA	10
0.5 mA	20
0.75 mA	30
1.0 mA	40
1.25 mA	50
1.5 mA	60
1.75 mA	70
2.0 mA	80
2.25 mA	90
2.5 mA	100

Replace case.

Meter and switch panel can be then installed as in Fig. 8. Switch positions for V_3 and V_4 should be marked "X 10" since a current of 6 mA through the valve will be read on the meter as 60 mA.

Leads from the switch can be plugged into the appropriate sockets, "Positive" leads going to H.T. end and "Negative" leads to anode end.

Final Adjustments

Check resistance between H.T. and chassis. Owing to the small leak of each electrolytic condenser, this will not be infinity, but should be at least ¼ megohm after the condensers have charged up.

Connect speaker, etc.

Switch meter to V_5 and switch on power supply. As the valves warm up, the anode current will rise to 55-60 mA., drop back to 30-40 mA. as the condensers charge up, and then settle to some reading around 50 mA. Switch to V_6 and adjust R34 until both valves are passing an equal current; switching from one to another to check this. Then adjust R40 until each valve is passing 50 mA.

Then switch to V_3 and V_4, and adjust R28 for balance on these valves. This will be at 5-6 mA. each.

Finally, plug in high-resistance 'phones at the 'phone jack, and, with a signal into the amplifier, adjust R26 so that the signal heard in the 'phones is at a minimum.

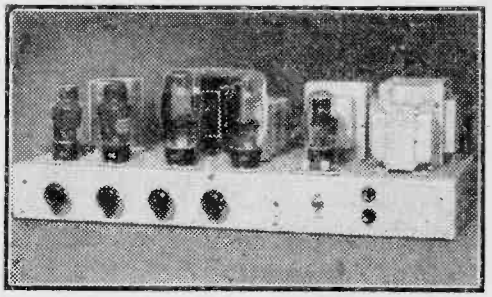
If the amplifier "howls" as it warms up, reverse the connections to the output transformer secondary (see notes on negative feedback).

The PX4s will remain balanced for periods of months. If, occasionally, on switching on, they appear to be a few mAs unbalanced, the amplifier should be allowed to run for 10-15 minutes when the valves will usually level up.

The balancing circuit shown is, in the writer's opinion, the best one, since only one heater winding is needed for the output valves and R40 can be adjusted for slight variations in supply voltage.

However, if separate bias control is desired for each PX4, the circuit shown in Fig. 9 can be used. This does not give completely independent control, because the 450 ohm resistor is common to both valves, but it does not need an extra heater winding.

The resistor R6 is the load resistance for the pick-up transformer. 100KΩ is the value for the Wilkins and Wright transformer. Values of R6 for other pick-ups are:



The completed amplifier with cover removed.

Lexington moving coil ..	1 megohm.
Brierley ribbon	15 KΩ.
Decca moving iron ..	250 KΩ (C8 omitted).
"Connoisseur" (no transformer)	100 KΩ (C8 omitted).

Values of load resistance for pick-ups not mentioned here can be obtained from the pick-up manufacturers. A peak input of more than 150 mV. will overload V_1 owing to the presence of R8, R9, R10, C9, C10 and C11. If C8 is omitted, up to ½ volt can be applied to V_1, however. This is because current negative feedback is applied via R7 when it is not by-passed.

Aerial Coupling Circuits—3

Concluding the Theory of the Coupled Circuit

By "EXPERIMENTER"

The performance of an R.F. transformer with $L_1 = 2$mH and $M = 112\ \mu$H is shown by the curves in Fig. 7, which illustrate the extreme constancy of the voltage gain and selectivity factors. They also indicate that gain is low and selectivity high, a feature which makes this circuit particularly suitable for use in communications receivers, where constant gain and good image suppression are essential. Roughly the voltage gain is given by MQ/L1 where Q is the factor for L2; for average values of M, Q and L1 the gain is unlikely to exceed about 5.

For this type of coupling the reflected capacitance is negative, is roughly directly proportional to the tuning capacitance and, for $M = 112\ \mu$H, varies from -5 pF at 1,500 kc/s to -37 pF at 550 kc/s, as shown in Fig. 8. Because of this great variation in reflected capacitance ganging cannot be so accurate as with the two previous types of coupling circuit and because the capacitance changes are most rapid at the low frequency end of the band the aerial trimmer should be adjusted at the high-frequency end to minimise the average ganging error over the band.

Because of the labour of winding a high-inductance primary and the difficulty in measuring or calculating M this type of aerial-coupling circuit is not so suitable for use by amateur constructors as some of the others described in this article.

3. Series-capacitance Aerial Coupling

This is a simple form of aerial coupling in which the aerial is connected to the high-potential end of

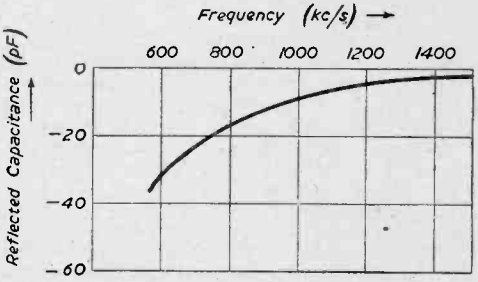


Fig. 8.—Variation with frequency of reflected capacitance for R.F. transformer with high-inductance primary winding.

the tuned circuit via a fixed capacitor (Fig. 9) and, provided the limitations mentioned later are observed, this coupling circuit is suitable for use by amateur constructors.

An advantage possessed only by this coupling circuit is that the reflected capacitance (which is positive) is independent of frequency. Unfortunately, unless the coupling capacitance is very small (about 10 pF) the value of the reflected capacitance varies with change in the aerial-earth constants and reganging is necessary every time a different aerial is used.

Fig. 10 illustrates the variation with frequency of the voltage gain and selectivity factors for a series

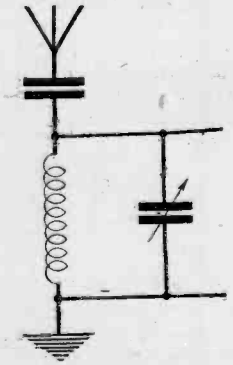


Fig. 9.—Series-capacitance aerial coupling.

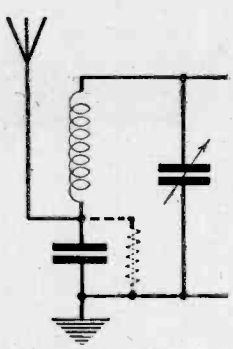


Fig. 11.—Shunt-capacitance aerial coupling.

capacitance of 50 pF and it shows that the performance is very similar to that of the tapped-coil or small-primary R.F. transformer.

4. Shunt-capacitance Aerial Coupling

This type of aerial-coupling circuit has a performance very similar to that of the high-inductance R.F. transformer but, unlike it, is very convenient for use by amateur constructors. As shown in Fig. 11, the aerial connection is made to the lower end of the tuning coil, and this point is earthed via a fixed capacitor which is thus common to and provides coupling between aerial and tuning circuits. To maintain D.C. continuity between earth and the grid of the valve following the tuned circuit, a high value resistor should be connected across the coupling capacitance as shown in dotted lines in Fig. 11.

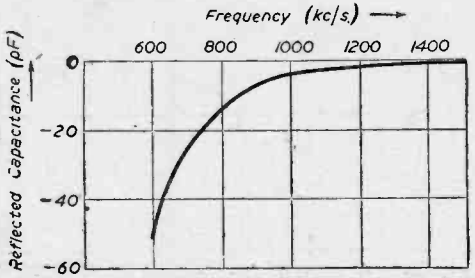


Fig. 13.—Variation with frequency of reflected capacitance for shunt-capacitance aerial coupling.

The coupling capacitor must not be less than about .002 μF in value (with a tuning capacitance of 500 pF maximum), otherwise it is impossible to tune to the low-frequency end of the waveband; in fact, even with this value of coupling capacitance a 40 pF trimmer must be connected across the tuning coil to maintain full coverage of the waveband. On the other hand, the coupling capacitance must not be too large, otherwise the voltage gain is too small. Fig. 12 illustrates the variation with frequency of the voltage gain and selectivity factors for a shunt capacitance of .005 μF. The curves show that voltage gain is low, selectivity high, and that both are remarkably constant.

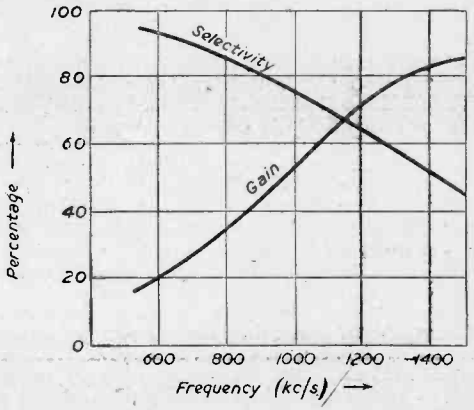


Fig. 10.—Variation with frequency of voltage gain and selectivity factors for series-capacitance aerial coupling.

The voltage gain is given approximately by:

$$\frac{Q(\text{of } L_2) \times \text{aerial capacitance}}{\text{coupling capacitance}}$$

When aerial capacitance = 200 pF, coupling capacitance = .005 μF and Q = 100, the voltage gain is 4 and the voltage gain factor 8. Slightly lower values are obtained in practice, as shown in Fig. 12.

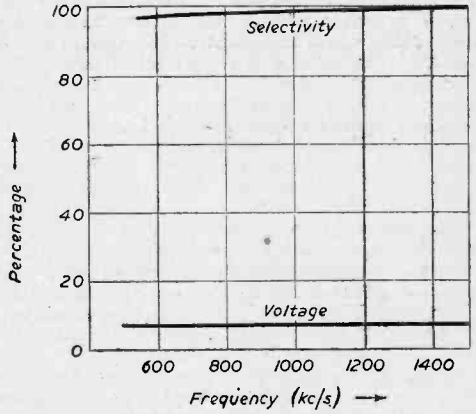
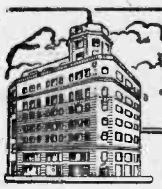


Fig. 12.—Variation with frequency of voltage gain and selectivity factors for shunt-capacitance aerial coupling.



ON YOUR WAVELENGTH

By THERMION

American Service Racketeers

THE Americans, like ourselves, have taken up arms against the service racketeer who preys upon the ignorance of the public and either charges for work which is not done, overcharges for work which he has done, or fits new parts which are not really required.

The campaign opened in Pittsburgh after a report by an investigating bureau which stated that two out of three shops swindled their customers by making and charging for unnecessary repairs. Sixty-eight firms selected at random in all sections of the district were included in the investigation. Of course, there is the type of customer who always thinks he is being swindled, even when reasonable charges are made, for repairs efficiently carried out.

The moral seems to be that the public should study radio and learn to carry out, as readers of this journal do, their own repairs.

The Cat's Whisker Again

GREAT interest has been aroused in radio and electronic circles by the recent announcement from America of the production of the Transitor, a three-electrode crystal which amplifies and oscillates like a valve.

In a recent B.B.C. "Science Survey" talk, Mr. T. H. Kinman, head of the H.F. Department of B.T.H., Rugby, described the development of the modern crystal rectifier which led to the discovery of this new device, which is called in this country the crystal triode.

We are all aware of the unstable type of crystal detector used in the early days of broadcasting. The point contact rectifier was inherently more efficient than the valve as a detector of short centimetre waves as used for radar.

Some of the better-known semi-conductors are: galena, carborundum, silicon, and the new material, germanium, which has many unique electrical characteristics.

A semi-conductor has characteristics which can be better understood by comparing it with a conductor and insulator in relation to voltage and current. The similarity, as a rectifier, of the crystal to the diode valve can be seen by comparing the function of the barrier layer between the crystal face and the cat's-whisker point, with the empty space between the valve electrodes.

The need of a stable and reproducible detector for radar work early in the war led to the production of a modern version called the crystal valve. It resembled a small cartridge fuse about ¾in. long and ¼in. in diameter. It was permanently adjusted and more robust than the valve. Many hundreds of thousands were made during the war, and this British design was copied by the Americans.

The characteristics of the two modern crystals, silicon and germanium, are now well known. In modern use these substances are combined with small amounts of boron and tin.

Whereas silicon when suitably treated was the best for centimetre-wave detection, germanium is, no doubt, the most interesting of all semi-conductors, its high resistance to voltage breakdown making it an attractive valve substitute in many applications.

Although our knowledge of semi-conductors is still incomplete, considerable progress has been made empirically, and this has led to the discovery of the crystal triode.

The crystal triode may be of commercial value if it can be reproduced on a commercial scale. I like the description of it as an electrical Siamese twin with two cats' whiskers spaced literally a hairsbreadth apart on the surface of a germanium crystal.

An Evening with the "Long Range Express Three"

THE first constructional article to appear in this journal was that which described the building of Mr. F. J. Camm's famous "Long Range Express Three." This article appeared in the very first issue of this journal, and a blueprint was presented with that issue; that was over 15 years ago. I built one of these to test it out at the Editor's request, and the other day I rescued it from the loft where I store receivers which have given place to new ones. After a little dusting I connected it up, and I was amazed at the quality even compared with modern standards.

The "Fury Four" was another remarkable receiver described in those days and, of course, it is a real ether searcher. Many tens of thousands of these receivers have been built, and I still receive letters from readers who continue to operate it.

At that time the home constructor was catered for by many weekly and monthly journals. This was the last in the field, and it has witnessed the obituaries of all of its competitors. This, I think, is the only example of a new journal ousting all of its competitors. There is still a steady demand for the blueprints of the two versions of the "Fury Four"—battery and mains models. I am glad to know that components for these receivers may still be obtained. I do not know how long it will be before component supplies are as plentiful as they were before the war. One of the difficulties encountered by the constructor to-day is in collecting the components. Whilst manufacturers are compelled to export a high percentage of their production I suppose the situation will remain as it is. Perhaps there will be a change in the eve-of-election Budget next year.

Radio Control of Models

APROPOS my paragraph on this subject in a recent issue, I see that our companion journal, *Practical Mechanics*, this month publishes the first of a series of articles on the construction of a radio-controlled model tank.

Building a Television Receiver—6

Notes on Final Layout, Alignment and Testing

By S. A. KNIGHT

THE vision receiver that has been the subject of the past five articles in this series has now been described in full from the constructional point of view, and all that remains is to carry out the unit interwiring, and alignment of the vision and sound chassis.

For trial purposes a long clear bench is required and a suitable layout for the various units is shown in Fig. 1. The power unit is placed on the extreme left-hand end of the bench, the tube unit follows—spaced a few inches to avoid any excessive interaction from the mains equipment, then time-base, vision and sound chassis follow in that order. There is no need for great spacing between these latter units, a couple or so inches or enough to allow manipulation of side mounted controls being sufficient. It should be emphasised that the whole bench should be cleaned down thoroughly before this trial layout is attempted; there is nothing worse than trying to work on a bench that is elbow deep in nuts and bolts, tools, pots of glue, flux and so on.

When the chassis are set out the interwiring must be done; the ten-way lead from the power unit is soldered to the ten-way tag strip (if not already done) at the rear of the tube unit, great care being taken to ensure that the lettered coding used for H.T. and L.T. wiring throughout this series is followed. The *order* along the strip does not particularly matter, but the right connections do! The H.T. and L.T. leads from the time-base unit are then wired to the tag strip, followed by the H.T. and L.T. leads from the vision and sound chassis as Fig. 1 shows. The outputs of line and frame pulses from the time-base plug into the Octal socket on the tube unit and the main interconnections are then complete. The earth lead, which is common, must be carried out in really heavy wire; a good plan is to bond chassis to chassis with heavy bonding weave from any convenient points. In all leads, fairly short connections should be aimed at, particularly in the heater wires carrying heavy currents.

Having completed this wiring there is the tube E.H.T. and grid input, synch input and sound input to deal with. A lead is taken from the cathode of V_{10} on the vision unit to the grid of the tube; this lead is *not* screened in any way and its length is in no way critical, but the shorter the better. Another lead, also unscreened but of minimum possible length, is taken from C_{33} in the vision unit to R_9 on the time-base chassis, this carries the synch pulses to the latter unit. A heavily insulated lead (ignition cable is best) is then taken from the + E.H.T. terminal on the power chassis to the tube anode via the small insulator mounted on the tube unit. Finally the coaxial lead from the sound receiver is plugged into the requisite socket on the vision receiver and a suitable loudspeaker is connected to the sound output transformer.

The variable controls, brightness, focus, line-hold, frame-hold are best mounted on four component brackets screwed to the bench for this trial layout; leads from them are wired to the appropriate points in the circuit.

Everything is now ready for test and alignment—except, of course, for the aerial input which is connected later on.

Preliminary Checks

It is assumed that all wiring on the individual chassis has been *thoroughly* checked before the interwiring just described is undertaken and that the two small errors which crept into the circuit diagram and parts list of the time-base unit have been rectified (see April issue). If the interwiring has now also been double-checked there is nothing to prevent the complete receiver from being connected to the mains and tried out. Turn the following controls to minimum: contrast, sound volume, brightness; set the following about half-way along their travel: line- and frame-hold, focus, linearity; set the following near maximum: width and height. The mains may now be connected.

Watch all units carefully while the receiver is warming up and listen carefully for any untoward "noises" that might indicate trouble. After a minute or so a very high-pitched whistle should be heard coming from the time-base unit; now turn up the Brightness control *carefully* and a raster of sorts should appear on the screen. This raster will

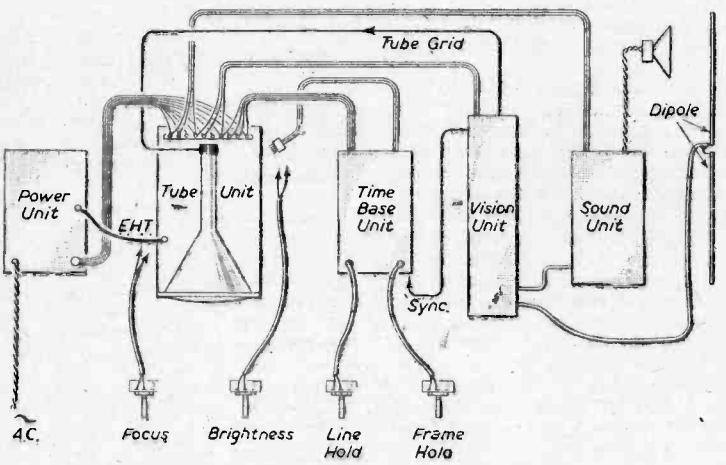


Fig. 1.—Layout of the various units for the preliminary tests.

almost certainly be out of focus and will also completely cover the screen, but this is of no importance just yet. Focus the raster as well as you can with the Focus control and try adjusting the Line-and Frame-hold controls. These will have the effect of changing the raster frequency in both directions and a point will be found where the lines are stationary (in the vertical direction), though this condition may not hold for long. Check the focusing of the lines again; they should be quite distinct and evenly spaced—the exact spacing does not matter for the moment. There will probably be slight defocusing at the edges of the screen. Keep the Brightness as low as possible and try not to work under a strong light. At this stage a bright line may be seen running down the raster or a fold-over appearance may be evident as shown exaggerated in Fig. 2 (a) and (b). If so, adjust the Linearity control (don't touch the E.H.T. lead !) and the line or fold-over should shift to one side and disappear. Choose the position where it is least in evidence for the present, even if it will not vanish completely. If the Linearity control is turned fully out without the line or fold-over vanishing, remove the series fixed resistor and set the variable control again.

Now turn up the vision contrast to maximum. The raster should brighten up (reduce this with the Brightness control) and the vision receiver valve noise will begin to modulate the trace, i.e., the clear raster will become "mottled" somewhat. If the raster "flares" violently beyond a certain setting of Contrast, then the vision receiver is unstable and the wiring must be checked particularly with regard to feed-through resistors (see Article 1). Normally, if the receiver has been copied carefully from the instructions it will be absolutely stable, and so no trouble of this kind should appear, and the raster will simply mottle up to maximum contrast.

It may happen, by sheer chance, that the sound receiver frequency-changer is oscillating at this stage at or near to 45 Mc/s and the I.F. line-up in the vision receiver is near enough tuned to the correct vision I.F. to receive it through the vision frequency-changer. In this case the raster will be violently striped with diagonal and zig-zag patterns, but these may be cleared by simply turning the oscillator tuning in the sound receiver a few degrees.

The preliminary check is now complete and if by now there is no smell of burning or other drastic indication of something wrong, the general wiring may be regarded as O.K. Voltage checks may be taken at this stage if desired, and for this purpose the following table is drawn up; this gives the voltages to be expected at the main points, after which the individual valve voltages (assuming no faulty parts) should receive their correct values. The readings shown, taken from the writer's receiver will no doubt differ slightly from others, but they show the general voltages one may expect—*serious* differences should be investigated before proceeding further.

Unit	Test point	Voltage
Vision ..	+ve A	230-250 D.C.
	H_1	6 to 6.3 A.C.
Sound ..	+B	230-260 D.C.
	H_1	As above
Time-base ..	+C	310-320 D.C.
	+D	300 D.C.
	H_2	6 to 6.3 A.C.
	H_3	4 to 4.1 A.C.
Tube Unit ..	Tube Heater	2 to 2.1 A.C.

Alignment

If it is at all possible to beg or borrow a reliable signal generator for alignment purposes of the receiver, this should be done. Avo, Taylor or B.P.L. instruments are all suitable types, failing which a good home-constructed unit (properly calibrated) may be used. The set *can* be made to line up excellently using no instruments apart from a voltmeter (the writer did it this way as an experiment), but a signal generator does lessen the work. The vision receiver is aligned first.

Remove V_3; set the generator to 15 Mc/s and connect it between chassis and the grid of V_6—the output being suitably terminated. Then

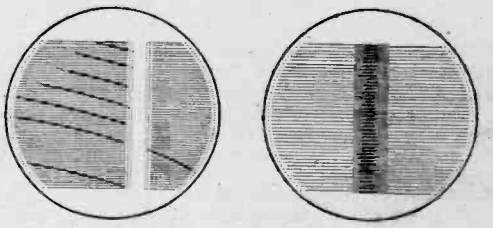


Fig. 2.—Typical oscillograms which may be obtained during tests.

adjust L_7 for maximum output. This output is best measured on a 0—1 mA. meter connected in series with R_{30} and chassis with short leads and by-passed with a 0.002 μF mica condenser; alternately, a 0—50 voltmeter may be connected *across* R_{35}. The tuning will be fairly flat and the input will be fairly large to obtain an output reading. Now transfer the generator to the grid of V_5, tune it to 11 Mc/s and adjust L_6 for maximum output. Transfer the generator to the grid of V_4, set it 12 Mc/s and adjust L_5 for maximum output.

Now replace V_3 but short out L_0 with a *short* piece of wire. Transfer the generator to the grid of V_3, set it to 13 Mc/s and adjust L_4 for maximum output. The generator output will have to be progressively reduced as this procedure works along from V_6 to V_3 and it should not be greater at any time than is necessary to give a clearly marked swing on the output meter. Have the Contrast control near maximum. Remove the shorting wire from L_0, transfer the generator to the grid of V_2, set it to 45 Mc/s and adjust VC_1 for maximum output. This control MUST be tuned with a non-metallic tool and turned very slowly; the spindle is at R.F. as well as H.T. potential. When a reading is obtained adjust L_3 in conjunction to give maximum output. Transfer the generator to the grid of V_1, set it to 43 Mc/s and adjust L_2 for maximum output. Finally transfer

the generator to the serial input socket, set it to 43.5 Mc/s and adjust L_1 for maximum output. If the generator does not cover the 45 Mc/s band, leave the R.F. tuning for alignment on an actual signal, but try to set the I.F. stages up carefully.

The sound receiver is aligned next. Transfer the generator to the grid of V_{19}, set it to 3 Mc/s and adjust L_5 and L_6 for maximum output (on the speaker if the signal is 400 cycle modulated, or on an A.C. voltmeter across the speech coil). Short out the oscillator coil L_9 (sound chassis) with a piece of wire, transfer the generator to the grid of V_{18}, and adjust L_3 and L_4 for maximum output. Remove the shorting wire from L_9, transfer the generator to the top end of L_1, set it to 41.5 Mc/s and adjust VC_1 for maximum output. As for the vision receiver, this control must be adjusted with an insulated tool and set carefully, though it is not so critical as the vision tuning. Now adjust L_2 in conjunction for maximum output. It is essential to set the oscillator tuning on VC_1 (sound chassis) to 41.5−3=38.5 Mc/s and *not* 41.4+3=44.5 Mc/s, therefore check for *two* peaking positions on VC_1 and use the one that comes up with the moving vanes most engaged, i.e., highest capacity position. With the sound receiver coaxial cable plugged into the vision receiver, transfer the generator to the vision aerial input socket and swing the generator through the range 40 to 45 Mc/s. The sound maximum indication should come through at about 43 Mc/s and will be very flat. This completes the alignment procedure.

Checking on Vision Signals

Connect the aerial input lead, advance contrast to maximum or very near maximum, turn up the Brightness until the raster is fairly bright but *not* glaring, and focus carefully. Be sure that the time is such that signals are being radiated, if possible during the morning test card transmissions. Adjust the frame-hold control until the raster becomes stationary in the vertical direction, then adjust the line-hold carefully when the picture frame should lock in steadily. A vertical black bar, which is usually unsteady, will indicate that the line-hold is almost in position, this bar being the synch pulses when running just off of correct hold. Final settings of Contrast, Focus and Brightness can then be carried out.

For those who must align the receiver without a signal generator the following method should be adopted. With the aerial connected, set all iron cores flush with the base of the coil formers (vision only). With contrast at maximum and brightness set as above adjust VC_1 on the vision chassis with an insulated tool *very slowly*. At one point a pattern *may* suddenly appear on the tube, a brightening of the raster accompanied with streaks of modulation. If so, adjust line-and frame-hold and try to resolve the pattern into an intelligible picture. You may be lucky in this way and find the signal first time. If so, leave VC_1 and adjust the R.F. cores for maximum picture. Then adjust the I.F. cores to give (a) best signal, (b) best definition. The I.F. cores will, if peaked and not staggered, give a "soot and whitewash" picture with all intermediate shades missing. For this reason the test card transmissions are best as the definition can be set to give the best results. After setting R.F. and I.F. cores to give the best picture, adjust VC_1 very slightly and then go over the I.F. cores again. It is a long process requiring much patience, but it can be done and it will lead to excellent results. You may not, of course, be lucky enough to find a picture first time you adjust VC_1. In this case give L_4 and L_7 a couple of turns inwards and try again. If again there is no result, give L_5 and L_6 a couple of turns inwards and repeat. It is a job requiring patience but with care, assuming there is no fault in the receiver, a picture of sorts can be found within 10 minutes, after which it is a matter of holding on to it while final trimming is carried out as above; for people living more than 60 miles from London (as the writer does), do not despair if nothing turns up at the first trial—long distance reception has "bad" days when the signal is almost non-existent and this may be one of them. No amount of preamplification can then do any good. Once the picture has been obtained the sound receiver can be adjusted separately, though the 3 Mc/s I.F. here should almost certainly be set up on a signal generator even if it is not a really accurate one. Then the sound VC_1 can be slowly tuned until a signal is heard, after which the sound L_1 and L_2 coils can be peaked for maximum. Two positions of VC_1 will give a signal; choose the one with most capacity. On the vision receiver L_1 must be set for best compromise between sound and vision once both channels are going individually. Even those who have aligned the set by signal generator might experiment by carefully adjusting the various cores and oscillator condensers when receiving a signal; the VC_1s on both chassis are critical and a slight readjustment of them on actual signal might be worth while.

There is one point the writer would like to raise with regard to the sound coupling coil loop on L_2 in the vision chassis. If a single loop of 34 s.w.g. wire is wound on the former space $\frac{1}{16}$in. from the earthy end of the main winding much better sound results can be obtained than if the self-supporting loop previously described is used; this particularly applies to long-distance viewers, and the results are well worth the slight modification work involved.

When the picture is steadily received the Linearity control should be finally set to give a kinkless horizontal trace: then Height and Width controls should be set to give the correct 5 : 4 picture size ratio. These controls will interact somewhat with the Hold controls and the latter will have to be reset as the former are adjusted. If the raster will not centre accurately check that the scan coils are right forward on the tube neck, and adjust the focus coil by *slight* tilting to move the raster bodily on the screen. If the picture is reversed left to right and/or upside down just reverse the line and/or frame coil connections.

Quite apart from luck, the secret of alignment without instruments lies wholly in the constructor's knowledge of television and his familiarity with the functions of all the parts of the receiver he has built. He must not turn blindly from point to point, screwing here and poking there; he must reason out his moves and exercise his patience until he is rewarded. The writer fully realises the great difficulty of covering such alignment procedure in a short article, and much must be left, therefore, to the commonsense of the constructor.

An Electric Coil-winding Machine—2

Further Constructional Notes and Some Practical Details on Coil Winding

By S. BRASIER

MOVEMENT is effected by means of a small threaded rod passing into the flanged piece and controlled by a little wheel fitted to a small bracket soldered to the lower plate (see Fig. 1). This provides for a minute adjustment of the angle of the two plates and therefore the pressure applied to the flanges of the wire-reel.

The photograph of the underside of the base plate shows the position of the motor and variable resistor. The tapped dropping resistor shown below the motor is necessary in the writer's case as the motor used was a 110v. type. There are many ex-Government 230v. motors on the market which are suitable for driving this machine. One of approximately 1/20th h.p. or more should be suitable and in the interests of smooth running and quietness it should be mounted on rubber bushes. A very small pulley is fitted to the motor and a belt from this connects to the largest pulley of the main pulley bank via the rectangular slot in the base plate. This arrangement reduces the speed at the main shaft—for the motor speed, assuming a high revving type, would be too fast—and at the same time imparts the utmost power to the machine. As will be seen, the whole base plate is surrounded with thick felt to ensure a smooth-running machine. The underside of the box, too, is fitted with rubber corners. A condenser of 0.01 μF may be required across the brushes of the motor if interference is caused.

In order to control the speed of the motor a variable resistor is connected in series with it. This component must be capable of carrying the current of the motor and upon this figure will depend the value of resistor required. Another factor bearing on this point is the amount that the voltage has to be dropped before the motor ceases to work. So the best plan to adopt is to connect in series with the motor a 0.3 amp. tapped dropping resistor as used in A.C./D.C. sets. One of these is usually available, and motors of the type required seldom take more than 0.3 amp. Then, with the motor on load, i.e., working the machine, adjust the tapping so that the winder is working as slowly as possible. Measure off this resistance and obtain a variable type of similar value. The one shown is of robust construction on ceramic former and has a value of 500 ohms. This heavy type of potentiometer or variable resistor is available from many advertisers.

The wave-winding attachment is worked by bevel gears driven by the main shaft (see Fig. 1). These were taken from ex-Government gear but if the reader finds them difficult to procure, such gears are often available in constructional toy spares. Alternatively, two small fibre pulleys, one running edge-wise on the flat periphery of the other, would undoubtedly work, as the power required is extremely small. The ratio, however, should be 1 to 1. The disc which provides the piston action is 11/16in. in dia. and has a 6 B.A. bolt soldered to the outer edge—radius 7/16in. A link rod loosely connected from this bolt is joined to a similar bolt soldered to the metal strip 3¼in. x ¼in., which provides the necessary movement for this type of winding. The bolt is soldered 15/16in. from the top. The arm is swivel-connected to a small bracket bolted to the base plate. These bolts should be tapped into the base plate so that the wave-winding attachment may easily be fitted or removed. As mentioned before, a large pulley of 3½in. dia. is fitted to the bobbin shaft for wave-winding so that an even pattern is obtained. The belt from this pulley is joined to the 1 13/16in. dia. pulley on the main shaft. When winding, the wire is passed through a small hole at the top of the strip and through the tube soldered to it.

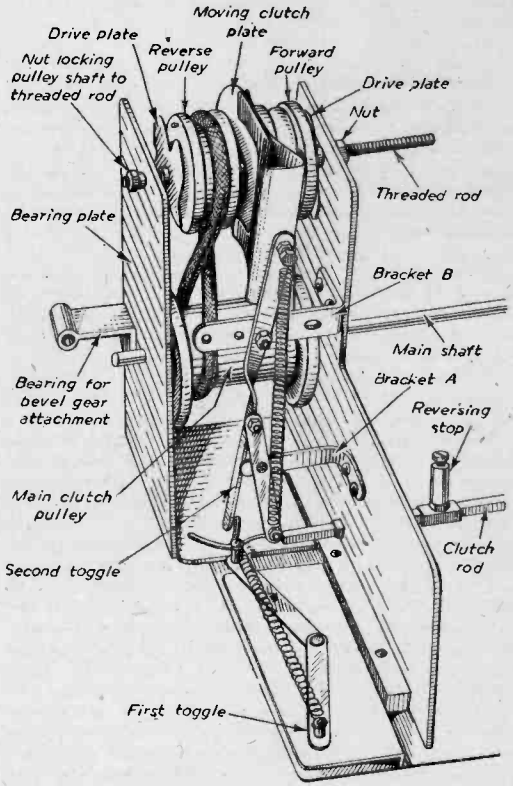


Fig. 7.—The complete clutch mechanism.

The turns counter employed is a standard cyclometer driven by the bobbin shaft via a collar into which a pin ¼in. long is soldered (Fig. 1). This pin engages the wheel on the cyclometer and, since it is not a direct drive, runs without vibration. The

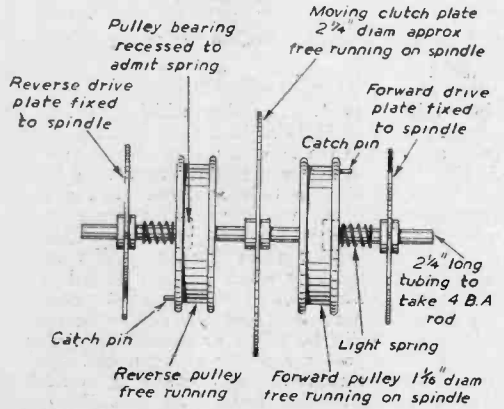


Fig. 8.—Detailed layout of part of the clutch mechanism. (Parts are spaced for clarity.)

cyclometer needs a slight alteration before it can be used. Unscrew the end plate and this will reveal the tenths ring geared to the centre spindle. This gearing should be removed (leaving the tenths ring in position) and direct drive substituted. This was accomplished by the writer in the manner shown in Fig. 10. A small brass plate A, with a hole in the centre is serrated at its outer edges so that it engages the inner aspect of the tenths ring. The cyclometer spindle fits through the hole in the plate and is soldered to it. All that remains is to make a bracket so that the counter lines up with the bobbin shaft.

Winding Back

If it is required to wind *back* from the bobbin on to the reel, a longer reel shaft should be kept handy with a pulley of any reasonable size attached. A *twisted* belt will give the desired result.

When using the machine for layer winding the procedure is to mount the bobbin to be wound centrally on the bobbin spindle and grip the bobbin holders firmly while tightening up. Switch on and give the wire guide a trial run and adjust reversing stops so that the wire guide reverses its direction when it is in line with the ends of the bobbin. Fix the wire spool and feed the wire over the guide and secure the end to the bobbin. The purpose of the 3 bank pulley on the main shaft and the 2 bank pulley on the bobbin shaft is so that different ratios may be obtained between the traverse speed of the wire guide and the speed of the bobbin shaft. The wire guide travels at a constant speed, i.e., the speed of the main shaft, but, by means of the variable ratio pulleys, the bobbin shaft may be run at various speeds in relation to it. Therefore, if fine wire is being used a large number of turns would be required to fill the bobbin length. By using the large pulley on the main shaft and the small one on the bobbin shaft, the bobbin revolves at high speed. Alternatively, with thickish wire the bobbin can be made to run slower in relation to the wire guide so that a smaller number of turns can be accommodated in the same length of winding. In effect therefore, we have a variable speed traverse of the wire guide. After a little experience one soon gets to know the best pulleys to use and in any case the wire is to a large extent self accommodating because, due to the steady tension, each turn lays itself snugly against the previous one, and so on.

It is essential that the guide is brought as close to the bobbin as possible. That is the reason for the extension rod on the wire guide and it should under no circumstances be omitted.

One or two adjustments may be necessary to the clutch mechanism before it works smoothly. The toggles should work nicely if the specification is followed. The springs should be strong enough to produce a nice snap action but not so strong that undue pressure is required to work the toggles. The light springs fitted between the forward and reverse clutch pulleys and their associated drive plates should be strong enough to move the pulley away from the plate when the opposite pulley is engaged. The springs, when compressed, i.e., pulley engaged, should fit within the recessed portion of the pulley (see Fig. 7). Another point to watch in order that a smooth clutch action is ensured is to see that both toggles are lined up accurately when held in their dead centre positions. The angle of the fork at the end of the first toggle may need some adjustment so that the arms pull over the second toggle when the first is just past dead centre.

The rubber bands on the clutch pulleys must be taut enough to prevent slip, but if too tight will prevent the pulley from being pushed against its drive plate by the moving clutch plate.

The link between the clutch actuating rod and

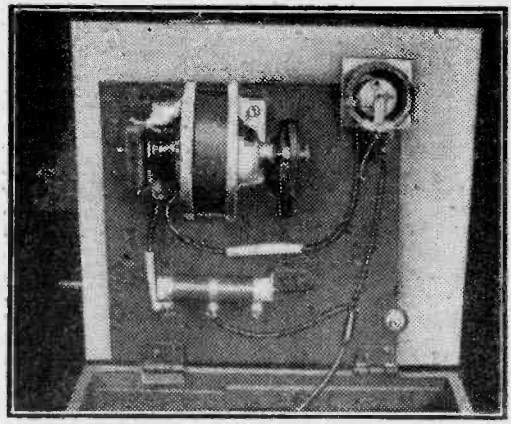


Fig. 9.—View of underside of base-plate showing felt surrounding motor, and speed control.

the first toggle must have a free action where it joins the toggle.

In conclusion, it can be stated that practically any coil, choke or transformer may be perfectly wound on this machine. As regards layer winding, mains transformers, of course, have to be interleaved, so that the machine has to be stopped

(*continued on page* 267)

(*continued from page 264*)

every two or three layers. There are many cases however, L.F. chokes, output transformers, etc., where the winder may be left to do its work unaided.

Practical Details

For a medium- and long-wave coil it is best to start with the long-wave winding, so it is necessary to fix the honeycomb attachment to the machine—not forgetting the large bobbin shaft pulley—and disconnect the main clutch pulley.

The width of the honeycomb coil produced by the machine is about ⅜in., although the throw of the arm is much greater. So, having selected a suitable paxolin former, mount it on the bobbin spindle so that the winding arm, when perpendicular, is in line with the centre of the space allocated for the long-wave coil. With regard to the guide tube through which the wire passes, it is essential that the inner aspect of each end is countersunk and perfectly smooth so that chafing of the wire is obviated.

From coil data tables wind on the required number of turns. It should be remembered that with a honeycomb pattern a turn is slightly longer than a straight pile wound turn, so that if a slightly larger frequency coverage is undesirable, the number of turns may be reduced.

The turns counter gives an exact indication. It reads to 9999 and a fifth figure shows tenths of a turn, so that there is plenty of scope for accuracy.

Having completed the long-wave winding, a coupling coil may be wound in the same manner if desired. Then remove the wave-winding attachment and its pulley. Tighten the screw in the main clutch pulley and this will put the traverse wire guide into action. The winder is switched on

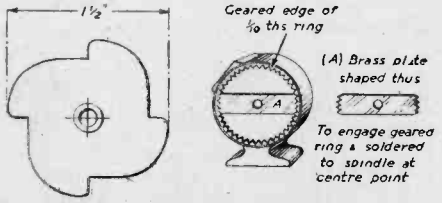


Fig. 10.—*The modifications to the turns counter.*

temporarily so that the wire guide may be brought to a position where it is in line with the start of the medium-wave winding. Then the wire is fed over the guide to the former and this winding may be completed.

I.F. Transformers

Intermediate-frequency transformers are easily made by adopting long-wave coil technique as outlined above.

At Fig. 12 will be seen a greatly enlarged section of a honeycomb coil showing the pattern produced. Fig. 11 shows a group of various coils produced on the machine.

With the automatic reversing clutch in use for layer winding, a minimum winding length of about ⅝in. is available which is handy for air-cored chokes as used in filter circuits, etc. High-frequency chokes may be wound in sections by moving the bobbin along the shaft after each section has been wound. If it is desired to pile wind into a narrow slot, this may be achieved by disregarding the wire guide. Before leaving the subject of honeycomb coils it may be mentioned that this type of coil

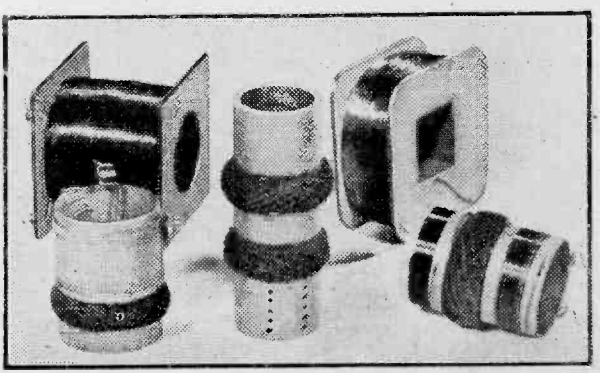


Fig. 11.—*A group of typical coils wound on the machine.*

may, with advantage, be coated with thin shellac varnish or dipped in wax and allowed to drain.

Transformers and Chokes

For such items as field coils, output transformers and L.F. chokes, the winder may be left unattended after completing the preliminary adjustments. These consist of setting the reversing stops for the length of winding required, using the approximately correct pulley ratio for the gauge of wire in use and roughly adjusting the wire tensioning device. Final adjustment of this latter feature is carried out during the early stages of winding. With regard to the pulley ratios, it will be found useful to keep a little reference data chart showing pulley ratios used for certain wire gauges.

When winding mains transformers it is unfortunate that full advantage may not be taken of the automatic feature because the machine has to be stopped to incorporate paper interleaving between windings. As is commonly known, commercial transformers are usually interleaved at every layer to ensure the utmost efficiency and service. After some years of transformer winding, however, it is the opinion of the writer that to interleave at two to three layers on the primary is sufficient. Using this procedure, only one failure has occurred—this on a transformer after eight years of service. The method seems to be justified as a time-saving factor when dealing with normal voltage transformers.

Concerning secondary windings, it is most advisable to interleave at every layer because the wire is usually fairly thick and this causes greater pressure of one layer upon the other, with the consequent risk of chafing insulation. Interleaving usually avoids this entirely. It should be mentioned that when using the winding machine any interleaving can, of course, be carried out *in situ* and further winding proceeded with.

If correct interleaving paper is not available tissue paper may be used successfully, but on no account should gummed paper be used.

It will, no doubt, be realised that there is a limit to the thickness of wire that can be wound on the machine. For example, it would be unreasonable to expect to wind 18 or 16 gauge

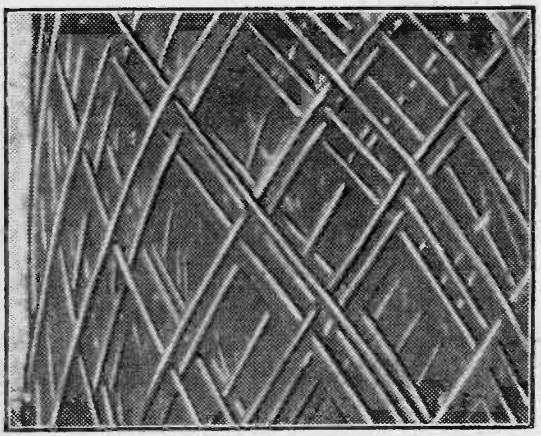


Fig. 12.—An enlarged view of the wave-wound coils.

which is commonly used for 4-volt windings requiring a current of 3 to 5 amps. Fortunately, however, the number of turns is usually small and hand winding is not difficult. For this purpose the machine is still valuable, for after the primary has been completed and insulated (the same set-up being retained) the secondary may be proceeded with by turning the bobbin with the left hand and guiding the wire with the right. And one still has the advantages of a stable bobbin and a stable reel of wire, together with the fact that the turns counter is still functioning.

Before starting to wind a transformer the bobbin cheeks should be drilled with a sufficient number of holes to avoid having to make them during winding —a distinctly awkward procedure. It is not difficult to visualise the approximate position of these holes, and in any case a few extra ones will be an advantage. Both ends of the bobbin should be used in an endeavour to even up the winding and to avoid lumpiness of the wound bobbin. During winding, a little judicious thought with regard to tappings will be useful. For instance, it is obviously better for a tapping to be taken from a turn lying near the end cheeks. This may often be easily arranged by spacing the turns so that the required turn comes in that position or by leaving the winding of that layer a little short. Incidentally, when dealing with thick wire carrying a heavy current, spacing of the turns is definitely an advantage.

Tapping Points

With regard to making the actual tappings, the following method may be adopted when using thick wire. Having reached the point where the wire is to be tapped, leave about 6in. beyond this and then snip off. At the exact point where it will pass through the end cheek bend the wire to a right-angle and pass the free end through. Because the wire is thick it will now be temporarily self-retentive. Clean off the insulation at the angle and with a large pair of pliers press a flat into the wire. Clean off the free end of the wire on the reel and squeeze flat. Then bend a small hook to engage the angle; see Fig. 13. The joint is soldered and will be very little thicker than the thickness of the wire. The joint should be insulated before proceeding. If it cannot be avoided to bring a tapping lead over previously wound turns, the wire must be extremely well insulated.

The design of a transformer is really quite simple providing certain laws are followed, and having constructed it according to plan and with normal care one can be certain that it will perform correctly. Various data is necessary so that one can assess the core sizes, current carrying capacity of wire, etc., and in this respect one cannot do better than procure the PRACTICAL WIRELESS publication "Oils, Chokes and Transformers." In this book will be found all the information required for designing any transformer, together with the necessary data sheets concerning wire and stalloy stampings.

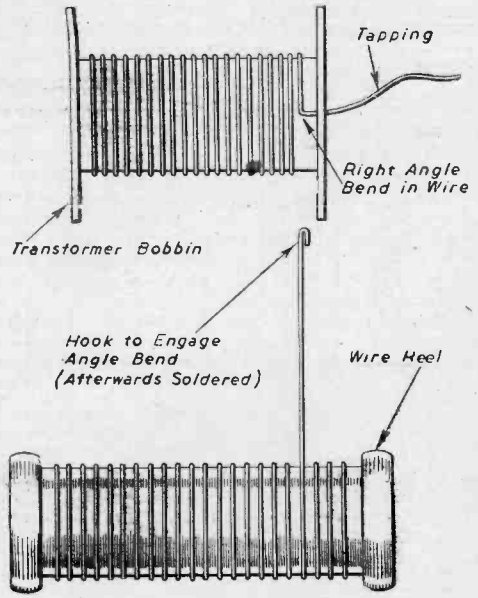


Fig. 13.—Method of making a tapping when using heavy gauge wire.

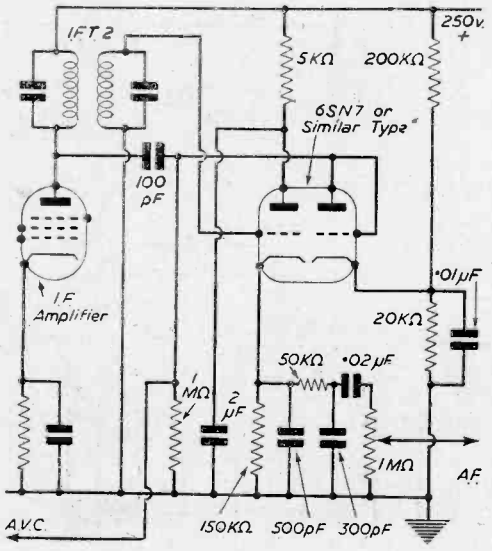
Practical Hints

A.V.C. Scheme

IN order to overcome the difficulty of providing A.V.C. in conjunction with an "infinite impedance" detector, the circuit shown was adopted in a superhet receiver designed for fairly high-quality reproduction.

The first section of a medium mu double triode is used as a normal "infinite impedance" detector, feeding via an (optional) R.F. filter to the audio stages. The grid and anode of the second section are strapped to provide the A.V.C. rectifier, the feed being taken from the primary of the final I.F. transformer in order that the low loading characteristic of the detector should not be lost.

In order to provide the usual delay voltage, a potentiometer across the H.T. supply maintains the cathode of the A.V.C. rectifier at a small positive voltage.



A.V.C. from a double triode.

Any double triode of amplification factor 20 may be used, though equally good results have been obtained from a valve type 6SL7 (amplification factor 70).—T. N. RICHARDSON (Whitley Bay).

Glass and Metal Cement

EVERY radio experimenter has experienced the annoying difficulty of loose valve bases and, on attempting a repair, has found that most of the normal cements do not stick successfully to the glass valves. A very successful cement for this purpose can be made up, using a mixture of gum and dental plaster of paris. The gum and plaster of paris is mixed into a stiff paste and pushed between the valve base and the glass of the valve body. This cement has been used successfully to cement a C.R. tube base which had come loose. Grid caps on screen grid valves have also been successfully repaired using this cement. The gum used is that which comes in a pyramid-shaped glass bottle with a rubber stopper. It is manufactured by "Le Pages." It is essential to use gum and not glue as the gum-plaster combination seems to work best and sticks the glass to the valve base very successfully.—G. F. MASON (Leighton Buzzard).

THAT DODGE OF YOURS!

Every Reader of "PRACTICAL WIRELESS" must have originated some little dodge which would interest other readers. Why not pass it on to us? We pay half-a-guinea for every hint published on this page. Turn that idea of yours to account by sending it in to us addressed to the Editor, "PRACTICAL WIRELESS," George Newnes, Ltd., Tower House, Southampton Street, Strand, W.C.2. Put your name and address on every item. Please note that every notion sent in must be original. Mark envelopes "Practical Hints."

SPECIAL NOTICE

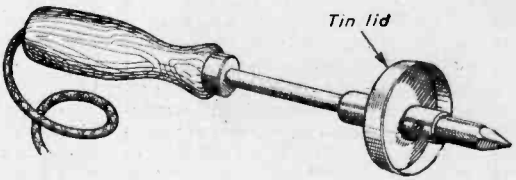
All hints must be accompanied by the coupon cut from page iii of cover.

Drip Cup for Soldering Iron

TO avoid hot solder dripping down his sleeves while soldering wire connections overhead, the writer has found that when the lid of a small tin can is fastened just below the copper bit (as shown in the drawing), it will not only stop the drips but will save the excess solder.

To fasten the lid it will be necessary to remove either the copper bit or the handle, whichever seems easier.

In addition, while in use the hot iron may be laid anywhere, as the bit will be prevented from damaging the surface on which it lies.—C. BRADLEY (W.C.2).



A soldering accessory.

Line Cord Substitute

CONSTRUCTORS of midget A.C./D.C. receivers find the selection and fitting of a line cord somewhat difficult, whilst others object to the hot lead, as it may mark polished furniture. It is not very well known that the line cord may be dispensed with, and various schemes have been proposed as a substitute. One of the most effective, used in a continental receiver, is the use of a standard electric light bulb in series with the heaters. The bulb is fitted into a holder mounted on the cabinet, which is designed as a bedside receiver, and the wattage rating required is easily worked out from Ohms Law.—H. HUMBERSTONE (N.5).

A "Local-distan

An All-wave Set for Both

By E.

THE "straight" or T.R.F. receiver, though often scorned by the superhet enthusiast, is still the type of circuit chosen by the discerning listener who requires good quality before anything else. The T.R.F. receiver can give good quality because it tunes less sharply than does the superhet, the full bandwidth of the modulated signal therefore being used; but against this advantage must be set the fact that the T.R.F. receiver in its usual form is not suitable for every reception location. In remote districts the "straight" set is often lacking in sensitivity, whilst in other areas its response is too broad, making the receiver liable to interference. The normal T.R.F. receiver is also unsuited to short-wave reception, so that its applications are limited.

By adding reaction to the detector stage the sensitivity of the T.R.F. set can be enhanced and shortwave reception can also be catered for, but then the set tunes much more sharply and the original advantage, that of quality reception, is lost.

The receiver to be described possesses most of the advantages of all types of T.R.F. receiver in having optional reaction on the medium and long wavebands, and a sensitive short-wave tuning range from 16 to 50 metres. It is therefore styled a "Local-distant" receiver.

For receiving the local medium- and long-wave stations the reaction is switched off, and good quality reception can be enjoyed. If interference is experienced the reaction control can be switched in and the tuning of the receiver thus considerably sharpened up, with reception quality still as good as, or better than, that of the normal superhet. For station "hunting" the reaction is further advanced to give cover over the usual European stations, whilst for short-wave listening the reaction is automatically employed as the wave-change switch is rotated to "Short."

The versatility of the receiver can therefore be imagined, and the circuit should prove ideal for the constructor who has no signal generator and who therefore labours under a very considerable difficulty should he build a superhet, with its attendant complicated "lining-up" process. The "Local-distant" receiver is aligned on stations and, with a little care on the short-wave range, the set is ready to work a few minutes after first switching on.

The Circuit

The circuit is shown in Fig. 1. V1 accepts signals from the aerial and is coupled into the detector stage, V2, by having the detector grid coils switched directly into the V1 anode circuit. The coupling is thus very tight and signal transfer is excellent, whilst at the same time the secondary coils on L4, L5 and L6 are left free for the application of reaction when required. S2 is the reaction switch; the short-wave coil L4 has its reaction winding always in circuit, but L5 and L6 have their reaction windings grounded via S2. With S2 open this grounded connection is broken and no reaction is applied.

V2 has only a low capacitance grid condenser, C13, and a fairly low grid leak resistance, R4. The values of 50 pFs. and 470,000 ohms must not be changed.

R9 works both as a volume and as a reaction control, whilst the mains on-off switch is ganged with the potentiometer. R9 varies the screen potential of V2 and thus the gain of the valve, so

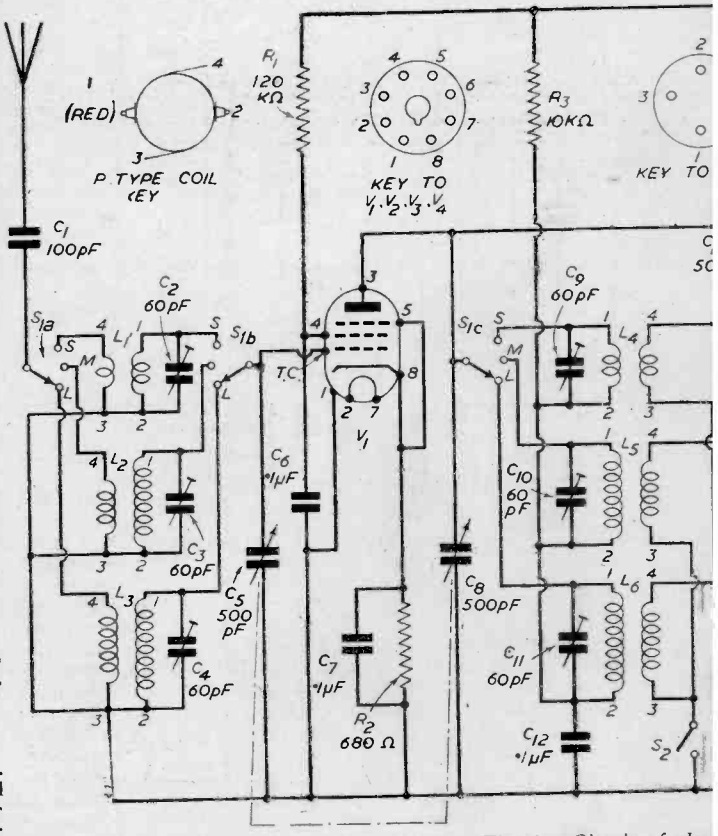


Fig. 1.—Circuit of the

T.R.F. Receiver

and World-wide Reception

ADLEY

that a very full control of volume is obtained. With S2 closed, R9 then also controls the reaction over the detector stage, and smooth operation is an outstanding feature of this type of circuit. No tuning shift is observable as V2 is brought in and out of reaction on the short waves. a further great advantage which potentiometer reaction control has over capacitance reaction control.

The audio output of V2 is filtered by R7 and C15 so that no R.F. is passed on to the output stage. Further filtering is given as a precautionary measure by the grid stopper R11, and as a result the circuit is very stable.

To make the receiver suitable for all conditions of supply an A.C./D.C. power pack is included, with a barretter in place of a resistance heater dropper. This removes all doubt from the constructor who has no means of measuring the heater current being supplied to the valves; the barretter automatically supplies the required 0.2 amp. from any 200-250 volts supply line and maintains heater current constant despite periodic mains fluctuations.

The mains leads are filtered for interference by a double suppressor choke M.S.C. and C22. R13 is a protective resistor, not absolutely essential in this circuit, but it has some effect on the heavy surges of current which flow through the rectifier, V4, and into the reservoir capacitor C21 on each conducting half cycle of V4.

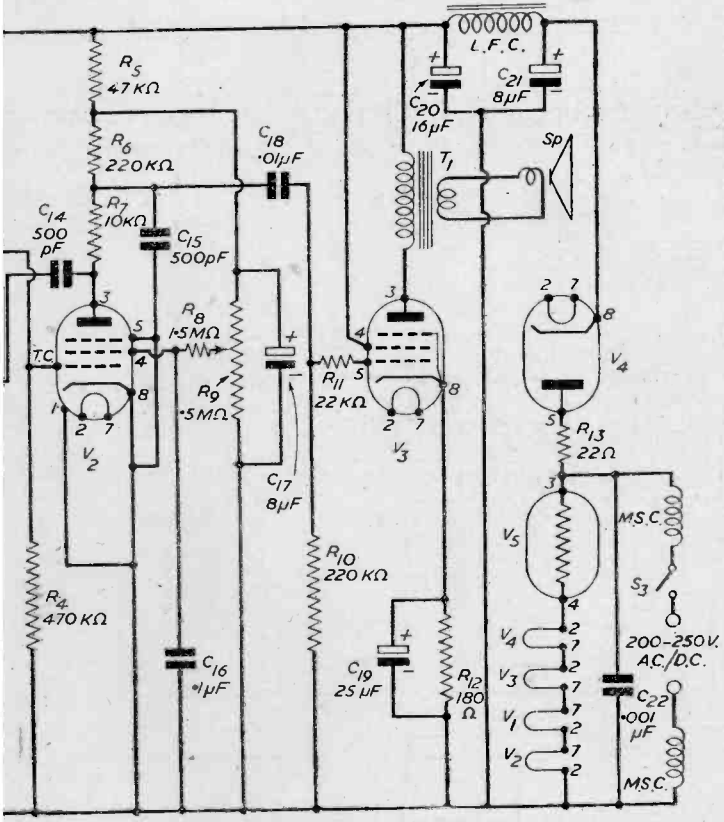
As the set is for A.C./D.C. operation a separate direct earth connection must on no account be used. If the effect of a short separate earth lead is found beneficial this must be connected to the chassis only through an 0.01 μF. 750 v.w. tubular capacitor, but trials with the original receiver showed no advantage in such an earth.

The value of C1 is open to experiment; different values may suit different aerials, though the 100 pF. chosen should prove satisfactory in all cases. The aerial must never be connected to the receiver directly, however; some isolating capacitor must be used in the C1 position whether its value be 50 pFs. or 0.005μF. A 500 v.w. component should be chosen.

Whilst any good make of switch, capacitor, resistor, etc., may be used for the receiver, the valve and coil specifications must be observed if the circuit is to work correctly. A rather unusual coil line-up is employed in that a pair of Wearite PO3 coils are used for the short-wave tuning. PO-type coils are actually designed for superhet oscillators, but the range of this type was found to be exactly what was required whilst aerial coupling and reaction characteristics were excellent.

The medium- and long-wave coils are respectively pairs of PA2 and PA1 coils. Here again the specification is unusual, for L5 would normally be a PHF2 and L6 would normally be a PHF1; constructors with these coils to hand may try them in the circuit, but the PA types rather than the PHF types are preferred by reason of the reaction control obtained.

The speaker with its transformer is mounted separately from the chassis. This type of construction has been chosen to make the set suitable for practically any vertical or horizontal cabinet the constructor may have to hand. In order that the chassis may be accommodated in almost any type of cabinet the chassis size has been kept small and the receiver measures 8in. by 6in. by 2¾in.



ul-distant" T.R.F. Receiver.

Constructing the Receiver

In Fig. 2 are shown the dimensions and drilling details, for normal components, of the receiver chassis. In the original set a J.B. type E tuning condenser was used, arranged so that the spindle fell over the central line of the chassis, with the vanes opening on to the right-hand side. This permits V1 and V2 to be placed close to the tuning capacitor on the left-hand side, so that the grid leads can be very short and direct (Fig. 4).

The smoothing choke used was a Partridge C25/60/VSE but other chokes will fit equally well into the small space available below the chassis, provided they are not more than 2in. deep to give clearance between the choke body and the holders of V3 and V4; perfect insulation here is, of course, essential.

Note the arrangement of the coils and wavechange switch. The leads from tags 1 and 4 of L1, L2 and L3 are brought through the chassis to the switch by holes drilled beside the 6 B.A. clearance holes drilled to take the coil-retaining screws; the leads thus pass down through the coilformers. The earth lead from tags 2 and 3 of this coil set is connected to the chassis by soldering it to the brass coil mounting lug on L1, and similarly the earth lead from tag 3 of L4, below the chassis, is soldered to that coil's brass bar.

The brass must be very well cleaned with emery before the soldered joint is made.

The choice of slow-motion drive and dial is left to the constructor, but the best which can be afforded should be employed for ease of tuning on the short waves. It is a good plan to obtain a drive and dial which can be calibrated by the constructor himself, if calibration facilities are available; this really needs a good signal generator, however.

Note that C17 and C20-21 are supported below the chassis by clips which can be purchased or made from scrap sheet aluminium.

All earth contacts are made to soldering tags fitted under component fixing bolts.

The arrangement of the grid capacitor and leak to V2 should be noted from Fig. 4. Connections to C5 and C8 from the wavechange switch are passed through the chassis to the underside lugs of the tuner, and connections to the valve grid caps are made from the top lugs of the tuner.

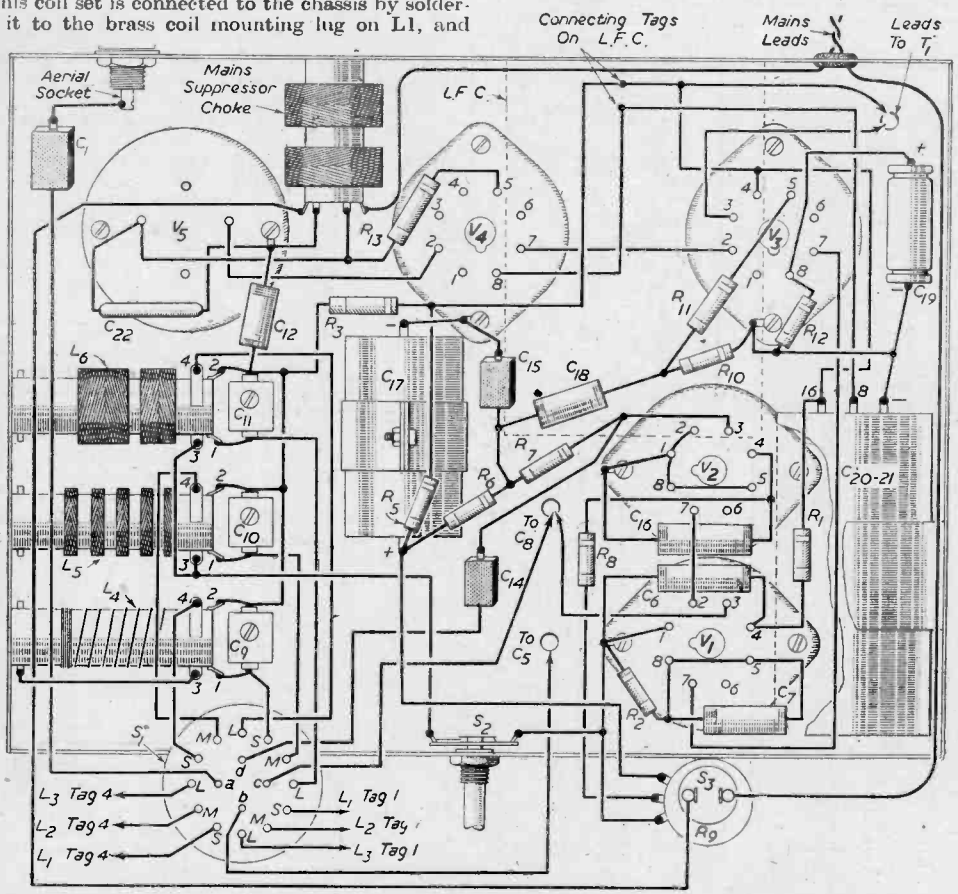


Fig. 3.—Underside of chassis. Leads are shown straight and angular for clarity. Note earth connections to soldering tags on valveholders.

This permits the grid leads to be short and unshielded; short grid leads are essential.

Chassis holes carrying mains and high-tension leads should be grommeted.

With the wiring all carefully checked the valves and aerial plug can be inserted, the loudspeaker connected and the set switched on for test. First switch to the long waves and tune in the Light Programme on 1,500 metres, with C4 and C11 set to midway positions, with S2 open. Vary the setting of C4 for best volume, then, if possible, find a station lower in wavelength and correct C4 if necessary.

Leaving S2 open, switch to the medium waves, set C3 and C10 to midway positions and tune in a station at about 250 metres—once again the 261-metre Light Programme will serve. Again adjust for maximum volume by adjusting C3, then close S2 and test the reaction control. Check the receiver with reaction off and reaction on; it should be found that more stations are heard under the latter conditions, especially after nightfall.

With S2 either open or closed switch to the short waves and tune in a strong station on the 19-metres band, if possible, with C2 and C9 set to midway positions. Vary C2 for maximum volume.

Some care is needed in the trimming, especially on the short-wave band, and if a signal generator can be used it will speed up the work. As a guide it may be said that in the original set with the detector trimmers half closed the R.F. stage trimmers needed to be almost to full capacitance, but this will not always be the case. If the set is incorrectly trimmed stations will still be tuned but results will be poor, especially on the medium waves, where stations will constantly interfere until the set is trimmed up correctly.

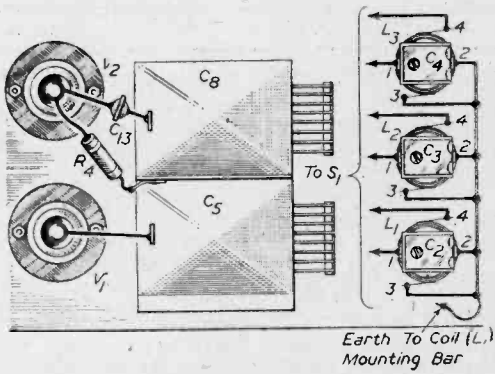


Fig. 4.—Arrangement of coils (H.F.) wiring to enable short leads to be employed.

If at any time uncontrollable reaction is obtained, whether S2 is open or closed, this will indicate that

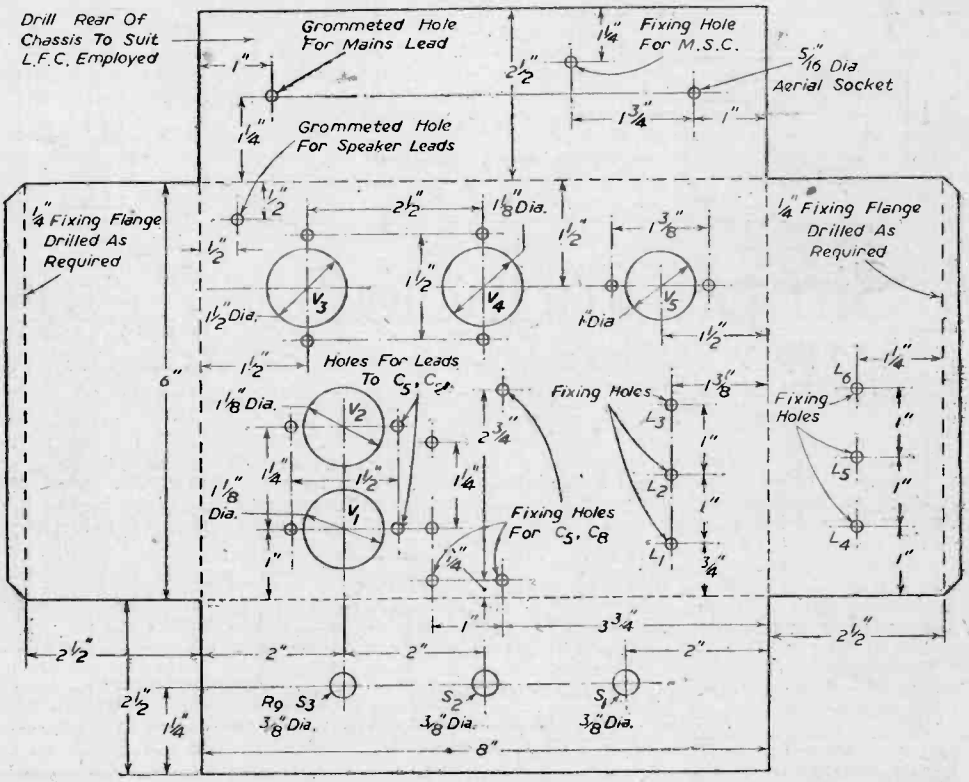


Fig. 2.—Chassis cutting and drilling details.

there has been some error in wiring up the coils, or the coil wires are too long and too close together.

If there are serious stray couplings caused by slack or long wiring V1 will oscillate as a T.G.T.P. stage, and the wiring must be inspected for faults.

lead to instability, however, and for this reason the layout as shown in the diagrams is recommended.

A differently constructed receiver which suffers from instability can often be cured by reducing the

LIST OF COMPONENTS

L1, L4, Wearite PO3 coils, 16-50 metres.
L2, L5, Wearite PA2 coils, 200-500 metres.
L3, L6, Wearite PA1 coils, 700-2,000 metres.
C1, 100 pFs. Mica, 500 v.w.
C2, C3, C4, C9, C10, C11—60 pF. maximum postage stamp trimmers.
C5, C8—500 pF. 2-gang tuning capacitor.
C6, C7, C12, C16—0.1 μF. Tubular, 500 v.w.
C13—50 pF. ceramic disc.
C14, C15—500 pF. mica, 350 v.w.
C17—8 μF. electrolytic, 350 v.w.
C18—0.01 μF. tubular, 500 v.w.
C19—25 μF. electrolytic, 12 v.w.
C20, C21—16 plus 8 μF electrolytic, 450 v.w.
C22—0.001 μF. mica, 750 v.w.
R1—120,000 ohms, ½ watt.
R2—680 ohms, ½ watt.
R3, R7—10,000 ohms, ½ watt.
R4—470,000 ohms, ½ watt.
R5—47,000 ohms, ½ watt.
R6, R10—220,000 ohms, ½ watt.
R8—1.5 megohms, ½ watt.
R9—0.5 megohm variable, with switch. Midget.
R11—22,000 ohms, ½ watt.
R12—180 ohms, 1 watt.
R13—22 ohms, 1 watt.
V1—Mullard EF36 or EF37.
V2—Mullard EF39.
V3—Mullard CL33.
V4—Mullard CY31.
V5—Philips C1C Barretter.
4 octal valveholders.
1 4-pin valveholder.
S1 a, b, c, d—4-pole 3-way wavechange switch.
S2—S.P. on-off, rotary.
S3—S.P. on-off, ganged with R9.
Sp. with T1—6in. or 8in. speaker with output transformer to match to 4,500 ohms anode load.
M.S.C.—Double mains suppressor choke.
L.F.C.—20 henrys, 60 mAs. smoothing choke. See text.
Chassis, cut and bent from sheet aluminium, as Fig. 2.
2 grid clips, 4 control knobs, aerial socket and plug.
Slow-motion tuning drive and dial.

The lay-out of the set is not rigid, so long as coil-to-switch wiring is neat, short and direct (the wiring shown in Fig. 3 is depicted as straight and angular for clarity's sake, and the wiring should actually be short and as direct as possible as in any other receiver), and different chassis sizes and layouts could be used. A poor layout will

H.T. voltage. This can be done by including a resistance in series with the L.F. choke before C20, but in a well-constructed receiver no such step should be necessary.

Never handle the receiver chassis until the mains plug has been inserted in the position which gives least hum in the speaker.

A Simple Inductance Tester

An Arrangement Which Can Easily be Made Up for Coil and Choke Tests

By D. McDONNELL

THE radio experimenter is very often confronted with the task of estimating the inductance of some commercial L.F. choke, or of winding an inductance to some specified value.

There are many elaborate methods of doing this, but as will be described below it is possible, using only a few components and no costly parts, to measure the inductance of low-frequency chokes to within an accuracy of five per cent.

The circuit of the instrument is as shown in Fig. 1. The switch S1 may be of the press-button or toggle type. The condenser, which is indicated as variable in the circuit, is shown thus to imply that this is the variable quantity in the circuit, although it is not practicable to have a variable capacity of the required size. Variation in this capacity is carried out by substitution of fixed condensers until the required value is found.

Operation

The switch S1 is closed with the inductance under test, between terminals 1 and 2. A condenser, larger than the estimated value (obtained by looking against the estimated value of inductance), is

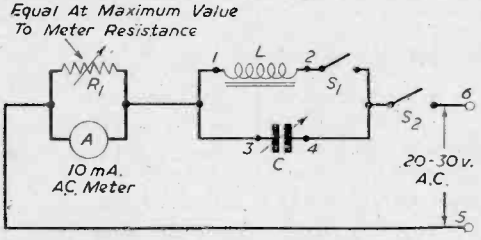


Fig. 1.—Circuit for the inductance tester.

connected between terminals 3 and 4. A supply of 20 or 30 volts (from the 50 c/s mains) is applied to points 5 and 6. This voltage may be obtained conveniently by a potentiometer as shown in Fig. 2. The resistance R1 is set to minimum resistance: S2 is closed and R1 adjusted to give about half-scale deflection on the meter, and the reading noted. S1 is now opened and the reading again noted. The capacity is now varied until the reading is the same whether S1 is open or not, i.e., decrease the capacity and note the meter readings with S1 closed and open. If the difference between them is less than it was at first continue decreasing C until there is no difference.

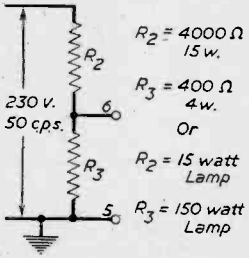


Fig. 2.—Obtaining a suitable voltage from an H.V. supply.

This value of C should now be noted and by use of the graph, Fig. 3, or from the formula below, L can be found:

Formula

$$L = \frac{10^6}{8\pi^2 f^2 C} \text{ or for 50 c/s mains.}$$

$$L = \frac{5 \cdot 2}{C} \text{ where L is in henries. C in } \mu F.$$

Vector Diagram Showing Conditions for Balance

Current through L = I_L
,, ,, C = I_C
Total current = I_T
Applied voltage = V

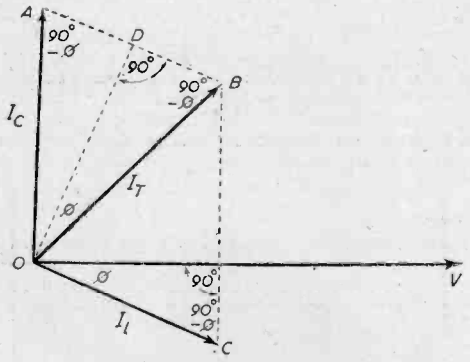


Fig. 4.—The current vector diagram.

From the current vector diagram above.

For balance $I_c = I_r$. Hence if $\triangleleft BDO = 90$, and $DOB = \phi$, then $< BDO$ and $\triangleleft BCO = (90 - \phi)$, making $\triangleleft VOC = \phi$.

Also $AB = I_l$ so that

$$DB = \frac{I_L}{2}$$

Referring to the voltage vector diagram below.

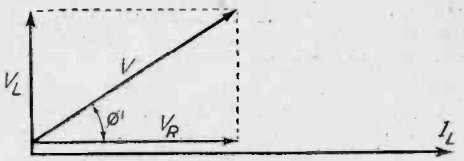


Fig. 5.—The voltage vector diagram.

V_L = Voltage across the inductance.
V_R = Voltage across the resistance (resistance of coil.)
V = Applied voltage.

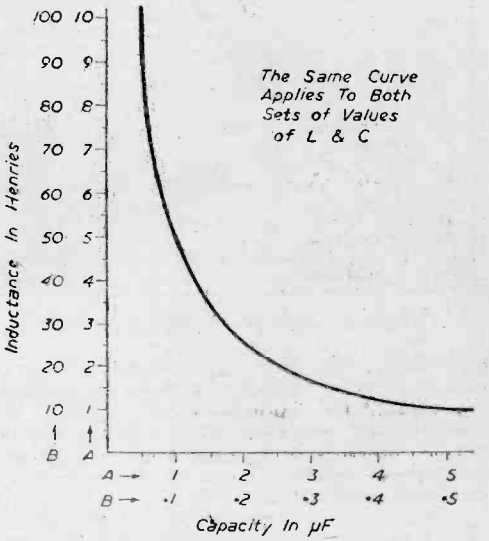


Fig. 3.—Typical graph from which C or L can be found.

I_L = Current through L and R.
R is the resistance of the choke.
For balance, from Fig. 4:

$I_c = I_r$. But $I_c = V\omega C$ also $I_r = \frac{I_L}{2 \sin \phi}$ (triangle DBO)

Giving $V\omega C = \frac{I_L}{2 \sin \phi}$

But from Fig. 5, $\sin \phi = \frac{V_L}{V}$

So that $V\omega C = \frac{I_L V}{2 V_L} = \frac{V}{2\omega L}$ $\left(\frac{I}{V} = \frac{I}{\omega L}\right)$

$$\omega C = \frac{1}{2\omega L}$$

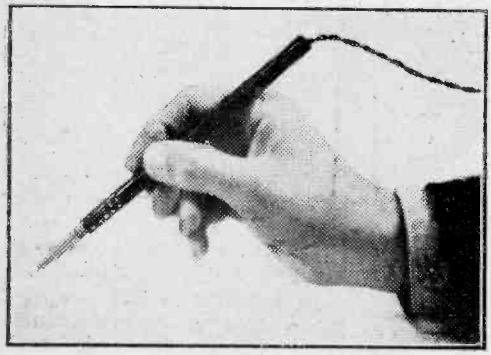
$$L = \frac{1}{2\omega^2 LC}$$, from which the graph was drawn.

$$L = \frac{I}{2\omega^2 C}$$, the inductance measurement being independent of the resistance.

News from the Trade

Ekco Soldering Pencil

ALTHOUGH not at the moment available to the home market, a new soldering pencil shown by Ekco at the B.I.F. is a most interesting product. It is intended primarily for use in the construction or repair of miniature electronic equipment and is consequently very small and light in weight. The illustration below shows the pencil in use. It can be used all day without



A useful soldering pencil produced by Ekco.

overheating, and may be used with mains or battery supplies. The time taken for the bit to rise to working temperature from cold is only 50 secs. Further details will be announced when the device is made available to the home market.

Eddystone Semi-automatic Key

THE illustration at the foot of this page shows the Eddystone "bug" key with its cover removed. This is a key built somewhat on the lines of the popular American key, but has a heavy cast base and cover, finished in black crackle to match the remainder of the Eddystone apparatus. The key is fully adjustable and can be used with equal facility by right- or left-handed operators. The dot-contact and adjustment is so designed that there is no trouble from spurious contacts or "spluttering," as it is sometimes called. Quite high speeds may be obtained with perfect readability, and the weight, combined with the rubber feet fitted to the base, will ensure that the key will remain in position during long working stretches.

Notice of Change of Address

LEE PRODUCTS (GREAT BRITAIN), LTD., state that their head office and main distributing centre is now at 90, Great Eastern Street, London, E.C.2 (telephone: Bishopsgate 3093), where adequate stocks and a competent staff are available.

Scophony-Baird, Ltd.

MR. DENNIS E. WISEMAN, who was until recently production and sales director of Messrs. Scophony-Baird, Ltd., is now travelling as overseas representative of that company throughout Canada and the United States.

He is investigating the potential market for the Baird television set designed specifically for television reception in those countries. This set is a transferable table television receiver with a self-contained aerial and suitable for A.C. or D.C. mains operation. For this reason it is ideally suited for use in blocks of flats, hospitals, institutions, etc., and the U.S.A. and Canadian trade has for some time shown great interest in the model.

Messrs. Scophony-Baird expect to obtain valuable orders as a result of Mr. Wiseman's visit.

New Mullard Valve Booklet for Service Engineers

A NEW pocket-sized booklet containing a comprehensive record of the Mullard range of valves has been produced specially for service engineers.

The booklet is the first of its kind to be issued by Mullard since the end of the war. It has fifty-eight pages and can be carried around as a complete valve reference. It contains the same information as the Mullard wall chart which was issued to dealers earlier this year.

In addition to prices and purchase tax, information includes operating data and characteristics, base connections and diagrams.

The booklet carries a complete list of equivalent types of valves in other makes, and there are recommendations for the substitution of obsolete types by modern valves.

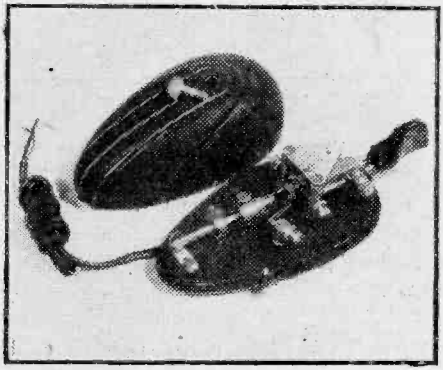
Goodmans' Loudspeakers

MESSRS. GOODMANS announce a new 12in. P.M. speaker (rated at 20 watts), available with two types of cones:

Cone "1205" fundamental resonance 75 c.p.s. (designed for public address use.)

Cone "1206" fundamental resonance 55 c.p.s. (designed for bass reproduction.)

This unit initiates a new range of medium and high power reproducers known as the "Audiom" series (regn. pending).



High speed semi-automatic key by Eddystone.

Programme Pointers

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

I ENJOYED "London Bus Ride," and feel it is an item that could be repeated, say, at monthly intervals. Its appeal would seemingly be for provincial listeners. Londoners, whose daily duties take them down its winding course too often for their liking, might be a bit more cynical towards the beauties of Trafalgar Square, the excitements of Piccadilly Circus and the nostalgia of Vauxhall Bridge Road. But the rarer visitors from afar should take kindly to memories of what were doubtless happy visits to the capital city of our whilom erstwhile Empire. The visits to the theatres *en route* were a valuable feature, and a route which didn't pass the doors of one, if such a one exists, couldn't claim inclusion.

Elgar Festival

All music lovers must wish this season's Elgar Festival a great success. He has been called the Laureate of English music, a title, in my opinion, richly earned, and worn to the manner born. Sir Adrian Boult has always been amongst the master's devoted disciples and skilful interpreters, and his reading of the first symphony—with, of course, the B.B.C. Symphony Orchestra on March 23rd—was as fine as ever. Whilst I much prefer works like Falstaff, Froissart, Enigma, etc., masterpieces every note of them, I nevertheless have the greatest admiration for what are, after all, the two foremost examples of their form in British music to-day. I doubt whether either Vaughan Williams's or Bax's can successfully challenge them. They may not bowl one over at first hearing, like Sibelius, but they grow and ever grow in your affection and esteem.

Litolff! I see, to my horror and astonishment, that his extremely vulgar and reprehensible "Scherzo" for piano and orchestra, is gradually permeating into programmes and surroundings which it can only contaminate but never adorn. Its proper sphere is Music Hall, where I heard Nan Kenway frequently do it unearned honour. It is a banal work which, by its ceaseless and unconscionable repetition of a tenth-rate "figure," robs itself of what little merit it might otherwise have possessed. Its superficial glitter can deceive no one other than the totally unthinking. Saint-Saëns' "Africa" is a masterpiece by comparison.

Boat Race Commentary

Trespassing for a few lines into another sphere, I heard the Boat Race commentary on television, and was at once struck with what will surely become the need for separate and different commentaries for the two mediums. What we are now given is a minute description of things hitherto hidden from us, but now made plain from Alexandra Palace for all to see. Do we want to be told continuously that, first, Oxford are gaining on Cambridge, and then Cambridge on Oxford, when we are watching it for all we are worth? Not to the same degree, surely, as hitherto. "In—out, in—out, in—out," is even more redundant. Until television is coloured, and light blue distinguishable from dark, some explanatory talk will be needed.

"Candida"

Bach's B Minor Mass and Shaw's "Candida" running concurrently on March 30th, I chose the latter, being unable to hear its repetition later. I particularly wanted to hear Dame Edith Evans in this famous role, as did most others I imagine. Whilst fascinated and intrigued by listening to her twist the two men round her little finger, and throw the sillier and more fatuous of the two out of the window, as it were, I felt the credit for it was the author's rather than the actress's. The most famous of all Mrs. Millomants and Lady Bracknells, Dame Edith seemed, perhaps, the most famous of all Dame Ediths rather than the most notable of Candidas. This is not to say that the presentation wasn't wholly delightful, with Andrew Cruikshank and Emlyn Williams excellent as the husband and calf-lover respectively. Pert little Proserpine Garnett, too, sounded most attractive as played by Patience Collier.

An exceedingly naive audience must have been listening to the famous Italian tenor Gigli, at a public concert somewhere in the North of England. As each famous song was started, its apparently much loved strain was applauded, whilst the ovation, started somewhere on the top note some seven or eight bars from its proper close, completely drowned the endings. Thus most of his performances were artistically ruined at both ends. Gigli was probably gnashing his teeth in metaphorical anger. There is at least one thing to be said in favour of studio broadcasts: such things cannot happen inside their four walls.

"Wozzeck"

The concert performance, again by Sir Adrian and his fiddlers three, of Berg's opera "Wozzeck" has been so highly praised by all and sundry that there is little left for me to say even if I had the space. Though not forgetting that a not inconsiderable volume of music came before him—the shadow of Wagner's warning finger seems to wag over more than one or two of its pages—Berg looks to the future. It seems as though the work will exercise a powerful influence in the days to come. Using the atonal system of harmony in large sections, the composer adopts the original method of painting the scenes and emotions of the old-fashioned, more-than-hundred-year-old story, by the use of different forms such as fugues, variations, inventions, etc., in its multitude of short scenes. All of which makes the music very objective and often taut and brittle.

There can be no doubt that such works must be listened to not only again and again, but with the greatest degree of toleration and sympathy, if new masterpieces are to be found. The eternal round of present-day programmes, if persisted in much longer, will bang, bar and bolt the door against creative adventure and enthusiasm, just as a 100

per cent. or more tariff will succeed in keeping out foreign produce except in trickles and driblets. Time will successfully sort the wheat from the tares.

Frank Tilsley, as the radio critic a Sunday or two back, discussed sporting commentaries with his colleagues. But I felt he should have mentioned what must surely be one of the chief reasons for tens of thousands turning them on, namely, to get the result by the speediest way at present known.

French Symphonies

French musicians have never been symphonically minded, and Saint-Saëns' attempt to join the great symphonists of other nations did not succeed by any stretch of the imagination. His third, in which chorus, soprano, contralto, tenor, bass, organ and piano all co-operate, is a singularly hollow, superficial, top heavy affair *qua* symphony. Many attempts have been made, and doubtless many more will be forthcoming, to extend the classical form, but so far they have resulted in products lagging far behind the masterpieces already extant. The attempt would seem to impinge or trespass on too many other pastures such as oratorio, mass, even opera and concerto, to make it seem likely that it will ever succeed.

Since my remarks on the too-frequent repetition of some of the tunes that intersperse "In Town To-night," I have noticed some welcome changes. But the whole show still seems to me very pedestrian, unoriginal and tired. I wonder how many people would notice the repetition of a programme of, say, six months ago, if it were put on?

The Brains Trust. So long as brains of the calibre of Lord Samuel's, and others, are to be called upon to adjudicate on the rival merits of washing-up and wiping, as they were the other night, we are only left capable of repeating Shelley's

My name is Ozymandias, king of kings;
Look on my works, ye mighty, and despair!

News from the Clubs

THE SOLIHULL AMATEUR RADIO SOCIETY

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

RECENTLY members joined in a discussion on "Oscilloscopes," and enjoyed a demonstration of a home-made "scope" constructed by one of the members. New members were enrolled, which now gives a strength of about 50.

With the summer months approaching many members are busy constructing D.F. receivers for the contests arranged.

It is with regret that the death is announced of a very popular member, G3DTW.

STOURBRIDGE AND DISTRICT AMATEUR RADIO SOCIETY

Hon. Sec.: W. A. Higgins, 35, John Street, Brierley Hill, Staffs.

MR. GEORGE BROWN (G5BJ) and Mr. Rhodes recently gave a talk on "F.M. Fundamentals and the Application of F.M. to Amateur Radio." The talk was most interesting and many members were avowed converts to F.M. on leaving. The description of F.M. was most clearly explained and Mr. Brown demonstrated some F.M. gear.

Meetings first Tuesday in each month. Next meeting, Saturday, June 18th at 7.30 p.m.

THE HOUNSLOW AND DISTRICT RADIO SOCIETY

Secretary: A. Pottle, B.Sc., 11, Abinger Gardens, Isleworth, Middlesex.

THE Hounslow and District Radio Society recently held a meeting on April 20th, when many members brought along various pieces of apparatus of their own construction for exhibition and demonstration. Among the outstanding exhibits were several oscillographs which were demonstrated and their various uses explained. A radio frequency E.H.T. generator caused great interest and the method in which it functions was also explained to the members. The secretary, Mr. A. Pottle, B.Sc., and Mr. K. H. Trott each gave very interesting television demonstrations with their own home-made sets and explained the various functions of the several parts.

SOUTH MANCHESTER RADIO CLUB (I.S.W.L.)

Hon. Sec.: Maurice I. Wilks, "Ormsby," 57, Longley Lane, Northenden, Manchester.

PLANS are going ahead for the construction of the club transmitter, as although the B2 is a excellent Tx/Rx the committee feel that a 'phone rig would be more suitable as many members are still unable to read morse at speeds fast enough to allow them to derive full enjoyment from the B2, and also building a Tx will give them practical experience in the snags to be found in constructing transmitting gear, etc.

As already mentioned plans for a small exhibition are being made, but as it will mean setting up the rooms and dismantling them the same evening it will entail a great deal of planning and the making of arrangements for the transportation of apparatus, etc.

For the warmer days a D/F competition is planned, and it is hoped to give members a lecture on the principles involved and then let them construct the necessary gear ready for the day.

READING RADIO SOCIETY

Hon. Sec.: Mr. F. Hill (G2FZJ), 997, Oxford Road, Reading.

MR. KEATING recently gave a talk and demonstration on the use of negative feedback, to improve the quality of reproduction in amplifiers. At a later meeting Mr. J. Pinchbeck (G5DF) described the R.S.G.B. National Field Day competition for those new to amateur radio, and gave details of the preparations so far made for this year's contest. After this, Dr. Lemon demonstrated the panoramic adapter, and described the circuit of the more important parts of this instrument.

The society is now starting an instructional section to help newcomers with their problems in basic theory and practice. During the summer months the instructional section will meet on the second Saturday of each month, and the main society meeting will be on the second Thursday of the month.

EXETER AND DISTRICT RADIO SOCIETY

Hon. Sec.: E. G. Wheatcroft, "Nine Oaks," Woodbury Salterton, Nr. Exeter, Devon.

THE above club has just moved into new premises at 9, Palace Gate, Exeter.

Meetings are held every Thursday evening at 7.30 p.m.

There is a membership of nearly 30 and new members will be welcomed at any club meeting.

PROPOSED CLUB FOR SLOUGH

IT is proposed to form a radio society in the Slough district, and with that end in view a meeting is being held at the Slough Public Library, William Street, Slough, on Thursday, June 30th, 1949, commencing at 7.30 p.m.

All who are interested in amateur radio are cordially invited to attend.—F. J. T. Tuckfield, Acting Secretary, "Cynon House," 13, Quaves Road, Slough, Bucks.

THE BRIGHTON & DISTRICT RADIO CLUB

THE club has now moved to new headquarters at the Eagle Inn, Gloucester Road, Brighton, where old and new members are very welcome. Meetings every Tuesday evening at 7.30 p.m. Recent discussions and talks have been on Hi-Fi amplifiers, individual SWL's, Rx's and the theory of the Oscilloscope. The Club TX, G3EVE, after temporary QRT, will be on the air again soon.

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).

Radio-controlled Models

SIR,—I have just read your issue for June and note the query of W. Kenneth Jones, of Birmingham.

I am a mere tyro in radio matters, but have been constructing large model boats for some time. I have tried to obtain the necessary information for so controlling my models, but without success. There is available a book on model aircraft control by radio, but same assumes the builder to be an experienced radio builder. What is actually required is an article from which any capable model engineer can build the necessary apparatus for transmission and reception on one of the two wavelengths approved for this purpose. I myself am interested in the higher of the two frequencies, but only because I am given to understand that I should then only require a short mast aerial on the boat.

As the first vessel which I intend to equip is a petrol-driven one, I am apprehensive of the effect of the ignition system, and it may be that the lower frequency will thus be more suitable.

The final requirements, as far as I am concerned, are as follows :—

(1) The transmitter should be simple, light in weight and cheap to construct. It should be rigidly set in its tuning and should require no attention other than battery changing.

(2) The receiver should preferably be a "one-valver" or at the most two. It should work from quite small batteries and run for about three hours on one set of batteries. It should have limited tuning for adjustment but, once set, should be immune from vibrational change.

(3) A simple sequence control should be provided, giving six to ten possible "effects" on the model, although I should prefer some means which did not involve mathematical calculations should a telephone dial be used as the control switch.

Finally, should you find it possible to run an article or series of articles on the above subject, I assure you there are many model builders in similar circumstances to myself who would be immensely grateful.

Your magazine is always of interest even to the mere tyro and I would close by saying : "Keep up the good work."—F. WRIGHT (Ilkley).

[*Constructional details of a radio-controlled battleship will appear in our companion paper, "Practical Mechanics," for July.*—ED.]

Phase Splitting

SIR,—Reference to your comments in the June issue.

First of all—having awakened from my unhappy "dream," I admit that I "boobed"—as we say in the R.A.F.—and that the answer was so obvious that, as the author states in this case, "My experience was greater than my powers of analysis."

Perhaps in all fairness to myself, although it was a mistake on my part, I redrew the circuit using two separate triodes for the phase splitting, thereby leading myself up the garden path and bringing about my own downfall.

I had not—as stated in his last paragraph—forgotten about action of feedback in the circuit, but having separated the double triode, I, of course, eliminated the common cathode, thereby also eliminating a feedback 180 per cent. out of phase with the incoming signal and, of course, to the second grid.

Well, I think I am sporting enough to admit my defeat—somehow the very obvious is often missed—and I fell for it. Hope there are no hard feelings for my comments in the previous letter.—(Ex) "PHASE CHANGE" (Norfolk).

Home-recording

SIR,—I have been tempted to write to your "Open to Discussion" page for some time now on "direct disc recording," and the article on the subject by Mr. J. Law has finally stirred me into action.

I am in full agreement with him with regard to high priced manufactured equipment which, more or less, flattens the enthusiasm of would-be amateur recordists, and would add that home-built, carefully designed gear can give results comparable to those of the most expensive disc recorders.

It is strange that Mr. Law's circumstances coincide with those of my own, as I took keen interest in the hobby some three or four years ago, starting with 5in. discs on clockwork turntables, and, by a good deal of trial and error, finishing up with quite a good 10in. to 12in. cutting.

My tracking mechanism now consists of an old Edison phonograph, suitably adapted, giving independent tracking at any desired pitch. The turntable is 16in. in diameter, machined in brass, and is a "throw-out" from a local private recording firm, themselves having installed new equipment. The steel centre spindle of this is mounted in a brass bush with ball thrust bearing.

My cutting head consists of a robustly constructed pick-up of high impedance, suitably mounted and counter-balanced by a magnet and an old micrometer! Finally, the turntable drive is supplied by a 1/16th H.P. synchronised electric motor through the medium of ½in. insulation tape (self-jointed), acting as driving belt, which, I may add, has proved quite adequate. Small Meccano parts and pieces of steel rod have all contributed to the final assembly. I obtain my blanks and cutting styli from a local sound equipment factor.

May I wish all success to those contemplating activity in this very interesting and useful hobby. —R. N. GOODWIN (Manchester).

Measuring Meter Resistance

SIR,—R. G. Thomas's letter in the May issue prompted me to investigate the various methods of measuring meter resistance. Here are the results :—

(1) R. G. Thomas himself uses E. N. Bradley's

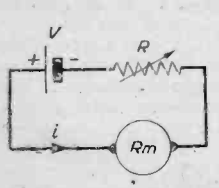
equation (article December, 1948) for the measurement of low resistance. This equation is incorrect since it assumes that the current supplied by the battery is the same in both experiments, i.e., $i-I$ does not equal $Rm \times I/X$. The equation should be:

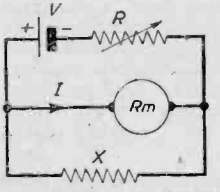
$$X = \frac{Rm \cdot I \cdot (V - Rm \cdot i)}{i - I}$$ where V is the battery voltage.

From this we can get Rm. in the form of a quadratic:—

$$Rm^2.I.i - Rm.V.I. + VX\ (i-I) = 0.$$

Also $Rm = \frac{VX}{EI}(i-I)$ where E is the p.d. across R (below.)





If V is made very large compared to the F.S.D. voltage of the meter (R becoming correspondingly large) then $\frac{V}{E}$ will be very nearly unity and

$$Rm = \frac{X}{I}(i-I) \text{ approximately.}$$

If R is known, then:—

$$Rm = \frac{VX}{R}\left(\frac{1}{I} - \frac{1}{i}\right)$$

The ratio $\frac{X}{R}$ could be found by the potentiometer method of comparing resistances so that neither actual value need be known. In this case V must be small so that R is not too large compared with X. It is not necessary that i should be a full-scale reading in any of the methods. I have worked out theoretical equations in which none of the constants R, V and X need be known. They involve four experiments and four current readings and the resultant equations would, if printed, take up about half this column! The accuracy, however, depends solely upon four meter readings.

(2) N. Mackinnon has a good method (article June. 1948), using a separate milliammeter and voltmeter. However, instead of his equation $Rm_2 = R_2 - R_1 I$ would suggest:

$$Rm_2 = \frac{V(i_1 - i_2)}{i_1 \cdot i_2}$$

One calculation instead of three!

The milliammeter should not be less sensitive than the meter under test, otherwise it will be impossible to read accurately.

(3) R. W. A. Hill (letter December, 1948) needs a low-reading voltmeter for his modification of G. Bryants' method. If such a meter is needed then why go all through that rigmarole? Measure directly by finding the p.d. across the meter on test when it is passing F.S.D. current. Then:

$$Rm = Vm/Im.$$

(4) The method used depends on the apparatus available. If one already has a multi-range meter, other meters and standard resistances it is all too easy. I should imagine that the reason for the whole problem in the first place is the desire to build a multi-range meter around the newly-bought instrument. In that case I would suggest doing four experiments and getting down to work with paper and pencil. If anyone wants that equation that I mentioned above they are welcome to it. I should be glad to get rid of it!—JOHN E. AMPHLETT (Highgate, N.6).

R. 1355 and Television

SIR,—I have noted with interest the various controversies that have arisen on the R. 1355, and I support Mr. Yarnold's comments regarding the range obtainable from this receiver.

I should like to point out that at extreme ranges it is very desirable as it is more sensitive than the average commercial vision receiver; my opinion is that it is very cumbersome for normal use coupled, of course, with its high-power consumption. Sound receivers do not, as a rule, present much difficulty and the converted R. 1124 or "P.W." are useful where a T.R.F. unit does not suffice.

After much experimenting with various types of time bases, I have found that push-pull deflection is really essential for a well-formed picture; I have tried a three-valve synchronised separator and time base unit employing a minimum of valves and components, but although a reasonable picture was obtained, the low output from the time bases made 1,000 volts G.H.T. desirable in order to obtain a 5in. × 4in. picture on my VCR97.

I have also found that the EF50 is definitely superior to the VR65 and their use in time bases especially, is strongly recommended for maximum efficiency.—PHILIP H. BEARMAN (New Barnet).

SIR,—As one who has met with a fair measure of success with the use of ex-Government gear for television conversions, I should like to pass one or two observations upon recent correspondence which I have read in your paper.

Firstly, to the question as to the suitability of the R. 1355 receiver? My reply is Yes. Eminently so; with the staggering of the I.F.s, properly carried out, I should say the bandwidth is nearer 3 Mc/s than the 2 Mc/s as stated by G2ATV and G3AYA.

Secondly, to those who are sceptical as to whether the stuff works, or not—they can see mine. (By appointment, of course.)

The gear used here consists of two R. 1355 receivers, complete with Type 25 units, one for vision, the other for sound; together with a Type 62 indicator.

The Type 62 unit, when entirely stripped down and rebuilt, lends itself to a practically ideal layout for the 'scope and time-base unit, but this would take too long to describe in a letter.

I made just two alterations to the circuit as used by G2ATV and G3AYA, viz., I discarded the use of 6SN7s in the amplifiers in favour of four separate 6J5 triodes, and altered the sync separator grid leak from one megohm to a quarter megohm.

In conclusion, I knew nothing about television and met with many snags, and am indebted to several friends for helpful hints, etc., in getting the thing going.

It can be done. All that is needed is a little more care than usual and a lot of patience, and given these, I am sure anyone can duplicate my results with ex-Service gear.—REG. BAKER (G6QN) (London, S.W.19).

Impressions on the Wax

Review of the Latest Gramophone Records

OF interest among the latest releases is a new recording of the Dvorak Symphony No. 4 in G, Op. 88, by Rafael Kubelik conducting the Philharmonia Orchestra. There was a time when exploration of Dvorak's symphonies other than the over-played E Minor ("New World") was not very enterprising. Now, however, the Fourth is considered not only one of the finest symphony of Dvorak's but one of the best in orchestral literature. Kubelik certainly has the temperament for Czech music and he makes the utmost of the sound construction of this G Major Symphony on *H.M.V.* *C*3852-6. This set of records is a notable addition to the series of first-rate works played and conducted by artists of world reputation made available on records of the plum label category.

Another orchestral recording of interest is Rossini's William Tell Overture which has been recorded by Victor De Sabata conducting the Symphony Orchestra of the Augusteo, Rome, on *H.M.V.* *DB*6880-1. Rossini has come to be regarded so much as a predominantly witty composer that it is occasionally forgotten how poetic he could be; and the slow section of this overture, with its *ranz des vaches* and pastoral air, is true poetry. In the conclusion of the piece, with its brisk gallop and sonorous climaxes, Rossini returns to his more usual style, the hall-mark of which is a dramatic use of *crescendo*.

Elgar's Pomp and Circumstance March No. 1 in D, and No. 4 in G, make a welcome appearance this month played by Sir Malcom Sargent conducting the Philharmonia Orchestra on *Columbia* *DX*1561. The March in D contains the famous tune used also in the Coronation Ode for "Land of Hope and Glory." The March in G was first performed at a Promenade Concert in August, 1907.

Vocal

Tannhauser is enjoyed by many and finds favour among devotees of the older forms of opera because its highly attractive melodies are still in the grand tradition of the romantic opera of the earlier 19th century. Elizabeth's Gebet (Elizabeth's Prayer) from Act III has been chosen by Mme. Flagstad for her latest recording on *H.M.V.* *DB*6795. She is considered one of the foremost interpreters of Wagner singing, and this is a record that I can thoroughly recommend.

The title Betly will probably be new to lovers of opera, even to Donizetti specialists. It was produced in 1836, one of three written in the same year by this incredibly rapid composer. The speed with which he composed perhaps explains the lack of substance in some of Donizetti's music; but he could always be relied upon to turn out a good tune. The aria *In Questo Semplice Modesto Asilo* was included in the important recital given by Margherita Carosio at the Royal Albert Hall in November last, and it proved a mighty success. She has therefore made a recording of the aria this month on *H.M.V.* *DA*1910. It is sung in Italian.

Jennie Tourel proves her extraordinary versatility and light touch in an attractive bunch of Offenbach songs on *Columbia* *LB*79-80. The final side of these two records is occupied by the lovely and famous Barcarolle from Hoffmann, in which Miss Tourel takes both the soprano and alto parts.

Although it is barely two years since Josef Locke started recording for Columbia he has already become one of the most popular tenors in the country. Apart from the quality of his fine tenor voice, he manages to impart that personal touch to his songs that so captivates the imagination and attention of listeners. This month he sings "Bless This House," a ballad with strong family appeal, and "Song Of Songs" on *Columbia* *DB*2514.

Light Music

Sidney Torch's versatile talent is evident in the latest recording by his orchestra of Falla's famous "Ritual Fire Dance" on *Parlophone* *E*11465. On the reverse side is "Tambourin Chinois," an amusing piece by the great violinist Fritz Kreisler. Its effect as an orchestra piece is no less fascinating than its more usual appearance as a solo for violin.

"The Glass Mountain" is a British film which is outstanding in several respects. George Melachrino and his Orchestra have chosen the two best-liked numbers from the picture for their latest recording on *H.M.V.* *B*9765. The first is Nino Rota's theme to the story, the other (by Toni Ortelli and Luigi Pigarelli) is a moving song said to be based on an old Italian folk melody.

"The Dance Of The Tumblers," or clowns, from Rimsky-Korsakov's opera "The Snow Maiden," makes its appearance this month as a highly refreshing piece for two pianos played by the famous duo-pianists Rawicz and Landauer on *Columbia* *DB*2521. On the reverse these two talented artists play their own arrangement of "Andaluza," by Granados.

Dance Music

Geraldo's legion of admirers have been intrigued by his broadcast versions of "A Rosewood Spinet" and "Sunflower"; here they are on record *Parlophone* *F*2356. Rosewood Spinet is the Nat Simon-Charles Tobias number about an old instrument, standing in a corner, which has sentimental associations. Sunflower, written by Mack David, is a hill-billy type of song telling of a girl who is the prettiest "sunflower" in the State of Kansas. Both these American tunes have been attractively arranged by Wally Stott.

Other popular tunes have been recorded by Oscar Rabin and his Band with "Carnival" and "By The Sleepy Lagoon," on *Parlophone* *F*2353, and Lou Preager and his Orchestra with "Hang On The Bell, Nellie" and "On The 5.45," on *Columbia* *FB*3486.

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Practical Television

Vol. 1. No. 5 NEW SERIES JULY, 1949

Televiews

Television in America

ACCORDING to a representative of an American firm of television manufacturers the order of programme popularity in the U.S.A. is variety, sporting events and drama. Plays are streamlined in the U.S.A., only one hour being allowed for them, compared with our one and a half to two hours. The result of this is that the American plays take only one week to produce as against our three weeks.

There can be no doubt of the belief of American manufacturers in the future of television, for they aim to sell a television receiver to every householder. It has reached a higher proportion of sales than radio has ever done, and it promises to become one of America's greatest industries.

There is a federal tax on radio in America but on television the tax only applies to the radio portion. The rest is free of tax to encourage development. The British Government might take a leaf out of the American book!

The programmes are paid for by sponsors who will pay up to 25,000 dollars or, say, £5,000 for a one-hour programme. American manufacturers are certain that there will be television in every home within 10 years. At present there are 75,000,000 radio sets in use in a country with only 38,000,000 homes. There are nearly 1½ million television sets now in use and manufacturers are producing 2,000,000 sets a year.

It is not thought in America that television will replace radio, as there are many places in that country where television cannot be used. For example, in the kitchens of America radio receivers are installed for the maids. They can do their work listening to the radio, but not watching a television programme. Some listeners like late night music or news in the bedroom, or whilst playing cards. Thus there is a field for both. But radio set production as well as set size is now being considerably cut.

The most popular size of tube in America is the 10in., although there are 7in., 10in. and 12½in. tubes. It is hoped soon to have 100 television stations providing unlimited programme material to aid in making television popular. In this country our one "take-it-or-leave-it" programme does not tend to foster interest nor to popularise television. At most, for some time to come, television will be enjoyed by two comparatively local areas.

An analysis in America shows that the presence of children in the family has an important effect on the interests of television. The interest is about 50 per cent. greater; the husband is found to be the motivating factor in 80 per cent. of interested families and the wife about 57 per cent.

About 77 per cent. of the American public earn less than £25 a week, thus placing the future of television in the hands of the middle income or mass market. This survey shows that only 11 per cent. of the people in television areas have not seen television, and in view of the present sales there is some reason to believe that the estimates of future possibilities have not been overstated.

Reception in the Fringe Area

WHEN a party of motor trade representatives visited Birmingham recently and toured a well-known factory making electrical equipment, a problem of interest to television viewers was raised by Mr. J. H. Hine, the traffic superintendent of Northampton. Northampton, he said, was on the fringe of the London television transmitter range and it was found that suppressors were sometimes apt to interfere with the signal itself.

A technical representative of the company said that the needs of television viewers had been considered and a satisfactory suppressor had, in fact, been put on the market.

Television Applications

TWO interesting television applications have been dealt with in the newspapers recently. One of them is in connection with surgery. An operation for appendicitis was televised in magnified detail at Guy's Hospital, and parts of the operation were later seen on the screens of viewers. Students in an adjoining room were able to watch the operation without being present. From the point of view of surgery, of course, an ordinary cinematograph film of the operation would be more effective.

In the second application television is being used to reduce the risks in dismantling explosive missiles. The work is done by remote control, the operator receiving his instructions by images from a television camera. This is in America.

Phonevision

IN America an announcement has been made of an invention for providing television via the telephone. The invention has been inspired so that those who object to the wisecracking salesmen who interject jokes and advertisement matter into the television programmes may look in to a play without such interruption.

The device was invented by Commander E. F. McDonald, and his plan is to form a sort of subscribers' club by means of which members will get a privately circulated programme with their television sets linked up to their telephone lines. When the subscriber wishes to look in he throws over a switch, and automatically the telephone bill will be debited with the fee—one dollar. The programme will be a feature film.

F. J. C.

Aerials for Television—2

This Month Indoor Types of Aerials are Discussed by W. J. DELANEY (G2FMY)

WITHIN a limited range of the transmitter it is possible to obtain quite good results on an aerial fitted in the loft or in the room in which the receiver is fitted, but it must be understood that the efficiency of an aerial of this type is very low. To give some idea of the results which may be expected some figures are given below. These have been obtained by Messrs. Belling and Lee, makers of both the outdoor and indoor types of aerials, and were compiled from information obtained from users of their aerials. They are for ordinary two-storied houses, which means that greater ranges would be expected on taller buildings, or where the aerials were erected on a mast or otherwise raised above normal chimney or roof level.

It will be seen from the table that the indoor aerial is only useful in limited conditions, and it is of little use increasing the gain of a receiver to make up for the loss arising from keeping the aerial inside the house. Background "noise" on the picture will increase if the gain is pushed too far, and furthermore, the signal-noise ratio will undoubtedly be decreased on sound. However, for those who require the indoor arrangement the following information is given.

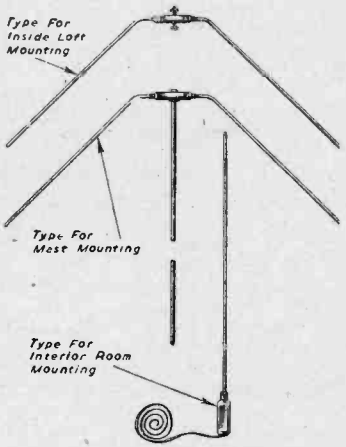
Attic or Loft Aerials

In many houses the space below the roof will accommodate the standard dipole, which may be supported on the purlins or tie-beams. If the roof is of the low type then a smaller aerial will have to be used, and it will be found that an inverted "V" is the best solution. As its name implies, this is a standard dipole bent at the centre so that the two halves are at right angles. This enables the aerial to be mounted right at the top of the normal roof and at the same time introduces a directional effect. This type of aerial (which, incidentally, costs two and a half guineas) has a sharp minima at right angles to its axis, so that it should be mounted, as with a normal "H" type aerial, whilst a picture is being received, so that the best position may be fixed. On account of this directional effect it may be found worth while in some cases to use it in preference to a simple dipole outside the house, for which purpose a special mounting suitable for a chimney stack may be obtained. For those who wish to experiment, there is obviously the same scope here as with normal outside aerials, "cage" assemblies of separate wires being used for each half of the aerial, with matching leads from the centre to the receiver. The separate halves could be attached on stand-off insulators to the rafters, or a simple assembly could be built up on lengths of timber and these could be supported as desired.

Some viewers have reported that good results have been obtained by merely supporting a length of wire horizontally across the loft, but in view of the fact that the television signal is vertically polarised, and that certain commercial receivers are very critical on the input side, this is not recommended.

Room Aerials

The remaining type of aerial is that which is fitted in the room with the receiver and this, although fairly efficient in itself, suffers from a number of drawbacks, some of these serious. Dealing with these troubles first, it should be explained that the picture is produced as a result of the signal energy picked up by the aerial. Thus, screening the aerial from the signal will result in a weaker picture, and, consequently, variations in the degree of screening will result in variations in the brightness of the picture. This applies to all types of signal, of course, and although many sound receivers are used with this type of aerial, the fading effects are not so noticeable to the ear as they are to the eye. Secondly, it must be remembered that the aerial is more or less a tuned circuit and thus is susceptible to changes in its capacity to earth. Now in the average room there are generally two or three walls which are common to adjacent rooms, and in some cases these rooms will not be part of the viewer's premises. Consequently, the viewer will not know what is mounted on or fitted near the other side of those walls. If a simple dipole or length of wire were supported on a wall, therefore, it might have running parallel with one part of it a length of metal electric-light conduit, or even an ordinary metal bath. The effect of the latter on the lower portion of



Some indoor aerials from the Belling-Lee range.

Aerial	Maximum Certain Range in Miles	Occasional Range in Miles	Known Extreme Range in Miles
Standard "H" on chimney	35	60—70	over 100*
Dipole chimney	18	50	no data
Inverted "V" on chimney	14	35	no data
Inverted "V" or "Doorod" in attic	10	30	no data
On second floor	6	16	30

* Johannesburg, South Africa.

a simple dipole would be considerably different when the bath was filled with water.

It thus becomes obvious that when fitting an aerial in a room some attempt must be made to place it so that its capacity to earth will not be varied, and also that there is some sort of balance between the two sections. Few rooms will be high enough to take a standard dipole in its normal form, but it is permissible to fold it or to adopt an arrangement whereby the upper part is vertical and the lower part is fixed at an angle. In one form of commercial aerial the upper part is metallic tubing and is intended to be mounted by the side of a door, whilst the lower portion is flexible and is intended to be fitted along the skirting board.

Alternatively, a standard dipole (from a dimensional point of view) may be folded on itself at each end so that there is a spacing of about 3in. to 4in. between each part of the fold. Other ideas may suggest themselves to readers, but as pointed out above, in view of the variation in results which are obtained when the self-capacity of the aerial is varied, disappointment may ensue.

Remember, that a person walking past the aerial on the other side of the wall may result in the picture disappearing altogether.

Underneath the Dipole

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

SOMETHING greater than a storm in a tea-cup blew up a month or so ago when it was announced that the B.B.C. had secured a contract with a leading film distribution company for the televising of a number of their films. This contract was not for an odd cowboy film, but for a series of British films which had been highly successful, starring Gracie Fields, George Formby, Will Hay and other top-line stars. These films were fairly old, but were still being shown at cinemas as re-issues, particularly for Sunday night programmes. There was much fluttering in the dovecots of Wardour Street, and the Kinematograph Renters Society passed a vote of censure on the "wicked" member who dared to enter into such an agreement.

Wailing in Wardour Street

The ashtrays of the Kinematograph Renters Society filled and overflowed with cigar ash as their angry Council members spent hours debating their grievance. An American pointed out that the type of films involved in the deal would not enhance the prestige of the film industry as a whole, although the films would be seen by only a relatively small proportion of the people. Other members gave their views. Television was a definite opposition to the cinema, they moaned, and it was not right that these films should be available to the television public for nothing.

"Bloop," "Bloop" Noises

We have now seen the films in question, and a few others, too. And what has been the reaction of the "relatively small section of the people" who saw them? The first of the Gracie Fields' films—"Sally"—seemed rather old-fashioned, but was still first-class entertainment. The other films were good, too, though the B.B.C.'s tele-cine equipment scarcely gave the best possible picture or sound reproduction. I particularly noticed the noise of the joins in the sound track, which made a very low-frequency bump sound with every change of shot. The joins were not heard when these pictures were originally shown at the cinemas, as the projection equipment could scarcely reproduce the 50-cycle "bloop" with which every join was punched on the negative at that time. The "bloop," I must explain, was a long diamond-shaped cut-out (sometimes also in the form of a triangle) which eliminated the cracking noise of an "unblooped" splice, and the result on the printed copies was a black reproduction on the sound track of the cut-out shape of the "bloop." With the improvement in the quality of sound film reproducers early types of "bloops" became audible, and recourse had to be made to lengthening the shape of the "bloop" to lower the frequency of the resultant sound. This had two effects: the sound negative film was weakened at the joins and tore very easily, and the "bloop" was so long that interruption in the continuity of sound was noticeable.

The Electric "Bloop"

On early films these "bloops" made all the more noise because the original dialogue negative was used excepting for those sections which had music and effects added later in a re-recording process. Re-recording was avoided, excepting where it was absolutely essential. Consequently, the release copies of early sound films, such as we have lately been seeing on television, were made from sound negatives which had almost as many "blooped" joins in them as there were changes of shot on the picture.

Nowadays, the noise of a join in the sound track is rarely heard. Firstly, the splices in the original dialogue sound negative are no longer "blooped" by punching the track; instead, the film printing machine is fitted with a special little fogging light which flashes on and blacks out the join on the print. Secondly, all joined-up dialogue sound tracks are re-recorded in entirety, whether music and effects are added or not, so that the final sound negative of a reel is all in one piece, with no splices in it.

The moral of this story is that if it is good enough to obtain new prints of these old pictures, so that they can be seen at their best via television, then it would be worth while to have prints made with the joins "electrically blooped." B.B.C. please note!

Easter Parade

What has been the result of the televising of films? In the case of the Fred Astaire film, "Second Chorus," it has reminded many a viewer of the versatility of that grand artist just in time for the release of his current picture "Easter Parade." It certainly does not seem to

have had any adverse affect on the long queues for this latest Technicolor musical, in which Astaire stars with Judy Garland. I am quite certain that a good many viewers went to see "Easter Parade" at their local cinema because they had enjoyed "Second Chorus" on television. This is a point which the disgruntled cigar smokers of the Kinematograph Renters Society should bear in mind. I think it won't be long before they'll be pressing to make use of television for special trailers of "forthcoming cinema attractions" and the like. That would be capitalising on television, which would be to the benefit of everybody.

Films on Television—The Future?

It is obvious that the television service needs the help of the film industry. In America all kinds of films are being televised at the dozens of stations now in operation, and the demand for any kind of film exceeds the supply. Old films and not-quite-so-old films are being sent out, some of them of very poor quality, to say the least. The competition for superannuated films which are of good quality has given them a new lease of life and provided an unexpected new source of income to the producers. A good deal of money is being lost by the big broadcasting companies, who are unable to persuade the "sponsors" to pay reasonably high sums for the limited number of viewers. The "limited number," by the way, is increasing day by day, and the position will shortly be changed.

I think British viewers would be interested in seeing some of the silent pictures, provided they were not treated primarily as pre-historic curiosities. Certainly, the peep we had recently at the excerpts of early Charles Chaplin films was most enjoyable. But this programme was immediately put into the museum category by the interpolation of a pompous explanatory lecture. The musical background was also not at all representative of the ingenious musical improvisations which were heard at even the most second-rate suburban cinemas. The Chaplin films require no academic explanation of motives, montage or any other arty-crafty dissection. They were comic films made by an ex-music hall comedian, whose hard experience with Fred Karno's company gave him an intuitive knowledge of what the public wanted. Therefore, let us have more Chaplin films, but let us hope they'll be served up without a damp blanket lecture or an inappropriate musical accompaniment.

New B.B.C. Equipment

New Equipment for Television Film Transmissions

LAST month, two sets of entirely new equipment for televising feature films, the B.B.C. Television Newsreel, and the daily demonstration film, were used for the first time at the London station.

One set has been manufactured by Cinema Television, Ltd., and the other by Electric & Musical Industries, Ltd.

Micro-wave Radio Link

B.B.C. engineers in collaboration with British manufacturers are actively engaged on the exploitation of lightweight television outside broadcast equipment. The aim is to extend the scope of these operations and to increase the speed with which the equipment can be set up so that events of exceptional topical interest can be televised. In particular, an improved radio-link has been developed to transmit television pictures from the cameras to Alexandra Palace for broadcasting in the normal service.

This equipment, which works on the extremely short wavelength of 4½ centimetres, is now being tested, and exceptionally clear pictures free from all interference are at present being received over a distance of 7 miles. There seems to be no reason why equally good results should not be possible at ranges of 20 miles, or by covering the distance in two or more hops even further.

At these extremely short wavelengths the aerial can be made to concentrate the radio waves into a very narrow beam. The transmitting and receiving apparatus is light and easy to carry, and thus marks an important advance from the apparatus used for this purpose before the war, which filled two large motor-lorries.

A Zoom Lens

A Zoom lens for television is a further step in the development of the television outside broadcast equipment. At the Cup Final one of the cameras was fitted with a device known as a Zoom Lens. This lens enables the camera to choose any part of the scene and then gradually magnify it until a close-up view is obtained. The effect is just as if the camera were moving towards this part of the scene, making it grow larger and larger until it fills the whole screen.

This particular lens is a wholly British development. The inventor is Dr. H. Hopkins, B.Sc., Ph.D., F.Inst.P., who is optical consultant to the B.B.C. Engineering Division, and also to the makers, Messrs. W. Watson & Sons, of Barnet.

Zoom lenses have been made before and used both here and in the United States in film-production and also in American television. The new British lens, however, works on an entirely different principle, and is by contrast much lighter and more optically efficient. It will undoubtedly be a most valuable acquisition to the B.B.C.'s mobile television equipment.

Sutton Coldfield Aerial

A novelty is being introduced into the aerial to be used at the Midland television transmitter. It will consist of a stacked and folded vertical dipole, arranged round the vertical mast, and the single aerial will radiate both vision on 61.75 Mc/s and sound on 58.25 Mc/s. It should be remembered that this transmitter will employ single sideband principles on vision, utilising the lower portion of the band. This system will also be adopted for the remaining transmitters in this country, but we understand that it is not proposed to change the A.P. system.

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"All-Wave" A.C. Three (D, 2 LF (RC))	—	PW54*
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THESE blueprints are drawn full size. The issues containing descriptions of these sets are now out of print, but an asterisk beside the blueprint number denotes that constructional details are available, free with the blueprint.

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

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