9d.

Vol 26. No. 525
APRIL 1950

EDITOR:
F. J. CAMM

# PRACTICAL WIRELESS


## CHIEF CONTENTS

**STERN'S BATTERY PORTABLE "PERSONAL" KIT.**
A complete kit of parts to build a Midget 4-Valve All Dry "Personal" Set.
Consists of regenerative T.R.F. Circuit, employing Flat Tuned Frame Aerial with Denco Iron Dust Cored Coil, thereby ensuring maximum gain for Single Tuned Stage, covering Medium Waveband.
Valve Line-up: 1T4 (R.F. amp.), 1T4 (Detector), 1S5 (1st A.F.), and 3S4 (Output). Includes 3½in. P.M. Speaker and with chassis already drilled and shaped.
Consumption of only 7 m/A ensures long battery life.
The kit is designed for a cabinet, minimum size 6½in. x 4½in. x 3in. Detailed Building Instr. and circuit, including Practical Layout included with each Kit, make assembly very easy (supplied separately for 1/6).
**PRICE FOR COMPLETE KIT, £3 18/9** (plus 16/7 P.T.).
Suitable Unpolished Cabinet, 12/9; E. Ready B114 Battery, 9/7

The **MIDGET A.C. MAINS 2 VALVE RECEIVER.** All the Components to build this popular Set, as specified in the March 1949 issue of Wireless World, can be supplied complete for **£3.** Reprint of detailed building instructions, giving practical layout and circuit supplied separately for **9d.**

We can now supply all necessary components to convert the above W/World **2 valve set** to the later **3 valve set** covering L. and M waves, including a drilled chassis for 33/6. Complete wiring diagram included (supplied separately for **9d.**).

The **WIRELESS WORLD 3 VALVE A.C. MAINS SET,** covering long and medium waves. We can supply the complete components to build this set, including drilled chassis, valves, M/coil speaker, etc., for £4/5/0. Complete wiring diagram and instructions included (supplied separately for 9d.).

Send **3d.** stamp for our Feb., 1950, comprehensive component stock list, this now shows the latest T/V kits with component prices, and our various other kits of parts. When ordering please cover post and packing.

**STERN RADIO LTD.,**
**109 & 115, FLEET STREET,**
**E.C.4.**

*Telephone: CENtral 5814 & 2280*

# NEW-TRUE FIDELITY by


The **G.P.20** MICROCELL PICK-UP establishes new standards in pick-up design. In addition to the features shown below and the availability of the interchangeable head for "long playing records" this instrument **REQUIRES NO EQUALISER**

- **Output ½v. at 1,000 cps**—*5 to 20 times greater than comparable magnetic types.*
- **Automatic bass-boost**
- *Negligible needle talk and motor rumble.*
- *Extremely low needle pressure (13 grams) virtually eliminates record wear.*
- *Unbreakable crystal element*
- *No needle change.*

The automatic bass-boost assures the finest possible reproduction of which your set is capable, without additional components.

Just connect up—that's all.

*Heavy export commitments have severely curtailed supplies of the G.P.20 to the home market. Every effort is being made to increase production and in the meantime we ask your forbearance.*

COSMOCORD LTD · ENFIELD · MIDDX

# ★ Radio Spares Bargains!

**We offer this month an Ex-R.A.F. unit for breaking down, containing amongst a multitude of parts and components the following:—**

3, 2 metre coils.
3, tuning condensers (split stator type).
4, 2 watt carbon resistors (all useful values).
1, tapped 20 watt resistor, vitreous enamelled, 20 and 17 ohm sections.
2, 2 watt carbon resistors (useful values).
6, .05 m.f.d. 1,000 volt paper condensers.
3, .1 m.f.d. 1,000 volt paper condensers.
1, Heavy metal chassis, size, 12in. x 7in. x 2in.
1, Louvred casing, size 12in. x 7in. x 4in. grey cellulose finish.
2, H.F. chokes.
4, .1 mfd 450 volts paper condensers.
2, .05 mfd 450 volts paper condensers.
5, .001 mfd mica condensers, bakelite enclosed.
1, .01 mfd. 3,000 volt paper condenser.
24, Rubber grommets (assorted sizes).
6, 1 watt resistors (all useful values).
6, half watt resistors (all useful values).
40, quarter watt resistors (all useful values).
40, silver mica condensers (assorted values, including 10, 15, 20, 40, 50, 150, 300 and 500 m.m.f. types).
4 English Octal valve-holders.
2, 5-pin valve-holders.
1, 9-pin valve-holder.
3, Diode D.I. valve-holders.
8, Condenser clips (assorted sizes).
2, Insulated output sockets.

Assorted nuts, bolts and P.K self-threading screws and miscellaneous bits and pieces including, 4 tag boards, 14 chassis mounting connection tabs, grid caps, (screened and otherwise), levers, rollers, connecting rods, rubber retainers, etc., etc.

**The value of these spares at present-day prices must be in the region of £6 at least. We offer you the complete unit at the bargain price of**

**4/6** plus 1/6 post.

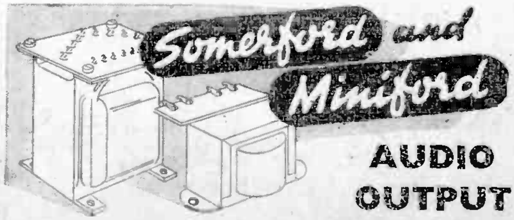
## ★ 6 VALVE BATTERY SHORT-WAVE RECEIVER

Ex-R.A.F., really sensitive, approx. 4.8 megacycles, receives dozens of short wave stations soon as batteries and phones are connected. Standard 2-volt valves.

**23/6** INCLUDING VALVES. *Plus 2/6 Post and Packing.*

**SUITABLE H.T. BATTERY, 6/6.** Plus 1/6 Postage. **PHONES 7/6 Pair.**

*Write to Dept. "R."* **INSTRUMENT CO.**
**11, GUNNERSBURY LANE, ACTON, W.3**




# AUDIO OUTPUT TRANSFORMERS

**CHARACTERISTIC CURVES** of Somerford Transformers showing frequency response between 20 cycles per second and 25,000 cycles per second are available upon request.

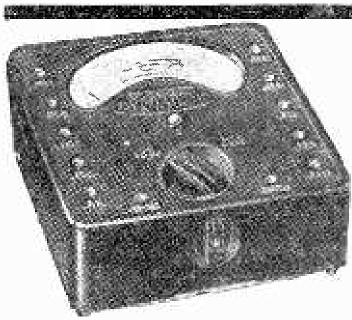
These two standard ranges of Output Transformers will meet all normal needs of the home constructor. They provide a degree of accuracy, quality and dependability which cannot be surpassed.

**SOMERFORD.**—A range of Output Transformers designed to ensure high quality and reliable performance. Suitable for single ended or push-pull circuits, covering the widest limits of the audio frequency band. May be used with confidence for the most exacting circuits.

**MINIFORD.**—A range of high quality transformers of economical design which provide excellent reproduction for domestic purposes, but over a more restricted range of audio frequencies than the Somerford Transformers. 2, 4 and 8 watt types suitable for all Outputs.

*Write for our New Folder giving details of these two ranges.*

**GARDNERS RADIO Ltd**
SOMERFORD CHRISTCHURCH HANTS
PHONE: CHRISTCHURCH 1025



# 'AVO' *Precision* ELECTRICAL TESTING INSTRUMENTS

*Registered Trade Mark.*

A dependably accurate instrument for testing and fault location is indispensable to the amateur who builds or services his own set. Stocks are now available of these two famous " Avo " Instruments. If you have any difficulty in obtaining one locally, please send us the name and address of your nearest Radio Dealer.

| D.C. Voltage | A.C. Voltage |
|---|---|
| 0—75 millivolts | 0—5 volts |
| 0—5 volts | 0—25 ,, |
| 0—25 ,, | 0—100 ,, |
| 0—100 ,, | 0—250 ,, |
| 0—250 ,, | 0—500 ,, |
| 0—500 ,, | |

| D.C. Current | Resistance |
|---|---|
| 0—2.5 milliamps | 0—20,000 ohms |
| 0—5 ,, | 0—100,000 ,, |
| 0—25 ,, | 0—500,000 ,, |
| 0—100 ,, | 0—2 megohms |
| 0—500 ,, | 0—5 ,, |
| | 0—10 ,, |

**GUARANTEE:** The registered Trade Mark " Avo " is in itself a guarantee of high accuracy and superiority of design and craftsmanship. Every new AvoMinor is guaranteed by the Manufacturers against the remote possibility of defective materials or workmanship.

## The UNIVERSAL AVOMINOR

(as illustrated) is a highly accurate moving-coil instrument, conveniently compact, for measuring A.C. and D.C. voltage, D.C. current, and also resistance ; 22 ranges of readings on a 3-inch scale. Total resistance 200,000 ohms.

*Size : 4⅝ins. x 3¾ins. x 1⅝ins.*
*Nett weight : 18 ozs.*

*Complete with leads, interchangeable prods and crocodile clips, and instruction book.*

*Price :* **£8 : 10 : 0**

## The D.C. AVOMINOR

is a 2¼-inch moving coil meter providing 14 ranges of readings of D.C. voltage, current and resistance up to 600 volts, 120 milliamps. and 3 megohms respectively. Total resistance 100,000 ohms.

*Size : 4⅛ins. x 3⅞ins. x 1⅛ins.*
*Nett weight : 12 ozs.*

*Complete as above*
*Price :* **£5 : 5 : 0**

*Sole Proprietors and Manufacturers:—*
**AUTOMATIC COIL WINDER & ELECTRICAL EQUIPMENT CO., LTD.**
Winder House, Douglas Street, London, S.W.1. 'Phone : VICtoria 3404-9

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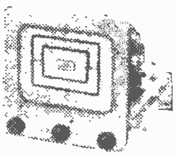
FOR THE UTMOST REALISM FROM RECORDS & RADIO

# LISTEN—IT'S A GOOD SOUND JOB

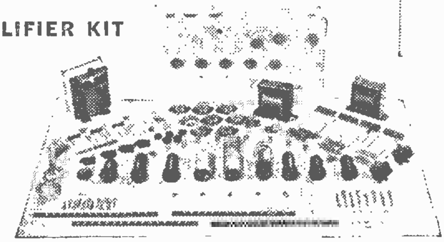


## THE R.A. TUNING UNIT

A really fine design with lasting high performance. R.F. stage on all wavebands. High fidelity superhet or T.R.F. performance, at the turn of the switch. Suitable for any amplifier.

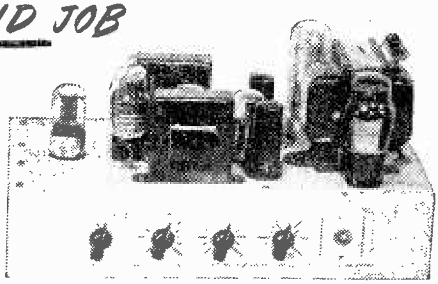
**10 Gns.** *plus* **£2 : 6 : 8** *tax*
*(2 years' guarantee)*
*(With escutcheon plate as shown 5/- extra)*

## THE K.I. AMPLIFIER KIT



The K.I. Kit is undoubtedly the best high fidelity amplifier kit available at the price. Absolutely complete, very simple to construct, the performance matches up to the high standard reached by moving coil pick-ups. We recommend either moving coil pick-ups or miniature moving iron types, such as the Connoisseur, which may be used without the transformer.

*Price* **13 Gns.**



## THE K.I. AMPLIFIER

This seven-valve amplifier, designed for the lightweight high fidelity type pick-up, is proving the real answer for the music-lover who seeks a high standard of reproduction at a moderate cost.

Independent bass and treble controls permit compensation for recording losses and reduce needle scratch. Tetrodes with negative feed-back ensure negligible distortion.

*Price Complete* **17 Gns.**
*Blueprint separately 2/6*
*(2 years' guarantee)*

*Write to-day for your copy of our fully illustrated catalogue.*

Charles
**AMPLIFIERS**
(Sales) LTD
**181 Kensington High Street, London, W.8**
*Phone :* WEStern 3350

*DEFERRED TERMS AVAILABLE*

*Our equipment can also be seen and heard at*
**Webb's Radio**, Soho Street, London, W.1
**Signal Shop**, 51, St. Mary Street, Bridgwater, Som.
**Ernest Buchan**, 28, Belmont St., Aberdeen
**Farmer and Co.**, 83, George Street, Luton

# Practical Wireless

18th YEAR OF ISSUE

EVERY MONTH.
VOL. XXVI. No. 525 APRIL, 1950

Editor F. J. CAMM


COMMENTS OF THE MONTH BY THE EDITOR

## "PRACTICAL TELEVISION"—Our New Companion Journal

### No. 1 OF "PRACTICAL TELEVISION" WILL BE PUBLISHED ON MARCH 24th

THE rapid and ever-increasing development of the science of television and the great expansion in the number of viewers due to the opening of the Sutton Coldfield station—the forerunner of a chain of stations which will cover the country—makes it impossible for us in the small Practical Television section in this journal to devote sufficient space to deal with the construction of television receivers, new developments, news of the industry, new apparatus and that interchange of opinion which is so vital to a new industry.

The Practical Television supplement to this journal therefore assumes a separate entity on March 24th when the first issue of *Practical Television* will appear. It will be similar in format and arrangement to PRACTICAL WIRELESS. It will be controlled by the same editor and it will give the same faithful and unremitting services to its readers as with other journals in our Practical group.

It will cost ninepence every month, but to secure a copy it is essential that you place an order with your newsagent now, for although paper rationing as far as periodicals are concerned was abolished on March 1st, that does not mean that periodicals will be in unlimited supply. Paper pulp may not be available for the mills to supply the extra demand for paper.

*Practical Television* is launched at a time when the whole British public is eager to learn more about the new science. Interest is not confined to the two present service areas, for the great success of the Sutton Coldfield Station has caused the B.B.C. to modify its plans, with the result that other stations will be erected more speedily than was at first thought.

At present the two stations cover a service area of about 5,000 square miles, but technical interest is nation-wide; and whilst, therefore, the new journal in its early days will on its constructional side appeal mainly to readers within those two areas, the other features will have an educational appeal covering the whole country.

*Practical Television* will not only tell readers how to build television receivers, but also how to operate them, how to remedy faults, how to choose a receiver.

For example, the first issue will contain the first of a series of articles by the editor on "Television Principles and Practice," an article on the construction of a television receiver, television news from England and abroad; a B.B.C. television engineer explains the television transmitting system; an up-to-the-minute news feature; a helpful criticism and causerie; news from the industry; details of new receivers and accessories; an article on projection television; a short history of television; television personalities; the television systems of other countries; a review of some commercial television receivers; servicing television receivers; correspondence; an explanation of the Emitron Camera; also ultra short waves, news from the clubs, correspondence. These are but a few of the features which will be contributed by authorities only. The services of some of the leaders in the various television fields have already been retained.

As with all our journals, it will be lavishly illustrated in half-tone and line.

We take pride in the fact that *Practical Television* will be the first new journal to commence publication after paper rationing ceased, for it appears 24 days after.—

F.J.C.


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


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

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

# ROUND the WORLD of WIRELESS

## Broadcast Receiving Licences

THE following statement shows the approximate numbers of licences issued during the year ended 31st December, 1949.

| *Region* | *Number* |
|---|---|
| London Postal .. .. .. | 2,315,000 |
| Home Counties .. .. .. | 1,636,000 |
| Midland .. .. .. .. | 1,699,000 |
| North Eastern .. .. .. | 1,873,000 |
| North Western .. .. .. | 1,579,000 |
| South Western .. .. .. | 1,044,000 |
| Welsh and Border Counties .. | 723,000 |
| Total England and Wales .. | 10,869,000 |
| Scotland .. .. .. .. | 1,114,000 |
| Northern Ireland .. .. | 198,000 |
| Grand Total | 12,181,000 |

## B.E.M. for Cole Designer

J. D. SWEETNAM, Production Superintendent of E. K. Cole, Limited, Electronics Division, Malmesbury, has been awarded the B.E.M. for outstanding work on production of special equipment for Ministry of Supply, particularly the 88 "Walkie-talkie" set.

## Broadcasting Committee

THE Broadcasting Committee recently heard oral evidence from representatives of the Theatres' National Committee and representatives of the Incorporated Society of British Advertisers, Ltd.

Later, the Committee heard evidence from representatives of the Institute of Incorporated Practitioners in Advertising, followed by representatives of Messrs. Horlicks, Limited, Lever Brothers and Unilever, Limited, Rowntree and Company, Limited, and Reckitt and Colman, Limited. Also from representatives of the Incorporated Society of Musicians, followed by representatives of the Songwriters Guild (of Great Britain), Limited.

## V.H.F. Radio in the Far East

WHEN oil is handled in bulk, speedy and effective communications are a vital necessity for making arrangements when ships are bunkering or when tankers are loading or unloading oil, as well as being essential should any emergency such as fire, sabotage or accident occur. The storage depots are often a considerable distance from the port town and docks from a point of view of safety, availability or suitable land and other similar factors, and V.H.F. radio often provides an ideal method of communication.

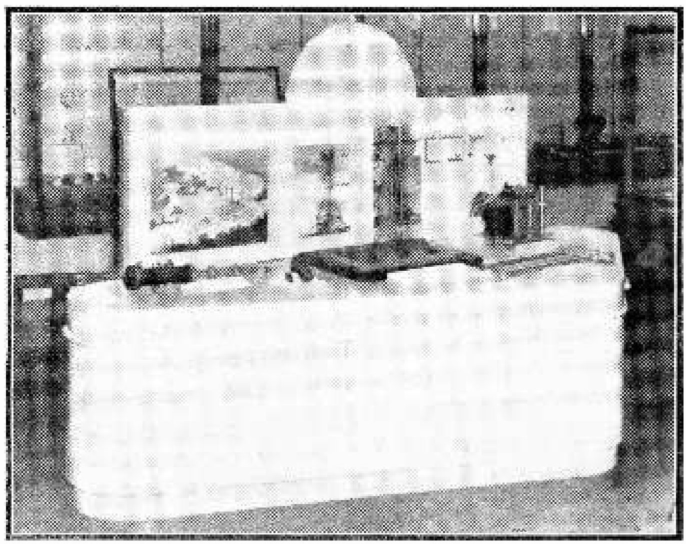
An excellent example of this use of V.H.F. radio is in the Singapore area, where the General Electric Co., Ltd., has installed two major systems of radio links for the Shell Oil Co., and the Standard Vacuum Oil Co.

## B.I.R.E. Meetings

THE following Meetings and Lectures have been arranged for March:

*London Section.*—London School of Hygiene and Tropical Medicine, Keppel Street, W.C.1 (meetings commence at 6.30 p.m.). March 23rd, J. E. Jacobs, B.Sc.(Eng.): "High Performance Television Monitors."

*West Midlands Section.*—Wolverhampton and Staffordshire Technical College, Wulfruna Street, Wolverhampton (meetings commence at 7 p.m.). March 22nd, A. A. Devey, Esq.: "Radio Interference with Broadcast Reception."



*A special display at the Science Museum showing the essential features of the London-Birmingham Television Link which was designed, built and installed by the G.E.C. to the specification of the G.P.O.*

*North-Eastern Section.*—Neville Hall, Westgate Road, Newcastle-on-Tyne (meetings commence at 6 p.m.). March 15th, Dr. Prowse, B.Sc., Ph.D.: "Electrical Breakdown of Gases at Ultra High Frequencies."

*South Midlands Section.*—The Coventry Technical College, Room A5 (meetings commence at 7 p.m.). March 30th, H. W. Shipton (Associate Member): "Electronics and the Brain."

## Central Unit for Hospitals

ATTRACTIVELY designed and requiring the minimum of space, the new Consolette Radio Equipment, introduced by Philips, provides the ideal central unit for radio distribution systems in hospitals. The range of amplifier units at present available provides for powers of 15, 25, 50 and 100 watts.

The top panel of the equipment is fitted with a radio receiver tunable over the short, medium and long-wave broadcast bands. To facilitate tuning, a pilot loudspeaker, with full switching facilities, is incorporated in one of the side panels.

## New Telephone Circuits for New Zealand

THE Department of Posts and Telegraphs of New Zealand have placed a contract with Standard Telephones and Cables, Limited, for the complete re-equipment of the two 40 naut. m. submarine telephone cables which link the North and South Islands.

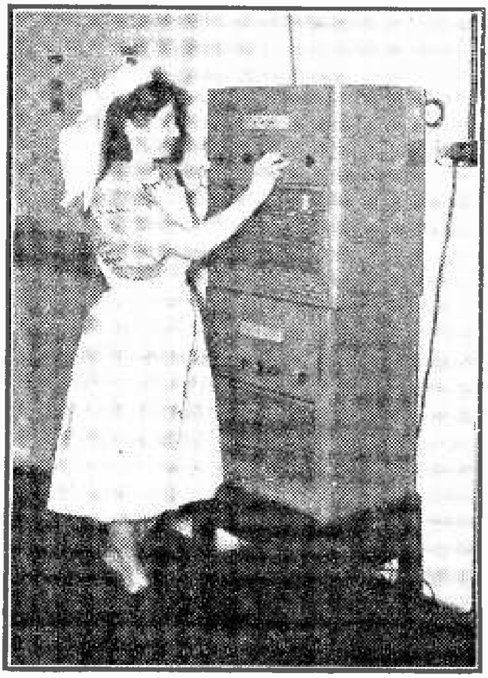
The new equipment to be supplied will operate up to a frequency of 300 kc/s. on each cable, providing on each cable 32 carrier telephone channels, one voice frequency telephone channel, and, what was not previously available, a music channel.

## Canterbury Cathedral

THE recent installation of a permanent sound reproduction system in Canterbury Cathedral represents a major achievement in acoustic engineering. Designed and installed under the direction of the Philips organisation, this system is fully automatic. This notable advance has been made possible as a result of an ingenious system of volume regulation incorporated in the equipment by means of which it is possible to ensure a uniform level of intelligibility throughout the Cathedral, irrespective of the microphone in use. In this system, loudspeakers likely to cause acoustic "feedback" are automatically muted when an adjacent microphone is brought into use. This new sound reproducing system has the great advantage over previous systems in that it does away with the necessity of having an operator in attendance at the amplifier controls during the service.

## Wire-drawing Achievement

A NOTABLE achievement in the drawing of fine tungsten wire was recently made in the wire-drawing section of the Osram Lamp Works of The General Electric Co., Ltd., when a length of 33 miles of 0.015 mm. diameter wire was drawn without a break. The wire started as an ingot of sintered tungsten 10in. long and was passed through 57 tungsten carbide and diamond dies before being reduced to its final diameter. The drawing time was 100 hours and during this time the metal traversed a distance of 250 miles. At its final thickness, about one-sixth of that of a human hair, it will be used in the manufacture of electric lamp filaments.



*A Philips double programme installation at the Westminster Ophthalmic Hospital, London.*

## MORE COPIES AVAILABLE!

We are happy to announce that more copies of PRACTICAL WIRELESS are now available. This means that many PRACTICAL WIRELESS enthusiasts who, for the past 10 years, have found it difficult to obtain their PRACTICAL WIRELESS regularly will now be able to purchase their monthly copy more easily. Even so, there is one thing that we would ask—if you have not already done so, place a *regular* order for PRACTICAL WIRELESS now. The demand for every issue is heavy and it is difficult for newsagents to assess the exact requirements of their customers unless they are warned in advance. Those readers therefore who rely on the casual purchase of copies as they see them displayed may still, on occasion, be disappointed.

# The Practical Wireless Television Receiver–5

## Building and Wiring the Mains Unit and Audio Output Stage

THE second unit of this receiver, as has already been stated, consists of the complete power supply and the audio output stage with loudspeaker. The complete unit is shown below and it will be seen that it may be placed alongside the other unit for inclusion in a table cabinet, or stood on the lower shelf of a console cabinet of normal dimensions. The chassis measures 12in. by

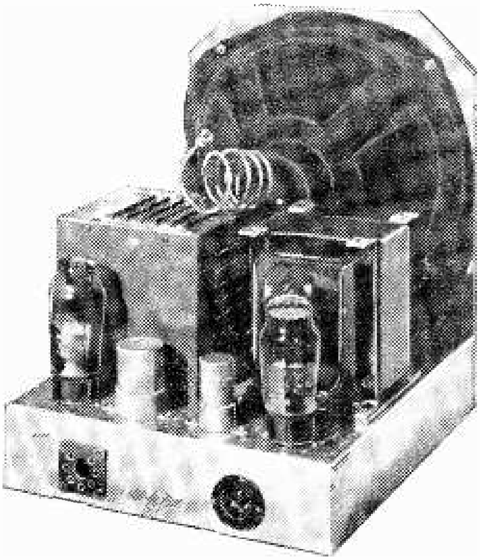


*Fig. 1.—Rear view of the mains unit ready for connection.*

10½in. and has 2½in. runners just as in the vision unit.

It should be made in the same manner from stout aluminium, and full cutting and drilling details will be found on the next page. As in the case of the previous unit, all fixing holes are ⅛in. in diameter and the only "odd" hole is that required for clearance of the grommet on the E.H.T. unit. It is recommended that this be 1in. in diameter, and its exact position should be marked by placing the E.H.T. unit on the chassis. No fixing holes have been shown on the drilling plan for this unit and it is suggested that all the remaining holes be drilled, the chassis bent up to shape and the mains transformer, etc., mounted before marking out for the E.H.T. unit.

The lower illustration on this page shows the irregular cut-out which should be made to clear the tags on the mains transformer. Some care must be taken here to avoid short circuits or risk of flash-overs, and the four fixing holes should be drilled, the opening cut roughly to shape either by drilling all round with the ⅛in. drill and knocking out the inner piece and then cleaning up the edges with a file, or better still, by drilling a single hole at one corner and then cutting out the opening with one of the abrasive hack-saw blades designed for such purposes.

**Speaking Mounting**

The chassis is given rigidity by the speaker mounting board bolted to the front edge (through the four 3/16th in. holes), and this is made from the same material as the board carrying the cathode-ray tube on the vision chassis—½in. plywood measuring 10½in. by 14in. high. A hole 9in. in diameter is cut with its upper edge 1in. from the top and with its centre on the vertical centre line, and four fixing holes should be drilled to accommodate the speaker used. The speaker should be held in position and the E.H.T. unit then placed on the chassis so that it is just clear of the rear of the speaker magnet and its position may then be accurately marked and the clearance hole drilled in a suitable position to clear the grommet through which the supply leads pass. If the units are to stand side-by-side, the lead already provided for carrying the high voltage will be found long enough and merely needs an octal type connecting clip soldered to its end. If, however, the unit is being placed some distance away a new lead should be fitted. Do not connect another length of wire to the end of the existing wire and rely upon insulating tape round the joint, as extremely high insulation is required on this lead to avoid flash-over to any nearby metal. The lead used should be soldered direct to the same point as the existing lead and

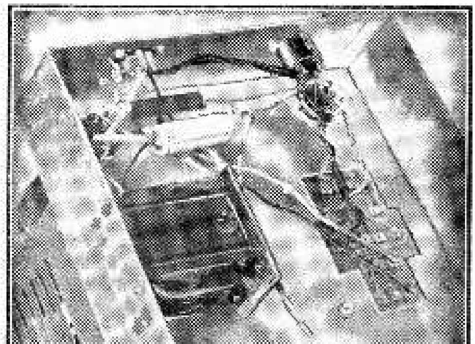


*Fig. 2.—Underside of mains unit showing the cut-out to clear the mains transformer tags.*

should be of either standard ignition cable such as is used in cars for sparking plug leads, etc., or properly designed high-voltage lead.

The multi-cable connecting the two units together must also, obviously, be long enough to enable the two units to take up their respective positions according to the cabinet in use, and when connecting the plug to the end make quite certain that the correct pins are connected. It is a simple matter to look at the plug from one end or the other and thus reverse the connections, but to avoid difficulty we have shown the plug separately on the wiring diagram on page 141 and have also numbered the pins on the top view of the socket at the upper part of the same wiring diagram, so no trouble should be experienced. The screened cable connected to pin 1 should have its metal sheathing joined to pin 3, and insulation tape should be wrapped round the exposed portion of the braiding to prevent a short-circuit to pin 2, across which it must pass. The smoothing choke is mounted on the side runner of the chassis, and should be put in position last—after the E.H.T. unit has been wired to the appropriate points.

Clearance holes for the centre lug of the two smoothing condensers C37 and C38 should be adequate, and to guard against possible short-circuits the condensers should be held slightly clear of the chassis before the clamping rings are locked up. The end of the bent-up lug may then be pushed over to come in the centre of the clearance hole.

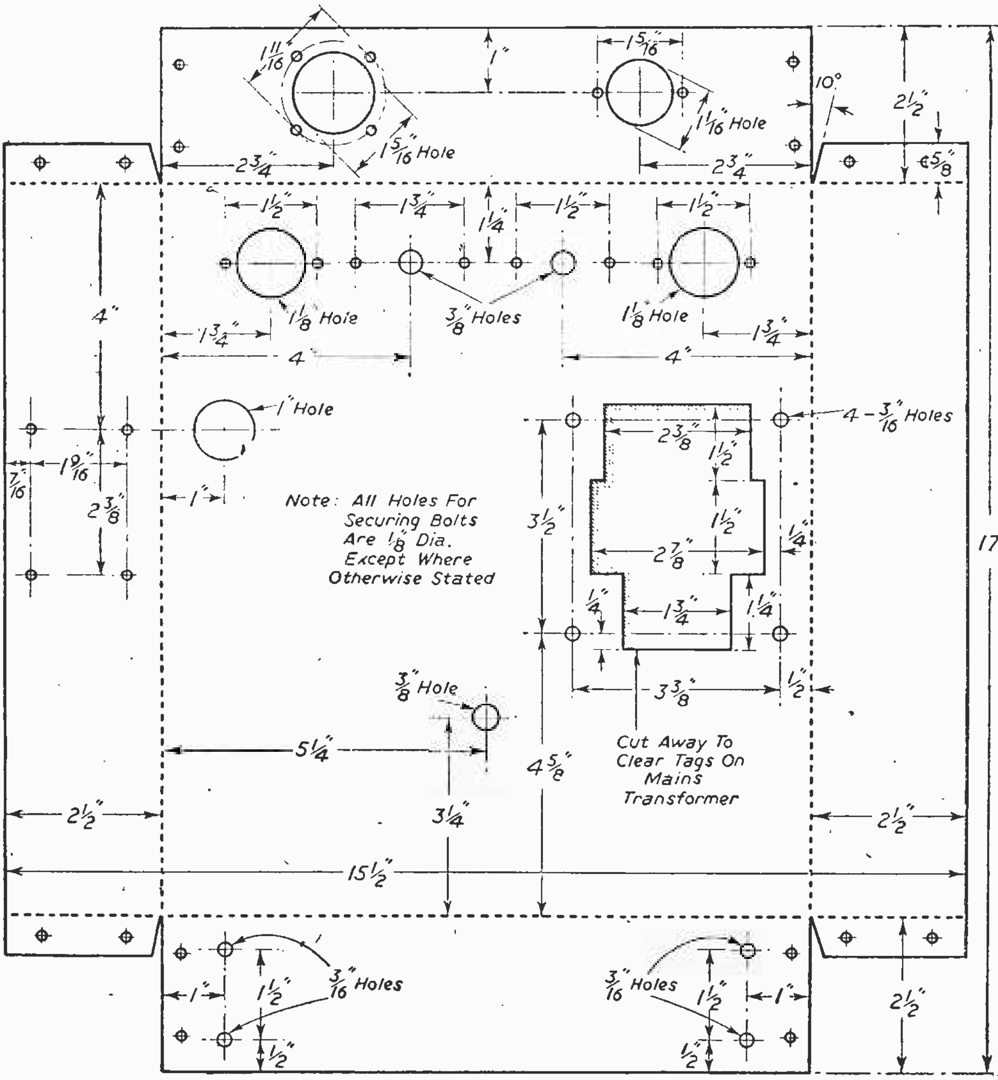



*Fig. 3.—Cutting and drilling data for the chassis of the mains unit.*

## Earth Connection

In the original model a three-pin mains socket was employed. The earthing connection of this socket is connected to the common negative line of the complete receiver, and as this carries the total amperage of the heater circuits a heavy gauge wire should be used throughout. A double length of standard lighting flex is probably the simplest method of carrying out this connection, soldering the ends together. This applies also, of course, to the lead connecting the two chassis together. If the house mains outlet socket is of the three-pin type, then a three-wire lead should be used to supply the receiver, and an earth connection is thus automatically obtained. It was found, however, that results were more reliable when a separate earth connection was employed on the receiver section, and it will have been noted that a socket is attached on the vision receiver, on the small bracket carrying the coaxial aerial socket, and this former socket is in direct connection with the metal bracket. In the installation used the aerial coaxial lead was taken to a three socket Belling-Lee connector mounted on the window-sill, and the inner lead of the coaxial was taken to one socket, and the outer braiding to another socket. A separate lead was then connected from the third socket to a buried copper earth spike. The lead from the receiver consisted of a length of coaxial to which was taped a length of insulated flex, provided at the set end with a plug for insertion in the earth socket, and the coaxial fitted with the plug portion of the standard Belling-Lee coaxial connector. This separate earthing arrangement seemed to assist in holding the set perfectly stable under the most drastic interfering conditions, namely, low-flying aircraft. These gave only a rapid fade on the picture, but no picture slip or tearing of lines which sometimes occurred if the separate earth spike connection was omitted.

## Preliminary Tests

The complete receiver is now ready for preliminary tests, and the following procedure should be adopted. The tube should be inserted in its mount and the valve socket placed on its base.

The tube is held in position in the following manner. Round the hole in the wooden support is tacked a length of rubber draught-excluder, and a portion of this and the wood will have to be cut out to clear the exhausting pip on the tube in some cases, but with the duodecal tube this is not necessary. The rubber mask is placed over the face of the tube, and this assists in holding it. When the tube is pushed home against the rubber surround, the plate glass is placed over the front of the mask and its lower edge is dropped behind the upturn of the long metal strip on the front of the chassis. The glass is now pushed gently until it is upright and the upper edge can be held in position in two different ways. The distance from the rear edge of the wooden support to the front of the glass should be measured, and either one strip 4in. wide or two 2in. wide should be cut. These should be the same length as the distance just measured and should be turned up at each end for sufficient distance to enable them to be dropped over the glass and the wood. It will be found that the top of the glass does not come up to the same level as the top of the wood, and therefore the turn-ups at each end of the clip, or clips, will vary. On one side only about ½in. is needed to drop behind the wooden support, but at the front about 2in. will be required—according to the upward rake of the long strip on the chassis front. When adjusted, however, it will be found a very simple matter to put the tube in position or withdraw it. It just slides back into the wooden support and the glass is firmly clamped between the lower strip and the top clip(s), the tube thus being held firmly between the rubber mask and the rubber ring surrounding the hole in the wooden support. The tube is safely and rigidly held and a support for the stem is not really required. It projects through the hole in the magnet support, and rubber grommets are obtainable which will just fit the hole specified in this support, and the tube will fit the grommet comfortably.

The scanning coil assembly should be pushed as far forward as possible, and to keep it secure it is desirable to wrap a layer or two of thick paper round the tube, adjusting the thickness until the coil unit is a nice tight fit and will not rotate or slip. Connect the E.H.T. lead to the anode cap on the tube and, assuming that you have previously checked that there are no short-circuits or wrong connections plug in all valves, making quite certain that the time base amplifiers are in their respective sockets. Turn height and width control to their maximum anti-clockwise direction, volume control to minimum and remaining four time-base controls to a mid-way position. Contrast should also be set to minimum-maximum rotation anti-clockwise.

Now rotate the combined brightness on/off switch until the switch clicks but do not turn it any farther. As soon as the valves reach operating temperature this control may be advanced slowly, but keep a careful look round for any suggestion of trouble due to an overlooked faulty connection. At about the centre of its travel the raster should begin to appear, but if a single spot, or a single horizontal or vertical line appears turn off instantly. As a further check at this point turn up the volume control, when a rushing noise should be heard from the loudspeaker without trace of instability.

## Raster Adjustment

If there is some sort of raster, and not just a single line, the appropriate time-base controls may now be adjusted to provide the required area of scan. It is extremely unlikely that the four controls will be in the correct position so the hold and form controls should be adjusted with the height and width controls to obtain a steady raster just filling the rubber mask. In this particular receiver it is not necessary to receive synchronising pulses from the transmitter to obtain a steady raster, and it should not be found difficult to obtain the necessary picture area. A horizontal black line running down or up across the screen indicates that the frame hold needs adjustment and if the scanning lines are running diagonally across the picture the line hold control should be adjusted until they are horizontal and steady. Similarly, the line form and hold controls will bring the lines to rest and a few minutes with these six controls will soon show their effect on the scan, and although it has taken several lines to describe the adjustment it will be found that the actual work is exceedingly simple and will only take a few seconds. Look carefully at the raster and note whether the lines are all parallel and of equal separation. It may be found that the upper part of the raster, for instance, has the lines gradually increasing in spacing. Frame form should close them up. On the line scan you really need a picture of the test card to adjust form to obtain the required linearity. (It might be mentioned here that the term linearity is sometimes used in place of form, and frequency and speed are sometimes used in place of hold.) You are now in a position to connect a suitable signal generator (or the aerial) and line up the vision and sound circuits.

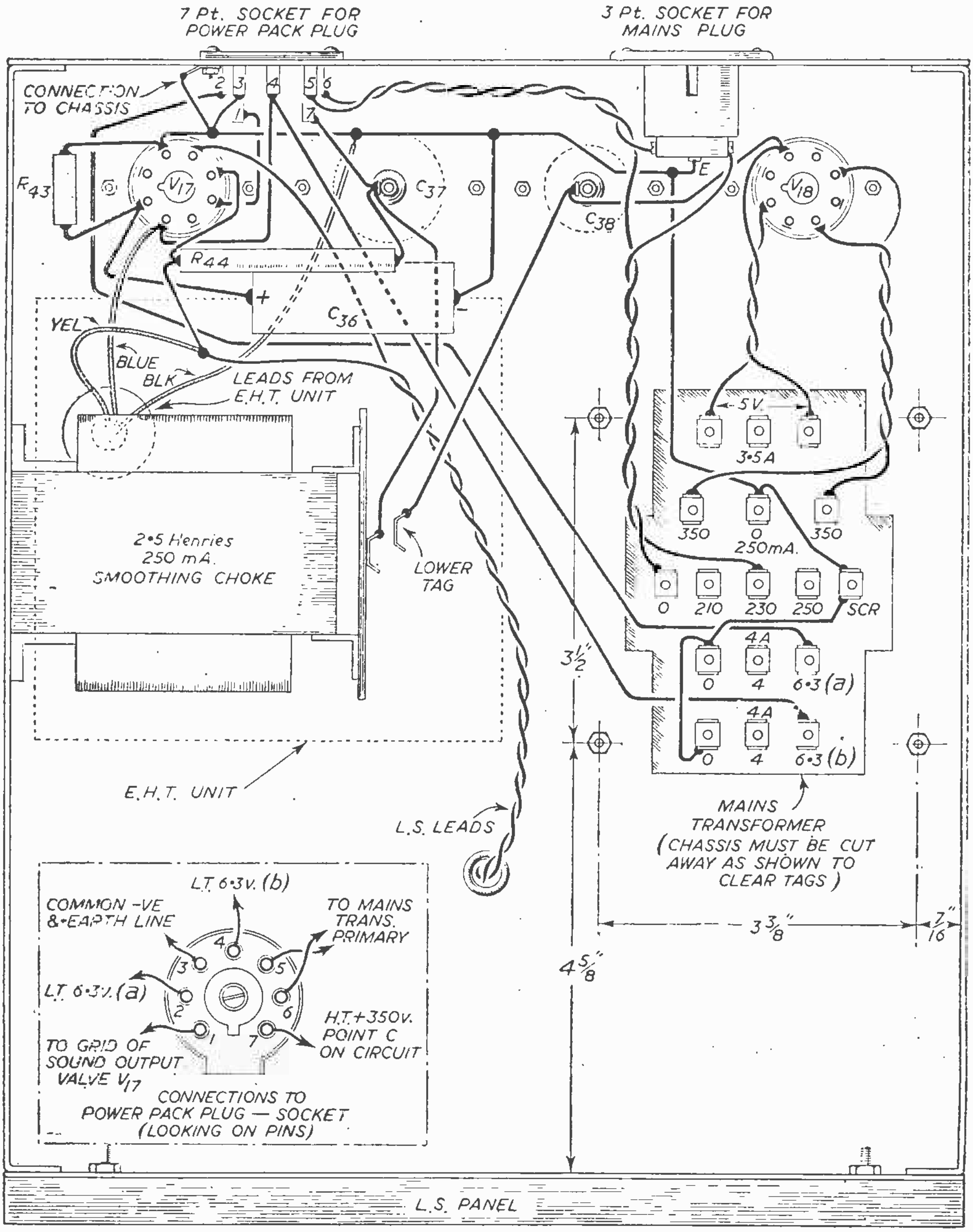



*Fig. 4.—Wiring diagram of the power supply and audio output stage.*

# Installing Car Radio—1

## The Principles and Practice of Modern Car Radio

By ERIC BALLS, A.M.I.M.I., M.A.E.T.

NO great difficulties are involved in the installation of radio receivers on motor cars. Care, discrimination and neat workmanship are, however, essential.

Some makes of vehicle manufactured recently are designed to accommodate a certain make and type of radio. The set will be fitted at the works if so requested. Should the owner not specify radio to be fitted, but subsequently change his mind, it is advisable that the standard apparatus should be installed, even though in some cases the fitting of another type may be the easier procedure. Owners of recently manufactured vehicles should therefore consult the car makers. Even so, there is the possibility that fortunate and happy owners of such rare possessions as new motor cars may acquire car radios of "incorrect" type (as a gift, for instance), in which case the following notes may be of use to them, in addition to owners of cars not originally intended to be radio equipped.

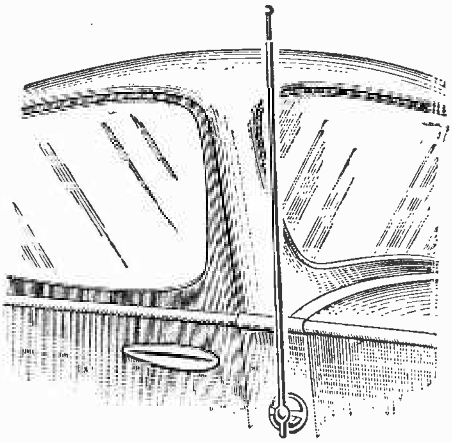


*Fig. 1.—Telescopic type aerial.*

There are two main considerations in the installation of wireless sets on motor cars; first, the positioning of the receiver, controls, loudspeaker, and aerial for maximum efficiency, ease of fitting, and convenience of operation; second, the suppression of interference from the ignition and other electrical equipment of the car. The two considerations are to some extent bound up with each other.

### Single-unit Sets

Some makes of set are in a single unit so that the relative position of controls, speaker, etc., does not enter into the question. A typical receiver of this type is illustrated on the cover which shows the set mounted beneath the dashboard. Note that the set is positioned centrally so as to be clear of driver's and passenger's knees. A point to be watched, however, is that the gear lever when operated does not foul the set. An alternative mounting position would be in a glove box or cubby hole. A disadvantage of this is that reduced space is available for parking the innumerable accessories incidental to motoring. The fitting of such a single-unit receiver is simple, the principal requirement being that the equipment should be mounted as near as possible to the aerial—this is important whatever the type of set. The simplicity of fitting is somewhat offset by the fact that it is not practicable to hide the main bulk of the apparatus from view (as is often possible with two- or three-unit sets) because the controls must be accessible.

### Two- or Three-unit Sets

There are various arrangements of two- or three-unit sets. The main assembly may consist of power unit, receiver and speaker, connected to a separate control head by means of flexible cables. Alternatively, the speaker may be quite separate, thus making a three-unit scheme. In one make of two-unit set the smaller unit incorporates controls, tuning scale and the R.F. stages. The output and power sections together with the loudspeaker are housed in the larger unit.

These more-than-one-unit sets allow considerable latitude in the disposition of the units—only the controls being required to occupy a prominent position on or near the dashboard, and the result is usually more satisfying from an æsthetic viewpoint. Against this advantage is the fact that there is more work involved than in fitting a single-unit set. Furthermore, the fixing holes and bolts for units which are to be mounted in "invisible" positions are very apt to be in exceedingly awkward and inaccessible places! Another disadvantage with some types of two- or three-unit set is increased risk of interference due to extended wiring. It is significant, however, that several leading manufacturers adopt the two- or three-unit arrangement.

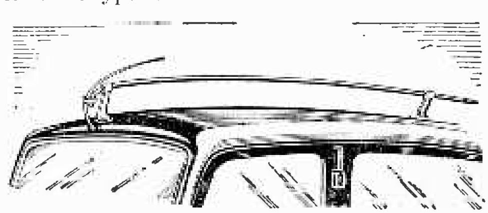


*Fig. 2.—Roof-top aerial.*

In systems where the speaker is a separate component, the set itself can be positioned regardless of accoustic considerations and can be mounted under the car bonnet provided that adequate screening is available. (In one type of modern car the standard radio set, as fitted at the works, is located in a metal box under the bonnet and over the driver's feet; control being effected by flexible shafts.) The speaker can then be fixed in any desirable position, the length of the connecting leads being of no importance. Probably the best position is in the centre of the header panel above the windscreen.

It is very important to avoid sharp bends in flexible control cables. Any undue kinking will cause difficulty of operation and a predisposition to failure.

### Points to Watch

Before fitting any type of set to a car it is worth while to give the whole receiver a test on the bench, using the car battery (or a substitute) and a rigged-up aerial. This procedure may obviate the exasperating discovery that the set will not function after fitting. It is possible, for example, for a valve to work loose in its holder due to vibration during transit; such a fault can easily be corrected on the bench, but if not discovered until after mounting on the vehicle the whole job may have to be taken down again. By the way, before testing a set *make sure it is the correct voltage for the car.*

Having decided upon suitable positions for the unit or units, it is best to try the components in position before actually drilling any holes or making any permanent alterations to trimming or bodywork. A good plan is to tie the units temporarily in position so as to ascertain whether the flexible controls are long enough to reach from control head to set, and whether the units will be clear of gear and brake levers and passengers' legs. Further, the position of the aerial must be considered in relation to the installation as a whole.

Whatever the type of set, the following main points are important and must be watched. Firstly, all equipment must be earthed, i.e., the metal cases of all units must be in good electrical contact with the car chassis. This result can usually be obtained by cleaning metal work around the fixing bolts, but if doubt exists an earthing cable must be run from casing to car chassis. There are exceptions to this rule, however, and manufacturers' instruction leaflets should always be consulted. Secondly,

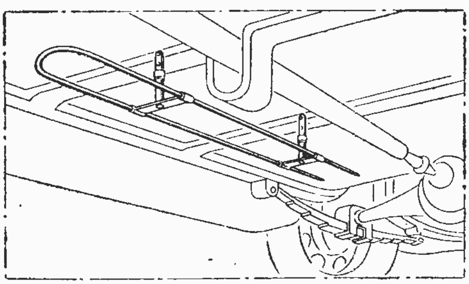


*Fig. 3.—Under-car type aerial.*

although unobtrusiveness of the equipment is desirable from considerations of appearance, allowance should be made for accessibility for future servicing purposes. Thirdly, each unit must be so firmly fixed as to prevent vibration when the car is running on the road. The actual method of fixing the unit or units (i.e., by bolts, brackets, etc.) is, of course, dependent upon design of the set.

Connection to the power supply—the car battery is usually effected by a single screened cable, the screening of which must be efficiently earthed. The best position for connecting the inner cable is probably to one of the ammeter terminals. Alternatively, connection may be made to a live terminal on the cut-out or fuse box. On British cars a terminal marked "A" or "Aux" is suitable; the latter usually has a fuse in circuit. A fuse for the radio set is, however, invariably incorporated in the screened lead.

When the set uses a non-synchronous vibrator the polarity of the battery is immaterial. If a self-rectifying vibrator is used some adjustment may be necessary on cars with the "wrong" battery pole earthed.

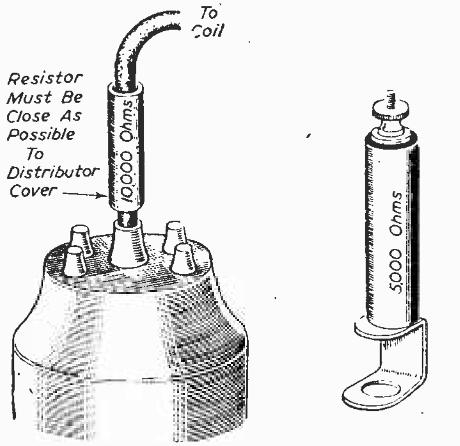



*Fig. 4 (left).—Suppressor resistor in main ignition H.T. lead.*
*Fig. 6 (right).—Plug lead suppressor.*

### The Aerial

When deciding on the position of the receiver, the type of aerial it is intended to use and the latter's proposed position on the car should be considered conjointly. The lead-in cable is usually screened to prevent pick-up or interference and if the length is increased beyond that recommended losses may be introduced due to self-capacity.

There are three principal types of aerial, a representative pattern of each being described below.

The telescopic type (Fig. 1) is probably the easiest to fit, is quite efficient and very popular. The usual position is on the side of the car to the rear of the bonnet. It is generally easier to fit the aerial to the left-hand side of the car owing to the absence of steering column and pedals, but the position of the ignition coil and wiring must be taken into account as the aerial should be placed as far as possible from these components. One solution is to move the ignition coil away from the aerial mounting.

The roof-top aerial (Fig. 2). This type gives good results and does not readily pick up interference. More difficulty may be experienced in fitting than with the telescopic type, especially if the roof has to be drilled in several places and interior trimming disturbed. The type illustrated is attached by means of suction cups and only one drilling is necessary. The fastidious owner may object to the appearance of this type, but the present example harmonises well with modern body contours. Keep the lead-in well away from screen wiper cables, etc.

The under-car aerial (Fig. 3), being completely invisible, cannot detract from the appearance of the vehicle. It has certain disadvantages in reduced sensitivity and a tendency to pick up interference from the driving wheels and other sources. The exhaust pipe is often a cause of interference and an under-car aerial should therefore be mounted under the opposite side of the chassis. To compensate in some degree for the aerial's comparative lack of sensitivity it is important that its effective "height," (i.e., distance from the receiver's "earth," the chassis) should be the maximum possible as is consistent with giving sufficient road clearance. Under-car aerials are liable to become gradually less efficient due to accumulation of dirt and moisture.

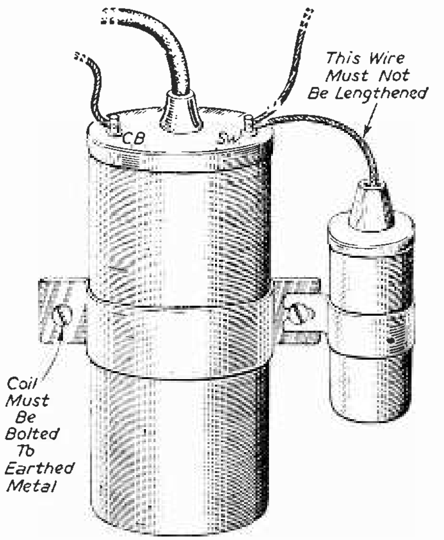



*Fig. 5.—Suppressor condenser connected to ignition coil.*

Regarding aerials in general and their relation to the ever present problem of interference suppression, it should be borne in mind that in order to obtain the highest signal-to-noise ratio every endeavour should be made to obtain the greatest possible aerial input to the set. An inefficient aerial cannot be compensated for by the provision of extra sensitivity in the set itself without resorting to abnormal methods of suppression on the car. Suppression methods will now be considered next.

**Interference**

It is much more difficult to obtain a quiet "background" with a car radio receiver than with the ordinary domestic type of set. The reason is the close proximity of the miniature power station which is the vehicle's electrical installation. Although a motor vehicle starting and lighting system is a low-voltage direct-current one there are radio-frequency components in the currents associated with several circuits, notably the ignition and dynamo sections. Then there are, to a lesser degree, the building up and breakdown of static charges due to such causes as friction between tyres and road or to faulty joins in metal panelling.

High-frequency currents in the wiring may cause interference in one of two ways, i.e., either by radiation from the cables carrying them (the radiations being picked up by the aerial or lead-in) or by feeding back into the receiver power unit via the car battery, which is the common energy reservoir for both radio set and lighting system. Static discharges are picked up by aerial or lead-in.

Prevention of the pick-up of interference radiated from cables is achieved by (a) screening the set, aerial, and lead-in; (b) positioning the offending cables as near as possible to earth (remember that in car radio work "earth" means the chassis and all metal directly bonded to it); (c) judicious relative placing of aerial and lead-in with regard to the car wiring.

Considering (a) above. Screening of the set itself is effected by encasing in metal. The lead-in is frequently encased in metallic sheathing (which must be earthed at both ends) while the aerial itself is conveniently screened by the presence of metallic bodywork between it and sources of radiation.

There are exceptions to the last generalisation. For example, a scuttle-mounted telescopic aerial (see Fig. 2) is not screened when the bonnet is open on the same side. Similarly, an under-car aerial (Fig. 4) is susceptible to the effects of static discharges from wheels, exhaust pipe, brake cables, etc.—this in addition to a low efficiency in picking up the actual required signal.

Concerning (b). The sparking plug cables are a cause of radiated interference. They should be kept as short as possible, bunched together and fixed as near as practicable to the cylinder block ("earth"). To avoid the transference of high frequency fluctuations to the low voltage wiring, the cables to the coil low tension terminals should be kept well away from the plug wires.

The requirements of (c) have to some extent already been considered. It is usually a simple matter to move the ignition coil or regulator box away from an aerial location. The lead-in can be positioned wherever desired provided its length is not increased.

Interference caused by feed-back of unwanted current fluctuations (which may be of radio frequency as in ignition H.T. circuits, or low frequency commutation ripples) may be suppressed in three ways: (1) By introducing a high resistance into a circuit carrying discharges of an oscillatory nature (i.e., spark plug wires) to damp the discharge, or, (2) by filtering suitable circuits (dynamo fields, for instance) by means of a combination of choke and condenser, or, (3) by simply by-passing the unwanted ripple component to earth through a condenser. The use of any of these methods also tends to prevent re-radiation by the conductors and pick-up by the aerial.

The ignition system is the main cause of interference. It is usually sufficient, with modern receivers, to insert a 10,000 ohms suppressor resistor in the H.T. cable between the centre of the distributor cover and the ignition coil as in Fig. 4.

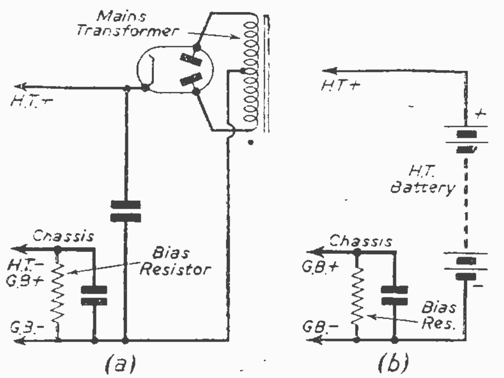
*(To be continued)*

# An Alternative Bias Supply for A.C./D.C. Equipment

### An Experimental Arrangement for Special Cases

THE average "universal" domestic receiver solves the problem of supplying its valves with their necessary grid bias by the process of using cathode bias resistors. This is a cheap and efficient method which is eminently suitable for circuits of this type. When, however, it is desired to adapt more complicated equipment for use from A.C./D.C. supplies it is sometimes found that cathode bias does not supply a workable arrangement. Apart from circuits which require a fixed value of bias regardless of cathode current (such as valves working at their cut-off point, etc.), there also occur cases in which it is necessary to have the cathodes of certain valves connected directly to chassis to obviate hum pick-up, and so on. What is required for apparatus of this type, therefore, is a bias supply whose voltage remains constant regardless of whether the input voltage is A.C. or D.C.

A circuit carrying out this function has been evolved by the writer. Although probably not original, he has considered it of sufficient interest to readers to make it the subject-matter of this article.




*Figs. 1 (a) and (b).—How "automatic" bias may be obtained from A.C. and battery-operated equipment.*

## Automatic Bias in A.C. Equipment

Before proceeding with a full description of the circuit, a short résumé of the method used to obtain "automatic" bias in A.C. (or battery-operated) equipment would not be out of place.

Figures 1 (a) and (b) show how this is done. A resistor is connected in series with the negative side of the H.T. supply and the chassis of the receiver. The total H.T. current of the receiver passes through this resistor thereby causing a voltage to be built up across it. As the "bottom end" of the resistor is negative with respect to chassis we may use it as a source of negative grid bias voltage. Differing voltages may be obtained by tapping into the resistor at different points or by connecting a potentiometer network across it. The condenser connected across the resistor is used to by-pass any mains, A.F. or R.F. voltages which may appear across it.

This is a reliable and widely used method of obtaining negative bias, it being assumed that the total H.T. current of the receiver is sufficiently constant to cause little variation in the bias voltage so obtained.

## Automatic Bias from D.C. Mains Equipment

This system may also be adapted to supply a bias supply for equipment working from D.C. mains.

Figure 2(a) shows a skeleton supply circuit for, say, an A.C./D.C. receiver which is being run from D.C. mains. It will be seen that the mains supplies a voltage for the rectifier (now acting simply as a resistor) as well as for the heaters. Now if we were to connect a further resistor between the chassis and the negative side of the mains we would have the situation shown in Fig. 2(b), in which we have available a voltage which is negative with respect to chassis. This voltage, suitably smoothed, could be used for a grid bias supply.

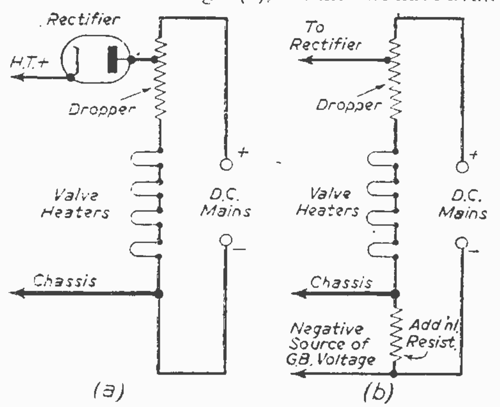



*Fig. 2 (a).—Skeleton diagram of a typical supply circuit for an A.C./D.C. receiver.*

*Fig. 2 (b).—How the inclusion of an additional resistor in the negative mains lead provides a suitable voltage for bias purposes.*

## Bias for A.C./D.C. Equipment

Figure 2(b), however, by no means solves the problem of bias supply for "universal" equipment, because, as soon as the receiver of Fig. 2(b) is connected to an A.C. mains supply the voltage developed across the additional resistor will not be D.C. but A.C., and will be quite unsuitable for biasing purposes.

The next step in developing this bias circuit, therefore, is to introduce some form of rectification which will convert the built-up A.C. to D.C. and yet will not alter the results obtained in Fig. 2(b).

This is done by the circuit of Fig. 3. Rectification is carried out by the diode. When the equipment is connected up to A.C. mains a voltage will be dropped across $R_1$. This voltage will be A.C. It will be passed by $C_1$ to the anode of the diode, with $R_2$ and $R_3$ (which have relatively high values of resistance) acting as leaks. As the diode will only pass current on positive half-cycles a negative voltage (with respect to chassis), will be built up

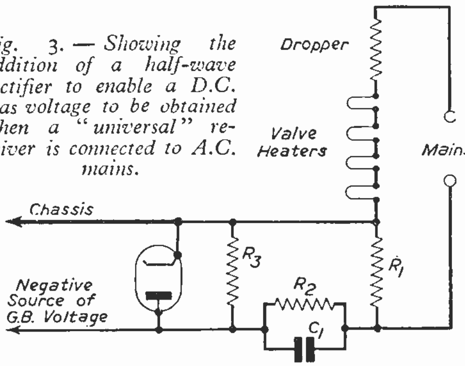



*Fig. 3.—Showing the addition of a half-wave rectifier to enable a D.C. bias voltage to be obtained when a "universal" receiver is connected to A.C. mains.*

across $R_3$. After smoothing, this voltage may be used for biasing purposes.

Let us now see how this circuit behaves when the set is connected to a D.C. mains supply.

When the mains supply is connected correctly, a negative voltage will be passed, via $R_2$, to the anode of the diode. As this voltage is negative with respect to the cathode of the diode it will cause no current to flow in the valve, whose effect may, therefore, be ignored. Similarly, $C_1$ may also be ignored as there is now no A.C. in the circuit. Fig. 3 then breaks down to the simplified diagram shown in Fig. 4,

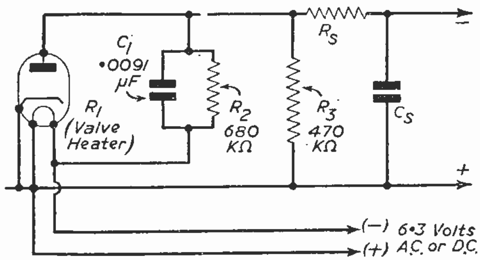



*Fig. 5.—A practical version of Fig. 3 with component values.*

in which a D.C. voltage is built up across $R_1$, this being passed to the potentiometer formed by $R_2$ and $R_3$ from which a tapping is taken at the junction of the two resistors.

It may now be seen that, whatever supply is used, a negative voltage is given from the circuit for purposes of grid bias. As, however, the two processes of obtaining this voltage are entirely different, we cannot be certain that the actual voltage obtained will be the same in both cases.

## A Practical Circuit

Owing to heavy pressure of outside work the writer has not been able to incorporate this biasing supply into any equipment as yet. However, to check the theory of the above arguments, he has made several experimental rigs. The one which will hold most interest for readers is shown in Fig. 5. The diode used was a diode section of an EBC33, and it was decided to use the voltage dropped across its own heater (6.3 volts) as the source of either A.C. or D.C. supply. The values of the condenser and resistors used in the diode circuit were carefully chosen to enable the bias voltages obtained from A.C. or D.C. to be approximately the same. Using the values shown, the bias voltage obtained was about 2.8 volts (as checked with a valve voltmeter) The 0.0091 μF condenser ($C_1$) was obtained by connecting a 0.1 μF condenser in series with 0.01 μF condenser. The components $R_s$ and $C_s$ are used simply for smoothing and could conveniently have values of 1 MΩ and 0.1 μF respectively.

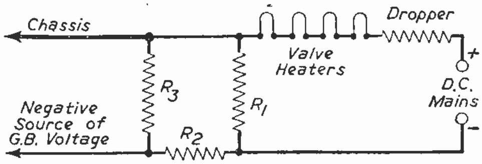



*Fig. 4.—Simplified version of Fig. 3, showing how that circuit functions on a D.C. mains supply.*

The writer does not wish to leave the impression that it is essential to use the component values of Fig. 5 in order to obtain correct results. These were only the values used by him for verification of the usefulness of the circuit. In actual fact, up to three-quarters of the voltage dropped by $R_1$ could be obtained for biasing purposes if required. The resistors $R_2$ and $R_3$ should first be chosen to obtain the required voltage from D.C. mains, the condenser $C_1$ being then adjusted to give the same voltage from an A.C. supply. Incidentally, if a potentiometer network is used before or after smoothing to enable different biasing voltages to be obtained, it should be remembered that the total resistance of this network will be in parallel with $R_3$, which should be adjusted accordingly.

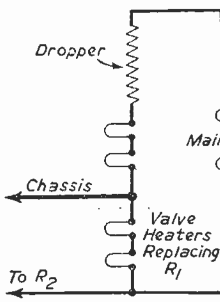



*Fig. 6.—Showing a method of replacing $R_1$ by valve heaters.*

## Using the Circuit in Practice

It may appear at first sight that this method of obtaining bias is somewhat extravagant in its use of additional components. However, this is not entirely true.

For instance, if we examine the diode circuit used for rectification it will be seen that the cathode of the valve is connected to chassis. Therefore, to take an example, assuming that the equipment in use was a superhet receiver, we could quite conveniently use one of the diodes of the double-diode-triode for this purpose without adding to the number of valves required at all. Alternatively, the output valve could be replaced by a diode-pentode, and so on. The same holds true for most other types of equipment. A triode or pentode

(*Continued on page 174.*)

# On your Wavelength

by THERMION

## A New Journal!

I AM not surprised to learn that your Editor is launching a new journal. I have been associated with him for so many years that I *expected* him to be early off the mark with a journal dealing with television. Indeed, *Practical Television*, the new ninepenny monthly, can be said to have been in a state of suspended animation since 1935, when the original *Practical Television*, edited by Mr. F. J. Camm, ceased publication.

Those fifteen years have metamorphosed television science. Gone are the disc machines and the transmitting system as we then knew it.

I have been privileged to be present at the birth of many new journals, and to me the excitement of the preparation of a first issue is a stimulating experience which spurs one on and acts as a mental goad. I wonder how many readers, reading the first issue of a journal, realise the amount of work which has gone into it. At first it takes shape from a nebulous idea. The scaffolding is erected when the policy is framed, and the brickwork in the form of articles and contributions gradually complete the journalistic structure. There is, of course, the tidying-up, for first issues must suffer from the imperfections of first issues. The editor, as the parent of the offspring, must breathe life into it and supply the driving force and the momentum which speeds the journal on its way. There are incidental things, such as ensuring originality of title, preparing cover designs, interviewing contributors and inspiring them, constructing the regular features, arranging for illustrations, planning the news service which acts as a filter for the industry, acquainting the trade with the policy of the new journal, selecting photographs, interviewing prospective artists and photographers, telephoning, selecting the type faces, planning the distribution (for a journal does not sell itself), attending to such items as notepaper design, drafting publicity to appear in the Press—these are but a few of the items which provide the excitement in the editorial office and the publishing house when the carefully guarded secret of a pending new publication at long last is bruited abroad. It acts as a fillip to the staff and, very much like the prima donna who nervously anticipates her first appearance at Covent Garden, so do the staff of a new journal anxiously await the reception of the symposium of their work by the public.

For, of course, a subtle sort of acumen is required as well as a logical mind to supply what is conceived to be a public need. It would be impossible to take a census of public opinion. The editor of a journal develops a sixth sense. He knows when the moment is ripe to cater for a hitherto uncatered-for public.

Your present scribe has been invited to contribute articles from time to time and mayhap supply the barbs, often useful, in disarming too shrewd a criticism.

Of course, in the early days of radio, new journals were springing up almost every other week, and those were indeed exciting days. Most of them have fallen by the wayside, some of them defeated by the too-energetic pursuit of a wrong policy and others by lack of policy.

PRACTICAL WIRELESS was, I think, the last to come into the field, but with one notable exception its competitors have died. Age, of course, proves nothing but antiquity. To have been first can mean nothing but senility, to have become first indicates progressive policy; to have become practically the only journal indicates a stamina and a virility and the maintenance of a vigorous outlook that is rare indeed in the spheres of competitive journalism. Indeed, it is rare for a new journal to oust its older competitors.

*Practical Television* will revivify the interest in television of many who had discarded it after a brief experience of the old disc machine, now a thing of the past. I forecast for the new journal a long and distinguished career and raise my glass here to its instantaneous success.

## Delivery Dates

IN a weak moment a few months ago I wrote a paragraph on the subject of the time taken by some firms in delivering goods ordered by our readers. I went to some pains to explain the reason for this and to some extent I sympathised with suppliers who found themselves caught out owing to an unprecedented demand for their goods. For it is often impossible to anticipate demand. Sometimes an expected good seller remains on the shelves and has to be jobbed off. On another occasion a line will go out of stock in a couple of days and the manufacturer is in the unfortunate position of having to write hundreds of apologetic letters and anxiously to await further deliveries.

That paragraph, however, has brought me some dozens of letters from readers who feel that I am able to wave some magic wand with advertisers and to secure delivery earlier than that promised by the makers. Your Uncle Thermion is a wizard in many things, but he is unable to do more than investigate and ascertain whether complaints are justified. Readers in their enthusiasm to get to grips with some new circuit allow their anger at delays to override their reason, and the result is a letter written in vitriol with an asbestos pen to your humble scribe, asking him what he is going to do about it. Indeed, from some of the letters it might be concluded that I am *advocatus diaboli*, and in league with the manufacturers to withhold goods from readers cantankerously.

In a few cases where complaints have been justified I have been able to secure either the goods or a refund of the money, and this provides me with the opportunity for saying that any reader may rest assured that if he is dealing with an advertiser in this journal he is assured of satisfaction.

# Radio Valve Review—1

## A Complete Guide to the Present Range of Valves

THE Editor has decreed that this series shall be a comprehensive review of all current British types of radio valves—a formidable task if ever there was one, as several valve manufacturers list well over a hundred different types.

There are many people—chiefly radio traders and service engineers—who complain that there are far too many valve types, and lay the blame at the door of the valve manufacturer. On the face of it, of course, this complaint appears to have some justification, but investigation of all the circumstances reveals that the present multiplicity of types is inevitable and is in no way the fault of the valve manufacturer.

Practically every valve listed was originally developed either to fill a very real need or to give the listener the benefit of some new technical advance. Progress must not be denied or thwarted, and so long as technicians are able to discover new applications in radio and in other branches of electronic engineering, just so long will valve manufacturers devote their best efforts to produce the improved valves needed for the realisation of the new discoveries. Conversely, whenever the research departments of valve manufacturers develop new principles and manufacturing technique, equipment manufacturers will produce the sets employing the new valves and giving the improved performance which these valves make possible.

These are the reasons for the development and original introduction of the hundreds of valve types listed to-day. But there is another aspect of the matter.

During the war manufacture of domestic receivers was practically at a standstill and listeners had, perforce, to keep in service old receivers which, in better times, would have been superannuated and replaced by more modern sets. Even to-day, when production of new sets is rapidly regaining its pre-war rhythm, the demands of export and other economic factors necessitate the retention in service of tens of thousands of old sets—some dating back 10, 15 or even 20 years; and valves of the older types must still be available for replacement purposes.

Those within the valve section of the industry know that these "replacement" types represent a very substantial proportion of the total number of types listed. They know, too, that the older types are gradually disappearing, and there is little doubt that the rate at which they disappear will accelerate as economic conditions improve and permit the replacement of more and more of the older receivers.

At the same time it is only fair to point out that disappearance of the old stagers will be accompanied by the appearance of newer valves. Whether the net result will be a very substantial reduction in the total number of types cannot at present be predicted.

### "Preferred" Types

The sum total of valve types listed by any one manufacturer, or by the industry as a whole, at any given time can be divided into a number of well-defined groups.

First, there are the "preferred" types, that is to say, the types which the manufacturer offers for use in new receivers—the valves which are actually being put into sets in current production.

Second, there are valves which, up to recently, have been "preferred types" but are now superseded by more modern valves. These are the valves sold for replacement in sets made two, three or four years ago.

The third, and by far the largest group, are valves needed for the maintenance of much older sets—the pre-war veterans whose owners will not, or cannot afford, to discard them.

Finally, there are what may be termed "development types"—new valves embodying the results of, perhaps, many months or even years of intensive research; valves which the set-maker is trying out in the new circuits which will appear on the market next year or the year after.

It is this kaleidoscope of valve types and techniques which it is hoped to present during this series of articles, in some sort of ordered sequence.

In planning this series much thought has been given to the most convenient way of presenting data on these hundreds of valve types to the end that the record should be as complete as possible and should contain the maximum amount of useful information consistent with the space available month by month.

### Various Classes

In this connection it must be remembered that there are very many different classes of valve—voltage amplifying pentodes; triodes; frequency changers; output valves; rectifiers; multiple valves of all kinds, as well as such special tubes as cathode-ray tubes, tuning indicators, voltage stabilisers, and so forth. Furthermore, each class of receiving valve is represented in battery-operated, A.C. mains-operated and D.C./A.C. (series running) ranges. Again, in each class and range there are valves of various manufacturing techniques—the old "pinch" construction and the various forms of all-glass construction with their wide variety of types of base. Then there is the possibility of chronological classification—the present-day "preferred" types, the immediate "maintenance" types, and the pre-war types now merging into obsolescence. Finally, valves can be classified under the names of their makers.

It has appeared best to deal with valves by general types, devoting one article to, say, H.F. pentodes, another to frequency changers, and so on.

For each class of valve, comments on the latest practice will be given, with reference to the characteristics of present-day "preferred" types. Thereafter will follow in tabulated form abridged data of current maintenance types in order of age, beginning with the most recent. This data will be given under the names of the manufacturers in alphabetical order.

Before embarking upon reviews of individual valves, however, it will be of interest to examine briefly the general lines of present-day British valve practice, and in particular the prevailing trends in valve technique.

Development in recent years has centred mainly around the high-frequency end of the receiver, i.e., R.F. voltage-amplifying pentodes and frequency changers, the position with regard to audio-frequency amplifiers, output valves and rectifiers being comparatively static. This, of course, is mainly the result of the large-scale use of short- and ultra-short-wave radio in radar and other military applications during the war, which stimulated intensive research and led to important advances in valve technique. The needs of television, also, have had a profound influence on recent development.

### "All-glass" Valves

It is true to say that the spectacular advances in high-frequency valve technique made during the last few years were greatly facilitated by the development, just prior to the war, of the first "all-glass" valves. In all-glass technique the long electrode connections inseparable from the original "pinch" construction are replaced by short, stout wires moulded into a flat glass base, and serving at one and the same time as both valve pins and electrode supports. Valve capacitances and inductances are thus greatly reduced, and this results not only in better performance, particularly at high frequencies, but also in greater uniformity of characteristics as between valve and valve of the same type and make.

Continued development of all-glass technique has also made possible substantial reductions in overall dimensions—a matter of considerable importance, as it permits equipment manufacturers to produce compact chassis and thus to effect considerable economies.

The familiar ranges of valves of "pinch" construction on the octal base are therefore being gradually superseded by various forms of "all-glass" valves, and particularly by "all-glass" valves of miniature construction. Among these are the miniature button-base (seven-pin B7G base) types and the eight-pin (B8A) base types. To accommodate all the external connections to certain types of multiple valve, and also for various technical and production reasons, a new nine-pin pressed glass base, known as the "Noval" (B9A) base, is being adopted for certain valves.

*(To be continued)*

# Meter Problems–2

## Improvisations and Methods of Making Use of "Unsuitable" Meters

By W. J. DELANEY (G2FMY)

LAST month we explained why it was necessary to obtain certain types of meter for inclusion in multi-purpose testers, and showed that some meters which readers have obtained are unsuitable. There is no need, however, for these particular instruments to be scrapped, and it is possible, if one does not mind a little extra trouble, to use them and obtain quite good indications as to working conditions. Unfortunately for some, this calls for a small amount of calculation, but no more than is normally used in ordinary amateur radio—the application of Ohm's Law. Take first the illustration given last month concerning the indication of working voltage on a simple detector stage. It was shown that the valve can be regarded as a resistance, and that the inclusion of a low-resistance meter across the valve effectively reduces the total resistance and thus gives a wrong indication of the voltage actually present at the anode. The illustration is repeated in Fig. 1, and if this is examined it will be obvious that if the circuit is *opened* at A, and a current indicating meter is inserted at this point, it will show the total current flowing, and again applying Ohm's Law we can calculate the total resistance in circuit. Alternatively, by consulting a valve makers data sheet covering the particular valve in use, we can find the voltage which is actually on the anode, and several other factors.

### Substitution

It is obvious, of course, that the low-resistance meter which is unsatisfactory when connected *across* the valve will have little effect on the working conditions when connected in *series* with the valve, but the circuit has got to be broken to enable this to be done, and the current itself, although it may perhaps be easily read on the particular meter in use, may not give us the indication we require. This may have to be calculated, as already mentioned, by applying Ohm's Law.

First of all, the meter has to be capable of giving a reading within the value which will be expected. That is to say, if the valve stage will be passing a current of about 10 mA. it is of little use including a meter reading only 1 mA. This will only damage the meter. Similarly, if the meter reads 100 mA. it will give a very inaccurate reading if it is included in such a circuit without modification. It is always desirable to arrange that the required reading is

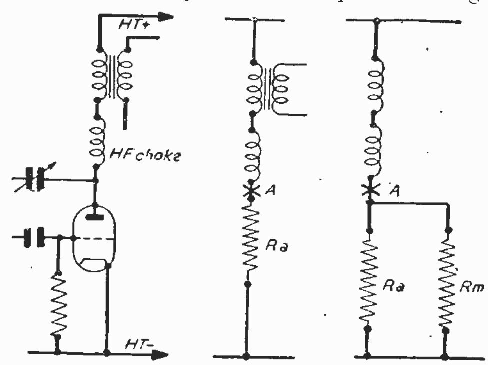



*Fig. 1.—Theoretical and equivalent circuits of a single valve stage.*

almost full-scale deflection (F.S.D.) and, therefore the meter has to be provided with shunts just as in the ordinary test meter technique, and so a low-reading meter is desirable in the interests of accuracy.

Suppose we have one of those low-resistance meters reading about 10 mA. We can include this in series, with a suitable shunt to measure the *total* H.T. current taken by the receiver ; we can then measure the current in each stage which takes, say, 5 mA. or over, and by deducting this total from the grand total may find the current in those stages which take very little. Thus it would be possible to find a detector stage voltage by this means, even if the current passed was only .5 mA., but as mentioned in the opening paragraphs it calls for a little more trouble—in opening each circuit where the meter has to be inserted (or using special adaptors), and then in doing the little bit of arithmetic. But it will be found cheaper than throwing away a meter and buying a new one.

### Stability

There are one or two precautions which must be borne in mind when using a meter in series with a circuit. In the case which was originally given (measuring a detector anode circuit), the inclusion of the meter in series may affect performance. It should be remembered that when a valve is working in a stable condition the anode current will differ from that when it is oscillating. Thus if a valve is operating under certain conditions it may be possible that the inclusion of the meter movement at certain points in its anode circuit may result in the valve going into oscillation, with the result that the anode current will change. This may be checked by putting the meter in circuit and then earthing the grid. If the anode current varies appreciably when the grid is earthed, then you will know that oscillation is taking place. To guard against this spurious oscillation the meter should be connected direct to the H.T. positive line—that is, included at the "earthy" end of the decoupling resistance, transformer, etc., and in general should be provided with a by-pass condenser. On standard types of receiver this should be .1 μF and on ultra-short wave equipment a mica .001 μF will probably prove adequate. For the same reason, the leads to the meter should be as short as possible, but where the instrument is fitted with long leads which cannot be shortened, the by-pass condenser should be included at the receiver end of the leads.

# Two-way Radio Communication in Industry

MAXIMUM efficiency in the use of transport vehicles and material-handling equipment can be extremely difficult to attain where plant operations cover a considerable area, and where a variety of mobile handling units is required. Many hours of working time, both for men and machinery, may be lost through inability exactly to locate, and direct to the required site, specific equipment.

Such plants as shipyards, steelworks, docks and railway yards, where a vast amount of material is regularly handled, require a wide diversity of trucks, trailers, road and track cranes, locomotives and tugs and lighters, all of which may be utilised over an area of several hundreds of acres, and to ensure an even, steady flow of materials it is essential that each of these be used to maximum capacity without overlapping or idle time.

It is in this respect that a system of two-way frequency modulated V.H.F. radio communication (such as that recently introduced by the Plessey Co., Ltd., and embodying the wide experience of the Bendix Corporation in this field), can play such an important part in cutting costs and increasing production. Originally developed for use on railways, and recently experimentally installed by courtesy of the Railway Executive in a busy marshalling yard in London, this particular system has a wide field of application in industry. All components have been specially designed to withstand the arduous conditions likely to be encountered in railway engine and heavy vehicle installations.

### Remote Control

Under this system, designed to operate in the 156-184 mc/s band, each vehicle is equipped with a crystal controlled transmitter with output rating of 10 watts, a crystal controlled receiver and a power unit, all housed within a robust, weatherproof container. In the above installation, this was mounted on the roof of a diesel shunting engine, with aerial adjacent. A central control station incorporates a crystal controlled transmitter and receiver and a power supply within a single metal cabinet. The main control may be up to 50ft. from this cabinet and incorporates a loudspeaker serving also as a "talk-back" microphone. Where required, a remote control point, with all the facilities of the master control, may be situated several miles distant, connection being by twin telephone line.

### Selective Calling Device

When employing this form of control, it is frequently advisable to be able to converse with individual vehicle drivers rather than to broadcast a message to all. With the Plessey system, an optional addition is a selective calling device whereby, at the turn of a dial the control point operator may speak to any one of up to ninety units, each of one or more vehicles, the remainder being "locked out." Completely undisturbed conversation is thus assured.

The control station may thus transmit instructions to, and receive progress reports from, any driver at will, and the operator is enabled to compile a complete analysis of the manner and efficiency of working of every unit. Instantaneous briefing of crews and rapid location of vehicles ensures that every vehicle is worked to its full capacity, being transferred immediately upon completion of one job to the next. In this manner, either the total number of vehicles necessary to achieve a given output may be reduced, or a considerably increased output may be obtained for the same expenditure.

# Medium-wave Converter for Communications Receivers

## An Unusual Unit for Use with ex-Service Equipment

By E. N. BRADLEY

WHILST many ex-Service communications receivers are now used by amateurs with excellent results over the short-wave bands the majority of these sets suffer from the defect that their range is relatively small—a common reception range is from 1.5 Mc/s to 18 Mc/s. or so. It is common practice to extend this range into the higher frequencies by the addition of a converter or converters to cover the 30 Mc/s amateur band and higher bands, but it would appear to be a good deal less common to add a converter which will enable the receiver to be employed for the reception of stations in the medium-wave band.

The circuit to be described was designed and built as an addition to a BC-342-L receiver, and as an alternative to the construction of a new broadcast receiver. The economy thus effected is obvious; the main receiver acts as the I.F. amplifier, detector, audio output stage and power pack, and the converter consists of two simple stages only, the mixer and the local oscillator.

The exact arrangement of these two stages, and the manner in which they are combined, must depend to some extent on the type of communications receiver with which the converter is to be used. The BC-342-L, for example, modified for amateur use in accordance with the suggestions given in the September, 1946, issue of "QST," has a convenient power outlet on the front panel, supplying about 250 volts H.T. and 12 volts A.C. heater power. As no 12 volt frequency-changer was to hand it was decided to employ two six-volt midget valves with their heaters wired in series, and the circuit built round these valves, the 9003 pentode and 9002 triode, is shown in Fig. 1.

V1, the pentode, acts as an anode-bend detector, the signal being coupled in a conventional manner through L1, the aerial tuning coil. Also injected into the grid circuit of this valve is the local oscillation, drawn from V2, the triode oscillator, via C4, and the stage produces an I.F. by rectifying the two superimposed carriers in the well-known manner. If the medium-wave converter is required for use with a communications receiver having a six-volt heater power outlet, the same two valves could be employed, their heaters then being connected in parallel, but alternatively a normal frequency changer such as the ECH35 could be employed. The circuit of Fig. 1 would then be built round the single valve, C4 being omitted since then the two signals would be combined within the valve itself.

The choice and production of the intermediate frequency is the main point requiring consideration in the designing of such a converter. It is impossible

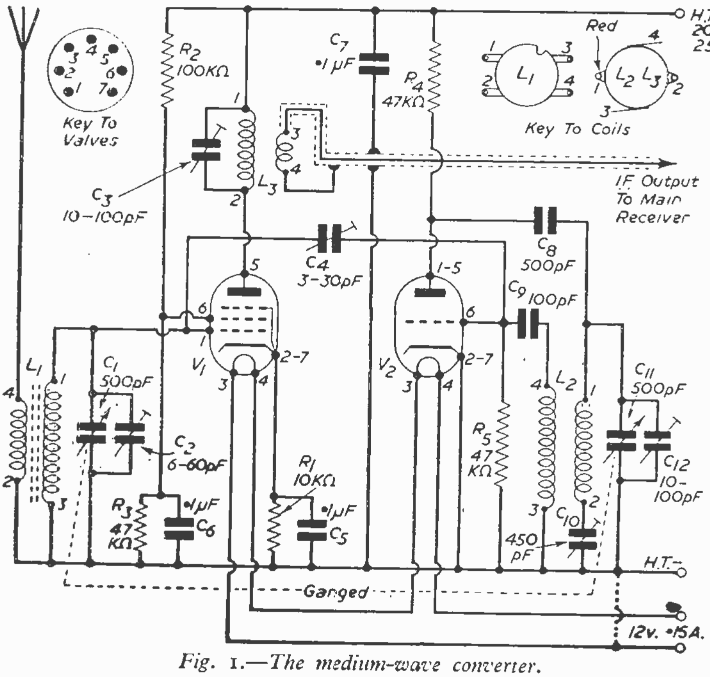



*Fig. 1.—The medium-wave converter.*

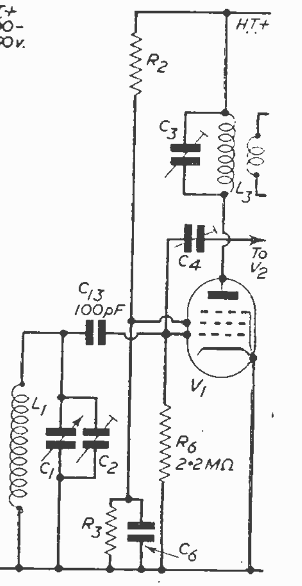



*Fig. 2.—An alternative mixer circuit.*

to employ a normal I.F. of about 450 kc/s since the I.F. given by the converter as an output must fall within the tuning range of the main receiver; for the same reason the majority of matched coils produced commercially are unsuitable for use in the circuit. The I.F. chosen should be a frequency to which the main receiver can readily be tuned and at which this receiver is sensitive and quiet in operation. With the BC-342-L a suitable frequency is 1.5 or 1.6 Mc/s. Commercial aerial and oscillator coils for an I.F. of 1.6 Mc/s can be obtained, but to maintain the economy of the circuit it was decided to use odd coils from the spares box. The coils employed in the prototype are: L1, an Atkins Laboratories White No. 2, L2, a Wearite PA6, and L3, an un-named medium-wave coil; a Wearite PA2 would serve excellently.

If it is desired to employ a different oscillator coil the component can be chosen with reference to the necessary oscillator tuning range. Presuming an I.F. of 1.6 Mc/s (1,600 kc/s), with the oscillator operating on the high side of the signal, and a main tuning range of from 1,500 kc/s (200 metres) to 500 kc/s (600 metres), the oscillator range will be from 3,100 kc/s to 2,100 kc/s. The specified coil, suitably trimmed and padded, covers this range very satisfactorily, but so will several other short-wave coils with an original tuning range of from about 95 to 200 metres or so.

An I.F. of 1.6 Mc/s is to be preferred as the converter tuning range can then commence at 200 metres. If an I.F. of 1.5 Mc/s is employed the oscillator will be tuned to 3 Mc/s at the 200 metre point on the main range, and will cause sub-harmonic interference.

## Improved Sensitivity

It should be noted that the circuit of Fig. 1 will serve well under all normal conditions, but that the converter will have rather more sensitivity if the circuit changes shown in Fig. 2 are incorporated—i.e., if V1 is made a grid detector rather than an anode bend detector.

## Construction

No chassis size or layout is shown since the unit may be made up in practically any form. The original unit is closely grouped around a tiny strip chassis, a midget two-gang tuner being employed, but results would not suffer if the parts were widely spaced and built into a small case or cabinet. Some form of screening round the unit is advisable, not to prevent interference with the main receiver, of which there should be no likelihood, but to keep the oscillator signal "at home" and prevent its interfering with any other short-wave receiver in the neighbourhood. In Fig. 1, the dotted line between the H.T.—(i.e., the chassis) and L.T. points, indicates that it is desirable to earth one side of the heater line. This may already be accomplished in the main receiver, however, so that care must be taken to avoid short-circuiting the heater supply if this connection is made in the converter.

## Aligning the Converter

Some doubts were felt, during the design and construction stages, as to whether the converter would track satisfactorily over the whole medium-wave-band with the chosen coils, which were picked at random, but the first trial showed immediately that tracking and reception generally were all that could be desired. The author employs the alternative grid detector type of frequency-changer as the circuit is used in a very poor reception area, and it can be said that under normal evening conditions it is difficult, without slow-motion tuning, to pick out the B.B.C. stations from the many foreign stations which come in at full strength.

If a signal generator is available the converter can be aligned with the main receiver in the usual way. Plug the converter into the power-supply socket on the main receiver and connect the core of the co-axial lead to the main receiver aerial terminal. Switch on the main receiver and the signal generator and allow them to warm up.

## LIST OF COMPONENTS

**C1, C11, 500 pF two gang tuner.**
**C2, 60 pF trimmer.**
**C3, C12, 10-100 pF trimmer.**
**C4, 3-30 pF trimmer.**
**C5, C6, C7, 0.1 μF 350 v.w. Tubular.**
**C8, 500 pF Mica.**
**C9, 100 pF Mica.**
**C10, 450 pF padder.**
**R1, 10,000 ohms, ½ watt.**
**R2, 100,000 ohms, ½ watt.**
**R3, R4, R5, 47,000 ohms, ½ watt.**
**For the alternative frequency changer, Fig. 2.**
**C13, 100 pF Mica.**
**R6, 2.2 megohms, ½ watt.**
**L1, Atkins Laboratories, White No. 2.**
**L2, Wearite PA6.**
**L3, Wearite PA2.**
**V1, 9003.**
**V2, 9002.**
**2 B7G valveholders.**
**Tuning dial, with drive.**
**Small chassis.**
**Co-axial output lead.**
**Aerial socket.**
**Power plug to suit main receiver.**
**Wire, sleeving, etc.**

Inject into the control grid circuit of V1 in the converter a weak 1.6 Mc/s signal from the generator, and tune the main receiver to 1.6 Mc/s when the signal should be heard. Trim C3 to bring up the signal to the best possible volume; the I.F. system of the converter is then set. This tuning will be found quite broad.

Now set the converter tuning capacitor, C1, C11, to about one-third mesh and inject into the converter aerial socket a 1,200 kc/s signal. With the trimmer C12 at minimum capacitance, increase the capacitance of this trimmer until the signal is heard in the main receiver. Mark the tuning point to which the main tuning capacitor is set, so that it can be repeated, and then set the vanes of C1, C11 to about four-fifths of full mesh. Inject a 600 kc/s signal into the converter aerial socket, and with the padder C10 at about its midway position, increase its capacitance until the signal is heard in the main receiver. Again mark the tuning point of the two-gang capacitor, then retune this component to its previous setting. Again inject the 1,200 kc/s signal and correct the trimming of C12, then trim C2 for maximum volume.

Return to the padding point and correct the padder C10 and continue to trim and pad in this way until correcting one capacitor fails to have any effect on the setting of the other.

It should be noted that these directions refer to a plain or blank tuning scale. If the main tuner is fitted with a wavelength or frequency scale, the trimming should be carried out with the pointer on the 1,200 kc/s (250 metres) mark, and the padding at 600 kc/s (500 metres).

Now connect in an aerial to the converter, and tune in the Light programme at 261 metres. Correct C2 if this is found necessary and if an increase in volume can be obtained, then tune to the Third programme at 514.6 metres, and vary the setting of the core in the aerial coil to obtain the best possible volume. Return to the Light programme and correct the trimmer C2, then tune once more to the Third programme for a further correction of the L1 core setting.

### Without Signal Generator

If no signal generator is available, the main receiver can be employed as an indicator against which the converter oscillator can be set quite conveniently; for the best results the converter tuner should be fitted with a marked tuning scale. Connect up the converter and main receiver as already described, and allow them to warm up to operating temperature. Without connecting the aerial, set the converter to the Light programme frequency, 1,149 kc/s, taking the position marked on the scale, and set C12 and C10 to their midway positions. Now tune the *main* receiver to the correct oscillator frequency, 1,149 plus 1,600 kc/s =2,749 kc/s, and trim C12 until the oscillator carrier wave is heard in the main receiver; the effect will be a cessation of background noise with microphonic noises as the trimmer is adjusted. Note that the main receiver and the converter main tuning controls are not touched during the setting of C12.

Now set the converter tuning to the Third programme, 583 kc/s, and tune the *main* receiver to the correct oscillator frequency, 583 plus 1,600 kc/s=2,183 kc/s, and pad C10 till the oscillator carrier is again heard.

Now return to the trimming setting of the main controls (Light programme point on the converter, and 2,749 kc/s on the main receiver) and correct C12 till the oscillator carrier is again heard, and repeat the padding process. Continue to correct the settings of C12 and C10 until variation of one has no effect on the other; the oscillator carrier will then be heard when the converter is tuned to the Light programme setting and the main receiver to 2,749 kc/s, and also when the converter is set to the Third programme point and the main receiver to 2,183 kc/s.

The oscillator of the converter is now trimmed up correctly. Tune the main receiver to the correct I.F. setting, 1.6 Mc/s, and connect the aerial to the converter input socket. Tune the converter to the Light programme, which should be heard, though possibly poorly, and trim up C3 for maximum volume. Then trim C2 for best reception. Tune the converter to the Third programme and correct the core setting of L1 for best volume, returning to the Light programme for a correction to C2.

Whether the converter has been aligned by a signal generator or by the method just described one control still remains to be set, the oscillator injection control C4. This capacitor is set by trial for the best all-round results; a value of 10pF is found satisfactory in the prototype.

After a major correction of C4 the trimmer C2 may need a slight resetting. C4 should be kept at as low a capacitance as possible to avoid any chance of "pulling" between the two converter stages.

The leads between the converter and the main receiver, and especially the co-axial I.F. lead, should be kept as short as possible. Some communications receivers have an "aerial trimming" control, and this, where fitted, must be set to the best point for reception by trial.

# Sub-miniature Valves

MULLARD ELECTRONIC PRODUCTS, LTD., have recently announced that their range of sub-miniature valves is to be extended to include a wide variety of valves and tubes for use in compact, lightweight communications and industrial electronic apparatus. Like the first valves in this range, which were produced specifically for use in hearing aids, the new types, with the exception of the diode EA71, all have 10 mm. diameter bulbs. The principal types are built up on flat glass bases in which the leads are disposed on a circle of 6 mm. pitch diameter. In the diode EA76, which has a maximum bulb diameter of 5.2 mm., the leads are disposed on a circle of pitch diameter of 2.3 mm.

### Type Numbers

The valves which have so far reached an advanced stage of development include both battery and 6.3 volt mains types. A voltage stabiliser 70B1 is also projected, having a burning voltage of 70 v. and a current range of 5-15 mA.

The battery sub-miniatures cover a wide range of applications and include the following types: DAF70 voltage amplifying pentode with single diode; DF72 R.F. pentode with sharp cut-off; DF73 variable-mu R.F. pentode; and DL75 A.F. output pentode.

The following are included in the range of mains types about to be released:—

EA76 single diode, having a maximum anode voltage of 150 v. and a maximum anode current of 9 mA.; EC70 R.F. triode, primarily intended for use as oscillator at frequencies up to 500 M/cs; EF70 high-slope R.F. pentode with short suppressor-grid base and giving a mutual conductance of 2.3 mA./v.; EF72 high slope R.F. pentode, with a sharp cut-off characteristic and a mutual conductance of 5 mA./v.; EF73 high slope pentode with suppressor-grid control characteristic for use in non R.F. applications.

# The Ban[d]
# Tuninc[g]

Further Constructional Details of This Inter[...]

By J.

WE are now nearing completion of the mechanical part. We must, however, finish the chassis on which the assembly is mounted before we may proceed. Two further parts are required and are shown in Fig. 13. Fig. 13(a) gives us an underside view of part J. The strip ½in. by 2½in. in the bottom right-hand corner should be bent towards the reader. The large hole is intended to take the bush of the D.P.S.T. wafer switch which has the job of switching on the bandspread condenser. This should be a small wafer switch, and should be so mounted that its contacts fall below those of the bandset tuning condenser when mounted. In addition, its locating mechanism should be so re-adjusted that the switch turns freely. This usually involves only the removal of a ball-bearing or the bending of a springy strip. This switch may now be mounted on part J.

Part K is shown in Fig. 13(b). The part bearing the two holes (½in. by 1⅜in.) should be bent through 90 degrees towards the reader.

13. The chassis may now be assembled, whereupon it should give the appearance shown in Fig. 14. Parts A, J and K are bolted together with 4 BA nuts and bolts, using the " 4 BA clear " holes available.

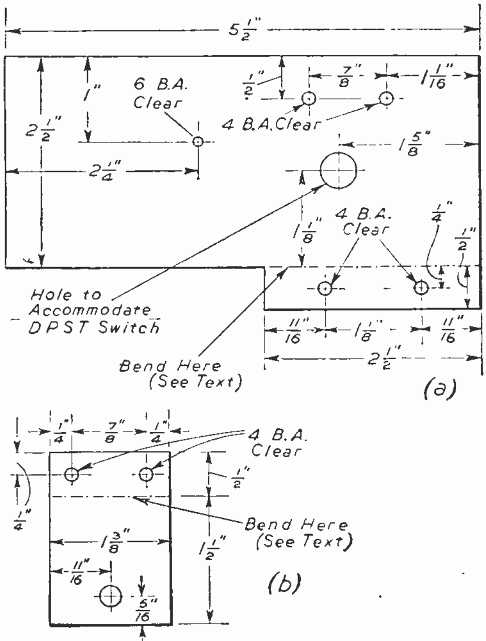



*Fig. 13.—(a) Part J, and (b) Part K.*

If care has been taken, these should coincide exactly. A small bracket may be fixed between the rear plate of the bandset tuning condenser and one of the 4 BA screws holding the parts K and J together. This will give strength to the chassis. Its dimensions depend upon the tuning condenser used by the constructor.

The ¼in. holes in the front plate (a) and part K should now accommodate a length of ¼in. shafting (brass or steel) which should be able to turn freely in these holes.

14. It is now necessary to cut the ¼in. shafting to length and also to drill a few holes in it. Fig. 15(a) shows how this is done. All the holes are drilled in the same plane. It may be found easier to file a small " flat " at each point where a hole is needed before drilling is commenced.

15. Another part, part M, has now to be made. This is mounted on the ¼in. spindle at the right-hand hole shown in Fig. 15(a) and its dimensions are given in Fig. 15(b).

16. Fig. 15(c) shows how part M is fitted to the spindle and also how part H is fitted to part M. It will be remarked that part H is already fitted to part G; for simplicity, however, part G is not shown in Fig. 15 (c). Fig. 16 shows the relationship between the parts now coupled.

17. We can now start assembly. A spacing washer, thickness 7/32in., must be placed over the ¼in. spindle next to part M and on the same side of M as are the other two holes in the spindle. (A large nut will provide a good spacing washer, if necessary.) This end of the spindle must now be slid into the ¼in. hole in the front of plate A. As it is moved in, it will be found that the inside arm of the lever G comes into contact with the 2 BA steel screw projecting from plate A. A thin washer

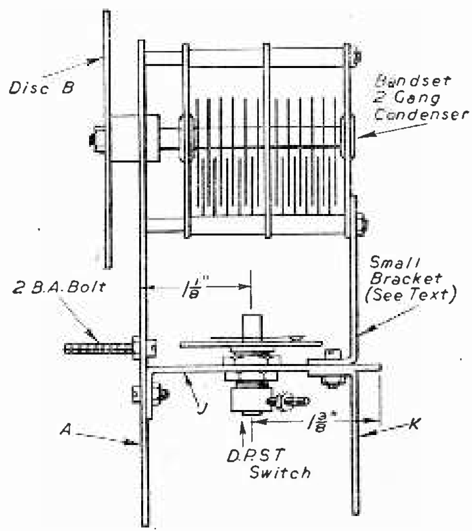



*Fig. 14.—Showing how parts A, J and K are bolted together.*

# .-searcher ·Unit–3

ıg Accessory for the Short-wave Enthusiast

DAVIES

must be put over this screw, then the inside arm of G may be pushed over the end of the screw. This inside arm must be followed by another washer, then the locating lever F may be fitted. Another washer is needed between the outside arm of F and that of G. Yet another washer is needed and then the lock nuts may be fitted on the end of the screw. Before the ¼in. spindle is finally pushed home into part K a thin ¼in. washer is slipped over it.

Fig. 17 shows in detail the assembly of components at the 2 BA screw. The photographs (Feb. issue) show the appearance from the front.

18. Two "stops" are now necessary. It will be found on examination that there are two "6 BA clear" holes still vacant on the face of panel A. These are shown at Y and Z in Fig. 3(a). A ¾in. 6 BA screw is mounted at Z and a 1¼in. 6 BA screw at Y. The long screw is needed for holding a return spring as well as acting as a stop. Reference to Fig. 12 will show that the 6 BA screw on lever G projects some distance from the front surface. A spring is fitted between the exposed portion of this screw and the top of screw Y. Two lock nuts on either side of the spring hold it securely on the screw mounted at Y. Two lock nuts also hold it on the screw on lever G. The spring when mounted should clear parts H and M adequately. The photographs show the position of the spring quite clearly.

19. Another spring is now necessary between levers F and G. Reference to Fig. 9(c) will show that one end of this spring is hooked around the bottom 4 BA screw of part F. The other end is fastened to the two unoccupied "6 BA clear" holes of part G. A small piece of wire is bent into the shape shown in Fig. 18 to hold the spring. Fig. 18 shows the appearance looking from the end of part G. This piece of wire can quite conveniently be tinned copper wire.

20. All that now remains is to prevent any lateral movement of the ¼in. spindle in its hole.

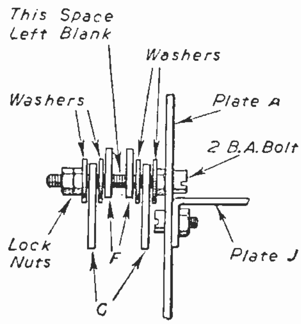



*Fig. 17 (above).—How levers F and G are mounted on the 2 BA screw fixed to plate A.*

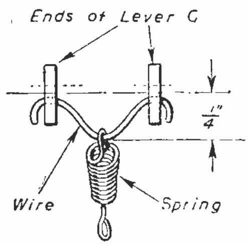



*Fig. 18 (right).—Detail of method of mounting spring to lever G.*

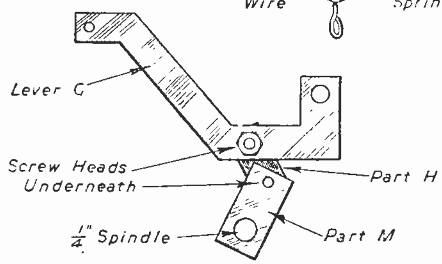



*Fig. 16.—Showing how parts G, H and M are all fitted together.*

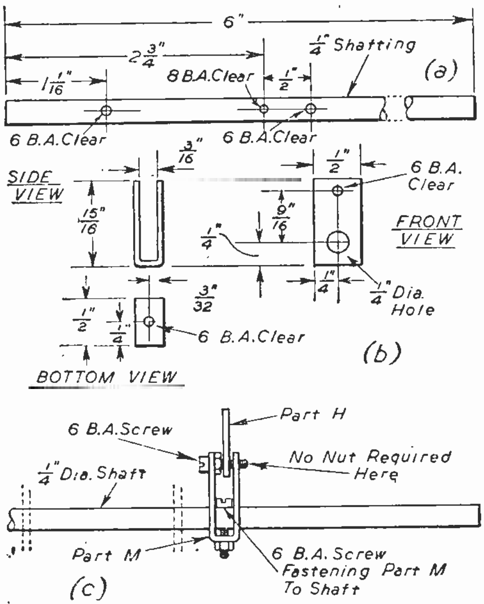



*Fig. 15. (a) and (b).—Details of shafting, and its mount. (c) How part M is fixed to the ¼in. spindle.*

This is done by passing a piece of wire through the 8 BA hole previously drilled. See Fig. 19. The wire is then twisted on itself and prevents the forward movement of the spindle.

## The Switch Mechanism

21. The action of the switch mechanism is extremely simple and it takes only a few minutes to put together. In paragraph 13 we mounted the

switch to the chassis plate, part J. We now fix a 1¼in. bolt to the remaining "6 BA clear" hole in the ¼in. shafting (i.e., the left-hand hole in Fig. 15(a)), so that the threaded part points towards the tuning condenser when the mechanism is in the "locked" position. The spindle of the switch (projecting below the chassis) is fitted with a bush which is locked with a ¾in. bolt. (See paragraph regarding the obtaining or manufacture of these bushes.) When the spindle is turned to the "condenser locked" position the bush is so adjusted on the switch spindle that the 1¼in. 6 BA bolt pushes the ¾in. bolt round sufficiently to put the

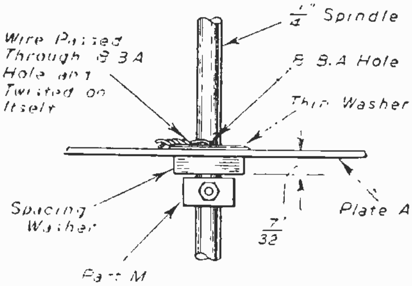



*Fig. 19.—Detail of method used to fix ¼in. spindle to plate A.*

switch in the "on" position. When the spindle L is turned to the "condenser released" postion, a spring pulls the switch back to its original position, thus disconnecting the bandspread condenser. The return spring is hooked on to the bolt holding the switch bush and is held by means of a nut on that bolt. The other end of the spring is anchored by a 6 BA nut and bolt fixed to the "6 BA clear" hole remaining in the chassis plate J. See Fig. 13(a). The photograph of the underside of the chassis shows how the switch parts fit together.

### The Warning Light Mechanism

This is also very simple to make up. As may be seen from the photographs a semi-circular piece of insulated rod has a series of contacts arranged along its length. These are touched by a pointed contact fixed to the disc B, and so give visual warning as a band is approached.

22. The first part to make is the semi-circular mounting. This consists of brass rod (or any other suitable material) of approximately 3/16in. diameter. This is bent to a semi-circle of 4in. diameter (Fig. 20 (a)), and is then fixed to a piece of mild steel sheet cut to the dimensions shown in Fig. 20 (b) by means of the two brass saddles of Fig. 20 (c). It will be seen that the two "6 B.A. clear" holes on either side of the large hole of part O coincide with similar holes on either side of the hole for the tuning condenser spindle on the front plate in Fig. 3 (a). The centre hole for part O should now be made equal in diameter to that used by the constructor for the condenser spindle on the front plate. When assembled, the semi-circular contact mount, etc., should present the appearance sketched in Fig. 20 (d). It will be noticed that the brass saddles are situated *behind* part O.

Insulating the semi-circular rod O is carried out by the simple process of carefully wrapping medical adhesive tape around it! Half-inch tape should be used, as wider tape is liable to "bunch." Tape of the elastic variety should not be used. Adhesive tape, or "sticking plaster," is ideal for the purpose required here, owing to its extreme stickiness and the fact that it is sticky only on one side. If ordinary insulating tape were used its stickiness would make the adjustment of the contacts extremely difficult. Actually the most professional touch would be obtained if the semi-circular rod were covered with electrician's pure rubber tape, being subsequently given two generous coats of shellac varnish.

*(To be continued)*

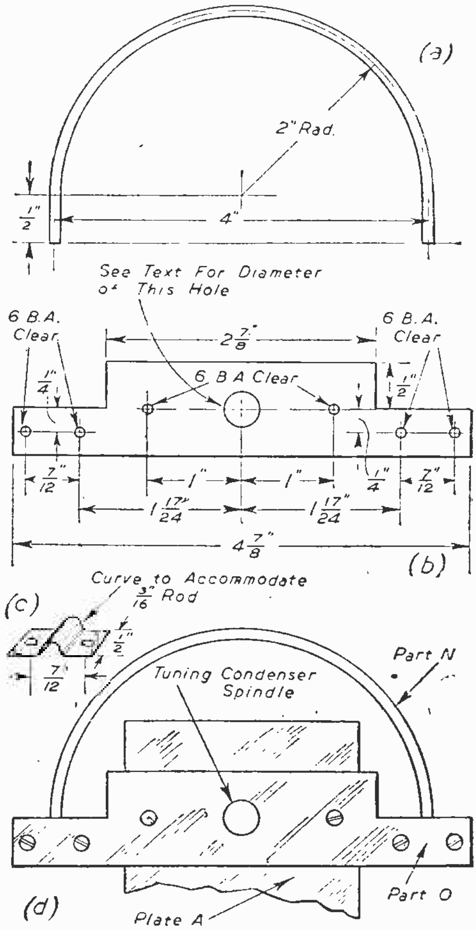



*Fig. 20 (a), (b) and (c).—Warning light mechanism, and parts N and O. (d) Appearance of semi-circular contact mounting when assembled. The brass saddles holding parts N and O together are mounted behind part O.*

# Recording Sound Effects

### The Principles and Practice of Recording Sound Effects for Dramatic Performances and for Synchronised Cine Sound-tracks on Tape

By K. KEMSEY-BOURNE

ANY competent amateur with a sound recording outfit, disc or tape, can serve a useful function—and make a little pocket money—by providing sound effects for the local dramatic society, or by recording sound tracks for the cine society in his district.

## Effects in General

Good effects in a radio, film, or stage production can make the show really effective, and just as surely a series of unconvincing effects can ruin the best performance. The key to the problem is this: The microphone is monaural, and the correct sound perspective can only be obtained by patient and careful technique.

There are commercial disc recordings of sound effects in the H.M.V. and Columbia catalogues, but using these may not be satisfactory for several reasons. They are copyright and can only be used for public performance on payment of royalties; they cannot legally be re-recorded. The effects are often not quite what is wanted, or they may be just too short in playing time. Some are marred by a high surface noise, and some are very obvious fakes, lacking in atmosphere. The commercial crowd effects are quite good, but sound better if they are mixed with the sound, either live or separately recorded, of another small crowd. This is worth trying, especially by small dramatic societies, whose crowd effects are usually provided by half a dozen stage hands.

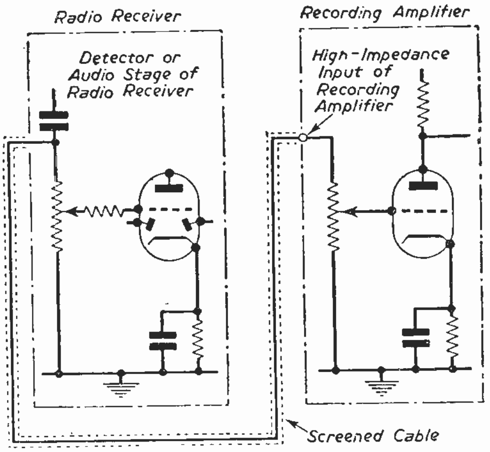



*Fig. 1.—Method of connecting radio receiver to recording amplifier to record radio material. Note: The output stage of the radio receiver may be used to monitor the programme material. Variation of the radio volume control will not affect the recording circuit.*

## Radio Effects

A number of plays call for the use of a radio set on the stage, and here is a chance for our bright recordists and audio men to shine. Obviously the radio set on the stage is a dummy, except that it contains a loudspeaker wired to play-back equipment off-stage. Even if the effect needed is only a simple announcement this is best recorded, since this ensures standard timing and removes the possibility of the pick-up of unwanted noise from a microphone in the wings.

Radio effects such as Big Ben, time signals or other standard items can be made direct by feeding signals from the detector stage of a radio receiver into the high impedance input of the recording amplifier. This gives better quality than using a microphone placed in front of the speaker of the radio set.

In all cases duplicate recording cuts should be made if at all possible, either together or on opposite sides of the same disc. One is kept for rehearsals only, and the other is used for the shows. These duplicates must have exactly the same run-in grooves, for cueing purposes.

## Disc or Tape?

Disc recording is useful for effects that are short and easily recorded on cue, such as clocks striking, cars starting, fireworks going off, or horses galloping past. Since a pick-up arm can be calibrated accurately, disc recording is best when a given effect, such as an air-raid siren or the sound of breaking glass, must come exactly at a specified place, perhaps so many seconds after a piece of dialogue. In goes the stylus at exactly the right time and place, and out comes the sound.

Tape recording is ideal for providing an effect that must continue over a period, such as the sounds of wind, rain, waves, railway trains, or aircraft. Such effects on tape can be made into an endless band that can be run for continuous playback as long as required.

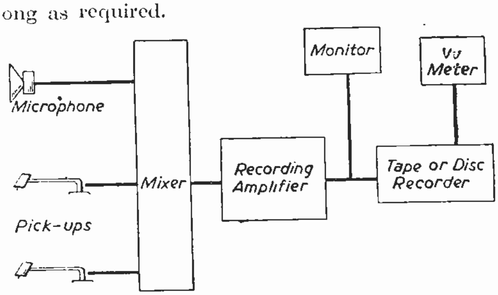



*Fig. 2.—Block diagram representing equipment for recording either (on disc) composite effects, such as voices plus crowd noise plus band playing, or (on tape) sound track to be synchronised with cine film.*

Tape and disc together make ideal partners. Remember that tape is capable of being "wiped" and re-recorded, but a disc once cut cannot be re-used. Suppose we want a recording of a genuine thunder-clap. Even at the height of a thunder-storm one never knows when the next crash is coming. We might cut one or more discs without getting the sounds we want, a very wasteful and expensive business. On tape we can afford to go on recording as long as the storm (or the tape) lasts. Then we play-back with a stop-watch, note any likely thunder-claps, and dub on to disc the required effect. The tape will be erased and re-used whether we succeed or fail.

Tape alone is an ideal medium for synchronised cine sound tracks. Dialogue and effects are separately recorded on tape until satisfactory, and then the required sounds are dubbed on short disc tracks. As the film is run through a projector the dialogue is recorded on a tape synchronised with the film, and effects are mixed-in, on cue, from the discs.

In a certain play production the script called for

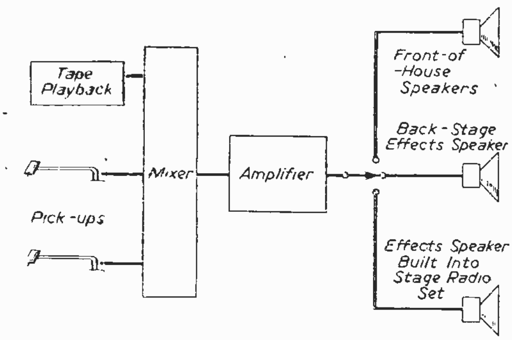



*Fig. 3.—Typical theatre set-up, capable of providing effects from tape, disc, or both, and interval music from disc. All speakers must be generously rated to avoid overloading.*

a general crowd noise off-stage, with Big Ben striking just after a particular speech on-stage. Tape provided the crowd noise (with some live crowd also), and Big Ben was added on cue from a disc recording, made from a radio transmission.

## Sound Perspective

Any recordist should know the effects of varying his microphone position, as well as the characteristics of the different types of microphone available. Trial and error still has the last word, and the monitor speaker knows best. Moving the microphone 3in. for a close-up effect makes all the difference between inaudibility and realism. Get to know your equipment, and keep experimenting.

## Putting Effects Over

Like good film music, effects should be balanced and not obtrusive. In the theatre, effects speakers must produce the sound from the correct direction, and at the correct sound level. We've all heard car effects that sounded more like the Brabazon. The play-back amplifier may be the same one as used for recording, but be sure that the response has been adjusted to correct for recording losses. A minimum of 10 watts available power is recommended, for both recording (on disc) and theatre play-back. Excessive bass-response is the most frequent fault of sound systems in amateur theatres.

## Some Suggested Effects

When recording close-up effects use a moving-coil microphone rather than a ribbon, which would appear to increase the bass component of the sound.

*Crowd noises:* Mix a recording of a genuine crowd with sound from a few "live" people. Record, and re-record, if possible.

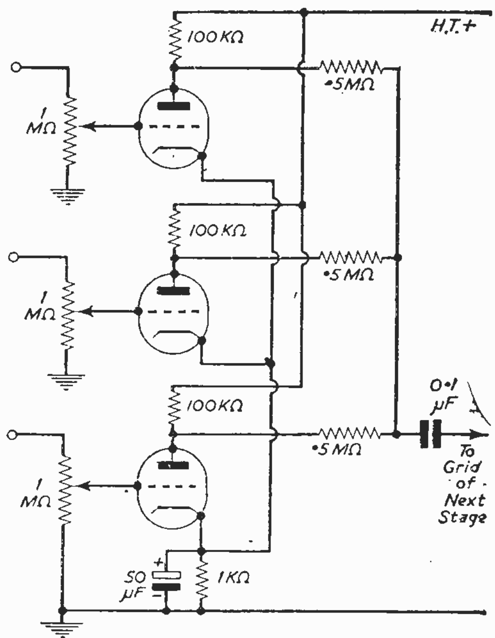



*Fig. 4.—Circuit of three-channel input mixer. Channels are completely independent, and more may be added, in parallel, if required. Valves used are general purpose triodes, such as 6C5, 6J5. Types containing two triodes in one envelope, such as 6N7, 6SN7, 6SC7, can be used more economically.*

*Fire:* Twisting cellophane close to the microphone. This needs two operators, and should be mixed with other sounds, such as voices, fire-bells, crowds, etc., to be convincing.

*Horses:* On a hard road, use the classical method of two half-cocoanut shells. On turf or grass, use suction cups on trays of earth or on one's own chest.

*Thunder:* Record the real thing, or, second best, roll a football bladder containing a few large ball-bearings near the microphone.

*Explosions:* Use fireworks, and add reverberation by re-recording.

*Steam:* Compressed air.

*Water:* To get boat effects you must have a heavy square tank with a loose canvas lining inside it. Water splashing against metal always sounds like water splashing against metal. A paddle is effective for imitating oars in water.

*Cars:* The only satisfactory way is to record the real thing. This also applies to trains, bird songs, etc. Out of doors a windshield may be needed to minimise unwanted background noise.

# Meter for Low Resistances

## A Simple Exercise in Theoretical and Practical Design, Providing a Useful Tool for the Experimenter

By R. D. PATERSON

THE resistance scale incorporated in most multi-range meters provides a quick and satisfactory means of measuring resistances of moderate value, but, in general, the scale is rather cramped towards the low-resistance end, and it is rarely possible to measure accurately below 20 ohms. The instrument to be described was built primarily to deal with resistances below 50 ohms, but in order to make it of still wider application, it has been modified to cover 8,000 ohms to less than 1 ohm in two ranges. The upper range, 8,000-300 ohms, is measured by the orthodox series arrangement of battery, limiting resistance, unknown and milliammeter; the lower, 300 ohms downwards, by shunting the unknown across the milliammeter.

### Theoretical Circuit

The theoretical circuit (Fig. 1) shows that the meter is simple and the components few in number. The ganged switch, S1S2, is shown in position 1, in which the battery is disconnected and the instrument out of action. The milliammeter can still be used as such for other purposes, as it is directly connected across terminals 1 and 2.

### The Milliammeter

The milliammeter has a full-scale deflection of 10 mA and an internal resistance of 12.5 ohms. It is scaled in milliamperes and can be read to the nearest 0.2 mA. A milliammeter of different characteristics can be used, but it must have a low internal resistance. The lower the internal resistance, the more open the low reading end of the resistance scale will be, and to provide that is the main object of this instrument. The upper limit of the lower resistance range is approximately 40 times the internal resistance of the meter, depending on how closely the scale can be read.

The values of R1 and R2 will have to be re-calculated to suit the substituted meter and the voltage from which it is energised. This should not prove difficult if the example below is followed.

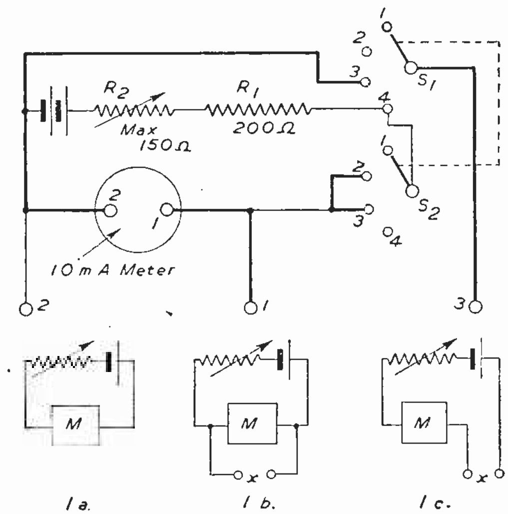



*Fig. 1—Theoretical circuit of the test meter.*

### Other Components

The battery is of the cycle-lamp type which maintains its voltage well over a fairly long life. It should be replaced when the voltage falls below 2.4; below that figure the voltage is unlikely to remain steady, even during the taking of a reading, with dire results upon the accuracy of the measurement.

The resistors, R1 and R2, are calculated to allow the meter to be set to full-scale deflection as long as the voltage lies between 3.2 volts (a very fresh battery) and 2.4 volts. The maximum combined value of R1+R2 must be such that the meter can be adjusted to full-scale deflection, 10 mA, even when the battery is at full strength.

By Ohm's Law:

Total resistance in circuit

$$= \frac{E}{I} = 3.2 \times \frac{1000}{10} = 320 \text{ ohms.}$$

This includes the resistance of the meter, so the correct maximum value of R1+R2,

$(R1+R2)_{MAX.} = 320 - 12.5 = 307.5$ ohms.

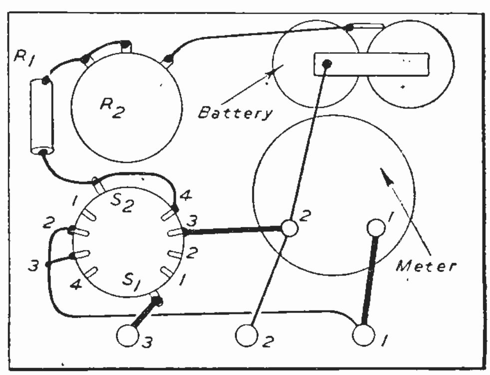



*Fig. 2—Rear of panel wiring diagram.*

Similarly, the minimum value of the resistors,

$$(R1 + R2)_{MIN.} = 2.4 \times \frac{1000}{10} \text{ ohms} - 12.5\text{ohms} = 227.5 \text{ ohms.}$$

These requirements can be met by using a variable resistor of maximum value greater than 320 ohms, but it is better to use two resistors and make R1 a fixed resistor of 200 ohms and R2 variable between zero and 150 ohms. The advantages are that the reduced value of the variable portion of the resistor makes it easier to set the meter accurately to full-scale deflection, and if the minimum setting of the variable resistance fails to produce full-scale deflection, it is a definite sign that the battery needs renewing.

## Constructional Notes

Since the instrument is designed to measure low values of resistance, the internal connections should be made as short as possible and of heavy gauge wire, particularly those shown in heavy line in the theoretical diagram and the wiring diagram, Fig. 2. The switch, whether Yaxley type or not, should be substantial and self-cleaning. The panel should be of wood or metal if insulated terminals are used, otherwise an insulating material should be used. The upper surface of the panel should be covered with white card appropriately drilled and marked, as suggested by Fig. 3. The container in which the instrument is housed is left to the discretion of the constructor, as are the details of how the battery is clamped. The leads to the battery should be soldered to the brass contact strips. When inserting the first battery or a renewal, make sure that the leads are connected so that the milliammeter needle is deflected in the proper direction.

## How It Works

As stated above, the instrument is out of action when the switch is in position 1, marked "OFF" on the panel. When a resistance is to be measured, fix it across terminals 1 and 3, and turn the switch to "SET." This completes the fundamental circuit shown in Fig. 1(a). Adjust the resistance R2 until the meter registers full-scale deflection. Turn the switch to "LOW." This places the unknown across the milliammeter, as shown in Fig. 1(b). If the unknown is less than 300 ohms, the pointer will take up an appropriate position on the scale. If the meter still shows full-scale deflection, or nearly so, switch to "HIGH." The unknown is now in series with the meter, as in Fig. 1(c), and the pointer will indicate its value if it lies between 8,000 and 300 ohms. If the pointer still fails to respond, the unknown is outside the scope of this instrument. Resistances in the lower group can also be measured by switching to "SET," adjusting to full-scale deflection and then, *and not before*, placing the unknown across terminals 1 and 2.

## Calibration

Means must be provided to translate the current indicated by the meter into terms of resistance. This can be done mathematically, but the calculations are long and tedious and their accuracy depends largely on the correctness of the initial determination of the resistance of the milliammeter. Instead, three practical methods are given, all independent of that factor.

(A) A minimum of three precision resistors is required for each range, one near either extreme of the range and the third about the middle. For instance, three resistors (10 ohms, 100 ohms and 200 ohms) taken separately, make suitable markers for the lower range, and in various combinations of series and parallel provide a wide variety of intermediate check-points whose true values can be calculated by the usual formulæ:

Series. $R = R1 + R2$

Parallel. $R = \dfrac{R1 \times R2}{R1 + R2}$

Each resistor, whether simple or compound, is "measured" in the new instrument and note made of the corresponding current indicated by the meter. Two graphs are then made, one for each range, plotting resistance against indicated current. These graphs may be pasted inside the lid of the instrument box and used directly to convert indicated current to ohms, or they may be used to read back selected values of resistance, which are then inscribed on the scale of the milliammeter itself or on subsidiary scales attached to the cover-glass. The latter are not recommended, since the distance between the pointer and the scales introduces parallax error unless the head is carefully kept immediately above the pointer when taking a reading. The two scales are, in effect, continuous, as the lower one reads from left to right and the other in the opposite direction.

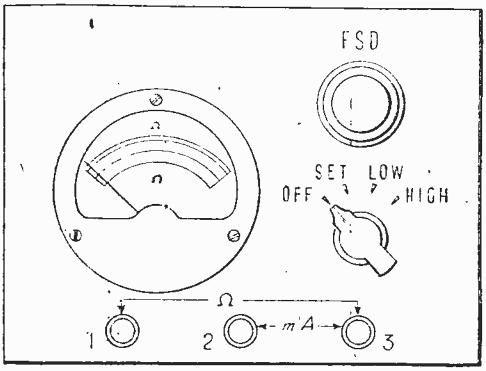



*Fig.3—Front of panel layout and controls.*

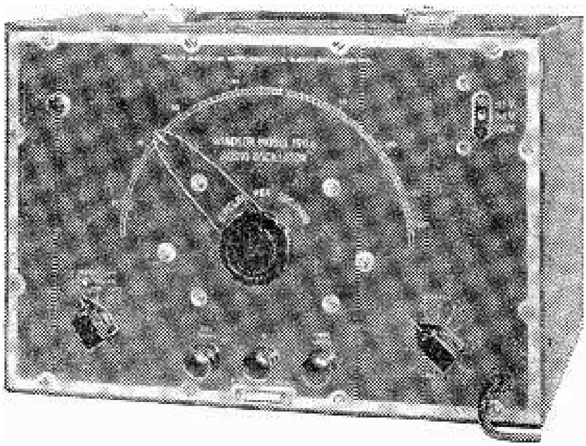
(B) Much closer calibration is possible by the second method, which employs a decade box or the decade arm of a Post Office box, if available. In either of these, resistances are built up in steps of 1 ohm from an ohm upwards and in turn applied to the meter. The resulting pointer deflections are marked directly on the meter scale and appropriately labelled.

(C) Finally, equally accurate calibration can be obtained by the use of one or more variable resistors, sufficient to cover the required ranges, in conjunction with a Post Office box or a resistance bridge. The latter is set to the desired value of resistance and the variable resistor adjusted until balance is obtained. The resistor is transferred to the instrument under calibration, and the pointer deflection it causes treated as described above. The resistor is then set to the next selected value, and so on, until both scales are sufficiently calibrated.

## Care of the Instrument

Switch off the meter after making a measurement. This will prolong the effective life of the battery. Do not allow an exhausted battery to remain in the case: it may corrode the wiring or the milliammeter. If the case is suitable, the battery should be housed in a separate compartment.

# WINDSOR AUDIO OSCILLATOR



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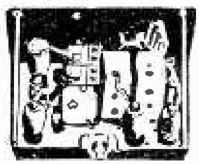

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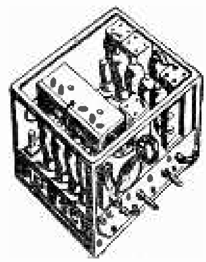

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# An Indoor S.W. Aerial

## Erecting an Efficient Aerial Indoors for Short-wave Reception

By A. W. MANN

THE subject of short-wave receiving aerials is a controversial one. Details of several types are usually to be found in text books. There are few, however, who have available sufficient space to erect them exactly to specification.

The average short-wave listener as a rule erects an aerial system based on accepted principles, but modified to suit individual circumstances.

Because of this, many otherwise good receivers cannot be used to the best advantage. The most unfortunate among the listening fraternity are in my opinion those who for various reasons have to use highly efficient receivers in conjunction with more or less makeshift types of indoor aerial.

### Damping Effects

An indoor aerial, suspended under the roof, has much in its favour so far as height and pick-up are concerned. Where a long down lead has to be carried close to the wall of a staircase, however, the excessive damping cancels out these advantages with drastic effects on the sensitivity and selectivity of the receiver. It is admitted that modern receivers perform well under such circumstances, but a more efficient aerial will show a marked improvement so far as all-round efficiency is concerned.

The facts outlined, however, should not influence the reader into regarding indoor short-wave aerials as inefficient, simply because they are located indoors.

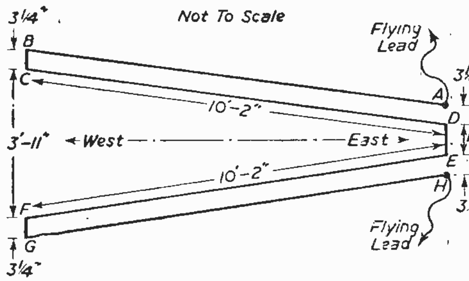


*Fig. 1.—Layout and dimensions of the aerial.*

### An Efficient Indoor Aerial

The purpose of this article is to place before readers who have a separate room in which their receivers and associated apparatus are located, details to enable them to erect a very efficient and versatile indoor aerial system with the minimum of trouble and expense.

### The Original Model

The original model has been used with various types of receiver, including simple regenerators, T.R.F., the 1155A and 1116A. The results obtained to date, and under somewhat adverse conditions have convinced the writer that this form of aerial has possibilities. These are to be fully explored and tests carried out over a long period.

During these tests, modifications or additions may suggest themselves, which will result in still greater overall efficiency. In any case some useful data should be obtained and used as the foundation on which to base further experiments.

The room in which my aerial is suspended is, approximately, 12ft. by 7ft. There are shelves at each end of the room, one foot below the ceiling. The aerial is suspended between them.

### Aerial Dimensions

The principal dimensions are given in the sketch at Fig. 1. There is one point which should be noted. It is that this aerial consists of one continuous length of insulated aerial wire. The down lead is a separate length, fitted at one end with a spring clip. The other end, of course, goes to the aerial input of the receiver.

### Suspension

This is carried out by means of small picture-frame rings, but hooks are recommended as more convenient. These were screwed into the front edges of the shelves. The same procedure can be followed so far as walls are concerned, although plugging might be necessary.

The starting end of the wire is first looped and bound with fine gauge wire, leaving what we will

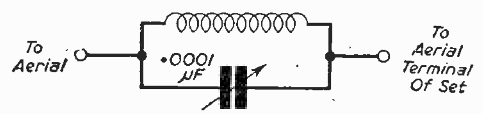


*Fig. 2.—Theoretical circuit of the aerial resonance tuner.*

term a flying lead about 2in. long.

The loop is hooked on to A and the wire passed through hooks at B and C, up to D and E, then down to F and G, and up to H, terminating with another loop which goes on to hook H. This is also bound so as to leave a flying lead.

As we are to clip the down lead to the end of the flying leads at A and H, also between D and E as required, sufficient insulation should be removed from the wire at these points to allow good electrical and mechanical contact between the aerial and the spring clip.

We now have an aerial of V formation, with each leg folded back. There are three different points to which we can couple the down lead, and if the ends A and H are bridged with a short length of wire, an additional point, this being the centre of the bridge wire to which the down lead may be clipped.

### Directional Properties

Tests have proved that this system possesses directional properties, which within limits may be varied, according, of course, as to which point the down lead is connected. This aerial can be used in conjunction with any short-wave receiver, including superheterodynes, T.R.F., or straight regenerators. It is at present being used in conjunction with the 1116A.

It should be noted that if a change of down lead connection is made after a transmission is tuned in, a slight readjustment of the receiver tuning will be necessary in order to obtain maximum signal gain.

In the case of the R 1116A this is carried out by means of the aerial resonance tuning condenser control. When the aerial is to be used in conjunction with receivers, other than the R1116-R1116A, the addition of a separate aerial resonance tuning unit will prove to be worth while.

### Aerial Resonance Tuner

The theoretical circuit of a simple series aerial tuner is shown at Fig. 2. The coils can be home made, consisting of a single winding, using discarded valve bases as the formers, the windings duplicating those of the coils used in the receiver as to the ranges covered. On the other hand, commercial-type four-pin coils can be used, using grid winding only. The tuning condenser used in the unit should be of .0001 $\mu$F capacity and should be fitted with a slow-motion dial.

### Tuning Procedure

Tune in the desired signal to full volume on the receiver. Further increase the gain by tuning the aerial to resonance by means of the tuning unit. The correct tuning point is just below the maximum gain position, and is recommended in the interests of stability.

The procedure outlined may appear to be a little complicated. This, however, is not the case. After all, the signal is the thing, and where DX is concerned we require the maximum signal-to-noise ratio. The facilities offered by this aerial system and, being able to tune it to resonance, will provide just that little extra sensitivity which is so desirable. A few evenings listening to 14 Mc/s phone and C.W. will, I think, provide convincing proof where doubt may exist.

### Full Range Tests

When testing out this aerial and your receiver over the full tuning range of the latter, make full use of the facilities provided. Alter the position of the down lead and thus find out which tap provides the greatest signal gain on individual transmissions. Do not forget to re-tune the receiver after each adjustment and adjust the aerial tuner for maximum signal gain.

When used with the 1116-type receivers it will be sometimes noted that a change of tapping will bring in a signal which has been too weak to hold even with the A.V.C. switched in. The way that the A.V.C. is triggered into action when the aerial tuning condenser is readjusted to bring the aerial into resonance after the change over is noteworthy.

### Comparative Tests

Careful note should be taken of the effects produced by variation of the down lead tapping points. A series of comparative tests, covering a long period and different reception conditions. Make a note of all transmissions received weakly under normal conditions at your location. Draw up a list of these and run the tests on those transmissions.

In addition, include the 7 Mc/s, 14 Mc/s and 3.5 Mc/s amateur phone bands. Much useful data should result and a useful cross-section as to overall performance obtained.

In some instances some modifications may be necessary in order to suit individual circumstances. Such modifications should be carried out with discretion. In conclusion, the writer wishes it to be understood that he does not present the details of this aerial system as the ideal in indoor aerials, but rather as a method whereby sufficient wire to assure good pick-up can be used to good effect in a restricted space, and which in addition may be adjusted in order to take full advantage of its directional properties.

## Third Programme Transmitting Station for Liverpool

DURING January, the Third Programme transmitter, at Dryden Road, Liverpool, which was installed in 1940, closed down and the service transferred to the B.B.C.'s new station in Mersey Road, Birkenhead. This station is on a two-acre site, and comprises a one-kilowatt transmitter housed in a temporary building and feeding into a T aerial supported by two tubular steel masts, 126ft. high. Ultimately, when the permanent building has been completed, the station will have two one-kilowatt transmitters, one for service and one in reserve.

### Remote Control

These transmitters will have no engineers on the spot to operate them, but will be remotely controlled over telephone lines from Broadcasting House, Manchester. By means of the remote-control system the engineers in Manchester will be able to bring either transmitter into service and check its performance, output power, etc. They will also be able to correct the carrier frequency of the transmission, should it deviate from its correct value, which is at present 1,474 kilocycles per second, corresponding to a wavelength of 203.5 metres.

The new station is 10 times more powerful than the original, and this increase together with the more efficient aerial that has been erected will result in better reception of the Third Programme in most parts of the district.

# R.F. Coils for S.W. Receivers

## General Principles of Coil Design for the High-frequencies

By "ELECTRON"

THE newcomer to short-wave work often finds himself at a loss to know exactly what types of coils to use for the R.F. and detector stages (and the local oscillator if a superhet is concerned). On medium waves the matter of coil design is not of such importance, but when it comes to the short-wave bands the choice of coil is extremely important if maximum efficiency is to be obtained.

The constructor can either wind his own coils or can purchase made-up coils which are readily available in radio shops. First of all, let us discuss commercially made coils.

Generally speaking, set manufacturers use coil packs—that is, units consisting of the various coils which are permanently installed in the receiver and which are switched into circuit as required. The coils are grouped around a wafer-type switch together with, if a superhet circuit, padding capacitors, enabling a set of coils for each range to be selected by the switching arrangement.

Such coils are, in modern receivers, each wound on their own formers, and although the method of grouping the coils around the selector switch is a great improvement over older methods the practice of close-grouping gives rise to absorption effects. If the home constructor is considering such an arrangement, a shorting strip on the switch should be incorporated so that the coils *not* in use will be automatically short-circuited. This will effectively overcome any absorption effects.

In the early days, it was the general practice to use bakelite insulation on such switches, but when the short-wave bands became popular the need for higher efficiency soon presented itself. The first improvement was the use of better insulation, and after various stages of evolution the "Yaxley" type of multi-way switch came into being. The modern trend for still greater efficiency manifests itself in the use of ceramic insulation.

There is little doubt that the home constructor finds the plug-in type of coil his favourite. The advantages of this type of coil are that shorter leads can be obtained and the losses due to switch wiring eliminated. With the circuit wiring at a minimum, a considerable reduction in stray capacitance will be obtained and this leads to higher efficiency. There is, of course, the disadvantage that to tune to another waveband a complete set of coils must be replaced and this precludes rapid band changing. However, the advantages of plug-in coils are real ones and it is interesting to note that the commercial set maker is giving more attention to such arrangements, vide: the HRO, etc. Two further advantages of plug-in coils are that (a) construction is simplified and (b) chassis space is conserved.

Commercial receivers using plug-in coils employ coil packs in which a group of coils are mounted, thereby enabling a complete set of coils to be withdrawn or inserted in one operation. Such coil packs are well within the capabilities of the average constructor.

Commercial coils are available in a number of different bases. Some fit British 4- and 7-pin valve bases; some fit International Octal bases; one type uses a special 6-pin holder; others use tagged terminals for direct soldering.

For T.R.F. circuits, two-winding detector stage coils are available—one winding for the grid and the other for regeneration. The same coils can be used for R.F. stages, the regeneration winding being in this case used as an aerial coupling coil. Three-winding coils can also be used, the additional winding being used for loosely coupling the aerial to the grid circuit or for coupling the R.F. stage output to the detector grid. It is usually advisable to use the loose coupled arrangement since the aerial will otherwise load the circuit and in some cases prevent oscillation. The longer the aerial the greater will be the damping effect. If a dipole aerial is used, of course a primary winding is essential. Similar coils for superhet circuits (which call for oscillator coils) are available.

### L/C Ratio

In short-wave circuits it is usual to use a parallel tuning capacitor of about 160 pF in order to obtain a reasonable L/C ratio—this holding good for frequencies between about 1.5 Mc/s and 25 Mc/s. Below these frequencies a smaller value capacitor is advisable. In a receiver covering the frequencies mentioned, four coils will be required for each tuned stage, so that a 1-v-1 would require only two coils in position at any given time as against eight coils and a wavechange switch if a built-in coil unit were used.

The choice of wire for short-wave coils is important. On the higher frequencies "skin effect"

**DATA FOR HOME-WOUND SHORT-WAVE COILS**

| Grid Winding | | | Aerial or RF Coupling Winding | | | Regeneration Winding | | | |
|---|---|---|---|---|---|---|---|---|---|
| No. on turns | SWG | Spacing | No. of turns | SWG | Spacing | No. of turns | SWG | Spacing | Frequency Coverage |
| 4½ | 18 | One diameter | 2 | 30 | Interwound | 3½ | 30 | Close wound | 12 Mc/s—26 Mc/s |
| 12 | 22 | One diameter | 4½ | 30 | Interwound | 7 | 30 | Close wound | 6 Mc/s—12.5 Mc/s |
| 30 | 24 | One diameter | 9 | 30 | Interwound | 13 | 30 | Close wound | 2.5 Mc/s—6 Mc/s |

The above figures assume the use of a 160 pF tuning capacitor and a 1½in. diameter coil former.

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(that is the tendency of the R.F. current to flow on the surface of the conductor) becomes more pronounced. Since the loss of energy is greater in the centre (a high resistance point) of the conductor than on the "skin," the diameter must be suitably large. This effect becomes more prominent as the frequency increases and, in fact, at very high frequencies the current through the centre of the conductor is so small that tubular conductors can be used instead of solid ones.

In order that the surface resistance should be as small as possible, silver-plated wire is normally used on frequencies higher than 15 Mc/s. On lower frequencies enamelled copper wire is quite suitable, although it should be of high conductivity. There is another factor which affects the "Q"—or goodness—of a coil, and that is the diameter of the wire in relation to the frequency. In order to maintain a low self-capacitance in the winding it is often necessary to space adjacent turns. The difficulty becomes acute when it is remembered that the thicker the wire and the larger the spacing, the greater will be the windings length for a given inductance and the larger will be the turns required.

An excessive number of turns will increase the R.F. resistance of the coil which will lower the "Q," and an excessive length of coil will also impair efficiency. In practice it is found that by spacing the windings by one diameter of the wire used a negligible effect on the self capacitance will be obtained. The ideal coil has a length equal to that of its diameter; that is, a coil 1in. long wound on a 1in. diameter former is ideal. The necessity to increase the wire diameter as the frequency increases helps to enable a good coil shape to be obtained, and even if the 1:1 ratio already mentioned cannot be obtained, if the length is not more than one and a half times the former diameter no extreme loss in efficiency will result. Incidentally, the "Q" of a coil can be calculated from the formula

$$Q=\frac{2\pi f L}{R}$$

where $2\pi=6.28$, f=frequency, L=inductance, and R=R.F. resistance.

Where, on medium waves, almost any insulation will be good enough, when it comes to short-wave work the effect of poor insulation has an increasing effect on efficiency and losses are more and more important. The coil former, then, must be of a high-grade material such as trolitul, ceramic, etc. And the material must be unshrinkable for obvious reasons. So that the leakage path can be increased, commercial coils often have ribbed formers which are threaded to enable the physical characteristics to be maintained.

One type of commercial coil uses metal slugs to increase efficiency. The slug, which is adjustable, slides inside the coil former. It is usual to use a magnetic metal such as iron for this purpose and it will result in an increase in the inductance of the coil. If non-magnetic slugs are used, such as brass or copper, the effective inductance will be lowered.

### Winding Data

The table on page 166 gives details for winding short-wave coils for the T.R.F. receiver. It should be borne in mind that the results will be influenced by the nature of the materials used and the manner in which they are used. Also, the figures given are for unscreened coils. The fitting of coil screens, unless they are clumsily large, results in a lowering of the effective inductance of the coil, which means that the minimum and maximum frequency coverage figures quoted will be raised. If coil screens are used, they should be of such a diameter that the distance between windings and the screen is not less than half the diameter of the coil former. A similar distance should separate the screen from the ends of the coil.

The figures given assume the use of a variable tuning capacitor of 160 pF and are approximate. They are particularly dependent on the total minimum capacitance of the grid circuit: this includes the grid-filament capacitance of the valve, which, in the case of a leaky grid detector, is in series with the grid capacitor. Other factors affecting the figures are the capacitances of the coil and the grid wiring and also the minimum valve of the variable capacitor.

## A New Hearing Aid

THE Belclere Monomite P.3 hearing aid is a new one-piece instrument in a silver rhodium case size only 3¼in. by 2½in. by ¾in., total weight with batteries being under six ounces. The instrument incorporates a printed silver circuit and has three stages of amplification using the newest low consumption Mullard valves. An entirely new type of miniature silver plate alkali accumulator is used for the L.T. supply, and this accumulator will give no less than 20 hours continuous use with the aid before needing recharging. It can be recharged overnight from the electricity supply by means of the charger provided in the presentation case. For the H.T. supply a small 15-volt battery is used, the current consumption from which is so small as to ensure at least 350 hours' service before requiring replacement.

Automatic volume compression is provided in the instrument and a special control enables the degree of automatic volume compression to be adjusted to suit the conditions of listening. A three-position tone-control lever is built in the chassis for adjustment to suit the individual.

Miniature magnetic and crystal receivers and a bone conduction oscillator are available and are interchangeable on the aid. The receiver cord is of the plastic type with plugs moulded on each end to make the conductors moisture proof. Special attention has been given to the design of the amplifier and the microphone mounting to eliminate surface noise, as well as to provide the highest possible intelligibility for speech.

The sound-to-sound effective amplification is over 50 decibels and the frequency range is from 200 to 5,000 cycles per second.

# Programme Pointers

Some Recent Programmes are Reviewed by Our Music Critic,

MAURICE REEVE

I DON'T suppose anyone knows for certain exactly how critical audiences are on festive occasions. As the vast majority of the items given us at these times are of the variety type, the conclusion reached may be that we are apt to take our Christmas radio, for instance, in a lighthearted and festive spirit, with a seasonably uncritical frame of mind, and a "let's turn the knob and see what's on" attitude. That was my outlook up to a point: I did study the *Radio Times* and choose my items rather than twiddle the knob around. I didn't care very much what was served up, but having selected my fare, duty compelled me to take it seriously.

My choices were Commonwealth Christmas, "A Christmas Carol," Gracie's Party, Scrapbook for 1899, B.B.C. Christmas Party and Barrie's "Quality Street." The standards seemed to be up to the B.B.C's usual Christmas level—very good, though several points need individual criticism.

Commonwealth Christmas didn't seem to equal the pre-war Empire tours, many of which were magnificent. This one was very good. Some of the visits paid seemed to be brief to the point of discourteous, and a cheery "Hello, So-and-so, a happy Christmas," might have been called out to those parts which were not stopped at and couldn't be for obvious reasons. One rather felt one was being shown a photo album rather than sightseeing and touring: it was as though the Empire meant slightly less to us than it used to, which, if correct, is doubtless the B.B.C.'s fault and not ours or the Empire's. And the "music" was appallingly inane. Two or three scrappy little brassy sounding bits constantly repeated. If better than this cannot be "specially composed." the producers would be well advised to call upon the classics. Howard Marshall's return was very welcome.

## Dickens's Best?

What a masterpiece "A Christmas Carol" is! And what a genius Dickens was for evoking the spirit of Christmas in all its many manifestations. May we never be without it in our Christmas celebrations! May we have "Dingley Dell" again next year, please? The production was excellent in all ways.

## Gracie Fields

Gracie Fields is one of those artistes who would seem to arouse in the breasts of her listeners the extremes of feeling: either one worships her without shame or qualification, or one is—just not interested. I'm afraid I must own to belonging to the latter group, the small minority, no doubt, and take my life in my hands in the admission. No one would pretend to claim that her "party" on Christmas afternoon was comparable to her classic music-hall turns: naturally, it was not meant to be anything but a famous and beloved star enjoying herself in our hearing, and relaxing amongst her family and friends for our pleasure. It succeeded admirably, and would do so even more on television. Our sympathy goes out to her in her recent bereavement.

## Scrapbooks

I always enjoy Scrapbooks and, as I have said before, they are an ideal form of radio entertainment. This one, for the year 1899, was a very good one. There were many exciting events which culminated in the outbreak of the Boer War. One couldn't help feeling that Mr. Churchill's escape and the episode of the armoured train were hugely overdone, dramatic as it was. But we were grateful for the reminder that it was the year which witnessed the births of "Enigma" and "The Dream of Gerontius," two of the greatest masterpieces in all music, and, from the point of view of the country's glory and fame, the year's outstanding achievement.

The B.B.C.'s Christmas party was on the same lines as Gracie's, though much longer and more elaborate. A galaxy of stars amused everyone for ninety minutes.

What a charming play Barrie could write, thoroughly sentimental, unpractical and nonsensical, but wholly charming, witty and nostalgic. How delightful Seymour Hicks and Ellaline Terriss must have been in the original stage production. The play being set in much the same period as "Vanity Fair," the Napoleonic Wars, the medium of the radio made it sound exactly the same; it might well have been a continuation of the recent "Vanity Fair" Sunday evening serial. Gladys Young, Dulcie Gray and Michael Denison were the chief protagonists in a very excellent performance.

## Riddle of the Sands

So much for Christmas. That famous pre-1914 best-seller, "The Riddle of the Sands," wherein the eternal sleepy, muddle-headed Englishman stumbles across his country's deadly danger, made a capital serial. The story, after the style of John Buchan, and the character, like that played almost throughout the war by the late Mr. Dennis Eadie in "The Man who Stayed at Home," is fascinating by virtue of its unsophisticated reality and its dramatic unfolding. One can scarcely realise, even now, that its brilliant author, Erskine Childers, was shot as a traitor in the Irish Rebellion.

## "Miss Hook of Holland"

The only points which the revival of the old Edwardian favourite musical comedy "Miss Hook of Holland" served to prove were that not only is this type of entertainment as dead as the dol-drums, but that it is thoroughly unsuited to the blind radio. It might go better at Alexandra Palace, though I doubt it. The quietness and salubriousness of the music and the propriety and placidity of the dialogue are, by more modern standards, unbelievable. How gauche and crude

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our fathers—and mothers—were, in some things. "Miss Hook of Holland!" Were they advertising the then Great Eastern Railway's route to Holland via Harwich and the H. of H.? Wouldn't "The Dutch Tulip" have sounded much more romantic? Or even "Holland," in the manner of "Oklahoma?"

### Music Hall

At the risk of being charged a "highbrow" or a hyper-critical observer, I must unreservedly condemn Music Hall and Half Century Quiz. The Music Hall programme on New Year's Eve touched an all time low, and it has been near rock bottom for some considerable time now; it was shocking. No seaside concert party would have failed to exceed its standard of wit or vocal ability. Vic Oliver, at nothing like his best, stood out head and shoulders. Surely, if the producers do nothing else, and if we must have a reference to a zither, they could at least call the programme together and order that one reference be made to it and only one, detailing the "comedian" to make it, if necessary. Zithers, Ground Nuts, Sir Stafford—how sick we all are of them as gags.

### Quiz

Half Century Quiz was a major blunder, run as it was. Why persons of eminence in public life should have been gathered together to listen to childish imitations of such things as Bleriot flying the channel, or musical comedy songs badly sung, and then asked to guess what they were, is beyond me to imagine. Although more has happened, and greater social changes achieved, in the last fifty years than in almost any comparable period of history, the producers seemed to be relying on musical shows and hit tunes for almost all their resources of show making. A dreadfully poor show.

It was good to hear "The Last Days of Hitler" again; the fantastic story can be listened to as history as well as incomparable entertainment.

The series of programmes devoted to the music of Liszt—now in progress—is as valuable as it is interesting. Some dross must be borne with for the gold that is there. The scheme of the programmes makes this unavoidable.

"Reunion Dinner," in which we met the "types" that foregather at these functions, was delightfully funny and realistic.

# News from the Clubs

## TORBAY AMATEUR RADIO SOCIETY

**Hon. Sec.:** K. J. Grimes (G3AVF), 3, Clarendon Park, Tor Vale, Torquay.

A WELL-ATTENDED meeting was held on January 21st at the Y.M.C.A., Torquay.

The chairman of the Society, Mr. F. J. Wadman (G2GK), who also welcomed members of the British Sound Recording Association, introduced Mr. Sands, A.M.Brit.I.R.E., who gave a most interesting lecture on "Wire Recording," followed by the demonstration of an instrument of his own design. The demonstration showed how versatile the instrument could be, as included in the recordings were some transmissions taken from the two-metre band.

## STOURBRIDGE AND DISTRICT AMATEUR RADIO SOCIETY

**Hon. Sec.:** W. A. Higgins, 28, Kingsley Road, Kingswinford.

AT our last meeting there was a very good attendance to hear an excellent talk on "Clapp V.F.O. and Some Interesting Constructional Innovations," given by Mr. C. Naylor-Strong (G2RQ). The Society is holding a competition for two trophies awarded by the President G6OI, and is entering gear in a Hobbies Exhibition.

## ROMFORD AND DISTRICT AMATEUR RADIO SOCIETY

**Hon. Sec.:** D. L. K. Coppendale (G3BNI), 9, Morden Road, Chadwell Heath, Essex.

AT the annual general meeting the officers for 1950 were elected. The chairman gave a brief review of the past year's activities, with special mention of the outdoor events entered into by the Club. There were several D.F. contests during the summer months and in the autumn: the club had a display of transmitting and receiving equipment at the local Y.M.C.A. Hobbies Exhibition. The general public were very interested in the transmitting activities of the exhibition and demonstrations took place every evening. The "shack" now has a decent floor covering laid down, and tea has been arranged, much to the delight of all members. A R107 receiver has been purchased, which will be used for the station RX as well as Field Day. The secretary is very anxious to increase the membership, so if there are any interested persons living locally, would they please contact the secretary, either at the club or by letter or telephone Seven Kings 3594.

## THE EXETER AND DISTRICT RADIO SOCIETY

**Hon. Sec.:** D. W. Thomasson, Ayton Cottage, Matford Avenue, Exeter.

THE winter session so far has been very successful under the new secretary, and there have been lectures on Direction-finding, Radiolympia, Apparatus design, Television (two), and Negative feedback, and a Mullard film-strip, "Valves," has been shown.

A club news-letter has been produced. Meetings are held every Thursday at 7 p.m. Further details are obtainable from the secretary.

## SOUTH MANCHESTER RADIO CLUB

**Hon. Sec.:** M. I. Wilks (G3FSW), 57, Longley Lane, Northenden, Manchester.

NEW members still come along, and the first lady member was recently enrolled. She was Mrs. Wood, wife of G5SI, who would like to form a ladies' section.

At the meeting on the 13th and also the 20th, the club station (G3FVA) was on the air and several local QSO's were made. Two cups will be presented annually for the best lecture given by a member and also for the best piece of equipment displayed by members during the year.

Plans are going ahead with a club news-sheet, "The Intercom," which it is hoped to duplicate and send to members. Meetings are being held fortnightly as usual, and classes in both fast and slow morse are being run by G5SI and G2HNR, in addition to those in preparation for the Radio Amateurs' Examination under G6DX and G3EON.

## KINGSTON AND DISTRICT AMATEUR RADIO SOCIETY

**Hon. Sec.:** R. S. Babbs, B.Sc., 28, Grove Lane, Kingston.

THE meeting held at the Society's new headquarters on January 18th was a great success. A Junk Sale was held, followed by a Brains Trust, whose answers to the questions were very instructive to all present.

## THE WEST MIDDLESEX AMATEUR RADIO CLUB

**Hon. Sec.:** H. C. Bostock (G3BWC), 1, Grange Road, Hayes, Middx.

THE club membership continues to increase steadily in spite of lack of proper accommodation, which tends to restrict the practical side of the club.

Members have recently been entertained by lectures on Ohmmeters, Aerial Demonstrations, and Junk Sales.

The future programme includes lectures on Electronic Gyroscopes, Amateur Receivers, and Multivibrators.

Meetings continue to be held on the second and fourth Wednesdays of every month at 7.30 p.m., at the Labour Hall, Uxbridge Road, Southall, Middx.

Visitors and prospective members can be assured of a warm and sincere welcome.

## NEW CLUBS

### EXETER

A NEW club for short-wave listeners only has been started in Exeter.

The club, the Exeter Short-wave Listeners' Group, caters for members of the I.S.W.L. and B.S.W.L., and also for non-members who are interested in short-wave reception and experimenting.

Meetings are held on the second and fourth Wednesdays in each month, the addresses of meeting-places and details of the programme for 1950 may be obtained from the secretary, Mr. G. J. Fowle, 20, Magdalen Road, Exeter.

### ECCLES

LOCAL residents interested in the formation of a radio club in the Eccles (Lancs) area are invited to write to S. Watkin, 6, Stanley Avenue, Eccles.


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).

## R.F. Unit 24

SIR,—While experimenting with R1355 and R.F. units 24, 25 and 26, I found that R.F.24 can be converted to T.V. sound (A.P.).

This is easily done by turning the range-switch to range 4, removing a few turns from the R.F. and mixer coils, and spacing the remainder a little farther apart.

The oscillator section does not need any alteration.

I had no trouble at all in finding A.P. sound, and the alterations and testing were completed in a very short time.—DENNIS E. GATES (Gt. Yarmouth).

## Miller Time-base

SIR,—The outstanding problem of frame non-linearity with Miller oscillators has been most ably solved by E. N. Bradley.

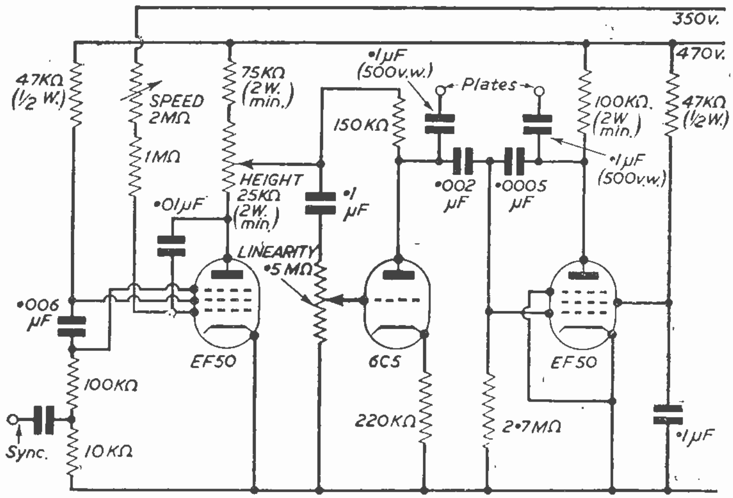
It seems probable, however, that many readers have dismissed Mr. Bradley's circuit as being too involved, or even not practicable, for use in television.

The accompanying circuit, which I have adapted from it, leaves very little to be desired and I am most indebted to Mr. Bradley for his very excellent contribution.

The only "fault" to be found is in a bright white line on top of the raster but, if a mask is being used, the height can be adjusted until it disappears from view.

Some "fiddling" must be done with the height, speed and linearity controls, but this is a simple operation and can be carried out quite easily by watching the relative width between lines.

It is recommended that all circuit values and voltages be strictly followed. Such valves as the S.P.61 or 6AC7 can be used, as can any valve similar to the 6C5, but good results cannot then be guaranteed. The height control (25 KΩ) and the 75 KΩ resistor can be replaced by a 100 KΩ potentiometer, but the present arrangement permits lower wattages to be used, with ample height control.—N. E. MOULD (Shirley, Southampton).




Note: All Capacitors Except The •1μF's Must Be Mica

*Mr. Mould's time-base circuit.*

## Series-condenser Heater Circuits

SIR,—I was surprised to read Mr. Bradley's suggestion that the "switch-on" surge is of no importance, as far as valve heaters are concerned, as I know to my cost. I had four valves burn out in one year with a series-condenser heater circuit.

There is an obvious remedy in the form of a "Brimistor" in the heater chain; this will completely eliminate any initial surge, with a resultant increase in valve life. The circuit then appears ideal, with a very slow current build-up to the correct value regulated by the condenser.—G. J. BUTLER (Fulham).

## VCR97

SIR,—Regarding the picture cut-off experienced by several readers with the VCR97, I have overcome this, in a number of T.V. sets I have built for friends, in the following manner.

When first tests are carried out, the tube base is wired up as follows. When viewed from the rear, the key slot is placed at the top, and pins numbered

8 and 12 are used as frame deflectors, and 9 and 11 as line-deflectors.

If cut-off is present, I remove the wires from these pins and turn the base so that the key slot is at right-angles to the top (on the left) still looking at the base from the rear.

Pins 8 and 12 are now used as line-deflectors and 9 and 11 as frame.

This is also a good idea to try out when insufficient width or height is obtained with either the VCR97 or any of the VCR517s.

Incidentally, if a larger picture is required, it is only necessary to increase the size of the resistor in the E.H.T. line, but the brilliance will suffer somewhat.

I have not experienced the non-linearity complained of by various constructors, with the exception of a slight opening out of the top eight to 10 lines, but as I always use width and height-controls in addition to frame and line-hold controls, this can be largely overcome by manipulation of frame-hold and height adjustments.

All these sets have been built with SP61s in the time-bases, and an H.T. voltage of 430.—E. J. WALKER (S.W.12).

SIR,—The focusing difficulties experienced by your correspondent, E. V. Ward (February issue) in connection with the VCR97 tube are not at all uncommon, and are doubtless due to astigmatism of the electron lens system which causes a distortion in precisely the same manner as in an optical lens. The fault may arise from several causes, chief of which is that the electron gun assembly of the tube is not correctly aligned with the rest of the electrodes. This defect may easily occur in these tubes which, after all, were never intended for television work which demands a high standard of accuracy in tube manufacture, and the symptoms are that the tube appears to have two "in focus" positions. In one of these the spot is elongated vertically and in the other it is flattened. In between these two points lies the so-called "circle of least confusion," at which the spot is at its best definition, and in this position should give the best picture (although not, of course, the best representation of the vertical test card lines). If Mr. Ward is not using push-pull deflection for his time-bases this could introduce the trouble due to the unsymmetrical potentials on the deflector plates, but as he says the fault remains with the time-bases inoperative, the electrode structure is probably at fault in his case.

With regard to the Miller time-base, I find that my own gives very good linearity except for less than ¼in. at the top of the frame scan, which is not noticeable. The H.T. used is 450 volts to an EF50 and its associated paraphase valve, with 47 KΩ anode loads and 33 KΩ screen resistors. The charging resistance is variable between 3 and 5 MΩ and this is taken to 300 volts H.T., the time-base condenser being .02μF. The output is adequate for a 5in. by 4in. picture, and higher anode loads seem to be unnecessary, provided the E.H.T. is kept below about 1,800 volts, and the resulting picture is bright enough and the spot size small enough for most purposes. Any lack of brilliance there may be is more than compensated for by the distortionless picture obtainable.—A. W. DALE (Leeds).

### Simplified Contrast Expander

SIR,—Referring to the above article in the February issue, two points which are causing some confusion in the minds of readers have been drawn to my notice, and I should like to clear these up.

First, an error in nomenclature of the amplifier valve has arisen. Any reference to a 6F7 should be read as 6J7. This includes the expander amplifier valve also, shown in Fig. 2.

Secondly, the paragraph headed "Change to 6L7" is misleading, and gives an incorrect idea of the connection of this valve. Re-writing the first few lines, it reads as follows:

". . . the 6J7 . . . should be changed for a 6L7 which is a heptode with the third grid connected to the same pin as is the suppressor grid of a pentode of the 6J7 type. Owing to the internal disposition of the 6L7 grids the control of amplification by varying the bias on the third grid is quite large for a much smaller voltage than would be required by a 6J7 for the same effect."

The reference to a suppressor grid (6L7) in connection with standing negative bias is, from the foregoing, intended to refer to the third grid. The suppressor grid of a 6L7 is already internally wired to cathode.

If these points are kept in mind no further trouble should be encountered in construction.—S. SIMPSON (Fife).

## ALTERNATIVE BIAS SUPPLY

(*continued from page 146.*)

in, say, an amplifier, could be replaced by a double-diode-triode or double-diode-pentode, thus giving the additional diode required at little, if any, extra cost. The only qualification necessary is that the valve chosen should have its cathode connected to chassis (which it should have, in most cases, seeing that it now receives grid- instead of cathode-bias!) and that it is not used in an early stage of an amplifier where it might be sensitive to hum pick-up.

Another component, the resistor $R_1$, should also incur no further expense. There is no necessity actually to use an additional resistor as it may be replaced by one or more of the valve heaters (see Fig. 6).

The other resistors and condensers used do not make for great expense, and will possibly not only counterbalance, but may actually prove to be cheaper than those which would normally be used for the various cathode bias circuits which they replace.

**Frequency of the Mains Supplies**

An important point which should be remembered is that the correct bias voltage will only be obtained when using mains supplies of similar *frequency*. As, however, almost all British supplies are standardised at 50 cycles, this presents no difficulty.

In conclusion, the writer hopes that the description of this biasing arrangement will prove of interest to constructors and will form the basis of further experimenting along these lines with A.C./D.C. equipment.

# Impressions on the Wax

## Review of the Latest Gramophone Records

THE Forty-eight Preludes and Fugues, by Bach, remain a monument still unsurpassed in their kind. They are perhaps the finest existing examples of preludes and fugues illustrating all the main keys, and although Bach's aim in writing them was technical, there is considerable emotional experience distilled in them. This month Denis Matthews has made a recording of "Prelude and Fugue No. 8 in E Flat Minor," on *Columbia DX*1635. He has a very extensive knowledge of the "Forty-eight," which enables him to give a first-class performance.

The "Tragic Overture," by Brahms, is constructed with his customary skill, the mood sustained with remarkable persistence except for a brief consolatory episode allotted to the violins. There is a fugato section based on matter from the first subject, a fine passage showing Brahms in full command of traditional forms. The overture occupies three sides of two records, *Columbia LX*1251-2, played by the Philharmonia Orchestra, conducted by Paul Kletzki, and the epilogue is an attractive arrangement of the Hungarian Dance No. 5, one of the many happy results of Brahms' early interest in Hungarian folk music.

After an interval of twelve years the series of International Chopin Competitions, inaugurated in 1927, was resumed in Warsaw in September, 1949. A jury composed of musicians from fifteen countries carefully weighed up the merits of all the competitors and finally awarded the first prize to two candidates of equal quality—Halina Stefanska and a Russian pianist. It may be accepted without question that the standard of playing achieved by the winners was extremely high. This month Stefanska makes her début for His Master's Voice, with a recording of Chopin's Mazurka in C Sharp Minor, Op. 63, No 3 and Mazurka in A Minor, Op. 68, No. 2, on *H.M.V. B*9866. The mastery displayed in the Mazurkas she has chosen promises a very great future for this gifted pianist.

### Vocal

Jussi Bjorling has been well served by the gramophone. His career on records has been one of steady development, beginning when he was only eight years old. Now in 1950, Bjorling is in the front rank of operatic tenors, with a magnificent voice of Caruso's power and a completely mature artistic personality. Accompanied by the Stockholm Concert Association Orchestra, conducted by Nils Grevillius, he has recorded in Italian "L'Alba Separa Dalla Luce L'ombra" and "Angels Guard Thee," which is sung in English, on *H.M.V. DA*1931.

The famous melody of "Star of Eve" must be one of Wagner's most poetical inspirations. Redvers Llewellyn, with the Philharmonia Orchestra, conducted by Warwick Braithwaite, gives a deeply sincere performance on *H.M.V. C*3952, and one feels that he is in truth Wolfram, the faithful friend of Tannhäuser. Turning the record over we come to the scene in the hall of the Wartburg. In this the melody is in the style of a recitative and, if not so familiar as its companion piece, has attractions all its own.

"The Lass with the Delicate Air" and its Polish companion, "Mother Dear," give Gwen Catley splendid opportunities for showing her excellent style of singing on *H.M.V. B*9867. Not, as is often thought, composed by Thomas Arne, the famous "Lass with the Delicate Air" is the work of his son, Michael.

### Variety

For his latest H.M.V. recording, George Melachrino has arranged a selection of intriguing tunes from the film "Look for the Silver Lining." As always, Melachrino extracts the best from his orchestra on *H.M.V. C*3957.

It is a long time since the wonderfully rich voices of the Don Cossack Choir were heard on records in this country—and that makes their return all the more welcome, for their singing has lost none of its old magic. They have recorded "Twelve Robbers" and "A Hazel Tree," on *Columbia DX*1639.

For recordings of the latest popular songs you can take your pick from Bill Johnson singing, "I Can Dream, Can't I" and "The Road to Sante Fe," on *Columbia DB*2648; the Tanner Sisters singing, "Mamma Knows Best" and "Round Her Neck She Wore a Yellow Ribbon," on *Columbia B*9873; Perry Como singing, "The Meadows of Heaven" and "A Dreamer's Holiday," on *H.M.V. B*9876; Frank Sinatra singing, "It Happens Every Spring" and "If I Ever Love Again," on *Columbia DB*2644; and the Radio Revellers singing "Dear Hearts and Gentle People" coupled with "She Wore a Yellow Ribbon," on *Columbia DB*2640.

### Dance Music

Most of the hit tunes have been recorded by a number of popular bands. This month Geraldo puts his distinctive sweet-music stamp on two British tunes, "Best of All" and "Long, Long Ago," which he and his orchestra have recorded on *Parlophone F*2399. Harry Roy and his Band introduce two well-tried favourites—"Tiger Rag" and "Canadian Capers," on *Parlophone F*1919. Oscar Rabin and his Band have recorded "Jealous Heart" and "Someday My Heart Will Awake," on *Parlophone F*2400, and Robert Inglez and his Orchestra introduce "Our Love Story" and "Scottish Samba," on *Parlophone R*3259. For the jazz enthusiast there is "Memphis Blues" and "Maple Leaf Rag," played by Humphrey Lyttelton and his Band, on *Parlophone R*3257.

**NEW R.S.G.B.** "Amateur Radio" Publications.—Simple Transmitting Equipment, 52 p.p., **2/3.** Receivers, 96 p.p., **3/9.** Both fully illustrated. The Transmitting Licence (3rd Edition), **1/-** (below).

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**BRITISH SHORT WAVE LEAGUE** (founded 1935)—over 20 departments (QSL Bureau; DX Certificates; Technical; Translations, etc.) and monthly "Short Wave Review." For membership details send S.A.E. H.Q., 53, Victoria Street, London, S.W.1.

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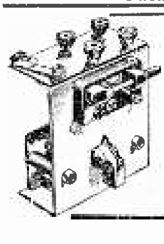

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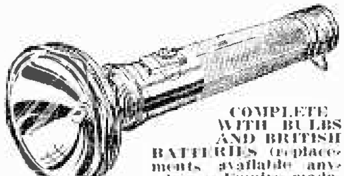

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