

PRACTICAL WIRELESS, FEBRUARY 1950

Albert E. Ryan

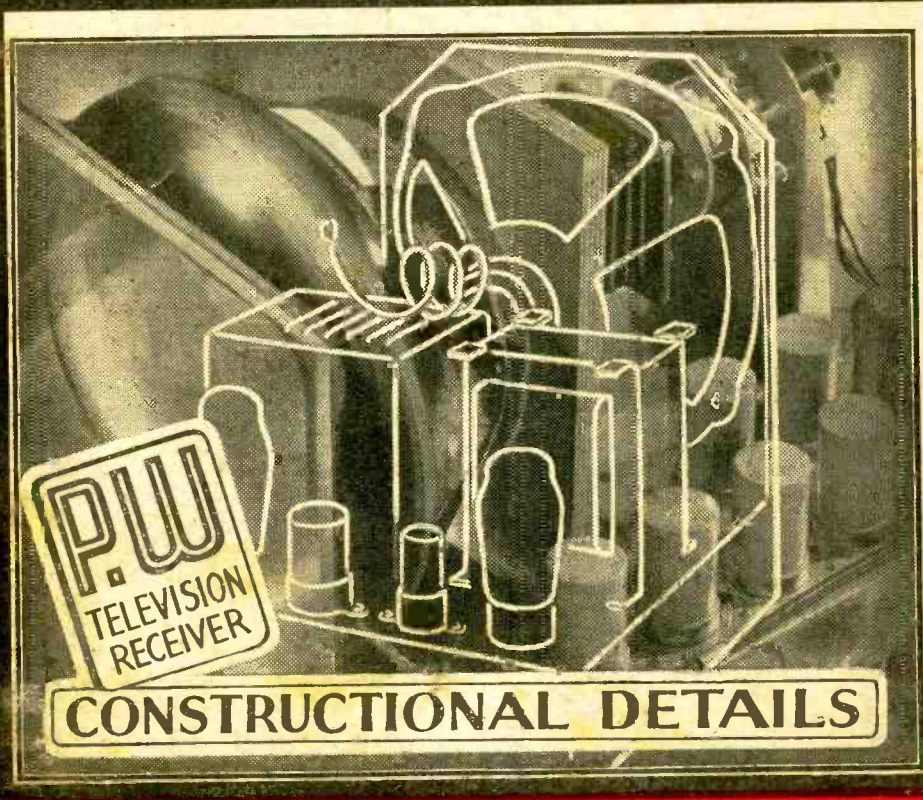
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Vol. 26, No. 523
FEBRUARY, 1950

EDITOR:
F. J. CAMM

PRACTICAL WIRELESS

AND PRACTICAL TELEVISION



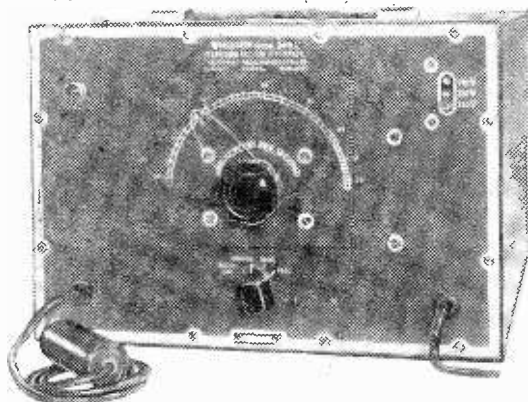
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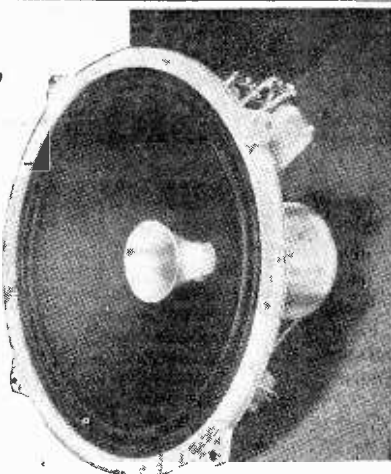
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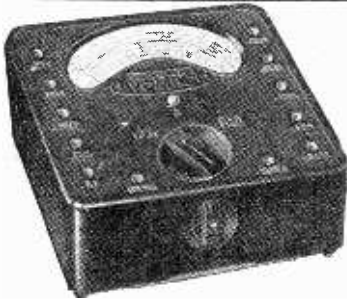
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Complete with leads, interchangeable prods and crocodile clips, and instruction book.

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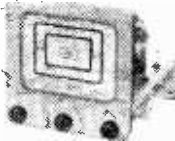
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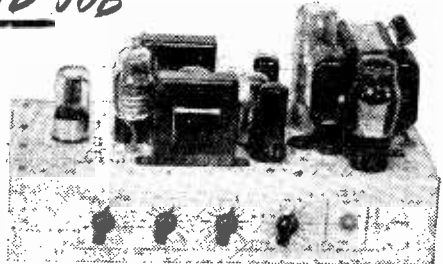
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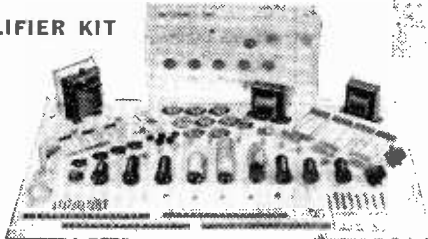
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Practical Wireless

18th YEAR
OF ISSUE

and PRACTICAL TELEVISION

EVERY MONTH.
VOL. XXVI. No. 523 FEBRUARY, 1950

Editor F. J. CAMM

COMMENTS OF THE MONTH

BY THE EDITOR

The Advance of Television

THERE can be no doubt that the opening of the Sutton Coldfield Television Station has given a terrific impetus to interest in television and to the demand for television receivers and equipment. The production of television receivers has been stepped up considerably since the announcement during the run of Radiolympia that the new station was to be opened on December 17th. But even so manufacturers are behind with deliveries. There is, too, great activity among those who prefer to build rather than buy, and the publication of our series of articles explaining the construction of a first-class television receiver indicates the solidity of that large band of experimenters who did so much to help in the perfection of radio.

Good as television is, it has a long way to go. Perfection cannot always be achieved in the laboratory; and so in these early days every viewer having technical qualifications (and all our readers are in that category) should regard himself as a monitor, carefully observing the programmes, recording results and passing along for the benefit of the industry any details of any adjustments or any experiments which he has found to be successful.

In the very early days of radio the personnel which built the industry was drawn from the experimenters. The position to-day is that we have many thousands of highly-qualified radio engineers able to divert their abilities to television, with a sound basic knowledge obtained by building receivers and experimenting with them nearly 30 years ago. The R.S.G.B. membership has performed signal service to the industry, which has been adequately acknowledged both in the Press and from public platforms. The time is ripe for the formation of a similar body specialising in television only and working closely with the industry.

Many thousands who had deserted the ranks of the home constructor have returned to the ranks with their appetites whetted by the remarkable progress which television has made.

As a technical journal it is our duty to publish technical information and the news of this offspring of radio, and in past issues we have devoted considerable space to this new science.

Although the service at present covers two service areas, each of 25 miles radius, we do not make apologies for the space we have devoted to television. Sooner or later television stations will serve the whole of the country and it is the duty of every reader to make himself acquainted with this new science in advance.

In 20 years' time the television receiver we know to-day will be obsolete, but progress in these difficult times cannot be more rapid. If, therefore, you are outside the service area you should still follow the trends and the television receivers described herein.

Errors in Direction Finding

ERRORS in direction finding by radio at high frequencies may occur because of deviations from the great circle plane of waves reflected from the ionosphere. The Department of Scientific and Industrial Research has recently published a report which gives details of the results of investigations on this problem that have been carried out during the years 1938-1947.

Some errors in the indication of certain direction finders occur when waves are received having a state of polarisation different from that for which the direction finder is designed. Instrumental errors of this sort vary when the polarisation of the received waves varies. They are reduced to negligible proportions in the spaced-loop type of direction finder used in the investigations. This equipment can indicate the correct direction of arrival of the waves to within a fraction of a degree. It has been found, however, that the bearing obtained is not necessarily in the great circle plane through the sending station.

Deviations from the great circle are random and variable, and may amount to several degrees. They are ascribed to a tilting of the ionospheric layer at the point of reflection of upwards of one or two degrees. The extent of these tilts is not known, but the experiments seem to indicate that they may be measured in tens of kilometres.

The tilts, some of which are systematic and occur at particular times, produce the most serious effects at short ranges. F.J.C.

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ROUND the WORLD of WIRELESS

Broadcast Receiving Licences

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

Region	Number
London Postal	2,294,000
Home Counties	1,630,000
Midland	1,686,000
North-eastern	1,869,000
North-western	1,574,000
South-western	1,039,000
Welsh and Border Counties ..	717,000
Total England and Wales ..	10,809,000
Scotland	1,120,000
Northern Ireland	196,000
Grand Total	12,125,000

The above total includes 188,350 television licences.

The Post Office has reason to believe that some sets are still being operated without licences. Each family using wireless apparatus, whether portable or otherwise, in a house, part of a house, or flat should have a licence.

Mullard in Birmingham

MULLARD ELECTRONIC PRODUCTS, LTD., announce that, as from December 1st, 1949, a complete valve and cathode-ray tube service department will operate from 108, Dale End, Birmingham, 4.

This department, which will work in close co-operation with the main Mullard valve service department at Waddon, Surrey, is intended primarily to serve radio and television dealers in the Birmingham area. The service will, however, be restricted to callers, and there will be no delivery or collection facilities available.

Egypt Buys British

THE Egyptian Government has placed with Standard Telephones and Cables, Ltd., London, a contract for the supply of two high-power short-wave broadcasting transmitters.

These transmitters, of a type similar to those used by the B.B.C., have two channels, an output power of 100 to 140 kW, and will operate in the 13-49 metre band.

The broadcasting station building, situated at Abu Zabal, about 20 kilometres from Cairo, is now under construction, and when in-

stalled, the transmitters will inaugurate the first high-power broadcasting service of the Egyptian administration.

50 Years' Training by Post

THE Bennett College, Sheffield, the famous study-at-home organisation, celebrated its 50th anniversary last year.

Since the college first opened in 1900 with a handful of students, it has grown year by year until to-day Bennett College trained men are to be found holding important posts at home and abroad.

Radiotelephone Service with S.S. "Oslofjord"

THE Postmaster-General announces that telephone service is now available with the Norwegian liner S.S. *Oslofjord*.

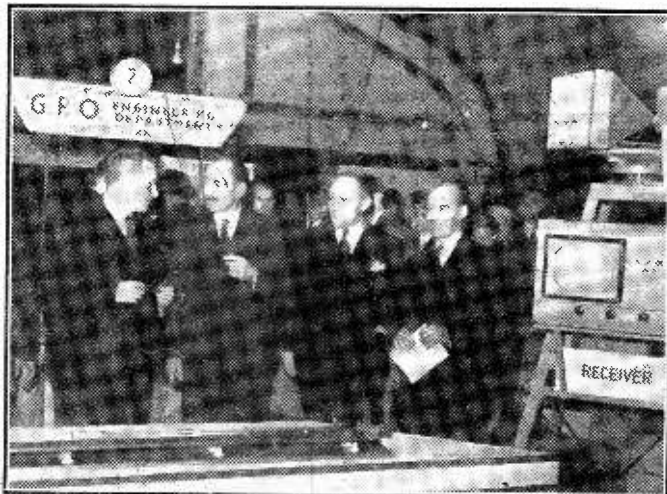
The charges for calls to the *Oslofjord* are the same as those for calls to British liners.

B.I.R.E.

THE following meetings have been arranged for January, 1950:

London Section.—London School of Hygiene and Tropical Medicine, Keppel Street, W.C.1 (meetings commence at 6.30 p.m.). January 19th, A. J. Tyrrell (Member): "The Performance and Stability of Permanent Magnets."

South Midlands Section.—Room A5, The Technical College, Coventry (meetings commence at



Sir Archibald Gill (Engineer-in-Chief, G.P.O.), Lord Sandhurst, and the President and President Elect of the R.S.G.B. at the Third Amateur Radio Exhibition. (See page 60.)

7 p.m.). January 26th, M. J. Millane, B.Sc.: "Commercial Marine Radar."

West Midlands Section.—Wolverhampton and Staffordshire Technical College, Wulfruna Street, Wolverhampton (meetings commence at 7 p.m.). January 25th, A. J. Tyrrell (Member): "The Performance and Stability of Permanent Magnets."

North Eastern Section.—Neville Hall, Westgate Road, Newcastle-on-Tyne (meetings commence at 6 p.m.). January 18th, G. H. Hickling: "Activities and Equipment of an Industrial Electronic Laboratory."

Mr. L. Hotine

THE Senior Superintendent Engineer, Mr. Leslie Hotine, is leaving the B.B.C. after more than 26 years' service. Mr. Hotine joined the Corporation in 1923 as Engineer-in-Charge of the Glasgow station, and was successively Engineer-in-Charge of Daventry and of Brookmans Park. He then joined the head office staff as Superintendent Engineer, Transmitters, and continued in that post until 1943, when he was appointed Senior Superintendent Engineer.

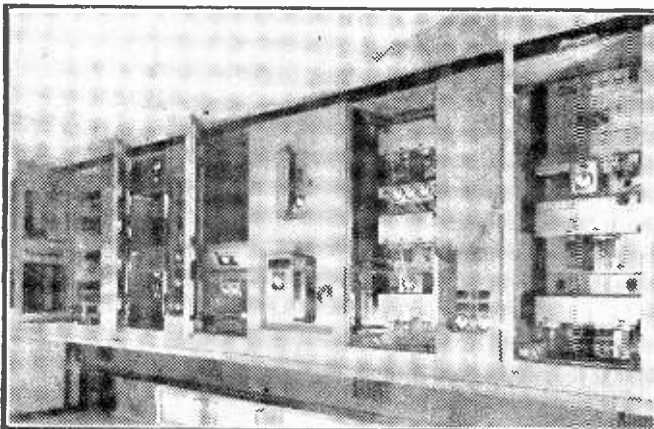
Mr. J. P. Jeffcock, O.B.E.

MR. J. P. JEFFCOCK, O.B.E., M.I.E.E., F.R.Ae.S., who until recently was Director General of Civil Aviation in the Government of Pakistan, has now joined Mullard Electronic Products, Ltd., as commercial manager of their Equipment Division. He has also been appointed a director of Mullard Equipment, Ltd., the subsidiary company which manufactures telecommunications and scientific equipment.

Mr. Jeffcock, who is 39, was educated at Lancing College and later studied electrical engineering at the City and Guilds College, London.

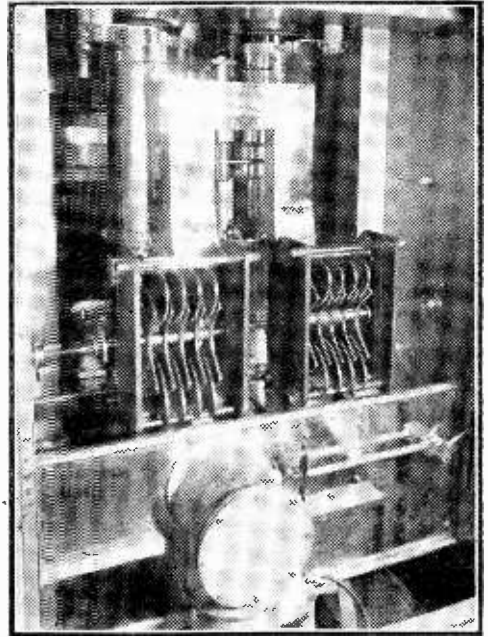
"Call Us Up and Buy One"

TWO-WAY radio communication has been extended to ice-cream transport. T. Wall & Sons, Ltd., of London, Manchester and Edinburgh, have installed Pye transmitter-receiver



The vision transmitter at Sutton Coldfield. The modulator stages are on the left, and the R.F. stages on the right. Other pictures will be found on page 7 in the television supplement.

equipment in a 30 cwt. Bedford and a 25 cwt. Ford van, at present operating experimentally in the New Forest area and on the Isle of Wight.



Rear view of the output stage of the new Sutton Coldfield transmitter. The CAT21 valves are above the vertical tubes, on front are the output tuning capacitors, and below is the concentric feeder leading to the vestigial sideband filter.

With a main transmitter-receiver at the headquarters depot in Southampton, Wall's can control the operations of these vehicles. In the future, when there are no limitations of supply, should a fête, race-meeting, sudden heat-wave or other emergency cause a run on ice-cream stocks, vans with extra supplies may be directed to the area at almost a moment's notice. Shopkeepers will telephone the central depot, whence a message will immediately be radioed to the nearest van.

B.B.C. Studio in Dundee

THE B.B.C. has recently completed and brought into service a studio in Dundee. As a result it is now possible to bring local talent before the microphone without the performers having to make the journey to Edinburgh or Aberdeen as they have had to in the past.

The studio is in the Dundee Corporation's Coldside Library. It is approximately 50ft. long and 25ft. wide, and is equipped with standard B.B.C. O.B. equipment for 4 microphones.

The Practical Wireless Television Receiver-3

Chassis Details and Preliminary Constructional Work

THE illustration below shows how the receiver is divided into sections, vertical screens being erected on the chassis to provide most of the divisions. To render construction as simple as possible, these screens are placed in after most of the wiring has been completed and thus all parts are readily accessible for the attachment of nuts, etc., and for the actual wiring. The R.F. valveholders in the vision and sound sections are fitted with vertical screens and the associated resistors, and condensers are wired up before mounting the valveholders in place, whilst the screen separating sections 4 and 5 is fitted with the ready-wired tag-boards and the two oscillator chokes before it is put into position. However, these facts will be fully covered when dealing with the wiring next month, and the first part of the work is to make up the chassis and screens. Fig. 2 shows the layout of the chassis and it will be noted that only two drills and a disc-cutter or special chassis punch (for the valveholders) are needed. The chassis should be cut from fairly stout aluminium—say 20 S.W.G., and the remaining screens and focusing unit mount from the same material. In addition six pieces of stout tinplate are also required cut to the size shown in the top right-hand corner of Fig. 4 on page 52. These are mounted on the valveholders as already mentioned.

Chassis Drilling

The chassis should be cut out to the dimensions given in Fig. 2, noting that a cut must be made at each corner to allow the sides to be turned down and an overlap provided. For the valveholders $1\frac{1}{2}$ in. and $1\frac{1}{4}$ in. holes are needed, and no difficulty should be experienced in identifying which is which, although in order to keep the diagram clear the measurements are only given twice. All of the small holes shown are for the clearance of the 6 BA bolts used for attaching screens, valveholders, coils, etc., and may be drilled either with a $\frac{1}{8}$ in. or a No. 33 drill. The remaining holes are $\frac{3}{16}$ in. diameter and on the rear strip you can open out a $\frac{3}{16}$ in. hole to approximately $\frac{1}{4}$ in. to accommodate a larger grommet to take the grouped supply leads, or, alternatively, may drill two holes, each $\frac{3}{16}$ in., and use two grommets and split the supply leads into two groups. At the front runner of the chassis are two further holes which need not necessarily be grommetted, but

in some cabinet designs it may be preferable to omit the two brackets mounted at this position and mount the volume and brilliancy controls direct on the cabinet front, taking the leads from these controls through the holes or below the chassis, according to the method of installing the chassis. Before drilling the mounting holes for the four Haynes chokes and transformers, check up the spacing on the lugs, or lay them over the screen (lower one in Fig. 3) and the sides of the chassis and mark them from the actual component. Incidentally two 4 BA screws will have to be used to attach the line transformer and the original holes may be opened with a file tang if a suitable drill is not available. When mounting these four components carefully clean away the wax round the feet to ensure that the holding down nuts are well locked down.

Mounting the Components

When the chassis has been drilled satisfactorily it should be bent up and the corners locked with $\frac{1}{2}$ in. 6 BA bolts and nuts. Bending may be carried out by clamping the metal between two pieces of stout wood or lengths of metal clamped in a suitable vice. At each of the coil mounting positions fit a $\frac{1}{2}$ in. bolt and lock it in position with a nut. Later,

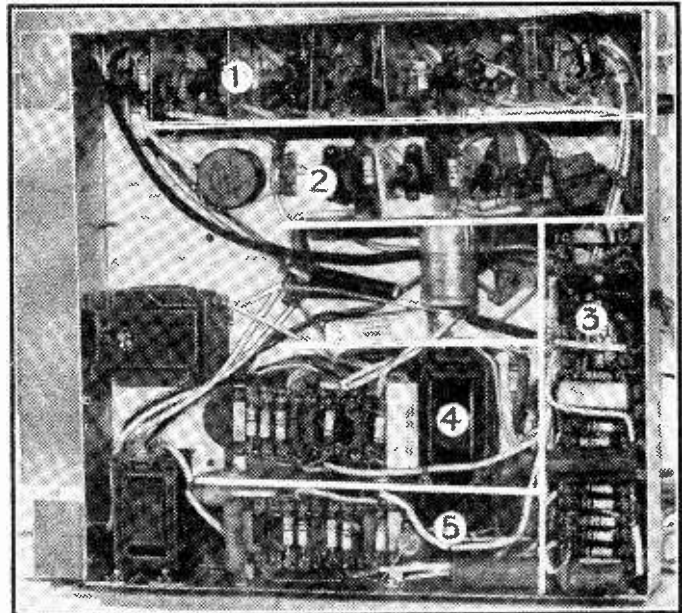


Fig. 1.—Underside of chassis. Section 1 is the vision receiver; Section 2 is the sound receiver; Section 3 is the sync. separator; Section 4 is the frame timebase; Section 5 is the line timebase.

the coil formers may be dropped over the projecting bolts and locked up, and this avoids the difficulty of having to register the holes in chassis and coil-former and pass a bolt through and put on a nut at the same time. Attach the various controls—contrast being that at the top of section 2 with the two 500 ohms controls on a level with it at the other side of the chassis. The Form and Hold controls are in a line behind these two (viewing the chassis from the front) and reading from left to right are: Hold; Form (Line) and Hold; Form (Frame). Next mount the two output chokes on the front and sides of the chassis and then all the valve holders— noting that the screws holding the first and sixth vision valveholders also grip the two coaxial clamping pieces. The five 3-way tag strips are then fitted, after which the 32 μ F. condenser should be attached to the 7in. vertical screen and then the two chokes should be attached to the 8in. screen.

Valveholders

The B9G valveholders are silver plated, and as will be seen next month the earthed points of the anode and grid circuits are "commoned" on the actual valveholders, which are built up as small, separate units. For the time being the small triplate screens should be soldered to six of these holders, placing them across pins 5 and 8 in such a manner that the central spigot clamping tag is against the screen, soldering the tag to the screen on one side and the two valveholder tags on the other side. The screens should be pushed down level with the top of the insulated part of the valveholder and this will leave space between the screen and chassis when in position to permit the L.T. and H.T. leads to pass between them.

The only remaining piece of work for this section is the focusing magnet mount and details of this are given in Fig. 6. Note that the bottom is bent in

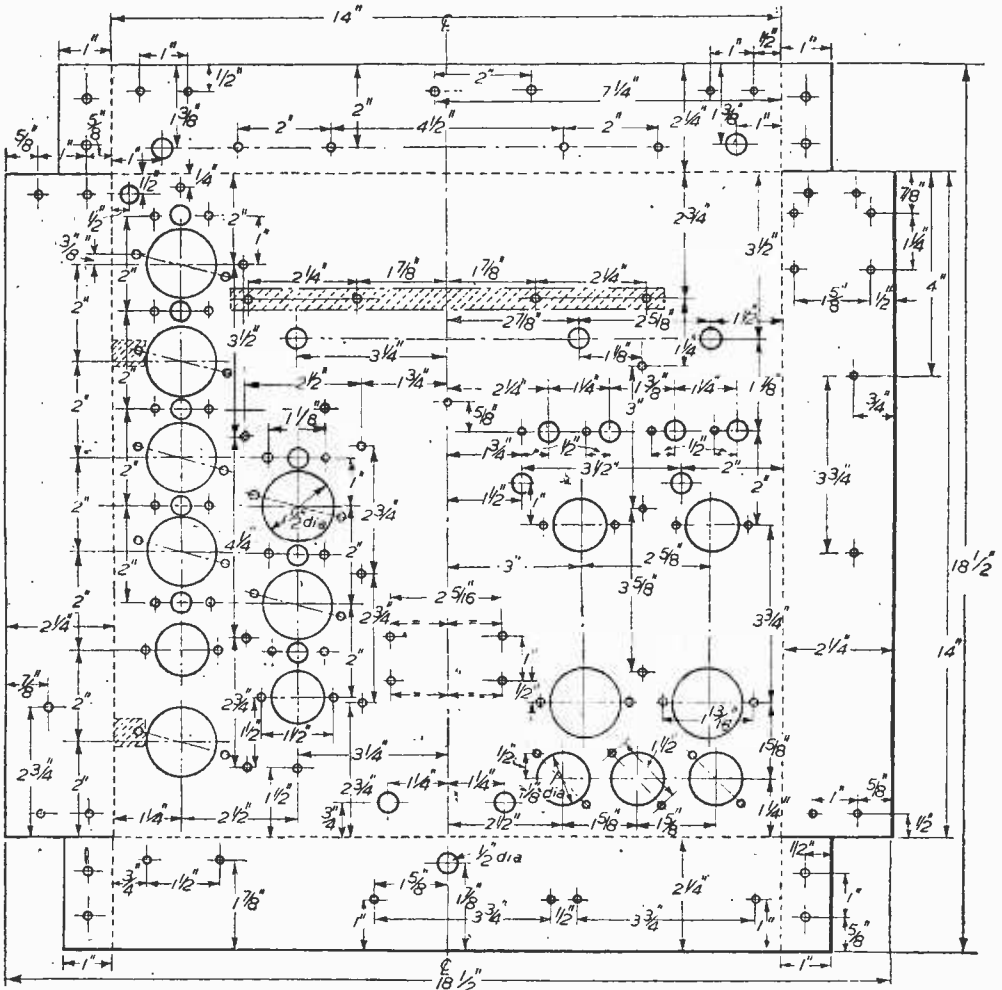


Fig. 2.—Main chassis details. The unmarked holes are either $\frac{1}{8}$ in. or $\frac{3}{16}$ in. in diameter and suit grommets, variable controls, and clearance for 6BA bolts.

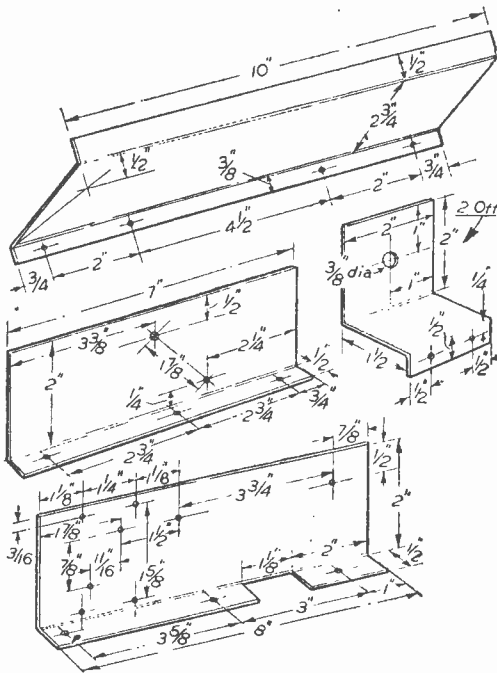


Fig. 3.—Separating screens, control mounts and protective glass mount details.

two different directions, and check the mounting holes with those in the chassis after bending as the thickness of the metal and the acuteness of the bend may affect the spacing between the two sets of holes. Alternatively, this piece may be constructed and the holes marked through on to the chassis and the latter drilled last.

Before going on to the wiring, which will be dealt with in the next issue, there are a few points which perhaps may not be clear to those who did not see the receiver at Radiolympia. Firstly, the tube is held in position by being clamped between the long front runner on the chassis (top of Fig. 3) and a wooden support, which is attached to the chassis by four No. 4 or 5 1/2 in. roundhead screws. The wooden support is preferably made from 1/2 in. plywood, and its position is indicated by the shaded area in Fig. 2. The support measures 9 1/2 in. by 9 1/2 in. and has a 6 1/2 in. diameter hole cut slightly off centre. This hole is lined with a short length of rubber draught-excluder and the tube is inserted from the front and presses against the rubber. A standard rubber mask is fitted over the front of the tube and in front of this the sheet of plate glass is pressed in the inner turned-up edge of the piece of metal already referred to (top of Fig. 3). Another piece of aluminium (or if preferred, two narrow strips) may then be put over the top of the wooden support and across to the top edge of the glass front and this holds the tube quite rigidly in such a position that the neck of the tube will be centred in the focusing mount. With some types of tube it will be necessary to cut out a small piece in the side of the hole in the wooden support to clear the evacuating pip on the cathode-ray tube, but the modern

duodecal tube has no such pip (it is actually inside the base of the tube) and therefore no cut-out is needed.

Power Unit

As mentioned last month the power unit incorporates also the output sound stage and loudspeaker and below is a view of the unit from the rear. On the upper surface of the chassis are the rectifier and output valves, two smoothing condensers, the mains transformer and the E.H.T. unit. Below the chassis is the smoothing choke, R44, and the

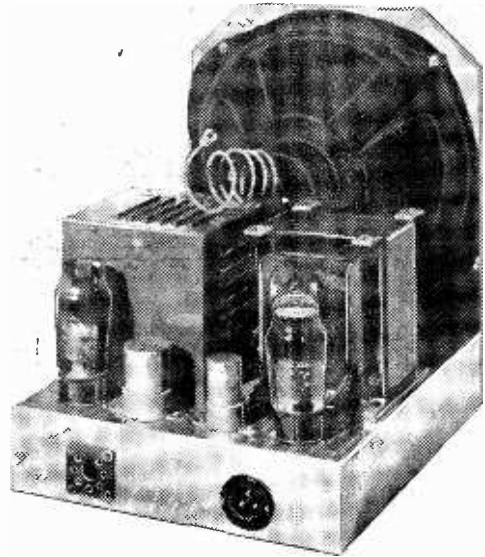


Fig. 5.—A rear view of the power unit which will be described next month.

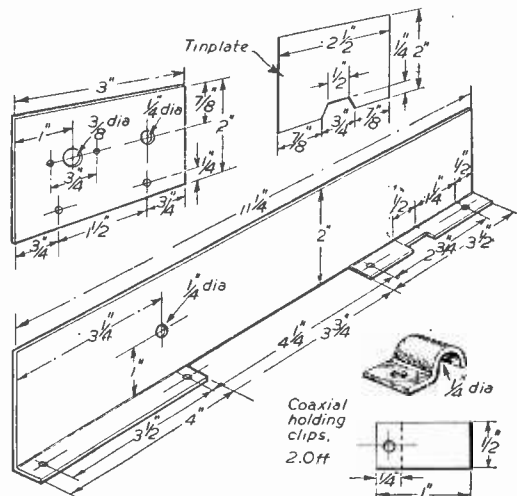


Fig. 4.—Further screens and coaxial cable clips. All screens, with the exception of the upper right-hand one of this group, are in aluminium.

output valve bias resistor and condenser. The front of the chassis is attached to a further wooden panel which is cut out to accommodate the loud-speaker and this panel may be made at this stage from the same material as the cathode-ray tube support— $\frac{1}{4}$ in. plywood. It measures $10\frac{1}{2}$ in. by $14\frac{1}{2}$ in., and the hole is 9in. in diameter, with its centre 8in. from the lower edge.

Chassis

The chassis is made from the same material as for the main portion of the receiver and when finished measures 12in. by 14in. with $2\frac{1}{2}$ in. deep sides. The only real difficult part about the preliminary construction will be met with in this part of the installation. The mains transformer is of the type supplied with an insulated plate carrying soldering lugs for the various connections, and to reduce the lengths of connecting leads the original model was constructed by using the transformer upside down. To accommodate the soldering lugs on the transformer a piece has to be cut out of the chassis and this is irregular in shape. It is not beyond the scope of the average handyman and can be executed with the drills already mentioned, either by cutting holes with the $\frac{1}{8}$ in. drill and round the opening and breaking away the inner piece, or by using the large valveholder punch or cutter in combination with the small drill. Alternatively, one of the abrasive type fret-saw blades may be used and the hole cut out neatly before bending up the chassis. As an alternative to cutting the

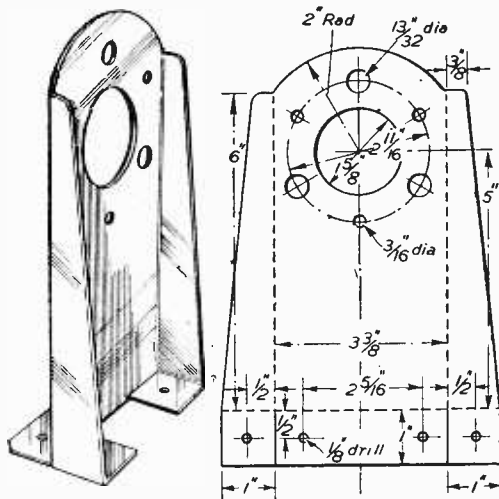


Fig. 6.—Support for the permanent magnet focusing unit.

hole the transformer could be mounted the right way up and leads taken down each side of the transformer through grommetted holes in the chassis. This may lead to trouble and does not look so neat.

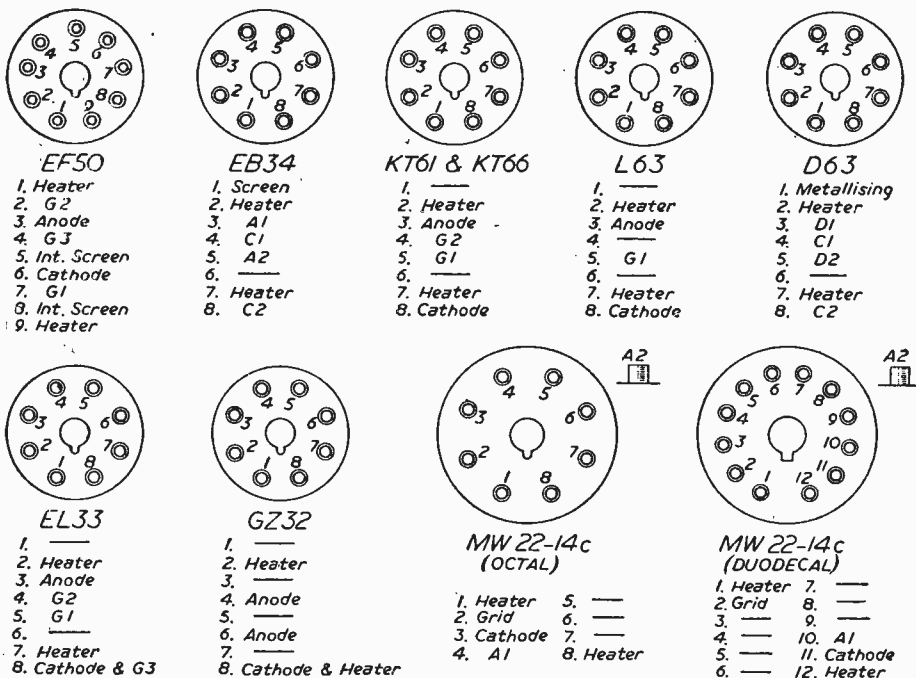


Fig. 7.—Details of valve bases for all the valves and tube used in the complete receiver. Existing stocks of the 22-14c valve are fitted with octal base, but this is being changed to the duodecal base. All views are of the valve or valve holder—seen from the underside.

Negative Feedback

The Theory and Application Explained

By H. SASSON

THERE is no special "know-how" attached to negative feedback practice, as there is, for example, to the construction of ultra-high-frequency or microwave equipment, in which cases skill and experience are essential requisites for success.

Negative feedback in an amplifier is feedback in a direction which lowers the stage gain. At first sight it appears to have little advantage and no practical value, but if there is sufficient of it, a surprising effect is obtained.

Let us consider the case of an amplifier having a gain A , and an input voltage of e_s . Then the normal output will be e_o , $A=V$. If we fed back in series opposition with the input a fraction B of the output voltage the gain would be reduced, and to obtain the same output as before, the input voltage must be increased by a value BV ; thus the effective input voltage becomes:

$$e_s + BV = \frac{V}{A} + BV = V \left(\frac{1}{A} + B \right)$$

and the effective gain

$$= \frac{V}{V \left(\frac{1}{A} + B \right)} = \frac{A}{1 + BA} = \frac{1}{B \left(1 + \frac{1}{BA} \right)}$$

If the feedback factor BA is large with respect to unity, then $\frac{1}{BA}$ tends to zero, and the amplifier gain tends to $\frac{1}{B}$ simply.

This means that the gain of our amplifier will depend on the fraction B of the output voltage, and will be independent of circuit conditions and constants, which in turn depend on the components

employed in the amplifier, including the valves. Thus the greater the amount of negative feedback, the more independent of circuit conditions and valve characteristics becomes the stage gain. The frequency-response characteristic of the amplifier will thus tend to become flat; i.e., amplification tends to be the same at all frequencies within the range for which the amplifier was designed.

One must bear in mind the fact that the action will break down if there is any phase shift from output to input, or if the amplifier itself suffers any serious phase shift. In the case of negative feedback over several stages there arises a danger of positive feedback (regeneration) for frequencies outside the desired frequency band. In all the above three cases self-oscillation may occur. Special care should be taken in the region of the cut-off frequencies, where there is an appreciable phase shift before a big enough drop in gain occurs, involving the danger described above.

Basic Arrangements

Figs. 1—3 give the basic circuits of representative types of amplifiers incorporating negative feedback. In Fig. 1 it will be seen that in each valve a small feedback is obtained by omitting the usual by-pass condenser across the bias resistor, while in addition there is a small extra feedback from output to input via R_3 and C_4 , the blocking condenser. Fig. 2 is the circuit of another basic type of feedback amplifier. Here the feedback fraction B of the output voltage which is fed back to the input and superimposed on the signal voltage in opposition to it is equal to $\frac{R_2}{R_1 + R_2}$. In the circuit of Fig. 3

there is an interesting variation—the feedback voltage is obtained from the grid and not from the anode, as in the other circuits. In this circuit the percentage feedback is $\frac{(R_1 \times 100)}{R_1 + R_3}$ per cent.

Negative feedback reduces the non-linear distortion and noise present in amplifiers. The

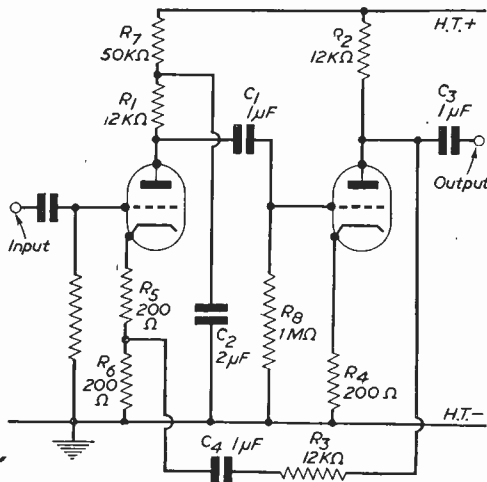


Fig. 1.—Two simple forms of feedback are shown in this circuit.

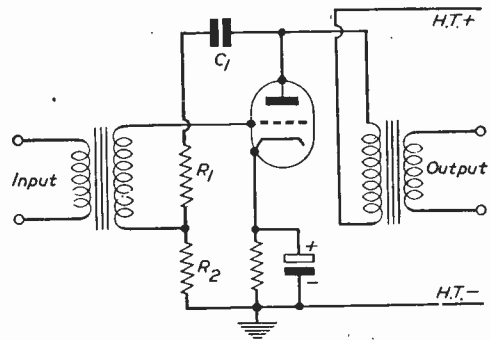


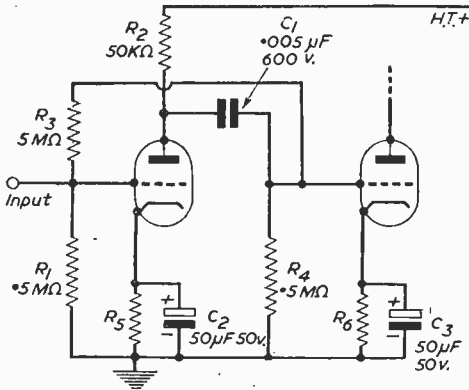
Fig. 2.—Another simple way of introducing feedback.

distortion components of the output voltage are fed back in such a polarity as to produce amplified distorted voltages which tend to cancel out the distortion generated in the amplifier.

Distortion with negative feedback =
Distortion without negative feedback
(1 + BA)

So when BA is large, there is a very great reduction in distortion.

Under certain conditions, negative feedback will improve the signal-to-noise ratio.



R₅ & R₆ Values To Be Calculated For Valve Used

Fig. 3.—Yet another feedback arrangement. In Figs. 1 to 3 triode valves are shown, but the circuits are suitable for tetrodes or pentodes.

$$\frac{\text{S/N ratio with negative feedback}}{\text{S/N ratio without negative feedback}} = \frac{a_f}{a_o (1 + BA)}$$

where a_f and a_o are the amplification between the place where noise is introduced and the output, with feedback and without feedback respectively.

Negative feedback will greatly reduce noise introduced in high level parts of the amplifier, such as from a poorly filtered power supply in the anode circuit of the final valve. It will not, however, reduce noise introduced at low power-level stages, such as thermal agitation noise, induced hum, microphonic noises, etc.

A 20 per cent. feedback is enough to reduce the impedance of a tetrode or pentode to a value below that of a power triode such as a 2A3 or 6B4. One of the effects of a lower impedance apart from those already mentioned is to make loudspeaker resonances less dangerous or liable.

Class B Amplifiers

The Class B amplifier is considerably more efficient than the Class A amplifier with respect to power input. The D.C. anode current of a Class B amplifier is directly proportional to the signal voltage applied to the grid, whereas in a Class A amplifier the mean anode current is constant whether a signal is applied to the grid or not. Therefore the maximum input to a class A amplifier is limited, to the rated anode dissipation of the valve. The result is that two valves, operated Class B, in a push-pull arrangement will deliver as much as twelve times the audio power as the same two valves

operated Class A. Thus it is only natural that modulators are invariably operated Class B.

In the Class B amplifier the grids are driven positive for at least part of the cycle, with the result that grid current flows and the grids consume power. The fact that the grids are driven positive for only part of the audio-frequency cycle means that the load on the driver stage varies in magnitude during each cycle. The effective load resistance is high when the grids are not drawing current and relatively low when grid current flows. This variation in load resistance must be allowed for when designing the driver, which must therefore have good voltage regulation.

The main essential for good regulation is a low internal resistance. This is to say that the valve should have a low anode resistance. Under normal conditions this requirement is satisfied only by the range of low- μ power triodes. If, however, sufficient negative feedback is applied to tetrodes and pentodes, such as the 6V6 and 6L6, then these become even better drivers than low- μ triodes without going beyond Class AB₁ operation.

Fig. 4 is the theoretical circuit diagram of a practical driver stage with negative feedback. The feedback voltage, derived from a voltage divider $R_4 R_5$ across the primary of the driver transformer, is fed back to the grid of the same valve via the anode resistor of the preceding 6J5 stage, R_1 . The total resistance of the voltage divider is calculated so as to be large compared with the rated load resistance of V_2 . A possible variation is to make use of a tap on the primary winding of the driver transformer T_1 , if one is available, instead of using a voltage divider. The feedback voltage appearing

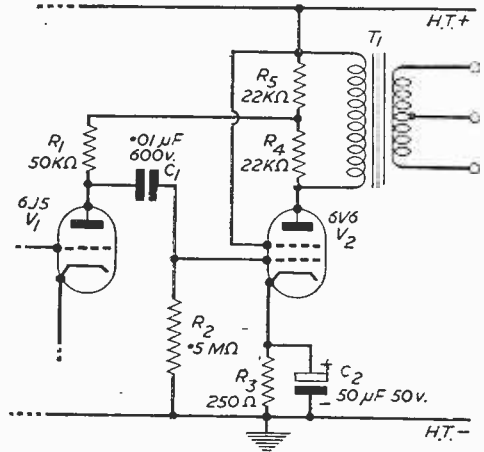


Fig. 4.—A Class B driver stage with feedback.

at the grid of V_2 is mainly dependent on the values of and the ratio between R_4 and R_5 but it is also influenced by R_1 , R_2 and the anode resistance of V_1 .

Fig. 5 shows a practical push-pull version of one of the basic types of feedback amplifiers (see Fig. 2), capable of delivering more audio power than the single valve arrangement of Fig. 4. The essential in this circuit is an A.F. inter-valve transformer with a split secondary winding. The A.F. feedback

voltage is derived from the voltage divider $R_1 R_2$. C_1 is a blocking condenser to prevent the application of the D.C. high tension voltage to $R_1 R_2$. The reactance of C at the lowest audio frequency to be amplified should be low compared to that of the

Fig. 6 gives the circuit diagram of a speech amplifier whose main feature is the inclusion of negative feedback and which is capable of delivering about 4 watts of audio power to the push-pull grids of the modulator.

A 6J7 was chosen as the first valve because of its high gain. Next are the two sections of a 6SN7 double triode. All stages are resistance-capacity coupled because by this method coupling is relatively inexpensive, good frequency response can be secured and there is little danger of hum being picked up from stray magnetic fields associated with heater wiring. It is the only type of coupling suitable for the output circuit of the high-gain 6J7 pentode, because with transformers a sufficiently high load impedance cannot be obtained without considerable frequency distortion, defeating the whole object of the inclusion of a negative feedback circuit. Because of the high gain of the 6J7 it is highly advisable to shield entirely the input circuit of the amplifier, which includes grid lead, top cap, grid leak, plug and socket and also the microphone and its connecting cable, as otherwise it might pick up hum or R.F. radiations or be the cause of positive feedback (regeneration) giving rise to howls and oscillations. If co-axial cable is not available for the microphone connecting cable, a good substitute is shielded two-wire conductor, but this should be kept as short as conveniently possible in order to keep losses down. The amplifier as described has enough gain to deliver full output when used with crystal microphone, despite the negative feedback. It pays to keep the heater wires to the first two valves in the corners of the chassis except where it is necessary to bring out the unearthed one out to the valve socket terminal.

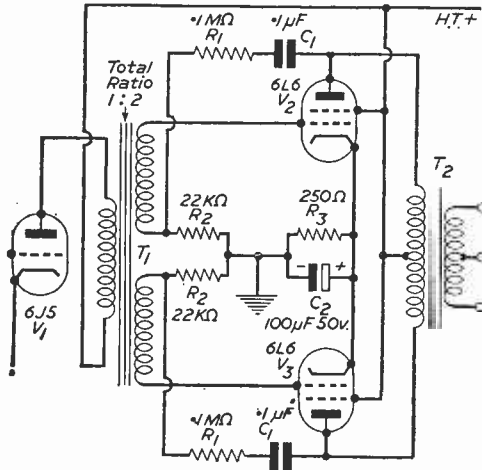


Fig. 5.—A standard push-pull stage with feedback.

sum of R_1 and R_2 . Also the sum of R_1 and R_2 should be large compared with the rated load resistances of V_2 and V_3 . The circuit is not designed for use with valves that are operated class AB_2 . The feedback percentage = $\left(\frac{R_3}{R_1 + R_2} \times 100 \right)$ per cent.

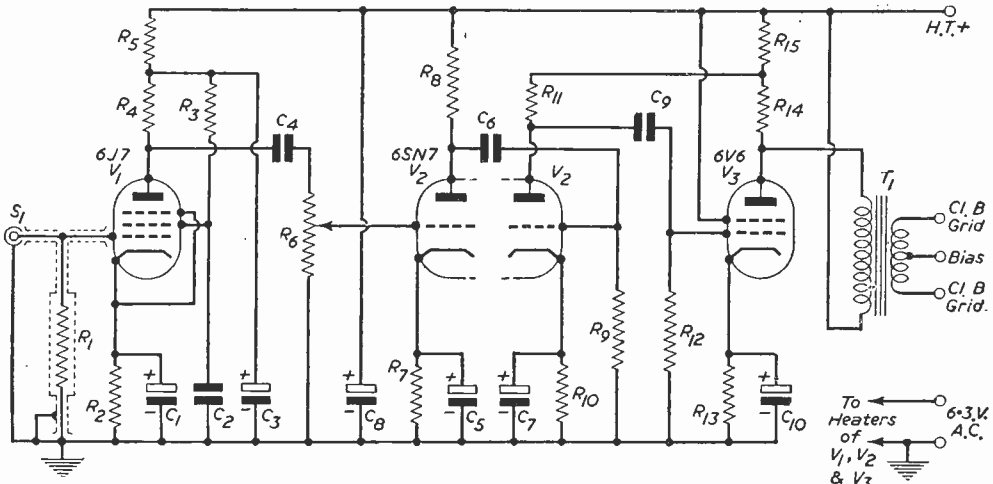


Fig. 6.—A four-watt amplifier suitable for use with a crystal pick-up. Components are as follows :

- R1—5 M Ω .
- R2—1.5K Ω .
- R3—1.5 M Ω .
- R4—0.22 M Ω .
- R5—50 K Ω .
- R6—1 M Ω potentiometer.
- R7—1.5 K Ω 1 w.
- R8—50 K Ω .
- R9—0.47 M Ω .

- R10—1.5 K Ω , 1 w.
- R11—50 K Ω .
- R12—0.47 M Ω .
- R13—250 Ω 10 w.
- R14—22 K Ω , 1 w.
- R15—22 K Ω , 1 w.
- C1—20 μ F, 50 v, electrolytic.
- C2—0.1 μ F, 200 v, paper.
- C3—8 μ F, 450 v, electrolytic.

- C4—0.01 μ F, 400 v, paper.
 - C5—8 μ F, 450 v, electrolytic.
 - C6—0.01 μ F, 600 v, paper.
 - C7—20 μ F, 50 v, electrolytic.
 - C8—10 μ F, 450 v, electrolytic.
 - C9—0.01 μ F, 600 v, paper.
 - C10—50 μ F, 50 v, electrolytic.
- All resistors unless otherwise stated are $\frac{1}{2}$ watt carbon.

On your Wavelength

by THERMION

The Cost of Radio

IT is generally admitted that the cost of wireless receivers and components is high. Even if we ignore purchase tax, the costs are still high, and perhaps one of the reasons is the increasing numbers of those ungainfully employed in radio and telecommunications and those gainfully employed. According to the result of the partial Census of Production taken in respect of the year 1946 and recently published, 23 people out of every 100 engaged in radio and telecommunications in 1937 were occupied in the administrative, technical and clerical staff. In 1946 the number had risen to 35.5! A surprising revelation is that in the radio and telecommunications branches of the Government the figures are 21.4 for 1937, and only 22.5 in 1946, a very small rise indeed.

This rise is apparently accounted for by the large numbers of men returning from the Services whom their old employers felt compelled to re-engage although their experience did not qualify them for the higher wages they claim because of their higher age group. A young man of eighteen, for example, called to the Services in 1939 would be earning comparatively small wages, but on his release from the Services after the war he is well into his twenties, he is probably married, and demands a man's wage on the strength of the experience of an apprentice. Very tragic, but very true. I am of the opinion that the radio and television industry should be released from the incubus of the iniquitous purchase tax, which was introduced during the war and should have no place in peace.

Sutton Coldfield

A TERRIFIC filip has been given to television by the opening of the Sutton Coldfield Station. There is a heavy demand for literature on television, and makers of receivers are inundated with orders. Most of them are quoting forward delivery dates of three months or so. The service area of the Sutton Coldfield Station is much larger than was originally expected, and perfect reception has been reported up to a radius of 50 miles. This may cause some readjustment to the plans for the locations of the other stations, and it may also cause a speeding-up in their construction; for Sutton Coldfield was regarded as an experiment, and plans for other stations could not be laid until it was known whether modifications were necessary. I learn from the Post Office Engineers that very little modification indeed will be necessary, and equipment for the new stations can now be ordered in the confident belief that it will not be rendered obsolete by the time it is required.

More About Baird

THE Editor has passed along to me a letter from Baird's biographer, R. F. Tiltman, who disagrees with my "astounding pronouncement"

that I do not think that Baird was mentally equipped to produce real television. Now a pronouncement sounds like something really clever. I adhere to my statement and indeed underline and emphasise it, and in saying this I do not belittle the efforts Baird made to popularise television by making use of the discoveries and inventions of other people. I stated that Baird had not the qualifications of a calibre which would equip him to produce television—a highly scientific and highly mathematical science. I am, of course, aware of Baird's history. In fact, I could claim that he was a personal friend. He would have been the first to admit the accuracy of my comments. I am well aware of the fact, as Mr. Tiltman points out, that he was a student of the Royal Technical College, Glasgow, where he received a diploma in electrical engineering before entering Glasgow University. I also know that he studied pure physics, but that his studies were interrupted by the 1914-18 war, and that he took a post of Superintendent Engineer with Clyde Valley Electrical Power Company.

Lack of Capital

He was a keen student of technical books in the public library in Hastings in the years 1922-24, when he was conducting his experiments there. It must be admitted that he was the first to demonstrate television, but he certainly was not the first to demonstrate true television. There were many before him. Apart from the handicap I have mentioned, he was always handicapped by lack of capital, and in his extremity I think he appealed to the public for money before he was ready to give them something in return; and that was where he demonstrated his further handicap, namely lack of business experience, for everyone lost their money. Baird made specious promises that "television would be in every home by Christmas," when he should have known that the old disc machine he was offering was a piece of laboratory apparatus, which looked as if it had been designed by a precocious schoolboy with a constructional toy outfit, and could not possibly be mass produced. Even though it could, it was not real television. Of course, there was the novelty value, but I will always feel sorry for those people who paid good money for a Baird disc machine.

Trifling Details

It was not until the financial interests which had backed him so well took over his affairs to protect the shareholders that the company made any progress. Most of Baird's patents were for trifling details not applicable to television as we know it to-day. Notwithstanding, therefore, the adulation which Mr. Tiltman, his biographer, feels for the subject of his biography, it is only fair to history that the other side of the question should be put.

Practical Series-condenser Heater Circuits—2

The Use of a Condenser in A.C. Receivers with Series-connected Heaters Described

By E. N. BRADLEY

THE whole heater circuit, comprising valves and condenser, has an impedance instead of a resistance and, remembering that a reactance and a resistance cannot be added directly to give an impedance, the impedance actually being the square root of the sum of the squares, it can similarly be said that the voltage appearing across the condenser is

$$V_c = \sqrt{V_s^2 - V_h^2}.$$

Where V_c is the voltage across the condenser, V_s is the mains supply voltage, usually taken as 230 volts, and V_h is the required voltage across the whole heater and dial-lamp chain.

Current in the Circuit

The current in the condenser is the current required by the heater chain, and if the current is denoted by I_h

$$X_c = \frac{V_c}{I_h}$$

where X_c is the reactance of the condenser. This is equivalent to writing

$$X_c = \frac{\sqrt{V_s^2 - V_h^2}}{I_h}$$

and, since the reactance of a condenser is also written as

$$X_c = \frac{1}{2\pi f C}$$

it only remains to combine these statements in order to extract the final value of capacitance needed in any heater chain circuit:

$$C = \frac{I_h \times 10^6}{2\pi f \sqrt{V_s^2 - V_h^2}}$$

The term 10^6 ($10^6 = 1$ million) appears in the top line of the statement to convert the capacitance from Farads to microfarads.

A Practical Calculation

The circuit in which the valve heaters are to be supplied through a condenser is a superhet with a valve line-up as follows: Frequency changer, CH35 (heater volts, 7); I.F. stage, EF39 (heater volts, 6.3); detector, A.V.C. and first audio, EBC33 (heater volts, 6.3); output stage, CL33 (heater volts, 33); rectifier, CY31 (heater volts, 20), and a 6.3-volt dial lamp. As the dial lamp is rated at 0.3 Amp., the full 6.3 volts is not dropped across the bulb, but the small discrepancy gives only a very small percentage error and can be ignored. The total heater chain voltage (all the valves draw 0.2 Amp.) is thus 78.9, say, 79 volts.

With $V_s = 230$ volts and $I_h = 0.2$ Amp., the formula can be written:

$$C = \frac{0.2 \times 10^6}{2\pi f \sqrt{(230 \times 230) - (79 \times 79)}}$$

and since for 50 cycles mains the expression $2\pi f$ can be taken as 314, this gives:

$$C = \frac{200,000}{314 \sqrt{46659}}$$

The square root can be calculated or taken from tables; the root of 46659 = 216 almost exactly. Thus:

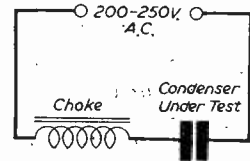
$$C = \frac{200,000}{314 \times 216} \text{ and} \\ C = 2.94 \text{ microfarads.}$$

Choosing and Testing the Condenser

The regulation of the system is good, but it may be taken that the condenser value should be accurate to within 5 per cent. Nevertheless, this means that a $3\mu\text{F}$ condenser may be used if its value is a true $3\mu\text{F}$, and not more.

In the original receiver the $2.94\mu\text{F}$ capacitance was made up of a $1 + 1\mu\text{F}$ condenser, the two sections being connected in parallel to make a $2\mu\text{F}$ capacitance, accurate by bridge measurement. A number of $1\mu\text{F}$ capacitors were then checked and one slightly low in value was chosen and connected in parallel with the existing $2\mu\text{F}$ capacitance to give a final value of approximately $2.95\mu\text{F}$.

Fig. 2.—A method of applying a test voltage across a condenser.



Not all constructors will have stocks or the facilities for building up the required capacitance in this way, and in this case they are advised to contact either a good supply house, where a suitable capacitance can be chosen and checked by bridge measurement, or to write direct to the order department of any well-known manufacturer specialising in condensers.

A really good component must be used, and it can be said that the economy of series-condenser operation is a long-term policy; the first cost of the condenser will generally be higher than that of a line-cord or barretter. The condenser must have a high-working voltage and must, of course, be of the paper-separated type. The newcomer to radio-construction is specially warned that on no account may an electrolytic condenser be used for this application, for such a condenser is polarised and would pass very high currents over a number of half-cycles, then breaking down, by which time the valves would be ruined.

The calculation shows that the condenser has across it 216 volts R.M.S., and its operating conditions are therefore arduous. It has been stated

that for safe operation on A.C., a condenser intended for D.C. should have applied to it no more than half the D.C. working voltage for which it is rated, or 250 volts A.C., whichever is the less, and if this rule is observed it means that the condenser must be rated for at least 500 volts D.C. and, preferably, 1,000 volts.

Before even a brand new condenser is used in the circuit it should be tested for A.C. operation, one really searching method of test being illustrated in Fig. 2. The condenser is connected, in series with a 10-henry choke, straight across the mains supply. If an ordinary smoothing choke of the above value is used, the inductance presented under these conditions will almost certainly be well above 10, since no D.C. is flowing, but, even so, a considerable voltage will be set up across the condenser. In the writer's test set-up a 10-henry choke was connected in series with each 1 μ F. section of the whole capacitance, when the series circuit was tuned to the mains frequency (10 henrys and 1 μ F. resonate at 50 c.p.s.).

In a series-tuned circuit the voltage across both the inductance and the capacitance, at resonance, is equal to the supply voltage multiplied by the Q of the circuit, and this meant that more than 600 volts A.C. was applied across the condenser. The test could only be run for a short time, as the choke became hot, but it proved the capabilities of the condensers chosen.

In this test set-up the choke takes the mains voltage should the condenser break down, thus protecting the supply circuit and fuses.

Different choke values and condenser values will result in different test voltages being applied to the condenser, but even so this type of test should prove adequate under almost all conditions.

The Choice of Dial Lamps and Fuses

When a series-condenser heater circuit is first switched on there is a current surge dependent for its magnitude and duration on the state of the A.C. mains cycle when the switch is closed. The surge is, in any case, short—it lasts for perhaps 1 millisecond—and so far as the valve heaters are concerned this surge is of no importance, for their thermal inertia causes them to heat up slowly. Some workers have found, however, that dial lamps are more affected by such surges and tend to burn out rapidly; this effect seems to be practically wiped out if 0.3 Amp. lamps are used on a 0.2 Amp. circuit. The writer, at least, has had no trouble with dial lamps, but if this should be experienced an alternative method of connection is to remove the lamp from the series circuit and employing a low current bulb, such as the 6.3 volt 0.04 Amp. type, to connect it in parallel with one of the valve heaters—the detector-first audio valve should be suitable. Admittedly this means that a proportion of the valve heater current is shunted through an alternative path, but the method works quite well in practice.

It is rather difficult to decide whether a series-connected dial lamp would protect the valve heaters in the event of a failure in the condenser insulation and, since the writer has not experienced any breakdowns and feels no desire to jeopardise good valves by making tests, it is perhaps as well not to be positive on this point. At the same time

any true fuse fitted must be able to stand up to momentary switching surges; for this reason a Belling-Lee cartridge type fuse is shown included in the heater chain in the receiver circuit, rated to carry 250 mA. Such a fuse stands up well to momentary surges, but if trouble is experienced a Mag-Nickel delay type fuse by the same manufacturer can be used, with the same steady current rating.

Regulation

If several values of condensers are calculated for various types of heater chains, it will be found that as the voltage across the heaters in series rises beyond about 100 volts for 0.2 Amp. valves the series capacitance required also rises in value more and more rapidly, and if a graph is drawn from such calculations it will be found to have a fairly flat curve for values of capacitance needed for heater chains drawing less than 100 volts or so. Such a curve also shows the regulation of the system, and it can therefore be said that heater chains needing up to, but not more than, 100 volts are the most suitable for condenser feeding.

For 0.3 Amp. valves this voltage figure can be reduced to 50 volts if good regulation is required. In either case it is quite a simple matter to design a comprehensive receiver whose heaters, in series, will need no more than the prescribed voltage.

To summarise the various points of design:

Condenser-fed heater circuits are economical in operation since negligible power is lost, and there is therefore no heat to dissipate, apart from normal valve heat.

The capacitance must be calculated carefully and an accurate value chosen from stock, or built up.

High voltage paper condensers only may be used; these should be tested as shown.

All of the points concerned with the design of a complete receiver on these lines have now been discussed and all that remains is to assemble a circuit which will work with this type of mains supply. A complete 4-valve circuit has been tested and next month full constructional details will be given.

(To be continued)

Books Received

FUNDAMENTALS OF VACUUM TUBES.

By Austin V. Eastman. 644 pp. Price 47s. Published by McGraw-Hill Publishing Co., Ltd., Aldwych House, W.C.2.

THIS book is now in its third edition and deals at length with the principal types of vacuum tubes, the laws underlying each type, with engineering analyses of the more important applications. The treatment is elementary but thorough, and an attempt is made to provide a text midway between those of a purely descriptive and those of a purely mathematical nature.

In the interests of simplicity, discussion of special applications of vacuum tubes has been avoided, and the material in the book is largely confined to the treatment of basic fundamentals of the performance of the tube and of those circuits in which it is most commonly used.

SIMPLE TRANSMITTING EQUIPMENT (2/-) and AMATEUR RADIO RECEIVERS (3/6).

Published by the Radio Society of Great Britain, New Ruskin House, Little Russell Street, W.C.1.

THESE are two of the small handbooks issued by the R.S.G.B. and are in line with those previously issued on similar subjects. The first-mentioned consists of a 50-page production with 20 illustrations, and the latter 96 pages with 98 illustrations. Postage on each of these books is threepence.

Amateur Radio Exhibition

Details of the Exhibits and Some of the Exhibitors at the Third Annual Show

THE third annual R.S.C.B. Amateur Exhibition was held in London in November and proved an even greater success than previous shows. There were 28 stands, and among the principal exhibitors were the following firms:

Webb's Radio
 Quartz Crystal Company
 Radiocraft Ltd.
 T.C.C.
 Taylor Electrical Instruments Ltd.
 Automatic Coil Winder and Electrical Equipment Co., Ltd.
 Southern Radio and Electrical Supplies
 Dangamo Weston Ltd.
 Woden Transformer Company
 Oliver Pell Control Ltd.
 S. G. Brown Ltd.
 Salford Electrical Instruments Ltd.
 Denco (Clacton) Ltd.
 Cyril French Ltd.
 General Electric Co., Ltd.
 E.M.I.

as well as other firms who specialise in metal work, cabinets, racks, publications, etc.

There was the usual array of special apparatus designed primarily for the amateur transmitter, and some very compact and interesting transmitters were to be seen. Many of the items had been seen just previously at Radiolympia, but in the smaller and more intimate atmosphere of the Royal Hotel it was possible to make a more thorough and detailed inspection.

A large range of test instruments could be seen on such stands as Avo and Taylor, and among the special instruments were the E.M.I. field strength and absorption wavemeter.

The new Weston S.75 is a multi-range test set, having no fewer than 53 ranges with a 6in. scale with 150 divisions.

Among the literature on the G.E.C. stand could be seen the technical publications which include one giving details of a quality amplifier which is now regarded as standard for hi-fidelity reproduction in domestic equipment. The new method of giving valve data with circuits is a great advance

over the older loose-leaf pamphlets which easily became mislaid.

Potted Transformers

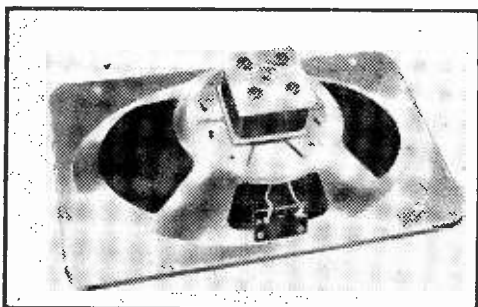
Mains transformers can be bulky items, and when designing a compact layout one is often faced with difficulty in putting chokes and transformers close to other items without wasting space. The so-called "potted" choke or transformer overcomes this difficulty, and some very good examples were to be seen on the Woden stand.

Probably one of the most ambitious exhibits was that of Southern Radio, who are stockists of all the well-known makers and endeavoured to make a representative show of something by all makers in addition to their own range of SORAD transmitters.

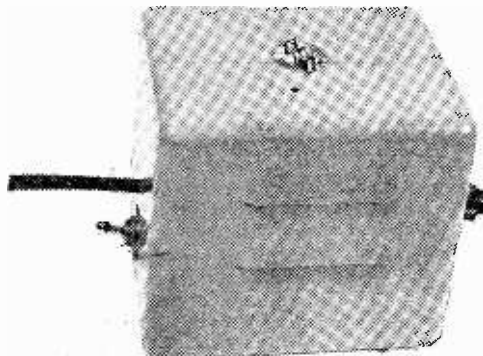
E.M.I. Amateur Division

One of the surprises to many visitors was the introduction of special amateur equipment by E.M.I. This equipment was displayed for the first time at the exhibition and included a most interesting range. The field strength and absorption wavemeter (V.H.F.) has already been mentioned, but there was also a simple absorption wavemeter for 1.6 to 30 Mc/s; a spot frequency marker, and two grid dip oscillators—one for the range 1.6 to 30 Mc/s and one for 40 to 150 Mc/s. These were quite reasonably priced, the oscillators costing £6 17s. 6d., and the spot frequency marker costing £7 12s. 6d.

E.M.I. also showed some I.F. transformers in three forms—midget, medium and large—and three loudspeakers. Of the latter there was the usual small standard type of unit and two of the elliptical shape—the medium being priced at £2 and the large at £4 17s. 6d. As a point of interest a complimentary three-element beam calculator was being given to visitors by E.M.I. and should prove of value to those who are contemplating erecting a beam aerial for use in the 28 or 60 Mc/s band. Copies of these may be obtained on application to the Amateur Division of E.M.I.



The E.M.I. Large Elliptical Loudspeaker—13½ ins. with 5Ω speech coil.



Spot Frequency Marker working at 1 Mc/s and delivering harmonics at 1 Mc/s up into the V.H.F. range.

Simplified Contrast Expander

A Two-stage Circuit which can be Included in the Majority of Existing Receivers.
By S. SIMPSON

ALTHOUGH most listeners to records or radio know that, for various reasons concerned with quality, a certain amount of volume limitation is essential at the recording amplifiers or transmitters, it may not be so well known that much of the loss of the realism so caused can be regained at the reproducing amplifier—provided a fair reserve of undistorted output is available.

The system used is known as "Auto-Volume Expansion" (not to be confused with the "Automatic Volume Control," now a standard fitment in all superhet radios). The effect, briefly, is to quieten down the "soft" passages of a musical or vocal piece and strengthen the "louder" passages, the weakening or accentuating being controlled by the average volume level of the received music and rising or falling with it. The amount of contrast is, in the following circuit, variable from nil to an over-contrast; the nil position is desirable because of speech programmes such as the "News," during which some announcers may raise or lower the speech level and this would be, of course, accentuated by the Expander. In plays, on the other hand, contrast is often an asset and the dramatic effect is enhanced by its use. To any listener who likes good music the trouble of adding the contrast expander is amply repaid by the pleasure of hearing the music "come to life."

A fairly general line-up for a radiogram capable of adaptation to contrast would use a 6H6 demodulator followed by a 6F7 as A.F. amplifier, which in turn feeds a 6J5 used as a phase inverter for two push-pull 6V6s. Contrast expansion is, in such circuits, applied to the pentode amplifier. There is, however, a drawback to using a 6F7 type of pentode in an expansion circuit. The releasing voltage is most readily applied to the suppressor grid as this causes least disturbance to existing wiring, but the voltage required by a 6F7 is fairly large and not easy to obtain without causing distortion elsewhere in the circuit.

Change to 6L7

For this reason the 6F7 in the radiogram outfit described above should be changed for a 6L7, which is a heptode with the "suppressors" connected to the same pin as is the suppressor of a 6F7. Owing to the internal disposition of the 6L7, however, the control of amplification by varying the bias on the "commoned" grids is quite large for a much smaller voltage than would be required by a 6F7 for the same effect. It was also found that the control was appreciably increased by keeping a small standing negative bias on the 6L7 suppressors. This was arranged for by taking the normal cathode resistor to chassis via a variable 2,000-ohm resistor shunted by a 50 μ F. 50 v. condenser, and feeding the grid bias to the signal grid from the junction of the original bias resistor, still shunted by its 25 μ F. condenser, and the 2,000-ohm potentiometer. This keeps the bias on the 6L7 signal

grid at a suitable voltage, and also provides a variable preset bias for the expander circuit. (See Fig. 1.)

The actual expander unit has been simplified from a quite elaborate system to the circuit shown in Fig. 2. As will be seen there is only one variable control, panel mounted, in addition to the bias preset control just described which can be fitted behind the radiogram chassis. The feed for the 6F7 expander amplifier is taken from the signal-diode load resistor which feeds the usual volume control potentiometer. To prevent shunting by the 6F7 input control from causing distortion in the radiogram amplifier, R2 is included. This limits the input to the 6F7 somewhat, but the expander still provides ample control output despite this.

The remainder of the 6F7 circuit is fairly normal, except perhaps the transformer in the anode circuit. R.C. coupling to the diode rectifier was attempted but discarded because of its rather critical adjustment and the elaborate filtering necessary to prevent A.F. variation on the bias from causing distortion.

Parallel feeding of the transformer was tried out, but a greater output from the 6H6 rectifier was obtained with the direct feed, and also as the effective anode load is less than the 6F7's impedance there is less voltage development due to accentuated bass passages and, therefore, less tendency to false contrast caused by bass instruments.

Controlling Results

The reservoir condenser in the diode load circuit requires some care. If too small the expansion is jerky and A.F. variation will be fed back to the radiogram amplifier, easily detected by rumble on bass music or a deep-voiced person's speech. If too large one gets a peculiar sustained effect. A solo instrument, for instance, following a passage by full orchestra seems over-load for a note or two then drops suddenly to quiet level. This is due to

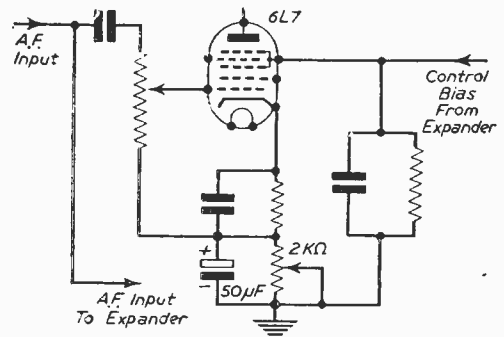


Fig. 1.—Modification to 6L7 to give standing bias on suppressor grids.

bias on the 6L7 suppressors lasting rather longer than the passage which caused the bias. The best all-round value is found to be $5 \mu\text{F}$, and in conjunction with a 100,000-ohm resistor the performance both as to timing and elimination of A.F. was found to be quite satisfactory.

Construction of the unit is straight forward and in the model used by the writer is comfortably held in a metal box 7in. by 5in. by 6in. high. The box is mounted on a wood baseboard, leaving a margin of 1½in. on one side for a terminal strip of ebonite on paxolin pillars. The L.T., H.T., and A.F., input lead of screened single flex and output

expansion effect to a negligible degree and also slightly reduces the normal volume one is accustomed to at the usual volume control settings; it is, however, the best position for "News Bulletins" or similar talks.

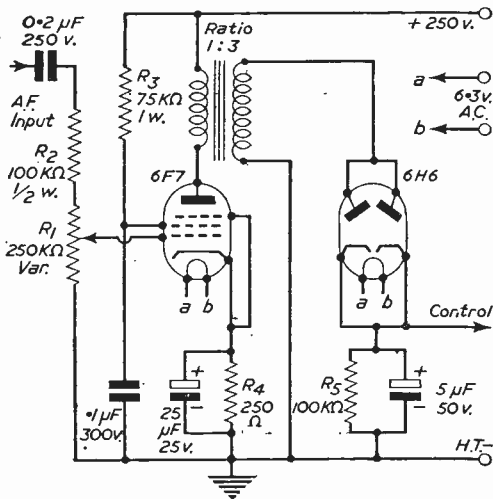


Fig. 2.—Complete circuit of the Simplified Contrast Expander.

lead carrying the control bias are taken to this strip. H.T. required is approximately 250 v. and the L.T. is 6.3 v. The screening of the input must be earthed both at the radiogram chassis and the expander unit. A multi-way cable forms the most convenient way of linking the expander to the radio set, and the small bulk of the expander can probably find room in the interior of the radiogram cabinet adjacent to the main chassis.

Using the Expander

Using the expander is quite simple. One should first set the pre-set bias control to about 2/3 of its travel "off", i.e., develop more standing bias. Next, set the "Contrast" control about 2/3 on, and at a quiet passage of music, etc., set the normal volume control for the usual level one uses. On reaching louder passages the volume lifts as in the normal radio, but because of the expander the lift is much more pronounced. If too great reduce the contrast by turning off the "Contrast" control a little. The quiet passages will be very slightly reduced and a small increase of volume control brings the level to the listener's requirements. Cut-off effect on quiet volume can be caused by too great preset bias, and, conversely, if sufficient contrast cannot be obtained an increase of bias is necessary. Turning off the "Contrast" control reduces the

COMPONENTS LIST

Valves :

6F7 amplifier.
6H6 rectifier.

Condensers :

0.2 μF . 250 v. A.F. input.
0.1 μF . 300 v. screen by-pass.
25 μF . 25 v. cathode bias (6F7).
5 μF . 50 v. control bias reservoir (made up of 4 μF . plus 1 μF in parallel).

Resistors :

R1: 250 k Ω variable.
R2: 100 k Ω ½ watt.
R3: 75k Ω 1 watt.
R4: 250 Ω 1 watt.
R5: 100 k Ω ½ watt.

Transformer :

3 : 1 ratio, step-up, to carry approximately 10 mA. in primary.

Additional items for main chassis :

2,000 Ω potentiometer.
50 μF . 50 v. condenser.
6L7 replacing 6F7 amplifier.

The system here described has now been in use by the writer for a considerable period, and has proved trouble-free and undoubtedly an asset to an otherwise normal radiogram.

Exeter Cathedral Sound Installation

WORK has recently begun on the installation of Philips sound reproduction equipment at Exeter cathedral.

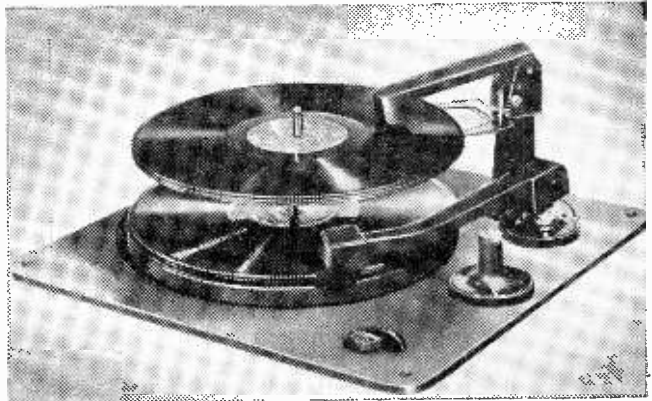
The complete system comprises 12 microphones and 32 loudspeakers. These will be operated from a three-tier console-mounted equipment located adjacent to the choir stalls. Automatic switching in this equipment greatly simplifies the duties of the operator.

The re-building of the bomb-damaged portion of the cathedral affords an unusually good opportunity for obtaining optimum acoustic conditions. A particularly interesting feature will be the incorporation of the loudspeakers in the lighting pendants. In this way it will be possible to direct the sound straight down on to the congregation, and thus overcome the trouble of long reverberation time, which is a common acoustic problem in most churches, due to the hard stone walls and lofty roof spaces.

The light pendants have been specially designed by Mr. H. H. R. Drury, F.R.I.B.A., the architect under whose direction the renovations of the cathedral are being undertaken. The loudspeakers form an integral part of the fittings, and are in complete harmony with the design. Another advantage of concealing the speakers in this manner is that the wiring can quite easily be brought down with the wiring to the lamps,

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By R. D. PATTISON

A MINIMUM of precision components is called for in this instrument, yet the ranges of resistance and capacity covered are ample for all ordinary requirements. There is only one scale to be read and one simple multiplication to be done to arrive at results.

The variable resistance should be of sturdy construction, wire-wound, and capable of being set accurately to 1 per cent. of its maximum value. The maximum value specified in the list of components simplifies the calibration of the instrument. If any other value is used the values of R1 and R2 must be altered in proportion as they, in conjunction with the variable resistance, form the ratio arms of the bridge. For instance, if the variable resistance is 5,000 ohms, then R1 must be 50 ohms, and R2 5,000 ohms.

The bridge is energised by a buzzer which acts as its own coupling transformer. This type of buzzer, easily obtained ex-W.D., has two coils, identical but electrically separate, on a common core. One coil operates the make-and-break and acts as the primary of the coupling transformer. The other, the secondary, transfers the energising voltage to the bridge.

The two-pole Yaxley switch selects resistors and condensers to provide the ranges given in detail in the accompanying table. The detector is a single carphone taken from a disused headset and

should be of high resistance—2,000 ohms, at least.

Precision Components

Precision resistors and condensers should be used if possible. If it is intended, however, to borrow another bridge to carry out the final calibration of the variable resistance the same instrument can be used before that stage is reached to pick out from stock resistors and condensers of sufficient accuracy to be used in place of bought precision components. Do not neglect the possibility of combining resistors in series or parallel so that opposite errors cancel out. Suppose that two resistors, nominally 500 ohms, are in fact 460 and 550 ohms respectively. In series they would form a resistance of 1,010 ohms, which is within 1 per cent of the nominal value. Condenser values can be adjusted in similar fashion. If another bridge is not available the cost of precision components should not be grudged if reasonable accuracy is to be expected from the finished instrument.

Layout

The layout of the components on the panel may be left to the constructor. A great deal will depend on the size of the variable resistance and of the box in which the instrument is to be housed. Set out on the panel a circle for the range-switch scale and two concentric circles for the indicator scales. Thick white paper glued to the panel provides a good surface to draw upon. Drill the panel for the variable resistance, switches and terminals, spacing the "X" terminals apart by more than the length of a crocodile clip. The reason for this will be indicated later.

Mount the variable resistance and provide it with a knob and pointer. Before going further, calibrate the variable resistance from another bridge or ohmmeter. Select the end of the resistance which is to be attached to the two ratio resistances R1 and R2. Place this end and the moving contact of the resistance across the "unknown" terminals of the bridge or meter. Set the

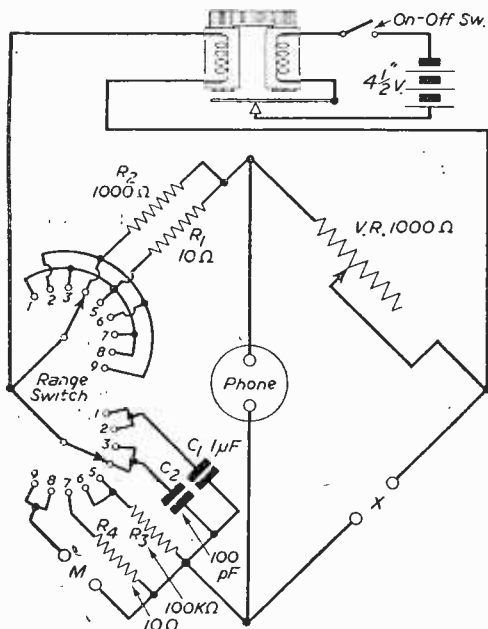


Fig. 1.—Theoretical Circuit of the Bridge

LIST OF COMPONENTS

- 1 variable resistance, 1,000 ohms maximum.
- 1 buzzer (see text).
- 1 2-pole, 9-way Yaxley switch.
- 1 on-off switch.
- 2 10 ohm 1 per cent. resistors (R1, R4)
- 1 1,000 ohm 1 per cent. resistor (R2).
- 1 100,000 ohm 1 per cent. resistor (R3).
- 1 100 pF 1 per cent. condenser (C2).
- 1 1 μF 2 per cent. condenser (C1).
- 1 4½ v. battery.
- 1 headphone.
- 1 box with panel and lid.
- 4 insulated terminals.

bridge or meter to 10 ohms and adjust the moving arm of the resistance until balance is obtained. Mark the position of the pointer on both scales. Calibrate the variable resistance in this manner from end to end at intervals of 10 ohms. Starting from the selected end as zero mark the successive 10 ohm intervals on the resistance scale as 1, 2, etc., up to 100 in black and the condenser scale similarly, in red, in the opposite direction.

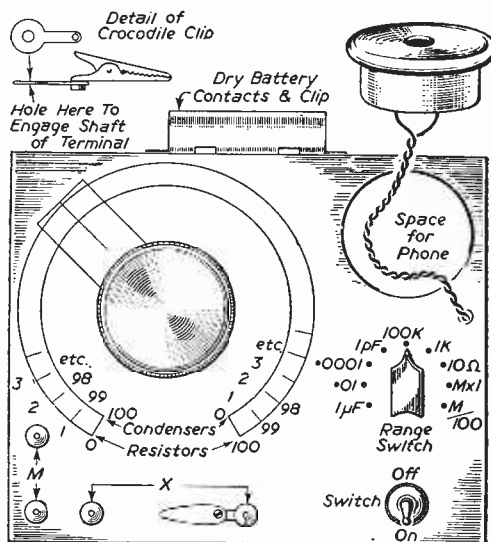
If no means of calibrating the scales directly is available, get a dealer to confirm the value of the resistance and if necessary adjust it to exactly 1,000 ohms. Measure with a protractor the sweep of the pointer in degrees and divide this into 100 equal parts by means of the same protractor.

RANGE TABLE

Switch Position	Ratio Arm, ohms	Standard	Set switch to	Range
1.	R1	1 μ F	1 μ F	1-100 μ F
2.	R2	1 μ F	0.01 μ F	0.01-1 μ F
3.	R1	100 pF	0.0001 μ F	0.0001-
4.	R2	100 pF	1 pF	0.01 μ F 1-100 pF
5.	R1	100,000 Ω	100 K Ω	100 K- 10 M Ω
6.	R2	100,000 Ω	1 K Ω	1 K-100 K Ω
7.	R1	10 Ω	10 Ω	10-1,000 Ω
8.	R1	Match	M x 1	M x 1 to 100
9.	R2	Match	M/100	$\frac{M}{100}$ x 1 to 100

vanishes or is at a minimum. The value of the "unknown" is that shown by the range switch multiplied by the position of the pointer.

The note of the buzzer should be adjusted experimentally to its highest as it will then give best results when dealing with high values of resistance and low values of capacity. The M (M for match) terminals can be used with suitable external standards to measure resistances and condensers



Suggested Layout of the Panel

This method will not be so accurate as that first described. Mark the scales as before.

Wiring

Mount and wire the remaining components. The wiring which comprises the bridge proper—that is, all except the buzzer circuit and the 'phone leads—should be kept as short and as well spaced as possible to minimise resistance and capacity errors, particularly at low values. Mark the positions of the range switch as suggested in the accompanying table. The battery may be fixed inside the box, but it is better to keep it outside to prevent possible corrosion of the wiring if the battery is left for a time and becomes run down. A U-strip will hold it securely against suitably placed contacts.

The single 'phone can lie loose on the panel or be fixed by a spring clip to the lid. Solder a crocodile clip to a strip of metal in which a hole has been bored to accommodate the shank of one of the "X" terminals. Between this clip and the remaining terminal components of different sizes can be easily applied for examination.

Using the Bridge

The method of using the bridge is as follows. Attach the "unknown" to the "X" terminals; set the range selector switch to the range expected to be required; switch on the bridge and adjust the variable resistance until the note of the buzzer

outside the ranges provided, but will find greater application in matching centre-tapped transformers or in making rough comparison of inductances.

A WAR STORY

THIS is the latest story of a Japanese "prisoner-of-war." It concerns the dual duty broadcasting station, Radio Hong Kong, covering that area and South China with programmes in English and Chinese.

A 75 kW. emergency generating set was supplied by the British General Electric Co., Ltd., before the war. When the Japanese occupied the territory, this set was taken away and reinstalled 2,000 ft. above sea level, at the highest point in the new territories. In this wartime location the power generated was used against the Allies, the Japanese employing it as part of a radar installation.

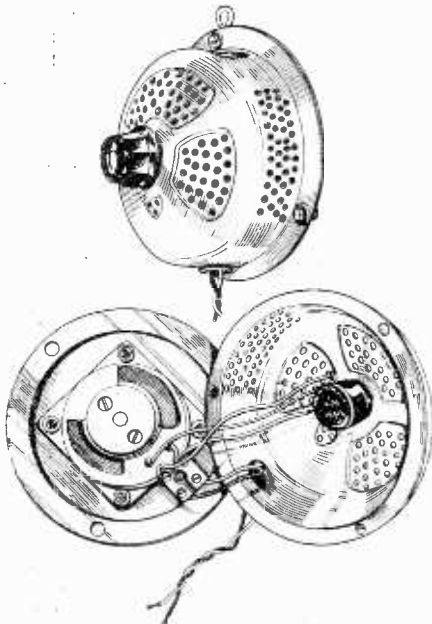
When the British Forces reoccupied the Colony, the Army found this generating set and returned it piece by piece to the Radio Station. The British G.E.C. was then called in to reassemble, build up and reinstall.

This generator is now working daily on medium and short wave broadcasts, and is also used in conjunction with air to ground communications at the Hong Kong airport.

Practical Hints

Protected Type Extension Loudspeaker

A SMALL but efficient protected type of loudspeaker suitable for use in the garage, car or small room can be made quite easily as follows: Procure a 2½ in. (2.3 ohm) speaker from one of the many types now on the market and a small type of volume control (6 ohms). Next obtain a flat type of deodoriser, which may be obtained in a selection of three or four colours. The back



Details of the novel loudspeaker suggested by Mr. Towndrow.

of this should be removed to enable speaker, volume control and connecting block to be drilled and mounted with B.A. screws. Provision can also be made on back or front for entry of connecting cable by the insertion of small ebonite bushes. After mounting of components, replace backplate with three B.A. nuts and bolts, the upper one having a small ring attached to enable speaker to be hung if required. The speaker is now ready for use.—F. F. TOWNDROW (Newquay).

THAT DODGE OF YOURS!

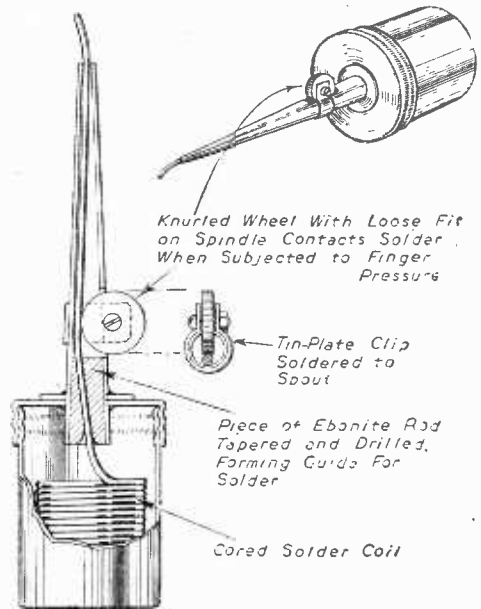
Every Reader of "PRACTICAL WIRELESS" must have originated some little dodge which would interest other readers. Why not pass it on to us? We pay half-a-guinea for every hint published on this page. Turn that idea of yours to account by sending it in to us addressed to the Editor, "PRACTICAL WIRELESS,"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

SPECIAL NOTICE

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

Solder Gun

BELOW is a diagram of a "solder gun" which I recently made up from small scrap parts, but which nevertheless has proved a handy addition to the work bench. The main portion is, as can be seen, a small oilcan. The total amount of resincored solder "fed" by the gun to date is one half pound coil of "eighteen gauge."—R. J. TALBOT (Morecambe).

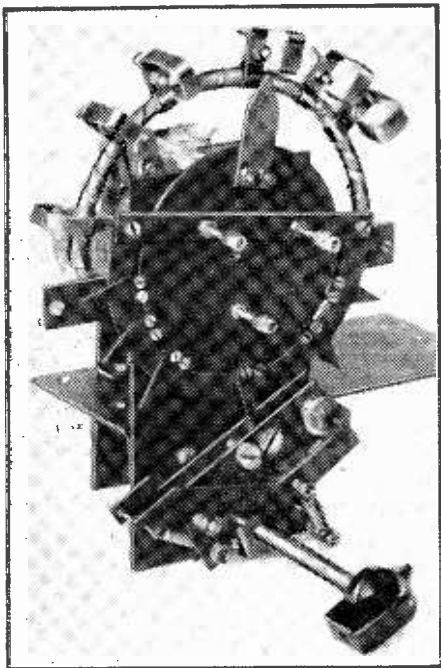


An oilcan converted to a solder gun.

THE LEADING ENGINEERING WEEKLY PRACTICAL ENGINEERING

Eight valuable data sheets included in every issue.

4d. Weekly—Every Friday



Three-quarter front view of the finished unit.

THE amateur constructor, when compared with the commercial manufacturer, finds himself both at a loss and at an advantage. Although the manufacture of their products subjects both people to the same common limitations, i.e., necessity of obtaining a good and reliable design, meeting cost of components and the requirements of production, etc., the commercial manufacturer has the great advantage of having at his disposal a well-equipped research section possessing instruments and equipment that are rarely available to the amateur. On the other hand, the home-creator has to hand an asset which is almost entirely denied the manufacturer. Time!

If a certain process in the construction of a commercial receiver would involve, say, an extra two hours' work on the part of one operative; then that will almost certainly raise the price of the finished set by at least eight shillings. On the other hand, it is a very poor amateur who will not devote a couple of hours to the improvement of his receiver!

In the bandspread tuning unit to be described here, the author gives details of an accessory which, whilst taking some time in its construction, costs almost nothing and will raise the reader's receiver well into the ranks of the more expensive commercial set. The time spent by the writer, who is an indifferent metal worker, consisted of six evenings, a total of about 22 hours. This time was spent not only in making the unit but in its design as well.

The Band-search

An Interesting Accessory for
By J. R.

The Tuning Unit

Every amateur is aware of the advantages of bandspreading on the short wave bands. It may easily be obtained by connecting a small value condenser in parallel with the main tuning condenser as shown in Fig. 1. It is very difficult, however, to obtain accurate calibration of the bandspread condenser.

One method used commercially is to have the bandspread condenser tune the commercial bands only. These are selected by a switch which connects the bandspread condenser to a coil so padded and trimmed as to tune the band required, or to a separate oscillator coil for each band, the aerial coil being padded and trimmed as before. (It is assumed in this article that the tuning unit described will be fitted to a superhet receiver. It could, of course, be used quite successfully with a straight receiver using an R.F. stage.) Alternatively, separate coils may be used as well. These methods allow the bandspread tuning condenser dial to be fairly accurately calibrated for each position of the switch.

Another method is to have a *mechanically* preset position for the bandset tuning condenser for each band requiring bandspread. This is occasionally used commercially and is the basis of the tuning unit here described. It has the advantages of eliminating switch contacts and of shortening coil leads so far as is possible.

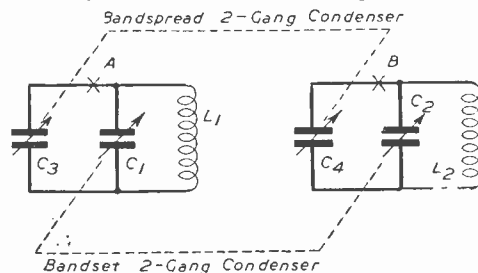


Fig. 1.—Showing how a bandspread condenser may be connected to, say, the frequency-changer stage of a superhet. C_1 L_1 represent the aerial tuned circuit and C_2 L_2 the oscillator tuned circuit. C_3 C_4 then represents the bandspread two-gang condenser. If necessary, the bandspread condensers may be switched in and out of circuit by two switches inserted at the points A and B.

Operation of the Unit

The functioning of the unit is extremely simple, the effect obtained is attractive and its operation capable of being carried out by the most non-technical of listeners.

Let us assume that the unit has been fitted and is aligned to spread the commercial or amateur

er Tuning Unit

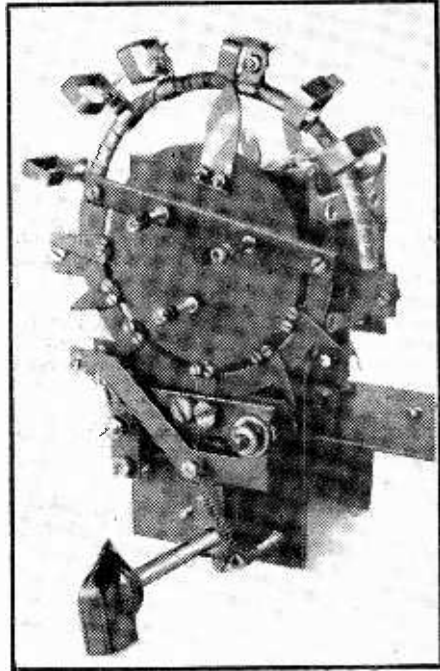
he Short-wave Enthusiast
AVIES

short-wave bands. The listener turns the bandset tuning condenser in the normal fashion and arrives at, say, the 31-metre band. He decides to listen to the stations in this band. As he passes the high-frequency end of the band a light shines on the dial. This light shines for at least two degrees of rotation of the main tuning condenser which would mean about half a turn of the actual tuning control. No "sharp" tuning is required. He then turns a knob. This switches in the bandspread condenser, and "gathers-in" and locks the main tuning condenser in a pre-determined position. He then has, by tuning the bandspread condenser, the whole of the 31-metre band laid out over 180 degrees of dial travel, being as easy to tune as the medium-wave band, and being *reliably and accurately calibrated*.

Functioning of the Unit

The functioning of the unit is also very simple. The switching on and off of the lights is accomplished, of course, by preset contacts actuated by a contact on the tuning condenser, and needs little comment in this paragraph.

The mechanical locking process is illustrated in Fig. 2. Fig. 2(a) shows a disc B fitted to the spindle of the bandset tuning condenser. (The letters used here to describe the parts of the mechanism correspond with those used later in describing the construction. This explains their apparently random



Another view of the unit.

Fig. 2(d) shows the addition of another lever G pivoted at the same point as F. Lever F is pulled upwards by reason of the spring joining F and G together. It is prevented from going too far by means of the stop on G.

Now, suppose that lever G were raised instead of lever F. It would carry lever F until the two pegs finally locked on to the pointed piece E. Lever F would then stop, but lever G would carry on, leaving F in position and held up by the tension of the spring.

That is all there is to it. To enable the whole thing to be actuated by turning a knob a small lever M is fitted to a spindle as shown in Fig. 2(e). This pushes a small distance piece H, which in turn pushes up lever G. It will be seen that, when the pegs on lever F have located with the pointed part E, the rotation of the spindle has the effect of opening out the spring insofar as the spindle is now pushing lever G up by itself. When the lever M has travelled as far as is shown in Fig. 2(f), (i.e., just a shade beyond the vertical), the spring begins to have the effect of trying to push this lever (M) in the direction indicated by the arrow. A stop is fixed at this position, its purpose being to prevent lever M from turning any further. Thus the spring between levers G and F not only assists in the locking process but also maintains the mechanism in the locked position. In actual fact, the "feel" of turning the spindle is similar to that obtained in turning a switch.

A second spring is also shown in Fig. 2(f). This is

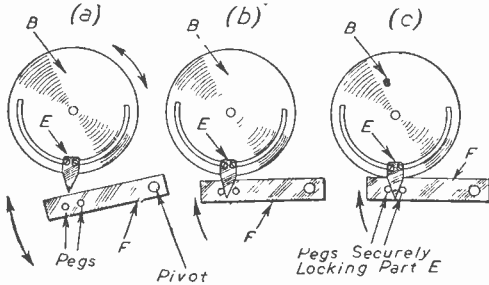


Fig. 2. (a), (b) and (c).—Showing how the tuning condenser is locked in a preset position, even though it may be some appreciable distance out of this position before the lever F is raised.

choice here.) A piece of metal E shaped to a point is securely fixed to the disc at any pre-determined position. Movement is obtained by sliding the piece along the semi-circular slot in the disc. A lever F is pivoted as shown and is provided with two pegs. This lever, on travelling upwards, "catches" the pointed part E, Fig. 2(b), and locks it as shown in Fig. 2(c). Owing to gradual wear and imperceptible differences in dimensions if several locating pieces E were used, it is not sufficient simply to push the lever F upwards. It must be held in tension by a spring device.

fixed to lever G in order to pull it back again when the mechanism is released.

When the mechanism is turned to the "lock" position a simple incidental mechanism throws over a spring-loaded D.P.S.T. switch, this switching in the bandspread condenser. The switch is connected in circuit at the points A and B of Fig. 1.

The Construction

We may now proceed to the actual construction of the unit. The vast majority of the work is carried out in 16 s.w.g. mild steel sheet of which a square foot should provide an adequate supply of material. Mild steel sheet will be found very easy to work and drill, and the various parts can be made in a surprising short space of time. Apart from the disc B and the locating spikes E, filing need not be extremely accurate. However, the marking out of the various holes is very important and care should be taken to ensure accuracy. It is necessary to centre-punch each hole before drilling.

A final word concerns the bandset tuning condenser. Any standard model of between 450 and 550

condenser spindle" should be centre-punched only for the time being.

2. The circular plate B is the next task. This also consists of mild steel sheet. (See Fig. 3(b)).

3. The bandset tuning condenser has now to be mounted so that its spindle is centred exactly at the point marked "for tuning condenser spindle" in Fig. 3(a); and also the circular plate B has to be firmly mounted on the spindle so that its inside edge is 5/16in. away from the outside edge of plate A. See Fig. 4(a). This latter task was carried out by the author by means of the bush illustrated in Fig. 4(b). To prevent any movement of the circular plate with respect to the condenser vanes a light, V-shaped file cut was made on that face of the bush which is held against disc B. See Fig. 4(c). Two, heavy centre-punch depressions were then made in the face of the disc as shown in Fig. 4(d) and (e). These depressions created small, sharp swellings on the underface of the circular plate and these located reliably with the V-cut, thus holding the whole assembly rigid. If the reader has difficulty in making this bush it will probably be possible to obtain one already made by breaking the plastic

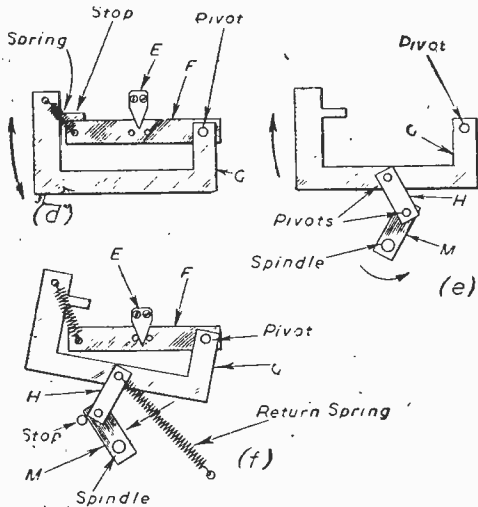


Fig. 2. (d).—Showing the addition of a second lever G, pivoted at the same point as lever F. Fig. 2 (e).—How lever G may be raised or lowered by rotating a spindle.

Fig. 2 (f).—An exaggerated diagram showing how the spring between levers F and G is extended after lever F is locked to part E. The unreferenced arrow shows the direction in which lever M is forced after it has travelled through the vertical.

pF may be used so long as its physical dimensions do not exceed 1 1/2 in. wide by 2 1/2 in. high by 2 1/2 in. deep. This excludes the projection of the spindle at the front, of course, and it assumes that the vanes are closed.

Steps in Construction

1. The first job is to make the front plate A out of mild steel plate as shown in Fig. 3(a). The diagram shows this plate as it would appear looking from the front of the unit. The hole marked "for tuning

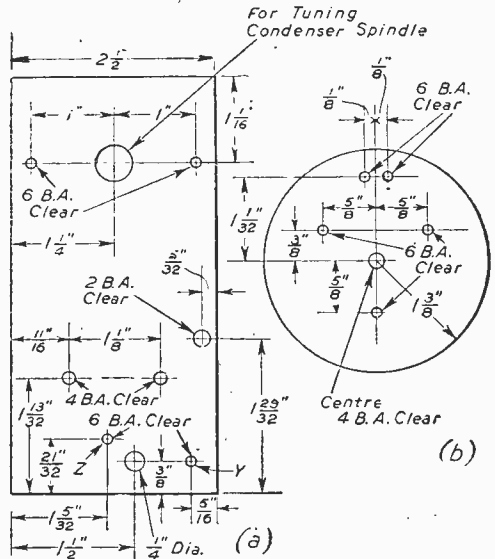


Fig. 3 (a) and (b).—Portions of the front mounting plate (a), and circular disc (b).

compound from a disused 1/2 in. knob and using the brass bush inside. Alternatively the circular plate may even be mounted to a knob itself if this is of the correct shape. The only requirements are that the circular plate must be rigidly fixed to the spindle and that an exact clearance of 5/16in. between the two plates exists. See Fig. 4(a).

The hole in the plate A may now be drilled out to the correct size in order to accommodate the particular bush used by the constructor. (This, of course, is the reason why no dimensions were originally given in Fig. 3(a).) (To be continued.)

REFRESHER COURSE IN MATHEMATICS
 8/6, by Post 9/- 4th Edition By F. J. CAMM
 From: **GEORGE NEWNES LTD.**
 Tower House, Southampton Street, Strand, W.C.2

Lord Reith's Autobiography

A Review of the Book Written by the Former Director-General of the B.B.C.

By F. J. CANN

THIS is a Reith size book by Lord Reith about Lord Reith. It deals mostly with his connections with the B.B.C. from the commencement of broadcasting in 1922 to the time that he left. The style is egregious, and one is forced to the conclusion that Lord Reith is no stylist. In places it resembles the staccato barks of a dog bereft of its bone. One comes rapidly to the conclusion that Lord Reith has a fine conceit of himself. He tells you that he came to the B.B.C. without experience.

His stock-in-trade was a religious fervour and an Aberdonian connection. The religious fervour he promptly injected into those miserable Sunday programmes, fortunately a thing of the past, designed on the principle "let's all be miserable together." Lord Reith speaks with some pride of the quality of B.B.C. programmes, but we must remember that a scintillating diamond can emerge from an inefficiently run lapidary's shop. In assessing quality the cost must be taken into consideration, and it can scarcely be denied that under Reith's régime the B.B.C. became over-departmentalised, until to-day it consists of a number of watertight compartments with little co-ordination and grossly overstaffed. Its overheads are enormous, and could be considerably reduced, with benefit to the taxpayer and the programmes.

As soon as a new problem arose another department was started, without any consideration as to whether the existing staff was adequate. On Lord Reith's own confession his main qualification was that he knew nothing of the job but then that also is the qualification of the First Lord of the Admiralty or the War Minister.

Lord Reith has a tremendous ego, which out-ages the late James Agate, who thought that the theatre was specially created to enable him to display his grammar school erudition. In this book, which might aptly be titled "Testimonials to Lord Reith," with additional testimonials by himself, every little sycophantic utterance (there were plenty of sycophants in the B.B.C. in those days) is here faithfully recorded with suitable comments and annotation. No wonder the B.B.C. became known as "Reith's Empire," over which he ruled almost by divine right. The book deals only very lightly with the criticisms of its author, which continued from the start until he left.

The fact is that almost anyone could have run the B.B.C. from the start. On his own showing it did not require a man of experience, and when you are given a free hand with no one above you to observe inefficiency, with almost unlimited funds at your disposal, it would indeed be a dolt who could not have run the organisation. Whatever was done was right. There was no yardstick by which it could be measured and found wrong.

Lord Reith says that he could not work under anyone. So great was his ego that he believed, and I think genuinely, that without experience or knowledge of radio he was born to rule the B.B.C.

The fact is that the B.B.C. created Reith, not, as he would have you believe, that Reith created the B.B.C. A good horse makes a good jockey.

Under such a system it was obvious that Lord Reith had to delegate a great deal of his work, contenting himself with taking the praise and the blame.

His almost iconoclastic attitude permeated his dealings with politicians. He had, as the book discloses, aspirations that way, with leanings towards, of course, the Prime Minister's office. He tells you with ingenuousness and naïveté, for example, that he and Churchill found themselves willy-nilly in the Government during the war and that *the country demanded it!* It did no such thing. Whoever happened to have been Director-General of the B.B.C. at the time would have found himself temporarily in the Government, purely so that our overseas propaganda could accurately reflect Government policy and safeguard security. Unfortunately for his aspirations Mr. Churchill, when he became Prime Minister, soon dispensed with the services of Lord Reith after forming his Cabinet. Lord Reith frankly admits that Mr. Churchill told him that the reason was that he did not get on well with people, and I think that is a fair comment. Churchill, as a fact, dismissed him in those terms and gave him the title "Lord Wuthering Heights."

Here are some typical examples of Reith's ego. A brigadier-general once said to him: "Reith, you are a hell of a fellow," and Reith's comment is, "But I knew that." He was given charge of a munitions project. "I knew nothing about the manufacture of small arms, but that bothered me not at all. It would be largely common sense and self-confidence!" Nothing came amiss to this *deus et machina*. He acknowledges that many of his earlier employers acknowledged his "consummate ability." He, of course, includes some of his own opinions about himself—mostly flattering. Page after page is used to impress the reader that he is a wonderful man, and one cannot refrain from the remarks of another Scotsman in *Macbeth*, "Methinks thou dost protest too much." You can hear the swish of the tartan and the skirl of the bagpipes in almost every line. Reith *uber alles* should be the sub-title.

Sir Ernest Benn once told him, "You hold the biggest job ever since the days of creation." The correct comment would appear to be: "So what," for holding the biggest job does not necessarily mean that you are equal to it.

Lloyd George: "If you were seconded to help me I could cure unemployment in a year." Well, Lord Reith certainly did his best to cure it by absorbing large numbers of often incapable people.

I could go on quoting from this autobiography, but this seems the appropriate place for a Sassenach facetiously to suggest that those who want to read this book, published at twenty-five shillings by Hodder and Stoughton under the title of "Into the Wind," should do so at a free public library!

Trade Notes

New Products and News from the Factories

A New Multi-cored Solder

SOLDERING is, when the operation is correctly carried out, a chemical, as well as a physical joint. The molten solder should actually penetrate the metals by a form of molecular action, thus forming an alloy between it and the metals joined by it. Hence the need for clean contact and, therefore, perfectly unoxidised surfaces, a condition hitherto difficult to obtain and maintain on many metals classed as "difficult."

Arax, an acid-free, non-resin flux with which the twin cores of a new solder introduced by Multicores Solders, Ltd., are loaded, possesses a vigorous cleaning action and is much faster than any separate fluid or paste flux. Whilst much, of course, depends on the nature of the work in hand, for many jobs it will not be necessary to pre-clean the parts before soldering, but paint, rust or grease must, of course, be removed.

One of the salient advantages of Arax Multicores Solder is its extraordinary effectiveness in soldering spring and stainless steels, iron and mild steel, cadmium-plated parts and, in fact, most metals with the exception of aluminium and its alloys. Hence, Arax Multicores Solder is of interest to metal fabricators for those soldering operations where hitherto fluid or paste fluxes with stick, ingot or wire solders have previously been used.

Mullard Disc Seal Triode

THIS valve is the second in the series of Mullard U.H.F. valves, the first of which was the 10-watt Disc Seal Triode ME1001, extensively used during the war for radar.

The ME1003 is indirectly heated and is intended for use as a common grid, earthed anode, concentric line oscillator or power amplifier. In a coaxial line circuit the power output is approximately 6 watts at 1,500 mc/s (20 cm.) rising to 20 watts at 430 mc/s (70 cm.). The lower limit of operating is a wavelength of approximately 13 cm. The principal characteristics are as follow:—

Heater voltage—6.3 v.

Heater current—1A.

Max. anode voltage—500 v.

Max. anoded dissipation with convection cooling—25 w.

Max. anode current—200 mA.

Max. peak anode current—500 mA.

Application factor—30.

Mutual conductance—20 mA./v.*

* At $V_a=300$ v. $I_a=80$ mA.

Samples of type ME1003 are now available and data on this valve and on type ME1001 will be forwarded on request to the Communications & Industrial Valve Dept., Mullard Electronic Products, Ltd., Century House, Shaftesbury Avenue, London, W.C.2.

New Television Camera Cable

A RECENT and notable cable development is the special multicore camera cable produced by British Insulated Callender's Cables, Ltd., for use with the latest television outside broadcast

equipment. This new polythene insulated cable is the only link necessary between the camera and mobile control van for distances up to 1,000ft., and is remarkably small and compact. Its facilities are unique in that it is capable of handling video signal with low attenuation, scan currents, speech intercommunication, power supply, cue light circuits, etc., and, from the mechanical aspect, gives a high degree of flexibility and robustness with an overall diameter of only .85in.

Wearite "P" Coils

THE impression which seems to have been gained that Wright & Weaire, Ltd., are no longer making "P" coils is erroneous. The company announces that these coils for aerial, R.F., and oscillator tuning are freely available in all ranges.

British Relay Wireless, Ltd.

THE Head Office of the above and its associated companies is now at Giltspur House, 6, Giltspur Street, London, E.C.1.

Plessey Terminal Panels

A COMPREHENSIVE range of terminal panels to meet the requirements of the radio industry has been introduced by Plessey. Manufactured of 1/16in. thick synthetic resin bonded paper, they may be obtained either plain or engraved with all normal markings, Aerial-Earth; Pick-up; Deaf Aid Phones; External Loudspeaker, etc. Tags and sockets are available in alternative finishes.

Price Increases

OWING to rising material costs Ace Radio, Ltd., have increased the price of their table model 500 6-valve receiver from 17 gns. to 18 gns.

The new prices are as follow: Model 500A (for A.C. mains only), £18.18.0, plus £4.18.10 purchase tax. Model 500U (for A.C.-D.C. operation), £18.18.0, plus £4.18.10 purchase tax.

Southern Radio & Electrical Supplies

THIS well-known firm have produced a new 54-page illustrated catalogue (No. 7) of amateur requirements. All goods listed are fully guaranteed.

Owing to the high cost of production it has been found necessary to make a small charge (which, incidentally, is considerably cheaper than cost of production). It can be supplied to readers at 9d. post paid. The address of the company is 85, Fisherton Street, Salisbury, Wiltshire.

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By F. J. CAMM

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- **MILLIAMPERE TEST.** 0/30 m.a. scale for testing total discharge from battery or testing single cell.
- **L.T. TEST.** 0-6 volts AC or DC.

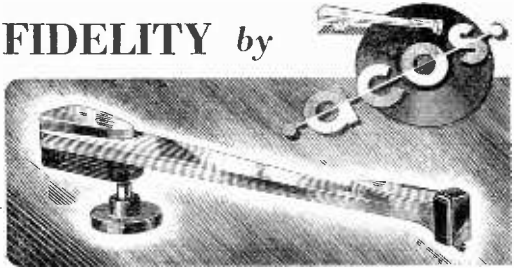
- **H.T. TEST.** 0-240 volts. May be used direct on any mains, AC or DC.

- **VALVE TEST.** Made by inserting valve in socket on front of meter.

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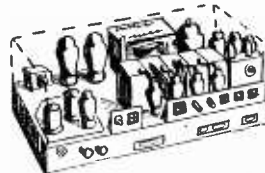
A selection of goods by the above makers was recently displayed at the Amateur Radio Exhibition held at the Royal Hotel, London, and here we received hundreds of testimonials to our catalogue and mail-order service. To those who were unfortunate enough not to attend this exhibition we suggest you try our service and see for yourself. You will not be wasting time.

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A Direct-reading Valve Voltmeter-2

How to Use the Instrument Described Last Month

By E. N. C.

SHORTING the input should have little effect on the zero setting of the meter needle. If it does, the valve V2 is probably suffering from grid leakage or slight softness and should be replaced. It will be advisable to let the unit have a warming up period of about 10 minutes, when the trouble may disappear. In the worst cases of softness or leakage it may be impossible to set to zero, but this is hardly likely if a reasonably good valve is used. This check is important as it determines that the meter is independent in its readings of source impedance over the working range of the unit. If the test is successful the unit is ready for D.C. measurements, the sockets C+ and DC- being used. When A.C. measurements are required the central VR2 should be adjusted until the meter indicates 0.4v., having first set to zero with VR1.

The unit is then ready for A.C. measurements, and the sockets C+ and ~ are used—the instrument indicating the peak value of the applied voltage. Note that while adjusting VR1 and VR2 the meter protection key should be operated. The r.m.s. value of the voltage is easily obtained by multiplying the peak value by 0.71.

Applications

Some of the applications of the voltmeter will now be detailed.

Measuring Power Output of Amplifiers

When measuring the power output of amplifiers, using the voltmeter, the loudspeaker should be replaced by a resistance which is equal in value to the impedance of the loudspeaker, and the A.C. sockets of the voltmeter connected across the resistance, or one end of the voltmeter connected to chassis and the other end through a condenser to the anode of the output valve, as illustrated in Fig. 4.

An A.C. input is applied to the amplifier and the reading of the voltmeter noted. Now the power

output of the amplifier is given by the formula $P = \frac{V^2}{R}$ where R is the anode load resistance and V

is the r.m.s. volts across the load. Since the meter indicates the peak value, the r.m.s. value is equal to meter reading $\times 0.71$ or, which is the same thing, meter reading $\div \sqrt{2}$. Therefore the power output is

$$\text{equal to } \frac{\left(\frac{\text{meter reading}}{\sqrt{2}}\right)^2}{R} = \frac{V^2}{2R}$$

For example, if

the voltmeter reading is 100 v. and the anode load resistance is 2,000Ω, the power output is equal to $\frac{100 \times 100}{2 \times 2000} = \frac{10000}{4000} = 2.5$ watt.

Measuring Amplifier Gain

When measuring amplifier gain it is desirable to have a decade box, but if one is not available a fixed and variable resistance will do the trick. The apparatus should be laid out as illustrated below Fig. 5.

The voltmeter is first switched to the top of the chain and the oscillator adjusted to some convenient voltmeter reading, say, 10 v. The voltmeter is then switched to the amplifier output and R₂ varied until the meter indicates the original reading, in this case 10 v. The gain of the amplifier is then equal to R₂ divided into R₁ + R₂. For example, if R₁ were equal to 99,000Ω and R₂ = 1,000Ω, gain = $\frac{99000 + 1000}{1000} = 100$.

Note.—The input volts across R₂ must not be such that the amplifier is overloaded.

Measuring High Resistance

For accuracy in the measurement it is important that the input resistance of the voltmeter be reasonably accurate. The apparatus is connected up as illustrated, where it can be seen that the unknown resistance is connected in series with a

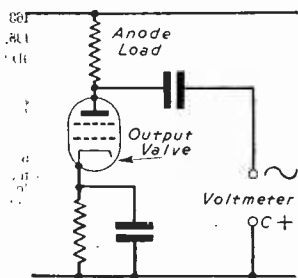


Fig. 4.—Measuring power output.

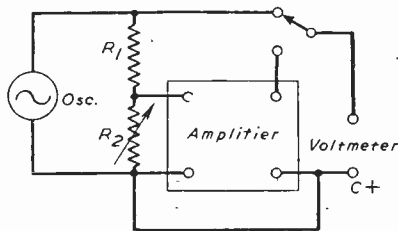


Fig. 5.—Measuring amplifier gain.

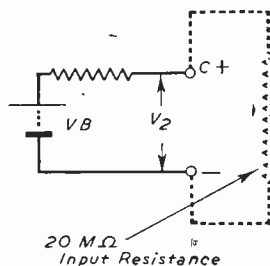


Fig. 6.—Measuring high resistance.

battery across the voltmeter D.C. sockets (Fig. 6).

Now, calling the 20 meg. input resistance R_2 and the input resistance R_1 , the voltmeter reading,

which we can call V_2 , is equal to $VB \cdot \frac{R_2}{R_1 + R_2}$

where VB = the battery volts. So, therefore,

$R_1 + R_2 = \frac{VB}{V_2} R_2$ so then $R_1 = 20 M\Omega \left(\frac{VB}{V_2} - 1 \right)$

For example, let the battery volts be 10 and the

reading V_2 on the voltmeter be 2 v. Then

$$R_1 = 20 M\Omega \left(\frac{10}{2} - 1 \right) = 80 M\Omega.$$

These are but a few of the uses of the voltmeter. Space would not permit explaining the huge numbers of uses, but it may be pointed out here that the valve voltmeter can be used as an R.F. ammeter by shunting the input sockets with a suitable resistance and measuring the volts developed across it.

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R1 = 1/10 meter resistance.

R2,3,4,5,6. Determined by instrument used.

R7 = 12 $M\Omega$

R8 = 4 $M\Omega$ } $\frac{1}{2}$ watt $\pm 1\%$

R9 = 4 $M\Omega$

R10 = 4 $M\Omega \pm 20\%$ $\frac{1}{2}$ watt.

R11 = 50,000 Ω 1 watt.

R12A + R12B = 15,000 Ω 3 watt.

R13 = 250 Ω $\frac{1}{2}$ watt.

R14 = 50,000 Ω 1 watt.

R15 = 100,000 Ω 1 watt.

VR1 = 5,000 Ω VR2 = 10,000 Ω .

S1A + S1B = 7-way 2-pole Yaxley switch.

V1 = Mazda UU6 or any other equivalent.

V2 = VR65 or VR65a. 6.3 v. heater or 4 v. heater.

V3—D1, if up 100 v. is sufficient or U22 or

EY51 if up to 500 v. is required.

V4—Cossor S130 neon stabiliser.

100 or 250 μ A meter.

Ranges of voltmeter: 0-5-10-25-50-100-250-500 v.

200 μ A meter.

Ranges of voltmeter: 0-4-8-20-40-80-200-400 v.

Aircraft Listening Watch

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R.A.F. and Naval vessels engaged on search and rescue operations, and Ocean Weather Ships, will listen out on the International Aeronautical Distress Channel on request only, however. A listening watch is already maintained continuously in an emergency on the R.A.F. Distress Channel (116.1 Mc/s.) by all search and rescue vessels and aircraft, and on request by Ocean Weather Ships. (The latter also maintain a continuous watch on the International Civil Air Organisation primary control channel of 118.1 Mc/s. from which they can switch quickly to 121.5 or 116.1 Mc/s. as required.)

All aircraft, marine craft and vessels engaged on search and rescue operations and that have independent receivers for the purpose, listen out continuously on the International Maritime Distress Channel (500 kc/s.) and on the HF/WT Navigation Aid and Distress Channels (0.500 kc/s. by day, 3.895 kc/s. by night); or, if they have not independent receivers, listen out between 10 and 20 minutes after the hour and again between 40 and 50 minutes after it on 500 kc/s.

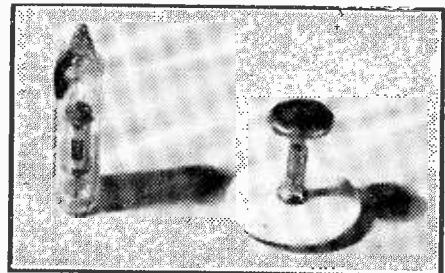
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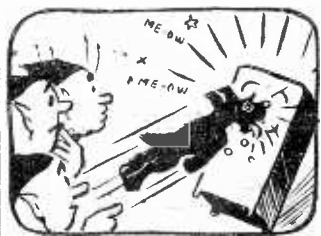
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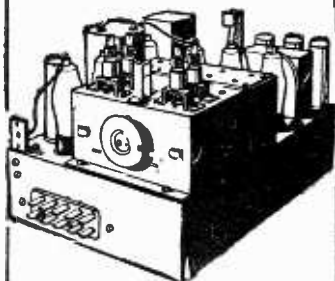
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MAINS TRANSFORMER, 230 v. Inpu 150/0/150 v. 150 mA, 6.3 v. 8 a., 5 v. 3 a. Output (new, ex-Govt.), 15/- each.

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LARGE TYPE RECTIFIERS. Output 50 v. 1 a., D.C. input 70/75 v. A.C. Half wave type, 8/6 each, post 1/6. TANNYO P.M. SPEAKERS (Small Hailers), 4 ohm speech coil, complete in wooden case with output transformer, 15/- each, carriage 2/6.

Programme Pointers

Some Recent Programmes are Reviewed in This Article by Our Music Critic,
MAURICE REEVE

DO creative artists expect to enter a realm of eternal peace and quiet, possibly with other rewards as well, on leaving this "vale of tears" for a far, far better world? When his departure hence draws nigh, and he realises that his last work has been written, does the great author, composer, or what you will, sink back on his pillows and enjoy thoughts somewhat like these?—"How mellifluous and enchanting it will be for me to observe countless generations of my disciples perform my work in all its sublimity and integrity. How soporific it will be to my pride to watch many times their number recline back in their seats and thrill to the beauties of my work. And how I shall gloat over seeing the piles of shekels and paper rendered up at box offices and turnstiles, throughout the ages, for the privilege of basking in my genius."

Poor souls! What shocks will they have in store! How long will it take them to realise, as they see their work murdered on stage, screen and in studio, that they are, *de facto*, in "the other place" and not in Nirvana at all!

Few men of genius have been more mercilessly treated by posterity than Chopin. Generations have maltreated him and made Roman holidays for themselves of his works. We all expected floods of "Chopin Recitals" in this his centenary year, but "floods" is a master word of understatement. Whilst there were one or two notable performances in the course of the B.B.C.'s tribute programmes—Arrau is a great pianist in all he does—there were some shockingly bad ones as well, with what must surely be an "all time low" by the Frenchman Casadesus, in the A flat Ballade. Never did I hear anything so soul destroying—a skeleton picked bare of every shred of flesh. The great Pole was most effectively "Casadesus-ed" on this occasion.

Neither did "Music Magazine" come anything like up to expectations. Not one bar of the major works was quoted; nor were we told anything of the great interpreters of the master.

Scrapbook for 1939

I CAN'T say I thought "Scrapbook for 1939" anything like as good as many of its predecessors. The fault probably lay in the too closeness of period and the too greatness of the events, thus probably preventing the producers from giving rein as is their usual wont. Others have commented on the regrettable absence of Haw Haw's voice, an opinion with which I fully concur. But the point, the truly regrettable point, I would like to underline, was the constant insistence and exposure of the appalling ignorance, levity and apathy of the great multitude—the listening masses, be it said—in the face of a daily accumulating crisis. Practically every time a portentous event occurred, such as the occupation of Czecho-slovakia, the latest dance band hit was used, as background music! Plus the narrator's observation "the people were more interested in *that* (the tune)," the nation was

held up to unnecessary, but shameful, exposure.

And so it went on until, on August 31st, the actual day before the war began. "Mass Observation" found out that 18 per cent. of the population alone thought there would be a war! Phew! I mop my brow in memory. Finally, three days later, the first units of the second B.E.F. marched out of their barracks to the tunes of the two worst marching songs ever blown by trained trumpeters. The third worst was added to the repertoire as winter approached.

In other words, the events which go to make a first-class scrapbook just didn't happen in 1939: no outstanding theatrical production, sporting contest, murder, general election or invention. The war and the events leading up to it were too poignant and too personal, and too close, for proper, impartial treatment.

Music

THREE musical events, as pleasurable as they were excellent, can be dealt with collectively, namely, Backhaus' B.B.C. Symphony Concert, Beecham's Strauss Memorial Concert, and Verdi's Requiem, done by Kubelik and various celebrated coadjutors. Backhaus wears marvellously, and, apart from white and less abundant locks, seems little different from yesteryear, when, amongst many recitals, he gave one in C sharp minor. He is at his best in Beethoven and the other great German classics. The cadenza he played in Beethoven's Third Concerto was a *tour de force*, but atrocious, as are all cadenzas. Beecham's flair for Strauss has been famed for 40 years or more, on both operatic and concert platforms. The incomparable "Don Quixote" was given a wonderful performance, with Antony Pini displaying great virtuosity and artistry in the solo part. Verdi's Requiem, a masterpiece if ever there was one, seems at last to be coming into its rightful place in the choral repertoire. Completed as a tribute to his great friend and compatriot Mazzini, one perhaps would expect it to abound in the dramatic, the sensational and the opulent, seeing that its creator was the century's greatest operatic figure. Wagner alone excepted. Those who like their Requiems liberally sprinkled with vivid and imaginative colouring will not go without them in this one.

Controversy

"WE Beg to Differ" seems to be one of the most amusing and effective features now running. An excellently chosen team of four ladies plays havoc with two men under the very benevolent chairmanship, so far, of Roy Plomley. It is vastly entertaining to hear the quite naked and unashamed sex bias of the charming quartet deal with the "troubles and trials" of harassed hubbies, vigorously but not always successfully countered by the male duet. Peals of laughter greet the banter and cross-fire of the protagonists with the chairman's gavel solemnly preceding a

judgment, in which more than one eye seems to be seeking not so much the approval as the pardon of the lovely four.

Somerset Maugham's sparkling play, *The Constant Wife*, came over effectively, though, most unusually, Miss Pamela Browne marred one or two climaxes through uncertainty with her lines. "*Boyd's Shop*" is a beautifully-constructed "Ulster comedy" by St. John Ervine, and was excellently done by the Ulster Group Theatre. One felt as near the footlights and real people as is possible away from the theatre, which, I imagine, is the measure of a good theatrical broadcast.

"Britain in Europe"

IT doesn't seem like a year since Bertrand Russell inaugurated the "Reith Lectures," and, speaking from memory, I don't think it is quite. But the second series, on "Britain in Europe," given by Robert Birley, is now over, year or no year. I have no space in which to pit my views on the subject against Mr. Birley's, but only enough to criticise the lecture as one of a series, and of the series as a whole. Mr. Birley seemed to completely uphold the value, or integrity and

prestige of them, and to confirm the wisdom of the B.B.C. in founding them. They should go from strength to strength, and be anticipated and looked forward to by all who appreciate stimulating broadcasts with the keenest relish and enthusiasm. Mr. Birley broadcasted excellently, and fully maintained the very high standard set last year. It must require a considerable effort, and art, to divest oneself on such occasions of all trace of the pedagogic and the omnipotent. If either of the Reith lecturers possesses these traits in real life they were very successfully effaced before the microphone, to the enhancement of the lecture's broadcasting value.

The Late Ginnette Neveu

I MUST conclude this month with my tribute to Ginnette Neveu, the tragedy of whose appalling death in the Azores air disaster shocked the whole musical world. Only 30, and with everything before her, this princess of violinists, and her scarcely less distinguished pianist brother, seems to have been lost to propitiate Moloch and the worst side of the concert world, as run to-day. It should never have been allowed to happen.

News from the Clubs

SOLIHULL AMATEUR RADIO SOCIETY

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

At the last meeting members of S.A.R.S. thoroughly enjoyed a lecture on "Radar Aids to Navigation," ably given by Mr. Radcliffe, who was introduced by G5TU.

It is intended to start constructional classes as soon as possible, to be attended by many members who are keen to make their own gear.

A reply from the G.P.O. regarding the club licence is eagerly awaited.

Visitors and new members are always welcome at the club headquarters, c/o Tucker Switches Ltd., King's Road, Tyseley, Birmingham.

TORBAY AMATEUR RADIO SOCIETY

Hon. Sec. : K. J. Grimes (G3AVF), 3, Clarendon Park.

At the last meeting of the society Mr. Launder, B.Sc. (G3FHI) continued his interesting series of lectures, with one on "Wave Propagation"—illustrated by diagrams.

For the December meeting G2BMZ carried on the series with a talk on "Aerial Arrays."

On January 21st, 1950, the society will be given a talk and demonstration on "Wire and Tape Recorders," by Mr. Sands, of Dawlish. It is hoped that members of the British Sound Recording Association will be present on this occasion.

Welcome was extended to juniors who joined and who are now admitted at the ages 14-17 years.

Visitors who are interested are welcomed to the society's meetings, which are held every third Saturday in the month, at the Y.M.C.A., Castle Road, at 7.30 p.m.

SOUTH MANCHESTER RADIO CLUB

Hon. Sec. : Maurice I. Weeks, 57, Longley Lane, Northenden, Manchester.

At a recent meeting one of the main items of interest was trying to get the club station on the air. However, the best transmitter was found to be minus its valves when all was ready and the only other available was rather a "lash-up" affair; nevertheless, a great deal of enjoyment was obtained and one contact made. It is hoped by the next meeting to have things arranged, and perhaps make some contacts with other clubs.

Plans are going ahead for the forthcoming "Top" Band Contest, and providing all goes well, G3EON will represent the club with a "watch of members" under that worthy gentleman's supervision each evening during the contest.

For the future a demonstration by a member of the "Radio Controlled Models" Society is planned and members having had a chance to inspect work done in this sphere at the National Convention Exhibition, are looking forward to this evening.

Meetings are still being held fortnightly at the Church Schools, Northenden, and new members will find a warm welcome.

THE MIDLAND AMATEUR RADIO SOCIETY

Hon. Sec. : W. J. Butler, 32, Pilkington Avenue, Sutton Coldfield, Warwickshire.

MEETINGS are held every third Tuesday in each month at the Imperial Hotel, Birmingham.

A recent lecture on television by Mr. F. Inchley (GEC) proved very interesting and was fully appreciated.

A "party effort" was instituted for the meeting of December 20th.

WALWORTH (MEN'S INSTITUTE) RADIO CLUB

Hon. Sec. : B. E. Symons, 100, East Dulwich Grove, S.E.22.

THE club announces with regret the resignation of their instructor, G4BC (Mr. P. W. Winsford), owing to professional promotion. However, he promises to visit the club from time to time.

The instructorship has now passed to the able hands of Mr. H. Lambert, and a continued successful winter session is anticipated. This includes: Short-wave RX Construction, High Quality Amplifiers, Test Equipment and Servicing, Fundamental Radio Theory.

Finally, an invitation is extended to new members, classes being held at the L.C.C. Institute, John Ruskin Street, S.E.5, on Wednesdays and Fridays, at 7 p.m.

READING RADIO SOCIETY.

Hon. Sec. : Frank Hill (G2FZI), 957, Oxford Road, Tilehurst, Reading, Berks.

OVER the last month there has been very considerable activity in the society.

There was a talk by Mr. Townsend of the M.O. Valve Co., on the design and construction of modern V.H.F. Tx valves. Later there was a series of tests of Extra-Sensory Perception.

About 120 members, friends, and visiting amateurs, including one from PA, were entertained at the society's annual Hamfest.

At a recent meeting Mr. Light, of Taylor Electrical Instruments, talked on the design, and method of using simple test gear, such as the signal generator, "Wobulator," and cathode ray oscilloscope. A large party from the Farnborough Radio Society was present at this meeting.

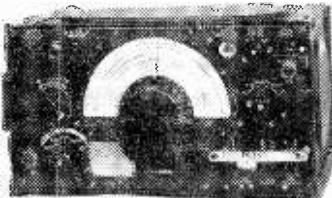
The next meeting will be on January 12th: "Test Equipment—Part 2," by Taylors.

ENFIELD RADIO SOCIETY

Hon. Sec. : F. Tickell, 10, Cowdrey Close, Enfield.

THE Enfield Radio Society have now occupied new premises at St. James Hall, Durants Road, Ponders End. Meetings are held every Monday, 7 p.m. The society are awaiting the issue of a licence for their own transmitter and a television set is under construction. Individuals interested are requested to contact the secretary.

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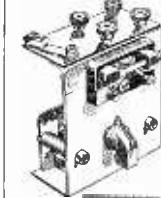
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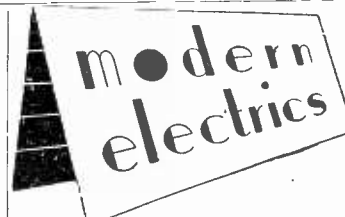


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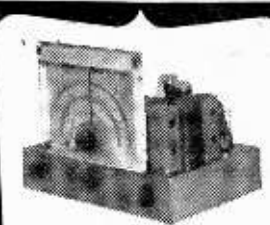
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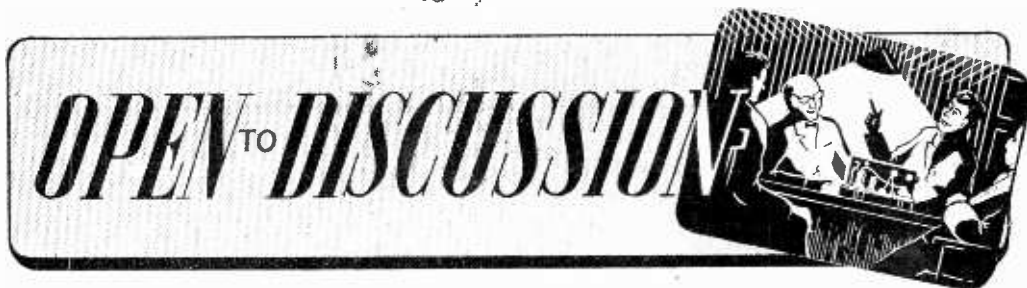
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The Editor does not necessarily agree with the opinions expressed by his correspondents. All letters must be accompanied by the name and address of the sender (not necessarily for publication).

D.C. Oscilloscope

SIR,—It has just been brought to my notice by a reader who has built up the circuit with apparently pleasing results that in the diagrams of my R.F. Power Unit and D.C. Oscilloscope (September, October and November issues) the grid leak of V1, the main oscillator, appears on the wrong side of C2, and so is shown as being connected across the coil. This is, of course, incorrect, and R1 should be connected between the grid of V1 and earth as an earth return.

The fault is mine, as I should have seen this when correcting the proofs, and I can only offer my apologies and plead extenuating circumstances.—**EDWIN N. BRADLEY** (Cornwall).

BC-454

SIR,—I was surprised to read Mr. J. R. Murch's letter in the "Open to Discussion" page of PRACTICAL WIRELESS of November, 1949.

For the last six years I have worked on the receiver BC-454, and this is the first time that I have come to hear of it working only when the H.T. positive is connected to the chassis. This receiver is one of the receivers used in the Dakota aircraft, where the return line (L.T. negative) is through the airframe. In most of the dynamotors the H.T. negative is also connected to the chassis, hence Mr. Murch's letter was more of a surprise to me than anything else. I would ask Mr. Murch to check up on the following points:—

1. A thorough comparison should be made between the base connections of the 12-volt dynamotor and the 24-volt dynamotor to see that they are identical.

2. A thorough check should be made of the 12-volt dynamotor to ensure that the H.T. positive and H.T. negative lines are not crossed over.

3. A thorough check of the BC-454 wiring should be carried out and compared with a wiring diagram of the same.

Lastly, I would request Mr. Murch to let us know the exact fault after he has discovered the same.—**B. R. TOORKEY, B.A., B.Sc.** (Bombay, India).

SIR,—For the information of Mr. J. R. Murch, the operation of the BC-454 is from a 28 v. negative earthed supply. He seems to have converted the heaters correctly, but not the power

unit. The three-pin rotary converter plug has the following connections. The spaced pin—pin 1—has H.T. and L.T. earth connections. The other pins, viewed from above the chassis, are clockwise from pin 1, L.T.+ and H.T.+ respectively.

The power unit should be checked for its rotation direction and output. If it rotates incorrectly the L.T. connections to the brushes should be inverted. If the rotation is correct the H.T. connections should be inverted. If the brush holders are not both insulated the holders may be interchanged, paying reverence to the fragile moulding whilst doing the operation.—**B. R. GIBBS** (Bournemouth).

Focus Control

SIR,—I constructed some months ago a television receiver employing a VCR97 tube, which has since operated quite satisfactorily. I am puzzled, however, by a lack of sensitiveness of the focus control as compared with an electromagnetic tube, and I am wondering whether any other of your readers may have experienced a similar effect. The position of the focus control which makes the lines most distinct renders the outlines of the image blurred in the direction of the lines, but alteration of the focus control to broaden the lines makes the image much more sharply defined and enables one to distinguish the high frequency lines (two megacycles, I believe) of the test signal. The answer appears to me to be the fact that the spot produced by the beam on the screen is elongated either in the horizontal or vertical direction in accordance with the focus control setting and that elongation of the spot in the vertical direction results in the maximum possible definition of the picture with simultaneous elimination of the spaces between the lines.

In order to check this idea I have experimented by rendering the time-bases inoperative so that I only obtain one spot on the tube and have then varied the focus. As far as I could see, the shape of the spot could be varied within limits, although, of course, the fluorescence of the screen immediately around the spot rendered observation difficult.

Other than this focus problem, my only other picture fault lies in distortion resulting from a non-linear Miller frame time-base, but I gather that there is no real cure for this trouble unless one fits a non-linear amplifier which corrects the distortion.—**E. V. WARD** (Tooting).

Home-made Television Receivers

SIR,—With reference to your correspondent's letters regarding the inability to obtain a full scan on some VCR97 tubes, the trouble is undoubtedly due to the construction of the tube.

These tubes vary with different manufacturers and the diameter of the neck varies considerably. The rubber bands mentioned by S. A. Knight are only fitted on the narrow neck type between the tube neck and mumetal screen.

I agree with David Wayne in that the outstanding snag with the Miller scanning generator is non-linearity and I would appreciate any information on the circuit which would lead to better linearity. No doubt much of the trouble is due to the use of high value anode load resistances which are necessary in order to obtain the large amplitude sawtooth voltage required.—G. BROOKE (Gravesend).

Meter and Rectifier Resistance

SIR,—“Puzzled” can solve his problem by plotting for each A.C. range a graph of meter readings against r.m.s. volts. The procedure is as follows:—

(1) Fit up the meter to measure, say, 0.5, 10, 50, 100, 500 volts D.C. and include a switch to bring in the rectifier for A.C. (2) For each range, plot a graph of meter reading with the switch in the A.C. position against D.C. volts (as measured with the switch in the D.C. position). There is now no need to worry about the volts drop across the rectifier. (3) Multiply each ordinate by 0.9. This gives the required curve, and the horizontal volts axis may now be labelled “Volts R.M.S.” It will be found that each A.C. range extends slightly beyond the corresponding D.C. range.

The theory behind step 3 is that the average value of a half sine wave represented by E volts r.m.s. is $2\sqrt{2}E/\pi$ volts = 0.9E volts. For strict accuracy one would have the laborious task of finding the average values of a number of distorted half sine waves. But I have found by experiment that step 3 is accurate enough for all practical purposes, even on the two lower A.C. ranges.—P. H. BLAKE (Hounslow).

SIR,—Regarding the problem of finding the resistance of a meter rectifier (“Puzzled,” December issue), the following notes may be of assistance. It is assumed that a reliable A.C. voltmeter is not available, since calibration would then be comparatively simple.

(1) The rectifier presents a much higher resistance to small currents than to large currents.

(2) The bridge rectifier often exhibits a different resistance when the applied potential is reversed.

(3) A moving coil meter measures average current and not r.m.s. current. A compensating factor of 1.11 must be used to convert average to r.m.s. or 0.9 to convert r.m.s. to average.

To overcome these difficulties, calibration can be done with D.C., allowing a D.C. voltmeter to be used. Several readings at different currents must be taken, and then these readings repeated at reverse polarity and the mean taken. It is advisable to graph results to avoid experimental errors.

The effective resistance at each setting can be

found by taking the reading on the voltmeter and dividing by the reading on the milliammeter. The figure of importance, as far as the ballast resistor is concerned, is the rectifier resistance at f.s.d. This should be deducted from the calculated figure of total resistance to give the ballast resistor, e.g., assume 1.2 volts D.C. is required to give f.s.d. of 10 mA, then rectifier resistance = 120 ohms.

$$\begin{aligned} \text{Total resistance for 5 volts A.C. f.s.d. at 10 mA} \\ = \frac{5 \times 1,000 \times 0.9}{10} = 450 \text{ ohms.} \end{aligned}$$

$$\text{Ballast resistor} = 450 - 120 = 330 \text{ ohms.}$$

For calibration at intermediate points the rectifier resistance is found as above and added to the ballast resistor, then multiplying by the current and by 1.11 gives the r.m.s. voltage.

For example, assume at 20 per cent. deflection (2mA) 0.5 volts D.C. is required.

$$\text{Then rectifier resistance} = \frac{0.5 \times 1,000}{2} = 250 \text{ ohms.}$$

$$\text{Total resistance} = 250 + 330 = 580 \text{ ohms.}$$

$$\text{Voltage} = \frac{580 \times 2 \times 1.11}{1,000} = 1.29 \text{ volts r.m.s.}$$

(Note that with a linear scale, the figure would have been 1 volt r.m.s.)

The scale can be calibrated by repeating this calculation for each measurement taken in the experimental set-up and plotting a graph of volts against scale reading.

The effects of curvature and rectifier resistance will decrease on the higher voltage ranges, and can probably be neglected on the 100-volt range and over.—G. E. NICHOLLS (Birmingham).

6K7 Pocket Receiver

SIR,—With reference to Mr. F. Lines's letter in the January issue, I recommend that he tries one of the 1.4 volt valve types now so easily obtainable, instead of the 6K7 in the 6K7 Pocket Receiver. An octal pentode such as the 1A5G, now obtainable for 5s., will consume only .05 amp. at 1.5 volts, as against the .3 amp. at 4.5 to 6 volts of the 6K7. If a midget valve is preferred, the 3S4 or 1S4 can be used, with a filament consumption of .1 amp. at 1.5 volts. I have found these valves very satisfactory in small sets of this kind, and a H.T. supply of 9 to 12 volts should be provided by means of small dry cells, which will last several months. The dry cell required for filament supply will only cost a few pence, and is, of course, replaced separately.—F. G. RAYER (Tewkesbury).

Tuned Earth

SIR,—With reference to your correspondent's letter under Tuned Earth; this is a very old idea. In some cases it removed H.C. effects. In others it was apt to make them worse, or even introduce them in a really stable receiver. Any reader who must use a comparatively long earth lead might care to try using a .0003 μ F. variable condenser in series with it and base his opinion on results. In closing, there are various firms advertising as loudspeaker repairers. I cannot remember seeing an advert by any firm that they undertake the remagnetising of P.M. speaker magnets.—A. W. MANN (Middlesbrough).

Impressions on the Wax

Review of the Latest Gramophone Records

MOST readers, no doubt, are able to link up many of the broadcast programmes by the signature tune with which they are introduced. The Columbia Co. have now made available the following records which give complete recordings of many of the signature tunes now being used. *Family Favourites*: "With a Song in my Heart," played by Andre Kostelanetz and his Orchestra, on *Columbia DB2107*; *Woman's Hour*: "Merry Wives of Windsor" Overture, played by the Philharmonia Orchestra, conducted by Josef Krips, on *Columbia DX1484*; *Paul Temple*: "Coronation Scot," played by the Queen's Hall Light Orchestra, on *Columbia DB2406*; *Grand Hotel*: "Roses of the South," played by Albert Sandler and his Palm Court Orchestra, on *Columbia DB2165*; *Dick Barton*: "Devils Galop," played by Charles Williams and his Concert Orchestra, on *Columbia DB2448*; *Housewives' Choice*: "In Party Mood," played by Charles Williams and his Concert Orchestra, on *Columbia DB2595*; and *Down Your Way*: "The Horse Guards—Whitehall," played by the Queen's Hall Light Orchestra, on *Columbia DB2406*.

Orchestral Recordings

One of the highlights of the orchestral recordings among the recent releases is the suite from "The Music for the Royal Fireworks," by Handel, played by the London Philharmonic Orchestra, conducted by Sir Adrian Boult, on *H.M.V. DB6968-9*.

Chopin in orchestral dress can be immensely attractive. Andre Kostelanetz contributes two masterly transcriptions of the "Fantaisie-Impromptu" and the electrifying "Valse brillante," on *Columbia DX1596*. The latter piece faithfully reflects the waltz as it was favoured at the time and yet is a composition of the highest musical value.

Tibor Varga (violin) with the Philharmonia Orchestra, conducted by Anthony Bernard, have made an interesting recording of Beethoven's "Romance No. 1 in G Major," on *Columbia DX1615*, whilst for ballet lovers there is Tchaikovsky's "Waltz" from the "Sleeping Beauty" Ballet, played by the Liverpool Philharmonic Orchestra, conducted by Hugo Rignold, on *Columbia DX1621*. On the reverse the same orchestra, with Henry Datyner, solo violin, has made an attractive recording of "Intermezzo" and "Serenade" from "Hassan," by Delius, arranged by Sir Thomas Beecham, Bart.

Weber's popular "Invitation to the Dance" is a firm favourite with many and the Philadelphia Orchestra, conducted by Eugene Ormandy, has made a pleasing recording on *Columbia LX1247*.

Rachmaninoff's "Concerto No. 1 in F Sharp Minor, Op. 1," on three 12in. discs, makes an attractive set of records, and with Benno Moiseiwitsch (pianoforte) and the Philharmonia Orchestra, conducted by Sir Malcolm Sargent, you are certain of a polished performance. The records are *H.M.V. C3932-4*.

Another fine pianoforte record is Malcuzyński's interpretation of two of Chopin's compositions.

They are "Grande Valse Brillante No. 1 in E Flat Major" and "Valse No. 14 in E Minor," on *Columbia LX1246*.

Finally, in this section, there is Borodin's "Nocturne for String Orchestra" played by the Philharmonia String Orchestra, conducted by Sir Malcolm Sargent, on *Columbia DX1618*, and "Caucasian Sketches, Op. 10," played by the Philharmonia Orchestra, conducted by Nicolai Malko, on *H.M.V. C3937-8*.

Vocal

The traditional Welsh song "All Through the Night" and "Mice and Men" are sung by the Glasgow Orpheus Choir, conducted by Sir Hugh Robertson, on *H.M.V. B9842*. The latter song is set to the psalm tune "Desert," with two traditional verses and a third verse by Robertson, who also does the arrangements.

John McHugh is at present touring in an Ivor Novello show. Novello's latest London production, "King's Rhapsody," bids fair to become one of the biggest post-war musical hits. From the attractive numbers in the score two have been chosen by John McHugh for his latest Columbia record: "Fly Home Little Heart" and "Gates of Paradise," on *Columbia DB2603*.

Gigli, like all Italians, has an intense vitality, which can be felt in the songs on his latest recording, *H.M.V. D.41924*. The "Cancion Moresca," is a successful attempt by an Italian composer to reproduce the quasi-oriental style of southern Spanish song. On the reverse he sings "Casarella."

Variety

Although Bud Flanagan and the Radio Revellers have been partners for months in the Victoria Palace show "Together Again," this is the first time they have teamed together on a record. "Wandering Along" is a new song, but it is in the melodic vein suited to Flanagan's particular style. Behind the chorus the Revellers are heard rendering a neat counter-melody. "A Shanty in Old Shanty Town" is an old favourite which appears on the other side, *Columbia DB2594*.

Dorothy Squires and Billy Reid have again "joined hands" to produce fine vocal and orchestral performances of delightful tunes. "Snowy White Snow and Jingle Bells" was given its debut in one of the B.B.C.'s Ladies' Night features, whilst "Say Goodnight but not Goodbye" was the waltz featured in the B.B.C. Welsh Rarebit programmes. The record is *Columbia DB2605*.

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Practical Television

Vol. 2. No. 2

NEW SERIES

FEBRUARY, 1950

Televiews

Recording Television

UNTIL recently television pictures have been ephemeral; once they have passed from the screen they are but a memory and cannot be recalled, like the spoken word and the neglected opportunity. However notable the event, and irrespective of the labour involved in planning and rehearsal, the picture flashes and is gone. With the advent of television recording, or telefilms, a new tool with great possibilities is available for the television programme builders. By means of it the pictures are preserved in an enduring photographic record on ordinary cinema film.

The system has reached the stage, where it is possible to telefilm a broadcast and reproduce it again in the programme later on with little loss of the original picture quality. The system has been perfected by W. D. Kemp, of the Planning and Installation Department of the B.B.C., from the suggestions of H. W. Baker, Engineer-in-Charge of Alexandra Palace; H. G. Whiting, now Engineer-in-Charge of the new Sutton Coldfield Station, and D. R. Campbell, one of the senior engineers at Alexandra Palace.

The result has been achieved after a detailed study of the problems of deterioration of picture quality that must inevitably take place in any recording process that combines the very complex electronic, optical and photographic methods. These losses are taken care of in the new process by a system of electrical over-compensation which it is claimed almost exactly counter-balances the degradation in picture quality that must accompany the recording process.

Telefilm makes use of a continuous motion camera. Two are provided to enable continuous recordings to be made. The movement of the film is chased by an optical image of the

television picture reflected from a rotating mirror drum and by this means all of the 405 interlaced lines of the picture are recorded on the film and the difficulties of relating the television frame frequency to the picture repetition frequency of the film are overcome.

This new recording equipment was introduced into the television service at the beginning of last November and the intention is to broaden the scope of its use in the near future. The first important outside broadcasts to be telefilmed in order that they could be shown in the evening to viewers who had been unable to see them during the day were the Service of Remembrance on November 6th and the Lord Mayor's Show on November 9th. This development follows delayed film television, which is almost as old as television itself. A process very akin to telefilm is dealt with in our Television Manual.

American Television Industry Expands

THE Federal Communications Commission has proposed a programme which will permit the setting up of no fewer than 2,245 transmitting stations in the United States of America. At present there are about 70 stations in the U.S.A. but they are not uniformly distributed.

If these proposals are carried into effect there would be a nationwide coverage and America would, of course, have the largest television service in the world.

One of the interesting proposals is for colour television by means of what they term "stratovision" transmission, which means the transmission of programmes from planes flying at high altitude—not necessarily the stratosphere.

The plan being considered by the Federal Communications Com-

mittee envisages 42 U.H.F. television channels which would be supplementary to the 12 V.H.F. channels at present in use.

The American market is an extremely large one. It has been estimated with some degree of accuracy that 2,500,000 television receivers are in operation in America at the present time.

The Americans recently have claimed to have surmounted the difficulty of adopting the new colour television technique without rendering existing receivers out of date. They claim to have produced an adaptor which can be coupled to existing receivers and permit them to receive on U.H.F.

A further claim which must be accepted with reserve is that they have developed a system of full coloured television applicable to existing technique. This claim is made by the Radio Corporation of America and the claims are to be investigated.

During the first six months of 1949 nearly 1,000,000 television receivers were sold to the American public.

Telenews

New Permanent H.Q.

THE B.B.C. announce that they have decided to develop their 13-acre White City site in two stages. Mr. Graham Dawbarn, C.B.E., M.A., F.R.I.B.A., has been appointed architect for the first stage, in association with Mr. M. T. Tudsbury, C.B.E., M.I.C.E., the Corporation's Civil Engineer.

Television Production

ESTIMATED production of television receivers during November was 35,000—8,000 higher than the October figure, which was the previous highest.

It is estimated that so far 40,000 sets have been sold by manufacturers to dealers in the Midlands.

Television Aerial Construction—2

Concluding Details for Both the London and Midland Stations

By R. SHATWELL

CAREFULLY reassemble the aerial, drawing the cable back slowly and making sure it is clear of all bolts passing through the tubes.

To render the assembly weather-proof, give all the connections a few coats of shellac, and from $\frac{1}{4}$ in. paxolin cut covers for the dipole and reflector assemblies and fix by 6 B.A. brass screws into tapped holes in the edges of the $\frac{1}{4}$ in. paxolin, as shown in Fig. 6. The top and bottom covers are drilled $\frac{3}{8}$ in. and slipped over the elements. Before screwing the covers in

and spread the strain over the corner of the brickwork. They are held in position by the frame itself. One frame gives sufficient rigidity with the Sutton Coldfield aerial, but possibly two will be necessary for the larger Alexandra Palace array. The bracket to which the mast is bolted is also of 1 in. angle iron and must be heated to red heat to bend in a vice, and again heated to hammer out any kinks resulting from bending. It should be about 12 in. between the fixing arms, and the arms should be kept as short as possible so long as the mast clears any buttress round the top of the chimney stack. The mast is fixed by two saddle clips and a bolt through the top clip passing through clip, mast and bracket.

General

It should be realised that the diameter of tubing

however, the only limiting factor, and the constructor can adapt the design to available material provided a margin of strength is allowed. The $\frac{1}{4}$ in. paxolin is capable of supporting any practical array without danger.

Noise

One final point and one which has been troubling many listeners, is the question of noise. If the aerial is erected in a very open position it may be found that in high winds it hums and the noise seems to be amplified in the rooms of the house on the side adjacent to the aerial. In the majority of cases this may be prevented by filling the aerial with some light packing material such as powdered cork, sawdust, etc. A plug should be cut and fitted firmly in the lower ends of the aerial and reflector after assembly, and then the material poured in at the upper end, after which a further plug should be inserted and painted with shellac or similar weatherproof material.

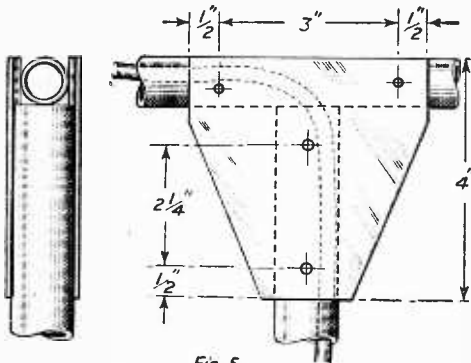


Fig. 5

Fig. 5.—The centre clamping piece.

position, coat the edges of the $\frac{1}{4}$ in. paxolin with Bostik, and spread this liberally around the elements where they will protrude. The gaps about the crossbar can also be packed with this material.

Chimney Lashings

These can be made quite cheaply from light 1 in. angle iron, again obtained from a scrap dealer. Dimensions obviously depend upon the chimney stack, but the work can be completed ready for fitting by counting the bricks used in the stack and measuring this on the outer wall of the house. The $\frac{1}{8}$ in. drawbolts used will allow up to $\frac{1}{2}$ in. adjustment in either direction on all dimensions. Figs. 7 and 8 show the essential details.

The draw bolts should be about 1 $\frac{1}{2}$ in. long and threaded at least 1 in. of their length. The upright angle pieces are about 9 in. long

used is dictated entirely by mechanical considerations. More fragile tubing would not withstand the rough weather, and although a greater diameter for dipole and reflector elements would increase the bandwidth, the result is, hardly likely to be noticeable, and the increase would also mean a proportionate increase in crossbar and mast to support the array. Weight is not the main factor, but wind resistance, which increases out of proportion to weight. This is,

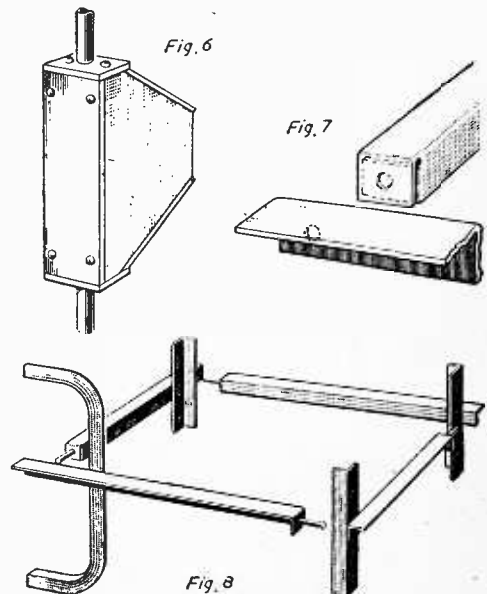


Fig. 6, 7 and 8.—Further clamping pieces and details of a suitable chimney lashing.

TELEVISION PICK-UPS AND REFLECTIONS

UNDERNEATH THE DIPOLE



By "Scavuer"

THE B.B.C. secured a wonderful bargain in their purchase of the Lime Grove Studios at Shepherds Bush. The way is now clear for a rapid expansion of stage facilities, for more rehearsals and for Bigger and Better British Television. In due course, the focus of attention will change from the Alexandra Palace to Lime Grove, where there is sufficient accommodation for the quite considerable office staff, technicians and producers now employed. Ever since the second day of the famous auction sale of furniture, effects and equipment at Lime Grove, wild rumours had been circulating that the B.B.C. had reconsidered the matter and bought the actual premises. The rumours turned out to be true; but rumours are still circulating about how the Director General suddenly changed his mind and approved the deal. I have been assured, however, that there is no truth in the story that a few television technicians and producers broke down the Director General's door and bludgeoned him into "approval"! No "blunt instruments" were used, nor were any doors broken down. But after decisions had been made and all was settled, a few of the technicians adjourned to the "local"—and the drink of the evening was a "gin and Lime-grove!"

Five-Floors and a Roof

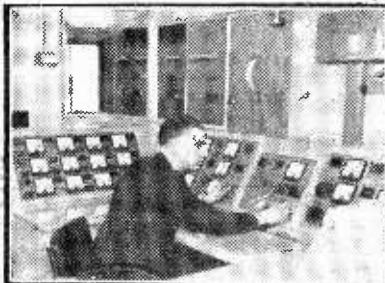
THE B.B.C. now have available at Lime Grove five big

studio stages, all of them considerably larger than those at the Alexandra Palace. Stage 4, the largest at Lime Grove, has a floor area of no less than 10,200 sq. ft., with a height of about 30 ft. This compares very well with other British film studio stages, which average at about 7,500 sq. ft. The largest stages at Denham, Pinewood, Elstree and Shepperton are considerably above this average figure, of course, and they possess special stages which approach the huge area of 20,000 sq. ft., in addition to those of the more normal size. These huge stages are necessary for specially large sets, but are not always the most economical to run for the handling of a number of small sets. I have seen a colossal stage actually being used for a small shot of a telephone box, a scene which could easily have been accommodated in a very small studio. It is obviously not an efficient proposition to use

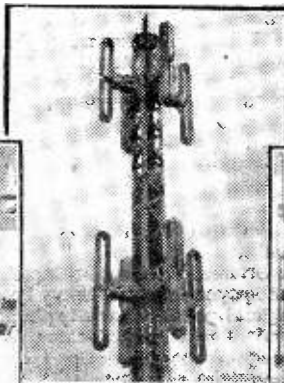
large stages for anything else but large sets, since the whole area has to be heated, ventilated and maintained, whether it is used or not. I should not be at all surprised if the B.B.C. decided to divide this large No. 4 Lime Grove stage, 120 ft. by 85 ft., into two smaller stages with large communicating doors. This arrangement would enable the two small floors to be converted temporarily into one stage for specially large sets when required, a system which has proved highly successful at Ealing. Then there is the roof of the Lime Grove Studio, which was specially made for shooting "sky-line" shots. It is here that—believe it or not—many of the close-ups of lancaers in "The Charge of the Light Brigade" (released as "Balaclava") were shot, edited into the longer shots which had been photographed on Salisbury Plain. This isn't quite so crazy as it sounds. Often, when a film sequence is edited, additional close-ups are found to be necessary. It is obviously less trouble to put a real or dummy horse on the roof of the studio and "shoot" the actor on it, with a sky as background, than take a long journey to Salisbury Plain.

Filming for Television

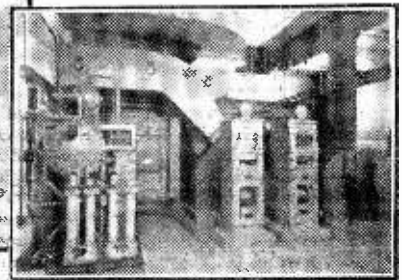
I HAVE previously mentioned the B.B.C.'s preoccupation with "direct" television transmissions from the studio or from the location unit. The B.B.C. producers seem to have profound



The combined control desk for the sound and vision transmitters at Sutton Coldfield.



The combined sound and vision aerial array consisting of 8 folded dipoles made from galvanized steel strip.



The valve-cooling plant used for cooling the CAT21 valves in the modulated output stage of the vision transmitter.

objections to filmed recordings of studio or exterior scenes, excepting for mere linking shots in plays, or for newsreels or documentaries. Even the documentary films are transmitted with live commentaries. In the meantime, no fewer than five small British film studios have reopened for the sole purpose of making feature-length films for sponsored American television programmes. The Kay Studios, Carlton Hill, formerly used principally for documentary films, has been turning out 36-minute mystery stories at the rate of at least one a week for the last three months, and other studios at Marylebone, Kensington and Cursitor Street (Chancery Lane), are now busily occupied in earning dollars by making films for American television. The new Devon Studio, Paignton, was converted from a large country house and well equipped for medium-sized feature films. But the slump came, and no films were made. At last the lights have been switched on and the cameras are turning at Paignton—on films for American TV! The first of these has been made on quite an elaborate scale and is to be followed by twenty-four more, at the rate of one a week.

For U.S.—Not for Us

WILL any of these films be shown in England at all? They are not necessarily suitable for cinema showing, being made with a technique specially evolved for television. Will the B.B.C. purchase the British rights of any of them? That remains to be seen. I am told that some of these dollar-earning television films are very good—and some of them very bad. But even the poorest of them couldn't be worse than some of the second-feature American cowboy films the B.B.C. has inflicted upon us. I suppose the answer is that the B.B.C. won't pay enough money for them, but that the competitive American television networks, with their hundred or so transmitters, can afford to pay a reasonable price.

"By Candlelight"

THE special technique required for television was carried out punctiliously in the play "By Candlelight," a light comedy with a Viennese flavour, produced by Harold Clayton. This play was

almost completely without long-shots. This fact was particularly noticeable on account of the extremely loud noise made by the skirt of the leading actress, which presumably brushed the floor as she moved about. Whether it was the skirt or not one could never be certain; the camera did not move back far enough to reveal her feet. The "frou-frou" noise was disturbing and unnecessary, together with many other creaks, footsteps and door noises.

Background noises of this sort become a problem when artists speak in a low voice. The sound "mixer" brings up his volume control to catch whispers and swallowed words and—hey presto!—the rustle of a sleeve sounds more like a ton of coke being unloaded, and the delicate clink of knives and forks at a tête-à-tête luncheon sound like the Battle of Hastings. The effects are even more intense if varionic amplifiers are used—an American description of amplification systems for recording which have forms of A.V.C. or compression which automatically increase the volume of soft sound. If the top 24 decibels are compressed into 12 db., the volume level can obviously be run higher, thus magnifying the weaker sounds. But the most popular ratio for compression is 20 into 10 db., which is a reasonable compromise. What ratio the B.B.C. use I do not know, but at times it seems pretty severe.

"Lend Me Your Ears!"

QUITE apart from technical considerations, there seems to be a craze for underplaying, both in action and voice, afflicting the actors of the stage and screen, and now it has reached television. Many a stage play is ruined by the actors being "natural" and throwing softly spoken lines away into cupboards or coal-boxes upstage, while audiences strain forward to hear what is going on, amidst the "jamming" or "local interference" from rustling chocolate papers, coughs, heavy breathing and, possibly, a faulty plumbing system in the cloak-room at the back of the pit! Good diction should be a first priority in the qualifications of a good actor, and with this goes the ability to "whisper" in a manner which sounds like a whisper, but can be clearly heard at the back of the gallery. The "stage whisper" is

often geyed by humorists, but is a necessity for stage, screen or television. The art of speaking is not entirely lost, in spite of the enervating influence of the microphone of the public address systems. But many speakers, singers and music-hall artists have come to rely on it and—indeed—would be quite lost without it. What would Irving, Tree and Garrick have thought about it? "Alas, poor Yorick!" they used to mutter, and it was heard clearly in the back row of the gallery of the largest theatre.

The High Pressure Mercury Lamp

THE lighting of outside television broadcasts is not an easy matter, especially when large areas are concerned. Lights are left on for long periods during transmissions and should be as unobtrusive and noiseless as possible. This more or less rules out the use of arc lighting, which, though giving the best type of light, requires the constant attention of electricians, who trim and adjust the carbons and replace them from time to time. The concentrated point of light in the high-intensity arc enables a highly efficient lens system to be arranged in front of it, the design of which is based upon the optics of a light-house lamp. The resultant beam of true "parallel light" gives a hard, crisp shadow, easily controlled and focused, enabling the best photographic effects to be obtained. The fine night scenes in "The Third Man" film are typical of what can be done.

But the arc lamp is now being overtaken by the compact light source lamp, the progress of which has been commented upon in this column from time to time. British made compact light source lamps are developments of the high pressure mercury street lamp (of horrifying hue!). But in their television and film studio models, the makers have now perfected a light which is visually and photographically white, has a gap between the electrodes as concentrated as the carbon arc and can be lit up almost instantly. Furthermore it gives off no smoke or noise and practically no heat. In fact, it is the ideal lamp for the television studio. The B.B.C. already possess a few of them; I don't think it will be long before they are a standard piece of equipment here and in America.

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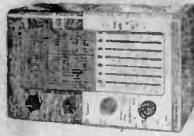
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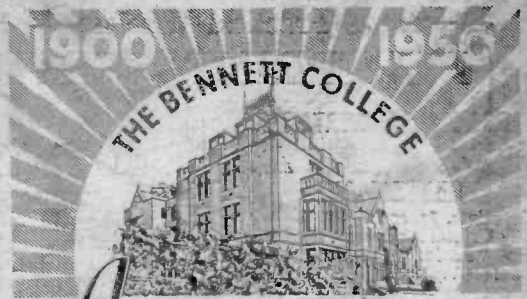
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