Practical Wireless

9D EVERY MONTH

AND PRACTICAL TELEVISION

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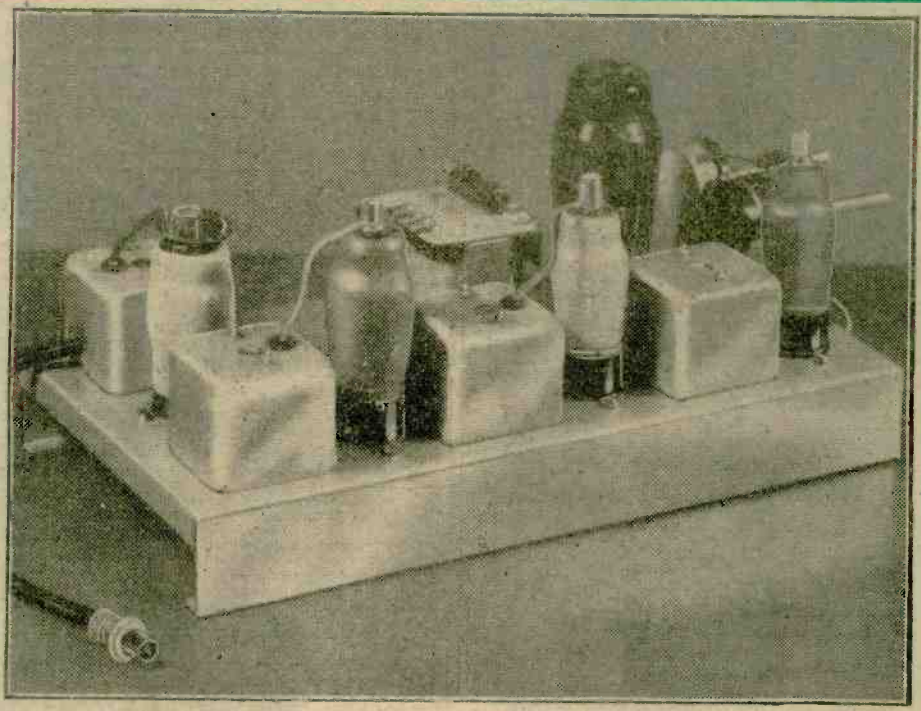

See Page 150

PRINCIPAL CONTENTS

Practical Wireless and PRACTICAL TELEVISION
17th YEAR OF ISSUE
EVERY MONTH
VOL. XXV. No. 513 APRIL, 1949
Editor E. J. CAMM

COMMENTS OF THE MONTH BY THE EDITOR

Television Servicing

THE City and Guilds of London Institute, in conjunction with the Radio Trades Examination Boards, has, as reported elsewhere, drawn up a syllabus for a television servicing certificate examination. The City and Guilds of London Institute certificates are a hall mark of technical qualifications in a wide number of industries. Had they, in the early days of radio, produced a similar scheme the public would have been safeguarded against swindlers, quacks and incompetent service engineers, and we should not have, even to-day, so many complaints regarding exorbitant charges for inferior work.

The C.G.I. is to be congratulated upon being so early in the television field. Television is developing, and if, as is confidently hoped, the purchase tax is removed after the budget in April there will be many more viewers and a corresponding increase in the demand for competent service engineers.

The servicing of a television receiver is a more complicated task than servicing an ordinary sound receiver, and it requires a more specialised knowledge as well as a greater range of test equipment.

Moreover, the average householder will not be able to undertake even the simpler adjustments of a television receiver, adjustments which he is able with confidence to effect in sound receivers, not only because he will not have the necessary equipment, but because of the high voltages employed and the corresponding danger if repairs are attempted by unskilled hands. The examination will comprise two written papers, each of three hours' duration, and a practical test of three hours' duration, and candidates must satisfy the examiners in all sections of the examinations. The written papers, set by the City and Guilds of London Institute, may contain questions selected from any part of sections A and B of the following syllabus:

Section A: Light and Vision; Production of the Picture Signal; Reproduction of Picture from Signal; Complete Simple Television System: B.B.C. Standard Transmission; Reception of Standard Transmission.

Section B: T.R.F. Receiver; Superheterodyne Receiver; Demodulation; Video-Frequency Amplification; The Cathode Ray Tube; Time Bases; Synchronising Pulse Separation; Sound Receivers; Power Supply Circuits; Aerial and Feeder Systems; Interference: Picture Defects, their Cause and Correction; Servicing Requirements.

Practical tests will be conducted under arrangements made by the Radio Trades Examination Board, and will include a soldering test of half an hour's duration. The written examination may be taken at centres throughout the country, at which other City and Guilds examinations are taken. The practical tests will be held at a smaller number of centres, each within the range of a television transmitter, and candidates will be asked to attend at the most convenient centre. Successful candidates will receive the television servicing certificate.

Entries must be made on a special form, obtainable from the Secretary, Radio Trades Examination Board, 9, Bedford Square, London, W.C.1. The examination fee is three guineas.

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

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

Car Radio Licences

IT is not generally realised that when a radio set is fitted to a car, a separate licence is required. The impression seems to be abroad that if a licence is taken out in respect of the home radio set this also covers the use of another wireless receiver in the car. The police, we understand, are instituting an extensive drive to detect unlicensed car radios. This drive, which will continue throughout the year, will be extended to all parts of the country.

More Copies of P.W.

AS a result of the increasing paper allocation many readers who have hitherto been unable to obtain this journal will be able to do so. The extra allocation does not, unfortunately, enable us to enlarge the journal, nor to revert to weekly publication. The whole of the allocation is being used to print extra copies, and so to reduce our lengthy waiting lists of would-be subscribers. The latter should go to their newsagent forthwith, and place an order for the regular delivery of this journal. It is still not possible for supplies to be made available to newsagents for casual purchasers.

ROUND THE WORLD OF WIRELESS

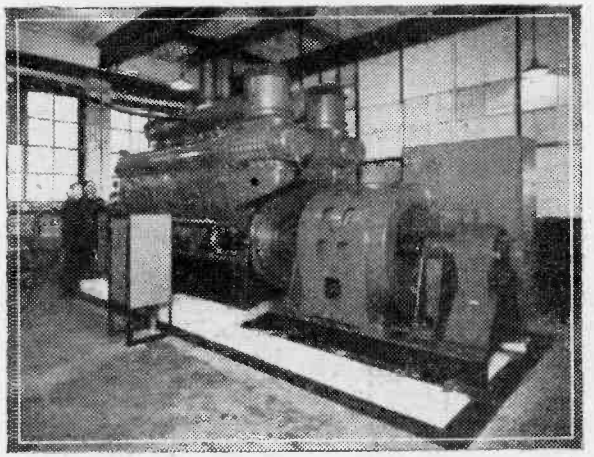
Broadcast Receiving Licences

THE following statement shows the approximate numbers of licences issued during the year ended December 31st, 1948.

Region	*Number*
London Postal	2,134,000
Home Counties	1,512,000
Midland	1,617,000
North Eastern	1,784,000
North Western	1,482,000
South Western	1,001,000
Welsh and Border Counties ..	662,000
Total England and Wales ..	10,192,000
Scotland	1,078,000
Northern Ireland	187,000
Grand Total	11,457,000

The above total includes 92,800 television licences —an increase of 10,400.

During December 658 prosecutions were authorised for operating wireless receiving sets without a licence. This number includes several cases of motorists who did not have separate receiving licences for the wireless sets fitted in their cars.



The newly installed 600 kW generator at Philips' Mitcham Works.

Radiolympia Organiser

THE Radio Industry Council's exhibition organising committee has appointed Dudley Stretton as organiser of Radiolympia (September 28th to October 8th) in succession to the late Alex. Moody. His appointment dates from February 1st.

Mr. Stretton is 45 years of age, and whilst with the Ministry of Information was responsible for the Exhibitions Division, "Greater London Plan" exhibition and the tours of "Back to Work" and "Mulberry."

E.M.I. Technical Papers

REPRINTS of Technical Papers read by members of the staff of Electric and Musical Industries, Ltd., before learned societies are now available at 2s. 6d. per copy. These Papers are printed on art paper with a semi-stiff cover, and are well illustrated. The titles at present available are:

Commercial Disc Recording and Processing: B. E. G. Mittell.

The Development of Sound Recording and Reproduction: Sir Ernest Fisk.

Sound Recording and Reproduction: G. F. Dutton.

High Quality Disc Recording: W. S. Barrell.

Others will be produced in due course.

Applications for copies of the above should be addressed to Advertising Division, E.M.I. Sales and Service Ltd., Hayes, Middlesex.

National Ekco Radio in India

FOLLOWING the recent agreement with the Tata Organisation for the manufacture of Ekco radio in India, E. K. Cole, Ltd., now announce the name of the newly formed company. It will be known as The National Ekco Radio and Engineering Company Ltd., with offices at Bombay House, Bruce Street, Bombay. Products, on which manufacture is starting immediately, will be distributed by General Radio & Appliances, Ltd. (previously Fazalbhoy Ltd.). Big developments in the V.H.F. and electronic fields as well as domestic radio are planned.

B.B.C. Helps Police at Cup-tie

AT the thrilling Yeovil v. Sunderland Cup-tie recently, F. N. S. Creek, the B.B.C. commentator, was probably more exhausted than the players.

Creek, who is an ex-amateur international, was briefed by the West of England sports editor, Nicholas Crocker, to record the high-lights of the game—five or six minutes of commentary for "Sport in the West" the same evening. But between two and three thousand people gathered in the narrow street outside the packed Huish Football Ground unable to obtain admission, so Police Superintendent G. S. Hamham asked the B.B.C. to help them to keep control of the situation. B.B.C. engineers Pyke and Fraser ran a line out to two police wireless cars and the locked-out spectators were then able to hear the commentary.

Norman Creek found he had to give 110 minutes of commentary as extra time had to be played instead of the 20 or 25 minutes of high-lights that he had intended to give. Then he rushed back to Bristol by car through the fog to introduce his own recordings in "Sport in the West," walking into the studio just as the red light went on.

The British Institution of Radio Engineers

THE London Section held a meeting at the London School of Hygiene and Tropical Medicine recently, when a Paper on "Radio Frequency Welding," was read by Mr. L. Grinstead (Member) and Dr. H. P. Zade.

The Paper considered the influence of frequency, voltage, variation in physical constants and thermal conductivity in the welding of thermo-plastic materials at radio frequencies.

Suitable R.F. generator circuits were specified and analysed in detail, and a review of present and future trends in R.F. welding technique was included.

Stand-by Generator

A NINE-HUNDRED horse-power diesel engine driving a 600 kW. generator has been installed at the Mitcham Works of Philips Electrical Ltd. in a specially built power house.

Night workers will be relieved for day duty by the provision of this equipment, as its output is about one-quarter of daytime consumption.

The 900 horse-power diesel component was designed and used as one of a pair of propulsion units in a tank landing craft. It weighs well over 15 tons and was purchased in the U.S.A., no suitable equipment being obtainable quickly in this country.

The Philips Plant Department at Mitcham constructed all accessory equipment, such as switchboard, control panels, cables and connectors and piping. For the storage of fuel a tank with a capacity of 28,000 gallons has been provided.

Further stand-by power arrangements have been made at other factories of the Philips Group.

At Philips, Balham, 100 kW. are provided, at Brixton, 60 kW.

Mr. L. H. Kendrick, senior plant engineer, said, in an interview :

"Two main purposes are served by the installation of these generators. We are complying with the Ministry of Fuel and Power's request to provide as much of our own power as we can to relieve the load on the public supply and, further, we feel a good deal less at the mercy of the weather this winter."

Mr. A. H. Whiteley, M.B.E.

READERS and many friends in the trade will be pleased to learn that Mr. A. H. Whiteley, of the well-known firm of Whiteley Electrical (makers of the W.B. speakers), has been awarded the M.B.E. in the New Year Honours List in recognition of his services to the A.T.C.

V.H.F. in Fact and Fiction

V.H.F. two-way radio telephony is rapidly breaking into many commercial fields.

Recently it has appeared in two quite unexpected places—one in fact and the other in fiction.

First, it was announced that a team of three Hillman Minx cars competing in the Monte Carlo Rally were equipped with Pye two-way V.H.F. mobile R/T for intercommunication between the three cars during the three and a half days' journey.

Second, two-way R/T appeared in its first strip cartoon, for Buck Ryan, hero of a hundred thrilling exploits in the *Daily Mirror*, adopted this latest V.H.F. development to aid him in chasing lorry bandits on the Great North Road.

In both cases, however, while showing ingenuity, this use of car-to-car communication must be regarded as exceptional, for in the ordinary way such equipment is permitted to be used only in conjunction with a fixed station.

The coincidence of the use of Pye equipment at this time for two such dissimilar purposes is perhaps not so extraordinary as it would seem. Mr. J. H. Kemsley, of Petts Wood, Kent, is an enthusiastic user of their R/T apparatus in his hire car service.

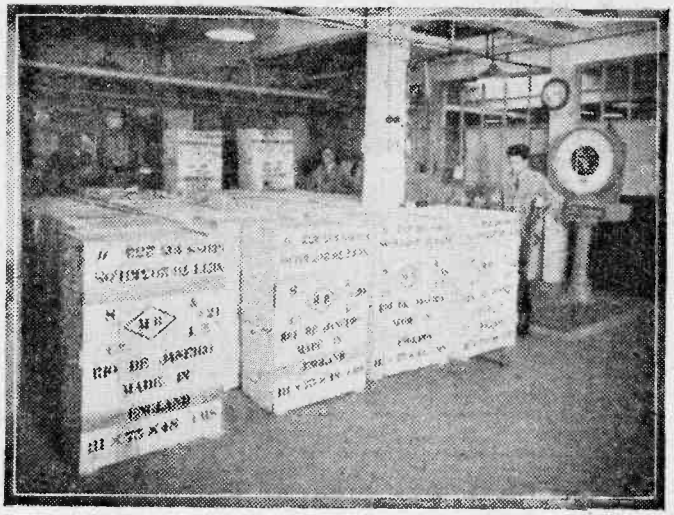
In the case of Buck Ryan, cartoonist Jack Monk, approached Pye Telecommunications London Publicity Office to obtain photographs of Pye R/T equipment, on which his drawings are based.

GOOD NEWS

We are now permitted by Paper Control to print more copies, although not sufficient to meet all demands. If you have not succeeded in obtaining PRACTICAL WIRELESS regularly, we would advise you to ask your newsagent at once to reserve a copy of every issue for the future. We hope you will be successful, but do not blame your newsagent if his supplies have already been exhausted.

Eddystone Brazilian Order

IN face of strong competition from U.S.A. and neighbouring countries, Messrs. Stratton & Co. secured an order for 100 of their "640" communication receivers for Brazil.



Some of the 100 Eddystone "640" receivers ready for despatch to Brazil.

Remote Control of Your Receiver—2

This Month J. R. DAVIES Discusses Some More Schemes

THE usual form of tone control which uses a variable resistor, and is shown in Fig. 5(d), is not of great use in the speaker circuit. This is because the relatively large power that may be developed in the A.F. circuit across the variable resistor is liable to cause arcing between the slider and the track, particularly when the slider is very nearly at the minimum resistance position.

Switching the Set On and Off

When we leave the province of volume and tone controls for that of switching the set on and off remotely, we leave the field where control may

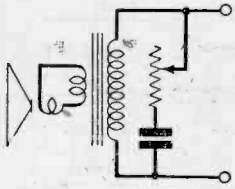


Fig. 5(d).—A method of tone control which is NOT recommended for connection at the speaker.

be effected by purely electrical means and enter that where use must be made of electro-mechanical devices. In other words, we have to start thinking of relays!

Fig. 6 shows the simplest possible circuit in which a relay may be used for switching a receiver from a distant point. It has the great disadvantage that, whilst energised, the battery is continually draining through the coil. For the home-constructor this method is therefore uneconomic and wasteful.

A home-constructed trip-operated relay as shown in Fig. 7 will afford a very useful substitute, however. It is very simple to construct and its operation is as follows: On pressing the remote

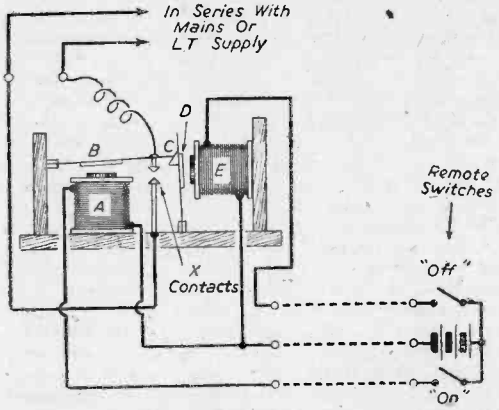


Fig. 7.—A trip mechanism for switching a receiver which takes current only momentarily from the energising battery.

"On" button the coil A energises, pulling the armature B towards it thereby making the contacts X. The button is then released and the armature B is held in position by the catch C on the second armature D. When the "Off" button is depressed the coil E is energised; this attracts the armature D, thus releasing the armature B, which springs back to its original position, breaking the contacts X and switching the set off again. The "Off"

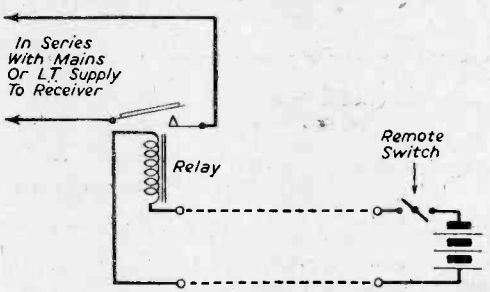


Fig. 6.—Simplest method of remotely switching a receiver on and off.

button may then be released, whereupon the whole cycle of operations can be started again.

Another system which uses only two wires between the two points makes use of a polarised relay, which may also be home-made, and which is shown in its essentials in Fig. 8. An armature A is pivoted at B and is free to move between the poles of a permanent horseshoe magnet C, as shown by the arrows. When the remote "On" button is pressed the armature is so energised by the coil C that the end adjacent to the magnet poles is magnetised as a south pole. This causes it to be repelled by the south pole of the permanent magnet and attracted to the north pole. It therefore swings over to the latter pole. This causes the contacts X to be made, thereby switching on the set. The "On" button is then released but, despite the lack of energising current, the attraction between the armature and the magnet pole still holds the armature in position. When the "Off" button is pressed, due to the method of connection of the remote batteries the current now flows through the coil C in the opposite direction and the end of the armature becomes a north pole. This causes the reverse of the previous operation and the armature swings over to the south pole of the permanent magnet, breaking the contacts X and switching the set off. Two brass slugs, D and E, are fitted to the magnet poles to prevent the armature actually touching them, as otherwise sticking might occur.

A third and very effective method of switching the remote receiver on and off, and which again only uses two interconnecting wires, is shown in Fig. 9. For this circuit one relay only is required. This relay is a high-resistance model having a resistance

of some 2,000 ohms or so and requiring 5 milliamps energising current to close. This circuit is only practicable with mains receivers, mainly because the relay is energised from the H.T. supply, and it would be very wasteful (and expensive !) to use an H.T. battery for this purpose.

The sequence of operations is as follows : When the remote switch A is depressed the batteries B energise the relay, which closes, switching on the receiver. After some seconds, the rectifier in the receiver will have warmed up sufficiently to pass H.T. current. The remote switch may then be released, and the relay will remain closed by the H.T. supply of the receiver, via the limiting resistor. When it is desired to switch off the receiver, the

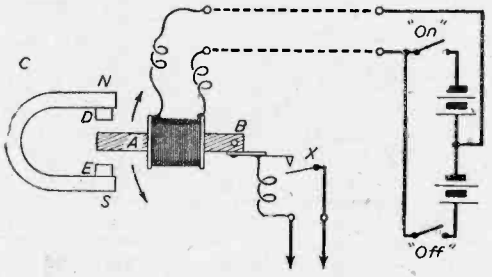


Fig. 8.—A polarised relay which takes current only momentarily from the energising battery and which only requires two leads for interconnection.

button C is depressed. This shorts out the relay winding, which then opens. The limiting resistor ensures that no excessive H.T. current is passed. The only disadvantage with this circuit is that the remote battery B needs to have a relatively higher voltage for the initial switching on. However, 25 volts is a more than sufficient value and can easily be supplied by means of three 9-volt grid bias batteries in series. It is also important to see that the battery is connected as shown in Fig. 9, as otherwise its voltage, when switched on, will be in opposition to that from the H.T. supply.

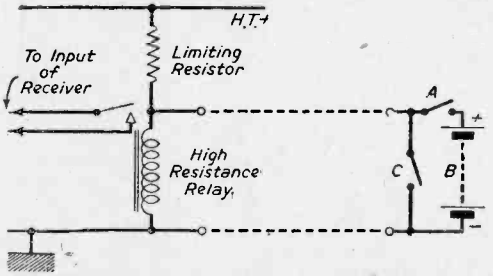


Fig. 9.—A relay circuit which may be used with a mains type receiver where there is no necessity to economise with H.T. current. The limiting resistor should have a value of approximately 40 KΩ and a rating of 5 watts.

Tuning the Receiver Remotely

To obtain complete control of the receiver, the only additional circuit that we now require is one that will tune the receiver remotely. This is a more difficult task than those previously discussed, and the complication of the circuit required is governed entirely by the number of alternative programmes that are desired.

Taking the simplest instance first, let us assume that only two stations, both on the same wave-band, are required. Fig. 10 shows how switching may be applied to a receiver with two tuned circuits, these being either the R.F. and detector circuits of a T.R.F. receiver, or the aerial and oscillator circuits of a superhet. (If a T.R.F. receiver is used it may be necessary to screen the two "live" relay contacts from each other to prevent instability.) The receiver is tuned by the

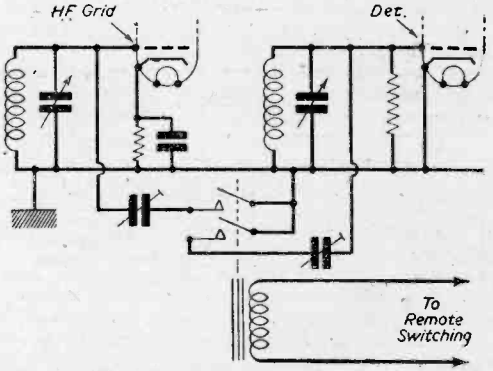


Fig. 10.—A simple method of changing stations using one relay.

normal tuning condenser to that one of the two stations which requires the least capacity in the tuned circuit for resonance (i.e., the station having the higher frequency). When the relay is closed the two preset condensers are then adjusted to bring in the second station. When it is desired to listen to the receiver from a remote position the set is tuned primarily to the first of the two required stations. Should the second station be required the relay is then energised, the required programme being switched on instantaneously. The trouble with this system is that it may be necessary to energise the relay for long periods of time. For the purposes of economy the energising voltage may be obtained from the accumulator in the case of a battery set, or from the H.T. supply (as in Fig. 9) in the case of a mains receiver. In the latter case, incidentally, it is better to employ the "shorting" method of switching the relay on or off as is done by the pushbutton C in Fig. 9, as this will ensure that the full H.T. voltage does not find its way into the remote control lines, with possible risk of shock or breakdown.

This method of changing stations may be extended, of course, by the simple process of using more relays if a greater choice of programmes is required. A further relay may also be added for wave-change purposes. The whole idea is quite practicable, the only snag being that of battery consumption mentioned above ; and it might be well worth while, if the construction of a new receiver is being contemplated, to incorporate a sufficient number of relays into the H.F. and detector (or frequency-changer) tuned circuits in the original design.

An entirely different method of tuning the receiver remotely is offered by using a version of the uni-selector. This possesses the advantage that

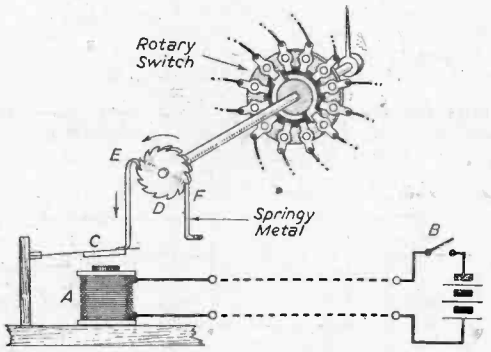


Fig. 11.—A solenoid operated rotary switch which may be used for station selection.

only momentary current is required for station selection and that only two interconnecting wires are needed. Given sufficient ingenuity a rotary switch may be constructed following the design of that shown in Fig. 11. The coil A, when energised by depressing the remote button B, pulls down the armature C. This, in turn, pulls round the ratchet wheel D by means of the hook E. When the button is raised, the coil A is de-energised and the hook springs back to the next tooth of the ratchet wheel, ready to bring it round when required. To prevent the wheel from turning backwards on the release of the hook, a pawl F is fitted, being so adjusted that it just falls from one tooth to the next when the coil is energised. The ratchet wheel is fitted to a spindle, this latter rotating a switch arm designed to make a different contact at each position of the wheel. (If the ratchet teeth are close together, these contacts may be made at spacings of two or three teeth.) When it is desired to set the switch to a different position, the remote button B is pressed the requisite number of times. This, incidentally, is a very simplified version of what occurs when a telephone number is dialled, the button B being replaced by the dial which, among other things, makes and breaks a contact a pre-arranged number of times, that number being proportional to the one dialled.

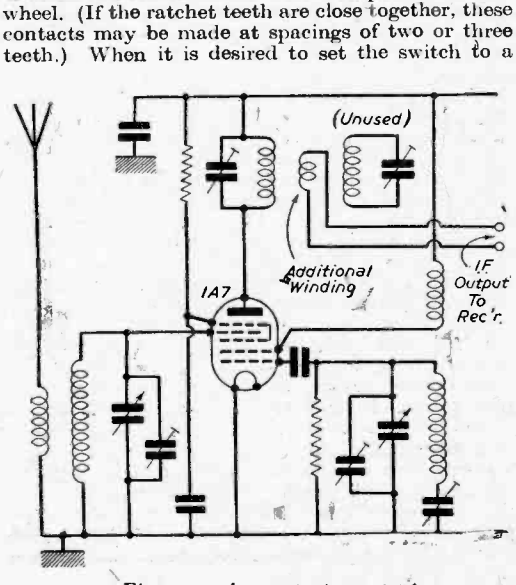


Fig. 12.—A remote tuner unit.

Using a Separate Frequency-changer

Yet another method of tuning a receiver, and one which enables as many stations as are required to

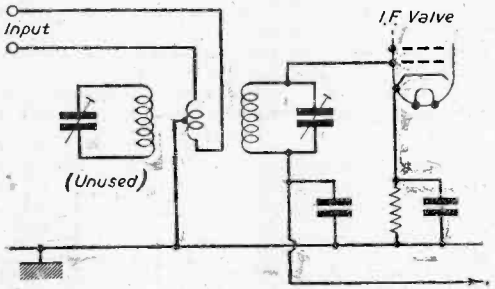


Fig. 13.—Connecting the receiver to the tuner unit.

be received, can be provided by using a separate tuning unit consisting of a frequency-changer with its associated tuned circuits, the intermediate frequency being led to the receiver by means of lines, where it is subsequently amplified and detected.

Fig. 12 shows a typical example. A 1A7 type valve is used, in common with a small, or midget-size, two-gang condenser. The coils may also be of small dimensions; Wearite "P" coils, for instance, being excellent for the purpose. The intermediate frequency is fed from the anode of the 1A7 to the I.F. transformer, one coil of which is unused, although it should be tuned to give maximum results if a tightly coupled transformer is chosen. To obtain a low impedance outlet to the receiver about 15 turns of thin d.c.c. or d.s.c. wire are wound on the transformer, these being connected to the lines to the receiver. Fig. 13 shows the method of coupling used at the receiver. Again, about 15 turns are added to an I.F. transformer, but this time care must be taken to see that they are accurately centre-tapped and are physically symmetrical on either side of this centre connection. This is to minimise radiation as far as is possible and ensure that no interference with neighbouring receivers results. For this purpose it is also advisable to use screened wire for the interconnecting link. Alternatively, lighting flex, or similar wire, could be used, provided that it runs for all its distance alongside a well-earthed pipe, such as a mains conduit, and is actually touching the pipe all the way. This would ensure considerable attenuation of any radiation.

(To be continued)

Using the Oscilloscope—5

Further Investigations Using Oscillograph Technique and an Interesting Time Base

By H. R. McDERMOTT

OF the many interesting tests and experiments that can be performed with the aid of the oscillograph there are few that require such a small number of auxiliary items as the simple time base to be described. Apart from the oscillograph, the only extra components required are one condenser and a variable resistor—not a very imposing list! The name "Time Base" does, to me at least, conjure up a vision of a horizontal line produced by the rapid motion of the spot from left to right, but this time base is rather different in that a circular trace is normally produced on the screen of the instrument.

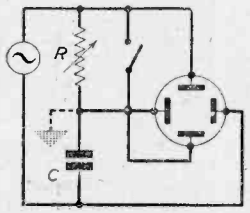


Fig. 1.—Circuit of a simple form of circular time base.

The circuit of this circular time base is nothing more than that of a simple R.C. phase splitter as shown in Fig. 1. If the sensitivity of both X and Y plates is equal and the voltages applied to them are equal too, and 90 or 270 degrees out of phase, a perfect circle will be produced on the screen. It is obvious that if we use a perfect condenser C, and a resistor R, then the voltage across C will lag, by 90 degrees, that present across R, and if these E.M.F.'s are equal then a perfect circle will be produced. To ensure that the voltage across the condenser and that across the resistor are equal, it is necessary that their impedances should be equal at the frequency under consideration. The required condition is that $R = 1/\omega c$, and for a frequency of 50 cycles, C may be 0.1 μF, and R, a 50,000 ohm variable resistance. The voltage required to produce an adequate circular trace on the screen depends on the sensitivity of the deflecting system of the tube, but generally 80 to 100 volts will be sufficient and may be obtained from a transformer or auto-transformer. The object of the variable resistor is to help compensate for any differences in the deflection sensitivities of the X and Y plates, and also in the measured value of the condenser C, apart from its value as stated on the label.

With this simple arrangement we can do some quite remarkable feats. For instance, we can measure very small periods of time, such as the opening and closing of a camera shutter or the speed with which various switches and relays operate, quite easily to an accuracy better than one tenth of a milli-second. Your first thought may be to suggest that this is stretching things just a little too far and that such a simple arrangement could not possibly do these things; however, a little further thought on the matter will help.

Time-controlled Mains

As previously mentioned in this series of articles, most of us have available in our homes a most accurate time-piece, (No! not that alarm clock) in the form of the time-controlled A.C. mains. Let us consider the method by which the circle is formed. It is evident that the spot revolves in a circular orbit, but what we require to know is the time taken by the spot to complete one revolution. If a very low frequency alternating E.M.F., say one cycle per second, were applied across a suitable R and C in series, then it would be observed that the spot performed one revolution each second; it follows that if the applied frequency were 50 cycles/sec., then the spot takes 1/50th sec. to complete one revolution and if 1,000 cycles/sec., 1/1,000th of a second. We are now in the happy position of knowing that when using 50 cycle mains the spot revolves once in 1/50th, i.e., 0.02 sec., and due to the combination of the tube afterglow and persistence of vision, we see a stationary circle, the problem remaining being the practical one of how to make use of this unique time-piece.

Probably the simplest method of utilising our knowledge is in the testing of a camera shutter, but before going any further, let us set up the equipment ready to perform the experiments. The top end of resistor R (Fig. 1), is connected to the Y or vertical plate and the bottom end of condenser C attached to the X or horizontal plate, the junction of R and C going to the common X and Y plate, usually earthed. The combination of R and C in series is fed from a 100-volt 50-cycle source.

The procedure for making the test is extremely simple and consists of taking a photograph of the tube screen. The camera is, of course, placed at a suitable distance from the oscillograph screen, depending on the type of lens used in the camera, so as to obtain good focus on the film. The more

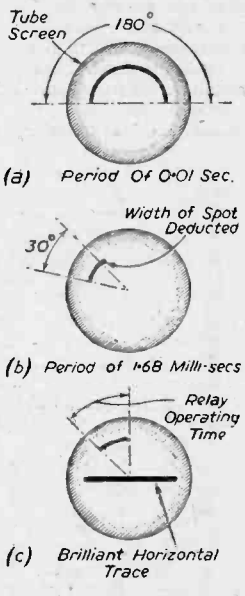


Fig. 2.—Oscillograph traces from the circular time base.

expensive cameras have high-speed shutters, usual times for operation are 1/100th and 1/250th of a second. You can imagine the difficulty in making sure, by ordinary methods, that the speeds are as specified. The speed at which the shutter opens and closes makes it impossible to judge at all accurately whether all is well.

Let us think for a moment of the revolving spot with the camera facing the screen ready for checking at 1/100th sec. When the camera shutter opens and closes in this position, the film should have been exposed for exactly 1/100th of a second; we know that with a 50-cycle voltage applied the spot takes 1/50th of a second to travel 360 degrees, so that in 1/100th of a second it will have covered half this distance, Fig. 2(a), i.e., 180 degrees, a semi-circle, and so we view the picture on the developed film. If the picture obtained is not a semi-circle, then it is obvious that the camera shutter did not stay open for 1/100th of a second. If the resulting

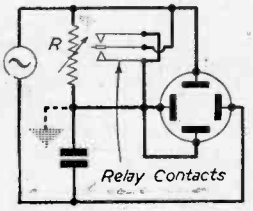


Fig. 3.—Modification of Fig. 1 for relay testing. The input to this and to Fig. 1 is a 50-cycle 80-100 volt A.C. supply.

arc was greater than 180 degrees, then the shutter was open for longer than 1/100th sec., and, if the arc was less than 180 degrees then the shutter-operating time was less than 1/100th second.

Method of Calculation

By means of a simple calculation we can reckon the time period indicated by say, one degree.

If the spot revolves 360 degrees in 1/50th sec., i.e., 0.02 sec., one degree is covered in:

$$\frac{0.02}{360}\text{ sec.} = 0.0000556\text{ sec.} = 0.0556\text{ milli-sec.}$$

$$= 55.6\text{ micro-sec.}$$

From this we can calculate the time period represented by any arc by measuring the angle, in degrees, subtended by it at the centre of the circle, and multiplying this by 0.0556 to obtain the time in milli-seconds, i.e., thousandths of a second. Few precautions are necessary, the main points being that a short persistence cathode ray tube is needed in order to avoid errors due to the afterglow of the screen and that, for accurate results, the width of the spot should be subtracted from the measured angle of the arc as in Fig. 2(b).

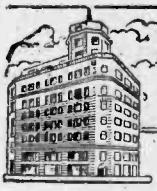
Often, it is necessary to know the speed, or otherwise, of operation of various relays and switches in some particular signalling circuit, which may be remote controlled. Again we are able to use this phase-splitting circuit to measure with good accuracy the lag in the opening and closing of the switches under consideration. Most normal relays take from three to 20 milli-seconds to operate and the measurement of this is easily within the scope of the device.

The method employed uses the same resistor and condenser as the previous circuit, but in parallel with R are the contacts of the relay to be tested. The circuit is arranged so that when the relay is at rest, R is shorted out and when the relay has closed R is also shorted out. It is only during the transient period of the relay, i.e., the period when it is actually operating, that R is again present in the circuit. The effect of this is that whilst R is shorted, the alternating voltage applied to the vertical plates is shorted too, resulting in the circle collapsing into a horizontal straight line. Whilst the relay is operating, R is no longer shorted and the spot, instead of travelling back and forward in a horizontal direction, leaps out from the line and starts to travel in a circular path. When the transient period is completed and the relay contacts closed, the spot falls back into its horizontal path again, resulting in an arc being produced on the screen corresponding to the time taken to operate the relay contacts. This time period is calculated exactly as in the previous method, a typical screen pattern for this type of test is shown in Fig. 2(c).

The requirements of the tube in this test, without resorting to photography, are exactly the opposite of the method previously described, in that a long persistence tube is a great advantage because of the fact that the spot is not constantly travelling in a circular path and the start and finish of the arc to be measured can be judged with accuracy. If a tube with a long persistence screen is available then the arc can be measured quite easily without having to photograph the image. Certain ex-Government cathode ray tubes have screens that remain bright for as much as twenty seconds after the electron beam has caused it to fluoresce, this type is admirable for the purpose. However, any other type of tube can produce good results if the image is photographed, so at this point we will turn to some matters that are easily overlooked.

As previously mentioned, the camera is placed at a suitable distance from the tube screen and the image is photographed. The shutter must be opened just before the relay opens and immediately after it has closed, just enough to photograph the full cycle of operations. If this is not done, there is great risk of the film fogging due to the brilliance of the horizontal base line which is present on the screen all the time except during the period that the relay is actually operating. The 50 cycle mains supply, as previously noted, may be used to supply the alternating voltage required, but if other than an isolating transformer is used then great care must be exercised otherwise a few hearty shocks may be acquired. In this latter connection it is well to note that in many oscillographs one X and one Y plate are tied down to earth, and in that case a hundred or so volts may be present from the case of the instrument to a true earth. It is much better to play safe and use an isolating transformer.

When you first try out the simple phase-splitter circuit, you will, in all probability, encounter a snag in the form of difficulty in obtaining an accurate circle. The first thing to do is to try changing the value of R by means of the variable element. The effect of this is to change the E.M.F. applied to one pair of deflector plates and so alter the screen image from an elipse to a true circle. If, even now, a true circle cannot be obtained then the fault is quite certainly due to the condenser used in position C. If this latter component has a poor power factor, the circle will become an elipse. The remedy is obvious—replace the condenser.



ON YOUR WAVELENGTH

By THERMION

Earthing to Water Pipes

A BOROUGH water engineer recently drew attention to the danger of earthing electrical installations to water pipes, and I understand that the British Water Works Association are considering making such connections illegal. It is, of course, a common practice to connect the earth lead of a wireless set to a water pipe in flats and other domiciles where a buried earthplate would necessitate a long earth lead which, as all readers know, is accompanied by serious disadvantages from the point of view of reception. The earth lead should be kept as short as possible. This water engineer was referring to a particular case at Machen, when a "short" in the electric cooker resulted in the water supply system becoming alive, and therefore dangerous. With the frequent use of asbestos-cement pipes by water undertakings, earthing to water mains does not become effective, and a water supply system would remain alive if a "short" took place. In my view the electric supply authorities should provide their own earthing arrangements as part of the installation. There have, of course, been a number of cases, some fatal, due to the earthing of radio and other electrical apparatus to water pipes. The danger is not confined to the householder. It spreads to the Water Board employees repairing services and supply mains.

A Tricky Point

ACCORDING to a new clause in the Wireless Telegraphy Bill, the Postmaster General has powers to prohibit a person who manufactures apparatus which does not comply with the regulations as to the radiation of electromagnetic energy from selling it or hiring it out. Many Northern listeners must have experienced the annoying whistle on the North Regional transmitter, due to a nearby receiver with a 465 kc/s I.F. being tuned to the Light Programme on 200 kc/s. In view of this, are manufacturers to be forbidden to use 465 kc/s., or will they be compelled to suppress the radiation in other ways? And what about the receivers already in use? Are listeners to be compelled to change their intermediate frequencies?

If this does not come under the new Bill there is nothing to prevent any enterprising youth from connecting and disconnecting his aerial at long and short intervals in order to contact his friend across the way.

No doubt the above trouble will take care of itself when the new wavelength reshuffle takes place, but meanwhile, does the hypothetical young gentleman require a transmitting licence?

Interaction

IF one compares the average home-built receiver with a comparable commercial receiver, several differences will be noticed. The chief difference is that commercial receivers are more compact, whilst the home-built receiver is much more "spread out." When the latter is tidied up and compressed a little it seldom works so well and this is undoubtedly due to poor screening and resulting interaction. It is in order to avoid this that certain conventional lay-outs have been adopted for the home constructor. The main thing to be avoided is interaction between two tuned circuits. When a set uses a stage of H.F. amplification, the grid circuit of the H.F. valve and the grid circuit of the detector (or the anode circuit of the H.F. valve—really the same thing) will be tuned to the same wavelength.

Since a tuned circuit consists of a coil and a condenser, it is obviously of little avail to screen the coils from one another while the condensers lie side by side on the front panel. This is one good reason for using a screen of the same depth as the base board, and partitioning off the H.F. stage altogether. A metal or metal-backed panel and a base board covered on the underside with copper foil help to avoid interaction.

The screen-grid valve was invented to remove the anomaly that whilst it is possible to screen the grid and anode circuits from each other, the grid and anode were still fairly closely coupled inside the valve. A meshed screen was therefore introduced between them, and the anode lead brought out at the end of the valve opposite to the others. To make the most of the screen-grid valve it is necessary to ensure that the grid and anode really are screened from one another.

The Advance of Television

THE introduction of a television supplement to this journal is a nostalgic reminder to me that the Editor of this paper in the very early days of television started a magazine entitled *Practical Television*, which suspended publication in 1939 when the television transmissions closed down. The rapid advance of television, an advance which will gather momentum within the next few years, gives me feelings akin to those I held in the early days of radio when Writtle, call sign 2MT, radiated its weekly programme of half an hour with P. P. Eckersley acting as chief announcer, chief engineer, and general factotum. I want to build a television receiver and am carefully studying all the literature on the subject and accumulating all the parts. One third of Britain's population will be within range of television this autumn when the Midlands station at Sutton Coldfield opens.

Television cost us about £700,000 in 1947-8, but only produced £91,000 revenue in that time. But £700,000 is a comparatively small sum of money to spend on the development of a science which will affect the lives of all of us, when we consider the cost of production of the Brabazon, which approaches £10,000,000. In fact, at least £10,000,000 will need to be spent on television if we are to retain the scientific lead achieved as the result of private enterprise.

General Purpose P.A. Amplifier

An Easy-to-build Three-stage Unit with 15-watt Push-pull Output

By K. KEMSEY-BOURNE

THIS unit is very economical in cost and space, since it uses for two of its stages small double triodes which each do the work of two normal triodes, and it has output valves just over 3in. high that are yet capable of giving 15 watts of audio power.

The specification of components is not critical; as long as the parts used satisfy the electrical requirements given in the list good results will be obtained. Only one resistor that is not a half-watt type is needed. All the valves are Octal based, and most of the parts will be readily available in the experimenter's workshop. No building instructions will be given here, since this circuit can be fitted on to almost any chassis in the 12in. × 8in. field, including the power-pack.

The power output is sufficient for dances, parties, and record recitals, or for providing music at dramatic shows in theatres holding up to 300 people. It could be used for recording or modulating a transmitter, and, although this is not claimed to be a high-quality unit, its performance is more than adequate for most normal purposes.

The Input Circuits

V1 provides amplification and completely independent mixing of the two inputs fed into controls R1 and R2. A high-impedance source, such as a moving-iron pickup or a radio feeder, can be connected direct to R1. Low-impedance sources, such as moving-coil microphones or pickups, are connected to R2 via a suitable matching transformer T3, which serves also to raise the signal level. T3 may be built permanently on to the amplifier chassis or not, at the discretion of the constructor, but if it is built-in then it should be shielded in a mu-metal case and mounted as far as possible from the mains transformer; otherwise a high hum level will result whenever this channel is brought in. The inputs fed through R1 and R2 are separately amplified in the two halves of V1 and the resulting signals are mixed in the anode circuit.

These input circuits are easily modified for special requirements. To mix two high-impedance pickups, for instance, omit T3 and feed the second pickup direct into R2, and replace C2 by a resistor and capacitor in series like R6 and C3.

Tone Control

V1 is resistance-capacity coupled to the phase-splitter stage of V2. Shunted across the output of V1 is the tone control, consisting of C4 and R7. As the setting of R7 is decreased in value the amount of top cut is increased.

Phase Splitter

This is a simple but effective design in which the first half of V2 amplifies the input from V1 and passes its output direct to V3 via C6. At the same time the second half of V2 receives via its cathode circuit a signal 180 deg. out of phase with the original, and this is equally amplified and fed to V4 via C7. Thus the grids of V3 and V4 are fed with equal and opposite voltages, since the two halves of V2 provide the same amount of gain. Unlike the cathode-follower this circuit serves to boost the signal level as well as feed the push-pull stage.

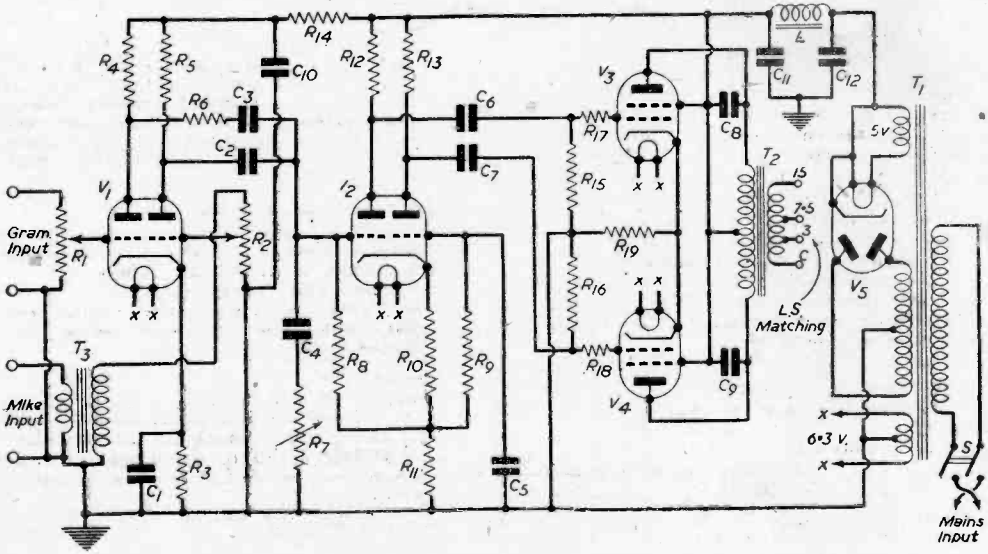


Fig. 1.—Complete circuit diagram of the amplifier described in this article.

Output Stage

Two beam-power valves are driven in class AB1, and will give 15 watts output with an input grid-to-grid swing of about 40 volts. The common cathode-bias resistor is not by-passed. R17 and R18 are grid-blocking resistors to suppress parasitic oscillation. C8 and C9 are shunted across the two halves of the primary of the output transformer to act as a corrective filter. The output transformer must be capable of carrying 50 milliamps in the primary windings and of handling the full 15 watts of output without saturation. The anode-to-anode load is 8,000 ohms, and this needs to be matched to 3, 7.5 or 15 ohms secondary load, or whatever value may be needed for transmitter or recorder.

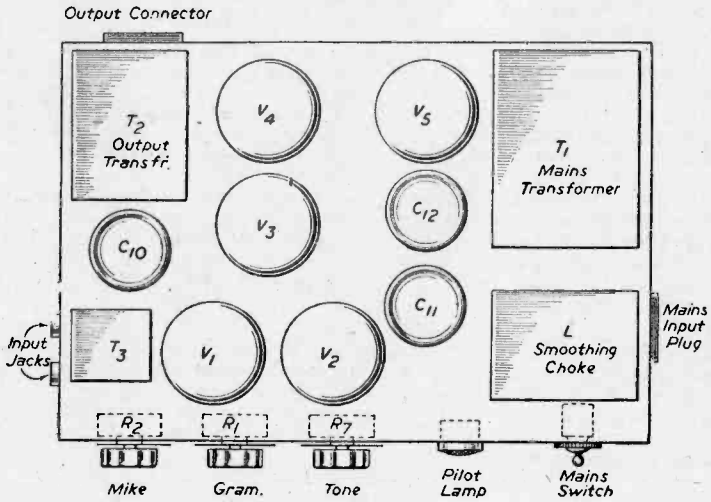


Fig. 2.—Typical component layout. Plan view, looking down on chassis.

Power Pack

This is conventional enough, using a full-wave indirectly heated rectifier and condenser-input smoothing filter. The amplifier requires approximately 100 milliamps at 300 volts, which is easily handled by a 5Z4. Like all the other tubes listed in the specification the 5Z4 is small and may be mounted in any position that is convenient, vertically or horizontally; ventilation must, of course, be adequate.

The H.T. positive line is 300 volts, and it must not be any greator than 320 volts. If you wish to use a 350-0-350 mains transformer then you must insert a dropping resistor in series with the choke L to bring down the potential to the correct figure. With a 350-0-350 volts transformer L may be replaced directly by a speaker field of 1,000-1,250 ohms.

Construction

There are no special precautions to be taken, other than the one mentioned with microphone transformers. The normal principles of layout should be observed, such as keeping all wiring as short as possible, twisting the heater leads together and screening the input leads to the grids of V1. A 12in. × 8in. × 2½in. chassis should be more than adequate. As regards layout, no doubt individual experimenters will use the time-honoured

LIST OF COMPONENTS

RESISTORS

(All are normal ½ watt rating except R19)

R1, R2—0.5 MΩ potentiometer.
R3—2kΩ.
R4, R5, R6—100kΩ.
R7—0.25 MΩ potentiometer.
R8, R9—0.75 MΩ.
R10—1kΩ.
R11—10kΩ.
R12, R13—68kΩ.
R14, R17, R18—47kΩ.
R15, R16—220kΩ.
R19—250 ohms, 2 watt, wirewound.

CAPACITORS

C1—50μF, 12 volts working.
C2—.005μF, 400 volts working.
C3, C6, C7—0.1μF, 400 volts working.
C4, C5—.01μF, 400 volts working.
C8, C9—.002μF, 400 volts working.
C10, C11, C12—8μF, 450 volts working.

TRANSFORMERS

T1—Primary for mains input. Secondaries, 300-0-300 volts (R.M.S.) at 120 milliamps, 5 volts at 2 amps (rectifier), and 6.3 volts at 3 amps (heaters).
T2—Output transformer. Primary load, 8,000 ohms, matching to secondaries 15, 7.5 and 3 ohms. Required ratios are 22.5, 32.5 and 52.5 to 1, respectively. Primary winding centre-tapped, to carry 50 mA each half.
T3—To match microphone to grid. Ratio, 100 : 1 or as required for particular microphones. Mu-metal screened.

OTHER COMPONENTS

L—Smoothing choke. 10-20 henries, to carry 120 milliamps, 500 ohms resistance. Replaceable by suitable speaker—field winding.
S—Mains toggle switch, D.P.S.T.
Also chassis, valveholders, pilot lamp, knobs, dial plates, input and output jacks, wire, flex, sleeving, etc.

VALVES

(Alternatives are listed in order of performance. Service code numbers follow in brackets)

V1, V2—6SC7 (CV1969), or 6N7 (CV1957), or 6SN7GT (CV1988). Equivalent glass types, normal size, are ECC32 or 6N7G (CV181 or CV1285).
V3, V4—6V6 (CV510), or 6V6GT (CV511).
V5—5Z4 (CV1864).

method of shuffling valve holders, etc., about on the surface of the chassis to find a satisfactory layout before drilling a single hole.

Performance

The average pickup gives plenty of gain, and it may be necessary to attenuate the input from a crystal pickup to prevent crowding of the controls.

On the microphone channel adequate boost is easily obtainable with medium-priced moving-coil microphones, and if the speaking distance is more than a few inches it will be necessary to apply plenty of top-cut to prevent the tendency to feedback when the microphone and speakers are in the same hall or room. Government surplus "hand microphone No. 7" gives plenty of good, clear speech at close talking distances. Throat microphones, which are invaluable for eliminating unwanted noise on P.A. occasions, give good results at reasonable quality.

Alternative Valves

Alternatives are given in the parts list. Whereas a 6SC7 has a stage gain of the order of 35 times, a 6N7 provides only 24 times and a 6SN7-GT has a voltage step-up of only 14 times. Obviously, with a high signal input two 6SN7-GT valves would give satisfactory results, but low input levels will need 6SC7 valves as V1 and V2 if the output stage is to be fully loaded.

The 6V6 and 6V6-GT have identical performances, and only differ in appearance and size.

The preferred valves are miniature metal types, so that the amplifier can be made very compact. If the equivalent glass-bulb types are used the performance will be the same, but more space must be allowed in construction, since the G types are longer and wider.

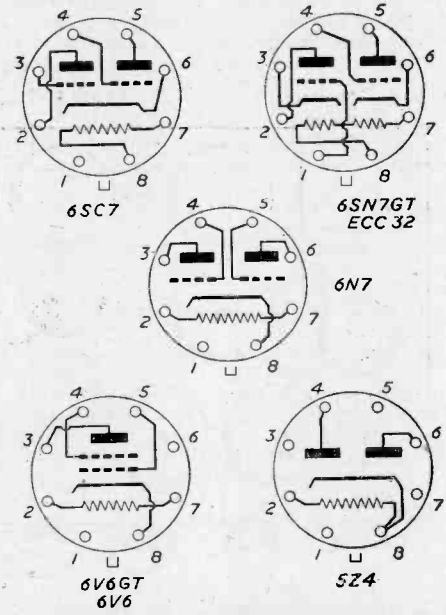


Fig. 3.—Diagrams showing base connections of all valves referred to in the parts list. All have International Octal bases.

Five-metre Converter

Instructions for Modifying Ex-Service RF Unit Type 26

By I. S. ROBERTSON and W. J. WHEELER

RF unit type 26, frequently seen advertised in the columns of this magazine, is ideal for conversion to the 5-metre band. As it stands, however, it is felt that one or two modifications are required.

Due to the noisy character of the local oscillator, and also the tendency towards frequency creep, the oscillator has been completely redesigned. Also, the damping of the mixer anode circuit is no longer required, as the original 4 Mc/s bandwidth is obviously not needed. Provision has also been made for stabilisation of the H.T. supply to the oscillator. All components removed are used in the modified circuit, and the only extra items needed are:

1. Eddystone VHF choke.
2. 10 kΩ 5 w. wire-wound resistor.
3. One voltage stabiliser, type VR 105-30, and
4. International Octal valveholder with fixing pillars.

The voltage stabiliser is of a type easily obtainable from surplus stores. The oscillator is of a design by Mr. Clapp, of the General Electric Co. of America, and described fully in the May 1948 issue of "QST." One of its advantages is its exceptional stability at high frequencies.

Dismantling

Fig. 1 shows the unmodified circuit diagram. First, locate R14 beneath the chassis, as shown in Fig. 2, and remove. Retaining the oscillator coil L4 in position, remove all other components from the oscillator compartment, excepting C26 and C27 (shown in Fig. 2). Also disconnect the wire joining end of "pipe" to L4. The trimmer C30 is carefully removed and is then replaced, but without earthing either tag. Do not remove the coaxial cable from the Jones plug or interfere with the heater wiring. With reference to Fig. 3, remove C31 and R13. The remaining connections in the oscillator should now appear as in Fig. 2. The wires joining the fixed vanes of the rear section of the two-gang variable condenser to the lower tag of L4 and to pin 8 of the oscillator valveholder should be removed.

Rebuilding

To the oscillator grid pin (pin 2) attach one end of the 100 kΩ resistor (formerly R13), the other end being earthed; also attach to pin 2 one lead of the 100pF. condenser (formerly C28), the other end of the condenser being attached to the upper tag of L4. To the cathode (pin 3) solder one end of the 500pF. condenser (formerly C25), the other end also going to the upper end of L4. One end of C30 is joined to the lower tag of L4, whilst the other tag of C30 is taken through the chassis via the small hole near the base of L4 to the lower tag on the stator of the rear portion of the 2-gang variable condenser. The frame of the condenser is already earthed. The V.H.F. choke is now connected between cathode and earth. A lead from the cathode is now joined to the "pipe," thus providing the injection voltage for the mixer.

On the rear panel above the valves is fixed an International Octal valveholder, mounted on two stand-off insulators, so that the tags are clear of the metal, having previously fixed two wires to pins 2 and 5. The wire on pin 2 is attached to one of the valveholder fixing bolts by means of a suitable tag. Mounted vertically, also on the rear panel, is a paxolin tag-board,

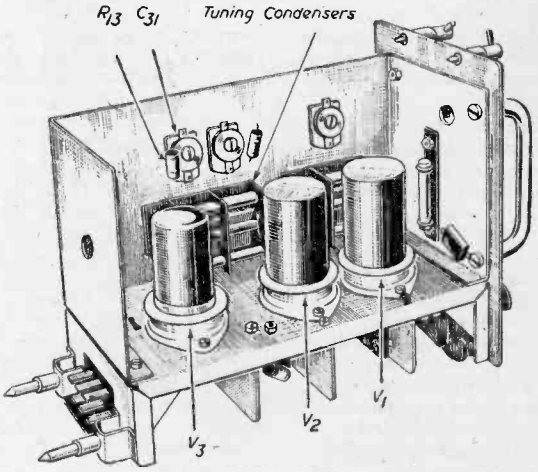


Fig. 3.—Pictorial diagram of the Unit with essential markings. Condenser C31 and resistor R13 are removed. Other modification details are shown in Fig. 2 on the next page.

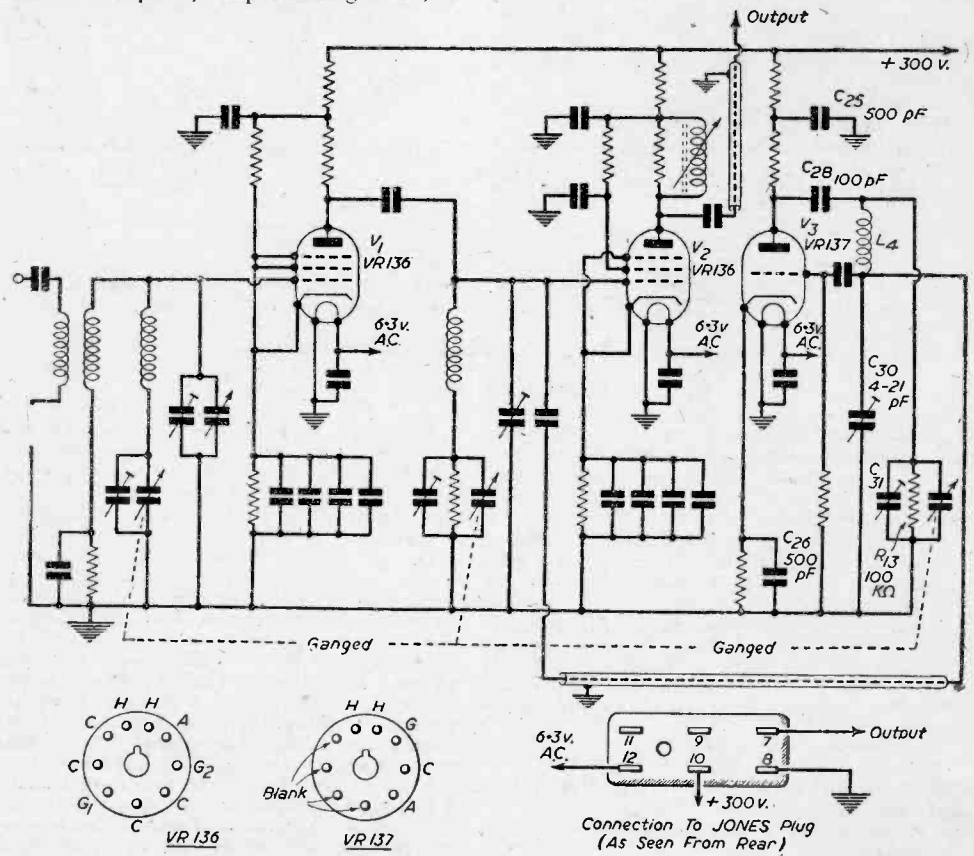


Fig. 1.—Unmodified circuit of the RF Unit Type 26, valve base and Jones plug connections.

similar to the one already fitted behind the front panel (this, incidentally, is used for holding the dropping resistor for the supply to the dial light above the vernier drive). If this light is missing this panel may be utilised, as the required bulbs are not easy to obtain. On this panel is fitted the 10kΩ

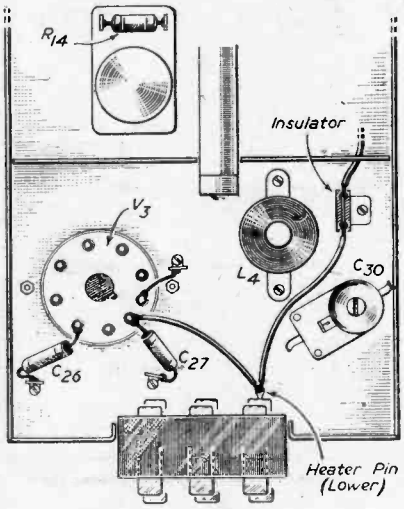


Fig. 2.—How the oscillator connections should finally appear.

5w. resistor, being placed above the chassis in order to prevent over-heating of the Clapp oscillator. To one end of the resistor is attached the lead from pin 5 of the International Octal base. This lead is then joined to the anode (pin 4) of the oscillator valve base. The opposite end of this resistor is joined to pin 10 of the Jones plug.

The local oscillator is now as shown in Fig. 4, thus completing the construction.

Operation

The next step is to get the converter lined up. H.T. and L.T. are connected via the Jones plug, and the output is fed to the aerial socket of a normal short-wave receiver tuned to 7.5 Mc/s, and at maximum gain provided that stability is maintained. The aerial is connected to the plug on the front of the converter and the aerial trimmer is

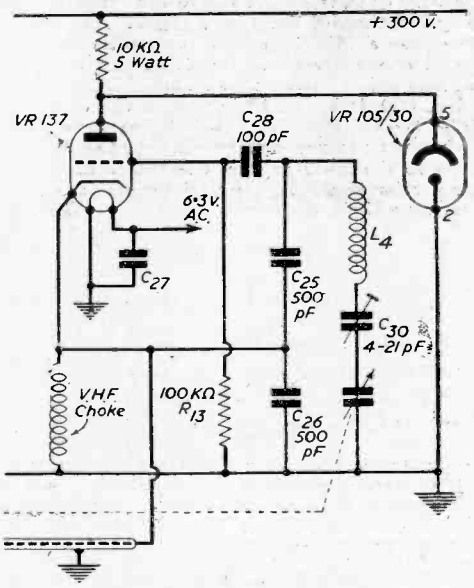


Fig. 4.—The redesigned oscillator circuit.

set for maximum noise. The main tuning dial is set to 170 and the oscillator trimmer C30 is also adjusted for maximum noise. The other trimmers beneath the chassis are then also adjusted to increase the noise.

The main dial is next set to 20 and the aerial trimmer readjusted. To increase the noise the two trimmers above the chassis are adjusted. This latter adjustment will slightly upset the previous adjustment at 170, which is therefore repeated as previously.

The converter is now ready for operation. The 5-metre band should appear between 30 and 50 on the dial.

British Radio Telephones For Netherlands

ANOTHER triumph for British radio technique abroad has been achieved by one of the leading British radio manufacturing firms, who have obtained and are carrying out a £10,000 order for VHF mobile radio telephone equipment for the Netherlands Government.

The firm concerned is Pye Telecommunications, of Cambridge, who have done much of the pioneer work in this country on the type of radio telephone apparatus now so widely used by police, ambulance and fire services, as well as many industrial organisations.

Police Radio

Already a considerable part of the contract has been fulfilled, and the familiar whip aerial, such as is seen on police and other vehicles equipped with mobile 2-way VHF radio telephones, is to be observed in the streets of Amsterdam, where, in the two cities, some sixty vehicles are already using their British radio telephone sets. These are in communication with a number of official fixed base stations.

Reports from the Netherlands already indicate the success of these first radio phone installations, and it is stated that they are giving extremely satisfactory service. What adds particular interest to the contract, however, is that it was obtained by the British company in face of keen competition both from the Dutch home market and from the United States of America.

MINISTRY APPEALS TO HOUSEWIVES
Keep Waste Paper separate, dry and clean for salvage.

A Personal Portable

A Midget 3-valve Receiver Using 1.4 Volt Valves and a 2in. Loudspeaker

By PHILIP H. BEARMAN

THIS easily constructed radio was designed to give maximum results with a minimum of expenditure, running costs have also been kept in view by the use of low consumption valves and also an unorthodox output valve which proves very satisfactory. The actual size of the completed receiver is 4¾in. x 4¾in. x 2¾in.

It is recommended that the case be built at the same time as the set as no chassis is employed and components are fixed directly to the case. Firstly, the base should be constructed of seven-ply wood, and then the front to the specification given. Any cloth or speaker fret may be employed for the grille. The frame aerial is semi-pile wound around four small nails insulated with sleeving. the front of the receiver may then be nailed to the base and the loudspeaker and output transformer fitted in their respective positions.

Controls

The side containing the controls should then be fitted and fixed to the base board. The tuning condensers, which may be purchased from Premier Radio, should have the spindle and screw thread cut down to a minimum to reduce the projection. When this has been completed, the wiring may be commenced. The author did not use a push-pull type switch as specified but a narrow two-way type which was stripped from an ex-Government unit. A small piece of ebonite or wood should then be cut to contain the two Hivac valveholders, and this should be arranged so that it may be tilted away from the set in order that the valves may be inserted; a similar arrangement is recommended for the output valve.

After completion of the wiring. the remainder of the woodwork can be completed and various types of attachment may be used to secure the back of the receiver. The author's set is constructed from three-ply with the exception of the base, which is of seven-ply; it may then be stained, although to give a professional finish, rexine or American cloth may be used; the addition of a handle would no doubt be beneficial and a leather strap would doubtless be extremely useful in this respect. The set operates in a similar way to any receiver employing a reacting detector and no difficulty should be experienced here. If the frame aerial is connected as per diagram one is certain of obtaining reaction, otherwise it may be very difficult to reverse one of the windings after the completion of the set. In the author's set, there

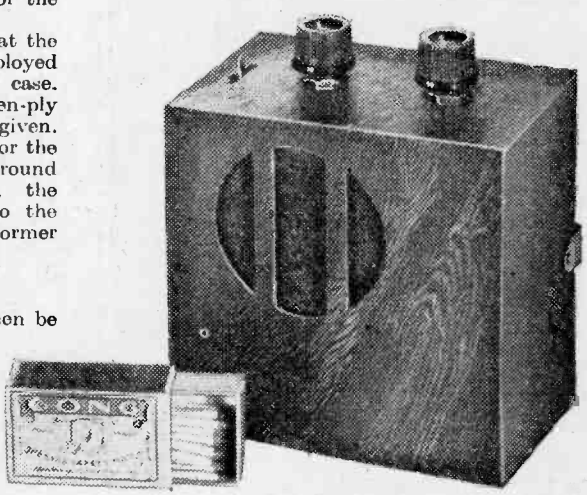


Fig. 1.—The finished receiver, photographed with a match-box to give an idea of its size.

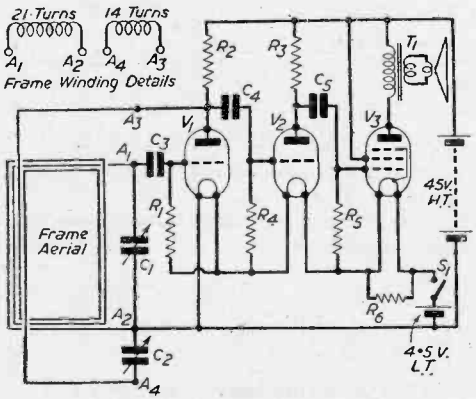


Fig. 2.—Theoretical circuit of the Portable.

LIST OF COMPONENTS

V1, V2	Hivac type XH.
V3	Type IT4.
T1	90 : 1 Midget o/trans.
C1, C2	.0005μF v/mica condensers.
C3	.0001μF.
C4, C5	.01μF., 150 v. working.
R1	2MΩ.
R2	100kΩ.
R3	150kΩ.
R4, R5	1MΩ.
R6	80Ω.
S1	Push-pull switch (see text).

45 v. Siemax H.T.
4.5 v. flashlight battery.
2½ in. Celestion L.S.
Two Hivac valveholders.
One button base valveholder.
Two midget knobs.
Miscellaneous wire, sleeving, wood, etc.

was a slight tendency to microphony due to a defective valve, and this was easily cured with cotton wool as will be seen from the photograph.

It may be found necessary to use some bias on the output valve and this may be obtained by running a potentiometer from the filament of the output valve to the earth to obtain the desired voltage.

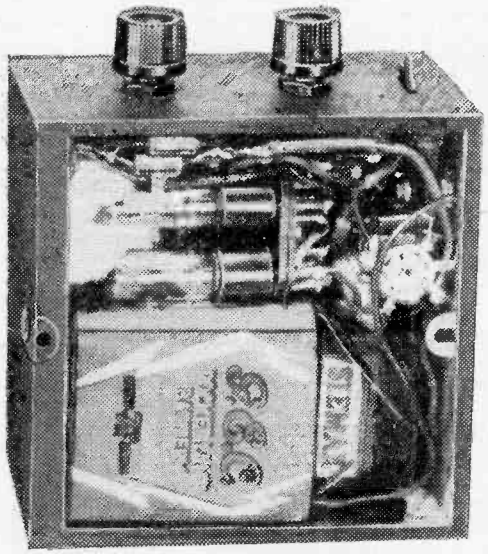


Fig. 3.—An interior view of the receiver showing the batteries.

The author's set is very satisfactory and has proved an invaluable lightweight, weighing, as it does, only two pounds.

The Frame Aerial

The aerial in the original model was wound with 34 s.w.g. enamelled wire. Double-cotton or silk-covered wire could, of course, be used if desired. In cases where insufficient volume is obtained, an external (outside) aerial could be coupled to the receiver by winding a few turns of wire round the outside of the case and connecting one end to the aerial and the other end to a nearby earth. This will, of course, give a considerable reduction in selectivity, and in some areas it may be found impossible then to separate the local transmitters.

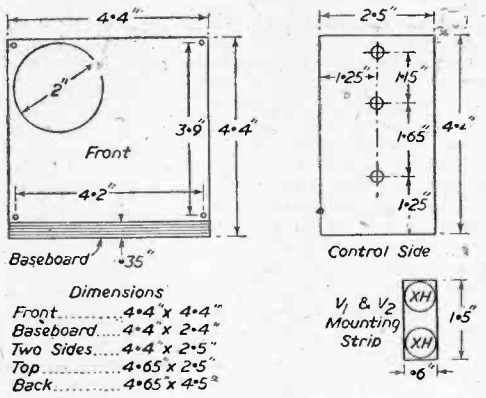


Fig. 4.—Details of cabinet construction.

Radio Aids

THE Automobile Association recently announced a new scheme whereby radio-controlled vans with modern equipment for roadside repairs are directed to the immediate assistance of motorists whose cars break down at night anywhere within the London Postal Area. The only cases which the scheme excludes are breakdowns caused by accidents and those which occur when the car is at the owner's home or at a garage. The committee of the Association has agreed to extend this service not only to all A.A. members but also to any unaccompanied woman driver who experiences mechanical trouble with her car between 6 p.m. and 6 a.m.

Throughout the night each breakdown team will be in continuous contact by radio telephone with the A.A. Headquarters at Fanum House, and it will thus be possible to locate and assist any motorist who is in difficulties and who telephones for help, with little or no delay.

This new London night service—believed to be the first of its kind in operation—is an extension of the A.A. Breakdown Scheme whereby members may have emergency repairs carried out by garages in any part of the country, the charges within certain limits being defrayed by the Association. It has been introduced owing to the inability of motorists to obtain mechanical first aid from garages in many parts of London after normal working hours, particularly at week-ends. It is emphasised that in providing this emergency assistance the Association is in no way competing with the motor trade, which often finds it uneconomical in certain districts to keep mechanics on duty throughout the night.

At present the A.A. Night Breakdown Service will apply only to the London area, but its extension to the big provincial cities will be considered should there be evidence of a sufficient demand for it.

Electric Ear to Defeat Burglars

AN interesting device produced by The General Electric Co., Ltd., is believed to provide an excellent solution to the problem of protecting warehouses, shops, stores and houses, etc., against burglars, without exposing the watchman to any risk of attack or causing the burglars' suspicions to be aroused.

In each of the areas likely to be broken into a special type of microphone is installed. They are wired to an amplifier and loudspeaker in the watchman's post. Should an unusual sound be heard, the watchman operates a simple switch arrangement and listens-in to each area in turn, an illuminated panel showing quite clearly the locality.

Once he is satisfied that there are suspicious sounds, he can telephone for the police without leaving his post.

Practical Hints

THAT DODGE OF YOURS!

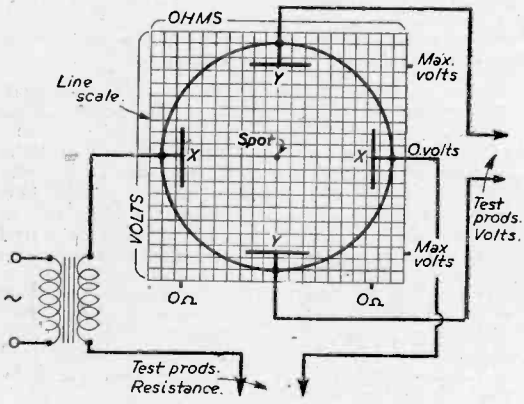
Every Reader of "PRACTICAL WIRELESS" must have originated some little dodge which would interest other readers. Why not pass it on to us? We pay half-a-guinea for every hint published on this page. Turn that idea of yours to account by sending it in to us addressed to the Editor, "PRACTICAL WIRELESS," 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.

C.R. Tube Meter

THIS device consists simply of a small C.R. tube working from a conventional power supply. To measure resistance, any pair of deflector plates are connected to the secondary of a low-voltage mains transformer, the circuit being broken by a pair of test prods. The effect of shorting the prods is to cause the spot to trace a line on the screen, and minimum resistance is indicated by maximum line length. It is a simple matter to place over the tube screen a line scale and to calibrate in ohms from known resistors. Various ranges can be used by putting a multi-way switch in the circuit, which switches in resistors, the values of which are found by experiment.



Using a C.R. tube as a testmeter.

To measure volts the remaining pair of plates are connected to test prods, and calibration carried out from known sources of potential. Maximum volts are indicated by maximum line length. Also, a great variety of ranges are available by placing a multi-way resistance switch in the circuit. A.C. volts are shown as a line length, D.C. is indicated by spot movement, the direction of which depends on the plate potential.

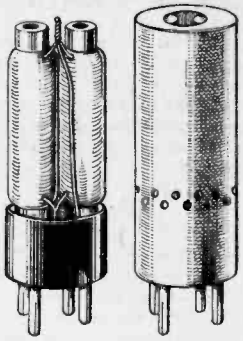
A word about the resistance values for the range switch. Ohm's Law does not apply, since only a potential is required on the plates to deflect the beam.—A. E. BOOTH (Coventry).

Line Cord Replacement

MANY American midgets are fitted with a ballast tube such as a 185.R8, etc., to bring the line voltage to 117 for American mains supply, and for British mains working a line cord is usually fitted. The drawbacks of the line cord are too widely known to need comment here. Therefore, when recently I had the common problem of a broken line cord, I used this method of dispensing with the line cord in a neat, unobtrusive manner.

The ballast tube (185.R8 with U.X. base) was removed and an old valve-base rescued from the "junk box." The total resistance required to replace the line cord *and the ballast tube* was calculated to be 425 Ω at 40 watts (for 200 v. working). The next step was to obtain a wire-wound vitreous resistor of this rating. This problem was solved by the purchase of two ex-W.D. resistors of 850 Ω, 20 watts, at sixpence each, from a "surplus" store. (These are obtainable at many such shops.) These were connected in parallel and mounted as shown on the valve-base, being secured by stiff lead wires to appropriate pins after the metal end clips were removed from the resistors. Next, the "junk box" supplied an aluminium can which was a press fit over the valve-base. A ¼in. hole was made in the top and several ⅛in. holes drilled in the sides just above the valve-base to assist in cooling by causing convection currents of air to flow through the can from bottom to top.

A line cord may be replaced by fixed resistors as shown in this hint by Mr. Watson.



Now, with the case fitted and the lower edge turned under (making sure not to short the pins), the finished article is rigid, efficient and has quite a commercial appearance. Plug in, *in place of* the ballast tube; use ordinary flex to connect the set to the mains and the set is ready for use. Total cost, *one shilling*, and you have the ballast tube left over for some other purpose.—F. H. J. WATSON (Plumstead).

Building a Telev

The Sound Unit is the Su

By S. A

THE theoretical circuit diagram of the sound receiver is shown in Fig. 1. It consists of a five-valve chassis, wired as a superhet, and comprises R.F. amplifier, frequency-changer, I.F. amplifier, second detector, A.V.C. and first audio-amplifier, and output pentode. The circuit itself is quite conventional, but it might be worth while to discuss briefly the function of each stage.

V17 is a pentode type SP61 (VR 65) working as a wide-band R.F. amplifier. Its input is derived from the vision chassis described in Part I of this series, and the first valve stage of the latter chassis is common to both vision and sound signals. The sound signal is taken from the second coil on the vision receiver by a single turn coupling loop and fed through a short length (1ft. to 2ft. or less as convenient) of coaxial cable to L1 of the sound receiver, where it is correctly matched by being tapped one turn up from the earthy end of the coil. The anode load of V17 is R2, a resistance of 7,500 Ω, which permits an appreciable gain to be obtained from the stage while retaining adequate bandwidth to do justice to the quality of the television sound signal. R3 and R4 in conjunction with C1 and C2 decouple the stage from the rest of the receiver.

V18 is the frequency-changer (ECH35) and is very similarly wired to the equivalent stage in the vision receiver. A.V.C. is applied to the control grid through R5, and C5 serves to prevent it being shorted through L2 to earth. The oscillator section is a Hartley circuit with VC1 as trimmer-tuner, L_0, the oscillator coil, being a Wearite type PA 4 with the coupling winding stripped off exactly as was described for the vision frequency-changer. C13 is included to make up the tuning capacity and so make the adjustment of VC1 less critical. The remainder of this part of the circuit is perfectly conventional and no more need be said about it.

In the choice of intermediate frequency there are conflicting factors to consider. From the point of view of high gain a low I.F. is indicated, but the difficulty here is one of oscillator drift. If an I.F. such as 465 kc/s is chosen, then the oscillator and signal circuits are only separated by this small frequency difference, and a drift in the oscillator (which must be working at about 41 Mc/s, sound being radiated on 41.5 Mc/s) of only a few hundred kc/s will completely throw out the I.F. tuning. At the same time there is little object in having an I.F. of 13 Mc/s or more as was the case in the vision receiver. There, a bandwidth of at least 2.5 Mc/s was aimed at; in the sound receiver a bandwidth of 20 to 50 kc/s is perfectly adequate. On these accounts the writer decided on an I.F. of somewhere between 2 and 4 Mc/s, and in practice a frequency of 3 Mc/s was found very suitable.

The I.F. transformers are hand wound and are perfectly simple to make. Details are given later. For the present L3 and L4 form the first I.F. transformer, tightly coupled in the anode circuit of V18, tuned by iron plungers and fixed condensers C10 and C11. The tuning is quite flat and there is no difficulty in setting up the I.F. coils during alignment, complete details of which are to be given in a later section of this series.

V19 is the I.F. amplifier EF39 (VR53) and is quite conventional. Its output is tuned by the second I.F. transformer L5–L6, and passed on to the detector, one diode of V20, which is valve type EBC33 (VR55). R13, C19 and C20 form an I.F. filter, and R14 is the diode load across which the rectified signal appears. This is applied via C21 and the volume control VR1 to the grid of V20, where A.F. amplification takes place. A.V.C. voltage is derived from the detector anode through C22, rectified by the second diode, and so applied

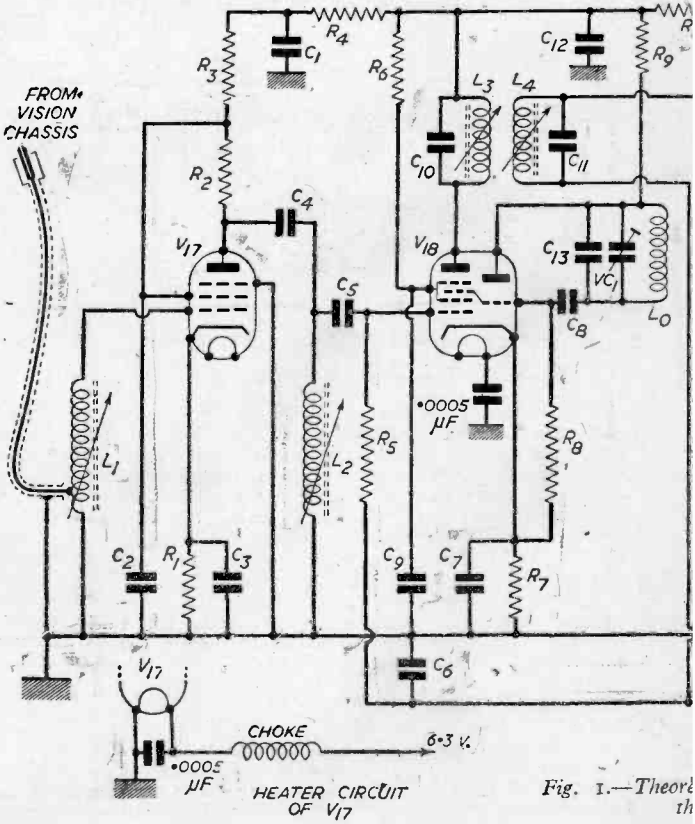


Fig. 1.—Theore th

ion Receiver—3

of This Month's Article.

IGHT

to V18 and V19 through the filter R18 and C25. Note that C6 and C25 are actually in parallel; C6, however, is wired close to the mixer end of the A.V.C. line to give decoupling at this point, C25 providing decoupling at the detector end. Note also that V19 and V20 have a common bias resistance R15, and this is decoupled by a midget 0.5 μF. condenser.

After V20 there is a tone control VR2, and the output valve is an EL33 conventionally wired. The output transformer should suit the valve, and its primary is shunted by C27. A 6F6 may be used as output valve provided R21 is increased to 400 Ω. No other change is necessary.

Construction Details

The photograph on the cover shows the general topper chassis layout and this arrangement should be followed as closely as possible. Fig. 2 shows the under-chassis layout, and this too should be closely followed, particularly in those parts associated with V17 and V18.

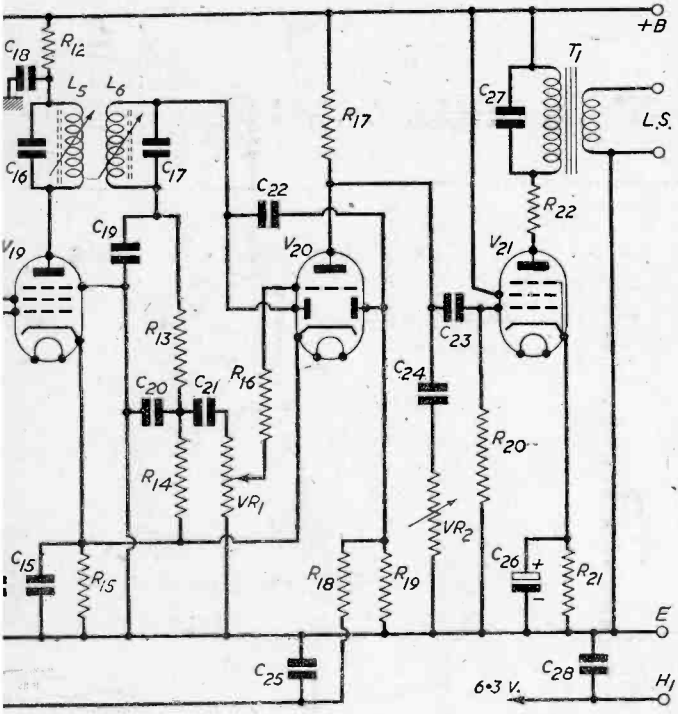
Aluminium is a suitable chassis material, and the size is 12in. by 6in. by 2in, although slight variations are permissible. Two aluminium screens divide V17 and V18 from each other and the rest of the circuit, and R4 and R11 pass through these screens as shown. This kind of construction is essential if stability is to be maintained. Notice also the heater choke in the heater feed to V17. This consists of 12 turns of 22 s.w.g. enamelled wire wound on a pencil shaft and then slightly expanded to become self-supporting.

There should be no difficulty whatsoever in wiring up the chassis, for it is much easier than the vision chassis and rather more liberties can be taken with the layout after V18.

The coils and I.F. transformers need some discussion as these are home-made components, and some little care is required in their construction. First, the tuning coils L1 and L2: these are wound on the small formers as used in the vision receiver, and are very similar. L1 consists of seven turns of 34 s.w.g. enam./s.s.c. wire tapped up rather more than one turn from the earthy end. Fig. 3 shows the dimensions to be followed. L2 consists of an untapped coil of six turns wound as shown in Fig. 3, the wire used being as for L1.

Now all coils, including the I.F. transformers, in this receiver are canned as the photograph shows. In the writer's receiver the cans measure 2in. all ways and were obtained from some old ex-Government gear. Any suitable screening cans may be used, though nothing less than 2in. square should be used on account of increased circuit capacity. The height is not so important. L1 and L2 are bolted down to the chassis, a hole being provided in the latter so that the iron core may be adjusted from below, and the can is then fitted over them. A small tag strip may be used close to the coils so that the grid lead which emerges from the top of the can is firmly anchored within; the free end of the coil which is thin should not be brought out through the can, either above or below the chassis, but heavier leads should be attached to a tag strip conveniently fitted inside the can close to the coil former. *In the can* with L2 are mounted the following: C4, C5 and R5.

Fig. 4 shows the layout of the I.F. transformers inside their cans. Both are identical. The formers used are the same as those for L1 and L2, two being used in each can. The actual coils are wound, as shown in Fig. 3, four in all being required. With care it is a simple matter to get two perfectly even layers of wire, each layer consisting of 25 turns, on each former, as shown. The ends



circuit diagram of the sound receiver. It is a 5-valve superhet, and . is 3 M/cs. Coil details will be found on page 153.

should be fixed with a little wax, and the whole coated with a dope such as polystyrene solution and allowed to dry hard for a few hours before fitting to the chassis. (This also applies to L1 and L2.) The coils are then mounted side by side on the chassis, the latter being drilled so that the iron cores may be adjusted from below. The dimensions are given in Fig. 4 and are not critical, though they should be adhered to as closely as possible. Inside each can are mounted the fixed tuning condensers associated with the coils, i.e., C10, 11, 16, 17. These are silver-mica components of 70 pF. capacity, tolerance ±2 per cent. This tolerance is necessary, though in an extreme case where such accuracy could not be obtained 5 per cent. types could be used. A tag strip is used in each I.F. transformer can to provide anchorage for the coil ends and the heavier outgoing leads. The connections to the ends of the coils are immaterial. When the formers are fitted to the chassis, and the downward going leads

LIST OF COMPONENTS

R1, R16—160Ω.
R2—7.5kΩ.
R3, R11—470Ω.
R4—1,500Ω.
R5—200kΩ.
R6—40kΩ.
R7—250Ω.
R8—68kΩ.
R9—30kΩ.
R10—100kΩ.
R12—3.3kΩ.
R13—22kΩ.
R14—270kΩ.
R15—270Ω.
R17—47kΩ.
R18—470kΩ.
R19—1MΩ.
R20—330kΩ.
R21—200Ω.
R22—47Ω.

Erie Ceramic, etc.

(All resistors ½ watt type, but ¼ watt could be used if desired for bias and A.V.C. circuits.)

C1, C4—.001μF.
C2, C7, C9, C21, C23, C24—.01μF.
C3, C6, C27—.005μF.
C5, C19, C20—60pF.
C8—30pF.
C10, C11, C16, C17—70pF. (± 2%).
C12, C28—.002μF.
C13, C22—20pF.
C14, C18—.1μF.
C15—.5μF.
C25—.05μF.
C26—25μF Electro.

Two at .0005μF for heater by-pass on V17 and V18, T.C.C., etc.

(Condensers in R.F., Mixer and I.F. stages should preferably be mica or silver-mica.)

VR1 (volume)—.5mΩ.
VR2 (tone)—.25MΩ.
Valves—One SP61 (VR65); one ECH35 (VR99A or ARTH2)*; one EF39 (VR53); one EBC33 (VR55); one EL33 or 6F6.

** The ARTH2 is a metallised valve, and is preferable to the VR99A, which is clear. This also applies to the vision mixer, where the ARTH2 may be used with advantage.*

Valveholders—One Mazda Octal; four International Octal.
Coil Formers with cores (plain or ready wound)—Six (Midco Radio, Wellingborough).
Oscillator coil—Wearite, Type PA 4.
Oscillator tuning—Ceramic air-spaced 25pF. max.
Chassis and dividing screens: 12in. x 6in. x 2in.
Coil cans: Four, minimum 2ins. square.
Output transformer: To suit output valve.
Wire, sleeving, length of coaxial cable, nuts, bolts, solder tags, tag strips, etc.

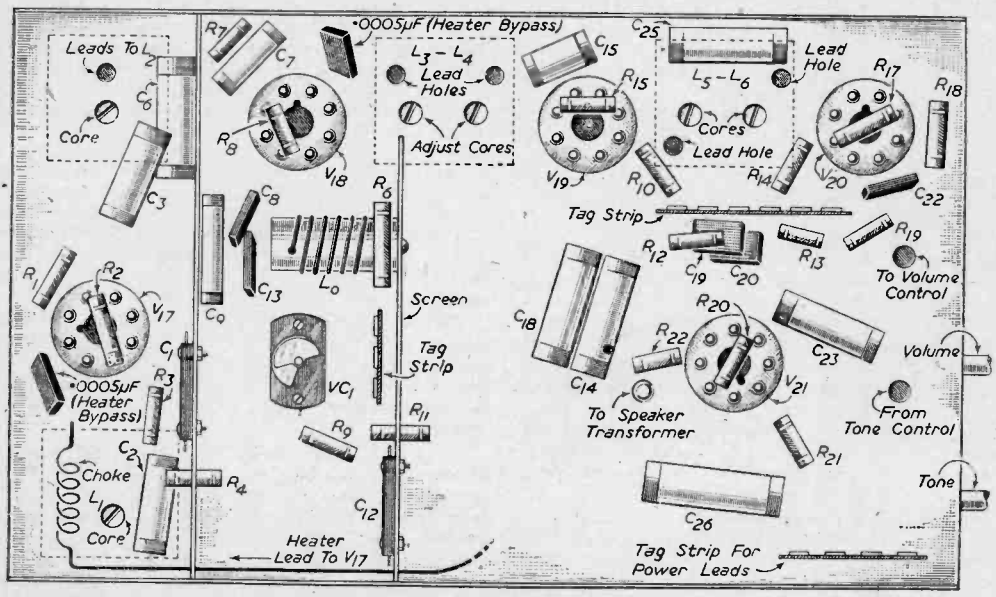


Fig. 2.—Layout for the sound receiver. R11 and R4 pass through the screens, as shown. Above the chassis are VR1, VR2, C21, R16, C24, C27 and the O/P transformer. VR1 must be completely insulated from the chassis.

have been passed through, the screening cans are fitted overall, the grid lead to V19 coming through the top of its can. *Check* that the can does not short anything to earth *before* actual wiring begins.

Turning now to the oscillator circuit the layout as shown in Fig. 2 should be closely followed. The trimmer VC1 is a small air-spaced ceramic insulation variable condenser of maximum capacity 25 pF. and it must be completely isolated from the chassis, that is, from the point of view of both fixed series. The coil should be mounted so as to clear the chassis by at least ¼in. It does not matter which way round it is wired.

There are few other points of importance. Keep all wiring tidy, make good soldered joints and use good components. The condensers used in the R.F., mixer and I.F. stages should be mica or silver-mica types in preference to rolled paper; all resistances may be rated half-watt, and ceramic types used where passing through screens is necessary.

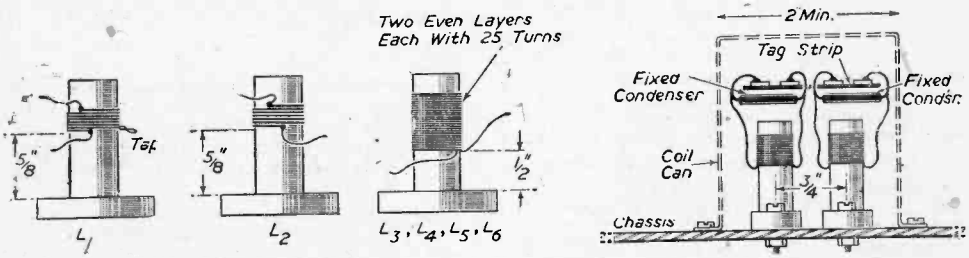


Fig. 3.—Details of the coils used. All are wound with 34 s.w.g. enamelled s.s.c. wire.

and moving vanes. The parallel capacity C13, which is a 20 pF. silver-mica component, is included to make the adjustment of VC1 less critical; the oscillator operates at a lower frequency than the signal circuit, that is, at 41.5—3 Mc/s.=38.5 Mc/s., and so the adjustment is much easier than the corresponding case in the vision receiver where the oscillator frequency is 58 Mc/s. The lower frequency is chosen instead of the higher (which would be 41.5+3=44.5 Mc/s) on account of the proximity of the latter to the vision signal on 45 Mc/s. The higher frequency results in the destruction of the picture on the tube due to feedback into the vision channel. The lower frequency overcomes this difficulty and there is no interaction whatever between vision and sound. The coil L_6, as already stated, is a Wearite PA 4, and the coupling winding is stripped off exactly as was described for the vision oscillator in Part I of this

For bias and A.V.C. resistances quarter-watt types are quite adequate. Valveholders are ordinary paxolin or Amphenol types, and wiring is carried out in 22 s.w.g. tinned copper run in insulated sleeving.

Outgoing power leads are taken from the receiver (good quality flex wire), and will later be connected to the power unit as marked. For the present they should be left of a good length, say, 2ft. or 3ft.; use a heavy lead for the heater and common earth return.

The Time Base

In last month's issue we described the Time Base Unit. In the circuit diagram on page 111 it will be found that condenser C6 has been omitted. It should be joined between the screen grid of V12 and resistor R20. It should also be noted that resistor R5 should have a value of 470 Ω and not 470 k Ω as given in the list of components.

The next article will describe the tube unit.

Nations Discuss R.F. Allotment

THE continuing growth of international air travel has increased the need for communication between aircraft in flight and ground stations. This, in turn, has produced a serious scarcity of the radio frequencies used in such communication and has made it necessary to redraft the world pattern of frequency allotment.

The draft allotment plan for the international air routes of 51 nations, members of the International Civil Aviation Organisation, was carefully examined by technical experts at the third session of the I.C.A.O. Communications Division which opened in Montreal recently.

The draft plan was originally prepared at a conference of the International Telecommunications Union. The I.T.U., which is the United Nations specialised agency responsible for the allocation of all radio channels, has invited I.C.A.O.'s help in completing a system to enable civil aviation to get the greatest possible service from the available frequencies

The first steps in the allocation programme were taken at New Delhi, India, last November, when an I.C.A.O. regional meeting co-ordinated the frequency requirements for South East Asia. As for European frequencies, a meeting is being held in Montreal concurrently with the Communications Division session.

The results of these meetings will be consolidated for consideration first by the Air Navigation Commission and the Council of I.C.A.O. They will then be transmitted to the International Telecommunications Union before the end of June, 1949.

Only 149 radio channels in the high-frequency bands are available for the exclusive use of civil aviation on a world-wide basis. During daylight hours a number of transmitting stations can operate on the same frequency without interference, providing that they are sufficiently far away from each other. On the other hand, at night, when radio signals travel much farther, stations working on the same frequency are likely to interfere seriously with one another even when they are far apart.

Occasional 6-volt Quality Three

A Low-priced Receiver for Operation from a Rotary Transformer

By R. V. LUMBARD

THE receiver to be described is intended to meet the need for a "quality" receiver that is essentially "non-mains." Special features include operation from a 6-volt car-type battery; the set being primarily designed for the occasional reception of selected Home programmes.

The circuit theoretical diagram is shown in Fig. 1. To assist in battery economy, a compromise is reached in limiting the number of valves to three. V1 serves the dual purpose of R.F. amplifier and diode detector. A pentode is used as A.F. amplifier; followed by a beam-tetrode in the output stage.

Negative feedback is taken over two stages,

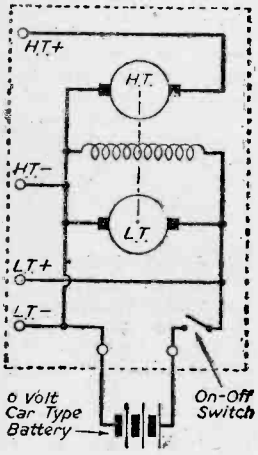


Fig. 2.—Theoretical circuit of a power unit using a rotary transformer rated at 6/200-225 volts at 50mA.

from output transformer secondary to a part of the cathode-bias resistance to V2. Reversal of the two feedback leads at "X" will be necessary if the feedback is found to be positive instead of negative.

The H.T. feed to the anode of V3 is separately smoothed by the choke L3 and 16 μF. condenser C15. The remaining H.T. feeds go via the resistor R16, and smoothing is completed by the inclusion of C13. The addition of C7, although in parallel with C13, ensures efficient by-passing of radio-frequencies.

H.T. is supplied by a rotary transformer. Fig. 2 shows the rotary transformer theoretical diagram. The heaters of the three valves are parallel connected for operation on 6 volts. The rotary transformer unit is best kept separate from the receiver; even without power-unit screening, no radio interference should be experienced if both are 3-4ft. apart. It is, in fact, convenient to have the power-unit on the floor near the battery.

An efficient outdoor aerial is advised; also a good earth. This, and the R.F. amplification available, ensures that sufficient signal input reaches the diode, so minimising distortion in the detector stage.

Tone Control

Tone control is included to give a substantial amount of "bass-boost." This is provided by the resistance/condenser network R6, R7, R8 and C9; resulting in some 6 db. rise in response approaching 40 c/s. Frequencies above 500 c/s are unaffected by the tone control.

Besides compensating for any general deficiencies in the bass response of the loudspeaker, the "bass-boost" tends to mask any hardness in reproduction due to a rise in speaker response above 1,000c/s. The inclusion of "bass-boost" is considered well worth while in view of the much better balance so obtained.

An infinite baffle arrangement is recommended for the loudspeaker. This greatly assists in the reproduction of the lowest frequencies. It also scores over the popular baffle mounting, since it can be accommodated in less space. A closed cube, with 'speaker aperture, and made of stout ½-¾in. wood is suitable. The size of the cube outside can be 15-18in. square. The inside of the cabinet is lined with thick felt; or covered loosely with cloth and the space between the cloth and the sides of the cabinet filled with sound-absorbent material. Fig. 3 shows this in sectional diagram form. Top and bottom are also lined.

The practical layout of the receiver is best carried out on a steel chassis to the constructor's own requirements. The main essential is to keep

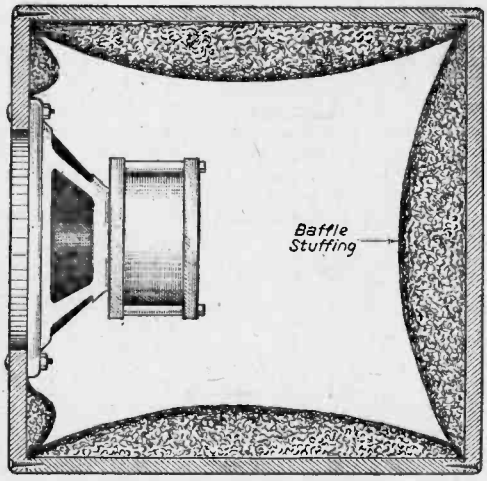


Fig. 3.—Section of infinite baffle 'speaker arrangement showing essentials.

the tuning coils L1 and L2 separately screened and apart; also seeing there is no undue stray coupling between the anode and grid circuits of V1. Insulation of C2 and T3 must be good to withstand the maximum H.T. voltage; and the presence of H.T. should be remembered when trimming!

Screening

The gain of V2 is considerable, and the grid lead will probably require screening. If V2 is close to V3, a metal screen may be necessary between the two valves to avoid instability.

If desired, the coils can be home wound on, say, a 1in. paxolin former, using 90-100 turns of 32 s.w.g.

LIST OF COMPONENTS

Condensers :
- C1, C2, two-gang .0005μF.
- C3, .1 μF tubular.
- C4, .0002 μF mica.
- C5, .0001 μF. mica.
- C6, C7, .1 μF tubular.
- C8, .02 μF mica.
- C9, .005 μF mica.
- C10, .1 μF tubular.
- C11, 25 μF electrolytic.
- C12, .02 μF mica.
- C13, C15, C16, 16 μF electrolytics.
- C14, 50 μF electrolytic.
- T1, 200 pF aerial trimmer.
- T2, T3, 60 pF trimmers.

Resistors :
- R1, 50,000 ohms.
- R2, 300 ohms.
- R3, 30,000 ohms.
- R4, .25 megohm.
- R5, .5 megohm volume control.
- R6, 350,000 ohms.
- R7, 150,000 ohms.
- R8, 2 megohm.
- R9, 1 megohm.
- R10, .25 megohm.
- R11, 1,500 ohms.
- R12, 100 ohms.
- R13, .5 megohm.
- R15, 2,500 ohms.
- R14, 250 ohms.
- R16, 2,500 ohms. (1 watt.)

Coils and Choke :
- L1, L2, medium-wave coils (as described).
- L3, smoothing choke.
- Output transformer; ratio 50 : 1 (2-3 ohm speaker).

Valves (Octal) :
- V1, 6B8-G. D.D. Pentode.
- V2, 6J7-G, Pentode.
- V3, 6V6-G, Output Beam Tetrode.

Loudspeaker :
- 10-inch P.M.

Power-Unit :
- Rotary-transformer, 6-volt inp./200-225 volt 50 mA. out.
- On-off switch, 5-amp.

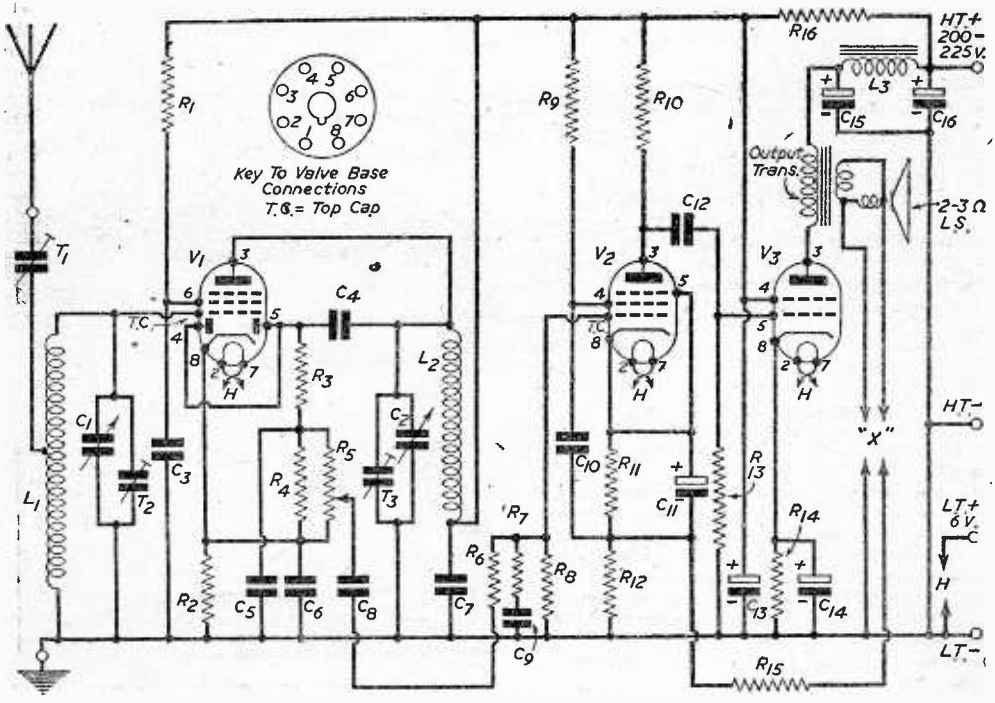


Fig. 1.—Theoretical receiver diagram—less power unit and on/off switch.

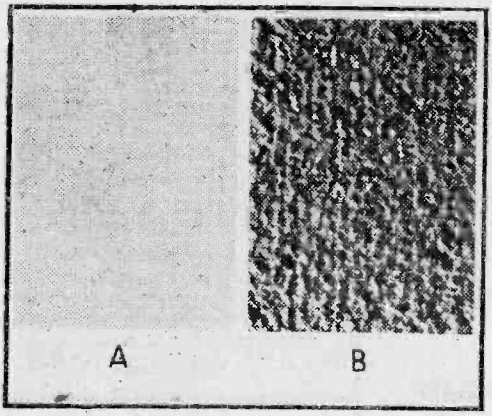
enamelled copper wire close wound in a single layer. Both the coils have the same number of turns, although L1 is tapped about 40 turns from the bottom to connect the aerial trimmer T1. Various other tappings can, in fact, be tried in order to match the tuned circuit to the particular aerial used.

An alternative to the two-gang condenser C1 and C2 and trimmers T2 and T3 is to use switched pre-set condensers for the two nearest local stations. This will also overcome any ganging troubles. Only the medium waves are covered. If standard medium-wave coils are already to hand, the aerial trimmer will be taken to the aerial winding of the R.F. coil instead of to the centre tap. Only the tuned winding of the detector coil will be used.

News from the Trade

Plessey Electrolytic Capacitors

THE present trend towards smaller and more efficient electrolytic capacitors has taken a further stride forward in a development by the Plessey Co., Ltd., Ilford, Essex, of a new type to be known as FP or fabricated plate. This is the outcome of the company's development of fabricated



Comparisons of electrode materials. Plain foil is shown at "A" and the new FP at "B."

electrode material, manufactured by applying pure aluminium to a gauze base of chemically inert material, the aluminium being deposited in a manner which leaves the metal pure and entirely free from contamination.

The plates so produced have a considerably greater effective area than either plain or chemically etched foil, this being due to the extremely irregular spongy nature of the surface and to the gauze or net-like structure of the electrode. The cathode in effect extends through the electrolyte to all surfaces of the gauze structure and results in appreciably reduced sizes of complete units: the capacity of a given area being up to 12 times that of the plain foil type.

Extensive tests have also shown that reliability, shelf and service life, and consistency of product show an improvement over contemporary designs. Leakage current and power factor are also improved, the only limitation being that compared with plain foil, some reduction in ripple current handling capacity has been shown, but the ripple current rating at even higher temperatures is still ample for the more usual receiver and communications applications.

The capacitors are housed in an aluminium casing which is negative and has a negative solder tag in the base.

The complete range has been covered in five diameters from $\frac{5}{8}$in.-1$\frac{1}{8}$in. and the length does not exceed 2in.

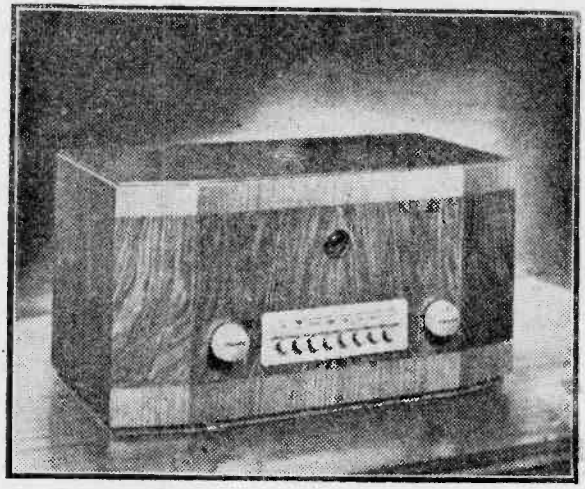
New E.M.I. Radio Unit

E.M.I. recently announced an electrogram—a high-quality record player with twin speakers. To go with this they have now produced a radio unit, illustrated below. It is not, however, limited to use with this equipment.

The output from the unit can be fed into almost any high-quality A.F. amplifier having a suitable input impedance, or alternatively it can be utilised to operate a sensitive high fidelity loudspeaker, when a large output is not the prime consideration.

The aerial is inductively coupled to the high efficiency tuned grid circuits of the R.F. amplifier. All coils are iron-dust cored and station selection is effected by switching in suitable trimming condensers in the signal circuits and coils in the oscillator circuit by means of the station push-buttons. Image rejection on long wave is provided. A visual tuning indicator is provided to facilitate setting the push-button controls.

The output from the detector is fed, via the volume control, to the A.F. amplifier, which is resistance-capacity coupled to the tetrode output valve. A degree of negative feedback is obtained by a connection from the secondary of the output transformer to the cathode of the A.F. amplifier.



The new E.M.I. radio unit referred to above.

Programme Pointers

Our Music Critic, MAURICE REEVE, Looks Back at the Christmas Programmes

IN discussing the Christmas programmes—which is the task I am allotting myself this month—two main factors will govern my conclusions, namely, about how many people do any listening during the holiday, and, secondly, what opportunities are there for good, critical listening. These two points may, at first glance, sound rather like one and the same thing. They are not, however, for the reason that a person may have every intention and desire to listen to a certain item, but finds that there is no opportunity to do so when the time comes. I feel that, if the item is wanted by a sufficient number, the B.B.C. should provide it. They cannot, naturally, be held responsible for providing the opportunities in our domestic and social arrangements for listening in.

Take the first point first—just how many people do listen-in during the Christmas vacation—which is the one that most concerns us here. My own opinion is, many fewer than normally. And those that do would do so much less critically. I wonder if I am right? It rather looks as if I am, on the second count, at any rate, judging by the types of items chosen for the Home Service, which were much "lighter" than average. I doubt whether many tuned in to the Scottish Regional's orchestral concert bang in the middle of Christmas afternoon, however; one hour long, immediately following the King, although their programme was airy and attractive. Or the Northern's concert on Boxing Day, from three until four-thirty, including the Brahms Violin Concerto and a Haydn Symphony—tough going, surely, for both players and listeners.

The inclusion of the first Reith Lecture, by Bertrand Russell, on the Sunday at 9.15, was criticised in some quarters. But I rather feel that the festive dining and wining had probably been well slept off by then, though visiting may have been taking place. Anyhow, I heard it in quite an alert frame of mind.

Well Chosen

On the whole, I thought the programmes were well chosen and entertaining. I missed "Christmas at Dingley Dell," a reading of which might well become an annual item, perhaps alternating with other classic descriptions of the festival from English literature. It would at least serve as a chastening reminder of the days and the life that are beyond recall, though the descriptions of the festive boards may be a little too much for our gastric juices in these less spacious days.

The "Good Neighbours" programme was interesting without being anything like up to the standard of similar Christmas tours, prefacing the date King George V's talks before the war. I liked *Hansel and Gretel* on Christmas Eve evening, a charming work, and, so far as I know, the sole survivor of the output of its composer, Humperdinck. The Christmas Day Music Hall was vastly superior to the usual stuff put out on Saturday evenings, as it was presumably meant to be, judging from the galaxy of stars that composed the bill.

The Sunday programme was an ordinary Sunday affair, with all the Sabbath features in their usual places; whilst the Boxing Day menu was even slightly lighter than Christmas Day, lacking, as it did, a symphony concert.

The Third Programme stooped and fell in line with the popular revels to the extent of including in its forbidding pages such "un-Thirdish" items as "Little People and Co.," a talk by Algernon Blackwood, "Christmas Remembered," by Lady Bonham Carter, and "The Stolen Turnips"; "The Magic Tablecloth," "The Sneezing Goat" and "The Wooden Whistle," told by Arthur Ransome. Such goings-on can never have been known before, and will doubtless not be repeated again till next Yule. Its honour was defended, however, by a full length symphony concert under Sir A. Boult, including Bartok's Concerto for Orchestra, and the Franck Sonata, by Campoli and Gritten. All the other days of the holiday, its austerity was at its usual flood level. Much as I usually like it—by temperament and nature, I am a "Thirder" rather than a "Homer," and certainly a "Lighter"—I wonder if it was listened to by more than a small handful? Still, perhaps it was better there, on tap, than that one hungry soul should be deprived of his Bartok or his Franck. In spite of my innate "Third" leanings, heaven help me, personally, from such stuff on Christmas evening, which brings us to the second point set out at the start.

"Good" Listening

The opportunities for good listening at Christmastime, as apart from just turning the knob and seeing what's on, must be so considerably fewer than normally that they are bound to influence programme building and to shift the centre of gravity from serious to light or lightish. For tens of thousands Christmas is a day of very hard work, at any rate, until the clock is well on its round. They can't listen to more than a catchy tune played or sung, or to pick up a joke from Much Binding or a similar show, as they pass to and fro on their lawful occasions. Entertaining and being entertained preoccupies many others, especially Boxing Day, not to mention the Boxing Night theatres and pantomimes. I shouldn't be surprised if listening-in was reduced to 50 or 60 per cent. of its normal, and critical listening to something even less than that.

To sum up, it was pretty good fare we were served up with. There was not too much repetition of the more commonplace Christmas adjuncts, though there were two performances of Holy-Hutchinson's Carol Symphony. Whether it is possible, and if possible, worth while, devising some startlingly original programmes for the next festival which would compel our attentions

more than at present, I wouldn't like to say. Something that would bring the public to the microphone—or back to the microphone—instead of taking the mike to the public. Perhaps a little too much emphasis is laid on that latter policy, but if I am right in my belief that there is little chance of selective listening at Christmas time, then that policy is obviously the right one.

(Note. Regarding my reference to broadcasting "Christmas at Dingley Dell," or some similar excerpt, I notice that "A Christmas Carol," abridged, was included in the Woman's Hour on Christmas Eve: a programme to which I am not normally accustomed to tuning in.)

Tommy Handley

No article on radio programmes would be possible without its author's personal tribute to the late Tommy Handley. At the time of writing, although it has been more or less decided there will be no more "Itma" programmes, the question of a successor on similar lines is still, I believe, open. If that type of show is finally abandoned, it will be the first time, in my recollection, at any rate, that "the show has *not* gone on." Will it be a precedent, and a break with one of the oldest traditions? "Itma," itself, was something entirely new in radio shows; it had a personality and a quality which were not only all its own, but which I don't think I am alone in saying were above even Tommy Handley. Was "that man" just Tommy and Tommy alone, or was it the prototype of a character, almost Dickensian in the width of its appeal; one which could be played in a tradition such as the Falstaffian or the Pickwickian traditions, by another comedian of genius, were he given the chance? I admit an adequate successor to Tommy Handley would be difficult to find. But before the curtain is rung down for ever, further counsel might be taken without loss to anyone concerned.

News from the Clubs

STOURBRIDGE AND DISTRICT AMATEUR RADIO SOCIETY

Hon. Sec.: W. A. Higgins (G8GF), 35, John Street, Brierley Hill.

TWENTY-EIGHT members were present at a meeting of the above society in the Science Block, King Edward's School, Stourbridge, to listen to a talk given by Mr. Pratt, of AVO, Ltd., London, entitled "Measuring Instruments." Some of the latest AVO equipment was on show and at the end of Mr. Pratt's most excellent contribution, members were able to inspect the instruments at close range.

Morse transmissions were arranged for non-transmitting members and the president (Mr. J. Timbrell) announced a scheme for the presentation by Stourbridge Borough to the society of station QSL cards for transmitting members.

All radio enthusiasts are welcome at meetings, which take place on the first Tuesday in each month and prospective members should contact the secretary.

THE WEST MIDDLESEX AMATEUR RADIO CLUB

Hon. Sec.: C. Alabaster, 34, Lothian Avenue, Hayes, Middlesex.

THE West Middlesex Amateur Radio Club continues to flourish and attract enthusiasts with a variety of radio and electronic interests. Recent meetings have been devoted to a lecture on valves given by Mr. S. R. Claudot, of the Radar Association, and a discussion on amplifiers by club members. Meetings in the immediate future will be given over to a junk sale and an evening's discussion on V.H.F.

Prospective members are cordially invited to attend the meetings which are held on the second and fourth Wednesdays of every month at the Labour Hall, Uxbridge Road, Southall, Middlesex, at 7.30 p.m.

SOLIHULL AMATEUR RADIO SOCIETY

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

A MEETING of the above society was held at its headquarters, "The Old Manor House," recently, when a very instructive and enjoyable lecture on radar was given by Mr. F. T. Smith (G6FK), of Wolverhampton. The next meeting of the club will be addressed by one of its own members, Mr. G. Hill (G8MZ), on his 10-metre rotary beam.

Meetings are held fortnightly at the above address, when visitors and new members will be cordially welcomed.

THE BRIGHTON AND DISTRICT RADIO CLUB

Hon. Sec.: R. J. Donald (G3DJD), 2, Canfield Road, Brighton.

AT the A.G.M. the following officers were elected—chairman, A. C. Sofe; hon. secretary, R. J. Donald; treasurer, F. R. Jupp. The club's station, G3EVE, is now active on 1.7, 3.5 and 7 Mc/s ('phone) and reports on reception will be welcome.

Meetings are held every Thursday at St. Mary's Hall, Bread Street, Brighton, from 7.30 p.m. The second Thursday in each month is the occasion of a talk by a visiting speaker. New members are invited to attend.

STAMFORD AND DISTRICT RADIO SOCIETY

Hon. Sec.: F. K. Parker, 122, Empingham Road, Stamford, Lincs.

THIS society, formed in October, 1948, has a membership of 12 at the time of writing. Full society meetings are held on the second Monday in each month at the Albert Hall, High Street, Stamford. Meetings are held for the remaining three weeks of the month at 31, St. Mary's Street, Stamford, at 8 o'clock. These meetings take the form of a general discussion on set subjects.

The annual subscription is fixed at 5s. payable to the treasurer, Mr. F. Naylor (G3CUD), on any club night.

Mr. T. Allen has been elected chairman of the society.

It is hoped that at some future date to arrange morse classes for those wishing to obtain amateur transmitting licences, while all members endeavour to help any prospective amateur in the task of passing the examination for the technical side of the problem.

Out of the 12 members on the society's books three have amateur transmitting licences, all signs being G3CUD, G3DKG, G3EKV.

Anybody who wishes to join the radio society (and the need for more members is very pressing) should communicate with the secretary.

SOUTH MANCHESTER RADIO CLUB

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

THE club is still going strong with an increase of membership at each meeting.

At a recent meeting members heard an interesting talk by Mr. King (G3EON) on the "Straight Receiver," commencing from the very simple Rx and gradually building up to the more elaborate types showing the reason for each component, its advantages and drawbacks, etc.

Plans for the club Tx are going ahead and it now all depends whether permission may be obtained for erecting a suitable antenna at the Church Schools. The rig the committee have in mind is something portable, as there is nowhere available to keep gear between meetings, and also in favour of the portable rig is the fact that during the coming summer it will be possible to have a field day, etc.

Plans for future meetings are still in the making and it is very difficult to tie down a certain lecturer to a given evening but talks, etc., are hoped to include V.H.F. technique, Practical Construction and The Part Radio Plays in Medicine.

Morse classes, which have dropped off at the last few meetings are to be restarted and two groups will be active at all future meetings, resulting in a little QRM and also an opportunity for both those only beginning and the advanced to have practice at the same time.

Regarding visits, it is hoped to have the chance to see the local police installations and also go round a newspaper office, etc.

Meetings are being held fortnightly throughout the year.

Open to Discussion

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

"Smash and Grab"

SIR,—In these days of a never-ending stream of smash-and-grab raids, where radio shops seem to be specially favoured, the police are often the target for a charge of inefficiency.

The following facts in connection with our own recent smash-and-grab raid go to prove that the police do sometimes get their men.

On the night of December 11th we were visited by the S. and G. gentlemen; on the 14th we were informed by the flying squad that they had apprehended two men and recovered a portion of the stolen property. The focal point moved to the London Sessions on January 13th, where one of the two men detained was given a sentence of 15 months' imprisonment and the other, a mere lad of 18, was given three years' Borstal training.

If you publish this letter we trust that the facts will provide a measure of comfort to our fellow traders who are all too often the victims of these pests.—MODERN ELECTRICS, LTD. (London, W.C.2).

"Crystal-grinding Technique"

SIR,—I was interested in the article "Crystal-grinding Technique" in the October, 1948 issue of PRACTICAL WIRELESS and would like to comment as follows:

In the list of apparatus required, Mr. Maloney itemises "a sheet of plate glass . . . (or old piece of window pane will do) . . ." It is most desirable that the working surface used for the lapping process be as flat as possible, i.e., optically flat. Any divergence from optical flatness will introduce a source of trouble when endeavouring to keep the crystal blank surface truly flat. For this reason the use of window pane is ill-advised as it is usually a long way from being flat. It is therefore most strongly recommended that any lapping carried out should be performed using nothing less true than twin-ground plate glass.

Referring to the point in the frequency spectrum at which the changeover from AT to BT cut occurs, the generally accepted frequency for changeover, in U.K., is around 3 Mc/s. My experience has been that although plates up to 4.5 Mc/s may be found in American type crystal units the position varies with British manufacturers and BT cuts may be found at frequencies as low as 2.9 Mc/s. I have not met an AT cut produced in U.K. with a frequency higher than 3.5 Mc/s. I have mentioned these points as they may save confusion to your readers when following the useful instructions laid down by Mr. Maloney.

In testing blanks prior to lapping or processing, Mr. Maloney does not mention the action which should be taken if the crystal plate is of poor or nil activity. The majority of thickness shear-mode crystal plates processed several years ago were finished to final frequency by lapping methods only. The "ageing" of a crystal plate so processed results in a loss of activity, due to deterioration of the major surfaces of the plate, and occurs in a very large percentage of units containing plates processed in this manner. It may, therefore, be of assistance to add a few more words on the method of processing plates found to be below par.

On the assumption that the crystal plate is found to be defective as the result of ageing it will be necessary to lap both surfaces of the crystal plate to remove the "disturbed" or aged layer of quartz. The amount of quartz, in terms of increase of plate frequency in kc/s., to be removed from each major surface to ensure complete removal of the disturbed layer, is given by $\frac{1}{4}f^2$kc/s. where f is the frequency of the crystal plate in megacycles. It would, therefore, be good practice to remove not less than this amount of quartz from one face of the blank and proceed to bring the plate to required final frequency by the removal of quartz from the other major face as detailed by ZL3DE. The lapping of both major faces of the blank is an unavoidable procedure with a badly aged plate and although it may result in a greater tendency for these faces to loose their parallelism, this is where the skill of the operator is of importance and is measured by the results achieved. It will be appreciated how important this point is when it is realised that if parallelism of the major surfaces is outside a tolerance of the order of 1 micron the activity of the plate drops.

Incidentally, and in conclusion, the reader will have noted that in the foregoing I have at no point mentioned the term "grinding." This latter term, although commonly used, is a slack one and is, technically, an erroneous one. The process is intended to be one of "lapping" and is a process distinct from that of "grinding." The separate meanings of the two terms may be illustrated by the following definition:

"Lapping is a refined finishing process using loose abrasive grains, and is distinct from grinding involving the use of bonded grains."

As a title to the article I would have preferred the term "Crystal Processing Technique."—E. A. BARNSDALE (Risley).

"R1355 and Television"

SIR,—Further to the letter of Mr. K. Berry, of Surbiton "R1355 and Television" (March, 1949), we should like to make the following comments:

Re the "4 Mc/s. bandwidth" we afterwards realised that this figure was incorrect, and when reprinting the articles as a booklet we altered this statement to read "has a suitable bandwidth."

Mr. Berry's statement that "the actual bandwidth is ±.6 Mc/s. for 6 dB down, i.e., 1.2 Mc/s. bandwidth," is itself misleading. This statement was taken from Air Ministry Publication 2557A Vol. 1, and refers to the position as the R1355 is purchased. By stagger tuning the I.F.s. and adjusting the R.F. unit trimmers to give single sideband reception, it is possible to resolve the 2 Mc/s. grating on Test Card C. Mr. Berry's statement that "the R.F. units 25, 26, 27, etc., are very suitable for

television as they stand" is obviously incorrect, as the R.F. 25 unit is the only one which covers the required frequencies without modification.

Should Mr. Berry be still unconvinced of the suitability of the R1355 receiver for television, maybe a personal demonstration would change his opinion. This we shall be pleased to arrange if he will contact us through these pages.—C. OVERLAND (G2ATV), LIONEL E. HOWES (G3AYA).

"D.C. Oscillograph Amplifier"

SIR,—I should like to raise two points in connection with my article "D.C. Oscillograph Amplifier," which appeared in the March issue of PRACTICAL WIRELESS. Ch.1, the choke in the anode circuit of the 6J7 should be about 20 millihenries, i.e., 2,900 turns of 30 S.W.G. on a ¾in. diameter former filling a length of ¾in. along the former to a height of ¾in. and held between cardboard cheeks. The output from the 50 cycle neon synchroniser should be taken via a 50 pF condenser to form a differentiating circuit. Also, the Mullard ECR35 is stated to be the same as the VCR135. This should be VCR138.—BRUCE F. WALKER (Dundee).

No. 18 Receiver

SIR,—On looking through February PRACTICAL WIRELESS, I see a further letter on the No. 18 receiver—Mk. III. I have had this excellent little set running for well over six months without any aerial tuning arrangement whatever. The aerial, incidentally, is 50ft. long, being a dipole resonating at 7 Mc/s, fed by a quite unbalanced feeder made from ordinary twin flex.

On seeing Mr. K. Berry's letter, I am hoping that this will not discourage anyone using the 1355 for a vision receiver, because the bandwidth can be brought up to about 3 Mc/s by staggering the I.F. trimming.

Now for the VCR97 or 517 question. Surely these widely differing results with the E.M.T. are due to the age of the tube. I have had no experience with either of these tubes yet but I feel this is the solution to the problem.—R. M. OLIVER (Tolworth).

SIR,—In view of the recent interest shown by the "Readers' Letters" regarding the No. 18, Mark III RX (6-9 Mc/s), here are my attempts at converting this receiver into a three waveband L.M.S. superhet for loudspeaker reception.

The results have proved so pleasing that I thought perhaps they would prove interesting to others.

On the H.F. side of the set I removed the two-gang .00017 μF tuning condenser, coils, R.F. and mixer valveholders and replaced them by a two-gang .0005 μF tuning condenser; an L.T.C. coil pack Model 30 and a KK32 valve was used as a frequency changer (the R.F. stage being discarded). On the L.F. side the output transformer was removed and the original chassis was extended by means of a small chassis 5in. by 2½in. to accommodate a PM22A output stage.

The set was aligned as recently described in PRACTICAL WIRELESS, and the quality is excellent on medium and long wavebands. Many DX broadcasting stations on the short waveband have been heard, including "All India Radio," "Radio Australia" and "Radio Canada."—DENNIS E. GATES (Gt. Yarmouth).

Ex-Service Equipment

SIR,—May I reply to J. Hall (Harrow) and M. Francies (N.W.5). To the former may I say that I am using a VCR97 with 3,000 volts through a 100 KΩ pot. and in all modesty technical friends have described the results as comparable to a commercial set-up employing magnetic deflection. Furthermore, this may be viewed in daylight.

The circuit line-up is 5 R.F.s, det., Video A, cathode follower, DCR., a two-stage Sync. Sep., Miller frame and line integrators with paraphase amplifiers.

This is no fluke, as two friends have used this line-up with similar results.

To Mr. Francies:

Try EF50 paxolin bases. These produce a perfect fit and the valves seat really beautifully and without all those wire and screw gadgets. These bases were used with confidence on Service gear for frequencies as high as 400 M/cs, which should speak for itself.

Personally, I discarded the ceramic type a long time ago.—A. S. TORRANCE (W.1).

Home-made Television Receiver

SIR,—I have read with interest the article concerning the construction of a home-made television receiver in the television supplement of your March issue. I find that I disagree with two statements that you make: (1) the lack of ease and simplicity with which they can be built, and (2) the need for test gear and instruments. I might also mention that I have never built a radio set, the reason for this being that I have no knowledge of radio. But on looking through your pages I saw an advertisement for a kit of parts for a television receiver. I contacted the advertiser and the result was that I purchased a kit of parts price £23 10s. Twenty-eight hours after receiving it I was viewing and hearing the transmission.

That should take care of part 1. As for part 2, the only gear I possessed was an electric soldering iron, a screwdriver, a pair of pliers.

The screwdriver was all that was needed to align the receiver.

There must be many amateurs who, like myself, thought television construction, at home, beyond their skill, but I now have proof every evening that this is not so.

The twenty-eight hours, by the way, were working hours.—J. E. JAMES (S.E.5).

Home Recording

SIR,—I would like to thank Mr. W. Mackintosh for the letter he sent about home recording. I, too, am very interested in this hobby, but, like the others, I am unable to obtain any sort of gear. I have had some very small success with pick-up recording, but it is nothing like good enough. There are (as Mr. Mackintosh suggested) quite a few of us interested in recording who are stuck because of equipment. Therefore I also would like to see some manufacturer enterprising enough to help us.—H. WOODWARD (Llanhilleth, Mon.).

Impressions on the Wax

Review of the Latest Gramophone Records

THE latest addition to Columbia's Masterworks Series is Prokofiev's Symphony No. 5 in B Flat, which has been recorded for the first time in this country by the Philharmonic Symphony Orchestra of New York, conducted by Artur Rodzinski on *Columbia LX*1147-51. The Fifth Symphony is probably better known in America than it is here. It is unsensational, but perhaps it is all the more worthwhile for an absence of excessive window dressing. Though the large orchestra is used very fully, there is little padding.

All Mozart's violin concertos are early works, written at Salzburg in his youth. The Concerto in D Major K.218, which has been recorded on *H.M.V. DB*6678-80 is dated 1775, in which year Mozart was 19. It is a buoyant, melodious work, the solo part being played by Jascha Heifetz, ably supported by Sir Thomas Beecham conducting the Royal Philharmonic Orchestra. The interweaving of sound between the orchestra and the purity of the soloist's tone is something that will give the keenest pleasure to every lover of music. The two great names of Heifetz and Beecham have been well served in the recording, which is clear and resonant.

In November, 1946, a new ballet, with music by Lord Berners and choreography by Frederick Ashton, was given at Covent Garden. It was the first ballet score undertaken by Lord Berners since before the war. An early Edwardian extravaganza, "Les Sirènes," transports its audience to the Riviera in 1904; the sirens are the Edwardian ladies in the height of fashion, and the music has all the wit and fantasy associated with the talented composer. "Les Sirènes" is recorded by the Philharmonia Orchestra, conducted by Ernest Irving on *Columbia DX*1542.

Another outstanding orchestral recording is Wagner's "Lohengrin," Prelude, Act I, played by the Philharmonia Orchestra, conducted by Paul Kletzki, on *Columbia LX*1153. "Lohengrin" is built entirely upon one theme, a beautiful one, expressive of the sanctity of the Grail, of which Lohengrin is one of the knights. Violins and flutes open the Prelude with long-drawn-out chords, followed by the Grail Motive in the violins. Some passages in this piece are still quoted in orchestral textbooks as superb examples of light, airy string writings. Though the one theme is used throughout the Prelude, Wagner's skill and invention prevent any feeling of monotony.

Light Music

Music lovers have, no doubt, welcomed the return of Peter Yorke's "Sweet Serenade" broadcasts. This is the third series of these popular Sunday lunch-time broadcasts. "La Vie en Rose" is the Continental favourite which, with its English title, "Take Me to Your Heart Again," recently swept to song stardom in this country. In his latest record, Peter Yorke treats it as an orchestral piece. On the reverse is "Heaven in Your Smile," a new British waltz, featuring the singing of Neville Williams, who was heard with Peter Yorke in his "Sweet and Lovely" broadcasts—*Columbia DB*2496.

Harry Davidson and his Orchestra conjure up warm musical memories with two fine interpretations of tunes that were all the rage just before World War I. The novelty piece, "Policeman's Holiday," has been recorded by Mr. Davidson in response to numerous requests. On the reverse is "The King's Waltz," which was written in 1913 by J. H. Greenhalgh, with steps devised by A. E. Brown—*Columbia DX*1547.

Many and varied are the works which George Melachrino selects and arranges for his famous strings. This month he chooses the enchanting "Valse Bluette," by Riccardo Drigo, the Italian composer, who died in 1930. "Valse Bluette," which is often heard as a violin solo, is here for the first time given a string-ensemble setting. It is coupled with an arrangement of "Stardust" on *H.M.V. B*9723.

Variety

Bill Johnson, whose recordings are becoming increasingly popular, has chosen the ever-popular Irving tune "Always" for his latest recording on *Columbia DB*2495. The coupling is a slow ballad by Eddie Cassen, "I Can't Get You Out of My Mind."

"It's Magic" is a number with a gay lilt, and a slightly beguine tempo. Tony Martin completely enters into the spirit of the lyric, and puts it over in a most persuasive manner on *H.M.V. B*9726. On the reverse is "It's You or No One."

The Geraldo Orchestra, in skilful arrangements by altoist Wally Stott, and featured vocalist Denny Vaughan, give fine performances of four outstanding American tunes. The titles are "On a Slow Boat to China" and "Bouquet of Roses" on *Parlophone F*2333, and "It's Magic" and "Put 'Em in a Box" on *Parlophone F*2334.

"It's a Wonderful World" and "I'd Love to Live in Loveland" are the two titles chosen by that popular combination The Organ, the Dance Band and Me, under the leadership of Billy Thorburn, who plays the piano. The number of the record is *Parlophone F*2338.

Edmundo Ros, popular band-leader at London's exclusive Bagatelle night spot, is undoubtedly Britain's most popular practitioner of genuine Latin-American music. On *Parlophone F*2336 he features "Chevere" with a samba coupling, "Mangueira." Joe Loss and his Orchestra have four popular titles for their latest discs. They are "Bluebird of Happiness" and "Maybe You'll Be There" on *H.M.V. BD*6032, and "For You" and "I Never Knew an Angel Told Lies" on *H.M.V. BD*6033. His new choral group, The Loss Chords, are featured in these titles.

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THE WONDERFUL NEW A.C. MIXED AUTOCHANGER by Collaro, finished in brown and chrom. with super crystal pick-up—our special introductory offer—only **£14** incl. tax, carr. pd. Collaro induction type AC gram. motor with variable speed and 12in. t.t., **£5.** No. 3 Collaro RP49 complete Radiogram Unit, with autostop and latest type magnetic pick-up, **£5/14/8.** No. 4 ditto (but induction type, with 12in. t.t.). **£9.** No. 5. as No. 4. but for A.C./D.C. operation. **£12/18/9.** Exhaustive Constructional Manuals, enabling even beginners to build fully professional standard radio sets : No. 1. 3-valve plus rect., T.R.F. L. & M. waves for A.C. operation, 3/-. No. 2 as No. 1. but A.C./D.C., 3/-. No. 3, 5-valve All-wave Superhet of extreme power and range. A.C., 5/-. No. 4 as No. 3. but A.C./D.C., 5/-. Complete Kits of Parts (incl. valves and speaker) to build above circuits : T.R.F., complete with very attractive moulded bakelite cabinet and illuminated glass dial, A.C. or A.C./D.C., **£7/17/6.** Superhet, less cabinet. A.C., **£9/12/6.** A.C./D.C., **£8/12/6,** figured walnut cabinets available. The Lee Products All-dry Battery Kit, complete (except cabinet), **£7.** The Mighty Midget Radio—3 valve plus rect., A.C./D.C., 200-500 metres. high "Q" coils, 5in. speaker. polished walnut cabinet, built ready to switch on, 12 months' guarantee, sensational bargain at **£6/19/9,** incl. p.t. (carr. 2/6). money back if not delighted. The N.R.S. Audio Amplifier. 4-watts output. pick-up and tuner inputs. volume, tone and negative feedback controls, A.C. 110/250 v.. special offer, **£5/19/6.** ex-Gov. 6J5 and L 63 valves. 3/6 each. 6 for 18/-. Osmor Coil Packs. 33/-. Send 2½d. for Bargain List of Kits. Amplifiers and components. Terms : c.w.o or c.o.d. N.R.S., 102, Parkhill Road, London, N.W.3. Tele. : Gulliver 1453.

TELEVISION chassis and components of the highest quality. ready for assembly to "Electronic Engineering" specification. S.A.E. for list.—Osmor Radio Products. Ltd., Borough Hill, Croydon, Surrey.

97/6. CHARGING SWITCHBOARDS, 12v./32v.. 500 to 1,260 watts, volts, amps. cut-outs, fuses, resistances, etc., 4 take-offs, superb unit. in case ; or send £5 carr. pd. 75/-, DYNAMOS. 24 volts, 1,000 watts, 12in x 7in., ¾in. spindle ; 80/- carriage paid. 75/-. 230v./1/50, 1/5 h.p. ELECTRIC MOTORS. 80/- carr. pd. 58/-. MAINS TRANSFORMER SWITCHBOARDS. 230v., A.C. to 12v., 5 separate take-offs, complete distribution panel, all switches, fuses, amps.. etc., brand new ; 60/- carr. pd. 55/-, ELECTRIC MOTORS, 12v. and 24v., ¼ h.p.. 4in. by 8in.. with ¼in. spindle for drive. beautiful job ; 60/- carr. pd. 70/- Reduction-geared ELECTRIC MOTORS, 24v.. 1/10 h.p., 2-stage, enclosed 2 r.p.m., superb precision instrument.
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ROTARY CONVERTERS. from 1-12 kW.. 110v. and 220v. D.C.—230v./1/50. from **£15.** MOTOR GENERATORS, 1-6 kW.. 110v. and 220v. D.C.—24v./35y. D.C. from **£9.** MAINS TRANS., ½-18 kva ; all types, from **£5-£59.**
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RAYMAX Television Sound Unit, complete kit, uses 2. EF50, EBC33. EL33. Chassis punched and main components assembled. Price (less valves) **£2 17s. 6d.** Valves supplied at current prices. We specialise in supplying kits for all circuits shown in PRACTICAL WIRELESS and Techni-Gen Series, and all well known amateur booklets. Full details of the above and our Home Constructors Service are given in our general list. Push-pull intervalve Transformers, ratio 3:1 each half, 3/- ea. Collaro rim driven Gram unit, magnetic PU and autostop. **£5 18s. 6d.** incl. tax. Inter. Octal moulded V/H. 7/- doz. Flying Tuning Kits, 33-1, comprising flywheel, 4in. drum, ball bearing drive spindle. cord and spring. 3/9 ea. All types of components available ex stock, including cabinets for TV and table radiograms. Our Console TV Cabinet at **£19 15s. 0d.** is worth "looking into." Good photographs of cabinets available at 6d. (returnable). Record Player Cases finished in black rexine, complete with motor board, carrying handle. etc., size 16in. x 15in. x 8in., a bargain at **£3 2s. 6d.,** or complete with Garrard motor, PU, etc., **£8 7s. 6d.** Stamp for bargain and general lists. Raymax Elec. Co., Ltd., 126, Norwood Road, S.E.24.

RF UNITS TYPE, 24, and 24 mod. 27, 8/6 ea., plus 1/3 postage. Type 25. 12/6. Type 26 and 27 at 21/9 ea., plus postage 1/3. Indicator Units : Most types available. See our lists. IF Transformers, all in can with trimmers, 465 kc/s std., 9/- pr. ; 200 kc/s midget dust tuned, 8/- pr. ; 13 mc/s std. and 14-16 mc/s std., 7/- pr. Special : 16 mc/s IF contains 2 sep. coils and formers. dust-tuned, ideal for TV use or rewinds. 2/6 ea. or 5 for 10/-. M.C.R.I. coils. type 2. 3 and 4. 10/- ea. ; 20pf ceramic variables, complete with metal bracket and ins bush. 2/6 ea. Resistor and condenser panels, 34 rs and cs, plus 3 Westectors, as new, 5/-. Phone plugs, 9d. One-hole jacks. 1/3, or with switch contacts. 2/-. R 1124 receivers for TV sound. including 6 valves, 17/6, plus 2/6 carr. Assorted coloured knobs, 2/- doz. Panel lamps, clear 1/- ; red or green, 1/6 ea. Set of 7 UHF coils, dust-tuned, 3-80 meters. 5/-. Six UHF. HF and SW chokes. all different. 3/-. Uni-selector switches. 25 w 8 b. 45/- ea. H.R.O. Senior, £20. S27 AM-FM., £30. R.C.A. crystal wavemeters, 200 kc/s-20 mc/s. £6/10/- ea. SEE OUR LIST FOR DETAILS. Phones, LR, 3/6 pr. ; Bal Arm type, 5/- pr. Moving coil, 10/6 pr. Voltmeters. 0-40 v., 4/6 ; 20-0-20 a. 4/6 ; 50-0-50 a, 4/6. Cell testers by Turner, 3-0-3 v. and 30-0-30 v., 3in. scale, 12/6 ea. VALVES, guaranteed. 955. 956. 6SN7, VP41. 10/- ea. ; EF39. EF36. EBC33. 12A6, 6J5, 9D2. 15D2, 8D2. 4D1. all at 5/- ea. Hundreds of others. See our lists. S.A.E. please.—H. English. Rayleigh Rd., Hutton, Brentwood. Essex.

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

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

Practical Television

Vol. 1. No. 2 NEW SERIES April, 1949

Television Standards Agreement

A RECENT announcement by the Radio Industry Council states that four leading manufacturers in Britain and Holland have agreed on television standards for use of the Continent of Europe. The four firms are Philips of Eindhoven, G.E.C., Marconi, and Pye, who have jointly agreed to standardise equipment for the Continent on 625 line picture definition and also on positive modulation for the vision signal. The latter is already in use in Great Britain, with 405 line definition, and in France, where a system of 819 lines is projected. In the United States of America, however, negative modulation is used extensively, and the Dutch had proposed to use it before the present agreement was reached.

Other technical standards agreed upon are 25 frames per second with a 2-1 interlace, vestigial side-band operation, and a total channel width of 6 megacycles. No recommendation has been made for the method of modulating the sound signal. It was originally announced that five firms had subscribed to this agreement, but the fifth—E.M.I. —later denied that they had taken part in the joint consultations which led up to the agreement. They state they are able to supply television transmitting equipment for any and all practicable standards, including the B.B.C. standard of 405 lines, the American standard of 525 lines, the new E.M.I. standard of 605 lines, and also for 625 lines or more when such are required.

One of the leading radio industrialists, who recently returned from Holland, expressed the view that the agreement on positive modulation is of vital importance and very satisfactory from the point of view of the British manufacturer. And, of course, it is obvious that if negative modulation had been adopted on the Continent the manufacture of sets with different forms of modulation for the home and foreign markets would have created a number of difficulties for British manufacturers, not the least of which is that, with a comparatively small demand as yet, costs would be high.

The British television industry has also been in favour of adopting its own 405 line system with positive modulation as the standard for Europe, and its view has not changed that it is still the most efficient system in relation to costs and to ether space occupied.

It has become increasingly apparent, however, that some of the European countries wished to take advantage of Britain's vast and unique experience of television in all its aspects, including studio and transmission technique, as well as receiver manufacture, whilst at the same time demanding a line definition nearer to or above the American system.

Uniformity on the Continent, especially with the British system of modulation, is of greater value than the partial acceptance of 405 lines, although the 405 line system will continue to be used and extended in Great Britain.

Sweden and Germany already favour the 625 line definition, which is higher than is used in the U.S.A. Television development work is recommencing in Sweden and Germany, and it is thought that other Scandinavian countries, as well as Belgium and Switzerland, are in favour of the 625 line system; for apart from the great advantage of being able to exchange programmes, and so sharing in the major cost of television, they would also benefit by economies in the manufacture of transmitters and receivers as a result of the standardisation now agreed.

British manufacturers state that they will at once commence production of sets suitable for export to the Continent.

Examinations in Television Servicing

The Department of Technology of the City and Guilds of London Institute announce details of a new examination in the servicing of television receivers which has been drawn up and adopted by the City and Guilds of London Institute and the Radio Trades Examination Board. Full details are available from the Institute at 31, Brechin Place, South Kensington, London, S.W.7.

The first examination under this scheme will be held in 1950, and arrangements are similar to those for the Radio Servicing Certificate Examination, which is also jointly conducted by the City and Guilds of London Institute and the Radio Trades Examination Board.

The syllabus has been based on the assumption that, before commencing to study television, students will have a good knowledge of the basic principles of radio and be proficient in the servicing of radio equipment for sound reproduction. The course of study recommended covers a period of two years, with attendance on two evenings per week, or the equivalent if part-time or day-time classes are available. It is considered essential that at least 50 per cent. of the time should be devoted to laboratory work and practical servicing, and it is pointed out that a large amount of no-signal testing of television receivers is both practicable and desirable. Candidates must prove that they have passed the Radio Servicing Certificate Examination, the examination in radio servicing held by the Radio Trades Examination Board from 1944-1946, the C.G.I. Examination in Radio Work, the examination of the B.I.R.E., or of the Scottish Radio Relays Association, or the third year examination of the Union of Lancashire and Cheshire Institutes.

(*See also leader on page* 131)

Underneath the Dipole

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

MORALE is high at the Alexandra Palace. In spite of the frustrations which afflict us all, and which seem to have especially retarded some aspects of the technical progress of British television, the development of the production side proceeds apace. There have been a few resignations from the television staff, true enough; but the majority carry on the good work in the magic atmosphere which is bound to surround an entirely new form of entertainment. The novelty of the medium, the pioneering and artistic experiments, the fuss about it in the Press—even the necessity for daily improvisation—build up a glamour about the job reminiscent of the earliest days of "blind radio."

From which you will gather that I have formed a very high opinion of Norman Collins and his production and engineering staffs at the Alexandra Palace. Nightly they accomplish that miracle of "independent frame," a couple of hours of entertainment produced on two small studio stages which would be considered inadequate for making a six-week "quota quickie" lasting 50 minutes on a cinema screen.

Creative Nonsense

It is fortunate that the A.P. production boys all take a very active interest in the technical side of their craft. This is unlike their equivalents in the film studios, who tend more and more to adopt a lofty attitude to the mundane matters of the tools which fashion the job. A leading authority stated recently: "The average director, cameraman, script writer, editor, proudly claims to be an artiste, not a technician—he takes pride in his ignorance of technical matters. To him the term creative is the exact opposite of technical." It is small wonder that British films are experiencing another slump if this attitude is general in British studios. But I must admit that I myself have been to meetings of the British Kinematograph Society at which important technical developments have been disclosed—notably in connection with lenses—and the audience has comprised a far larger number of television people than it has film personnel. At one meeting, dealing with the Taylor, Taylor Hobson lens and the new "transmission" system of calibrating (which will ultimately replace the long established "F" system) there was but *one* cameraman present.

Apathy

Mind you, this apathy, laziness or call it what you will, is not confined to the technical side of the business. Meetings of technical societies and of trade unions are equally ignored, thus delivering the latter safely into the hands of the cranks, crack-pots and bobby-soxers. Fortunately the technical societies have no particular attraction for the fifth-column element in our midst. At least, not yet! Behind the iron curtain there is even a party line on every biological axiom, and no Communist will admit to you that the foal of a Derby winner will ever win a Derby! No wonder such imbeciles have become known as "Red Nazis." Let us hope that Norman Collins keeps them away from the Alexandra Palace, even if he can't do anything about that Third Programme.

Propaganda

The television newsreel has now acquired a sure editorial touch, and has tackled this "Red" angle in a subtle way. For instance, scenes from a recent grand military parade in the Red Square at Moscow (reminiscent of Hitler's parades) were followed immediately by carnival parades and battles of flowers in Hollywood, thus effectively contrasting evil and good. Musical background and commentary forcefully drove the point home.

Newsreel Music

Incidentally, I think that the music used on the television newsreel is pretty good, don't you? After a time, it does become rather familiar, however, and one comes to expect a certain Finck-like intermezzo on every ski-ing story (of which there seem to be many) and a specially heavy "dramatic melo" on earthquake and fire scenes. Shots of the Royal Family have their special tunes, of course, which are used impartially on the launching of battleships or laying of foundation stones. Then there's a nice little light tune which seems to be handy for bicycle races, skating or the old crocks run to Brighton, while a first-class piece of "hurry-music" does duty equally well for horse racing or car hill-climbs. Please don't think I am trying to run down the practice of using "stock" pieces of background music on the television newsreel. As a matter of fact, I am all in favour of it. Cinema newsreels, please copy!

16 mm. Competition

Just before the war there started a development of the 16 mm. cinema field in parts of the country not well served with normal films. Country districts which were unable to support full-sized cinemas in their small towns and villages welcomed the visits to their village halls of mobile 16mm. film shows. Both American and British film distributors became interested, and sub-standard copies of the biggest films were printed a few months after the films had finished their run on the normal 35 mm. theatres. Slowly but surely the business grew, and there are now many towns and villages which receive a weekly or even bi-weekly visit from the modern version of the itinerant showman. A few of the more successful village shows have even gone so far as to be fitted up with genuine tip-up seats! Alas! Mobile cinema exhibitors in the Home Counties fear that B.B.C. television may put them out of business. During the last few months there has been a marked drop in attendance at these 16 mm. shows in the areas near London, and it has been found that many of the regular patrons have now purchased television sets and stay at home. To make matters worse, those who haven't got sets are invited to the houses of friends who have. I must say that you can't blame

a person for wishing to stay in a comfortable arm-chair watching his home-screen in preference to going out into the night to a none-too-warm village hall to sit on a none-too-soft wooden seat looking at a none-too-new cowboy film.

Competition

Where will the competition of television lead? In certain towns of the U.S.A. there is already a choice of half a dozen television stations transmitting simultaneously, and what the American programmes (for the moment) lack in quality they make up in quantity and alternative choices. It is no wonder that the American television craze has lowered the cinema takings in some cities by as much as 40 per cent. This is, of course, catastrophic.

Curiously enough, the attendances at "live" shows have not suffered to anything like the same extent. My forecast is that in England the competition of television will be felt by the entertainment industry to a much less extent, particularly the music-hall and theatre. The fact is that the public will tend to become satiated with mechanised entertainment and there will be re-created a desire to patronise "live" talent.

Trade Notes

New Mullard Receiver

MULLARD ELECTRONIC PRODUCTS, LTD., announce the release of a table model Television Receiver.

Known as the M.T.S. 389, the new set embodies the very latest developments. It is housed in a well-designed walnut cabinet 17in. high, 25½in. wide and 13in. deep (plus a 2in. projection at the back of the cabinet to take the end of the cathode-ray tube).

The M.T.S. 389 has a 9in. tube giving a clear, well-defined black and white picture that can be viewed with ease in normal room lighting. Due to the incorporation of special limiter circuits, exceptional freedom from external interferences on sound and vision circuits is experienced.

The price of the new receiver is 48 guineas, plus £11 6s. 5d. Purchase Tax. Total £61 14s. 5d.

Magnavista Television Lenses

DEVELOPED by Metro Pex, Ltd., pioneers in television lens design, the Magnavista Lens is now available for use with all types of television receiver. Magnifying the original image two and a half times, these lenses are guaranteed against discolouration. They can be supplied for fixing direct to the receiver or with a patented telescopic stand which enables the lens to be stood on the table directly in front of the receiver and adjusted instantly to the correct height whatever the distance between the screen and the base of the set.

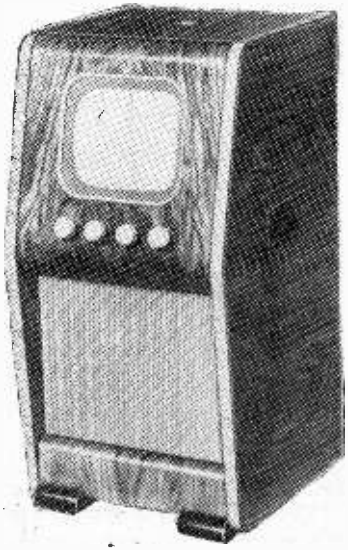
Magnavista Lenses are stocked by all the leading dealers in sizes suitable for makers' standard 9in. tubes and 10in. tubes respectively, at prices ranging from 6 guineas to 8½ guineas.

Enquiries should be sent to Metro Pex, Ltd., 71, Queens Road, Peckham.

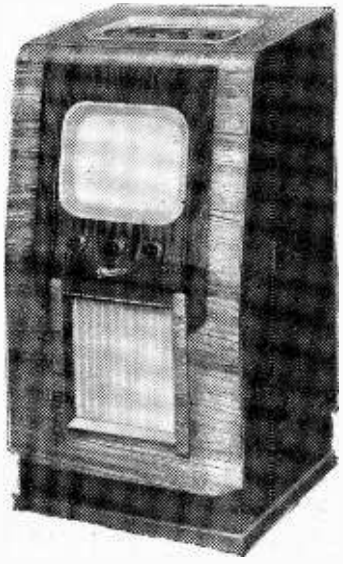
"His Master's Voice"—Model 1805—19-Valve Television Console

GIVING a picture 8⅞in. by 6⅝in. approximately, specially designed T.R.F. circuits are employed for both sound and vision channels. The former incorporates a pre-set sound sensitivity control—enabling the level of the sound signal to be adjusted to suit reception strength in a particular area—and a special envelope follower automatic interference suppressor. Interlocking of the brightness and contrast controls eliminates the necessity for re-setting the brightness control when the contrast is varied over normal operating amounts. The 10in. Emiscope tube is of special design and gives a degree of brightness far above that of the ordinary tube.

Total mains consumption is 200 watts, and the sound output 5 watts maximum.



The new H.M.V. Model 1805.

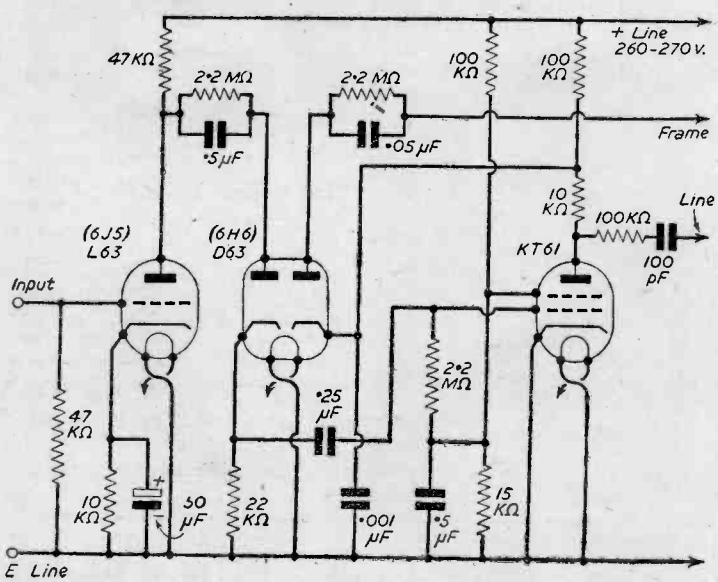


Marconiphone latest combined radio and television receiver, Model VRC52A.

A New Sync. Separator

A 3-valve Circuit Which Provides Accurate Interlacing

MANY experts hold that the sync separator is the most important part of the modern television receiver, and although it may be open to argument there is no doubt that unless perfect interlacing is obtained the best will not be seen of the television transmission. As most readers know the function of the synchronising circuits is to pick out the frame and line sync pulses and pass them to the respective time bases. No trace of picture impulses should be carried into these parts of the circuits, and the pulses themselves must be separated from one another. Various schemes have been recommended from time to time and claims have been made as to their efficiency. We have tried quite a number, but one of the most reliable yet tested is that shown below and which is recommended by Haynes Radio. As will be seen it employs 4 valves, two of these being diodes and contained in one envelope. The input design has one very great advantage over many devices which are in use, namely, it may be used with any type of video stage. Some sync separators must have a positive input and others a negative, but by simply taking the signal to grid or cathode this circuit may be used with practically all modern video stages. As shown (with input to grid) it has been used by us connected to the cathode of the video stage, the tube being cathode modulated from the video anode in the usual way. The positive-going pulses at the anode of the first valve are taken to one section of the double-diode triode and the other section of this valve feeds the frame time base, being itself fed from the limiter valve. The arrangement is fairly flexible and none of the components has been found very critical, although the limiter can give erratic results if certain of the components are faulty. For instance, a leaky screen-grid decoupling condenser will give rise to erratic frame pulses, and feed-back from the line time base will be experienced if the 100 pF coupling condenser is leaky. In this connection the resistor in series with it may also prove critical. But speaking generally, it has been found to give the best results yet in our experimental equipment, giving a perfect interlace, perfect locking over a reasonably wide adjustment of the frequency controls, and permitting adjustment of amplitude in both directions without upsetting other controls (over the normal ranges of adjustment).



The circuit of the sync and limiter stages.

Time Bases

The unit may be made very compact, the 6H6 being one of the very small American-type valves, and by using a KT81 for the limiter (also a small valve) the unit could be made small enough to tuck away in an existing set and probably replace the existing arrangement. The Haynes time bases which are recommended for use with this circuit are of the type designed for a total H.T. supply of less than 300 volts, frame and line output transformers having been done away with. Further details may be found in the Haynes Technical Publication No. 29. Choke feed is employed for the line and frame deflector coils. These circuits too are simple to make up and very efficient in operation.

Technical Tips

REMEMBER that the line output stage develops very high fly-back voltages and can be more dangerous than the EHT supply. Do not attempt to measure the voltage on the anode of the line amplifier.

AVOID laying out a home-built television receiver in such a manner that large transformers or chokes come near the picture tube. The scanning beam is easily deflected by external magnetic fields.

PLASTIC effects can be obtained in some cases by using a large by-pass condenser across the video cathode resistor and can give added detail to the picture. This is merely an artificial aid and must not be overdone and it is better, if possible, to improve the band-width of the vision receiver.

DEFOCUSING can be caused by a focus coil getting hot during the programme time. This may be due to the presence of large power-type valves near it, or to bad ventilation. So make sure there is plenty of air circulation at this part of the equipment.

Practical Wireless
BLUEPRINT SERVICE

PRACTICAL WIRELESS	*No. of Blueprint.*	
CRYSTAL SETS		
Blueprints, 1s. each.		
1937 Crystal Receiver	—	PW71*
The " Junior " Crystal Set	—	PW94*
STRAIGHT SETS. Battery Operated		
One-Valve : Blueprints, 2s. each.		
All-Wave Unipen (Pentode)	—	PW31A
Beginners' One-valver	—	PW85
The " Pyramid " One-valver (HF Pen)	—	PW93*
Two-valve : Blueprints, 2s.		
The Signet Two (D & LF)	—	PW76*
Three-valve : Blueprints, 2s. each.		
Selectone Battery Three (D, 2 LF (Trans))	—	PW10
Summit Three (HF Pen, D, Pen)	—	PW37*
Hall-Mark Cadet (D, LF, Pen (RC))	—	PW48*
F. J. Camm's Silver Souvenir (HF Pen, D (Pen), Pen) (All-Wave Three)	—	PW49*
Cameo Midget Three (D, 2 LF (Trans))	—	PW51*
1936 Sonotone Three-Four (HF Pen, HF Pen, Westector, Pen)	—	PW53*
Battery All-Wave Three (D, 2 LF (RC))	—	PW55*
The Monitor (HF Pen, D, Pen)	—	PW61*
The " Colt " All-Wave Three (D, 2 LF (RC & Trans))	—	PW72*
The " Rapide " Straight 3 (D, 2 LF (RC & Trans))	—	PW82*
F. J. Camm's Oracle All-Wave Three (HF, Det, Pen.	—	PW78
1938 " Triband " All-Wave Three (HF Pen, D, Pen)	—	PW84*
F. J. Camm's " Sprite " Three (HF, Pen, D, Tet)	—	PW87*
The " Hurricane " All-Wave Three (SG, D, Pen, Pen)	—	PW89*
F. J. Camm's " Push-Button " Three (HF Pen, D (Pen), Tet)	—	PW92*
Four-valve : Blueprints, 2s. each		
Beta Universal Four (SG, D, LF Cl. B)	—	PW17*
Nucleon Class B Four (SG, D (SG), LF, Cl. B)	—	PW34B
Fury Four Super (SG, SG, D, Pen)	—	PW34C*
Battery Hall-Mark 4 (HF, Pen, D, Push-Pull)	—	PW46*
" Acme " All-Wave 4 (HF Pen, D (Pen), LF, Cl. B)	—	PW83*
The " Admiral " Four (HF Pen HF Pen, D, Pen (RC))	—	PW90*
Mains Operated		
Two-valve : Blueprints, 2s. each.		
Selectone A.C. Radiogram Two (D, Pow)	—	PW19*
Three-valve : Blueprints, 2s. each.		
Double-Diode-Triode Three (HF Pen, DDT, Pen)	—	PW23*
D.C. Ace (SG, D, Pen)	—	PW25*
A.C. Three (SG, D, Pen)	—	PW29
A.C. Leader (HF Pen, D, Pow)	—	PW35C*
D.C. Premier (HF Pen, D, Pen)	—	PW35B*
Ubique (HF Pen, D (Pen), Pen)	—	PW36A*
F. J. Camm's A.C. All-Wave Silver Souvenir Three (HF Pen, D, Pen)	—	PW50
" All-Wave " A.C. Three (D, 2 LF (RC))	—	PW54*
A.C. 1936 Sonotone (HF Pen, HF Pen, Westector, Pen)	—	PW56*
Mains Record All-Wave 3 (HF Pen, D, Pen)	—	PW70*
Four-valve : Blueprints, 2s. each.		
A.C. Fury Four (SG, SG, D, Pen)	—	PW20*
A.C. Fury Four Super (SG, SG, D, Pen)	—	PW34D
A.C. Hall-Mark (HF Pen, D, Push-Pull)	—	PW45*
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SUPERHETS		
Battery Sets : Blueprints, 2s. each.		
£5 Superhet (Three-valve)	—	PW40
F. J. Camm's 2-valve Superhet	—	PW52*
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A.C. £5 Superhet (Three-valve)	—	PW43
D.C. £5 Superhet (Three-valve)	—	PW42*
F. J. Camm's A.C. Superhet 4	—	PW59
F. J. Camm's Universal £4 Superhet 4	—	PW60
" Qualitone " Universal Four	—	PW73
SHORT-WAVE SETS. Battery Operated		
One-valve : Blueprint, 2s.		
Simple S.W. One-valver	—	PW88*
Two-valve : Blueprints, 2s. each.		
Midget Short-wave Two (D, Pen)	—	PW38A*
The " Fleet " Short-wave Two (D (HF Pen), Pen)	—	PW91*
Three-valve : Blueprints, 2s. each.		
Experimenter's Short-wave Three (SG, D, Pow)	—	PW30A*
The Prefect 3 (D, 2 LF (RC and Trans))	—	PW62*
The Band-spread S.W. Three (HF Pen, D (Pen), Pen)	—	PW68*
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Three-valve : Blueprints, 2s. each.		
F. J. Camm's ELF Three-valve Portable (HF Pen, D, Pen)	—	PW65
Parvo Flyweight Midget Portable (SG, D, Pen)	—	PW77
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Lucerne Tuning Coil for AW427	1s.	
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PTP Three (Pen, D, Pen)	—	WM389
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65s. Four (SG, D, RC, Trans)	—	AW370
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Lucerne Straight Four (SG, D, LF, Trans)	—	WM350
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