MAKING AN R.F. EHT POWER PACK

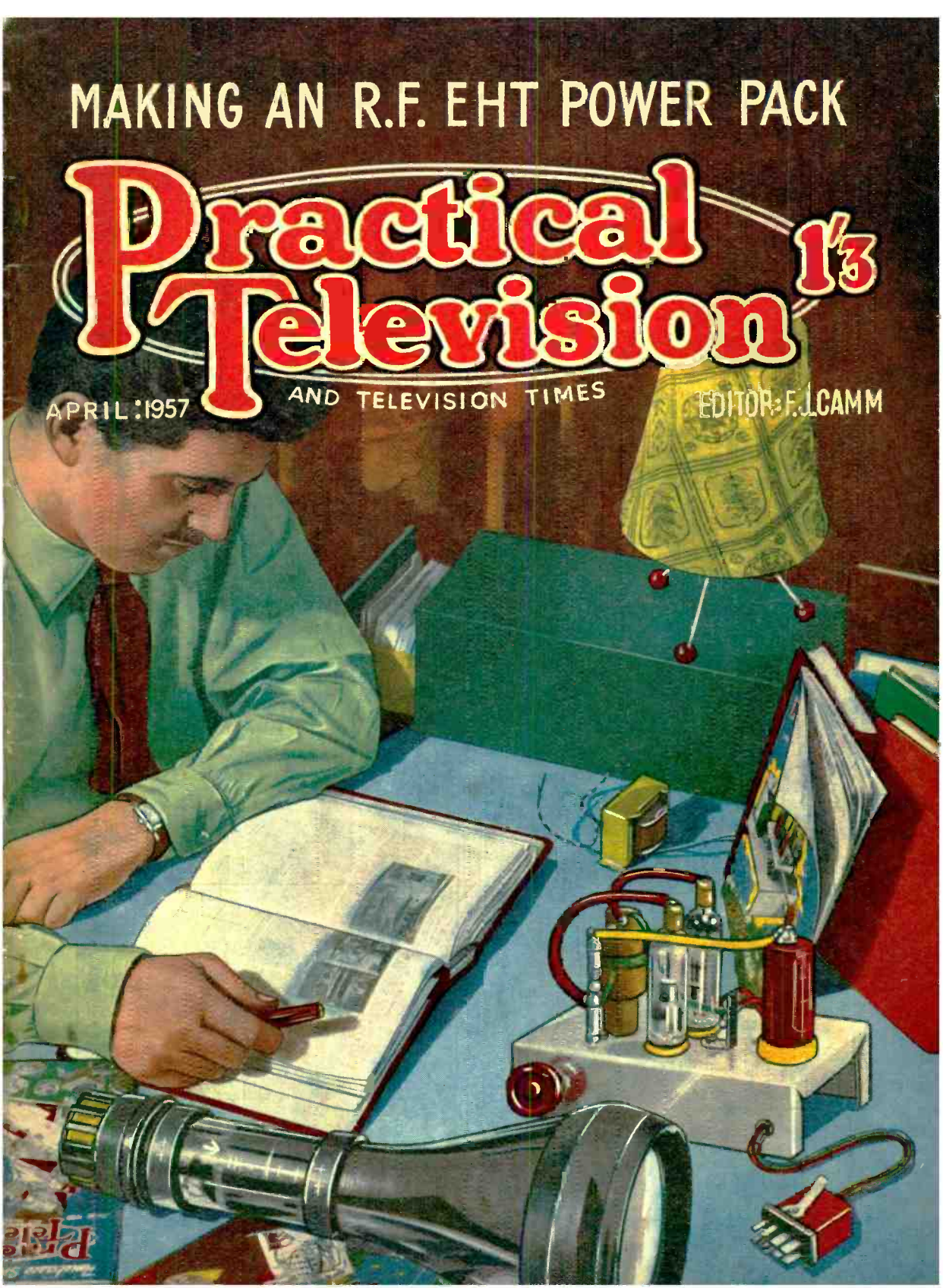
Practical Television

1/3

AND TELEVISION TIMES

APRIL: 1957

EDITOR: F. J. CAMM



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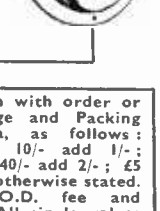

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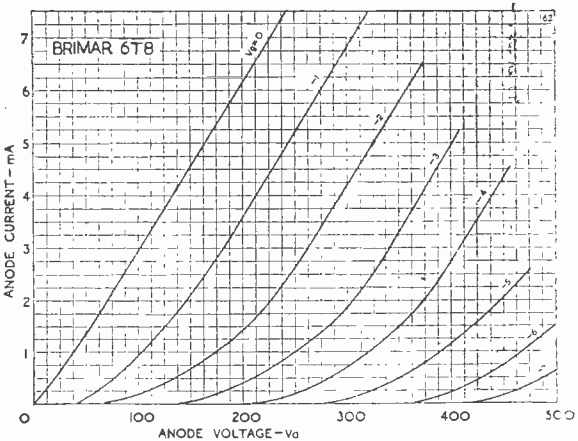

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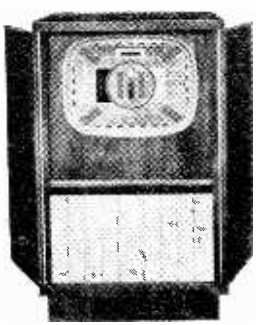

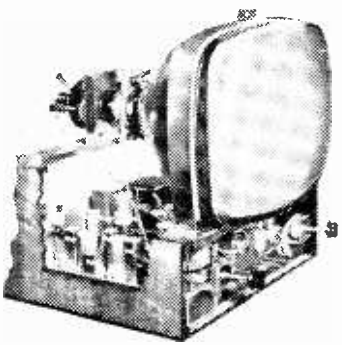

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Practical Television

& TELEVISION TIMES

Editor : F. J. CAMM

Vol. 7 No. 81 EVERY MONTH APRIL, 1957

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CONTENTS :

	Page
Editorial	405
A Multi-range Test Meter	406
An R.F. EHT Unit	410
More About Aerials ...	413
Beginner's Guide to TV ...	416
Servicing the Pye V14 and V14C, etc.	418
The Amplification of Light	423
A Televisor From Indicator Unit 62	425
P.T. Data Sheet (Cossor Model 947)	430
Telenews	433
Underneath the Dipole ...	437
Correspondence	441
Your Problems Solved ...	442
News from the Trade ...	449

The Editor will be pleased to consider articles of a practical nature suitable for publication in "Practical Television." 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 to : The Editor, "Practical Television," George Newnes, Ltd., Tower House, Southampton Street, Strand, W.C.2.

Owing to the rapid progress in the design of radio 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.

TELEVIEWS

BBC TV RECEIVED IN AUSTRALIA

ONE of our Australian readers, Mr. Norman Burton, resident in New South Wales, reports that he has received the London BBC TV signals on a number of occasions during the past few months. His experiments commenced last October and met with rapid success. Signals were received from the sound channel 16 times up to December 22nd. The vision channel was only heard three times but on one occasion these signals were so strong that they would have given pictures on a standard 405 receiver. At first the signals were difficult to identify, but my reader was able to supply to the BBC data of titles of music heard at the correct times. The BBC has verified this by letter. This reception is thus a world record for the overseas reception of the BBC TV service, and it opens out immense possibilities. This reader has also heard signals from the French TV service. He used a two-element beam aerial of English manufacture, mounted horizontally for lower noise level from auto interference, and it is installed at a height of one wavelength above earth.

THREE-D TV

I UNDERSTAND that three-dimensional or stereoscopic television was successfully demonstrated recently.

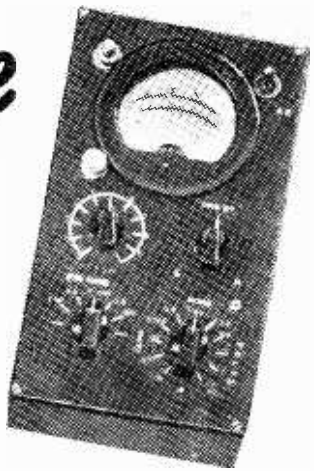
A camera with two lenses is employed and the images which are picked up are relayed to two standard monitors. The two images are combined optically, and the operator of a remote-controlled device then views the two images through spectacles and thus obtains a stereoscopic view of the object being controlled. It was developed primarily for use at Harwell where tongs are operated remotely to avoid the operator coming within a dangerous field. The apparatus would not, of course, be of much use for mass viewing, but is yet another development of the many uses to which television has been put commercially.

TV IN AMERICA

THE U.S. has 496 commercial TV stations, whereas seven years ago it had 69. This means that nearly 300 communities have at least one station and 90 per cent. of the American people are within viewing range. There are 128 applications for new stations on hand. Television in America, however, has not overawed sound radio to the same extent as it has over here, for there are 2,896 commercial A.M. stations and more than twice as many as in pre-TV days. Commercial F.M. stations have however, dropped to 530. There are 164,000,000 in operation in America—over 60 per cent. of the world's total, and of these 39,000,000 are TV sets.—F. J. C.

Our next issue, dated May, will be published on April 18th.

A Multi-Range Test Meter



A VALUABLE ACCESSORY FOR THE EXPERIMENTER OR SERVICEMAN

By H. M. Thomson

EVERY television experimenter needs a general purpose test meter in addition to specialised equipment, and the following details concern a useful instrument for either television or radio. The meter has a sensitivity of 2,000 ohms per volt, with an accuracy of 2 per cent. on the D.C. ranges and 5 per cent. on the A.C. ranges. Resistor testing is covered in three ranges of 0.05 ohm to 5 ohms; 2.5 ohms to 100 ohms; and 200 ohms to 20,000 ohms. The two low ohm circuits operate on the shunt system, while the high ohm circuit is of the series type. The adjust ohm potentiometer of 0-200 ohms is used to zero-set all resistance ranges by means of suitable switching arrangements.

A neon circuit is incorporated to provide a means of testing condensers for leakage, continuity, and an indication of their value. The range covered is approximately 0.0005 μF to 0.1 μF; leakage can be detected up to 20 megohms. Resistors between 20,000 ohms and 5 megohms can also be checked for their values, but a separate scale or chart will be required.

The neon circuit also provides an A.F. source for the testing of L.F. stages in radio receivers. The neon lamp used is an ex-A.M. 10E/327, but any similar type can be used.

The basis of the testmeter is an ex-A.M. 500 micro-amp moving-coil meter with a scale length of 2½in., and was manufactured by Ferranti Ltd., Ref. No. 10A/7736. The resistance of the meter is 75 ohms, but this value was brought up to 100 ohms by adding a "swamp" resistor of 25 ohms in series with the meter. Apart from making a round number on which to base further calculations, the "swamp" resistor, which is made of Eureka resistance wire, swamps any change in resistance of the copper wire coil of the meter due to temperature variation.

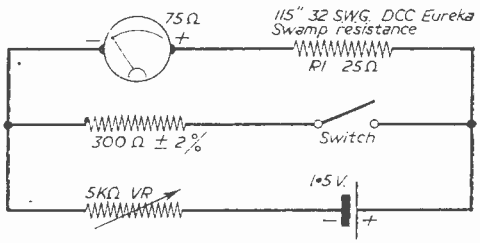


Fig. 2.—Adjusting the meter.

The "swamp" resistor is made by winding 115in. of 32 s.w.g. D.C.C. Eureka wire on to an insulated former. It is then connected in series with the meter and adjusted to give a meter resistance of 100 ohms (see Fig. 2).

As with all ex-Government equipment, we regret that we are unable to give sources of supply, as stocks are limited.

The Circuit

A single potential divider is used for both A.C. and D.C. voltages. This is of a rather unusual design owing to the desirability of having a coincident A.C. D.C. scale. The potential divider consists of 5 high-stability carbon resistors with a tolerance of ·2 per cent., and paralleled by condensers and resistors in series, the reactance of which reduces the D.C. value of the divider by 1.11 on A.C. volts. Condensers could, of course, be used alone in the parallel positions, but their values would be awkward to make up to the required reactance and they would have to be of the close tolerance types which would add to the cost and size of the testmeter. The resistors in series with the condensers not only give greater accuracy, but they allow the use of the same value of condenser in all three parallel positions, and they protect the meter against damage should any of the condensers develop a leak.

The A.C. voltage is rectified by a S.T.C. bridge type meter rectifier.

25-volt A.C. Range

As will be seen from Fig. 1, a condenser is used in

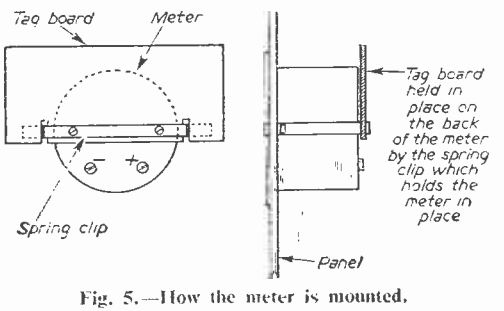


Fig. 5.—How the meter is mounted.

this position in order to correct the non-linear characteristic of the rectifier which occurs on low A.C. volt ranges.

As the impedance of this range is dependent on the value of the condenser, plus the resistance of the rectifier and meter, it will be seen that any change of rectifier will alter the total impedance of this range. For those constructors who may wish to use a different value of rectifier which they may have

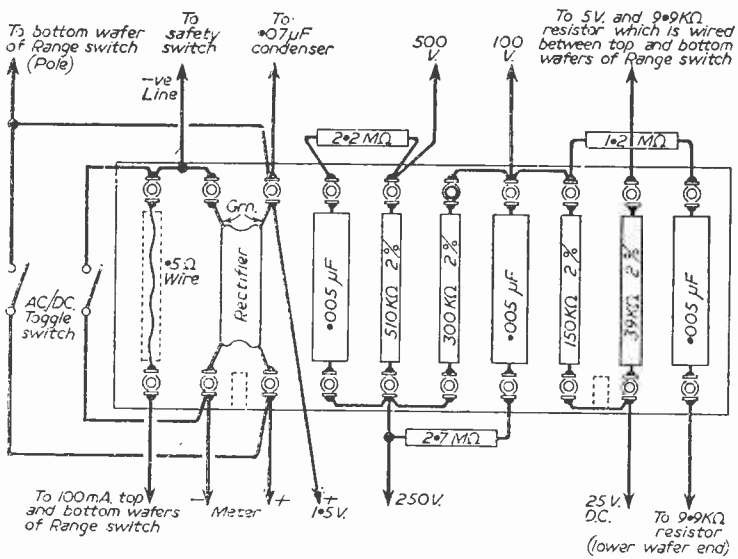


Fig. 3.—Details of the resistor mounting panel.

available, it will be necessary to recalculate the value of condenser required as shown here.

Impedance of circuit is $\frac{50,000}{1.11} = 45,045$ ohms

This value is made up by adding the reactance of the condenser to the resistance of the rectifier and meter, but as this will be 90 deg. out of phase, it is necessary to apply the following formula :

$X = \sqrt{Z^2 - R^2}$ where X = Reactance required.
Z = Impedance of circuit.
R = Resistance of rectifier and meter.

Inserting the values used by the author, we have—

$X = \sqrt{(45,045)^2 - (4,000)^2} = 44,850$ ohms.

A condenser with a reactance of this value at 50 cps. is found from the formula—

$$\frac{10^6}{2 \times 3.14 \times 50 \times 44,850} = .071 \text{ mfd.}$$

The use of a meter rectifier of lower resistance is quite permissible, as it will have a negligible effect on the other A.C. voltage ranges.

An alternative to recalculating the condenser required for a change of rectifier would be to add a resistor in series with the condenser to make up the required total of the *resistance* in the circuit to 4,000 ohms, i.e., with a 1 milliamp meter rectifier of approximately 1,000 ohms, a 3,000 ohm resistor should be placed in series with the condenser. The resistor should be fitted between the condenser and the range switch, otherwise the D.C. measurements will be affected.

A.C./D.C. Switching

A double-pole toggle switch is connected over the rectifier as shown in Figs. 1 and 3 in order to change over from A.C. to D.C. voltage readings. As will be seen, part of the rectifier is left shunted over the meter on D.C. ranges. This, however, has no effect on D.C. readings owing to the very high reverse resistance of the rectifier.

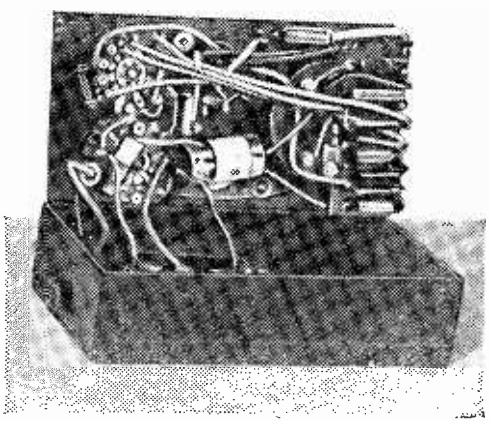
The current shunts were made by winding the required lengths of Eureka resistance wire round high-value carbon resistors and soldered to the ends of the resistors.

The switches used in the prototype were of the Yaxley wafer type. Selector switches 2 and 3 and A and B in Fig. 1 are single wafers each of two-pole four-way, mounted one above the other on the same spindle, wafer A-B being to the outside or top. This arrangement saves space and reduces switches required.

The range switch is a Yaxley two-pole 12-way type. As double switching is used in the range switch this prevents inaccuracy on the current ranges due to any slight resistance in the switches themselves. However, this does not necessarily apply to the lowest resistance range. It is, therefore, recommended that, if possible, the range switch should be of the special high-contact low-resistance type of meter switch. These switches are more expensive than the Yaxley type, but they will give greater accuracy and long-lasting trouble-free service.

Safety Factors

It should be noted that a simple push type of switch is fitted in the negative lead, and the operator can then be ready to press this switch if there is any doubt as to the value about to be checked. On pressing the switch the current will remain cut off



A view of the finished instrument.

until the switch is pressed once more. This switch can also be used to cut off the current before changing the current range, thereby obviating the necessity to disconnect the test prods from the apparatus being tested.

An additional safeguard against damage to the meter is provided by shorting out the meter via the volt range switch should the selector switch be set to the wrong position.

Resistance Ranges

The resistance ranges consist of a high resistance range and two low resistance ranges. The high resistance range is a straightforward series circuit with a variable shunt adjuster. The current limiting resistor of 1,444 ohms is made up of 1,300 ohms 2 per cent. tol. plus 100 ohms plus 22 ohms 10 per cent. As the 1,300-ohm resistor used was on the high side of its tolerance this gave the value required.

The low ohm resistance ranges utilise the 100 milliamp and 5 milliamp current ranges thereby obviating the necessity to make separate shunts for the low ohm ranges and also reducing the number of switch positions required.

The same potentiometer used on the high resistance range is now made to operate as a series adjuster on the low ohm ranges by means of suitable switching. The 100 milliamp range covers 0.05 ohm to 5 ohms and the 5 milliamp range covers 2.5 ohms to 100 ohms. As it would be difficult to mark all the required resistance points on the scale a chart was made up which gives the resistance values opposite the current reading which will be obtained when testing resistors. The chart is given in Fig. 4.

Construction

The meter and all components are mounted on a piece of imitation Vitrolite panel 8½in. × 5in. × 1/10in. which is obtainable from shop fitters or hardboard

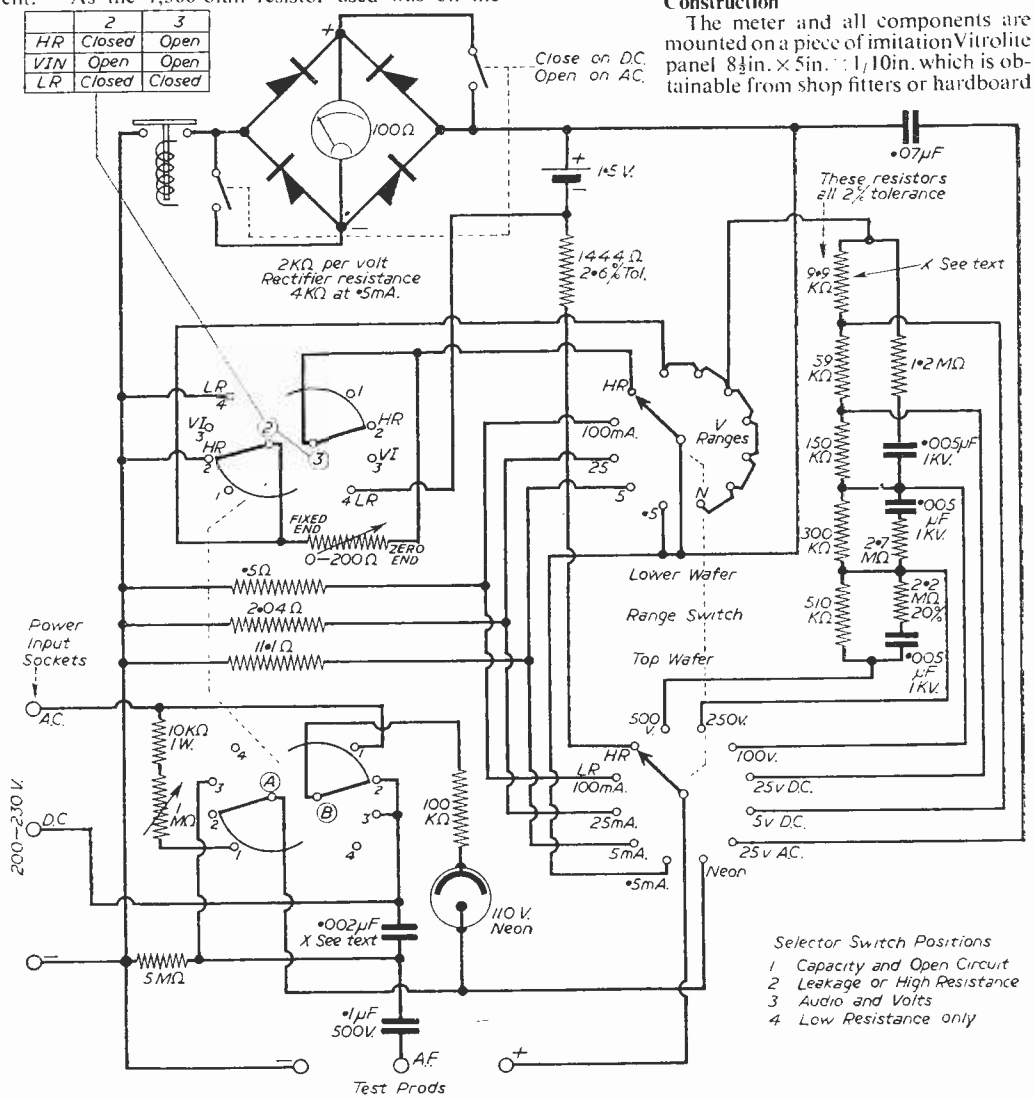


Fig. 1.—Complete wiring diagram of the test meter.

dealers, but paxolin sheet is quite suitable if preferred.

An opening 3in. in diameter was cut by drilling a ¼in. hole at any point on the scribed circle and inserting an "abrafile," which is then fitted to a hacksaw or abrafile frame. The holes for the switches are then drilled out, using a ⅜in. drill. The hole for the neon lamp will have to be cut out unless a ½in. drill is available. Measurement details will be given in Fig. 6.

High ohms		Low ohms (100 mA shunt)		Low ohms (5 mA shunt)	
Ohms	Reading microamps	Ohms	Microamps	Ohms	Microamps
200	441	.05	45	2.5	100
400	395	.1	83.3	7	206
600	357	.2	145	10	250
800	326	.33	200	15	300
1 KΩ	300	.5	250	25	357
1.5 K	250	.75	300	50	417
2 K	214	1	333	100	455
3.5 K	150	2	400		
6 K	100	3	430		
10 K	65	5	455		
15 K	49				
20 K	35				

Fig. 4.—The ohm range chart, assuming that a F.S.D. 500 μA meter used.

The meter is held in place on the panel by the spring clip which is attached to the back of the meter by two screws. A tag board is now cut to size, as shown in Fig. 10, and the potential divider resistors, condensers and rectifier mounted and wired as shown in Fig. 3. The 2.3in. length of Eureka wire is soldered between two tags and is covered by a length of insulated sleeving.

The tag board is held in place on the back of the meter by the two slots which slip under the spring clip holding the meter on the panel. See Fig. 5.

The A.C./D.C. toggle switch and the "push-push" safety switch are now fitted into their respective holes on the panel and wired as shown in Figs. 1 and 3. The neon, potentiometer, range and selector switches are now fitted in position.

Wiring can now commence. It is advisable to remove the outside wafers of the range and selector switches in order to facilitate wiring of the inner wafers. All wiring should be of at least 20 s.w.g. and as short as possible and covered with insulated sleeving.

The condenser for the 25-volt A.C. range is made up of 0.05 μF and 0.02 μF wired in parallel and taped together with scotch tape and mounted under the tag board on the A.C./D.C. switch side of the meter and supported in this position by the wiring.

The current shunts for 5 milliamp and 25 milliamp are mounted between the range switch and the negative line on the selector switch. A Vidor baby torch cell, No. V0011, is soldered in its position just above the neon potentiometer and is supported in this position by the wiring. All other resistors are wired between the switches.

The completed unit was fitted into a cigar box, the lid of which was removed and the protruding ends sawn level with the top of the box. The box was given one undercoat of paint and finished in black enamel. All the paper on the box must be removed, otherwise the paint will not adhere to the surface. The panel markings were made with transfers.

Calibration

The 9.9 KΩ resistor, shown in Fig. 1, was made by obtaining a 10 KΩ carbon resistor of the older type which has no protective covering and is on the low side of its tolerance. A voltage of 4.5 is applied to the 5-volt range of the meter and the resistor is then filed to increase its resistance until the meter reads 450 microamps, this value being equal to a 4.5 volt reading on the meter scale.

The 100-volt A.C. range is calibrated as follows, using the circuit shown.

1. With Rx out of circuit adjust V/R for a meter reading of 470 microamps.
2. Switch off.
3. Connect resistors at Rx between "A" and "B" of from 1 to 1.5 megohms until F.S.D. is obtained.
4. When the resistor that will give F.S.D. is found remove the temporary connections and the V/R and solder this resistor into place on the tag board.

Should a good A.C. voltmeter be available it could be used as a standard in calibrating the A.C. volt ranges.

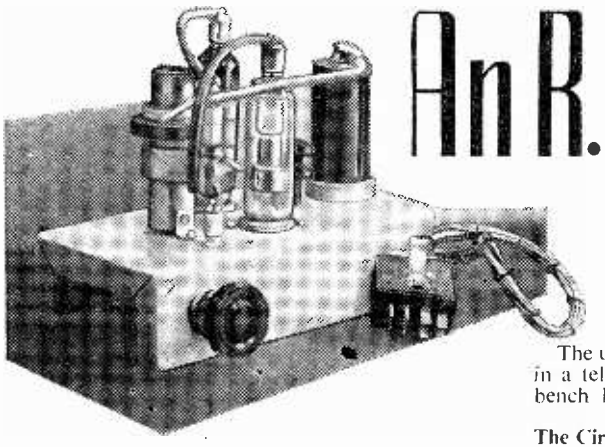
The mains voltage is now applied to the 250 and 500 A.C. volt ranges and resistors of the approximate values shown in Fig. 1 connected in parallel until 230 volts A.C. is obtained on the 250 and 500 volt ranges respectively. The approximate values of the parallel resistors are 2.7 megohms and 2.2 megohms.

ASSUMING METER RES. OF 100Ω

R	I	Wire	Length
.5Ω	100	32 s.w.g. D.C.C. Eureka	2.3in.
2.04Ω	25		9.4in.
11.1Ω	5		51in.

Fig. 5.—Shunts can be wound over 1 MΩ 1 watt resistors which are covered in sticking plaster.

(To be continued)



An R.F. EHT Unit

A SOURCE OF SUPPLY FOR ELECTROSTATIC TUBES

By J. E. Tanner

The unit described here is suitable for incorporation in a television receiver, oscilloscope, or for use as a bench high-voltage supply.

EHT supplies for small tubes are always presenting difficulties, the two major ones being :

(a) Difficulty in obtaining sufficiently high voltages without involving undue expense.

(b) Hum due to the supply being obtained from the 50 c s mains supply.

The advantage which the magnetic constructor has in the form of line flyback EHT supply is not available to users of the small static type tubes—the VCR97 being the best known. The 2 kV or so required by these tubes in order to give a really well defined bright picture, if used for television, and to give a sharp image in oscillograph work, is usually obtained in one of two ways, from the mains or by some EHT generator. The relative advantages and disadvantages are listed.

Mains Derived Supplies

(i) Transformers.—These are very expensive, liable to break-down, and are heavy. The associated condensers have to be large capacity and, therefore, again expensive.

(ii) Voltage doubling circuits.—Once again the large high voltage working condensers are required and also the EHT is rather limited. From a 350-0-350 mains transformer about 1 kV can be obtained. Voltage tripler circuits and doublers for higher voltages involve the use of higher, more expensive condensers and metal rectifiers. Valve rectifiers in the doubler circuits require highly insulated, separate windings for each valve heater.

The advantages of mains-derived supplies are that they give a well-regulated supply and are easily built, but mains-derived supplies are dangerous. Their internal resistance is usually low enough to let at least 5 mA flow. If an accidental shock is received from a 2 kV supply at 5 mA it could be very serious—perhaps fatal.

R.F. EHT generators are capable of producing very large voltages, such as the 25 kV as required by projection television tubes. They are not so easily built, but with a reasonable amount of care good results can be obtained. The available current is only about ½ to 1 mA, and if a fairly heavy load is applied, as when receiving a shock, the voltage rapidly drops. Hence these R.F. generators are not nearly so dangerous as other types. Nevertheless 2 kV of EHT is to be respected at all times.

The Circuit

Two valves are used. In the original these were an EL81 Oscillator/Output (V1) and an EY86 EHT Rectifier (V2), although any power valve, preferably with a top cap anode, may be used for V1, and any EHT rectifier may be substituted, as explained later. By suitably connecting the rectifier either positive or negative EHT may be obtained with respect to chassis. If metal rectifiers are used, either output may be obtained, but with valves it is rather more difficult to obtain positive than negative. This is because of the peak voltages which occur between the heater and cathode.

Fig. 1 (A) and (B) involve no difficulty because the rectifiers can be connected either way round, but in (C) and (D) the valve heaters have to be taken into consideration. In (C) the heaters *must* be run from a separate, highly insulated supply, because the cathode heater insulation of the valve will not stand the 6 kV or so peak voltages which will occur. The circuit in (D), however, uses the cathode down to earth, and hence the heater supply may be obtained from the common line. To overcome the difficulty

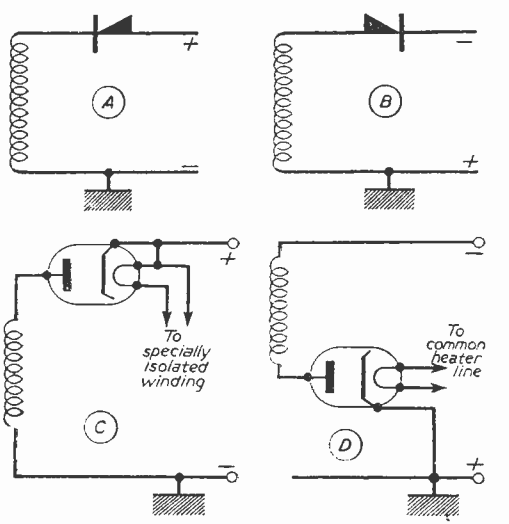


Fig. 1.—H.F. generators utilising metal and valve rectifiers.

found in (C) a valve of the EY51 or EY86 class may be used with the heaters run from a small winding of five or six turns of thick wire round the coil. This may cause too much load to be put on the circuit and a subsequent loss of voltage could occur, in which case metal rectifiers will have to be used. Because of the ease of operation for negative EHT the circuit with the cathode to earth is described here.

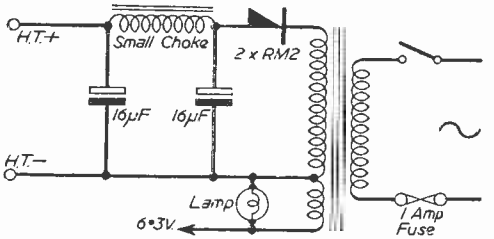


Fig. 3.—Circuit using a metal rectifier.

In this circuit the EY86 is shown because it was to hand when the original was being built.

Alternative valve types :

For EL81

6V6 for outputs not exceeding 2 kV } Or any large power valve, but if single ended only use to 2 kV.

807 }

EY86 }
EY51 } or any similar type for positive EHT.

EY86 }
EY51 } or any rectifier which will handle 4 kV
VU120 } at about 1 mA for negative EHT.

Construction

Construction and layout is simple, as can be seen from the diagrams and illustrations. The only points to watch are that the two secondary leads from the coil are kept well clear of the chassis and all other wires ; also the wires from the grid circuit should be wired up to allow easy reversal when setting up, similarly with the EHT overwind. Good, well insulated cable should be used with all wires concerned with the coil and EHT circuits, except the H.T.+ lead and the grid winding. The peak R.F. voltages will discharge through normal thickness P.V.C. ; a good cable is the inner conductor from co-ax, after having removed the screening, etc.

Power Supply

Enough details have been given regarding the rectifier heaters and nothing further will be mentioned here. The unit requires H.T. at 250-300 volts at about 40 mA (according to valve). L.T. at 6.3 volts at .6 amp., and other voltages if required for rectifier. If the unit is to be used as a bench supply, the power unit could be built on the same chassis, but if the unit is being used in a piece of apparatus the power could be taken from existing supplies, providing there is sufficient to spare. A suitable power unit circuit is given.

Coil

The coil is difficult to wind without a wave-winding machine, and a suitable one can be obtained from Amos (Electronics) Ltd., High St., Fenney Stratford, Bucks.

Setting Up and Testing

When the unit is complete it should be checked, especially the wires from the coil—it is easy to cross over one anode and one grid coil wire with disastrous results. A 0-100 mA meter is very useful, but if this is not available a small .1 amp. torch bulb should be wired in series with the H.T. line. Switch on, and if the bulb lights brilliantly or burns out switch off *immediately* and change over the wires to the grid winding. The bulb should only glow with moderate brilliance. Hold the blade of an insulated

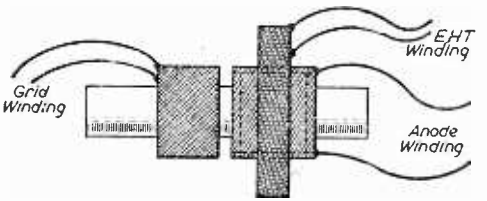
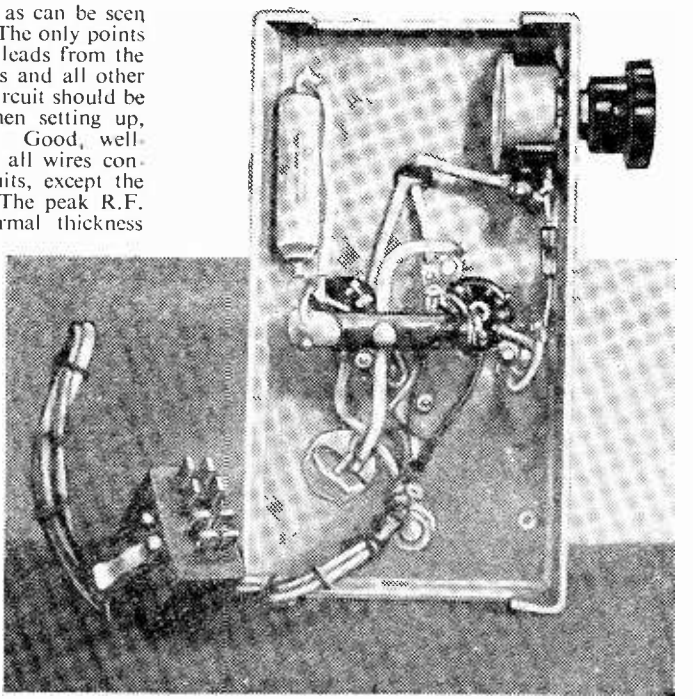


Fig. 2.—Details of the coil unit.

screwdriver near the anode of the rectifier, a large spark should be obtained. If not, hold the blade near the other end of the coil. If the spark comes here—reverse the wires from this winding. The spark should be obtained from the outside wire of the coil and from the rectifier anode. This avoids the insulation between the EHT and anode windings being put to undue strain. To check the EHT output a chain of



A view of the underside of the unit.

10 1MΩ resistors should be put across the EHT output with a 0-1 mA meter in series. Then :

EHT output = current in mA × 10,000.

The unit should give up to 4 kV. if pressed, but 3 kV. should be obtained easily. If insufficient or too much EHT is obtained the condenser across the anode winding should be varied.

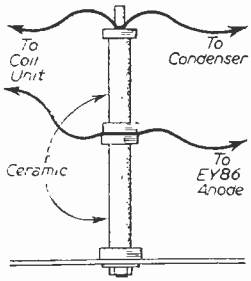


Fig. 5.—Details of the stand-off insulator.

To peak the circuit up, a variable condenser (2 × .0005 in parallel) can be connected and the value obtained which can be measured and the equivalent fixed value substituted.

The condenser marked with an asterisk should be a very good quality one as it has to stand quite a large peak voltage. No trouble has been experienced with the 330 pF ceramic which was used in the original. Finally, the unit should be screened well, because the R.F. output is rich in harmonics and the fundamental lies near 200 kc/s which is the Light Programme frequency. If possible the circuit should be set up just off this frequency. Suitable screening would consist of an earthed metal box with sufficient holes to allow ventilation. If the unit is to be used as a bench supply, a switch in the H.T. lead is useful as an on/off switch which does not necessitate continual switching of the heaters.

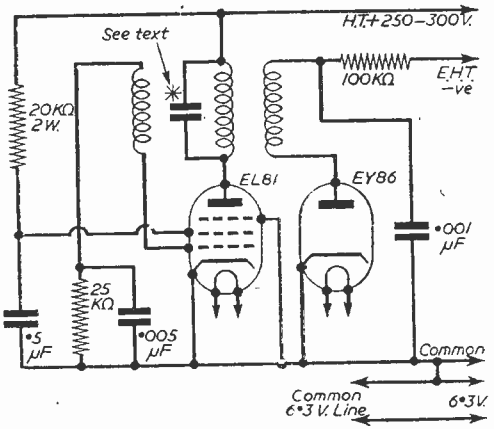


Fig. 4.—Circuit of the unit.

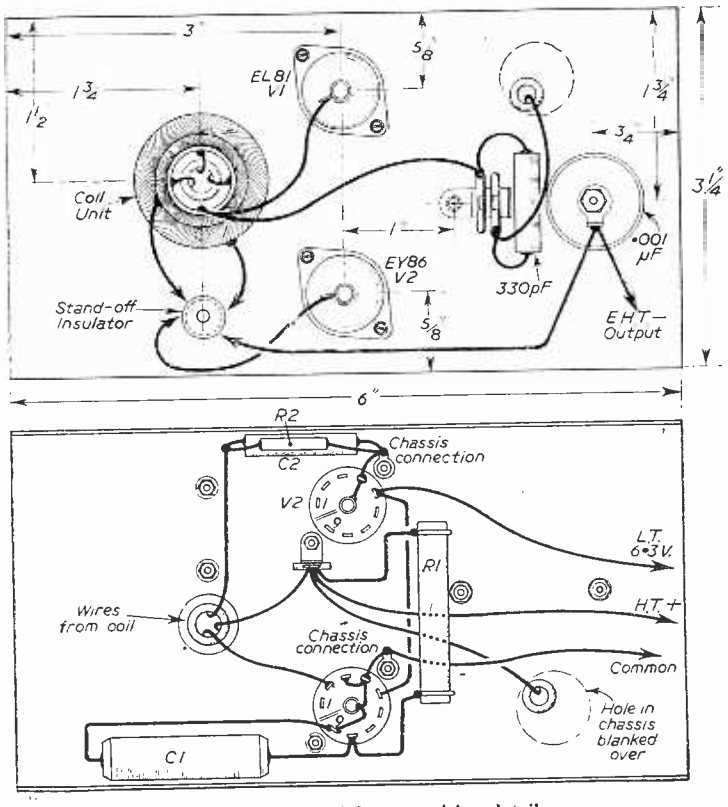


Fig. 4.—Top and bottom wiring details.

Scottish TV

THE exciting prospects of Scotland's new medium of fireside entertainment—Scottish Television—can be sampled by visitors to 21 local Television Exhibitions during the next few months. In that time, Scottish Television, Ltd., plans to bring to each small township in Scotland's transmission area—from Dunbar to Ayr and Dundee to Helensburgh—a foretaste of the new programmes which they can enjoy soon.

The major emphasis of the exhibition lies in the alternative programme which televiewers will see regularly, bringing the best in British, Continental and American entertainment into their homes, added to the distinctive Scottish flavour of programmes from Scotland's own television studios.

Mr. Roy Thomson, contractor for Scottish Television, Ltd., under Independent Television Authority, told an audience in Portobello where the first exhibition opened that they, the public, would decide the kind of programmes they would see (see also page 415).

In each exhibition the latest television sets show, on alternate stands, the BBC and I.T.V. programmes side by side. This is made possible by the outside broadcasting unit, which will be used during the exhibition to beam sample programmes.

More About Aerials

WHAT TYPE TO CHOOSE? WHAT IS A POLAR DIAGRAM? THESE AND OTHER DETAILS ARE DEALT WITH IN THIS ARTICLE

By W. J. Delaney

THE recent articles on aerials have apparently done much to clear the air, but still leave a number of points which need clarification. A typical request which we often receive is, "Can you give me instructions for making a Band III aerial?" We have tried to make it clear before, that it is not possible for us in London to recommend an aerial for a viewer in, say, the heart of Yorkshire. Although we could state that he would need an aerial for a certain channel, the form which the aerial would have to take often needs to be decided on the actual building, as will be shown later. In order to make this quite clear it is necessary to understand a polar diagram. The Belling Lee company recently produced a very interesting coloured film strip with recorded dialogue, for the use of traders and service engineers, and this makes the various features governing aerial design and use very clear, and by permission we include several stills from the film, and the following descriptions in this article.

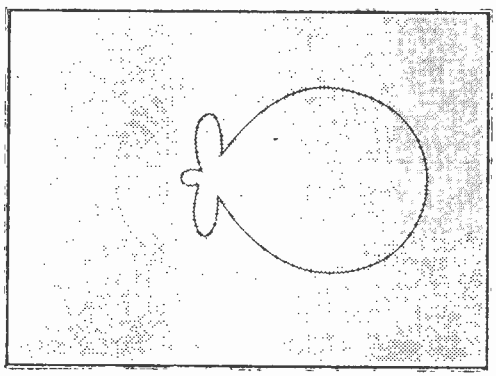


Fig. 1.—The polar diagram of a receiving aerial.

The first illustration shows a typical polar diagram. For such a diagram the aerial would be assumed to be in the centre of the four curved sections, and in the case of a receiving aerial it indicates the relative strengths of signal which are picked up. In this diagram maximum signals are picked up to the right and in various strengths over the more or less circular shape taken up by the right-hand section or lobe, whilst in a direction towards the top and bottom of the illustration a very much weaker signal would be received. At the rear of the aerial, that is to the left of the diagram, only a very weak signal would be received, whilst at the points where the black outline approaches the centre white dot the signal pick-up would be at its weakest.

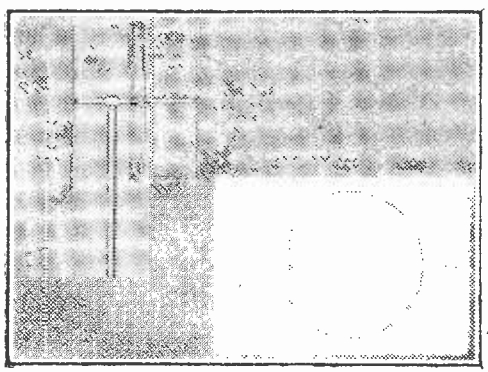


Fig. 2.—A typical three-element aerial and its polar diagram.

Now in Fig. 2 is shown a simple three element aerial with folded dipole, and the polar diagram which such an aerial possesses (dependent on the spacing of the elements and other factors, but ignoring the effects of near-by chimneys etc.) is shown below it

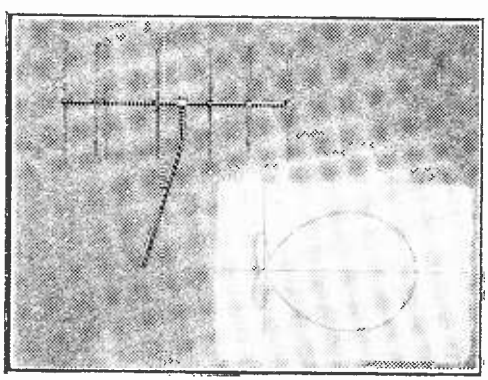


Fig. 3.—A six-element aerial and its polar diagram.

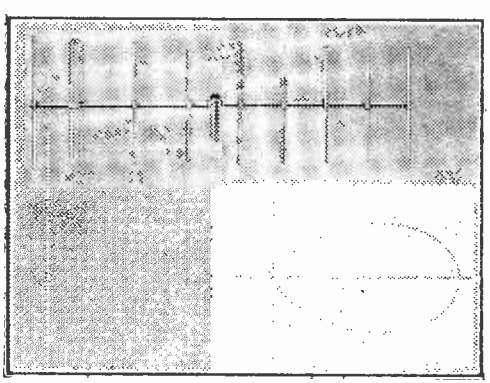


Fig. 4.—A nine-element aerial and its polar diagram.

From this it will be seen that it picks up more or less equally over a large area in front but practically nothing from the rear. Fig. 3 shows a six-element aerial (four directors, a folded dipole and reflector) and this provides a polar diagram similar to the illustration in Fig. 1, giving a very good forward pick-up and little rear pick-up with minimal positions to the right and left.

Turning now to Fig. 4, the nine-element array provides maximum forward pick-up and no side pick-up, with a very small rear effect.

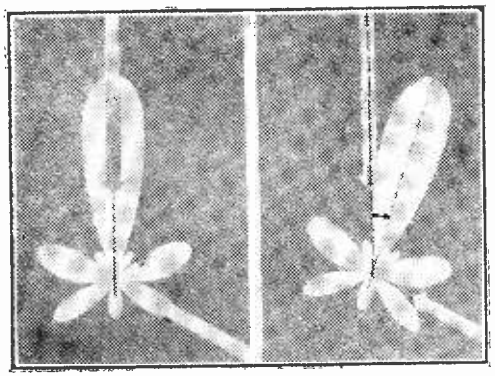


Fig. 5.—A selective aerial and its effect on a true and reflected signal.

Using the Polar Diagram

It might be thought that there is little to interest the amateur in these diagrams and that they are only of interest to the technician, but let us see how one can make use of them. Signals on Band III are theoretically shot along in a straight ray similar to a beam of light, and are deflected by buildings, trees, etc., whilst a hill, for instance, could divert the signal in such a manner that it could not be picked up by any form of aerial situated in the "shadow" of the hill. Now the signal which arrives at the aerial direct from the transmitter would be received before any signal which had been reflected from any other source (due to the shorter more direct course taken), and this, of course, gives rise to the well-known "ghosts," that is a second image displaced slightly from the main image, the actual displacement depending upon the point where the reflection took place and the amount of reflection. Sometimes, of course, part of the signal is absorbed by the reflecting body. Now take a situation where a reflecting body, say a large gasometer or similar structure is situated beyond the reception point. This would direct back to that point a reflected signal, and in the illustration on the left of Fig. 5, the main signal is shown coming down from the top of the illustration, whilst the reflected image is coming from the lower right-hand corner.

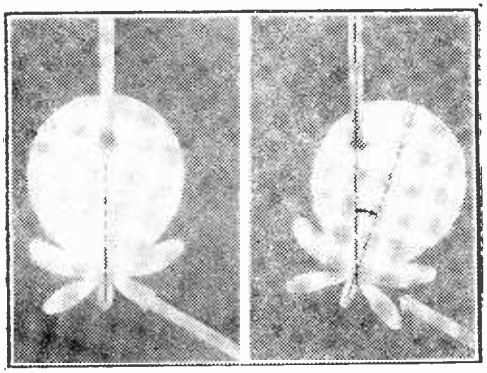


Fig. 6. Illustrating how a different polar diagram would assist in maintaining signal strength and eliminating a reflection.

Now with the particular aerial in use at the imaginary point the polar diagram is shown by the white elipses and if the aerial had been erected so that it was geographically correctly placed, or for maximum signal, then the reflected image would coincide with the lobe as shown and quite a good reflected image would be picked up. But, if the particular type of aerial is rotated slightly, so that it no longer points to the station, the reflection would fall in one of the "blind spots" and would not be heard, but notice that the main signal now also comes outside the main lobe, and thus not only has the "ghost" or echo been lost, but also the main signal. In such a case, therefore, one would have to use a less directional aerial. Not, as one might think a *more* directional one.

Look now at Fig. 6. The left-hand illustration shows

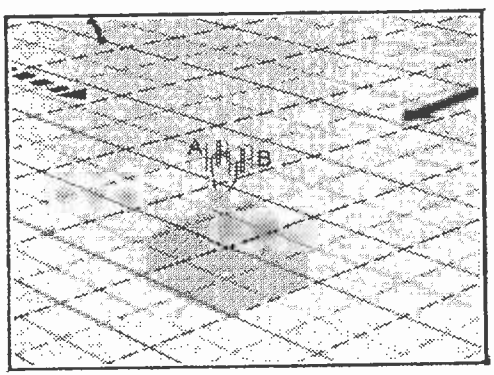


Fig. 7.—Two alternative positions for an aerial on a roof and the positive and negative phases of a true and reflected signal.

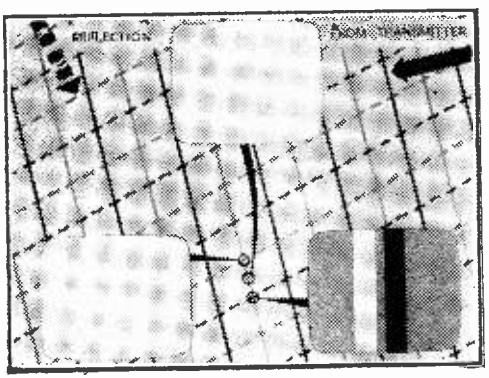


Fig. 8.—The effects on a screen produced by the different phases of the two signals.

the same situation as in Fig. 5, but the type of aerial now illustrated has nowhere near so great a forward gain and a much bigger forward lobe. The echo still comes in on the rear lobe. Turning now to Fig. 6 (right) it will be seen that by turning the aerial to the same position as in the previous illustration, not only has the echo fallen in the blind spot as before, but the main signal will still be picked up almost at the same strength as before the aerial were turned. This illustrates the point, therefore, that the *best* aerial is not necessarily the one with most elements, and therefore the best aerial for any particular location depends upon the amount of reflection, its direction, and the strength of the original signal in that location.

Phase Differences

There is still one other point which needs explanation and this is illustrated by the last two pictures. The signal is constantly varying from negative to positive, and thus on the direct line as well as on the reflected lines these changes will be taking place. As the reflected signals travel a longer distance, apart from reaching the receiving aerial at a later time, there is a possibility that the phase of the signal will also be different. In Fig. 7 the direct signal is coming from the right and is indicated by the broken lines, the light and dark lines indicating positive and negative peaks. The reflected signal is coming from the left and is indicated by the solid lines. Now, on the house shown in the centre are two aerials at A and at B. At the point where the true and reflected signal cross at A, the signals are in-phase, that is, the two signals are each at their maximum strength and assist each other. The result would be that the two images would be more or less of equal strength and thus on your screen you would have a positive ghost image. Now only a few feet away on the roof, position B, the signals are out of phase. This means that the signals will act against each other, or subtract, giving a negative ghost. These points are more clearly seen in Fig. 8, where a grey screen is shown with a white bar on it—an assumed transmission. At point A mentioned above, that is where the signals are in phase (upper point in Fig. 8), the positive ghost will produce a second white bar as shown on the left-hand screen, whilst where they are out of phase the negative ghost produces a black bar as shown in the right-hand screen. Thus, by moving the aerial on the actual roof only a few feet either way, it may be possible to find a point where a good signal may be obtained, whilst if it is just placed in position haphazardly, a very bad ghost may be received.

From the above it will therefore be seen that it is extremely difficult to say what aerial is needed at any particular point, and as we have previously stated the best plan is to look around and see what *general* type of aerial is called for in the locality, and then to experiment, not only with the direction, but also the exact position and the number of elements. The two illustrations in Figs. 7 and 8 illustrate the point that one house may need a different type of aerial from that used next door.

Scottish Radio and Television Show, 1957

THE Exhibition, at Kelvin Hall, Glasgow, from May 22nd to June 1st, is the first to be held in Scotland since the war by the manufacturers. (There have been two very successful exhibitions at St. Andrew's Hall organised by the dealers, with newspaper and BBC co-operation.)

Before the war the Radio Manufacturers' Association (predecessor of the existing organisations in the radio industry), ran three exhibitions at Kelvin Hall—in 1933, 1934 and 1935.

The 1957 exhibition will be the biggest radio and television exhibition yet held outside London.

There will be about 55 exhibitors, including all the leading manufacturers of radio and television receivers (27 firms), six specialists in the manufacture of aerials, manufacturers of valves and cathode-ray tubes and components, and six well-known wholesalers or factors. Retailers are not eligible to exhibit, but the Scottish Radio Retailers' Association will have a large stand as a meeting place for its members.

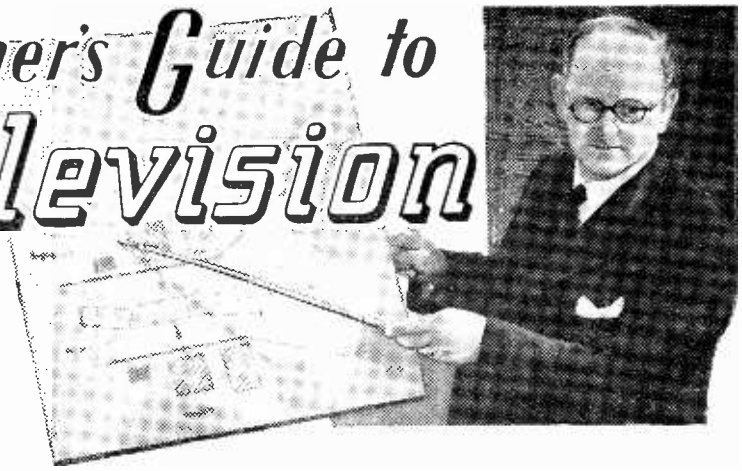
About 100 television receivers on the stands will be in operation almost all day, all capable of being switched from a BBC (Band I) frequency to an I.T.A. frequency (Band III).

From the Radio Industry Council's sound-proofed, glass-walled control room, in which technicians and announcers will be seen at work, television programmes will be distributed round the exhibition from six different sources—over the air from the BBC at Kirk O'Shotts; direct from the BBC arena in the exhibition; direct from the Scottish (independent) television film-scanner; direct from the camera in the R.I.C. continuity suite; or from the R.I.C. film-scanner or caption-scanner.

This is the Earls Court Radio Show technique, and it will be the first time that the Scottish public will see two television programmes being controlled simultaneously.

The BBC's demonstration of the making and control of their sound and television programmes will be on a larger scale than ever before in Scotland. Occupying the partitioned-off space used for circuses, they will have an acting area of 100 square feet, and seats for 1,000 round it. Seven TV and three sound programmes will be broadcast from here—one each day—some going in the national network.

A Beginner's Guide to Television



13.—TECHNICAL TERMS

By F. J. Camm

HAVING now dealt with the general principles of television transmission and reception, let us consider in greater detail some of the technical terms which have been used throughout this series. I will deal with them in alphabetical order.

Afterglow

This is a term used to describe the emission of light from a fluorescent material after the exciting cause has passed away.

Fluorescent material which has any very appreciable afterglow is useless for television purposes, for a cathode-ray fluorescent screen made of such material would emit light after the scanning spot had moved on and would thus result in a greater or less degree of image blurring and confusion. Material, however, which possesses a very slight afterglow is often decidedly advantageous, as it enhances the effect of "persistence of vision," and thus assists in the building up of a clear image on the cathode-ray tube screen.

The particular range of phosphors used on television tubes was explained in a previous article.

Amplitude Modulation

The term applied to the modulation system of a transmitter when the "carrier" wave has its amplitude varied or modulated by another waveform corresponding to the sound affecting the microphone, or variations in light intensity in the case of television picture transmission. The frequency of the "carrier" is not affected.

Aspect Ratio

The proportion of length to height of the raster in the television receiver. In the present British system this is 4 : 3.

Beam Current

The electron current of the beam arriving at the screen on the TV tube.

Black After White

A form of picture distortion in which dark objects are outlined on the right-hand side by a white line. In a simple form, picture sharpness is improved and the line is hardly discernible, but in extreme cases several lines will be apparent and spoil the picture. Causes are over-amplification of the higher frequencies.

Blocking-Oscillator

A type of oscillator in which oscillations are generated by the charging of a capacitor through an impedance followed by the discharging of the capacitor through another impedance, and used in conjunction with an electronic device to provide a scanning-field.

Cathode Rays

Name given to a stream of electrons which are emitted from the cathode, or negative electrode, of an electron discharge tube exhausted to a high degree of vacuum. They were first discovered by Sir William Crookes.

In 1899, Sir J. J. Thomson showed that the cathode rays were quite independent of the nature of the cathode used for their generation, and that they were, in fact, nothing more nor less than a stream of negative electrons travelling with a high velocity. It is upon this electron stream in a cathode-ray tube of special design that many of the modern cathode-ray systems of television are based.

Cathode-ray Tube

An electrical device for giving a visual indication of the magnitude, shape, etc., of an oscillating current. It may also be employed to provide actual images of valve characteristics and/or other wireless data. It consists of a large glass tube which is conical in shape. The large end, or the base of the cone, is coated on the inside with some fluorescent material. At the point of the cone, or the narrow end of the tube, is sealed a cathode. A short distance from this cathode is fixed an anode. The arrangement so far, then, is a replica of an ordinary wireless valve, and it works on practically the same principle. If a negative potential is applied to the cathode and a positive potential applied to the anode, a stream of electrons will be shot off from the cathode, and will be driven with great force on to the anode.

In the oscillograph a small pinhole is made in the anode, and the force of the electron bombardment drives some of the electrons through this pinhole. The tube is not completely vacuated, but contains a residuum of gas, and the gas tends to conduct the electrons which pass through the hole, so that a stream

of electrons passes from the anode down towards the fluorescent screen or plate. Immediately beyond the anode are two pairs of plates, one pair disposed horizontally and the other vertically. These are suitably connected to a circuit so as to form magnetic fields, or fields of stress between the plates, and these fields divert the stream of electrons. The fluorescent plate glows where the stream strikes it, and the size of the hole and all other internal details of the oscillograph have to be so designed that the spot of light on the plate is only a mere point. Various improvements on the above simple arrangement have been carried out.

Coaxial Cable

Term applied to a special cable for television land-line transmission and H.F. work. One conductor is placed inside the other, the outer usually being a screening cover.

Continuous Film Systems

Name applied to a system of film television transmission in which the object or scene to be televised is photographed on a cinema film. The film is automatically led to a developing tank and from thence to the television transmitter, where it is scanned in the wet condition.

Contrast

Term signifying the relationship between the degrees of light and shade in a picture or image, televised or otherwise.

Convergent Rays

Light rays which converge or close in as they travel to an object. Rays of light which are focused from an object on to a television transmitter or a camera screen are convergent.

Definition

A term denoting the degree of sharpness with which images are projected by a lens, or other optical system, or are reproduced electrically in a television receiver.

Deflection Coils

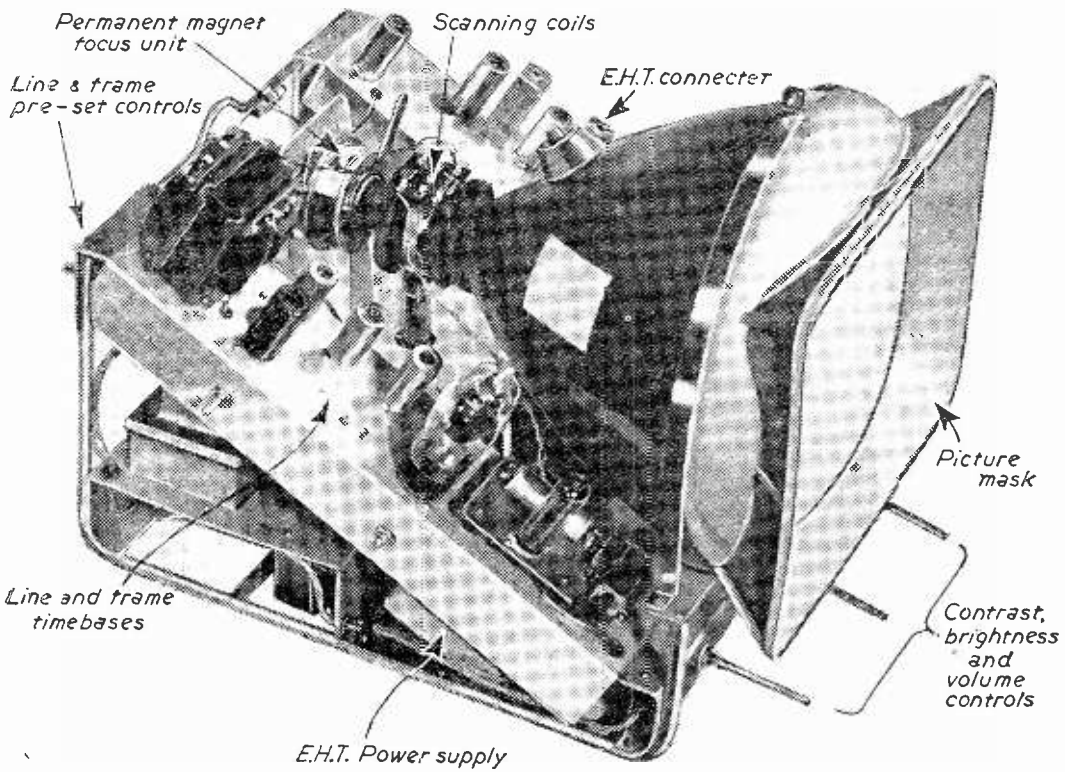
Another name for scanning coils.

Deflector Plates

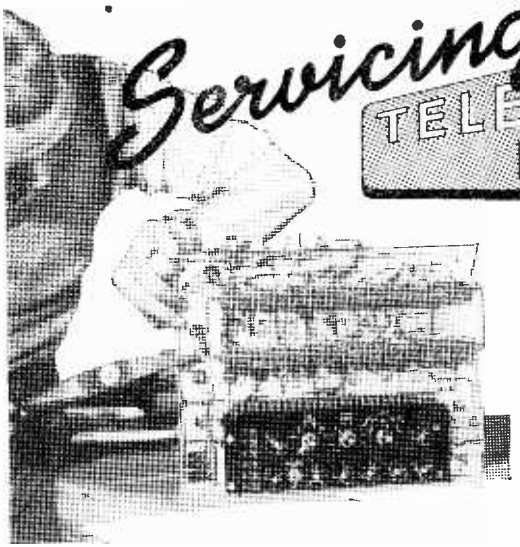
Name given to two pairs of metal plates which, in a cathode-ray tube, are fixed at right-angles to each other in the path of the cathode-ray beam. Their function is to deviate the beam of rays from its path in accordance with varying voltages applied to them, thus causing a movement of the spot of light on the fluorescent screen at the end of the tube.

Dipole Aerial

A form of aerial used for ultra-short-wave work and particularly for television reception. It consists of two short lengths of metal rod, vertically disposed on the same axis, with a space separating them. The transmitter or receiver is joined to the centre. A similar arrangement may be used for reception. The overall length of the aerial must be equivalent to one-half of the wavelength of the transmission. Also known as a half-wave aerial.



A typical home-constructor receiver, with essential parts marked.



No. 29.—THE PYE V14 AND V14C, ETC.

By L. Lawry-Johns

THESE are dual-band receivers featuring automatic picture control, flywheel line synchronisation and several other circuit refinements.

An upright chassis is incorporated and generally servicing is extremely simple. Most of the valves are immediately accessible once the rear cover is removed, and the whole chassis may be removed by unscrewing the four fixing screws from beneath the cabinet and removing the front control knobs. To release these knobs, rotate the outer rim until the hole coincides with the grub screw of the inner knob. Slacken the screw with a fine screwdriver, remove the inner knob and pull off the outer ring. This, of course, applies to the brilliance and volume and the finer tuner and channel selector only. The preset controls are removed with the chassis.

Without a doubt the most common fault symptom is loss of line hold, i.e., the picture runs into lines and cannot be locked horizontally.

In almost every case this is due to the PCF80 (V24) changing its characteristics and varying its cathode emission. A new valve must be fitted, since other valves of this type in the receiver will have been in use for some time and will probably exhibit the same symptoms.

The valve manufacturers have stated that the future issues of this type of valve will have more stable characteristics.

The fault almost always first shows as a loss of line hold when the receiver is first switched on. The picture can at first be locked with the horizontal hold control, but on a change of programme, or when changing from one channel to another, the picture will pull sideways and the control will again require adjustment. As this control has a limited range, the preset horizontal hold control can be adjusted to lock the picture, but this will only be a temporary cure and it will not be long before the hold becomes critical again and pulling is evident as before, prior to the picture being lost completely.

Also it will be noted that contrast is lost as the hold is lost. This is due to the automatic picture control circuit being dependent upon the line circuit frequency, and once hold is restored the picture will again resume normal contrast.

Hence, as soon as the horizontal circuit becomes troublesome, no time should be wasted on checking other parts of the circuit. Instal another PCF80 in the V24 position and if this doesn't cure the trouble, try another one!

It is sometimes the case, however, that the PCF80 is not at fault and then other components must be checked. These should include the Metrosil (cathode circuit V24) and the M3 clipper diode in the control grid circuit of V24 (pin 2, pentode control grid).

Frame Scan

The next most common fault is perhaps non-linearity of the frame scan, i.e., the top and bottom of the picture are not evenly presented. The top is probably extended whilst the bottom appears to be crushed and a black bar is obvious at the lower part of the screen.

To a certain extent this symptom is quite normal after a period of running and is due to rising temperature inside the cabinet. To check upon this, remove the rear cover so as to allow better ventilation, whereupon the symptoms should not be so obvious.

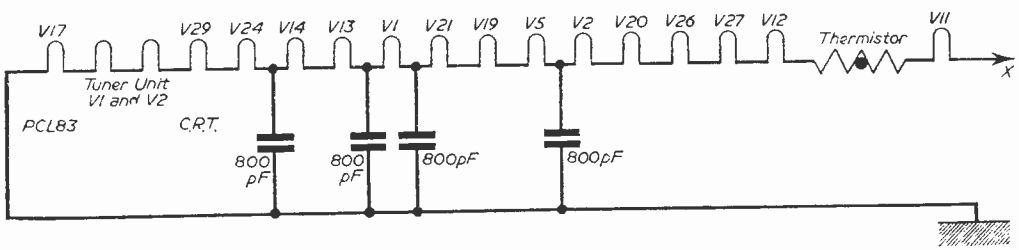


Fig. 1.—The heater wiring for the Pye models dealt with here. (A list of the valves will be found on page 420).

However, if the lower part of the picture is compressed to a point where severe distortion of the picture is obvious, check the setting of the vertical linearity and height controls and then suspect the PL83 (V20) mounted just below the mains input and fuse panel.

Tube Faults

The usual tube defects such as an A1 to control grid or control grid to cathode short are to be expected, and for the benefit of new readers it is proposed to touch upon this subject briefly.

When first switched on, allowing the usual three minutes for the PY81 cathode to reach operating temperature, the picture may appear quite normally (or may not appear at all). After an unspecified period the screen may flash up bright a few times and the picture will fail completely. Upon inspection it may be found that whilst the tube anode cap is connected there is no EHT, i.e., no high voltage at the anode cap or the EY86 EHT rectifier.

As soon as the anode cap is removed from the tube, the EHT vigorously comes to life and will spark to practically anything near the disconnected cap, including one's hand! Although the shock is not lethal, at the same time it is not pleasant and the distance that the spark will jump is sometimes surprising.

With the cap replaced the EHT once more fails, indicating that at least a partial short-circuit is present in the tube. It is common practice to write off the tube when this fault occurs, but this is not at all necessary.

There is more than one way of overcoming the effect of the short which is normally caused by the rather high voltage present at the first anode of the tube (not the final anode to which the EHT is applied) at tag 10 of the tube socket. It is quite often possible to reduce the A1 voltage by removing the lead from tag 10 and connecting a fairly high value resistor between the lead and the tag and another between the tag and chassis. Various values around 1 or 2 megohm may be tried in order to produce a reliable

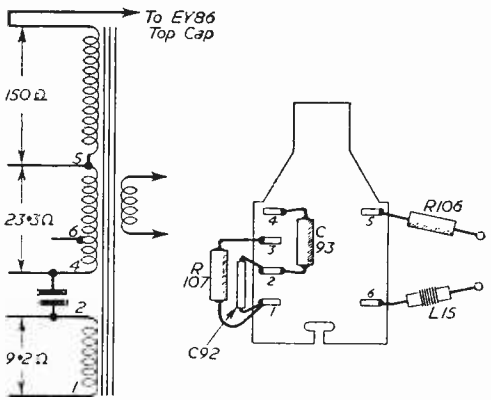


Fig. 2.—Details of the EHT components.

picture at the maximum brilliance. A more certain way of overcoming the defect, however, is to remove any connection which may be made to tag 7, the pins being counted clockwise from the locating slot, spaces being counted as pins even where these are not fitted, and then rewiring the tags as follows.

Remove lead to tag 10, solder to tag 7. Remove lead to tag 2, solder to tag 10. Place a short length of wire from tag 2 across to tag 11 (thus shorting the grid to the cathode).

Advance the brilliance until a raster (or picture) is visible, adjust the ion trap magnet on the rear of the tube neck to maximum brilliance and adjust the brilliance and contrast to form the most satisfactory picture. If this is done carefully very little loss of brilliance will be noticed although the brilliance control will have to be further advanced than hitherto. Now it is possible that the EY86 may not have survived the heavy current demand of the shorted tube and this may have to be replaced before a satisfactory picture will be obtained.

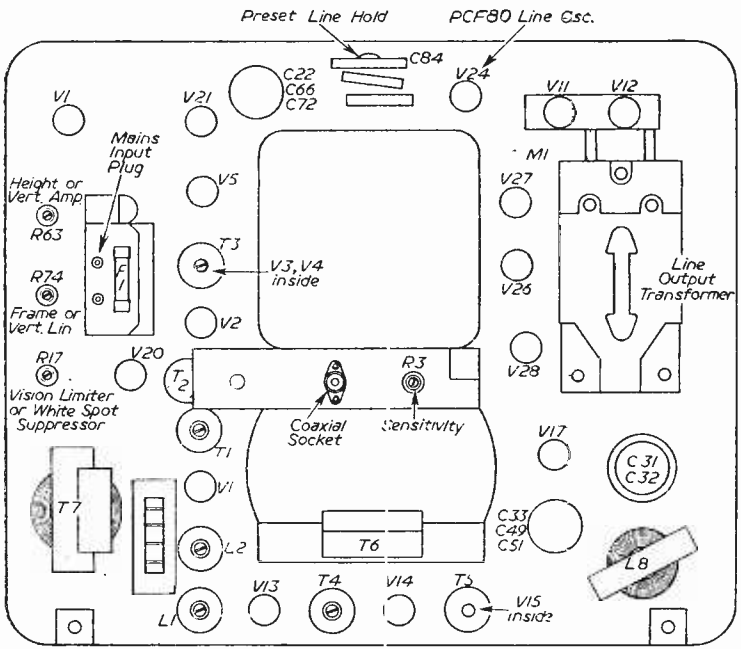


Fig. 3.—General details of the layout.

Condenser Shorts

If it is found that upon removing the tube anode lead in the first place that EHT is still not present, check valves V24 (PCF80), V26 (PL81) and V27 (PY81). A common fault is a short between the electrodes (screen grid to control grid) of the PL81. A perhaps

less often encountered, but still common, fault is leakage between the sections of the triple unit electrolytic capacitor cans.

As an example, C66, C72 and C22 are all sections of a common can mounted on the upper left side of the chassis (see Fig. 1). The observed symptoms may be an expansion and contraction of the picture height as the picture content changes; this should

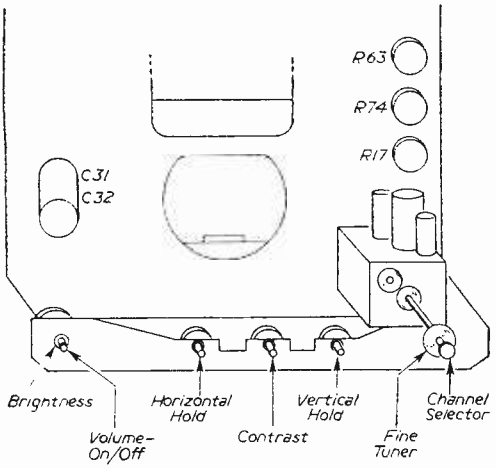


Fig. 4.—Details of the rear controls.

not be confused with variation of picture size at high brilliance levels. This latter is usually due to poor EHT regulation and in mild cases is due to the inherent characteristics of the line output derived EHT system. In more severe cases change the EHT rectifier, which in these receivers is the EY86. However, if the variation of height continues even though the brilliance is turned down, but is more pronounced as the contrast and sensitivity controls are turned up, suspect interaction between the 16 mfd. sections of the can containing C66, C72 and C22. Replacing the can complete will, of course, cure the trouble, but removing one lead and joining this to a separate 16 μF (other end to chassis) may clear the fault, if the right lead is removed, of course !

Not for Fringe Areas

These receivers cannot be regarded as highly sensitive, and the more complex VT4 or CTM4, for example, should be used in fringe areas. However, if the receiver has been performing well and a fall-off in sensitivity is noticed, necessitating an advancement of contrast and sensitivity controls, a check upon the PCC84 R.F. valve in the tuner unit should be made. Note that this loss of gain will be more marked on Band III than on Band I. If the PCC84 is not at fault the remaining valves should, of course, be checked.

On one or two occasions it has been noted that the PCC84 is responsible for a slight positive voltage appearing on the A.P.C. line thus rendering the contrast control practically inoperative.

It is perhaps unnecessary to point out that all the valve heaters are in series, but it is of interest to note that the C.R.T. is not the last heater in the chain, it is in fact "above the tuner unit valves" and the PCL83 sound A.F. and output is the "final" heater. The fuse is an 850 mA anti-surge and a higher rating should not be employed.

To enable the reader to identify the various valves the following table should be read in conjunction with Fig. 1.

V11—PY82 H.T. Rectifier.
V12—PY82 H.T. Rectifier.
V27—PY81 Efficiency Diode.
V26—PL81 Line Output.
V20—PL83 Frame Output.
V2—EF80 2nd Vision I.F.
V5—PCF80 Video Amplifier and Cathode Follower.
V19—ECC82 Frame Multi-vibrator.
V21—PCF80 Sync Separator and Flywheel Line Sync Amplifier.
V1—EF80 1st Vision I.F.
V13—EF80 1st Sound I.F.
V14—EF80 2nd Sound I.F.
V24—PCF80 Line Multi-vibrator.
V29—MW36-24 C.R.T.
Tuner Unit { PCC84 R.F. Cascode Amplifier. PCF80 Frequency Changer.
V17—PCL83 Sound Output.

(To be continued)

The Growth of Television

AT the end of December, 1956, there were 6,570,097 television licences in force throughout the country, an increase of 648,077 over the figures at the end of June. The increases were as follows :

England (excluding Monmouthshire)	from	5,241,433	to	5,776,673
Wales and Monmouthshire ...	from	269,424	to	297,191
Scotland	from	365,646	to	440,401
Northern Ireland ...	from	45,517	to	55,832

London Postal Districts

The number of licences increased from 674,361 to 709,511. The south-eastern district had the highest number of licences with 151,531, followed by the eastern district with 142,970 and the northern district with 125,156.

Wales

Of the Welsh counties, Glamorganshire had the largest number of licences with 163,744, and of the towns, Cardiff headed the list with 58,349, followed by Newport with 47,952. Aberystwyth and Blaenau Festiniog share the lowest positions in the table with 99 and 101 respectively.

Scotland

Glasgow led in Scotland with 136,668, followed by Edinburgh with 57,178.

Northern Ireland

Belfast had 45,210 licences and Strabane had the lowest figure with 62.

There are 99 towns and districts throughout the country where the number of combined sound and television licences exceed those of sound only—37 in and around London, 19 in the North West, 9 in the North East, 26 in the Midlands, 6 in Wales and 2 in the South West.

This information is taken from the "Quarterly Return of Broadcasting Receiving Licences," which is issued by the Post Office. Copies of the return may be purchased at 15s. each by written application to G.P.O. Accountant-General's Department, Ledger Branch III, 12-15, Finsbury Circus, London, E.C.2.

The Amplification of Light

IS THIS THE ANSWER TO BIG-SCREEN TELEVISION? SOME DETAILS OF MODERN PROGRESS IN THIS DIRECTION

FOR some time now there has been considerable speculation as to whether or not the cathode-ray tube is the real solution to television. A large picture in the home, say 21in., calls for a heavy and bulky tube which is quite expensive, or alternatively a projection set, and at last year's radio show the latter type of set was seen to be on the way out. One or two firms who previously specialised in this type of receiver had either ceased to exist or had discontinued this type of equipment.

When it comes to colour the tube is a most complicated piece of equipment and as a result is very expensive. Some alternative scheme would therefore, appear necessary, if colour television is to be available to everyone at a low price and able to give any desired size of picture. At the moment there appears to be no method which can be used and we must wait for some young inventor to produce something on completely different lines, but the amplification of light may be something which will assist in this direction.

Experiments are taking place in both the U.S.A. and this country, and recently a paper was read before the B.I.R.E. by T. B. Tomlinson, B.Sc., Ph.D., A.M.Brit.I.R.E., A.M.I.E.E., of the Research Laboratories of the G.E.C., the title of which was "The Principles of the Light Amplifier and Allied Devices" and the following extracts are given with permission. The complete paper will be reprinted in the journal of the B.I.R.E.

The paper first considered the necessary component parts of a light amplifying system and briefly pointed out the advantages of using solid stated devices. A system was outlined which consisted of a photo-conducting layer in series with an electroluminescent phosphor layer. . . .

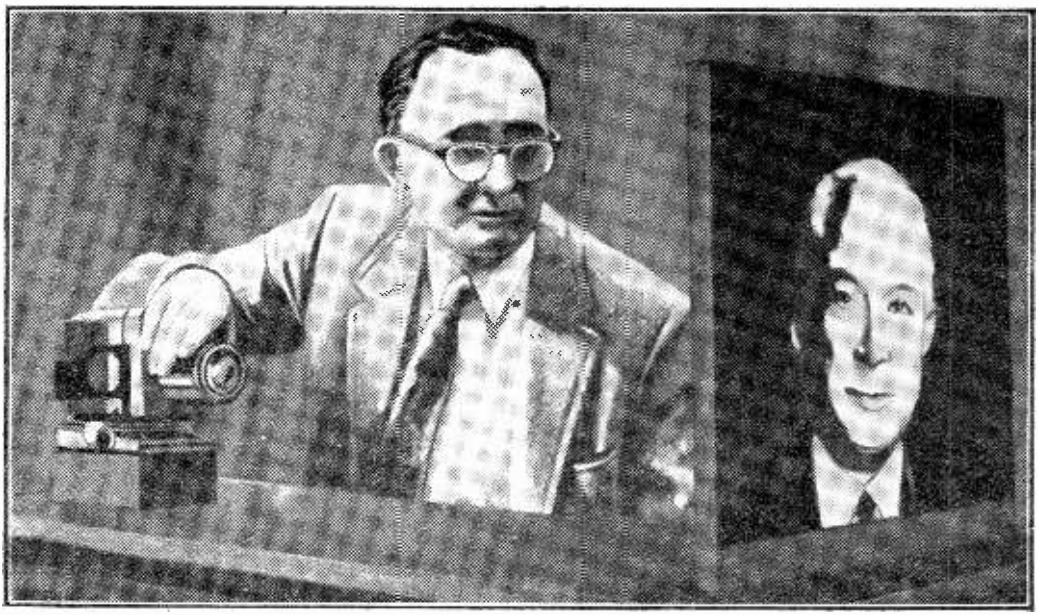
Optical feedback depends on the spectral emission distribution of the electroluminescent layer and the spectral response of the photoconductor. An amplifier with optical feedback such that the loop gain exceeds unity can be triggered by a light pulse and then remains in the light emitting condition until the supply voltage is reduced. . . .

A light-amplifier system, taking its input power from an electrical supply must have two basic properties. These are :

(a) Provision of the input light either as uniform illumination or as a picture ; in the latter case the device is also called an "image intensifier" and may be thought of as a multiplicity of units which amplify each picture element separately.

(b) Sensitivity to incident radiation so as to control the amount of electrical energy converted to light radiation.

It is possible to make a light-amplifier in which these two properties are combined in one material. Thus thin films of ZnS:Mn have been synthesised by evaporating Zn dust with a small percentage ZnC12 and MnC12 on to a hot glass substrate at 500-600 C. in an atmosphere of H2S. Such films luminesce when exposed to u.v. radiation or X-rays, and the application of a high field across the film



The American Light Amplifier referred to in this article.

results in an enhancement of the luminescence (" photo-electroluminescence "). Intensification of the image by the factor of 11 times (photon gain) has been achieved for low intensity u.v. excitation. The output light is yellow-orange : the amplifier characteristic is fairly linear, but the response time is slow varying from 1/100 sec. at highlight levels to several seconds at low levels. . . .

An image intensifier in which the two basic properties are provided by separate materials can be made from a combination of a cathode-luminescent screen and a photo-emissive surface. This system requires an evacuated envelope and is therefore bulky; it also needs high voltage supplies. In order to reproduce a picture, the photo-electrons must be kept to their appropriate paths and this requires a focusing system, usually provided by an enclosing magnetic focusing coil.

A simpler construction is achieved in the " panel amplifier " which is made up of a photo-conducting layer superimposed on an electroluminescent layer, sandwiched between electrodes to which an alternating voltage is applied.

The Panel Amplifier

The electroluminescent layer converts A.C. energy. The photoconducting layer is electrically in series so that the voltage appearing across the electroluminescent layer, and therefore the light output, is determined by the incident light on the photoconductor. A low intensity image incident on the photoconducting layer may lead to the reproduction of the image, at the increased brightness level, by the electroluminescent panel.

In the dark regions of the incident image the dark current of the photoconductor is so low that only a small voltage appears across the phosphor layer in that region and there is negligible local light output. In regions of higher light intensity that increased photocurrent leads to a larger proportion of the applied voltage appearing across the phosphor layer with the consequent increase of output light intensity. . . .

It would appear that no panel has yet been produced in this country suitable for display in public. No great effort has been put into the development of such a panel because of the uncertainty of its eventual suitability unless the maximum brightness level can be increased. R.C.A. have produced, by a complicated process, a 12in. panel which they claim has uniform resolution comparable in quality with commercial television pictures.

A phosphor layer, 1 thou. thick, is sprayed on to a conducting glass plate in the normal manner. Next comes a thin (1 thou.) opaque layer of lamp black in Araldite. Above this is spread a thick current-diffusing layer of semi-conducting CdS. This layer is then machined to a thickness of 10 thou., covered with a thick layer of photoconducting CdS powder in Araldite and the surface again machined flat to leave the last layer approximately 14 thou. thick. The photoconducting surface is sprayed with silver paint, and then " V-shaped " grooves 15 thou. are cut into it at 25 thou. intervals. Thus the bottoms of the " V " grooves just cut into the current diffusing layer and the tops of the grooves are left as narrow lines of conducting silver which are connected in parallel as a common electrode. Light incident on the photoconductor causes a " surface type " photoconduction current to flow down the sides of the grooves. This would cause the electroluminescent layer to be activated only in narrow strips, but the current diffusing layer serves to prevent this. The scheme successfully overcomes the difficulty of photoconduction through a thick layer (of small capacitance), but gives one the impression of being difficult to manufacture on a large scale.

Unless the previously mentioned opaque conducting layer is interspersed between the electroluminescent and photoconducting layers the light output of the former is incident on the latter thereby providing the optical feedback. This feedback might be used to increase the " gamma " of the overall system, but in the reproduction of a picture it is undesirable since the half-tones are lost. The feedback " ratio " will depend on the relative spectral response curves of the two parts. . . .

Light Amplifiers

The most promising use for this in the near future is for the intensification of X-ray images. Apart from the possible dosage reduction it also means that the radiologist does not have to become dark adapted before using the equipment. The colour and response time limitations are not a disadvantage here.

There is a possibility of infra-red conversion if a suitable photoconductor is developed (CdSe, CdTe).

From the point of view of television, electroluminescent panels are not so efficient as cathode-ray tube screens and, more important, the maximum brightness is considerably less. However, the advantages of a flat screen and much less bulk will encourage further work and we may yet see successful results but there are many technical difficulties to be overcome. . . .

U.S.A. Experiment

In America an electronic light amplifier which can increase by up to 1,000 times the brightness of projected light images, was demonstrated by R.C.A. scientists in connection with General Sarnoff's fiftieth anniversary in radio. The electronic light amplifier (an illustration of which appears on page 423) consists of a thin screen formed by two closely spaced layers, one of photoconductive material and the other of electroluminescent phosphor. Between these is a very thin layer of opaque material to prevent feeding back of light. The layers are sandwiched between two transparent electrodes and voltage is applied across the entire assembly.

When an extremely dim light image falls directly on the photoconductive layer, it permits a corresponding pattern of electric current to flow through to the electroluminescent layer. Under the influence of this current pattern the electroluminescent phosphor emits light, forming a high-brightness image of the original picture. The photoconductive material acts as an insulator in the absence of light ; the electroluminescent material remains dark until it is excited by an electric current.

In the demonstration of the light amplifier, an image too dim to be seen clearly by the human eye was projected against the photoconductive layer on one side of a panel. On the other side of the panel the image formed by the light emitted by the electroluminescent phosphor appeared as an extremely bright picture of television quality.

A Televisor From Indicator Unit 62

MAKING AN INEXPENSIVE RECEIVER FROM A POPULAR EX-GOVERNMENT UNIT

WE are continually receiving enquiries for television receiver designs which can be built by a beginner or experimenter, and for designs which can be built round certain ex-Government units. Some time ago (1951) we published details of a simple televisor built from the popular Indicator Unit 62, and although the appropriate issues are now out of print, and the article has been reprinted in our PRACTICAL TELEVISION circuits, in view of the demand we are reprinting the necessary details in this issue. At the same time we must point out that we have no modification data to enable this unit (or the 62A) to be used as a straightforward oscilloscope. This television receiver is not of the most up-to-date type, but is very cheap to construct and many readers are using it successfully in spite of the small picture. For the constructor's "den," for the bedroom, and similar cases, it will offer a very good alternative set, and may also prove very useful as a basis round which to carry out experiments on vision or sound receivers, or even on timebases.

The Indicator Unit 62 is built on a two-deck chassis and provides most of the components for a vision receiver and timebase. The power unit is built on a separate chassis, as it thereby relieves the main unit of a great deal of weight and thus makes it easier to handle.

The illustration on the next page shows the position of the main items, with the tube removed. The sound receiver is in the foreground; on the opposite side of the chassis is the timebase, while the vision receiver occupies the upper deck in the background. The EHT supply is contained in the unit at the back of the vision receiver, being fed from a mains plug fitted on the back of the unit.

Stripping the Unit

When the unit is received it is advisable to check the tube, if possible, under normal working conditions on a friend's televisor. If this is not possible, the filament should be tested and the base of the tube examined for looseness. Some of the dealers who sell this unit will change the tube if it is faulty.

The tube can be removed by unscrewing the screw fitted at the bottom of the bracket which supports the tube holder; the bracket can then be drawn back. The potentiometer pane on the top of the chassis can then be swung back on its hinge by undoing its retaining screws, and the tube can then be withdrawn from the chassis.

After removing the valves the whole of the unit should be completely stripped with the exception of the valve holders, the tube holder, the 0.05 μF 2.5 kV. condenser (which becomes C75), the D.C. restoring diode and the associated resistor on the top of the chassis (these become V19 and R73), the focus and the brilliance controls (which become VR9 and VR8), and the bleeder network (this becomes R76, 77, 78 and 79). Do not remove leads from C.R.T. holder.

Remove everything else from the chassis including the double-sided paxolin strip underneath the unit and the VR92 valveholder by its side.

The valveholder (see Fig. 1) in V20 position is removed and is replaced with a ceramic-based type for the EHT rectifier valve. The valveholder occupying the next position is removed for C78. The valveholder in V1 position is removed and is replaced with one of the EF50 type. Change the valveholder at V10 position with that of V9. Change the valveholder at V13 position with that at V11. Remove all the potentiometers from the top panel. Remove the front metal (double) panel.

Finally, test all the condensers for leakage. This is important, as a leaky condenser can cause some very puzzling faults, especially in the timebase.

The First R.F. Stage

The circuit diagram is given on page 429. It uses an EF50 valve (V1) and provides a good signal for feeding into the sound and vision receivers. L1 and

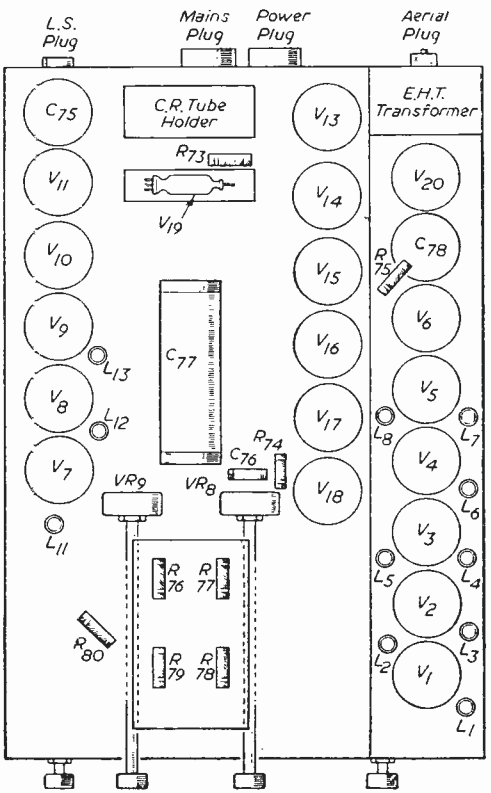


Fig. 1.—Layout of chassis top.

L2 are mounted under the chassis in the position shown in Fig. 1, the metalwork being drilled so that they can be trimmed from the top of the chassis. (This principle applies to all the tuning coils.) Coil winding data is given on page 428.

The various components can be grouped around the valve base, taking care to keep the leads short, and the metal screen 2in. by 2in. should be erected between this stage and the first vision R.F. stage. It will be found convenient to erect this screen after the components have been wired. The aerial connection is made on a Pye socket fitted at the back of the unit and a piece of co-axial cable is run from this socket to L1. The sheath of the cable should be earthed at both ends.

The Vision Receiver (Fig. 3)

This consists of four R.F. stages using VR65 valves, which feed into the VR92 diode detector, whose output is injected into the VR65 video valve. Sound rejection is provided by L5 and L8. All coils are mounted underneath the chassis in a similar manner to L1 and L2. Screened leads to the valve grids (top caps) should not be used, but V3 and V5 valve caps should be screened.

Metal screens 2in. x 2in. should be mounted between each stage after the components in each stage have been wired. Keep all leads as short as possible and do not mount anode components near grid components.

Anode decoupling components can be mounted on a paxolin strip fitted on the side of the chassis underneath the valveholders. These components are: R5, C8, R8, C10, R13, C18, R17, C22, R18, C25, R23, C31.

VR1 forms the contrast control and is fixed on the front panel.

V5a and its associated components, L9, R22, C30 and L10, are wired directly on the tag strip, no valveholder being used.

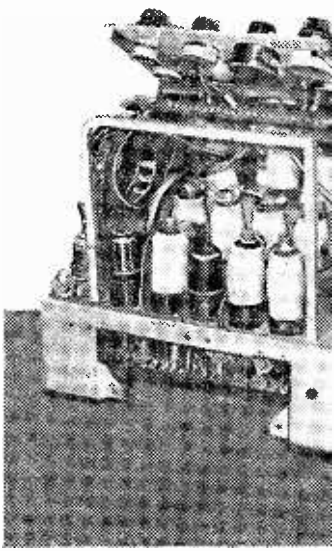
The Timebase (Fig. 4)

All valves are VR65s with the exception of the D.C. restorer diode (V12), which is a VR92. (Note there are *two* D.C. restorers in this unit, one in the timebase and one in the C.R.T. circuit.) V13 is the phase splitter, the signal for the C.R.T. grid being taken from the cathode resistor, R43. V14, the sync separator, follows and feeds the sync pulses to frame and line timebases.

The line timebase receives its sync pulse from the condenser C58, which is made variable so as to obtain the best amplitude of sync pulse, for triggering the line oscillator.

Both line and frame timebases use the Miller integrator combined with Transistron oscillator as sawtooth generators. V15 is the line oscillator, its frequency being varied by VR3 which forms the "line-hold" control. Output of sufficient amplitude is obtained by paraphase amplification which employs V16. The output to the deflector plates is taken from the anodes of these two valves via C60 and C61, which are 450 volt working.

The frame oscillator (V17) is similar in nature to V15, the only difference being in the component values. VR5 is the "frame-hold" control and V18 forms the other half of the paraphase amplifier. The frame deflector plates are fed from C68 and C74, which are both 450 volt working.



A view of the set v

Components marked with an asterisk in Fig. 4 are mounted on the double-sided tag strip taken from underneath the chassis. It will be found convenient to wire up this strip before fixing it back in the chassis, leaving about 6in. long leads where inter-connection between strip components and chassis components are to be connected together.

On the other side of the strip should be mounted the components for the sound receiver which are indicated in Fig. 5.

Great care should be taken not to get the leads mixed and each 6in. length should be suitably labelled.

Before remounting the strip, the valveholder for

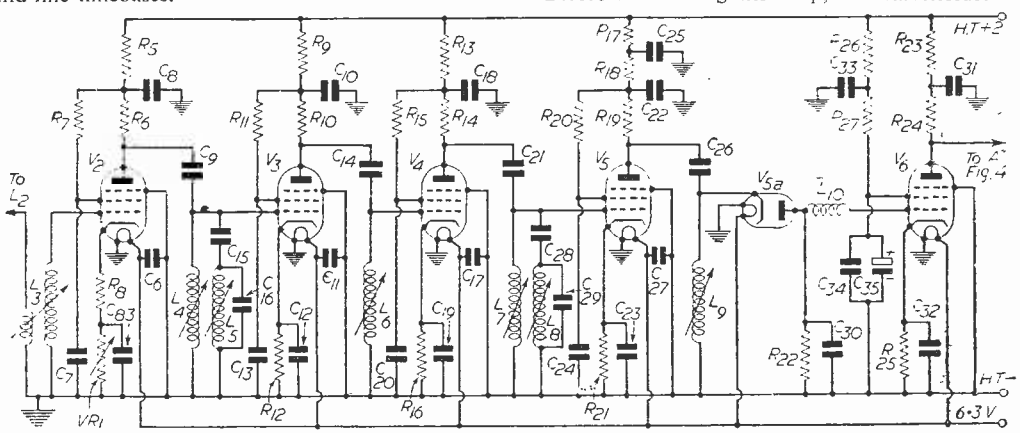
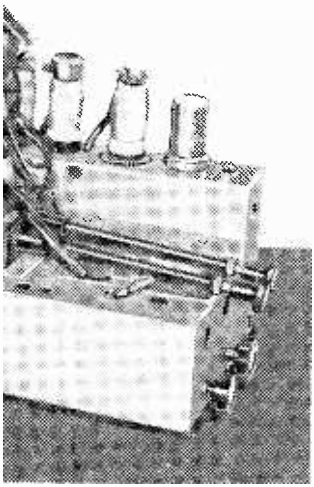


Fig. 3.—The vision section.

V12 (originally removed from underneath the chassis), should be remounted towards the back end of the chassis (underneath). The strip can now be replaced and the wiring of the timebase completed.

C54 and R44 are mounted on a small paxolin strip fitted underneath the EHT transformer on the back end of the chassis. The strip should be fixed right at the bottom, well clear of the EHT leads.



tube removed.

The connection between C54 and "A" (Fig. 4) should be made in coaxial cable, the outer sheath being earthed *at each end*.

The height of the picture is controlled by varying the H.T. applied to the anodes of the frame timebase valves. VR4 forms the control and is one of the 25 KΩ potentiometers previously removed from the top panel. It is shunted by a 1-watt resistor, R83.

The connection to the deflector plates and to the grid of the C.R.T. can be made by utilising existing wiring.

The Sound Receiver

Two R.F. stages using VR65s (V7 and V8) are transformer coupled. V9 is a VR54 and one half forms the detector, while the second half is used for noise-limiting.

The output from V9 is fed into the first A.F. valve, a VR65 (V10), which is R.C. coupled to the 6V6 output valve, V11. VR2 is the volume-control. Screened leads and valve caps can be used, though they should not be found necessary.

Trimmers T1, T2 and T3 should be firmly wired and fixed so that they are easily accessible from the side. The coils are mounted in a similar manner to those in the vision receiver. When mounting these coils it will be found that the best method is to wind on the secondary, bolt the former to the chassis, and then wind on the primary.

Connection between L11 and L3 (Fig. 2) is made in coaxial cable, the outer sheath being earthed at *both* ends.

If the anode circuit of V11 is disconnected while the valve is working, heavy current will flow via the screen and the valve may be severely damaged. It is, therefore, wise to permanently wire the loudspeaker transformer in the circuit, detaching it from the loudspeaker if necessary, and making connection between the transformer secondary and the speech coil via a plug and socket.

EHT Supply

The EHT transformer is mounted at the end of the deck containing the vision receiver (see Fig. 1). It will be noted that the positive EHT is earthed. The reason for this is to keep the peak inverse voltage from the transformer windings. When the negative is earthed we have on the second half of the A.C. cycle (when V20 is not conducting) the potential across C78 (2.5 kV.) added to the inverse voltage (2.5 kV.) which appears across the windings of the transformer. This is the reason for many early breakdowns in EHT transformers.

Another benefit derived from earthing the positive is that the working voltage of the coupling condensers to the deflecting plates of the C.R.T. need only be that of the timebase H.T. 450 volt working condensers provide a good safety margin.

One snag with this system is that the cathode and heater of the C.R.T. are at EHT potential and must be carefully insulated from the earth. This feature is catered for in the layout of the 62 unit, but it is important to bear the fact in mind when handling the televisor when it is working.

All EHT wiring must be thoroughly insulated

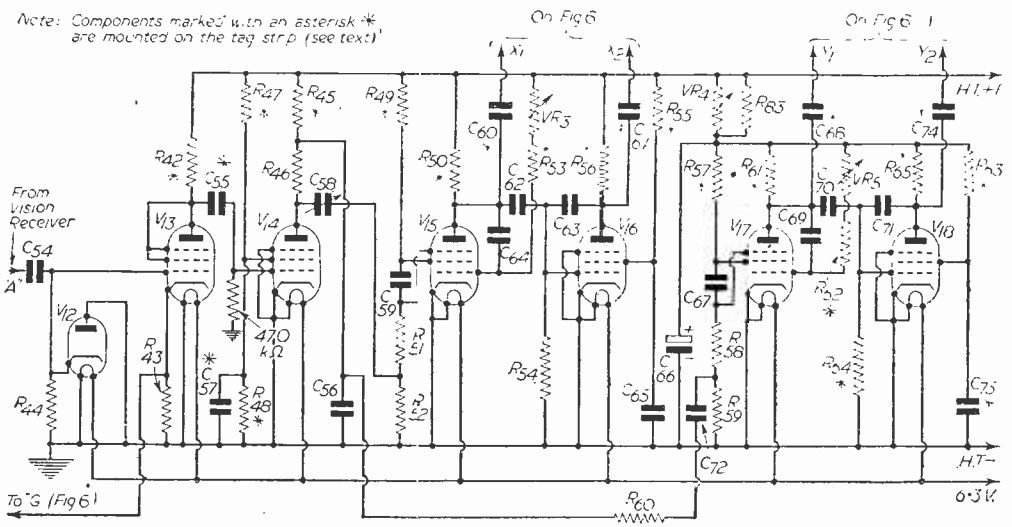


Fig. 4.—The timebase section.

LIST OF COMPONENTS

RESISTORS

No.	Value	No.	Value
1	100 Ω	43	3 KΩ
2	2.2 KΩ	44	1 MΩ
3	4.7 KΩ	45	47 KΩ
4	5 KΩ	46	10 KΩ
5	1 KΩ	47	100 KΩ
6	4.7 KΩ	48	10 KΩ
7	10 KΩ	49	56 KΩ
8	100 KΩ	50	120 KΩ
9	1 KΩ	51	47 KΩ
10	4.7 KΩ	52	4.7 KΩ
11	10 KΩ	53	1 MΩ
12	100 KΩ	54	2.2 MΩ
13	1 KΩ	55	56 KΩ
14	4.7 KΩ	56	120 KΩ
15	10 KΩ	57	100 KΩ
16	100Ω	58	100 KΩ
17	1 KΩ	59	50 KΩ
18	1 KΩ	60	33 KΩ
19	4.7 KΩ	61	150 KΩ
20	15 KΩ	62	5.6 MΩ
21	100Ω	63	47 KΩ
22	4.7 KΩ	64	2.2 MΩ
23	1 KΩ	65	150 KΩ
24	4.7 KΩ	66	2.2 MΩ
25	47Ω	67	2.2 MΩ
26	30 KΩ	68	2.2 MΩ
27	1 KΩ	69	2.2 MΩ
28	4.7 KΩ	70	100 KΩ
29	10 KΩ	71	100 KΩ
30	100Ω	72	100 KΩ
31	4.7 KΩ	73	1 MΩ
32	10 KΩ	74	2.2 MΩ
33	100Ω	75	510 KΩ
34	2 MΩ	76	180 KΩ
35	4.7 KΩ	77	470 KΩ
36	2.2 KΩ	78	470 KΩ
37	10 KΩ	79	470 KΩ
38	20 KΩ	80	390 KΩ
39	150Ω	81	1.5 KΩ
40	1 MΩ	82	1.5 KΩ
41	47 KΩ	83	25 KΩ
42	470Ω		
42a	10 KΩ (2, 20 KΩ 1 watt in parallel)		

CONDENSERS

No.	Value	No.	Value
1	500 pF	41	500 pF
2	500 pF	42	500 pF
3	500 pF	43	500 pF
4	500 pF	44	500 pF
5	500 pF	45	35 pF
6	230 pF	46	0.001 μF
7	230 pF	47	0.01 μF
8	230 pF	48	0.01 μF
9	100 pF	49	0.01 μF
10	230 pF	50	0.01 μF
11	230 pF	51	0.002 μF
12	230 pF	52	50 μF 25 v.w.
13	230 pF	53	0.05 μF
14	230 pF	54	0.01 μF
15	5 pF	55	0.1 μF
16	5 pF	56	0.005 μF
17	230 pF	57	0.25 μF
18	230 pF	58	0-75 μF
19	230 pF	59	100 μF
20	230 pF	60	0.01 μF
21	100 pF	61	0.01 μF
22	230 pF	62	50 μF
23	230 pF	63	60 pF
24	230 pF	64	100 pF
25	0.01 pF	65	0.5 pF
26	100 pF	66	8 μF
27	230 pF	67	0.003 μF
28	5 pF	68	0.01 μF
29	5 pF	69	0.01 μF
30	15 pF	70	0.001 μF
31	0.01 μF	71	0.001 μF
32	0.1 μF	72	0.01 μF
33	0.1 μF	73	0.5 μF
34	230 pF	74	0.01 μF
35	8 μF	75	0.03 μF 2.5 kV
36	500 pF	76	0.1 μF 500 v
37	500 pF	77	0.1 μF 2.5 kV
38	500 pF	78	0.1 μF 2.5 kV
39	500 pF	79, 81	16+8 μF 450v
40	500 pF	80, 82	16+8 μF 450v
		83	500 pF

T1, T2, T3 — 0-30 pF postage stamp type trimmers.

All resistors ½ watt unless otherwise stated above or in the text. Component tolerances + or — 15 per cent. Components should be combined or in series or parallel to make the utmost use of those in the 62 unit.

POTENTIOMETERS

VR1—5 KΩ, Contrast.
VR2—¼ MΩ, Volume.
VR3—½ MΩ, Line-hold.
VR4—25 KΩ, Height.
VR5—2 MΩ, Framehold.
VR6—100 KΩ, Shift.
VR7—100 KΩ, Shift.
VR8—100 KΩ, Brilliance.
VR9—500 KΩ, Focus.

VALVES : CIVILIAN EQUIVALENTS

VR65—Mazda SP61.
VR92—Mullard EA50.
VR54—Osram D63.

TRANSFORMERS

EHT. 200-230 volt input ; Output, 2,500 volts 3 mA., 4 volts 1 amp. C.T., 4 volts 1 amp. C.T. ; H.T.—200-230 volts input ; Outputs, 350-0-350 volts 160 mA., 5 volts 3 amps., 6.3 volts 3 amps., 6.3 volts 6 amps.

COIL WINDING DATA

L1, L2 — Primary 1 turn, Secondary 4½ turns.
L3—Primary 4 turns, Secondary 4 turns.
L6—4 turns.
L4, L7 — 4½ turns.
L9—5 turns.
L11, L12, L13 — Primary 2 turns, Secondary 4 turns.

All above coil forms are ⅜in. diameter.
Secondary spacings approximately 2 mm. between turns.
Wire gauge. 18 s.w.g.
L5, L8 — 9 turns 22 s.w.g. ¼in. forms.

NOTE.—The above data refers to Sutton Coldfield (Channel 4). For Channels 3, 2 and 1 add 1½ to 2 turns in each case, except on primaries. Add half-turn on the primaries. For Channel 5 remove 1 turn ; leave primaries.

L10, 50 turns 40 s.w.g. enamelled wire wound between cheeks ⅛in. diameter spaced 1/64in. apart mounted on a 1 MΩ resistor.

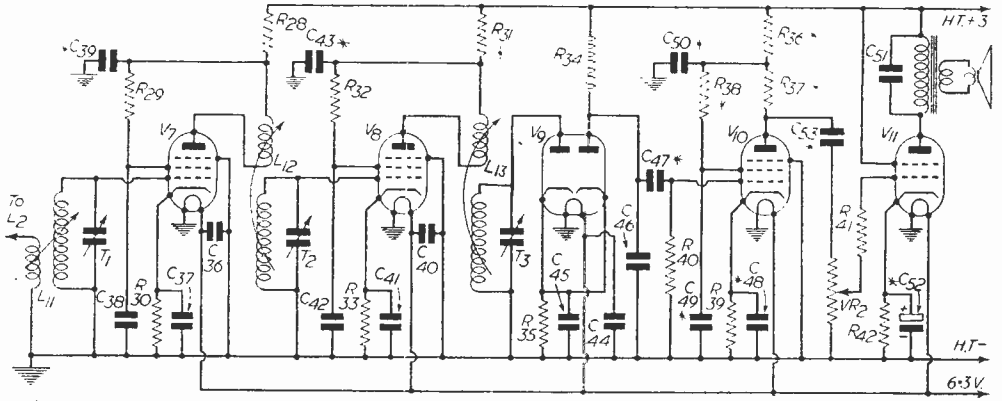
In the prototype the wires were first covered in systoflex sleeving of sufficient diameter to contain the wire, and then covered again with another length of systoflex of larger diameter.

Soldered terminations must be made with care, no stray ends being left to set up brush discharges.

connections to the cathode and anode of the valve must be reversed, and any wiring between the cathode and heater must be removed.

C.R.T. Network

Bias for the deflector plates is obtained from the



Note: Components marked with an asterisk * are mounted on the tag strip (see text)

Fig. 5.—The sound receiver section.

C78 is mounted in the position shown in Fig. 1 and R75 wired directly to the top terminal of the condenser, its remote end being supported by the insulated strip mounted on the supports of the potentiometer panel.

VR8 is already *in situ* and R75 is connected directly to it. R76, VR9, R77, R78, R79 will be found *in situ* and wired. R79 is earthed at one end and this connection is broken so that R80 can be inserted. C76 and R74 are wired across VR8, both components being supported by their own wiring. Care should be taken when fixing these two items so that they do not make contact with the chassis, or with the mu-metal screen of the C.R.T. when it is in place.

The D.C. restorer V19 and associated resistor R73 are already *in situ* adjacent to the C.R.T. base. The wiring can remain as it is except that the timebase H.T. supply. The coupling resistors R66, 67, 68 and 69 can be wired directly to the tube holder, R72 (2 watts) and R70 and 71 are mounted on the potentiometer panel. VR6 and VR7 form the shift controls for centralising the raster.

It should be possible to obtain even focusing over the whole of the raster, but if this should not be the case (some tubes are temperamental), the deflector plates 11 and 12 can be taken to separate shift controls. To do this disconnect R66 and 67 at their junction and from each other; connect two more 100 KΩ controls across the biasing network in a similar manner to VR6 and VR7. Connect the centre of one potentiometer to R66 and the centre of the other to R67. (This modification was made to the prototype as a refinement, though it was not really necessary.)

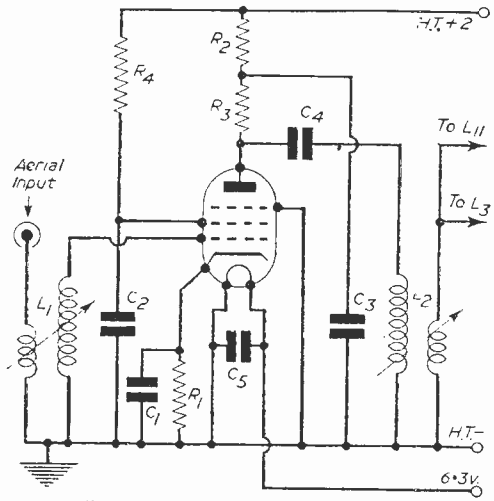


Fig. 2.- Circuit of the first R.F. stage.

Power Pack

This is made on a separate chassis. It relieves the unit of a great deal of weight, though it is possible to fit it on the existing chassis, provided a transformer of suitable size can be obtained. If this is done it should be mounted underneath the chassis at the front end, below the bleeder network. Metal rectifiers will have to be used and the whole carefully screened from the rest of the equipment. A separate chassis is recommended for the reasons given.

Timebase H.T. is derived directly from the smoothing choke, while the sound and vision receiver supplies are separated by the voltage dropping resistors R81 and R82. These resistors should be rated at 5 watts. It is wise to insert a fuse in the circuit as shown, because a complete breakdown of C79 would result in the loss of the 5U4G rectifier valve, V21.

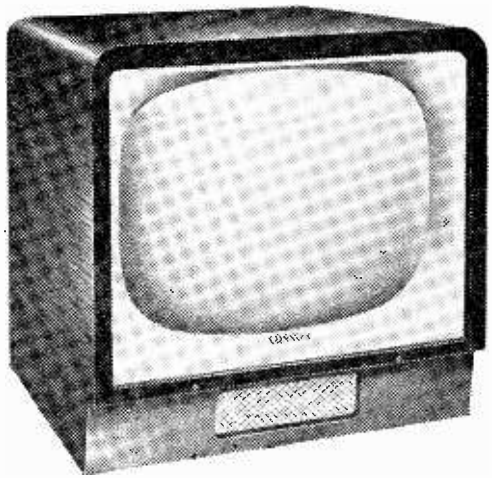
The on off switch can be incorporated with the volume control.

No details of chassis construction are given because any type which will accommodate the components will do.

(To be continued)

THE P.T DATA SHEETS

No. 5.—COSSOR MODEL 947



THIS is a 21in. table model designed for A.C. or D.C. mains operation. This is claimed to be the highlight of the Cossor range and is the first Cossor set to be built on the single-deck principle. Removal of the base gives immediate access to the underside of the chassis and the entire cabinet can be lifted clear in 90 seconds. Amongst other constructional features which will appeal to the service man are a plug-in EHT rectifier and a safety cover glass which is designed to slide out on the removal of only two screws, so that the face of the tube may be cleaned.

Among the circuit features may be mentioned the positive "Syncrolock" control, which is a self-centring flywheel synchronisation device with provision for immobilising the correction system whilst the Horizontal Hold is being set. The tube is of the 90 deg. type, aluminised and provided with a compensated pre-focus circuit which allows maximum brightness without de-focusing. The speaker is of the round type, not elliptical, but only 5in. in diameter. The set is fitted with a 3-position Sound Interference Limiter, and a continuously variable Vision Interference Limiter.

The cabinet, in polished walnut veneer, is provided with non-scratch Polythene feet and a stand is available as an optional extra.

COSSOR SPECIFICATION

Physical Dimensions Model 947
Height 22⅜in. Width 23⅛in. Depth 19½in. plus 3in.

Type
21in. Table Model.

Mains Supply
A.C./D.C. 200-250 volts (A.C. 50 cycles).

Consumption
120/150 watts.

Channels
Channel selection by 12-position turret with Turret Touch Tuning. Supplied with coils for channels 1, 2, 3, 4, 5 (BBC) and 8 and 9 or 9 and 10 (I.T.A.). Provision for coils for additional channels as they are allocated.

Intermediate Frequencies
Vision 34.65 Mc/s. ; Sound 38.15 Mc/s.

Valves

7AN7	Cascode R.F. Amplifier.
8A8	Frequency Changer.
6BY7	Common I.F. Amplifier.
6BX6	Vision I.F. Amplifier.
8A8	Video Amplifier and Output.
6AL5	Vision Interference Limiter and Automatic Contrast Control, Clamp Diode.
PCL82	Vertical Time-base Blocking Oscillator and Output.
6BX6	Sound I.F. Amplifier.
PCL82	Audio-frequency Amplifier and Output.
8A8	Sync Separator and Phase Splitter.
12AU7	Horizontal Multivibrator.
PL36	Horizontal Output.
EY86	E.H.T. Rectifier.
17Z3	Boost Rectifier.
PY32	H.T. Rectifier.

Crystal Diodes

M3	Cascode A.C.C. Clamp Diode.
CG12E	Vision I.F. Limiter.
CG12E	Vision Detector.
Q3/4	Vertical Time-base Interlace Diode.
CG6E	Sound Detector.
M1	Sound Interference Limiter.
D3/2/1Y	Sync Phase Comparator.

Cathode Ray Tube
Cossor type 212K, 21in. Aluminised Rectangular Type.

Loudspeaker
5in.

Sensitivity

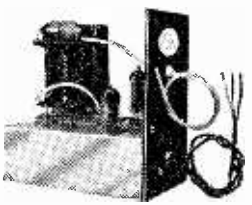
		Vision	Sound
Better than	Band I	63μV.	20μV.
	Band III	126μV.	40μV.

Aerial Input
70/80 ohms unbalanced. Single co-axial Plug and Socket.

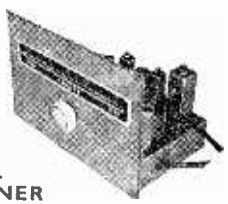
THE "ESTRONIC" BAND III CONVERTER

To-day's best value in Band III converters suitable for your T.V. or money refunded. Complete ready to operate. **49 6** non-mains or **79 6** mains, post and insurance 3/6.

THE ELPREQ E.H.T. GENERATOR



This unit contains three BVA valves. Output from 6 kV to 9 kV rectified with normal H.T. rail input but somewhat higher outputs can be obtained with higher H.T. supply. Dimensions are 6½ x 4½ x 7in. Price **69 6**, post, packing, etc., 5/-.

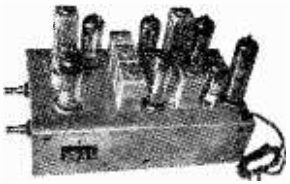


F.M. TUNER

This is a high fidelity unit which although moderately priced has a performance equal to the highest priced. Its stability is very good and extremely good results have been received with the simplest of aerials as far away as Eastbourne. The unit is made up ready to work and has its own power supply for A.C. mains. Demonstration at all our branches. Price **12 gns.** or **£1.12.0** down and 6 payments of **£2.** Post plus insurance 5/-.

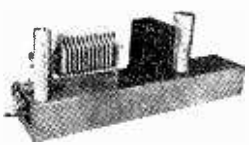
TELEVISION SECTIONS

THE I.F. UNIT



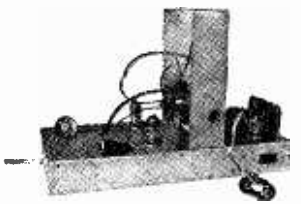
This unit employs 8 miniature all glass valves, the first two of which are common to sound and vision. After separation, sound and vision are amplified separately at 34.46 and 37.5 mc/s respectively. Vision is then detected and passed to two stages of Video amplification, and sound is detected and further amplified by output valve type EL84 to give just over one watt of high fidelity sound. The circuit employs a variable peak white clipper to reduce vision interference and the second section of the audio detector is used to limit sound interference. The unit, which can be driven by any standard 34-37 mc/s turret or other tuner, is beautifully made and contained on a chassis size approx. 8in. x 4½in. x 2in.
The unit with valves made up, aligned and ready to work is available price **£9.12.6.**

THE POWER UNIT



Intended for A.C. D.C. working with .3 amp valves, this unit contains all the necessary power components. Rectification is by metal rectifier, smoothing is by a 3 Henry choke, and large electrolytic condensers ensure freedom from hum and a clean picture. The ballast resistor has ample tappings to compensate for H.T. voltage as well as heater current and a thermistor protects the circuit against initial current surges, fuses are fitted in the mains input lead.
There is a front control comprising a double pole on/off switch, this is attached to the sound volume control which, although not part of the power unit, is included for the sake of convenience and symmetry. The size of the unit is 15½in. x 3in. x 2in. It is all wired up and ready to work, price **£3.5.0.**

THE TIME BASE CHASSIS

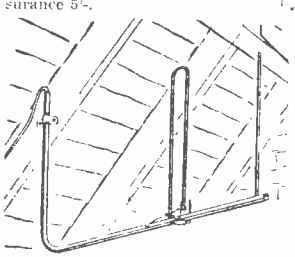


This uses 6 valves and includes the sync separator, the focus magnet, scanning coils and ion trap. The line time base is of the self-oscillating type employing an auto wound O.P.T. and efficiency diode to provide boost voltage for the line fly back E.H.T. transformer which gives about 12.5 kV., the frame time base is multivibrator type, using an ECL80.
The whole unit measures 15½in. x 6¼in. x 2in., and the metal work includes tube support for chassis mounting a 14in. tube, but up to 21in. tube can be scanned but will require separate mounting.
Price for the unit with valves ready made up and tested is **£12.15.0.**

NOTE.—These three units, although quite separate and usable separately, may also be joined together and then comprise a complete T.V. less only tuner unit and speaker (available if required). Demonstrations at all branches- circuit diagrams, etc., 3/6.

THE "CRISPIAN" PORTABLE RADIO

A 4-valve truly portable battery set with very many good features as follows: Ferrite rod aerials, low consumption valves superhet circuit with A.V.C., ready-built and aligned chassis if required, beautiful two-tone cabinet covered with I.C.I. Rexine and Tygan. Guaranteed results on long and medium waves anywhere.
All parts, including speaker and cabinet, are available separately or if all ordered together the price is **£7.15.0** complete or **£1.15.0** deposit and 7 monthly payments of **£1**, post and ins. 3/6, ready-built chassis **30**- extra. Instruction booklet free with parts or available separately price **1/6.**



BAND III AERIALS

This is a 1 wavelength, 3 element array. Of all alloy construction, the aerial is completely assembled and ready for instant mounting in loft, bedroom cupboard window frame, etc. Price **12/6**, plus 2/- post and insurance.

THE OCTAVIAN HIGH FIDELITY AMPLIFIER

3 valve 4 watt with frequency response better than 40-15,000 C.P.S. Control panel size 8 x 2½in. comes fixed to chassis but is intended for independent mounting. Separate bass and treble controls giving fullest variation of cut and lift. Separate switch, absolutely no mains hum. Remarkable value at **7 gns.** or **£1** deposit and 7 payments of **£1**, plus 3/6 post & packing.

TELENEWS

Television Licences

THE following statement shows the approximate number of Television Receiving Licences in force at the end of January, 1957, in respect of receiving stations situated within the various Postal Regions of England, Wales, Scotland and Northern Ireland.

Region	*Total*
London Postal	1,429,343
Home Counties	797,399
Midland	1,125,950
North Eastern	1,052,239
North Western	966,740
South Western	492,630
Wales and Border Counties ...	376,493
Total England and Wales ...	6,240,794
Scotland	456,773
Northern Ireland	59,618
Grand Total	6,757,185

BBC TV in 1956

DURING 1956 the BBC Television audience grew from 14,450,000 to about 17,500,000. At the beginning of the year the coverage of BBC Television was 93 per cent. of the adult population of the British Isles; it now covers 97 per cent.

In the course of the year BBC Television viewers will have seen around 30,000 artists and speakers. This is the estimate based on the 23,400 contracts sent out in the year. Some of the contracts were for groups of artists (such as a dance team) and for musicians.

The Light Entertainment department will have staged 565 "live" shows from the London studios in the course of the year, equal to 320 hours of transmission. This figure takes no account of the entertainment shows on film such as *Hey, Jeannie*, Burns and Allen and the like, or of regional programmes.

Astronomical TV Equipment

THE Pye TV camera designed to aid the special observation of Mars during its recent "close approach" to the earth has been transferred to The Radcliffe Observatory, Pretoria, from Bloemfontein, South Africa, where it had been used by the National Geographical Society's Mars expedition. The Radcliffe Observatory which was transferred in 1948 from Oxford, where it had been established for more than 150 years, now possesses a 74-in. reflecting telescope which is the largest in the southern hemisphere.

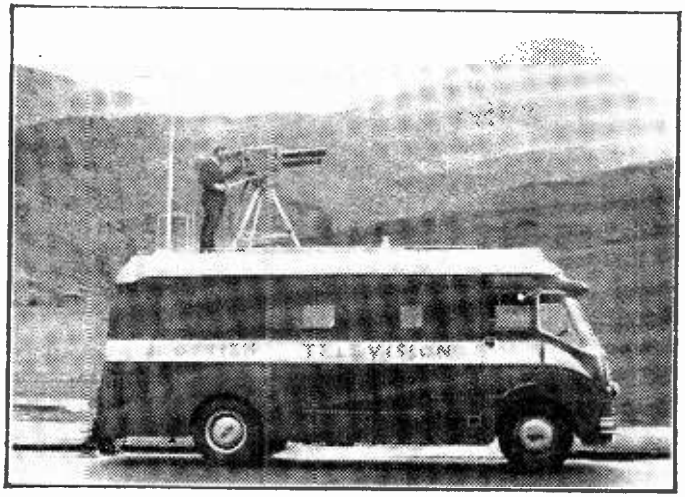
In practice the Pye television equipment operates in conjunction with any large refracting or reflecting telescope. The object of the equipment is to detect a greater amount of the light which has been collected by either the lens or mirror of the telescope.

During the observations of Mars at the Lamont-Hussey Observatory, Bloemfontein, Mr. B. V. Somes-Charlton, of Pye Ltd., obtained over 1,500 television photographs, which have been taken to America for examination by Dr. E. C. Slipher, a leading authority on the planet.

Ferranti-Ekco Link

FERRANTI LTD. and E. K. Cole Ltd. have issued a joint statement announcing that arrangements have been made for E. K. Cole Ltd. to take over the marketing of domestic radio and television receivers under the "Ferranti" trade mark.

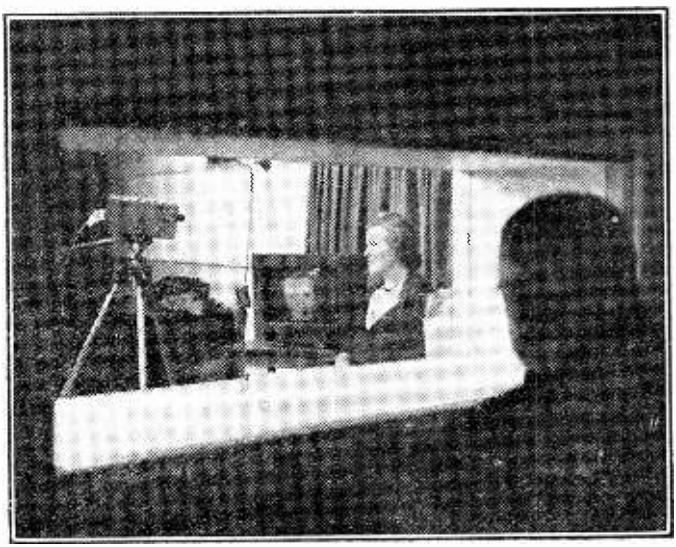
A new company is to be formed and Ekco will make an early announcement to Ferranti dealers in regard to future plans. In the meantime, deliveries of the current range of receivers will continue.



The Outside Broadcasting unit made specially for Scottish Television, Ltd., by Pye, Cambridge, seen in the Queen's Park, Edinburgh. It is valued at over £37,000 and is the most advanced machine of this type in Great Britain at present. The unit is touring the S.T.V. reception area filming local scenes and activities for transmission at a series of television exhibitions.

TV for Beginners

BETWEEN 50 and 60 Tory M.P.s and candidates have gone through the television course at Tory Central Office, in Victoria Street, Westminster, London, in the last few months. The Central Office has a studio with a closed circuit TV on which the pupil can see himself perform. He is shown how to stand and how to talk into the microphone, and warned of the common faults made by beginners. The instructors are Brigadier Hinchcliffe and Mrs. Crum Ewing.



Brigadier Hinchcliffe, in the sound-proof monitor room, and Mrs. Crum Ewing demonstrate the closed circuit TV used for TV courses at the Tory Central Office in Westminster.

B.O.A.C. Try TV Announcements

TV equipment will allow airline passengers using B.O.A.C.'s airways terminal at Victoria not only to hear the announcements being made by receptionist Miss Joan Bray, but also to see her on 21in. Pye TV receivers placed in various parts of the building.

Miss Bray will be the "star" on an experiment by B.O.A.C. with closed circuit television. The Corporation will be deciding whether television can be used at airways terminals to "personalise" announcements and as a sales promotion aid.

A camera is to be placed on the balcony of the main hall of the building so that it can be trained either on Miss Bray as she makes her announcements of flight departures and arrivals and gives other information about B.O.A.C. services, or on the general scene in the hall below.

Smaller TV Camera for Calder Hall

IN only four weeks a special television camera has been designed and manufactured to enable engineers at Calder Hall to carry out extremely complicated inspection inside the pressure vessel of the reactor.

The new camera has been reduced to under 3in. in diameter and 24in. in length, so that it can form part of a mechanical grab which will be lowered into the fuel channels of the graphite core to remove possible obstructions. The focus for this particular camera, which carries its own source of illumination, is pre-set to the fingers of the mechanical grab before it is inserted in the reactor.

For the purpose of obtaining the fullest information on the behaviour of fuel rods, which supply the heat for the power station, it has been found that television provides the most effective method of routine internal inspection. Experience with cameras previously installed by Pye at Calder Hall proved so valuable that site engineers worked out modifications to extend the use of TV still further. In order to incorporate these modifications immediately, Pye technicians were asked to produce the new model as quickly as possible.

The new camera is one of a range of more than half a dozen television cameras of different shapes and sizes which Pye has manufactured for special uses in industry. They vary from cameras with dust, heat and waterproof cases to units with remote lens changing and remote pan and tilt attachments.

Britain Leads European Colour TV Research

BRITAIN is carrying out considerably more experimental work on the development of colour television than other European countries.

This was reported by two British delegates to the Radio Corporation of America's conference held at Zurich during December to discuss the latest developments in TV.

The delegates, Messrs. E. P. Wethey and J. Gifford, chief engineer and television engineer respectively, of Kolster-Brandes Ltd., Footscray, Kent, leading British radio and TV manufacturers, joined TV technicians from France, Italy, the BBC, P.M.G. and other British companies, at this two-day meeting.

Messrs. Wethey and Gifford said that developments in colour TV in America are taking place so quickly that British technicians cannot get components sufficiently quickly to keep up to date. They added that at the present time no colour tubes are being made in this country—only in the U.S.A.

Programme of the conference included a detailed lecture and discussion on the latest colour receiver circuits, and a demonstration of a colour transmitter and receiver.

Incidentally, K-B's Mr. Wethey is chairman of the colour TV subcommittee of BREMA (the British Radio Equipment Manufacturers' Association).

Tube Frauds

FROM the U.S.A. comes news of extensive frauds with renovated picture tubes. It is stated that these are provided with forged code numbers and trademarks and sold at a discount with a fake one-year guarantee to dealers who believed they were from the manufacturers. A Bronx serviceman is held on charge in connection with the fraud and it is claimed that the G.E. Company have lost about one million dollars a year and that the R.C.A. has also lost about the same. More than 30,000 of the tubes have been seized by the Bronx District Attorney's office.

—not when you fit a

SPENCER-WEST PATTERN ELIMINATOR

The SPENCER-WEST Pattern Eliminator has now been further improved so that a smaller Band I signal into the unit provides sufficient drive to enable complete neutralisation to be secured. The unit is very simple to fit and is provided with plugs and leads—it is only necessary to plug in to complete the installation. Instructions and trimming tool are supplied free with each unit. Many thousands are already in use and there is no reason at all why you should tolerate pattern interference when receiving the ITA programmes.

Full technical data is available on request and the unit is available either from your dealer price **25/-** *or post free from the address below for* **25/-** (C.O.D. if you prefer)

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Phones : 4794 and 3009.
Grams : Spencer-West, Great Yarmouth.

What the Experts say :

● **GORDON KING in Practical Television "Eliminating Breakthrough" says :**

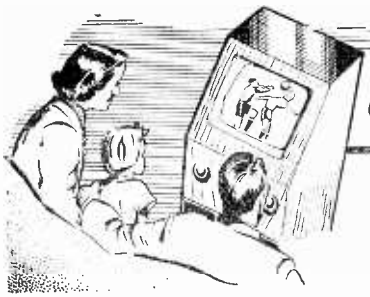
"A perfect solution to the problem has been provided . . . hitherto engineers and experimenters have often been obliged to abandon the simple add-on mode of conversion purely on the grounds of BBC breakthrough. Now, however, aided by the unit, conversions of this nature can be carried out with complete success. . . ."

● **The WIRELESS WORLD says :**

"The conditions of the test were so severe that the Band III signal could barely be detected through the Band I. It was too much to expect that the unit would remedy this, but it did in fact enormously reduce the Band I signal. The balancing adjustments proved to be smooth and definite and the unit behaved exactly in the manner described by its makers . . . there is no doubt at all that the unit will do what it is intended to do, which is to remove the pattern produced on a Band III picture by a considerably weaker Band I signal picked up by the receiver. . . ."

● **The WIRELESS AND ELECTRICAL TRADER says :**

". . . Spencer-West Ltd., who seem always to have an original approach to the solution of problems associated with domestic television reception, have devised a means by which to eliminate the converter's principal weakness : breakthrough of the Band I signal while receiving the Band III transmissions. . . ."



UNDERNEATH THE DIPOLE

TELEVISION PICK-UPS AND REFLECTIONS

By Iconos

NEWSREADERS

THIS column has been "having a go" at the BBC-TV news for several months, comparing it unfavourably with the I.T.A. news, especially as regards the methods used by the newscasters. Perhaps the views I have expressed have not been without effect in adding to the many complaints—for the BBC has been making striking changes in their news presentation, bring their newsreaders closer to the camera, experimenting with the Teleprompter machine for cueing, and even inducing them to show the ghost of a sickly smile now and again. So far, so good. But the BBC will have to make more progress and give their announcers much more freedom of expression before they are able to reach the standard of Ludovic Kennedy, Robin Day and the other I.T.A. newscasters—all of whom seem to be more at ease and carry greater conviction than the best of the BBC men. Technically, this may be due to the latitude allowed the I.T.A. newsreaders to make minor modifications to their news-script, which makes it easier for them to read in their own particular style. The I.T.A. News does marvels with the limited equipment at its disposal. It has now become so popular—and so important—that I think the I.T.A. should allocate more money for the purchase of newer and better apparatus—especially of TV cameras. Their image orthicon cameras still do not flatter—they tend to add years to the victim interviewed or to the newsreader.

INVENTING A NEW TV PARLOUR GAME

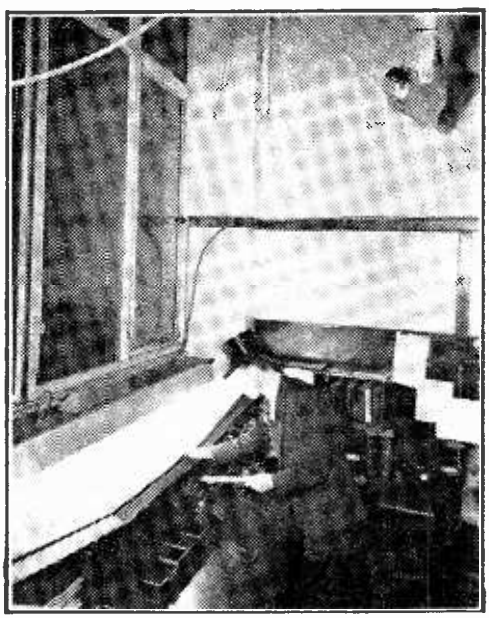
HOW nice it would be to invent some simple little gadget like a hair-pin, a zipp fastener or a collar-stud—and then to sit back in opulent luxury enjoying the royalties it brings in! There must be few of us who have not indulged in such pipe-dreams. This kind of wishful thinking might still come true, even if in a more utility and not-so-opulent manner, if we could invent a new TV parlour game programme which showed some likelihood of achieving popularity. Really good ideas in this line are worth a lot of money.

"THIS IS YOUR LIFE"

NOTWITHSTANDING the fact that you and I may not care very much for *My Wildest Dream*, *Double Your Money*, *Make Up Your Mind* and the rest of them, there is no denying the popularity of these parlour game programmes. The professional viewer-poll organisations say so, and the advertisers on TV put their trust in their weekly scrutiny of the viewing public's habits. The great appeal of the panel game cannot be said to arise from the fact that it is transmitted "live." As a matter of fact, some of them are filmed or tele-recorded, and I am not aware that this has made any difference to their appeal—if the main idea of the programmes has caught the viewer's fancy. Some of the panel games are not strictly games at all. The only feature which brings them into this category is the fact that they have a master of ceremonies to pilot the train of events. Take that delightful BBC feature *This Is Your Life*. Here is an idea which has a most powerful appeal, particularly if the "victim" is a well-known personality, able to hold his own with the M.C., and has a good memory. Under the skilled chairmanship of Eamonn Andrews, *This Is Your Life* has steadily improved. Latterly, there has been some emphasis on show business personalities, which naturally rank high in entertainment values. This, I think, is live television at its best.

GRANADA PROGRESS

SOUTHERN viewers will have noted with interest the steady increase in the number of Granada presentations networked into the Rediffusion and A-TV programmes. Their quality and slickness is steadily increasing, one of the best efforts recently being the full-length play, *The Lion's Share*.

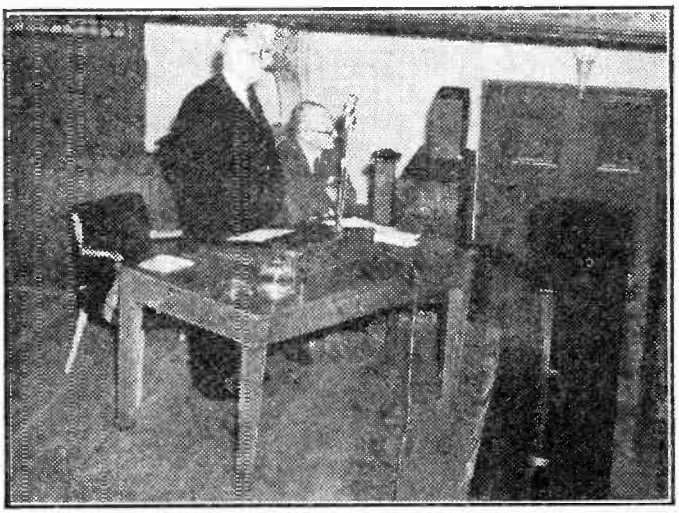


Price movements being recorded at the Stock Exchange by means of a closed TV circuit.

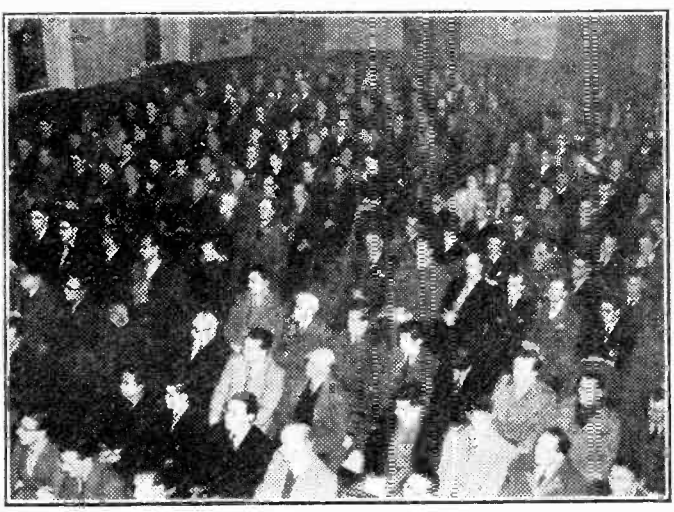
The Granada domestic scene, *My Wife's Sister*, is mildly amusing, but suffers in comparison with the American domestic comedy TV series, which are pre-filmed and edited into a slickness that is difficult to attain on live TV. Technical values of Granada productions are of a very high standard. It is interesting to note that this organisation has extended its activities into the other extreme of the entertainment world: it has taken over several music-halls, including the Metropolitan, Edgware Road; the Empress, Brixton; and the Chelsea Palace—all of which are now putting on first-class live variety shows in a new streamlined form. The Palace, Walthamstow, a fine large music-hall, that closed about a couple of years ago, has also been acquired by Granada, but still remains closed. Can there be any connection between the building up of television star material at these Granada-owned houses and the programmes from Manchester? Or is it simply a case of bringing these suburban music-halls up to the standard of luxury and comfort, coupled with first-class acts, which packs the London Palladium nightly? Incidentally, the regular Sunday night A-TV programmes from the Palladium have not kept audiences away during the week; if anything, they have increased. I shouldn't be at all surprised to find that Granada, like A-TV, are blazing the trail for a revival of that somewhat faded British institution—the music-hall.

THE EAMONN ANDREWS SHOW

IN the first *Eamonn Andrews Show*, this top-line commentator and panel game chairman tried his voice in song to the consternation of viewers. He neatly capitalised on this disaster in the second show of the series, in which he repeatedly guyed his own inability to keep in tune. The highlight of this show was a hilarious sketch about a teacher of singing—excellently played by Warren Mitchell—who was patronised by commentators Eamonn Andrews, Brian Johnston, Max Robertson and boxer Freddie Mills. An exceptionally strong cast also included Ruby Murray, Frankie Vaughan and Ike Hatch, all of whom made sparkling contributions to the musical side of the show. Ike Hatch, the dusky personality man from the old Harry Pepper sound radio shows, including the *Kentucky Minstrels*, put over some numbers with terrific pep—quite a relief from some of the male torch-singers who groan into the microphone. Freddie Mills played several parts which proved that he is an excellent light comedian as well as a heavyweight boxer, with pleasing personality and a most genteel "cut-glass" voice. Eamonn Andrews dominated the show, however, and more than recovered the ground lost in the first edition.



The Editor and Mr. Gardner, of Mullards, opening the film show which was given in January at Caxton Hall.



A section of the audience at the recent film show at Caxton Hall given by Practical Wireless and this paper, in conjunction with Mullards.

I.T.V. IN SCOTLAND

SCOTTISH TELEVISION LTD., the company which is to operate commercial television in Scotland from August, 1957, has taken over one of the most important theatres in Glasgow, the Theatre Royal, in Hope Street.

The usual apron stage and camera runways will be installed, vision and sound control rooms, property rooms and so forth. There is a parking ground at the rear of the theatre where mobile "travelling eye" trucks can be stabled. The managing director, Roy Thomson, says that it will be one of the most modern and best-equipped TV centres in Britain.

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CHEAP TUBES. Slightly faulty with burns or Cathode to heater shorts. Your enquiries invited.

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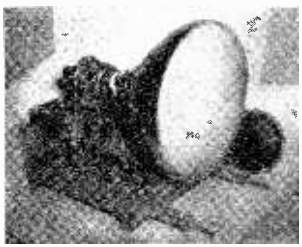

Complete with tube and speaker. Modified ready working. Fully guaranteed for 3 months. These are demonstrated to personal callers. LESS valves. As above with 5 of the valves, **£15.19.6.** Or with all the valves, **£19.19.6.** Some delay on the latter. Ins., carr. incl. tube, 25/-. **17 Tube Rectangular** on adapted chassis. LESS valves, **£19.19.6.** With 5 valves, **£21.19.6** or complete with all the valves, **£25.19.6.** Plus 25/- ins., carr. FREE catalogue.

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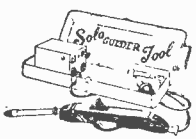

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6 volt 200 240 volt **45/-**

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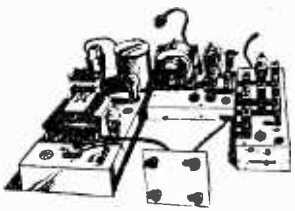

Complete chassis by famous mnfr. Easily converted to I.T.A. R.F. E.H.T. unit included. A.C. s'het. 3 separate units (power, s vision, t base interconnected). 8 P.M. speaker and drawings FREE with each order. I.F.s 16.5—19.5 m cs.; Carr. & Ins. 10/6.

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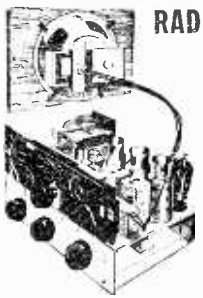
POWER PACK. 45/-. R.F. E.H.T. unit, tested working. LESS valves. FREE drawing. Ins., Carr., 5/-.
TIME BASE. 30/-. Tested working. Complete with focus coil. LESS valves. FREE drawing. P.P. 3/6



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ARE YOU SUFFERING from B.B.C. breakthrough? All our converters now fitted with B.B.C. breakthrough pattern rejector. ALL fully wired, aligned and ready for use. ALL with power pack, knobs, aerial switching, metal rectifier and 2 valves 12AT7. Direct switching from B.B.C. to I.T.A.

DON'T FIDDLE at the back of your set, our converters have rubber feet to stand on top where you can reach.

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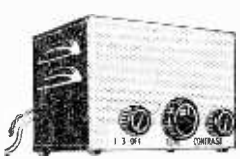

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With two knobs. Stove enamel grey hammer finish, slug tuning.

OR metal cabinet, 3 knobs, fine tuning on front, and as illustrated, **£4.7.6** (p. & p. 2/6).
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Chassis in Kit Form, **61/-** (p. & p. 1/6).
Variable Attenuator, **7/6** (p. & p. 1/-).
Aerial Splitter, **8/-** (p. & p. 1/-).
Band 3 Aerials, mast mounting:
3-element, **27/-**; 5-E, **35/-**; 8-E, **55/-**.
Low-loss co-axial **8d.** yard.

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ECC84	11/-	KTW63	7/6	1R5	8 6	6F6	2 6	12K7	7/6
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CORRESPONDENCE

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).

SHARED CHANNEL INTERFERENCE

SIR,—We note with interest Mr. B. L. Morley's notes concerning shared channel interference.

The pattern eliminator unit, technical details of which were recently described by Mr. Gordon King in PRACTICAL TELEVISION, can be employed to reduce or remove shared channel interference and we have received several reports describing its satisfactory use both for this purpose and for the removal of major interfering ghost signals.

Incidentally the stub which Mr. B. L Morley recommends as a filter should be open circuited at its end, not short circuited. It is also rather more efficient if fitted at a point on the aerial feeder approximately one-quarter wavelength from the receiver socket.—S. WEST (Spencer-West Ltd.), Gt. Yarmouth.

THOSE ADVERTS

SIR,—Now that we have had a good run on Band III, I wonder if other readers feel as I do that, whilst not wanting to do away with the "commercials" some steps should be taken to control the form taken. Several of these are not only quite nice to look at, but also the speech is in keeping. On the other hand some of them are not only silly but the announcers shout as though that will make the viewer dash out and buy the product. Surely, it has the opposite effect, and brings the manufacturer into ridicule. Also, as I believe I have seen in your magazine before, if this practice should grow it will lead to the development of advert. killers as in the States with the eventual result that the viewer will not hear or see *any* of the commercials. By the way, do any readers know of a *simple* "commercial killer"? The only circuits I have got in this connection call for six or seven valves. I do not, of course, want to go to the lengths of fitting photo-electric cells and use a torch as in the Columbia models.—B. BROWN (W.6.).

STRANGE SIGNAL PICK-UP

SIR,—Regarding the various solutions which have been offered in this connection, whilst it is quite true that Police and other signals are often heard on the TV frequencies, there is also the possibility of shared frequency signals coming through under abnormal conditions. I have had two or three reports of this resulting in a form of ghost when the programmes were identical, and cross-talk when different programmes were being radiated. Also, due to these abnormal conditions which arise from time to time, American signals have been picked up, and break up the picture as with sound-break-through due to bad tuning. The effects have been noticed to vary in strength as aircraft pass overhead. —H. BAINES (Nottingham).

UNIT CONSTRUCTION

SIR,—Referring to the article by W. J. Delaney in the March issue, it is a great pity that a vote cannot be taken of the preference of layout in chassis construction, because judging by the talks I have had with fellow fans and my own experience, I feel sure that an overwhelming majority would be for the separate unit method.

I am a maintenance electrician, being well used to dealing with intricate relays, etc., and know the trouble of trying to line up a vision strip mounted on a large chassis. So heaven help the poor chap with little in the way of instruments and little used to "live" jobs.

Before closing, may I touch on the power unit? I am greatly in favour of separate H.T. for timebases and sound and vision. So often are poor results in the sound and vision caused by hum from the timebases via the H.T. line. The initial expense would, of course, be greater, but where the home constructor is concerned I do think it would be repaid by ease of testing, etc.—F. R. BROWNE (Watford).

SPECIAL NOTE

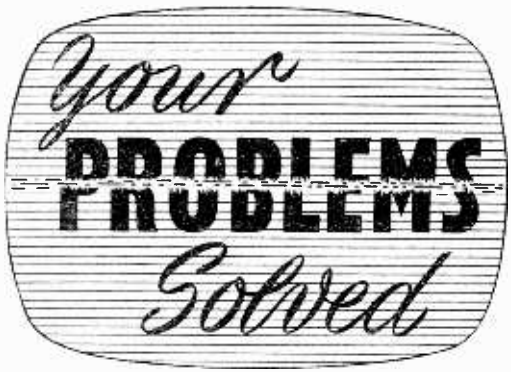
Will readers please note that we are unable to supply Service Sheets or Circuits of ex-government apparatus, or of proprietary makes of commercial receivers. We regret that we are also unable to publish letters from readers seeking a source of supply of such apparatus.

SIR,—Referring to W. J. Delaney's article in the March issue, I feel sure that unit construction would solve what is probably the chief problem of many home constructors of televisors, namely how to modify the televisor without causing an unwelcome interruption in the family's viewing. If all units were interconnected by plugs any unit could be replaced quickly and without the risk of dropping solder on the carpet! The new assembly could then be tried out on Test Card C or some other transmission of no general interest. If the new picture proved to be inferior to the old, due possibly to a fault that could not be located immediately, very little time would suffice for refitting the original unit so that the set would be in working order for the next programme which the family wished to view.

I suggest that designs of timebase unit permitting the use of C.R.T.s of 12in. and upwards in diameter should be published, as many readers will wish to continue using their present tube. The following additional features, some of which may be included in the design as optional, appear desirable on account of the continually increasing number of viewers who live in a fringe area of either a Band I or a Band III transmitter: efficient, adjustable black spotter, flywheel synchronisation, gated A.G.C. and flyback suppression.

Given a good design, many home constructors will make a televisor equal in performance and superior in reliability to the commercial article, in which inferior components mounted inaccessibly, dry joints and shoddy wiring are only too common.—W. F. G. JONES, B.Sc., A.M.Brit.I.R.E. (Newport).

[These are only a few of the many which have been received on this subject, and it appears, therefore, that there is a real need for a unit type set, and experiments will therefore be carried out in this direction. Perhaps manufacturers of suitable home-constructor apparatus would get into touch with us on this subject.—ED.]



Whilst we are always pleased to assist readers with their technical difficulties, we regret that we are unable to supply diagrams or provide instructions for modifying surplus equipment. We cannot supply alternative details for constructional articles which appear in these pages. WE CANNOT UNDERTAKE TO ANSWER QUERIES OVER THE TELEPHONE. The coupon from p. 449 must be attached to all Queries, and if a postal reply is required a stamped and addressed envelope must be enclosed.

PHILCO BT1840/M

Would you let me know if I could get a converter for I.T.A., also Wenvoe, as I shall be moving to Swindon shortly; also the type of aerials?—J. Adams (Oxford).

The 1840/M can be easily tuned to Wenvoe frequency by adjustment to the aerial, R.F., and oscillator coil cores. These are at the far end of the R.F. chassis, the oscillator core being in the centre protruding through the chassis.

The receiver converts well to Band III (I.T.A.); the choice of aerials depends upon the signal strength available in your locality. Your present aerial (BBC) will probably be effective in the Wenvoe area, but, of course, a Band III aerial will be required, and in your present area a high-gain array is desirable. A double four-element gives quite good results.

COSSOR 918

The last 12 months I have had this set overhauled and repaired three times by different dealers. My trouble now is that I can get sound but no picture. I have replaced the EHT rectifier SV61 and also the 185B, without result. This is as far as my knowledge goes, as I am a novice regarding TV. I would like your advice.—Alfred S. Barber (Widnes).

If, when the brilliance control at the rear is advanced, no raster can be observed on the screen, it is likely that the EHT is absent. If the SV61 is not heated, ensure that the 6SN7 valve, almost in the centre of the chassis, has both its heaters alight. If this is in order, have the 7Y4 (behind the 185BT) tested and then test for H.T. at the anode of the 185BT. If there is none present it is likely that the line-output transformer primary winding is open-circuit.

PYE VT2

My problem is that, on occasions, such as peak periods or when the electric stove is used, a black line 2½in. wide appears on the right-hand side of screen. Linehold and ampere controls will not cure.

The mains supply is 240 volts A.C. By altering the voltage tapping on the set to the 200 volts tap I can cure the fault and get much improved all-round performance, but am I damaging the set in any way ?

Lastly, on looking at the circuit diagram I see the 5.6 K screen-dropping resistor has been changed to 8.2 K (PL81 valve). Can you explain this, as I feel this has some bearing on the fault that has been happening since the set was new?—J. C. Davies (Mold).

The correct value for the screen-dropping resistor of the PL81 is 8.2 KΩ in the VT2 and 5.6 KΩ in the V2. If the voltage setting is at present 240, it is surely possible to reduce to, say, 220 in order to achieve correct operating conditions. It would not be wise to leave the setting permanently at 200 if the mains input is normally above this. It would be as well to check valves PY82, PY81 and PL81.

SIMPLEX MAGNETIC MODEL

With your help I have overcome all my troubles but one in my Simplex Magnetic Model.

It is the foldover at the top, and nothing that I can do can get rid of it.

Briefly, I would like to fit a blocking oscillator.

I have the blueprint of such a circuit, but being an amateur am not quite clear what the conversion would involve. I am not concerned with expense or trouble as this annoying fault is the only one which mars a picture, which for definition and linearity is far in excess of any commercial set I have seen.—William Herbert (Stirling).

It is possible that the use of a blocking oscillator will still leave you with the same trouble. One point is that if this type of oscillator is used, then the frame-output stage must be adjusted to work with it. A blocking oscillator is essentially non-linear and correction is made in the coupling and feedback stages. Use a complete blocking oscillator with its output stage.

Have you tried a 10 henry choke across the output valve's load resistor ?

CO-AXIAL LEAD

I have on hand a coil of co-axial cable which a friend tells me is ex-Government. This cable is brand new and seems to be much superior to ordinary types for sale. It is about ½in. diameter. Will it be suitable for television (BBC), 75-80 ohms ?—L. Ryan (Lancaster).

The coaxial cable you have to hand will be satisfactory for normal BBC reception, but it is not 75 ohms. We would not be inclined to use this type of cable, however, since it is rather difficult to lay and route, and will not give superior results to the more common, and easier to handle, 75-ohm co-axial.

PHILIPS 1115

I have not a service sheet for this set so am pretty much in the dark as to positions. The horizontal hold is extremely critical. For quite long periods it is steady, then slowly the top of the picture leans to the right ; this creeps down until the whole picture is displaced, but the merest touch of the control puts it right, but any further improvement of the control in either direction upsets the picture completely. —T. I. Jibson (Marske-by-Sea).

One of the two ECL80 valves is most likely to be causing the horizontal hold trouble. The left side of the chassis (viewed from the rear) is that which carries the timebase valves, etc. The first ECL80

(*Continued on page* 445)

C.R.T. ISOLATION TRANSFORMER
Type A. Low leakage windings. Ratio 1 : 1.25 giving a 25% boost on secondary.
2 v., 10/6 ; 4 v., 10/6 ; 6.3 v., 10/6 ; 10.8 v., 10/6 ; 13.3 v., 10/6.
Ditto with mains primaries, 12/6 each.
Type B. Mains input 220-240 volts. Multi Output 2, 4, 6.3, 7.3, 10 and 13 volts. Input has two taps which increase output volts by 25% and 50% respectively. Low capacity, suitable for most Cathode Ray Tubes. With Tag Panel, 21/- each.
Type C. Low capacity wound trans-former for use with 2 volt Tubes with falling emission. Input 220-240 volts. Output 2-2½-21-23-3 volts at 2 amps. With Tag Panel, 17/6 each.
NOTE.—It is essential to use mains primary types with T.V. receivers having series-connected heaters.

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RESISTORS. All values. 10 ohms to 10 meg., ¼ w., 4d. ; ½ w., 6d. ; 1 w., 8d. ; 2 w., 1/-.
HIGH STABILITY. ½ w., 1%, 2/-. Preferred values 100 ohms to 10 meg.

5 watt	WIRE-WOUND RESISTORS	1/3
10 watt	25 ohms—10,000 ohms	1/6
15 watt		2/-

15,000 ohms—50,000 ohms, 5 w., 1/9 ; 10 w., 2/3.

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MAINS TRANS. 350-0-350, 80 mA., 6.3 v. tapped 4 v., 4 a., 5 v. tapped 4 v., 2 a., ditto 250-0-250, 21/-.
HEATER TRANS. Tapped prim., 200/250 v., 6.3 v., 1½ amp., 7/6 ; tapped sec., 2, 4, 6.3 v., 1½ amp., 8.6 ; prim. 230 v. Sec. 6.3 v. 3 amps., 10.6.
COPPER PLATED AERIAL RODS. ¼ x 12in. push fitting, 3/- doz., p. & p. 1/-.
ALADDIN FORMERS and core, ½in., 8d. ; ¾in., 10d. 3in **FORMERS** 5937 8 and **Cans TV1 2.** ½in. sq. x 2½in. and ¾in. sq. x 1¾in., 2 - ea., with cores.
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MAINS DROPPERS. 3in. x 1¼in. Adj. Sliders, .3 amp. 750 ohms, 4 3. .2 amp., 1,000 ohms, 4/3.
LINE CORD. .3 amp., 60 ohms per foot, .2 amp., 100 ohms per foot, 2-way, 6d. per foot, 3-way, 7d. per foot.
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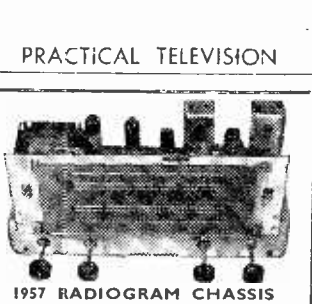
1T4	9D2	9U4	6J5	12AT7
1S5	EF50	2 6	6K6	12AV7
3S4	Equip.	E1148	6K7G	EBC41
3V4	SP61	EB34	EB91	EBF80
5U4	SP41		HA R2	ECL80
6AM6	EF92	3 6	(sweep)	ECH42
6AT6	PEN 46	3D6	6SK7	EF41
6J7		6H6M		EF80
6K8	7 6		7 6	EL41
6SL7	6B16	7 6		EL84
6SN7		6V6G	12BE6	EZ40
6V6GT	6BW6	6X4	EL32	KT33C
12BG3	6D6	6X5	HVR2A	MU14
12F50	6F6	807	PEN25	PY81
5Y3, Red	6K7GT	EF39	VP23	12K7
1F91		11 6		35Z4
EZ80	EY51	1 25	PL81	6Q7



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4/450 v.	2	16/16/500 v.	4	25+20/450 v.	5 6
8/450 v.	2 3		6/	32+32/350 v.	4 6
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25/25 v.	1 9	64/350 v.	5 6		12 6
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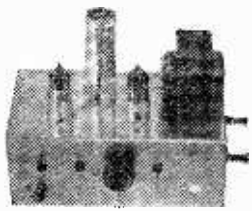

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STANDARD ¼in. diam. Polythene insulated. GRADE "A" ONLY

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10%, Type.	½ w., 9d.: ¼ w., 1/-:	10w.)	10,000 ohms 1/6
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		5w.)	33,000
		10w.)	ohms 2/3

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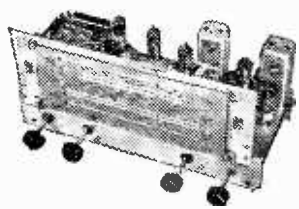

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6AT6	8/6	EB91	6/6	EL41	10/6	PY81	9/6
6K7	6/6	EBC41	10/6	EL84	11/6	PY82	8/6
6K8	8/6	EBC33	8/6	EY51	10/6	U25	11/6
6Q7	8/6	ECC84	12/6	EZ40	8/6	UBC41	9/6
6S7	8/6	ECF80	12/6	EZ80	8/6	UCH42	
6V6	7/6	ECF82	12/6	MU14	9/6		10/6
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on the right side of this is the sync separator, line clipper. To the left of this, in the centre of the chassis, is the line oscillator. Both valves are suspect. Occasionally a resistor associated with the centre valve can cause the same effect when its value changes.

COSSOR 933

I wish to clean the glass front, which has become very dirty on the inside. Can you advise me on how to remove the tube as the makers have not put this on their service sheet—only how to remove chassis? —F. Hawkins (Staines).

To remove the C.R.T., first lay the cabinet face down on a soft surface. Remove the two 4BA bolts located at the back edges of the cabinet securing the focus gantry bracket to the side of the cabinet. The C.R.T. unit may then be removed. Take care not to damage the aluminium foil on the inside of the cabinet.

MARCONIPHONE VT59DA

Can you identify the trouble in my set ? It has sound but no vision. The C.R.T. is blank, although the heater is alight. There is a slight spark at the anode of V12(U151) and the anode of V11(N152), but there is no spark from the C.R.T. anode even when disconnected from the C.R.T.

I have checked the continuity of the windings of T3 and found them O.K., and the U151 has just been replaced.—D. MacBeth (Motherwell).

This symptom is indicative of failure of the line timebase. Make sure that the N152 is in good order and check that it is in receipt of anode and screen voltages. If the valve becomes very hot, suspect lack of oscillator drive signal (check line oscillator stage), or shorted turns in the line output transformer. This latter fault may not be revealed by a simple resistance check of the windings.

TRANSMISSION DETAILS

I wonder if you would be good enough to let me know the following :

1. The television waveform with front and back porch pulse periods chiefly.

2. Is the black 35 per cent. modification or 30 per cent. ?

3. Are the active picture elements still 377 x 377 x $\frac{4}{3}$ or 388 x 388 x $\frac{4}{3}$?

4. Is the back porch the beginning of a line or is it the front porch or negative leading edge ? Does flyback take place during 10 m.s. line pulse ?—H. Poolock (Sale).

From zero carrier amplitude to black level is 30 per cent. of the peak carrier amplitude.

The number of lines effective in the picture is 188.5 for each frame, and 377 per picture.

At the end of each line the modulation falls to black level and remains there for 1.5 to 2 micro-seconds (front porch) ; it then falls to zero and remains there for 10 micro-seconds (line sync). Then it rises again to black level and remains there for 6.5 micro-seconds; the picture signal then re-commences. The line flyback occurs during the line sync pulse.

PYE FV1

On adjusting the frame hold control, the height of the picture varies considerably, necessitating constant alteration of the height control when picture is unsteady.

Since the BBC started transmitting from Crystal Palace I have had a very grainy picture, and I can only just distinguish the 2.0 Mc/s bars on Test Card C. Is it necessary completely to re-align the receiver for single side-band working or is there a short cut ?

Is the A.G.C. system described in the October, 1954, issue of " Practical Television " (page 202) suitable ? This circuit only gives control on one I.F. stage, and my receiver has two controlling I.F. stages. Would it be practical to make one only a controlling I.F. and the other fixed ? Also, is sync sep.. etc., F.V.1 suitable for conversion in this way ? V1 and V3 (as per A.G.C., etc.) will be the existing EF80s in my set. Are the given values suitable ?—D. E. Andreoli (Ramsgate).

We would advise you to check the capacity of C14B (12 μF) connected from the " top end " of the frame hold control to chassis. We would also advise you to readjust the oscillator core slightly. This is the second core from the right side above the station selector screws.

A.G.C. may be applied to the final vision I.F. amplifier control grid circuit from the sync separator stage.

VIEW MASTER

I find that since fitting a View Master converter to my View Master TV that I cannot get a clear picture without a loud hum on the speaker and the sound going very faint. If I adjust C18 to get the sound without the hum, I lose the picture. The I.F. amplifier is O.K., as I have had this aligned by a friend on a signal generator, so the fault must be in the converter, but we are at a loss to find the trouble. Can you please advise us?—R. Squires (Birmingham).

Interference of the type you describe may occur close to a transmitter where the swamp signal is so great as to cause cross-modulation in the first valve. This can be overcome by fitting an aerial attenuator. We suspect, however, that it is your I.F. amplifiers which have been incorrectly aligned and you will probably find that if re-checked that the separation between the vision and sound I.F.s is not 3.5 Mc/s. We suggest that you carry out these checks and, if necessary, re-align the sound I.F. amplifier.

H.M.V. 1816

When the brightness control is advanced beyond a certain point, the screen begins to turn black. This effect happens when there is a picture on or when aerial is disconnected. The effect on the picture is to make it like the negative of a photograph. Voltage check on cathode of tube gives 70 volts ; on tube grid 67 volts. Then when brightness is advanced to bring picture or raster brighter, the black begins and grid-volt goes up to 90, cathode still at 70 volts. Test meter used, Taylor 88A. The tube heater is run from a multi-ratio transformer on 25 per cent. boost. On switch-off a very brilliant spot appears which takes quite a time to die away.—S. Dovey (Abercarn).

The U151 EHT rectifier should be changed. If still defective, check the video amplifier 5.6 KΩ load resistor (the reading of 70 volts on the cathode of the C.R.T. is the lowest reading which should be recorded and something like 80-85 volts is more normal).

BUSH MODEL TV24C

On switching on the sound comes through in the normal period, i.e., two to three minutes . . . about one

minute later the screen brightens, giving a blank, bright raster showing the flyback lines. This state of affairs continues for any period from five to 20 minutes, then the picture will appear, and this is of good quality, I may add, and sometimes remains so for the rest of the evening. On other occasions it will flick off and on all the evening. The sound is unaffected

I have fitted an isolating transformer since this fault developed, but this has had no effect on the fault. I have also replaced the two EB91 valves.—A. W. Powell (Via Warrington).

We would advise you to alter the tube base wiring as follows :

Remove A1 lead from tag 10 and insulate. Remove grid lead from tag 2 and solder to tag 10. Short empty tag 2 to tag 11 with short length of wire. Pins are counted according to the spaces, not to the actual number of pins fitted.

R.G.D. 1455T

The set is working O.K., but I cannot centre the picture. Also it has a faint white line running down the centre.—R. Brown (Coventry).

The picture-centring adjustment is located upon the focus magnet assembly. It is a small lever capable of side to side and in and out movement.

Some slight adjustment to the ion trap magnet may be necessary if some brilliance is lost as a result of the adjustment.

COSSOR MODEL 937

The above set has given excellent pictures until four weeks ago, when switching on no picture but lines appeared. I have to adjust the horizontal control each time I switch on to get a picture. Also, when picture appears you get three or four pictures slipping into one another horizontally. There is very little adjustment on the control, but once set, picture is O.K. until switched off and then on again. I have had a dealer to see it ; he has replaced the two rectifier valves and seems to have tested the other valves, but to no effect.—R. Ed. Williams (nr. Wrexham).

The V13, line-phase detector 6AB8 should be substituted. If this does not cure the effect, check the line oscillator 12AU7 and then change the 2.2 MΩ resistor which is associated with the horizontal hold and the grid circuit of the 12AU7.

ULTRA V8-15

This is giving me trouble with the picture definition ; also, when switching on the set, it takes 20 minutes before the picture comes to its full brightness. When switching on the picture just becomes a dull glow. When I turn the brightness or contrast up the picture becomes out of focus and grey.

The set is three years old. Do you think it is a tube fault ? At present the contrast is on a little more than the brightness, giving a decent picture. Have replaced the 6K25 that was faulty.—F. R. Mills (nr. Doncaster).

We would advise you to change the U25 EHT rectifier. This is mounted inside the right-hand screened section and requires soldering into position.

EKCO MODEL TC268/1

It is very noticeable that when dark or black parts of picture subjects such as black hair, dress suits, black horses, any dark parts of anything *moving*, a *blue* penetration is very noticeable on these dark parts, but usually only when moving. On a test card it isn't seen. It quite spoils a good picture.

My 21in. tube is about 2in. on each side " out of focus " ; is this not more than one should expect with this size tube ?—S. V. Bancutt (Shripney).

We can not, unfortunately, suggest a remedy for either of the imperfections you mention. A slight adjustment to the focus lever may help to provide better definition at the edges, but this should not be done at the expense of the centre point of optimum focus.

We are not too clear about what is meant by a " blue penetration " on moving objects. The effect could be due to the chemical make-up of the tube face, but we would advise you to call in your dealer to observe it and ask for his comments. Also, if possible, ask if you can examine the displayed picture on a similar receiver, in order to obtain a comparison.

MURPHY V.200

A month ago my set developed a short to earth on the E.H.T. condenser C39, causing the picture to go off. On replacing this I found that my set worked perfectly apart from the first 15 minutes after switching on, when severe line displacement to the left would occur. I suspected the sync pulse separator valve 20F2. I had the valve tested and was told it had an intermittent control grid to earth short. The valve was replaced only to find the severe line displacement lasted for only five minutes this time.

Checking the anode voltage of the above valve, I found that on the anode pin there was 160 volts.

Would it be possible, therefore, for the anode load resistor to have gone high or for the EHT rectifier EY51 to have suffered because of the breakdown of C39. —P. Garth (Leeds, 7).

We would suggest that you replace the *screen* dropping resistor of the sync separator (1MΩ). If the line displacement continues and is accompanied by de-focusing, suspect heater/cathode leak in C.R.T. If there is no de-focusing, check sync feed capacitor to 20F2 control grid.

MURPHY TV V250

This set was purchased in October, 1955.

A new EHT rectifier was fitted last spring. Now there are two disturbing faults :

1. The channel selector switch : Picture and sound instability on Channel 9 only, especially after switching from Channel 1.

2. C.R.T. : Low emission when first switched on, and lasting from one to five hours. Becoming worse. Any increase of brightness control produces the " satin " effect, but not negative image, during this " warming-up " period. Afterwards no trouble is experienced. When the low emission fault is seen the ion-trap seems not to function, i.e., switching off produces a " spot " in the centre of the tube face. —C. H. Tedman (S.E.6.).

The unstable Band III picture is probably due to improper connection between the contacts of the turret tuner. It is quite a simple matter to check this since the desired reception will be obtained a little before or a little after the normal switch position, i.e., between the " clicks." Adjustment to the spring contacts will cure this effect. Alternatively, the effect may be due to the aerial system which doesn't appear to be lined up to a reliable signal source.

The C.R.T. definitely appears to be failing and to preserve the emission as much as possible, ensure that the voltage selector is set to the actual mains voltage.

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News From the Trade

New Audio Output Valve—the G.E.C. KT88

A NEW audio output valve, the KT88, with an anode dissipation of 35 watts, has been introduced by the General Electric Co. Ltd. This valve is a higher-power version of the familiar KT66, although it is smaller in size. It does not replace the KT66, but is complementary to it for output powers in excess of those readily available from existing KT66 circuits.

An example of the usefulness of this new valve for public address equipment is that at a supply voltage of 500 volts, with auto-bias operation, the available power output is 50 watts or twice that obtainable from a pair of types KT66. At a supply voltage of 560 volts, with fixed bias operation, output power of 100 watts is available.

The KT88 has a larger cathode, allowing for a higher mutual conductance, and a more modern type of construction permitting the use of higher anode voltages and dissipations. It is designed for use mainly in a push-pull circuit and will operate satisfactorily as either a triode or a pentode. In the ultra-linear (UL) circuit satisfactory operation is obtained with the screen grids connected to tapping points including from 20 per cent. to 40 per cent. of the total turns of each half-primary.—G.E.C. Ltd., Magnet House, Kingsway, W.C.2.

Revised Price for G.E.C. 14in. TV Receiver

THE General Electric Co. Ltd. announces that the price of its 14in. table television receiver, (BT.1252, is now revised from 63 gns. to 57 gns. including P.T.).

	Previous List Price	*Previous P.T.*
B.T. 1252 14in. table model	£47 2s. 2d.	£19 0s. 10d.
	New List Price	*New P.T.*
	£42 12s. 5d.	£17 4s. 7d.

G.E.C., Magnet House, Kingsway, W.C.2.

Philips New 17in. Table Television

A NEW 17in. table TV receiver, the 1772U, has been added to their current range by Philips Electrical Ltd. It is styled in line with prevailing public taste and completes the "family" of Philips 14in. and 17in. TV models. It incorporates automatic gain control on sound and vision and sells at 73 gns. (tax paid). Supplies are available ex-stock.

Specification

Mains voltage : 200-250 v. A.C. (50 c/s) or D.C. *Consumption :* 150 w. *Picture Size :* 14 x 10½ ins. *E H T Voltage :* 12 kV. *Focusing :* Permanent Magnet (Magnadur) *Speaker.* 5in. round. *Channels :* Coils fitted for Channels 1-5 (Band I) and Channels 8, 9 and 10 (Band III). *Main Controls :* Concentric on/off volume and brightness controls. NEW ERA turret tuner switch with concentric fine tuning control. *Pre-set Controls :* Height, width, horizontal and vertical hold, contrast and interference limiter. *C.R. Tube* MW43/64. *Valves:* EF80 (4), ECL80 (3), PCC84, PCF80, EBF80, PL81, PY81, PY51, EB91, PY32. One crystal diode OA70. *Cabinet size :* Height 21½in. Width 19in. Depth 17in. *Price :* List £54 11s. 8d. Plus PT £22 1s. 4d.—Total 73 gns.—Philips Electrical Ltd., Century House, Shaftesbury Avenue, W.C.2.

Ediswan Mazda Transistors

THE first complete range of metal clad transistors to be released in this country is now being manufactured in the new Ediswan Transistor Department.

The rigid construction of these transistors incorporates a strongly welded metal to metal seal, which renders them completely impervious to moisture penetration even with high humidity at high temperatures.

A highly important advantage of the all-metal "top hat" construction is the excellent thermal conduction which can be obtained through the metal envelope thus enabling full use to be made of a "heat sink." This heat dissipation is particularly important for power output transistors since, in the absence of sufficient heat conduction, the temperature may rise continually, resulting in "thermal run away."

Ediswan Mazda are manufacturing a complete range of transistors under the following type numbers :

Type		Application
XA101 ...	...	I.F. amplifier
XA102 ...	...	Frequency changer/oscillator
XB102 ...	...	Intermediate L.F. stage
XB103 ..	...	Intermediate L.F. stage
XC100 Series	...	Matched pair for push-pull output

—Edison Swan Electric Co. Ltd., 155, Charing Cross Road, W.C.2.

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