Whiting

BOOSTING E.H.T. SUPPLIES

PRACTICAL TELEVISION

AND TELEVISION TIMES

1/-

EDITOR
F. J. CAMM

A NEWNES PUBLICATION

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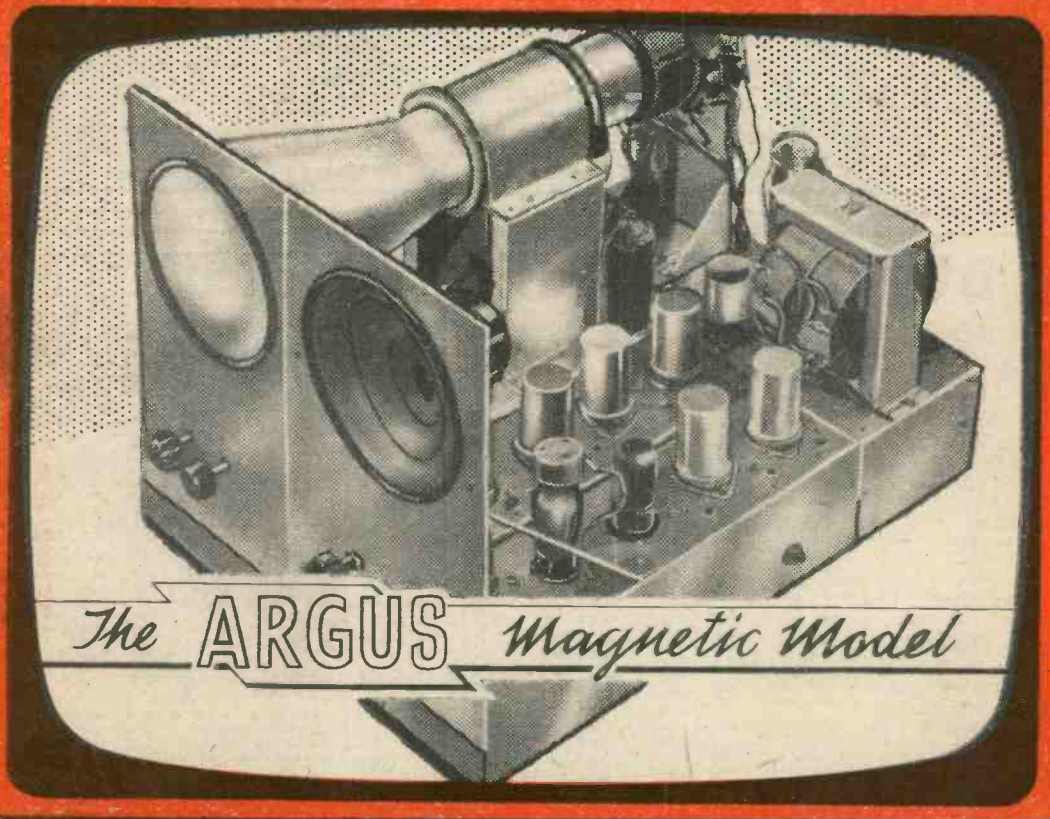
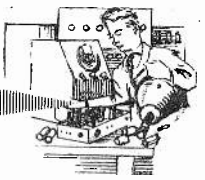


FEATURED IN THIS ISSUE

Practical Television



& TELEVISION TIMES

Editor : F. J. CAMM

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Televiews

COMMERCIAL TV

ALTHOUGH we are promised commercial TV programmes this year, it is obvious that the Independent Television Authority will be handicapped by lack of high-powered transmitters for some time. The service is expected to begin either in September or in October, and at first it will provide a service for about a quarter of the viewing public living in the metropolis and at present served by the Alexandra Palace transmissions, and for about one-sixth of those served by the Crystal Palace Transmissions, which are likely to commence at the end of next year.

Not until the new BBC equipment is installed at Crystal Palace will I.T.A. be able to use the same mast, and the latter until that time must use the temporary transmitter at Croydon. This is of comparatively low power and the coverage will be limited in general to the boundaries of the Metropolitan area in the north and south and slightly beyond that area to the east and west.

The I.T.A. transmissions will be on a higher frequency in Band III and, therefore, viewers will need a second aerial. It is said that these may cost between £15 and £20. Thus, those who wish to view the BBC as well as the I.T.A. transmissions must have two aerials, and this will introduce switching arrangements so that one aerial can be cut out. The installation of two aerials in one building will introduce complications if interaction is to be avoided.

THE COST OF COMMERCIAL TV

ACCORDING to an advertisement issued by a well-known radio dealer commercial television will cost the advertiser about £1,000 a minute. This advertisement also contains the following statements : "This is the estimated cost to the advertisers of providing the commercial TV programmes ; the service will be scheduled to start about September 1st, 1955 ; the first London Area Transmitter is due to be erected at Beulah Hill early in 1955 ; the situation of the new station should give very favourable reception in the Croydon area ; the station will operate on Band III and you will not be able to enjoy these programmes unless your television receiver is either a new multi-channel model or has been fitted with a converter ; in many cases it will not be practical to fit converters to receivers more than four years old ; in the case of 9in. and 10in. receivers of this age or more, the conversion may be uneconomic ; there are approximately 38,000 TV licences issued in the Croydon area. If we assume 5 per cent. without licences, this means 40,000 sets in use. Not more than 2,000 are likely to be multi-channel models ; this leaves 38,000 conversions or replacements to be provided in nine months if everyone wants to see the opening of the new service ; *this is impossible !* We estimate that, converting 25 sets per week, it would take us three years to modernise the sets we have actually sold, even assuming that the converters are available."

OUR ANNUAL INDEXES

MAY we remind readers that a volume of this journal comprises 12 issues, from June to May inclusive. At the end of each volume we publish an index which may be obtained from our Publishing Department for 1s.

Arrangements have been made for Messrs. Hazell, Watson and Viney, of 52, Long Acre, London, W.C.2, to undertake the binding of your issues in complete volumes with the appropriate index. If you are desirous of having your issues bound, Messrs. Hazell, Watson and Viney will be pleased to let you have a quotation for the work on receipt of an inquiry. Those readers who prefer to have their copies bound by a local bookbinder can obtain not only the above-mentioned index but also an index for any previous volume from us direct.

Whether you have your issues bound or not, you will find it convenient to possess indexes of all our volumes. These should be kept in a folder, so that particular information can be conveniently traced without having to handle the loose copies.

—F. J. C.

Converting the "Argus"

CONSTRUCTIONAL DETAILS FOR CONVERSION TO MAGNETIC C.R.T.

THE details which have been given for a magnetic version of the Simplex (our £16 televisor) have aroused great interest, and many constructors of the original Argus televisor have asked if the data can be used to convert their own electrostatic televisor, so that it can be used with a magnetic C.R.T.

The answer is yes! The details given in the November, December and January issues of PRACTICAL TELEVISION, for the conversion of the Simplex, can be used for the Argus, after a few simple modifications to the existing Argus timebase.

Now while the timebase of the Argus is somewhat similar to that of the Simplex, the chassis layout is rather different; removal of the electrostatic tube does not allow sufficient room for the fitting of a magnetic tube, together with the timebase amplifiers, and it is considered that the tube and amplifiers should be built on a separate chassis.

Constructional details of a suitable chassis are given in Fig. 2 and the dimensions have been so arranged that it can be fitted above the existing Argus chassis if desired, connection between the two being made by use of angle iron.

By this method the completed televisor forms a double-decked unit which can be used as a console model if desired.

Like the magnetic version of the Simplex, a 9in. or 12in. C.R.T. can be employed, and as grid modulation is used it is possible to obtain satisfactory pictures with a tube having a cathode-heater short circuit.

Design Notes

It is necessary to have the data for the conversion of the Simplex; this data was published in the November and December, 1954, issues of PRACTICAL TELEVISION and also in the January, 1955, issue.

The basic principles of the conversion are that the existing timebase is retained almost in its entirety; an amplifying stage for the frame circuit and line circuit, complete with power supplies and C.R.T. network is constructed on a separate chassis

With electrostatic tubes, the electron beam within the tube is deflected by a sawtooth voltage applied to the deflector plates With an electromagnetic tube the beam is deflected by sawtooth currents through the deflector coils. In the former case we require a voltage amplifier and we use paraphase amplification: in the latter case we require power amplification and so we employ power output valves. Moreover, as a much higher E.H.T. is used in the electromagnetic tube, a much greater power is required to swing the beam than is necessary with the smaller tube.

For the vertical scan (the frame circuit) we feed the output of the frame oscillator from the Argus timebase into a 6V6 power output valve. For the horizontal scan even more power is required, and so a special valve (an EL38) is used for amplification.

The magnetic version of the Simplex has proved to be very suitable for conversion from electrostatic to magnetic working, and hence the main features of the design have been employed for the conversion

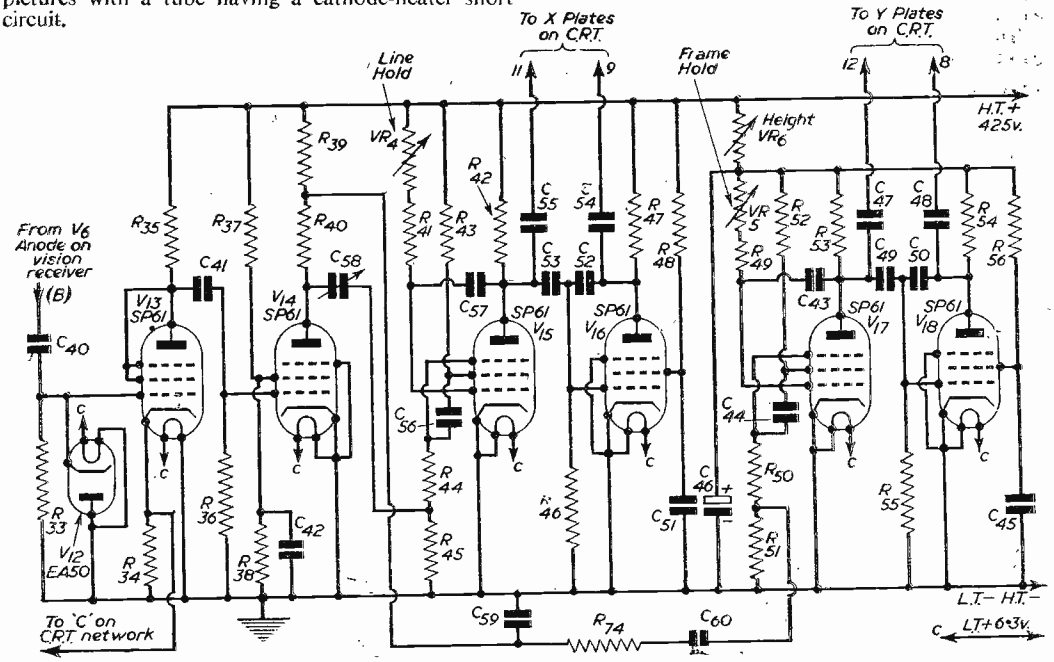


Fig. 1.—The original timebase circuit.

of the Argus. All that is necessary is to modify the existing timebase of the Argus as given here, and then to follow the instructions for the magnetic Simplex for the last two stages, i.e., stage V (M) and Stage VI (M).

The outputs from the Argus timebase are taken to the new chassis via coaxial cable links.

Modifying the Argus Timebase

The modifications required are very simple. In the frame circuit some component values are altered a little, and the paraphrase amplifier valve V18 and associated components are removed.

In the line circuit similar slight alterations are made to the line oscillator and the paraphase amplifier V16 and associated components are removed.

The first step is to remove the C.R.T. and supports ; the tube base and E.H.T. network ; the E.H.T. transformer and rectifier valve ; and all components of Fig. 11 of the original Argus data (reproduced on page 00).

Argus Frame Circuit

Modify as follows :

Change R53 to 47 K. 1 w.

Add an 0.01μF condenser across C43.

Change C44 to 0.005μF.

Use C47 to feed the new frame output valve.

Remove V18 and then Cs 45, 48, 49, 50 ; Rs 54, 55, 56.

The output side of C47 is connected to the centre conductor of a short length of 80 ohm coaxial cable, the outer sheath of which is earthed.

The far end of the coaxial cable is terminated in a plug.

Line Circuit

Connect a 100 pF across C57.

Change R42 for 100 K. pot., carbon.

Disconnect C55 and replace by an 0.002μF.

Remove V16 and Cs 51, 52, 53, 54, 55 ; Rs 46, 47, 48. (Note if R56 has been increased to increase width then reduce it to 100 pF.)

In place of the V16 valveholder insert an I.O. and wire up for a 6SN7 valve. This circuit should be wired as shown in Fig. 3, page 265, November issue of PRACTICAL TELEVISION.

The complete timebase of the Argus should now appear as in this figure.

The far side of CM17 is connected to the centre conductor of a length of coaxial cable, the outer sheath of the cable being earthed. The far end of the cable is terminated in a plug.

The final re-arrangement is to connect the cathode side of R34 (Fig. 6 of the original Argus data) to the centre conductor of a length of coaxial cable, the outer sheath of which is earthed, the far end being terminated in a plug.

The new chassis can now be constructed as given in Fig. 2. At the left rear will be mounted the three preset controls VRM2, 3 and 4, and on the right, three sockets for the corresponding connections to the Argus timebase.

From this point the constructor should follow the details for the Simplex magnetic model, starting from Stage IV (M) on page 293, December, 1954, issue of PRACTICAL TELEVISION.

There is only one point of difference and that is the connection of a 47 K. resistor between the magnetic C.R.T. grid and earth on the new chassis.

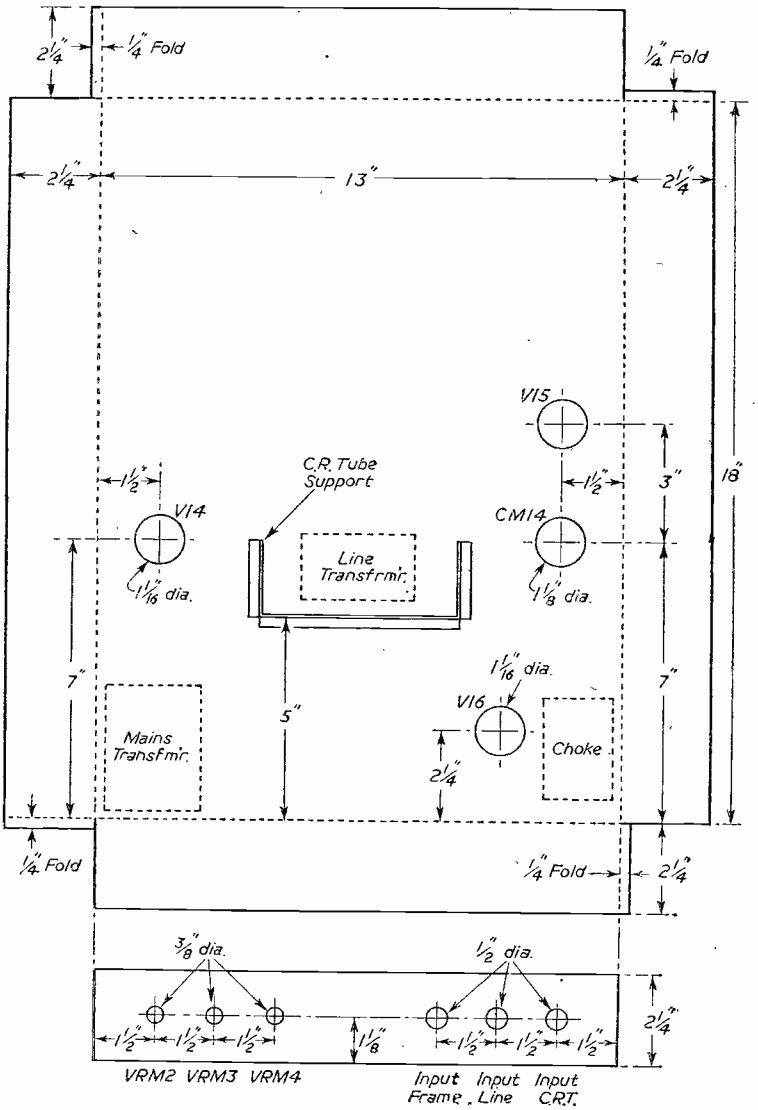


Fig. 2.—Details of the new chassis and position of various parts.

The "View Master"

SOME PRACTICAL OVERHAUL HINTS

By P. Green

THERE must be thousands of "View Master" sets now in use that have been working for a period of two or three years, and now require an overhaul. A few practical hints from one who has made a success of his overhaul might be of use to other PRACTICAL TELEVISION readers.

My set, a 12in. model, constructed for Sutton Coldfield, has now been in use nearly five years. Changes have been made from time to time, and when Holme Moss began operating modification had to be made to the coils. After some consideration it was decided to change seven coils only, and extra turns were wound on the coils as shown by Fig. 1, 27 s.w.g. wire (S.S.C.C.) being used. With care it takes two hours to do this job, and proves satisfactory.

Other changes carried out were as follows. The 2 μF condenser C42 was replaced by a 2 μF paper condenser, as the aluminium leads with pressed-on tag ends of C42 soon gave trouble. The 3.3 MΩ resistor R21 was replaced by a $\frac{1}{2}$ watt rating, as the specified resistor soon goes high; both gave symptoms of picture slipping. For best adjustment to picture linearity, modifications were carried out as described in PRACTICAL TELEVISION several times, viz., R46 reduced in value to 47 KΩ and connected in series with a .1 MΩ wire-wound variable potentiometer mounted on a small bracket at the rear of the set, near to the valve V9.

Replaced Condensers

The present modifications have just been carried out with very satisfactory results. The set was removed from the cabinet and the following condensers replaced: 1 μF C32; .001 μF high voltage C45; .015 μF C49; 250 μF C51; 100 μF C53 and C54; 2,500 μF C55. The 6D2 valve was also replaced. The four timebase valves were replaced twelve months ago. Then with a heater auto transformer (Radiospares) and a filament rheostat of good quality, a "brightener" was made, as shown in Fig. 2. The 6.3-volt tube heater leads were cut at a suitable point ready for connecting to the terminals. The 4-volt taps of the transformer were taken to one pair of terminals, the other pair of terminals were connected in series with the rheostat and the outer 6-volt taps on the transformer. A pointer was fitted to the rheostat, to enable calibrated voltage positions to be indicated on the vulcanite panel. Using an A.V.O., markings were made at 6.3, 7, 8 and 9 volts. The "brightener" was now connected in circuit, and the set switched on. Adjusting to 7$\frac{1}{2}$ volts, I had a greatly improved picture, but same was out of focus.

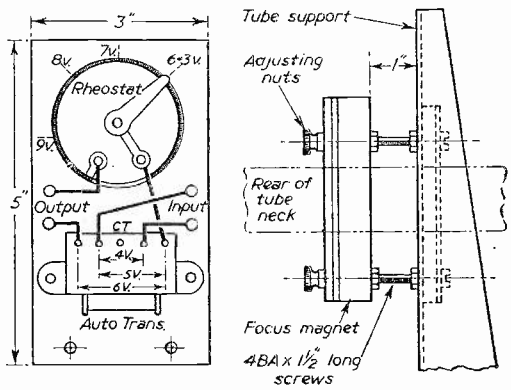


Fig. 2 (left).—Details of a brightener, and Fig. 3 (right).—the focus assembly.

Focus Magnet

After so much use, the focus magnet must have deteriorated, so there was only one thing to do, viz., try moving it. The C.T. tube was slowly moved outwards, and it was found that at a point 1in. from the original position the picture came back into focus. The tube was now removed, to enable modifications to be carried out for the new position of the focus magnet 1in. to the rear. The three short screws were replaced by No. 4 B.A. × 1$\frac{1}{2}$in.-long cheese-head brass screws. Six nuts were required, two on each screw—one for locking the screws in position on the tube support, and the other for locking the focus magnet in position, see Fig. 3. Care must now be taken in removing or replacing the tube, as greater leverage can be exerted on the neck of the tube due to the new position of the focus magnet. The tube was now replaced and a try-out began. After a few adjustments to the focus magnet screws, a perfect picture was obtained. The results are so good we can even view with the room lights on.

Here's hoping for a few more years' service from the old tube.

I suggest that all TV sets should be fitted with extension sockets for sound, as one finds there is often someone in a family who is hard of hearing. I have fitted, in a convenient place, a jack socket; connections to which are taken from the speaker tranformers. A low-resistance phone is used as the hearing aid. This socket can also be used for connecting a tape recorder.

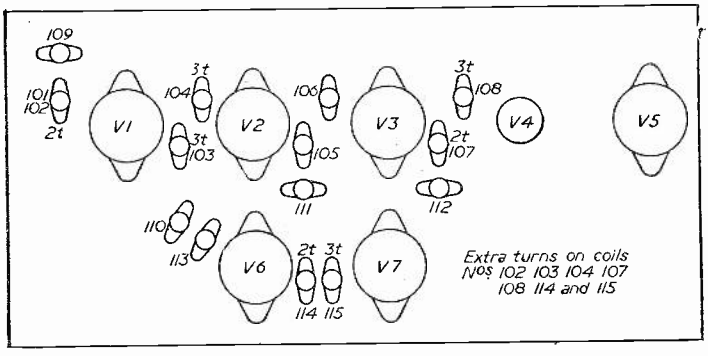


Fig. 1.—Layout of vision and sound sections.

BOOSTING THE E.H.T.

SOME METHODS OF INCREASING THE NORMAL E.H.T. SUPPLY

By "Erg"

MODERN cathode-ray tubes require a greater E.H.T. than their predecessors and while it is possible to use one of these tubes, requiring up to 9 kV, on an older television receiver which previously used a tube giving about 6-7 kV, some of the advantages of the newer tube are lost ; further, it is always advisable to operate a C.R.T. as close to the manufacturer's rating as is possible.

There are several methods of boosting the E.H.T. supply. The actual method employed will depend largely upon the circuit arrangements of the televisor and it is obvious that we cannot give details for all makes. However, it is possible to describe some of the general methods which can be employed.

Although modern technique employs, in the main, the line flyback pulses for generating E.H.T., there are still some receivers which use mains transformers. In some respects this sort of supply is superior as the regulation is good and the E.H.T. is entirely independent of the line circuit.

By " regulation " we mean the ability of the supply to retain the voltage irrespective of the load. With flyback sources of E.H.T. the regulation is comparatively poor as any excess load will immediately cause the voltage to drop. The result is that where regulation is rather poor, the peak whites of the picture will go out of focus, the condition being known as " defocusing on whites."

An advantage of poor regulation is that if an accidental contact is made with the supply, the voltage drops considerably until it reaches what is termed a " safe " figure. The result, where accidental personal contact is made, is that a severe shock may be felt but the shock is in no way dangerous as the voltage drops immediately.

With mains-supplied E.H.T. the regulation is good, the voltage does not drop so rapidly and such circuits should be treated with great respect. (Incidentally, it is an axiom for the service engineer when handling such circuits, to keep one hand in his pocket to avoid a dangerous shock across the body from one hand to the other.)

Boosting Mains E.H.T.

A standard circuit of mains supply E.H.T. is given in Fig. 1. A bleeder network is always used as, because of the low mains frequency, large smoothing condensers are necessary and these hold a considerable charge. When the mains is switched off the bleeder discharges the condensers. Note that when dealing with a mains supply E.H.T. circuit, it is wise to allow a minute or so for the condensers to discharge before handling the wiring, etc.

The circuit shown will give a supply of 5-7 kV according to the output of the transformer. It is possible to double this output simply by using a voltage doubler arrangement.

The circuit is shown in Fig. 2.

The original valve is retained and an additional E.H.T. rectifier (a K3/100) is inserted. If one side of the E.H.T. winding is connected to the core then this should be removed and, in order to safeguard the transformer, the transformer should be isolated from the chassis by mounting it on insulating blocks.

Although the regulation of the E.H.T. supply thus obtained will not be as good as it was previously, it will be quite good enough for the purpose and defocusing on whites should not be experienced.

Adding a Transformer

A second method of increasing E.H.T. is to add a second E.H.T. transformer so that the two E.H.T. voltages are additive. The circuit is given in Fig. 3.

T1, V1, R1, R2, C1 and C2 form the original E.H.T. supply. V1 may be a valve or selenium rectifier.

The output voltage will vary according to the transformer but in this case we will take it as being about 5 kV.

A second transformer T2 is now added, its output depending upon the desired E.H.T. voltage. If, say, 10 kV is required then T2, V2, C3, C4, R3 and R4 will duplicate the original circuit. If a smaller E.H.T. is required, say, 7.5 kV then T2 must supply 2.5 kV.

In the latter case it is practicable to use one of the transformers designed for an ex-Govt. tube, such as the VCR97, as these can be obtained very cheaply.

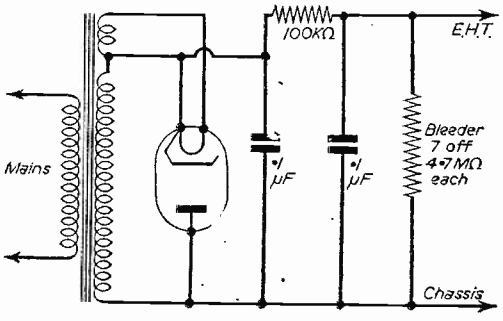


Fig. 1.—A standard mains E.H.T. circuit.

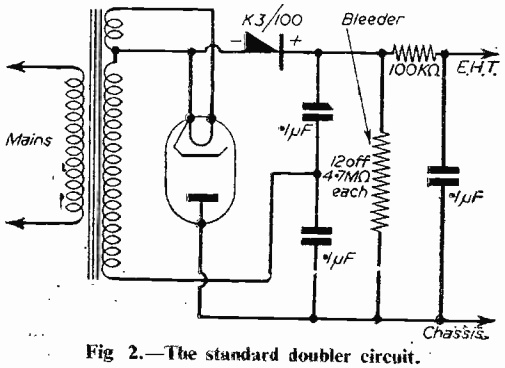


Fig 2.—The standard doubler circuit.

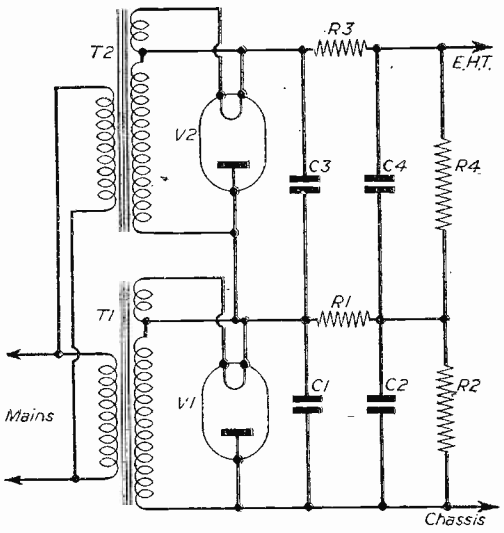


Fig. 3.—A doubler circuit using two transformers.

It is important, whatever the type of the transformer, to insulate the core from the chassis.

C3 and C4 should be 0.1μF, the working voltage being that of the transformer output. In the case we have quoted C3 and C4 will have to be rated at 2.5 kV.

R2 should be 47 KΩ minimum, and R3 a bleeder network comprising six 470 KΩ1 watt resistors mounted on a panel, well insulated from the chassis. The network is essential, and must not be omitted under any circumstances.

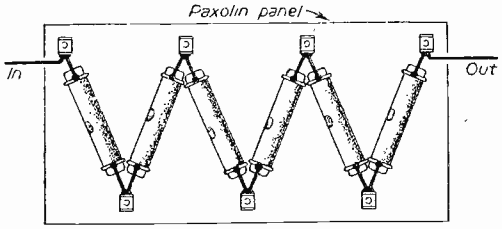


Fig. 4.—Arrangement of the bleeder resistors.

The resistors can be mounted on a paxolin panel in zig-zag formation as shown in Fig. 4.

A table of the SenTerCel selenium rectifiers with their operative voltages is given below :

K3/25	650 volts.
K3/40	3.2 kV
K3/45	3.6 kV
K3/50	4.0 kV
K3/100	8.0 kV
K3/160	12.8 kV
K3/180	14.4 kV
K3/200	16.0 kV

A suitable valve rectifier is the SU2150A (service equivalent VU120) which will handle up to 5 kV.

Adding Flyback E.H.T.

Where a transformer is supplying the E.H.T., it is possible to supplement it by adding E.H.T. obtained from the flyback at the anode of the E.H.T. rectifier. The circuit is quite straightforward and is given in Fig. 5.

A condenser rated at 0.001 μF 3 kV working is connected to the anode of the line output valve : on the line flyback a pulse of 2-3 kV appears at this anode. The pulse is rectified by the K3/50 rectifier and is added to the existing transformer supply.

The components in the flyback circuit should be mounted well clear of the chassis.

Flyback E.H.T.

Most modern receivers employ the flyback pulse for E.H.T. A typical circuit is shown in Fig. 6.

The simplest method of supplementing the voltage in this class of circuit is by a voltage doubler. This is shown in Fig. 7.

The existing E.H.T. is taken via the resistor R to the anode of the additional rectifier valve V2, and the anode of this valve is connected via C1 to the anode of the existing rectifier valve. E.H.T. is taken from the cathode of V2.

A major difficulty with this circuit is the heater supply for V2, which must withstand a potential equal to the E.H.T. voltage.

An ordinary heater supply transformer can be adapted by taking off the heater winding and applying a wrapping of oiled silk (about five complete turns) to the exposed primary layer. The heater windings are then replaced, care being taken to ensure that the ends of the windings are kept clear of the primary and the core.

The output of the heater transformer should be that of the valve heater. Where the popular EY51 rectifier is employed the voltage should be 6.3 volts.

It is not necessary to use a valve, as a selenium rectifier can be employed. The circuit is given in Fig. 8, which is a duplicate of Fig. 7, except that V2 is replaced by the selenium rectifier.

This rectifier should be rated at the existing E.H.T. supply voltage.

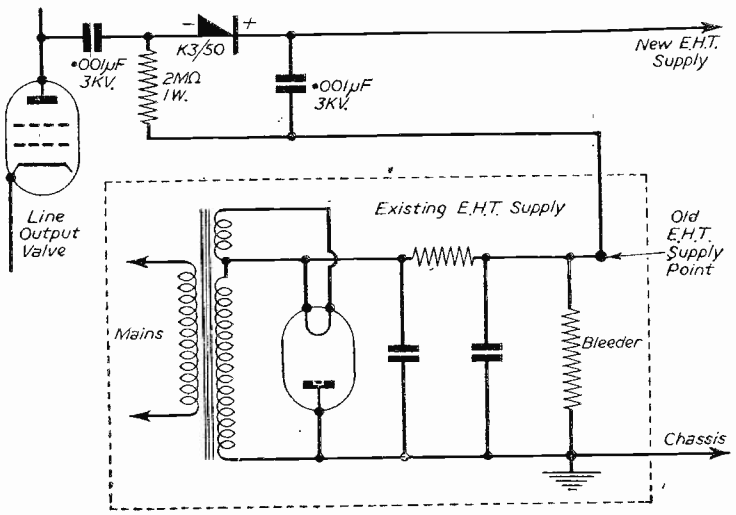


Fig. 5.—A typical flyback E.H.T. circuit.

Note that in each case C1 is rated at the working voltage of the existing E.H.T. and C2 at twice this voltage.

R in each case is six 1 MΩ resistors, mounted as shown in Fig. 4.

Yet another circuit which can be used is to add the flyback at the anode of the output valve to the flyback obtained from the overwind section of the line output transformer.

A typical arrangement is shown in Fig. 9.

Increasing Timebase Power

It should be noted that in all cases an increase of E.H.T. means that more power is necessary in the timebases or the picture will be much too small.

In most cases there will be sufficient power in the frame timebase to allow full vertical scan to be obtained by simply readjusting the height control. Some adjustment to vertical linearity may be required.

The line timebase, however, may not have enough power to scan fully the width of the mask. In this case the first thing to do is to reduce the value of the screen feed resistor. It should not be made too small or the screen will become red-hot and the valve will be damaged.

A second method is to reduce the value of the cathode resistor which feeds the line output valve, but once again care must be taken not to overload the valve, or to introduce non-linearity in the line circuit.

A third method is to increase the value of the decoupling condenser in the line output cathode circuit, but here great care is necessary to avoid, non-linearity.

To improve the overall drive it is possible to increase the timebase H.T. rail voltage. A supplementary supply is derived from a separate transformer and is added to the existing supply as shown in Fig. 10.

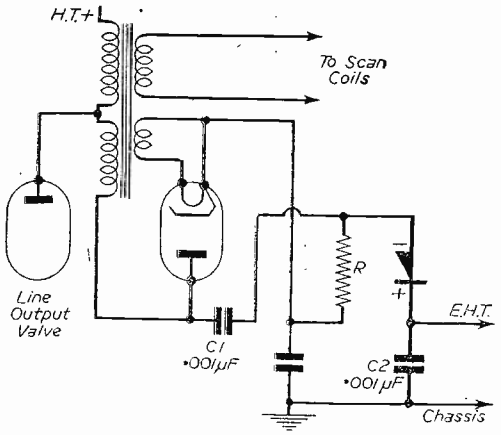


Fig. 8.—An E.H.T. doubler (flyback) with selenium rectifier.

The maximum voltage so obtained will depend upon the rating of the valves and, generally, should not exceed a total of 350 volts.

In some cases it will be possible to increase the drive of the line output valve by use of an economy or recovery diode. This circuit recovers the energy of the line flyback in the scanning coils and uses it to boost the drive of the line output valve.

A typical circuit is given in Fig. 11. C is rated at 50 μF 50 volt working and the rectifier RM is a Westinghouse 14D36.

When employing this circuit it is essential to disconnect any circuit arrangements used for damping the flyback, as it relies on the overswing of the flyback for its operation.

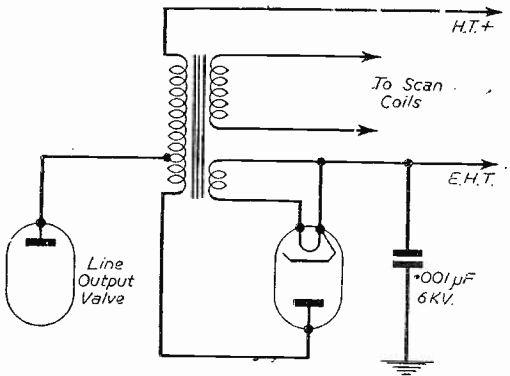


Fig. 6.—Typical flyback E.H.T. circuit.

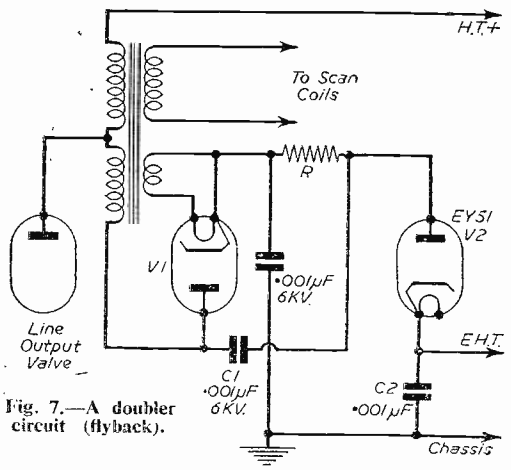


Fig. 7.—A doubler circuit (flyback).

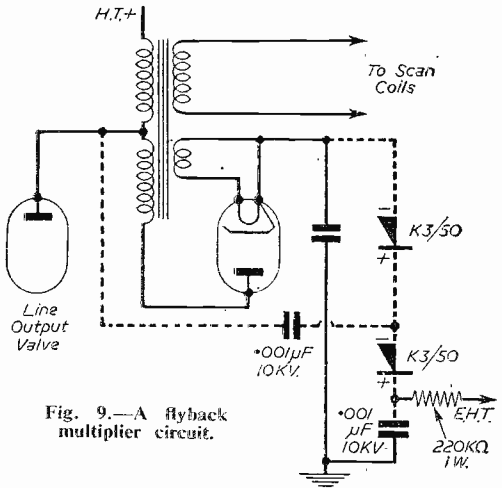


Fig. 9.—A flyback multiplier circuit.

Note carefully the direction of positive and negative of both the rectifier and the electrolytic condenser.

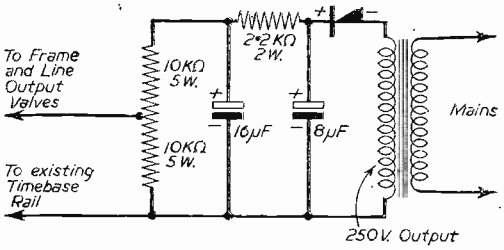


Fig. 10.—A supplementary mains E.H.T. supply.

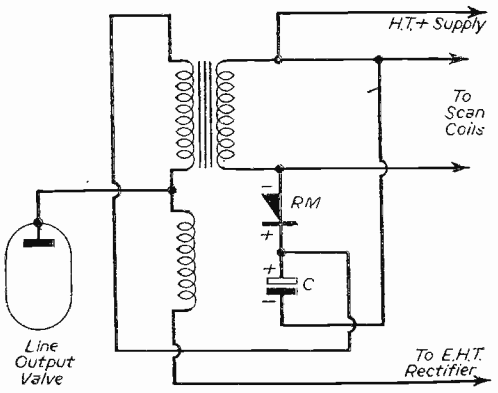


Fig. 11.—A recovery diode circuit.

Conclusion

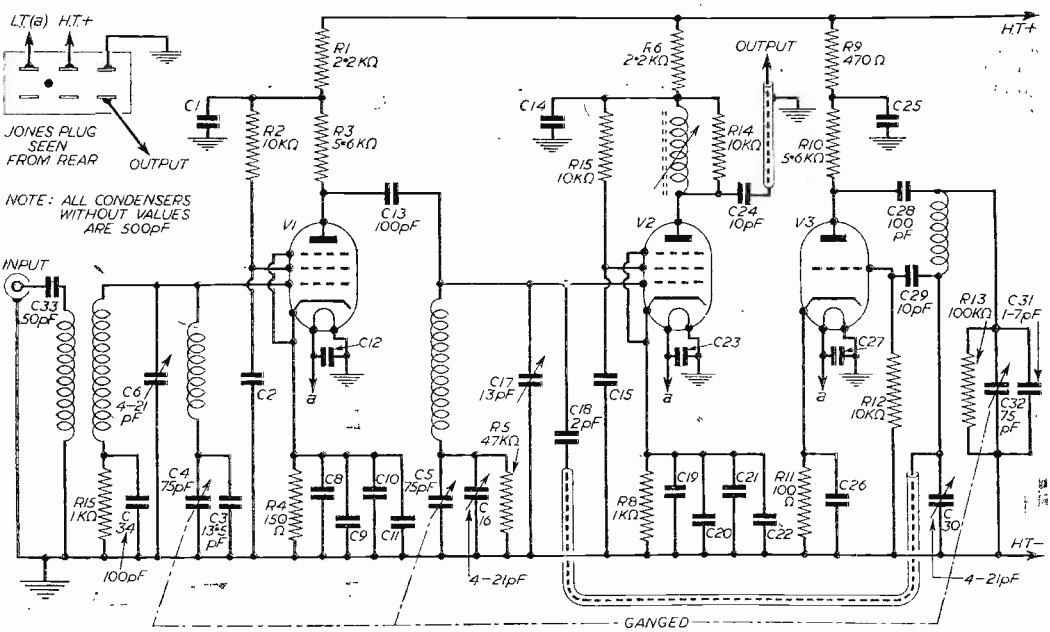
It will be appreciated that it is not possible to specify the best method for any particular make of television receiver, owing to the multiplicity of the circuits now in use. However, it should not be difficult for the constructor to decide, from the data given, the method which is most easily applied to this own particular needs.

RF Units 24, 25, 26 and 27

IN our last issue we dealt with the use of the above units for television reception. Reference was made to R.F. Unit No. 26, but the circuit (Fig. 4) was not included in the issue. In response to many enquiries we give the circuit of this unit below, with all values marked, but must point out that we cannot undertake to inform individual readers of a source of supply. We would have to contact various advertisers, and having found one with suitable stocks, by the time we had informed the reader and he had sent off, the stocks may have been disposed of. We can, therefore, only suggest that readers study the advertisements for suitable stockists, but these units are in great demand and stocks are very variable.

Condensers

A word of warning may be repeated here concerning not only the R.F. units, but all similar ex-Government radio apparatus. The tubular paper condensers fitted in these units have now been in position for some years, and the conditions under which the units have been stored is unknown. When these condensers are used for coupling or decoupling a leakage will almost certainly lead to trouble. Unless a good bridge with power factor measurements is available for test purposes, it is a sound axiom to remove all paper tubulars from such apparatus and replace by new components of reputable make.



Circuit of the R.F. unit No. 26, referred to as Fig. 4 in the article on RF Units on page 408 of last month's issue.

The Cathode Follower

ITS PROPERTIES AND USES, AND DESIGN PROCEDURE

By Hugh Guy

Introduction

IN this article it is proposed to examine the functions of the very widely used cathode follower circuit, and to show how it may be used in a variety of different ways, thus enabling experimenters to design their own circuits incorporating this useful arrangement where applicable.

Many would-be designers often feel a trifle frustrated when they wish to depart from component values specified in a particular circuit merely because they lack the know-how when it comes to rearranging them to their own liking or convenience. The rule "It's easy when you know how" could not be more true in this particular case, provided that one or two elementary rules are not overlooked, and since the cathode follower is such a very useful electronic tool the process is laid out below.

The Circuit

The invention of this arrangement is generally attributed to one of Britain's leading "back-room boys," Blumlein, who lost his life on a radar test flight during the war, and it is interesting to note that such a useful circuit requires only three components in its simplest form.

Why "cathode follower"?

Well, the secret lies in its name. It is common knowledge, of course, that in a valve application of a negative-going signal to the control grid causes the anode current to decrease. Thus in the normal amplifying stage shown in Fig. 1 the decreasing anode current through the anode load causes the anode potential to rise towards the H.T. potential, and this same current through the cathode load causes the latter potential to fall. Summarising, a negative signal on the grid causes the anode to go positive and the cathode to go negative; that is, the cathode "follows" the grid. This is all rather obvious and at first glance a little puerile, but let us examine the process more analytically.

If we take our output from the cathode rather than from the anode as in a conventional amplifying stage we can dispense with the anode load R_L and this just leaves us with the circuit in Fig. 2.

From this an immediate disadvantage of this circuit becomes apparent. We can see that the input voltage is the sum of the voltages Eg (appearing between grid and cathode) and Ek, the output voltage appearing across the cathode load Rk. This means, of course, that the output voltage is always less than the input voltage and hence the gain $\frac{Ek}{E}$ is less than one.

This apparent snag, however, is well compensated. Before we can go any farther we have to make use of an established relation within the valve which tells us what happens when we vary the voltage on the grid. The mutual conductance or Gm is the parameter we require, since this ties up anode current variations with grid voltage swings, for any given anode voltage. For example, a valve having a Gm of 5 mA per volt would have an anode current change of 5 mA if we changed the grid potential by 1 volt. This change in anode current flowing through the cathode load Rk produces a voltage change equal to the product of current and resistance—just Ohm's Law. This information is all that is utilised in the analysis of the cathode follower. Admittedly we have neglected one or two things, such as the effect of the Ra of the valve, but the influence of such extras modifies the result to such a small extent that their omission is fully justified.

Having written the procedure in words, let us have it in figures, and so tie it all up with one or two simple formulæ. The output voltage Ek is the product of the anode current Gm Eg and the cathode resistor Rk.

Thus $Ek = Gm\ Eg\ Rk$

But $E = Eg + Ek$

and substituting for the value of Ek in the first line,

$$E = Eg + Gm\ Eg\ Rk$$
$$= Eg\ [1 + Gm\ Rk]$$

Then the stage gain G is :—

$$G = \frac{Ek}{E} = \frac{Gm\ Eg\ Rk}{Eg[1 + Gm\ Rk]} = \frac{Gm\ Rk}{1 + Gm\ Rk}$$

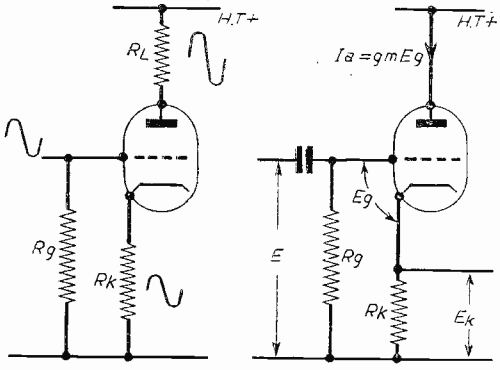


Fig. 1 (left).—Resistance-loaded amplifier with cathode bias. Fig. 2 (right).—Cathode follower.

If we rearrange this formula slightly we obtain another important result.

Dividing top and bottom lines of the fraction by Gm gives :—

$$\frac{Ek}{E} = \frac{Rk}{\left[\frac{1}{Gm} + Rk\right]}$$

showing that

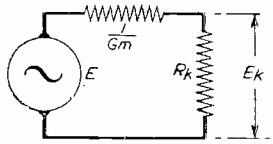
$$Ek = \frac{Rk}{\left[\frac{1}{Gm} + Rk\right]} \times E$$

We can therefore draw the equivalent circuit of the cathode follower as in Fig. 3, which shows a generator or signal source providing an output E

to a load Rk through an output impedance $\frac{1}{Gm}$. If, in fact, the output voltage appearing across Rk is calculated it will be that given above.

Thus the output impedance of a cathode follower may be said to be 1/Gm, and this is much less than the output impedance of a conventional anode-loaded amplifier as can be seen if we reconsider the value of Gm stated earlier, viz., 5 mA/v. A valve with this Gm as a cathode follower would have an output impedance of approximately 200 ohms.

It is this property that makes the cathode follower such a versatile instrument in such devices as valve-voltmeters, cathode ray oscilloscopes, and output stages of, say, pre-amplifiers feeding equipment over long lines, etc.



$$E_K = \frac{Rk}{\left(\frac{1}{Gm} + Rk\right)} E$$

Fig. 3. — Approximate equivalent circuit of cathode follower $Zo = \frac{1}{Gm}$.

In fact wherever the effects of stray capacity are likely to become apparent due to the latter loading the output, then the cathode follower is the circuit generally used to overcome the difficulties.

A practical example illustrates this very well: Imagine that we wanted to examine the waveform appearing at the anode of the valve driving the C.R.T. in a television set; that is, the video output stage. Here the signal contains picture information of all frequencies up to, say, 3 Mc/s. Because of the inherent stray capacities appearing across its terminals connecting an oscilloscope directly from anode to earth of this stage would seriously load the output, resulting in a shunting to earth of the high-frequency components of the signal.

Connecting a cathode follower in circuit as a buffer amplifier, though resulting in a uniform reduction in signal level, does not present any appreciable load to the stage in the way of stray capacities. These "strays" are in fact less than those associated with a normal triode amplifier and by careful wiring can be made negligible. Furthermore, the output can now be taken down a relatively long piece of screened wire, (which in itself may have a very high stray capacity), to the 'scope which can now be located more conveniently away from the TV set in question.

How then do we go about designing a simple cathode follower which can be used for such a purpose?

Design Procedure

Obviously the best results are obtained using a valve with a high Gm. On the other hand, however, we do not want a valve which gives this high Gm at the expense of a large anode current. Choose, for example, the Mullard valve EC91. In tables this is quoted as having a Gm of 8.5 mA/v for an anode voltage of 250 volts and an anode current of 10 mA at a grid voltage of −1.5 volts. The simplest design would use the cathode load as the bias resistor as well. Hence to produce 1.5 volts across a resistor by passing 10 mA through it requires a resistance of 150 ohms. We now know the approximate gain and output impedance of the cathode follower by applying the formulæ developed earlier.

From $G = \frac{Gm\ Rk}{1 + Gm\ Rk}$ the gain is 0.56

and the output impedance is simply 1/Gm and is thus $\frac{1000}{8.5}$ i.e., 117.5 ohms, say, 110 ohms.

The gain is seen to be rather low and a higher value could be obtained by the alternative method described below:

Assuming the H.T. supply is 350 volts; then for an anode voltage of 250 volts we can afford to drop 100 volts across the cathode load. Ohm's Law thus shows us that the total cathode load must be 10 K ohms. The grid-to-cathode voltage, however, must only be −1.5 volts. One method of achieving this is to use two fixed resistors as shown in Fig. 4a between H.T. and earth, their junction potential being the necessary one-and-a-half volts below the cathode potential. This is achieved in the circuit shown by the use of the two resistors of value 1.2 M and 470 K respectively.

A better method is illustrated in Fig. 4b. Here we tap into the cathode load at that point which gives us the necessary grid-to-cathode voltage. The errors involved by departing from the strictly calculated values of resistance, so as to conform to the standard range of available resistors, are negligible, and so we retain the 10 K cathode resistor, merely adding the 150 ohm resistor at the cathode end of the chain. We tap the grid leak in at this point and hence obtain the necessary bias for the stage. Condenser C merely decouples the bias resistor.

This method gives a slight improvement over the method outlined in Fig. 4a, due to the fact that the input impedance to the stage is increased. This is not apparent from the circuit, but is a feature of this mode of connection.

In both cases the gain is found to be 0.99, or almost 1, while the output impedance remains as before, approximately 110 ohms.

"Experts" will point out here that in the value for gain above the effect of the anode impedance of the valve has been overlooked. Tables give this value as 12 K and, in fact, this modifies the gain only very slightly, making it not 0.99 but 0.98, an error of about one per cent.

Why this difference in gain?

Well, although this circuit masquerades under the

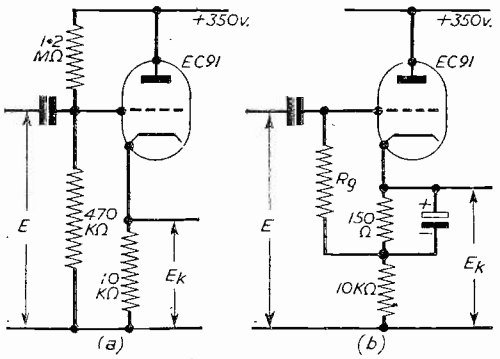


Fig. 4.—Improved cathode followers showing two methods of biasing.

name of cathode follower, it is still nothing more than an amplifier, but the load is in the cathode instead of the anode. Furthermore, as an amplifier it is still subject to many of the shortcomings of a normal amplifier.

Reconsidering the first example, with Rk of 150Ω, some of the setbacks can be demonstrated by viewing the stage as a straightforward amplifier. To start with the valve cannot really see the input signal as we do. To the valve the applied signal is that appearing between its grid and cathode, which for purposes of this approach we will assume is of one volt amplitude. The current through the valve will promptly change by 8.5 mA when we apply this signal voltage, and hence the cathode voltage will change by 8.5 × 0.15 volts, i.e., by 1.275 volts. The valve does really give us a gain of greater than one ; in this instance it gives us a gain of 1.275. But this is the story only as seen by the valve, since we know that the true input signal appears not merely between grid and cathode, but between grid and earth, and, therefore, any voltage output we get is reapplied as part of the input signal. The significance of this is obvious to those readers who first queried the relation

$$E = Eg + Ek$$

—the circuit is really an amplifier with a certain amount of negative feedback applied to it, the degree depending on the value of the cathode load.

Now look at the circuit of Fig. 4b. Applying the signal of one volt here and passing the resultant current change through the cathode load of 10 K causes the cathode voltage to change 85 volts. Here, then, is an amplifier with an "internal" gain of 85, and yet its "external" gain is barely 1. We must get something for all this effort! And we do get some advantages.

One of them is a low output impedance, while others include improved linearity and an increased grid base, and it is this latter feature we must now examine.

What is the limit to the input voltage?

The limits of the grid-cathode voltage of any amplifier are defined by the region of grid current in one direction and anode-current cut-off in the other. In symbols Vg=O and Vg=c.o. respectively.

If we were using the EC91 as a straightforward amplifier, then with a bias of −1.5 volts the nearest limit would be the grid current region at Vg=O, and we could, therefore, apply an input of 3 volts, measured peak to peak.

In a cathode follower, however, it is not directly obvious what the grid-cathode voltage is at any given instant, and the limits are, therefore, best determined from the "cut-off" anode current conditions.

In the cases under consideration the valve draws 10 mA. Application of a negative voltage to the grid decreases this current, cutting it off in the limit. Since this current is controlled by the product Gm Eg, then the value Vg=c.o. is found to be $\frac{-10}{8.5}$ volts. This is a negative-going signal of 1.18 volts approximately. The maximum negative-going signal that could be applied between grid and earth is thus the sum of the standing cathode voltage and the grid base. In the case of the 150-ohm cathode load this makes the maximum signal 2.68 volts on the negative excursion. And how much positively?

The permissible positive-going excursion will be greater since we can apply a grid-cathode voltage of +1.5 volts before we reach the condition Vg=O, and grid current. (Actually, in most valves, grid current starts to flow before Vg=O is reached.) Here the 1.5 volts change increases the current in the valve by 1.5×8.5 mA, and the cathode voltage increases accordingly. For the 150-ohm load the positive input signal could, therefore, be a maximum of 3.41 volts.

Since we normally design for an input waveform which is symmetrical about the bias point, the minimum limit is chosen, fixing the amplitude of the input waveform for the 150-ohm load at slightly less than twice 2.68 volts, measured peak to peak.

Things are, however, vastly improved with the larger value of cathode load.

With 10 K in the cathode circuit a negative-going grid-cathode voltage of 1.18 volts is still sufficient to cut off the anode current by the same reasoning as in the previous case, but the true maximum input then becomes 1.18 volts, plus the standing cathode voltage of 100 volts.

The peak to peak input can thus be 200 volts approximately.

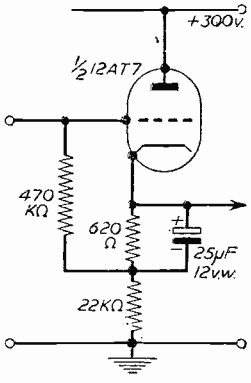


Fig. 5.—Cathode follower analysed in table below.

Note that in these simple calculations it has been assumed that the value of Gm has remained constant over the range of current swings. The Gm does, of course, vary, but the assumption of a mean value, such as that quoted in valve tables, gives reasonable results in practice. Another effect overlooked is that due to the variation of the "cut-off" grid voltage as the anode-cathode voltage of the valve alters. This can be ignored if a reasonable safety margin is allowed on the amplitude of the input signal catered for.

TABLE OF CHARACTERISTICS FOR CIRCUIT OF FIG. 5.

Ek	Ia	Eg	E	Ek (A.C.)	E (A.C.)
0	0	−8.5	− 8.5	−102	−107.7
25	1.1	−6.5	18.5	− 77	− 80.7
50	2.21	−4.85	45.15	− 52	− 54.0
75	3.31	−3.8	71.2	− 27	− 28.0
100	4.42	−2.9	97.1	− 2	− 2.1
102	4.5	−2.8	99.2	0	0
125	5.52	−2.0	123.0	+ 23	+ 23.8
150	6.63	−1.25	148.8	+ 48	+ 49.6
175	7.73	−0.6	174.4	+ 73	+ 75.2
200	8.84	0	200.0	+ 98	+ 100.8

Summary

The foregoing has presented in some detail an explanation of one or two of the effects peculiar to the cathode follower. All the salient points for the design will now be crystallised and put in tabular form to

enable the experimenter to lay his hands on the relevant information without having to peruse the article at length.

It is assumed that the following information is known before the design proceeds :

1. Amplitude of input signal.
2. Frequency of input signal, and if composite frequency highest and lowest frequencies involved.
3. Desired output impedance. (Zo.)
4. H.T. voltage and maximum H.T. current drain.

Items 3 and 4 will help decide the choice of valve, since Zo is approximately 1/Gm, and the latter will be decided, for any given valve, by the anode current.

Pentodes can be strapped as triodes to produce an increased Gm ; in the case of the B7G-based pentode, Z77, the pentode Gm of 7.5 mA/v can be increased to 9.4 mA/v by so doing.

Next consider the input amplitude. Say this is A volts peak to peak. Then, assuming the gain is 1, the minimum standing cathode voltage must be greater than A/2 volts. For the value of Gm fixed upon the valve tables will quote a particular anode current, say, 1 mA. Then the cathode resistor is found by Ohm's Law to be A/I kilohms. The value of bias specified in the tables must now be produced by tapping in to the cathode load. Thus if V volts bias are required a resistor of value V/I kilohms is required. The cathode load now consists of two resistors ; one from earth of value (A/I—V/I) kilohms, joined to the other of value V/I kilohms, and thence to the cathode. The circuit will then resemble that of Fig. 4b.

A point to remember when calculating the resistors if a pentode is being used : the cathode current is the sum of the anode and screen currents. It is very easy to forget the screen current when doing the arithmetic. The screen is usually tied to the anode and the suppressor to the cathode in this mode of connection. There is seldom any necessity for using a pentode as a cathode follower, and so the method is not mentioned here.

Parasitic oscillation can occur with this circuit just as in any other, and hence care is required in its wiring up.

In conclusion it will be mentioned that the cathode follower is the heart of many a more involved circuit, some of which are mentioned below.

The Super Cathode Follower. This is a two-valve circuit by means of which extra low output impedance may be obtained.

The Long-tailed Pair. This exists in a variety of forms, the best known of which is the Paraphase amplifier used for driving push-pull output stages.

The Cathode-coupled Multivibrator. A square-wave generating amplifier driven from an input pulse.

The Cathode-coupled Amplifier. This is really a composite circuit comprising a cathode follower input stage and grounded grid output stage, each valve sharing the same cathode.

The design of all these different devices relies to some degree on the understanding of the analysis of the cathode follower.

A table of cathode follower characteristics appears on page 445 for the circuit of Fig. 5. It was prepared from the Ia/Va curves of the 12AT7 valve, which is a double triode on a B9A base. Only one half of the valve is used.

The first four columns are obtained direct from the valve curves. The outlined row corresponds to the conditions under which the valve draws current with no external signal applied to the grid. The fifth and sixth columns, corresponding to the actual A.C. working conditions, are then obtained by subtracting the datum values of Ek (i.e., 102v) and E (i.e., 99.2v) respectively from the remainder of the values in each column. The peak to peak input voltage is thus seen to be 200 volts and over this range the gain is nearly constant, demonstrating the linearity of the circuit.

Books Received

RADIO & TELEVISION ENGINEERS' REFERENCE BOOK by E. Molloy. 1,600 pp. 1,860 illustrations and tables. Published by Geo. Newnes, price £3 10s.

ARRANGED on similar lines to the Electrical Engineers' Reference Book, this brings together, in one volume, technical data and information on the latest developments in the transmission and reception of radio and television signals, and allied subjects.

The book is arranged in 45 main sections, each dealing with a specific branch of the subject, and specialists in the appropriate field deal with each subject. The material covered is of the greatest use to those engaged in designing, maintaining, operating, servicing or selling modern radio and television equipment. In addition, the instructor and student will also find the information of great value.

All this information, of course, calls for a rather bulky production and the actual size of the book is approximately 7½in. by 4½in. by 2½in. thick.

FUNDAMENTALS OF TRANSISTORS by L. M. Krugman. Published by Messrs. Chapman & Hall, price 21s.

Permanent Anglo-French TV Link

THE BBC announces that, following on the successful series of European Television Programme Exchanges during 1954, it has placed an order with the Post Office for a permanent two-way television link between London and the Continent. This will replace some of the temporary equipment that has been used for the experimental programme exchanges, and is a step towards making such exchanges a regular feature in the programmes of European television services.

Three Years

The first section of the permanent link, which it is hoped will be ready for use before the end of this year, will consist of co-axial cables between London and St. Margaret's Bay. The next section will consist of a two-way radio link across the English Channel to be operated in conjunction with the French P.T.T. This will take some three years to complete, but in the meantime the permanent co-axial cables will be temporarily extended from St. Margaret's Bay to Swingate near Dover, where the BBC and Radiodiffusion et Television Francaise will provide and operate a temporary two-way cross-Channel radio link between Swingate and Cassel in Northern France.

Buying a Second-hand Televisor

SOME POINTS TO CHECK WHEN PURCHASING A USED TV RECEIVER

By "Alpha"

FROM time to time there appear on the market second-hand television receivers which are offered at quite attractive prices, and the amateur is tempted to purchase one of these receivers with a view to bringing it up to date to meet modern requirements.

As is the case with other second-hand articles it is possible to make an error of judgment and to find that extra money has to be laid out which, in the end, turns out to be more costly than a new receiver. In all cases it behoves the buyer to beware! Bargains can be bought—but so can costly experience!

The most important point of all when undertaking such a project is to insist on seeing the televisor working so that the general condition can be observed.

The Cathode-ray Tube

It is fairly common for a televisor to be thrown on to the market when the cathode-ray tube is becoming faulty. There are obvious faults, and those which are not quite so obvious, and the following points should be checked. The tube is, after all, the most expensive single item in the televisor and careful observation of its condition should be made.

The likeliest fault is failing emission, and little can be done to cure it beyond giving the tube a temporary lease of life by boosting the heater voltage. The main symptoms of failing emission is that the general brilliance of the tube is on the low side and advancement of the brilliance control effects no improvement. Often the fault is not noticed when first switching on and the screen should be observed for at least a quarter of an hour before deciding that the emission is in order.

If the brilliance control (as distinct from the contrast control) has to be advanced after the receiver has been on for a short period, then a failing tube can be suspected.

It is possible to have a dim picture when the E.H.T. system is failing but this is generally accompanied by a greatly increased size of picture which overscans the tube.

Tubes with low emission can be rejuvenated and in some cases an extra life of eight to 12 months can be obtained. It is as well to verify if this has been done.

It is also possible temporarily to improve the brilliance of a failing tube by the use of a heater booster transformer, and it should be verified if such an item is fitted; if it is, an extended life of about nine months maximum is all that can be expected except under favourable conditions.

A booster transformer must not be confused with a heater isolating transformer, of which more will be said later.

Another fault to watch for is the state of the vacuum of the tube. If the vacuum is impaired (we say the tube is going soft) it is usually indicated by the appearance of the "gettering" inside the tube. The gettering is the silvery deposit inside the bulb arranged during manufacture in order to exhaust completely the unwanted gases within the tube. It should appear as a silvery deposit and if it has any sign of milkiness then the tube is beginning to fail.

It is possible to check the actual condition of the cathode of the tube by observing its image on the screen. To do this the E.H.T. should be reduced to about one-third its normal working value and the bias should be reduced to about zero by means of the brilliance control and/or brilliance network. If the deflector coils are now disconnected the image of the cathode will appear on the screen. Where the cathode is in good condition it will appear as a circle of evenly illuminated light, but if parts of the cathode have become inactive the inactive patches will show as dark blobs covering the general circle of illumination.

Ion Burn

Most modern televisors are fitted with aluminised screens or with ion trap devices, but many of the older receivers are not so equipped. Bombardment of the screen by the low inertia ions eventually destroys the active material of the screen. The ions are not deflected in the same manner as the electron stream and consequently the continued bombardment shows itself as a brown patch almost in the centre of the screen. In a bad case the patch can be seen when the tube is not working; in cases of lesser severity the patch only appears when the tube is working, and in the light cases it only becomes apparent when the brilliance and contrast are lightly adjusted.

Nothing can be done to cure ion burn. It eventually becomes more severe and can completely ruin the picture.

Corona Discharge

This is not strictly speaking a tube fault but can be caused by dust covering the tube in such a fashion that the E.H.T. leaks across the tube. It shows itself on the screen as specks of light which are present even when the aerial is short-circuited. Generally, it can be detected by the smell of ozone coming from the televisor after it has been working for a short time.

Cathode-heater Short

This is quite a common trouble and can be cured—or at least the symptoms can usually be mitigated. The actual effect on the picture varies very much according to the circuit design. In some cases it is manifested by the apparent ineffectiveness of the brightness control which appears to have no control over the general illumination of the screen; in other cases the picture just appears smeary, while in yet other cases all synchronisation is lost after the receiver has been on for a period.

It is possible in some cases to clear the trouble by applying the output from a spark coil across heater and cathode. The fitting of a low capacity isolator transformer is often very helpful in effecting a cure, but this is not generally possible in a D.C. televisor, or in A.C./D.C televisors where all heaters are in a series chain.

Obsolete C.R.T.s

In some early televisors the cathode-ray tubes are now obsolete and replacement may be difficult. It is possible, in some cases, to adapt the newer tubes to the circuit, but it should be noted that most modern tubes use a much higher E.H.T. than the earlier models and arrangements must be made to increase the E.H.T.

While it is not a difficult matter to increase the E.H.T., it may be found that the power of the timebases is insufficient to cater for the increased "stiffness" of the electron beam and modification of the timebases may have to be made.

Other Screen Symptoms

When checking a TV receiver it is far better to view the picture when some standard signal is being transmitted, such as the tuning signal. It should be observed that the tone gradations on either side of the clock are equal in length and that the clock itself is round.

Timebase valves which are losing emission can still scan the tube in width and height, but not in a linear manner. If it is not possible to obtain correct linearity in height or width without reducing the overall size of the picture, then suspect loss of emission in the timebase valves.

The majority of the TV receivers now in use obtain the E.H.T. from the line flyback, and where this valve is failing the overall brilliance of the picture will suffer. The fault can usually be separated from that due to loss of emission of the C.R.T. by the fact that both height and width are usually overscanned.

A non-rectangular picture in electromagnetic televisors is generally due to short-circuited turns in the deflector coils, and these would have to be replaced. There may be some difficulty here if the set is very old; substitution by other scanning coils is not generally satisfactory.

Where the height of the picture becomes reduced as the programme continues, the fault is likely to be due to failing emission of the frame output valve.

Other symptoms of failing frame circuit valves are the gradual appearance of a fold or bright band at the top or the bottom of the picture.

If the picture tends to start to roll after the programme has been on for some time, then the most likely trouble is that of a failing emission in the sync separator valve.

When this valve begins to fail, another symptom usually manifests itself and that is that the horizontal circuit shifts. At first only a few lines at the top of the picture are affected, but quite often the whole of the picture will jump slightly to left.

Black parts of the picture streaking, or black-after-white effect is usually due to the alignment of the receiver being out of adjustment. In older receivers it is often due to drift of the oscillator valve and can usually be corrected by adjustment of the oscillator circuit, or the fitting of a new oscillator valve.

Under no circumstances should the tuning of the I.F. coils be touched unless suitable equipment and data is available for re-alignment. If it is found that the tuning of the I.F. coils has been adjusted, then it is wiser not to purchase the receiver, as without proper apparatus it is a very difficult job to correct alignment of I.F. stages.

The focus of the picture should be noticed. Electromagnetic focus coils have been used in many receivers, but have now given way to the almost universal use of permanent magnets. Excessive drift of the focus during the programme may be due to short circuits in the focus coil and replacement may be difficult.

Checking the Controls

All the controls should be checked, including the preset ones at the rear of the televisor. This will give a good indication of the general condition of the timebase. There should be sufficient latitude on each control to enable a peak working position to be obtained.

Power Supplies

Power supplies will not normally present any difficulty. The main faults likely to arise are a general deterioration in the performance of the televisor due to failing rectifiers. This is often more noticeable where metal rectifiers are used, though replacements are generally easy to obtain.

Where valve rectifiers are employed some caution must be exercised, as some types are difficult to obtain.

Impending failure of electrolytics is usually heralded by some discharge, or by a bulging of the condenser. Replacements of electrolytics presents no difficulties, and although one of the exact pattern used may not be available, other makes can be employed, provided they cater for the capacity and working voltages of the receiver.

Mains E.H.T. supplies should be regarded suspiciously and care taken to verify if corona discharge is taking place. Intermittent loss of brilliance where mains E.H.T. is used generally implies a failing transformer.

Mains E.H.T. transformers are still available and a replacement can usually be effected, but it is better to employ some other method of deriving E.H.T.

Line Output Transformer

The line output transformer is often the weakest part of the televisor. Breakdowns usually occur through the E.H.T. section and the transformer should be carefully checked. Intermittent brilliance, corona splashes on the screen, observable corona discharge on the transformer, all indicate impending failure.

Line output transformers are expensive items and direct replacements for some older models are not obtainable.

Converting the Channel

Modern televisors are equipped with tuning arrangements to cover at least the five channels in Band I, but many of the older models were built for a single channel.

Such receivers can be converted to work on a different channel quite successfully and details for such conversion have been given in past issues of PRACTICAL TELEVISION.

It is therefore quite practicable to purchase a televisor designed for one channel and to use it on another. This is especially true where the channels are adjacent, but is more difficult (though still practicable) where the channels are wider apart, and this fact should not prevent the purchase of an otherwise satisfactory second-hand televisor.

TESTING E.H.T VOLTAGES

DETAILS OF A SIMPLE HOME-MADE UNIT WHICH CONSUMES NEGLIGIBLE CURRENT

By H. H. Jones

THE total voltage on a television tube has an important effect on the picture quality. Changes cause variations of focus, brilliance and, indirectly, the definition of the picture. With some forms of E.H.T supply, voltage changes may be an indication of a time-base defect. Measurement of the actual voltage is difficult because of the very high load imposed by even a good meter. The extent of this loading can be realised when it is remembered that the power consumption of a meter with the high rating of 20 K ohms per volt is half a watt and that of the normal 1,000 ohms per volt movement 10 watts at 10 K volts.

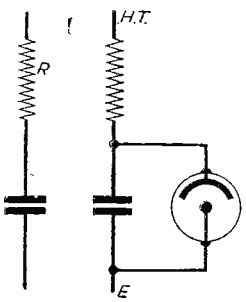


Fig. 1. (Left). — A simple condenser charging circuit. Fig. 3. (Right).—Constant voltage discharge method for a condenser.

A way out of this difficulty would be to use some form of measuring device that does not draw current continuously, and for this a condenser would seem appropriate. This could be charged through a high resistance, as shown in Fig. 1. The initial current would be high, but would fall as the potential across the condenser rises and finally drops to a very low value, determined by the circuit leakage. The process is indicated in Fig. 2, which shows that after a sufficient time the voltage across the condenser will be practically that of the supply and the current practically zero. It follows that for periods of time less than necessary for fully charging the condenser, the voltage across it depends on the time that it has been taking current. Therefore, if an indicator can be found that will work at a definite voltage less than that of the supply, *time* can be measured and will give a measure of the applied volts, because the higher the voltage the more rapidly will the condenser reach a potential sufficient to work the indicating device. A neon lamp is a suitable indicator, and with this the measuring circuit becomes that of Fig. 3, which will be recognised as a simple form of time-base.

The Neon Indicator

A neon takes no current at all until a critical voltage is reached. It then "strikes" and takes a very large current until the applied potential drops by about 30 volts, when it ceases to glow and again becomes non-conducting. Striking generally takes place at about 130 volts, but this can be varied to some extent during manufacture. When the circuit of Fig. 3 is first switched on, current flows through R into the condenser, resulting in a large volt drop across R. As the condenser charges, its potential rises, the charging current falls and so does the volt drop across R. During this time the neon is taking no current, but when the potential across the condenser reaches the striking voltage of the neon the lamp conducts and discharges the condenser because sufficient current cannot flow through the resistance R to maintain the potential of the condenser. As soon as the neon goes out the charging process begins again, with the result that the neon gives a series of flashes, the rate of flashing being governed in any one case by the value of the charging voltage.

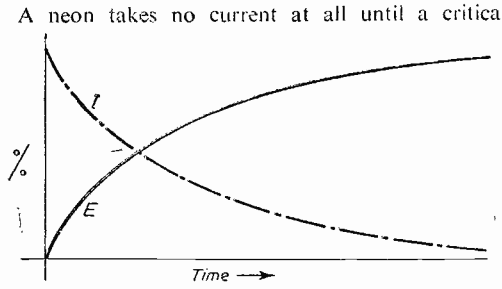


Fig. 2.—Voltage E across, and Current I, flowing into the condenser of Fig. 1 plotted against time.

Practical Considerations

Ordinary small signal neons are quite suitable, but if the type sold for domestic use is favoured it will be as well to remove the base resistance. The capacity of the condenser will depend on the energy requirements of the neon, but .5 to 1 μF seems to suit most small indicators. The insulation resistance of the condenser should be high, but the working voltage need not exceed 250 volts.

The charging resistance will depend on the actual H.T. volts, the condenser and the neon. A total of 50 meg. is of the right order for measuring in the 5 to 15 Kv. range. If the chain is completed by a variable resistor of about 5 meg. (Fig. 4), control of the flashing rate becomes possible. The chain should be tapped if a range of voltages is to be measured. These tappings must be fitted with suitable high-voltage sockets and the high-potential end of the chain and the connecting lead must be of adequate insulation.

The resistance chain is best made up from a series of 1 watt components of 2 to 5 meg. each, arranged as shown in Fig. 5. Each unit is held in place by passing its end wires through a strip of bakelite paper and connecting at the back, as shown by the dotted line. After completion, a similar strip is

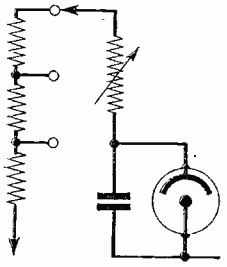


Fig. 4.—The circuit of Fig. 3 adapted for a range of supply voltages.

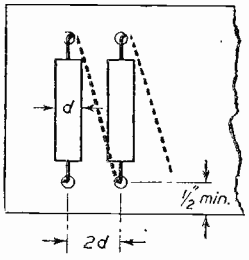


Fig. 5.—Method of mounting resistors to form the voltage-dropping chain.

placed on each side of the unit, and the whole can then be wrapped round the condenser and fixed in a suitable can, wax filled if desired.

Calibration

For service purposes the main requirement is a knowledge of the comparative state of the apparatus ; the actual potential is not of very great importance. Accordingly, the tester can be scaled on a good/bad basis by connecting it to a series of receivers known to be in order, and then adjusting the tapping and the variable resistance to give a standard flashing rate. This is conveniently about one per second as it can be timed with very fair accuracy against the normal pulse beat. Testing a receiver is then merely a matter of setting the tapping to the appropriate place and noting whether the flashes are close to the normal pulse rate. If the resistor setting has to be reduced to give the normal rate, the H.T. is low. With a little practice quite good consistency can be achieved, and the indication given seems to impress customers very favourably.

On the bench it is possible to detect quite small voltage changes, the limit of accuracy being set by the contact of the variable resistance. An ordinary stock component will enable a drop in H.T. to be detected well before any deterioration on the screen is noticed.

This circuit can easily be adapted to read resistance and capacitance values, but the advantages of portability, quick use and—an important point—comprehension by the layman are then lost.

Norwich Low-power Station

SERVICE from the Norwich temporary low-power station, which has been built at Tacolneston, some 10 miles south-west of the City, commenced on February 1.

The temporary station, comprising low-power vision and sound transmitting equipment installed in a wooden building, has been built so that the television service in East Anglia can be started at a much earlier date than would otherwise have been possible. It will continue in service until the permanent television station, which is to be built on the same site, can be completed. In addition to its television transmitters the permanent station will include V.H.F. sound transmitters to give improved reception of the Home, Light and Third Programmes in East Anglia.

The temporary television station operates on the same frequencies as those later to be used by the permanent station so that receivers and aerials set up for reception of the temporary station will not have to be changed when the permanent station comes into operation. The technical details of the transmissions are as follows :—

Vision frequency — 56.75 Mc/s (Channel 3)
Sound frequency—53.25 Mc/s (Channel 3)
Polarisation—Horizontal
Transmission — Asymmetric side-band system.

The frequencies of the vision and sound carriers will be slightly offset from those of the high-power station using the same channel (Kirk o' Shotts) so as to reduce the effects of mutual interference in the fringe areas.

The area served by the temporary station will include Norwich and its immediate surroundings, and will extend approximately to a line through Aylsham, East Dereham, Watton, Diss, Beccles and Acle. Reception may be possible at somewhat greater distances, but will be liable to fading and interference at times. Later when the permanent station is completed, the coverage will include the greater part of Norfolk and Suffolk.

International Award

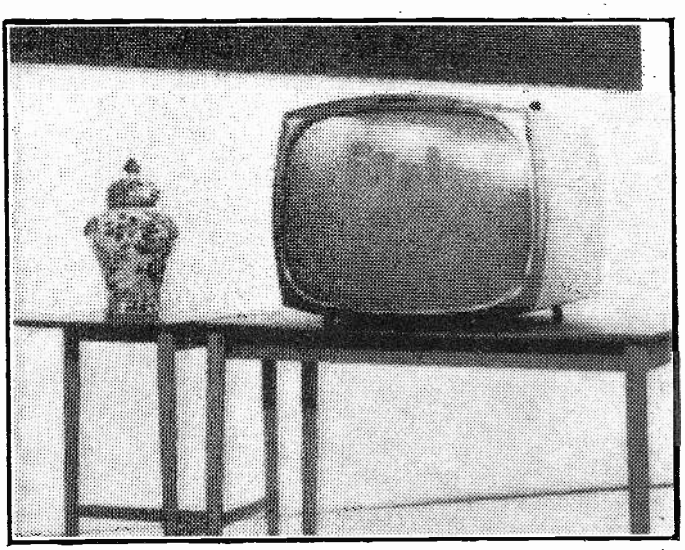
AT the Decima Triennale, Milan, Italy, the American Raytheon TV " Challenger " model was awarded highest honours for its artistic and functional excellence.

The exhibition is held once every three years and is international in scope. It specialises in modern art and decorations.

Five " Challenger " models were exhibited, one as the design for a modern TV receiver, and four fitted into completely furnished examples of modern living-rooms.

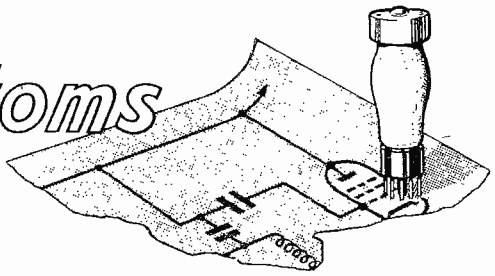
The International Jury awarded the " diploma of Honour," the highest prize for the " best " example of modern artistic design, to the Raytheon Manufacturing Co., Waltham, Mass., the only American firm to receive this award.

The winning model, shown below, was also displayed at the entrance to the visitors as a prize . . . showing that the " Challenger " won the approval of the general public as well as the International Jury of art experts.



The Raytheon " Challenger " model referred to above.

Fault Symptoms



THE CAUSES OF COMMON FAULTS, AND METHODS OF CORRECTION

By Gordon J. King, A.M.I.P.R.E.

(*Concluded from page* 398, *February issue.*)

Attenuators

ALTHOUGH our aim is to reduce the signal applied to the receiver, it is essential that we do this without involving any serious mismatch in the feeder system. Mismatching can be attributed to additional losses, since a proportion of the signal energy is reflected to and fro between aerial and receiver. Signal input is reduced and standing waves are set up over the length of the feeder.

The two types of attenuator commonly used for domestic television are the "pi" and the "T". Fig. 88 illustrates these in two forms; one form is used with coaxial feeders, and the other form is necessary when balanced twin feeders are used.

The "pi" type is more suitable for television signal attenuation since it employs higher resistance values. With the "T" type the resistance value of R2, above 20 decibel attenuation, becomes much too low for most experimental purposes.

In both kinds of attenuator the resistors should, of course, be non-inductive, and stray capacitances should be kept at a minimum.

Table 1 provides resistance values of R1 and R2 for various attenuation ratios; it will be noted, however, that resistance values for the "T" type have been given to correspond up to 20 decibels only. When high attenuation ratios are required it is much better to connect two or more pads in series, because the use of a single high-ratio pad is liable to introduce considerable noise into the receiver. The total attenuation of two or more pads connected in this way is equal to the sum of the attenuation ratio of individual pads in decibels.

Feedback in the H.T. Circuits

Feedback of A.F. voltage, mainly from the sound output valve, to the timebase or video circuits, can sometimes be attributed to the symptom of sound interference on vision. In a large number of cases of this particular fault, deterioration in an electrolytic capacitor decoupling the H.T. circuits which are common to these two sections is responsible.

In the K.B. FV30 series receivers, for example, failure of the 8μF electrolytic capacitor decoupling the screen grid of the 6V6GT sound output valve readily provokes the symptom without causing any appreciable loss in sound volume or quality.

Fig. 89 illustrates the circuit of this part of the receiver, in which it is well worth while, particularly as a time-saving factor, to shunt-test the capacitor concerned with one known to be well up to standard.

It is also as well to bear in mind that the display of sound interference on vision, caused by feedback of A.F. voltage, can be reduced and eliminated by turning down the sound volume control for, of course, when the sound is turned right off no A.F. voltage is available to be fed back anyway. This is a good check and one which will quickly prove that tuned-circuit misadjustment is not responsible; since, as will no doubt be realised, alteration to the setting of the volume control will have no effect whatever on the symptom which originates in the R.F./I.F. stages.

Valve Microphony

The symptom of sound interference on vision caused by "noisy" or microphonic valves in the vision section, results from an electro-acoustic feedback loop between the set loudspeaker and the vision channel.

What happens is that the sound-waves coming from the speaker provoke vibration of the electrodes within the faulty valves; the electron stream thus becomes modulated to the pattern of the audio signal, and in this way the A.F. finds its way into the vision channel.

Again, the symptom resulting from this cause can be eliminated by turning off the sound; and, furthermore, valve microphony can often be established by tapping the receiver cabinet when the vision is working normally, and when the sound is turned off.

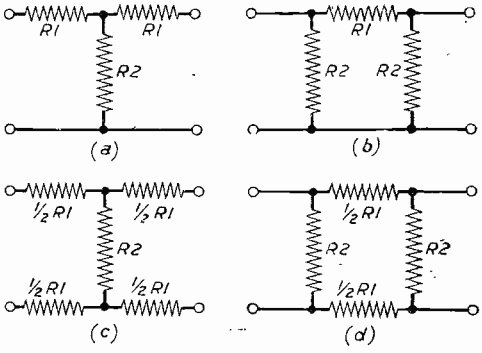


Fig. 88.—Attenuators: (a) "T" type for coaxial feeders; (b) "pi" type for coaxial feeders; (c) "T" type for twin feeders; (d) "pi" type for twin feeders.

Dark horizontal lines will appear across the picture as the microphonic valves are subjected to vibration in this way.

Removing the back from the receiver and gently tapping each valve in turn, whilst observing the picture, represents a rapid method of locating the valve—or valves—responsible for the disturbance.

The frame amplifier valve is a frequent offender in

this respect, and this is especially true of the N37 valve occupying such a position in the G.E.C. BT2147 series receivers.

Apart from replacing the defective valve, there is generally little that can be done to alleviate the effect, although, it should be mentioned, it is sometimes possible—when microphony is of a mild form—to apply acoustic damping to the offending valve.

Success in this respect can often be achieved by enveloping the valve in a sponge rubber jacket, or by securing a length of cotton wool round the valve by means of an elastic band.

Vision Interference on Sound

From sound on vision we come to the disconcerting symptom of vision interference on sound. This is evidenced from the loudspeaker by a harsh 50 c.p.s. note accompanying the sound signal. It is sometimes possible to mistake the symptom for ordinary mains hum, though not generally for very long, because the volume of the disturbance noticeably alters with a change in the picture signal. As conclusive proof, however, one needs only to remove the aerial from the set, when, if vision on sound is responsible, the background noise will disappear completely.

The symptom is caused by a part of the vision signal reaching, and being amplified by, the sound channel. The bandwidth of the sound channel of a television receiver is considerably wider than the sound channel of an ordinary broadcast receiver—from the R.F. point of view anyway. This feature prevents excessive attenuation of the sound signal, which might otherwise occur should the tuned circuits associated with the sound section have a tendency to drift in frequency —this often happens ; the wide band feature also permits successful operation of the sound inter-

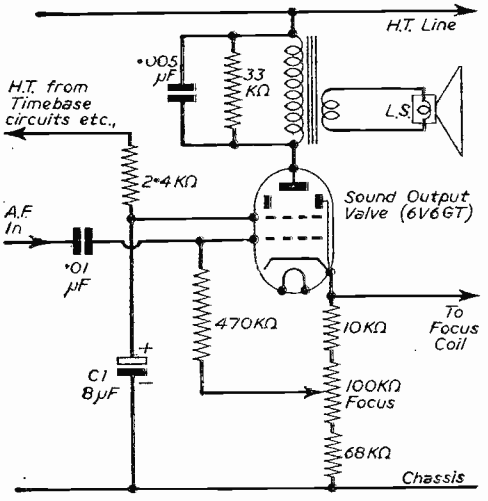


Fig. 89.—The sound output stage of K.B. FV30, FV40 and FV50 series receivers.

ference limiter circuits (see, for instance, "Interference Suppression," PRACTICAL TELEVISION, November, 1951).

Nevertheless, compared with the bandwidth of the vision section, the bandwidth of the sound section is relatively narrow, and generally ranges in the region of 150 Kc/s. The full curves of Fig. 90 depict the relative positions of the sound and vision responses of a single sideband receiver and, as will be observed, the sound response is such that no significant part of it falls within the vision passband.

Clearly, then, if the bandwidth of the sound channel is too wide (as represented by the broken line curve (a)), or if the sound channel is mistuned towards the vision carrier frequency (shown by the broken line curve (b)), a relatively large component of the vision signal is bound to gain admittance to the sound stages to provoke the symptom.

When investigating a fault of this nature, therefore, one should first of all make absolutely certain that the

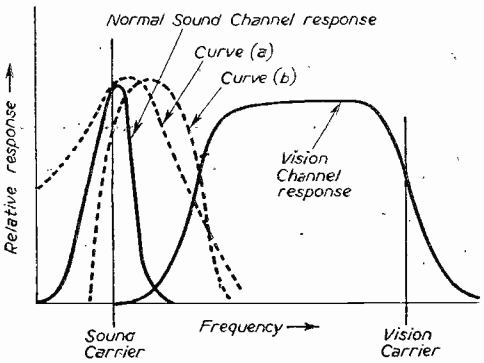


Fig. 90.—The sound and vision responses of a single sideband receiver, showing how the vision signal may gain admittance to the sound channel by curve (a) if the sound channel bandwidth is too wide, or by curve (b) if the sound channel is mis-tuned.

sound tuned circuits are correctly adjusted, and in this respect it is desirable to follow the maker's alignment instructions, for, as previously mentioned, a suppressed response might well upset the operation of the noise limiter and, apart from this, a very peaky sound channel response is liable to instigate conditions for instability.

If the receiver is of the superhet model a drift in the frequency of the local oscillator might well be responsible, particularly if the drift is opposite to that necessary to cause sound interference on vision. The local oscillator tuning should, therefore, be checked and readjusted for maximum sound consistent with minimum *sound interference on vision.*

TABLE 1

Approx. attenuation Db	"pi" Type R1	R2	"T" Type R1	R2
10	150	100	39	56
20	470	100	68	16
30	1,500	82		
40	3,900	82		
50	10,000	82		
60	39,000	82		

Adjusted so, one can be almost certain that persisting vision interference on sound must arise elsewhere.

Other causes of the symptom nearly always lie in the common R.F. stages or in the aerial system itself, though it is as well to remember that an *excessive* aerial signal may be inciting cross-modulation, the cure for which—as we discovered in the previous article in this series—lies in reducing the signal input to the receiver by the inclusion of a suitable attenuator network.

cleaning with C.T.C. or "Thawpit" effected a complete cure. I stress the fact that this fault was unusual, and other causes should be thoroughly investigated first should trouble with focus be experienced. A fault which I have met very often on this model and which is rather tedious to cure is that of fading vision and sound, sometimes failing completely. It may be found that trimming the oscillator condenser will restore signals temporarily, but no permanent cure can be achieved here. The cause is a defective 15 pF oscillator grid coupling condenser. Its position is indicated in Fig. 1. It is extremely difficult to replace this component if this job has not been tackled before, and it should not be undertaken unless the repairer has a goodly knowledge of servicing. The fading may be accompanied by flashing across the picture and crackling on the sound.

In this receiver the frequency changer is an ECL80 and the suspected condenser is in the grid circuit of the triode section.

Poor Frame-hold or Jittery Raster or Both

This fault is almost invariably due to the interlace filter which is two crystal diodes, MR3 and MR4. One may either be open-circuited or short-circuited. Their position is indicated in the relevant diagram.

In dealing with what appears to be a multiple fault attention should be directed to the potential divider network from the H.T. rail to chassis. This contains both the brilliance control and the frame hold. Obviously an open circuited resistor or control will result in an apparent fault in another part of the receiver. A study of the circuit diagram will show the position of these components. I have mentioned this point whilst on the subject of frame hold, or rather lack of it, because I have often found this network to be responsible for the non-operation of the frame time-base.

Another fault which has been met a few times is a picture which very slowly alters in height. The raster compresses slowly and then expands upward and downward, perhaps accompanied by a jitter which may only show up every once in a while.

This fault is always traced to a defective frame oscillator transformer. Sometimes tapping the transformer will either worsen or stop the fault for a short time. On one occasion the raster remained at a constant height but jittered in a way which suggested a defective interlace filter. Replacement of these small rectifiers did not, however, cure the fault, and the oscillator transformer had to be replaced before a steady raster was obtained. Turning to the line time-base I have already made reference to the PL38 causing poor focus and, of course, this valve could also cause a lack of adequate width. In faults like these, however, the voltage of the H.T. supply from the metal rectifier should be checked. If this is much below 200 volts the metal rectifier should be changed, as this will certainly cause a lack of width and incidentally, poor focus.

Anode Resistor

On this model I have found on more than one occasion that a lack of width was due to neither of these causes, but to the anode load resistor of the line oscillator going high. A careful voltage check should always be carried out before replacing any expensive component. Hopefully changing valves and transformers can be both expensive and fruitless, and the appearance of even a "well-known" fault should be treated with suspicion until a case against a particular component is reasonably proved. I would stress that these articles are meant more as a guide than a definite set of instructions to replace this and that. The use of these notes should be accompanied by a meter check which is understood, and common sense. However, to continue.

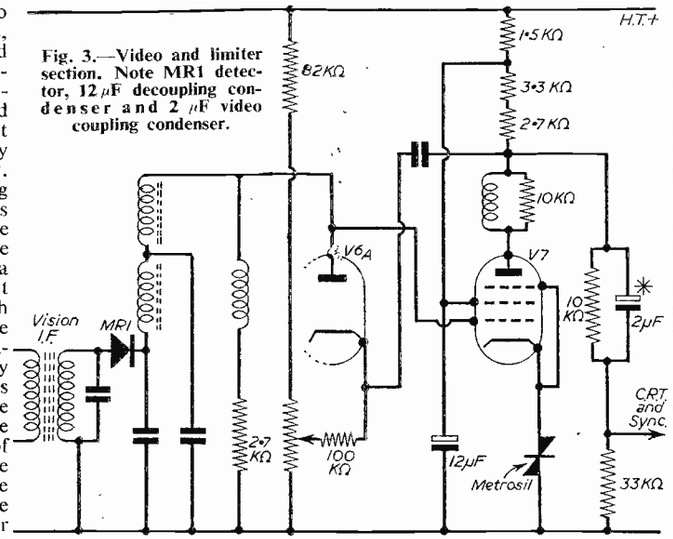


Fig. 3.—Video and limiter section. Note MR1 detector, 12 μF decoupling condenser and 2 μF video coupling condenser.

Thermistor

This receiver, in company with most other A.C./D.C. sets, often develops a fault which may appear to be a trifle obscure. The symptom is no results with the valves and tube lighting very dimly. In other words the heaters are not receiving an adequate supply of current. The thermistor, left-hand side, mounted adjacent to the mains dropper, develops a crack or other defect which offers a high resistance to heater current.

I have known this fault to be caused by a high resistance valve or tube heater, but normally a replacement thermistor will completely cure the trouble. It will be noted that even though the thermistor may be completely O.C. its shunt resistor will allow a certain amount of current to pass through the heater chain.

Assuming that all the valve heaters are in order, the tube is also lighting up, heater that is, and the grid and cathode voltages are normal and yet no raster can be resolved on the tube face, it will be necessary to ensure that E.H.T. is present on the tube anode. The metal end of a well-insulated screwdriver should draw a healthy spark from the anode cap.

If no spark can be obtained, the set should be switched off, the anode clip removed from the tube, and suspended safely away from any nearby metal. Allow at least one minute before switching on again, and then try to draw a spark from the suspended clip. If a spark is now present it will mean one of two things. First that the EY51 E.H.T. rectifier may be very low on emission, and second that the tube has an internal leak or short. Obviously the EY51 should be changed first. This valve is located under the metal cover in the screening box on the left side of the chassis. It is a fairly simple operation to unsolder its three leads and remove the valve, but when replacing remember to ensure that all three connections are made with round blobs and not sharp triangular lumps of solder.

Assuming that the replacement EY51 is a new valve in good order, a healthy spark should now be drawn from the anode when the clip is replaced on the tube. If no spark is present it will normally indicate that the tube is defective. If, however, the E.H.T. to the tube anode is present and yet the tube does not give a raster, attention should be turned to the first anode as this is a tetrode tube. As this electrode is supplied through a Metrosil, it is not easy to measure the voltage on the tube base pin.

A valve voltmeter which presents negligible loading is necessary to obtain an accurate reading. A normal meter will not give this accurate indication, and an alternative method of testing will have to be employed. A connection from the H.T. line may be used to replace the normal lead from the Metrosil, and although this voltage is only half that normally present when using the Metrosil circuit, an indication will be given by this means. If the fault is in the Metrosil circuit, when the alternative connection is made, the raster should become visible even although it may be out of focus. If this is the case, the Metrosil should be replaced.

Two of these components are used in this receiver. One is referred to above, and the other is used as a bias resistor for the video amplifier.

A friend informs me that he has had several instances where a defective Metrosil to the first anode of the tube has become defective and resulted in a negative picture. That is, the whites become black and blacks white. I have not yet encountered this fault, but it is a tip worth bearing in mind. This, of course, does not refer only to this particular receiver but to any set using a Metrosil supply to a tetrode tube. For the benefit of those readers who have not seen a Metrosil, it is a small "slab" of metallic material, about the size of a rounded postage stamp. Normally coloured red with a wire lead out at each end.

In the Pye FVI attention is drawn to the heater supply to the efficiency diode. In the diagram what may appear to be chokes will be seen on each side of the heater. These are windings on the line output transformer, wound in opposite phase so as to cancel out the high potential difference between the cathode and heater, thus minimising the risk of heater to cathode failure.

General Description

The receiver operates as a superhet using the lower sideband of the vision carrier. It is designed to cover the five channels of Band 1 by means of tapped R.F. and oscillator coils.

Channel changing is achieved by means of a tapping plug for the aerial coil and shorting screws for the R.F. and oscillator. R.F. and frequency changer stages are common to both sound and vision. The aerial input is designed for 75 ohm co-axial feeder, the input being isolated from a D.C. point of view by two small condensers. However, two 2.2 MΩ resistors act as leaks from the input socket to chassis to discharge static, being of such high value as to obviate shocks from the aerial due to a "live" chassis. An I.F. filter is included in the aerial circuit to minimise break-through at the intermediate frequencies. These are vision 35.9 Mc/s and sound 38.5 Mc/s. High value of I.F. is desirable on multi-channel receivers. The R.F. valve has the "sensitivity" control in its cathode circuit. The mixer and oscillator valve is a triode-pentode ECL80, the triode oscillator grid being coupled to the pentode mixer grid by a small condenser. From the mixer anode both sound and vision I.Fs are passed to the grid circuit of the first vision I.F. amplifier, EF80,

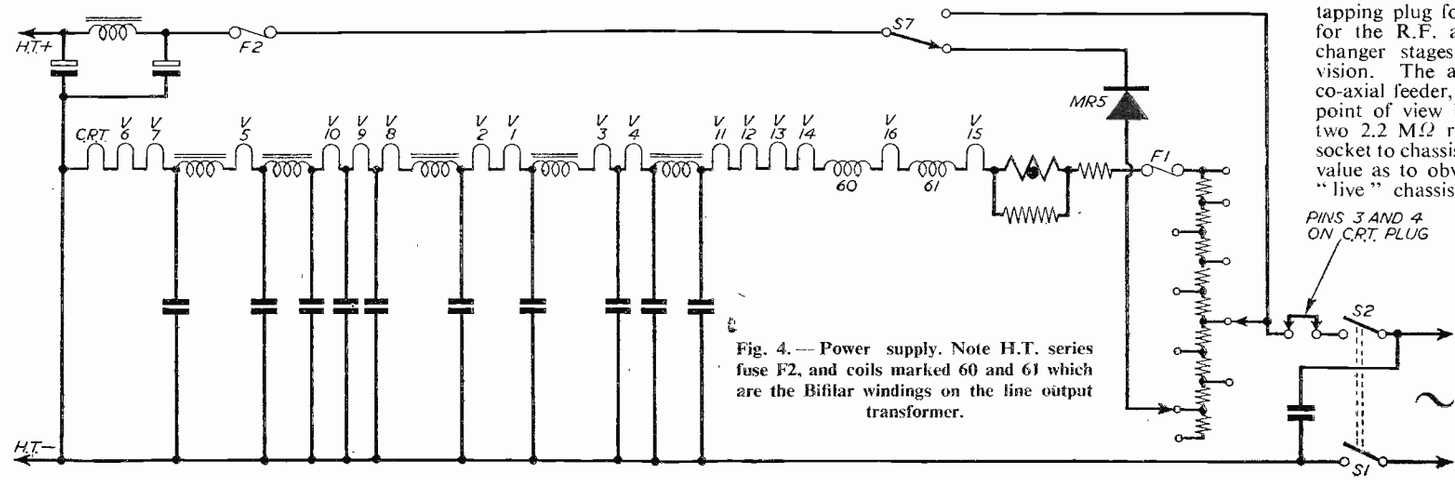


Fig. 4.—Power supply. Note H.T. series fuse F2, and coils marked 60 and 61 which are the Bifilar windings on the line output transformer.

From here the sound is tapped off and fed to its own I.F. amplifier V8, another EF80.

The vision signal is amplified by V3, V4 and V5, before being passed to the crystal rectifier detector MR1. All I.F. transformers from V2 (frequency changer) to MR1 are of the band-pass type. The sound transformers from V8 to V9, V10 and MR2 are of the single-peaked type.

The gain of V3, V4 is controlled by the "contrast" control in the cathode circuits. Resistors in the grid circuit of each vision valve preserve the bandwidth, which should be 2.75 Mc/s over the whole vision amplifier. The rectified signal from MR1 is passed to the video amplifier V7, EF80, being developed across a choke and resistor in series. The value of the resistor is 2.7 KΩ and this and the choke should be checked for continuity should a very weak picture (and sync) be evident.

The manner of connecting the anode signal of V7 to the tube cathode will be seen from the diagram. The electrotytic condensers C1 and C2 should always be checked when vision and sync troubles crop up. As stated, V7 is cathode biased by a Metrosil, the resistance of which does not vary appreciably with changing current. Interference limiter, diode V6A, is shown in the diagram, and conducts above peak white if the limiter control is correctly adjusted.

Maladjustment will cause a flat picture, lacking in detail and highlights. Defective resistors feeding the cathode will produce similar effects.

The sound channel is taken from the grid of V3, through sound I.F. amplifiers V8, V9, V10, detected by MR2. Some of the D.C. component is fed back to the grids of V8 and V9 as automatic gain control.

Audio signals pass through noise limiter V6B to the volume control, thence to the PL33 sound output valve. Should the sound be delayed in coming through, and then arrive with a loud bang or similar noise, this valve should be suspect. In the event of no sound at all, its cathode voltage should be checked, approximately 5 volts. This valve is V11. MR3 and MR4 are the interlace filters which ensure that only the correct pulses are fed to the frame time-base. The frame oscillator is the triode section of V13, ECL80, and is of the blocking oscillator type. The pentode section of V13 is the frame output. Note that the grid circuit of the sync separator, V12, EF80, is passed to the chassis through the cathode circuit of V13. This is to limit the noise passed to the time-bases by providing a small positive bias. This bias increases the grid current during the sync pulses and limits the noise which is normally present on the base of the pulses.

The weak links in the frame time-base are the oscillator transformer, MR3, MR4, and the ECL80 itself. Line oscillator is V14, EF80, operating as a blocking oscillator with screen to grid coupling by the oscillator transformer. Line output is V15, PL38. This operates the line output transformer in which circuit is coupled the booster diode, V16, which provides approximately an additional 80 volts. The extra heater windings, known as "bifilar windings," are connected as previously described.

E.H.T. of about 9 kV., obtained from the line output transformer overwind, is rectified by the EY51. H.T. is provided through a metal rectifier of conventional type, this being shorted out on 200 volt D.C. only.

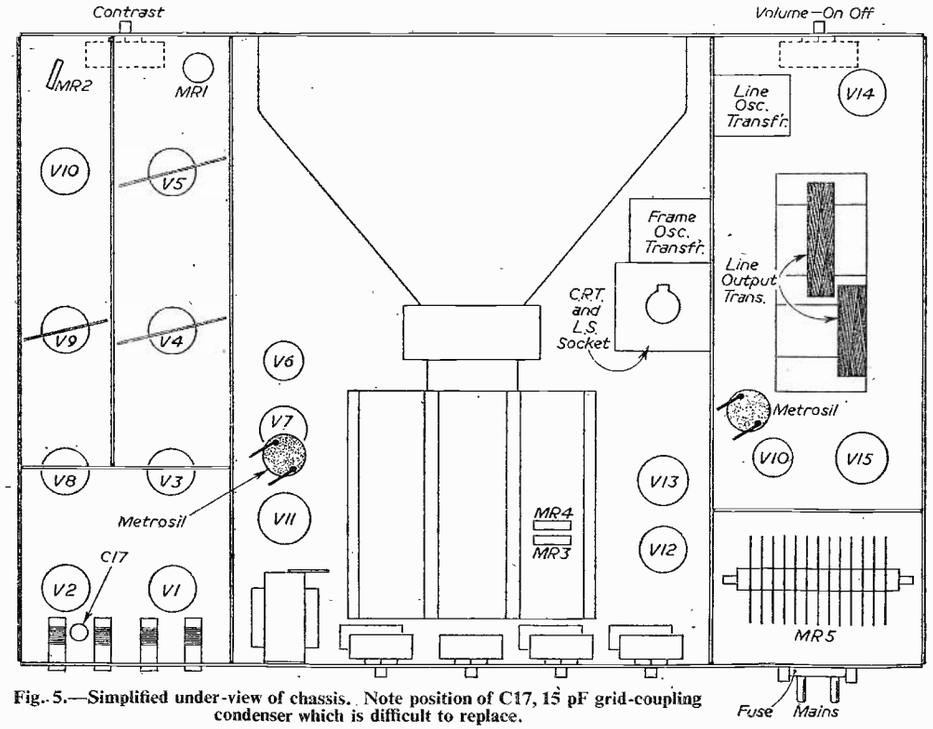
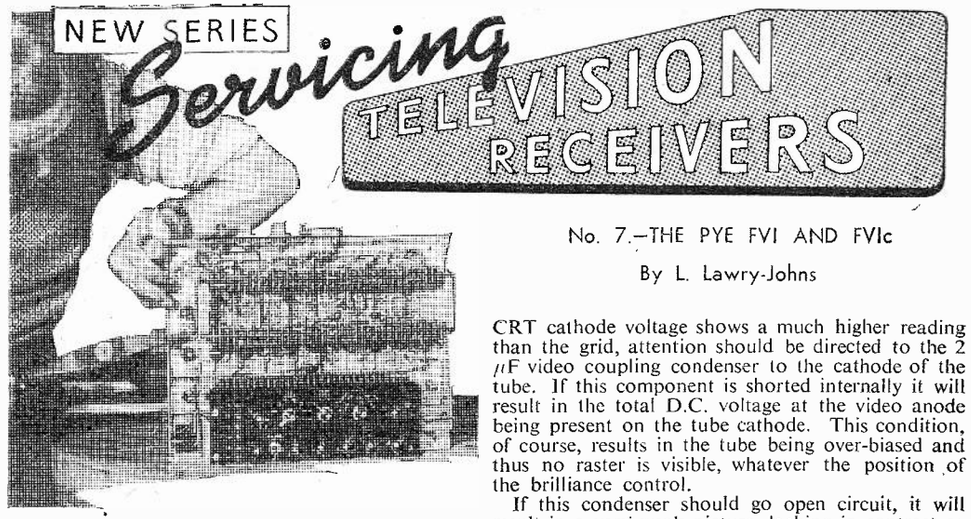


Fig. 5.—Simplified under-view of chassis. Note position of C17, 15 pF grid-coupling condenser which is difficult to replace.



No. 7.—THE PYE FVI AND FVIc

By L. Lawry-Johns

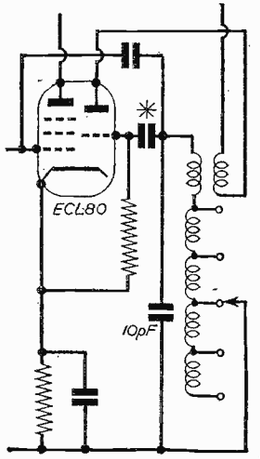
Picture Faults

TWIN white lines across an otherwise normal raster. This is a common fault and replacement of the frame time-base valve ECL80 will effect a cure. Weak synchronisation, although the picture is maintained at fairly good contrast, is often due to a defective crystal diode vision detector. This may appear rather strange, as normally a defective vision detector results in a weak or non-existent picture, but in this case the higher frequency picture detail is passed and the synchronising pulses are attenuated.

If no picture can be resolved at all, and a measurement of CRT cathode voltage shows a much higher reading than the grid, attention should be directed to the 2 μF video coupling condenser to the cathode of the tube. If this component is shorted internally it will result in the total D.C. voltage at the video anode being present on the tube cathode. This condition, of course, results in the tube being over-biased and thus no raster is visible, whatever the position of the brilliance control.

If this condenser should go open circuit, it will result in a very weak picture, lacking in contrast as the A.C. coupling has been removed.

Poor focus, assuming the H.T. voltage to be well up, is often due to a defective PL38 line output valve. Flaring on the whites, focus varying according to the picture content is normally due to a low emission EY51 E.H.T. rectifier. If this valve is very low, a raster will be seen without the aerial plug connected, but as soon as this is put in the raster will vanish, due to the EY51 being unable to cope with the varying tube current. I have known this fault to puzzle many set owners (and builders). An unusual focus fault that I encountered was due to a greasy magnet assembly. Stripping and



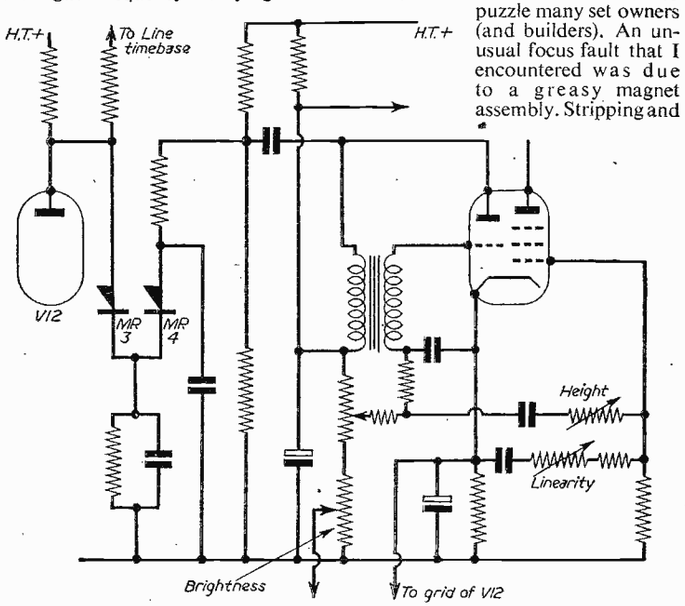
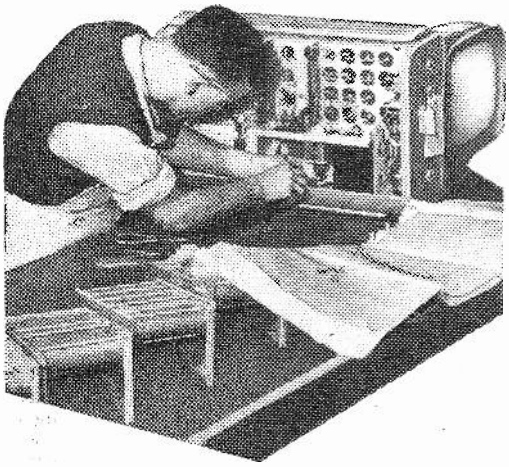


Fig. 1 (left). — Oscillator circuit. Condenser marked with an asterisk is 15 pF and is mentioned in the text. The 10 pF is less likely to cause the symptoms described. Fig. 2 (right). — Showing interlace MR3/MR4, frame oscillator transformer, and Brightness and Frame Hold potentiometer.

PAGES FROM A TELEVISION ENGINEER'S NOTEBOOK



26.—AERIAL AND FEEDER MEASUREMENTS

QUERIES have often arisen regarding practical methods of measuring the characteristic impedance of a transmission line or the correctness of the match of such a line to a television receiver, and although such measurements are not normally undertaken by the home experimenter, a few notes on one of the basic methods might be of interest and provide the equipped amateur with the means of making some checks on his own.

There are several methods of tackling this problem, but for the simple one to be described the requirements are an oscilloscope, with a good wideband amplifier, and a sweep generator, or wobbulator, capable of swinging over linearly and at constant amplitude a few megacycles in the frequency band on which measurements are taking place. In addition, some simple type of detector is needed but this can take the form of a crystal with the usual load and filter components. A typical circuit is shown in Fig. 1, where the crystal is of the ordinary video pattern.

Basic Method

The basic method of all measurements depends upon a determination or an observation of the voltage standing-wave ratio (VSWR) existing when a length of feeder is not terminated in its proper impedance. If a signal is injected into a length of transmission line such as a coaxial cable, and the far end of the line is either open- or short-circuited, the whole of the incident or forward wave is reflected on reaching the termination and returns towards the generator. The generator may be an aerial system and the load may be the input circuit of a television receiver, although the latter is not likely to present the limiting cases of open- or short-circuits. The combination of forward and reflected waves set up so-called standing or stationary waves on the line much in the manner of standing waves on a vibrating string, the amplitude of these waves being greatest for the open- and short-circuited cases of termination. For other terminations, other amplitudes occur and for a proper termination or "match," as this condition is called, the standing waves vanish, for the forward wave is totally absorbed by the load and no reflection occurs. When the best match between a line and a load is obtained, the VSWR is very close to unity and, in the case of a perfect match, never realisable in practice, it would be exactly one.

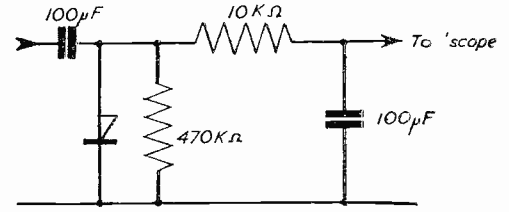


Fig. 1. — A simple detector set-up for the VSWR measurement system described.

If the VSWR in a particular system is not close to unity, the circuit load can be substituted by resistive loads of various values until the VSWR obtained originally is restored ; the impedance of the load can then be found by a direct measure of the resistance substituted for it. Alternatively, by adjusting the resistance to give a VSWR of near unity, the matching impedance required by the circuit is readily determined.

Wave Ratio Measurement

Consider the arrangement of the above-mentioned instruments as shown in Fig 2. The sweep generator feeds into the end of a length of cable and also into a crystal detector, which in turn connects to the amplifier of the oscilloscope. If the line is now terminated by a resistive load equal in value to the characteristic impedance of the line, the voltage developed by the crystal will be completely independent of the frequency of the sweep generator and no output will be observable on the oscilloscope.

If, however, the line load is different from this proper terminating resistance, the voltage across the crystal load and hence that applied to the oscilloscope will change with frequency, and the amplitude of this change will be a measure of the reflected voltage on the length of line.

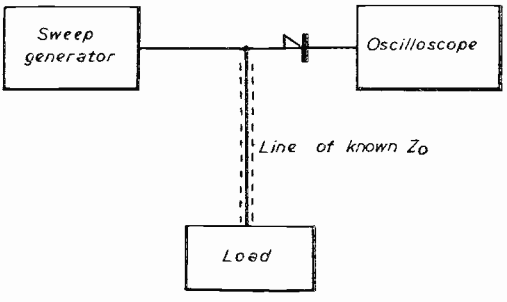


Fig. 2.—Block diagram of the test gear arrangement.

As is generally known, the maximum impedance is presented at the input of a line when the length of the line is an odd number of quarter-wavelengths ; at the input frequencies making this condition true, therefore, the voltage developed by the crystal will be at maximum. Similarly, since the minimum impedance of the line occurs when its length is an even number of

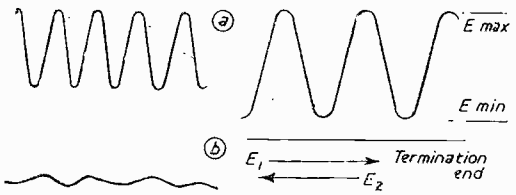


Fig. 3 (Left).—Oscillograms of mismatched and matched conditions of line load respectively. Fig. 4 (Right).—Measurement of VSWR.

quarter-wavelengths, the crystal voltage is lowest at these frequencies. The output as shown on the oscilloscope is consequently of the form shown in Fig. 3(a) where the frequency sweep is controlled by the timebase voltage in the usual way.

This shorted line method can be used to give a direct measure of the amplitude ratios of the forward and reflected waves on a length of line over a range of frequencies by noting the wave amplitude with a shorting (zero) load and comparing it with the amplitude existing with other finite loads. If the detector and 'scope amplifier are linear, the relative amplitudes correspond to the relative levels of the forward and reflected waves. If a base line can be provided on the oscilloscope screen, the VSWR can be directly derived from the formula—

$$\frac{E\ max}{E\ min} = \frac{E1+E2}{E1-E2} = VSWR$$

E1 and E2 being the forward and reflected waves respectively (see Fig. 4).

For accuracy in such measurement it is necessary to avoid reactive elements at the cable termination. For the shorted case it is sufficient to twist the inner and outer conductors (of a coaxial cable) firmly together for a matter of about ½in., but when a resistive load is substituted this must be of a carbon non-inductive variety and the connecting leads must be cut back to an absolute minimum. Several wavelengths of cable should be used on such tests.

To check the set-up, or find the characteristic impedance of a cable accurately, a resistive load of the nominal value of the line impedance is used at the termination. The pattern on the 'scope will then approximate to a straight line as shown in Fig. 3(b). When the best result is obtained, the line impedance is equal to the resistance value which can be measured by Ohm's law.

If a dipole is substituted for the load, the match can be determined in the same way, and if facilities are available for experiments on the aerial element lengths, spacing, etc., a good match at that end is readily obtained.

Usually such aerial experiments are not without practical difficulty and, provided the set is well matched into the cable, a mismatch at the dipole is not important, since reflections from the receiver end are the main consideration. This part of the circuit is usually more accessible and the same principles can then be employed to provide an indication of the matching accuracy here.

For television purposes an accurate match is not vital and a VSWR up to 2 is permissible before the power loss exceeds 10 per cent. (0.5 db). The above method, which has some advantage over the slotted line measurement system, is not so accurate as this latter, but errors no greater than 10 per cent. may be expected.

Band III Transmissions

FOR industrial purposes only, a vision signal on a commercial television frequency is to be radiated from a temporary mast on the I.T.A. site near Croydon some months in advance of the opening of commercial television.

The transmissions will be carried out by Belling & Lee, Ltd., well-known aerial manufacturers, who, working in close co-operation with the industry and the I.T.A., are to be given permission by the G.P.O. to radiate a one-kilowatt Band III, Channel 9, vertically-polarised vision signal, such as a test pattern.

It is expected that the low-power transmissions will start about April 1. Details regarding times of transmission will be announced later.

"The purpose of this signal," a Radio Industry Council spokesman said, "is mainly to supplement by practical means the aerial manufacturers' technical appreciation of the problems of Band III reception.

"It will also provide useful additional data for receiver manufacturers and it will help retailers in making initial installations of receivers and aerials, but only within a very small area as compared with that which will be covered on the opening of the I.T.A. transmitting station on Channel 9 in the late summer."

American Figures

THE 33,500,000 television sets being used by the American public as at January 1st, 1955, represent a cost-to-consumer aggregate of $13.5 billions. This figure is derived from production, factory sales and retail figures published in the Television Factbook released recently by Television Digest of Washington, D.C.

Cumulative factory set sales of $6,451,000,000 during the nine years of TV from 1946 to 1954 are projected to a retail value of $9 billions, to which industry sources add an estimated $2 billions spent for servicing, $1.5 billion for components and aerials, $435,251,000 for picture tube replacements, $518,230,000 for receiving valve replacements. Tables setting forth production and sales year by year are featured in the Factbook.

On the programme side, TV Factbook estimates that $900,000,000 was spent by advertisers for time, talent, production and all other costs during 1954—a far cry from the figure for 1946, when only 10 stations were operating and their revenues aggregated only about $500,000. Annual volume, revenue, expense and earnings figures are tabulated—and within the trade it is estimated the total will go to $1.3 billion for 1955. Digests of staffs and technical facilities of the 427 U.S. and 25 Canadian TV stations associations, etc., are also included.

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A High Quality Amplifier designed by Mullard engineers. Robust high fidelity, with a power output exceeding 10 watts and a harmonic distortion less than .4% at 10 watts. Its frequency response is extremely wide and level being almost flat from 10 to 20,000 C.P.S.—three controls are provided and the whole unit is very suitable for use with the Collaro Studio and most other good pickups. The price of the unit completely made up and ready to work is £12/10/- or 25/- deposit, plus 10/- carriage and insurance.

RESPONSER UNIT

Ideal for Commercial T.V. These contain 6 valves type SP61, and one each RL7, RL16 and EA50. Six IF transformers 12 Mc/s. band, and hundreds of other useful components. Price 39/6, plus carriage and packing 7/6. Those receivers are unused.

POTTED TRANSFORMERS

These are of really superior construction fitted in cast metal cases and compound filled. Terminals come to ebonite baseboard. All are upright mounting and have 220/230 normal 50 cycle mains input and fully screened primary.

Type 5F1. 265-0-265 at 300 m.a. ; 6.3 v. at 7 amp. ; 4.4. v. at 2.5 amp. ; Price 35/- plus 3/6 carriage.

Type 5F2. 365-0-365 at 150 m.a. ; 4 v. at 2.5 a. ; 6.9 v. at 4.2 a. Price 32/6, carriage and packing 3/6.

Type 5F3. 1540 v. 2 v. at 2 a. ; 4 v. at 1 a. This is an ideal transformer for televisors and scopes using V.C.R. 97, etc. Price 25/-, carriage 2/6.

GREATLY REDUCED CATHODE RAY TUBES

VCR97. Brand new and unused, "cut off type," ideal for 'scope, etc. Price 12/6. Carriage and insurance 5/- extra. Ditto but full picture type for T.V. 39/6, plus carriage 5/-.

VCR517. 6½in. guaranteed full picture. 29/6. plus 5/- carriage and insurance.

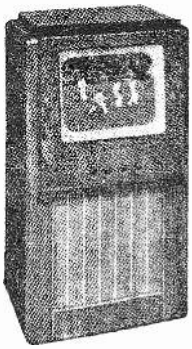
VCR138A. 2½in., 32/6. plus 2/6 carriage, etc.

VCR138. 3½in. electrostatic short persistence, suitable for T.V. and ideal for 'scope work, 37/6 plus 3/6 carriage, etc.

VCR112. 5in. electrostatic, persistence not known, 15/- each, plus 5/- carriage, etc.

CV996. 6in. electrostatic, persistence not known, 15/- each, plus 5/- carriage, etc.

CV1140, CV1590, CV1546. All 12in. magnetic long persistence, £4/10/-, plus 10/- carriage.



A FEW REMAIN

This cabinet is offered below cost. It is suitable for a televisor using tube sizes varying from 12in. to 17in., its overall dimensions being 3ft. 5in. high, 1ft. 4in. deep, 1ft. 10in. wide. It is complete with plywood back and "Bowler Hat." Originally made for a very expensive televisor and really good quality. Unrepeatable. Offered at £6.19.6 carriage, packing, etc., 12/6. Note : These are cut for 12in. tubes, but the holes for the controls are not drilled.

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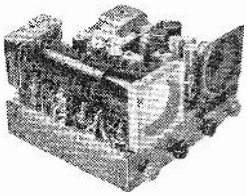

MINIATURE PORTABLE T.V.

The Elpreq Miniature Televisor uses standard conventional circuitry, employing a total of 13 valves and 2 crystal diodes. The cathode-ray tube used is a 2½in. Service type VCR139A, which has a standard equivalent and will therefore always be obtainable. The layout is extremely clean, straight-forward and professional. The wiring, whilst naturally being a little more intricate due to miniaturisation, is nevertheless completely accessible. The total cost comes to £16-£17. Its size will be approximately 9½in. x 8in. x 6in.

Full construction data, layouts, diagrams, templates, etc., running into some 50 sheets is available, price 5/-, post free.

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Extremely well built on chassis size approx. 9½ x 7½ x 8½, using only first-class components, fully aligned and tested, 110-240 volt A.C. mains operation. Three wave bands covering medium and two shorts. Complete with five valves, frequency changer, double diode triode, pentode output and full wave rectifier. Special cash-with-order price this month, £5/19/6, carriage and insurance 7/6.

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YOURS FOR £1

R1155 is one of the finest communication receivers available ; frequency range is 75 kc/s to 18 Mc/s. Complete with 10 valves in metal case. Made for the R.A.F. so obviously a robust job guaranteed in perfect working order. Price, Grade 2, £7/19/6 ; Grade 1, £9/19/6, or new and unused, £11/19/6, or will be sent on receipt of deposit of £1. Balance by 12 monthly payments. Carriage and Transit Case 15/- extra.

MAINS POWER PACK FOR R.1155

With Pentode output stage. Plugs into socket on receiver so no internal modifications are required. Price £5.10/- complete with speaker ready to work, carriage 3/6. If bought with receiver deposit is 11/-.

POTTED CHOKES

These chokes are in similar type cases and therefore match the transformers on left.

Type 5F4. 5 H. at 300 m.a. Price 10/-, carriage and packing 2/6.

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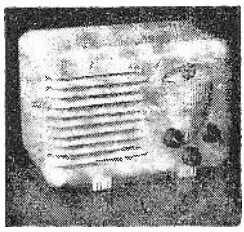
NOW A.C./D.C. MULTI-METER KIT

We can now offer a kit of parts suitable to making a multimeter to measure A.C. volts as well as D.C. volts, milliamps and ohms. Price for kit containing all the essential items including moving-coil meter, metal rectifier, resistors, range selector, calibrated scale, etc., etc., is 19/6, plus 1/- post and packing. The D.C. only version is 15/- plus 9d. post and packing.



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Uses high-efficiency coils—covers long and medium wavebands and fits into the neat white or brown bakelite cabinet—limited quantity only. All the parts, including cabinet, valves, in fact, everything, £3/19/6, plus 2/- post. Constructional data free with the parts, or available separately 1/6.

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Employs modern circuit ensuring good reception on both medium and long waves. All parts including three valves, resistors, tuning condensers, in fact, everything except loudspeaker, cabinet and chassis (available if you haven't something suitable) costs only 19/6 ; data available separately, price 1/6.

HIGH POWER TRANSFORMERS

For R.F. Heaters, transmitters, etc., etc. These are open wound type for maximum cooling and have the normal 200-250 primary fully screened.

Type 5F6. 1,000 v. at ½ amp., e.g., .5 kV.A. Price £8/10/-, carriage and packing 5/-.

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SPECIAL.—Semi-air spaced polythene, 80 ohm Coax ¼in. diam. Stranded core. Losses cut 50%. (Just released) **9d.** yd.

BALANCED TWIN FEEDER per yd. 6d. ½ 80 TWIN SCREENED COAX FEEDER per yd. 1/- ½ ohms 50 OHM COAX CABLE, 8d. per yd.

TRIMMERS, Ceramic, 30, 70 pf., 9d.; 100 pf. 150 pf., 1/3; 250 pf., 1/6; 600 pf., 1/9.

RESISTORS.—All values: ¼ w., 4d.; ½ w., 6d.; 1 w., 8d.; 2 w., 1/-; 3 w., 1/6, 2/-.

WIRE-WOUND RESISTORS.—Best Makes Miniature Ceramic Type—5 w., 15 ohms to 4 K., 1/9; 10 w., 20 ohms to 6 K., 2/3; 15 w., 30 ohms to 10 K., 2/9; 5 w. Vitreous, 12 K. to 25 K., 3/-.

WIRE-WOUND POTS. 3 WATT. FAMOUS MAKES Pre-Set Min. TV. Type. Knurled Slotted Knob. All values 25 ohms to 30 K., 3/- ea. 50 K., 4/-. Ditto Carbon Track 50K. to 2 Meg., 3/-.

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L.F. CHOKES 10 h. 65 ma., 5/-. 20 h., 150 ma., 12/6, 15 h. 100 ma., 10/6. SIMPLEX 10 h 150 ma., 10/3.

MAINS TRANS.—Made in our own workshops to high grade specification. Fully inter-leaved and impregnated. Heater Trans., tapped prim., 0-200 v./250 v. 6.3 v. 1½ amp., 7/6. 12 v. .75 amp., 7/6. 6.3 v 3 a., 10/6. 350-0-350, 80 ma., 6.3 v. 4 a. 5 v. 2 a., ditto 300-0-300 ditto 250-0-250, 21/-. Viewmaster, auto type, 35/-. Teleking. 30/-. Lynx, 30/-. Coronet, 30/-. Simplex (modified with 4 v. tap), 35/-.

TV. AERIALS. Aerialite etc. full range all channels in stock. Indoor loft type Inv. T., 13/6 etc. etc.

TYANA.—Midget Soldering Iron. 200/220 v. or 230/250 v., 14/11. Triple Three mod. with detachable bench stand, 19/6. Solon Midget Iron, 19/6.

TAG STRIPS.—2- or 3-way, 2d.; 4- or 5-way, 3d.; 6-way, 4d.; 9- or 10-way, 6d.; 28-way, 1/3.

ENAMEL OR T.C. WIRE.—¼ lb. 14 to 20 s.w.g. 2/-; 22 to 28 s.w.g., 2/6; 30 to 40 s.w.g., 3/9.

XTAL DIODE.—Sensitive G.E.C. type, 3/6. H.R. Phones (S. G. Brown) or Hi-grade Amer., 15/6 pair.

SIMPLEX TELEVISION

Detailed price list available.

STAGE 1.—VISION AND SOUND.

7 Valves 30/-
12 Resistors ... 3/-
16 Condensers ... 9/-
2 Potentiometers 6/-
7 Coil formers with cores 4/6
7 Valveholders ... 3/6
Sundries (with undrilled chassis) ... 22/6

STAGE 2.—TIME BASE.

6 Valves 29/-
20 Resistors ... 8/8
15 Condensers ... 15/6
5 Potentiometers 12/6
6 Valveholders ... 2/6
Sundries 1/6

STAGE 3.—POWER SUPPLY.

2 Resistors ... 2/-
5 S.T.C. Rectifiers 27/6
5 Condensers ... 23/6
1 Choke 10/6
1 Mains Trans. Tapped 4 v. and 5 v. ... 35/-

STAGE 4.—C.R.T. NETWORK

9 Resistors ... 4/-
1 Condenser ... 6d.
4 Potentiometers ... 10/-
Sundries 3/6

COMPLETE SIMPLEX KIT (less tube) 12 gns. Drilled Chassis, Screens etc., 17/6, or 10/- extra with KIT or Sundries (Stage 1). VCR97 TUBE TESTED & GUAR., £2 (P. & p., 2/-).

NEW BOXED VALVES ALL GUARANTEED

1R5	8/-	6K8	9/-	6AC7	8/6
1S5	8/-	6L6	10/6	6C9	12/6
1T4	8/-	6P25	15/-	35L6	10/6
1S4	8/-	6Q7	9/6	80	9/-
3S4	9/-	6SL7	9/-	EA50	2/-
3V4	8/-	6SN7	11/-	EB91	7/6
2X2	5/6	6U5(Y63)	8/-	EBC33	9/6
5U4	10/6	6V6	8/-	EF39	9/-
5Z4	9/-	6X5	9/-	EF50	
6AM6	9/-	VT127	(Pen		Equip 5/6
6AT6	10/6	46)	9/-	British	7/6
6H6M	3/6	12AT7	10/6	Syl.Red	10/6
6J5	7/6	U25	12/6		

EF91	9/-	6500	
EY51	12/6		
PL81	13/6		
PY80	11/6		
PY82	10/6		
5P61	8/6		
U22	9/6		
ECL80	12/6		
EF80	10/6		
12AX7	10/6		
ECH42	12/6		
EF55	12/6		
MU14	9/6		

Huge Stock B.V.A. Valves at 1951 low tax prices.

TV. PRE-AMP.—Channel 1, easily modified to other channels or converter use. Midget chassis 6in. x 3in. x 1¼in. Complete with conv. lead, plug and EF42 valve. Brand new (boxed). Listed £3/15/-. Special clearance, 27/6, p/p. 1/6.

P. and P., 6d. £1 orders post free. Lists 3d.
ALL TRANS. P. & P. 1/- extra please.

T.R.S. THO 2183 **RADIO COMPONENT SPECIALISTS**

70, Brigstock Road, Thornton Heath, Surrey.

Buses 130, 133, 166, 159.

C.R.T. HEATER ISOLATION TRANS. Ratio 1 : 1.25 Low leakage winding with 25% sec. boost, 2 v. 10/6; 4 v., 10/6; 6.3 v., 10/6; 12 v., 10/6.

BRIMISTORS.—CZ1 .3 a., 3/6. CZ2 .15 a., 2/6.

CONDENSERS.—New stock. .001 mfd. 6 kV. T.C.C., 5/6. Ditto, 12.5 kV., 9/6; 2 pf. to 500 pf. Micas, 6d.; .001 Mica or Tub. T.C.C. 500 v., .01. Sprague 500 v., .02 N.S.F. 500 v. .1 mfd. 350 v. Micamould Tub. 9d.; Hunts Moldseal 500 v. .005, .01, 9d.; .05 mfd. and .1 mfd., 1/-; .25 mfd., 1/6. .5 mfd., 350 v., 1/9; 1 mfd., 1,500 v. T.C.C., 3/6.

SILVER MICA CONDENSERS.—10%. 5 pf. to 500 pf., 1/-; 600 pf., to 3,000 pf., 1/3. DITTO 1% ex Stock 1.5 pf. to 500 pf., 1/9; 515 pf. to 1,000 pf., 2/-.

ELECTROLYTICS ALL TYPES NEW STOCK

Tubular Wire Ends		Can Type, Clips, 3d. ea.	
2/450 v. B.E.C.	2/3	8+8/500 v. T.C.C.	4/6
4/500 v. Hunts	2/-	16/450 v. T.C.C.	3/6
8/450 v. B.E.C.	2/3	60/350 v. T.C.C.	6/6
8/450 v. T.C.C.	2/9	250/350 v. B.E.C.	8/6
8/500 v. Dubilier	2/9	8+16/450 v. B.E.C.	5/-
16/500 v. Dubilier	4/-	8+16/500 v. Dubilier	5/6
8+8/500 v. Dubilier	4/6	16+16/450 v. B.E.C.	5/6
16+16/500 v. Dub.	6/-	16+16/500 v. T.C.C.	6/-
32/500 v. Dubilier	5/-	32+32/275 v. B.E.C.	4/6
32+32/350 v. Dub.	5/6	32+32/450 v. B.E.C.	6/6
25/25 v. Hunts.	1/9	32/350 v. Dubilier	4/-
50/12 v. B.E.C.	1/9	60+100/350 v.	11/8
50/50 v. Plessey	2/-	100+200/275 v.	12/6

SPECIALS—500 mfd. 12 v., 3/-, 1500 mfd. 6 v., 4/6 6000 mfd 6 v., 5/6, 1000+1000 mfd. 6 v., 6/6.

SENTERCEL RECTIFIERS.—EHT Type. Flyback Voltage.—K2/25 2 kV., 4/3; K3/40 3.2 kV. 6/-; K3/45, 3.5 kV., 6/8; K3/50 4 kV., 7/3; K3/100 8 kV., 12/6; K3/160 14 kV., 18/-. MAINS TYPE.—RM1, 125 v., 60 ma., 4/-; RM2, 100 ma., 4/9; RM3, 120 ma., 5/9; RM4, 250 v., 275 ma., 16/-.

KNOBS, GOLD ENGRAVED.—Walnut or Ivory, 1¼in. diam., 1/8 each. Not engraved, 1/- each.

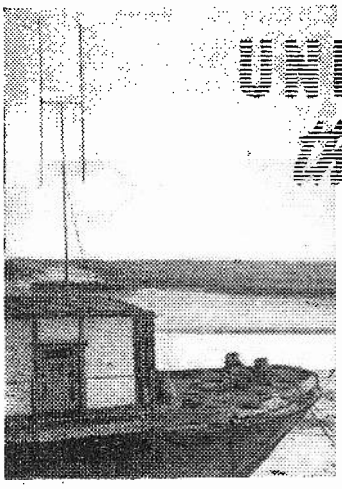
LOUDSPEAKERS P.M., 2 OHM.—3in. Plessey. 12/8; Goodmans, 4in. square, 15/6; 5in., 14/6; 6½in. 16/-; 8in. R. & A., 17/8; 7in. Elliptical, 18/6; 10in. R. & A., 25/-; 6½in. with transf., 19/6.

SLEEVING—Various colours, 1, 2 mm., 2d.; 3, 4 mm., 3d. yd.; 6 mm., 5d. yd. TOGGLE SWITCHES EX-GOVT. "On-Off," 9d. Ersin M'core solder, 60/40, 16 g. or 18 g., 4d. yd., 5/6 ¼ lb.; PVC Connecting wire, 10 colours. Single or Stranded 2d. yd.

V'HOLDERS.—Pax: 1O, 4d.; EF50, EA50, 6d.; B12A CRT, 1/3. Moulded: 1O, 6d.; B7G, 9d.; with screening can, 1/6; B8A, B8G, B9A, 1/-; Ceramic: EF50, B7G, 1/-. All English, 5, 7, 9 pin and U.S.A. UX types, 1/-. VCR97 moulded holders, 2/6.

ALADDIN FORMERS and core, ½in., 8d.; ¾in. 10d.

INT. OCTAL CABLE PLUG (8-pin), with cover, 1/3.



UNDERNEATH the DIPOLE

TELEVISION PICK-UPS AND REFLECTIONS

By Iconos

FILMING IN AFRICA

VIEWERS differ in their likes and dislikes of humans on television, but when it comes to animals they appear to be quite unanimous. Everybody seems to like visits to the Zoo, horse shows, circuses, dogs and all the animals on the farm. It followed naturally that Armand and Michaela Denis's "Filming In Africa" would achieve great popularity on TV with the unique record of their journeys through the jungle. A great deal of the success, however, is due to the expert editing of the material obtained, to the presence in many shots of this delightful couple and to the excellent commentary. For this series of films, 16 mm. Kodachrome colour film was used and the expedition carried with it one Arriflex and five Bell and Howell cameras, all equipped with a wide selection of lenses, a multitude of accessories and gadgets and a magnetic tape recorder. The interesting technical point to note is the use of 16 mm. colour film.

SUB-STANDARD OR STANDARD ?

OVER here, the BBC have standardised largely on 35 mm. film for its newsreel, for telerecording and for filming documentary films or interpolated sequences in TV plays. In America the accent has been on the use of 16 mm. film, which is very much cheaper and easier to circulate to upwards of a hundred small TV stations all over the United States. The cost of daily transport of 35 mm. film by air would be a large item, whereas 16 mm. film takes up far less space and weighs less. Apart from the difference in width, it must be remembered that 400ft. of 16 mm. film has the same running time as 1,000ft. of 35 mm. film. In addition, the five regulations in some states make it impossible to use 35 mm. film in any place other than an approved projection booth of the cinema type. It seems that, unlike the position in England, 35 mm. film on the old highly-inflammable celluloid base is still circulating, or, at any rate, that the authorities still legislate for this type of film stock being used. There is no doubt that when shown by a ciné projector on a small screen, 16 mm. film is capable of giving a picture having quality and definition better than most TV sets will reproduce. Nevertheless, the quality of reproduction of 35 mm. film on BBC transmissions is very much better than when 16 mm. is used. Of course, the BBC only need two or three copies of their films and can even do without any prints at all, by scanning the negative for red-hot newsreel items. Nevertheless, 16 mm. film reproduction has its place, as has been demonstrated with the Armand Denis films, and it is to be hoped that the technicians at Lime Grove will hasten progress with their 16 mm. scanning equipment to bring it up to the standard they have achieved with 35 mm. film.

GEORGIA STORY

SOME years ago I read a biography of Fanny Kemble, the famous actress who achieved stardom in London in 1829 and who later went to America. It was an enthralling narrative, quite different from "Georgia Story," the TV play by Constance Cox, which concentrated on one particular period in her life when she lived with her American husband on a cotton plantation in Georgia. For 90 minutes viewers were regaled with a series of parables and sermons for the abolition of slavery, to the detriment of characterisation. Joyce Redmond, one of the finest actresses who have mastered the difficult technique of playing before TV cameras, was given little scope to convey the glittering personality of the great actress from London, the part itself being little more than that of a heroine tortured by the depravity of the people with whom she had come to live. Robert Beatty, in the part of her husband, Pierce Butler, was similarly hampered by a role which was little removed from the heavy villain of old-time melodramas. The most convincing performance was perhaps that of George Coulouris, whose portrayal of the half-caste overseer, Mr. Lee, was not overweighted with dialogue. Technically, "Georgia Story" was well presented and the producer, Campbell Logan, used his cameras most expertly in this over-long play.

"THE VOICES"

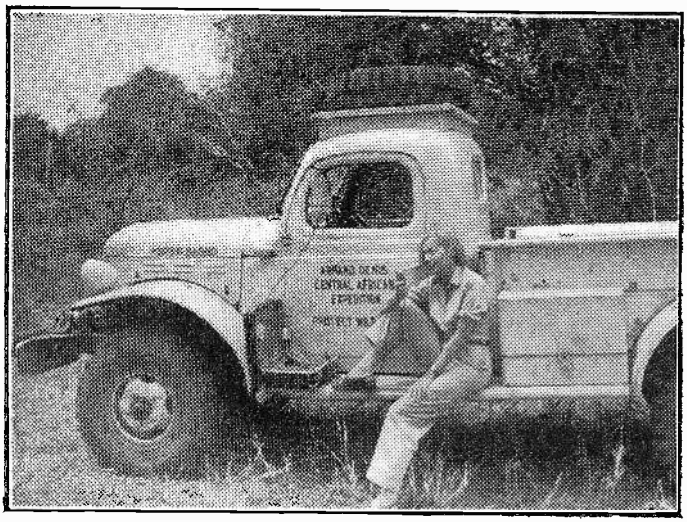
THE BBC continue to start the week brightly with horrific Sunday night plays which, at any rate, have the advantage of securing much valuable space in the national newspapers on subsequent days when the TV critics and their correspondents let their opinions fly. Big Brother of "1984" was still vividly in our memories when "The Voices," a play set in the year 2021, was presented to us by producer Denis Vance. This was an adaptation by George Kerr of Robert Frane's novel "Hero's Walk" and is largely set in the gigantic Palace of Intercos, where a world Government deals with the problems of inter-planetary attack or defence. With little or no humorous relief, plot and counter-plot develop amidst an atmosphere of space-guns, inter-planetary battle wagons and peculiar sounds from magnetic tape being run backwards. The non-intelligibility of these messages from outer space was one of the weakest spots, defeating even the only credible character in the whole show, the scientist, Professor Harrison, played with a horrific make-up by Willoughby Goddard. Not so very many years ago, Eille Norwood used a similar type of make-up, representing a horrible facial disease, for his film part as Sherlock Holmes in "The Dying Detective." The producer decided

to retake the scenes as being too horrible for cinema audiences. Presumably the TV viewers are made of sterner stuff!

A large number of first-class cinematographers in Hollywood have turned over to the photography of films for television, including several top-line men from the big feature films. Karl Freund is responsible for the photography of the popular "I Love Lucy" series, sponsored by Philip Morris cigarettes and "Our Miss Brooks," sponsored by General Foods. Robert de Grasse, Hal Mohr, Phil Tannura, Harold E. Wellman and Edward Colman are other ace cameramen similarly engaged. Edward Colman's work has been on "Dragnet," a series of half-hour dramas which have been made by an independent company working at the Walt Disney Studios for Chesterfield Cigarettes. I expect that some of this product will be seen over here on the I.T.A. network when that starts operation. In the meantime, we see the Inspector Fabian series on the BBC which was made at the Twickenham Studios, primarily for release on American TV. The veteran American film producer, Hal Roach, has also turned over to TV films and for some time now has been shooting everything in 16 mm. colour, though his films are still being reproduced by black-and-white transmitting stations only. He claims that the colour film stock gives superior quality, particularly as regards grain—and, in any case, can be used in due course by the colour television stations.

ASPECT RATIOS

THE aspect ratio of 16 mm. film picture is 1.33 to 1, this being the width of the picture compared with the height. The same aspect ratio has applied until recently to 35 mm. film at the cinemas—that is, until they started installing the huge screens which are now the fashion. Unfortunately, some of the screens were so large that the patrons at the back of the stalls could not see the full height of the screen, owing to the sight lines being cut off by the front of the circle. Consequently, top and bottom of the picture was cropped and a shorter focus lens employed, giving an aspect ratio of 1.66 to 1. Some theatres made even more severe cuts up to a ratio of 1.85 to 1. CinemaScope, which uses an anamorphic attachment on the lens, spreads the picture to a ratio of 2.5 to 1. The camera work has to be appropriately adjusted to meet the new projection problems, the cameraman composing his picture to suit this new look. These changes pose a problem for film makers who sell their films to TV stations in one country and cinemas in another. Armand Denis, who has been equally successful in both fields, compromises by shooting his pictures for a 1.66 aspect ratio. This gives reasonable results on both TV and cinema projection, though he has to take care that no important action takes place at the bottom of the picture and is likely to be cut out if the projection is slightly out-of-rack.



On their last African Safari, Armand and Micheala Denis used an Emidicta tape recorder, powered by the electrical system of their truck, for putting book material and TV film commentaries on tape. Michaela is seen here using the equipment.

THE CIRCUS

BILLY SMART, the genial showman and circus proprietor, has a soft spot for television. He even has it installed in his luxury travelling caravan. The transmission from Birmingham of excerpts from his circus, presented by Keith Rodgers, was highly successful and must have proved a valuable advertisement for his show. In very quick succession, a large number of equestrian and animal acts were put over with slickness, together with first-class gymnastic turns and the changes of apparatus and equipment were well "covered" by the amusing antics of the clowns. I suppose that in another day and age, Billy would have felt entitled to call himself "Colonel Smart," "the Hon. W. Smart" or "Lord William Smart," following the precedent of Lord George Sanger and Sir Robert Fosset. Billy Smart followed the precedent by leading the parade of performers and animals around the ring. He wore the traditional ten gallon hat and his cheerful grin started off proceedings in the right manner. We felt that he was going to enjoy himself as much as we were.

ANNOUNCERS TO GO

IT is learned with regret that the BBC intends dispensing with its announcers, or with their faces at least if not their voices.

Looking back, it seems that Macdonald Hobley, Sylvia Peters and Mary Malcolm have been the only real "friends" we have made through the medium of television. More interest is aroused by the introduction of a new announcer than any panel game personality no matter how stormy or jovial the latter may be. Noelle Middleton, Avis Scott, Peter Haigh, Donald Gray; these are all names that have helped form that personal and friendly link between the viewer and the BBC's television programmes. Without them our evening's viewing will take on that cold and formal atmosphere and our screens are going to be much the poorer without them.

TELENEWS

Commercial Date—September 1st

THE Independent Television Authority has announced that its London station will commence operation on September 1st.

The Holme Moss and Kirk o' Shotts stations are scheduled to begin in December.

No " Victory on a Plate "

GIVING the BBC's policy towards commercial television, Sir Ian Jacob, Director-General of the BBC, says : " There can be no question of handing victory on a plate to our competitors. Competition for the best people is very strong at the moment and may be even stronger in the immediate future. Special care is being taken to see that their value is correctly recognised."

Tele-'phone

A GLIMPSE into television of the future was provided by Pye, Ltd. at a Jubilee Exhibition in Hull recently.

While a caller is speaking on the telephone, a miniature TV camera sends his picture to the person at the other end. At the same time the reverse process is taking place and he can watch the person he is talking to on a monitor in front of him.

Television Appointments

THE BBC announces that Mr. S. J. de Lotbiniere has been appointed to the new post of Assistant Controller Programmes, Television. He will deputise for Mr. Cecil McGivern, the Controller of Television Programmes during his absence, and will be in charge of such programme services as production management, make-up and wardrobe, design and bookings.

Mrs. J. R. Spicer becomes Head of Programme Planning, Television. Her previous post of Programme Organiser has been abolished.

Russians Experiment With Colour

ACCORDING to radio reports from Moscow, television transmissions in colour were made in Russia towards the end of last year.

The experiments are claimed to have been successful.

Television Licences

THE following statement shows the approximate number of television licences issued during the year ended December, 1954. The grand total of sound and television licences was 13,872,633.

Region	*Number*
London Postal ...	1,073,809
Home Counties ...	443,962
Midland	778,110
North Eastern... ...	595,665
North Western ...	599,396
South Western ...	208,062
Wales and Border Counties	221,893
Total England and Wales	3,920,897
Scotland	215,225
Northern Ireland ...	19,867
Grand total ...	4,155,989

Screens Large Enough

THE contention that a larger screen means more detail for the TV viewer was refuted by Mr. Kenneth Wright, Head of Music, BBC Television, at a recent meeting of composers in London.

" Our television system works on 405 lines for its picture," he said, " and however large the screen may be, you still have the same number of lines."

Cumberland Station

IT is learned that a television transmitter is to be built in Cumberland to serve the far North-western area and possibly a V.H.F. radio station as well.

This is the result of a campaign begun by Keswick Urban Council in protest against poor radio reception in the area.

Princess Royal to Open Show

H.R.H. THE PRINCESS ROYAL has consented to open the Northern Radio Show at City Hall, Manchester, on Wednesday, May 4th.

All space in the exhibition has been taken. The exhibitors include the leading manufacturers of radio and television receivers and the organisers, the Radio Industry Council, are to build a studio within the exhibition from which the BBC will broadcast both sound and TV programmes.

The show will close on Saturday, May 14th.

Every day Wilfred Pickles receives scores of requests in connection with his " Ask Pickles " programme. Here, Wilfred and his wife Mabel sort through some of the letters from viewers.

Interference From Army Radio

G.P.O. officials are investigating reports from Colchester viewers of interruptions in TV sound reception by local Army radio transmissions.

Recently, the Colchester TV public were watching a BBC play when they found that their sound was fading. In a few seconds it had been replaced by a boxing commentary from nearby Colchester barracks. Viewers have also overheard Army exercises in recent weeks and a private " walkie-talkie " conversation between two soldiers.

Long-term Planning

IN spite of the general belief that colour television in Britain is still a long way off, a well-known manufacturer of television receivers and equipment is to erect a new building to be used solely for the making of colour tubes and sets.

" Look at it This Way "

THE new Eric Barker series which began on February 16th under the above title is his fourth in four years.

With Barker are his wife, Pearl Hackney, Cameron Hall and Nicholas Parsons, who were all members of the original series in 1951.

Engineering Appointment

THE BBC announces the appointment of Mr. E. N. B. Hammond as Engineer-in-charge of the new Norwich television station. He will also continue to be responsible for the Home Service transmitting station at Postwick, near Norwich, where he has been Engineer-in-charge since May, 1950.

Mr. Hammond joined the BBC in 1934 as a maintenance engineer.

Dr. Glyn Daniel and Sir Mortimer Wheeler, two personalities well-known to viewers, posed for this picture at a recent Literary Luncheon held in London to mark the publication of Sir Mortimer's autobiography " Still Digging."

No " Tailor's Dummy "

BRITISH tailors regard BBC male announcers as very poor advertisements for the tailoring trade in this country and have offered to fit them out completely free of charge.

I.T.A. Site

MR. P. A. T. BEVAN, chief engineer of the I.T.A., has stated that the Authority's Lancashire station will probably be situated on the Rivington fells between Preston and Bolton.

The I.T.A. has decided to have one transmitter for Lancashire and one for Yorkshire instead of one station to serve both counties.

Commercial Station

THE first commercial television station in Europe is to be opened by Radio Monte Carlo.

As the transmitter is so powerful that even Moscow can receive it, the station will have the largest potential audience in the world.

News Service Improvement

SIR IAN JACOB, BBC Director-General, has informed his news division that he wants to see an improvement in the " News and Newsreel " feature by next winter so that there can be two news screenings each evening, at 7.30 p.m. and at 10.30 p.m. This will mean an increase in the number of cine-cameramen—there are 12 in the present team—and mobile TV units will be used, bringing the total annual expenditure up to an estimated £14,000 a week. This is £500,000 a year more than the original estimate for " News and Newsreel."

Mr. Harry Watt

GRANADA Theatres, who have been allotted the Manchester station for the Monday to Friday period by the I.T.A., announce the appointment of Mr. Harry Watt, film director and writer responsible for " Target For Tonight," " Nine Men " and other films, to supervise the production of actuality programmes for Granada.

Uganda Sees TV

TELEVISION was demonstrated for the first time in Uganda recently, when British firms took part in an exhibition in Kampala.

Expansion of Glasgow Headquarters

THE size of the BBC's headquarters in Queen Margaret Drive, Glasgow, is to be doubled and the new building will contain studios and offices controlling a special television service for the whole of Scotland.

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.

THE COMPACT TELEVISION AERIAL BY ANTIFERENCE LTD.

Supplied complete with universal mounting and backplate in neutral brown finish. Overall length 5ft. 6in. Packed in carton 3ft. 4in. long. Complete with full instructions. Cat. No. CD4. Original price 50/-. Our price, 12/6. Post, etc., 2/6.

LOUDSPEAKER UNITS

ROLA 5in. Speaker with transformer ... ... 16/- ea.
PLESSEY 6½in. Lightweight unit ... ... 16/6 ea.
ROLA 6½in. standard type... 17/6 ea.
LECTRONA 6½in. with transformer ... ... 18/- ea.
TRUVOX 6½in. wafer type... 20/- ea.
PLESSEY 8in. lightweight unit ... ... 17/6 ea.
PLESSEY 10in. unit ... 19/6 ea.
ELLIPTICAL 4in. x 7in. unit 18/6 ea.
MAINS ENERGISED 8in. unit 1,000 Ω ... ... 21/- ea.
MAINS ENERGISED 6½in. unit, 600 Ω ... ... 17/6 ea.

WAX TUBULAR CONDENSERS WITH WIRE ENDS

.001 mfd. 350 v. 5d. each or 4/6 doz.
.002 mfd. 400 v. 5d. each or 4/6 doz.
.002 mfd. 1,000 v. 9d. each.
.005 mfd. 600 v. 9d. each.
.01 mfd. 500 v. 5d. each or 4/6 doz.
.02 mfd. 1,000 v. 7d. each.

POCKET TEST METER

Ex Govt. volt meter, two ranges 0-15 v.; 0-250 v. D.C., complete in case, 17/6 ea.

NYLON CORD

25yd. reels Nylon drive cord on wooden reel, 2/9 ea.

CONDENSERS

BI. waxed cartons with flying leads. 4 mfd., 500 v., 1/6 ea.; 4 x 4 mfd., 500 v., 3/4 ea.

IRON ELEMENTS

Standard adaptable type, 230 v., 450 v. ... ... 1/8 ea.
Morphy Richards replacement type ... ... 3/9 ea.
H.M.V. replacement type... 3/- ea.

PLIERS with side cutters, 3/9 pair.

DOUBLE TRIMMERS

250/250 pf.; 100/100 pf.; 100/50 pf. All 6d. ea.

YAXLEY SWITCHES

1 pole, 9 way, 1/9 ea.; 4 pole, 2 way, 1/9 ea.; 3 pole, 3 way, 3 bank, 1/6 ea.; 4 pole, 3 way, 2/6 ea.

OCTAL PLUG & SOCKET (SCREENED), 1/- ea.

PRESET CONTROLS (CARBON) 50 KΩ; ½ megΩ; 1 megΩ; 2 megΩ, 1/9 ea.

TRANSFORMERS FOR BATTERY CHARGERS

230 v. Input Tapped 6-12 v. 1 amp. ... ... 13/6 ea.
230 v. Input Tapped 6-12 v. 3 amp. ... ... 18/- ea.
(Both with tap on Primary for 2.5 v. Pilot light.)

SENTERCEL RECTIFIERS

RM1, 3/9 ea.; RM2, 4/2 ea.; RM3, 5/- ea.; RM4, 16/- ea.

METAL RECTIFIERS

12 v. ½ amp., 1/6 ea.; 12 v. 1 amp., 4/6 ea.; 2 v. 1 amp., 3/- ea.; 250 v 45 mA., 6/3 ea.; 250 v. 75 mA., 7/6 ea.; 300 v. 60 mA., 7/6 ea.

OSMOR COIL PACKS

Type H.O., 48/- ea. Type LM. 40/- ea. Type T.B., 50/- ea. Type TRF, 40/- ea.

ALPHA FOR VALVES

GUARANTEED NEW AND BOXED.

AC/P4	8/-	KT33C	11/6	VU111	3/6	6C6	6/6	7S7	8/6
AC/P	6/9	KT66	11/6	VU120A	3/-	6C9	8/-	7Y4	8/6
AC6/PEN	5/6	KTW61	7/9	W76	9/-	6CD6G	13/6	75	10/-
ATP4	6/6	KTW63	7/9	W76	9/6	6D3	7/6	77	8/-
DDL4	4/-	KTZ41	6/9	W77	8/6	6D6	7/3	80	8/6
DH73M	10/-	LD210	6/9	W81	10/-	6F6G	7/6	807	7/6
DH81	11/-	LP220	6/9	OZ4	6/-	6F6M	8/6	8D2	2/9
EA50	2/-	MH4	5/6	1A3	9/-	6F8G	7/-	9001	5/6
EB34	2/-	MS/PEN	5/-	1A5GT	6/6	6F13	13/6	9002	5/6
EB41	11/-	P61	3/9	1A7	11/6	6F15	11/6	9003	5/6
EBC33	7/6	PCC84	12/6	1C5GT	8/-	6G6G	6/6	9004	5/6
EBC41	11/-	PCF80	12/6	1H5	10/-	6H6	3/6	9006	6/-
EBF80	11/6	PCF82	12/6	1L4	7/6	6J5G	5/-	954	2/-
ECC33	11/6	PEN25	8/-	1LD5	6/9	6J5GT	5/6	955	4/9
ECC35	11/6	PEN46	8/6	1R5	7/6	6J5M	6/6	956	3/6
EC52	6/3	PL81	13/6	1S4	7/6	6J6	8/-	10C2	11/6
EC91	9/-	PL82	11/6	1S5	7/6	6J7G	6/6	10F1	11/-
ECH35	13/-	PL83	13/-	1T4	7/6	6K6GT	8/6	10F9	10/6
ECH42	10/6	PM12M	10/-	1U5	8/-	6K7G	6/-	10LD11	11/-
ECL80	14/6	PM2B	5/6	220VSG	6/9	6K7GT	6/6	10P13	11/6
EF8	6/6	PM22B	5/6	2A3	6/9	6K7M	6/9	10P14	11/6
EF36	6/-	PY80	11/-	2X2	5/-	6K8G	8/-	12A6	6/9
EF39	6/6	PY81	11/6	3A4	8/-	6K8GT	9/6	12AH8	11/6
EF41	10/-	PY82	10/6	3D6	5/-	6L1	11/6	12AT7	9/-
EF50Syl	8/-	PX25	15/-	3Q4	9/-	6L6G	9/-	12AU7	9/-
EF50	6/-	S130	8/6	3Q5	10/-	6L7M	7/6	12AX7	10/-
EF54	7/-	SP220	6/9	3S4	8/6	6N7	7/6	12BA6	11/-
EF55	10/-	SP61	3/9	3V4	8/-	6Q7G	9/-	12BE6	11/6
EF80	11/6	SP41	3/6	4D1	3/-	6Q7GT	9/-	12C8	8/-
EK32	8/-	TP26	9/-	42	8/-	6R7G	8/-	12H6	5/-
EL2	12/6	U10	9/-	5U4(U52)	8/6	6SA7GT	8/-	12J5	6/-
EL33	13/-	U22	8/-	5Y3GT	8/6	6SG7	7/6	12K7	9/-
EL41	11/6	U25	14/6	5Z3	8/6	6SH7	6/-	12K8GT	9/-
EL84	13/6	U281	10/6	5Z4G	8/6	6SJ7GT	8/-	12Q7GT	9/-
EL91	10/6	U404	10/6	6A7	10/6	6SK7	6/3	12SC7	7/6
EM31	9/-	UAF42	12/-	6A8G	10/6	6SL7	8/-	12SH7	5/6
EY51	14/6	UB41	9/-	6AC7	6/6	6SN7GT	9/-	12SJ7	8/6
EY91	10/-	UBC41	11/-	6AG5	7/6	6P25	11/6	12SK7	8/6
EZ40	10/-	UCH42	13/6	6AJ5	9/-	6SQ7	9/-	12SL7	9/-
EZ41	11/-	UF41	11/-	6AK5	9/-	6SS7	8/-	12SQ7	8/6
E1148	2/-	UL41	11/6	6AL5	7/-	6ST7	7/6	12SR7	7/6
H30	5/-	UY41	10/6	6AM5	7/6	6U4GT	15/-	20D1	10/6
H63	7/9	VP23	8/-	6AM6	7/6	6U5G	8/6	20L1	10/-
HL23DD	7/6	VR105/30	5/6	6AQ5	8/6	6V6G	7/6	20P4	11/-
HP210	6/9	VR116	4/-	6AT6	8/-	6V6GT	7/6	25A6G	9/-
HP211C	7/6	VR150/30	9/-	6B4	6/-	6X4	8/-	25L6GT	8/6
HR210	6/9	VT52(EL32)	8/-	6B8G	4/-	6X5GT	7/9	25U4GT	12/-
KBC32	8/6	VT75(KT44)	7/6	6BA6	8/-	7B6	9/6	25Z4G	9/-
KF35	8/6	VT501(TT11)	6/-	6BE6	8/-	7B7	8/6	25Z6GT	8/6
KL35	8/6	VU39(MU12/14)	8/6	6BR7	9/6	7C5	8/6	35L6GT	8/9
KLL32	8/6			6BW6	8/6	7C6	8/6	35W4	10/-
KT2	5/-			6C4	8/-	7H7	8/-	35Z4GT	8/6
				6C5GT	7/6	7Q7	8/-	50L6GT	8/6
						7R7	8/6		

HUNTS CONDENSERS

Type W99, 200 pf. 350 v. ... 7d. ea.
Type W99, .005 mfd. 150 v. 7d. ea.
Type W48, .1 mfd. 400 v. .. 1/- ea.
Type L44, .1 mfd. 500 v. ... 9d. ea.

RESISTORS 2 WATT

2.2 KΩ; 470Ω; 7.5 KΩ; 22Ω; 150Ω; 5.6 KΩ; 390Ω; 150KΩ; ½ megΩ; 39Ω; 1.5 megΩ; 56 KΩ. All 4d. each.

BAKELITE CASED B.I. CONDENSERS

.1 mfd. 1,000 v.; .03 mfd. 4 KV; .03 mfd. 500 v.; .001 mfd. 4 Kv. All 1/6 ea.

DUBILIER NITROGOL CONDENSERS

12 mfd. 350 v., 5/6 ea.

SPRAGUE CONDENSERS

.05 mfd., 500 v.; .01 mfd., 1,000 v.; .1 mfd., 350 v.; 0.2 mfd., 750 v. All 9/- doz.

CONDENSERS MOULDED MICA

.0001, .0002, .0003, .0004, .0008, .0005, .001, .002, .003, .005, .01 50 pf. 20 pf.
All 4½d. each.

TCC VISCONOL CATHODERAY CONDENSER

Type CP57XO, .002 mfd., 18 Kv. ... ... 7/6 ea.
Type CP55QO, .001 mfd., 6 Kv. ... ... 5/- ea.
Type CP55TO, 500 pf., 10 Kv. ... ... 5/- ea.

VIBRATORS, ETC.

Vibrator unit for 6 v. operation, 14/6 ea. Post 1/6.
6 v. and 12 v. Vibrators, 4 pin, UX types, 6/6 ea.

RESISTORS. Asstd. All values from 10 Ω to 15 MegΩ. 20/- per 100.

SILICONE COATED WIRE WOUND RESISTORS

Tolerance 10%. Available in following sizes: 25, 50, 68, 100, 150, 200, 250, 350, 500, 680, 1,000, 1,500, 2,000, 2,500, 3,500, 5,000, 6,800, 10,000 ohms.
5 watt size ... ... 1/- ea.
10 watt size ... ... 1/3 ea.
15 watt size ... ... 1/9 ea.

TERMS: Cash with order or C.O.D. Postage to be added to orders as follows: 9d. up to 10/-; 1/- up to 20/-; 1/6 up to 40/-; 2/- up to £5. MAIL ORDER ONLY: Send 6d. in stamps for illus. catalogue. When ordering please quote "Dept. P.T.V."

HIGH RESISTANCE HEADPHONES

Type CHR, 11/6 pair: DHR, 13/6 pair. American phones by Trimm & Co., 13/6 pair.

CONNOISSEUR PICK-UP

Standard model, magnetic type, complete with matching transformer. Listed at £4/10/5. Our Price 29/6.

NUTS AND BOLTS

Box of 4 BA. nuts and shakeproof washers and bolts mixed, countersunk and round head, over 100 items 1/- box.
2 meg. Amplion vol. controls, double pole switch, 2/6 each.
1 meg. Erie vol. controls, double pole switch, 2/6 each.
100 KΩ; ¼ megΩ; ½ megΩ; single pole switch, 2/- each.

RECORDING TAPE

1,200 feet tape on Cylden reel. (Brown plastic type.) 18/6 reel.

INTERNATIONAL OCTAL VALVE HOLDERS

Paxolin 4d. each. Amphenol 6d. each. Ceramic 1/- each.

MAINS TRANSFORMERS

2-WAY MOUNTING TYPE MT1
Primary: 200-220-240 v.
Secondaries: 250-0-250 v. 80 M/A 0-6.3 v, 4 amp. 0-5 v. 2 amp. Both tapped at 4 v. ... ... 17/6 ea.

MT2
Primary: 200-220-240 v.
Secondaries: 350-0-350 v. 80 M/A 0-6.3 v. 4 amp. 0.5 v. 2 amp. Both tapped at 4 v. ... ... 17/6 ea.

MT3
Primary: 200-220-240 v.
Secondary: 30 v. 2 amp.
Taps at 3 v., 4 v., 5 v., 6 v., 8v., 9v., 10 v., 12 v., 15 v., 18 v., 20 v., 24 v. ... 17/6 ea.

EX GOVERNMENT AND SURPLUS CONTROLS

This popular range is suitable for all Television constructors, etc. Keep your costs down when building the "Argus" or "Simplex" receivers. Available: 500Ω, 600Ω, 1,500Ω double type, 2KΩ, 5KΩ, 10KΩ, 20KΩ, 25KΩ, 50KΩ, 200KΩ, 100KΩ, ¼ megΩ, ½ megΩ, 1 megΩ, 2 megΩ, 50KΩ, double type.
All 1/2 each.

COLVERN PRE-SET CONTROLS

Type CLR 1106/88 1,000Ω 1/9 ea.
Type CLR 1126/78 250Ω ... 1/9 ea.

PERSPEX IMPLOSION GUARDS incorporating escutcheon and filter. 12in. size, 11/6 ea.; 16in. size, 14/6 ea.

CRYSTAL DIODES

Plastic case, wire ends, 2 for 2/1.

CO-AXIAL CABLE

Single Strand Solid, 1/022... 7½d. yd.
Stranded Type Solid 7/0076 8½d. yd.
Semi Air Spaced 1/036 ... 1/- yd.

ION TRAPS, Type IT6, 35 mm. type, 2/9 ea.

VCR97 TUBES, Ex Equipment. Complete with Screens, etc., 29/6

VARIABLE CONDENSERS

3 gang .0005 mfd. ... ... 5/9 ea.
2 gang .00035 mfd. ... 5/9 ea.
2 gang .0005 with feet and trimmers ... ... 7/6 ea.
2 gang Midget with dust cover .00035 mfd. with trimmers ... ... 8/6 ea.

HEATER TRANSFORMERS

Input Voltage 230 v.
2 volt .5 amp. ... ... 4/6 ea.
2 volt 3.0 amp. ... ... 7/9 ea.
4 volt 1.5 amp. ... ... 5/- ea.
4 volt 3.0 amp. ... ... 10/- ea.
5 volt 2.0 amp. ... ... 10/- ea.
6.3 volt .5 amp. ... ... 5/- ea.
6.3 volt 1.5 amp. ... ... 6/- ea.
6.3 volt 30 amp. ... ... 9/- ea.
12 volt 75 amp.. ... ... 5/- ea.

ALPHA RADIO SUPPLY CO.

5/6 VINCES CHAMBERS, VICTORIA SQUARE, LEEDS 1.

AMERICAN experience has proved that manufacturers in that country find it worth their while to spend large sums of money to advertise their products. If Press stories can be believed, a single hour's programme with an outstanding star and cast can cost almost as much as an entire week's programme by the BBC, based on the statement in their Handbook for 1955 that the average cost per hour is £1,900.

Programme Contractors of the ITA will not be called upon to expend astronomical sums, but they will nevertheless have to spend more than the BBC's £1,900 an hour. This figure is the child of monopoly ; in other words, staff and artists have been subject to the bargaining represented by the powerful words *either or*. Those days have gone or are going, and, in an industry seeking for skill and talent, salaries and fees are bound to increase. But it will not be enough for Programme Contractors to do as well as the BBC. They must do better and this generally means higher fees to secure the services of outstanding performers in their various spheres.

OUR CORRESPONDENT "Q" DISCUSSES SOME OF THE DIFFICULTIES ENCOUNTERED BY THOSE PREPARING FOR COMMERCIAL TELEVISION.

Lack of Facilities

Whereas the BBC has studios and equipment, the Programme Contractors, with the exception of Norman Collins at Highbury, have none. Studios will either have to be built or existing buildings adapted. As all hope to start operations in September everything will have to be done at speed and at extra cost. Television equipment is expensive. So that whereas the present BBC average cost per hour is £1,900 and bound to rise, it is considered not unreasonable in all the circumstances to estimate that the average cost of an ITA programme will be at least double, about £4,000 per hour. On top of this the Contractors will hope to be able to add another figure representing their profits.

Filmed Advertisements

What of the advertisers—the people who are expected to pay the bill to enable them to sell more products and so make more profits. They are debarred by the Act from influencing the contents of the programme and, apart from paying for the programmes to which their commercial will be attached, they also have to provide and pay for their advertising matter which, incidentally, will almost certainly always be recorded on film so that no human frailties or production errors can detract from its message. This film will probably cost a few hundreds of pounds.

The position of a would-be national advertiser is not yet clear. Obviously this must come, but at the present time it would appear that advertisers may have to make individual arrangements with the various Programme Contractors operating in different parts of the country. If national broadcasting had to be done piecemeal by repeating live programmes on different days, the total cost would probably scare even the advertisers with large sums to spend. It is possible that in the beginning advertisers will enter into commercial television with the knowledge that they are unlikely to get value for money. They will regard it largely as an investment for the future and will support it in order to nourish it during its period of growth.

The initial audience to receive commercial television will be comparatively small. They will have to be convinced by all the skill of the advertising profession that not to view is to suffer irreparable loss. The advertising world faces a challenge to make viewers spend up to £10 to adapt their receivers so that they can then receive programmes which will incite them to spend more money.

If advertisers are not to be allowed to sponsor programmes, must they then be expected to buy a pig in a poke ? With recorded items it will be easy for them to judge whether they form suitable entertainment to act as the jam to cover the commercial pill. With live shows it will be more difficult ; advertisers will have to cultivate the ability to judge a script and appraise the probable performances of artists and staff. Moreover, the type of programme must to some degree represent the type of product it is designed to sell. One absurd example will illustrate this point. If Rolls-Royce choose to advertise by commercial television would they care to be associated with a programme composed chiefly of dancing girls ?

Manufacturers who are proud of their products—and who are not ?—will show increasing care over the type of programme with which they are identified. It may well be that they will gladly share in the experiment at the beginning but the time will come, inevitably, when a comparison is made between costs and results. They will examine with some anxiety reports that in the home, as in the cinema, the " commercials " are sometimes greeted with derisive cheers. They will experiment with different forms of attack such as the bludgeon, the rapier, sweet reasonableness, and infiltration. And although there is certain to be resistance to such an alien thing as commercial advertising by television in the home, the advertisers will, month by month, study cause and effect in terms of cash.

Testing Time

The advertising industry is being " put on the spot." Viewers too are in for some surprises. It is safe to prophesy that the successful commercial programmes will frequently be very different from those now acclaimed as best by the BBC. Personalities will mean more than ever before and these will be closely followed by the brains of the business—the people, highly paid, who will write and produce programmes with the main ambition of beating the BBC.

News From the Trade

WOLSEY "TWIN-BAND" AERIAL

WITH the forthcoming commercial programmes, a new aerial will be required, and the Wolsey company have produced a combined aerial for Band I and Band III. This takes the form of a standard "H" array, with the Band III aerial arranged on one element, and this enables a single down-lead to be utilised, and the need for a cross-over unit is obviated. The performances of both aerials are almost identical, and that on Band I is the standard normally expected from the ordinary type of "H" aerial. The "Twin Band" costs £4 12s. 6d. A conversion kit is available for the standard Wolsey "H" aerial, and costs 15s., whilst a special cross-over unit, necessary where two separate aerials are employed, is available for 15s. in a wall or wainscot mounting type, or 17s. 6d. for pole mounting.—Wolsey Television, Ltd., 43/45, Knight's Hill, West Norwood, S.E.27.

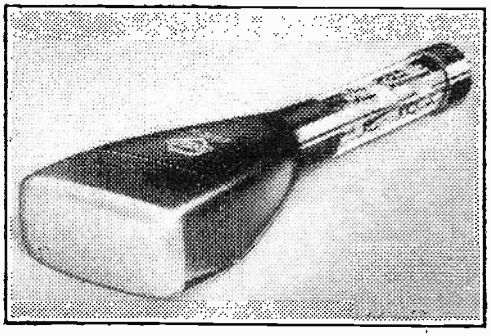
RECTANGULAR SCOPE TUBE

IN radar and oscilloscope displays, it often happens that only a small horizontal strip in the centre of the screen of a cathode-ray tube is occupied by the trace. If, instead of a conventional circular face, a face of rectangular form is used, the trace can occupy the whole of the working screen area. Such a rectangular screen has been adopted in the new Mullard DG16-21 tube, which enables much equipment space to be saved. It is the first British tube of its kind.

The tube will find particular application in radar range-finding, decoding I.F.F. or beacon signals, and echo sounding equipment.

Where it is desirable to compare visually the signals in several channels, DG16-21 tubes, because of their bulb shape, can readily be stacked close together, thus facilitating easy direct comparison.

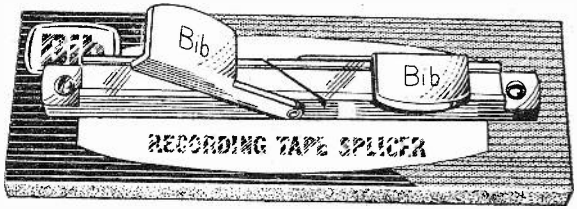
The DG16-21 tube has a screen size of 5¼in. x 1¼in. The deflection sensitivity is of the order of 0.2mm./V. The angle alignment between X and Y plates is kept within one degree of the nominal value of 90 degrees; this close tolerance ensures the high degree of perpendicularity necessary where accurate measurements have to be made. The tube has a 6.3 volt heater, and would normally operate at a final anode voltage of 6 kV. —Mullard, Ltd., Century House, Shaftesbury Avenue, W.C.2.



A Mullard rectangular tube

TAPE SPLICER

MANY television constructors use a tape recorder, either for musical recordings outside television, or for the recording of special television sound—in view of the much better quality which the latter gives. When editing the tape, either removing announcements, or joining together a number of items, the question of cutting and joining the tape arises, and this can be not only awkward, but can give rise to trouble if done carelessly. An aid to accurate splicing is, however, to be found in the Multicore product, the Bib Tape Splicer, illustrated above. This is similar in construction to a normal film splicer, two clamps at either side holding the tape rigidly in a guide-way the width of the tape. A diagonal slot across the centre of the device enables the ends of the tape to be cut with the aid of a razor blade, and if the broken or roughly-cut ends are first overlapped very slightly over the diagonal, the two edges may be cut simultaneously and will butt perfectly. A short piece of cellulose tape is then pressed over the joint, and the edges of this are trimmed, again making use of slots running along the top and bottom of the guide-way, thus producing an almost undetectable joint which will pass the guides, pressure pads, and heads on any tape recorder. The price of this handy device is 18s. 6d.—Multicore Solders, Ltd., Maylands Avenue, Hemel Hempstead, Hertfordshire.



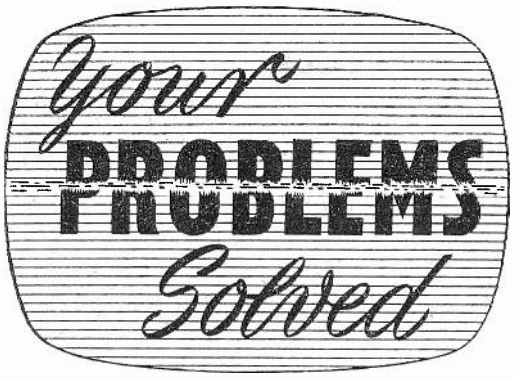
An artist's sketch of the Bib Tape Splicer, a Multicore product

A NEW EMITRON OSCILLOGRAPH TUBE

AN entirely new oscillograph tube incorporating post-deflection acceleration is now in quantity production at the High Wycombe plant of Electronic Tubes, Ltd. This Emitron tube—type 4EP1—has many new features making for improved performance and reliability in all oscillographic applications, especially where high frequency operation and high writing speed with good definition are required.

The use of side connections to the deflector plates allows the tube to operate at very high frequencies (i.e., with millimicrosecond pulses) due to the extremely low deflector plate capacity and inductance.

Further details are available on request to Electronic Tubes, Ltd., Kingsmead Works, High Wycombe, Bucks.



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. 479 must be attached to all Queries, and if a postal reply is required a stamped and addressed envelope must be enclosed.

GHOSTS

My 14in. Ferguson is haunted by the ghosts so well described in your article in the November issue.

I would like to try the cure by use of the slot aerial, as you describe, and will be grateful if you can give me further particulars.

Stoke Poges is three miles north of Slough and 22 miles from Alexandra Palace, and the signals are quite strong.

When using coaxial cable, how long and how wide should the rabbit wire mat be (you say ½in. mesh material and with 1ft. wide slot)? How long should the slot be and are there any particular features such as insulation required for the fastening of the centre wire of the coaxial cable for half of the slot length ?

Will you please indicate the plane of the mounting required?—A. H. Stow (Stoke Poges).

For Channel 1 the slot should be 10ft. 2in. long. The inner conductor of the coaxial cable can be readily held in the centre of the slot as illustrated in the article by means of light cord, or other similar insulating material. The slot aerial should be mounted horizontally so that it points broadside toward the transmitter.

K.B. FV30H

My set, a K.B. model FV30H, two years, eight months old, shows the following symptoms. When viewed on ordinary programme a displacement of parts of picture to the left whenever a white object appears on the extreme right of picture (as one views it) viewed on test card " C," the vertical lines forming the squares are displaced to left, opposite white blocks on right edge of picture. This is pronounced at top of picture but smooths out towards the bottom unless I turn up contrast above normal setting, when it becomes general from top to bottom.

I may add there is no reduction of definition on frequency blocks, and neither line, hold or line drive will eliminate above symptoms.

Could you please tell me the most likely cause of this rather annoying effect.—G. P. Kennedy (Mossley).

Since you mention that the frequency response of your K.B. is quite normal, the symptom of " pulling on whites " is almost certainly the result of an alteration in the value of a component associated with the sync separator valve. You should, therefore, check the value of the parts concerned, paying particular attention to the anode, screen and coupling components. Also ensure that the insulation of the coupling capacitors is of high standard—replace any dubious component.

COSSOR 85K TUBE

Can you please tell me which is the correct focus ring to use with an 85K 15in. Cossor tube? Should the ring I now have (W.B. 109/2) which I use on a Mullard 31-16 12in. tube be suitable?—W. S. Emery (Wirral).

The magnetic focusing field is really dependent on the tube final anode potential. The focus unit you use on the Mullard tube will probably have insufficient field to focus the Cossor tube properly, though it may be worth trying if you contemplate using a relatively low E.H.T. potential.

PYE VT4

Could you please suggest any faults which could account for lack of E.H.T. on model VT4 Pye?

E.H.T. from the cathode of the EY51 is non-existent but a very small amount is to be found on the anode, insufficient to induce energy into the heater winding of the EY51. Checks, etc., already made are as follows (numbers refer to maker's [service chart) : valves V19-VZ9 excluding VZ4 and VZ5, a reliable check for which would be appreciated other than replacement condensers C110 (68pF at 5 kV), C10Z (27pF at 1,500 v) ; all voltages on valves are normal and all choke and transformer windings intact giving correct D.C. resistance across windings ; C106 (.5 μF) checked also.

What little H.T. is to be found on the EY51 anode is variable with the horizontal hold control. Oscillator can be heard working.—G. Blackburn (Swaffham).

If you are certain as to the goodness of the smaller capacitors and resistors in the line timebase, we feel almost certain that lack of E.H.T. is caused by short-circuited turns in the line output transformer. Unfortunately, transformer substitution represents the only practical test in this respect, and no attempt should be made to measure it with ordinary meters.

MURPHY 134C

The lead from the top cap of the U22 has come loose and I am not sure from the present signs and length of same whether it should be soldered to either the top of the nearest 8,000 volt condenser (one on the U22 Stand) or to the chained top cap of the Mazda 6P28s. The W/22 does not light up with this wire off. I do not know if this is correct.—E. Perry (Bedford).

The anode of the U22-E.H.T. rectifier valve in your Murphy should be connected to the top caps (anodes) of the two line output valves—6P28. The heater of the E.H.T. rectifier should light irrespective of whether its anode is connected or not. Lack of heater voltage here should lead you to investigate for a fault in the line output stage.

TRU-VUE PORTABLE A33

The line cord is damaged and I would like to replace it with a mains dropper or resistance. Thanks to

your "Practical Television" monthly, I am capable of doing this alteration, but must ask you for type and value of resistor, etc.—Robert J. Clare (Speke).

A 0.3 amp. line cord is necessary as a replacement on your receiver. Its actual value can be readily computed by first adding up the heater voltages of all the valves plus that of the picture-tube and subtracting this figure from the mains voltage in your area. The necessary line cord resistance will then be the derived figure divided by 0.3.

BAIRD EVERYMAN

I have a Baird Everyman 9in. set, and it has developed a peculiar trouble. I have a good picture, and then I get a lot of lines superimposed on the picture. Sometimes it only covers about a quarter of the picture area, but always they are horizontal lines. Sometimes it covers the whole of the picture just like a *film* over the whole of the picture, and occasionally the frame trips about a third of the way down the picture with the black band at the top and then you get bright fly-back lines over the rest of the picture. No amount of setting of the controls affects it.

I must add that the focus control gets hot as well, but before it always ran cool.—A. H. Hurley (Birmingham).

This symptom may indicate that one of the electrolytic smoothing capacitors has reduced in value and developed an intermittent leak, or it could mean that one of the valves associated with the frame timebase intermittently develops a heater-to-cathode short. You should check on these possibilities by substituting the suspected parts with ones of known goodness.

We would also point out that a form of external R.F. interference is liable to give rise to a very similar symptom. You should endeavour to establish that this is not the cause in your case before delving into the receiver proper.

G.E.C. BT.2147

In my G.E.C. BT.2147 the picture continually jumps from bottom to top of screen with a clicking noise inside the set. The vertical hold adjustment only increases the speed of jumping. If I turn the sensitivity control right up it almost stops the jumping, but if I alter the contrast then it starts all over again.

This clicking noise is more like a thumping noise and is present at all positions of the contrast and sensitivity controls, even with the aerial disconnected.

Also, there is a bright line along the bottom of the screen accompanied by a black band which jumps with the picture.

I have changed the N37 frame output valve as I had trouble before on this valve, but it did not make any difference.—W. Harris (N.12).

You should check the condition of the B36 valve —this is used as frame and line generator. You should also ensure that the resistors, which are connected directly to the frame hold control itself, are of correct value. It often happens that one or more of these rise in value to put the frame locking point out of the range of the control.

SIMPLEX

I have recently made the Simplex TV complete with sound output (my first attempt at TV) and have met with the following two faults which I hope you will be able to help me put right.

(A) Overheating of mains transformer and R43 on full load. R43 still gets hot when lead to vision section on R43 is disconnected, the transformer remains cool being on half load. C29 to C34 I have tested by substitution. (B) Failure to pick up sound from L3. Sound and vision signal can be heard quite clearly with headphones connected to R6 and pin 3 on valve 5. The sound will come through valve 6 and the output stage but the cores in coil L5 and 6 do not increase it or make the slightest difference in adjusting. VR2 has no affect on volume. VR1 has an effect on sound if all the coils are turned to sound, but there is no real volume. Could this trouble be tied up in any way with fault A, faulty H.T. ? I would like to add that all the parts in the sound section have been tested by substitution and the wiring of the set is O.K. and the shift controls are insulated from the chassis.—T. King (Manchester, 10).

If R43 still overheats when the H.T. feed is disconnected from it we can only conclude that C38 is leaky—we would mention that it is quite in order for R43 to run hot. You must make certain that RM's 3, 4 and 5 are connected to right way round, that is with their positive sides towards the H.T. line.

Your second fault must lie somewhere in stages V6 and V7. If possible, you should check the voltages on V6, this will almost certainly give you a clue as to the trouble. You will probably find that you have a short on the H.T. line due to incorrect connection or a valve short.

FOCUS COIL

I have a 9in. television tube, an Emiscope 3/3, which has a base 42 mm. in diameter, but I have been unable to obtain a focus coil large enough to fit this. I would like to wind my own coil, so could you give me any information to enable me to do so, please ?—D. J. Monckton (Morden).

A focusing magnet consists essentially of a coil wound on a former which slips loosely over the neck of the tube so that the axes of the coil and the tube are coincident. Since it is necessary to have a uniform field it is nearly always essential to encase the coil in iron. The iron should enclose the coil except for a narrow gap through which the flux extends.

The number of turns required depends on the current through the coil, its precise design and its position on the neck of the tube. With an iron-clad coil, however, using an E.H.T. potential in the region of 5 kV on a triode tube, something like 400 ampere-turns are necessary.

PAM 908

I have the latest model of Pam, Model 908. During the day reception is normal, but at night the picture curls up (horizontal) by as much as 3in. Sometimes it happens at the top of the screen. Could you please solve this problem ?—A. M. Benson (Glasgow).

This, you will almost certainly find, is due to fluctuating mains voltage. During the day it is probably quite normal (that is during viewing times), but after dark when the mains system is more heavily loaded the voltage probably falls considerably. This results in under-running of the frame timebase section and is displayed on your screen in the form of picture cramping.

You should get your dealer to measure the local mains voltage for you and make sure that your set is adjusted to suit. Excessive voltage fluctuation should lead you to contact your local Electricity Board.

T.V. 12IN. CHASSIS, 97/6. Complete Chassis by famous manufacturer, easily adapted to Channel 3, R.F. E.H.T. unit included, drawing free; easily fitted to Table or Console model. Owing to this chassis being in three separate units (power—sound and vision — timebase) inter-connected. This chassis is less valves and tube, but see our catalogue for cheap valves. Our £5 Tube fits this chassis. List of valves by request; carr. 5/-. Personal shoppers can see a demonstration model working. DUKE & CO., 621, Romford Rd., London, E.12.

AMPLIFIER, 17B, store soiled, **17/6;** brand new R.F. Units, types 26 or 27, **30/-;** 24, **12/6;** 25, soiled, **12/6** (post paid); LF Chokes, 10H, 200ma, **8/6;** 8H, 80ma, 4/-; Potentiometers carbon, most values, 1/- each, preset and spindled; 25k. w/w, 4w, **1/6;** Hunts PVC sleeved Condensers, .001 1kVw, .01 1kVw, .1 350v, .1 500v, 5/- dozen. Terms: cash with order, postage extra; immediate delivery. 1½d. s.a.e. for bargain list or enquiries. W. A. BENSON, 308, Rathbone Rd., Liverpool, 13.

R.F. UNITS, types 26 at **27/6,** 25 at **15/-,** 24 at **11/-;** brand new in original cartons, with valves; postage 2/6. E.W.S. CO., 69, Church Rd., Moseley, Birmingham.

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TV SIMPLEX COILS, 21/-; all other Coil Sets to order; TV 3in. Canned Formers, 2/3 ea., VHF, FM Receivers, "Mullard" Amplifiers, Transistors, BEL, Marlborough Yard, Archway, N.19. (ARC 5078.)

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RATES: 4/- per line or part thereof, average five words to line, minimum 2 lines. Box No. 1/- extra. Advertisements must be prepaid and addressed to Advertisement Manager, "Practical Television," Tower House, Southampton St., Strand, London, W.C.2.

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The engagement of persons answering these advertisements must be made through a Local Office of the Ministry of Labour or a Scheduled Employment Agency if the applicant is a man aged 18-64, inclusive, or a woman aged 18-59, inclusive, unless he or she, or the employment, is excepted from the provisions of the Notification of Vacancies Order, 1952.

TELEVISION TECHNICIANS—all districts. Big money for you in your spare time. Opportunity to establish your own business. Write, giving fullest particulars of training, experience, whether owner of test equipment, age. All replies treated in strictest confidence. Apply to TELEPATROL LTD., Federation House, Epsom.

MINISTRY OF SUPPLY requires craftsmen to serve as Research and Experimental Mechanics (Special) for Electronic work at Boscombe Down. Applicants must have served a recognised apprenticeship or have had equivalent experience, and must be able to read and interpret schematic wiring diagrams of electronic equipment, and have ability to lay out, assemble and wire panels for electronic test apparatus from rough sketches and verbal instructions. They should also be familiar with the operations and servicing of standard commercial units, oscilloscopes, valve voltmeters and amplifiers, etc. Rate of pay for 44-hour 5-day week 147/10 + 26/- merit lead on entry, with prospects of increase in merit lead in 1-3 months. Apply giving details of apprenticeship, training (including Forces training), qualifications and experience to AIR COMMODORE COMMANDING, Aeroplane and Armament Experimental Establishment, Boscombe Down, Wiltshire."

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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).

HOME-MADE AERIAL

SIR,—Here are details of an Indoor Television Aerial I have used, and wonder if it would be of interest to other readers.

As a result of numerous experiments the following aerial, owing to its structure, is suitable for indoor attic or loft use, and has been devised and used with considerable success. It will, no doubt, appeal to readers as it is easy to construct and erect, and very inexpensive. It is made of ordinary copper-stranded wire as purchased in shops for sound broadcast receivers.

Rods $\frac{1}{8}$-wave long are drilled $\frac{1}{2}$in. from each end, and aerial wire is threaded through, or either knotted or carried down and threaded through, so as to be of one piece, soldered at joint. Rods can be made of any $\frac{3}{4}$in., $\frac{1}{2}$in. or similar copper or other tube available. The wire is cut into two lengths $\frac{1}{2}$-wave long ; the rods " shorting " the ends.

The centre of the aerial is made of hardwood or ebonite, or, in fact, any non-conductive material, and has holes drilled 2in. apart, and the aerial wire threaded through.

Feed 80 ohm cable to set, to be soldered to aerial wire at direct centre of wire. This aerial is directional, any deviation above 10 degrees will cause loss of signal.

The aerial in my case gives equal gain to an X-aerial erected at same height outside the house, 50 miles from Wenvoe. Wenvoe measurements : each wire " arm " 3ft. 6in. ; rods, 1ft. 9in. long.—R. M. SATTERTHWAITE (Warminster).

INTERFERENCE

SIR,—I am always interested in the " Problems Solved " pages, and recently experienced a fault which might interest others. Shortly after the programme had started a series of fine spots appeared on the screen in four rows. I immediately thought someone had started up a small electric motor nearby, but there was no accompanying interference on sound. The dots came and went at odd intervals for about half an hour, when we switched off—the programme items we were interested in having ended. Shortly after settling down to read, my wife said, " You haven't switched off." I was surprised, as I was certain I had, but I went to the set and it was off. She said she could hear the background of slight mains hum and the line whistle. I looked at the back of the set and it was definitely off, and just as I was about to mention this one of the lamps in a three-lamp centre-room fitting went out. Presumably the filament was breaking down and gave not only the radiated electrical interference, but also an acoustic interference which was audible to my wife.—G. MUNRO (Hendon).

HIRE-PURCHASE DISADVANTAGE

SIR,—Your correspondent F. Griggs, of Ceylon, seems to have missed the point in connection with young men of today being put off constructing their own television receivers because of the ease with which one can buy a set through the various hire-purchase systems.

He states that provided one has the urge and interest in the subject, one is not likely to be put off by such a small thing. But surely it is only because it has always been so difficult to find such a large amount of money to pay out at once for a set that young men have been forced to think of making their own.—R. K. SANDERS (Abbey Wood).

UNGUARDED MEDIUM

SIR,—In the February issue, your contributor " Iconus " suggests that each play presented on television be given a category letter " U," " A," " H," or " X " just as films must have when shown in cinemas. In this way, he says, viewers will be given an idea of the kind of play they are about to see and if of a nervous disposition they can switch off. That is exactly where I believe the BBC are misusing the medium of television. If a film warrants an " A " or " X " certificate it is judged as being unsuitable for children, and it is an offence for children under 16 to be admitted to a cinema showing an " X " film. Had the now-fabulous " 1984 " TV play been filmed it would undoubtedly have been given an " A " if not an " X " certificate, and children on their own would be barred from seeing it. Yet the BBC televised this play although it was quite likely that children on their own could have seen it.—F. G. ARNOLD (Beckenham).

HOME-CONSTRUCTED TV SETS

SIR,—I observe from your February editorial that the component manufacturers are beginning to evince a lively interest in the constructor market. It is to be hoped that this may lead to home-construction becoming worth while, which at the present time it definitely is not.

A television receiver is a complex thing of which none of its very numerous parts can be allowed much tolerance in standard, and its construction by the amateur is not a matter to be lightly undertaken. Nevertheless, in undertaking it, the home-constructor should reasonably be able to save himself at least one-third if not more of the price obtaining for a comparable factory-built job. But does he? Not likely ! I doubt if there exists one sponsored receiver which, when the present cost of its ingredients is finally totted up, does not cost appreciably more. This is, of course, after paying out over £40 on valves and a tube, the life of which is regarded with such apparent dubiety by the makers that they can only offer six months' guarantee thereon.

In some ways this state of affairs is reminiscent of the early 1920s, when up to five shillings was demanded for a simple grid condenser, and impecunious home-constructors had to manufacture their own components in order to be able to pay for their valves through the well-known nasal channel.—F. D. SIMPKINS (Rugby).

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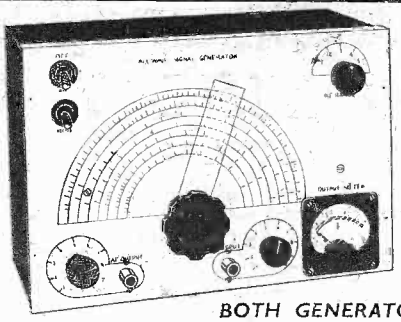

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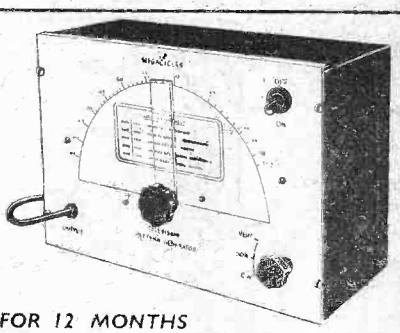

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40-70 Mc/s direct calibration, checks frame and line time base, frequency and linearity, vision channel alignment, sound channel and sound rejection circuits and vision channel band width. Silver plated coils, black crackle finished case 10 x 6½ x 4½in. and white front panel. A.C. mains 200/250 volts. This instrument will align any T.V. receiver, accuracy plus or minus 1%. Cash price **£3 19 6** or **29/-** deposit and 3 monthly payments of **£1**. P. & P. 4/- extra.

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with heater cathode short.

M.W. 31/74 12in. bent gun ... **£3.17.6**. P. & P. 7/6 extra
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Any of the above complete with Line E.H.T. trans., 9 KV. Ferrocart core. Line and width control scan coils and frame O/P trans. 35/- extra.

Used Mazda C.R.M. 123 Cathode heater short aluminised. Complete with rubber mask, Elac P.M. focus unit, scan coils, low line, low frame and frame O/P trans., **£5.10.0**. P. & P. 7/6.

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Heater Transformer, Pri. 230-250 v. 6v. 1½ amp., 6/- ; 2 v. 2½ amp., 5/- P. & P. each 1/-.

T.V. Convertor for the new commercial stations complete with 2 valves. Frequency : can be set to any channel within the 186-195 Mc/s band. I.F. : will work into any existing T.V. receiver designed to work between 42-68 Mc/s. Sensitivity 10 Mu/v with any normal T.V. set. Input : arranged for 300 ohm feeder. 80 ohm feeder can be used with slight reduction in R.F. gain. Circuit EF91 as local oscillator, ECC81 as R.F. amplifier and mixer. The gain of the first stage, grounded grid R.F. amplifier 10 db. Required power supply of 200 v. D.C. at 25 mA., 6.3 v. A.C. at 0.6 amp. Input filter ensuring complete freedom from unwanted signals. 2 simple adjustments only. **£2.10.0**. P. & P. 2/6.

Line and E.H.T. Transformer, 9kV. Ferrocart core. EY51 heater winding, complete with scan coils and frame output transformer and line and width control. **£2.5.0**. P. & P. 3/-.

As above but complete with line and frame blocking transformers, 5 henry 250 mA. choke, 100 mfd. and 150 mfd. 350 wkg., 380 mA. A.C. ripple. **£2.19.6**. P. & P. 3/-.

Standard wave-change Switches, 4-pole 3-way, 1/9 ; 5-pole 3-way, 1/9 ; 3-pole, 3-way, 1/9 ; 9-pole 3-way, 3/6 ; Miniature type, long spindle 3-pole 4-way, 4-pole 3-way and 4-pole 2-way, 2/6 each. 2-pole 11-way twin wafer, 5/- ; 1-pole 12-way single wafer, 5/-. P. & P. 3d.

T.V. Filter in lightly tinted perspex, size 13½ x 11 x 3/16in., **4/6**.

USED metal rectifier, 250 v. 150 mA., 6/6.

R. and A.T.V. energised 6½in Speaker with O/P Trans., field coil 175 ohms. Requires minimum 150 mA. to energise maximum current 250 mA. 9/6. P. & P. 2/6.

R. and A.M.E. 6½in. with O/P Trans., 440 ohms field, 10/6 plus 2/6 P. & P.

Combined 12in. Mask and Escutcheon in lightly tinted perspex. New aspect, edged in brown. Fits on front of cabinet. **12/6**. As above for 15in. tube, **17/6**.

Frame Oscillator Blocking Trans., 4/6.

Line Oscillator Blocking Trans., 4/6.

Smoothing Choke, 250 mA., 5 henry, 8/6 ; 250 mA., 10 henry, 10/6 ; 250 mA., 8 henry, 8/6.

P.M. Focus Unit for any 9 or 12in. tube except Mazda 12in., with Vernier adjustment, **15/-**. **P.M. Focus Unit** for Mazda 12in., without Vernier adjustment, **15/-**. **Wide Angle P.M. Focus Unit,** Vernier adj., state tube, **25/-**.

Energised Focus Coil, low resistance mounting bracket, **17/6**.

Ion Traps for Mullard or English Electric tubes, **5/-**. Post paid.

T.V. Coils, moulded former, iron cored, wound for rewinding purposes only. Ali-can 1¼in. x 1in., 1/- each ; 2 iron-cores Ali-can, 2¼in. x 1in., **1/6** each.

Dubilier .001 10kV. working, **3/6**.

Cyldon 5 channel T.V. tuner, **12/6**. Post paid.

MAINS TRANSFORMERS

Primary, 200-250 v. P. & P. 3/-.
300-0-300, 100 mA., 6 v. 3 amp., 5 v. 2 amp., **22/6**.
Drop thro' 250-0-250 v. 60 mA., 6 v. 3 amp., 5 v. 2 amp., **14/6**.
Drop thro' 250-0-250 v. 80 mA., 6 v. 3 amp., 5 v. 2 amp., **14/6**.
280-0-280, drop through, 80 mA., 6 v. 3 amp., 5 v. 2 amp., **14/6**.
250-0-250 80 mA., 6 v. 4 amp., **14/-**.
Drop thro' 270-0-270, 80 mA., 6 v. 3 amp., 4 v. 1.5 amp., **13/6**.
Drop thro' 270-0-270 60 mA., 6 v. 3 amp., **11/6**.
250 v. 350 mA., 6.3 v. 4 a., twice 2 v. 2 a., **19/6**.
Auto-trans. Input 200/250, H.T. 500 v., 250 mA., 6 v. 4 a., twice 2 v. 2 a., **19/6**.
250-0-250, 60 mA., 6.3 v. 1.5 a., 0-5-6.3 v. 1.5 a., **10/6**.
Auto Trans. Input 200/250. H.T. 350 v. 350 mA. Separate L.T. 6.3 v. 7 a., 6.3 v. 1½ amp., 5 v. 3 amp., 25/- P. & P. 3/-.
Heater Transformer. Pri. 230/250v. 6v. 1½ amp., 6/-; 2v. 2½ amp., 5/-.
Pri. 200/250. Secondary 9 v. 3.5 amp., 6.3 v. 3 amp., **12/6**.
Pri. 230 v. Sec. 500-0-500 and 500-0-500 250 mA., both windings, 4 v. 3 amp., 4 v. 3 amp., **39/6**. P. & P. 5/-.
Mains Transformer, fully impregnated, input 210, 220, 230 and 240. Sec. 600-0-600, 275 mA., and 200 v. at 30 mA., complete with separate heater transformer. Input 210, 220, 230, 240. Sec. 6.3 v. 2 amp. three times, 0, 4, 6.3 v. at 3 amp. and 5 v. 3 amp., **45/-**. P. & P. 5/-.
Mains Transformer fully impregnated. Input 210, 220, 230, 240. Sec. 350-0-350 100 mA. with separate heater transformer. Pri. 210, 220, 230, 240. Sec. 6.3 v. 2 amp., 6.3 v. 3 amp., 4 v. 6 amp., and 5 v. 2 amp., **30/-**. P. & P. 5/-.
Mains Transformers, chassis, mounting, feet and voltage panel. Primaries 200/250.
350-0-350 75 mA., 6.3 v. 3 a. tap, 4 v. 6.3 v. 1 a., **13/6**.
500-0-500 125 mA., 4 v. C.T. 4 a., 4 v. C.T. 4 a., 4 v. C.T. 2.5 a., **27/6**.
500-0-500 250 mA., 4 v. C.T. 5 a., 4 v. C.T. 5 a., 4 v. C.T. 4 a., **39/6**.

Valve Holders, moulded octal Mazda and loctal, **7d.** each. Paxolin, octal Mazda and loctal, **4d.** each. Moulded B7G. B8A and B9A, **9d.** each. B7G moulded with screening can, **1/6** each.

32 mfd., 350 wkg. **2/-**
16+24, 350 wkg. **4/-**
4 mfd., 200 wkg. **1/3**
40 mfd., 400 wkg. **3/6**
16+8 mfd., 500 wkg. **4/6**
16+16 mfd., 500 wkg. **5/9**
16+16 mfd., 450 wkg. **3/9**
32+32 mfd., 350 wkg. **4/-**
32+32 mfd., 350 wkg., and 25 mfd., 25 wkg. **6/6**
25 mfd., 25 wkg. ... ... **11d.**
350 mfd., 12 v. wkg. **1/-**
16 mfd., 500 wkg., wire ends **3/3**
8 mfd., 500 v. wkg., wire ends **2/6**
8 mfd., 350 v. wkg., tag ends **1/6**
50 mfd., 25 v. wkg., wire ends **1/9**
100 mfd., 350 wkg. **4/-**
100 mfd., 450 v. wkg., 280 mA., A.C. ripple **3/11**
150 mfd., 350 v. wkg., 280 mA., A.C. ripple **4/6**
100+200 mfd., 350 wkg. ... **9/6**
16+16 mfd., 350 wkg. **3/3**
50 mfd., 180 wkg. **1/9**
65 mfd., 220 wkg. **1/6**
8 mfd., 150 wkg. **1/6**
60+100 mfd., 280 wkg. **7/6**
50 mfd., 12 wkg. ... ... **11d.**
32+32 mfd. min. 275 wkg. **4/-**
50 mfd., 50 wkg. **1/9**
Miniature wire ends moulded, 100 pf., 500 pf., and .001, ea. ... ... **7d.**

Where cost and packing charge is not stated, please add 1/6 up to 10/-, 2/- up to £1 and 2/6 up to £2. All enquiries S.A.E. Lists 5d. each.