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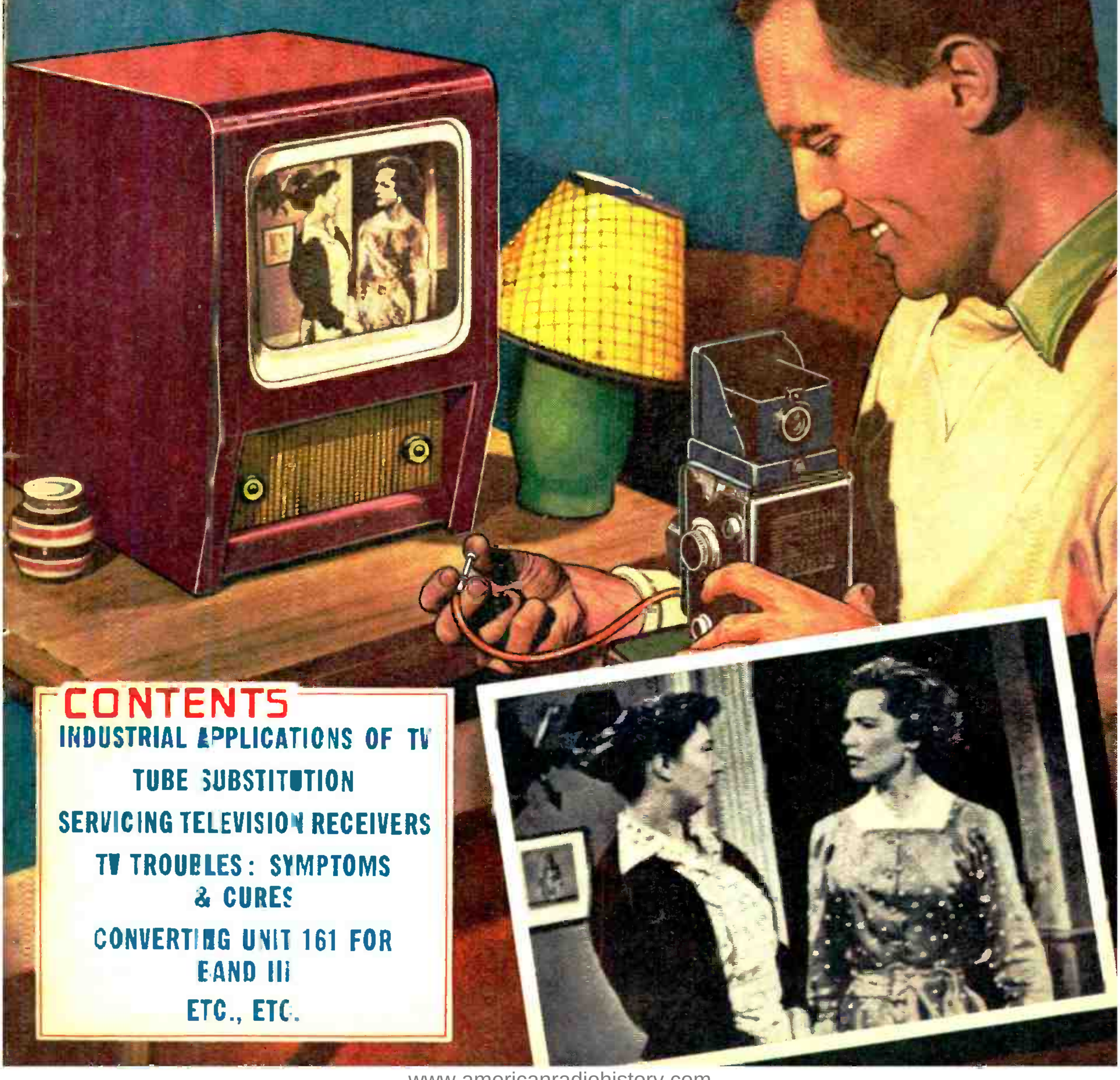
Practical Television

1/3

AND TELEVISION TIMES

DECEMBER 1956

EDITOR: F.J. CAMM



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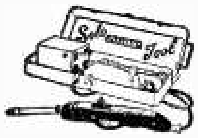

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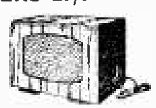

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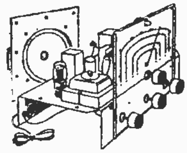

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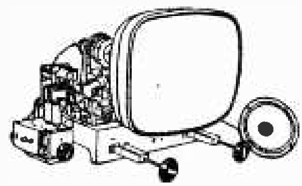

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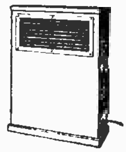

Practical Television

& TELEVISION TIMES

Editor: F. J. CAMM

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CONTENTS:

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

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

TELEVIEWS

AN HISTORIC OCCASION

FOR the first time in seven centuries of English Parliament, the State Opening of Parliament on October 28th was televised for the benefit of the British public, who thus gained a more intimate knowledge of this panoplied and historic ceremony. With the continental linkup, several foreign countries were enabled to gain an insight into English traditions and democratic government. Peoples of those countries whose own governments have had a very chequered career must have wistfully viewed the solemn scene in our seat of Government. The suggestion that this centuries-old ceremony should be televised has been turned down year after year and it is a good thing that wiser counsels have now prevailed. Thus does television and radio forge a closer link between the public and its Government.

We hope that other national ceremonies not hitherto televised will fall into line. Television may thus help to relieve the congestion caused when vast crowds foregather to witness historic ceremonies. There are the diehards who wish to preserve the age-old order of things without change, and who would suppress the intriguing scientific developments which help to provide a more enlightened outlook. Age proves nothing but antiquity. It is possible to hang on to tradition for too long. Even tradition must progress!

H.P. RESTRICTIONS ABOLISHED

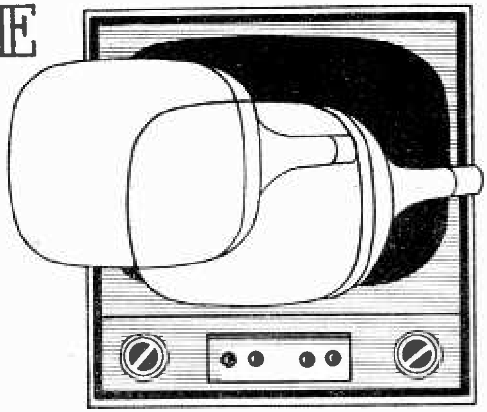
IT was pleasant to hear during the opening ceremony, the Government's proposals to abolish all hire purchase restrictions and that, of course, includes radio and television receivers. The intention is to encourage home sales which hitherto have been frowned upon by the Government which has placed oppressive restrictions on hire purchase. Radio and television to-day are necessities.

THE "P.T." CAXTON HALL LECTURE

THERE is still time for you to apply for a free ticket for the P.T. and P.W. Caxton Hall Film Show which takes place at the Caxton Hall, Westminster, at 7.30 p.m., on January 22nd, 1959, under my chairmanship. This film show, which has been arranged in conjunction with Mullard Ltd., will deal with the principles of the transistor; the manufacture of junction transistors; and the conquest of the Atom, the latter in colour. There will be an interval for refreshments which will be provided free. Address applications for tickets to "Caxton Hall Lecture," PRACTICAL TELEVISION, address as on this page.—F. J. C.

Our next issue, January, 1959, will be published on December 19th

PICTURE TUBE SUBSTITUTION



FACTORS TO BE CONSIDERED WHEN REPLACING A CATHODE-RAY TUBE BY ONE OF A DIFFERENT TYPE

By G. Earl

IT often happens that the experimenter only has available a picture tube that is not an equivalent of the one he wants to replace, or the correct replacement tube may no longer be available and the experimenter requires to know whether or not a tube of a different type could be used.

Before we consider these possibilities there are one or two things that should be made clear. It is always desirable to use as a replacement a tube of the make and type for which the receiver is designed. Tubes are not as easily substituted as valves, for there are various electro-optical factors to bear in mind as well as the purely electronic and mechanical.

Secondly, it is not generally possible, without severe alteration to the timebase and EHT circuits, to use a tube with a scanning angle larger than that of the original. This means that a 9in. or 12in. tube cannot be easily replaced by a 14in., 17in. or larger. Such substitutions have been performed by experimenters, and provided the basic electrical and mechanical requirements have been satisfied, some form of picture is usually obtained, but, unfortunately, the results are far from encouraging, for the picture is rarely up to the standard expected of a modern tube.

The requirements of the tube have always dictated the design of the receiver. This was not so bad in the early days of 9in. and 12in. tubes, for the requirements of those were much the same, and one chassis design served for both, with little modification.

Larger Scanning Angles

As the scanning angle of tubes increased, new designs for receivers were needed to supply the larger scanning power and higher EHT voltages. This problem is still with us, even to-day, for now the scanning angle has increased from 70 deg. to 90 deg., and very shortly will be increased again to 110 deg.

The reason for this development is essentially a mechanical one, and is that as the beam is deflected over a greater angle, the length of the tube can be decreased for a given screen size. This means that very slim receivers can be produced without the ugly bulge at the back of the cabinet, which on older receivers houses the tube base and part of the neck.

In order to supply the greater scanning power to deflect the electron beam, and to supply higher EHT voltages, new line output valves and line output transformers have been evolved, as also has new circuitry. Therefore, an old-style chassis is incapable of supplying the necessary power to do full justice to a modern tube.

Changing from 9in. to 12in.

It is possible, from the electrical aspect, to change directly from a 9in. to a 12in. tube. The only modifications concern the fitting of the larger tube on the receiver chassis, and in the cabinet, and these are purely mechanical considerations dependent on the receiver concerned.

Receivers featuring the CRM91 and CRM92 range of Mazda tubes usually respond to this treatment by using as a replacement the 12in. CRM121 series. The CRM121B needs an EHT potential of 7-10 kV which may be unobtainable from a 9in. chassis. It is recommended that the CRM121B, or the CRM123, is used only if the EHT voltage exceeds 7.5 kV. This stipulation is given by the maker, and is well worth observing. It is also worth noting that a maximum of 7 kV can be applied to the CRM92 and 7.5 kV to the CRM121 only if the neck of the tube is insulated from the focus and scanning coils by

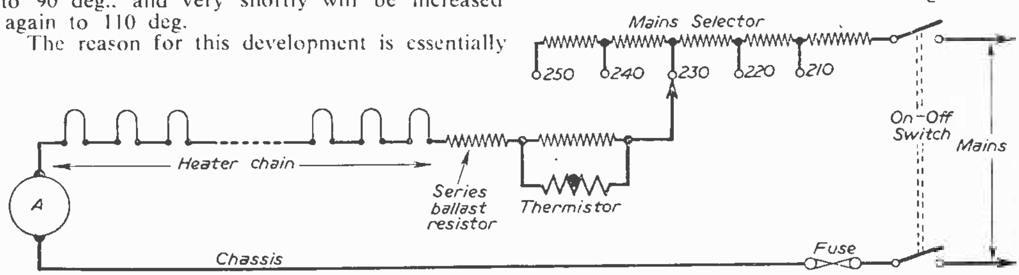


Fig. 1.—Including an A.C. ammeter in the circuit to check the heater current.

a layer of polythene or similar material. This may be required if some means of increasing the EHT voltage is devised.

Certain 12in. tetrode tubes of the Mullard range can also be used in a 9in. chassis, provided it is ensured that the heater current of the replacement tube matches that of the original. If necessary, the tube base connector should be changed to suit the replacement tube and the base chart should be consulted to ascertain that the pin connections of the two tubes match.

Heater Considerations

The heater of a tube which is designed for connection in a series heater chain is invariably

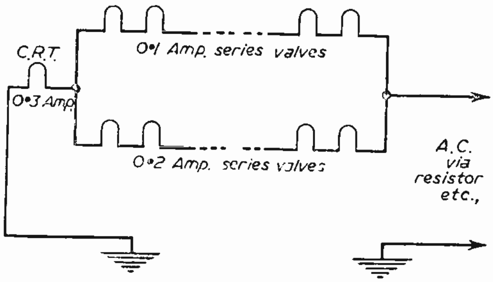


Fig. 2.—An alternative circuit for series connection of valve heaters.

rated at 0.3 amp. This means that the correct voltage will appear across the heater when it passes a current of 0.3 amp. It can thus be seen that the heater voltage is not all that important in series circuits, and it ranges between 6.3 and 13 volts with the various types of tube.

If it is required to replace a 6.3-volt tube with one having a 13-volt heater, this can be arranged without undue modification, provided the heater current of the replacement matches that of the original tube. In this case, the drop in the total heater circuit will increase by 6.7 volts, but since this is shared by all the heaters in the circuit, there will not be severe under-running of any one heater.

The same applies, of course, if a tube with a 6.3-volt heater is used to replace one with a 13-volt heater. If it is considered warranted, the heater current can be balanced by introducing an A.C. ammeter in the heater chain (in series with the tube heater is the most convenient position) and adjusting the mains selector to give the closest value to 300 mA (see Fig. 1). If a close balance cannot be secured by this means, then the value of the heater ballast resistor can be altered slightly to compensate.

It is often required to use a 2-volt tube to replace a 6.3-volt tube. If the original tube is in a series-connected heater chain, the heater wires should be removed from the tube base and then connected together, making sure that the join is sound and adequately insulated. This will complete the series chain circuit, and heater current balance can be restored as already described.

The 2-volt heater, of which the current requirements will be about 1 amp, will need to be energised from a separate heater transformer connected across the receiver's mains input circuit,

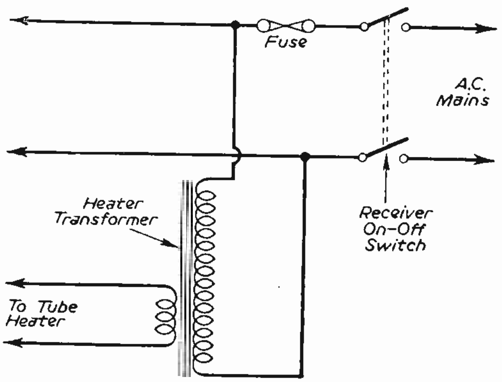


Fig. 3.—Using a separate transformer for the tube heater.

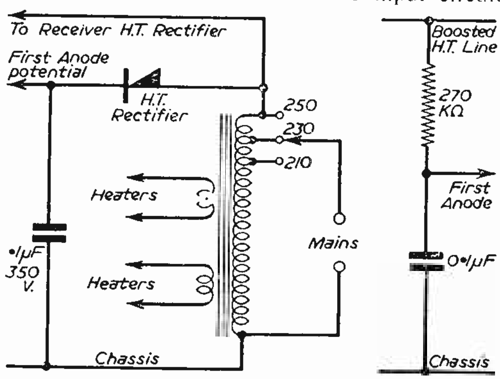


Fig. 4 (Above, left) and Fig. 5 (Above, right) show two methods of obtaining a potential suitable for the first anode of a tetrode.

as shown in Fig. 3. If a fuse is fitted in the mains lead, this may have to be slightly overrated in order to withstand the additional heater power. It will be understood, of course, that this modification will make the receiver suitable for use on A.C. supplies only.

If a 6.3-volt tube is to be used to replace one with a 2-volt heater, the tube heater leads should be removed and insulated from each other, as the 2-volt supply is obtained from a mains transformer and a short across it will cause it to burn out. Heater power for the 6.3-volt tube can be obtained either from a separate heater transformer, as in the former case, or in some sets from the 6.3-volt winding on the mains transformer which supplies the valve heaters.

Using a Tetrode in Place of a Triode

This modification is often made, and Mullard Ltd. have issued a number of modification sheets dealing with various types of receivers. Apart from the heater problem, which has now been fully considered, there is also the question of obtaining a potential suitable for the tetrode first anode.

There are several ways, and a method which is

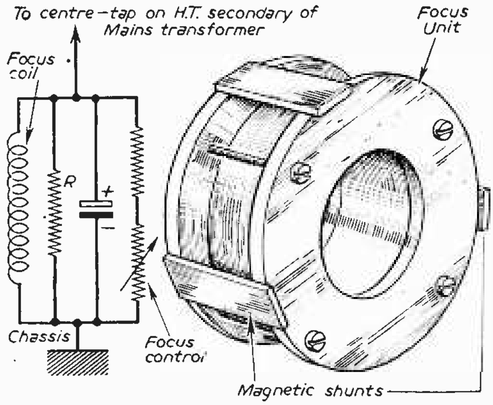


Fig. 6 (Above, left).—The resistor R is used to reduce the current through the focusing coil.
Fig. 7 (Above, right).—Using steel strips as magnetic shunts to reduce the field of a permanent magnet focus unit.

highly successful is shown in Fig. 4. This is suitable for those sets which use a mains transformer with a tapped primary and one which has secondary windings for supplying the heaters of the valves and tube. An additional H.T. rectifier is employed and is connected to the top of the primary winding, to the point where the receiver's H.T. rectifier is usually connected, and the resulting D.C. voltage is applied direct to the tube first anode.

The rectifier can be a Westinghouse type 16HT20 or a Sentercel type K3-15, with a capacitor of 0.1 μF 350 v.w. as reservoir.

On receivers with a 300-350 volt H.T. line, the first anode can be connected direct to this without difficulty. In cases where an efficiency diode is used, a suitable first anode potential is available on the boosted H.T. line and can be extracted by way of a 270 kΩ resistor which is decoupled by a 0.1 μF 350 v.w. capacitor (see Fig. 5). This may be the only method available for receivers of the A.C./D.C. variety.

Focusing Problems

Since a tetrode tube requires a smaller focusing field than a triode, an optimum point of focus can be obtained when a tetrode is used in place of a triode only by reducing the focusing field, either by reducing the current in the focus coil or by the fitting of magnetic shunts to the permanent magnet unit.

The current in the focus coil can easily be reduced by shunting the coil with a wire-wound resistor, or by including such a resistor in series with the coil. The actual arrangement adopted and the value of resistor required will depend upon the type of circuit, but where a shunt resistor is called for, its value should be in the region of 500 ohms and it should have a 5-watt rating.

Fig. 6 shows the focusing arrangement of the Ambassador TV1 receiver and the resistor R is used to limit the focus current. Here the total H.T. current of the set flows through the focus coil, which is of low resistance. Where a high resistance coil is fitted, it may be connected across the H.T. circuit and a series resistor should be used to reduce the current.

The field of a permanent magnet unit can be reduced to a suitable level by employing magnetic shunts. These consist of mild steel strips about $\frac{1}{2}$in. wide $\times$ $\frac{1}{8}$in. thick and of sufficient length to bridge the pole pieces of the unit. Three such shunts are usual and should be placed symmetrically around the periphery of the unit as shown in Fig. 7.

It must not be forgotten to fit and adjust an ion trap magnet on the neck of a tube which has an ion trap assembly, and it is also most important to earth the external conductive coating by means of chassis contacts, even if the original tube had no such coating.

New Screen Phosphor

A NEW type of screen phosphor with the property of storing images for periods of up to twenty minutes, which can then be released by shining infra-red on the face of the cathode-ray tube, has been developed by the Electronics Department of Ferranti Limited.

The property of storing images for such long periods makes the new "Y" phosphor suitable for radar applications in which images which have previously been received can be made visible at will. For example, if the phosphor was used in a radar tube, it would be possible to store a long succession of radar images, so that a clear indication of the path of a moving echo could be obtained over a period of several minutes.

Traditionally, the storage of images has been achieved by means of a long persistence phosphor, which permits information to be built up on the face of a cathode-ray tube so that the observer may relate spacially information arriving sequentially in time. However, there are many drawbacks to the use of such a phosphor, chief among these being the difficulty of storing information for a period of several minutes before viewing. Any attempt to do this would require such intense traces that permanent phosphor damage would occur.

A solution to this and the other problems associated with long persistence phosphors is found in the use of the new "Y" phosphor whose afterglow is under the control of the operator who may release it at any moment he wishes, at an intensity, which will ensure that no persistent image remains when the next field is presented. This requires provision of an infra-red source arranged so as to illuminate the whole screen of the tube uniformly when switched on, with provision for its intensity to be varied. A suitable method of doing this is by the use of a viewing hood in which a number of small filament lamps have been mounted facing the screen. Each lamp is carefully screened by means of a filter which eliminates as much as possible of the visible illumination, whilst passing the short and medium infra-red.

MODIFYING THE "UNIT 161"

THIS ARTICLE DEALS WITH ITS CONVERSION FOR BAND III

By H. Bayliss

WITH few very simple modifications this ex-A.M. equipment can be used with a Band I receiver as an add-on converter for Band III. It can also be used with modified London-only receivers and with "Pye-strips" working as I.F. amplifiers. The writer has never seen its complementary I.F. strip advertised as on sale to the public, but it must be similar to a Pye-strip, as they are both part of a transmitter/receiver, interrogator, or responser unit. The circuit diagram is shown in Fig. 1.

The RU.161 is a V.H.F. converter, which operates on frequencies in the range of 170-220 Mc/s and its I.F. output is about 45 Mc/s. The power supplies required are 250 v. D.C. H.T. and 6.3 v. A.C. or D.C. for the heaters. The input and output connections are via Pye coaxial plugs and sockets. The valve line-up is: R.F. strip, CV66 (EC54); mixer, VR136 (EF54); I.F. pre-amplifier, VR136 (EF54); and the local oscillator, VR137 (EC52). The oscillator works on the low frequency side of the signal, this giving correct relationships between vision and sound I.F. outputs for injection into a Band I receiver. The unit operates on four preset frequencies in the range of 170 to 220 Mc/s. Positions 1 and 2 appear to be in the lower part of the range, and positions 3 and 4 in the upper part. The tuning is preset by altering the positions of the range, and positions 3 and each Channel. The frequencies are selected by the rotation of a turret holding in all eight coils. Each coil may be selected remotely by a four-position switch and associated wiring which cause an impulse relay (see Fig. 2) to rotate and hunt until the selected one of the four is in position and at this point the supply to the relay is broken.

The electrical rotation of the turret will be found to be very effective; very rapid; and very noisy. The turret can be moved manually by pressing down the armature of the relay.

Circuit Analysis

From the input coaxial socket (this has a black painted surround) the signal passes through an I.F. rejector circuit, L1, C1, which is tunable in the range 44-50 Mc/s. The signal then goes to the R.F. amplifier, a grounded-grid triode EC54, through a tapped coil L2 to the cathode. The grid, which is brought out to four pins, is earthed by four silver mica condensers.

In the anode circuit of this valve an H.F.C. completes the H.T. circuit, but acts as a high impedance to the signal. A series-tuned circuit, consisting of Cak, L3 and C10, is tuned to the signal frequency. L3 is one of the four in

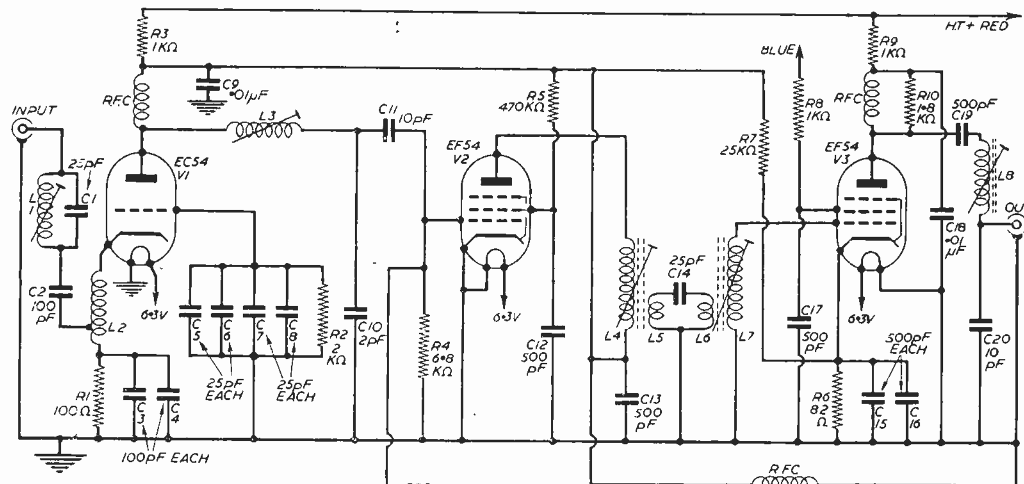
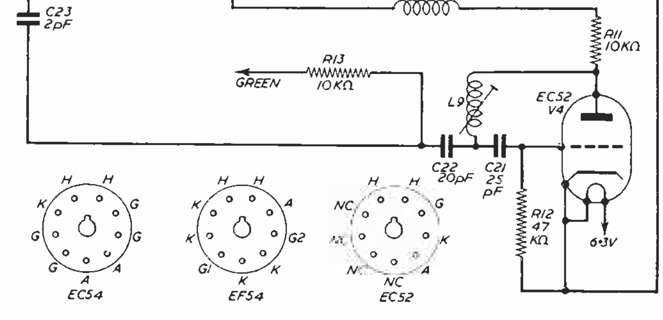


Fig. 1.—The circuit diagram.



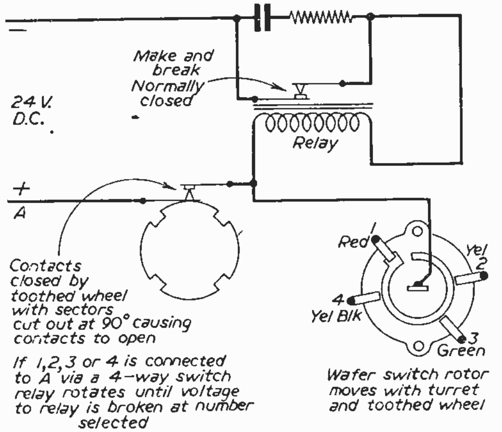


Fig. 2.—Circuit and operation of the impulse relay.

the turret and from this coil the signal passes to the grid of the mixer, which is a V.H.F. pentode, an EF54.

The mixer is an additive type, the local oscillator frequency being injected into the grid circuit. The difference frequency, which appears at the anode, is filtered out by L4 and L7, which are coupled inductively and by single turn coils L5 and L6 on each former, and also by C14. The actual intermediate frequency produced is between 40 and 50 Mc/s, depending on the adjustment of L4, L7 and L8. This I.F. signal is amplified by the second EF54. In the anode circuit of this valve is an inductance of high impedance at I.F. damped by R10. The series inductor L8 and C20 are used to match the output to the 80 ohm coaxial feeder.

The local oscillator valve is an EC52, operating in a Colpitt's circuit, working in the frequency range 125 to 175 Mc/s (on the low side of the signal) to ensure maximum frequency stability. L9 is one of the four preset coils on the turret.

The power supply cable consists of the following wires—red: H.T. +, white: 6.3 v. for the heaters; black is the earth lead and the return wire for the heater circuit; blue goes to the screen of I.F. valve (V3) screen and the V1A 1K ohm resistor; the green lead goes to the grid

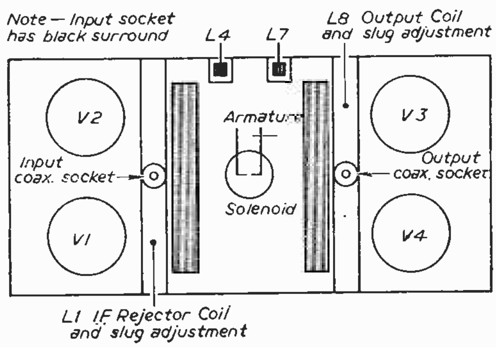


Fig. 4.—Underside view of chassis.

COIL DATA

L1 : 5 turns* on $\frac{1}{2}$ in. diameter former.
L2 : 5$\frac{1}{2}$ turns air-spaced, tapped at 2$\frac{1}{2}$ turns.
L4 and L7 : 5 turns
L5 and L6 : 1 turn } **on a $\frac{1}{2}$ in. diameter former.**
L8 : 5 turns

*** The number of turns of L1, L4, L7 and L8 is doubtful : the writer did not wish to damage these wax-covered coils but L7, which was investigated, had 5 turns, and the others cover similar frequencies.**

L3	L9	Position of Turret
4 turns	6 turns	1
4 turns	6 turns	2
3 turns	3 turns	3
3 turns	3 turns	4

of the local oscillator valve via a 10K ohm resistor. The turret relay control cable has six wires in a p.v.c. sleeve; for position one the wire is red: for two, yellow: for three, green; for four, black. Yellow is the positive pole of a 24 v. supply, and black the negative.

The modifications to be made are quite easily carried out: (1) The grid leak of the mixer has the low value of 6.8K ohms at present, and this is changed to 1M ohm. The blue lead of the cable which goes to the screen of the I.F. valve can be disconnected and a 1K ohm resistor connected from the screen to H.T. +. The green lead, connected to the grid of the local oscillator

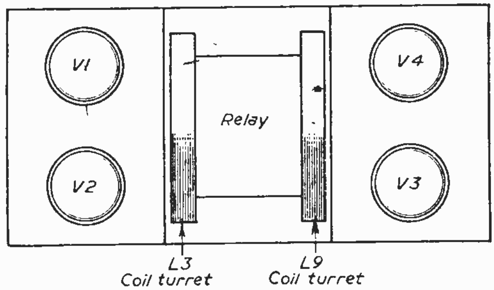


Fig. 3.—Top view of chassis.

can be disconnected and the 10K ohm resistor associated with this lead can also be removed. The H.T. end of the 25K ohm, 5W. vitreous resistor should be disconnected and also the connection to the cathode of the I.F. valve. (5) The value of R6 can be increased from 83 ohms to 150 ohms. This modification is not essential but will lower the H.T. consumption.

The modified unit has many uses: (a) as already stated, it can be used as an add-on converter to a Band I receiver without any change in the coils. (b) As also stated, it can be used as a front-end for a converted Pye-strip or London-only straight receiver, using 6.8 pF condensers across the coils to lower the intermediate frequency output from 45 to 36 Mc/s. (This is the vision I.F.) (c) By removing one or two turns with L1, L4, L7 and L8, the unit can be used with Band I receivers operating on Channels 3, 4 or 5. Positions 3 and 4 on the converter would have to be used for Channels 10 and 11.

UNUSUAL INTERFERENCE

TRACING SOURCES WITHIN RECEIVERS

By J. Booth

WE are receiving a number of reports from our readers about a curious form of interference which may occur either on the picture of the ITV or BBC, but rarely on both bands simultaneously. If it is present on the ITV picture, for instance, and the set is switched to the BBC, the picture in this case is invariably clear, and vice versa.

This interference takes the form of elusive, thin vertical white lines which may stay unsteadily on the picture for a few seconds, and then quickly sweep across the screen to the right, disappear off the edge of the screen and then

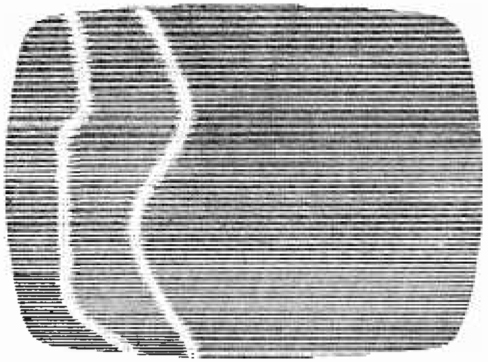


Fig. 1.—Showing how the "windscreen wiper" effect may appear momentarily on the screen.

reappear again at the left to repeat the performance. There may be one, two or even more lines and they may not be perfectly straight, but may have a kink or a bend in the middle. If they stay on the screen long enough and remain steady for a while it will be seen that they are composed of vertical columns of very narrow horizontal lines.

Owing to the sweeping nature of the lines across the screen, the effect has very appropriately been termed "windscreen wiper interference" by service technicians and dealers.

Investigation has revealed that the interference effects results when two sets are operated fairly close to each other, and when one is tuned to the BBC and the other to the ITV. It does not happen with all sets and the interference may not be mutual; that is only one receiver of the two tuned as above may be affected.

If a receiver operating on, say, Channel 9 happens to be in range of such interference from a receiver operating on Channel 1, then the interference on the Channel 9 receiver will not remain beneath the tube mask, but will sweep in a random manner across the picture and give the windscreen wiper effect. The converse may also follow, of course, but in both cases the owner of the offending receiver may be totally unaware that his set is disturbing his neighbour's viewing.

It will be remembered that the line flyback is initiated by the line sync signals radiated from the transmitter along with the picture signals. Although the character of the signals radiated by the BBC and ITV is identical—both systems employing the same number of lines, the same number of line signals during the framing pulses and both being locked to the 50 c/s power frequency—there is a random drift in phase between the line sync signals of the two transmissions during the frame flyback period. And it is this random phase drift which is responsible for the asynchronous line flyback and the windscreen wiper effect. The sketch in Fig. 1 gives some idea of how the effect may appear momentarily on the screen.

Effect Obscured

The causes detailed may or may not produce interference on the receiver responsible. If the interference effect is present, then steps would undoubtedly be taken to clear it, but it may be present though not visible on the picture as such. It must be remembered that the flyback operation occurs when the beam current is cut off by the picture signal, so under normal conditions a disturbance during the flyback may not be displayed. However, if the width of the picture is reduced so that the left-hand edge is clearly visible on the screen, the telltale, ragged, vertical line of interference may be seen superimposed on the edge of the picture or raster. It may be necessary to increase the setting of the brightness control in order to secure a clear display.

Before the days of Band III, interference of this nature would have been of little consequence, it being hidden beneath the tube mask. These days, though, it may well be responsible for windscreen wiper interference on a neighbour's receiver. The interference is often radiated over short distances, and on receivers which are tuned to the same station as the offending one the interference effect may occur right at the edge of the picture beneath the mask, and the viewer may not realise that interference is present. The

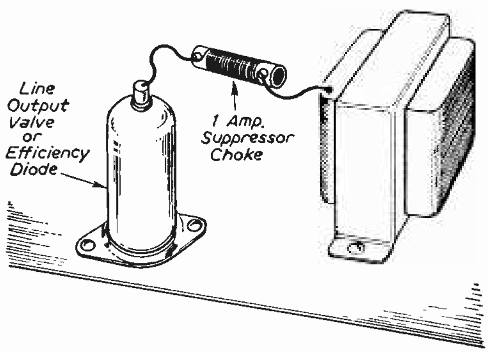


Fig. 2.—The introduction of a small iron-cored suppressor choke is often sufficient to damp the diode switching effect and B-K oscillation.

effect occurs in the same position on the screen of both the affected and offending receivers in this case because the line timebases are running perfectly in step, both being controlled by the same transmitted signal.

Line Timebase Radiation

It is well known that radiation occurs from the line timebase of a television receiver and a whistle is often heard from a broadcast receiver when it is used near to a working television set. This effect, however, is caused by harmonics of the flyback and the resulting interference modulates the programme material so that it is present only when the broadcast receiver is tuned to a station.

During the line flyback there are other disturbances produced in the line amplifier, and one of these is the production of a form of electron oscillation in the line output valve itself. This is usually known as Barkhausen-Kurz oscillation (B-K for short) and is caused by the anode

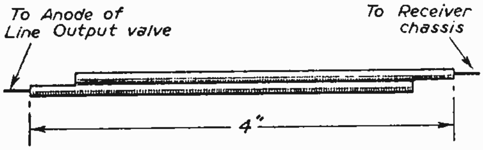


Fig. 3.—A small value capacitor can be produced from a length of twin p.v.c. covered cable. The conductors act as the plates while the p.v.c. covering acts as the dielectric.

of the valve suddenly becoming less positive than the screen at the time of the flyback. This results in an oscillatory movement of electrons in and out of the mesh of the screen electrode, which in turn sets up oscillatory currents in the associated wiring and components. This in itself is liable to cause interference on the receiver producing it and also on nearby receivers, but the frequency of the B-K interference is generally above that of the television signals so that it does not enter the receiver through the aerial circuits by way of the normal acceptance channel.

However, it may well get into the receiver indirectly by mixing with the signal produced by the receiver's local oscillator. In this way signals at sum and difference frequencies are produced which have a B-K component, and one of these may get into the receiver through the main or a spurious channel. This kind of interference causes the display of white vertical lines, made up of vertical columns of short irregular horizontal lines, on the offending receiver itself and also, possibly, on a nearby receiver. However, although these lines are of similar style to those described in relation to windscreen wiper interference, they remain steady on the screen of the responsible receiver and on other receivers which are tuned to the same channel as the offending receiver.

It is possible that this interference will occur only when the receiver is tuned to Band III. This is because the B-K signal may be of a frequency corresponding to a Band III channel and thus outside the range of Band I frequencies. It often happens that the interference occurs after a Band III tuner or multi-channel adaptor has been installed. If this is the case, then attention should be given to the positioning of the tuner and associated connecting leads, and it should be ensured that they are as far as possible away from the line output stage. As mentioned previously, a weak signal aggravates the effect, and on Band III the signal may be considerably weaker than on Band I. Attention should, therefore, also be given to the Band III aerial system, making sure that the aerial is orientated for maximum signal pickup.

Corona

Another cause is corona or flashover either in the line output transformer, as the result of impaired insulation, or in a component or circuit associated with the EHT pulse voltage and current. For example, if an arc is drawn from the end of a screwdriver from the anode of the EHT rectifier valve from the anode of the line output valve or from the cathode of the efficiency diode when the receiver is producing a picture, a vertical white line will appear on the picture. Again, this line will be made up of short, irregular horizontal lines, one above the other, forming a vertical column. This effect will, in fact, occur if an arc is drawn from any part of the line amplifier circuit, including the scanning coils, width inductor and linearity inductor, on which there is a pulse potential. Clearly, if the flashover is promoted by insulation failure the same symptom will result, though possibly on a less startling scale, since a vigorous discharge in a component would result in more disastrous effects. Nevertheless, the cause and effect can be demonstrated readily as described above without damage to the receiver.

Corona troubles will need replacement of the faulty part, possibly the line output transformer, but due attention should also be given to the associated wiring, and all traces of dust removed from the line output transformer, EHT rectifier valve, tube anode connector and surrounding glass.

The main difficulty is finding the receiver which is responsible for the trouble, but since the radiation does not usually cover a very large area, examination of nearby receivers for the telltale symptom soon reveals the offender. In severe cases the Post Office are often prepared to offer their services in establishing the interfering source.

Switching of the Efficiency Diode

Interference of a very similar nature may be caused by the conduction and cutting off of the efficiency diode during the normal line scanning cycle. Energy for the first half of the line scan is obtained through the efficiency diode from that stored in the inductive elements of the circuit during the flyback. After this energy has been exhausted the efficiency diode, in effect, switches off and the line output valve commences to conduct to provide the energy for the second half of the scan. It is this repetitive switching on

(*Continued on page 250*)

TELEVISION TROUBLES

Their Symptoms and How They May be Cured—5

By G. J. King

THIS month we deal with timebase faults in the Cossor 916, 917, 918, 920 and 923 range of receivers. Although these are fairly old 10in. and 12in. models, a large number of them are still used by our readers, and hints on fault correction should be useful.

Frame Timebase Failure

This gives the symptom of a bright horizontal line, and to avoid burning the screen this should be reduced in intensity by retarding the brightness control setting. In the first instance the 6SN7 oscillator valve and the 7C5 output valve should be checked, preferably by substitution if the heaters can be seen glowing. The 6SN7 is a double-triode valve, and this is the oscillator for both frame and line timebases, the frame circuit being given in Fig. 1.

It sometimes happens that the heater of one triode only fails, and if this is associated with the frame the symptom as above will result. Careful examination of the valve when in operation will show that the heater in one section is not alight, and valve replacement will restore the frame scan.

However, if the valves are in order, a voltage check should be made at the anode of the triode (pin 5). The voltage is normally very low as indicated on the circuit, but if the horizontal line flicks up and down the screen when the anode tag is connected to the meter probe, one can be fairly certain that the amplifier section is working and that the fault lies somewhere in the oscillator circuit. Zero voltage at the anode would indicate open-circuit of the blocking oscillator transformer primary (yellow and black wires), R48 or R57. The transformer primary should measure about 220 ohms and the secondary (white and red wires) 320 ohms.

A conclusive voltage reading cannot be obtained at the grid of the triode, but if the raster tends to open up when a meter is connected to the white wire on the transformer (the "hot" end of C38), the most likely cause of the symptom is open-circuit or increase in value of R51.

It is handy to remember that R51 and R48 sometimes become intermittently faulty, resulting in the frame collapsing in a random manner. Both resistors have metal end caps and are mounted close together on the large paxolin panel at the front of the chassis. By tapping them with the handle of a screwdriver or by bending the paxolin panel the symptom may be made to appear and disappear, which is fairly reasonable proof that one or other of them is faulty.

If the frame oscillator is working, as can usually be proved by connecting a pair of high-resistance headphones across R52 and listening for the 50 c/s frame signal which should vary slightly in pitch as the vertical hold control is adjusted, a check of the voltages at the base of the 7C5 should be the next move. These are given on the circuit diagram.

The primary of the frame output transformer may be found to be open-circuit or well above its normal 1,180 ohms resistance. In this case the anode voltage will be almost non-existent and the screen electrode in the 7C5 will be glowing red-hot. If the anode and screen voltages are normal but the cathode voltage is zero, either the valve emission has failed completely or there is a short across the cathode by-pass electrolytic. In the latter case, there will be a frame scan of considerably impaired linearity.

Faint Horizontal Line Across Picture

This line may be about ¼in. wide and accompanied by a weak frame lock and cramping at the top of the picture. A check of the primary of the frame oscillator transformer will show that its resistance has increased well above normal. In fact, a frame scan of a sort has been produced even when the winding resistance has increased to some 30k ohms.

Poor Frame Linearity

Slight cramping at the top of the picture can often be corrected by shunting the cathode resistor (R54) of the 7C5 valve with a resistor of 2,700 ohms. If this does not cure the trouble completely, the shunt resistor can be reduced to about 1,500 ohms without ill effect.

Additional linearity correction is available by altering the value of R50 between in range of 180k to 330k. More recent models of the series are modified in this section to provide an adjustable vertical linearity control. R50 is changed

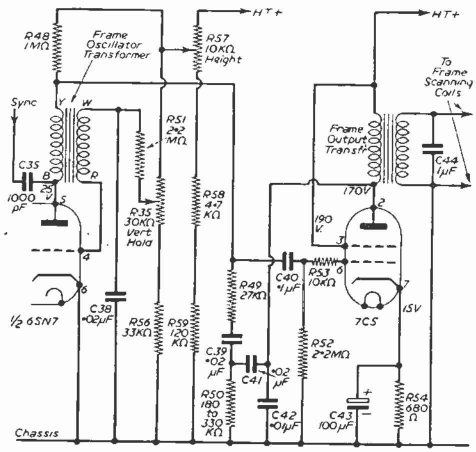


Fig. 1.—Frame timebase circuit of Cossor Models 916, 917, 920 and 923.

to 100k ohm ¼ watt and a 0.5 megohm variable resistor is connected in series with it to chassis.

Insufficient Height

This symptom is often caused by an increase in value of R48 which is connected to the primary of the oscillator transformer. However, if this is not the trouble and the valves are in order, R54 in the cathode of the 7C5 can be changed to 560 ohms or the existing resistor can be shunted with an additional resistor valued at 2,700 ohms.

No Frame Lock

If the frame tends to roll and only just locks when the vertical hold control is right against

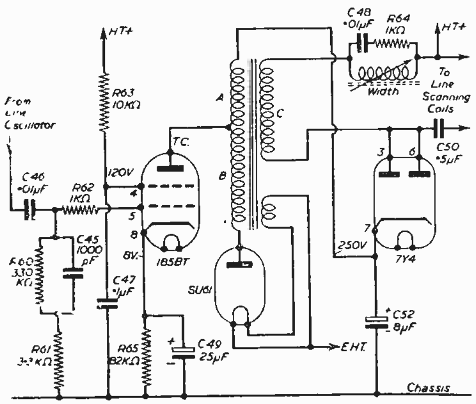


Fig. 2.—The circuit of the line amplifier.

one of its stops, the trouble is almost certainly caused by an increase in the value of R51 connected to the slider tag of the control.

Frame sync is applied to the oscillator through C35 from the anode of the sync separator valve. This capacitor has been known to become defective and cause the effect, but in this case a very light lock is secured within the range of the hold control. It should also be remembered that trouble in the frame oscillator transformer may be responsible.

Line Timebase Failure

The symptom would be lack of raster owing to the resulting EHT failure—EHT in this series is obtained from the line flyback.

The line oscillator is very similar to the frame oscillator apart from differences in component values. It is as well first to ensure that the appropriate section of the 6SN7 valve is operating and that the stage is in fact oscillating. Usually the line oscillator whistle can be heard from the oscillator and line output transformers, and the pitch of the whistle will vary as the line hold control is adjusted (the aerial should be removed for this test to avoid locking the oscillator to the sync pulses of the signal).

If the whistle cannot be heard, the oscillator or output stage may be faulty. A test of the oscillator can be made by connecting a pair of high resistance headphones across R60 and R61 (Fig. 2). If there is still no whistle, a detailed check should be made of the oscillator section, including the line oscillator transformer whose primary and secondary resistances should be 43 and 61 ohms respectively.

If the signal is present, however, a spark test at the heater of the EHT rectifier (SU61) will, at least, show whether or not lack of EHT is responsible for the blank screen. If there is no EHT, but a good arc can be drawn from the anode of the EHT rectifier, the rectifier should be replaced.

If there is no arc at the anode even though the line oscillator is working as tested above, the electrode voltages of the 185BT line amplifier valve should be checked. The screen resistor (R63) often goes open-circuit, but if this is in order and the cathode voltage is zero the trouble may be caused by open-circuit of A winding on the line output transformer or lack of EHT at the top of the winding. The winding should be checked for continuity and a voltage check should be made at the cathode of the 7Y4 efficiency diode. (It is never good policy to make a voltage test at the anode—the top-cap—of the line amplifier valve.)

If there is no voltage at the cathode, but the anode voltage is normal, the valve itself is possibly faulty, but before it is replaced the reservoir capacitor (C52) should be checked for insulation resistance and replaced if necessary.

Cramping at the Left of the Screen

This symptom is often caused by low emission of the 7Y4, but if valve replacement does not effect a cure, attention should be directed towards the reservoir capacitor, which will probably be open-circuit.

Low H.T. voltage, owing to a low emission 27SU H.T. rectifier valve, also aggravates the trouble, but this generally reflects into the frame timebase giving the symptom of insufficient height.

Low EHT Voltage

This trouble may well be caused by a component defect in the line timebase generally, but it has also been known to be caused by a faulty line output transformer. The EHT rectifier heater may light up normally at first, but as soon as the cathode has heated sufficiently for normal conduction a flash may be observed in the rectifier and in some cases the heater may blow. This is due to poor insulation of the heater winding on the transformer, and replacement of the transformer is the only cure.

Shorted turns in the transformer will usually promote total failure of the line amplifier, even though a weak line whistle is audible, and this trouble should be suspected in those cases where everything appears to be normal, but the stage remains inactive. A resistance check of the windings against the values given by the manufacturer is never conclusive since a shorting turn or two will hardly be measurable, and in any case there is always a certain resistance tolerance. However, to serve purely as a guide, the resistance values quoted by the manufacturers for windings A, B and C (Fig. 2) are 59 ohms, 335 ohms and 7.5 ohms respectively.

Relaxation Oscillators—1

THE FIRST OF A SERIES OF NON-MATHEMATICAL ANALYSES

By R. Couvela

ONE of the most puzzling branches of electronics that is frequently encountered is the group of circuits which falls under the broad heading of "Relaxation Oscillators." Coupled with this is the fact that this group of circuits is coming into greater use almost daily, as they are used extensively in radar and television. Amateurs with only a fundamental knowledge of electronics need have no fears about following this series, as it will be strictly non-mathematical: it will explain in everyday electronic terms how some very puzzling circuits work, while "popular" or evasive explanations will be rigorously avoided.

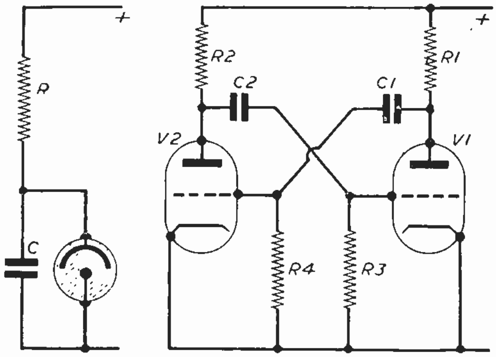


Fig. 1 (Left).—Neon timebase oscillator. Fig. 3 (Right).—A Multivibrator circuit.

Neon Oscillator

The simplest form of relaxation oscillator is the basic sawtooth generator, employing a neon tube. The author does not presume to suppose that there will be many amateurs who do not know how this circuit functions, but the description is given as a means of indicating the type of approach to be used throughout the series, and also as a means of introducing the basic principles on which all the circuits to be described later depend.

A neon tube consists of two electrodes in a glass envelope containing the gas neon at very low pressure. On the application of a D.C. potential across its electrodes, no current will flow until the potential is increased above a critical value (the "striking voltage"). Then current will flow, even if the voltage is reduced below the striking voltage, and a red glow will be seen at the cathode. If, however, the current in the tube falls below a certain value, the tube will revert to its original "cut-off" condition.

Refer now to Fig. 1; when a potential is applied across the terminals marked, current will flow through R to charge C. As C has no charge initially, it cannot have a P.D. (Potential Difference) across it, so the tube cannot strike. The P.D. across C rises exponentially towards the supply potential, until it reaches the striking voltage of the neon. The neon strikes and in this state will act as a very low resistance, which will discharge C. When C is almost discharged, the current through the neon is almost entirely composed of that coming through R from the supply and R is arranged to have such a value that eventually the P.D. across the neon is insufficient to maintain the discharge and the neon is cut off. The cycle is then repeated.

In practice, R is fairly high, so the charging time is longer than the discharge. The waveform is therefore as shown in Fig. 2.

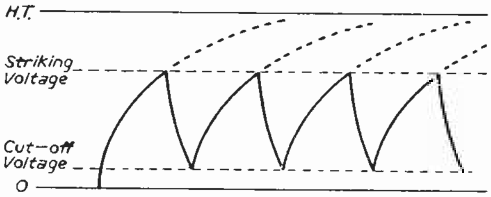


Fig. 2.—Neon timebase waveforms.

From the above description, it will be easy to see the derivation of the term "Relaxation Oscillator." The cycle is composed of two types of action: in the first case, there are exceedingly short periods of intense activity (the discharge time, above) and then there are the comparatively long periods of relaxation, during which the circuit recovers from the effects of this activity. The circuit is never in a stable condition: even during the relaxation periods there is a continual drift towards the striking point. The waveforms produced by these oscillators vary quite considerably: apart from the triangular form above there are square waveforms and even triangular pulses or step functions are obtainable.

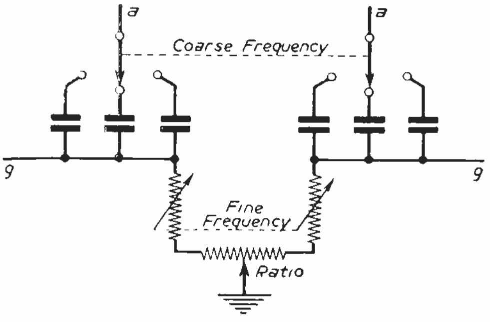


Fig. 4.—Controlling the frequency of the multivibrator.

The Multivibrator

So much for the neon timebase; now for the multivibrator. The circuit in its simplest form is shown in Fig. 3. Suppose initially that each valve is passing constant current, and that these currents are equal. Both the grids are at earth potential, so no current is flowing in either R3 or R4.

Now suppose that for some reason. such as valve noise or microphony, or H.T. hum, the current in V1 increases suddenly by a very small amount. This action immediately increases the voltage drop across R1. By subtracting the voltage across R1 from the H.T. value, the voltage on the anode of V1 (Va1) may be found. If we make this subtraction both immediately before and immediately after our supposed alteration in current, we see that Va1 has dropped slightly as a result of the action. Now, C1 was charged to the initial value of Va1, and, if it is to remain stable, must now discharge slightly to the new value of Va1, and this discharge must be through R4. As R4 is large, this discharge will take an appreciable time, and in the meantime the grid of V2 is carried slightly negative by the potential drop across R4 caused by the discharge current from C1.

The fact that the grid of V2 has been made more negative naturally results in a reduction of anode current of V2, and the reverse of the action described above occurs. The reduction of current in V2 results in an increase of Va2. which is passed to the grid of V1 in the manner described above, resulting in an increase of current in V1. Note that this last result is the same as the effect which caused it in the first place, so that we have started a "landslide": the increase of current in V1 has been passed round the circuit, and is now acting in such a way as to increase its own effect, thus speeding up the action all round the circuit. V2 is therefore very quickly driven into cut-off. It should be clearly understood that all the above has happened in an almost immeasurably short space of time. The current in V1 has risen to a very high level. which means that there is a large voltage drop on R1. so Va1 is at a very low value. C1. however, has still not had time to discharge appreciably, and the grid of V2 is held at a voltage well below zero. This is sometimes thought strange, but remember that unless C1 discharges it must retain its initial voltage. which was that of the anode of V1. Va1 might have dropped by, say. 50 volts. in which case the grid of V2 will now be seen to be at -50 volts to earth. Naturally. C1 is discharging as fast as R4 will allow. but in the meanwhile. V2 is held at cut-off. and its anode has risen to H.T. value, there being no current through R2. Note that C2 now has time to charge up to the full H.T. value through R2. the grid and cathode of V1 acting as a diode.

It might be thought that V1 could be damaged by being allowed to pass an indefinite current. but this current is. in fact, restricted by R1. A good method of fixing the value of R1 and R2 in practice is to make them of such a value that they would pass the maximum permissible anode current if connected directly across the H.T. supply. Thus. if the H.T. supply is at 300 volts, and the maximum permissible value of anode current is 15 mA, then the anode load resistors will be given by Ohm's law, i.e.,

$$R1 = R2 = \frac{\text{V H.T.}}{\text{Ia max.}} = 300/0.015 = 20{,}000 \text{ ohms.}$$

Thus, neither valve could be damaged by excessive anode current.

Soon, however, C1 discharges sufficiently to allow the grid of V2 to reach its cut-off value. Immediately, current starts to flow in V2. and the anode voltage drops slightly. This drop is transmitted to the grid of V1. through C2. which is charged to H.T. value, causing the grid voltage to fall slightly below zero. This effect slightly reduces the current in V1, causing its anode voltage to rise a little. This has the effect of raising the grid voltage of V2. and once more we are in a landslide. This time, however. it is in the opposite direction. and we finish up with V1 cut off and V2 in full conduction.

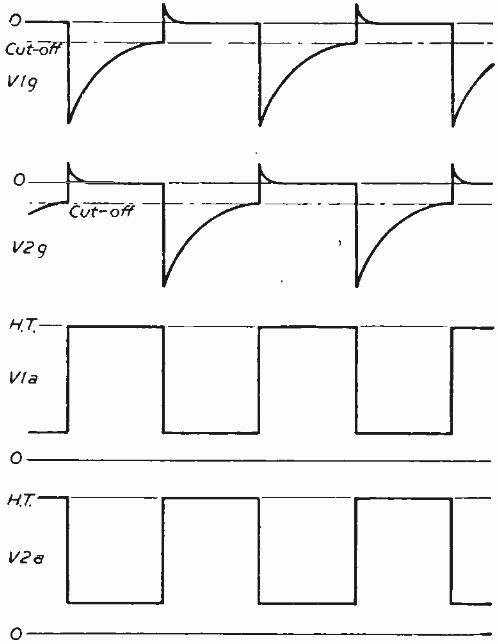


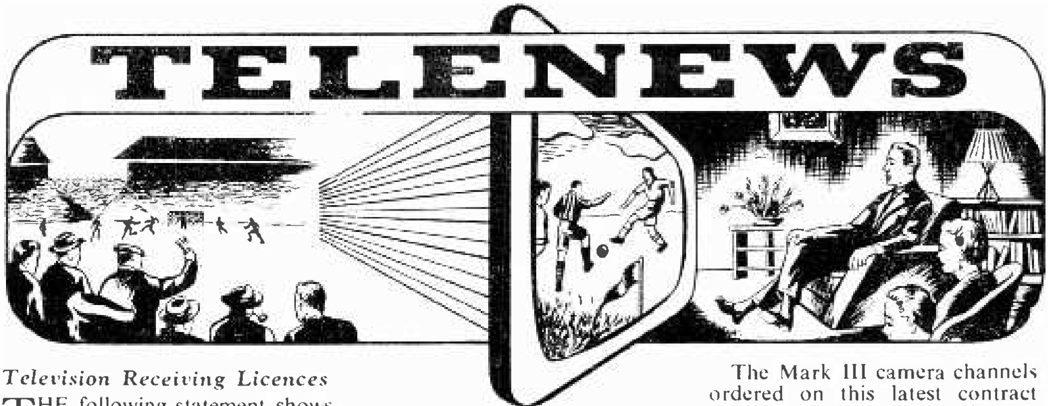
Fig. 5.—Waveforms in the multivibrator.

The potential of the grid of V1 is holding that valve well beyond cut-off. its anode being at H.T. value. C1 is now charging up again, through R1 and the grid-cathode circuit of V2, thus holding the grid of V2 slightly above zero, and V2 is conducting heavily, limited only by R2. This fact holds the anode of V2 at a low value. which holds the grid of V1 negative. and V1 cut off, pending the discharge of C2.

As soon as C2 discharges sufficiently to allow the voltage on the grid of V1 to rise to cut-off value. the cycle is repeated.

The waveforms to be found in the circuit are shown in Fig. 5 which should answer any queries about the action. This diagram should be self-explanatory. especially if the above description is read again.

(*Continued on page* 245)



Television Receiving Licences

THE following statement shows the approximate number of Television Receiving Licences in force at the end of September, 1958, in respect of receiving stations situated within the various postal regions of England, Wales, Scotland and Northern Ireland.

Region	*Total*
London Postal	1,611,154
Home Counties	1,051,929
Midland...	1,341,639
North Eastern	1,355,329
North Western	1,173,927
South Western	665,943
Wales and Border Counties ...	488,492
Total England and Wales ...	7,688,413
Scotland	643,642
Northern Ireland	91,457
Grand total	8,423,512

TV Safety Glass

TV safety glass as a dust-catching reflection producer in front of the picture tube may soon become a thing of the past. Two American glass companies have announced new implosion plates bonded to the tube itself, and they claim 8 to 10 per cent. more brightness and virtual elimination of reflections, plus the possibility of reducing cabinet depth still further. One company calls its development the "safety tube." It consists of a lightweight glass window curved to fit the tube face and acid etched to a satin finish to diffuse light reflections. It is laminated directly to the face of the picture tube with a layer of transparent polyester resin.

Another company achieves a similar effect with its "contoured twin-panel tube." It uses a curved glass plate with a flange which is cemented around the edge of the picture tube. The space between the tube face and the glass plate is filled with clear mineral oil (one quart is used in a 21in. tube). The oil can be tinted and is intended to provide clear viewing and reduce or eliminate the possibility of implosion.

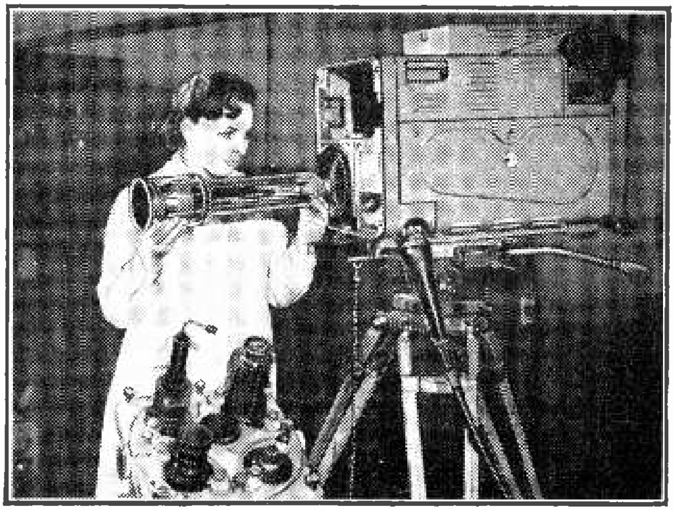
Canada Buys British

A FURTHER order from the Canadian Broadcasting Corporation for six Mark III television camera channels brings the total number of Marconi camera channels purchased by C.B.C. to nearly seventy. The orders for these were all obtained through the Canadian Marconi Company. The six channels ordered in this latest contract are for the new C.B.C. studios at Montreal and Toronto, the major programme-originating centres for the French and English networks respectively.

The Mark III camera channels ordered on this latest contract can be used with either the 3in. or 4½in. Image Orthicon tube manufactured by the English Electric Valve Company. This company, together with Marconi's, pioneered the use of the 4½in. tube which is now generally accepted as giving the best possible results for television studio work, being especially free from spurious edge effects and having exceptionally good signal-to-noise ratio. In addition to the above, the camera channels include normal black stretch circuits and also a novel automatic alignment circuit which saves considerable time in setting up the camera channels.

TV Picture 13 Miles Up

A TV picture 13 miles up was viewed by Minneapolis residents when the U.S. Navy's



A 4½in. Image Orthicon tube being fitted into a Marconi Mk. III camera. See "Canada Buys British" above.

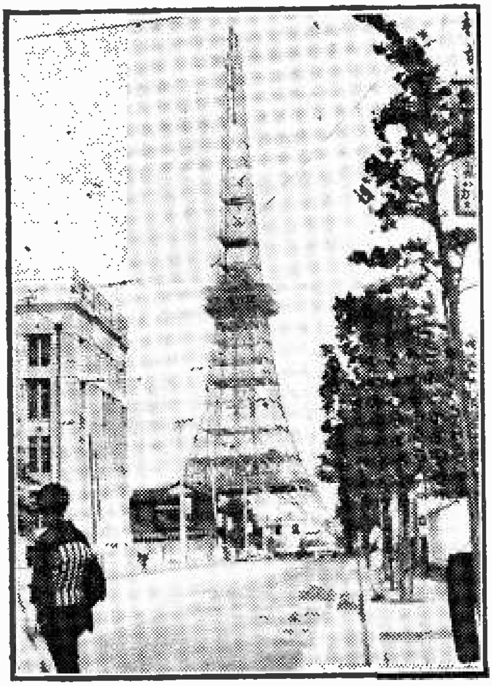
"Strato-Lab" set up a manned-balloon ascent record of 82,000ft. Installed in the 7ft. wide gondola was a transistor Vidicon camera and a 30 watt transmitter tuned to a U.H.F. channel. The television pictures, which were relatively uninspiring views of the inside of the gondola, were televised live from the local station from the 60,000 and 70,000ft. levels.

Tallest TV Aerial Mast

THE Independent Television Authority has placed a substantial contract with E.M.I. Electronics Ltd. for what, when completed, will be the tallest television aerial mast in the Commonwealth. The 1,000ft. mast will be situated at Mendlesham, Suffolk, and will carry ITV's East Anglia programme from the studios of Anglia Television in Norwich. It will serve nearly two million people when the new station opens towards the end of next year.

The order includes the supply and erection of the mast, special directional aerial system and feeders from the transmitter. Known as the Mesny Type, the aerial system is of a special E.M.I. design not used before in this country. This has several advantages over others in general use. The aerials are lighter and so the weight of the supporting mast can be considerably reduced, and because fewer feed points are necessary than normal, the de-icing problem is simplified and the overall complexity reduced.

The mast will be triangular in section with sides 6ft. 6in. wide. The aerial system will comprise 4 bays, each 100ft. long and will radiate horizontally polarised signals on Channel Eleven.



Tokyo's "Eiffel Tower" reaching its final top storey.

The unsymmetrical radiation pattern required from this station could not have been met adequately with an aerial of conventional design. Strong signals were required in the directions of Norwich, Peterborough, Cambridge and Colchester, but the radiation had to be reduced drastically towards London, the South Coast and Amiens areas to meet international planning requirements.

The radiation system provides exceptionally high aerial gain, enabling a comparatively low input of 8 kW from the transmitters to give an effective radiated power of 200 kW in the desired directions. This means that while the economic advantages of a low-powered transmitter can be utilised, the E.M.I. aerial design will give the people of East Anglia a service of the highest possible quality.

Twenty-one Million ITV Viewers

ITV viewers have increased by more than 20 million in just over three years—from 670,000 when ITV began, to the current total of 21,000,000—reports Television Audience Measurement Limited (TAM).

Other audience landmarks in ITV's progress were May, 1956—5,000,000 viewers, February, 1957—10,000,000, and October, 1957—15,000,000.

Tokyo's "Eiffel Tower" Going Up Fast

TOKYO'S new television tower, which is very like the Paris Eiffel Tower, but taller, is now well past the second stage of construction at Shiba Park, Tokyo. Air line companies are getting worried about its effect on aircraft from the nearby Maneda International Airport, for the machines have to make a turn nearby, and in misty weather it would be hard to see. The tower, however, is to be equipped with lights that can be seen fifty miles away.

Teleducation

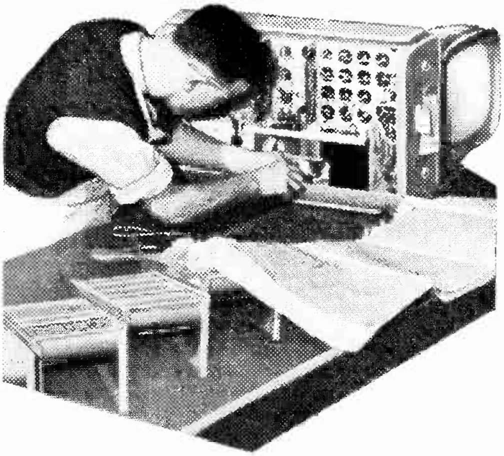
TELEDUCATION — use of closed-circuit TV systems in teaching—is now incorporated in the curricula of 119 American schools and colleges. A survey by the Joint Council on Educational Television, Washington, revealed that 133 closed-circuit systems are in use in the 119 institutions, about twice as many installations as there were two years ago.

Tyne Tees TV

THE studios of Tyne Tees Television Ltd., at City Road, Newcastle, are rapidly nearing completion.

The new station (which will be on Channel 8) will extend ITV coverage to the north-east, and will not start transmission to the public until January 15th, but to the staff December 1st is the operative date. From that day on, the entire organisation will operate as though it were already "on the air." For six weeks producers, technicians, artistes will work on programmes which, although they will be "dummy runs" on a closed-circuit, will be subject to the same discipline and split-second timing as the genuine article. In this way the inevitable "bugs" will be eradicated from the complex equipment and the transition from "dummy" to live on January 15th will be so smooth as to eliminate any trace of first night tension.

A NEW SERIES



Analysing and Servicing TV Receivers

No. 3.—The Sound Stage

By "Diadem"

CONTINUING from the October issue we deal with further information on faults affecting the vision strip.

Lack of blacks.—Picture grey:—check cathode volts on tube and the video output valve and its components first, check all the vision strip and if sound is weak as well, examine the aerials and feeder: check EHT rectifier, and if the picture is still milky when the brilliance is advanced and the whites go whiter and the blacks fade out, do not forget the crystal detector; sometimes this is inside the last I.F. transformer can in commercial receivers, as in the Ferguson 988T.

White flare all over screen.—R.F. or I.F. instability. Examine all the decoupling condensers or short circuit each control grid to chassis in turn until the flaring ceases: commence at the first R.F. stage. Make sure the coil cans are making good contact with the chassis as an ohmmeter reading of one or two ohms can sometimes be obtained owing to the aluminium filming over. Vision instability can also be caused by an incorrect setting of the sound rejector; when this is in the cathode circuit the screen will light up very brightly with no picture in most cases. Do not confuse the above faults with uncontrollable brilliance in the C.R.T.

Inability to tune in sound and vision together.—Coils not tuning broadly enough; check the damping resistors across the tuning coils if fitted, and examine the oscillator/mixer valve and its components. A weak signal is often the cause; this is especially noticeable on Band III.

Ringing.—This is almost entirely an alignment fault. Relign the tuned circuits; if only one coil is out of alignment the fault will be visible, so turn one slug at a time and then bring it back to its original position and watch the test card. But first make sure the oscillator has not drifted as

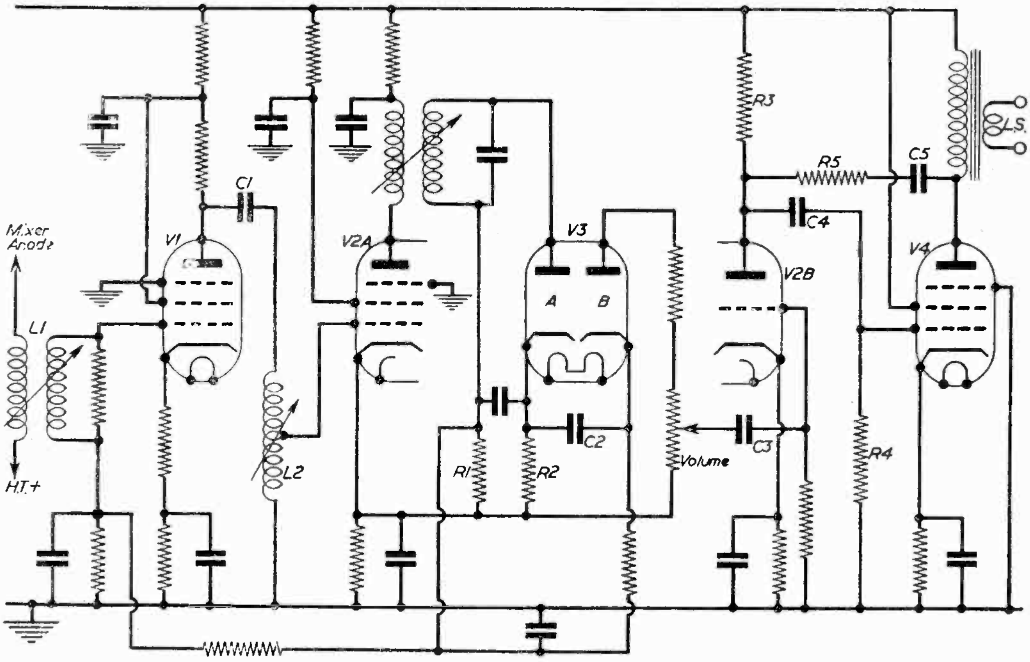


Fig. 15.—The sound circuit.

this is the most likely cause. Tune the oscillator for maximum sound possible with minimum sound interference on vision.

Picture brilliance, varying during viewing.—Check the video output valve for emission and its anode resistors for variation, and the crystal diode detector. If the picture fades this could be worn valves or tube. See that the valves are seated properly and clean the pins if necessary.

Picture either brighter or dimmer than usual when first switching on, and low sound sometimes accompanied by sound on vision or vision on sound, i.e., dark bands with brightness varying or hum on sound, the hum varying with picture content. After a short while this alters to the normal picture and sound. Suspect oscillator drift: change the valve first and then the condensers across or in series with the oscillator coil and replace with the same values and types, i.e., mica for mica and ceramic for ceramic.

Vision signal suddenly drops with dim picture and can be brought back to normal by switching the set on and off or by operating a

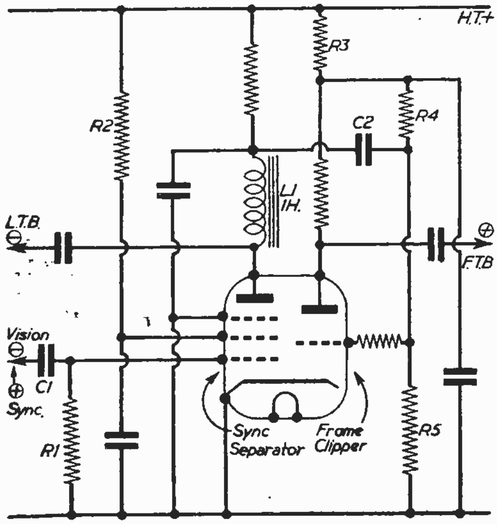


Fig. 16.—The pentode sync separator.

light switch in the house or by placing a test prod from the test meter on any voltage line in the vision strip; suspect a faulty condenser anywhere in the strip.

Slight ripple on verticals.—Usual cause is hum in the vision strip; check smoothing and decoupling capacitors and valves for electrode leakages. Don't confuse this fault with sound on vision.

Hum bars.—This does not always originate from faulty smoothing in the power supply or frame timebase. Suspect valve heater to cathode leak in the vision strip especially the detector and don't forget the C.R.T.

Ghosts.—Caused by nearby objects reflecting signal back on to the aerial, or can be caused by faulty feeder matching. When object is close to the aerial, instead of double or treble images being observed only a white outline after black is noticed. Don't confuse this with white after black where misalignment causes poor H.F. response.

Video amplifier screen red hot.—Cause is overloading, turn the contrast down and also check for instability in the vision strip decoupling condensers. While we are discussing the video amplifier, if its electrolytic condenser in the cathode lead dries up this will cause a weak picture, and the loss of gain will also weaken the frame sync pulse, feedback is created when this condenser loses capacity leaving the cathode resistor unbypassed.

Half the screen black and the other half white in a horizontal direction. If a heater to cathode short appears in the vision noise limiter this will place A.C. on the tube cathode in most circuits, also check vision strip decoupling condensers and don't forget the heater condensers and H.T. smoothing capacitors.

Half the screen black and the other half white in a vertical direction. Check for interaction between line and frame, examine the routing of the frame flyback suppression network and see that the line output valve and the output transformer screening can fit properly. Oscillations from the timebase frequency are probably being induced into the tube wiring. Check the decoupling capacitors between the tube grid and chassis and A1 if fitted.

The Sound Stage

Although there are many variations of the sound circuit (Fig. 15), only one is given as there is a similarity of working in most types. The sound signals which are amplified by the sound and vision R.F. amplifier and mixer stages are taken off from a coil in the anode circuit of the mixer or in some cases in the I.F. amplifying stages if greater gain is required. This latter arrangement depends on the position in the circuit of the sound on vision rejector. The sound signal must be taken off before the rejector, otherwise the signal will be blocked.

V1 gives further amplification at sound I.F. The amplified signal appears at the anode of V1 and is passed through the coupling condenser C1 to the tapped I.F. coil, L2. The same procedure then occurs in a further I.F. amplifying stage V2A. The signal is then rectified by V3A and appears across R1 and R2. The bias developed across R1 is fed back to V1 giving A.G.C. The signal across R2 is then passed through C2 to the series noise limiter V3B. The A.G.C. voltage biases V3B cathode negatively and makes the valve conductive. When there is a positive-going interference pulse, the valve is cut off, provided that the pulse is of greater amplitude than the A.G.C. voltage. The sound signal appearing at the volume control is fed into the A.F. amplifier V2B via C3. The amplified signal is passed via the resistance capacity network R3, C4, R4 to the output valve V4. Negative feedback is caused by R5 and C5 between the anodes of V2B and V4.

Faults Affecting the Sound Strip

Vision on sound.—This causes a loud buzzing sound from the speaker which varies in intensity with the picture content. Tune the oscillator trimmer for maximum sound with minimum

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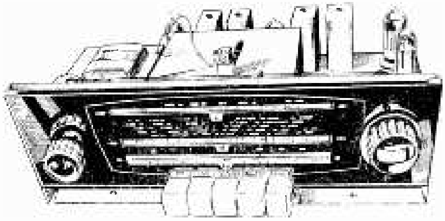

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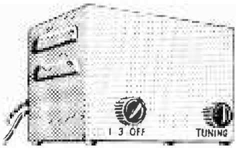

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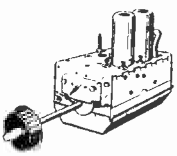

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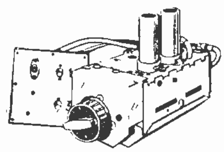

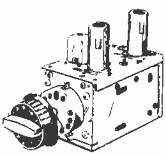

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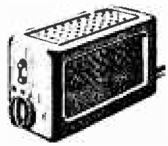

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sound interference on vision. If much adjustment is needed check the oscillator valve and the capacitors across, or in series with, the oscillator coil.

Any replacement capacitors must be of the same values and types as those previously fitted. Also try the effect of realigning the R.F. stage preceding the frequency changer stage.

Bubbling hum on sound.—If this occurs when the volume control is at its maximum position, check the sound circuits and the screening on the lead to the volume control. Hum radiated from the frame timebase is the cause.

Hum originating in the sound strip.—This can be caused by a heater-to-cathode leak in the sound detector, and by defective heater decoupling condensers.

Distorted sound or stressed sibilants.—The anode resistor of the noise limiter may have increased in value. If there is negative feedback from the sound output stage to an earlier stage, check the feedback capacitor.

Intermittent screeching sound.—The electrolytic smoothing capacitor may be faulty.

Weak sound.—If the sound is not distorted, and vision is normal, check the sound I.F. stages first.

The Synchronising Separator Stage

The function of the sync separator valve is to remove the picture content from the demodulated signal, leaving the sync pulses which fire the timebases at the correct instants. The valve is biased so that conduction takes place only on the sync pulses. The separated pulses are taken from the anode circuit, or, sometimes, if the sync separating valve is a pentode, from the cathode or screen grid.

These pulses are separated from one another by differentiating and integrating networks: a differentiating network is used to pass only the line pulses, which are of a high frequency compared with the frame pulses, which are passed only by the integrating network. A frame pulse clipper is sometimes used to prevent any line pulses from reaching the frame timebase. This clipper also shapes the frame pulses, and, where a triode clipper is used, a certain amount of amplification of the pulses also takes place. The sync-separating valve and the pulse clipping valve can be diodes, triodes or pentodes. In some designs the clipping valve is replaced by crystal diodes, often referred to as interlace diodes.

The Sync Separator Stage

The pentode sync separator (Fig. 16) and the triode frame pulse clipper are both contained in one glass envelope.

The positive sync pulses and negative picture signals are present at the grid of the pentode. The pentode is so biased that D.C. restoration takes place between the grid and cathode, eliminating the need for a separate diode restorer, which would otherwise be necessary because C1 blocks D.C. The correct choice of values for C1, R1 and R2 causes the valve to be cut off on the video signal and conducts only the sync pulses, which appear at the anode.

Amplitude differentiation takes place in the pentode anode circuit, to separate the frame pulses from the line pulses. It is possible to reduce the rate at which the voltage changes at the beginning and the end of each pulse by introducing an inductance L1 in the anode circuit.

There are still small line pulses present in the waveform. These have to be removed, otherwise interlacing of the two frames in each picture would be affected. The waveform is applied to the clipper through C2 and the grid is connected to a potential divider R4, R5 across the H.T. supply to the valve and grid current flows until the arrival of the frame pulse, when the grid is biased beyond cut off. This flow of current in the grid circuit removes any remaining line pulses, and prevents these pulses from appearing at the anode. The frame pulses are applied to the frame timebase which is thereby synchronised with the transmitted frequency. The video signal appearing at the grid of the sync separator is positive-going on sync pulses (Fig. 17). The grid current develops a bias across R3 which drives the valve beyond cut-off except for the duration of the sync pulses. The cathode is unbiased and D.C. restoration takes place automatically, replacing the D.C. component of the signal which was removed by the inclusion of C1. The screen voltage is higher than that on the anode thus assisting the removal of the picture content from the signal.

(To be continued)

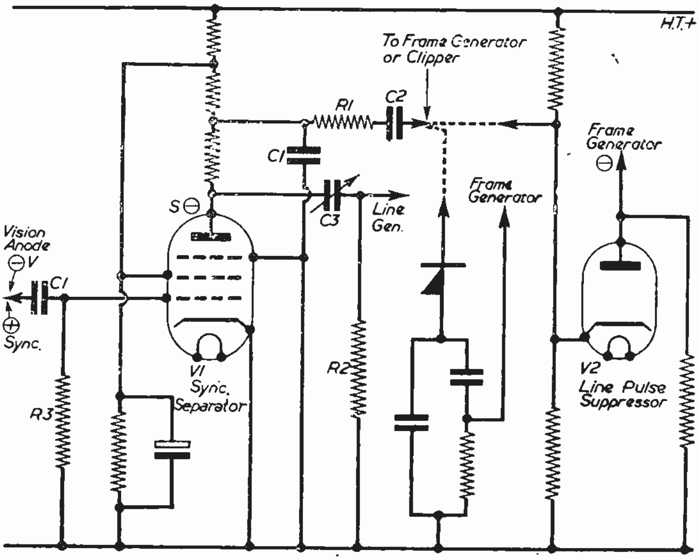


Fig. 17.—Sync separator.

Television in Industry

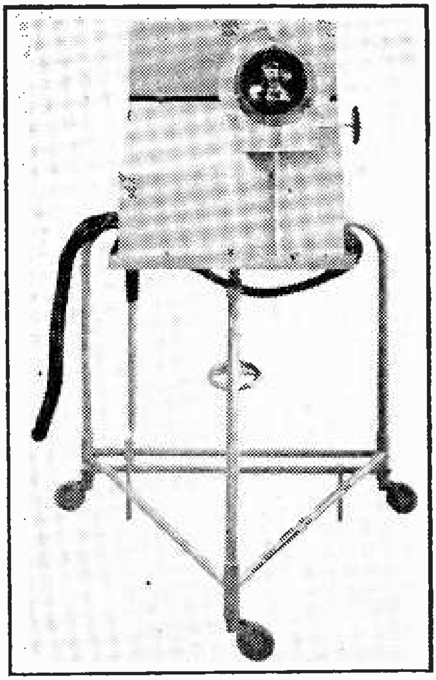
SOME UNUSUAL APPLICATIONS

By H. J. Barton Chapple

IN their usual forthright manner, the Americans have a way of saying that if it is too inaccessible, too expensive, too dangerous, too far, too hot, too cold, too tiring, too small, too dark, too difficult, too low, too inconvenient or too high to make direct observations for a variety of tasks, then use some form of closed circuit industrial television. It is only over the last few years that this utilisation of television's principles has had a wide application, certain spectacular achievements having served to give it a much needed impetus.

To quote just one example, there was the location of the sunken submarine *Affray* with the aid of an underwater television camera linked to a viewing monitor on board the salvage ship, while the dangers associated with atomic development have been eased materially by employing suitable industrial television cameras to check stages in the various processes involved.

Although in this industrial field, a normal type of television camera can be employed, since many of the applications have no three-dimensional aspects, considerable simplification of the equipment is possible. Industrial cameras, their associated power packs and scanning generators have been specially designed as compact units and these have incorporated image dissector tubes, staticons, vidicons, etc. The versatility of these industrial devices is remarkable and can best be demonstrated by referring to a number of applications which are already in everyday use.



The industrial TV camera is often shorn of refinements.

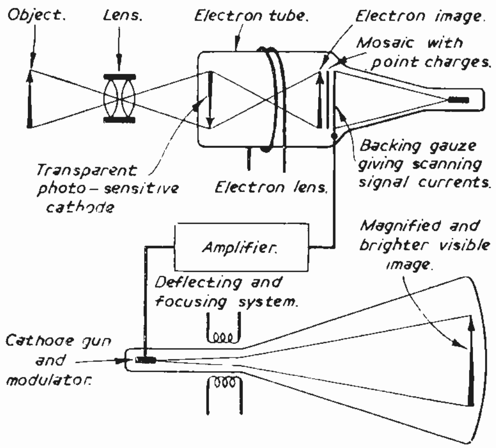
One of the many jobs undertaken at the N.P.L. is a study of flight performance by using a compressed-air wind tunnel. Until quite recently, difficulty was encountered when photographs were required of models undergoing tests and also in making exact observations. By installing an adaptation of the E.M.I. Mark VI camera channel and incorporating the actual camera unit in a housing able to cope with extremely high air pressures, coupled with remote control for focusing, etc., the observations have been materially simplified.

Transmission of Documents

The transmission of pictorial information such as maps, documents and signatures as required by a bank for cheque records, lends itself admirably to industrial television. Many business houses, both in this country and abroad, have taken advantage of this, particularly those who have found it either impossible or too expensive to accommodate the necessary documents or files at the physical location where checking is essential. The receiver tube screen, of a size compatible with the range of items under observation, will display the information both accurately and without waste of time and a consequent saving in money. One of the essentials in this scheme is an even illumination over the document or card coupled with precautions to prevent any such lighting falling direct on to the camera lens. Frequently it becomes necessary to use a higher standard of definition such as 625 lines in order to bring out small detail and ensure legibility under even the most adverse conditions.

Where the cards or documents are large compared with the brightly lit area of scan, some form of mechanical shift is incorporated and in this way the whole object is viewed in a sequence of sections to give all the information required at the receiving end of the closed circuit chain. To conserve the life of the camera tube—and this applies to many forms of these industrial television devices—the units are designed so that although all the other circuits are energised continuously, the tube itself is switched on by remote control from the receiving end only when required for viewing purposes.

In many cases of these industrial designs it has been found possible or even better to eliminate the ruggedised camera tube and substitute an electronic form of light spot scanner. This comprises a specially designed projection cathode-ray tube giving an intensely bright scanning spot in conjunction with a Schmidt optical system. The degrees of light and shade reflected from the document surface during the scanning motion are picked up by suitably positioned modern photo electric cells which can incorporate electron



A simple form of industrial television equipment for image magnification.

multipliers if required. The resulting signal is then amplified at video frequency and fed to the cable linking the transmitting and receiving locations.

Mention was made earlier of the underwater examination and identification of the submarine *Affray*, which sank in such tragic circumstances in 1951. When it was decided to adapt television's principles for this project, the equipment which used an image orthicon for the camera tube, was designed and built in a very short space of time. Considerable improvements in these underwater industrial devices have taken place since then and most of these hinge on the intensity and type of illumination necessary to overcome any effects brought about by the turbidity of the water, coupled with increases in sensitivity of the camera tube itself to offset any lack of object illumination. Naturally, remote operation is essential and cable insulation together with adequate protective covering is important.

Studying the action of explosives, destructive tests of machinery, observing water level in boilers or meter readings at remote plants, also fall within the ambit of industrial television. In the case of the last two items they can be of vital importance as false readings which might occur due to defects in any other electrical devices used to ascertain the readings, could cause serious and costly accidents. A recent example of the first-named, uses a standard Pye industrial television camera unit at an explosives factory. The housing is pressurised and weatherproofed and lens changing, camera panning and elevation are all under the remote control of the observer.

The examples quoted by no means exhaust the multitudinous applications which have come under the heading of this rapidly expanding industrial side of the television industry. As a rule each installation has its own specific problems to overcome so that adaptations and modifications to standard forms of industrial camera units are necessary, but enough has been said to demonstrate the importance of this section of television's ramifications.

RELAXATION OSCILLATORS

(*Continued from page 236*)

It should be understood that the supposition of "a small change of current through V1" is not strictly accurate, but is necessary for an initial understanding of the action. In fact, no trigger action is required by this circuit, as it will oscillate immediately when the valves work. It would be most difficult to force the oscillator to take up the stable condition assumed at the start, without altering component values.

Control of the Multivibrator

On the assumption that $C1=C2=C$, and $R3=R4=R$, i.e., the circuit is entirely symmetrical, the frequency of oscillation will be given by:

$$f \simeq 1/2CR$$

This is only approximate, as the frequency is, to some extent, dependent on H.T. and valve characteristics, but the formula will serve as a guide. C is, of course, in Farads, and R is in ohms, so for $C=0.001\ \mu F$, and $R=100\ k\Omega$,

$$f \simeq \frac{1}{2.10^5 . 10^{-9}} = \frac{1}{2.10^{-4}} = \tfrac{1}{2} \times 10^4 = 5\ kc/s.$$

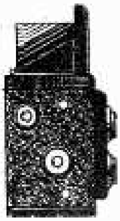
Control of frequency may be obtained by variation of either C or R, or both, in ganged pairs: independent variation of any component will produce unequal pulse widths, i.e., the positive pulse may be shorter than the negative one, or vice versa.

Deliberate control of relative pulse width (ratio) is best made by a relative variation of R3 and R4 together, as shown in Fig. 4.

Transitron Oscillator

The second in this series of articles by R. Couvela on the working of relaxation oscillators will include descriptions of the transitron oscillator and timebase (the Fleming-Williams timebase) and of the cathode-coupled multivibrator timebase. Approximate formulæ for frequencies of oscillation will also be given.

(*To be continued*)



PHOTOGRA[PHS FROM] TELEVISION

By W. R. B[...]

QUITE a popular form of photography in recent years is the taking of photographs from the television screen. All that is needed is a camera with a lens aperture of at least $f4.5$, a roll of fast film and careful attention to focusing. But supposing your lens aperture is not the recommended $f4.5$—well, you can still take photographs from the TV screen, even if you have only a pre-war box camera.

"Close-up" Lens

Obtain a "close-up" lens of 1, 2 or 3 dioptres, it does not really matter which. If your camera is fitted with a "portrait attachment" that will be quite satisfactory. Fit the close-up lens in front of the camera lens in the usual way and then set up the camera in front of the TV on a tripod or other firm support. If you are uncertain about focusing, take the back off the camera and place a piece of tissue paper or ground glass in the film plane. With the shutter set on "time" you should have no difficulty in getting the screen in focus. When you have done this (and it is worth while spending some time in making sure that your focusing is truly accurate) set the shutter to 1/25th second (or to "I" if yours is a box camera), adjust the aperture to $f11$ and place a roll of film in the camera. Any of the really fast films such as HP3, HPS or Tri X will do. You can now go ahead and take pictures of any reasonably static subject which takes your fancy. When you have used up your roll of film, remove it from the camera and load it into the developing tank in the usual way.

THE PHOTOGRA[PHS] SHOWN ON THESE P[AGES] ILLUSTRATE THE EXCE[LLENT] RESULTS WHICH MA[Y BE] ACHIEVED BY EMPLO[YING] THE TECHNIQUE DESC[RIBED] BY THE AUTHO[R]

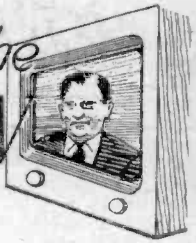
Use "Universal" Developer

For development, one of the popular "Universal" developers will be quite satisfactory. Mix one part of developer to four parts of water (this may seem to be too strong a solution, but it gives good results) and develop with occasional agitation at a temperature of about 68 deg. Fahrenheit for *half an hour*. At the end of this period, pour away, rinse and fix and wash in the usual way. You will probably find that there is a certain amount of fog on the negatives, but you should have no difficulty in printing them. You can, if you like, halve the strength of developer and double the development time, or use any developer strength/time ratio that will give the same end product, but the figures quoted above have been found to be quite satisfactory.

$2\frac{1}{2}$ x $3\frac{1}{2}$ Plate Camera

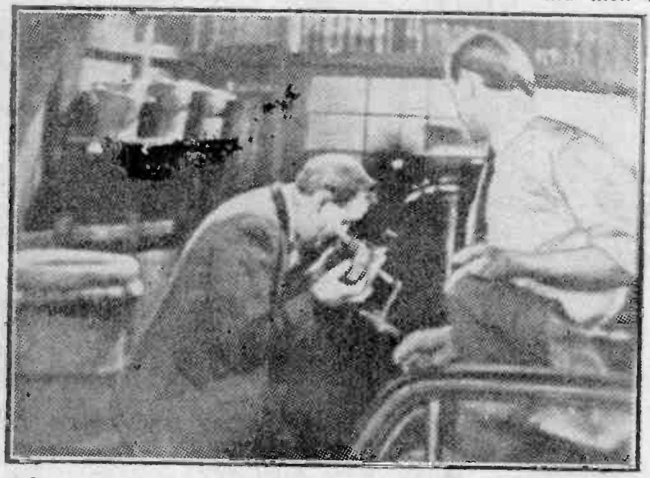
By way of proof, the accompanying pictures were all taken with an ancient $2\frac{1}{2} \times 3\frac{1}{2}$ plate camera with roll film adapter and using the above-mentioned technique.

PHS from the SCREEN



lanck

There is nothing new in all the foregoing. Forced development and development to finality have been practiced ever since the beginning of photography, but it is always exciting to put old methods to new uses and there is always the thrill of achievement in making a simple piece of apparatus do the work previously regarded as the purlieu of its more expensive and elaborate brethren.



PHS GES ENT BE ING BED

Adjusting the Receiver

It is important to alter the setting of the controls of the receiver to compensate for the differing intensities of the various scenes depicted on the screen. Many examples of photography from the television screen which the author has examined make faults in the receivers very evident; in many cases, the height control has been incorrectly adjusted, elongating faces, and making everyone appear mournful. Another common mistake is faulty adjustment of the brightness and contrast controls. All too often, the picture is either composed of the proverbial "soot-and-whitewash," or is a uniform, pale, insipid grey.

The recommended procedure for securing the optimum brightness and contrast settings is as follows. First remove the aerial from the input socket of the receiver. Turn the contrast control to minimum, and then increase the setting of the brightness control until the screen lights up (that is to say, until the raster is visible). Next reduce the setting of the brightness control until the raster just disappears. This control is now set.

Interesting Hobby

Next replace the aerial in its socket and increase the contrast control setting for best picture quality. If the contrast is insufficient, the setting of the brightness control may be reduced slightly.

This fascinating hobby has endless possibilities. Imagine recording such historic moments as the State Opening of Parliament, televised in full for the first time on 29th October this year, and pictures brought to you from far-off countries by the Eurovision link.

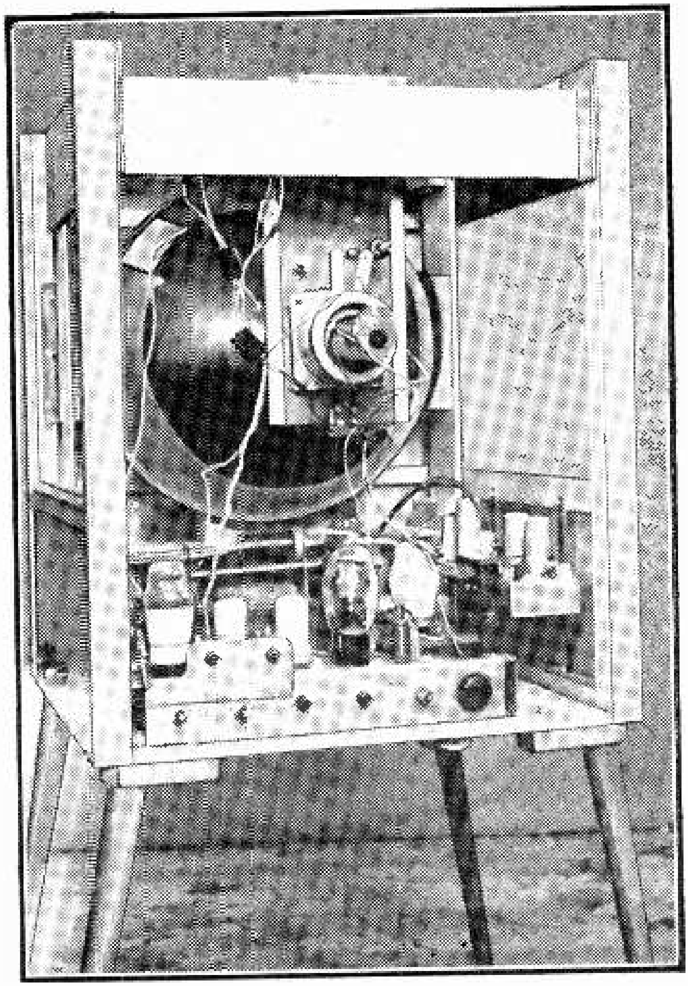
A Home Constructed TV

Receiver

THIS ARTICLE INCLUDES CONSTRUCTIONAL DETAILS OF THE CABINET

(Continued from page 177 of the November issue)

By P. Green



Rear view of the receiver.

EHT Multiplier

An EHT multiplier was used as described in the June, 1951, issue (see Fig. 13); this is mounted above the mains transformer. 20 Kv. .001 μF condensers are used, as the smaller type were found unsuitable. To obtain a clear focus on the Mazda CRM 152B 15 in. tube, the EHT voltage was reduced by four 10 MΩ (40 MΩ) one watt resistors to earth. The size of the picture obtained is 11in. $\times$ 12¾in.; the mask is a little smaller, and this is made on a wood frame, to which is glued shaped cardboard. Grey plastic sheeting was glued to the cardboard, and this was allowed to project ⅛in. at the front, just to pass through the cabinet panel. The mask was not fastened down, but allowed to float. A wood screw at each corner of the wood frame allows a final positioning (see Fig. 14).

The Cabinet

A great deal of thought was given to the design of the cabinet, to allow for easy access to all trimmers, and the removal of any part or chassis. This was accomplished by making the sides and top removable for servicing purposes. Fig. 15 gives three views, showing how the cabinet was constructed. The tube rear support, Fig. 16, was made from bakelite with aluminium angle strengtheners, and was clamped to the top strut, along which it can be moved. There is also some adjustment to the centre height, by means of the slots at the top. The Perspex window at the front can be easily removed for cleaning the tube. All connections are made by plug and socket which allows removal of any part without unsoldering one connection.

The mounting legs, which now have rubber feet, give the cabinet a modern appearance. This has been stained a beautiful light brown and has since been given several coats of wax polish, which gives a not too glossy finish, and does not easily scratch.

Aerials

Aerials for both BBC and ITV are fitted in the loft; the BBC down lead being twin-feeder. The ITV aerial is one modified from a four-element wide-spaced aerial, purchased from a P.T. advertiser, the down lead being co-axial.

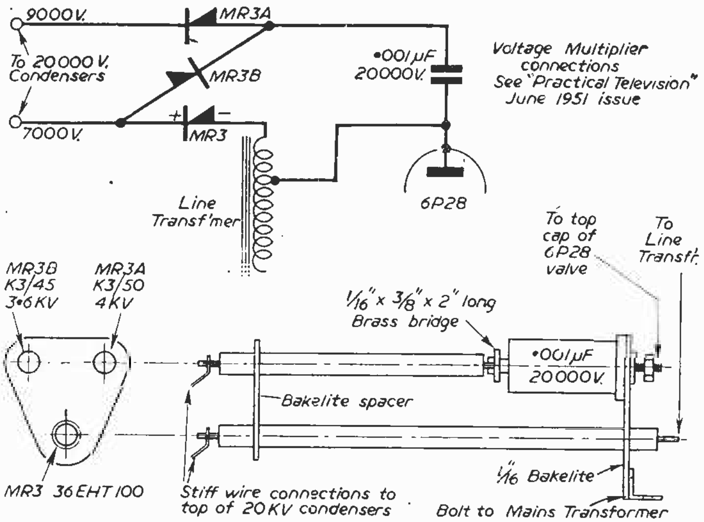
Instructions for trimming the sound and vision chassis have already been given in P.T. The picture obtained is very good and all that could be desired.

Finally, anyone who has a "View Master" and wishes to convert his set to ITV, and uses any or all of the above modifications, can rest assured that they give satisfactory results.

Alignment Details

We repeat the alignment details as given in the December, 1955, issue for the benefit of those readers who do not have the old copy.

To obtain the best possible results it is essential for the alignment to be carried out with the aid of an accurately calibrated signal generator. Though it may be possible to obtain a reasonable picture by alignment on a transmission it is only likely to be satisfactory if the converter feeding the I.F. amplifier has itself been accurately aligned and is, therefore, giving an I.F. output at the correct frequency.



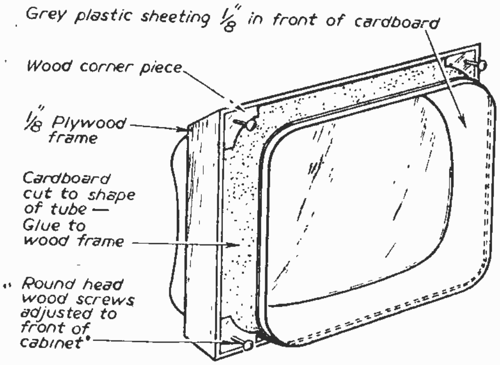


Fig. 13.—The circuit and mounting of the voltage multiplier. Fig. 14 (Below, left).—Construction of the tube mask.

Where a constructor will be making his own converter the difficulties of aligning this in conjunction with the alignment of the I.F. amplifier make it almost impossible to be certain of results, and the constructor is recommended to beg, borrow or buy a signal generator, since only then can he be assured of a really satisfactory performance. At this point it must be stated that technical details relating to the operation of the I.F. amplifier are in the main covered in the View Master booklets and are not, therefore, dealt with in this article; only details specifically concerned with the conversion of the vision chassis to an I.F. amplifier are dealt with here.

Having checked that there are no obvious

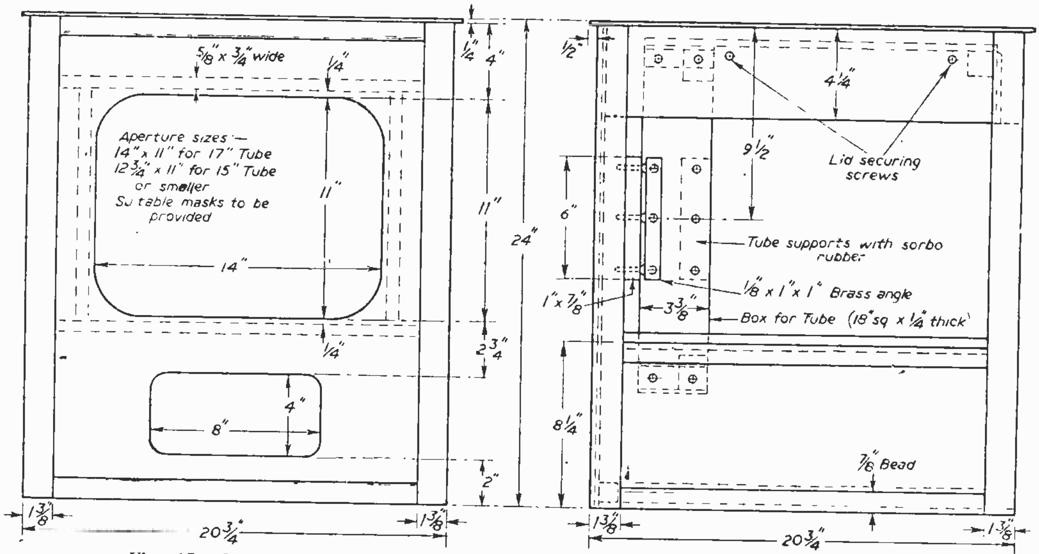


Fig. 15.—Details of the cabinet construction. (Left) front view. (Right) side view.

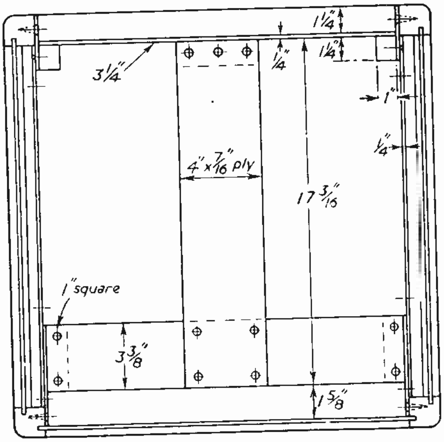


Fig. 15a.—More cabinet measurements.

faults in the I.F. amplifier, the power supply may be switched on and a warming up period of around five minutes allowed. The following procedure should then be carried out:

Connect generator to grid of V3.

Tune V4 anode circuit to maximum output at 35 Mc/s.

Tune V3 anode circuit to maximum output at 37.5 Mc/s.

Connect generator to grid of V2.

Tune V3 grid circuit to maximum output at 35 Mc/s.

Tune V2 anode circuit to maximum output at 37.5 Mc/s.

Tune rejector circuit for minimum output at 38.15 Mc/s.

Connect generator to grid of V1.

Tune V2 grid circuit to maximum output at 35.5 Mc/s.

Tune V1 anode circuit to maximum output at 37.75 Mc/s.

Tune V6 grid circuit for maximum output at 38.15 Mc/s.

Tune V6 anode circuit for maximum output at 38.15 Mc/s.

Tune V7 diode circuit for maximum output at 38.15 Mc/s.

Connect generator to lower end of V1 grid coil. Tune for maximum output at 35 Mc/s.

Repeat all above, but with signal generator connected to lower end of the V1 grid coil.

Note: For alignment purposes only a 220 ohm resistor may be connected from the lower end of the V1 grid coil to chassis so as to permit a voltage to be developed when the signal generator is connected across it.

(To be continued)

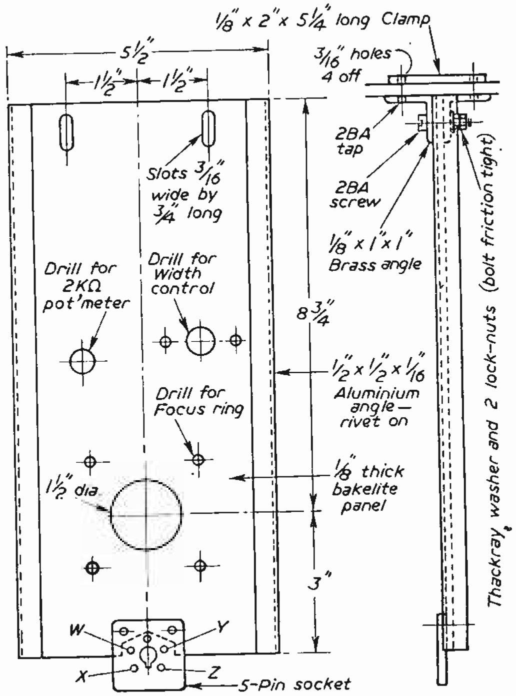


Fig. 16.—Details of the support for the tube neck

UNUSUAL INTERFERENCE

(Continued from page 232)

and off of the diode which is responsible for the interference effect in this case.

The Cure

The interference caused by this switching action can be suppressed quite adequately by introducing a small choke in the lead to the cathode of the valve. In modern sets, the top cap of this valve is the cathode and connection is easily made as shown in Fig. 2. A 1-amp TV suppressor choke of the kind that is used for the suppression of small electrical appliances lends itself admirably to this application.

If the disturbance is not completely eliminated by one choke, an additional choke can be connected in the anode lead of the line amplifier valve, which is also connected to a top cap, and if found necessary, another choke can be wired in series with the anode lead of the EHT rectifier valve. But in this case extreme caution is demanded in order to avoid a flashover between the choke and screen of the line output transformer.

The application of chokes may also alleviate B-K interference, but in obstinate cases it may be necessary to replace the line output valve. Subjecting the valve to a magnetic field may well damp the electron oscillation within, and this practice is adopted by certain manufacturers, who employ small ring magnets clamped to the envelope of the valve and which can be orientated to the position giving least interference. It sometimes helps to connect a very small value capacitor between the anode, top cap, of the line output valve and chassis. This can be made up from a length of twin p.v.c. covered cable, the conductors acting as the capacitor plates and the p.v.c. as the dielectric (see Fig. 3).

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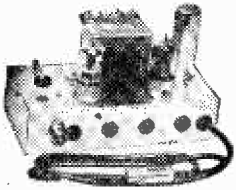

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20% ¼ w. **3d.**, ½ w. **5d.**, 1 w. **6d.**, 2 w. **9d.**
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5Z4	9/6	35L6	10/6	EF91	8/6	PL82	10/
6AT6	8/6	EABC80	9/6	EL41	10/6	PL83	11/6
6K7	6/6	EB91	6/6	EL84	11/6	PY80	9/6
6K8	8/6	EBC41	10/6	EM85	11/6	PY81	9/6
6Q7	8/6	ECC83	9/6	EY51	12/6	PY82	8/6
6SN7	8/6	ECC84	12/6	EY86	14/6	PY83	10/6
6V6	7/6	ECF80	12/6	EZ40	8/6	U22	8/6
6X4	7/6	ECF82	12/6	EZ80	8/6	U25	13/6
6X5	7/6	ECH42	10/6	EZ81	8/6	UCH42	10/6
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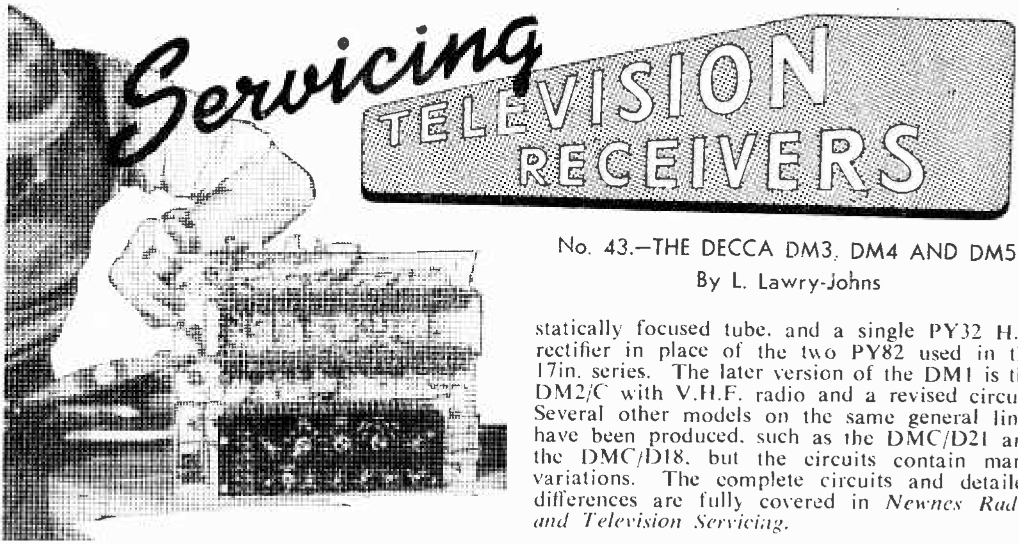


No. 43.—THE DECCA DM3, DM4 AND DM5

By L. Lawry-Johns

THIS is a range of 17in. models all of which use the same chassis. The DM3 is a table model; the DM4 has a similar cabinet, but with doors; and the DM5 is a console version. A series of later models, the DM4/C, DM3/C, are somewhat similar, the DM4/C incorporating V.H.F. radio, whilst the DM3/C uses an EY86 in place of the EY51 E.H.T. rectifier.

The DM1 is a 14in. model using an identical chassis to the DM3, but with an AW36-21 electrostatically focused tube, and a single PY32 H.T. rectifier in place of the two PY82 used in the 17in. series. The later version of the DM1 is the DM2/C with V.H.F. radio and a revised circuit. Several other models on the same general lines have been produced, such as the DMC/D21 and the DMC/D18, but the circuits contain many variations. The complete circuits and detailed differences are fully covered in *Newnes Radio and Television Servicing.*

The Chassis

The chassis in all models is remarkably clean and access to all components is simple. This is a point to be appreciated when checking suspected components.

The simple and efficient design of the earlier and very similar DM17 series has been maintained with the minimum number of frills added. The tuner unit in all models is of the turret type, allowing the various coil biscuits for different

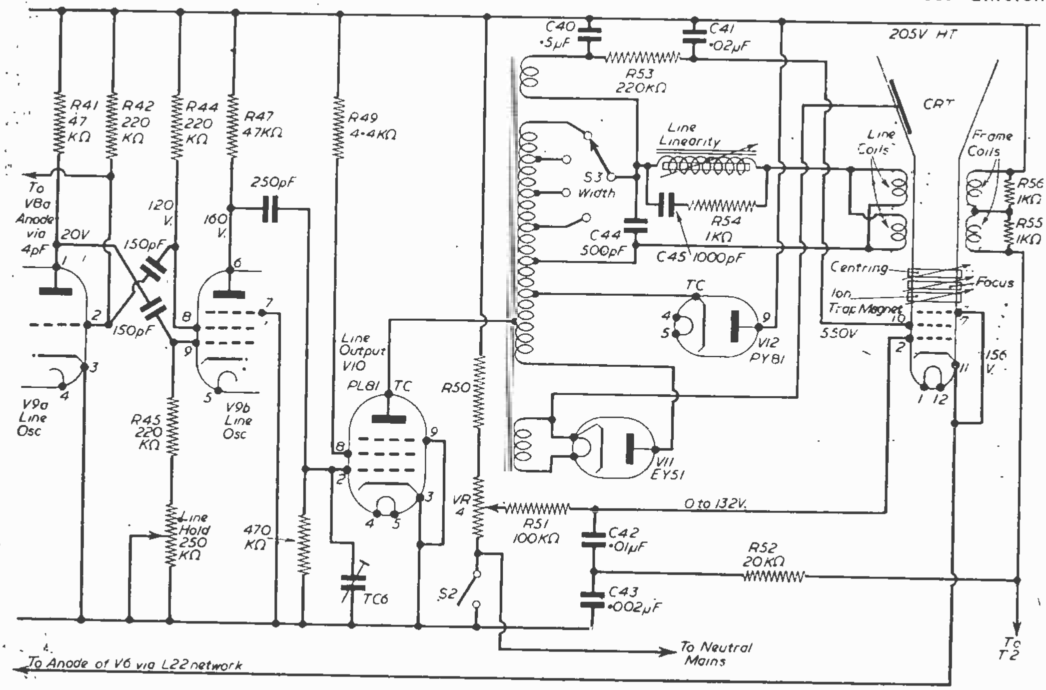


Fig. 1.—Circuit of line oscillator and output stages.

channels to be removed and replaced at will. Let us here dismiss one apparently widespread misconception. If a model is designed to receive TV channels only, it is not possible to clip in a pair of V.H.F. coil biscuits and receive the Home, Light and Third radio programmes. V.H.F. models incorporate a specially designed detector circuit and consequent switching arrangements. Therefore, there is no simple way in which a TV-only model can be modified for reception of Band II V.H.F. radio programmes.

Cleaning the Tube Face

Another point which is often raised is in regard to cleaning the front of the tube and viewing window. On this range of models this is very simple as the window is removable. It is only necessary to unscrew the three wood screws under the top of the surround, remove this strip and ease the window outward. "Ease" because the rubber side strips may be a trifle sticky.

Fault Finding

Intermittent reception may be due to poor contact between the springs and studs in the turret tuner. The contact surfaces should be cleaned using a reliable switch cleaner or spirit and then lightly smeared with MS4 silicone grease. The spring tension should not be adjusted.

No Sound

Suspect V18 (PCL83) sound A.F. and output valve. This is situated on the front right side as viewed from the rear. Normally, there is no other cause but, of course, V16 and V17 could be at fault as could any one of the associated components.

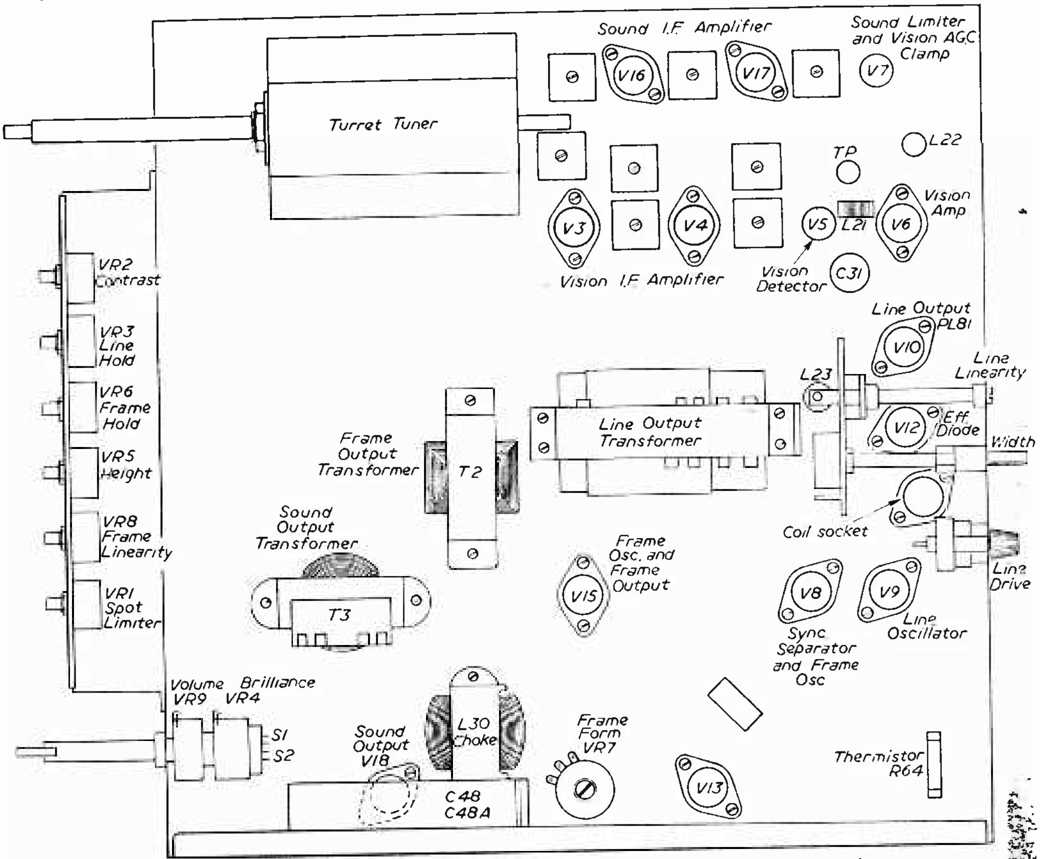
Sound Oscillation

Loud howl, unaffected by controls—except the on/off switch! Suspect C78 500 μF bias decoupling capacitor of V18—pins 3 and 7 to chassis.

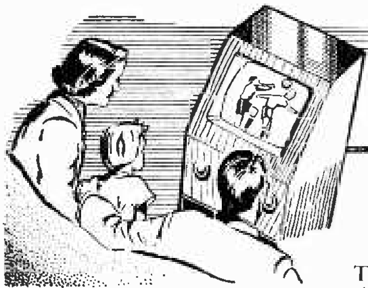
No Vision—Sound in Order

Remove rear cover of centre (line output) section, secured by four P.K. screws. The PL81, PY81 valves will be revealed and also the EY51 in its cradle on top of the transformer. By this time it will have been noted whether the line time base whistle is audible, normally so or very weak. If the latter, the oscillator V9 is working, but not necessarily the line output.

(To be continued)



Underside view of chassis.



UNDERNEATH THE DIPOLE

A MONTHLY COMMENTARY

By Iconos

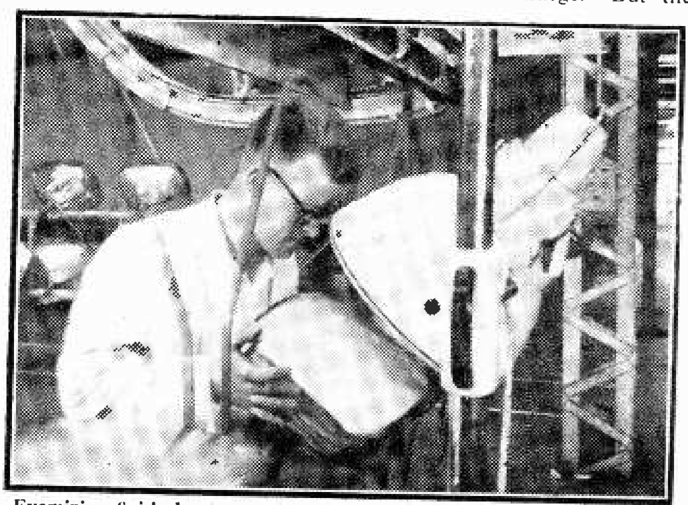
PUBLIC taste in popular entertainment is an ever-changing one. Theatres, music-halls, skating rinks, waxworks, military bands, pierrots, musical comedy, circuses, silent and talking films, and "steam" radio have all had their boom periods. Some of these forms of entertainment have suffered a serious decline over a long period, particularly the live theatre, for which talkies used to get the blame, linked, of course, with the entertainments tax. Now it is the cinemas themselves which are experiencing a recession, and television is now cited as the cause of all the trouble.

The Benefactor

TELEVISION, however, is doing something which none of its predecessors in entertainment did. It is taking steps to keep the older lines of show business, particularly the live theatre, alive. I.T.A. programme companies have made a good start with subsidies to repertory companies and theatres in all parts of the country. A-TV, Granada, Scottish Television and others have made generous contributions to sustain the repertory movement. Scottish Television is the latest patron of the theatre and has presented £5,000 to the Scottish Theatre Trust, under whose jurisdiction repertory theatres are run in Glasgow, Edinburgh, Dundee and Perth, in addition to the Pitlochry Festival Theatre. When the cheque was presented Sir Robert Fraser, I.T.A.'s Director-General, claimed that television was not a threat but a helping hand to the live theatre. However, the repertory theatres need audiences even more than money, and it would be a gracious move for regional I.T.A. companies to persuade viewers to take occasional nights off from their TV sets to patronise these theatres. A practical gesture would be to allocate a free 30-second live advertising slot, announcing "what's on" at the theatres in the area on one evening each week. This would really please the actors and managements. After all, quite a lot of free advertising space is given to film releases both by the BBC and I.T.A. in such programmes as *Picture Parade*.

"A Tale of Two Cities"

I MUST admit that opera is not usually my cup of tea, but I had heard so much about the elaborate planning, rehearsals, sets and casting of the BBC's *A Tale of Two Cities* that I felt honour bound to give it my attention. Like ballet, opera is a combination of movement, music, colour, costumes and scenery—but with emphasis upon vocal music. I was interested to see just how the producer, Rudolph Cartier, could sustain a full-length opera on television without the colour of costumes and scenery to help him, and whether he could avoid the conventional theatricalities of opera as usually seen on a stage. He succeeded admirably, by giving it the pace and movement of a motion picture, with camera movement, change of scene, restrained naturalistic acting and a sense of drama rarely seen in an opera house. The most difficult part for me to assimilate was the music of Arthur Benjamin, which was anything but reminiscent of the popular operatic melodies whistled by my milkman! There were scenes in this presentation of great dramatic power and poignancy, especially those leading up to the guillotine, in which fine camera work and lighting played an important part. For me, the most moving performance was that of Heddle Nash in the pathetic part of Dr. Mannette; but all the artistes gave of their best, particularly John Cameron and Alexander Gouring as Carton and Darnay respectively. Heather Harper as Lucie Mannette and Amy Stuart as Madame Dafarge. But the



Examining finished tube screens at the Ediso[illegible] Swan works. Ultra-violet light is employed for th[illegible]s test.

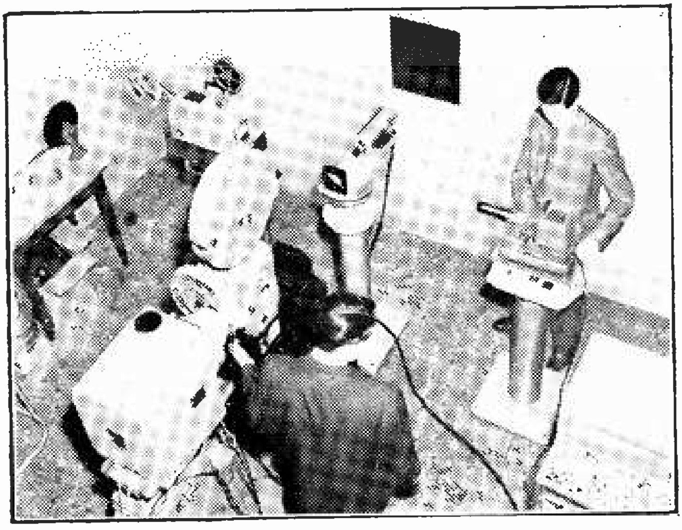
greatest credit really belongs to the producer, Rudolph Cartier, for devising a new idiom of presentation, a kind of "method" system for television opera. I look forward to more TV opera from Rudolph Cartier, but with slightly more digestible music.

Sub-miniature Films for TV

RECENT improvements and developments now being made to 16 mm. film and equipment will probably lead to its increased use for telecine, especially in the provincial regions, both BBC and I.T.A. There are now available two or three makes of 16 mm. ciné cameras which are capable of photographing pictures and, at the same time, recording sound on a magnetic stripe on the same film. Improvements have been made in the quality of the negative photographic emulsion to give a finer grain and to make it more suitable for the direct transmission in its negative form, without necessity for a print. The method of perforating the film has also been improved to give greater accuracy to the perforations. 16 mm. film carries only one perforation per frame, and it has been the practice until now to perforate three or four frames at a time. Much greater accuracy can be obtained by punching each perforation singly with a high precision perforating machine. The evenness of magnetic material which is applied to the sound stripe has been improved too, especially in the avoidance of the thickening-up near the edges of the stripe. On the opposite side of the film, next to the perforations, is a balancing stripe, also of magnetic material, which is applied solely to enable the film to be wound up evenly. This balancing stripe is of the same magnetic material because it is the cheapest and easiest method of balancing up the thickness of both edges of the 16 mm. film. This balancing stripe is now likely to be used for a second sound track for background noises. Though this magnetic track is only 29 mils wide it does this job perfectly. Gevaert, the Belgian film stock maker, has been giving special attention to the manufacture of 16 mm. pre-striped film negative, especially for use on telecine, in its negative picture form. Rank Precision Industries have been making progress on the equipment side, with new 16 mm. magnetic sound and picture cameras and also apparatus which should greatly assist in the editing of the film in its negative form. These developments, together with the new improved flying spot and Vidicon telecine machines, should give results almost as good as 35 mm. film. Furthermore, improved editing and cutting techniques will give 16 mm. single sound and picture systems all the flexibility of the separate 35 mm. picture and sound films at about one-tenth of the cost. It will introduce an entirely new factor into television.

Telecine

THERE is a steady increase in the number and variety of telecine and slide machines used at BBC and I.T.A. studios. Each successive I.T.A. programme contractor is installing more ambitious equipment, though it is the BBC Planning and Installation Department which retains the initiative in research and development in this field, in conjunction with manufacturing companies. At the commencement of operations, a couple of telecine machines of the Vidicon type were considered sufficient at an I.T.A. programme contractor's studio centre. Later, it was considered worth while to install an extra telecine of the more expensive flying spot type. Nowadays, at least four telecine machines are considered to be essential for smooth operation and handling of 35 mm. and 16 mm. film and slides. Tyne Tees Television will be starting up with four E.M.I. Vidicon telecine machines of the latest type at Newcastle. Southern Television have four Cintel flying spot telecines at their Southampton studio. The BBC have four Pye Staticon telecines at their Alexandra Palace centre, where news is mainly handled—together with colour television. The principal grumble that the chief engineers of all companies have is the inability of the 16 mm. projectors to stand up to continuous week after week operation. These machines, which project the picture on to the photocathode of a vidicon camera tube, were originally designed for occasional home or schoolroom use. There is a real need for a heavy-duty precision 16 mm. projector to be manufactured in this country.



L.P.E. Television Ltd., the television, cinema and radio Advertising Division of the L.P.E. organisation, has commissioned the planning, engineering and installation of the most comprehensive system of closed-circuit television and telecine of its type in this country and possibly the world. Picture shows a typical installation of the Marconi BD871 telecine camera in a projection room.

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STANDARD 35 mm.

Line Output Transformers 6.9 kV. E.H.T. and 6.3 v. winding. Ferrox-cube	19/6
Scanning Coils. Low imp. line and frame	12/6
Ditto, by Igranic	14/9
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Frame Output Transformer	7/6
Focus Magnets : Without Vernier	12/6
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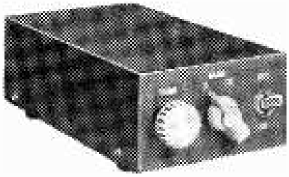

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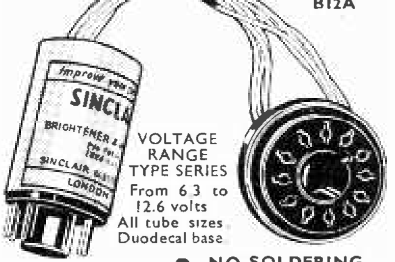

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CORRESPONDENCE

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).

SQUARE AERIALS

SIR,—With regard to recent articles and subsequent remarks on the square aerial for TV reception you may be interested to hear that a 2ft. 4½in. square functions very well on both Channels 2 and 10, even when used in the loft space. Where the transmitters are not co-sited I add a floating 7in. square in the centre of the larger square and this balances the signal strengths quite well, the two squares being parallel connected with 1ft. 2in. of coax. This type of aerial has been tried for me by a retailer friend in several awkward spots and in every case we have had good results and left the aerial in and made another.

Other readers may like to work out sizes to suit their own Channels. For preference ½in. diameter tube should be used, but although ⅜in. works quite well, I must admit to inferior reception when using ¼in. tube. —D. WOODHEAD (Yorks).

SPECIAL NOTE

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

STRANGE AERIAL EFFECT

SIR.—I know that many of your readers are keen on solving unusual problems, and I have one which I think is interesting. I had two separate downleads running to my set and recently purchased a diplexer. I made a note of the picture strength before connecting this (I had to change over the aerial leads, of course) and then connected up the unit and plugged the single lead into the set. Strange to relate, the BBC signal was three or four times as good as before, whilst the I.T.A. was weaker. I thought I may have reversed the connections, so changed them over. Results were then very poor on both stations, and the original way was as marked on the case. I have now had to fit an attenuator between the unit and the BBC aerial lead. How could I have got a bigger signal from the use of a simple aerial coupler of this kind?—G. R. BATTY (N.W.)

INTERLACING

SIR.—I was interested in the circuit you published in your September issue on the pattern generator suggestion from Mr. Paterson, but I have yet to see a response to a letter you published some time ago on obtaining readers' suggestions for improved interlacing. After looking at practically every make of receiver, including many which have been home-made, I have been impressed with the difficulty which seems to be present in this part of the receivers. Many sets give pairing, whilst I have seen some which only have a single scan. Quite a number give a "floating" effect, and I think it is this which causes eye-strain and gives rise to complaints that television is bad for the eyes. I saw one which continually changed its frame formation during a programme. Suddenly the centre of the picture, over about one-third of the depth, opened out whilst top and bottom narrowed. This gave no alteration to the overall size, but the features of the person changed shape. I have seen the same thing happen at the top and bottom, but not to the same extent. This set did it several times in one evening. So come along you experts, let us have something new in interlacing which really works.—G. H. T. RAMSEY (S.E.).

BAND THREE CONVERTER

SIR.—As a regular reader of PRACTICAL TELEVISION I thought you would be interested in the following.

I constructed the Improved Band Three Converter which you printed in November and December of last year, and had it working in January with my Ekco T161. Having already in my possession two EF50s and a EC52 my total outlay was twelve and threepence for odd condensers and resistances which I had not got. This also included the extra coaxial cable which I required.

The power supplies I took from the pre-amp. socket of the set, which gave H.T. of 220 volts and also heater supplies.

I must say that the results have been outstanding, not a sign of oscillator drift and the picture and sound quite comparable with the BBC transmissions.

Your magazine is certainly money well spent.—E. C. KEMP (Glasgow).

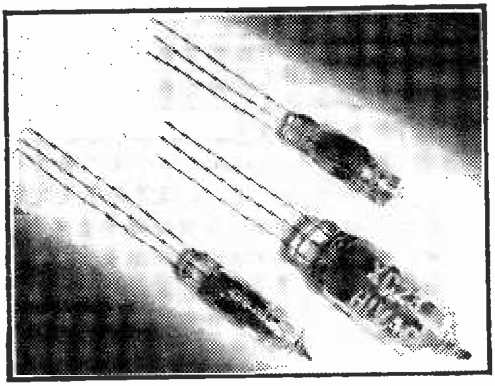
WRONG DIAGNOSIS

SIR.—*Re* 988 Ferguson; screen and EY51 not lighting, a well-known television service firm reported to me that the tube had gone, also one EF80 and one ECL80, and quoted £27 10s. for repairing. As I wrote and told you I had the set returned unrepaired and asked your advice. The ECL80 timebase was O.K., so I replaced the 60-250 μF electrolytic (16s. 6d.), switched on the set and after the usual warming up time the EY51 lit followed by a perfect picture. Before the set had gone the lines were drawn out at the top and cramped at the bottom, but this replacement has cured that also. I must thank you for your great help, you may well guess how I feel, being told it would cost £27 10s., whereas with your help it was completely cured, with a better picture than received for a long time, at a cost of only 16s. 6d. I cannot understand a firm quoting that amount, and giving a list of what had gone, unless they had thought I was a possible green client. Once again PRACTICAL TELEVISION may I say "thank you."—CLAUDE PAGETT (Birmingham).

News From the Trade

New Cold Cathode Tube by Hivac

A NEW sub-miniature cold cathode triode is now on the market. It is manufactured by Hivac and is known as the type XC23. Characteristics of the XC23 are similar to those of the XC18, the main differences being an increase in the maximum current rating (7.5 mA) and some consequent increase in external dimensions. The XC23 is 48 mm. long and 16 mm. in diameter.



A group of the new Hivac sub-miniature cold cathode valves.

Characteristics of the XC18, XC22 and XC23 cold cathode tubes may be seen in the following table:

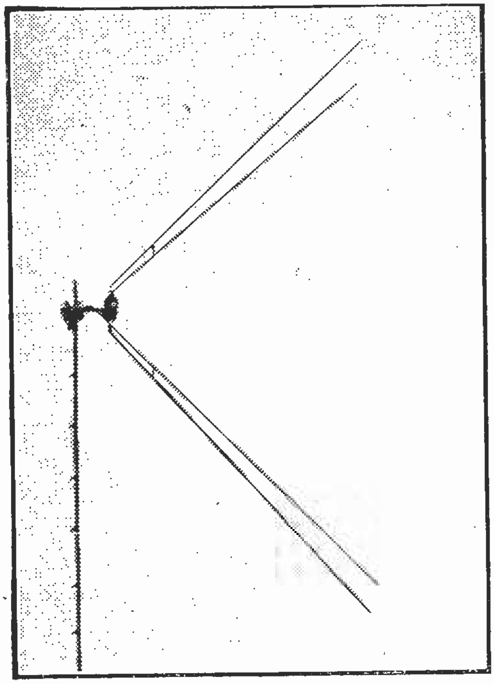
	XC18	XC22	XC23
Minimum anode breakdown voltage	210	210	200
Nominal anode maintaining voltage	73	70	67.5
Nominal trigger breakdown voltage	68	69	70
Maximum continuous cathode current (mA)	1	0.25	7.5

Hivac Ltd., Stonefield Way, Victoria Road, South Ruislip, Middlesex.

Labgear Spacematch Aerials

LABGEAR LIMITED is the first company in the United Kingdom to introduce a medium range outdoor aerial which will cover all 13 television channels plus V.H.F./F.M. without resorting to sliding tubes or other adjustable members. The new aerial is known as the Spacematch and works on the principle of the conical "V" beam. The characteristic impedance of the new aerial is equal to that of free space and, therefore, unlike the vast majority of television aerials, it is terminated by its characteristic impedance and behaves as a travelling wave aerial. This means that it will yield a uni-directional polar diagram without the use of directors or reflectors and, moreover, possesses a very substantial band width. The gain is constant within about 2 to 3 db over the whole of Band III and is equal to that normally realised by a channellised 5 or 6 element Yagi. On Band I, the aerial behaves as a broad band dipole and on Band II it possesses, due to its configuration, mixed polarisation, so it is responsive to V.H.F./F.M. signals regardless as to whether it is mounted vertically or horizontally.

It will be appreciated that the new Spacematch design greatly facilitates the basic stocking problem, particularly of the large wholesalers who have branches throughout the country, as it is possible completely to forget about channellisation. The Spacematch Standard (C16 Series) is intended for use in those areas where one would normally employ a dipole on Band I plus twigs for F.M. plus 5 or 6 elements on Band III. In those cases where the Band I signal requires something better than a dipole, the Spacematch Super (C17 Series) has been introduced and this basically consists of the Spacematch Standard, referred to above, plus a channellised Band I reflector. This can be orientated independently of the Band III directivity and therefore the aerial is entirely satisfactory, whether or not the BBC and I.T.A. stations are co-sited. Labgear Spacematch aerials are now in quantity production and prices range from 70s. retail. Labgear Ltd., Willow Place, Cambridge.



The new Labgear Spacematch aerial.

● AERIALS ● TURRET-TUNERS ● CONVERTERS

Our I.T.V. service offers a complete before and after sales advice.
Your problems settled by return mail. Whether novice or expert, let our extensive I.T.V. experience ensure your success.

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● 5 *ELEMENT* add-on I.T.V. aerial at **39/6** complete with universal clamp bracket and cranked stand-off arm.

8 *ELEMENT*, as above. **51/6.**

● *EASIFIX*. All aerials pre-assembled and collapsed for transit.

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ACCESSORIES

● *CO-AX*. High grade low-loss cable. **8d.** per yard. (Any length supplied.)

● *DIPLEXERS* (filter boxes). Skirting board type, **10/3.** Outdoor type, **13/-.**

● NOTE : Outdoor type is *essential* if using *existing* download for BBC/ITV. Indoor type is *optional* with separate downleads—often used to avoid changing over aerial leads.

IF IN DOUBT :—We advise using a separate download for best results on I.T.V.

STATE YOUR NEEDS or **ASK OUR ADVICE.** We can supply any accessories from wall nails to chimney lashings.

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The famous BRAYHEAD Turret tuner, **£6.19.6.** Plug-in adaptor to suit your particular T.V., **7/6.**

● *EASIFIX*. Over 600 models can be altered to up-to-date turret tuning and I.T.V. by simple plug-in technique.

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● No external converter can equal the performance of a turret tuner, BUT OUR EXTERNAL CONVERTER comes very near to it.

● Handsome appearance.

● Easifix—in fact, dead easifix ! Place on top of T.V. and connect up. No Alterations to T.V. necessary.

● Efficient. 2 valve circuit—the best external converter on the market for the money. Not junk, giving re-radiation, etc., but a first-class job. **£6.19.6.** Accessories, **7/6.**

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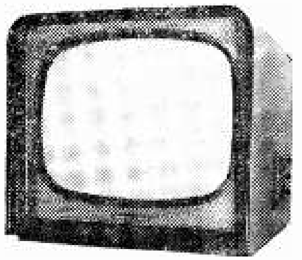

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GUARANTEED NEW AND SURPLUS VALVES

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Your PROBLEMS Solved

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

BUSH TV53

After 10 minutes or so the width starts to decrease until the picture is 2in. from either side of the screen. I have the service instructions for the set and have altered the plug on T4 to the maximum position. The valves PY82, PL81 have been tested and found all right but the PY81 was tested and found defective and replaced by another but with no effect on the picture.—J. Travis (Altofts).

This symptom is invariably caused by deterioration of the emission of either the PY82 or PL81 as the valve increases in temperature. A simple emission check would not reveal this trouble, of course, and it is often necessary to prove this possibility by quickly substituting the suspect after the fault has occurred, before the valves reduce in temperature.

PAM 952

Are the I.F.s of the above receiver standard?—R. Mockridge (Alresford).

The Pam 952 has a sound I.F. of 38 Mc/s and a vision I.F. of 34.5 Mc/s, local oscillator beating high.

PYE VT4

The fault I have is no brightness. The EHT is all right, also all the valves in the set. I have plenty of contrast and good focus.—A. W. Buzzard (Birmingham).

Your fault is either a low emission tube or displaced ion trap magnet. The latter is clamped around the tube neck and should be set in the position of maximum brightness.

EKCO 17in., Type T231

When I switch the set on I get a very dull picture for about 30 to 45 minutes, then the picture gradually brightens to normal, and then I get a perfect picture all day. It is just the initial 40 minutes or so. The sound is not affected. I would be most grateful for your assistance in this problem.—R. Patterson (Aberdeen).

Your fault is almost certainly a low emission tube, which may improve with the fitting of a 13 volt (plus boost) heater isolation transformer. This is connected to pins 1 and 12 of the tube after the existing orange and yellow wires have been removed and shorted together.

Mains for the transformer can be picked up between voltage flylead "A" and the chassis, and it is necessary to re-position voltage flyleads C and D to the setting correct for 10 volts higher.

SOBELL T347

During the past two years I have had very good reception from this set. About three weeks ago I had to replace the tube and I find that no matter how much adjustment is made I have a vacancy of 1in. at the top of the screen and that the picture "rolls over" and causes the top of the actual picture to be covered with about 30 white lines.

The rasters over the remainder of the picture are even.—W. B. Morgan (Mon.).

First of all check the frame timebase valve ECL80 which is by the front inside corner of the line transformer. A quick check is to exchange it with the line oscillator, but as both valves are about the same age they may both have the same fault. If this fails to cure your trouble check the 100 mfd. electrolytic which decouples the frame ECL80 cathode.

EKCO T221

Please can you tell me the correct method of fitting Channel 10 coils to a turret tuner, also for adjusting the fine tuner, when fitted?—F. Hayden (Sussex).

Normally it is possible to fit the Channel 10 coils adjacent to the Channel 9 ones without unboxing the set by removing the cardboard bottom and pulling on the hole in the front of the turret lid.

Set the fine tuner to midway and adjust each of the four coils, using a plastic trimming tool. The local oscillator is the front one and should be set for maximum sound. The two R.F.s are next to it and should be tuned for best compromise between sound and picture.

The aerial coil is the one on its own and is tuned for maximum picture. We assume that you are moving out of your area as there is no Channel 10 station in the locality. The new Isle of Wight transmitter uses Channel 11.

COSSOR 916

For some time, after the set has been working for approximately 2½ hours, the sound becomes distorted, giving the effect which one gets when a speaker requires re-centering. The sound before the fault occurs is very good indeed, gradually becoming distorted, until eventually it is too bad to listen to. If the set is switched off for an hour the fault clears.

The second fault, which is more serious and which has prompted me to seek your advice, concerns the vision. I am unable to lock the picture

which continues to roll and flicker. The flyback lines are very distinct. No adjustment of the controls at the back of the set has the desired effect and the picture either rolls or remains stationary with the bottom half of one frame above the top frame of another.

I shall be pleased if you will identify the components which may be at fault as I have the circuit.—P. A. Vine (Coventry).

Your sound fault is probably the loudspeaker which is mains energised and gets very hot, producing cone distortion. The simplest cure is to replace it with a permanent magnet one and use the present one laid in the bottom as a smoothing choke.

For your other fault we advise you to check the 6AM6 and 6SN7 valves beneath the focus unit.

MURPHY V120TV

The frame scan has collapsed, leaving the usual thin line across the tube face. I have no service sheet or technical information for this set and cannot make out what type of frame oscillator the circuit is.

What seems to be frame output transformer is insulated from chassis. I unsoldered one end of frame coils, ohm meter across reads under two ohms, the hum oscillator seems to be working. Ohm meter across output transformer core and one end of winding to scan coils gives zero ohms. —G. E. Cappello (Scunthorpe).

The frame timebase in the V120 is a T41 thyratron and Pen 45 output, located on the upright chassis nearest the front of the set. Murphy Radio usually insulate the output transformer metal parts and connect them to some suitable potential. Voltages around the stage are: T41 anode—82 v., cathode—varied by hold control. Pen 45 anode 240 v., screen 190 v., cathode 10.5 v. (varies with height).

The T41 anode feed is via a feedback winding on the output transformer and the screen of the Pen 45 is decoupled to the cathode by an 8 mfd.

SOBELL T121W

From the moment of switching on a crackling is heard in the speaker and interference similar to that of non-suppressed car ignition is visible on an otherwise good picture.

This interference begins quietly, builds up to a climax in about 10 seconds, then after an extra loud popping sound in the speaker all is perfect for a further 4 or 5 seconds, then off it goes again. A sudden slight brightening of the picture accompanies the extra loud popping noise.

After replacing the first two valves (EF80s) I have continued by replacing 3 or 4 condensers and resistors in the first two stages, but to no avail.

Can you advise me of the likeliest cause of this trouble?—M. W. Clarke (Bradford).

We suggest you try to isolate the fault using a .001 mfd. decoupling condenser. Starting at the R.F. valve, work successively back up the sound and vision I.F. strip, decoupling the EF80 grids (pin 2) in turn until the noise ceases. Once the faulty stage is isolated, first check the valve and then the decoupling condensers by bridging each with the .001 mfd. We would say it is in the early stages of the sound I.F. strip.

MURPHY V214

I have acquired a Murphy television, A.C. model V214.

I find that it has a fault in the EHT circuit. When the set is switched on there is a sizzling noise and smoke from the largest condenser situated in the centre of the chassis. The chassis is also covered with grease which I take comes from this condenser. I would like your advice on whether there is any other cause for this condenser failing other than normal component failure. Also I would like to know the value of this condenser and the method used for removing and replacing it.

This set is BBC only and I would like to convert it to Band III. Is there a converter specially made for this model on the market?—H. R. Roberts (Herts).

The Murphy C1 (external) or C2 (internal) converters are suitable for this set. The large "condenser" of your description is in all probability the line output transformer, which is oil-filled and sounds to be breaking down. An exact replacement is necessary and it is fitted in from underneath, with considerably awkward wiring above chassis to be changed.

POWER CABLE INTERFERENCE

I seek your advice as to how to reduce interference in my television alleged to be caused through power (electric) cables and their anchorages to the respective supporting poles. Also from a nearby electric mains transformer situated in a field.

This house is one of 27 which comprises a council housing estate—built just over five years ago and, of course, we are surrounded by light and power cables.

The interference takes the form of what, I am told, is termed "snow," also three sets of broken lines across the screen. When the "snow" is at its worst a hissing sound can be heard coming from the set. Now and again viewing is tolerable, but, generally, it is very bad. The picture is excellent, but it gets almost blotted out by the interference—chiefly from the "snow."—Cecil G. W. Grimmett (nr. Barnstaple).

There is no way of filtering out this sort of interference at the receiver. The answer, as always in problems of this kind, is to erect the most efficient aerial available so as to increase the signal strength from the required direction only.

K.B. LFT50

I cannot obtain a steady picture. It seems to be swaying all over the screen. Sometimes it slides away to the left then slows up and begins sliding in the opposite direction, at the same time it is sliding vertically very slowly. Any adjustment of the horizontal or vertical controls break up picture completely. All valves have been

(Continued on page 269)

SETS & COMPONENTS

MAINS FROM 12v. CAR BATTERY.—American Dynamotor Unit, runs 200/250 AC/DC radios, televisions, tape recorders, etc., from 12v. car battery, continuous duty, perfect, cost £25, 80/-; s.a.e. full details. SCIENTIFIC PRODUCTS, Cleveleys, Lancs.

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36/24, £5.10.0	CRM141, £5.10.0
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CONVERT YOUR T.V. to I.T.V. in 30 mins. with the Brayhead Tuner. All instructions supplied. State make and model number of T.V. and channels required. **£7/7/-**; c.w.o. or c.o.d.; p. and p. 2/-. R. MALLINSON, 38, Ingleton Ave., Welling, Kent.

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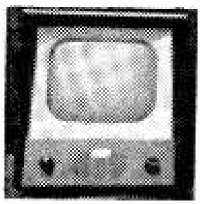

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METERS, contain 2 separate micro-amp. movements and 2 neons, new, 8/6. Crossover Needle (L/R) 100 uA each section, new, **12/6**, or 1 mA x 2, used, **8/6**. Meters, 2in. Rd. D.C. 20 amps., **8/6**; 40v., **8/6**; 3½in., 5 mA (scaled 3 kv), **8/6**. Switches, toggle, U.S.A. DPDT, new, **1/6**. Relays, U.S.A., new 12v. semi-rotary action, massive silver DPDT contacts, with SPDT minor contacts and SPST, **7/6**. Indicators with C.R.T.s VCR530 and VCR139A, 10 valves, etc., **50/-** (rail 8/6). Converters (Rotary), 24v. D.C. to 50v. A.C. 4 A., **40/-** (rail 7/6). Mic Inserts, G.P.O. carbon, **2/6**; inserts, bal. armature type, **2/6**. Morse Trainer Set with buzzer and key wired for 4½v. battery, **8/6**. Drives: slow-motion Admiralty 200:1 ratio, scaled 0-100, **5/6**. RF26, RF27, good cond., **18/-** (post 3/-). Potentiometers, new, 500k or 100k, **5/-** doz. Condensers, Sprague, 0.1 mfd. 500vw., 5/- doz; 0.1 mfd, 1.5 kv., **7/6** doz.; 32 mfd. 450vw, large can, **2/6**; 60 mfd. 350vw. 1⅜in. dia., **3/6**. I.F. Trans., 465 kcs. pair **5/-**. List and enquiries: s.a.e., please! Terms, c.w.o., postage extra; immediate despatch. W. A. BENSON (P.T.), 136, Rathbone Rd., Liverpool, 15

CATHODE RAY TUBES used but in good working order, with three months' written guarantee. 12in. to 17in. Mazda, Mullard and Equivalent types only, at **£4/10/-**, plus 12/6 for carriage and insurance. Enquiries and orders to BHP DISTRIBUTORS (LONDON) LTD., 379, Staines Rd., Hounslow, Middlesex. (Tel.: HOU 5144.) Our terms are c.w.o. or c.o.d.

COMPONENTS, Valves, Tubes, etc. Write or phone for free list. ARION TELEVISION, 4, Maxted Rd., Peckham, S.E.15. (New Cross 7152.)

QUANTITY 12in. Televisions needing attention, **30/-** each; also Working Models of all types. WILKINSONS, 146, Goldhawk Rd., Shepherds Bush 4379.

(Continued overleaf)

SETS & COMPONENTS *continued*

TELEVISION BARGAINS.—Special reductions for one month only. Lowest-ever prices. Buy now and be ready for the Christmas programmes. All popular makes in stock, including Bush, Ekco, Ferguson, etc. Channel 2 receivers: 12in. **£7**, 5 channel receivers: 12in. **£10/10/-**; 14in., **£14**; 15in., **£15**; 17in., **£22** to **£26**. Also 13 channel 14in. and 17in. receivers, prices on request. All the above sets are in working order. Non-working receivers from **£4**. Please add **£1** for carriage, etc. Quantities supplied, callers and trade enquiries welcomed. GRAINGERS, 21, Kenwyn Ave., Blackpool.

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ALL TYPES OF VALVES WANTED. PL81, ECL80, EY51, U25, PCF80, PZ30, U801, etc., etc. Best cash price by return. STAN WILLETTS, 43, Spon Lane, West Bromwich, Staffs. (Tel.: WES 2392.)

NEW VALVES WANTED. — EY51, PL81, ECL80, and similar types. R.H.S., 155, Swan Arcade, Bradford, 1, Yorks.

IMPORTANT.—All types new B.V.A. Valves wanted. Same day payment. ROBERT, 414, Whitefoot Lane, Bromley, Kent.

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DAILY 9 till 6 including SATS.

Over 500 TVs from £3 working, 10/- not. Radios, grams, washing machines, fridges, vacuum cleaners, typewriters.

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MAINS RADIO IN YOUR CAR, complete unit runs 200/250 AC/DC radio, television, tape recorders, etc., from 12v. battery, perfect, cost £25, **80/-**; stamp full details. SCIENTIFIC PRODUCTS Cleveleys, Lancs.

VALVE CARTONS at keen prices. Send 1/- for samples and list. J. & A. BOXMAKERS, 75a, Godwin St., Bradford, 1.

Sturdy case, 12/6. 8½in. x 7½in. x 3½in. deep. Covered in burgundy and grey washable rexine. Strong clasp, hinges and handle. Ideal for Portable Radio Chassis, or Transistor Set. Can be adapted as a Record-carrying case to hold 18 7in. long-playing records. P. & P. 2/6.

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(Dept. E.12)

621/3, Romford Road, Manor Park, E.12

Tel.: ILFord 6001/3

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100 BAYS of brand new adjustable steel Shelving, 72in. high x 34in. wide x 12in. deep, stove enamelled, dark green; sent unassembled, 6-shelf bay, **£3/15/-**; sample delivered free; quantity discounts. N. C. BROWN LTD., Eagle Steelworks, Heywood, Lancs. (Tel.: 69018.)

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CO-AXIAL CABLE, unbeatable offer. **8d.** a yard air spaced.

TELEVISION TABLES cancelled order. 20" x 20", 18" legs, 4-quartered veneering, veneered both sides, in medium oak, walnut and supele mahogany. Unrepeatable offer while stocks last. **32/6**, carriage 2/6.

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HOW TO USE EX-GOVT. LENSES and Prisms. Nos. 1 and 2. 2/6 ea. Vertical Enlarger Plans for 35mm. to 2¼in. sq., 3/6 ea. Optical Condensers and Achromatic Lens to suit. 33/-. Lists. S.A.E. H. W. ENGLISH, Rayleigh Rd., Hutton, Essex.

TELEVISIONS.—12in. **£7/10/-**; 5 chan., **£10**; 13 chan., **£16**. 14in.: 5 chan., **£15**; 13 chan., **£20**. 17in. from **£22**. Non-workers, etc., cheap. Callers only. TELEGRAM ELECTRICAL, 68, Kings Ave., Clapham, S.W.4. (Phone: TUL 6971.)

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All Guaranteed for 6 months—Carriage and Packing 12/6. We have sold many hundreds of these guaranteed tubes and receive many repeat orders.

9 INCH. Cossor 75K-108K. **G.E.C.** 6501, 6502, 6503, 6504, 6505. **Brimar** C9A, C9B. **Mazda** CRM91, CRM92. **Mullard** MW22-7, MW22-14, MW22-14C, MW22-16, MW22-17, MW22-18. **Ferranti** T9-2, T9-3, T9-5. **£3.10.0.**

10 INCH. Cossor 75K, 108K. **Emiscope** 3-16, TA10, **£3.10.0.**

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14 INCH. Emitron, 14KP4, 14KP4A. **Cossor** 141K. **G.E.C.** 7101A, 7102A, 7103A, 7204A. **Brimar** C14BM, C14FM. **Mullard** MW36-22, MW36-24. **Ferranti** TR14-1, TR14-2, TR14-4. **£4.10.0.**

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17 INCH. Brimar C17FM. **Emitron** 17ARP4, 17ASP4. **Emiscope** 4-15. **Mullard** MW43-43, MW43-64. **Mazda** CRM171, CRM172. **Cossor** 171K, 172K.

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1-19 yds.: **7½d.** per yd., p. & p. 1/3.
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Table models complete with cabinets less valves, speaker and tube, **29/-**, post free. 100's more, to callers on Saturdays only.

TV AERIALS By "View-Well." Top quality finish.

Unapproachable value. Please state channels. Carriage free.
E.M.—existing mast. W.—wall mounting. Number—No. of elements.
Band III Aerials: 3 E.M., **26/-**, 4 E.M. **31/-**, 5 E.M. **38/6**, 6 E.M. **43/6**, 8 E.M. **53/6**, 3 W. **30/-**, 4 W. **35/-**, 5 W. **42/6**, 6 W. **47/6**, 8 W. **57/6**.
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Combined Band I/III (consisting B.B.C. folded dipole mounted with I.T.V. multi-element): C3 W. **34/-**, C4 W. **39/-**, C5 W. **46/6**, C6 W. **51/6**, C8 W. **61/6**.

GUARANTEED TV VALVES
24-HOUR SERVICE

6AM6	6/9	EAF42	9/-	EY51	10/3	U22	7/6
6AT6	8/-	EB41	7/6	EY86	15/-	U24	12/6
6BA6	6/6	EB91	5/6	EZ40	8/-	U31	9/-
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6F12	6/6	ECC82	6/6	KT61	9/6	U404	7/6
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6F14	11/-	ECC84	9/9	LZ319	9/-	UABC80	10/-
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6J6	4/6	ECF80	12/-	P61	2/6	UAF42	9/-
6L1	9/-	ECH42	9/3	PCC84	9/-	UB41	9/-
6L18	9/6	ECL80	12/6	PCC85	11/6	UBC41	8/6
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6X4	6/-	EF41	9/6	PL36	15/-	UL41	8/6
10F1	9/6	EF42	12/-	PL38	11/-	UL44	9/6
10P13	11/-	EF50(A)	3/6	PL81	13/6	UL46	9/6
10P14	12/-	EF50(B)	4/9	PL82	9/-	UU7	9/6
20D1	9/6	EF54	4/-	PL83	11/-	UU8	11/-
20F2	9/6	EF80	7/6	PY31	10/-	UY41	8/-
20P1	11/-	EF85	7/-	PY80	8/-	W76	6/6
30L1	8/6	EF89	9/6	PY81	8/6	W77	5/-
B36	11/-	EF91	6/9	PY82	8/9	Z66	15/-
EA50	1/6	EL33	11/-	PY83	8/6	Z152	8/-
EABC80	9/-	EL41	9/6	PZ30	12/-	Z719	7/-
EAC91	6/6	EL84	9/6	SP61	3/-	ZD152	8/6

For full list of valves, etc., send

S.A.E. FREE LIST. 500 SNIPS

All items less 5% and post free for a dozen.

Post 1/3 in £1. Min. 9d. No. C.O.D.

10,000 SNIPS FOR CALLERS.

TECHNICAL TRADING CO.

350/352, FRATTON ROAD PORTSMOUTH

tested and are found to be in perfect working order. Please tell me how I can correct this. I would also be much obliged if when describing the "cure" you could do so in the most simplified manner as you possibly can as I am not too familiar with television.—Hugh Connelly (Glasgow, S.W.3).

Viewing the chassis from the rear, on the right side are two rows of valves. The rearmost (nearest) valve on the inner row—immediately to the right of the focus magnet is the 6AM6 sync separator. This should be replaced. If the symptoms remain, check the 1 MΩ resistor and the .1 μF capacitor wired to pin 7 of the valve base.

PHILIPS 1446U

When I switch on for test card, the same is narrow in the centre, but gradually fills out. When switching on picture, the top right corner takes a minute or two to fill up, the rest of picture being all right. Could you tell me what to check?—G. H. Nash (Cross Keys).

This is caused by the formation of an uneven electrostatic charge on the face of the picture tube. A defect in the tube itself is often responsible, but in other cases dampness on the tube or mask or incorrect fitting of the tube in the cabinet and chassis should be suspected. Check that the external conductive coating on the tube is correctly "earthed" to receiver chassis by way of the spring clips provided.

PETO-SCOTT 127

When the set has been on for twenty minutes the glow of the EY51 goes out and a few seconds after the picture fades and goes off altogether. I have replaced the EY51, but it is still the same as mentioned above. The sound is good; and the picture is good when it is on.—J. E. Emerton (Sutton-in-Ashfield).

We note that the picture remains for a few seconds after the EY51 heater fails. This would appear to indicate that the line timebase is functioning correctly (otherwise the picture would collapse first). Therefore a poor connection to the EY51 heater is suggested and this wiring should be most carefully examined.

REMOTE CONTROL

I am very keen to provide for a bedridden friend complete control of his set from the bedside table, and the tube and speaker at the other side of the room connected by a five yard plug-in set of cables (or 10 yard length if left permanently connected).

I am proposing to divide a set into two parts to do this, and leave the timebases in the cabinet with the tube. Can you please advise me on the following points?

Is it possible to run the signal from the vision detector along a five or 10 yard cable successfully to the sync separator stage or is it likely to be preferable to run the signal from the vision I.F. amp. stage carefully screened, etc., to the vision detector in the main cabinet with the timebases?—A. Phillips (N.W.8).

It is quite possible to run a coaxial cable from the video output stage to the separate C.R.T. and sync separator stages and this is commonly done. It is not so practical to run a cable from the I.F or detector stages. however. We presume you have taken into consideration the H.T. and heater supply leads and the necessity to screen and decouple these. It is assumed that the C.R.T. and timebase chassis will also contain the power pack and loudspeaker and that the receiver unit—at bedside—will contain the tuner unit. I.F. stages. sound output (including transformer) and video stages. The extension cables will thus require to be on/off control. video/sync signals. speaker leads. H.T. and heater cables. As you do not say whether the receiver is for A.C. only or the type. we cannot comment further.

PYE V14C

The 13 channel tuner is faulty, it needs a new one. Please could you tell me how I could disconnect the tuner so that I can use the set for BBC only?—P. Smith (E.7).

The tuner unit is of the 13 channel type with its output feeding the I.F. stages of the receiver. Therefore, the receiver will no more receive the BBC than the ITV when the tuner unit is removed. To make this quite clear. the receiver will not function at all without the tuner unit.

ULTRA V17-60

The continual trouble with this set is defective sound, a blurred speech that cannot be understood. Have checked fine tuner and valves 1, 2 and 3, but still have not found a permanent cure.—D. Smith (Abercarn).

We would suggest that you first check the 30PL1 audio and output valve. If this is not at fault. check the resistors associated with the 6D2 sound detector and limiter. 1 MΩ to pin 2 and 1 MΩ to pin 5.

PYE FV1

I can't hold the frame properly, if I do get it settled the picture then starts shimmering violently and to say the least it is most annoying. When the set is first switched on the picture rolls over very fast but gradually slows down, but never becomes steady.—A. Cook (Cheadle).

We suggest you check the ECL80 frame timebase valve which is in the square metal can just outside the line transformer case at the point where the EHT lead emerges.

[redacted]

Published on the 22nd of each month by GEORGE NEWNES, LIMITED, Tower House, Southampton Street, Strand, London, W.C.2, and printed in England by W. SPEAIGHT & SONS, Exmoor Street, London, W.10. Sole Agents for Australia and New Zealand: GORDON & GOTCH (A/sia), LTD. South Africa and Rhodesia: CENTRAL NEWS AGENCY, LTD. Subscription rate including postage for one year: Inland 19s., Abroad 17s. 6d. (Canada 16s.) Registered at the General Post Office for the Canadian Magazine Post.

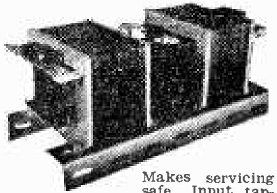
A.C./D.C. Multimeter Kit

Ranges: D.C. volts 0-5, 0-50, 0-100, 0-500, 0-1,000. A. C. volts 0-5, 0-50, 0-100, 0-500, 0-1,000. D.C. milliamps 0-5, 0-100, 0-500, ohms 0-50,000 with internal batteries. 0-500,000 with external batteries. Measures A.C./D.C. volts. D.C. current and ohms. All the essential parts including metal case, 2in. moving coil meter, selected resistors, wire for shunts, range selector, switches, calibrated scale and full instructions, price 19/6. plus 2/6 post and insurance.

Motor Snip

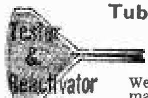
Miniature motor 2¼in. long x 1¼in. diameter, laminated poles and armature, separate winding for reversing. Operates off 20-30 v. D.C. or off A.C. mains through stepdown transformer. Original cost at least £3 each. Snip price for one month only 6/6. plus 1/6 postage and insurance.

Mains Isolation Transformer



Makes servicing safe. Input tapped 200-250 v., output tapped 200-250 v. Rated at 500 watts, intermittent rating 2,000 watts. Screens for suppressing mains interference. Size 14in. x 6in. x 6in., weight 40lbs. Price £5/12/6. Carriage 7/6 (up to 250 miles).

Tube Tester and Re-Activator

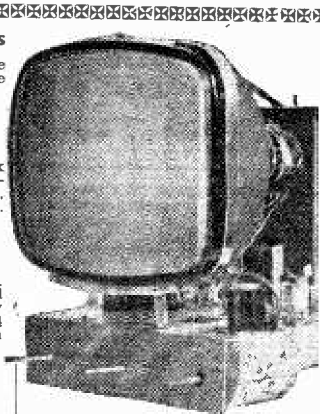


We can supply all the main components for making this unit which will not only test Cathode Ray Tubes but will also re-activate them, supplied complete with full instructions. Price £3, plus 2/6 post and ins.

Morganite Potentiometers

Single and 2 gang types available, standard size with good length spindle all new and boxed. Single types 1/- each, values available: 5K., 10K., 25K., 50K., 100K., 250K., 1 meg., 2 meg. Gang type, 3/- each—values available: 5K. + 5K., 100K. + 100K., ½ meg. + ½ meg., 2 meg. 2 meg.

Build this 17" T.V. for 22 guineas



This is a very modern circuit and when you have completed it it will be equal to any factory made model. Note these special features:

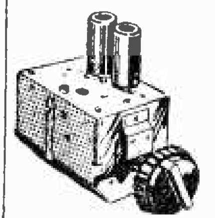
Miniature valves and metal rectifier
12 channel turret tuner
Ferrox E.H.T. and scan coils
A.G.C. and A.V.C.

Supplied in component form with all metal work prepared and supplied with pictorial layout and theoretical wiring diagram (these are available separately, price 3/6). Total cost is only £23/2/-. LESS C.R.T.

Stereo Amplifier Outfit

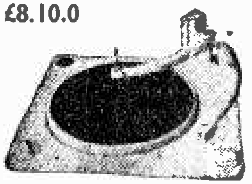
comprising 8 watt twin channel amplifier for A.C. mains working and two 8in. P.M. speakers on veneered and polished corner baffles. Whole outfit giving really terrific reproduction and amazing 3D effects. £14 complete, plus carriage and insurance, or £1 down and 28 weekly payments of 10/-.

LATEST TYPE Turret Tuner



Brand new stock, not surplus, with coils for Band I and III complete with valves. Model 1 I.F. output 33/38 Mc/s. Series heaters Model 2 I.F. output 16/19 Mc/s. Parallel heaters. With instructions and circuit diagram, 79/6. With knobs 3/6 extra, post and insurance 2/6.

Yours for 10/- down and 17 fortnightly payments of 10/- or cash price £8.10.0



The latest, most up-to-date Record Player made by the famous B.S.R. Company. Using Hi-Fi Crystal Pick Up and fitted with every modern device. Definitely a record changer which will give years of trouble-free music. Not surplus but the current model. Price £8.10/- or Terms.

Black & Decker D500

new heavy duty motor develops terrific power—normal chuck with geared key grip—side handle for additional stability—indispensable tool for any workshop. Takes up to ¼ drills, also is power unit for polishing—sawing and turning, etc., etc. Price £6/19/6 or 10/- deposit and 14 fortnightly payments of 10/-.

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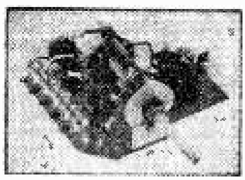
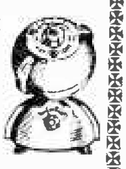


Covers the Medium Waveband 200-550 metres and two short wavebands 35-120 metres and 13-42 metres, for 465 k/c. I.F. Extremely well made, supplied complete with diagram of connections. Only 9/6, plus 1/6 post and insurance.

Channel Converter

A really super converter with exceptionally high gain, trouble free in operation, uses two valves and has the following controls: Fine Tuner, Band Switch, On/Off Switch which also controls the T.V. receiver, no alterations necessary to the T.V. When ordering please specify the channels required. Price £7/10/-. plus 5/- carriage and insurance, or 10/- deposit and 15 weekly payments of 10/-.

Novelty Radio



Completely wired tunable medium and long wave, originally intended for B7G valves and external batteries but could easily be converted for transistors with internal batteries. Less valves and speaker, otherwise complete 15/-, plus 1/6 postage.

Don't Be Caught Like This

Car Starter Charger Kit

All parts to build 6 and 12 volt charger which can be connected to a "flat" battery and will enable the car to be started instantly. Kit comprising the following:

Mains Transformer	22/6
5-amp. Rectifier	17/6
Regulator Stud Switch	3/6
Resistance Wire	2/-
Resistance Former	2/6
Mains on/off Switch	2/6
0-5 amp. Moving Coil Meter	12/6
Construction Data	1/6

Or if bought all together price is 52/6. plus 3/6 post and packing.

For convenience of callers all items advertised may be obtained from the following companies.

Electronics (Ruislip) Ltd., 42-46, Windmill Hill, Ruislip, Middx. Phone: RUISLIP 5780. Half day, Wednesday.

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Electronics (Finsbury Park) Ltd., 29, Stroud Green Rd., Finsbury Park, N.4. Phone: ARChway 1049. Half day, Thursday.

C.R.T. ISOLATION TRANSFORMER

Type A. Low leakage windings. Optional 25% and 50% boost on secondary. 2 v. or 4 v. or 6.3 v. or 10.8 v. or 13.3 v. with mains primaries ... ... 12/6.

Type B. Mains input. Multi Output 2, 4, 6.3, 7.3, 10 and 13 volts. Boost 25% and 50%. Low capacity ... ... 21/-.

Type C. Low capacity transformer for 2 volt Tubes with falling emission. Mains Primary. Output 2-2½-2¾-3 volts at 2 amps. 17/6.

TRIMMERS, Ceramic. 30, 50, 70 pf., 9d.; 100 pf., 150 pf., 1/3; 250 pf., 1/6; 500 pf., 750 pf., 1/9.

RESISTORS, Preferred values. 10 ohms to 10 meg., ¼ w., 4d.; ½ w., 4d.; 1 w., 6d.; 1½ w., 8d.; 2 w., 1/-.

HIGH STABILITY. ½ w., 1%, 2/-. Preferred values 100 Ω to 10 meg. Ditto, 5%, 100 Ω to 5 meg. Ω, 9d.

WIRE-WOUND RESISTORS 25 ohms—10,000 ohms: 5 watt 1/3; 10 watt 1/6; 15 watt 2/-.
15,000 ohms—50,000 ohms, 5 w., 1/9; 10 w., 2/3.

12/6 PURETONE RECORDING TAPE

1,200 ft. on standard 7" Metal reels.
Spare Reels 7" plastic, 4/-; 7" metal, 2/3.

SUPERIOR 1,200 ft. Plastic Tape on 7" Plastic Reels. Quality Guaranteed, 21/-.
"Instant" Bulk Tape Eraser, 27/6.

O.P. TRANSFORMERS. Heavy Duty 50 mA., 4/6. Multiratio, push-pull, 7/6. Miniature, 384, etc., 4/6.

L.F. CHOKES 15-10 H. 60/65 mA., 5/-; 10 H. 85 mA., 10/6; 10 H. 150 mA., 14/-.

MAINS TRANSFORMERS

STANDARD. 250-0-250, 80 mA., 6.3 v. tapped 4 v. 4 a. Rectifier 6.3 v. 3 v. or 4 v. ... 22/6
ditto, 350-0-350 ... ... 22/6
MINIATURE. 200 v. 20 mA., 6.3 v. 1 a. 10/6
MIDGET. 220 v. 45 mA., 6.3 v. 2 a. ... 15/6
SMALL. 220-0-220, 50 mA., 6.3 v. 3 a. ... 17/6
STANDARD. 250-0-250, 65 mA., 6.3 v. 3.5 a. 17/6
HEATER TRANS. 200-250 v. 6.3 v. 1½ amp. 7/6
Ditto, tapped sec. 2, 4, 6.3 v., 1½ amp., 8/6
Ditto, sec. 6.3 v. 3 amp. 10/6

ALADDIN FORMERS and core, ¼in., 8d.; ⅜in., 10d. ⅜in. **FORMERS 5937 8 and Cans TV1 2.** ⅞in. sq. x 2⅛in. and 1½in. sq. x 1¾in., 2/- ea., with cores.

TYANA. Midget Soldering Iron. 200/220 v. or 230/250 v., 16/9. **Solon Instrument Iron, 24/-.**

MAINS DROPPERS. 3in. x 1¼in. Adj. Sliders, 0.3 amp. 750 ohms, 4/3. 0.2 amp., 1,000 ohms, 4/3.

LINE CORD. 3 amp., 60 ohms per foot, 2 amp., 100 ohms per foot, 2-way, 6d. per foot, 3-way, 7d. per ft.

LOUDSPEAKER P.M. 3 OHM. 2½in. & 5in., 17/6. 5in. Plessey, 19/6. 7in. x 4in. Goodmans, 21/-. 9½in. Goodmans, 18/6. 10in. R. & A., 30/-. T.S.L. Tweeter, LSH75, 8/6. 12in. Plessey, 30/-. 8in. M.E. 2.5k. field, tapped O.P. transf., 24/6. 12in. Baker 15 watt 3 ohms, or 15 ohms, 105/-.

CRYSTAL DIODE G.E.C., 2/-. **GEX34, 4/-.**

HIGH RESISTANCE PHONES. 4,000 ohms, 16/6 pr.

MIKE TRANSF. 50 : 1, 3/9 ea.; 100 : 1, Potted, 10/6.

SWITCH CLEANER Fluid squirt spout, 4/3 tin.

TWIN GANG TUNING CONDENSERS. 365 pf. miniature 1in. x 1¼in. x 1⅛in., 10/-. .0005 Standard with trimmers, 9/-; less trimmers, 8/-; midget, 7/6.

SINGLE. 50 pF., 2/6; 100 pF., 7/-; 150 pF., 8/6. Solid dielectric 100, 300, 500 pF., 3/6.

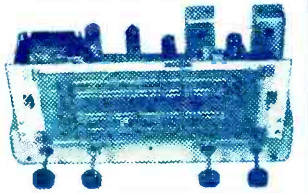
SPEAKER FRET. Expanded Metal Silver. 12½in. x 9¼in., 2/- each.

GOLD CLOTH 17in. x 25in., 5/-; 25in. x 35in., 10/-. **Tygan** 4ft. 6in. wide, 10/- ft.; 2ft. 3in. wide, 5/- ft.

All Boxed **VALVES** 90-day Guarantee.

1R5	8 6	6K8	8 6	EABC80		HABC80	
1S5	8 6	6L6	10 6		10 6		12 6
1T4	8 6	6N7M	7 6	EB91	6 6	HVR2A	7 6
2X2	3 6	6Q7	10 6	EBC33	8 6	MU14	10 6
3S4	8 6	6SA7	7 6	EBC41	10/6	P61	6 6
3V4	8 6	6SJ7M	10 6	EBF80	10 6	PCC84	12 6
5U4	8 6	6SN7	8 6	ECC84	12 6	PCF80	11 6
5Y3	8 6	6V6G	7 6	ECF80	11 6	PCF82	11 6
5Z4	10 6	6V6GT	8 6	ECF82	11 6	PCL82	11 6
6AM6	8 6	6X4	7 6	ECH42	10 6	PEN25	6 6
6B8	5 6	6X5	7 6	ECL82	12 6	PL82	10 6
6BE6	7 6	12A6	7 6	EF39	7 6	PY80	10 6
6BH6	10 6	12AH8	10 6	EF41	10 6	PY81	10 6
6BW6	10 6	12AT7	9 6	EF50	5 6	PY82	10 6
6BW7	8 6	12AU7	9 6	EF80	10 6	SP61	5 6
6CH6	10 6	12AX7	9 6	EF91	8 6	UBC41	10 6
6D6	7 6	12BE6	10 6	EF92	5/6	UCH42	10/6
6F6	7 6	12K7	8 6	EL32	5 6	UF41	10 6
6H6	3 6	12Q7	8 6	EL84	10/6	UL41	10 6
6J5	6 6	35L6	9 6	EM81	12/6	UY41	10/6
6J6	7 6	35Z4	9 6	EZ40	10 6	U22	10/6
6J7	8 6	80	10 6	EZ80	9 6	VR105	8 6
6K6	6 6	954	1 6	EZ81	11 6	VR150	8 6
6K7	5 6	EA50	1 6	E1148	1 6	U76	9 6

FINEST VALUE



1958 RADIOGRAM CHASSIS

THREE WAVEBANDS **FIVE VALVES**
S.W. 16 m.—50 m. LATEST MULLARD
M.W. 200 m.—550 m. ECH42, EF41, EBC41,
L.W. 800 m.—2,000 m. EL41, EZ40.
12-month guarantee.

A.C. 200/250 v. 4-way Switch; Short-Medium-Long-Gram. A.V.C. and Negative feedback 4.2 watts. Chassis 13½ x 5½ x 2¼in. Glass dial 12½in. x 5¼in. horizontal or vertical 10in. x 4½in. 2 Pilot Lamps, Four Knobs Walnut or Ivory. Aligned and calibrated. Isolated Chassis.

£9.10.0 Carr. & Ins. 4/6.

TERMS: Dep. £5.5.0 and five monthly of £1.

MATCHED SPEAKERS FOR ABOVE CHASSIS. 8in., 17/6; 10in., 25/-; 12in., 30/-.

OUR PRICE **£6.19.6**

TERMS: Dep. £3.10.0 and four monthly of £1.

COLLARO HIGH-FIDELITY AUTOCHANGER
Mixer Model RC456
4-SPEEDS 10 RECORDS
With Studio "O" pick-up
BRAND NEW IN MAKER'S BOXES
OUR PRICE £8.5.0, post free.

BUILD THIS REPRODUCER BARGAIN SINGLE PLAYER KIT

Ready for immediate assembly.

4-speed Collaro "Junior" Unit......	£4 12 6
Handsome case, 17½ x 13½ x 7in....	£2 5 0
Ready-built 3-watt amplifier with two valves and loudspeaker......	£3 12 6

or **£9.15.0** complete kit post free.

ALUMINIUM CHASSIS. 18 s.w.g. undrilled. With 4 sides, riveted corners and lattice fixing holes, 2½in. sides, 7 x 4in., 4/6; 9 x 7in., 5/9; 11 x 7in., 6/9; 13 x 9in., 8/6; 14 x 11in., 10/6; 15 x 14in., 12/6; 18 x 16 x 3in., 16/6.

TRANSISTORS, GENUINE PYE GOLTOP. Audio, 15/-. R.F. (3 Mc/s average), 24/-. Complete data sheets supplied.

HANDY VOLT METERS. 0-25 v. and 0-250 v., D.C. with leads and leather case, 9/6.

CRYSTAL MIKE INSERT by Acos, precision engineered. Size only ⅞in. x 3/16in., 6/6.

HI-GAIN BAND 3 PRE-AMP KIT. Cascode circuit with valve ECC84. Price 29/6. With Power Pack, 49/6. Plans only 6d.
Band I version same prices.

TELETRON "TRANSIDYNE"
MIDGET SUPERHET PORTABLE 6" x 4" x 1¾"
6 transistors, printed circuit, Ferrite aerial. All parts and cabinet, £12.19.6.
We include 6 Pye Goltop Transistors for maximum performance. Plans 9d.

GARRARD 4-SPEED SINGLE RECORD PLAYER 4SP.

AUDIO PERFECTION

Designed to play 16, 33, 45, 78 r.p.m. Records 7in., 10in., 12in. Lightweight Xtal pick-up. GC2 turnover head, two separate sapphire styli.

OUR PRICE **£8.0.0** each. Post Free.

Amplifier Player Cabinets, 45/-.

Volume Controls

Long spindles. Guaranteed 1 year. Midget 5K ohms to 2 Meg. No Sw. 3/-; D.P.Sw. 4/9.
Linear or Log Tracks.

80 ohm COAX CABLE

Semi-air spaced Polythene insulated. ⅜in. dia. Stranded core. Losses cut 50%. **9d.** yd.
Fringe Quality Air Spaced. **1/6** yd.

COAX PLUGS ... 1/- **DOUBLE SOCKET** ... 1/3
SOCKETS ... 1/- **OUTLET BOXES** ... 4/6

BALANCED TWIN FEEDER yd. 6d. 80 or 300 ohms.

DITTO SCREENED per yd. 1/6. 80 ohms only.

WIRE-WOUND POTS. 3 WATT. Pre-set Min. T.V. Type. All values 25 ohms to 30 K., 3/- ea. 50 K., 4/-. (Carbon 50 K., to 2 m., 3/-.)

WIRE-WOUND 4 WATT. Pots 2¼in. Spindle Values, 100 ohms to 50 K., 5/6; 100 K., 6/6.

CONDENSERS. New Stock. .001 mfd. 7 kV. T.C.C., 5/6; Ditto, 20 kV., 9/6. 100 pf. to 500 pf. **Micas, 6d.;** Tubular 500 v. .001 to .01 mfd., 9d.; .05, .1, 1/-; .25, 1/6; .5/350 v. 1/9; .1/350 v., 9d.; .01/2,000 v., 1/9; .1 mfd., 2,000 volts, 3/6.

CERAMIC CONDS. 500 v., .3 pf. to .01 mfd., 10d.

SILVER MICA CONDENSERS. 10%, 5 pf. to 500 pf., 1/-; 600 pf. to 3,000 pf., 1/3. Close tolerance (± 1 pF.) 1.5 pF to 47 pF., 1/6. Ditto 1%, 50 pF. to 815 pF., 1/9; 1,000 pF. to 5,000 pF., 2/-.

I.F. TRANSFORMERS 7/6 pair.
465 Kc/s Slug Tuning Miniature Can. 2½in. x 1in. x 1in. High Q and good bandwidth. By Pye Radio. Data sheet supplied.

Wearite M800 I.F. 465 Kc/s. 12/6 per pair.
Wearite 550 I.F. 465 Kc/s. 12/6 per pair.

NEW ELECTROLYTICS. FAMOUS MAKES

TUBULAR		TUBULAR		CAN TYPES	
1/350 v.	2/-	100/25 v.	2/-	8+16/500 v.	5/6
2/450 v.	2/3	8+8/500 v.	4/6	16+16/450 v.	5/6
4/450 v.	2/-	16+16/500 v.		25+20/450 v.	5/6
8/450 v.	2/3		6/-	32+32/350 v.	4/6
8/500 v.	2/9	**CAN TYPES**		32+32/450 v.	6/6
16/450v.	3/6	Clips	3d.	50+50/350 v.	7/-
16/500v.	4/-	16/500 v.	4/-	60+100/350 v.	11/6
32/450v.	5/6	32/350 v.	4/-	100+200/275 v.	12/6
25/25 v.	1/9	64/350 v.	5/6	1,000+1,000/6 v.	
50/25 v.	2/-	500/12 v.	3/-		6/6
50/50 v.	2/-	8+16/450 v.	5/-		

SENTERCEL RECTIFIERS. E.H.T. TYPE FLY-BACK VOLTAGE. K3/25 2 kV., 5/-; K3/40 3.2 kV., 7/-; K3/45, 3.6 kV., 7/6; K3/50 4 kV., 8/-; K3/100 8 kV., 14/6; 50 c.p.s. voltage, 30% of above.

MAINS TYPE SELENIUM 300 v. 85 mA., 7/6.

CONTACT COOLED 250 v. 50 mA., 7/6; 60 mA., 8/6; 85 mA., 9/6. 14RA1-2-8-3, 27/6.

COILS Wearite "P" type, 3/- each. Osmor Midget "Q" type adj. dust core from 4/-. All ranges.

TELETRON. L. & Med. T.R.F., with reaction, 3/6.

FERRITE ROD AERIALS. M.W., 8/9; M & L., 12/6.

T.R.F. COILS A/HF, 7/- pair. **H.F. CHOKES,** 2/6.

FERRITE ROD 7in. x ⅜in. dia., 2/6.

JASON F.M. TUNER COIL SET, 26/-. H.F. coil, aerial coil, Oscillator coil, two I.F. trans. 10.7 Mc/s. Ratio Detector and heater choke. Circuit book using four 6AM6, 2/-.

COMPLETE JASON F.M. KIT WITH VALVES, £6.15.0. Fringe area kit, 22/6 extra.

MULLARD 3-3 AMPLIFIER READY BUILT. Spare Power for Tuner, etc., £7.17.6.

FULL WAVE BRIDGE SELENIUM RECTIFIERS: 2, 6 or 12 v. 1½ amp., 8/9; 2 a., 11/3; 4 a., 17/6.

CHARGER TRANSFORMERS. Tapped input 200/250 v. for charging at 2, 6 or 12 v., 1½ amps., 15/6. 2 amp., 17/6; 4 amps., 22/6. Circuit included.

VALVE and **T.V. TUBE** equivalent books, 5/-.

TOGGLE SWITCHES. S.P. 2/-, D.P. 3/6, D.P.D.T. 4/-.

WAVECHANGE SWITCHES

5 p. 4-way 2 wafer long spindle	6/6
2 p. 2-way, or 3 p. 2-way short spindle ...	2/6
2 p. 6-way, 4 p. 2-way, 4 p. 3-way long spindle...	3/6
3 p. 4-way, or 1 p. 12-way long spindle ...	3/6

VALVEHOLDERS. Pax. Int. Oct., 4d. EF50, EA50, 6d. B12A, CRT, 1/3. Eng. and Amer. 4, 5, 6, 7 and 9 pin, 1/-. **MOULDED MAZDA** and Int. Oct., 6d. B7G, B8A, B8G, B9A, 9d. B7G with can, 1/6. B9A with can, 2/6. **CERAMIC** EF50, B7G, B9A, Int. Oct., 1/-. B7G with can, 1/9.

NEW AND ENLARGED SHOWROOMS NOW OPEN. H.P. AVAILABLE.

OUR WRITTEN GUARANTEE WITH EVERY PURCHASE. Please address all Mail Orders correctly as below.

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OPEN ALL DAY—(Wed. 1 p.m.) *Catalogue 6d.*

Tel. THO 1665. Buses 133 or 68 pass door. 48-hour postal service. *P. & P. 1/-, over £2 post free. (Export Extra) C.O.D. Service 1/6.*

71C