TV RADIATION—CAUSES AND CURE

Practical Television

AND TELEVISION TIMES

1'3

MAY 1959

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CONTENTS

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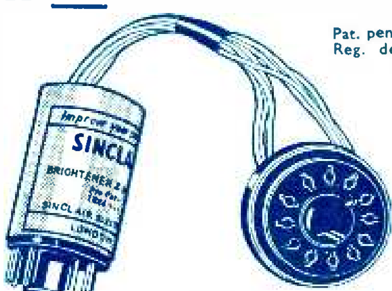

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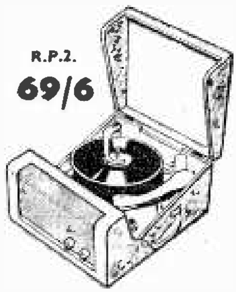

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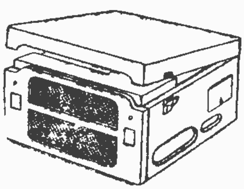

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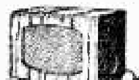

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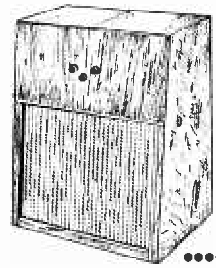

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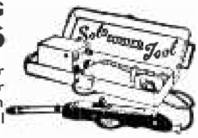

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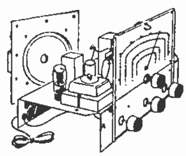

5 valve superhet chassis, including 8in. P.M. speaker and valves. Four control knobs (tone, volume, tuning w/change, switch). Four w/bands, with position for gram p.u. and extension speakers. A.C. Ins. carr. 5/6.

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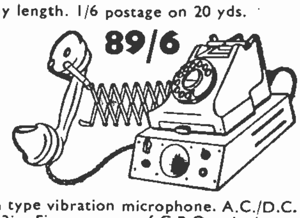

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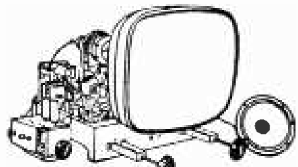

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17in. Rectangular Tube on modified chassis. Supplied as single channel chassis covering B.B.C. channels 1-5 or, incorporating Turret Tuner, which can be added as an extra, at our special price to chassis purchasers of **50/-**, giving choice of any two channels (B.B.C. and I.T.A.). Extra channels can be supplied at **7/6** each. Chassis size 12 x 14½ x 11in. less valves. Similar chassis are used by well known companies because of their stability and reliability. With Tube & Speakers (less valves) **16 guineas.** Complete and working with valves and Turret Tuner **24 guineas.** 12 months' guarantee on the tubes. 3 months' guarantee on the valves and chassis. Ins., carr. (incl. tube), 25/-.

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As above, with 14in. Rectangular Tube, 12 months' guarantee on Tube. 3 months' guarantee on chassis and valves. Chassis with Tube and Speaker (less valves), **11 guineas.** Complete and working with valves and Turret Tuner, **19 guineas.** Ins., carr. (incl. Tube), 25/-.

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Complete chassis by famous manufacturer. R.F. E.H.T. unit included. Easily fitted to table or console model owing to this chassis being in three separate units (power, s/vision strip, t/base interconnected). This chassis is less valves and tube. Speaker FREE. I.F.s 16-19.5 Mc/s vision. Channels 1-5 easily converted to I.T.A. by use of a Turret Tuner. Drawings available at **2/6** or FREE with order. Ins., carr. 10/6. 12in. Tube available at **£6**, plus ins., carr. 15/6.

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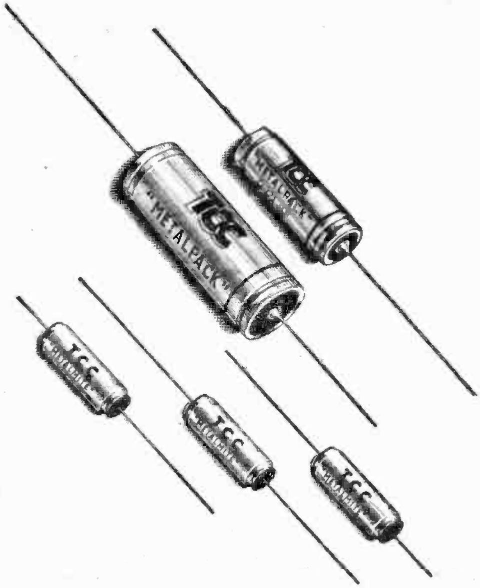

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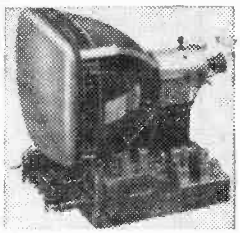

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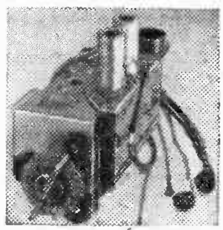

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Practical Television

& TELEVISION TIMES

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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

MORE LINES?

THE problem of a third television service is causing much discussion in technical circles. Apart from the important question of the frequency upon which it will be transmitted, there are a number of problems connected with the type of transmission which also tie up with the question of colour television. The P.M.G. announced recently that he is postponing a decision on a third programme until the question of the line definition had been settled. A committee is meeting to discuss this factor. As readers are aware, the British system stands alone with 405 lines. Many experts consider that much better definition is obtained with the American standard of 525 lines or Continental 625. The American standard uses negative modulation for the picture, and the sound section operates with F.M. This is the system which has been adapted for colour, and which the experts in this country have modified to operate on the British standards.

Would it not be desirable to change our system so as to standardise it? Then export markets would be open to our manufacturers, and advantage could be taken of developments introduced in any country without having to try and adapt them to our system. It will be seen, therefore, that the question of line definition is one which needs very serious and unhurried consideration.

ADVERTISING ON TV

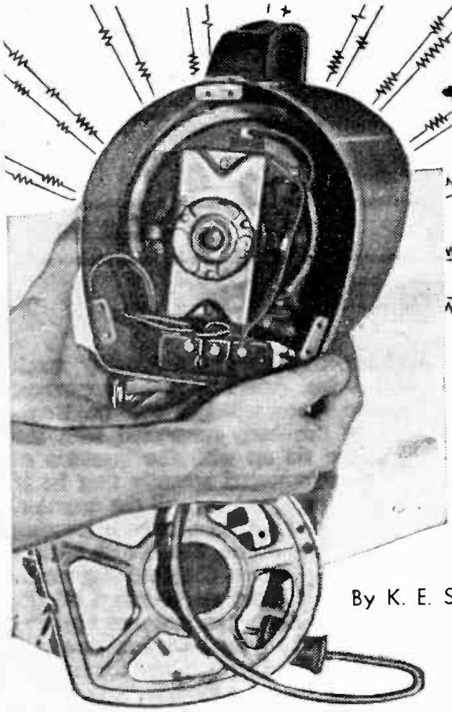
THERE is no doubt that advertising on TV has resulted in increased prosperity in many industries and concerns. At first the advertisers aimed to please the viewer; they amused him with cartoons, for example. Now the emphasis is on the "hard selling" or "direct selling" of goods. The commercials based on this principle are, in our opinion, harsh to both eye and ear in many instances.

With the possibility of the establishment of another commercial TV network in the not too distant future, we think it time for a detailed review of advertising charges and methods, lest the systems reputed to be employed in the U.S.A. make their appearance here.

BUILT-IN SAFETY GLASS

AN American manufacturer has made 23in. tubes with a safety panel bonded to the face. This new method of construction will make possible new cabinet designs and smaller tubes for the same picture area. Also, it is said that the light output is increased, as there are fewer reflecting surfaces. This is a logical development from the tube with the separate safety glass and one which should appeal to set designers.

Our next issue, dated June, will be published on May 22nd



Fitting T.V. Interference Suppressors

THE USE OF CHOKES AND CAPACITORS WITH ELECTRICAL EQUIPMENT

By K. E. SCOTT

MUCH annoyance can be caused to users of TV sets by interfering electrical appliances. The most common sources of trouble are commutator or universal motors. These are used in a large number of household appliances, such as vacuum cleaners, hair dryers and sewing machines. They need not be faulty in either a mechanical or electrical sense to be a source of interference, although inefficient maintenance may increase the trouble, especially if the offending appliance has been in service for a long time.

Domestic electric motors should be cleaned periodically and all dust and fluff removed. The commutator should be kept clean, and the brushes examined to see that they are well seated on the commutator.

Causes of Interference

The only other cause of interference likely to be encountered in the domestic field is from thermostats of the bi-metal type, as used in irons, heaters, and refrigerators. Interference can be caused when the thermostat opens and an arc is drawn between the two contacts. The modern thermostat has a snap action and causes little interference, but there are still many of the older type in use.

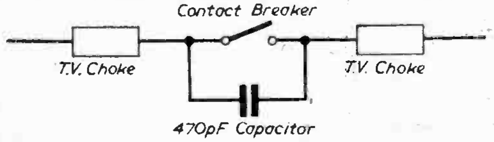


Fig. 2.—A suppressor system for thermostats.

The cure for interference is to connect a system of capacitors and inductors or chokes into the circuit of the offending appliance. This neutralises the generated interference. Most cases can be cured completely, and in others annoyance can be reduced to a tolerable level.

Use Correct Type of Capacitors

A word of warning is necessary here. The correct type of capacitors for interference suppression must be used. These comply with BSS 613, and are not the type of component used in radio construction. They are obtainable from any good radio or electrical dealer. The capacitors commonly available have a value of 470 pF, and may be obtained either single, with two wire connections, or double with three wire connections. Inductors, or chokes, are current rated at 1, 2 or 3 amps., and care must be taken to ensure that the correct rating is used for the appliance being suppressed. Overheating and destruction of the chokes may be the price paid for overloading.

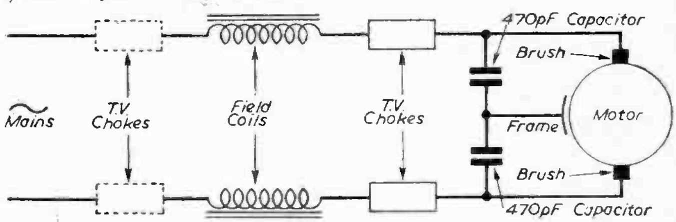


Fig. 1.—Showing how to include the chokes.

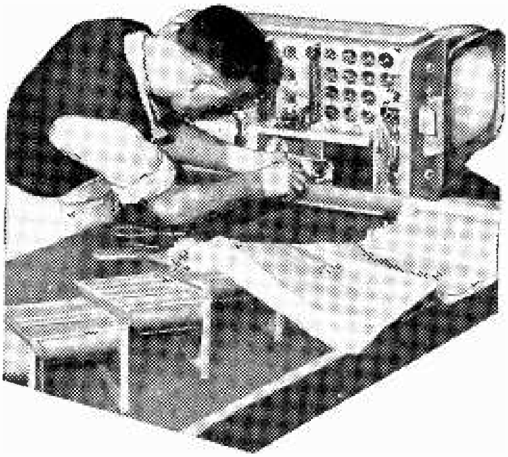
Suppressors may be obtained already built up into units to be incorporated into the flexible lead of appliances. Generally, however, suppression must be applied at the source of interference to be fully effective. If flex lead suppressors are used they should be connected as close to the appliance as possible.

Wiring of the Chokes

If suppressor capacitors and chokes are to be fitted to commutator motors the chokes are usually

(*Continued on page* 491)

A NEW SERIES



Analysing and Servicing TV Receivers

No. 6—Line Timebase Faults

By "Diadem"

(*Continued from page 410 of the March issue*)

CONTINUING from the March issue, we deal with more faults associated with the line timebase.

No raster, no EHT in self-oscillating line output stage. If oscillation ceases, check all resistors for overheating, watch for red-hot anode and screen grids. A shorted turn in the line output transformer can cause this. If a raster is present, and if the line output valve screen gets red hot in the case of a separate oscillator being used, check drive from line oscillator output to line amplifier. Another cause for the line output stage anodes and grids getting red-hot is a C.R.T. with shorting electrodes; pull off the tube cap and if output stage returns to normal the tube must be checked. (Switch off first!)

Line ringing; vertical bar or bars.—Check line scan coil resistor and condenser damping components and also the width coil (see "striations").

Very bright line on left caused by line foldover. Check line linearity control and its components and the efficiency diode.

Lack of width.—Check H.T. voltage, rectifier and line output valve for low emission, and all its resistors for increase in value. Screen or cathode resistors altering in value in this stage will prevent the stage from operating at its full efficiency. If a separate generator (oscillator) stage is fitted, check this valve for emission and its output condenser for correct capacity. Increasing the width may overdrive the valve and cause distortion. If no fault can be found shunt the line scan coils with a high voltage capacitor of just sufficient capacity to give the required width and refocus. A 200 pF-750 pF condenser will do. The efficiency diode should also be checked, especially if the raster is not linear.

Sawtooth edges on all verticals, ragged picture. Check the line output valve and line transformer (see sync faults).

Left-hand side stretched.—Check the damping resistor and condenser across line scan coils for high resistance and capacity and the anode resistor in the line generator. In extreme cases of non-linearity a white bar on the left may be seen.

Left-hand side compressed.—Check the damping resistor and condenser across line scan coils for low resistance and high capacity. A low voltage on the screen grid or a high bias voltage will also have this effect. Check the efficiency diode.

Right-hand side cramping and foldover. Drive voltage may be too high. Adjust drive control if provided or check the capacity of the condenser coupling the line generator anode to the line amplifier control grid. Check the line output valve for low emission, also the booster diode. Check the bias resistor in the line amplifier, and the screen grid resistor for high resistance. Alteration of bias resistance will also affect width: a low bias causes a cramped right-hand side.

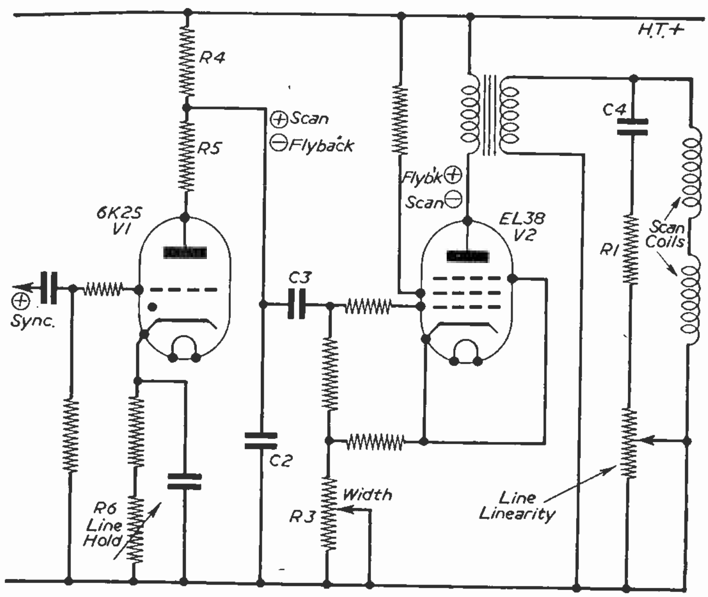


Fig. 24.—A thyratron timebase circuit.

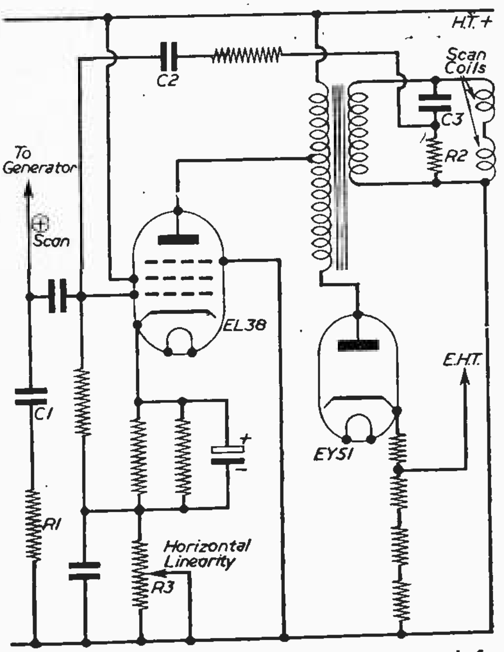


Fig. 25.—Line output stage with feedback network for linearity.

Lack of width on the right with extended left.—Check the efficiency diode and control grid resistor in line output stage; the line output valve and the H.T. line voltage.

Foldover can also be caused by shorting turns on the line output transformer.

Diagonal white lines across the screen from corner to corner. Suspect booster diode fault.

Diagonal band across screen. Check for shorting in line scan coils.

Bowed verticals appear while servicing. Keep speaker magnets and transformers, chokes, etc., away from the tube, and the speaker away from the line valves or the line may refuse to hold. If the fault persists check the H.T. smoothing condensers.

No raster, no EHT, in self-oscillating line output valve, with the line whistle still operating but weak. This is usually caused by shorted turns on the EHT overwind.

Horizontal drift.—If the set is fitted with flywheel synchronisation, intermittent drifting will take place if any alterations occur in the characteristics of the two diodes associated with this circuit.

Horizontal drift when not caused by the line generator or its components can be caused by the coupling resistor from the sync anode to the line generator altering in value. Also examine the components of the line clipper if fitted.

Picture ripples when camera swings rapidly. Check H.T. smoothing condensers.

Picture will not lock in a horizontal direction. This is the most common fault in the timebase. Check the line oscillator valve and hold control. The fault will nearly always be found to be increase in value of the resistor connected in series with the hold control. A leaky charging capacitor should also be suspected. Where a blocking oscillator transformer is used this should be suspected last, as a fault in this will also distort the scan if turns are shorting. If the windings have developed a high resistance, weak horizontal locking is usually present. Do not forget to check the input to the generator from the sync output (see sync faults) and the line clipper stage if fitted.

Wavy edges on raster and verticals wave slowly down the raster. Poor smoothing or interaction of frame pulse on line. Do not confuse this with sound on vision. Long "S" shape on edge of raster with one dark horizontal bar across denotes poor smoothing in half-wave rectification power supply. Check the electrolytic smoothing condensers in the H.T. line, and the smoothing condensers in the EHT supply if it is mains driven. Another check for mains ripple is to reverse the mains plug and the bar will alter position. Two "S" shapes, one "S" being above the other, accompanied by two dark and light bars is the same fault as above but occurs in full-wave rectification circuits.

Red-hot efficiency diode.—Examine the cathode condenser. This was a common fault in the Ferguson 978T. The .5 μF develops a dead short and the PY31 anode overheats. The replacement condenser must be of 500 v. D.C. working.

Faulty generator.—Do not always suspect the line amplifier and EHT rectifier. A faulty generator can cause tearing, a touchy line hold, lack of width, a dim picture, poor focus, and even make the size of the raster vary with picture content. Check the generator valve for fault or low emission and the coupling condenser to the line amplifier.

RESEARCH FLIGHTS BY RADIO SCIENTISTS

SCIENTISTS of the Radio Research Station D.S.I.R. are flying with the Meteorological Research Flight of the Air Ministry to obtain new data affecting radio wave propagation. They are measuring and recording changes in the refractive index of the lower atmosphere at heights up to at least 10,000ft. using a microwave refractometer specially built at Slough for this work.

The refractive index is a measure of the property of the air which produces bending of radio waves. Under certain meteorological conditions the strength of an ultra-high frequency signal at a receiving station beyond the horizon is considerably influenced by the atmospheric structure and the variation of the refractive index. Earlier methods of measurement have produced only limited information on this feature of the lower atmosphere—and it is hoped that this airborne technique will fill in the gaps in existing knowledge.

The first stage in this research began at Slough about a year ago, when scientists started construction of a suitable microwave refractometer which could be installed into a Hastings aircraft. Equipment proving flights followed, during which the apparatus was tested under varying conditions. Now the scientists look forward to going ahead with the actual measurement work.

TELEVISION RADIATION

ITS CAUSES AND CURE

By "Engineer"

THE purpose of this article is to assist the home constructor and make newcomers aware of the interference caused to radio sets by an unscreened television receiver. The interference can be particularly bad in large blocks of flats where many television receivers are operating. The unfortunate radio listener is in a hopeless position in these circumstances unless certain precautions are taken.

Receiver Design

In the last few years, commercial receiver manufacturers have gone to great lengths to prevent radiation from the line timebase causing interference with neighbouring radio receivers. In an effort to reduce excessive radiation all manufacturers now work within the accepted limits of a B.R.E.M.A. standard passed several years ago.

In the writer's opinion very few constructors go as far as the manufacturers in screening receivers. Sometimes constructors use no screening at all. As for the real experimenter, he is never satisfied until perfection is obtained and therefore the receiver never sees an ordinary cabinet, let alone a screened one.

Old receivers and certain types of old surplus line transformers and components purchased by constructors are the worst offenders.

All television receivers cause a certain amount of interference with radio reception. This is due to radiation from the line timebase. This radiation is rich in harmonics and its fundamental frequency is approximately 10 kc/s. The resulting interference appears to be worse on the Long waveband. The Light programme on 1,500 metres (200 kc/s) is particularly affected as 202.5 kc/s is the 20th harmonic of the line timebase frequency.

How Interference Travels

Interference travels from TV set to radio by three main routes: (i) by direct radiation and pick-up; (ii) by radiation from the TV aerial owing to poor layout or faulty decoupling in the TV receiver. (Also, that part of the aerial lead in the set may pick up radiation direct from the line timebase circuit); (iii) by way of the mains wiring.

The crux of the whole situation is the line transformer. In some older models this transformer was provided with a metal casing, but nowadays it is supplied unscreened. To reduce radiation, not only must the transformer be screened but the screening should also include the line output valve, the booster diode and the width and horizontal linearity controls. All these components can be fitted into one screening box if desired or into separate boxes. Where the valves are included in the same box as the transformer it is wise to place a screen between the valves and the transformer to prevent the heat from the valves melting the transformer wax or affecting its frequency. The box should be of generous

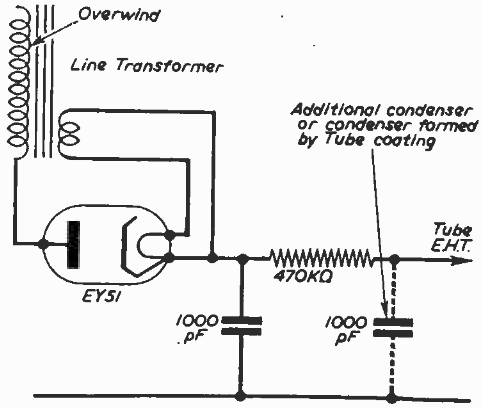


Fig. 1.—Additional smoothing provided by the tube coating.

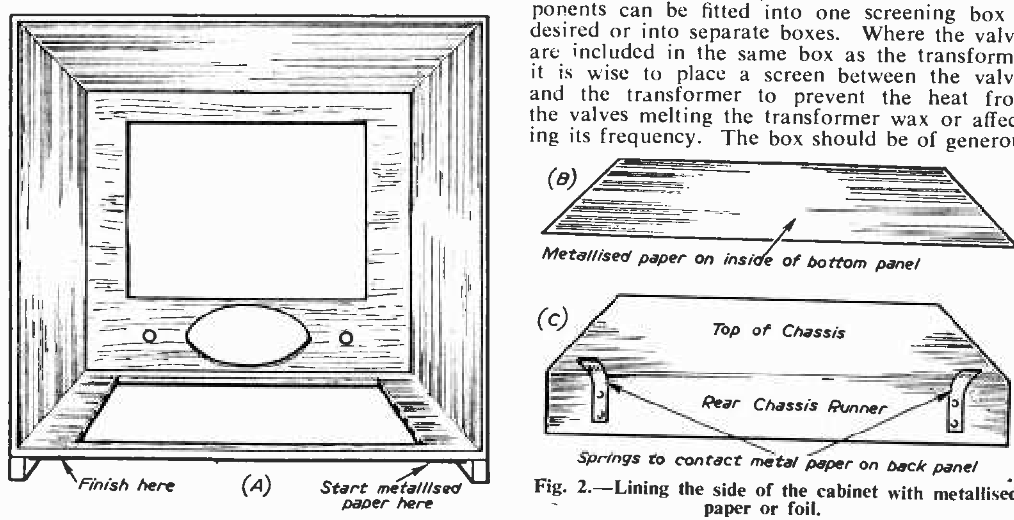


Fig. 2.—Lining the side of the cabinet with metallised paper or foil.

proportions and at least an inch from the transformer all round including the top. It should be adequately ventilated at the sides and top and painted matt black to prevent heat reflection, and most important of all it should make good contact with the chassis and there should be at least two or more connections from the box to the chassis. Holes should be cut or drilled in the

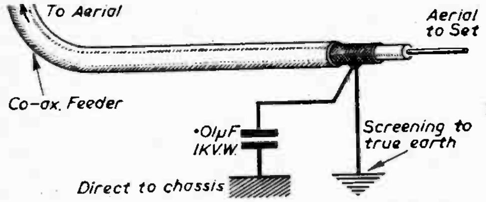


Fig. 3.—The screening of the coaxial lead should be connected direct to earth.

chassis round the base of the transformer to allow an upward draught. You may think the battle is nearly over and that we have all the culprits boxed up, but there are two more still at large, namely the scanning coils and the tube coating.

The Scan Coils

The deflector coils can be screened by wrapping paper-backed metal foil coaxially round the coils and connecting the foil to the chassis, or the coils may be placed in an aluminium can. As the pulse voltage on the line coils is rather high, care must be taken against insulation breakdown between the coils and the metal foil.

If the tube is provided with an external graphite coating make sure that the phosphor bronze spring is making good contact with the coating and chassis. Two springs are required for maximum efficiency. Good connections here will help to reduce forward radiation from the scan coils.

Whether the tube is provided with an external graphite coating or not, an extra modification will help (Fig. 1). Some receivers have the EHT lead taken direct from the rectifier to the tube anode cap. This lead should be broken preferably at the rectifier end if there is room and a $\frac{1}{2}$ watt resistor value 100kΩ to 2MΩ should be inserted—470kΩ is a popular value in this position, but the value must be found by experiment. Now connect a high voltage condenser between the tube anode cap and chassis adjacent to the resistor, its value being .001 μF and its working voltage will depend on the final anode voltage, this may be any voltage from 6 kV to 16 kV.

Metal Foil Screening

Owing to the layout of certain models it may not be possible to screen all the line components mentioned, if this is the case the alternative is to glue metal foil (paper-backed) on the inside back and bottom panels and connect these to the chassis *via* phosphor bronze springs (see Fig. 2). The cabinet top and sides should be treated in the same way. As the foil cannot be soldered it should be glued to the cabinet in one piece, starting on the outside of the cabinet underneath. Then when the bottom panel is in place with the foil facing inwards, electrical contact can be made without the use of a spring connection. When the chassis is inserted this will also make contact with the foil. The ventilation holes in both panels must not be covered and will have to be remade by puncturing the foil when the glue is dry. Latex adhesive is the most suitable as it is not affected by heat generated inside the cabinet. As a safety precaution, make sure it is not possible to touch any of the metal foil once the panels are in place.

Radiation Through Walls

As back radiation appears to give the most trouble, especially if a television receiver is installed against a party wall, screening the back panel as given above will help to cut interference to a minimum. Even the simple expedient of placing a metal tray at the back of the receiver and earthing it has cut down radiation and made listening bearable for the unfortunate neighbour. In the place of metal foil, the entire inside of the cabinet including the back and bottom panels can be painted with graphite if desired. The procedure regarding connections and precautions are the same as for the foil. All the above remarks apply to direct coupling between the two receivers. Another test can be carried out if direct coupling is suspected by disconnecting the aerial from the TV receiver. If the interference persists, direct coupling is almost certain to be the culprit.

Indirect coupling. If interference is diminished somewhat by disconnecting the TV aerial, this indicates that the interference is mainly due to radiation from the aerial system. The following modifications to the TV should then be tried. Earth the outer screening of the coaxial cable direct to a good low resistance earthing point (see Fig. 3). Connect a .01 μF 1,000 v. condenser from the chassis to the coaxial cable screening. Connect a .5 μF condenser from the H.T. line to the nearest chassis connection (Fig. 4). This condenser should be connected as near as possible to the line transformer H.T. feed.

Check that all the screened parts of the cabinet are making good contact with the chassis.

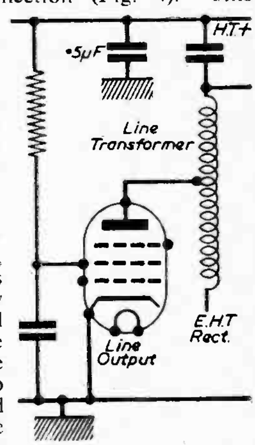


Fig. 4. — Additional smoothing for the H.T. line.

The Aerial Lead

Where a multi-channel tuner unit is in use, the re-routing of its coaxial aerial cable may be necessary to avoid pick-up. If this cable runs underneath the chassis from back to front, it should be moved to run along the outside of the chassis runner and the aerial input coaxial cable screening true earthed. Make sure no part of the coaxial screening comes in direct contact with the chassis runner if the receiver is of the A.C./D.C. type.

No direct connection should be made between the chassis and an external earthing point unless the receiver is working from a double wound mains transformer which completely isolates it from the mains.

When radiation from the timebase finds its way into the mains wiring, this can cause as much trouble to radio reception as direct coupling. Each pole of the mains supply should have a condenser of .05 μF. 600 to 1,000 v. working connected between them and the earth terminal (see Fig. 5). A more effective method is to fit suitable filter chokes and condensers in both leads of the mains supply after the on/off switch. These can be home wound or a filter can be supplied ready made by Belling and Lee Ltd.

A filter suitable for incorporation in the set lead is the type L300/3 rated at 1 A or the L305 at 2 A. These may both be used for radio or TV mains inputs, and will reduce line timebase whistle on the medium and long waves.

When designing a filter the maximum value of capacitor for connecting across the mains supply should be 0.5 μF and fuses should always be fitted in both wires of the supply on the mains side of the filter to protect it in case of capacitor breakdown. The paper condensers should be

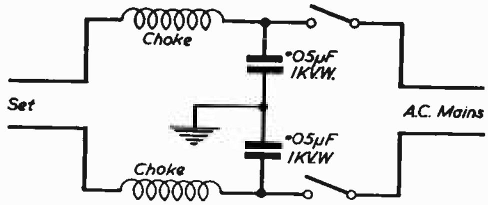


Fig. 5.—Preventing feedback to the mains by means of choke/capacitor network. This is similar to the Belling-Lee L300/3 filter unit.

tested before use, and new stock used, although some ex-Government Mansbridge types (metal cased) are suitable. Other types of ex-Government condensers stripped out of units are nearly always leaky and should not be used.

Storage

Paper condensers that have to be stored for future use should be kept in a polythene bag or a glass jar with a screw top lid, as it is almost impossible otherwise to keep the damp out.

Winding the Choke

A low-resistance filter choke can be wound at home to reduce interference in general from reaching the receiver. This choke consists of 300 turns of 26 s.w.g. enamel covered wire wound on a ¼in. former, with side cheeks 1½in. in diameter and ½in. apart. Its resistance is about 2½ ohms.

Parasitic Oscillations

In commercial TV receivers steps are taken to prevent interference caused by the re-radiation of parasitic oscillations generated in the receiver and therefore this is seldom of a serious nature. In a home built receiver, however, care should be taken to see that this is kept to a minimum. Particular attention should be paid to the oscillation stopper resistors in the grid and anode circuits, especially in the line output stage. (These can be 10 to 30Ω. ½ watt.) Ferrite beads could be threaded on to the anode and grid leads as close to the valve as possible.

The Radio

The listener can also take steps to reduce the radiation hazard. The radio aerial should be disconnected to ascertain whether radiation is being picked up by the aerial or the set wiring. If the interference persists with the aerial disconnected, the following can be tried. The receiver should be moved from a party wall and tried out in different parts of the room. Screen the cabinet with foil. If the whistle diminishes when the aerial is removed the siting of the TV and radio aerials downleads can be altered in an effort to keep these as far apart as possible.

A further improvement to interference free reception is to fit a screened downlead to the radio aerial. Providing the feeder does not exceed some 20ft. in length it will not be necessary to fit a matching transformer.

The radio listener can also fit filter chokes and condensers in the mains lead to prevent interference reaching his set by this route. Condensers alone will often reduce the interference.

FITTING TV INTERFERENCE SUPPRESSORS (*Continued from page* 486)

fitted on the brush side of the field coils. The first stage is to remove the brush leads from the holders, and a choke of suitable rating is inserted in each lead (see Fig. 1). The wire ends of the choke must first be covered with sleeving and the connections then soldered. Two capacitors, or a double capacitor are used. The wire ends are sleeved and a capacitor connected to each brush holder. The second wire of each capacitor is then connected to the frame of the motor, as shown in Fig. 1. If a double capacitor is used one wire is connected to each brush holder and the third wire to the motor frame.

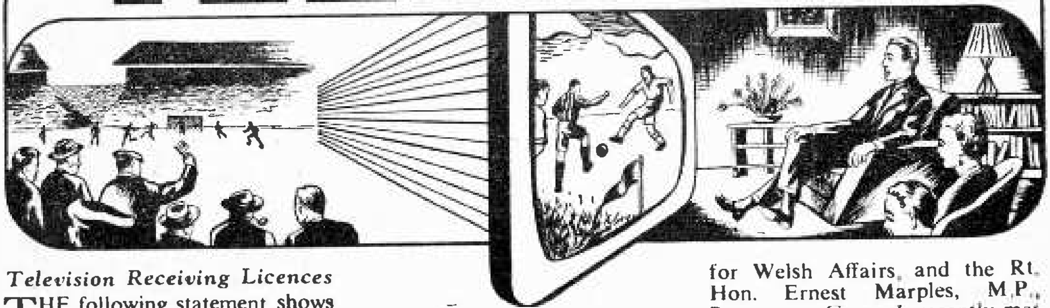
There is not usually a lot of spare room in these motor cases, but the chokes can be tucked in beside each field coil. A way can usually be found if the situation is considered.

Fitting Extra Chokes

Should a further pair of chokes be needed to obtain better results in a stubborn case, they can be incorporated into the leads on the supply side of the appliance, shown dotted in Fig. 1. This second pair of chokes may be mounted in the hollow handles of hair dryers and vacuum cleaners. If this is done the heater of the hair dryer will be in circuit and the current rating of the chokes must be chosen with this fact in mind.

A suppressor system for thermostats is shown in Fig. 2. Chokes are incorporated on either side of the contact breaker, and a 470 pF capacitor is then connected across the contacts.

TELENEWS



Television Receiving Licences

THE following statement shows the approximate number of Television Receiving Licences in force at the end of February, 1959, in respect of wireless receiving stations situated within the various Postal Regions of England, Wales, Scotland and Northern Ireland.

Region	*Total*
London Postal	1,677,785
Home Counties	1,179,081
Midland	1,421,129
North Eastern	1,489,990
North Western	1,257,708
South Western	744,960
Wales and Border Counties ...	543,285
Total England and Wales ...	8,313,938
Scotland	734,503
Northern Ireland	104,486
Grand Total	9,152,927

Colour Television

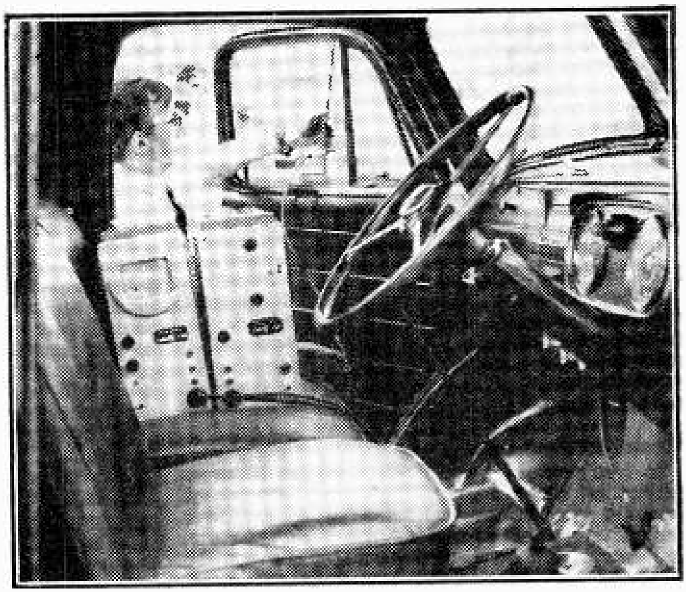
THERE have been a number of experimental colour television broadcasts undertaken by the BBC and the international aspect of this problem will be studied at the forthcoming C.C.I.R. International Plenary Assembly being held at Los Angeles in April. In the meantime, it is interesting to note that apart from the U.S.A., where regular schedules of broadcasts are made using the N.T.S.C. system, there have been colour transmissions in Havana and Japan, while it is anticipated that France will follow suit during 1959.

Test Transmissions from Mendlesham Station

THE Independent Television Authority plans to send out low-power test transmissions from its Mendlesham station near Stowmarket in the summer. The precise date depends on the speed with which the 1,000ft. transmitting mast can be erected and this in turn depends upon weather conditions. However, as far as can be ascertained at this time, test transmissions might begin in July or August. Signals from one of the sets of Pye transmitters will be sent out from a temporary aerial mounted about half-way up the permanent transmitting mast. The effective radiated power will be approximately 10 kW on Channel 11, horizontally polarised. All being well, the Authority hopes to commence full-power trade test transmissions on October 1.

TV Service for Wales Discussed

THE RT. HON. HENRY BROOKE, M.P., Minister for Welsh Affairs, and the Rt. Hon. Ernest Marples, M.P., Postmaster General, recently met the Welsh Parliamentary Party at the House of Commons for a full discussion on the question of a self-contained television service for Wales. The Welsh M.P.s stressed the importance of such a service to Welsh culture and the Welsh language, which the two Ministers gave assurance that they fully recognised. The M.P.s asked that the needs for such a service should be fully taken into account in considering the future allocation of TV channels. The Ministers explained the technical background and assured the M.P.s that the case which they had put forward would be carefully considered.



Television is being employed by Vauxhall Motors to test car behaviour under varying conditions. (See page 493.)

Open Circuit Television

TO help in studying the behaviour of cars and trucks in motion, Vauxhall Motors' engineers are now using open-circuit television at the Vauxhall Test Centre at Chaul End. near the company's Luton and Dunstable factories.

The camera, mounted on the vehicle close to the component being observed. is connected to a small transmitter inside the body or cab. The aerial is fixed to the roof of the vehicle, and transmits to a receiver aerial on the roof of the nearby Research Laboratory. This is connected to a normal TV receiver inside the building. where several people are able to study the picture at one time. This new "tool" has already successfully revealed the cause of intermittent localised vibration on some models at certain critical speeds.

North Eastern ITV Homes

A MID-FEBRUARY survey of the North Eastern ITV area —the second to be carried out by Television Audience Measurement Limited (TAM) since the area opened on January 20th—revealed that 358.000 homes were then receiving ITV programmes—an increase of 68,000 in approximately four weeks. This rapid increase brought the density of ITV homes to 43 per cent. of all households in the area, a very much higher percentage than that recorded in any other area after a comparable period.

TAM estimate that the number of homes in the North Eastern area receiving ITV is 369.000 as at March 8th last. Individuals in these homes number 1,325.000, rather more than half of the area's 2,615,000 inhabitants.

Scottish TV's New Video Tape

A NEW audio-video tape recording machine—Ampex —recently installed in the Master Control studios of STV, is now ready to reproduce a complete programme on the screen within two minutes of the original production. One of the latest recording machines in the country, the Ampex is basically a "memory," as it records a complete programme, both in sound and vision, in such a way that it is almost indistinguishable from the original.

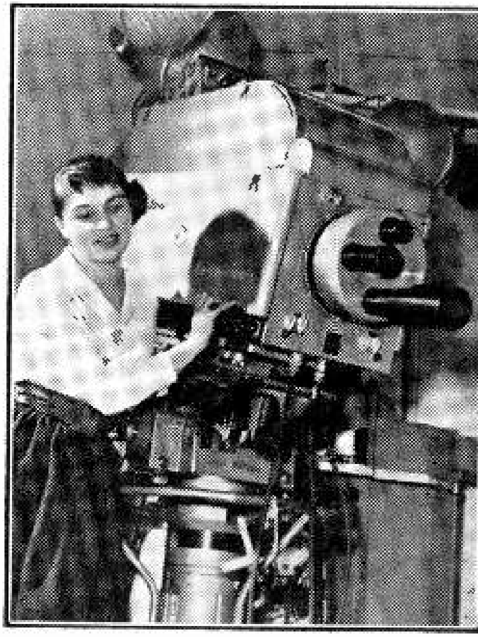
Mr. A. Becker, STV's chief engineer, said: "We shall now be able to produce a programme at any time of the day and insert it into our outgoing schedule at any desirable time. It can be flashed back on the screen straight away in the time that it takes the audio-video to rewind the tape, approximately two minutes."

British Standard

"FIXED electrolytic capacitors (aluminium electrodes) for use in telecommunication and allied electronic equipment." (Part 1: General requirements and use)—B.S. 2134: Part 1: 1959. Part 2—to be published later—will specify sizes, ratings, etc., of a standard range of electrolytic capacitors. Use of this standard (as with others in the series) requires reference to B.S. 2011. "British Standard climatic and durability tests for components," which fully describes a range of tests to which components may be subjected in accordance with the requirements of the relevant standards for the individual components. Copies of the Standard may be obtained from the British Standards Institution, Sales Branch, 2, Park Street, London, W.1. Price 7s. 6d. (Postage will be charged extra to non-subscribers.)

Western Nigerian Television Equipment

PREMIER Obafemi Awolowo's Western Nigerian Government has given a "letter of intent" to Marconi's Wireless Telegraph Company Limited of Chelmsford, to purchase from them television transmitting and ancillary equipment for the Western Nigerian television network to be inaugurated later this year.



Showing the Marconi 3-tube colour camera at the Leipzig Trade Fair.

Industrial Photographic and Television Exhibition

A MAJOR advance in the history of industry is now being projected (April 20th to 24th) in the Royal Albert Hall, London. The Industrial Photographic & Television Exhibition is the first full-scale display of its kind, designed to speed and raise the efficiency of modern industry through the art of photography. It is sponsored by Industrial & Trade Fairs Ltd. The show has the powerful support of the various trade, technical and specialist periodicals of the younger but no less important sciences in industry.

Equipment on show ranges from basic standard plate cameras to photo-electric controlled units. The whole gamut of development is being shown —industrial television, infrared photography, radiography, spectrography, photomicrography, including cathode-ray oscillographs and other processes.

TURRET TUNERS

DETAILS OF THE INSTALLATION AND ALIGNMENT

By Hugh Guy

AT the stage reached in last month's article the circuit is almost ready for test, the incorporation of a Band I stop filter being left until the necessity for it has been proved.

First, however, tag C on the terminal board (Fig. 3) at the rear of the convertor must be accommodated. The circuit shows that tag C is connected to the earthy side of the cathode bias resistor in V1. Normally this point would be connected to a variable resistor, functioning as a contrast control in the set in which the convertor is installed. For test purposes, this point may be earthed directly *via* tag H on the same terminal strip, thus giving the convertor maximum gain. This connection may be left permanently if the picture ultimately obtained proves satisfactory, but should it appear too contrasty then a 1,000 ohm wire-wound potentiometer, connected as a variable resistance, should couple tag C to earth.

Supplies to the convertor may now be connected. The heaters in the convertor are series-wired, and are arranged to be connected in series with the existing set heater line-up. The TV set must necessarily be of the A.C./D.C. type having a series heater line-up of 0.3 A current rating.

Superhet and Straight

When the convertor is connected to a superhet set, as explained previously, two valves are removed from the set, as their circuit function is replaced by the convertor. The total heater voltage therefore remains the same in this case.

In the straight set, however, the two convertor valves are an *addition* to the heater chain, and, strictly speaking, some adjustment of heater voltage should be made accordingly. A total of 16 v. is required to supply the circuit, and should be offset by appropriate reduction of the fixed resistance normally present as part of the heater chain of the set.

If this is impossible then the mains tapping on the set should be reset to the next lowest range of input voltages. This will increase the H.T. voltage as well, but in general this should not seriously adversely affect the life of the set. For the worried reader, however, a safety precaution can be adopted : this is to change the position of the point at which the rectifier is tapped into the heater chain to some 20 volts or so below the present set value, while still readjusting the mains tap as recommended above.

As a final comment most sets will work satisfactorily unmodified in this respect, being unaffected by the additional 16 v. of heaters added to the chain. On 240 v. supply the heaters will then be operating at approximately 7 per cent. lower voltage than required.

The heater chain is generally most accessible at the base of the tube and one lead of the two to the tube heaters should be disconnected and wired in series with a lead to tag D, say, on the rear terminal. The other heater tag, tag F, should then be connected to the tube heater pin to provide a series circuit for the heater chain.

The earth lead—tag H—is easily accommodated, being wired to the nearest convenient point on the main chassis. Tag M must be connected to the positive H.T. line, and in some sets this is available at the second anode pin on the picture tube base, where the tube in use is a tetrode.

One further point remains to be checked before proceeding, it is an advantage to know which of the thirteen channels provided is the correct one for I.T.A. signal reception. The continuous rotation obtainable with the switch makes this a little difficult. The appropriate switch position —number 9 for London I.T.A.—can be identified, however, by an examination of the wiring associated with the switch inside the convertor.

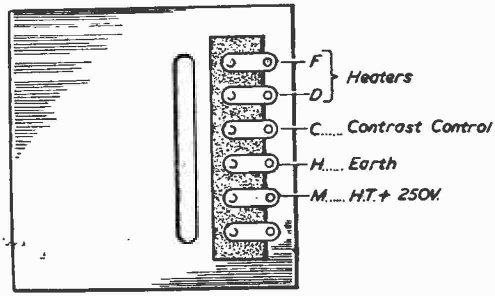


Fig. 3.—The terminal board at the rear of the tuner.

The wiring loop starts on position 1, next to the tag to which one connection of L5 is made. Count round eight positions in a clockwise direction viewed from the spindle, and the switch wipers should now be in contact with the ninth channel.

Alignment

For test purposes some sort of Band III signal should be obtainable from the existing Band I array. If the latter is selective, however, owing to a complicated series of elements, it may be necessary to improvise. If this is necesssary a temporary Band III aerial can be prepared from two 1ft. 2in. lengths of rod, connected as a dipole to a length of coaxial cable. The other end of the coaxial cable should be terminated in tags A and B on the top of the convertor, the screened braiding being connected to tag B.

To provide an output lead to the set, a short length of coaxial cable should link the aerial socket on the set with tags G and H on the four-way terminal strip on top of the chassis, tag H being earthed. Ensure that the polarity of the mains is such that the chassis will not be live, and then switch on.

(Continued on page 496)

Replacing C.R. Tubes—5

FURTHER PYE MODELS ARE DEALT WITH THIS MONTH

By H. Peters

(*Continued from page 445 of the April issue*)

PROCEEDING with the unboxing of Models V4, VT7 and V7, unsolder the red and black loudspeaker wires from the tag strip beside the scan coils, remove the tube base, the ion trap magnet (note its setting), the EHT connector, undo the two self-tapping screws holding the scan coil tag strip to the tube cradle and remove the four 2 B.A. bolts with saucer washers holding the scan coil and focus assembly to the tube clamp and remove the whole assembly, chassis and turret to a safe place. Lay the set face down on a cloth and remove the four screws on the outside of the tube clamp which will release the clamp from the tube and enable the tube to be lifted out.

On 17in. sets there are four bars which brace the tube clamp to the cabinet farther down and these should be detached from the tube clamp and swung to the sides prior to the removal of the clamp. The two inner (self-tapping) screws on the two bars on the outside of the tube clamp are locking devices and should be slackened off a turn where fitted.

Reassembly

Thoroughly clean the cabinet inside and all parts before reassembling, bearing in mind the fact that the "safety glass" is Perspex and if not cleaned with an anti-static compound will attract dust during the refitting process. Refit in the reverse order, making sure that the bronze springs on the tube clamp contact the graphited bulb, and that the thick rubber ring is placed over the tube neck first. It is essential that no strain is placed upon the tube neck when the deflector coils are refitted and a sleeve of corrugated cardboard can be fitted as a centering device. Refit the ion trap magnet, tube base connector, EHT connector (before replacing turret), resolder loudspeaker wires and set up as for VT17.

Screen Cleaning

Withdraw chassis to extent of leads, lay set on its non-turret side, remove card bottom, bracket holding speaker and rectangular clip beside it. Peel off the sticky tape and slide the Perspex sheet down through the slot. If it is at all stiff a clammy hand placed flat on the middle of the Perspex usually provides sufficient adhesion to get it started. To re-use the sticky tape, heat it in front of the fire.

Boosting

Use a 6.3 v. transformer, and connect the secondary to pins 1 and 12 of the tube, having previously removed and shorted out the existing heater wiring. Mains for the booster can be picked up between chassis and tag No. 5 of the voltage selector.

V14 and V14C Removal of C.R.T.

Remove card back and four large bolts underneath the chassis. On V14C remove four front knobs and loudspeaker leads and withdraw chassis back through cabinet. On V14 lay set on it face and lift wooden part of cabinet backwards off set. Then remove four front knobs and unscrew black plastic front. Both models:—Slacken the four screws which tighten the metal bands from the tube bowl to the scan coils. Remove EHT lead, ion trap magnet, and base. Take off the two brackets at the top corners of the safety glass and lift out the glass (*). Remove the four clips holding the rubber mask in position and remove the tube and mask.

Refitting

Clean and fit tube to mask face downwards. Refit to chassis, making sure that the rubber ring around the tube neck fits centrally over the scan coils. Fit the clips, window and corner pieces back and tighten up the four metal bands so that the focus assembly is concentric with the tube neck. Ensure that the scan coils are well forward against the tube by slackening the four screws in the twisted slots and screwing the plate in. Refit ion trap magnet, EHT connector, C.R.T. base, and set up picture as for previous models.

Screen Cleaning

Proceed as for changing C.R.T. as far as (*) above.

Boosting C.R.T.

Use a 6.3 v. transformer as for VT17. Obtain

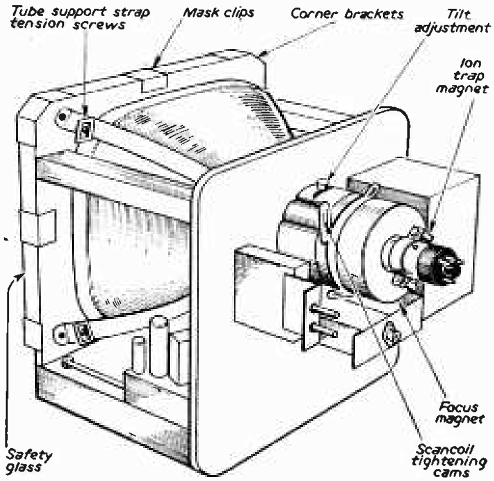


Fig. 12.—Details of the tube assembly on Models V14 and V14C. See notes above.

mains for it from between chassis and the centre contact of the voltage selector plug.

Important.—Most of the work in the above tube change is on stiff Philips headed self-tapping screws which are close to the tube. It is preferable to buy the correct sized Philips screwdriver before you start than to use an ordinary screwdriver and perhaps seriously damage some component.

VT7 14in. Transportable

C.R.T. removal : Take off the two halves of the outer cover by removing two screws from the underside flange of each half. Remove the front escutcheon and safety glass (six screws around the edge) (†). Remove the EHT cap, base connector and ion trap magnet, slacken band around the tube face and withdraw the tube. Reassemble in the reverse order.

To Clean Screen

Proceed as above as far as (†).

To Boost Tube

Connect 6.3 volt (plus boost) winding of transformer to pins 1 and 12 of tube having removed previous wires and taped them back unshorted. Pick up mains from the central (thick pin) contacts of the two voltage selector plugs, *not* between either of these and chassis, as this receiver incorporates a double wound transformer to isolate it from the mains.

Note.—For convenience the two chassis are hinged and may be swung outwards upon release of the central front screw.

Pye FV1 and Other Models in the "FV" Range. Changing the C.R.T.

Remove back and three screws holding rear chassis flange. Unplug 12-way lead from chassis, EHT lead and the pink and blue free leads. Chassis will now withdraw. Stand set on face, unsolder loudspeaker at tag strip, remove C.R.T. base connector and ion trap magnet, undo large nuts at "scissors" supports on the side of the tube cradle and lift out cradle placing it face downwards. Slacken band around tube bowl and lift tube cradle off tube and mask. Clean, fit new tube to mask and replace in reverse order, making sure anode cap comes in the same relative position.

Refitting

Adjustment of the scan coils so that they are tight against the bowl is accomplished by slackening the clamp holding their canister and moving the latter forward. When reconnecting to the chassis the pink free lead goes to the line transformer, the blue one to the chassis beneath the tube base. Setting up as for VT17.

Boosting

Remove wires from pins 1 and 12 of the C.R.T., short the wires together and tape them off. Connect 6.3 volt side of boost transformer to pins 1 and 12 of C.R.T. Mains for the transformer can be obtained from the two shorted pins on the 12-way plug and the chassis wire next to them, making it convenient to service the set without first having to remove the transformer from the woodwork.

Earlier Models

The majority of earlier receivers have the tube strapped to the chassis. The method of changing them is thus self-evident upon unboxing and provided the general principles outlined in previous articles are observed, no difficulties should be experienced.

(*To be continued*)

TURRET TUNERS

(*Continued from page* 494)

After warming up, if all is satisfactory, the I.T.A. raster (or picture) should present itself, although the sound may not be present. On the other hand, the reverse state of affairs may be applicable, and in either event adjustment of the fine trimmer should yield both picture and sound.

If sound only is faintly discernible switch the tuner back to Channel 1 to receive the BBC programme, and then adjust the iron dust core of L8, the output transformer. for maximum signal. This procedure will ensure that the I.F. transformer is on tune. Reset the switch to the I.T.A. channel and readjust the trimmer capacity *via* the shaft on the switch spindle to obtain a picture with sound. Better coverage may be obtained by careful variation of the spacing of the turns on L5, using a matchstick, say. Some adjustment of L7 may also be necessary to optimise results.

Modifying Aerial Array

On completion of the preliminary alignment the screening cover should be replaced after switching off the set, and the cabinet drilled to facilitate mounting access to the controls.

However, should tests in conjunction with the correct aerial array show a prohibitively large amount of BBC breakthrough on I.T.A.—an effect which makes itself apparent as annoying varying bands of light moving across the picture, and in some bad cases actual BBC picture moving in a random horizontal fashion superimposed on the I.T.A. picture—then it may be necessary to modify the aerial array.

Greater protection against cross-talk can be achieved by tuning the aerial elements to I.T.A. resonant lengths only. On Channel 1, the BBC will still be received although the aerial will not be functioning as a true dipole.

An alternative and more academically correct solution, involving a little more work on the part of the reader, is to incorporate a simple filter circuit in the converter. This can take the form of a series-tuned circuit designed to resonate at 45 Mc/s, and coupled to the I.T.A. Channel contact on the input wafer of the switch and earth. As a rule, however, aerial adjustment is all that is necessary to obtain an acceptable picture on both channels.

A TV OSCILLOSCOPE—3

THE DEVELOPMENT OF THE COMPLETE CIRCUIT

By R. Coates

(*Continued from page 453 of the April issue*)

IN the cathode-follower valve-voltmeter circuit which was shown in Fig. 6 last month the voltage on the input grid is developed almost entirely across the cathode resistor in the form of a difference voltage which is then compared with the voltage across the resistor in the cathode of an identical circuit. The matching of valves or resistors is rendered unnecessary by the inclusion of the "set-zero" preset potentiometer, which should be placed in series with the cathode resistor which proves to have the lower resistance of a pair that are nominally identical. There is no need to measure these values if you do not have the facilities, as if you connect the potentiometer in the wrong circuit you will not be able to set the zero: the potentiometer should then be wired in the other circuit, when the setting will be found.

Potentiometer Value

The value of the "set-zero" potentiometer should be about one-third of the value of the cathode resistor, which should be calculated from the values of the voltage across them (assuming the cathodes to be at earth potential), divided by the required anode current in each valve. These currents should be the same. If the potentiometer will not zero the meter when set in either circuit, then the circuits are perfectly matched, and should be put out of balance by adding a resistor of value about half that of the potentiometer in the circuit which does not contain the potentiometer. On the other hand, if the potentiometer is found to have too low a value, then it should be placed in that circuit in which it comes closest to balance, and a resistor of value about half that of the potentiometer should be added in series with it. An alternative method of setting the zero is by adjusting the voltage on the grid of the reference valve: this may be done in the same way as the suggestion for the provision of Y-shift mentioned above.

The input grid resistor may have a very high value indeed, if it is so desired. The A.C. output should be taken to the potential divider gain control of the amplifier. Various ranges of D.C. measurement may be obtained in the usual way by switching in various values of series resistor to the voltmeter.

The Synchronisation Circuit

In most home-constructed oscilloscopes it is considered sufficient to use as a source of synchronisation signal the output of the final Y-amplifier. It is certainly possible to obtain reasonable results in this way, but here it is assumed that the constructor requires a better circuit than this simple arrangement.

A suitable amplifier circuit is shown in Fig. 7, which uses a high-gain pentode such as a 6AM6 or EF91. The biasing arrangements may be new to some, but it is the standard method of biasing many oscillators, e.g., the Colpitts oscillator used in most superhet radio sets. The principle is that, if the grid capacitor is initially uncharged, then grid current will flow when the grid is made positive by the incoming signal. This grid current will be of such a polarity as to charge the input capacitor in such a way that the grid will become negative. Naturally, the charge will leak away slowly through the grid resistor, so that the grid voltage will drift slowly towards zero again. This is prevented when the next positive peak of the waveform causes grid current to flow momentarily once more, thus restoring the grid to its negative voltage.

Pulses

Now, if we consider the anode current during this operation, we find that it is almost cut off for most of the time, but naturally, when the grid goes positive momentarily, the anode current reaches a high maximum. Thus we find that the waveform at the anode consists of a series of sharp, short pulses. These pulses will be negative, that is, the anode will normally remain at a voltage close to that of the H.T. supply, but will become more negative (i.e., less positive) during the pulses, so that a series of negative pulses will be delivered at the output. This is then joined directly to the synchronisation input of the timebase, that is, the screen grid.

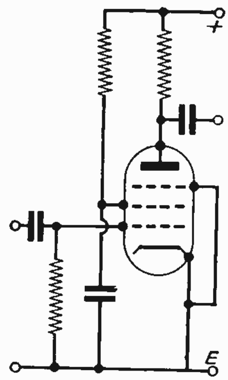


Fig. 7.—Circuit of the sync amplifier.

If we wish to display on the screen more than one cycle of the waveform being investigated, we may well find that the pulses provided by this circuit are of such great amplitude that the timebase will not lock to any but the exact frequency of the wave being investigated: we must then attenuate the output of the amplifier, and this is best performed by fitting a variable resistor in the anode load position in Fig. 7, and taking the output via the existing capacitor from the tap on the variable resistor. A potential divider circuit should not be used directly between the two circuits, as this will have an upsetting influence on the D.C. conditions of the timebase, so, if it is desired to use this particular method, two coupling capacitors will be essential.

Valve Life

It may be thought that the valve is being operated under adverse conditions with regard to length of service, but this is in fact not true. The value of the grid current flowing will be limited to a very small value if the grid resistor is fairly high, say, half a megohm. The value of the input capacitor will need to be determined experimentally: it is possible that in some designs the optimum value will need to be changed with frequency. in which case it is best altered by a switch ganged to the timebase frequency switch. The anode load can be high, and a quarter of a megohm would not be excessive: the screen resistor should be about twice the value of the anode load. The screen decoupling capacitor need not be large, and neither need the output coupling capacitor.

Distortion

There is one disadvantage of the use of this type of circuit, and that is the tendency to distort the incoming signal. If only one cycle is being examined, however, this distortion is of little importance, as the part of the trace which is distorted will be the part which occurs during, or very close to, the flyback. The distortion is caused by the sudden very short pulse of current which flows to recharge the capacitor: thus there are two methods of reducing it, firstly by using a small value of input capacitor, and secondly by feeding the circuit from a source of low impedance. The best input point is one of the Y-plates, but this is a high impedance source, so the amplifier may be fed from a cathode follower which is R-C coupled from one of the Y-plates.

Picture Display Facilities

This is the only point mentioned in the original specification which has not been covered by the description so far, but it is mainly a matter of providing suitable switching : the grid we have already mentioned as being brought out to the front panel for the brightness modulation, and the only other considerations concern the timebases. As the requirement in the oscilloscope is for a voltage deflection system, it would seem to be best to use the variable timebase for X-deflection, as usual, and insert. the Y-deflection at the normal Y-input.

The Complete Circuit

All the foregoing has been to explain the details of the basic design of the various circuits which go to make up the complete oscilloscope, and reference has been made to the interconnection of each separate circuit, but it is possible that some beginners have been confused by these cross-references even though they have been deliberately restricted for this reason. Accordingly, the complete circuit is shown in Fig. 8, and it is hoped that reference to this will clear up any remaining doubts or queries that may have come to mind.

On the left is shown the simple D.C. valve voltmeter circuit, as found in Fig. 6. Here, the circuit has been completed, to show the voltmeter range switch and the set zero control. Note that the output must be via a capacitor. The gain control system has been omitted from the completed circuit in order to avoid the confusion which would inevitably result from such complication of the diagram. However, the positions of insertion are marked, and full instructions are given in Fig. 5 for the wiring.

Although the input is shown via a capacitor, the negative feedback amplifier is here shown in its D.C. amplifier form. This is so that the complete diagram will tie up more closely with Fig. 4. The necessary modifications for conversion are detailed in the text.

X- and Y-shifts

The method of Y-shift mentioned in the text is shown in the complete circuit, coupled, as recommended, with the X-shift control.

The tube circuit and timebase circuit are exactly as described previously, and the only modification to the sync amplifier is that it has been connected to the negative supply rail instead of the positive. In actual fact, this makes no difference whatsoever, except to the consideration of the respective supply currents. The circuit, complete with its buffer amplifier, may be transferred to the positive supply without any modification. The buffer cathode follower is perfectly conventional in design.

Power Supply

It will be seen that the power supply circuit is of the form of Fig. 1(a), this being the most satisfactory for general use. There is no vital necessity for the use of full-wave rectification of the negative supply, and metal rectifiers are to be recommended. On the other hand, a conventional double diode rectifying circuit for the positive supply would be perfectly satisfactory. Modern rectifiers do not even require a separate heater supply, as they are made to withstand the high tension voltage being placed between heater and cathode. This point, incidentally, will need to be watched if valves are used in the positions marked for the sync amplifier valves, as they will need either a high heater-cathode insulation or a separate heater supply. The manufacturers' data should be consulted.

The grid of the cathode ray tube is seen to be brought out to the front panel for brightness modulation, and this terminal should be earthed when not in use, in order to prevent unwanted 50 /cs brightness modulation owing to the heater. As an alternative, it may be conected to the sync amplifier anode for fly-back suppression, the latter also being brought out to the front panel for external synchronisation purposes.

Valve Testing

There are many uses to which an oscilloscope can be put in addition to the normal one of waveform inspection, and one of the most useful is the display of valve characteristic curves.

The theory of the method is that a signal is applied to the grid of a valve, and simultaneously to the X-deflection plates: this signal need not have any particular waveform, and a sine wave will do just as well as a linear timebase. Now, if there is a small resistor in the anode circuit, a voltage will be developed across it which is at all times proportional to the anode current. If this A.C. signal is now displayed, via an amplifier, on the Y-deflection plates, the tube will trace out the grid voltage/anode current characteristic of the valve being tested. By measurement of the slope of this curve, the gm of the valve may be determined: the complete instrument is best calibrated initially using two or more valves of known gm, as most radio dealers have facilities nowadays for measuring this characteristic.

It will be a relatively simple matter to arrange that the anode, screen, and grid voltages are variable, so that the complete valve tester is fully versatile and can be used for a wide variety of valves.

Dynamic Characteristics

By the provision of a switched range of anode resistors, the dynamic characteristics of the valve may be measured. These are simply the mutual characteristics measured under operating conditions, i.e., with a sizeable anode resistor which causes large fluctuations in the anode voltage when an A.C. signal is applied to the grid. The anode resistor for measuring the mutual characteristic should be as small as possible, in order to give the minimum of such variation of anode voltage consistent with supplying a suitably large output signal.

As mentioned above, the input signal may be of any waveform: the frequency also is of no importance at all, and the amplitude should be sufficient to give a wide swing of grid voltage, so as to display the cut-off and grid current parts of the characteristics. The source providing the signal should have low impedance, and a heater voltage supply is perfectly suitable if of sufficient amplitude to drive the valve from cut-off to grid current in each cycle.

Frequency Response Testing

Another very useful application of the oscilloscope is the direct display of the frequency response of any component, such as a transformer, amplifier, or tuned circuit. The best source signal for this purpose is the timebase in the unit, which is displayed in the normal way. The output of the timebase is also used to control the frequency of an oscillator.

The oscillator is arranged in such a manner that its frequency of oscillation is dependent upon the voltage which is applied to an input terminal. This may be brought about in a number of ways all of which are too intricate to be discussed here, but any constructor who is interested will find quite a lot of literature has been published on this subject.

If the timebase output is used as the input to such an oscillator, then the frequency of oscilation will rise at a steady rate as the timebase output voltage rises, and then fall suddenly to its lowest value, this cycle being repetitive. As the frequency rises, so the spot on the cathode ray tube will move from left to right. The starting frequency is controlled within the oscillator, and the range of sweep of frequency is controlled by the sweep voltage amplitude applied to the oscillator input.

If the output of this oscillator is used as the input to the amplifier to be tested, e.g., an I.F. strip, the output of this amplifier is rectified and applied to the Y-deflection plates, then the spot on the screen will trace out the frequency response of the amplifier. With this trace on the screen, the tuned circuits in the amplifier may be adjusted to give the desired frequency response. The system is not, of course, limited to high frequencies: there is no reason why, with a suitable oscillator, the same system should not be applied to audio frequencies.

Null Indicator

The oscilloscope with its associated amplifier is a very effective null indicator. This is the type of indicator which is used to indicate a balance on an A.C. component-measuring bridge. One of the easiest to construct is the type called the

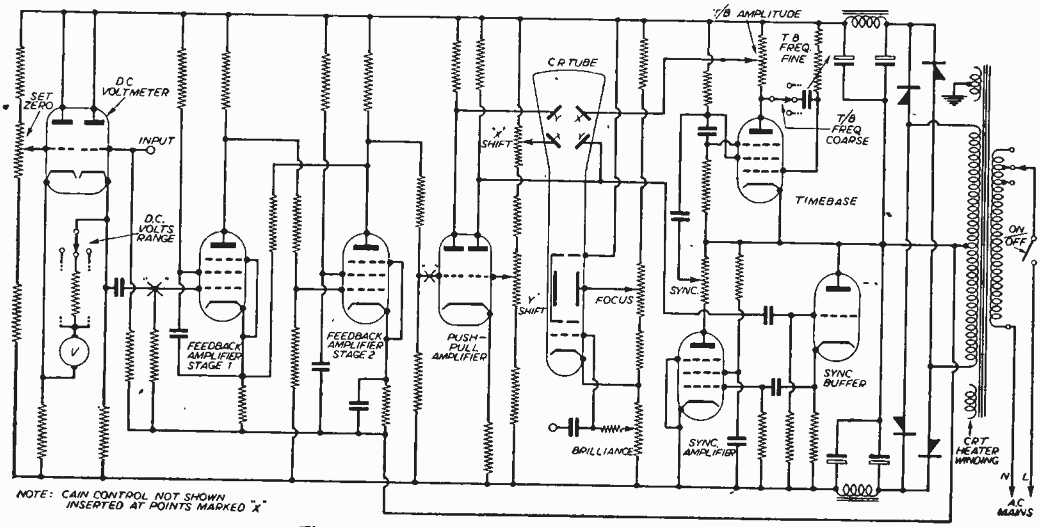


Fig. 8.—The complete theoretical circuit diagram.

transformer bridge, which is fed by a sine-wave oscillator of a suitable frequency. The input signal is fed to the primary of a transformer, which has a double-wound secondary. These two windings should be identical as far as possible. The component to be measured is connected between one end of the winding and earth, and the oscilloscope is connected between the centre tap of the double-wound secondary and earth. No signal will be seen on the screen when the other end of the secondary winding is connected to earth via a network which is identical to that being measured.

If an inductor is being measured, then it may well be inconvenient to compare it with another inductor, in which case there should only be a resistor in the "standard" arm, and a variable capacitor should be connected in series with the unknown inductor. When the null setting is found, the value of the inductor may be calculated from the well-known formula: $f = \frac{1}{2\pi\sqrt{LC}}$ or $1/L = 4\pi^2 f^2 C$ where f is the frequency in cycles, C is the capacity in Farads, L is the inductance in Henries. $\pi = 3.14159$ . . . .

The frequency of an unknown signal may be measured by the use of an oscilloscope by displaying it on the Y-plates, via the amplifier, if necessary. Then a known variable frequency is displayed on the X-plates, and adjusted in frequency until one of Lissajou's Figures is seen.

If the two signals are of the same frequency, then a circle will be seen. If the unknown frequency is half the known, then a figure-of-eight will be seen. If the unknown is twice the known, then a figure-of-eight will be seen, but lying on its side.

Still-picture Transmitter

By H. J. Barton Chapple, B.Sc.

MONOSCOPE equipment is used quite extensively by both the BBC and Independent Television Companies, to provide test card pictures for the benefit of the industry and the trade in checking receiver performance. This special apparatus is primarily a post-war development, but it is interesting to note that equipment was designed prior to the war for testing sets without in any way being dependent on an external transmitter for the signals. The vision signal itself was produced through the medium of a special type of tube which to all intents and purposes was a modified form of cathode ray tube. In place of the usual fluorescent screen was mounted a nickel plate on which was "printed" a picture. The picture, a positive one, was made from a half tone block, similar to those used in these pages, so that both half tones as well as black and white effects would be included in the picture.

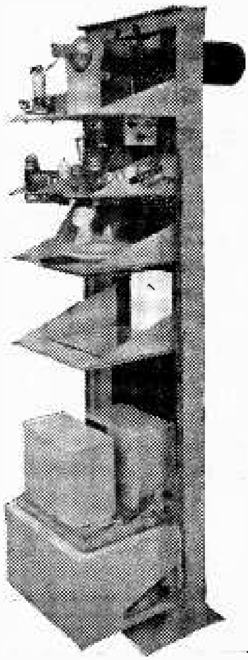
Function of Tube

The tube functioned on the principle of varying secondary emission. When the electron beam produced by the normal electrode assembly scanned the picture on the plate, varying numbers of secondary electrons were released according to whether the beam was traversing the metallic portion of the plate or the special composition filling the interstices of the metal. More electrons are released by the metallic portions than by the composition, and this varying secondary electron emission constituted the picture signal, being picked up by a collector anode formed by metallising the inside wall of the tube.

Equipment Housed in Two Racks

The whole equipment was housed in two racks. The picture tube, magnetically focused, was mounted in the top section together with a two-stage vision amplifier, the output from which constituted the vision signal proper. Below this was the monitor tube, mounted vertically, the picture being viewed in a horizontal mirror.

The necessary power supplies were at the base of the rack while the second rack housed the frame and line synchronising pulse generators of the picture tube and the cathode ray tube monitor. The signal output could be made to modulate a standard carrier fed round the factory and so provide a convenient and efficient test signal.



(Above).—The picture tube. (Right) The rack mounting for the equipment.

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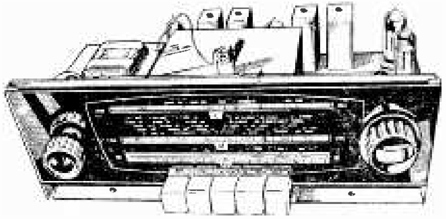

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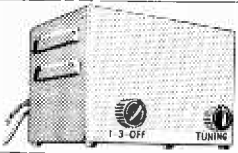

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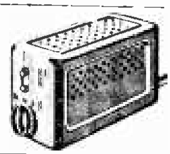

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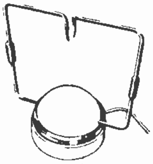

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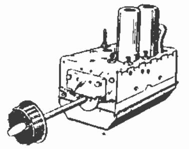

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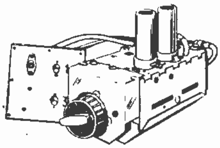

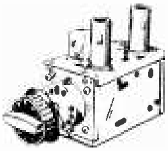

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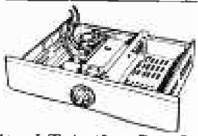

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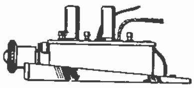

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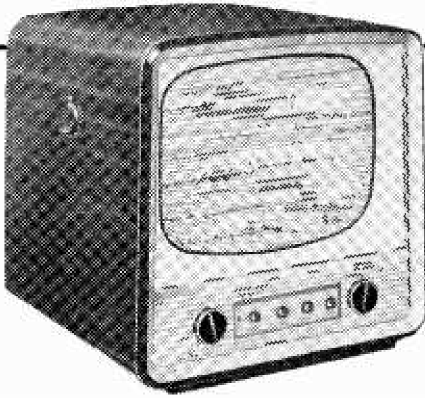
TELEVISION TROUBLES



THEIR SYMPTOMS AND HOW THEY MAY BE CURED—9

By G. J. King

IN this article we deal with timebase and sync faults in Ferranti receivers. Over the years a large number of Ferranti models have been created, and although some of them have chassis which are almost identical to a model of a different number, each will be considered under the appropriate number in this article. One should, therefore, bear in mind that a fault given under any particular model may well apply also to receivers of similar chassis construction.

14T3 (Frame Hold at End of Range)

The symptom in this case is that the frame will lock only with the frame hold control set almost at the end of its travel and with the height control turned to maximum. Any deviation from these settings will result in frame slip, sometimes known as "picture roll."

In some cases, the trouble is caused by an alteration in characteristics of the ECL80 frame timebase valve, and can be cured by valve replacement. Value increase of one or more of the resistors in the frame oscillator circuit is another cause, particularly the 1 MΩ resistor connected to the slider of the hold control.

However, in obstinate cases of the symptom, attention should be directed to C45, which is an 0.003 μF capacitor connected to the anode circuit of the sync separator valve (see Fig. 1). This often goes open-circuit or reduces in value.

Broad Black Bar Horizontal Across Picture

While this symptom may not be connected directly with timebase or sync trouble, the impression that the cause lies in these circuits may be given when the symptom is first encountered.

The trouble is caused by a heater-to-cathode leak in the picture tube, and the symptom may not appear until the receiver has been running for an hour or so. Conclusive evidence that the tube is, in fact, responsible can be secured by gently tapping the tube neck while the symptom is present. If this action temporarily clears the effect, the tube is to blame, and should either be replaced or a low-loss isolating transformer installed.

14T4 (Lack of Sync)

If there is neither vertical nor horizontal lock the sync pulses are lacking from both timebases. After a check has been made of the sync separator valve and this is found to be in order, a check should be made of the 0.05 μF sync coupling capacitor connected between the video amplifier anode and the grid of the sync separator valve. This is C74 in the circuit in Fig. 2.

Incorrect Frame Speed

This is a fairly common symptom on Ferranti models, and can often prove bewildering when all the smaller parts in the frame oscillator stage appear to be normal.

The trouble is generally caused by a faulty frame blocking oscillator transformer, which may well exhibit the correct winding resistance and yet have a shorting turn which completely alters its characteristics. The only conclusive test when such trouble is suspected lies in transformer substitution. The winding resistances of the transformer can also be checked. The resistance of the primary should be about 375 Ω and that of the secondary about 1,150 Ω.

Apart from the obviously incorrect timebase speed which cannot be corrected within the range of the frame hold control, the effect is that the picture is severely folded over and little more than 2in. in height.

It is often possible to bring to light transformer trouble by pressing the windings with the blade of a screwdriver; this may temporarily correct the effect.

Line Timebase Whistle in Loudspeaker

It is usual to hear the 10,125 c/s whistle from the line output transformer (if one has an auditory response which extends to such a high limit). However, if the whistle comes from the loudspeaker,

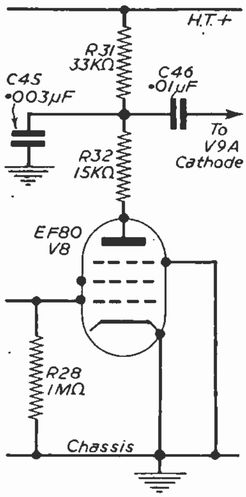


Fig. 1.—Basic circuit of the sync separator stage in Ferranti Model 14T3.

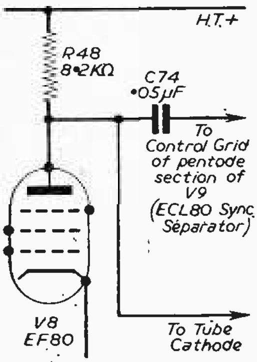


Fig. 2.—Part of the video amplifier stage of Ferranti Model 14T4. Loss of line and frame sync is caused if C74 goes open-circuit.

then something is wrong.

In the 14/17T4 series the line timebase signal sometimes gains admittance to the A.F. stages by way of unwanted coupling between a bunch of wires in proximity to the volume control tags. The cure lies in separating the wires concerned so as to reduce the coupling, but in obstinate cases it is necessary to fit a small metal shield (earthed to chassis) so as to screen the volume control tags and connections.

Ripple on the Picture

If this trouble happens to be caused by defective smoothing electrolytics, the ripple resulting from the hum is usually steady on the screen. Where the ripple slowly ascends the screen, however, attention should first be directed to the line output valve (PL81), for if this has poor heater-to-cathode insulation or other troubles it may be responsible. It is best to check by substitution if possible.

When this is the cause, the line hold control may also be rather critical and require frequent resetting to hold the picture.

17K4 (Frame Flyback Lines Visible)

If the frame flyback lines are clearly visible at normal picture brightness even though the frame is locking properly, the trouble is almost certainly caused by open-circuiting of the 0.005 μF capacitor connected between the anode winding of the frame blocking oscillator transformer and the grid pin of the picture tube. Its replacement should effect a cure.

17T5 (Insufficient Height)

After making the usual tests, a symptom of this kind should lead to a check of the frame scanning coils. Each of the two sections of the coil is shunted by a 2.2 k resistor, and if the coil section goes open-circuited continuity is maintained by the appropriate resistor. This, though, results in reduced frame scan with either the top or the bottom of the picture being considerably compressed.

Another symptom that this fault produces is a wavy band of picture with four peaks across the screen about 2in. in height.

20T4 (No Frame Scan)

This is a projection receiver which features a tube protection circuit which comes into operation and cuts off the tube beam current when either timebase fails. Without a battery of instruments it is sometimes difficult to establish (a) whether a blank screen is caused by timebase failure and (b) which timebase is responsible if the protection circuits have been brought into action.

If the receiver is allowed time to warm up, the effect on the screen when it is switched off may well provide a clue. Usually, there appears a diffused patch of illumination on switching off, but before this happens it is often possible to get a glimpse either of a vertical line (indicating that the line timebase is at fault) or a horizontal line (signifying frame timebase trouble).

In the latter case, the Varite frame stabilising feed resistor should be checked. This is mounted between two tags on an insulated strip on top of the mains transformer, but is hidden from view beneath the strip.

24SK4 (Black Horizontal Lines on Picture)

Internal coupling between the EHT generator and the vision circuits causes this trouble, and in most cases it is due to low value of the main electrolytic smoothing capacitor.

129 (Line Timebase Drift)

In order to hold the line oscillator in sync this trouble makes it necessary frequently to reset the line hold control, but this eventually means that the control is at the end of its travel and will not control the lock any more.

The trouble is often due to value alteration of one or both of the 68 k resistors which shunt the line scanning coils, there being a resistor across each coil section. These resistors should be replaced when this symptom is experienced.

T1205 (Frame Jitter)

Sometimes the frame blocking oscillator transformer is to blame, but there have been many reports of the symptom being due to value increase of the frame linearity control.

T1405S (Critical Line Hold)

The effect here is that the picture tends to fall

(*Continued on page* 505)

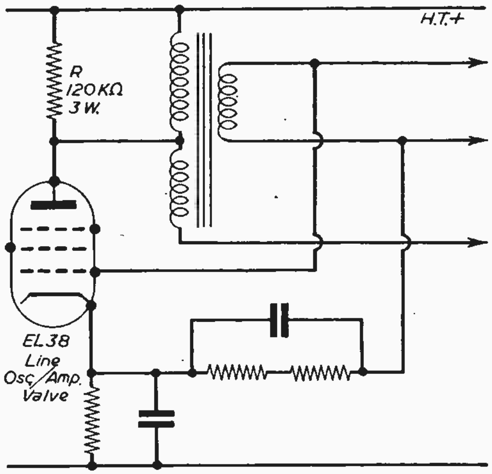
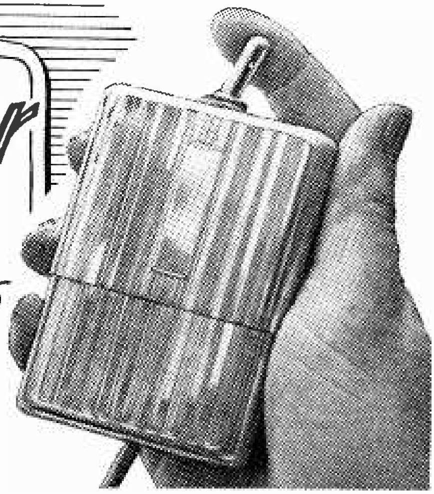


Fig. 3.—The basic line oscillator/output stage of Ferranti Model T1405S. If resistor R decreases in value, a critical line hold often results.

A Remote TV Silencer



MAKE UP THIS USEFUL DEVICE TO REMOVE UNWANTED SOUNDS

By G. Zygmund

HOW many times do you turn your TV sound on and off every day? With the TV "Silencer" you can turn your set off without getting up from your chair, from anywhere in the room—at a cost of less than ten shillings.

Components Required

Few parts are required. An SPDT toggle switch, a 1-watt resistor of from 10 to 1,000 ohms, ten or more feet of three-conductor cable and a small box (the author used an aluminium cigarette case designed to hold an American-style "pack"). Optional is a three-conductor socket and two plugs.

What the TV "Silencer" does is to switch the secondary of the output transformer from the speaker to the load resistor. Just breaking the speaker circuit would eventually damage the output transformer, so the artificial load of the resistor is switched in.

This remote switch can be installed on any TV set without removing the chassis—if the speaker leads are accessible.

Installation

Installation is simple. Cut one of the leads going from the output transformer to the speaker. Attach each end of the cut wire to one of the conductors in the three-conductor cable. The third conductor is attached to the other speaker lead, but *do not* cut this lead.

The SPDT switch should then be soldered to the other end of the cable. Wiring should be arranged so that in one position the SPDT switch completes the speaker circuit, and shunts it through the resistor when in the other position.

Fig. 1 explains most of the constructional details, but there are a few things that should be mentioned. An extra plug and socket may be wired in. This serves two purposes. First it allows the TV "Silencer" to be disconnected, and replaced by a plug wired to complete the speaker circuit. The second reason is that in case someone stumbles over the cable, the plug will pull out before any internal wiring is damaged. In spite of this precaution, however, it is still a good idea to anchor all wires well.

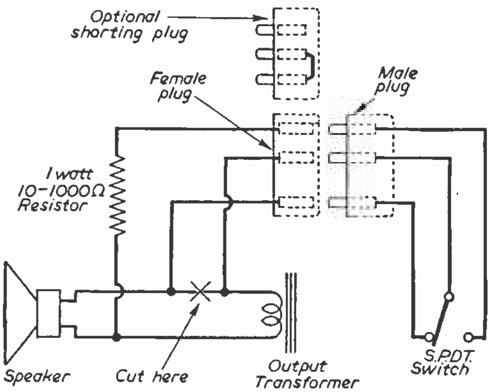


Fig. 1.—The constructional details.

TELEVISION TROUBLES

(*Continued from page* 504)

out of line lock very easily as the picture brightness varies, and that the trouble can be produced simply by increasing the setting of the brightness control.

This model uses a self-oscillating line amplifier stage (EL38), whose circuit in basic form is given in Fig. 3. In most cases of the symptom, resistor R in the anode circuit of the valve has been found to have decreased in value from 120 k to 50 k. Replacement should be made with a 3-watt component.

T1415 (Poor Frame and Line Holds)

With this fault the locks become considerably more stable at a high setting of contrast, but then, of course, the picture is far too "contrasty."

In this model the video, sync and frame timebase circuits are decoupled by way of a common 40 μF electrolytic. Low value or open-circuit of this component causes the trouble due to common coupling effects.

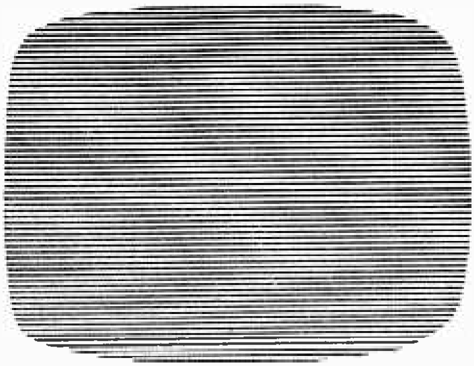


Fig. 1.—Perfect interlace.

The Problem

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TO THE DETRIMENT OF THE PICTURE QUALITY

THE subject of interlace is one which has caused considerable worry to many viewers, and it is found that in many cases, receivers are operating with only a single scan, or with what is known as "pairing." Fig. 1 (above) shows a scan taken from a 17in. tube with correct interlace, whilst Fig. 2 shows to the same scale, the same scan without interlace. From this, it is clear that pictures seen with the line structure of Fig. 2 will be coarser than those in Fig. 1, and at the normal viewing distance the line structure will always be visible if there is no interlace.

Degree of Interlace

It is, of course, a rare occurrence for interlace to be completely absent, but very seldom is it perfect in either commercial or home-built receivers—or one might hear less clamour for "more lines." Most often the lines are paired, the divergence from perfect interlace ranging between 20 per cent. and 60 per cent. It is, moreover, not always the cheapest receiver that errs most. "Pairing" gives the appearance of lininess at normal viewing distances, and because the average living-room gives an average viewing distance of about 8ft., a 17in. tube is often really too large. If full interlace can be achieved, the lines on a 21in. tube do *almost* disappear at 9ft. or thereabouts.

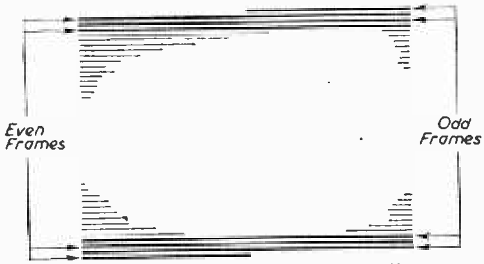


Fig. 3.—The lines of "odd" and "even" frames.

While it is a simple enough matter to specify the conditions needed for perfect interlace, the practical side is quite a different matter. However, it will be as well to set forth the task in theory, so as to see what practice entails. It will then be possible to suggest means whereby the difficulties may be overcome.

Triggering Accuracy

It is assumed that the reader is familiar with the way in which alternate frames begin and end in the middle of a line, and the half-line-width vertical displacement relatively of odd and even pairs. This understood, it is not difficult to appreciate that the perfection of interlace depends directly on the accuracy with which the frame timebase generator is triggered on both odd and even frames. In the ensuing discussion, it will be assumed that "odd" frames *begin* with a half-line and "even" numbered frames *end* with a half-line. Fig. 3 shows this convention graphically.

Examination of the sync pulse wave-form during the frame pulse shows that the arrangement of line and frame sync pulses is different for odd and even frames. This must necessarily be so, since in odd frames the first frame sync pulse comes at the end of a line and in even frames half-way along the line. Moreover, to keep the line timebase generator synchronised during frame flyback, line sync pulses are kept going at a steady rate throughout a transmission. Fig. 4 shows the difference in sync pulse wave-forms for odd and even frames.

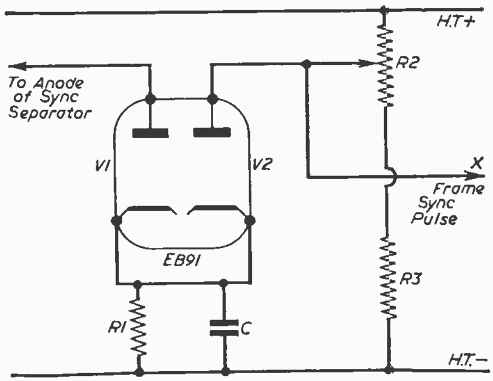


Fig. 5.—Interlace diode.

D.C. Component

Although over a considerable period, for example over the whole of the sync period, the D.C. component of the two pulse trains is the same, during the short period at the beginning of the pulse and likewise at the end, there are notable

# of Interlace

ION RECEIVERS WHICH IS OFTEN NEGLECTED,

By D. R. Bowman

differences in the way the D.C. component would "build up" or "decay." Now these are just the periods when matters are at their most critical for synchronisation purposes. It follows that accurate synchronisation cannot be obtained if the sync separator relies upon the difference in D.C. component between line and frame pulses to trigger the frame timebase. This is where the plain "integrator" circuit fails: such a circuit converts differences in pulse duration into differences in pulse amplitude, and because on odd frames less time elapses (since the previous line pulse) than is the case on even frames, the resulting voltage starts off at a somewhat greater value. In other words, the sync voltage for odd frames builds up at a greater rate from a higher initial level; the pulses are slightly different for the two frames, and good interlace cannot be obtained—except perhaps by accident.

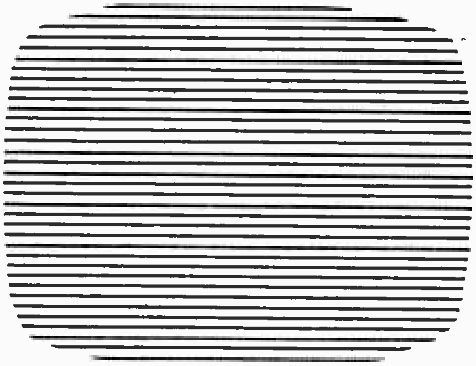


Fig. 2.—Complete lack of interlace.

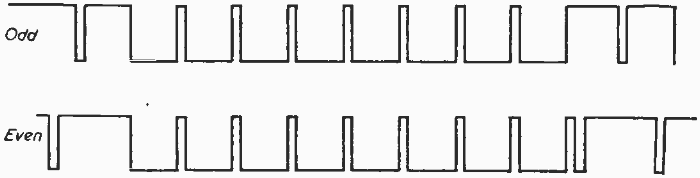


Fig. 4. — Sync pulse wave-forms for odd and even frames.

Frame Generator

Something also depends on the type of waveform generator used for the frame scan. If the flyback is achieved within the frame pulse, differences in the sync pulses at the end of the pulse make no difference. If, however, the frame sync pulse ends first, any differences of the pulse for odd and even frames affect the discharge of the capacitor in the generator, thus causing poor interlace once again. It is hence possible for a sync separator to give good interlace on flyback with poor or no interlace on scan. Conversely, the scan may be well interlaced whilst the flyback is *not*. In such circumstances the error in triggering is just offset by the error at the end of flyback.

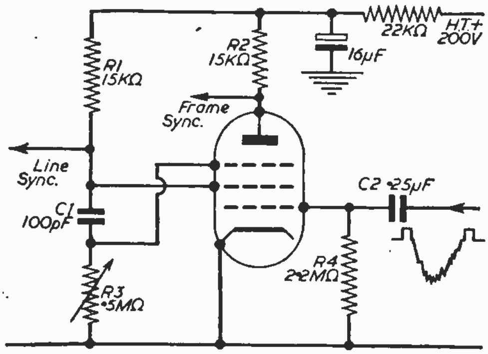


Fig. 6.—Flip-flop sync separator.

Identical Pulses

It may be said in conclusion that for accurate interlace on "scan," the sync separator must produce identical pulses on odd and even frames *either* at the beginning of the frame pulse—if the timebase generator flyback is completed within the frame pulse—*or* at both beginning and end of the frame pulse, where the flyback takes longer than the frame pulse. The frame sync pulses take altogether about 400 μs; it is therefore necessary to have a timebase generator of less than 400s flyback time, compared with a scan period of 20,000s—a ratio of 50:1, which is not easy to achieve—if the flyback is to be achieved within the frame sync pulse.

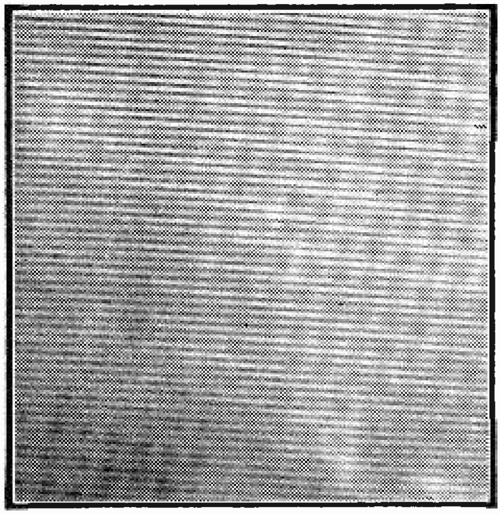
In general, therefore, it is more practicable to aim at the second and more exacting of the above requirements. With a thyratron or blocking oscillator generator, a short flyback can be obtained, but with the more usual multivibrator the flyback is relatively long.

There are only three circuits known to the writer which comply with the requirements stated in a really reliable manner. Others, which are commonly encountered in receivers, are not described here.

The Interlace Diode

Fig. 5 shows the best-known of the circuits. It is preceded by the usual pentode sync separator, from the anode of which line sync pulses are taken in the usual way. In this circuit R1,C is given a time-constant of about 40μs (or somewhat more). C should be kept small—100 pF is a good value—and R1 to suit will be about 470 k. 200 pF and 220 k also work well, as these values are not critical.

The action of the circuit is as follows. The sync separator is fed with positive-going sync pulses (negative-going picture). This is usually taken direct from the C.R.T. cathode though the usual D.C. restoring capacitor and grid leak (0.1 μF and 1 Meg.). Negative-going pulses are thus passed into the first diode of Fig. 5. V is thus cut off during the pulse and C discharges through R. Between pulses C is charged to the full H.T. voltage through the internal resistance of V and the anode load resistor of the sync separator stage.



Patchett's Separator—a three-minute exposure of the camera indicates the high rigidity of scan which is obtained.

On line pulses C has time only to discharge a little, and the cathode of V does not fall below its anode in voltage, which is less than the H.T. voltage because of the voltage dividing network R2, R3. Since the individual frame pulses are of 40 μs duration each, during these pulses C discharges to a much greater extent; the cathode of V2 falls below its anode in voltage, and a pulse of current flows through V2 and R2 to charge C again.

Differentiation

In order to obtain a sharp leading edge to the output, it is as well to differentiate the voltage obtained at the point "X." As it stands, the leading edge is not sharp, but quite "sloping." Connection of "X" through a capacitor of about 100 pF to the grid of the timebase generator, using a grid leak of 100 k. or less will give a suitable sharp-edged pulse for synchronising purposes. It will, however, be positive-going and suitable for a thyratron generator.

Alternatively, a small transformer may be used to complete the timebase generator. The primary winding should be put in series with the anode of V2, and the secondary connected to the grid of the generator. A miniature audio-transformer has been found suitable. Where a blocking oscillator follows, a tertiary winding of about the same number of turns as the primary can be used for the coupling.

The Flip-flop Separator

The second type of circuit to be described is also dependent on discrimination between the durations of line and frame pulses. It is an equally simple circuit, and is shown in Fig. 6.

The circuit is essentially that of a transitron flip-flop. Assuming C1 to be completely discharged, the screen is nearly at H.T. potential and the suppressor is at earth potential. Screen and anode current both flow, resulting in a drop in screen potential because of current flow through R1. This drop in potential is transmitted through C1 to the suppressor, driving it negative; this causes anode current to be diverted to the screen and screen current increases still more, and again its potential drops further. This in turns drives the suppressor more negative; the action is cumulative, resulting in a rapid cut-off of anode current and increase of screen current until the screen is "bottomed." At this point, screen potential cannot drop further, and C1 begins to charge again. As soon as the suppressor potential has risen to the point where it no longer cuts off anode current completely, current begins to be diverted from screen to anode; screen potential begins to rise and the upward trend of screen voltage, communicated to the suppressor *via* C1, causes the suppressor to go more positive. This then diverts more current from screen to anode, again causing screen current to decrease and screen potential to rise. The action is cumulative once more, ending when the anode is "bottomed" by heavy anode current: at this point screen current is minimum and the screen nearly at H.T. potential. The process then repeats, giving fairly rectangular pulses at screen and anode, the width of which depends on the time-constant C1.R3.

Valve is Cut-off

To effect sync separation, a negative-going video signal (sync pulses positive) is impressed on the control grid through the D.C. restoring components C2, R4. The low operating potentials of the pentode ensure that the valve is cut off at black level, conducting only during the sync pulses. It is, therefore, only during such sync pulses that the transitron can operate. While cut-off at black level, anode and screen currents are zero, and anode and screen are at H.T. potential.

When a line sync pulse appears on the grid, the screen draws current and immediately the suppressor is driven negative; anode current thus cannot flow. If line sync pulse were of considerable duration, the transitron would begin to oscillate, but if C1.R3 is given a suitable time-constant *greater than* the line pulse duration, the line pulse ends before the suppressor can recharge.

(To be continued)

Aerial Attenuators

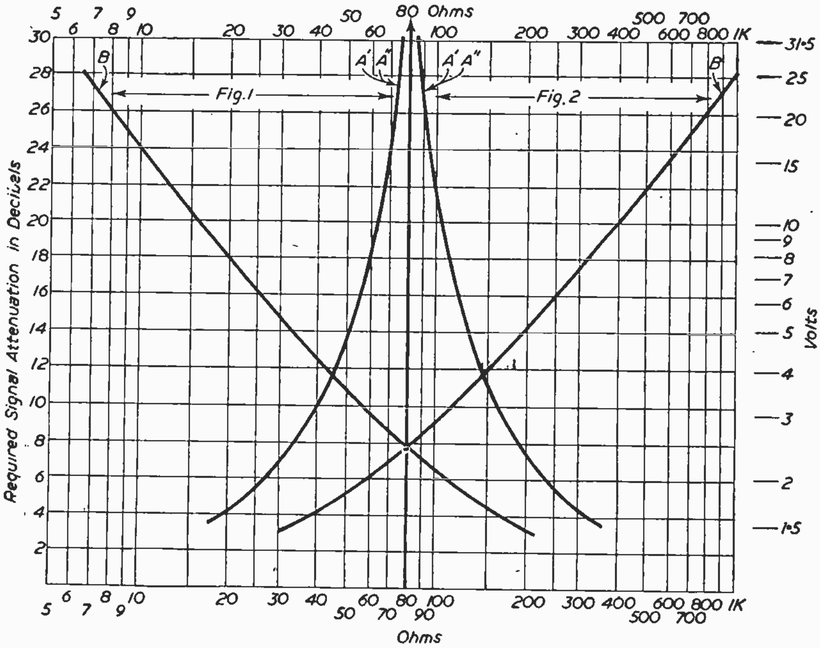
THEORETICAL AND PRACTICAL CONSIDERATIONS OF SIGNAL STRENGTH CONTROLS

SINCE the power of the BBC London transmitter was increased we have received an increasing number of complaints of overloading from this station. Difficulty also seems to be experienced as viewers adapt their receivers to two-station reception, owing to one signal being much stronger than the other. One of the most effective forms of reducing a signal is by means of an aerial attenuator, for reasons which will be explained later, and in response to many requests we give below some details of this device which was originally published in 1952, but which is now entirely out of print. It should be emphasised that the information is applicable only to Band I.

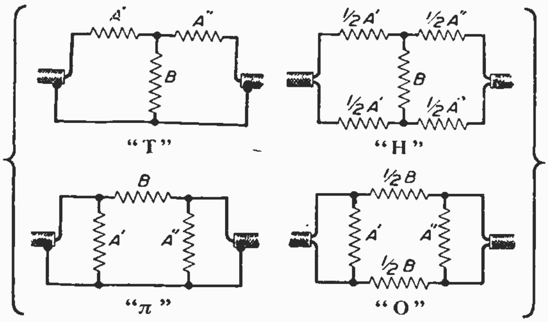
If the signal is too strong it will produce an over-white picture lacking in high-light details, which is obtained even with the contrast control turned to minimum; if the brilliance is reduced, a "soot and whitewash" effect is observed, i.e., a picture in which there is an absence of all the intermediate tones between black and white.

An indoor or other low-efficiency form of aerial may provide a satisfactory solution to the problem in the majority of cases, provided that the level of mains-borne and other forms of interference is negligible. In some instances, however, where the indoor aerial happens to be situated in a closely built-up area, despite a high-field strength, there is a possibility that local industrial and domestic equipment will produce an appreciable background of interference and, furthermore, if the installation is situated alongside a main thoroughfare, the ignition radiation from traffic may also mar reception. In such cases a great improvement is effected by erecting an outside aerial, such as a single dipole or "H" type, on the roof of the dwelling, but then the chances are that the signal input to the receiver is much too great.

Having secured an improved signal-to-noise ratio, it then becomes necessary to reduce the amount of signal reaching the receiver and for this purpose a simple resistive network can be inserted between the aerial feeder and the receiver input socket. The description "simple resistive network" is real in practice, but examination of the curves shown in Figs. 1 and 2 reveals that the combination of resistance values for different levels of attenuation is cer-



"T" and "π" networks for unbalanced coaxial lines.



"H" and "O" networks for balanced pair.

Figs. 1 & 2.—Nomograph for the design of "T," "π," "H" and "O" attenuators with input and output impedance of 80Ω for use with television aerials.

tainly not so simple as one might expect. The reason for this is that not only does a required attenuation call for a definite proportioning of the elements A′, A″, and B, but that the input and output resistance of the attenuator must always be constant, i.e., in this instance 80 ohms. If an attenuator has an input and output resistance other than 80 ohms, it may introduce reflections back along the aerial feeder. The fact that it also delivers more or less attenuation than originally intended is of little importance, but as mismatching can, under some conditions, introduce undesirable responses on the picture, all that need be stressed here is that in a correctly terminated aerial circuit distortion of this nature is absent.

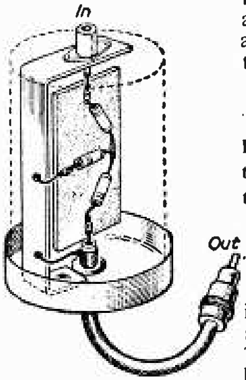


Fig. 4.—A practical interpretation of an attenuator of the type shown in Fig. 3, showing a suitable screening can.

Type of Attenuator

An attenuator used for the purpose described here is a resistive network designed to introduce a specified power loss when inserted between two circuits of known impedance. The term impedance must be mentioned here because the practical circuits with which we are concerned, i.e., the aerial and input coil of the receiver, contain inductive and capacitive reactance as well as resistance, and it is not usual for such circuits to maintain an entirely resistive condition over the band of frequencies needed for television reception. However, the sum total of resistance and reactance can still be visualised as "so many ohms" and for our convenience the generalised use of the term "resistance" will, where necessary, imply a combination of both components.

Figs. 1 and 2 illustrate two types, and from their configuration the names "T" and "π" are easily recognised. Neither has any functional advantage over the other, but for attenuations greater than 30 dbs the B resistance in the "T" type can be replaced by a short length of screwed 6 BA rod or thick wire as described later.

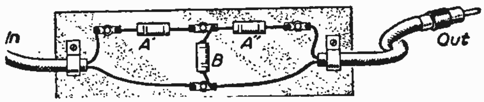


Fig. 3.—Practical layout of an attenuator.

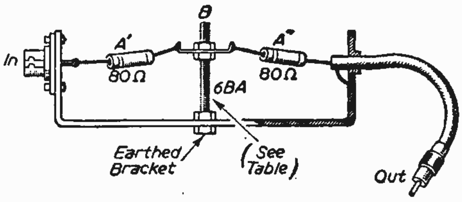


Fig. 5.—A length of screwed rod forms the B resistance in this arrangement. Note that the output lead screening is earthed.

Use of Graphs

The calculations necessary to determine the values of the resistances for any desired level of attenuation are relatively straightforward, and a number of examples for both "T" and "π" types have been worked out and presented in the form of an easy-to-work graph for quick reference. An illustration of the use of the graph can be given by assuming that the input voltage to a receiver is to be reduced by 10 times (or 20 dbs in power, whichever terminology is preferred) and then reading the values of resistance in ohms at the points where the 10 times (20 dbs) line intersects the A′ A″ and B curves. From the graphs, a "T" attenuator requires A′ A″ resistances of 65 ohms, and a B resistor 400 ohms. In any example taken from these graphs the attenuation factor, input and output resistances will be accurate to about 5 per cent., and the use of 5 per cent. resistors will keep mismatch and attenuation factors within acceptable limits.

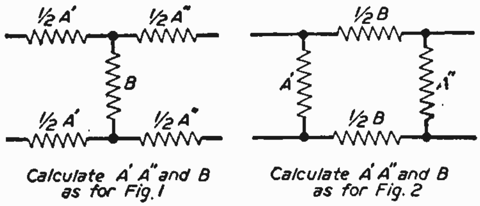


Fig. 6.—Networks for a balanced line.

Construction

The layout should be symmetrical, as shown in Fig. 3, with the internal connections kept as short as possible by using small carbon composition resistors to assist this requirement. It is best enclosed within a small screening can as suggested in Fig. 4 which is the most convenient form for immediate use.

At 28 dbs attenuation, the B resistance in the "T" type has a value of 6.5 ohms and at 45 Mc/s a 1in. length of 6 B.A. rod has a reactance of approximately 4 ohms. If the A′ A″ resistances are made 80 ohms and a 1in. length of 6 B.A. rod is used as the B resistance (Fig. 5) an attenuation of 32 dbs is obtained. Other lengths may, of course, be used.

The attenuators described are for use with an unbalanced (co-axial) feeder, and where an attenuator is required for a balanced line the A′ A″ or B resistors are reduced in value by one-half and inserted in both sides as the configuration shows in Fig. 6. Constructional details are as previously described.

Transistors in TV Receivers

THE FIFTH ARTICLE OF A SERIES DEALING WITH THE USE OF TRANSISTORS IN MODERN TELEVISION EQUIPMENT

(Continued from page 460 of the April issue)

THESE quadrupoles have their diverging planes set at 90 deg. relative to each other. The optical analogy of the pair is shown in Fig. 16. Figs 16(a) and (b) can be compared to the requirements shown in Fig. 15. Figs. 16(c) and (d) show the complete system of focusing and magnification for an axial beam.

Sensitivity to EHT Variations

As the magnification of the magnifying lens in the horizontal directions is large the virtual object distance of this lens is relatively short. A small absolute change in the position of the virtual object produces a large change in position of the real image. Consequently the final focus is very sensitive to changes in the EHT potential and in the focus lens (see Fig. 17). In the receiver a change of EHT potential of 50 volts in 18 kV is noticeable.

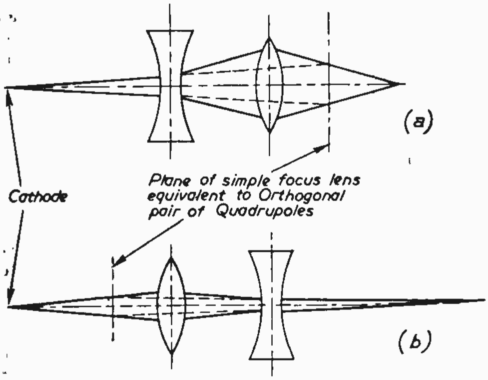
Having achieved a small size for the undeflected spot the problem is to maintain this with deflection. Simple theory suggests that the field in the magnifying quadrupole should have a constant gradient along both the vertical and horizontal axis in the plane of the quadrupole. Thus the beam suffers the same focusing or defocusing action as it is deflected by either deflection system acting by itself. This field shape (Fig. 18(b)) is achieved (ignoring end effects) by the use of poles shaped as equilateral rectangular hyperbolæ. An adjustable quadrupole of this ideal shape is indicated in Fig. 18(a). The effect of fringe fields and other requirements (raster shape) modify this simple conception but it will at this stage in the discussion establish that the deflection defocusing problem is not outright impossible.

The information given in this short series is taken, with permission, from a Paper read to the Television Society by B. R. Overton, B.Sc.(Eng.), A.M.I.E.E., and published in the Journal of that Society.

Special measures are needed to maintain focus in the horizontal direction as the beam is deflected vertically. Consider the system with the magnifying lens removed and note two of its properties. Namely, the depth of focus in the horizontal plane is very small (Fig. 19(a)), and owing to the relatively large deflection angle in the vertical plane the image field curvature produced by the deflection assembly is large (Fig. 19(b)). The result is a significant movement with frame scan of the magnifying lens' virtual object such that the deflection defocusing effect shown in Fig. 20 is produced. Correction may be effected by additional windings on the deflection yoke, energised by the frame timebase, and arranged to give added divergence in the horizontal direction. A complete deflection yoke is shown in Fig. 21.

Raster Shape

The use of a magnifying lens of the form shown in Fig. 18(a) results in considerable pincushion distortion of the vertical edges of the raster. This arises from the greater path length of the electrons in the horizontal diverging field when they are also deflected vertically. Thus the



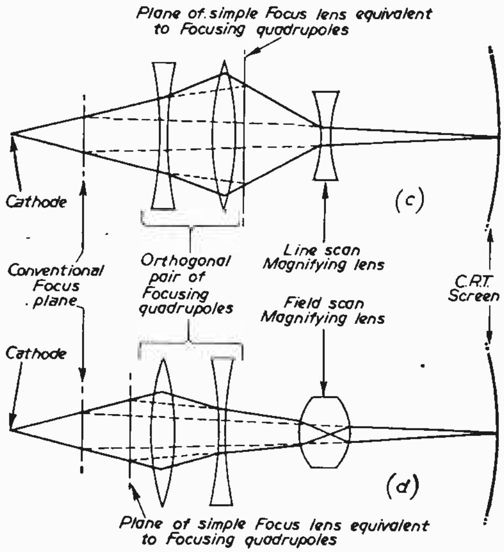


Fig. 16.—Quadrupole focusing system—Optical Analogy. Solid lines represent extremes of axial beam in quadrupole focusing system. Focusing action of orthogonal pair of quadrupoles : (a) Horizontal plane. (b) Vertical plane. Focusing system in combination with magnifying lens. Dashed lines refer to a conventional focusing system. (c) Horizontal plane. (d) Vertical plane.

magnifying lens must have a field with relatively greater diverging properties along the horizontal axis than away from the axis in comparison to the field shown in Fig. 18(b). A magnifying lens giving good raster shape may have the form shown in Fig. 22.

One form of a complete system comprising

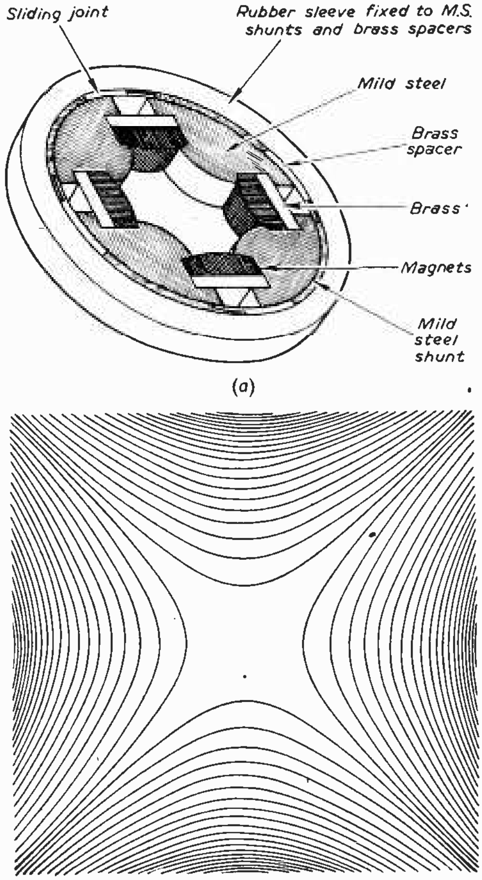


Fig. 18.—An adjustable quadrupole having pole shapes suggested by simple theory. (a) Isometric view. (b) Idealised field shape.

focusing, deflecting and magnifying elements is shown in Fig. 23.

The system of scan magnification described herein achieves a power saving of 100:1 for the line timebase and approximately 4:1 for the field timebase. It imposes certain restriction on the focusing and EHT systems. Nevertheless, it seems certain that with further development scan magnification will be an essential part of television-like display units designed to be most economical in power.

Line Timebase

The problem of the line timebase was mentioned in the introduction. Circuit techniques

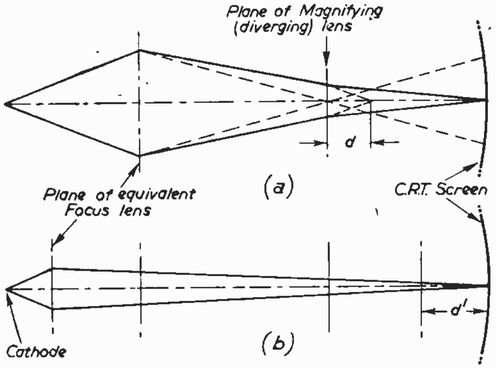


Fig. 17.—Diagram illustrating the sensitivity of the final focus to change in EHT potential. (a) Optical Analogy—horizontal cross section. The extreme case is illustrated in which the initial focus moves the short distance (d) to take it to the centre of the magnifying lens, thereby losing all final focus. (b) The conventional tube optical system to the same scale. The effect of a proportional change in focus (d¹) is so small as to be inconvenient to show on the diagram. This can be seen from the angle involved.

had already begun to emerge, but no suitable transistor was likely to be in production for a very long time. Scan magnification changes the situation so completely that the circuit techniques may need rethinking. For example, the EHT supply can no longer be looked on as an almost free by-product of the line scanning. Is it still the best plan to keep these functions of line scanning and EHT generation together? Will it be possible to have a common stage and yet achieve the degree of EHT stabilisation required? These and many other questions will be answered in the future. For the present the experimental receiver employs a separate line scanning stage

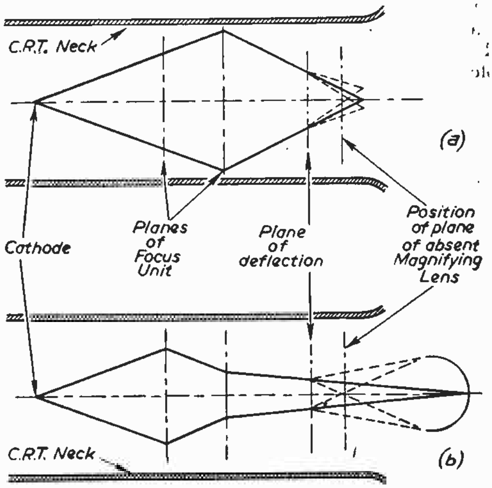
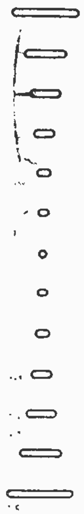


Fig. 19.—Action on electron beam of focusing and deflection system without magnifying lens. (a) Horizontal plane—dotted lines show the effect of horizontal deflection. (b) Vertical plane—dotted lines show effect of vertical deflection.



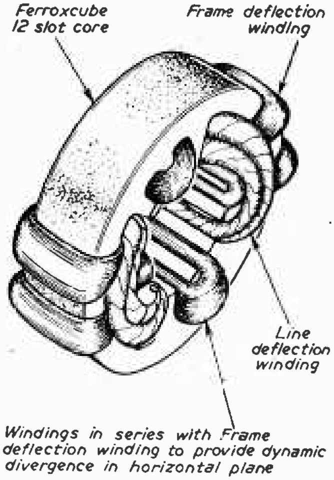


Fig. 20 (Left).—Spot size variation for frame scan without image plane curvature correction.
Fig. 21 (Right).—Scanning yoke having correcting windings for image plane curvature.

employing currently available low power transistors in an energy recovery circuit.

The deflector coils require a current of approximately 400 mA p-p and have a resistance of 0.76 Ω and an inductance of 0.9 mH. They are choke-capacitor (L38, C95) coupled to the grounded emitter output stage (Tr28). This form of coupling is necessary to compensate the stretching of the picture edges which occur with flat faced tubes if they are scanned with linear current waveforms. (The system of scan magnification somewhat accentuates this effect.) The circuit operates in the efficiency diode mode, the efficiency (D4) diode conducting for 40 per cent. of the scan. A saturated reactor type of linearity control (L37), and a flyback tuning capacitor (C94), complete the output collector circuit.

The grounded collector driver stage (Tr27) is required to minimise the loading on the oscillator stage so that low power H.F. transistors may be used for the oscillator. Thus fast switching is achieved in the oscillator multivibrator (Tr25 and Tr26), a short rectangular positive-going pulse being produced at the collector of the transistor Tr26. A sawtooth waveform having an extra positive-going pulse during the flyback period is generated by the network R113, C92, R114, RV5, C93 and R115 and applied to the base of the driver transistor Tr27.

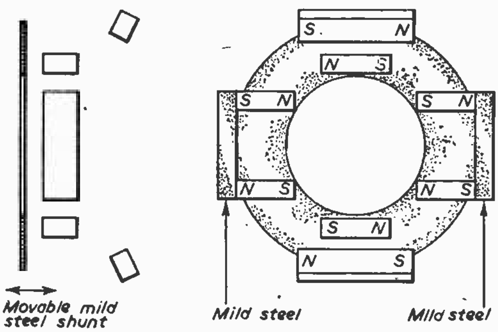


Fig. 22.—Adjustable magnifying lens having a field corrected to give good raster shape. Non-magnetic parts of the complete structure are not shown.

A positive-going pulse is applied directly to the output transistor base via the components C91 and L36. (The latter is required to permit initial regeneration in the multivibrator.) This positive pulse provides a reverse bias on the output transistor and ensures a quick clean-up of stored holes at the start of scan. The pre-set variable resistor RV5 is used to set the bias conditions on the driver and the output stage so that the output stage does not bottom too hard, and so to minimise the hole storage.

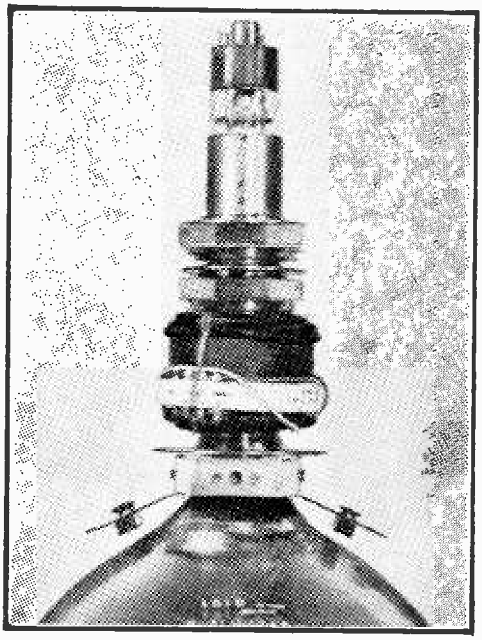


Fig. 23.—Complete focusing, deflecting and magnifying assemblies in position on 90 deg. picture tube neck.

This arrangement leaves much to be desired as no stabilisation against temperature is incorporated. The same criticism applies with particular force to the oscillator (and in fact to many parts of the field timebase about to be described). Considerable development is needed here; a start has been made by some workers, but the possibility of a practical output stage gives added point to the problem.

The present circuit has a total consumption of 32 mA from the 12 v. H.T. line. The output transistor has a peak collector potential approaching 60 volts, a peak collector current of approximately 200 mA and a mean current of 58 mA. The mean efficiency diode current is about 35 mA.

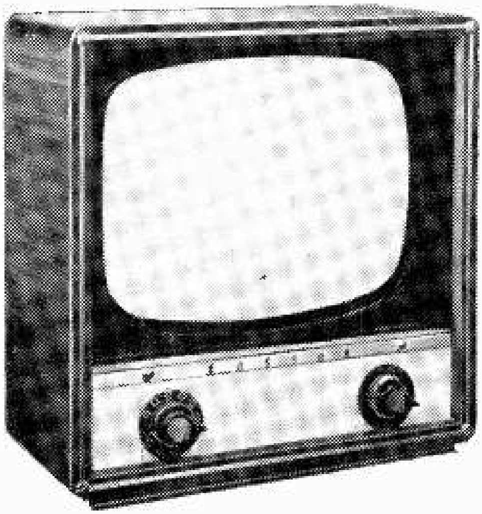
A circuit for the line timebase referred to above will be given next month.

(To be continued)

News From the Trade

Model 948F Cossor

A NEW 17in. Fringe Model 948F printed circuit "unit" construction television receiver has recently been announced by Cossor Radio & Television Ltd., Cossor House, Highbury Grove, London, N.5. It is similar in appearance to Model 948 and, as with that model, all controls are positioned to permit adjustment to be made with screen in full observation. It costs 69 gns. including purchase tax. Matching legs are optional at 2 gns. extra.



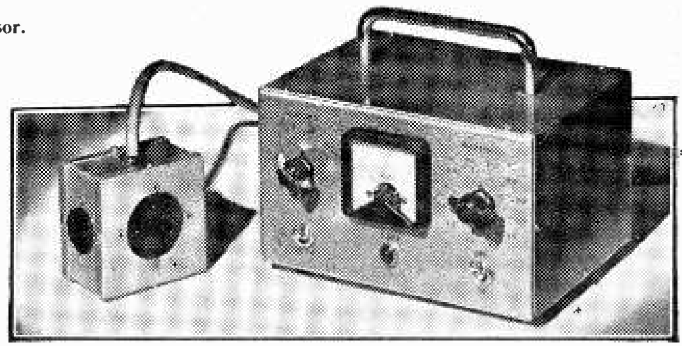
The 17in. Model 948F Cossor.

Labgear Tube Rejuvenator

THE new Labgear Tube Rejuvenator provides a calibrated heater supply so that the tube may be overrun in a controlled fashion for a period of time (normally about 25 per cent. excess voltage is recommended). Simultaneously a positive bias is applied to the control grid by the instrument and the cathode current is monitored by a dual-range moving coil milliammeter.

In practice it will generally be found that the cathode current starts at a very low value but quickly rises. The rate of rise decreases as the rejuvenation process nears completion, and when the cathode current has become reasonably static the rejuvenation process is complete, and the tube may be operated in the normal way, but should be "soak" tested for a few hours. This rejuvenator is supplied complete with a universal adaptor at the end of a multi-way cable enabling any popular cathode ray tube to be treated *without* removing the set from the cabinet. It will be appreciated, therefore, that a minimum amount of labour is involved in undertaking the process and whilst it cannot be guaranteed that all tubes will respond to treatment, the operation is so cheap and simple that it is always worthy of trial.

The period of time for which the tube can be expected to give reasonable service after rejuvenation is also indeterminate, but in a number of instances it has been proved that some six months of additional life has been obtained. When one bears in mind the high cost of C.R. tubes and the fact that the Labgear rejuvenator is virtually everlasting, it will be seen that at a net trade price of £13 10s. it represents a first class business proposition. The instrument measures $7\frac{1}{2}$in. × $4\frac{1}{2}$in. × $5\frac{1}{2}$in. and weighs 8lb. It is made by Labgear Ltd., Willow Place, Cambridge.



The Labgear Cathode Ray Tube Rejuvenator Type E5119.

Television Tubes and Valves Reduced

SIEMENS EDISON SWAN LTD., have now considerably reduced the prices of many Ediswan-Mazda television tubes and valves. These reductions have been made possible by improved manufacturing methods and the use of high speed automatic equipment in the company's Sunderland factories.

The maximum reduction is on the most popular 17in. types which with the reduced purchase tax show a saving of up to £3. 4s. 10d. to the man in the street.

"Truvu" Tubes

WITH reference to the note on page 447 of the April issue, concerning the manufacture of television tubes in Scotland under licence from the Radio Corporation of America, we are asked to point out that the price which was quoted is a trade price, and at the time of going to press, no retail price has been decided upon, and all prices quoted by the manufacturers and distributors (Bryterlite Ltd.) are strictly net trade.

Prices of part of the Ferranti range of television cathode-ray tubes have now been reduced.

The 12in. and 14in. have been reduced to £10 10s. (purchase tax £4 12s. 2d.) and the 17in. have been reduced to £17 5s. 4d. (purchase tax £5 5s. 4d.).

TV CONVERTORS

INTERNAL FITTING. Tunable to any Band I station plus any 2 Band III stations—switch tuned, T.R.F. Band I, superhet Band III. Famous make complete with escutcheon knobs, gain controls, instructions, PCF80, PCC84 valves, easily adaptable almost all sets. Listed over £7. Carr. 3/-. **£3/10/-**

EXTERNAL I.T.V. CONVERTORS WITH INTERNAL POWER PACK. Well-known make, at a very competitive price, completely enclosed. Finished in hammered gold. Very compact. Can be put inside practically all T.V.s. Gain and Trimming controls. Listed at £7.7.0. Our Price. Carr. 2/6. **£3/19/6**

TURRET TUNERS. Compact 13 Channel, with all coils. PCF80, PCC84 Valves. 38 M/cs or 16 M/cs if as fitted in Pye T.V. sets. £2.15.0.

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LABGEAR SPIRAL COMBINED BAND I AND BAND III T.V. AERIALS. For localities of high signal strength. Adjustable matching unit incorporated. Plug into standard co-ax socket—e.g. either straight into the back of the T.V. set or into a wall socket. (Price 3/6 if required.) Listed 27/6. Our Price, 9/6.

BURWELL T.V. AERIALS. Complete Illustrated Price List of 1 to 12 element Band I and III aerials at amazing competitive prices. (3d. stamp.)

CO-AX CABLE. Low loss High Grade 70/80 ohms. 1-19 yds., 7d. yd ; 20-99 yds., 6d. yd.; over 100 yds., 5½d. yd.

LATEST B.S.R. TYPE AU8 AUTOCHANGERS. Gold and Fawn finish, 10 records all sizes, unrepeatable value at £6.19.0. Carr. 4/-.

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B.S.R. 4-SPEED AUTOCHANGER PORTABLE RECORD PLAYERS. Consisting of the above type AU8 autochanger and 2.2 watt amplifier with speaker, assembled in a two-tone rexine case. Truly amazing value. (Listed over £20.) £13.13.0. Carr. 6/-.

4-SPEED SINGLE PLAYERS

COLLARO 4-speed RC554	£6.19.0
GARRARD 4-speed 4SP	£7. 7.6
GARRARD 4-speed TA MKII ...	£8.19.0

Carr. and pack., 3/-.

10 RECORD AUTOCHANGERS

COLLARO RC511 3 spd.	£8.19.6
COLLARO CONQUEST 4 Spd. ...	£8.17.6
B.S.R. AU8 4 Spd.	£6.19.0
GARRARD RC75A Senior	£7.19.0
GARRARD RC80M A.C./D.C. ...	£10.19.0
GARRARD RC88/4	£13.15.0
GARRARD RC120D MKII	£9. 7.6
GARRARD RC121/4 MKIII ...	£9.19.0

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FACTORY REVACUUMED. ALL GUARANTEED 6 MONTHS. Carriage and insurance 12/6. Enquiries welcomed for any types not listed. Due to the high quality of our tubes and low number of returns, we are able to maintain the following unusually low prices.

3/16, 108K, 6501, 6504, 6505, CRM91, CRM92, MW22/7, MW22/14, MW22/14C, MW22/17, MW22/18, TA10. **£2/15/-**

3/18, 6703A, 6801A, 6802A, C12D, C12F, C12FM, C14FM, CRM121, CRM121A, CRM122, MW31/7, MW31/14C, MW31/17, MW31/18, T12-54, T12/504. **£3/19/-**

3/31, 12KP4, 12KP4A, 14KP4, 14KP4A, 121K, 141K, 6706A, 7102A, 7201A, 7202A, 7203A, AW36/21, C12B, CRM121B, CRM123, CRM141, CRM142, MW31/16, MW31/74, MW36/24, MW36/44, T12/549, TR14/4. **£4/10/-**

3/6A, 4/15, 17APRA4, 17ASP4, C17FM, CRM151, CRM171, CRM172, MW43/43, MW43/64, 7401A. **£4/15/-**

6901A, MW43/80, C14BM, C17BM, CRM152A, CRM152B, CRM153, MW41/1, TA15, TR14/2, MW43/69. **£5/10/-**

C21HM, C21NM, CRM211, CRM212, MW53-20, MW53-80. **£7/10/-**

Supplies of a few types, particularly 15-inch round types, are at present irregular.

TRANSISTORS AND DIODES

RED SPOT. Transistors for I.F., L.F. and Output up to 800 kc/s, 6/6. **WHITE SPOT,** R.F. and I.F. 2.5 mc/s., 9/9; XA103, 15/-; XA104, 17/6; XB104, 10/-. GET15, 25/-. **GERMANIUM DIODES.** General purpose famous make, 9d., 8/- doz. **DIODES.** Equivalent to GEX44, 3/9.

RECTIFIERS. SPECIAL OFFER. Fully guaranteed ex-equipment. RM4, 9/6; 14A/86, 9/6; 14RA 1-2-8-2, 9/6; 14RA 1-2-8-3, 9/6.

H.T. RECTIFIERS

280LU679A (240 v. 80 mA), 5/-; RM1, 6/-; RM2, 6/6; RM3, 9/-; RM4 (ER4), 15/6; RM5 (ER5), 21/-; 14A86, 17/-; 14A97, 23/-; 14A100, 25/-; 18RA 1-1-16-1, 7/9; 14RA 1-2-8-2, 18/-; 18RD 2-2-8-1, 14/-; 14RA 1-2-8-3, 22/-.

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RECTIFIERS. Iron selenium full wave. 12 v. 1 amp., 5/-; 12 v. 2 amp., 8/-; 12 v. 3½-4 amp., 9/6.

TRANSFORMERS. (Primary 0-210 v.-240 Secondary 0-3.5 v.-9 v.-17 v.) for charging 2 v., 6 v. or 12 v. batteries. 1 amp. size, 9/9, 1/- post. 2 amp. size, 14/6, 1/6 post. 4 amp. size, 19/-, 1/9 post.

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TV SALE

SATURDAY IS BARGAIN DAY. At our store at the junction of Somers Street and Green Road, Southsea. 100's of Televisions from £2 **COMPLETE.** Cabinets, Chassis, etc., etc.

TV SETS

5-CHANNEL T.V.s. Modern. Table 12in., tested pictures before dispatch, all good tubes. Tunable all B.B.C. stations. all top makes. Carr. etc. 15/-. **£8/-/-**

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1A3	2/6	5Y3G	6/6	6BW6	8/6	6J5	5/-	7C5	8/-	25Z4G	8/6	DAF96	9/6	ECC83	8/-	EL95	10/-	PCC89	19/-	U50	6/6	UU9	7/6
1A7	14/6	5Y3GT	8/6	6BW7	8/-	6J5G	3/-	7C6	7/-	25Z6	9/6	DD41	4/6	ECC84	9/6	EM34	6/-	PCF80	9/-	U52	7/-	UY41	8/-
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1D5	15/-	6A8G	8/-	6C5GT	5/6	6J7G	5/-	7V7	8/-	30FL1	9/6	DF96	9/6	ECF80	12/6	EM84	10/-	PCL83	13/-	U281	8/6	VP133	9/-
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1L4	4/6	6AC7	5/-	6C9	9/6	6K6GT	7/6	10C1	9/-	35L6GT	9/6	DH77	7/6	ECH35	6/6	EN31	12/6	PEN25	5/-	U403	9/6	W76	6/6
1N5GT	10/6	6AG7	5/-	6C10	9/6	6K7G	3/6	10C2	12/6	35W4	8/-	DK91	7/6	ECH42	9/-	EY51	10/6	PEN45	12/6	U404	7/6	W77	5/-
1R5	7/6	6AJ7	5/-	6CH6	11/-	6K7GT	5/6	10F1	9/6	35Z4GT	6/6	DK92	10/-	ECH81	9/-	EY86	13/6	PEN46	6/6	U801	31/4	X61M	9/6
1S5	6/6	6AK5	7/-	6D2	4/6	6K8G	7/-	10F9	10/6	35Z5GT	8/6	DK96	9/6	ECL80	11/-	EZ40	7/6	PEN383	9/-	UABC80		X65	11/-
1T4	5/6	6AL5	4/6	6D3	6/6	6K8GT	10/6	10LD11	12/6	42	7/6	DL35	11/6	ECL82	12/-	EZ41	9/6	PL33	9/6		10/-	X66	9/6
2A7	8/6	6AM6	5/-	6D6	5/-	6K25	9/-	10P13	14/-	50C5	10/6	DL92	7/6	EF36	4/-	EZ80	8/6	PL36	16/6	UAF42	9/-	X78	12/6
2D21	4/6	6AT6	7/6	6F1	9/6	6L1	13/6	10P14	12/-	50L6GT	9/6	DL94	8/6	EF37	7/-	EZ81	9/-	PL38	14/6	UB41	8/6	X79	9/6
3Q5GT	9/-	6B8G	4/-	6F6G	7/-	6L6G	8/-	12AT6	9/-	53KU	11/-	DL96	9/6	EF39	5/-	GZ32	9/6	PL81	14/6	UBC41	6/-	Y63	6/-
3S4	7/6	6BA6	6/-	6F12	5/-	6L7	6/6	12AT7	7/-	54KU	11/-	EA50	9d.	EF40	14/-	GZ34	12/6	PL82	8/6	UBC81	12/-	Z63	5/-
3V4	8/6	6BE6	6/-	6F13	9/6	6L18	9/6	12AU7	7/-	61BT	9/6	EABC80	9/-	EF41	9/-	HL41DD	9/6	PL83	9/6	UBF80	8/-	Z66	9/6
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5R4GT	11/-	6BJ6	7/-	6F15	9/6	6LD20	9/6	12BA6	8/6	80	6/6	EAF42	9/-	Brit.	3/-	KT33C	8/6	PY32	16/-	UCC85	10/-	Z152	6/6
5U4G	7/-	6BH6	8/-	6F33	6/6	6P25	9/6	12BE6	9/-	83	6/6	EB34	1/6	Red	3/6	KT36	9/6	PY80	8/-	UCF81	9/-	Z719	6/6
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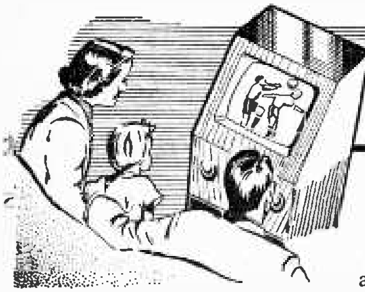

UNDERNEATH THE DIPOLE

A MONTHLY COMMENTARY

By Iconos

I'VE caught the hi-fi bug! Taking a little holiday from the TV set, I have invested in an ambitious array of pre-amplifiers, power amplifiers and loudspeakers which reproduce sound from VHF radio, magnetic tape, or discs with the finest possible clarity, realism and "presence." Of these descriptive adjectives, the last—"*presence*"—is the most important. Leaving my hi-fi speakers to visit a friend's house one night, I could hardly believe the degradation in sound quality that he was cheerfully accepting. To me it sounded woolly and distorted, utterly lacking in both presence and intelligibility. I had been "drugged" with good quality hi-fi sound—this was the other extreme.

Baffled!

IT does seem to me that while the picture side of commercial television sets is steadily improving the sound side gets worse and worse. Utterly inadequate loudspeakers are pushed into the chassis, usually at the side, and many of the fundamental principles of good loudspeaker designs and housings are ignored. Of course, I realise that the most important factor in the choice of a television set by the man-(or more likely the woman-)in-the-street is the appearance of the cabinet, and that the shape which presents a large picture filling the entire front of the set has a big feminine appeal, for some reason or another. I think, however, it would be fairer to the males (who, after all, want to hear the football and racing results clearly) if external loudspeaker connections were provided as a standard facility. The husband who wanted to hear more clearly the words of some of the mumbling actors could then connect up his hi-fi loudspeaker set, complete with cross-over network and tweeters. Separate loudspeakers are a very good idea, anyway, and they can be stood below and in front of the TV set.

Tape Progress

SURPRISING new facts are being revealed almost every week by users of video tape machines. Speaking at the Royal Society of Arts recently, Mr. T. C. Macnamara, Technical Controller of A-TV, told a British Kinematograph Society audience that it ought to be possible to get better quality telerecordings on film *via* an Ampex video tape machine than by direct telerecording. He immediately followed up this assertion by showing excellent demonstration films, which supported his cautious forecast. Direct telerecording was a chancy operation, he said, which sometimes gave very disappointing results through some slight discrepancy in any one of the seven or eight links of recording, printing and processing. Faults in early parts of this process are magnified in later stages. On the other hand, direct recording on to magnetic video tape immediately overcomes the first contrasts hazards, making possible a later transfer under less urgent and more controlled conditions, either direct into a reversal positive film, to a negative film (for transmission by phase reversal) or to a final positive print. Mr. Macnamara's paper was packed with valuable practical information and he was ably assisted by Mr. David Stiles, who is in charge of A-TV's Video Recording Department. In the discussion which followed the paper a large audience of technicians plied the speakers with questions. I have since heard of further possible uses to which the Ampex machine could be put. It is a proposal that 16 mm negative scenes could be transferred on to Ampex tape, for

The Postmaster General, The Rt. Hon. Ernest Marples, watching a videotape recording of himself opening the new extension to the Granada TV Centre in Manchester. In the foreground may be seen the very wide tape which is employed.

improved results in the subsequent "playing off" on the air. It seems that the machine (and amplifying equipment used with it) can be used for grading and generally levelling out the photographic qualities from shot to shot.

Programmes and Commercials in the U.S.A.

SENATOR JOHN MARSHALL BUTLER, a member of the Senate Commerce Committee in Washington, recently stated that "a great proportion of American TV programmes are not even second-rate—they are just plain trash." This is a pretty strong statement to make, which will surprise British viewers of the many American TV films shown by the BBC and I.T.A. organisations. However, it has been confirmed to me by three or four visitors returning recently from the U.S.A. that American TV is not always ahead of us. One of these disillusioned people was Paul Beeson, a well-known British film cameraman. "The quality that is tolerated by the public on the receiving sets is atrocious," he said. "My hotel-room set was in such bad shape that I 'phoned for room-service attention. A few minutes later, a radio engineer arrived to repair it. He took a glance at the picture and said—'Say, boss, it must 'a got right while I was on my way up in the elevator.' To him it looked O.K.!" An actor from England noticed some fine new equipment in one of the studios. "If only we had equipment like that in the British television studios!" he said. A technician pointed to the labels—which had under the manufacturer's name the heartening words "Made in England."

Fred Karno TV

ANOTHER visitor, managing director of one of the new I.T.A. programme companies, described the happy-go-lucky methods of operation at some of the smaller American stations, resembling in many respects the combined efforts of Heath Robinson and Fred Karno. "Nobody bothers very much and many of the operators are part-timers, whose principal source of income is from the local garage," he said. But the main grouse of American viewers themselves is the way in which commercial plugs are introduced into the sequences and action of programmes, a method which is far more annoying than the so-called "natural break" for advertising used over here by I.T.A.

As for the American programmes we see over here; these, I am told, are the very best—the few choice grains of wheat selected from many bushels of chaff. It seems that we can lift our heads fairly high on artistic, technical and organisational matters in TV. But we must give full credit for the fantastic evolution of the Ampex video tape system, world acceptance of which has resulted in the expansion of the Ampex factory at Redwood City, Cal., into a veritable city over a period of months.

"The Melody Dances"

BRIGHT and gay musical shows have become relatively commonplace on TV. In fact, there is a comparative embarrassment of riches in this particular department. I am happy to record appreciation of *The Melody Dances*, the streamlined musical and dance show starring Cyril Stapleton and his band. Producer Dicky Leeman carried this show through at a slick pace leavening a wide choice of dance orchestra close-ups with well-presented vocal numbers by Shirley Sands, Jo Shelton and Michael Desmond. There was also some delightful exhibition ballroom dancing by Brenda Winslade and Desmond Ellison and formation dancing by the Maurice Jay Dancers. All were cheerful, good-looking and splendid artists, even when viewed by this writer through the jaundiced eyes of approaching influenza. *The Melody Dances* may be routine stuff, but it is first-class of its type.

On the same evening one of the poorer episodes of that usually good, but never-ending *Wagon Train* followed. My germs had evidently thrived on the discordant musical background, so I gave up the struggle and went to bed! But I firmly believe that had it not been for *The Melody Dances* my 'flu would have been far worse! On the other hand, I like to kid myself that the 'flu would never have developed had I switched off after the last genial close-up of Cyril Stapleton before *Wagon Train* started.

"Land of Song"

IT is not very often that we in London see features from the smaller provincial programme companies or from the BBC's regional TV centres. Plenty of shows come from Manchester and Birmingham, but nothing much from elsewhere. It was, therefore, a great pleasure to see and hear TWW's "Land of Song" one recent Sunday. This was a well-conceived production, with excellently designed sets, first-class camerawork and a good general gloss and professional touch, which the smaller local stations rarely have the opportunity of attaining. Christopher Mercer directed this musical programme which took full advantage of the spacious 60ft. by 80ft. stage at Pontcanna Studios, Cardiff. It is a sensible, useful floor area and the clearance height to the girders is only 23ft. This is useful, too. Greater height clearances are wasteful for an all-purpose studio. The floor area gives plenty of space for sets which can be used and re-used only requiring refurnishing and re-dressing. Small area stages are a mistake, constantly requiring sets to be built and struck to make space for new sets. Compliments to TWW and to Walter Kemp, their Technical Controller.

...another TRS Winner

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Latest 4-sp. BSR Player Unit and P.U. ... ... *£4.12.6 carr. 3/6*
2 v. Amplifier wired complete with speaker, etc., on Mounting Board. ... *£3. 5.0 carr. 2/6*
Contemporary styled light-weight case in Maroon and Grey. 14½in. x 11½in. x 6in. ... ... *£1. 7.6 carr. 2/6*

SPECIAL OFFER
all 3 units
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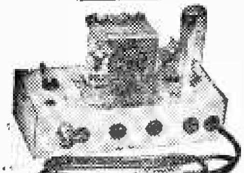

BAND 3 T/V CONVERTER—180 Mc/s-205 Mc/s

Suitable for London, Midland, North, Scottish, Welsh and I.o.W. ITA Transmissions.

Mk. 2 Model, as illustrated. Latest Cascode circuit using ECC84 and EF80 valves giving improved sensitivity (+18 db) over standard circuits. Built-in Power supply AC 200-250 v. **Dimensions only** 6¼in. x 3in. Ht. 4in. Simple and easy to fit—only external plug-in connections, wired, aligned and tested ready for use. State Channel required. Guar. Bargain Offer—good results or full refund, only £3.19.6. Carr. & Pack., 2/6. Band 1-Band 3 c/o Switch and BBC aerial socket, fitted and wired to converter, 8/- extra.

ELECTROLYTICS ALL TYPES NEW STOCK

Tubular Wire Ends		32+32/350 v. B.E.C.	5/6
25/25 v. 50/12 v.	1/9	Can Types, Clips 3d.	ea.
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16/450 v. B.E.C.	3/6	32+32/450 v. T.C.C.	6/6
16/500 v. Dub.	4/-	250/350 v. B.E.C.	8/6
16+16/450 v. T.C.C.	5/6	60/350 v. T.C.C.	6/6
32/350 v. B.E.C.	4/-	60+100/350 v. B.E.C.	11/6
32/500 v. Dub.	5/-	60+250/275 v. B.E.C.	12/6
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CONVERTER ACCESSORIES
Band 1-Band 3 Cross-over Unit, 7/6. Var. Attenuators 6db-36db., 7/6. BBC Pattern Filter, 8/6. Band 3 Aerials—outside Single Dipole with 4 yds. co-ax., etc., 18/9. 3 Element Beam, 25/-. 5 Element, 32/6, etc.

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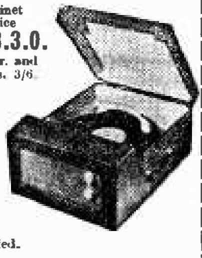
10,000 ohms—2 Megohms. All long spindles. Morganite **Midget type.** 1¼in. diameter. Guar. 1 year. **Log.** or ¼in. Ratios. Less Sw. 3/-. D.P. Sw. 4/9. Twin-ganged controls, ½ meg., ½ meg., 1 meg., all less Sw., 8/9 each.

RECORD PLAYER CABINETS
Contemporary style, rexine covered cabinet in fawn and brown with cream interior. Size 18¾ x 13¾ x ht. 8½ in., fitted with all accessories, including baffle board and anodised metal fret. Space available for all modern amplifiers and autochangers, etc. Uncut record player mounting board 14 x 13in. supplied.
Cabinet Price **£3.3.0.** Carr. and Ins. 3/6.



2-valve AMPLIFIER Mk. 2
Latest developed circuit giving a higher fidelity response and greater output (2-3 watts) using twin stage valve ECL82 and neg. feedback Tone Control. Complete with knobs wired and tested with 6in. Speaker, etc., ready to fit in above cabinet. Only £3.19.6. Carr. 2/6.

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SINGLE PLAYERS 4-speed BSR (TU9), 92/6; 4-speed GARRARD (4 S.P.), £7.15.0. GARRARD (TA Mk. II), £9.5.0. Carr. and Ins. 3/6.
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All isolation Transformers now supplied with alternative *no boost plus* 25%, and *plus* 50% **boost taps, at no extra charge.**

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Designer Approved Kit of parts to build this modern highly successful unit, drilled chassis and superior type dial. Coils, cans, and all quality components, etc., for only 5 gns., post free. Set of 4 spec. EF91s or equiv. valves, 30/-, post free. Illustrated handbook with full details, 2/- post free. FREE WITH KIT. 48 hr. alignment service. 7/6 plus 2/- P. & P.

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1S5	7/6	DK96	9/-	EF80	10/6	PCL83	12/6
3S4, 3V4	8/-	DL96	9/-	EF86	14/6	PL81	14/6
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
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The Editor does not necessarily agree with the opinions expressed by his correspondents. All letters must be accompanied by the name and address of the sender (not necessarily for publication).

COLOUR TELEVISION

SIR,—Compatibility is a term we have come to associate with lack of progress in the field of Colour Television. Because of this rather naïve desire to progress and stand still at the same time, a situation has arisen which is both frustrating and downright stupid.

With colour television we had a chance to dispense with silly conventions and give the public a really high definition picture in full colour. But what do we do? We shackle ourselves by clinging to the old out-of-date 405 line system: we add enormously to the time and money spent on development work by trying to ensure that people with black and white receivers also get pictures from the colour transmitter. One wonders if the old low-definition television were still in existence whether the colour experts would be making provision for it as well!

Colour television cannot develop fully until it is completely divorced from its black and white counterpart. As the theatre and cinema have developed side by side for years past, so must these two mediums of television be allowed to develop along their own channels. One medium may eventually disappear but this is the price of progress! One thing is certain. No real progress will be achieved until we have dispensed with this idea of "compatibility."—R. D. COYLE (Harlington).

AERIAL RESULTS

SIR,—On page 116 of PRACTICAL TELEVISION, October, 1958, issue, reference is made to a Band III aerial described in the June, 1957, issue. I made this aerial at the time but could only get sound. After much experiment I found the dimensions given were wrong for Channel 9 which the author claimed to be receiving. So in order to remedy this, I remade the aerial to the correct dimensions and at once got a trace of picture. I then made a duplicate array for use in parallel and got slightly better results. However, the final aerial which gave me a good picture was by removing the two folded dipoles and replacing them with a skeleton slot as described in another issue of PRACTICAL TELEVISION. With this I used a ½in. mesh galvanised wire netting reflector.

I have now no need of this loft array; with the opening of Chillerton Down on Channel 11 a normal six-element array suffices.

Nevertheless, I think it quite an achievement to receive Channel 9 with a loft aerial at this distance. I can well imagine after my better reception with a slot aerial that the quad aerial described in recent issues must be very effective for fringe area reception of Band III. I use an inverted Tee loft aerial for Band I. This gives me the choice of Channels 1, 2 and 3.—A. W. LYON (Worthing).

RECEIVER DESIGN

SIR,—It seems to my way of thinking that most designers have thrown away many refinements which would ensure the viewer better viewing such as line flywheel sync.

Recently a well-known organisation brought out the "Syncroguide" system which I should imagine would be economical to produce and could be included in every make of TV as it is designed around a single valve of the double-triode variety, but some made one run with this facility and then they have reverted back to the blocking oscillator or multivibrator systems, which, I should think, are just as costly to produce as the "Syncroguide" system.

I would sooner pay the extra pound or two for a receiver with an efficient A.G.C. system and flywheel sync, rather than pay less for the old style receiver.

When shall we be able to purchase a receiver with these refinements cheaper than they are being sold today?—F. MALPASS (Hednesford).

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.**

UNUSUAL PHENOMENON

SIR,—I recently came across the following phenomenon. On fitting a Band III converter unit to my TV receiver a strong interference pattern persisted on the ITV signal even after careful and accurate adjustment of the converter tuned circuits. Various methods such as wave traps, etc., proved to be of no avail. On checking the leads connecting the aerial to the R.F. amplifier, it was found that an unscreened lead had been used. These, surprisingly enough, were the original leads used by the manufacturer. This ran from the aerial input terminals from the back of the receiver for a distance of about 15in. along the right-hand side of the set to the R.F. end up in front. The strong Channel I signal was being picked up by this lead and hence causing the strong interference pattern on the screen. Replacement of this lead by a short length of standard 72Ω coaxial soldered direct to the coupling coil eliminated this interference completely and now an excellent interference-free picture is obtained.

May I take this opportunity of thanking you for an excellent and informative monthly magazine.—P. E. PERERA (London).

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

H.M.V. 3807

I intend to fit a turret tuner to my receiver. I will dispense with the first stage R.F. (Z77), making the X78 the first stage. Will the RFT1 aerial input at present serve as an input coil from tuner to the new I.F. stage? If not, can I make an input coil to suit this purpose? I realise I have upset the heater chain by this modification. How can I check and adjust to get this heater line correct? I have a good multimeter.—N. Parry (Liverpool, 8).

Inject tuner output to pin 2 of V2 (X78), removing .001 μF, and 220 kΩ resistor, wiring a 100 Ω resistor in place of the latter. Remove connections to pins 6 and 7 and connect these pins to 3. Derive tuner H.T. from pin 7 of V1 and tuner heaters from pins 3 and 4 of V1. Set voltage adjustment from 5 to 4 or 4 to 3.

EKCO TC209

I have had the above set for three years and the picture is perfect except that it has been slowly dimming until daylight viewing is now almost impossible and the sound has lost some of its volume.

I thought that if I renewed the rectifiers and boosted the tube it would help. If you agree with me please tell which valves to change and how to boost the tube and any other information. I did try moving the mains tapping from 240 v. to 230 v. and it gave quite an improvement though not enough to bring the set up to standard.—R. Sourbutts (Wembley).

The H.T rectifier is the metal Automat TV5 which is along the front of the chassis, and which is unlikely to be faulty. We suggest you first try boosting your tube using a 13 volt low capacity C.R.T. transformer. Connect the secondary to pins 1 and 12 of the tube having previously removed and shorted the orange and yellow wires. Mains for the transformer may be taken from between chassis and voltage flylead A, taking this latter wire *via* the spare set of contacts on the F.M./TV switch so that it is disconnected on F.M. Voltage flyleads C and D must be set to the tapping correct for 10 volts higher (i.e., to 250 v. from 240 v.) to compensate for the absence of the tube from the heater chain.

PYE V4—BBC ONLY

My set is five years old and the picture is very good except for a 3in. strip on the left-hand side of the screen which is quite dark. On increasing brightness it becomes milky and the rest of the picture lacks contrast. On increasing contrast the picture becomes silvered or negative. Could you please tell me, in simple terms, what may be the cause of this as I would like to repair it myself if possible.

Also could you please suggest a suitable converter or turret tuner which would be simple and easy to fit?—D. Graham (Glasgow S.5).

Your shading is probably due to an open circuit bias condenser 25 μF 25 v. between the cathode of the PL81 and chassis. We suggest you use a Clydon P16H turret tuner on your set.

COSSOR 933A

The picture is very dark. Advancing the brightness control just brightens the raster and removes the picture; advancing the contrast control makes the picture break up.

Voltages around the tube base, taken on the 500 volts range of a Universal Avominor, show first anode 240 v.; cathode 180 v.; grid 0-50 volts, relative to chassis. I have tried increasing the grid voltage to a maximum of 120 volts, without satisfactory results, also lowering first anode volts.

The set failed when I first had it, and a service engineer took it away saying the tube had failed. He returned it to me with an old tube fitted, which, he said, should last for a while. After a few months the set failed again and I assumed it to be the tube, so I obtained a rebuilt tube and fixed it into the set according to instructions I read in "Practical Television," with the results that I have already mentioned—i.e., very dark picture. The picture is quite normal in all other respects.—A. Palmer (Rotherham).

You describe all the symptoms of yet another faulty C.R.T. We suggest that you first check the ion-trap magnet, which may have lost some of its strength or may have slipped, and the 6BX6 video amplifier which is on the lower deck adjacent to the video plug and socket. This valve may be exchanged with one in the sound I.F. strip as a quick check.

EHT DISCHARGER

I have been asked on several occasions to examine television receivers, but am dubious about handling the EHT circuits, as I have read of test prods disintegrating. Could you suggest a tool for discharging the EHT condenser with particular reference to suitable insulators.—R. Dent (Newcastle).

A simple tool to discharge EHT lines can be constructed from a length of flexible insulated wire (2ft. of coax inner) with a crocodile clip for

(*Continued on page 525*)

connection to chassis at one end and a 10 meg 1 watt resistor at the other. This resistor can be housed in the front end of an insulated sleeve to provide a probe and an empty ball pen case may be used in this respect. Always discharge EHT points more than once, as they charge themselves up again from the C.R.T. glass charge.

PYE 18T

The fault is a click from the loudspeaker plus an immediate darkening of the picture. There is no change to either the focus or size of picture. During the few minutes immediately following this disturbance the picture gradually increases in brilliance until it is back to normal conditions. The fault is of an intermittent nature and may not always occur. The tube was recently repaired, but as the set belongs to my sister I do not know whether the fault was in existence before the repair or whether it is a fault in the tube.—R. J. Lean (Cambridge).

The usual cause of your fault is dirty valve pins or faulty decoupling in the vision R.F. stages. We suggest that as a first check you exchange the vision and sound EF50 valves and notice if the fault transfers itself, then progressively bridge each decoupler in the circuit in turn with a good .0015 μF ceramic condenser.

STELLA TYPE ST.1480U

I should be glad if you would assist me in finding a fault which has developed. There is no raster visible at any setting of the brilliance control and the line whistle seems to be absent. The valves UL44 and UY41 have been tested and are O.K. A resistance check between the anode cap of the UL44 and the anode of one of the EHT rectifiers shows only 10 Ω. The sound is perfect.—J. P. Batty (Beverley, Yorks).

The symptoms are typical of a deflective line output transformer and this should be replaced. However, check the small electrolytic capacitor associated with the UY41 cathode as this could be open circuited.

PHILCO 1551

I should be pleased if you could help me find the fault in my 12in. table model TV. I have a perfectly good picture, but down the left-hand side of the screen there are bands of black and white running vertically and covering about one-fifth of the screen horizontally. This gives the impression of a folded curtain, but one through which the picture can be seen, although distorted. When the brilliance control is advanced to maximum, image reversal takes place—this I take to be a failing tube, for which I have fitted a booster transformer with very little effect.—P. Towell (Hartlepool).

Two .001 μF capacitors are wired across the line scanning coils in series. A variable trimmer is wired from the junction of these to the C.R.T. grid. Check these components.

FERGUSON 992

This is a five-channel set which has been converted to ITV, with a Ferguson tuner unit. I installed this second-hand set for a friend in the Midland region, the channels being 4 and 8. The picture on BBC was perfect for a few days, but then it became distorted as though water was flowing across the screen from left to right. Sometimes it would settle and the picture would be perfect, but when I turned the horizontal lock control the picture would break up again. The ITV picture is very poor and it will not lock. I used a combined chimney aerial, made by Antiference. Could you please inform me what would cause these troubles, also if I can remove the Ferguson tuner unit without interfering with the BBC on Channel 4 ?—A. McGarry (Reading).

Ensure that the BBC is correctly tuned by means of the rear right side station tuner. Tune the required ITV programme in by adjusting the three nuts on the switch spindle so that they depress the tuning pedals (which actuate the coil cores of the tuner unit). Depress these pedals by hand, all together until sound is heard, adjust nuts to bring pedals to this point. Check the vision EF80 valves and the crystal diode vision detector (inside final I.F. coil can).

PYE BV20

I wish to replace the 100 + 50 μF condenser. This is a 280 v. working electrolytic and I have one which is a 350 v. working. 64-120 μF. Will this do in its place ? What effect will the change make ?—D. Cole (Coventry).

You should not notice any difference by replacing your condenser by the one you suggest. Be sure and put the 64 μF section nearest the rectifier.

PYE MODEL V4

Sound is O.K. but there is no raster and no whistle. On removing chassis I found no EHT also EHT rectifier (EY51) failed to light up. I then found that the 500 mA fuse was blown and the anode connecting wire to the top of PY81 was off (looked like melted solder connection between wire and clip). After renewing fuse I made a temporary connection of the PY81 anode and immediately the sound dropped and distorted and the PY81 anode glowed red. This was renewed with the same results. This also caused a resistor coupled from PY81 to PL81 to heat up but I don't think the resistor is at fault. I suspect the line output transformer or scanning coils may be short circuited but have no means of checking this, furthermore I have no service sheet.—R. M. Earle (Northallerton).

We suggest you try and isolate your fault as follows :—Run the set with PL81 top cap connection removed. If PY81 (assumed to be O.K.) still glows suspect line transformer or scan coils. Remove line scan coil feed (screened and pink wires at tag strip beneath scan coils). If this cools the PY81 down replace the scan coils. If it does not. replace the screened lead. If the PY81 still overheats replace the transformer.

PYE RTL/17 CONTINENTAL

Could you tell what is wrong with the above set which is 16 months old. There is no picture (or raster) and no sound. On shorting heater pins on tube MW43/69 sound is heard and there are blue flashes in the tube gun. A distinct

pinging sound can be heard, which becomes louder when the volume is turned up. I was wondering if it was a short in the tube heater and, if so, would an isolating transformer be of any use ?—E. Skade (Manchester).

We would say that your tube has an open-circuited heater and is most probably soft. If this is the case, the fitting of an isolating transformer will be of no assistance.

EKCO T161

My set gives an excellent picture though it is slightly cramped up at the bottom with the lines wider apart at the top. The trouble is that the picture will keep rolling. If I reset the vertical hold, it will be O.K. for a few minutes then roll the other way, and so on, up and down all evening. The vertical hold is central but very critical for position. I have changed the 20L1 and the .25 μF condenser on the chassis without effect.—H. R. Webb (Cambridge).

We advise you to replace the Q3/4 metal interlace rectifier which is situated alongside the frame blocking oscillator transformer and is coded orange-yellow. This should restore your hold. but may still leave a distorted scan. If so, suspect also the 6L18 frame output valve.

BUSH TV24C

This set works quite normally on Band I. When the set is switched over to Band III it works normally for about an hour, then horizontal bands of light flash across the screen. These bands of light move in rapid succession from the top to the bottom of the screen and are accompanied by a crackling in the loudspeaker. If I switch back to Band I it sometimes eliminates the flashing on Band III for about half an hour. Other times the flashing will go off itself for a period. I can tune the crackling out with the loss of sound, but then the bands turn from white to black.—R. Griffiths (Shiremoor, Northumberland).

You should remove the bottom cover of the tuner unit and thoroughly clean the switch contacts. Try the receiver again. If it is still defective, check the PCF80 valve and associated components.

MURPHY 202C

I have recently added an Aerialite converter for Channels 5 and 8, to my set, which gives good results but with a certain amount of patterning. My main problem, however, is that once or twice during viewing, the picture has gone opaque for a second and then restored itself to normal again. The contrast control is right back almost to its stop and if advanced much the picture is too brilliant and the figures stretch vertically. Can you indicate the faulty component, please ?—C. Firth (Co. Durham).

Your symptoms are those of a heater-cathode short in the tube. This may be overcome by the fitting of a low capacity isolating transformer to the heaters. This will take the place of the existing 2 volt supply to the heater pins (1 and 12) and mains supplies for its primary should be derived from the set side of the on-off switch.

RE FERGUSON 984T

I have the service sheet and alignment instructions for the above set, but these instructions state that the 2 mA range of an Avo Model 7 should be used for vision alignment, in conjunction with a potentiometer, etc.

I wish to use my Avo Multiminor for this, but this meter has no 2 mA range. Could you please let me know what range I can use on my meter and what difference this will make to the potential value, etc.—A. Simester (Bournemouth).

It is not unduly critical which milliamp range is used for reading the signal current as this is really only for comparison purposes. A voltmeter across the video anode load resistor would serve. The degree of deflection or indication of variation is what is required provided the total resistance exceeds 50 kΩ.

H.M.V. 3815

Kindly give me a clue as to what to look for (and where) to cure a slow downward roll on my set. This model is the Northern model, but it has been converted to Rowridge and Chillerton, with a Brayhead.

The vertical hold is fully to the left when facing the open back of the set, and at one point when moving it to the right, a bright bar of light with the picture superimposed on top of it, appears, accompanied by considerable narrowing.—John M. Welchman (Ventnor).

We would suggest that you replace the 25 kΩ pot. (vert. hold) and also the 2.2 MΩ resistor (red-red-green) situated under the flat type capacitor on the long tag strip (yellow lead) near the Z63-B36 valve bases.

FERGUSON 996T

I require to change the EY51 on my set. As it looks rather a complicated business owing to the restricted space, may I ask your advice regarding its removal and replacement.—J. Mulholland (Glasgow).

Pull off front knobs. remove bottom panel and pull out speaker leads from sockets. Remove bottom chassis fixing screws and slide out chassis. Remove tube base socket and ion trap magnet. Remove EHT cap from side of tube. release tube front clamping band and carefully remove tube. Unscrew P.K. screws from metal case covering EY51 box and lift lid. Remove EY51 and solder the new valve into position, having cut the leads to the right size and make connections with well rounded blobs of solder.

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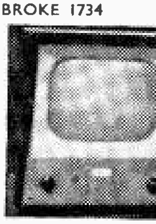

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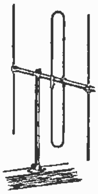

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