MOUNTING WIDE-ANGLE TUBES

PRACTICAL TELEVISION

AND TELEVISION TIMES

1/-

EDITOR
F. J. CAMM

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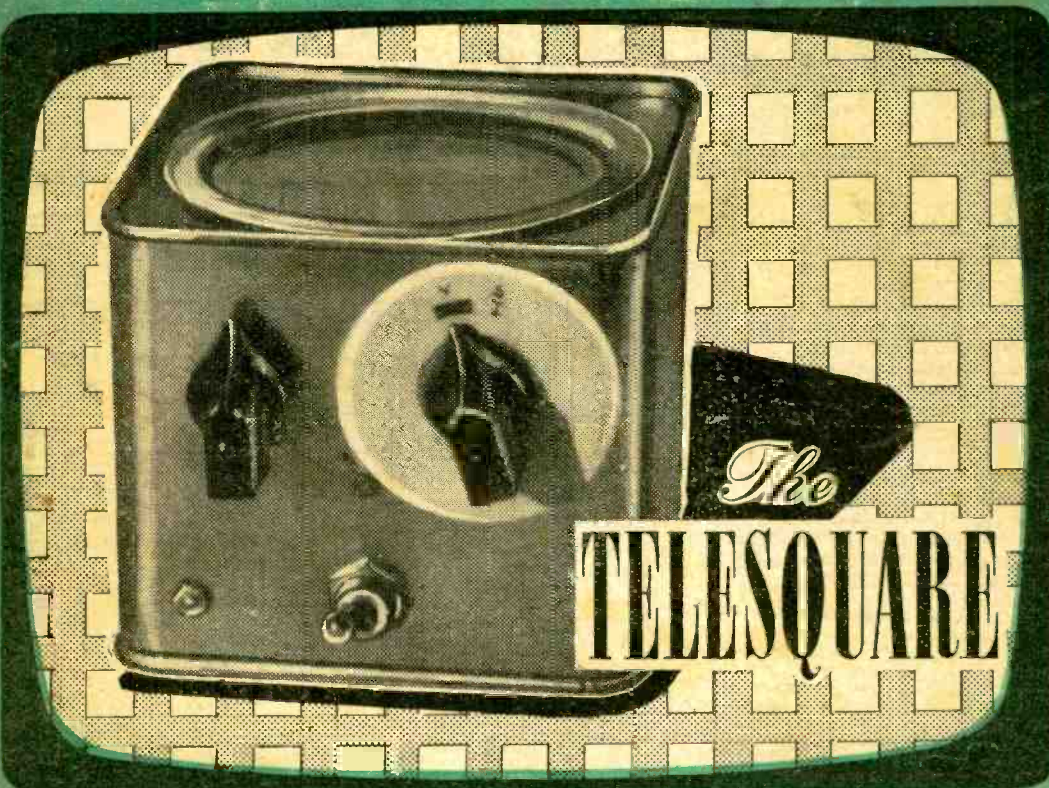

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Editor : F. J. CAMM

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TELEVIEWS

Ban On TV Stations

THE Government has decided not to proceed with the three projected low-power television stations which were intended to serve the Aberdeen, Southampton and Plymouth areas. The Postmaster-General, giving the reason for this decision in the House of Commons, said that it would not be in the national interest at a time when important industrial investment is still severely limited on account of our defence and export drive to devote more economic resources to the construction of new stations, and still more to the manufacture of the receivers which the opening up of these new services would demand. The ban is only "for the time being," but there is no hope that it will be lifted soon.

He was careful to explain that it was not a question of the BBC being unable for technical reasons to erect these stations in time for the Coronation ; it is the drain on national resources which is the determining factor. Suggestions have been made that commercial enterprise might be allowed to provide stations, but in the opinion of the Government this would not dispose of the objection, and for these reasons the Government cannot allow television relay companies to operate in areas not covered by the BBC stations.

The objection that the rearrangement of the defence programme would cause a recession in the radio industry this year brought forth the reply from the P.M.G. that there was no sign of it. The number of sets produced in October last year was more than twice that produced during August. He said that the danger is if erection of these new stations were to be permitted it might encourage the creation of a far greater number of sets than the industry could normally carry in average times, adding that the limiting factor is not so much the transmitting equipment as the receiving sets. At the present time the value of the receiving sets in the homes of this country exceeds £100 million. From the point of view of the industry the decision is disappointing, because it had been hoped that a new demand would help to bridge the gap which will be created this year by the reduction in the rearmament programme forecast by the Prime Minister. A spokesman for the industry said that it could undoubtedly provide the necessary receivers for the areas of all five low-power stations without any interference with exports or rearmament. The three remaining stations now banned would serve 700,000 households, approximately 4 per cent. of the total for the country. These households will be denied the possibility of viewing the Coronation. The temporary stations at Pontop Pike and Belfast have naturally created a desire for similar facilities to be provided, especially in those areas which will ultimately be served by the three remaining low-power stations—Aberdeen, Isle of Wight and Plymouth.

COMMERCIAL TV

IT is now clear that commercial television sponsors will not be able to open their own TV stations by this autumn as anticipated, and efforts are being made, therefore, to bring pressure on the Government to permit a certain amount of programme time on the BBC system for such sponsored programmes. It is known that the BBC vigorously opposes such a policy. The BBC insists that commercial TV should not be permitted while the Government prevents the BBC from building the TV stations needed to complete their country-wide network. It is known that many members of the Cabinet are in favour of commercial TV, which can only have a free hand when the BBC network is complete. Prominent advertisers have drawn up plans to make commercial TV possible by August, based on a Government-controlled body under whose supervision would lease programme time. As we go to press no statement has been made to clarify the somewhat tangled position.

TRANSISTORS

APROPOS our statement last month on the development of transistors in America, we learn that considerable developments have taken place with transistor triodes in this country and that we are by no means behind America in these developments. In time transistors must eventually oust the thermionic valve, but that will not be for some years. Valve manufacturers do not view with equanimity the great changes which transistors will bring about in their own industry, for transistors rarely need replacing. Replacement valves still represent an important part of the valve trade.—F. J. C.

Germanium Crystal Diodes

THE APPLICATION OF THESE NEW DIODES ON TV WORK

By B. L. Morley

THE modern germanium crystal diodes appear to have been somewhat neglected by the constructor, so far as TV work is concerned, though several commercial televisors use them, the G.E.C. being pioneers on the British Market.

Some uses of the diodes in television design are given below :—

(a) Vision detector.
(b) Vision interference limiter.
(c) D.C. restorer.
(d) Sound detector.
(e) Sound A.V.C.
(f) Sound interference limiter.
(g) Sync separation.
(h) Frequency convertor. (Mixer).

In brief, except for the power supply, crystals can be used wherever a thermionic diode is used.

The advantages they possess over ordinary diode valves are :—

(i) Great sensitivity.
(ii) Long life (10,000 hours minimum).
(iii) No current consumption (i.e., no heater current and associated wiring).
(iv) Low self capacitance (less than 1pF).
(v) Robustness.
(vi) Compactness. (They can be soldered directly into the circuit and take up very little space).
(vii) Able to withstand heavy transient overloads.

The history of the development of germanium crystal diodes is a fascinating one (interested readers are referred to the articles published in the December and January issues of our companion journal "PRACTICAL WIRELESS"), but although of such recent birth the new component is well beyond the laboratory stage and is being produced commercially in large quantities : mass production methods allow them to be retailed for as low as 4s. 6d., and 6s.

Construction

The diodes are manufactured mainly by three firms in Britain ; they are B.T.H. Ltd., G.E.C., and Westinghouse. The principles of construction are similar in each case.

The crystal itself (a flake of germanium) is fixed inside a glass tube ; the modern "catswhisker" has its pointed end in direct contact with the crystal, the point being made a permanent fixture during manufacture so that no alteration is needed when using the crystal. The "catswhisker" is made of tungsten wire.

Two wires are brought out from the glass tube and these wires can be soldered directly in the circuit.

Fig. 1 shows the construction of the B.T.H. type, and although each manufacturer has his own particular mounting methods the principles are similar.

One important point the constructor should note is that care must be taken when soldering the crystals into the circuit. The connecting wire should be gripped with a pair of pliers *between the crystal and the soldering tag*, so as to divert the heat away from the crystal.

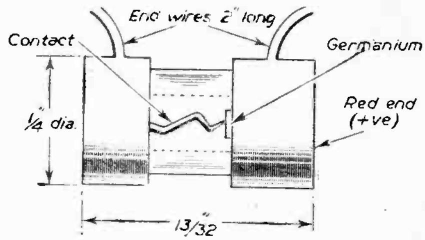


Fig. 1.—General details of construction of the B.T.H. pattern Germanium crystal diode.

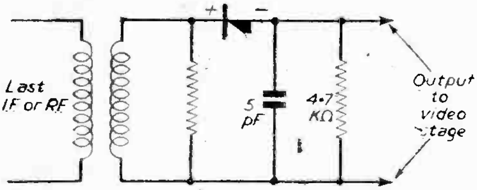
Polarity Markings

The general practice is to mark one end of the crystal red and this is the cathode end, being equivalent to the cathode in the thermionic diode. The other end is the anode and is coloured according to the characteristics of the crystal.

The correct method of connection can be determined by remembering that if A.C. is applied to the anode, positive potential will appear at the cathode (red end).

B.T.H. Ltd., uses the following colour code (cathode red) :—

Type	Colour of anode
CG1	Green
CG4	Blue
CG5	White
CG6	Black
CG8	Brown



(Output can be taken via compensating filter desired)

Fig. 2.—Typical vision detector circuit.

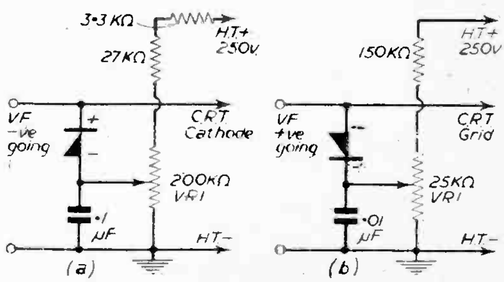


Fig. 3.—Vision interference circuits using the diode.

The G.E.C. use the following code (cathode red) :—

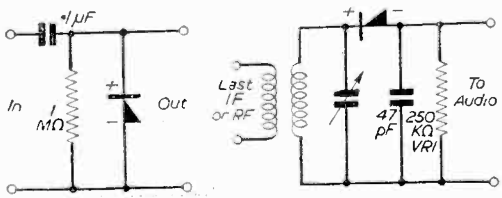
Type	Colour of anode
GEX33	Orange/Orange.
GEX44	Yellow/Yellow.
GEX45	Yellow/Green.
GEX55	Green/Green.

The Westinghouse have the code number marked on the body.

Equivalent Tables

Although each diode has its own particular characteristics the following types are approximately equivalent and can be used in similar circuits.

B.T.H.		G.E.C.		Westinghouse
CG4	=	GEX55	=	WG7A
CG5	=	GEX45	=	WG7B
CG6	=	GEX45	=	WG5A
CG5	=	GEX33	=	WG4A



Figs. 4 and 5.—Typical D.C. restorer and sound detector circuits.

The equal signs should not be taken to mean that one is exactly equal to the other, but that one can be used in a similar circuit to another. Manufacturers' tables should be consulted when required.

Characteristics

It is not possible to give a complete set of characteristics of each type available because of reasons of space, but the following table has been compiled as a guide for the constructor.

	CG6	GEX45	WG5A
Max. Volts (peak reverse volts)	50	60	40
Max. Input (continuous current)	50mA	50mA	50mA
Transient Surge. (mA)	400	500	500
Min. forward current at ± 1v.	2mA	5mA	1mA
Max. reverse current at ± 10v.	100mA	33mA	100mA

The average figure of resistance taken at + 1 volt is 500 ohms and minimum back resistance taken at —10 volts is 100,000 ohms. These figures will, of course, vary from one type to another, but can be taken as a general guide.

The capacity is less than 1 pF, the shelf life is 10 years minimum and the working life is 10,000 hours minimum.

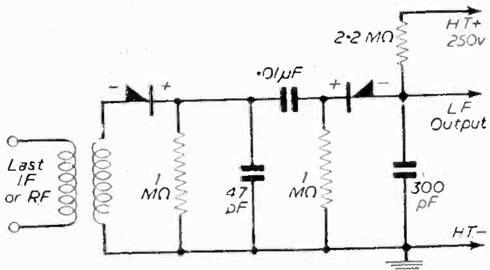


Fig. 7.—Interference limiting and sound detection are shown here.

Circuits for the Experimenter

Vision Detector

Fig. 2 shows the circuit. The output is negative and is therefore suitable for grid driving of the CRT when fed into a video valve ; a positive signal will appear at the anode under these circumstances.

A positive output can be obtained simply be reversing the diode and this will yield a negative signal at the

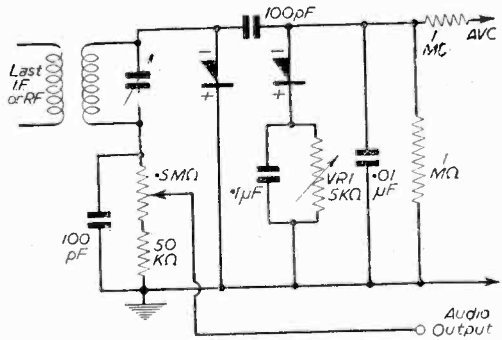


Fig. 6.—In this circuit A.V.C. is obtained as well as rectification.

anode of the video valve for driving the cathode of the CRT.

Types to use are CG5, GEX33, WG4A.

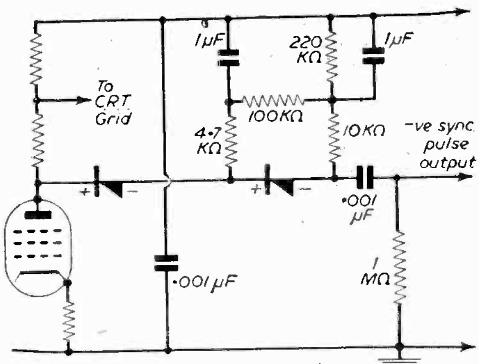
Vision Interference Limiter

Two circuits are shown in Fig. 3. (a) is for limiting when the output of the video valve is negative going. The degree of limitation is set by VR1 which should be adjusted in the following manner :—

The control is set to minimum operating position so that the brightness is normal. The control is then turned until the high lights just begin to turn grey. The control is now turned back slowly and carefully until the highlights are just restored.

This method of adjustment is applied in both cases whether Fig. 3 (a) or (b) is used.

The limiter in both cases, is applied at the point



(Courtesy BTH Ltd)

Fig. 8.—A sync separator circuit using two diodes.

where a direct lead is taken from the video valve to the cathode or grid of the CRT, i.e., after any compensating filters.

Types to use are CG6, GEX33, WG6A.

D.C. Restorer

Fig. 4 shows the very simple circuit for using the crystal as a D.C. restorer. Suitable types are CG6, GEX44, WG7A.

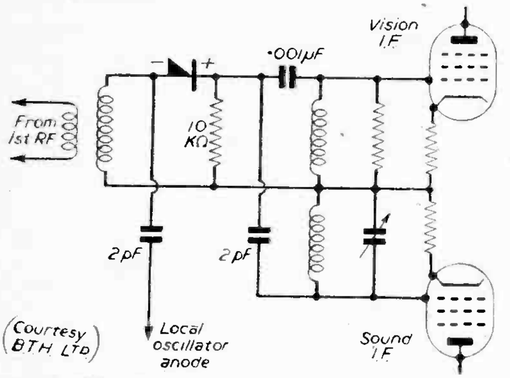


Fig. 9.—The customary mixer valve is replaced in this frequency changer circuit by a diode.

Sound Detector

Fig. 5 shows the crystal used as a sound detector. The control VR1 can be a potentiometer for the purpose of volume control. Suitable types are CG5, GEX44, WG5A.

Sound Detector and A.V.C.

Fig. 6 shows the circuit for applying A.V.C. which is useful in areas of high signal strength and avoids having a sensitivity control ; it also helps to counteract fading at long distances. The amount of A.V.C. is controlled by VR1.

Suitable types are CG5, GEX44, WG5.

Sound Detector and Interference Limiter

The circuit is shown in Fig. 7. Limiting is automatic and requires no pre-adjustment. Suitable crystals are CG6, GEX44, WG6A.

Sync Separator

Fig. 8 shows the circuit which is for negative sync output (positive picture signal), and requires a positive signal input.

If the circuit requires cathode modulation and/or a positive sync pulse then phase splitters can be used to effect the reversal where required.

A suitable crystal is the CG6 (the circuit is a B.T.H. circuit).

Frequency Convertor (Mixer)

Fig. 9 shows the simple circuit which dispenses with the mixer valve entirely. A suitable crystal is the CG5 and this circuit is also a B.T.H. suggestion.

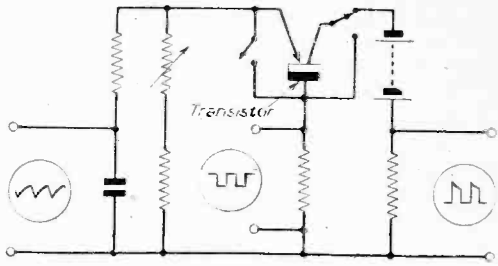


Fig. 10.—The transistor, or crystal *triode*, in an American experimental circuit.

Recent Developments

One of the latest discoveries is a new method of making contact with the crystal. This is carried out by forming the rectifying barrier, or junction as it is called, *inside* instead of on the surface of the germanium ; thus the contact by fusing is made extremely robust and stable.

Further research has resulted in the discovery that by adding a second "catswhisker" to the crystal a triode is formed which will actually amplify signals in a similar manner to the thermionic triode ; a current of only a few milliamps is required. The triode is termed a "transistor."

The very latest circuit development of transistors is that of the sawtooth oscillator. Under certain circumstances the transitor is found to be capable of regeneration by positive feedback. This feature can be applied to the usual time constant circuit and sawtooth oscillations produced. An experimental circuit is shown in Fig. 10.

A New Phase Meter

THE K159 phase meter is a simple, self-contained and relatively inexpensive instrument which gives a direct reading of the phase difference between two sinusoidal signals with sufficient accuracy for most normal laboratory purposes. Besides being more accurate than the conventional method of observing Lissajou's figures with the aid of a cathode-ray oscilloscope, it avoids the use of relatively elaborate and expensive equipment which in many cases could be better employed for other purposes.

By merely connecting the two inputs to terminals on the instrument and carrying out a very simple procedure, the phase difference may be read on the scale of a meter calibrated from 0 to 90 degrees. Phase angles from 90 degrees to 180 degrees may be measured by inverting one of the inputs and subtracting the reading from 180 degrees. The instrument does not discriminate between angles of lead and lag, but this may be readily determined, in cases where there is any ambiguity, by introducing a small phase shift of known sense into one of the input circuits.

Principle of Measurement

The instrument employs a variation of the "three volt-meter" method, whereby each of the inputs is first adjusted to a standard amplitude and the difference between them measured by means of a differential valve voltmeter. It is clear that when the two signals are exactly in phase the measured difference will be zero, whereas when they are in opposite phase the difference will be twice the amplitude of either signal. For intermediate phase angles the output voltage is given by :—

$$V_0 = 2V_1 \sin\frac{\phi}{2}$$

As the scale is very cramped between 90 degrees and 180 degrees, the meter is calibrated from 0 to 90 degrees only, measurements between 90 degrees and 180 degrees being taken by inverting one of the inputs as described above.—**Southern Instruments Ltd., Hawley, Camberley, Surrey.**

Mounting Wide-angle Tubes

SOME HINTS FOR THE CONSTRUCTOR WHO IS THINKING OF CHANGING OVER TO THE LATEST TYPE OF PICTURE TUBE

By W. J. Delaney (G2FMY)

DETAILS have already been published in these pages of the circuit changes which are necessary when modifying a receiver to make use of the latest types of wide-angle tube, but there is another point which will be found of great importance to the constructor who is contemplating such a change in a home-made receiver. That is the problem of mounting the tube. In general, it will be a fairly correct assumption that the existing receiver utilises the older 9in. tube, and that this is nearly the end of its useful life, and therefore the receiver is to be brought up to date by using the larger tube. The circuit changes already mentioned

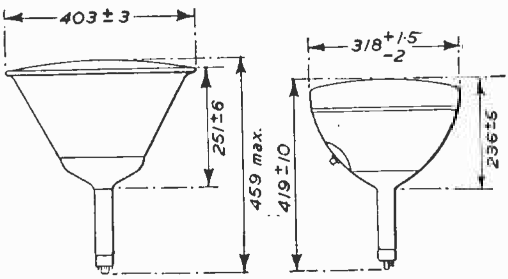


Fig. 1.—Main dimensions of the most popular rectangular tube (right) and the all-metal (left).

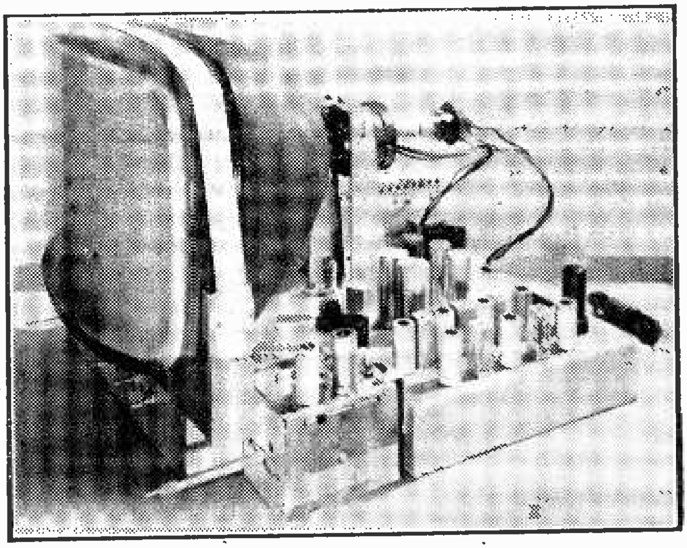
will not be difficult to incorporate, but the new tube will occupy considerably more space and, what is more important, will be very much heavier than the older tube and will, therefore, present some problems. In addition, if one of the circular metal tubes is to be used, this will also introduce some further difficulties.

The earlier home-constructed and most commercial models made use of a metal bracket or shelf upon which the circular edge of the tube rested, and a rubber band was generally passed round the edge of the tube to clamp it to the bracket. Apart from the fact that the curvature of the bracket will not be correct it will no doubt be found that the bracket material will be too weak to support much more weight. Furthermore, there will probably be components or valves on the chassis which will prevent the tube from being placed in the same position.

Types of Tube

Fortunately, the modern wide-angle tube is available in rectangular form and it will be found that, as a general rule, this type of tube will be the most satisfactory as a replacement due to its shape. The first problem is whether the tube will fit in the space on the chassis, without it being necessary to lengthen the latter in any way. As has already been pointed out the overall length of the tube is no greater than a normal tube, although it will be naturally slightly longer than the older 9in. models. Details of average sizes are given in Fig. 1, and a roughly cut paper template may be made to try out the chassis layout. The picture centre will be raised slightly compared with the older tube, and that will mean that the aperture in the cabinet will have to be raised as well as opened to the new size. The overall height of the front of the tube may then be such that there is insufficient room, and the centre of the opening will have to be lowered, with the result that the tube will have also to be lowered.

The rectangular tube is undoubtedly the easiest to mount, and the most satisfactory support is a block of wood the length of the tube face and about 1½in. to 2in. thick, on the upper surface of which a strip of thick sponge rubber is fixed. This is available in strips, and if not thick enough two or three layers may be placed one on top of the other, using Bostik as the adhesive. A thick layer is desirable to prevent the tube from slipping forward—which it is inclined to do due to its taper or funnel shape. A strip of thin metal may be attached to the sides of the block and clamped by means of a bolt as shown in Fig. 2, inserting strips of rubber at the two upper corners. Alternatively, the metal band may be replaced by a webbing band such as is readily available from ex-military stores (part of soldier's equipment). This block will raise the tube and



A good example of a commercial method of mounting rectangular tubes.

this may permit it to clear components on the chassis, but will introduce the difficulty of accommodating the opening in the cabinet front. If it is too high the block of wood should be fitted on the front runner of the chassis, and it may even be necessary to pack it out with a further block between it and the chassis to clear the edge.

Rear Support

A tube should not, of course, be supported merely at the front and the ideal method is for a rear support to be provided immediately behind the scanning coils, this support taking the weight of the focus coil or magnet and removing any strain on the neck of the tube. You will therefore require a new support, and this may be of thin plywood attached to two metal brackets provided with slots so that it may be pressed home against the scanning coils after the tube is in position. Thin strip rubber or felt may be wedged around the opening in the support to assist in centralising it.

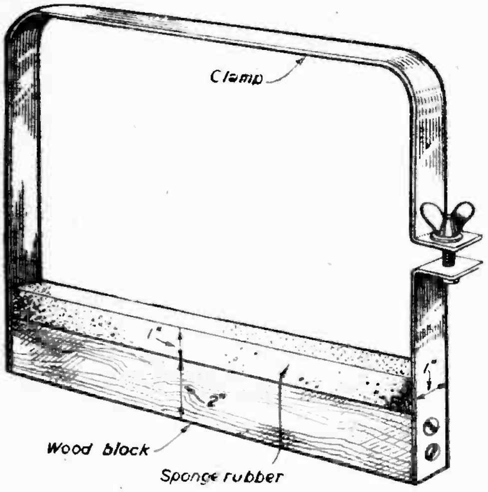


Fig. 2.—Ideal mounting arrangement for rectangular tubes.

All-metal Tubes

In the case of the large metal tubes the problem is greater, as apart from the much increased size and weight of the tube the anode connection has to be made to the edge of the tube. Undoubtedly the most satisfactory and simple arrangement is the use of metal clips supported on the standard type of insulator as shown in Fig. 3. A large creepage surface must be provided from the metal edge and the makers recommend not less than 2in. The type of insulator shown provides such a length without undue height, and the supporting clips may be of brass or copper, and the E.H.T. lead is firmly soldered to one of them. A rear support as already mentioned should be made and no other fixing should be necessary. Provided the supporting clips are fairly stout a turn-up of ⅛in. will prevent the tube from slipping forward, and the supporting bracket pushed up firmly against the scanning coils will hold the tube quite securely.

Dust-proofing

There is, however, a further point which must not be overlooked in mounting this type of tube. The front face of the tube carries a fairly high charge and as a result will be found to attract considerable dust in the cabinet. As a result it gets dirtier much quicker than the ordinary type of tube. Special arrangements should therefore be made to provide some form of dust-proof fitting against the cabinet front. Suitable rubber masks are not readily available, and therefore the opening in the cabinet front should be cut to provide the picture frame exactly, and at the back layers of sponge rubber as already mentioned should be stuck so that the tube may be pushed

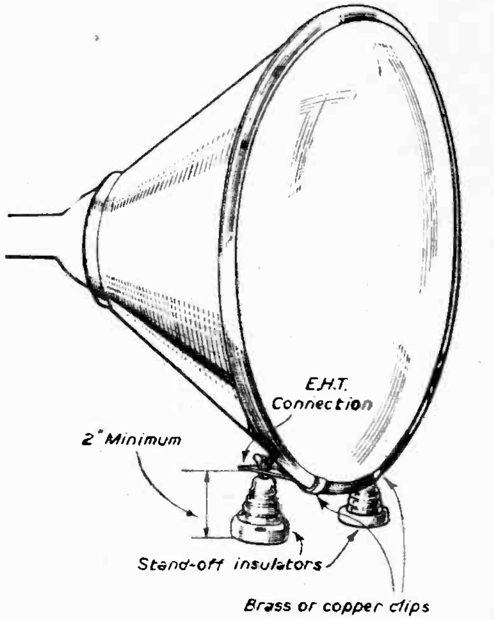


Fig. 3.—Metal tubes are best mounted as shown here.

right up close and form an almost air-tight joint. For the same reason it will be found highly desirable that the cabinet front, or at least the upper part of it, should be hinged so that it may be opened periodically and the tube face and protecting glass may be cleaned without having to lift out the heavy tube and chassis.

Finally, the modern wide-angle tube calls for the use of an ion-trap magnet, and this, as well as the focus magnet or coil surround, and any other metal round the neck of the tube, should be soundly earthed.

PUBLICATIONS ON ELECTRONIC MEASURING INSTRUMENTS

THE Industrial Group of Philips Electrical Limited have recently published a brochure on their electronic measuring instruments for the laboratory and test bench of the radio and television engineer. The brochure is intended to give concise information and illustrations, and to encourage inquiries for fuller details of individual instruments.

A great number of the instruments mentioned in this publication are recent additions to the Philips range.

A similar brochure on instruments applicable in engineering laboratories and workshops is in preparation at the moment.

Copies of the publication are available, free of charge on request to the Industrial Group of Philips Electrical, Limited, Century House, Shaftesbury Avenue, W.C.2.

Line Output Stage Developments

DETAILS OF SOME MODERN CIRCUITS

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

AN article entitled "Energy From the Line Flyback" (PRACTICAL TELEVISION, September, 1951) gave rise to much correspondence and showed that a large percentage of constructors and experimenters are keenly interested in the complexities of the line output stage. This may, of course, be due to the bewildering problems which always seem to crop up in this section, especially when putting the final touches to a new model—how patient one has to be, for instance, to obtain perfect horizontal linearity coupled with sufficient line amplitude. While, again, those "illusive" faults always seem to be traced, in the end, to the line output stage. The aim of this article is, therefore, mainly to give the constructor an insight to current developments in this direction, and thus enable him to be more prepared to tackle faults in the line output stage of a modern receiver.

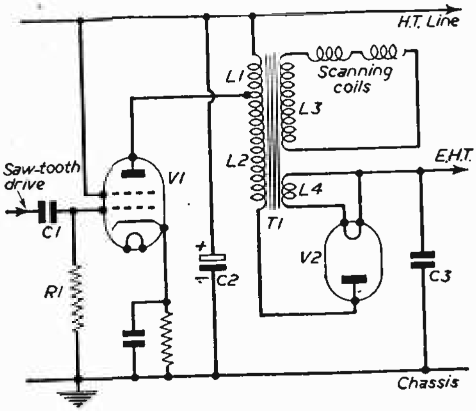


Fig. 1.—A typical line output circuit.

The general trend in modern equipment is the employment of a large screen picture-tube. These, in the main, appear to be taking on a rectangular shape so that the actual screen size can be considered as the diagonal measurement. The two most popular sizes, at present, are 14in. and 17in., i.e., giving a picture size precisely the same as a round screen of the same dimension. If, however, the length of the tube was increased in proportion to the screen area the advantage gained, in virtue of size, by eliminating the unused screen area would be far outweighed, and for this reason the overall length of the tube does not appreciably exceed that of a standard 12in. specimen.

Clearly, then, the scanning angle of the electron beam will need to be far greater in order to embrace the full area of fluorescent screen on the modern tube, than the angle necessary for full deflection on the older style tube. Moreover, so that the modern large diameter picture-tube can be viewed in daylight it is necessary to use a greater E.H.T. potential than that necessary for a 9in. or 12in. tube; this usually means that, compared with 9-10 kV. which is sufficient for a 12in. tube, 13-14 kV. is now a necessary figure.

By considering the foregoing in the light of scanning power, we can see that not only do we need extra power to deflect the electron beam over a larger angle, but owing to the increase of E.H.T., even more power is necessary to deflect the beam, since as we have already seen, "Scanning Amplifiers" (PRACTICAL TELEVISION, May, 1952), the scanning amplitude is proportional to the square of the E.H.T. potential. This reasoning indicates correctly that, apart from the line output stage, the frame output stage must also provide additional power; but here the problem is less severe, for owing to the lower repetition frequency of the frame signals, additional linear amplification is fairly straightforward—in any case, it should be remembered that the frame output stage produces scanning power only.

Necessary Capabilities of the Line Output Stage

The modern line output stage must, therefore, be capable of providing sufficient energy to deflect linearly the electron beam over an angle of 70 deg., as compared with an angle of about 50 deg. in the older style tube. To do this with a higher velocity beam, and also to create an E.H.T. potential in the region of 14 kV., fed quite frequently, from a H.T. line not exceeding 250 volts—surely, no mean feat! Furthermore, a modern line output stage employs quite often just a single valve having the dual function of saw-tooth oscillator and line output amplifier. But before we can go on to discuss modern developments in this direction it will be advantageous briefly to reconsider the older style system.

General Principles

Looking at Fig. 1, a typical line output amplifier circuit, we can see that the anode of the line amplifier valve V1 is taken to a tapping on the primary of the line output transformer T1, and that energy is conveyed to the scanning coils by a separate winding L3—mainly to facilitate an impedance match.

The H.T. end of L1 can be considered, from the A.C. aspect, as being at chassis potential—this is because of the low-impedance circuit offered by the H.T. system and decoupling capacitor C2 at line frequency. A saw-tooth drive applied to V1, via the R.C. coupling network C1, R1, will cause an increasing current, during the

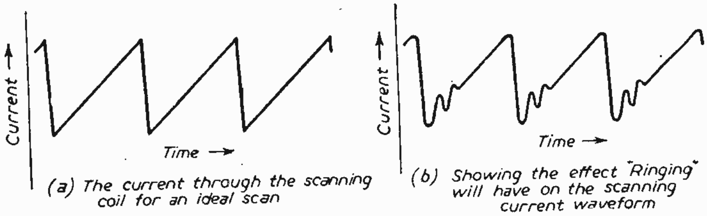


Fig. 2.—Waveforms in the line circuit.

scanning stroke, to flow through L1, and a sawtooth current to flow through the scanning coils. A strong magnetic field will, therefore, be set up in these components. At the end of the scanning stroke V1 is cut-off giving rise to flyback conditions; the magnetic field collapses, and the energy so stored is released, producing at the anode of V1 a large positive pulse.

The Production of E.H.T.

The extra primary winding L2 functions as an auto-transformer in conjunction with L1 and has the effect of stepping up the positive pulse at V1 anode to a magnitude sufficient for the purpose of E.H.T.—the larger the winding L2, the greater the pulse induced across it. This positive pulse plus the pulse across L1 is applied to the E.H.T. rectifier anode, V2; heater current for this valve is supplied by a further winding L4, and rectification takes place in the usual way. The E.H.T. supply circuit is completed by the smoothing

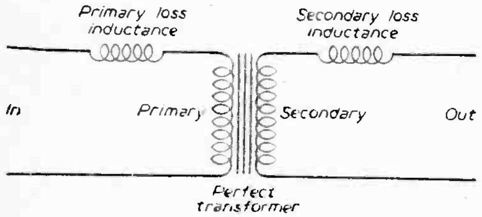


Fig. 4.—Showing how the loss inductance is included when considering a practical transformer.

capacitor C3, frequently comprised of an earthed external graphite coating on the outside of the picture-tube, the other plate being the coating inside the tube connected as final anode.

"Ringing" Scanning Coils

The sudden pulse of voltage created on the flyback causes the scanning coils to "ring" in the form of damped oscillations. Oscillation frequency is governed by the inductance of the coils together with their self capacitance, and stray circuit capacitances in shunt with them. Such action is exceedingly undesirable so far as the scanning stroke is concerned, for the damped oscillation is not completely exhausted before the next scanning stroke commences; when, instead of the current waveform following the ideal curve of Fig. 2(a), the current through the scanning coils may take the form of Fig. 2(b). This will cause the initial part of the horizontal scan to be far from linear; in fact, the effect will appear on the picture as alternate vertical dark and light bars.

At one time, damping the scanning coils by a resistor capacitor combination, proved a popular—although wasteful—means of overcoming this defect. Later models, instead of throwing away the oscillatory energy in the form of heat, employ a reclaim circuit, allowing

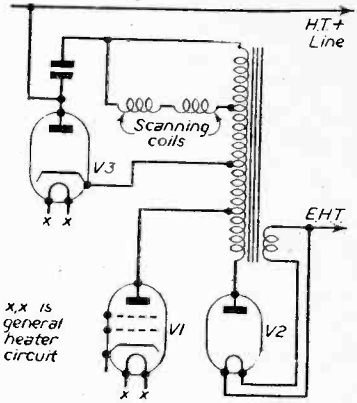


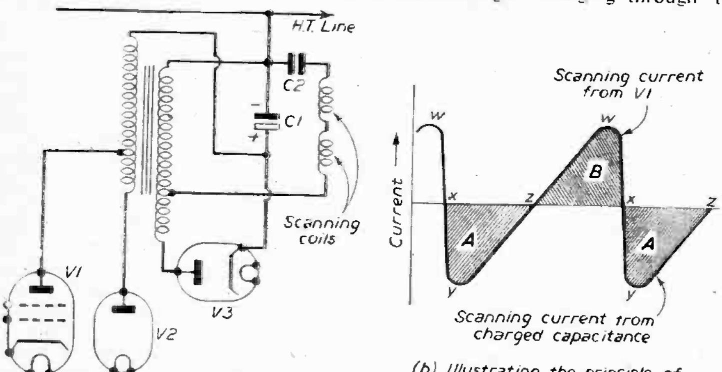
Fig. 5.—A basic line output stage circuit showing the auto-transformer principle.

the oscillatory energy to be stored by capacitors and given back to the circuit when required.

The Reclaim Circuit

The reclaim circuit is to-day still the most important development of the line output stage; a basic circuit sufficient to describe its working is depicted by Fig. 3(a), and as will be noted the highlight of the circuit is the additional diode (reclaim diode) V3 connected in series with capacitor C1 across the scanning circuit. In conjunction with Fig. 3(b), let us consider the action of the circuit commencing at the end of the scanning stroke; at this point, w Fig. 3(b), the current in the scanning coils is maximum, but very quickly decays to point x, during which time the stray capacitance of the circuit charges.

At point x to point y the scanning coils commence "ringing," and in effect the current in the scanning coils at this time is provided by the stray capacitance discharging through them. From point y to point z the reclaim diode conducts, and the charging capacitor C1 is effectively connected across the scanning coils through the secondary windings of the transformer. Thus, it can be clearly seen that energy for the initial part of the scan, y to z, is directly derived from the energy of the first half cycle of damped oscillation (area A). At point z the reclaim diode anode swings negative—the valve stops conducting—and V1 commences to conduct, tracing the latter portion of the scan from z to w (area B). It should be noted, of course, that due to the conduction of the reclaim diode, only the first and wanted half cycle of damped oscillation is allowed to develop, the remaining



(a) The basic reclaim circuit

(b) Illustrating the principle of the reclaim circuit

Fig. 3.—Typical line circuit and waveform.

half cycle and evanescent cycles are effectively eliminated by the shunt effect of the conducting diode.

With receivers of the A.C./D.C. principle—or transformerless types, where the H.T. line voltage is limited, assistance is given by the reclaim circuit in the form of a booster voltage for the line output valve, and sometimes for the second anode of a tetrode picture-tube. The circuit of Fig. 3 illustrates this point, for it is clearly shown that the bias voltage across C1 is effectively in series with the H.T. line voltage to the anode of V1. With slight modifications to overcome the difficulty of arranging the diode to cease conducting when the line amplifier commences, this style of circuit is still used in certain receivers.

Later Developments

The efficiency of the line output transformer plays a very important role, especially when additional scanning and E.H.T. power is required for the larger diameter picture-tubes. It is essential, for instance, that the magnetic losses incurred in the transformer are very small by the employment of the latest type low-loss core materials.

Not only core losses, but coupling losses must also receive due attention—mainly the coupling between the primary, and the secondary winding which feeds the scanning coils and reclaim diode. The theoretical consideration of a perfect transformer is one which has 100 per cent. coupling coefficient. This means that the magnetic flux created by every turn of the primary winding must completely embrace every turn on the secondary winding. In practice, such conditions are impossible to achieve, for certain turns give rise to magnetic fluxes to no purpose, and which do not surround other turns. A practical transformer may, therefore, be considered as a perfect transformer, reduced in efficiency by the inclusion of inductances in series with either winding, and these inductances represent the magnitude of loss inductance in the transformer (see Fig. 4). In practice other losses such as winding resistance, winding capacitance and core loss network are prevalent. but for the purpose of this discussion need not be considered.

Now we have observed already how the flyback pulse induces " ringing " in the scanning coils, and. unless corrected, noticably distorts the horizontal scan. The same effect occurs by " ringing " of the loss inductance; again prompted by the flyback pulse, but distortion by this reason is much more difficult to eliminate, for as the core efficiency of the transformer is enhanced so the magnitude of " ringing " increases ! It remains, therefore, to pay special attention to the coupling efficiency of the transformer, reducing the leakage inductance as much as possible ; and with this end in view, designers have modified the line output transformer to such an extent that in conjunction with improved circuits very little " ringing " is manifested, even though more power is produced.

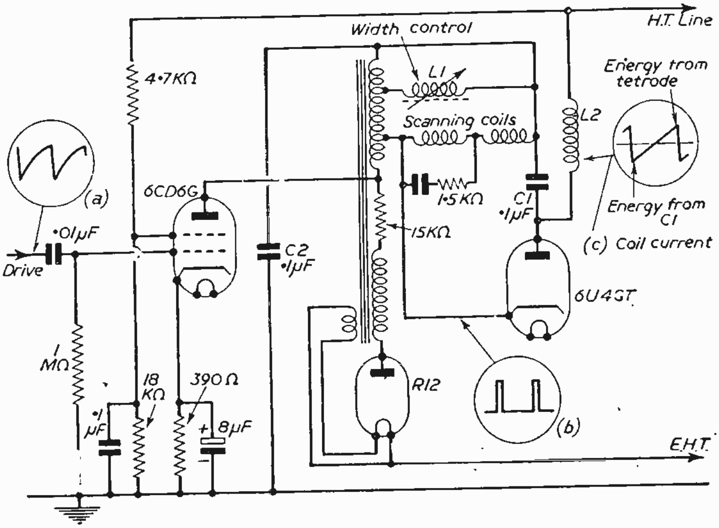


Fig. 7.—A modern line output stage by K.B.

The auto-transformer provides a striking advantage in this connection, and a number of manufacturers appear to be favouring this style of transformer in their larger screen receivers. The basic circuit takes the form of Fig. 5, where it is shown that the primary winding performs most functions by means of tappings. The only secondary winding is used to provide the E.H.T. diode with heater current. This method greatly eases the loss inductance problem, and also enables extra power to be taken from the line output stage without causing excessive " ringing."

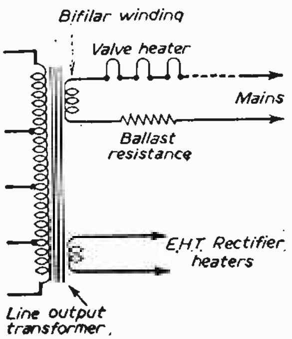


Fig. 6.—The inclusion of a bifilar winding to minimise valve failure.

Practical Considerations

The line output valve and reclaim diode need to be capable of providing the additional power required of them without suffering any ill-effects. A valve which is specially designed for large screen scanning is the Brimar 6GD6G—one of the largest line output valves so far produced. The reclaim diode presents a bit of a problem, too, for a study of the circuit will show that a large pulse potential, in the region of 3-4 kV., is formed between the heater and the cathode ! To cater for circuits of this nature Brimar has recently brought out a reclaim diode capable of withstanding such large pulse voltages—the valve, a 6U4GT, has a 6.3 volt 1.2 amp. heater, and a heater to cathode insulation of 4.5 kV. ; a rectified current of 125 mA. can be maintained. Indeed, it seems as though the present-day trend is to design valves around a circuit rather than the converse method formerly adopted !

A system which is sometimes employed to reduce heater to cathode pulse voltage, especially when the reclaim diode is not specifically designed for large heater to cathode voltages, comprises a bifilar winding included on the line output transformer, and connected in series (with an A.C./D.C. receiver) with the valve heaters. By this means a pulse of similar magnitude is applied to both cathode and heater, and thereby prevents the possibility of valve failure due to a breakdown of insulation between heater and cathode.

A Modern Line Output Stage

Fig. 7 illustrates a modern circuit used with great success in large screen K.B. receivers. The stage is driven by a multi-vibrator line oscillator, the output of which is very similar to the waveform at (a). Now, to consider the action of this circuit, let us suppose that the grid signal is at its maximum—at the end of a scanning stroke, for instance. The tetrode current is, of course, also at a maximum, but the reclaim diode is cut-off (or nearly so). The flyback commences, and the control grid is swung negative. This results in a rapid change of current through the scanning coils, creating a back E.M.F. in the form of a pulse (waveform b), and the self-capacitance of the scanning coils acquire a charge.

The scanning coils, therefore, start to "ring," but after the first half cycle of oscillation the reclaim diode cathode goes less negative than the anode, and the valve commences to conduct, which not only prevents the occurence of further oscillation, but also charges C1. At this point the scanning current is zero, but gradually (relatively speaking) rises on the first half of the scanning stroke. Now it is important to note that energy for the first half of the scanning stroke is supplied solely from the charge of C1. The tetrode does not start conducting until approximately halfway through the scanning stroke (waveform c), after the charge of C1 is exhausted ; the tetrode current then takes over to complete the scanning stroke.

Since the scanning coils possess a certain amount of resistance, C1 tends to discharge through them exponentially, giving rise to conditions for a non-linear horizontal scan. In order to eliminate this effect the network comprising C1, C2 and L2 provides a correcting voltage. The variable inductor L1, in shunt with the scanning coils, forms a typical width control which by-passes a ratio of scanning current depending on the inductance value selected.

Faults

After modifying existing equipment, or when testing a newly constructed large screen receiver, the manifestations—as earlier defined—of line output stage "ringing" may be apparent. The effect may be due to a dubious, or unsuitable (for wide-angle scanning) line output transformer—a narrow scanning angle transformer if overrun, for instance, is inclined to "ring."

The additional power developed in a wide-angle line output stage tends to give rise to an increase of electromagnetic radiation, but apart from aiding the G.P.O. engineers when tracking unlicensed TV receivers with their new style detection equipment, this may cause an unwanted coupling within the receiver, between the cathode or grid leads of the picture-tube and the line output stage. The effect on the picture is very similar to line output stage "ringing," but it is possible quickly to establish the origin by temporarily decoupling the cathode and grid pins on the picture-tube to chassis, via a large value paper capacitor. Should the then unmodulated raster be free of distortion the fault definitely arises from unwanted coupling, and the picture-tube grid and cathode leads must be re-routed clear of the line amplifier. If, on the other hand, the distortion still remains, and provided the reclaim and damping circuits are free from fault, the line output transformer should be closely examined to make sure that it is suitable for the circuit in which it is employed.

Another effect, but indicated on the left-hand side of the picture as *white* vertical lines, sometimes arises from a beat frequency between the local oscillator and a spurious signal from the line amplifier. Again, this defect can be prevented by reducing unwanted coupling between the two circuits involved. A small capacitance formed by a short length of P.V.C., connected between the line output valve anode and chassis, usually assists in reducing the power of the spurious signal.

These days of rapid development make it extremely difficult for us to keep up to date with our hobby, but it is hoped that this article will help remove, at least, a few of the problems encountered in the modern line output stage by up-to-date experimenters and constructors.

New 150-volt Stabiliser

In response to the demand for a very high performance stabiliser, working at 150 volts, the Communications and Industrial Valve Department of Mullard, Ltd., have recently introduced the 150B2 which is of the miniature B7G construction.

This stabiliser will set a new standard in the design of power supplies for use with both communications and industrial electronics equipment. This is particularly true in the portable instrument field where the small size and simplicity of the ordinary neon stabiliser circuit has decided advantage over the larger and more complicated series valve regulated supply. Under these conditions, and particularly where a comparatively constant load current is taken, the 150B2 will provide the stability and freedom from sudden large jumps in output voltage, which are so vital in all measuring equipments. For wherever large variations of mains voltages occur, only an adequately regulated H.T. supply enables the instrument designer to achieve the high degree of stability necessary in modern electronic measuring equipment.

The 150B2 is intended to be used as a simple stabiliser over the current range of 5 to 15 mA. where the "stability with time" is the most important consideration. In the design of the tube the Mullard sputtered-metal technique, so successfully used in the manufacture of the well-known Voltage Reference Level Tubes 85A1 and 85A2, ensures freedom from trouble caused by the liberation of contaminating gases from the walls of the tube.

The temperature co-efficient is low and the stability at any one current is better than the exceptionally good figure of ± 1 per cent. over the life of the tube.

The principal characteristics of the 150B2 are as follows :

Minimum voltage necessary for ignition, 180 volts.

Burning voltage (variation from tube to tube), 143-147 volts.

Current range, 5-15 mA.

Incremental resistance (max.), 500 ohms.

Temperature co-efficient of burning voltage, 10 mV/°C.

Ambient temperature limits, -55 to $+90$°C.

Further technical details can be obtained on request from the Communications and Industrial Valve Department, Mullard, Ltd.

PRE-DETECTOR STAGES—4

MORE ABOUT THE FREQUENCY CHANGER

A SEPARATE triode valve (or pentode strapped as a triode) is sometimes worked as an oscillator, using a circuit similar to that of above, but in this case it is necessary to use an inductive or capacitive oscillator voltage valve to the grid of a high-slope pentode functioning as a mixer.

The rather unusual mixer circuit of Fig. 14 may provoke interest; this style of circuit is used in certain Murphy television receivers with a high degree of success. Two diode valves working as mixers are fed in parallel from the amplified signal source, via a suitable impedance tapping on the secondary of the R.F. bandpass transformer; such a feed also facilitates correct damping across the transformer. The two diodes are used as independent sound and vision mixers thereby allowing the two circuits to be tuned without interaction.

A triode valve connected in the form of a Colpitts oscillator produces the necessary heterodyne voltage, which is fed to the diode anodes through a 10 pF. capacitor. The I.F. voltages are developed across the cathode circuits; these are correctly selected by the tuned couplings L2 and L3 and thus applied to the vision and sound amplifier valves respectively.

The circuit of Fig. 15 depicts the general trend in mixer design. Only a single high-slope valve is required; this is made self-oscillating by using the control and screen grids as oscillator grid and anode. The coil L1 in conjunction with C1 determines the oscillator frequency, which is connected to the valve in the form of a Colpitts oscillator. The amplified signal voltage appearing across the tuned load in the anode circuit of the R.F. valve is fed direct to a suitable impedance tapping on L1. This connection also allows the screen grid (grid 2) to receive a positive potential. Inductor L2 selects the correct I.F. signal, which functions also as the coupling coil to the I.F. amplifier.

Oscillator Stability

Owing to the comparatively narrow bandwidth of the sound channel, coupled with the problem of sound rejection, and the necessity of maintaining the vision carrier frequency minus 6 db. down on the I.F. response curve, the consideration of oscillator stability is extremely important. The greater the ratio between oscillator frequency and I.F. the more important is this consideration. For instance, assuming a channel 1 receiver with an I.F. of 13 Mc/s, and an oscillator frequency of 32 Mc/s, an oscillator drift of approximately one part in 1,000 will change the I.F. by 35 Kc/s.

Although such a small oscillator drift may have little effect on the picture, it will tend to detune the sound channel to an extent, and in some cases resulting in a marked deterioration in sound quality. Even more important, however, is the effect oscillator drift will have on the sound rejectors, for since they are of normal high Q circuits an I.F. change of 35 Kc/s may be sufficient to render them inactive at the desired frequency, producing not only the effects of sound on vision, but giving rise also to the effects associated with an incorrectly shaped I.F. response curve, due to the formation of a trough in the actual vision passband where it is not wanted.

With single sideband working the vision carrier frequency will also shift on the I.F. response curve, and that very undesirable picture distortion will result in consequence as explained in Part 2 of this series.

A lot can be done to minimise oscillator drift, which arises mainly from voltage and temperature changes. A change in temperature within the oscillator valve itself—during the period when it is acquiring its normal operating temperature—can create a marked effect on the valve capacitances, and since these form an appreciable portion of the total capacitance across the oscillator coil, a modification in oscillator frequency is bound to occur during the warming-up period. Adequate ventilation around the oscillator valve will reduce the time taken for the valve to reach a stable operating temperature.

As will be noted from the circuits of Figs. 13, 14 and 15, it is general practice to include a capacitor in parallel with the oscillator coil, and not, as is usual with the signal frequency and I.F. stages, to rely on stray and valve capacitances. If the oscillator tuning capacitor is the largest portion of the total shunt capacitance across the oscillator coil, the small alteration in valve capacitances will have less effect on the frequency of the oscillator, and in this way much better frequency stability is achieved. Oscillator tuning may be provided by altering the coil inductance with iron-dust or brass cores, or by employing a small air-spaced trimmer across the oscillator coil.

Temperature effects on associated oscillator components form a major factor in the problem of oscillator stability. Capacitor and resistor values tend to alter slightly as they warm up, and in this way the valve potentials and the shunt capacitances are modified. Good cabinet ventilation will help in this respect, making sure that the heat developed around the oscillator section can be dissipated as quickly as possible.

The tuning capacitor across the oscillator coil may sometimes be comprised of two separate capacitors, one of which has a positive temperature co-efficient, while the other has a negative; thus the effect of heat will increase the capacitance of one and reduce the capacitance of the other in the same ratio. Therefore, any detuning effect due to heat will be neutralised, and the generated frequency will remain constant.

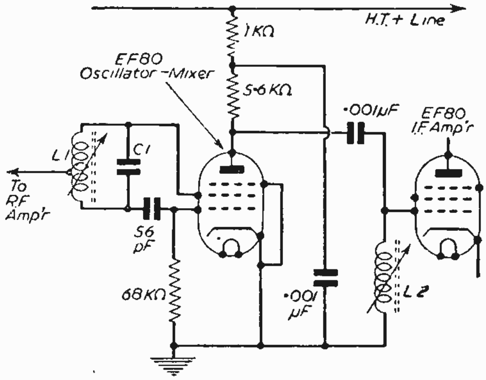


Fig. 15.—A typical frequency changer system of the modern receiver.

The voltage supply to the oscillator section should be taken from the most stable point in the receiver. The highest voltage point is usually the best, and the voltage can then be dropped by a potential-divider together with suitable decoupling components, which also assist from the point of view of a stable H.T. supply.

To prevent oscillator radiation thorough screening of the mixer stage is desirable. Radiation might not affect the performance of the offending receiver, but it can play havoc with neighbouring receivers, especially if they are working on a different channel, which passband embraces the frequency of the radiating oscillator.

Oscillator Frequency

The oscillator frequency can be the I.F. higher than the signal frequency, or the I.F. lower than the signal frequency. From the point of view of stability the lower frequency is definitely the better of the two, although from the second channel aspect the converse may be true. Let us take for an example a channel 1 receiver with vision I.F.s of 13 Mc/s. Now, using the lower oscillator frequency, 32 Mc/s (45 minus 13 Mc/s), the second channel falls in the region of 19 Mc/s (i.e. 32 minus 13 Mc/s). This is right in the centre of an active portion of the short-wave band, and unless adequate pre-mixer selectivity is achieved trouble may be experienced from high-power short-wave stations breaking through on the vision signal. The higher oscillator frequency, however, will produce a second channel in the neighbourhood of 71 Mc/s (58 plus 13 Mc/s), where the possibility of second-channel break-through from broadcast stations is relatively less.

Now that the adoption of five channel receivers is coming into the foreground the higher oscillator frequency appears to be the designers' choice. The higher frequency facilitates the oscillator frequency change necessary to embrace the five channels without the use of complex switching. The oscillator coil inductance is sometimes varied to shift the oscillator frequency from one channel to another, and when this is the case a composite core is generally used. This means that instead of the core being wholly iron-dust or brass, it is divided into two sections, the lower section of iron-dust and the upper section of brass. Both cores are secured to a threaded rod and are easily adjusted from the top of the coil by means of a thumbscrew.

This arrangement enables a coil of given inductance to tune a frequency range greater than would be attained by a wholly iron-dust or brass core. The iron-dust core increases the inductance of the coil, while the converse effect is created by the brass section of core.

The tuned input circuit and the tuned coupling to the mixer is altered in a similar way, so that channel changing merely involves the shifting of oscillator frequency, and a follow up on the first two tuned circuits—the external adjustment of three tuned circuits, which can be easily adjusted by a non-skilled operator without the use of instruments. In certain receivers a small variable capacitor is employed for oscillator frequency mutation, although inductance tuning is still used for the two R.F. circuits.

Circuit Constants

The gain of a frequency changer stage is much less than a signal frequency stage, and in certain cases it is sufficient if it does not attenuate ! The actual gain can be calculated from the gain formulas (5) and (6) of section 1 by substituting conversion-conductance (gc) of the mixer valve in place of mutual-conductance (gm).

Slightly better performance is obtained by the use of a separate oscillator valve, and a high gm pentode acting as mixer; for where the gc is only of the order of 0.7 mA/V for a triode-hexode, it may reach the 3 mA/V mark with the two valve arrangement.

The self-oscillating single-valve circuit may produce a gain reaching nearly one-third of that of the same valve working as an amplifier. The correct amplitude of oscillation has, of course, appreciable effect on the conversion-conductance of the mixer stage, and in most cases an oscillator amplitude which gives rise to a current of between 120 to 180 microamps through a 50 KΩ oscillator grid leak is of suitable value.

Parasitic oscillations may occur should the amplitude of oscillation by excessive, or should the coil or tuning capacitor leads be too long. The oscillator grid capacitor will affect the amplitude of oscillation which will increase

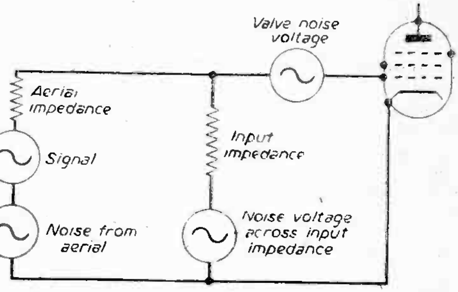


Fig. 16.—Showing in simplified form how the various noise voltages are distributed in the first stage input circuit.

with capacity. A small value as possible should be aimed at, for then the tuned circuit is loosely coupled to the valve resulting in higher frequency stability. Greater oscillator voltage is obtained with a high Q coil, which in conjunction with a small grid capacitor is the ideal combination.

Noise

In fringe areas especially, it is very important for the noise performance of a receiver to be as high as possible. Noise in this sense is not meant only to apply to the characteristic hiss which is emitted from the loud-speaker of a sensitive radio receiver, when off-tune, or tuned to a weak signal, but also to the grain effect shown on the screen of a television receiver when the contrast is fully advanced. It is not meant, however, to include man-made interference, or usual static disturbances.

White noise as it is sometimes referred to is due mainly to two causes : one, the unsettled state of electrons in all conductors giving rise to minute current fluctuations (thermal agitation) ; and two, the uneven passage of electrons between cathode and anode in a valve (valve noise).

Added to this are random signals originating in space, little about which is known, although at higher frequencies their effect appears to be more marked than at lower frequencies. This is known as inter-stellar noise, and at television frequencies it is usually of such a low magnitude as to be completely swamped by white-noise.

White noise is a sound which has no definite frequency and, in fact, extends in frequency from zero to infinity. It follows, then, that as we extend the frequency response of any piece of amplifying equipment, we extend also the *quantity* of white noise which is amplified. Quantity we can call noise-power, for since the noise originates from random movement of electrons in a conductor, we get noise-current (NI), and since the conductor has resistance, we get noise-power (Np), which is equal to either $NI^2.R$, or Ne^2/R, where Ne is the noise-voltage. These random voltage or current variations are affected also by temperature, which, together with bandwidth, is included in the well-known noise formula—Np equals 4kTB—where k is Boltzmanns constant, which is equal to 1.374×10^{-23}, T is the temperature in degrees absolute, and B is the bandwidth.

Now, the importance of noise in a television receiver depends completely on the noise voltage relative to the signal voltage at the same point. As an example, if the input signal to the first stage of a television receiver is 100 mV, and the noise at the same point is 100 μV, then, obviously, noise will have no effect at all on reception. With fringe area working, however, the conditions are vastly different, for in certain cases the noise-voltage might well outweigh the signal-voltage, which will undoubtedly result in a poor picture having a very "dirty" background.

Clearly, then, the noise problem is focused mainly on the first stage where the signal is relatively weak. Let us suppose, for instance, that the first stage has a gain of 10; the signal-voltage on reaching the second stage will, therefore, be approximately 10 times as great, which will completely over-ride the noise due to the second stage. This is the reason why the first stage should have a high as possible gain, especially in the fringe area where a superhet is used, for, as we have already seen, very little amplification can be expected from the mixer stage. The aerial signal applied directly to the mixer, instead of through a signal frequency amplifier, would therefore considerably enlarge the effective noise due, of course, to the noise of the mixer amplified by—and including—the noise from the first I.F. stage.

The first valve noise also contributes appreciably to the total output noise. Noise due to a valve is usually directly compared with thermal noise by assuming an equivalent resistor (Req) which, if connected in the grid circuit of the valve, would create the same noise current in the anode circuit by the thermal effect. If a valve has a Req of 4,000 ohms, for example, it simply means that an external resistance of the same value connected to the grid of the valve will produce a thermal noise equal to the valve noise.

Fig. 16 shows in simplified form how the various noise voltages are distributed in the first stage input circuit. For maximum transfer of signal the aerial impedance should match the input impedance as we have already seen in part 1 of this series, but unfortunately these conditions are not, in general, the same for maximum signal/noise ratio. In practice it is frequently possible to reduce the noise slightly, by reducing the turns ratio of the aerial input transformer, although this is not very often done owing to the inevitable reduction in sensitivity.

The more practical considerations for a high signal/noise ratio are: one, ensure that the aerial feeder loss is as low as possible (in fringe areas it is well worth while to use low-loss feeder); two, use a very efficient aerial system or, in other words, gain as much signal as possible before it reaches the receiver; three, use a high gm low Req valve for the first stage; and four, make certain that the input bandwidth is no wider than absolutely necessary.

Grounded grid, and neutralised triode stages are inherently quieter than pentode stages, due mainly to the fact that the anode current flows through a triode direct from cathode to anode, whereas with a pentode it is divided between screen and anode. When reception at extreme ranges is required the signal/noise ratio is somewhat increased by mounting a triode amplifier directly on the aerial so that the feeder loss comes after the amplifier instead of before it.

In conclusion, it should be said that although we have considered the television pre-amplifier stages from quite a few angles in this series of articles, the author does not claim that they have been given exhaustive treatment—for to do so would need far more space than that required for only three articles. Nevertheless, it is hoped that the more up-to-date, and less theoretical, aspects selected, will be of advantage to the constructor and service engineer, and so enable them to keep in line with modern developments from a practical plane.

TV at Schoolboys' Exhibition

DURING the ten days' run of the "Schoolboys' Exhibition" at the New Horticultural Hall, over a thousand schoolboys and schoolgirls took part in television programmes. A complete, although miniature, production studio with artistes' room, make-up room staffed by a make-up artist from Leichner's, and control room, was provided by the British Electrical Development Association with the active co-operation of Messrs. Pye, Ltd., Cambridge, as part of their exhibit dealing with "Electronics"—the heart of radio and television and the "Master Robot of Industry."

The tiny "set" on which the visitors took part in the largest-ever quiz programme measured only 18ft. by 10ft., but contained all the necessary equipment which was similar to that supplied for use in American TV studios.

Miss Elizabeth Cruft, the BBC's juvenile announcer, introduced the ten-minute programmes, of which there were some 15 daily.

The programmes were viewed on the Electricity Stand, where a bank of six receivers with 12in. screens served 120 boys at a time. The interior of the studio was also in full view of people in the hall, and spectators were also able to see into the control room where monitor screens enabled the production engineers to maintain a perfect picture. The technical producer was Mr. Reg. Thompson, of Pye, Ltd.

Elsewhere on the E.D.A. stand there were television receivers in various stages of construction, and a television engineer explained the principles of its working. Also on view was the Pye deep-sea TV camera as fitted in the deep-diving vessel H.M.S. *Reclaim*.

Using the 5CP1 and ACR2X in the "Argus"

DETAILS OF THE MODIFICATIONS REQUIRED TO C.R.T. AND TIMEBASE CIRCUITS

THE low price of the above tubes has resulted in queries from readers regarding their use in the "Argus" timebase instead of the VCR97. *The beginner is advised to adhere to the original specification* and the use of the VCR97, which has proved a very good tube. However, the experimenter who wishes to reduce the cost of the televisor can use one of the cheaper tubes, though study of the modifications required will reveal that quite a lot of work is involved.

It should be pointed out here that it is not possible to supply blueprints of the alterations or complete blueprints containing the new tube circuits.

Although the modifications suggested here are directed specifically for Argus constructors, the principles and circuits can be adapted for similar timebases.

5CP1

This tube uses a higher E.H.T. than the VCR97 and the spot size is smaller. The persistence is short and the picture is of very good quality though of a smaller size than the VCR97, the tube diameter being 5in.

However, due to its lower price it is an attractive proposition for those who are seeking economy.

Magnifying lenses such as are used with the VCR97 can also be used with this tube, and the resultant picture appears much larger than the diameter of the tube suggests.

Special E.H.T. transformers for use with the tube can be obtained at the same price as that of the VCR97 from Henry's Radio.

C.R.T. Network

Due to the higher E.H.T., the C.R.T. network has to be modified; when using the transformer mentioned above, negative earth E.H.T. must be used and not positive as existing in the Argus.

The new C.R.T. network is shown in Fig. 1, and it will at once be noted that more resistors are used in the bleeder network because of the increased E.H.T. It is not possible to use a smaller number with higher values due to the possibilities of flashover; the potential difference across each resistor must be kept to a safe level.

The same method of staggering the resistors as used at present in the Argus must be employed, and it will be found possible to arrange this in a similar position to that shown in the blueprint. Care must be taken in mounting them so that at least ½in. exists between any resistor in the chain and the chassis.

Great care should be taken over the insulation of the connecting wires and double protection as advised in the Argus data should be employed.

It will be noted that no D.C. restoring diode is used, as the grid is taken direct to R34 and not through a condenser.

The coupling condensers C54, 55, 47, 48 should be of the same value as specified in the data, but the working voltage should be 2.5 Kv and not 450v. It is not necessary to make their working voltage the same as the applied E.H.T. (3,250v.) as they occupy a position lower in the bleeder network than the intensifier anode.

As negative earthing of the E.H.T. is employed, it is not necessary to take the precautions mentioned in the original data with regard to the cathode and heater circuits, as these are at almost earth potential as compared with E.H.T. positive. However, great care must be

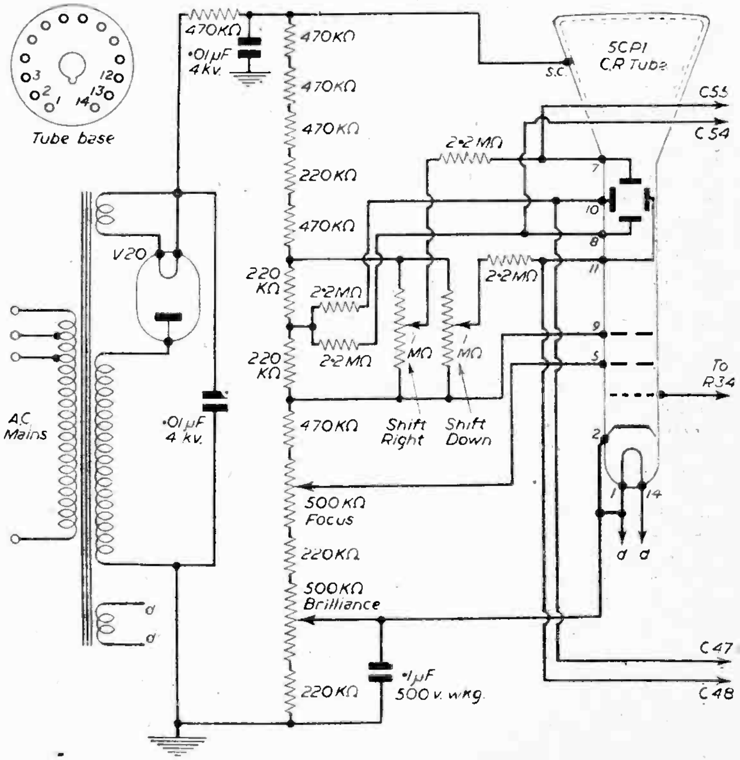


Fig. 1.—Revised C.R.T. network.

taken with the accelerating anode and intensifier wiring, full E.H.T. insulation being applied.

Timebase

It is possible with some tubes to obtain full scan without modifying the timebase other than applying boost H.T. to the line valves. An H.T. boost circuit suitable for this purpose was described by Mr. R. J.

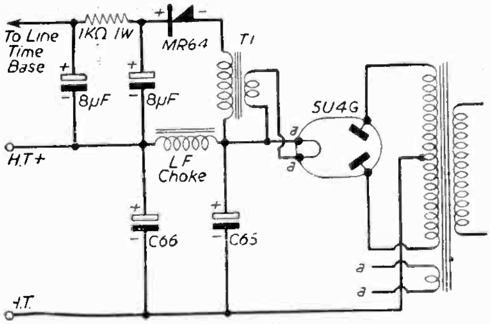


Fig. 2.—Modified H.T. boost circuit.

Talbot in the October issue of PRACTICAL TELEVISION, and a slightly modified version is shown in Fig. 2.

The transformer T1 is an ordinary output transformer feeding a low-impedance speech coil. The low-impedance side is connected across the heater of the 5U4G rectifier used in the Argus power pack, and the resultant stepped-up voltage is rectified by the selenium rectifier MR64, the current being smoothed by the 1 KΩ resistor and the two 8 μF electrolytics. The working voltage of the electrolytics should be 250 volts.

C65, 66 are the existing condensers in the power pack.

The method of connecting the two 8 μF electrolytics should be noted, the negative side going to the normal timebase positive. If the electrolytics used are of the metal-can type, with the can forming the negative electrode, care must be taken to ensure that the can is not earthed to chassis via the mounting clip. To avoid this a strip of insulation tape can be inserted between the metal case and the mounting holder.

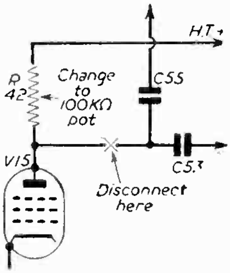


Fig. 4.—Modification to V15.

Almost any type of output transformer can be used for the job, and the constructor will probably find a suitable component in the spares box.

Fig. 3 shows the method of connecting the boost H.T. to the line amplifier.

In some cases it will be found beneficial to increase the amplitude of the line sync pulse by connecting across C58 an additional condenser of 50 pF. C58 is then adjusted for optimum amplitude of sync pulse.

If some control over the width is required, a width control can be fitted in a similar manner to the existing height control. This is done by connecting a 25 KΩ 2-watt potentiometer in series with the line timebase H.T. rail and decoupling it with an 8 μF electrolytic. If the H.T. boost circuit is used, the electrolytic can be connected so that the negative side goes to the normal timebase H.T. positive.

The components of the H.T. boost circuit can be mounted under the C.R.T. network chassis by careful rearrangement of the existing components.

Amplification by Duo-triodes

A better method than the H.T. boost circuit of obtaining the required increase in deflection power, is the use of a 6SN7 valve in place of the paraphrase amplifier.

V16 and all its associated components should be removed and the valveholder changed to accommodate the 6SN7.

The circuit should be disconnected from V15 at the point indicated in Fig. 4 and R42 should be replaced with a 100 KΩ potentiometer. The slider of the potentiometer should be taken to the new amplifying circuit via an 0.05 μF condenser, as shown in Fig. 5.

The new potentiometer now forms the height control and becomes VR11.

The 6SN7 should be wired up as shown in the theoretical circuit, an additional potentiometer value 1 megohm being used as a linearity control. It was found that without this control the full amplification of the 6SN7 could not be used due to severe cramping on the left of the picture.

The two 100 KΩ 2 w. anode load resistors can be accommodated on the tag strip where R42 and R47 were fitted.

The controls, shift focus brilliance, etc., function in the same way as for the VCR97, and the instructions given in the Argus data should be followed when the circuit is set up.

One advantage of the C.R.T. network which has been employed in this circuit is that the functioning of the network can be checked without the timebase in operation. The bias for the deflector plates is obtained from

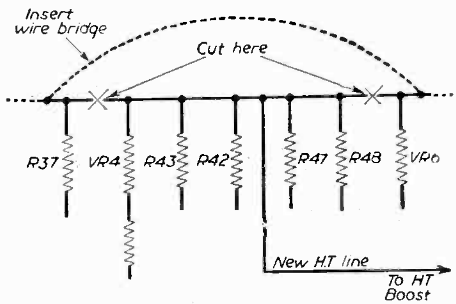


Fig. 3.—Method of connecting boost circuit to line amplifier.

the E.H.T. supply and it is possible to check the spot by not connecting the normal power pack into circuit.

The mains should be switched to the E.H.T. transformer only and when the circuit has warmed up a spot will be found on the screen. Its brilliance should be adjusted by the brilliance control and the spot focused with the focus control. Care should be taken to ensure that a very finely focused spot is not kept stationary on the screen with the brilliance control over advanced or a black spot will be burned on the screen.

The operation of the shift controls can be checked and set so that the spot occupies a central spot on the screen.

Although C54 and C55 shown in Fig. 5 are of the same value as given in the Argus data it is important to observe that their working voltage should be 2.5 Kv. minimum.

The ACR2X

This tube is being retailed at an attractive price and is suitable for use in electrostatic circuits. The screen is

5.25in. in diameter and the maximum final anode voltage is 3,000 v. No special E.H.T. transformers are manufactured for this tube and while a transformer giving 3,250 v. is commercially available (the type used for the 5CP1 with voltage dropper for the heater), the sensitivity of the X plates is rather lower than those of the VCR97 and the full E.H.T. voltage is not recommended ; it would be difficult to obtain full width.

The reason for this is that the higher the E.H.T. voltage the " heavier " is the beam ; it therefore requires more power in the deflecting circuits to move the beam and where the power is limited the low sensitivity would prevent full scan being obtained.

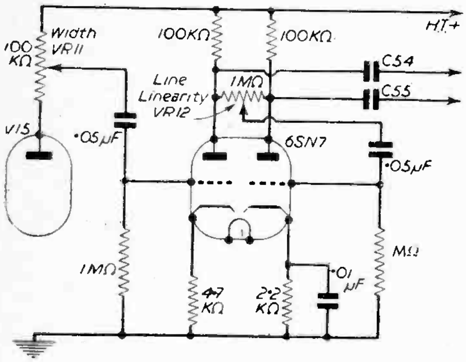


Fig. 5.—New amplifier circuit.

C.R.T. Network

In the Argus the use of the positively earthed E.H.T. enables the timebase H.T. to be added to the E.H.T. normally available, thus the overall E.H.T. is 2.5 Kv. plus 450 v., making almost 3,000 volts in all. In the circuit using the ACR2X the more usual negative earthing of the E.H.T. is employed so that maximum E.H.T. applied to the final anode is 2.5 Kv.

The circuit is shown in Fig. 6 and it will be observed that no D.C. restoring diode is used. The reason for this is that by earthing the E.H.T. negative the cathode and grid are not at E.H.T. potential and the grid can therefore be directly coupled to the phase splitter at R34.

As no condenser is in the grid circuit the D.C. component is not lost and this part of the circuit can be made the same as that in the 5CP1 network.

As in the 5CP1 the biasing for the deflecting plates is obtained from the bleeder network and therefore, like the 5CP1 circuit, the spot can be checked without the aid of the timebase H.T. The method used is to connect the mains to the primary of the E.H.T. transformer (standard VCR97 type) and adjust the brilliance and focus controls and centralise the spot as given in the preceding paragraphs.

The tube can be mounted on a chassis in a similar manner to the VCR97, though some juggling will have to be done to avoid the side connections of the tube.

Timebase Modifications

As the Y plates are a little more sensitive than those of the VCR97 no modifications are needed in the frame timebase (V17 and 18) : if too much height is obtained a 25 KΩ 2 w. resistor can be inserted in series with the height control though this was not found necessary in the experimental model.

The line timebase, however, needs some modification, mostly in the amplifier section. It is recommended in the first instance that the output of the sync pulse be increased by connecting a 50 pF. condenser across C58.

The method of increasing the output of the line timebase is to dispense with the paraphase amplifier valve and fit in its place a 6SN7, as given in Fig. 5.

H. T. Boost

With a timebase H.T. of 500 v. it was found that sufficient scan could be obtained under these conditions, but those who find that they cannot get the full width of the picture could fit the H.T. boost circuit given in previous paragraphs.

Condenser Ratings

As deflector plate bias is obtained from the E.H.T. network the coupling condensers to the timebase both frame and line should be 2.5 Kv. working, the capacity being the same as given in the Argus.

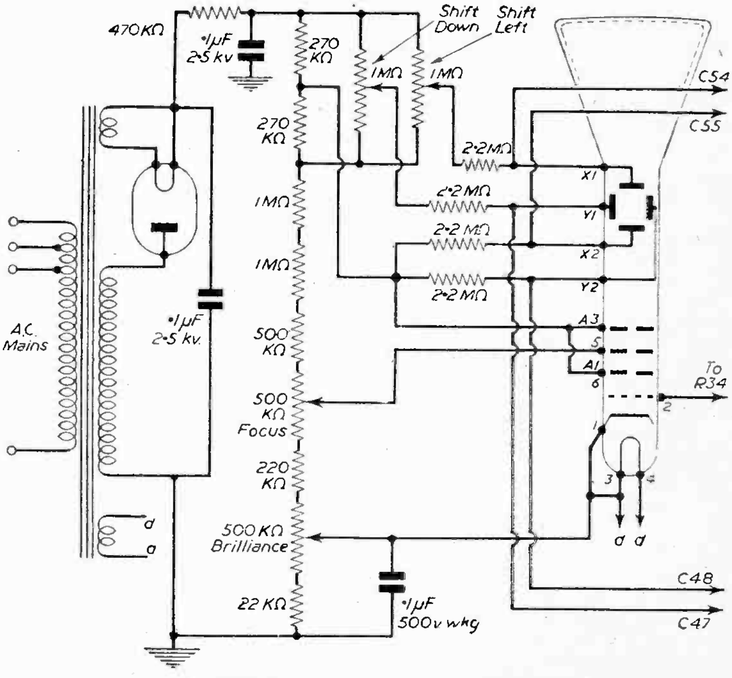
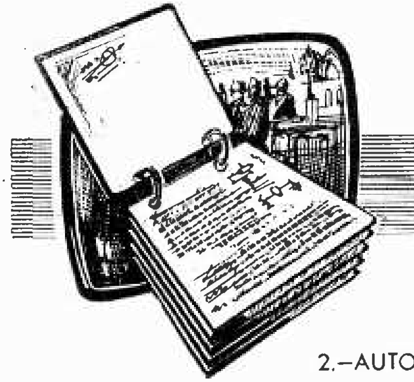


Fig. 6.—Revised tube network for ACR2X tube.



Pages from a TELEVISION ENGINEERS Notebook

2.—AUTOMATIC CONTRAST CONTROL

THERE has been correspondence recently on the problems of automatic contrast control in television receivers, and the following notes might therefore be useful in clarifying some of the misconceptions that might have arisen in connection with this subject.

Automatic contrast control is, of course, the equivalent of the familiar automatic volume control found in all sound broadcast superhets, the object being to maintain a constant detector output voltage irrespective of changes in the signal input to the receiver.

In broadcast receivers the carrier wave of the signal being received is constant and is therefore used as the reference level. As the carrier is a continuous reference, nothing more is required than a mean signal detector to produce the control voltage, and the a.v.c. detector is almost invariably a diode fed directly from an I.F. signal source.

The television signal, however, has a discontinuous or pulsed reference level corresponding to the brightest parts of the picture being transmitted, and it is therefore necessary to use a system of detection that does not depend upon a mean or averaging principle. One of the simplest of television A.C.C. systems, therefore, uses a peak detector operating from the video amplifier, and a typical circuit is shown in Fig. 1.

It will be seen that a diode is employed, the time-constant CR being made sufficiently great so that the charge on C does not fall appreciably between line synchronising signals. The D.C. voltage output across CR will thus be unaffected by the video modulation, and will be substantially constant for all picture contents. In this circuit, the vision detector is D.C. coupled to the video amplifier and the synchronising pulses thus occur in the anode circuit at fixed values for either black or white picture modulation.

It is not a difficult matter to determine the minimum requirements of the time constant of CR. In Fig. 2, the video waveform at the anode of the amplifier is shown, with the output voltage of the A.C.C. detector drawn as a dotted line. The necessary conditions are obtained if the D.C. level does not fall below that of the synchronising pulses during the period of a line scan. If the detector was ideal and had zero impedance on the charging cycle over a sync pulse period, then the output voltage level would be equal to V_1, the height of the envelope. The minimum value for CR may therefore be solved by using the equation of the discharge of a condenser through a resistor :

$$V_2 = V_1 .^{-\frac{t}{CR}}$$

where V_2 is indicated in the figure and t is the period of one active line of signal. The BBC standards are such that the sync pulse height is 30 per cent. of the maximum (peak white) signal, and so $V_2/V_1 = 0.7$, and the period $t = 84$ μsecs. Solving the equation for CR, therefore, gives

$$\log \frac{V_1}{V_2} = \log e^{-\frac{t}{CR}} = \frac{t}{CR}$$

or

$$CR = \frac{t}{\log \left(\frac{V_1}{V_2}\right)} = \frac{84 \times 10^{-6}}{\log 1.43} = \frac{84 \times 10^{-6}}{0.358}$$

$$= 235 \times 10^{-6} \text{ seconds}$$

If R is made equal to 1·MΩ, therefore (10^6 ohms), C must be *at least* 235 pF. (235×10^{-12} Farads) to satisfy the requirements of the minimum time-constant stipulated above. In practice, a longer time-constant is necessary because the diode is not ideal and V_1 volts

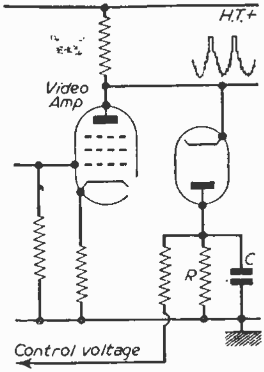


Fig. 1.—A simple circuit for A.C.C.

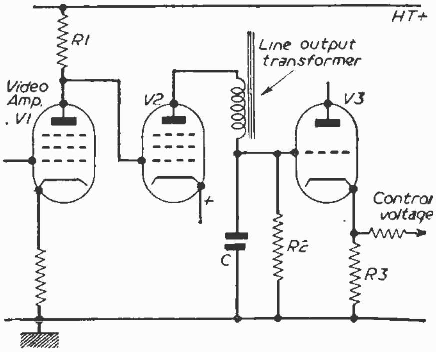


Fig. 3.—A more elaborate system.

are not attained on the charging cycle. A value of 300 pF for C would be suitable when R is made 1 MΩ.

Other combinations of C and R can be used to produce the required time-constant, of course, but it can be shown that it is also necessary (as V_2/V_1 must be at least 0.7), that the ratio of the diode impedance Ra to the load R must be less than 0.05; any diode of the EA50 or EB91 class with the above value for R satisfies this latter requirement.

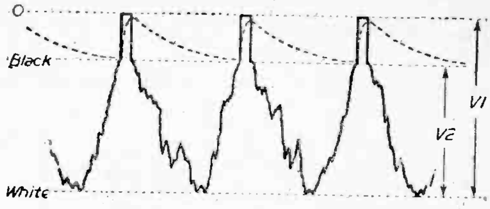


Fig. 2.—Waveform at video amplifier anode.

Gated Systems

A more elaborate system of A.C.C. operates on the sync pulses alone, and a skeleton circuit is shown in Fig. 3. Here a pentode V_2 is "gated" by having its anode voltage derived from the line output transformer, so that conduction only occurs during the period of the line synchronising pulse, and a negative D.C. voltage is developed across R_2 in the grid circuit of a cathode follower V_3. The greater the signal on the grid of V_2 (sync amplitude), the greater the D.C. level across R_2 and the greater the A.C.C. voltage developed by R_3.

This system is particularly useful in dealing with aircraft flutter, but the value of C must be chosen with care. Too small a value will lead to signal variations during the frame synchronising pulses, and a typical rating is 0.25 to 0.5 μF.

Converting Aerials for Horizontal Polarisation

IN view of the introduction of the new low-powered BBC stations with horizontally polarised aerials, the following data, which has been supplied by the makers of the well-known Aerialite aerial systems will no doubt prove of great interest. Although applicable mainly to their own products, there are a number of points of general application, and these should clear up many doubts which are being expressed daily in our correspondence from viewers or prospective viewers in the areas covered.

All current Aerialite aerials can be adapted to suit the horizontally polarised transmissions from these new stations, in most cases no additional fittings being required and no structural modifications necessary other than rotating the elements into the horizontal plane and adjustment of the element and boom lengths to suit the wavelength of the local station. Conversion and erection details are tabulated in a special list available from the makers.

Aerial Polarisation and its Effects

There is no fundamental difference in the design of a good TV aerial for either vertical or horizontal polarisation, the chief requirement being that the aerial should be installed so that its elements lie in the same plane as those of the aerial at the transmitter, this being known conventionally as "the plane of polarisation." The BBC higher power TV transmitters use vertical elements (in fact, two stacks of four vertical folded dipoles), the transmitted wave is said to be "vertically polarised" and TV receiving aerials in these areas employ vertical elements.

Since the elements in the new transmitter aerials will be horizontal, it follows that receiving aerials will similarly require horizontal elements, but in all other respects they will be similar to those in present use.

The horizontal directional response of a vertical TV aerial array is generally different from the response of the same array when its elements are horizontal.

This difference is perhaps best illustrated by its effect on a simple dipole which, as a vertical aerial, is non-directional, responding equally to signals from all directions; the same aerial used horizontally to receive the new transmissions will be bi-directional, with a broad maximum response in the two directions at right angles to the length of the element, and with two sharp nulls of minimum response in the direction off the ends of the element. This directivity of a simple horizontal dipole must be taken into account when installing them, since the maximum signal in the horizontal plane is no greater than the normal response in any direction when the aerial is vertical.

The directional response of two-, three- or four-element arrays is broadly similar in both planes, but the acceptance angle is smaller (i.e., the directivity is more pronounced) in the plane of the element. The maximum forward gain and front-to-back ratio of any aerial are not affected by the change, but the directions of minimum response are (as with the single dipole) substantially at right angles to the main lobe (or maximum signal direction) and may differ widely from those in the published H plane polar diagrams.

A factor of considerable practical importance in the erection of three- and four-element aerials for horizontal polarisation is the negligible effect of the mast and down-lead on the response of the array. The mast can therefore be attached to the boom at its centre point or adjacent to the folded dipole as desired, to improve the mechanical balance of the structure.

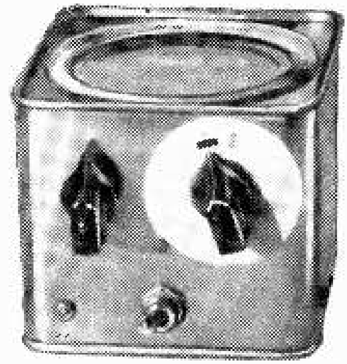
Indoor Aerials

With the exception of inverted T aerials, which may only be used as V aerials for horizontal polarisation and will therefore only be suitable in high field strength areas, all other Aerialite indoor aerials may be used horizontally without loss of response. In particular, the Model 71 will have an increased field of application, since there will invariably be space in the loft for its installation, and it may also be fitted "under-the-carpet" where conditions permit.

Dublex Aerial

The high forward gain and front-to-back ratio of this aerial remain unchanged when used for horizontally polarised reception. The polar diagram in the E plane differs only from that published in being somewhat sharper in the forward directions (with a reduced acceptance angle); the directions of minimum response are substantially at right angles to the maximum signal direction. This is particularly valuable in reducing ghost signals from hills and large reflecting objects which are most likely to be troublesome in these directions.

BUILDING THE TELESQUARE



A NOVEL PATTERN GENERATOR FOR TESTING RECEIVERS

By Edwin N. Bradley

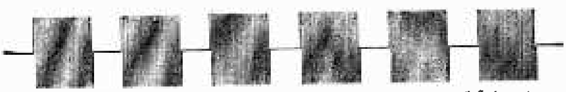
ALTHOUGH several television test-pattern generators have been described at one time and another, practically every one has been limited to supplying a pattern of bars across the screen, the bars being either vertical or horizontal according to the selection of a switch position. Some generators supply only a "low-frequency" output—that is, they are designed to connect directly into the video amplifier of the receiver under test, giving no modulated carrier to test the R.F. and I.F. sections of the set.

A comprehensive pattern generator should certainly supply a modulated R.F. signal, for many televisor faults originate in the early stages of a receiver, whilst it is very desirable to have a reliable signal on which to align receivers in out-of-transmission periods. At the same time the modulation, and thus the test-pattern shown on the screen, should, if at all possible, be more comprehensive than a set of bars. Commercial pattern generators show quite complicated figures, consisting of various crossing patterns with tone modulation of the background areas, but probably the best that can be done with simple, home-constructed equipment is the setting up of crossing bars on the screen, with squares of full-white modulation between them. Such a pattern shows at a glance whether the spot deflection is linear, even a slight degree of non-linearity being shown up very clearly, whether the spot focus is even over the whole screen, and whether there are any side or corner "shadows." At the same time the low- and high-frequency responses of the receiver as a whole are tested quite reasonably well, since the transition from full white to deep black should be well marked in both the horizontal and vertical planes, whilst ringing, black-after-white or similar defects are clearly shown on the edges of the vertical bars.

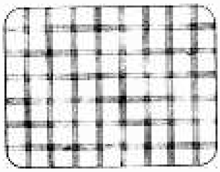
By turning the tuning control, the pattern generator can supply an audio test signal, whilst the tuning scale can be calibrated to show a band of coverage for the vision carrier and a sharp tuning point for the audio carrier. Coverage for only the local television channel is envisaged; the tuning system could proably be made to cover all five channels by employing the method described in the writer's "Television Grid-Dip Meter" (PRACTICAL TELEVISION, June, 1952), but this does not seem desirable in the present instrument.

The test-pattern generator is ideal for home construction since its various functions are all derived from a single-valve circuit, a double triode of the ECC91 (6J6) type being used. A simple power pack consisting of a heater transformer, selenium rectifier and a resistance smoothing system supplies the circuit from A.C. mains, and since there is no direct connection between the generator and receiver, such a half-wave rectification system is perfectly satisfactory; the case of the instrument must be connected to the neutral side of the mains, of course, for safety.

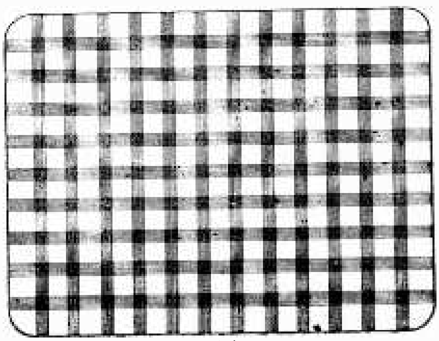
Constructors whose mains supplies are D.C. can also build the test-pattern generator. In their case it will only be necessary to employ a suitable line cord in place of the heater transformer, the smoothing resistor being increased by trial to give a main H.T. line voltage of 150 volts. In the A.C. version of the unit no reservoir capacitor is employed, the H.T. voltage being suitably low and space being saved as a result. C7 may be omitted in a D.C. version of the unit since this feeds a 50 c.p.s



(a) Typical oscillograph trace obtained from point "A" (Fig.1)



(b)



(c)

Typical patterns for (b) small and (c) large screens

Fig. 2.—Waveform and typical patterns.

pulse to the frame oscillator as a synchronising pulse. The circuit will be found sufficiently stable, however, to give little trouble without the sync pulse.

Circuit

The R.F. oscillator is built up round the first or left-hand triode section of the valve in Fig. 1. and consists of a tuned grid coil, L1, with an anode feedback coil L2. As is normally found at television frequencies, the usual proportion of grid turns (approximately one-third) in the anode circuit are insufficient for regeneration, and it is necessary to have at least as many turns in the anode as in the grid coil.

The grid circuit is returned to earth through a second tuned circuit consisting of a long-wave tuning coil with a relatively high capacitance shunted across it. The anode circuit of the triode is completed through the secondary winding of the long-wave coil, oscillation thus being obtained at a relatively low frequency determined by the value of C2 and C3. This oscillation deeply modulates the high-frequency carrier due to L1 and L2 so that the output from this first section of the triode could be received by a televisor and would produce a series of vertical bars across the screen. The number of bars would, of course, depend on the final frequency of the L3, L4 oscillatory circuit. The line frequency of a televisor is 10,125 c.p.s., so that an oscillatory frequency in L3, L4 of 101,250 c.p.s. would set up a series of 10 bars across the screen, of which nine would actually be visible, the tenth serving as a sync and black-out bar.

The second section of the triode is connected into a low-frequency oscillating circuit built up round a normal frame blocking oscillator transformer, L5, L6. The transformer is not allowed to operate normally, but is connected as shown and shunted by a damping capacitor, C6, so that at frequencies of between 150 and about 500 c.p.s. the output of the stage as a whole is a very fair square wave. The final frequency control is provided by the pre-set potentiometer R4, and a measure of synchronisation is applied by C7 which passes a pulse to the oscillatory circuit at each half-wave current surge through the rectifier.

With the frame oscillator out of action, the first section of the triode would also go out of action, sufficient bias being set up across the cathode resistor R3 to prevent high- and low-frequency oscillations. With the frame oscillator working the second section of the valve is cut-off at regular intervals when the current through R3 and the bias across R3 correspondingly falls. This triggers off the first section of the valve, the final output consisting of "blocks" of line frequency modulation interrupted by cut-off periods at a frequency sufficiently low to make these serve as frame bars. The final pattern on the screen is, therefore, as shown in Fig. 2.

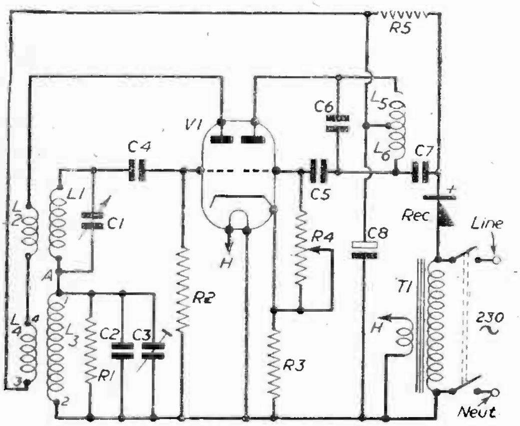


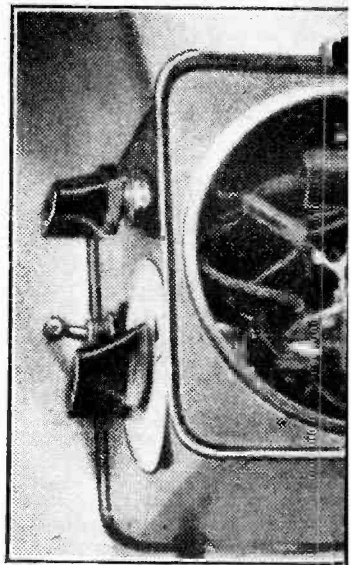
Fig. 1.—Theoretical circuit of the Telesquare.

Small Screens

If the pattern generator is to be employed with small-screen televisors (namely, home-constructed electrostatic receivers), it is recommended that the pattern of Fig. 2b be set up, consisting of eight vertical and six horizontal bars. For this the oscillators will actually need to supply nine verticals, a frequency of 91,125 c.p.s. in the L3, L4 circuit, and seven horizontals, a frequency of 350 c.p.s. in the frame oscillator. The extra bars, as already mentioned, are used automatically in the televisor as sync bars and do not appear on the screen.

Large Screens

When the generator is to be used with large-screen



The finished

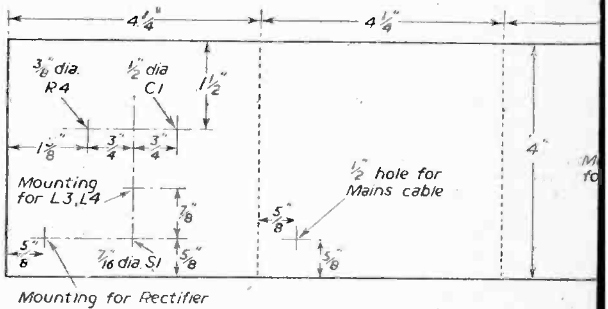


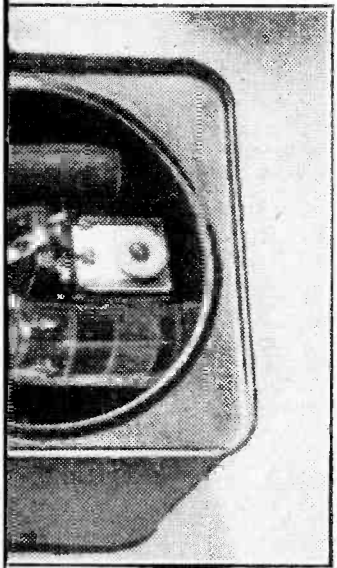
Fig. 4.—Chassis cutting and ben

LIST OF COMPO

L1, L2—Channels 1 and 2, 6 turns 28 S.W.G. enam. Channel 3, 5 turns 28 S.W.G. enam. Channels 4 and 5, 4 turns 28 S.W.G. enam. All air-cored windings on ⅜ in. diameter former closewound, with L2 close beside L1.
L3, L4—Wearite PA1 coil.
L5, L6—Frame blocking oscillator transformer.
C1—50 pF. tuner, Jackson Bros. type C 804 Air Tune.
C2—For small screens, 0.0015 μF. mica, 350 v.w. For large screens 500 pF. mica, 350 v.w.
C3—500 pF. max. padder type semi-variable.
C4—100 pF. silver-mica, 350 v.w.
C5, C6—0.01 μF mica or tubular, 500 v.w.
C7—0.001 μF. mica, 350 v.w.
C8—8 μF. electrolytic, 350 v.w.

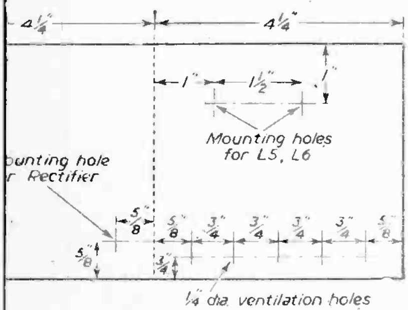
R1—10
R2—10
R3—
R4—
R5—1,
V1—M
B7G
Rec.—
T1—H
S1—D.
Metal
Rubber
Pointer
Mains

televisors the number of bars should be increased to at least 12 verticals and 9 horizontals, though for 16 in. tubes it might be as well to have 16 verticals and 12 horizontals. It is recommended that the ratio of 4 : 3 be maintained so that the intersections of the bars leave practically square bright-ups.



instrument.

The original generator was constructed in a small metal case which served as a screen round the oscillator. In use the case lid is removed for ventilation and also for greater output. If desired, a short rod aerial can be connected to the point A in Fig. 1 between the L1 and L3 tuned circuits; this will increase the coverage of the oscillator and the unit can remain entirely screened. The layout shown in Fig. 3 is that of the original unit and as can be seen, it led to some crowding of the components. A quite different layout could be employed, for the circuit is not at all critical so long as normal television techniques are followed in the construction. The valve, in the prototype, was mounted by sweating the valveholder on to a semi-cylindrical tinplate bracket of suitable length, the other end of this bracket being sweated to the tinplate wall of the case. This placed the valveholder pins close to the tuned circuits, permitting short wiring, without the use of a sub-chassis to support the valve.



ding details.

ENTS

,000 ohms, ½ watt.
0,000 ohms, ½ watt.
00 ohms, ½ watt.
meg. pre-set potentiometer.
00 ohms. 1 watt.
ullard ECC91 (American 6J6).
lveholder.
enTerCel 250 v. 30 mA.
ater transformer, 6.3v. 1 A. output.
P. mains on-off switch.
case and scrap metal for valve mounting.
grommets.
knob for tuning.
lead, wire, sleeving, nuts, bolts, etc. etc.

Observe that the main tuning capacitor, C1, must have both sides insulated from earth so that it cannot be mounted directly on a metal chassis. In the original instrument it was found satisfactory to mount this component in a rubber grommet, large-diameter washers on either side of the grommet giving adequate grip for a firm support. Connect the rotor to the "earthy" side of L1.

The connections to L1, L2 and to L5, L6 must be checked by trial. In the case of the blocking oscillator transformer it is generally satisfactory to make the larger winding the grid side of the tapped inductance, the grid being taken to the start of the coil. The end of this winding should be taken to the start of the smaller winding, the junction serving as the H.T. connecting point, the anode being connected to the end of the second winding.

Operation

The operation of the circuit as a whole (apart from the carrier oscillator) can be checked by connecting point A to the Y amplifier of an oscilloscope, the 'scope earth being taken to the chassis of the generator. (Ensure that the oscilloscope may be connected in this way to a half-wave rectifier circuit before making the connection, and make sure that the generator case is neutral.) The pattern obtained for a low-sweep speed should be that shown in Fig. 2a. If the blocks of line oscillation seem to be low in amplitude try the effect of reducing R3 slightly, to, say, 820 or 680 ohms; the reduction must not be so great as to stop cut-off of the line oscillations at the correct periods. Variations in R3 should not be required, but if a 6J6 is employed in the generator it may need slightly modified working conditions from those obtaining in the prototype, this valve being a little subject to broad tolerances.

The generator is best set up by watching the pattern on a televisor known to be working correctly, the pre-set controls C3 and R4 being adjusted to give the required numbers of vertical and horizontal bars. The tuning control, C1, can be calibrated against a good signal generator, the televisor being employed as an indicator, or it may be set with reasonable accuracy against the televisor itself, the tuning arc being marked out as that swing of C1 which will produce a pattern on the screen and the audio tuning point being marked with the generator set to give maximum audio volume.

(*Continued on page* 428.)

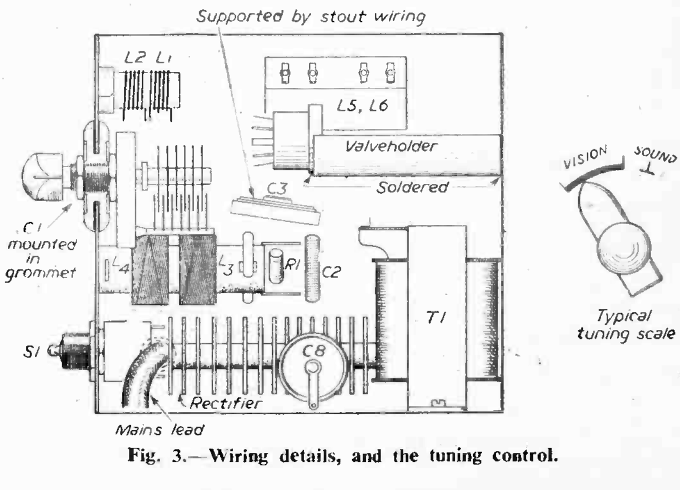


Fig. 3.—Wiring details, and the tuning control.

NO VISION—NO SOUND

SOME HINTS FOR THE HOME CONSTRUCTOR—By B. L. Morley

HAVING completed a new television set, the constructor usually makes sure that the time-base is functioning correctly and that the raster does all that it is supposed to do. The next step is to erect an aerial and align the vision and sound receivers. Sometimes he is rather lucky and obtains the signals quite easily ; more often only sound or only vision can be tuned ; quite frequently—alas, all too often—neither vision nor sound can be tuned and the constructor comes up against a blank wall.

It is at this point where many go wrong ; trimmers are twiddled, slugs screwed in and out and still—nothing. As one despairing reader said in his letter to our Query Dept., " . . . the only picture I've seen on the screen is the reflection of my own worried countenance ! "

Now, an obstacle of this nature is not nearly so formidable as it may appear at first sight : it is merely a question of knowing what procedure to follow, and it is hoped that the information given in this article will enable the constructor to take the thing in his stride.

First, it is assumed that the raster has been obtained and behaves normally. If so, then tackle the vision receiver before the sound. This last statement may come as a surprise to some readers, and the general method is to try to get the sound first ; the reason why the writer advocates vision first is that it is radiated at a stronger power than the sound and occupies a much broader bandwidth, thus making it far easier to tune in.

Checking the Video Stage

The next step is to check that the input circuit to the CRT is working correctly. An easy method of doing this is to inject into the input of the video valve an audio signal ; this can be obtained from the normal broadcast receiver tuned to any station radiating any programme. Take a pair of leads from the " Extn. L/S " sockets to the video valve, inserting a pair of condensers in series with the leads. The condensers can be of any value from 0.1-2 μF. (preferably the latter figure). Fig. 1 shows the scheme. If the extn. L/S output is designed for a low-impedance L/S, then an ordinary L/S transformer can be inserted, as shown in Fig. 1b.

Do not have the volume control too high.

If the video valve and circuit to the CRT is working, then a pattern will modulate the raster (do not have the brilliance turned up too far). If no pattern appears, then a fault exists between this point and the tube, so the process should be repeated on the output side of the video valve. The result here will indicate whether the video valve or the connecting circuit to the CRT is at fault, no pattern meaning that a disconnection exists between here and the tube.

If a pattern is received at the input to the video valve, then no vision means trouble in the vision receiver itself and a systematic check must be made.

Checking Vision Receiver

The most important point to consider at this stage is that a *good* aerial must be used. Quite often the constructor, anxious to get a picture, slings up a make-shift aerial or even trails a bit of wire round the room. This method is inviting trouble and materially increases the odds against success.

Always use a good aerial of the type normally in use in your district and erect it as high as possible. If you are pioneering in the outer fringe area, then use at the very minimum a four element array comprising two directors, dipole and reflector, and use a pre-amp. at the televisor end.

A quick check can be made to verify that the vision receiver is working by tapping a short-circuit across the aerial socket. If the brilliance is advanced so that the raster is visible the tapping should cause the raster to " jump." If the raster does not respond, then the vision receiver is faulty and if no click is heard on the loud-speaker with the same action, the most probable point of the fault is in the stages common to both sound and vision, and this part of the televisor should be checked.

The volume and contrast controls should be at maximum when this test is made.

Where glass-based valves are used such as the EF50 and the modern TV miniatures, it is wise to check the valve base as, although the valve may appear seated correctly, the pins may not be making good contact.

Ex-Government valves which have been in store should have the pins cleaned with emery paper ; they are a potent source of trouble.

If the constructor is the lucky possessor of a signal generator, then the job is greatly simplified, as the signal from this can be used to check each stage. If a generator is to hand, then the instructions given in the succeeding paragraphs can be followed, but instead of tapping about with a screwdriver the output of the generator can be used.

Returning to our aerial socket test, no response may be due to insufficient amplification and the point can be checked by inserting a pair of earphones (high resistance) in the anode circuit of the video valve. Alternatively, the output of the video valve can be connected to the pick-up sockets of a broadcast receiver. Fig. 2 shows the method.

It should be possible to hear the short circuit tapped across the aerial. If nothing can be heard, try tapping the grids of the R.F. valves with the blade of a screw-driver, starting with the last R.F. valve nearest the detector and working back to the aerial ; a click should be received from each stage, becoming progressively louder as more stages are included. No click at any

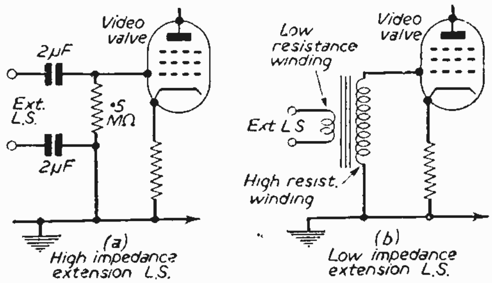


Fig. 1.—Checking the input to the video stage.

point indicates a fault between that point and the last one from which a click was received.

If a superhet is being used, then a few yards of wire can be tapped on the anode of the mixer valve. Various stations should be heard which are transmitting at the intermediate frequency ; if nothing is heard, tap the wire on the anode of the last I.F. valve and work back to the mixer in this fashion. If no signal is received at any stage then that is the faulty stage.

Should response be obtained from the anode of the mixer then the fault lies between this point and the aerial. The oscillator should be checked to verify that it is oscillating ; this can be done by inserting a milliammeter in the anode circuit of the oscillator and then short-circuiting the oscillator coil. The current should change when the coil is short-circuited if the oscillator is functioning correctly : no change in the reading indicates the oscillator is not working.

If the oscillator is functioning correctly, and the

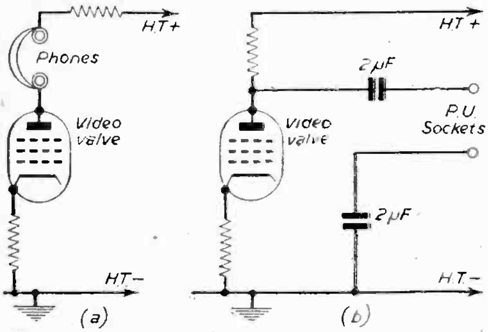


Fig. 2.—Checking the output from the video stage.

mixer stage is in order, then the procedure given for the R.F. stages should be followed.

When the Signal is Weak

If a faint click is heard when the aerial socket is tapped, then reconnect the aerial and listen for the vision signal ; it sounds like a mixture of motor-boating and 50-cycle mains hum. The coils should be trimmed to bring the signal up as loud as possible ; quite a large volume of signal is needed to operate the tube, and it is possible for the vision signal to be present at the beginning, yet to be too weak to affect the screen of the tube.

The rejector coils should receive attention, as if they are tuned to the vision channel serious attenuation of the video signal will take place. They should be adjusted for minimum sound, and though it will not always be possible to eliminate it completely, yet it can be reduced to a volume so low that it does not affect the tube.

In some cases it may be found that the rejector coils do not peak to the sound, while seriously attenuating the vision ; in this case connect a 10pF condenser across the two ends of the coil and retune.

Supposing it is possible to get the click effect from the aerial but still no sound or vision? The trouble then will be either a fault in the aerial system, or the tuning coils are not covering the correct band. The aerial can be checked, paying particular attention to the connections both at the aerial end and at the plug-and-socket end.

Tuning Coils

If the aerial is satisfactory then the only reason for no response is in the tuning circuits. (It has been assumed, of course, that all the wiring has been thoroughly checked.)

With home-constructed televisors the original wiring of the prototype may not be duplicated exactly, and it is possible for the tuning range of the coils to be affected. Usually the coils are designed to allow a certain amount of tolerance. If the coils are wound to specification and with the spacing given, then the tolerance allowed in the design will cover stray capacitances. When a circuit has been adapted then it is possible that the tuning range of the coils has been changed.

The range may be above or below that of the specified frequency.

The easiest way to check this point is to connect a 10pF condenser in parallel with each coil ; if a coil has a primary and secondary and one or the other is only one or two turns, then the 10pF condenser should be connected across the winding with the larger number of turns. The circuit can then be retuned and a search made for the signal.

If this fails then reverse the procedure by trying a lower wavelength. If iron-dust cores are used then they can be substituted by brass ones, but if brass cores are not available then take one turn off each coil (except those small windings mentioned above).

Once the vision signal has been obtained it may be found that it is not possible to peak each tuning coil. This has probably been deliberately contrived in the design so as to obtain a broad bandwidth.

Where the signal is weak some advantage may be gained by peaking the coils, though the bandwidth will be reduced.

The coils can be peaked by closing up the space between turns on those coils which do not peak when the core is right in, and widening the space between turns of those coils which do not peak when the core is screwed right out. An alternative method is to add one turn to the coils in the first case and to take off one turn from those in the second case.

The Sound Receiver

The sound receiver can be dealt with on similar lines employing the tapping technique. Start by applying the short circuit to the aerial, and if no click is heard in the loudspeaker (volume and sensitivity controls at maximum), then the audio stages should be checked by injecting sound from a broadcast receiver into the input of the first audio stage. The method given in Fig. 1 can be employed.

Each audio stage can be tested and proved in this way ; if any of the audio stages fails to give a response then a fault is indicated and the stage must be inspected.

The methods of listening for the click applied to the R.F. stages in the vision receiver can be applied to

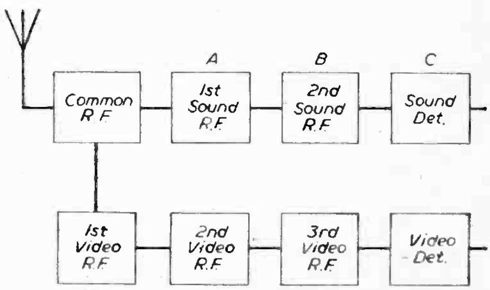


Fig. 3.—Typical block diagram of a modern television superhet set.

the sound receiver. If all is satisfactory proceed to the next stage.

Where trimmers are used for tuning, the iron cores of the coils should be screwed level with the tops of the formers and each trimmer set at maximum. Each trimmer should then be turned ⅛in. towards minimum position. The volume and sensitivity controls should be set at maximum, and the process repeated until all trimmers are at minimum position.

If the first R.F. stage is common to vision and sound, then search should be made for the sound without touching this stage once the vision has been obtained.

Should it be found that the whole range of the trimmers can be run from maximum to minimum without picking up the sound, then the cores should be unscrewed to minimum position or taken right out, trimmers set at maximum, and the process repeated.

As soon as any trimmer reveals the sound signal work should stop on that trimmer, and those preceding it tuned to the sound and those following it tuned to the sound to obtain maximum volume.

Even this method might fail to pick up the sound, and if this is the case the coils in the common R.F. stage must be tackled.

The process of tuning the trimmers from maximum to minimum is repeated, but this time the cores of the common R.F. stage are given half a turn towards maximum every time a complete set of trimmers is turned ⅛in.

A note should be made of the number of half turns given each coil so that they can be returned to their original position to pick up the vision signal again if necessary.

It is quite possible for the vision signal to be heard before receiving the sound. In this case tune each stage for maximum volume of the vision signal, and then move each trimmer slightly towards maximum capacity. Very quickly a point will be reached when the vision signal will disappear and this is the threshold point of the sound signal ; the trimmers should now be operated most carefully to tune in the sound.

If the sound receiver is not fitted with trimmers then the coils will be tuned directly. Screw the cores in until they are at maximum position, and then unscrew each one half a turn at a time. This is equivalent to decreasing the trimmer ⅛in.

Fig. 3 should make the tuning process quite clear. The televisor demonstrated has a common R.F. stage and 2 R.F. stages (A and B) on the sound side.

Coils will be found in A, B and C (detector stage). Here is the procedure :

(1) Set volume and sensitivity controls to maximum.
(2) Set all cores level with the tops of their formers.
(3) Set all trimmers to maximum capacity.
(4) Unscrew trimmer C ⅛in.
(5) ,, ,, B ,,
(6) ,, ,, A ,,
(7) ,, ,, C a further ⅛in.
(8) ,, ,, B ,, ,, ,,
(9) ,, ,, A ,, ,, ,,

and so on until the signal is found.

The Superhet

With the superhet the job is much more simple. A wire tapped on to the anode of the mixer should cause short-wave stations at sound I.F. to be heard on the loud-speaker. (This should be done after the check of the R.F. stages has been made as indicated previously.) If nothing is heard then the anode of the last I.F. valve should be tapped, and if nothing is heard here then the detector stage is faulty.

Should the sound be heard at this point then the wire should be moved, back to the next I.F. valve and so on until the faulty stage is located.

If the test from the mixer is satisfactory, and the oscillator valve has been checked to verify that it is oscillating, then the R.F. stages should be checked by the " click " method. If response is obtained, then the oscillator frequency should be varied with the aerial connected until the sound is picked up.

If it is not possible to find the optimum position of the oscillator where sound and vision are received together, then the sound I.F's must be adjusted.

As an example, assume that the vision is received with the oscillator in a certain position, but one complete revolution of the trimmer towards maximum is found necessary to pick up the sound, then the sound can be retuned by making the I.F's follow the oscillator.

Peak the sound, and then reduce the oscillator trimming towards the vision point until the sound can only just be heard ; now retune the I.F's until maximum sound is reduced again. Reduce the oscillator again, tuning it towards the vision channel until the sound almost disappears, and then once again retune the I.F's. By repeating this process the vision and sound can be brought together quite easily.

All final adjustments of the vision should be made on Test Card C, and when dealing with superhets it should be remembered that it is not the position of the oscillator which gives maximum vision signal which is the correct position. Due to the difficulties of transmission of single sidebands a " lift " is deliberately given at the carrier frequency ; in other words, more power is radiated at carrier frequency than at the other frequencies. In order to get the correct passband in the receiver this increase must be counteracted by setting the carrier 6 db down on the vision carrier. This can be done quite easily by noting the position of the oscillator which gives maximum signal and then tuning the oscillator towards the sound channel until the brightness of the picture is reduced by half.

Test Card C should be used for final alignment of straight and superhet receivers for the best results.

TELEVISION EQUIPMENT FOR ITALY

A CO-ORDINATED group of orders for British equipment, amounting to £300,000, when completed will give Italy a permanent television network on a national scale.

The orders, from Marconi's Wireless Telegraph Co., Ltd., through their Italian company, are for studios at Rome and Milan, medium-power transmitters at Rome and Pisa, and outside broadcasting units at Rome.

This is believed to be the largest export commitment of its kind from any British firm, and is designed to expand the existing experimental stations of the official Italian broadcasting corporation, Radio Audizione Italiana (R.A.I.), into a full-scale network.

The main transmitter will be at Rome, with a satellite at Pisa. Each will have a 7½-kilowatt vision (174-216 Mc/s) and a 2½-kilowatt sound transmitter.

Large studios now being constructed, two at Rome and one at Milan—the political and industrial centres respectively—will be completely equipped each with four Marconi Image Orthicon cameras, a zoom lens attachment for one camera, and full switching and mixing controls. R.A.I. have decided to adopt the B.B.C. studio plan with separate rooms for producer and technical control.

The whole system will operate on a 625-line standard, 50 cycles.

More About Transistors

SOME FURTHER DETAILS AND THE RESULTS OF EXPERIMENTAL WORK IN THE U.S.A.

FURTHER to our Editorial note in the last issue, the following details have been obtained from the U.S.A. Demonstrations were recently given to the trade, and appraising the present status of transistor development, Dr. E. W. Engstrom, Vice President in Charge of RCA Laboratories Division, said :

"These demonstrations highlight the fact that transistors are to-day no longer entirely a research concern. They are, in the fields of radio and television, an immediate problem for advanced development by industry engineers who can learn how to put them to work in evolving more versatile, smaller, sturdier, and eventually lower cost equipment for industry and the public.

"We can report that transistors, after a brief four years in the laboratory, can be made to do many of the electronic jobs that valves could do only after the first twenty years of their existence," Dr. Engstrom continued. "Because transistors, many of which are no larger than a pea, have certain properties that differ from valves, we find there are some tasks they perform more effectively than valves. Also of course, there are now and always will be applications where only valves will perform.

"We haven't yet worked out mass production techniques for transistors," he continued. "Although germanium itself is available, it requires careful processing to get it in the form that gives transistors their remarkable characteristics. Thus, the cost of even those few types of transistors that are available in limited quantities is still high.

"Even so, a demonstration such as this would have been impossible a year ago, even a few months ago." he continued. "We are just at the outset of trying a new variety of transistor types in operating circuits. As other new types of transistors come from the laboratory, providing greater power, operating at higher frequencies, and functioning with greater reliability, we will try them out as we have experimented with the types you see here."

Dr. Engstrom said that RCA does not expect the transistor to supplant the valve "any more than radio replaced the gramophone. In fact, the market for valves may even increase under the full impact of commercial transistors.

"This is because the transistor will allow the development of electronic devices now undreamed of," he said. "Many of these devices will still require the work of valves and in quantities that will continue to tax the manufacturing capacity of the valve industry. Thus, as transistors begin to replace certain valves in present electronic equipment, the displaced valves will find new jobs in new devices made possible by the development of the transistor."

Dr. Engstrom said that the experimental equipment demonstrated represented exploratory employment of transistors in may phases of electronics and that the items were laboratory models in a research stage. Neither the transistors nor their applications are yet in commercial form, he pointed out.

Dr. Engstrom of the R.C.A. with samples of the transistors made from germanium crystals.

Two Types

At the present time, there are two kinds of transistors of major interest, the point-contact type and the junction type. The point-contact transistor was developed first. While it has performed at higher frequencies, the junction transistor promises to be more important than the point-contact type in many applications. Also, the junction types have lower noise, higher power gain, greater efficiency, and higher power-handling capabilities.

The art of crystal growing is rapidly progressing and the uniformity of germanium has progressed to the point where various transistor characteristics such as current amplification, power gain, feedback resistance, and input and output resistance have been controlled to close limits.

At present, the characteristics of high gain. low noise, greater stability, higher efficiency and higher power capabilities indicate that the junction transistor will be widely used in audio and radio amplifiers. Another feature of the junction transistor is its ability to operate with power inputs around a millionth of a watt.

The point-contact transistor may be applied to very-high-frequency circuits wherever noise is not a limiting factor. Another feature of the point-contact transistor is the negative resistance properties which are especially useful in counter and similar circuits and in oscillators. Negative resistance means that an increase in voltage decreases rather than increases the current.

Estimates of the time when transistors will be available in quantity for production of saleable products must be somewhat speculative.

The problem of providing adequate supplies of processed germanium with proper characteristics at reasonable cost remains to be worked out. Also quantity manufacturing processes, machinery and other facilities are yet to be developed.

Portable Television Receiver

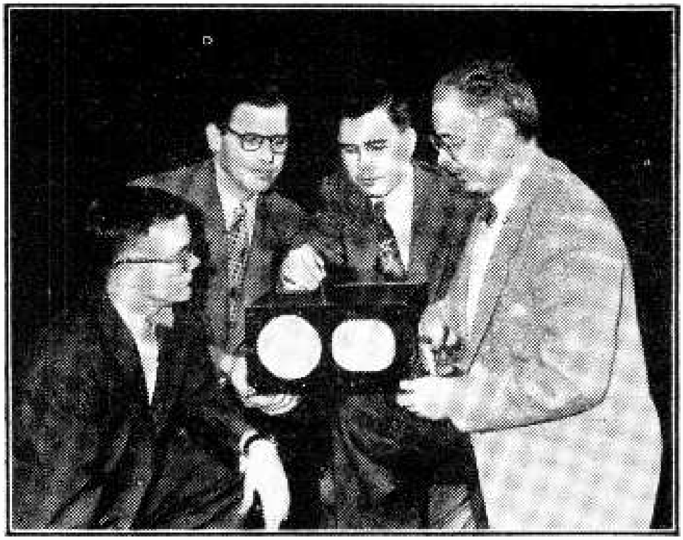
Among the experimental equipment shown was a portable, battery-operated television receiver, valveless except for the picture tube. This item represents a pioneering attempt to build a completely portable television set using transistors in the place of all valves except for the picture tube. The purpose was to try transistors in all TV receiver circuits so as to uncover the problems and make an initial effort towards their solution.

The preliminary result is a single-channel receiver, with a five-inch screen, in a case no larger than that of a portable typewriter case (12in. by 13in. by 7in.). In recent tests, the 27-pound battery-operated receiver produced a satisfactory picture when operated off its self-contained loop aerial five miles from the Channel 4 transmitter on the Empire State Building. With a small "rabbit-ear" aerial a similar picture was obtained fifteen miles from the transmitter.

The experimental receiver has 37 developmental and experimental transistors, both junction and point-contact. Its total power consumption is 14 watts, less than one-tenth that of a standard table-model set.

Transistor applications in industrial television equipment.—Study of partial introduction of transistors into the control (monitor) unit of industrial television equipment was initiated to find ways of reducing weight, size, power consumption and circuit complexity in this type of semi-portable, closed-circuit television equipment. With eight RCA developmental point-contact transistors used in the synchronizing generator circuit to do the job of three double triodes and four transformers, the initial result is a three-fold reduction of the size of this component and a ten-fold reduction in its power consumption. The performance is roughly comparable to that of all-valve equipment. Further work is in progress on the problem of protecting the transistors from being overheated by the valves.

Transistor application in RCA "Walkie-Lookie."—Since "Walkie-Lookie" TV equipment must be completely portable (at present the back-pack unit weighs 50 pounds), weight, size and power drain on the self-contained batteries are extremely important considerations. Initial employment of 17 developmental point-contact transistors in four circuits reduces power consumption of the back-pack unit by more than one-third, promising reductions in battery size and weight. By transistorizing more than half of the valves in the unit. it should be possible to cut total power consumption and over-all volume by at least 50 per cent.



A Portable Battery-operated Television receiver without valves.

Transistor applications in a standard TV receiver.—In this item, developmental transistors were tried only in those circuits of a standard TV receiver where transistors, at their present stage, appeared most feasible.

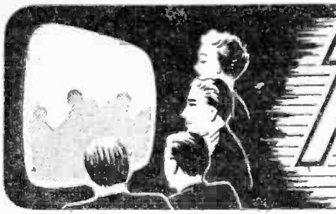
A RANGE OF RADAR TUBES

THE rapid growth of radar during recent years has produced a demand for cathode-ray tubes having characteristics which differ in certain respects from those required for television picture tubes. In order to make use of the detailed information obtainable from modern radar systems they should, for example, provide the extremely high resolution so necessary in this class of equipment. They should also provide a picture of high brilliance and contrast, and, in addition, operate reliably under the continuous and arduous conditions of service encountered in many navigational radar applications.

A range of flat-faced radar display tubes, recently introduced by the Communications and Industrial Valve Department of Mullard, Ltd., have been specifically designed to meet these requirements. These tubes give pictures of very high definition and contrast. They are also notable for their low deflection defocusing, low astigmatism and long persistence.

All the tubes employ magnetic focusing and the screens are metal-backed magnesium fluoride giving an easily visible orange afterglow. The heater voltage is 6.3 volts and current consumption 0.3 A.

The range includes a 5in. tube MF13-1, a 12in. tube MF31-55, and a 16in. tube MF41-15.



TELENEWS

Television Licences

THE following statement shows the approximate number of television licences issued during the year ended November, 1952. The grand total of sound and television licences was 12,844,740.

Region	Number
London Postal	648,186
Home Counties	215,320
Midland	412,224
North Eastern	186,714
North Western	217,950
South Western	43,289
Welsh and Border ...	53,462
Total England & Wales ...	1,777,145
Scotland	36,390
Northern Ireland ...	255
Grand Total	1,813,790

No Irish Service

SPEAKING at a recent Dublin Publicity Club luncheon, Mr. Erskine Childers, Minister for Posts and Telegraphs, told members that there was absolutely no likelihood of television for Ireland in the near future.

People could safely go ahead and buy radio sets, he said, for it was not fair play if dealers gave the impression that listeners should buy television receivers.

Producer Released

MR. ERIC FAWCETT, BBC Television Drama Producer, was released for one year from January 1st, 1953, to direct a series of productions for High-Definition Films, Ltd. These productions, in the form of television programmes ready for transmission anywhere in the world, will be designed primarily for export to the United States and Canada.

Whenever the subject of Mr. Fawcett's productions is of interest to home viewers, the programmes will be shown on BBC television.

Obituary

IT is with deep regret that we announce the death, at his Keswick, Cumberland home, of Mr. John Glover Robb, M.I.E.E., F.Inst.P., former deputy engineer-in-chief of Marconi's and chief of their Research Laboratories, at Baddow. Mr. Robb, who was 62, passed away on Tuesday, December 16th.

The death is also regretfully announced of Wilfred F. Kent, contracts manager at Marconi's, who first joined the company in 1913. He was 57.

Export Order

THE first export order for British underwater television equipment calls for the supply of Marconi-Siebe, Gorman equipment to Jugoslavia.

The order has been placed by the Belgrade shipping material imports company of Brodoimpeks for dock and harbour inspection work in Jugoslavia's Adriatic ports.

Holland May See Coronation

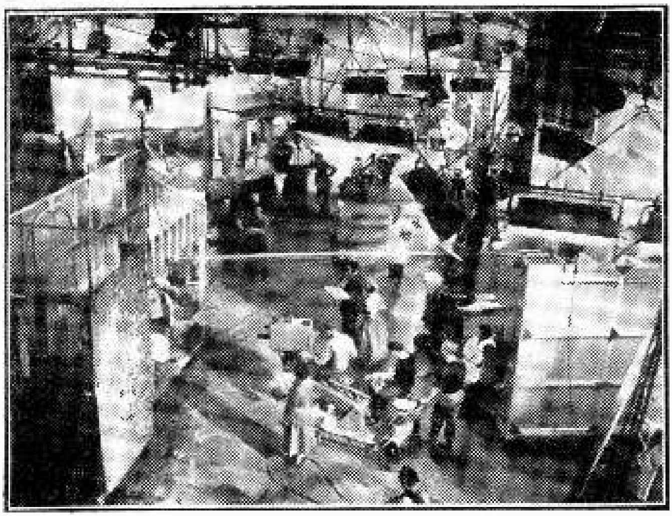
HOLLAND has reached agreement with the BBC on the transmitting of Coronation pictures to the South of England and across to France, Belgium, Holland and West Germany.

Other countries may receive the relay as well.

Tube Service

A NEW cathode-ray tube stores and service department is now in operation at the Brimsdown factory of the Edison Swan Electric Co., Ltd.

The Cathode Ray Tube test section in the new Brimsdown Service Dept. of The Edison Swan Electric Co., Ltd. The operator on the left is testing tubes on the "factory type test panel," whilst the other two operators are preparing tubes for testing under operating conditions in receiver chassis.



A general view of Studio G, Lime Grove, during rehearsal of a production. The studio, the second largest at Lime Grove with a floor area of over 5,500 square feet, is air-conditioned and can be kept at a comfortable temperature even on very hot days with the full 300-kilowatts of lighting on.

A special conveyor system has been installed to link the factory to the stores so that as tubes are completed, tested and packed, they are loaded on to the conveyor and transported direct to the stores.

Piped TV

IF experiments being performed by Professor Harold Barlow, of University College, London, prove successful, the coaxial cable which links London with the Holme Moss transmitter in the Pennines may be replaced by a thin copper tube.

The tube would be a cheaper and simpler method of television communication, the theory being to impel a very strong radio wave through it.

Mr. R. P. Browne in Hospital

MR. R. P. BROWNE, secretary of the Radio Industry Council, who recently entered London Hospital, Whitechapel, for an orthopaedic operation, has been given leave of absence for some months.

Acting in his absence, under the director, Vice-Admiral J. W. S. Dorling, is the deputy secretary, Mr. G. B. Campbell.

Adult Survey

FOLLOWING the survey among young people of Coventry on the effects of television in the home, the Birmingham University Extra-Mural Department is sponsoring another television inquiry, this time among the adult population of Coventry.

A questionaire has been compiled and distributed to families. Viewers are asked whether TV has induced them to stay at home more and whether the family atmosphere has been improved.

No Sale

A RADIO dealer at Bilston, Staffs, has received an order for a television receiver from an African residing at Kumasi, Gold Coast.

There is, of course, no television transmission in Africa and it would seem that completion of the order is extremely unlikely.

Detector's Success

SALES of TV licences in districts visited by the G.P.O. television detector van show that the "pirate hunter" is proving itself invaluable.

In Manchester alone, the number of licences issued was increased by five times as much after the detection swoop. A G.P.O. official has stated that the function of the van is not so much to catch licence dodgers but to act as a gentle reminder to all local viewers when it arrives in each district.

Fire Chief's Protest

MR. BERNARD SMITH, Chief Fire Officer for Nottinghamshire, has protested strongly to the BBC concerning Christmas programmes which he described as a "disgraceful example" of how fires may be caused.

One of the transmissions concerned was a children's programme in which Christmas decorations were hung dangerously near lighted candles. Another, an instalment of "The Appleyards," showed a man making a fire blaze by holding a newspaper in front of it.

Newquay Protests

NEWQUAY URBAN COUNCIL has unanimously passed a resolution to protest to the Government against the decision not to extend the BBC Television Service to Devon and Cornwall in time for the Coronation.

"Perfect" Reception

ACCORDING to a report from Russia where three TV stations are in operation, at Moscow, Kiev and Leningrad, Soviet experts expect soon to perfect three-dimensional coloured pictures on 12ft. by 9ft. screens.

False Alarm

MANY telephone calls and complaints were received in Bristol when the Wenvoe station sent out its first full-power transmission.

The stronger signal had caused sets to produce a completely white picture so that local dealers were inundated with inquiries and customers seeking advice. Although all the adjusting necessary was the reducing of brilliance and contrast, many people were so bewildered by the slightly technical talk that engineers were sent out to perform the simple "attenuating" task themselves.

TV at Sea

THERE is a strong possibility that the Coronation Naval Review at Spithead in June may be televised, but no definite decision has been made.

The scheme would present few technical difficulties; the pictures could be relayed to a receiving station on the mainland and on to London by land-line or link stations.

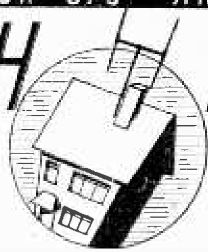
Larger Screens in America

OVER 50 per cent. of television sets manufactured in America this year will have screens 21in. wide. Ten per cent. will have screens as wide as 24in.

This was predicted in New York recently by Mr. L. F. Cramer, vice-president of the Avco Television Company.

TELEVISION PICK-UPS AND REFLECTIONS

UNDERNEATH THE DIPOLE



By Iconos

RELAYS

THE old year departed with a flourish of trumpets so far as TV was concerned. Some of those trumpets were in the "pit" bands of the London Palladium, the London Casino and the Empress Hall, where, by arrangement with Messrs. Val Parnell, Emile Littler and Claude Langdon respectively, viewers were able to see and hear excerpts from "Dick Whittington," "Jack and Jill," and "Jack and the Beanstalk on Ice." In addition, the Crazy Gang from Jack Hylton's Victoria Palace show "Ring Out the Bells" were seen at Jack Hylton's Circus on the newsreel, and also Muffin the Mule from "The Muffin Show" visited the studio. Thus does the BBC take the bit between its teeth in providing "publicity" entertainment to beat the menace of sponsored television!

"BY ARRANGEMENT WITH——"

IT is many years since the late Sir Oswald Stoll was alone amongst London impressarios in allowing excerpts from his spectacular musical shows to be televised, and at long last the "penny has dropped," and other big men of show business are eager to join in the television trailer rush while it is still free, as it is bound to be on the BBC. I presume, of course, that a "puff" on the forthcoming rival sponsored television stations would cost them money—unless some kind advertiser of pills or perfume steps forward and pays the transmission fees. I foresee an era of credits even more complicated than now: "Norman Collins presents on the High-Definition Network, on behalf of Twick-Vita (the Rugger Beverage), excerpts from the thousandth performance of "Ring Out the Bells Circus on Ice", specially performed at the Wembley Ice Rink (by the courtesy of the Lions). It seems quite crazy, but the competition for outside television broadcasts will put the theatrical managers in a position sufficiently strong for them to expect substantial fees for television puffs for their shows. Quite a Gilbertian situation!

PANTO TV

AND what about the televised pantomimes themselves? From the impressario's point of view, the object is to whet the appetite of the viewer so that he will immediately want to book seats. But no wise showman will give away the best sequences in his shows, the most spectacular scenes or the funniest dialogue. And yet he does not want to put before the viewer anything that is second best. I think that the Palladium transmission of scenes from "Dick Whittington" fulfilled this requirement, giving just enough production numbers to indicate the vast proportions of the show, with hints (by judicious commentary) of the unseen delights of the transformation scenes, and the spectacular effects of the shipwreck. King Rat (whose sequin-covered tunic scintillated in a most peculiar manner on the TV camera) shot out of trap doors from time to time in such unexpected places that the camera was sometimes pointing in the wrong direction, and occasionally the cutting from camera to camera was untidily done, especially during musical numbers. But the hilarious kitchen scene in which the Mate (Richard Herne) and the Cook (Sonny Hale) carry out cookery hints from an enthusiastic Philip Harben in the best slapstick manner, must have set a couple of million viewers rocking with laughter. As was to be expected, "Mr. Pastry" was in his element, flinging lumps of sticky dough at his colleagues with great accuracy. The inclusion of this scene, with characters familiar to so many viewers, was a shrewd choice for drawing the TV audience to the theatre.

LOW KEY LIGHTING

A VERY considerable amount of British film studio space is occupied with making films for American television. The Douglas Fairbanks Studio at Elstree has several units working simultaneously, turning out two or three subjects a week, and Wembley Studio is expanding its facilities to increase its output of television films. In the meantime, Norman Collins has announced that the High-Definition Films Studio at Highbury is almost ready for action, with Eric Fawcett and Desmond Davis, BBC TV producers, lining up a number of subjects for recording on film with the electronic camera process. More surprising was an "aside" to the effect that negotiations were taking place with the BBC which would give the Corporation British television rights to the company's film output, U.S.A. rights being sold to American advertising interests. The target is two hours of TV entertainment per week, to be made by experienced television technicians and using entirely television technique. For America, the appropriate advertising tags will be affixed to the beginnings and ends. I can't help thinking that Mr. Collins is approaching this TV-film proposition from the right angle, using personnel and techniques from the television field rather than from the film industry. I have heard of very disappointing results arising from the work of experts who are trained to think in terms of the big cinema screen and fail to allow for the limitations of the average home TV set. Too much emphasis on long shots, over-speedy cutting and low-key lighting may be very effective on a large screen, but on the end of a 12in. Cathode-ray tube, they carry little impact. Experienced TV producers know that two-shots or close-ups are the most effective camera set-ups and stick to them as much as possible. Mind you, the BBC themselves sometimes slip up with low-key lighting effects as they did with the play "Markheim." It may look very arty-crafty on the closed circuit reproducers at Lime Grove, but on most commercial sets the result is a few pallid faces looming up out of complete blackness.

THE "LE MANS" FILM

PHILIP DORTÉ has often expressed the view that the cutting from shot to shot in the newsreel and other BBC film features is intentionally slowed down, compared with the cutting in cinema newsreels. Having seen the Shell Film Unit documentary *Le Mans* on a big cinema screen, I was interested to see it again via TV on my 10in. x 8in home screen. I must say that this excellent record of the 24-hour motor race did not seem nearly so effective by TV. The principal reason for this was the restless editing treatment, the ultra-fast cutting, which was maintained throughout. Again, the low-key night shots failed to come over, though the dawn shots were good. The same results were noticeable to some extent on the "Victory at Sea" films, made specially for American TV. In this case a very fine but rather over-elaborate musical treatment obtrudes. Turning down the sound volume unfortunately also weakened the commentary—and so the very moving picture records of war events did not quite carry the same atmosphere of authenticity to which we have become accustomed in similar features from the BBC. However real the scenes may be, strength is lost in the gloss imposed by ultra-slick editing, elaborate optical work, symphony orchestras and the like.

NEWSREEL PROGRESS

I WAS privileged recently to see experimental BBC newsreels, with varying amounts of background music, commentary and direct recording; also with an interpolated newsreading which would be televised "straight." The experiments demonstrated that the BBC newsreel department was not standing still —and also that the present style of presentation was by far the most acceptable. Musical backgrounds have also been experimented with separately and efforts have been made not to repeat musical recordings too many times. This side of the business has many problems of its own, with copyrights and royalties keeping a small department busy. If the newsreels used some of the modern impressionistic music, it occurs to me that it could be played backwards—thus giving double the musical footage for the same money! From the technical point of view, a great deal of the TV musical recording, made on magnetic perforated film, surpasses in quality many recordings made for sound radio.

VICTORY AT SEA

THE BBC's collaboration with the National Broadcasting Corporation of America has produced good dividends over the years, chiefly in the useful American contributions to the newsreel. The American war series "Victory at Sea," compiled from official American and British Admiralty films plus contributions from France, from captured German and Italian films and from various newsreel archives, is a monumental work. The sources of the material are so varied and yet are so brilliantly combined during editing and linked with commentary as to give the impression of a vast integrated historical work—a television equivalent to Churchill's great series of second world war memoirs. It would be difficult to assess the time and research required to knit together material originally taken from so many and varied points of view. The television screen is kind to the different qualities of photography, the small screen covering up flaws and deficiencies which would be glaring on a large motion picture screen. Some of the scenes were taken from original negatives; but others came from "dupes"—i.e. duplicate negatives made from prints which were sometimes worn or in bad condition, instead of from original negatives. Occasionally, the importance of some of the shots justified the use of second generation "dupes," i.e. dupes of dupes, or even of dupes to the third generation—by which time the photographic graininess becomes almost intolerable. The small size of the TV screen does mean that lower standards are quite acceptable.

TWO-WAY TRAFFIC

THE increasing volume of TV film material exchanged between Britain and the U.S.A. is in no small measure due to the diplomatic negotiations of Philip Dorté, Head of Television Films, who combines a sound administrative and technical background with the outlook of a skilled and respected diplomat. Recently, he gave a paper on the TV newsreel before the British Kinematograph Society, attended by an audience of professional film technicians. The film trade and the BBC are generally at loggerheads, but Dorté's personal popularity with the film people is the principal hope of ultimate co-operation.

TRADE NOTES

"View Master" Service

WATTS Radio have a special service for constructors of the View Master. Special lists are available, detailing the specified components and suitable alternatives, with full details of price, and the firm can also supply a special resistor kit, in which all the resistors are separately packed in labelled envelopes, giving not only the values but the position in the circuit (R1, etc.). Hire purchase terms are available, and copies of the list, etc., may be obtained from Watts Radio (Weybridge), Ltd., 8, Baker Street, Weybridge, Surrey.

Telcon Branch Office in Manchester

THE Telegraph Construction and Maintenance Co., Ltd., announce that a branch office was opened on December 1st, 1952, at 43, Fountain Street, Manchester, 2, telephone number: Central 0758, under the charge of Mr. J. Taylor. P.V.C. cables and flexibles, also radio frequency and broadcast relay types of cable, will be held in stock at this depot. Subsequently other products manufactured by the company will be added.

Direct TV Replacements

UNDER the direction of A. Rose, this firm is able to supply direct replacements for the large majority of television receivers. It is in the form of a pool, and the 21-page manual which they supply lists the receivers in alphabetical order, together with the main special parts with their list number and price. Time is saved for the servicemen as the goods may be ordered direct, and are available C.O.D. or cash with order. Home-constructor parts are also supplied, together with special servicing equipment. Direct TV Replacements, 134/136, Lewisham Way, New Cross, S.E.14.

Airmec—Change of Name

FOR some time now it has been felt that the word "Laboratories" in the name of this company has tended to give a misleading impression, not only of size and manufacturing capabilities, but also of the quality and type of equipment produced by Airmex.

A change of name has, therefore, been registered, and with effect from November 10th, 1952, the official name and address is:

Airmex, Ltd., High Wycombe, Buckinghamshire.

Aerialite Price Reductions

PRICE reductions are announced for certain Aerialite television aerials, and the following retail prices now apply:

Model 53	...	27s. 6d.
Model 58	...	44s. 6d.
Model 58A	...	37s. 6d.

and Coaxial Boxes Part No. 153, 5s.

Aerialite, Ltd., Castle Works, Stalybridge, Cheshire.

CORRESPONDENCE

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

ARGUS HINTS

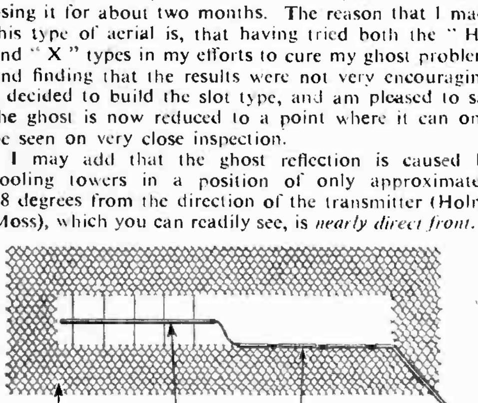
SIR,—Re letter under above heading in current issue (Jan.) of PRACTICAL TELEVISION from A. C. Deverell. (3) L.T. windings centre tapped. Some confusion may be caused by this statement and readers may be tempted to earth the centre point of the windings as indicated by the reader. This would result in severe damage to the transformer if not carried out correctly. The recommended method is to leave the centre tap disconnected and free from earth; one outer of the L.T. winding is then earthed and the other outer is carried to the L.T. line. One outer L.T. and the centre tap *must not* be earthed together.—B. L. MORLEY (Bristol).

SLOT AERIAL

SIR,—With regard to your note in the December, 1952 issue of PRACTICAL TELEVISION, that the "Slot-Type" aerial is very effective in combating ghost reflections on TV; I feel that I must write supporting your belief in this aerial.

I have, in fact, made a slot aerial, and have been using it for about two months. The reason that I made this type of aerial is, that having tried both the "H" and "X" types in my efforts to cure my ghost problem, and finding that the results were not very encouraging, I decided to build the slot type, and am pleased to say the ghost is now reduced to a point where it can only be seen on very close inspection.

I may add that the ghost reflection is caused by cooling towers in a position of only approximately 18 degrees from the direction of the transmitter (Holme Moss), which you can readily see, is *nearly direct front*.



Details of Mr. Rosbottom's aerial.

The slot aerial that I have built, differs from the one shown in your February 1952 issue, as it is connected with coaxial cable.

It seems to me that there must be a great many readers who would wish to build a slot aerial, with coaxial lead-in, but do not know the best method.

My slot aerial has a length of metallic rod or stout wire along the slot, extending from the centre to approximately 1in. from one edge, with the coaxial connections being: Inner conductor to end of rod or wire, and metallic braiding along edge of slot, at intervals of not less than 1ft.—J. ROSBOTTOM (Wigan).

TELEVISION AERIALS

SIR,—As a small dealer in Bristol I feel that the benefit of my experiences may be of interest to many people who have become potential TV viewers since Wenvoe opened, expecially on the fringe. Should this appear in print, I shall probably find myself most unpopular with all concerned in the manufacture and sale of fringe aerial equipment. However, I am concerned only with my own practical results when attempting to obtain decent reception from Sutton Coldfield. When that station first opened, I, in common with everybody else interested, was told by the aerial people: "Ah! at this distance of about 95 miles, and considering the strength of the transmitter, you will only require an H type." Then, when things were not so good, we were told to buy three or four element arrays, folded Di-poles, and anything else that could be devised. These all made a cumbersome mass of metal to stick up on the roof, whose sole useful purpose, in my humble opinion, was to provide additional perches for the birds.

Now comes the headache to the dealer when he has to install and advise on an aerial for a potential sale. Each location is different, even when they are adjacent, and the "fringier" you are the more pronounced this becomes. Should you be foolish enough to advise an H, you will obtain enough signal to whet the appetite of your client, providing there is a signal there at all. He will blame you because it is not even better, and you will be forced to install a multi-element job. My guess is that you would have to make still another change and revert to the H, thus making three erections for the cost of one small H. The only answer to the problem was to follow the trend of fashion and install large arrays costing anything between £15 and £25 and, thinking this was bound to be the best, the customer would pay up like a hero. Personally, for my own use, I stuck to my original cheap H which gave me fair results for my low location. During the following two years I sold a lot of sets complete with a lot of expensive arrays, finally compromising with a standard H with single director at about £15 for the complete installation. I was never tempted to put one up for myself, and my experiences have led me to some very definite conclusions which I hope may benefit others in obtaining good reception at the lowest figure. It must first be realised that the simple Di-pole is the collector of energy in any array, and the higher it is the better. Also, the importance of the reflector can be understood because it helps to prevent unwanted signals, thereby increasing the signal/noise ratio. The addition of directors will help this ratio as well, in a really noisy situation, but owing to the difficulty of obtaining a really good matching to your feeder, I am in considerable doubt as to whether any appreciable signal gain arrives at the set end of your cable. With a lot of experimenting with the matching I think it might be possible to get a lot of extra gain out of decent array, but you are still left with some pretty nasty joints to protect from the weather. On the whole the best bet seems to me to be a ½-wave H mounted on the longest wooden pole you can obtain, and if it is fitted with the best low-loss feeder you can find I am sure you will be surprised at the results in any location where a signal is possible.—"DEALER" (Bristol).

A.C./D.C. TELEVISOR

SIR,—I should like to point out a small error in Fig. 1 of the A.C./D.C. Televisor described in the July-Sept. issues of PRACTICAL TELEVISION. C58 should connect to the anode of the line oscillator valve V13 and not to the slider of R64.

Failure to make this change will tend to destroy horizontal linearity, and the time-base frequency will be dependent on R64 as well as the actual Hold control R65.—S. A. KNIGHT (Chelmsford).

VIEWMASTER LAYOUT

SIR,—With reference to the trouble experienced by Alastair Stewart (Fife) of interference on sound on his console Viewmaster, I venture to suggest that he will never be completely rid of interference until the top-cap grid connection to V7 is fitted with a screened connector and lead.

Although he may improve matters by tuning the sound receiver more accurately there will still be a residue of frame time-base interference, a fault which is inherent in the console model only, due to the position of V7 directly underneath the frame transformer and associated sub-chassis components.

A marked improvement may be noted by interposing the cupped hand between the top-cap of V7 and the upper-deck chassis. This proves beyond question the necessity for fitting a screened connector.

I experienced the same trouble myself some two years ago with the Viewmaster console chassis, realised the source and cured it inside ten minutes by the measures stated.—E. V. BROCK (Birmingham).

LOW-NOISE PRE-AMPLIFIERS

SIR,—Mr. W. E. Thompson's letter in your December issue criticising the article by Mr. A. Thomson on the use of the 6AK5 in low-noise pre-amplifiers should not be allowed to pass unchallenged.

Although the 6AK5 has the suppressor directly connected to the cathode, it is generally agreed that this has no adverse effect on the operation of the valve as a triode with screen and anode strapped together.

The Radiation Laboratory Series, in the volume on amplifiers, gives figures showing this valve, when triode connected in the above manner, to be superior to all others in noise level. It is stated that this is due to the plating of the grid with gold to lower the grid emission.

Finally, the EF95 is a new valve, stated by the makers to be an exact equivalent to the 6AK5.—E. D. FROST (Brentwood).

"SPOT WOBBLE"

SIR,—May I make a suggestion which has occurred to me although I have not yet tried it out. It seems to me that "spot wobble" is a makeshift method of filling in the spaces between the scan lines and likely to cause slight loss of horizontal definition. Experiments with electrostatic tubes show that a spot which is elongated can be produced either horizontally or vertically. A slightly different design of focusing magnet or an additional magnet could be utilised to "stretch" the spot vertically, and thus fill the lines without loss of horizontal definition when utilising magnetic tubes. It may be argued that towards the outer edges of the raster the "spot" will be considerably distorted, but seeing that this is already the case, and particularly with wide angle scanning is it so, I do not think that point so important. Indeed, I believe that careful examination of the lines will show a progressive thickness towards the upper and lower extremities of a normal raster.

With regard to the various requests for a quality TV receiver, I would like to make a point which must have occurred to many constructors with the possibility of advent of commercial stations—or should I say sponsored stations? It has been suggested that adaptors could readily be made to convert frequencies for input to normal receivers. It appears to me that the superhet. receiver could be made more versatile in preparation by the inclusion of two additional input sockets direct to the vision and sound I.F. stages and a muting switch to the existing oscillator or mixer section. With the independent inputs the conversion of widely separated sound and vision channels would be simplified, assuming that the all-important question of cross-channel interference was taken care of.

My third point concerns the suitability of C.R.T.s and scanning coils. One of your contributors points out that these must be matched, otherwise "barrellsided" or "pin-cushion cornered" rasters will be produced. I have written to some manufacturers upon the point, but they are evasive upon the matter. If you could publish a table of as many types of each, grouped to show their suitability, I am sure constructors would be grateful. —L. A. BARKER (Liverpool).

SYNC SEPARATORS

SIR,—The few experiments I am able to make have all been in connection with the improvement of the interlaced scanning, and I have come up against a number of difficulties. It is suggested in the valuable Haynes' booklet that the taking of sync from the detector has advantages, as it enables the picture to be eliminated and at the same time to obtain a synchronised raster. I tried this with most valuable results and have so far tried several published circuits, but without 100 per cent. success. Could any of the expert readers—those, for instance, who are employed in the research labs. of the larger firms—say whether 100 per cent. interlace is, in fact, possible. I have been told by a dealer that it is not, and that a compromise is always necessary, as the broadcast intelligence is subject to mains fluctuations. Perhaps some of our experts can confirm or deny this. At the same time, I wonder if some of them can supply some new circuits for the purpose—even if experimental, as it would give something to work on. Of course, if they can be built round surplus valves, it would be all the better. I might mention that the circuit in the August, 1951, issue did not prove very successful, mainly because of the difficulty of completely eliminating the picture impulses. I tried overcoming this by connecting the grid-leak of the limiter to a positive potential, variable by a potentiometer across a low-voltage source.—G. WIDNES (Kingsbury).

Building the Telesquare

(*Continued from page* 409)

If the generator appears to have dead spots over its tuning range, or if it fails to come into oscillation easily, first check by reversing the connections to L2, then, if this does not improve matters, increase L2 by a further turn or so.

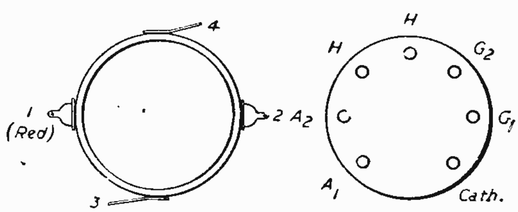


Fig. 6.—Details of coil and valve connections.

Remember that the circuit is connected directly to the mains and see that the case is made the neutral or earthed line. Do not make direct connections between the instrument and a televisor under test.

LOOK! R1355, cpte., 35/-, less valves, 15/- (carr. each 6/-). Indicators with VCR97 and 11 valves, 65/- (carr. 5/-). RF Units: Type 24 22/6, 25 25/-, 27 47/6. LF Chokes, 9H 100ma, 7/6; 20H 120ma, 10/6; 20H 80ma, 8/6; 3H 200ma, 5/-; 10H 60ma, 4/-. Aladdin Formers, cored, ½in. and ⅜in., 9d.; ½in. Poly., 9d.; 2in. x ½in. pax., 4 for 1/3. IFTs, canned, new, 10/13mcs, 1/6; 7mcs (R1355), 1/6; Diode type, 2/-; Wideband, 10mcs, 2/6. EHT Conds. 0.5mfd. 3.5kV, 4/-; 0.15/8kV twice, 6/-; .05/16kV, 6/-; .1/2kV twice, 5/-; .001 9.6kV, 4/-. Valves at 5/6; 2X2, EF50, EF54, EC52, RK34, 717A, EF36, 12A6, 6SH7, 6AG5, 6C4, 9001, 6J5G, 12SK7, KTZ41, MS/Pen, 955, etc. Stock list and enquiries, s.a.e. Terms, c.w.o. Immediate delivery. W. A. BENSON, 308, Rathbone Rd., Liverpool, 13.

"VIEWMASTER" Valves, guaranteed new, boxed, set of 12 as listed, £6/2/6; 6AM6, 8D3, EF91, 8/-; EB91, EF92, 6AT6, 6/6; EL33, KT61, 11/6; PL38, EL38, ECH35, CCH35, PZ30, 13/6; 10F1, 10C1, PL33, CL33, 10/6; 6F6M, 5Z4, U50, 5Y3, 6X5, 35L6, 35Z4, 12K8, 9/6; 1T4, 1S4, 1S5, 1R5, 3S4, 8/6; 1A7, DK32, 12/6; 6CD6, 12/6; EF39, EBC33, Red EF50, 8/6; 6SN7, 6SL7, 6SK7, 6N7, 6J7GT, EL32, 7S7, 7Q7, 8/6; 6K7G, 6/-; 6K7GT, 7/-. "Special" L/make mains Trans. 325-0-325, 6v, 5v, 80ma, 23/6; usual list price, 45/-. O/trans. P/pull, 10,000, 5 ohms, 5/9. Co-ax Cable, stnd. ¼in., 80 ohms, 8/6 doz. yds. 1953 bargain lists available, stamp. RADIO UNLIMITED, Elm Road, London, E.17. (Phone: KEY 4813.)

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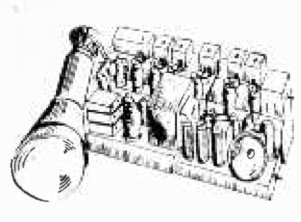

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6F6	9/6	12K8	10/6	EF91	10/6
6G6	6/6	12Q7	10/6	EF92	9/6
6H6	3/6	35L6	10/6	EY51	12/6
6J7	8/6	35Z4	10/6	EY91	8/6
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YOUR Problems SOLVED

Whilst we are always pleased to assist readers with their technical difficulties, we regret that we are unable to supply diagrams or provide instructions for modifying surplus equipment. We cannot supply alternative details for constructional articles which appear in these pages. WE CANNOT UNDERTAKE TO ANSWER QUERIES OVER THE TELEPHONE. The coupon from p. 432 must be attached to all Queries, and if a postal reply is required a stamped and addressed envelope must be enclosed.

LEAKY COUPLING CONDENSERS

My "Inexpensive Televisor 1355," with Miller timebase, 6SN7 output, has developed a peculiar fault after three years of good reproduction.

The picture, after approximately an hour's use, drifts to the right, as seen from the front, until only half the picture is visible. The other half appears to be at the back or side of tube.

Shift control will, for a time, return it to normal position, but only until full travel is reached.

I have renewed the 1 MΩ control on shift, but the fault persists.—H. L. Nicholson (Liverpool, 14).

Drift on an electrostatic tube of this sort is due either to a leaky coupling condenser from timebases to the plates, or a very high or open-circuited plate-return resistor, or a high-resistance plate connection inside the tube base or tube envelope itself. In general, the plate is isolated on that side from which the picture drifts.

You should renew the line-coupling condensers, as only an extremely small leak will produce this trouble; also the return resistances, and check for poor connections at the tube base.

FOLD-OVER ON FRAME

My Premier magnetic TV has developed a bright line about 1in. wide along the bottom of the picture. On inspection this is obviously fold-over. I have replaced C12 and C13, and disconnected in turn each half of C16, and also interchanged V2 and V4 without effect. Any suggestions, please?—J. B. Woodham (Coventry).

The trouble of bottom fold-over may be due to the ageing of the frame output valve, and if possible an alternative should be tried. If this does not improve the raster, check on the screen and bias resistances of the stage for a possible change in value, and generally measure as far as you can all small parts of this sort associated with the stage.

Shorting turns in the output transformer are sometimes responsible, but if the remainder of the scan is linear, this is not likely in the present case. If the whole of the output stage is in order, the oscillator should be examined, particularly the anode load of this valve.

"VIEW MASTER"—TUBE FAULT

Please can you help me with a fault which has developed in my View Master TV? I built this set about February last, using all the specified components. It has given excellent results until recently when the picture clouded over. This clouding or lack of brightness appeared as horizontal strips until it finally covered the whole screen. Now the opposite is occurring, the dull picture becomes bright in horizontal strips sometimes a few inches wide and sometimes only the width of a few lines. When the picture is dull, there is a bad flare on the right-hand side of all objects, and figures seen to be transparent when standing against a horizontal line such as a shelf or staircase. I have checked the spot suppressor components and replaced them, with no result. Although there is a flare on the right side of objects when the picture is dull, the same objects are cut off clean and sharp down the right side where there is a bright strip. I have run the heater of the tube from a separate transformer, but the result is just the same. Incidentally, it is a Mazda 12in. tube with the extra components for increased E.H.T. The raster when run without a signal does not seem to have any fault.—J. Snoddon (Liverpool).

The fault you describe is undoubtedly due to an intermittent heater cathode short in your C.R.T. and it may be that you will have to replace the tube. We suggest, however, that you endeavour to reduce the heater voltage slightly and note whether this has the effect of clearing the short. Also check that R.71 has not become disconnected.

CHOOSING A CIRCUIT

I propose building a television receiver and I should be greatly obliged if you would give me some advice and information on the subject.

My nearest transmitter is Holme Moss, approximately 30 miles away, and excellent sound and vision are received in this district. I would like a superhet circuit with probably a 12in. or 15in. tube (local A.C. mains 210 v.), preferably non lethal E.H.T.

I saw in a recent issue that you recommended the conversion of a R.1355 for fringe area reception, and I wondered if there was any published data for this set to be used with a large tube. If so, would you please let me know where I could obtain the information with regard to conversion and units required and the approximate cost of the complete receiver with 12in. tube? Alternatively, could you recommend the conversion of any other R.A.F. receivers or do you know of any commercial kit to meet my requirements?—A. Bell, B.Sc. (Sheffield).

The R.1355 is suitable for conversion to a vision unit, but a R.F. head is required for this, and in the circumstances it is as well to construct a superhet circuit to a published design; many ex-Government parts can normally be used in this way. The receiver need not, of course, be superhet, and at 30 miles from Holme Moss a straight receiver of four stages will be suitable. Suggested circuits are: the P.T. receiver (August to November, 1950); Combined Superhet (July to September, 1951); A.C.-D.C. Receiver (July to September, 1952).

All these circuits use their own time-bases and are suitable for either 9in. or 12in. tubes; the average cost is about £45, but this can be reduced by the use of ex-Government parts, particularly valves. Ex-Government paper condensers are not recommended.

SOUND CHANNEL FAULT

I have a Pye table model type B16T television. It uses a T.R.F. circuit with the first two R.F. stages common to vision and sound channels.

My trouble is that after working for about two hours the sound becomes distorted. The distortion takes the form of a kind of rattle of the speaker diaphragm. I believe it is caused by the heat generated in the set, because if the set works out of the cabinet the defect is not

noticeable, and when the set cools down the trouble disappears.

Can you please suggest the component that is causing the trouble ? I have tried renewing the valves in the sound channel without effect, and the vision channel is not affected.—C. Newson (Braintree).

As the vision channel is not affected, the fault will lie in the sound channel after the first two common stages. As the valves are not at fault, a change in a resistance value seems most probable, and this is most likely to occur in the output stage. You should check on all components which are situated close to hot parts such as the rectifier valve or the line output valve or the dropper resistance. The speaker itself may, of course, be at fault, and heating of this component may cause distortion of the speech coil clearance ; try the set with the speaker out of the cabinet for a while. Another source of such distortion is the noise limiter on the sound channel, and all components associated with this should also be carefully checked.

FRAME SCAN TOO GREAT

I have recently completed the View master console 12in. with double-deck chassis Wenvoe. I am using a Mazda CRM 123. My picture is good, but I am troubled by the following faults.

Non-linearity of the frame time-base and picture is over-scanned, cramping at top and expanding at bottom. Lines are pulled out right in the centre of the tube. I have tried various values in R.66 and have carried out adjustments to R.65 but cannot remedy this.

My other problem, which is very disturbing, is that I get excessive hum or rattle on sound. My picture is not affected. With volume at minimum this hum and rattle is not evident, but as I bring sound in, on it comes, a vibrating sound. By pressing on the sound vision chassis or putting my finger over the tops of coils 411, 412, 410 seems to practically eliminate this noise. I have tuned thoroughly to try and get this clear, but have had no success. I have screened the frame time-base from the EBC33, which is lying directly underneath. This cuts out some of the noise, but there is some other source also ; it is most evident when the transmitted picture is white or has much white element in it. I should be grateful if you could help me in this matter. I am quite satisfied with my picture, which is steady and clear.—A. V. Badman (Bristol).

To reduce the frame scan we suggest increasing the value of R.56 until R.64 is able to control the frame amplitude to the desired size.

The hum which you describe is caused by vision interference on the sound channel and it will be necessary very carefully to re-tune L.413, 414 and 415, since only if these circuits tune sharply will they have adequate selectivity. Also connect the negative end of C.29 closer to V.7 than at present.

AGED COMPONENTS

I have a Ferranti T.1205 12in. console which has recently developed a fault.

When I switch on, the picture slips in the vertical direction. The " Vertical Hold " knob is at its maximum in one direction and when altered only makes the picture slip down faster.

The only way I can counter this slipping or rolling is by turning the " Height " knob and diminishing the size of picture vertically to nearly half.

After the set has been on for about an hour I can increase the height by turning the " Height " knob gradually until the picture is almost full size.

This happens each time I switch the set on.—H. L. Ewing (Manchester).

It appears that the frame oscillator valve or an associated component has aged, and the normal locking position on frame now lies outside the range of the control. You can try changing the valve, but it might be possible to effect a cure by " padding " up the hold control with resistances on either side so that the range is altered relative to the applied voltage. You should reduce the resistance on the side of the control at which the slider is set when the picture is rolling least, and increase it correspondingly on the other side.

The dependence of hold on height points to the possibility that the H.T. line to the frame time-base is not properly decoupled, and a check should be made with this in mind.

EXCESSIVE E.H.T.

I have recently completed the Premier 9in. magnetic televisor, but cannot get enough width on the tube. How can I increase this ?

Also on the height the lower flyback lines are compressed together into a white bar about $\frac{3}{16}$in. wide, otherwise height seems all right.—W. H. Clarke (Sidcup).

Lack of width on Premier receivers is generally due to excessive E.H.T. on the tube, and you should therefore reduce this by means of a high-resistance bleeder chain wired across the output terminals. A maximum resistance of 50 MΩ (5 x 10 MΩ) is suitable, and the final anode of the tube can then be tapped down this until sufficient width is obtained. On the other hand, the line output valve may be down in emission, or the H.T. applied to this stage may be low ; a check on the voltages on the various electrodes compared with those given in the booklet will cover this point.

On the frame side, experiment with the anode load of the oscillator and the bias of the output stage.

TUBE SHORT-CIRCUIT

Will you please tell me the reason for a purple glow and arcing which has developed around the electrodes of my cathode-ray tube after about a quarter of an hour's use ?

The signal on the tube was satisfactory before that, but I noticed two or three flashovers in the tube. I have checked over the E.H.T. and tube circuit and can find nothing abnormal.—A. F. W. Fielder (Kempston).

A glow around the gun of a cathode-ray tube may be due to a soft tube, but if arcing is also occurring, it appears that a partial short-circuit has developed between two of the electrodes, and if this is so, it is likely that the tube will have to be replaced.

QUERIES COUPON

This Coupon is available until February 18th, 1953, and must accompany all Queries.
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