A BEGINNER'S RECEIVER

PRACTICAL TELEVISION

AND TELEVISION TIMES

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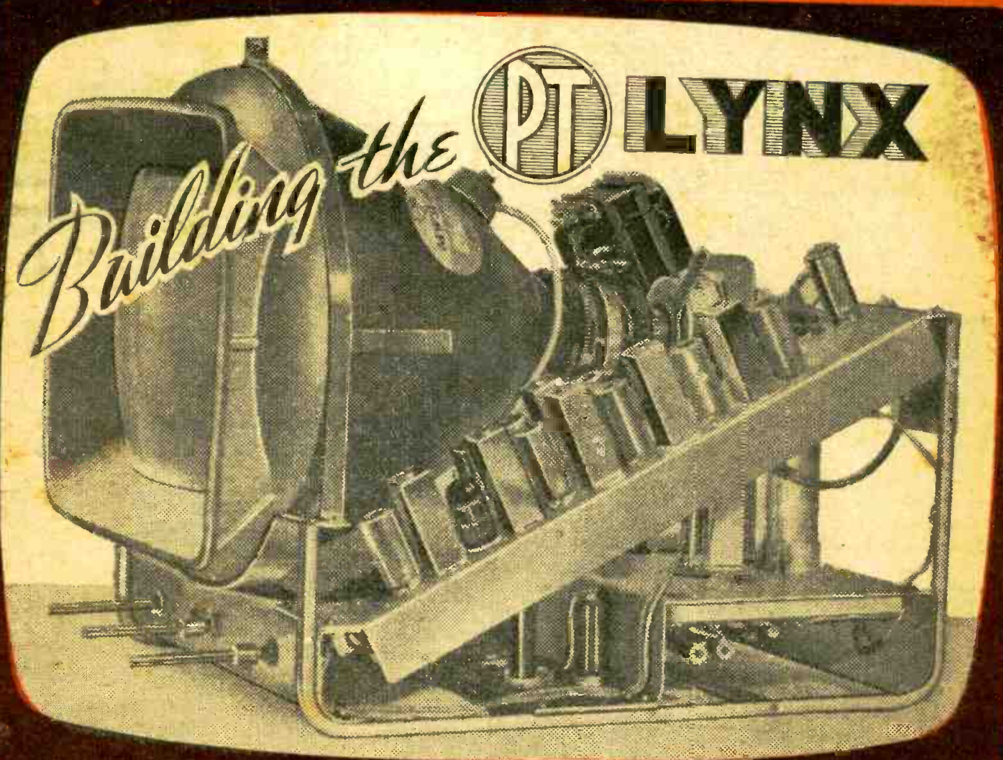
EDITOR F. J. CAMM



FEATURED IN THIS ISSUE

PRACTICAL TELEVISION

& "TELEVISION TIMES"

Editor: F. J. CAMM

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TELEVIEWS

A New "P.T." Receiver—"The Lynx"

ELSEWHERE in this issue is the first article describing the construction of our latest receiver, "The Lynx." Hitherto most of the receivers described in this journal have employed straight circuitry. "The Lynx" employs a superhet circuit, and as will be seen from the photograph, it is incorporated in a new system of chassis construction providing much greater accessibility than the normal chassis, making for easier wiring, testing, alignment and servicing. It employs a 12in. tube and 18 valves.

Needless to say, the receiver has been thoroughly tested in our laboratory, and we launch this latest TV receiver with the confidence that those who build it will be gratified with its performance. We shall, of course, publish full-size blueprints for those who prefer to build from full-size drawings, and like our "P.T." Receiver, the "Argus" and other designs which we have sponsored, it is backed by our free advisory service. This month we publish the circuit, a list of components and preliminary circuit details. Next month wiring diagrams will be given. We have arranged for the manufacture of a special cabinet for the convenience of readers who are without facilities for woodwork.

SPONSORED TV

IT is a sign of the coming times that a new company has been formed to exploit the relaying of sponsored TV programmes, and the terms of its registration indicate that the company has been formed to operate existing relay concessions and to develop new ones. It will take over all or part of the capital of several existing concerns, including Link Sound and Vision Services, which is jointly owned by Pye Ltd., and Murphy Radio. The new company is named British Relay Wireless and Television, Ltd., and it will have a capital of £875,000.

AUTOMATIC PICTURE CONTROL

DEVELOPMENTS in TV proceed apace and one of the latest is the automatic picture control receiver recently demonstrated in London by Pye. It will be of particular value in areas where signal fading occurs—by no means uncommon in certain districts. In these areas at some time during an evening's viewing controls have to be reset due to a change in signal strength, and it is claimed that A.P.C. will provide a steady picture of constant contrast in brilliance even with picture signal strength variation as great as 10 to 1. In the demonstration, although the picture blacked out completely on an ordinary TV receiver, due to signal fading, the A.P.C. set was not appreciably affected.

Another advantage is incorporated in this new receiver—an interference damper—which considerably reduces snowstorm interference. In the bright areas of the picture streaks of interference stay white, but in dark areas where normally they show up white on the screen they now become grey and hardly visible.

TELEVISION IN INDUSTRY

THE possibilities of employing TV in industry and science for optical observation purposes have been demonstrated many times in this country by the three companies manufacturing TV cameras —Emitron Television, Marconi's and Pye. In recent years cameras have acquired more lenses and the latest have a turret carrying six, together providing a very wide range of viewing angles and a sensitivity which closely approximates that of the human eye. The average cost of a camera with its control gear is about £5,000. The cumbersome cameras of twenty years ago have been replaced with lighter and more readily portable cameras. Some, indeed, can be carried about in a suitcase and there is a miniature camera containing a 1in. tube, 6in. long, although it makes use of lenses of the conventional type as used on 16 mm. cameras. Test pattern cards and boards which formerly were used for focusing the camera are now engraved direct on the face of the pick-up tube and are in regular use by the BBC. The latter employs cameras made by each of the three companies, and still uses, at Alexandra Palace, an E.M.I. camera supplied in 1936.

In industry research work of a dangerous nature can be made safer by the use of remotely placed cameras. Particularly is this so in the case of experiments with high voltages, such as circuit breakers, where it is considered dangerous to approach nearer than 200ft.—F.J.C.

TV for the Beginner—2

A NEW SERIES EXPLAINING THE PRINCIPLES OF RECEPTION FOR THE NEWCOMER TO TELEVISION

By "Alpha"

(*Continued from page 520 April issue*)

The Sound Receiver

HAVING passed through the filter gate, the sound signal then proceeds on its way in a manner similar to that in the normal broadcast receiver. There is one usual addition, and that is an interference limiter which acts as a filter and causes heavy voltages due to car ignition to be filtered off. The diagrammatic representation given in Fig. 4 last month shows the filter gate.

The carrier which conveys the sound is retained and amplified with the sound until the sound is able to look after itself; at this point the two are separated (detector stage) and thereafter the sound alone is amplified and fed into the loudspeaker.

Of course, in neither case is vision or sound a pure square-shaped wave, such as has been shown in the diagram; the sound is a complicated sinewave and the vision an even more complicated one. The square forms have been used for demonstration purposes only.

In the detector stage the same proceedings take place whether the normal carrier frequency is retained (signal frequency is the popular name for it) or whether the original carrier frequency has been changed into a new figure as in the superhet.

We will now deal with the basic principles of the vision signal amplifier, detector and video stage.

The Vision Section

It will be remembered that the first stage of a televisor is usually common to vision and sound. In the case of a straight receiver (i.e., one which amplifies throughout at signal frequency), it is usual to make the first amplifying stage common to vision and sound.

After separation of vision and sound signals has taken place by means of gate filters and traps, the sound and vision are amplified in separate channels, the sound finally ending up at the sound reproducer (loudspeaker) and the vision ending up at the vision reproducer (picture tube).

It is usual to employ three stages of vision amplification at signal frequency up to the detector, and sound traps (rejector coils, as they are sometimes termed) are fitted at one or more of these stages (Fig. 5.)

At the detector the vision signal is separated from its carrier in a similar manner to that of the sound signal and it is passed on to the vision amplifier—or video amplifier as it is popularly called.

Now between the aerial and the detector are four amplifying stages; it is a difficult matter to design an amplifier which will pass the broad range of frequencies which comprise the vision signal (from black to peak white) without introducing serious losses. It is possible by careful design and choice of components to use pairs of tuned circuits in the coupling stages. Fig. 6 shows what is meant by a single tuned circuit and a coupled pair of tuned circuits.

The usual method is to make the centre of the tuning point of the pair at 1.5 Mc/s from the carrier and by careful coil construction and circuit design the response can be made fairly flat over the range of picture tones.

Such coupling coils must be wound with great care and rigid adherence to the specification to enable the best response to be obtained; for this reason single tuned circuits are usually employed for amateur construction. It is possible to allow more latitude in coil construction with this type.

It is difficult to design a wideband amplifier using single tuned couplings between stages which will provide the necessary amplification, and the usual method of overcoming the problem is to "stagger tune" the stages.

Stagger tuning is arranged so that each stage amplifies a certain proportion of the band so that at the detector the sum of the different amplifications results in an overall flat-topped response. Fig. 7. shows the idea.

It will be seen that by tuning each stage to its particular band the total result of the stages is a wide band amplified signal applied to the detector.

The same principles apply in the case of a superhet, though tuned coupled pairs are usually used for inter-stage amplification.

To ensure that the resultant bandwitdh is adequate it is common practice to flatten the tuning of each coil by loading the input to the valve with a low valued resistor. This resistor must be lower than the actual input resistance of the valve and for this reason values over 6.8K Ω (6,800 ohms) have little effect.

The resistance is actually placed across the coil where tuned grid circuits are used.

The Video Detector

Up to this point we have considered the vision signal as being a simple band of waves whose frequency extends from zero to 3 Mc/s. In fact it is, of course, an extremely

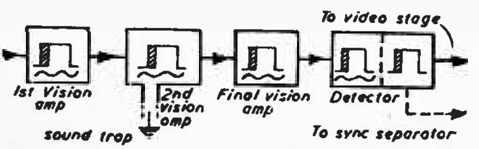


Fig. 5.—Block diagram of the vision R.F. section.

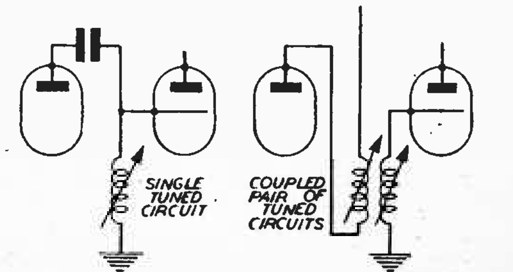


Fig. 6.—A single circuit and a coupled tuner.

complex affair and the analysis of its component parts is a study in itself.

We are not concerned in this series with such a detailed study; what we are concerned with at this point is that not only does the video signal contain the detail of the picture intelligence but it also contains the synchronising pulses which keep the spot on the tube in step with that in the camera at the studio.

These pulses must be extracted from the video signal at some point so that they can be fed to the timebases and trigger their respective oscillators. Quite often

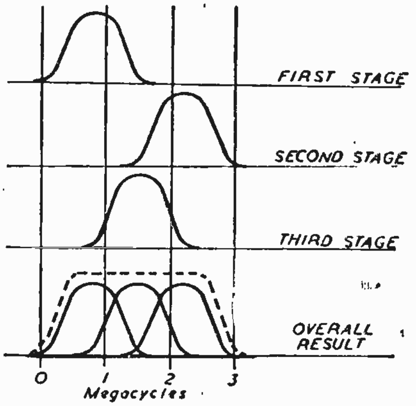


Fig. 7.—Diagram illustrating the effects of stagger tuning.

the extracting process takes place in the detector stage so this stage not only performs the function of separating the video from its carrier but also separates the sync pulses from the picture intelligence.

Now we must be very careful here because things are not quite so simple as that. In the timebase we require pulses to trigger the oscillators and these pulses must be free from picture intelligence; if the pulses contain picture information then a sudden change in scene from, say, a light scene to a much darker one would cause a spurious pulse and the timebase oscillators would be thrown off their normal course—result, break up of the picture on the C.R.T.

When we feed the video signal to the picture tube then it has two functions to perform. It has to modulate the beam from the cathode so that the beam varies in brilliance from light to dark shades which correspond to the light and dark shades of the scene being televised; the signal also has to black out the beam on the retrace stroke when it has finished one line and is starting the next, and when it has finished one frame and is starting the next.

It will be seen, therefore, that we require two separate conditions (a) pulses free from picture content for the timebase and (b) video signal, including sync pulses for the C.R.T.

The two conditions are shown in Fig. 8.

The detector is often made the point of separation; a double-diode valve is frequently employed, one half of the valve acting as the normal wide-band detector and the other half as a sync separator.

Sync separation at the detector is more often employed with hard-valve timebases; thyratrons require a strong pulse and it is usual in these cases to make the separation after the video amplifying valve (Fig. 9).

It will be noted in each case that the outputs are more or less in parallel; to avoid the one exit affecting the other the circuit values are very carefully chosen.

Before leaving the detector valve the method of connection must be discussed. If the detector is connected so that the output is taken from its cathode the output will be positive. If the detector output is taken from its anode then a negatively phased signal will result. This is important because we can predetermine the correct phase of signal for operation of the C.R.T. according to whether grid modulation or cathode modulation is desired.

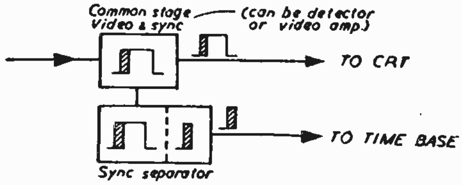


Fig. 8.—Illustrating the special requirements of the tube and sync stages.

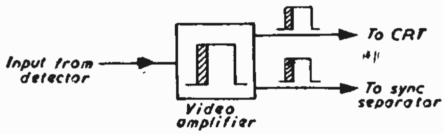


Fig. 9.—The video stage as commonly employed.

When a signal is passed through a valve, reversal of phase takes place between the anode and grid of the valve. For example, supposing a positive voltage is applied to the grid, then the movement of voltage on the anode is in the negative direction. The movement of the voltage on the cathode is in the same direction as that on the grid.

Fig. 10 shows the position.

Now when the signal indicates that a bright section is being transmitted then we must make the screen on the tube brighter. There are two ways of doing this: one is to cause the grid voltage of the tube to become more positive and the second is to make the cathode more negative. (Making the cathode more negative with respect to the grid in effect makes the grid more positive.)

Some designers prefer grid modulation and some cathode modulation of the C.R.T., but whichever form is used the output of the video valve must conform to this condition.

As a phase reversal takes place in the video valve then

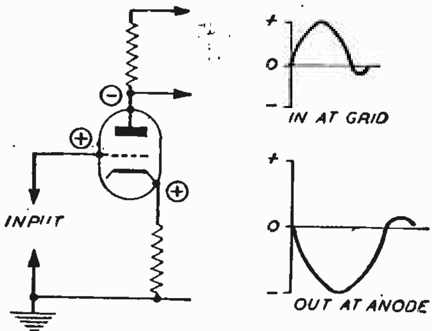


Fig. 10.—A video stage showing the reversed signals in anode and cathode circuits.

the input to that valve must be arranged to be opposite to the desired output. As an example, supposing we are going to modulate the grid of the C.R.T., then peak white means that the C.R.T. grid must move in the positive direction to pass more beam current ; our video valve output must therefore be positive on whites and its input must be negative on whites. To obtain this condition the output from the detector must be taken from its anode.

The Video Valve

This valve has a strenuous job to do, as it must amplify the whole frequency range from 0 to 3 Mc/s evenly, if it is not possible to obtain a very large gain with it, and it will be found that the anode load resistor is very small. Every effort is made to embrace the range of frequencies required, and in some circuits a little artificial boost is given at the high-frequency end in the form of a small boost choke. The low-frequency end must not be forgotten, and it is quite usual to find that the normal decoupling condenser on the screen is shunted by a much larger condenser.

The cathode circuit presents some problems, and it is usual to allow for a certain amount of negative feedback here by keeping the decoupling condenser across the cathode resistor on the small side. Actually the relation between the cathode resistor and decoupling condenser must be carefully balanced for optimum results, or distortion of the waveform will result.

To obtain the maximum gain from the stage it is possible to make the anode load resistor up to 20 per cent. higher than that quoted in the design, and also to increase the value of the decoupling condenser up to some 50 μF. If these modifications are made, the quality of the picture is bound to suffer, although a greater gain will be obtained from the stage. This factor is useful in the fringe areas where the extra gain may be worth the small sacrifice in picture quality.

The value of the cathode resistor which controls the bias of the video valve differs widely for the same valve type, and is dependent upon whether the output is designed to be positive going on peak white or negative.

If the output is to be negative going, then the input to the grid will be positive. The valve must, therefore, be biased so that maximum white (i.e., maximum positive on the grid) does not drive the valve into grid current or off the straight portion of its characteristic curve. The value of the cathode resistor must therefore be on the high side (for EF50's about 220 Ω).

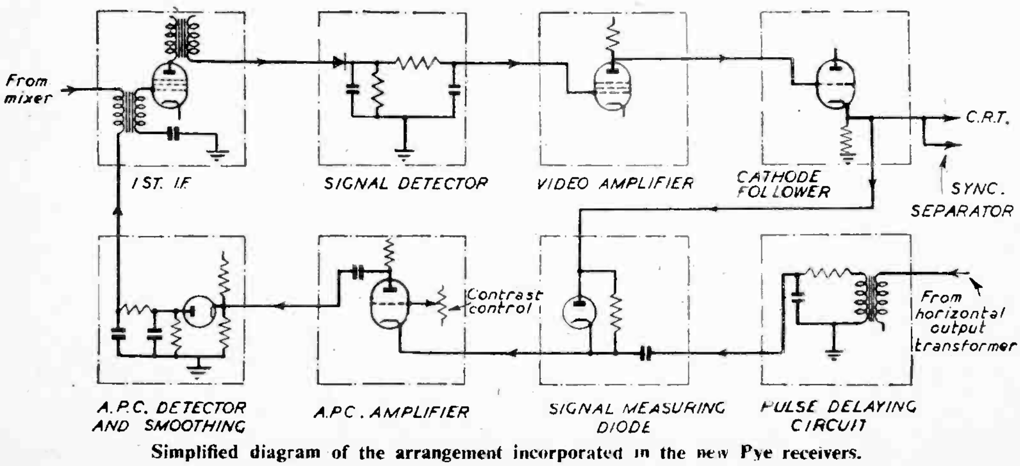
On the other hand, if the input to the video valve is negative, then the cathode resistor must be a low value or the heavy negative representing peak white will drive the valve on to the lower bend of its curve and the picture will be distorted in tonal values. A value of about 68 Ω is usual for an EF50.

Next, we will discuss the fundamentals of the cathode-ray tube ; the merits and demerits of cathode versus grid modulation of the tube will be dealt with and an introduction to the basic principles of the timebase.

(To be continued)

Automatic Picture Control

THIS feature has been incorporated in some new Pye models, and is an adaptation of the auto gain arrangement which has been described in previous issues. As has been pointed out before, A.V.C. as used in radio equipment cannot be employed in a television receiver owing to the fluctuating picture level, and the black level has to be employed for the reference. To enable readers who are interested to follow the scheme the block diagram below is given to show the working. It will be seen that the signal is rectified by the video detector, amplified by the video amplifier and fed via the cathode follower to the picture tube, sync separator and automatic picture control circuits. The pulse voltage at the line output transformer during flyback is applied to the pulse transformer which provides a short delay, and the pulses are applied to the cathode of a signal-measuring diode. The arrangement results in the valve taking current during the pulse period, thereby connecting the cathode of the cathode follower to the cathode of the automatic picture control amplifier during the black level periods. The peaks of the delayed pulses are therefore set at the potential of the cathode follower output during the black level period, and this potential alters as the signal amplitude varies. The amount of pulse fed to the controlled stages is settled by the contrast control. Attention is drawn to the letter on page 579 on this subject.



Simplified diagram of the arrangement incorporated in the new Pye receivers.

Conversion To Magnetic C.R.T.

DETAILS OF TWO EASILY BUILT UNITS BASED ON ELECTROSTATIC TIMEBASES

SOONER or later the home constructor who has been using one of the smaller tubes such as the VCR97 feels a desire for a larger tube; the main deterrent is the cost of the tube itself, coupled with the rather heavy cost of a completely new timebase to work it.

With electrostatic deflection the timebase has to deliver power in the form of heavy voltage waves in order to deflect the spot; with electromagnetic deflection, power in the form of heavy current waves has to be used. This is the essential difference between the two forms of deflection and the reason for the need of a different technique.

Most of the data for this type of conversion which has been published previously involves the wholesale scrapping of the existing timebase and the building of a completely new one. This is quite an expensive business, and an endeavour has been made to form a new approach to the problem; practical experiments have been conducted and the resultant units described in these pages make use of practically the whole of the existing timebase.

Two units are described, the first being the most inexpensive but requiring the most labour, and the second a more orthodox type.

In each case the unit is completely self-contained so far as power supplies are concerned; some simple modifications are made to the existing timebase, the output from it being fed into the unit and thence to the tube.

The cost of the cheaper version should not be much more than £10, and the constructor who has a useful junk box can make it for rather less. Expenditure on certain items is unavoidable and would be incurred whatever system was used; these items are scanning coils, focusing magnet, line output transformer, and E.H.T. system, and these form quite a large proportion of the total cost.

A complete shopping list of specified components has been prepared, and it will be seen that all parts are standard and are easily obtainable. The cost can be kept at a lower level by employing certain items which become available very cheaply from time to time due to purchase of bankrupt stock. The use of such items was avoided in the preparation of this data, as such material is liable to disappear suddenly from the market. There is no reason why these items should not be used provided that the scanning coils and output transformers are matched; this is essential.

Another feature of the designs has been the possibility of the use of inexpensive C.R.T.s which are available from time to time, having cathode-heater shorts; it is possible to purchase a 9in. tube with slight ion burn plus cathode-heater short for as little as 35s. from advertisers in this journal, and these will provide a reasonable picture in either of the circuits given.

The circuits can be used with practically any form of timebase which uses Miller type oscillators. Examples are the Argus, the £9 televisor, the Inexpensive Televisor, and the Premier Electrostatic.

Basic Principles of the Conversion

Fig. 1(a) shows a block schematic of the existing timebase. Most electrostatic timebases follow this general scheme, though it will be found that in some cases the frame oscillator does not feed one of the deflector plates directly but only the frame amplifier, the latter being a duo-triode which feeds both of the plates; the line section is similar.

Whichever system is used the same method of modification is applied to each. A block diagram of the conversion is shown in Fig. 1(b). The new timebase amplifier is shown in dotted lines.

It will be seen that everything in the existing timebase

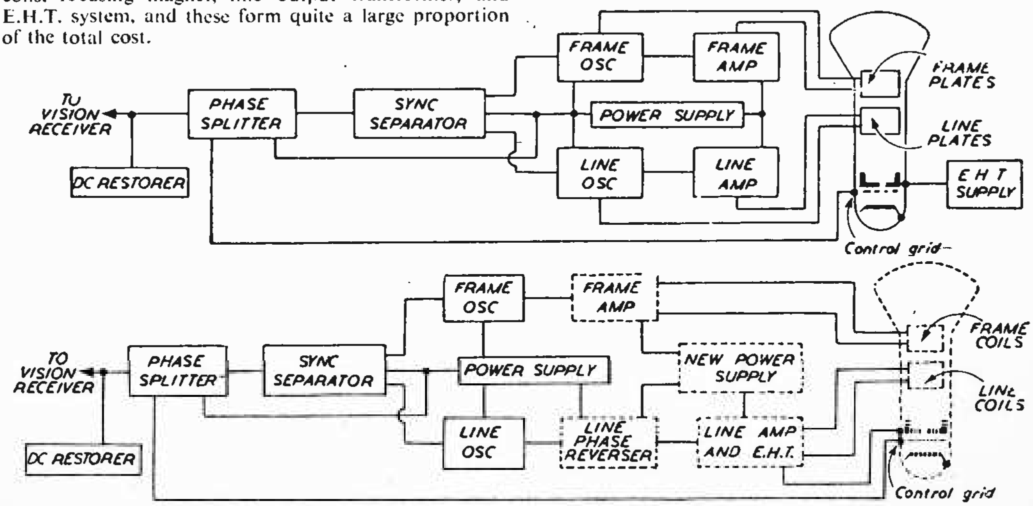


Fig. 1 (a) (above).—A standard electrostatic timebase, and below (Fig. 1 (b)), an electromagnetic arrangement.

is retained as far as the frame and line oscillators. In the case of the frame oscillator the existing amplifier valve is disconnected and the output from the oscillator is taken to a new frame amplifier which feeds the frame deflector coils.

In the case of the line section the line amplifier which is existing is changed into, or replaced by a line-phase reverser; the output from the reversal stage is fed into the line-amplifier which in turn feeds the line-deflector coils. E.H.T. is derived from the line flyback.

The New Unit

The new unit is built on a separate chassis which contains frame and line-amplifying valves and the

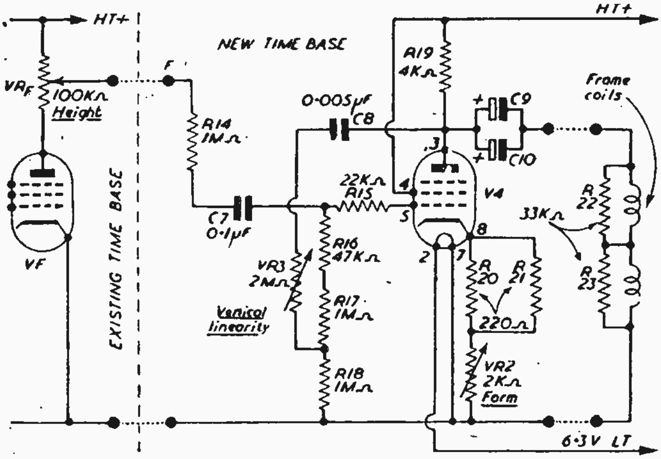


Fig. 2.—A frame timebase amplifier.

E.H.T. circuit. The tube is mounted separately on a wooden chassis and is connected to the amplifier by plug and socket. It was considered that a separate mounting for the tube was the better scheme for the home constructor as it enables him to turn the amplifying chassis upside down for testing and preliminary adjustments.

As mentioned previously, two versions have been built, the first being the most inexpensive of the two, and this one will be discussed in detail.

Each unit can be separated into two parts, the frame amplifier and the line amplifier, and as the frame amplifier is the easier it will be described first.

Fig. 2 shows the theoretical circuit. It consists of a single valve, a 6V6, whose output is fed directly into high-impedance frame coils. This method enables an expensive frame transformer to be dispensed with.

The existing oscillator valve is modified by disconnecting the anode load resistor and inserting a 100 KΩ potentiometer in its place. This potentiometer becomes the height control. In some cases (the Inexpensive Televisor is an example) the anode load resistor of the frame oscillator is already a potentiometer which is used as a height control, and in these cases no modification need be made, excepting the disconnection of the existing feed from the centre slider, and the connecting of the new circuit.

The amplifying valve is quite orthodox. The output is developed across R19 and is fed into the frame coils via C9 and C10. These two condensers are electrolytics and it is important to note the method of connection. Two separate condensers are specified and they are wired in parallel. The positive sides go to the anode of V4 and the negative sides to the frame coils. It is important to note that the negative side is not earthed and the cans should not come into contact with any earthed section of the circuit or chassis.

The cathode bias is made variable by VR2 and this becomes the " Form " control. Linearity is obtained by negative feedback from the anode, the feedback being controlled by the variable resistor VR3.

It might be thought that VRF (height) and VR3 (linearity) would have been sufficient to enable a linear scan; unfortunately this was not so and some of the various timebases which were tried with the circuit had the defect (in varying degrees) of cramping at the bottom. In order to cater for varying timebases it was considered the addition of the Form control worth while.

A further point to note is that the values of R14 and C7, with the network R15, 16, 17, 18, have been given specific values as a compromise between various timebases. If it is found difficult to obtain reasonable linearity with the circuit, then the value of C7 and R14 can be varied.

The link between old chassis and new can be made by use of coaxial cable and Pye plugs and sockets. It is important that a good earth connection exists between the two.

R22 and R23 are damping resistors connected across the frame coils to prevent distortion of the left-hand edge of the raster due to modulation from the line coils.

Line Amplifier and E.H.T. Supply

Fig. 3 shows the circuit. It is divided into two parts as shown by the dotted line. The line oscillator is dealt with in a similar manner to the frame oscillator, a potentiometer being inserted in lieu of the existing anode load resistor to form the height control.

The existing line amplifier is converted into a phase reversal stage (VL2). Quite a large number of circuits use an SP61 at this point, in paraphase circuits, for electrostatic deflection; the Argus is an example. In this case the valve circuit can be easily modified to that shown in Fig. 3.

Where a duo-triode valve such as the 6SN7 is used at this point in the existing chassis, then it is worth

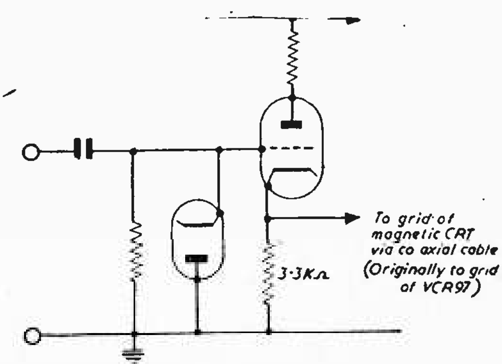


Fig. 4.—A typical phase-splitter as used in the VCR97 timebase.

while recovering the valve and replacing it with an inexpensive triode. The phase reversal valve can be practically any sort of valve which is to hand, such as the 6J5 for example. In Fig. 3 the SP61 (VR65) has been shown with screen and suppressor grids strapped to the anode to form a triode.

It is necessary in the line circuit to have this phase reverser as the output from the Miller oscillator is not of the correct phase to operate a line-amplifying valve.

V1 is a standard EL38 which has been found eminently suitable in a circuit of this type. The output is fed directly into the simple line transformer which is not overwound for E.H.T. A transformer of this kind is inexpensive and is less liable to breakdown than a cheap overwound type.

The line coils are low resistance type and damping is effected by the condenser C2 with R6 and the variable resistor VR1. This latter forms the "Linearity" control.

A small valued resistor (actually two in parallel) is connected in the line coil circuit and the voltage developed across this resistor is fed back into VL2 cathode. This provides a high degree of negative feedback and is a good aid to linearity.

The CRT is grid modulated in the same manner as is usual with VCR97 circuits. It seems to be fairly standard practice with these circuits to employ a phase splitter as seen in Fig. 1, and to feed the grid of the CRT from the cathode resistor. This practice is continued in the present circuit and the wire which is normally connected to the cathode of the phase splitter and feeds the VCR97 grid is disconnected, the grid of the new tube being connected in its place.

To obtain the maximum quality the wire from the phase splitter to the tube should be as short as possible and unshielded, though it is quite in order to make the wire of a convenient length during the setting up period, and to shorten it when the unit is mounted in its cabinet.

The heater supply for the tube is obtained from a simple home-made transformer (T3). One of the commercial heater transformers can be used if desired though they are quite easy to make. If a brand new tube is being used then the heater can be fed directly from the 6.3v. supply provided, of course, that the tube's heater is rated at 6.3v.

In the prototype the transformer was constructed from an old one removed from a radar unit. The existing windings were completely removed and new windings constructed. Full details will be given later.

E.H.T. is obtained from line flyback using a voltage doubler circuit. T2 is another simply made transformer and has been found to be perfectly reliable. V2 and V3 are VU120's, which are high voltage rectifiers requiring a heater voltage of 2 volts. These valves were used because one was available in the old E.H.T. supply for the VCR97 and the other was available at a very low cost; they can be bought for as little as 3s. 6d.

Any ex-Government E.H.T. rectifier valve can be used in this position. Where a four-volt rectifier exists in the VCR97 unit, then the only alteration will be in the windings of T2. It is advisable to make one of the rectifiers a 2v. valve so that the windings can be easily accommodated on the transformer core.

The condensers C4, 5 and 6 are 2.5 Kv. working and can be obtained for as little as 1s. 6d. The components associated with this part of the circuit should be mounted on a paxolin panel and kept at least ½ in. clear of any earthed object.

Control over brilliance is obtained by varying the positive voltage on the cathode; the potential is obtained from the network R11, VR4, R12, R13 and VR4 forms the brilliance control.

Construction of T2 and T3

Some doubt was felt over this part of the circuit, as many constructors seem reluctant to tackle a job of this nature. However, as the primary of the transformer is fed from the 6.3 volt supply, the windings are very few in number and can easily be put on by hand. For those who think they cannot tackle the job, the alternative circuit has been designed and this uses the more normal overwound type of line transformer. Details of the alternative circuit will be given later.

(To be continued.)

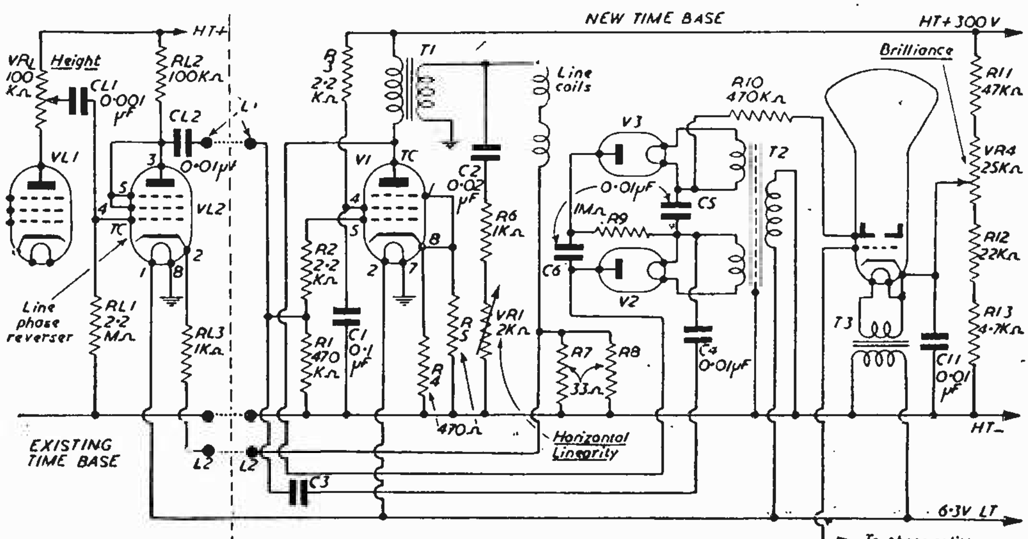


Fig. 3.—The line amplifier, E.H.T. circuit and C.R.T. network.

Pages from a TELEVISION ENGINEERS Notebook

5.—DETECTOR FILTERS

THE main function of a vision detector is, of course, to rectify the modulated carrier signal, but in addition to this, it is necessary for the stage to provide adequate filtering of the radio or intermediate frequencies. This filtering action corresponds to the function of the circuit found in broadcast receivers, generally wired as shown in Fig. 1, where R_1C_1 constitute the combined load and filter elements. The condenser cannot discharge at the R.F. or I.F. rate but can only follow the comparatively slow variations corresponding to the low-frequency modulation.

In TV circuits, however, such a system will not normally provide adequate filtering as the video-signal extends over a range of some 3 Mc/s., the difficulty being generally more acute in superheterodyne receivers than in straight T.R.F. designs. With the average signal frequency of 55 Mc/s. for the carrier, the ratio of R.F. to the highest video-frequency is about 18 to 1, but for I.F. carriers in the region of 13 Mc/s. the ratio falls to as low as 4 to 1. Simple by-pass capacities, therefore, do not provide sufficient discrimination between the R.F. and the video-frequencies, for a capacity small enough to exhibit an appreciable reactance at the highest video-frequencies will not present a small enough reactance to the intermediate frequency; and conversely, a capacity big enough to have a negligible reactance at the intermediate frequency will not present a large enough reactance to the video-frequencies.

Some Common Forms

Filter coupling is therefore employed in practical TV designs, and a few of the more common π-forms are shown in Fig. 2. Such systems have a characteristic similar to that shown in Fig. 3, where the cut-off frequency f_c is arranged to fall in the region of the highest video-frequencies. The cut-off frequency of such π filters is given by

$$f_c = \frac{1}{\pi\sqrt{LC}}$$

where $C = C_1 + C_2$. In the design of such a filter it is general to have $C_1 = C_2$, one half of the total capacity for the required cut-off frequency being permitted in each parallel capacitive element. C_2 is the input capacity of the video-amplifier mainly and with strays is not likely to be less than some 10 pF. The terminating or load resistance R is found from the equation

$$R = \pi f_c L$$

Compensation

Besides normal filtering of the R.F. or I.F. component, the circuit being discussed can be made to compensate the detector to give a uniform high-frequency response. The coil L_1 in Fig. 2(b), for example, compensates the H.F. response of the detector diode in much the same way as the anode inductance of a video-amplifier compensates that stage. Fig. 2(c) uses two filter sections in series; this system emphasises the band-pass characteristics of the filter and provides sharp discrimination between the video pass-band and the intermediate frequencies. The centre condenser in such an arrangement as this can be made twice as large as either of the end capacities, a useful feature when a capacitive load, such as a sync separator, has to be taken from the detector output instead of the video-amplifier anode circuit.

Working with the above equations, and assuming an I.F. of 13 Mc/s, with a top video-frequency of 3 Mc/s., we have, for an input video-amplifier capacity of 10 pF. the following component values: (Fig. 2(a)). $C_1 = C_2$ (input capacity) = 10 pF.; L = 1 mH. and R = 10 k Ω, to round figures.

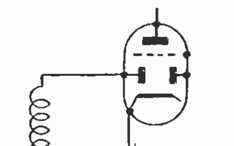


Fig. 1.—Load and filter elements of standard form.

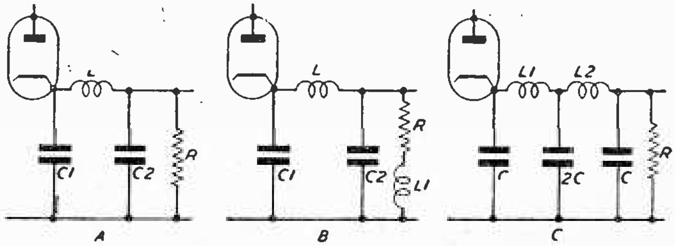


Fig. 2.—Networks as found in general types of television detector stages

These figures, however, are not really practicable, for a 1 mH. coil would have such a large self-capacity that it would become a parallel tuned circuit acting in the filter arm and so would invalidate the general reasoning. The best plan is to design the filter coil so that it resonates with its self-capacity at the frequency at which high attentuation is desired, and there is then some control over the point at which this takes place. An inductance of 175 μH. has been found suitable for L (Fig. 2(a)), when used with a 10 pF. condenser and a 4.7 k Ω load into an EF91 video amplifier, the I.F. being 13 Mc/s. Such a coil consists of 185 turns of 40 S.W.G. enamelled wire close wound on a ½ in. diameter former.

When a double filter as in Fig. 2(c) is used, the two parts can be arranged to be filters for the I.F. and R.F. carriers respectively; that is, L_1 may be wound as described above, with L_2 wound to have an inductance of about 10μH. for 45 to 70 Mc/s filtering.

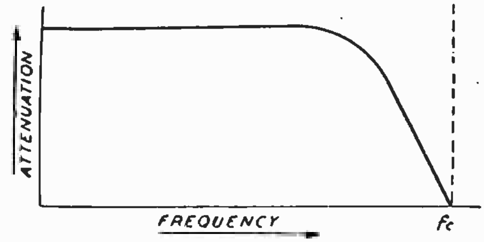


Fig. 3.—Characteristic of the networks shown in Fig. 2.

Improving Your Picture

SOME COMMON FAULTS AND THEIR CURE

By P. Dodson

THE home-constructed receiver, built to suit the particular signal conditions of the locality in which it is to be used can, when correctly adjusted, produce unrivalled results as to picture quality.

Picture distortion should not be tolerated. It is usually caused either by maladjustment of the video channel or a non-linear timebase. Optical distortion, not so common, can result from a defect in the picture tube, focusing or scanning arrangements.

Poor Definition

If the picture is correctly focused, poor definition is almost certainly due to insufficient bandwidth in the R.F./I.F. or video amplifier stages. In addition to poor definition, the following faults may also be apparent: smearing, pulling on whites, black line after white outlines and vice versa, all of which are due to poor H.F. response. The vision R.F. amplifier should have a flat frequency response of approximately 2.5 Mc/s on either side of the vision carrier for double sideband working and about 2.5 Mc/s on one side of the carrier in the case of single sideband transmissions, as indicated in Figs. 1 and 2. The response of the receiver is easily checked on test card " C." It should be possible, at full contrast, to see the vertical lines in the first three squares from the top of the left-hand frequency grating and the first three squares from the bottom in the right-hand grating. These lines correspond to frequencies of 1.0, 1.5 and 2.0 Mc/s respectively. The fourth and fifth squares on either side represent 2.5 and 3 Mc/s. On a good receiver the 3 Mc/s modulation lines should be visible but at reduced contrast. In the absence of a signal generator it is best to adjust all the circuits to resonance on the vision carrier by tuning for maximum picture brightness. When this has been done the response should be broadened by slightly detuning each circuit for best definition. The procedure for tuning a superhet differs from that used for a T.R.F. receiver only in that the wide-band amplifier operates at a lower frequency.

Sometimes damping resistors are connected across anode or grid tuned circuits to broaden the bandwidth. These should be checked. If one has gone " high," this would cause reduced H.F. response. The usual value is between 2.2 KΩ and 5.6 KΩ. The lower size giving the greater bandwidth and making for ease of adjustment. However, difficulty may be experienced in obtaining adequate sound rejection.

If it is still not possible to resolve the 2.5 Mc/s bars, then the video stage should be suspected. For maximum picture detail the anode load resistor must be of low value: also the valve must have a low impedance. Special video valves are available such as 6AG7 and EF55, and these may be used with a load as low as 1.5 KΩ. Two EF50 valves in parallel work excellently with a load of 2.5 KΩ, giving a great improvement in picture quality and gain over a single EF50 valve. The cathode bias condenser and resistor values should be experimented with, as they will have an important bearing on results. Suitable values bring about some degree of video correction by top lift. More "highlights" may be obtained by inserting a video correction choke in the anode circuit. When a boost choke is used the

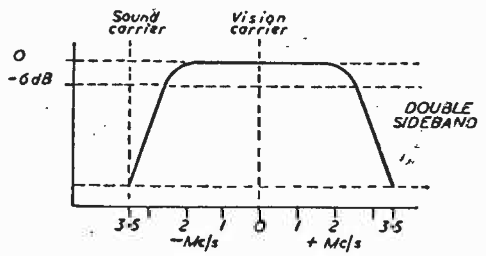


Fig. 1.—Response curve of a double sideband receiver.

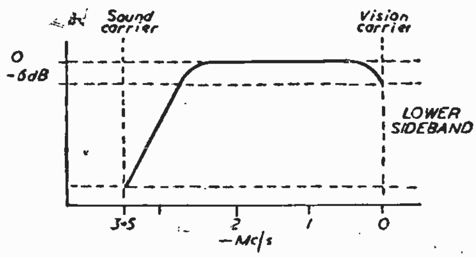


Fig. 2.—Response curve of a single sideband receiver.

anode load may be increased, thus obtaining greater stage gain. However, with a low anode load resistor the need for video correction may be avoided. If the C.R. tube is grid modulated it may be possible to remove the bias from the video valve. It is best to be guided by results, as over-correction by selective feedback can cause outlining or ringing.

The frequency response of the video stage can easily be checked if a signal generator is available. The output of the signal generator should be connected into the grid circuit of the video amplifier. With the generator tuned to 300 metres, corresponding to 1 Mc/s, a series of vertical bars will appear on the screen if the timebases are carefully adjusted. The definition of these bars should be very good. Increasing the frequency to 2 Mc/s (150 metres) will increase the number of bars and, if the frequency response of the video stage is good, they should be clearly visible.

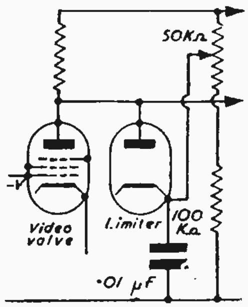


Fig. 3.—Circuit of a manually-set noise limiter for a vision receiver.

Low-frequency Response

The low-frequency response of the video receiver can be checked by noting if the black bar in the white surround immediately above the centre circle in test card "C" is reproduced with uniform brightness on a clean white background. There should be no evidence of "streaking."

"Pulling on Whites"

As mentioned previously, "pulling on whites" can be due to poor H.F. response. However, if the picture definition is good the trouble may be caused by the coupling components at the input to the sync separator valve. They should be mounted well clear of the chassis, particularly the large coupling condenser.

Loss of Highlights

If the emission of the C.R. tube is O.K., lack of highlights in the picture may be due to one or more valves in the vision channel overloading, if the contrast control is at its usual setting. An incorrectly set vision noise limiter can cause loss of definition in the white areas of the picture. The limiter diode should be arranged to conduct just above the peak white level of the picture.

Fig. 3 show the circuit of a manually-set limiter which is to be preferred to the self-setting type. When positive-going signals are applied to the grid of the video amplifier the connections to the limiter diode must be reversed, the cathode being taken to the video amplifier anode.

Poor Linearity

The linearity of the timebases can be checked with the aid of test card "C" by observing the white grid which forms the background.

Non-linearity of either line or frame timebase will cause the white grid squares to appear as rectangles.

Stretching or cramping is usually due to the incorrect operation of the timebase output valve.

Cramped Right.—Line amplifier bias too low. Valve emission failing. Low H.T. voltage, including boost voltage if a booster diode is used. Drive voltage too high.

Cramped Left.—Bias too high. Low screen grid voltage. Linearising components wrong values.

Cramped Bottom.—Frame output valve bias too low. Valve emission low. H.T. low. Negative feedback circuit faulty.

Cramped Top.—Bias too high. Negative feedback components wrong values.

The anode load of the oscillator valve also affects linearity.

Should a linearity fault develop in a receiver which has been working correctly, a check should be made of the fixed condensers. A leaky condenser or a fixed resistor gone "high" will upset linearity.

Stability

In conclusion it should be emphasised that the success of any receiver is governed by its stability. R.F./I.F. instability, however, slight, can be disastrous so far as picture definition is concerned. A stable receiver when used at maximum gain, at a time of no transmission, should give brilliant and sharply defined interference spots against a dead black background.

Royal Air Force Films

THE BBC Television Service is working on a project whereby it is hoped to produce a series of films showing how the Royal Air Force prepared in the immediate pre-war years for the problems which war would bring to them; of the manner in which they handled their tasks during 1939-1945; and of the fruits of victory as exemplified by the Royal Air Force to-day.

The Air Ministry has many millions of feet of film, shot during the war and it is agreed to make this material freely available to the BBC. Although it is, of course, catalogued, every foot of film will have to be viewed before deciding whether it covers sufficient ground to make possible a production of one or of a number of films.

Air Chief Marshal Sir Philip Joubert, has agreed to be the chairman of a small viewing committee to see and to assess the Air Ministry film material, and to advise on the practicability of producing a series of films. The Committee will include Philip Dorté, Head of BBC Television Films, who is himself an ex-Group Captain of the Royal Air Force, and representatives of the Air Historical Branch of the Air Ministry, and BBC Television Film Department Editors. The Committee which will start working very shortly will, it is hoped, be able to make its recommendations in a few months' time, and it is hoped that the outcome will be an outline scheme for 13 30-minute films.

If the material proves adequate, it is the intention to attempt a survey of air war as a whole with particular reference, of course, to the part played by the R.A.F. Our war-time allies will be asked to provide a certain amount of film material where necessary and captured enemy material will be drawn upon.

If a series emerges from these preparations, it is hoped that it will be possible to televise the films during 1954, and Air Chief Marshal Sir Philip Joubert has agreed to act as narrator.

Protecting Your Receiver

SAFETY DEVICES WHICH CAN BE FITTED TO ANY RECEIVER

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

WHEN battery receivers were more popular a lot of thought was given to the problem of protecting the valves and batteries in the receivers against overloads, which were a frequent occurrence when the operator inadvertently crossed the battery connections, or caused a short-circuit while endeavouring to "hot-up" the performance of the receiver.

The problem of damage from lightning discharges was also very real when aerials were of a necessity so elaborate. The popular protection devices of those days, therefore, resolved into two main items, namely, the fuse bulb, and the conspicuous aerial earthing switch; but whether they proved more ornamental than protective is another story!

To-day, however, we are mainly concerned with the problem of protecting our television receivers, particularly the expensive picture-tube, from a host of causes, which may easily originate from one or other of the many sections of the receiver developing a fault.

Protecting the Screen

In the first place, has it ever been considered what a disastrous effect, in certain receivers, a fault developing in the mains rectifier may have on the picture-tube? In this respect let us consider a receiver that derives its E.H.T. from a 50 c.p.s. mains transformer source. These receivers, although not so popular to-day, are still in constant use, and usually employ two rectifiers: one solely for E.H.T. purposes, and the other, a large valve, for supplying H.T. for the rest of the set.

A fault developing in this valve, or anywhere in the main H.T. circuit, so that the H.T. voltage is reduced to zero, has a far more detrimental effect on the picture-tube than one would at first realise. The whole receiver, apart from the valve heaters and E.H.T. system, is rendered inactive, the scanning generators cease to function, and the bias is removed from the picture-tube.

This results in a brilliant unfocused blob in the centre of the screen, and even switching the receiver off does not immediately remove it, for the heater of the picture-tube takes a while to cool off and cease emitting, while plenty of E.H.T. remains stored in the smoothing capacitor. Considerable damage may, therefore, ensue to the screen phosphors before much can be done to remedy the defect. Furthermore, a similar effect is frequently evinced each time certain receivers are switched off, for instead of the screen going completely blank the raster dissolves into an unfocused blob, which often takes quite a time to disappear. The net result of this after a few months is that the centre of the screen loses its luminescent property, and a distinct patch is observed in the centre of a picture—the tube is frequently referred to as having an ion burn.

For very little trouble and expense we can devise a means whereby this harmful effect can be prevented. The circuit at Fig. 1 illustrates the general trend the artifice takes in conjunction with the style of receiver in question, and as will be observed, the highlight of the circuit is the inclusion of a relay, the coil of which is energised from a suitable point on the H.T. rail.

The relay contacts are wired directly in series with the cathode of the picture-tube, and arranged so that the circuit is open only when the coil ceases to be energised.

A slight alteration is also made to the E.H.T. bleeder circuit by including a 1 watt ½ megohm resistor (marked R in the circuit diagram) in series with the *earthy* end of the bleeder chain. The "hot" end of this resistor, where it joins the bleeder chain, is connected directly to the cathode of the picture-tube.

On switching the receiver off, or should the H.T. system fail, the relay contacts part, and the picture-tube cathode loses the outweighing influence of the potential from the brilliance control system; but the cathode does not go completely open, for it rises to the positive potential developed across R. This is, of course, the same as the picture-tube grid swinging heavily negative, and immediately results in beam current cut-off.

The system functions very satisfactorily in practice, and is included as a modification by, at least, one commercial receiver manufacturer where the 50 c.p.s. E.H.T. principle is adopted. The permanent connection from the bleeder chain to the picture-tube cathode has negligible influence when the relay contacts are closed, for the brilliance control potential is derived from a circuit of very much lower impedance than that supplying the

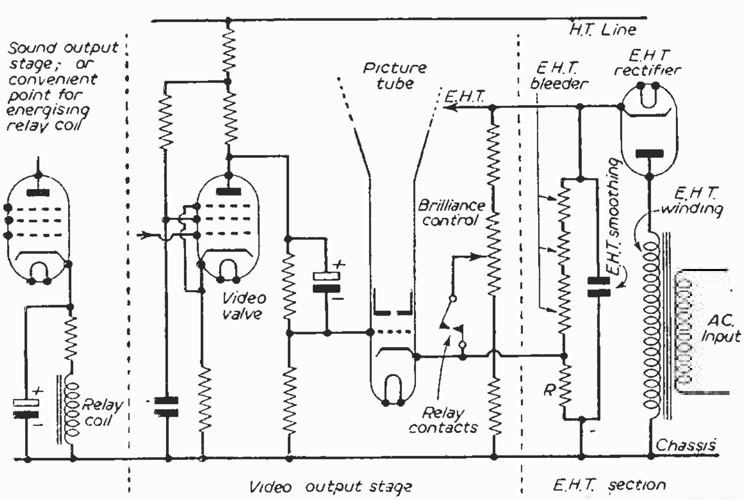


Fig. 1.—A picture-tube protection arrangement—for grid modulation.

cut-off bias potential—the latter being far outweighed by the former when the receiver is working normally.

The actual relay energising current depends, of course, on the type of relay employed. Many ex-government varieties are quite suitable for this purpose ; one with a low resistance winding can be energised by the cathode current of the output valve, as shown in Fig. 1, while one of the high-resistance types can obtain power direct from the receiver H.T. rail, via a suitable value limiting resistor.

Fig. 1 shows the connections for a grid modulated picture-tube, since this method is more frequently adopted than cathode modulation in this style of receiver. Should the receiver desiring treatment employ cathode modulation, however, a relay with *low-capacitance* change-over contacts will be needed, and should be wired as shown by Fig. 2.

Protecting the Valve Heaters

As more home constructors are now concentrating on the A.C./D.C. technique for their new designs, a word

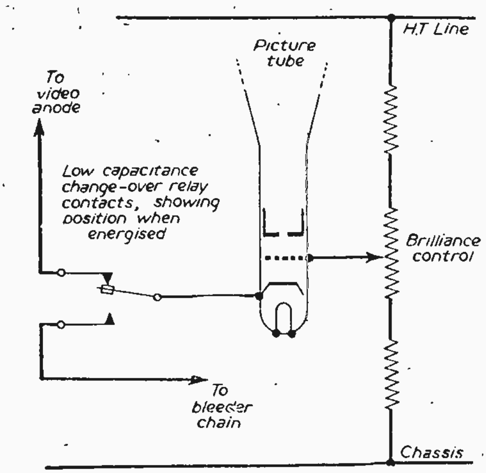


Fig. 2.—Showing how relay contacts should be modified for cathode modulated tubes.

on valve heater protection will not be amiss at this stage. With this style of receiver all the heaters of the valves are wired in series together with a suitable voltage dropping resistor, and then to the mains supply. And this is where trouble and expense can be incurred unless some sort of precaution is taken, for it must be remembered that valve heaters possess a *positive* temperature coefficient of resistance. Or in everyday language this simply means that the resistance of the heaters rises with temperature, and since it is the valve heater current which determines the temperature, we can draw a curve, such as that of Fig. 3 (a), depicting resistance as a function of current.

Observation of the curve will, therefore, make clear the fact that on first applying mains to the heater circuit an excessive current surge is bound to ensue ; this effect has, no doubt, been noticed by constructors of A.C./D.C. broadcast receivers which employ a bulb in the heater chain for tuning dial illumination. When first switching on such a receiver, the pilot bulb invariably lights up brilliantly, but gradually falls to normal illumination as the receiver acquires the necessary operating temperature.

With television receivers, however, the effect is even more marked, owing to the greater number of valves plus the picture-tube heater employed in the chain, and the consequent lower value dropping resistor needed. It is, therefore, essential to include a form of current limiting device in series with the heater chain to prevent very frequent valve heater failure.

Fortunately, a very simple and effective means is available to the constructor for this purpose. It takes the form of an element which has a large *negative* temperature coefficient of resistance, and is for inclusion in series with the heater chain. Such elements are manufactured by Standard Telephones and Cables under the name of Brimistors, and are produced in various ratings suitable for all types of valve heater circuits.

The curve at Fig. 3 (b) illustrates how the resistance of a Brimistor decreases as the current through it increases —due to the resulting temperature rise. It is, therefore, obvious that a circuit possessing both positive and negative temperature coefficients in their correct proportions will ensure a constant current during the initial warm-up period, and thus prevent instantaneous current surges which are so harmful to the valve heaters.

A Brimistor should not be connected between individual valve heaters, but between the voltage dropping resistor and the first valve in the chain—usually the mains rectifier—as shown by Fig. 4. In certain cases, where the maximum instantaneous current exceeds the rating of the Brimistor employed, it must be shunted by a resistor of value suitable to absorb the additional current.

Harmful Mains Fluctuations

Referring again to the more popular types of receivers in which the heaters of the valves and picture-tube are connected in series, we are confronted these days with the problem of wide fluctuations in the voltage of the mains supply. This is more harmful from the aspect of the heaters of the valves and picture-tube, but can also prevent correct functioning of certain sections of the receiver, for with series-fed heaters much bigger voltage variations are liable to occur than with transformer-fed systems.

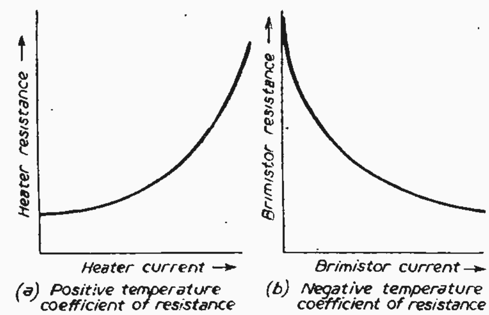


Fig. 3 (a).—A positive temperature coefficient of resistance. (b) A negative temperature coefficient of resistance.

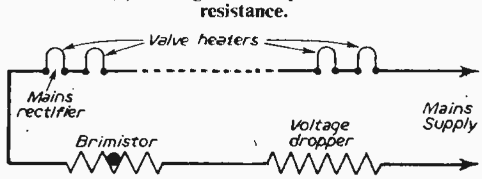


Fig. 4.—Showing how a Brimistor should be included in the heater chain.

Apart from the question of life reduction then, we must consider also the effect voltage fluctuations will have on receiver performance generally. Investigation in this direction has shown that the valves most likely to affect performance are those directly associated with the production of the unmodulated raster. Coming under this category we have, of course, the picture-tube itself; the horizontal and vertical generators—including their respective amplifiers, and the reclaim diode; the E.H.T. rectifier can be excluded in a receiver of this nature since its cathode is invariably heated by energy from the line flyback.

It is not uncommon these days for the mains fluctuation to exceed ±10 per cent.—although usually more in the negative direction. The chief effects are that the picture loses height and width; and the optimum focus setting is well outside the mechanical or electrical limits of the control. The mains voltage tapping on the receiver could, of course, be altered to a modified setting, but, then, unless one keeps a watchful eye on a mains voltmeter, the damage that may result—should the mains voltage suddenly go back to normal—might far outweigh the inconvenience of a poor picture. If the receiver derives its power from an A.C. source the obvious —although expensive —solution is a constant voltage feed transformer.

There is, however, a less expensive, although more of a compromise, method—suitable also for D.C. supplies—of maintaining a fairly constant heater voltage to the picture-tube, and to the valves connected with the critical parts of the circuit, by adopting a double heater chain—one fed from a modified voltage dropping resistor, and the other from a barretter. The circuit of Fig. 5 depicts the general arrangement, in which V1 to V6 correspond to the following heaters respectively:—picture-tube, horizontal and vertical generators, horizontal and vertical amplifiers, and booster diode. The valves in question will, of course, be of the A.C./D.C. variety, thereby enabling one or other of the current barretters, which are frequently used in 5 or 6 valve broadcast receivers, to complete the chain.

The remainder of the valves, those which are less affected by heater variations, comprise mainly the vision and sound amplifiers, and are fed in the normal way via a voltage dropping resistor. This can be the original one in series with an additional element (R) to counteract the 6 valve heaters which now form the compensated chain. The value for R can be easily calculated from Ohm's law; for instance, let us suppose that the valves in the receiver are 6.3 volts at 0.3 amp., then, the additional voltage we need to drop is 6 times

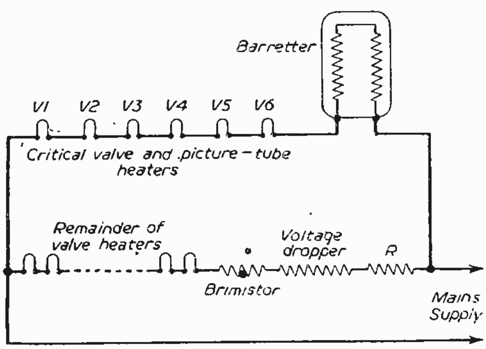


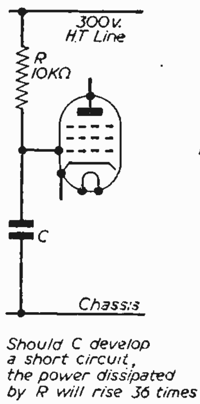
Fig. 5.—A method of counteracting mains voltage fluctuations.

6.3, or 37.8 volts. To find the resistance we divide 37.8 by 0.3, which works out to exactly 126 ohms. The power rating may be resolved by multiplying the dropped voltage by the current, or 37.8 times 0.3, thereby indicating the necessity of employing a wire-wound resistor having a power rating of, at least, 12 watts.

Protecting the Mains Transformer and Rectifiers

As in the days of the battery receiver, the solution of protecting a television receiver by means of a fuse included in the power input circuit is much of a compromise. For if we use a fuse rated at a value only slightly higher than the total current taken by the receiver, it will tend to go open circuit on the—sometimes unavoidable—occurrence of heavy surges. With A.C.-only receivers heavy current surges often result at the moment of switching the receiver on. When the switch action creates a back E.N.F. across the primary winding of the mains transformer, which happens to be of similar phase to the applied mains voltage.

We can see that it is, therefore, essential to employ a fuse rated considerably higher than the normal receiver current in order to prevent its frequent replace-



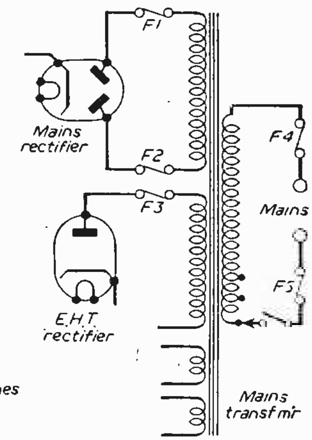


Fig. 6 (left).—Should C develop a short circuit, the power dissipated by R will rise 36 times.
Fig. 7 (right).—Indicating fuse positions for maximum receiver protection.

ment. But the value so demanded will be useless to protect the lower current circuits from damage should they develop a fault: although we may be lucky in protecting our rectifier should the reservoir capacitor suddenly develop a short circuit.

To illustrate this point, let us consider a normal decoupling circuit after the style of Fig. 6. Here the decoupling resistor R is adequately rated to pass, say, 5mA to feed the screen grid, but should the capacitor C develop a short circuit, the resistor current will immediately rise to 30 mA, and result in considerable overheating. Such an effect has been known by the writer to ignite the bakelite resistor panel and cause extensive damage to a receiver—for after all, 36 times as much power is dissipated by the resistor under fault conditions!

Nevertheless, power input fuses should always be fitted, since they do protect the mains transformer from a severe overload, and with A.C./D.C. receivers, should a heater-to-cathode short develop in one of the valves, they often "blow" before the rest of the valves, which have not been by-passsed due to the fault, light up like beacons.

By far the best way for maximum receiver protection is, however, by including separate fuses in series with the anode leads of the rectifiers as shown in Fig. 7. The two mains rectifier fuses, F1 and F2, should have a rating in the region of 250 to 500 mA depending on the type of receiver, while F3, the E.H.T. fuse, should have a 60 mA rating. A 2 amp fuse rating for F4 and F5 usually handles the power input current, including surges, without the need of frequent replacements.

Static Discharges

In certain parts of the country it is still necessary to employ elaborate television aerial installations positioned as high as possible above adjacent structures. These arrays, therefore, tend to become the target points for static discharges during the summer months. This should not be taken to mean, however, that because the aerial is fixed to the chimney-stack, the associated building will be more vulnerable to damage from lightning. Indeed, the records indicate that television aerials so secured afford a certain safety factor in this respect, for its function can be very similar to that of the so-called "lightning conductors."

Before a flash of lightning occurs, the atmosphere in the vicinity of the flashover point becomes progressively charged with static electricity, until a state exists when the potential difference between the charge and the nearest object—sometimes another cloud—is so great that the insulation of the atmosphere breaks down and the charge is suddenly released in the form of a flash.

Generally speaking, the purpose of the lightning conductor is to leak away to earth any static charge which may develop in the close proximity of the building, and thus reduce the possibility of a destroying flashover occurring. It follows, therefore, that a television aerial can have the same effect, and for this reason the reflector(s) and cross member of the array should be connected to earth through stout copper wire via the shortest possible route.

In A.C./D.C. receivers, where the chassis is in direct contact to one side of the mains supply—this, by the way, should be arranged to be the neutral side—the aerial feeder must be isolated from the chassis by suitably rated capacitors. The capacitors C1, C2, and C3 of Fig. 8 perform not only this function, but also couple the aerial to the input circuit from the point of view of the signal.

Under these conditions facilities must be provided in the aerial circuit to leak away static charges which may develop on the dipole itself. This is catered for in the circuit of Fig. 8 by including resistors, R1 and R2, so that discharge can occur even when the receiver is switched off, by returning R2 to the neutral side of the mains instead of direct to the chassis.

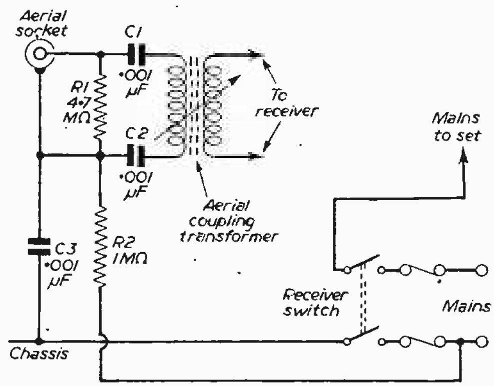


Fig. 8.—Showing a static discharge aerial circuit for A.C./D.C. style receivers.

BBC Television News

Temporary Low-power Television Station

THE BBC is now able to give details of the temporary low-power television station to be installed near Brighton in accordance with the statement made by the Assistant Postmaster General in the House of Commons on December 3rd. It will be in service before the Coronation. The site selected is at Truleigh Hill, three and a half miles north of Kingston-upon-Sea, and the station is intended to improve reception in the populated districts of Brighton, Hove, Worthing, and Shoreham-upon-Sea, where reception from Alexandra Palace is at present unreliable.

The station will work on the same frequencies as those later to be used by the permanent medium-power station which the BBC intends to build at Rowridge in the Isle of Wight when this is permitted by the Government. These frequencies are 56.75 mc/s for vision and 53.25 mc/s for sound, which are also used by the high-power station at Kirk o' Shotts, in Scotland. The new temporary station will use the single side-band method of transmission and vertical polarisation. In both these respects it will be similar to the permanent station later to be built at Rowridge, so that viewers may be assured that receivers and aerials arranged for reception of the temporary station will be suitable (possibly with some change in the direction in which aerials are facing) for receiving the transmissions from Rowridge. Viewers in particularly favourable situations in the neighbourhood who already receive a satisfactory signal from Alexandra Palace need not, of course, make any change when the Brighton transmitter comes into service.

BBC Orders Three Television Transmitters

The BBC has ordered three medium-power television transmitters from Marconi's Wireless Telegraph Co. Ltd. Delivery will be in the spring of 1954.

The order includes three 5-kilowatt vision transmitters, three 2-kilowatt sound transmitters, combining units, monitoring and control equipment for each.

The BBC has not stated where these transmitters will be installed. The range of transmitters at this power with large aerial is expected to be up to 30 miles.

A BEGINNER'S RECEIVER—3

AN EASILY-BUILT SUPERHET CIRCUIT, UTILISING AN EX-GOVERNMENT UNIT—R3170A

By B. L. Morley

(*Continued from page* 514 *April* 1953 *issue*)

RECOVER single turn coil in black wire on first I.F. coil; this wire runs from the single point tag strip to earth. Disconnect yellow wire from condenser 0.25 μF. which is mounted with the 10 KΩ 2 w. resistor on rear tag strip, and recover the condenser.

V10 valve: disconnect white wire on pin 6; disconnect 330 Ω resistor from pin 7 and recover the resistor; recover wires from pin 2, 3 and 4 and reconnect condenser on pin 2.

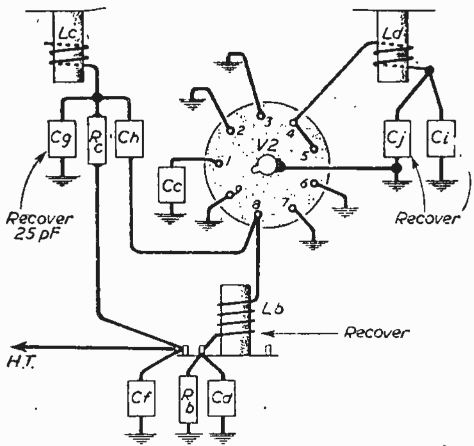


Fig. 14.—Details of this stage were commenced in the last issue.

V11: disconnect wires on pin 2, 3 and 4 and from pin 6; disconnect the far end of the 180 Ω resistor from the tag block. Pin 7 requires the 330 Ω resistor to be recovered. Recover 4.7 KΩ resistor between tag strip adjacent to V11 and earth and recover 33 KΩ on the tag strip. Recover 0.1 μF and 100 KΩ adjacent to V11.

Remove screen over V1 base; recover 22 KΩ from cathode of mixer valve; recover 22 KΩ from grid of oscillator valve; recover 100 pF. from V2 heater. Recover 500 pF. and 150 Ω from cathode of first vision I.F. (V5) and recover 500 pF. and 150 Ω resistor from centre tag of tag strip between V1, V2.

Cut chassis to fit mains transformer as shown in Fig. 15. Cut hole for rectifier valve and recover rectifier holder from its present position. If it is intended to use the existing rectifier valve with the modifications mentioned previously, then it can be fitted in its new position, otherwise an international octal type of valve-holder must be fitted.

Fit international octal holder where rectifier holder was originally fitted; fit smoothing choke in position shown and fit a tag for earthing under the bolt nearest the rear of the chassis. Fit an 0.1 μF. condenser on bottom of tag strip below the 10 KΩ 2 w. resistor at rear of the chassis; fit L/S output transformer in the position indicated.

Fit the smoothing condenser in the position indicated, using the retaining clips which originally held the 2.5 Kv. condenser. It will be found that there is a hole in the chassis at this point and the bottom negative-common tag of the condenser will go through this hole for earthing under the chassis. The 6 v. bulb can be fitted if desired though it is not strictly necessary.

Mount the spare diode in the position indicated for V12: it will be found that holes exist in this position though washers will be necessary. (Note: there is no need to purchase nuts and bolts as sufficient are recovered for all requirements.)

Wind L1 in accordance with the data and fit in position using one of the recovered coil forms which has a very few turns on. Use 22 S.W.G. wire.

Make L3 by using a recovered coil form which has a large number of turns on it and take off 7 turns. Mount in the position shown.

Wind L18, 19 and 20 with approximately 30 gauge wire close-wound. L18 = 8½ turns. L19 = 11 turns. L20 = 10 turns. Fit coils in positions indicated on the diagram.

This concludes the preliminary work.

Section II. The Oscillator

For the advanced worker: Do the work mentioned in the last six paragraphs above and then wire oscillator circuit in accordance with Fig. 5. The condenser C11 should be fitted last. This condenser is the one which was mounted on the sub-chassis. Complete the modifications to the mixer valve so that it is wired in accordance with Fig. 6.

For the novice: Wire the oscillator in accordance with the wiring circuit given in Fig. 16.

1. The heaters are already wired; the 8 pF is *in situ*.
2. Wire 500 pF and 100 Ω (½ w.) in cathode lead.
3. Wire 10 KΩ ½ w. between V3 grid and earth.
4. Wire mixer circuit by inserting 150 Ω ½ w. and 500 pF condenser between cathode (pin 6) and earth.
5. Solder insulated wire on pin 4 V3 (anode), and another on the grid. Leave about 2in. of wire free from each point.
6. Fit the variable condenser C11 which was recovered from the sub-chassis. Fit engraving plate and knob, etc.

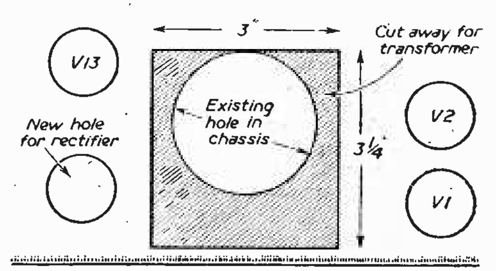


Fig. 15.—Cut-out to accommodate mains transformer.

7. The oscillator coil. As found, it is suitable for Wenvoe and Sutton Coldfield; for Kirk o' Shotts and Holme Moss, make an exactly similar coil in the same gauge of wire but with one extra turn and mount in lieu of the existing coil. For London, make an exactly similar coil to the one existing but with two extra turns and mount in the same position. Wire the back end of the coil (the end furthest from the front panel) directly to the fixed vanes of the condenser C11.

8. Wire in 100 pF between anode of oscillator and fixed vanes of variable condenser using the 2in. wire end left on the anode.

9. Wire L10 between grid of mixer and earth (for turns see table).

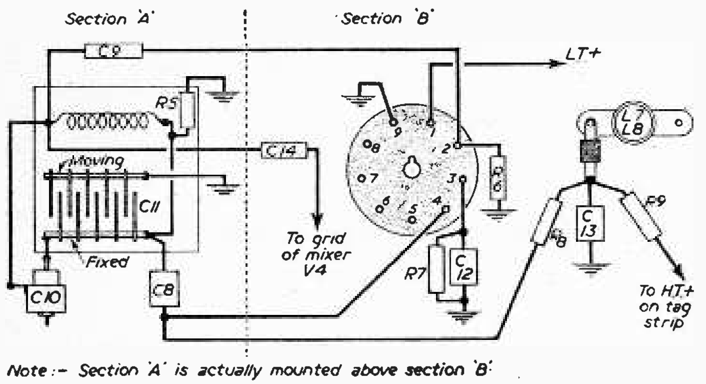


Fig. 16.—Wiring of the oscillator stage.

10. Wire a 100 pF condenser from this coil to the anode side of L4.

11. Wire 8 pF between end of oscillator coils and grid of V3 (one end of this should be *in situ*).

12. Wire 2 pF condenser to grid of mixer.

13. Twist the single tag strip mounted on the first I.F. coil so that a 4.7 KΩ can be wired between it and the 100 pF condenser in the oscillator anode. Also wire 500 pF condenser between the tag and pin 4 of the mixer valve.

14. Connect 47 KΩ from H.T. common to the above tag strip.

15. Earth moving vanes of condenser.

16. Connect 100 KΩ from fixed vanes to earth, and fit the 30 pF trimmer C10.

17. Run a coaxial cable from cathode of first I.F. valve to the Contrast control which should be mounted on the front panel. This control was originally on the sub-chassis and has a 500 pF condenser across it. This condenser should remain as it is on the control. The centre wire of the coaxial goes to cathode V4 and the braiding goes to earth. (Fig. 17 shows mixer valve wiring.)

This completes the work round the oscillator valve.

Section III. The R.F. Stages

The R.F. stages should now be wired and the advanced worker can proceed directly from Fig. 4. The novice is provided with a wiring diagram for each stage shown in Fig. 18.

The heater chokes are made similar to each other and comprise 30 turns of 32 S.W.G. enamelled wire on ¼in. formers. These formers are the solid ones recovered previously from the unit. The connection of the common heater chain is broken at V2 and the choke inserted. A short length of wire is used to bridge the gap to the heater of V1.

Section IV. The Vision Receiver

For the advanced worker: little remains to be done to the vision section. The detector must be reversed if cathode modulation is to be used and the cathode bias resistor of V9 changed to 180Ω. The output circuit should be modified in accordance with the data given. If grid modulation is to be used the video valve cathode resistor should be changed to 68 Ω. The "video coupling" switch should be wired in accordance with the diagram (Fig. 6), and a 10 KΩ 2-watt resistor connected across the existing 10 KΩ resistor in the anode circuit of the video valve. The inductance which is connected between the H.T. rail and the 10 KΩ resistor should be either removed or short-circuited. If it is removed and the gap bridged, then the coil can be used elsewhere in the circuit. The red and red-white wires which feed the H.T. circuits can be connected together at any convenient point on one of the coil mounts on which they are fastened.

For the novice :—

1. Picture tone switch (video coupling). Remove 50 pF. and replace with 500 pF.

2. Recover red and yellow wire going up through chassis.

3. Solder black wire coming up through chassis to bottom tag of tag strip nearest the switch and run an insulated wire between this point and the end tag, further end.

(To be continued)

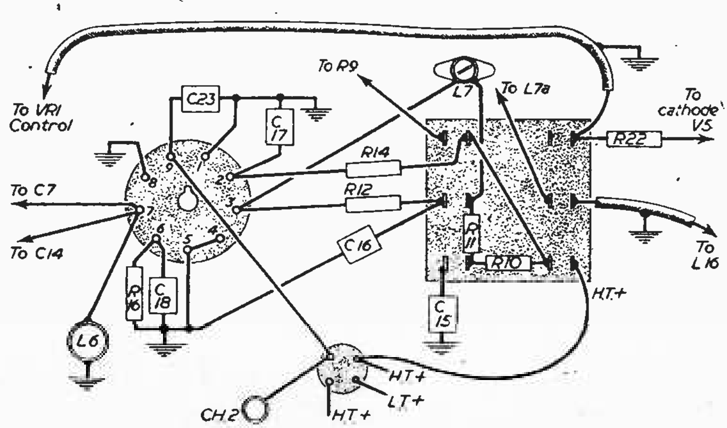


Fig. 17.—Details of the mixer stage.

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Operating With a Heater-cathode Short

HOW TO CONSTRUCT A SPECIAL TRANSFORMER TO ENABLE A DEFECTIVE TUBE TO BE USED

By A. Dalziel, B.Sc.

Introduction

THIS is a very common fault with TV tubes in current use, and any modification to allow continued use of the tube seems well worth while. This article describes and explains the arrangement which enabled the writer to overcome this trouble, and gives perfect results, no difference in picture being observed due to its use. It involves the construction of a special transformer, but this is a very simple design and should present no difficulty to the amateur. After incorporating it in a "Viewmaster" circuit, Test Card C continued to be resolved up to and including the 3 Mc/s lines.

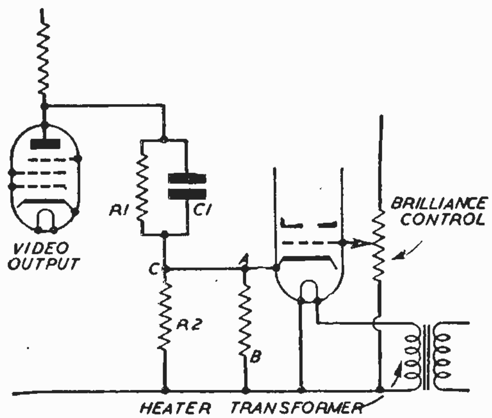


Fig. 1.—Circuit diagram illustrating the effect of the heater-cathode short-circuit on the video stage.

Symptoms

An intermittent heater-cathode short shows itself by a series of bands running horizontally across the picture, giving greatly reduced quality, or it may be the whole picture is similarly degraded. There may also be a change in the general brilliance level.

Cause and Cure

Referring to Fig. 1 it will be seen that a short from A to B effectively short circuits R_2 which changes the steady cathode potential and hence the voltage between grid and cathode which determines the picture brilliance. This can be prevented by feeding the heater through an isolating transformer. See Fig. 2.

There is now no D.C. path to short out R_2 and therefore the steady potential of the cathode is at its proper value determined by R_1 and R_2.

Vision Frequency Leakage

However, this does not cure the fault, for the vision frequency voltages fed to the cathode are still short-circuited to earth by way of the capacity existing between the primary and secondary of the isolating transformer. This is shown in Fig. 2 as a separate capacity C_2.

To maintain a good quality picture, frequencies up to at least 2½ Mc/s need to be retained and quite a moderate capacity to earth is enough to prevent this.

The New Transformer

Accordingly, a special transformer has to be used, having as low a capacity between primary and secondary as is practicable. This capacity depends on the spacing between the coils and the area of the surfaces facing each other. The normal layer winding produces too large a facing area, and if the separation is made too wide the transformer will have very high losses. However, the following design was found to produce a satisfactory compromise. It is suitable for use with a 2-volt heater.

Constructional Details

An old power transformer was stripped of all its windings till the bare bobbin was left. If this has not been done before care should be taken to see how the laminations are interleaved; they will need to be replaced in the same way. The new primary was then wound as follows, using 22 s.w.g. wire—wire from an old heater winding would serve.

The Primary

Starting near one end of the bobbin, wind on 12 turns in three layers so that the width of bobbin used is only four thicknesses of wire. The wire is then secured with tape and laid along the top of the bobbin to the other end, where a similar three-layer winding of 12 turns is put on. The whole primary, therefore, consists of 24 turns wound in two sections at the extreme ends of the bobbin. See Fig. 3.

The whole primary is now wound over with one layer of corrugated cardboard to introduce a little spacing as well as insulation.

The Secondary

The secondary is then wound over the cardboard using the centre part of the bobbin directly over the space

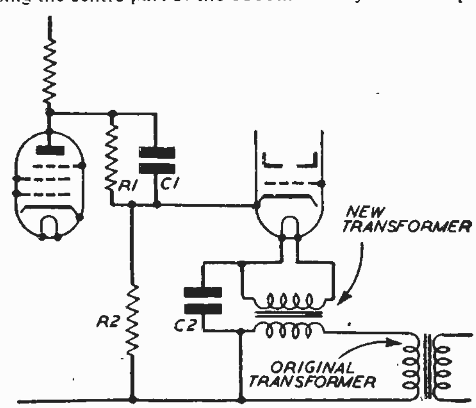


Fig. 2.—C2 short-circuits the video signal here.

between the two primary sections. Twenty-six turns were used, put on in about four layers.

Great neatness here is not important as long as the winding is kept to the centre of the bobbin. The laminations should then be reassembled and the whole tried out on load.

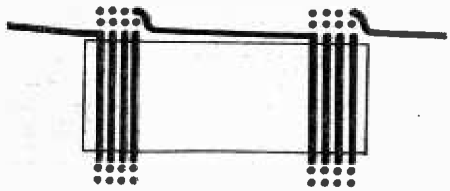


Fig. 3.—Details of the primary winding of the new transformer.

Testing and Adjustment

An A.C. voltmeter should be used to check the final voltage on load, as variations in winding can affect the losses. If required, it will be found easy to add or remove an odd turn or two without dismantling the transformer. When satisfactory, the winding can be taped over.

Such a transformer is not so efficient as a normal design but in the one originally made a primary current

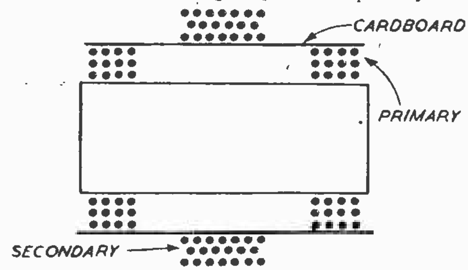


Fig. 4.—Details of the position of the secondary winding.

of 2.3 amps. at 2 volts was necessary to provide an output of 1.4 amps. at 2 volts.

The heater transformer in the set was found to give this 2.3 amps. without overheating, but even if another 2 volt 3 amp. heater transformer has to be obtained, the cost is still far below that of a new tube.

Big-screen Television in Theatre

SPECIAL SCREENS OVERCOME BRILLIANT LIGHTING

BOTH sides of television were seen by the audience at the Scala Theatre, where four big-screen projectors had been installed for the National Television Awards Show in January. The audience were able to follow the continuity of the programme on the television screens, seeing both the action taking place on the stage and the actual transmitted picture, including film sequences televised from Alexandra Palace.

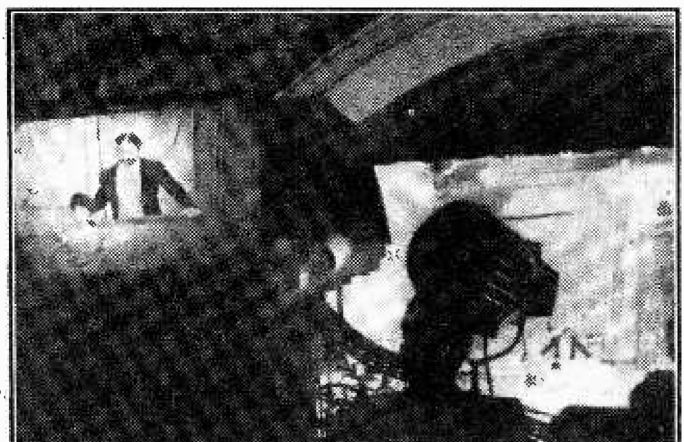
The screens erected on either side of the proscenium appeared to be in a hopeless position, since they came under the direct glare of powerful spot-lights illuminating the stage. Despite this apparently impossible situation, however, excellent pictures were seen in most parts of the house due to the efficient directional properties of the special screens used.

The receivers were standard " Nera " Projector Consols using the " Mullard " projection unit and " Nera " 4ft. x 3ft. screens. The fact that pictures were obtained under such adverse conditions of external lighting is a tribute to the progress being made in large-screen television technique.

One advantage that this type of apparatus possesses over the normal domestic projection receiver, is that the picture is much brighter and the screen and projector are separated. They may thus be placed in the most suitable position according to the number of people viewing. Owing to the larger size of the screen a greater number of people can see the picture, and on this account a number of hospitals, homes for disabled and aged persons, and similar institutions are adopting this type of equipment. Reports have been received of a number of such institutions which are installing the apparatus for the Coronation, and in many cases one room is being specially set aside as a " television theatre," and in view of the number of viewers who will be able to see the show the overall cost of the installation is less than that of a number of separate standard television receivers which would be needed to serve the same crowd.

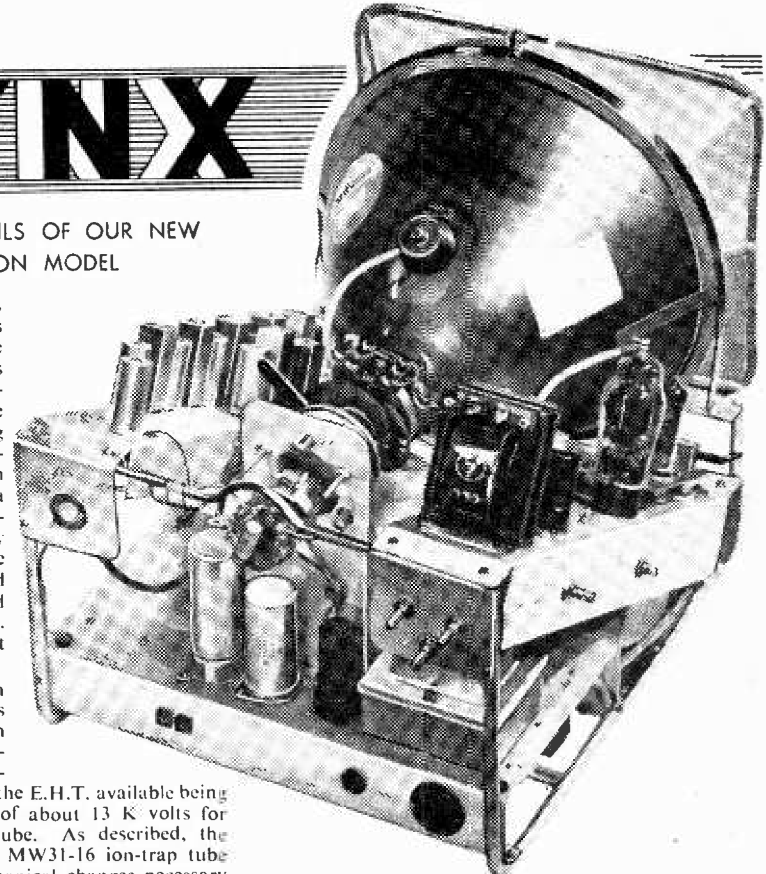
Coronation Relays

As we go to press we are informed that a number of big-screen relays of the Coronation ceremony will be given in various places in London, including certain colour relays. Full details are not yet available but will be given as soon as they are received.



The stage, and the big screen in position in the Scala Theatre.

The LYNX



PRELIMINARY DETAILS OF OUR NEW CORONATION MODEL

THIS television receiver is designed for A.C. mains supplies in the voltage range 200 to 250 volts, and is a superheterodyne with a single-sideband I.F. amplifier suitable for use on any of the existing television channels. The receiver is built on an aluminium framework in a form that is a little unusual for home constructors, and consists basically of the four following separate sections; the vision and sound receiver, the time-bases and H.T. booster system, the E.H.T. supply, and the power-unit sound-output chassis.

The time-bases use high efficiency scanning components and are suitable for use on either narrow-angle or wide-angle tubes up to 14 in. rectangular without modification, the E.H.T. available being adjustable up to a maximum of about 13 K volts for use with the latter type of tube. As described, the chassis uses a 12 in. Mullard MW31-16 ion-trap tube working at 9 kV, but the mechanical changes necessary for other and larger tubes are not serious to the average constructor. Aluminised tubes may, of course, be used.

Fig. 1 shows the complete theoretical circuit of the receiver. The coaxial aerial input socket SK 1 connects to the isolated coupling winding L1 and so passes to the grid of the R.F. amplifier V1, tuning being accomplished by means of the iron core threading L2. The output of the stage is transformer coupled through L3 L4 to a double-triode type of mixer stage V2, the right-hand section of which is a conventional centre-tapped Hartley type oscillator. Coupling to the mixer section grid takes place through a small capacity C5, and the resultant I.F. signal for both vision and sound channels is developed across the anode coil L6. This coil is not externally tuned, but is wound to be flatly resonant at 12.3 Mc/s. The grid coil of the first vision I.F. amplifier V3 is tuned by a brass core to 10.6 Mc/s and the degree of coupling to L6 is set to give the requisite passband, assisted with damping resistances R9 and R10. The sound signal at 9.5 Mc/s is taken off the mixer anode through C29, and this condenser, in conjunction with the parallel circuit L16 C30, forms the first sound trap of the system. Above resonance, the capacitive reactance of this trap provides desirable shunt capacity across L6.

Contrast control is applied conventionally to the first vision I.F. stage by the potentiometer VR1; for localities close to the transmitter, it is advisable to include V1 in this control system to prevent overloading and cross-modulation at the mixer, but more will be said of this later.

The anode circuit of V3 is tuned by L8 to 12.2 Mc/s. and is coupled to the second amplifier V4 through C13. The input of this stage is shunted by the sound trap L9 C 15 which is loosely coupled by C14 to the grid circuit. The anode circuit of V4 is similarly tuned by a single coil L10, this time to 10.2 Mc/s. and a further sound trap L11 C20 shunts the grid resistance R18 of V5. The final I.F. amplifier stage is transformer coupled to the detector-limiter V6, the tuning frequency here being at 11.5 Mc/s.

The detected positive-going vision signal is filtered by C23 and L14 (220 μH) and is developed across the load resistance R22 in the grid circuit of the video-amplifier V7. The vision signal is also applied to the cathode of the limiter diode (right-hand half of V6); here the current in R21 maintains the cathode of this valve at a positive level which follows the peak white of the video modulation. In the absence of sharp interfering pulses, therefore, the diode is almost non-conducting, but when the anode is driven suddenly positive by an interfering pulse at the main detector cathode, the limiter cathode cannot follow because of the long time-constant of C24 R21 and the diode effectively shunts the detector output.

The video-amplifier is straightforward and calls for little comment. Anode H.F. correction is obtained by an inductance L15 (175 μH), and the load consists of two 10 KΩ resistances in parallel. The coupling to the tube cathode is through a long time-constant network R26 C26, this type of feed being useful in overcoming fading of a comparatively slow type, such as is often experienced from aircraft flutter. The tube heater is returned to the cathode through a resistance R28 of 100 KΩ. Brightness control is conventionally applied through VR2 to the tube grid.

Sound Receiver

Turning now to the sound receiver section, this consists of a single I.F. amplifier V8 which is transformer coupled at 9.5 Mc/s to the diode-detector L.F. amplifier stage V9. The diode load R32 is directly coupled to the amplifier grid, and provides direct bias to this stage in place of the more usual cathode system. The L.F. output across the load R31 is passed through a conventional sound limiter crystal V10, and so on to the output amplifier V17, this latter valve being mounted on the power chassis. Control of volume is effected by VR5 and an output of about 3 watts is normally available.

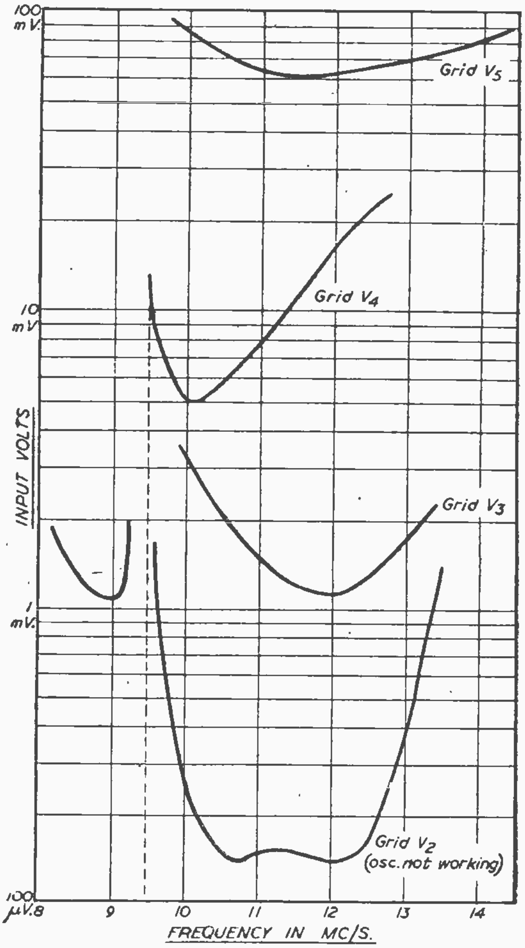


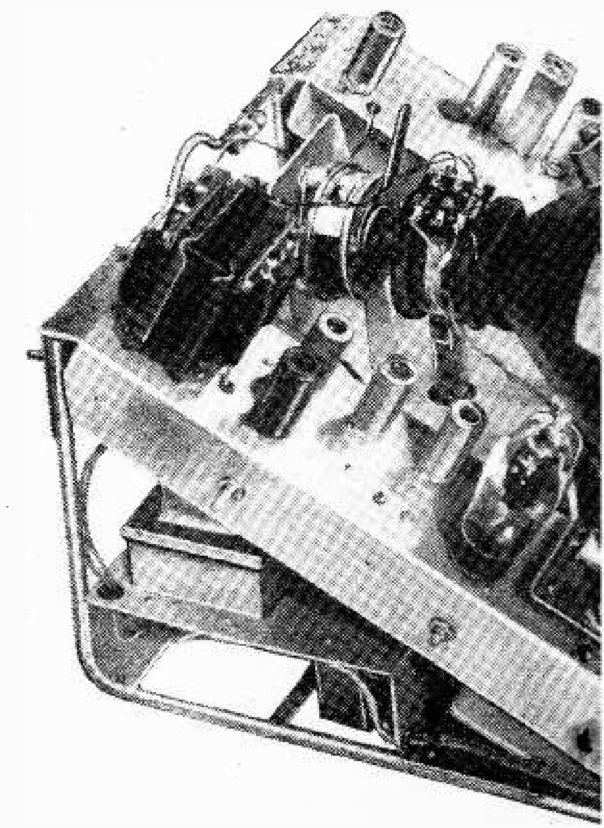
Fig. 2.—Response curves of vision I.F. stages.

Time-Bases

The sync separator stage V11 is coupled from the video-amplifier anode through R27 and C39 and is a normal pentode limiter working over a short grid base. Line pulses are taken directly from the anode through R40 and C42 to the line triode blocking oscillator V12, but the frame pulses are passed through a further diode clipper and integrator stage (diode part of V15) before reaching the anode of the triode-section frame blocking oscillator.

The line oscillator is conventional and uses a Haynes blocking transformer T5, control of frequency being adjustable by the Hold control VR3. The sawtooth output across C43 is coupled to the line output amplifier V13 through C45 and R44. The output transformer T6 has an overwinding for purposes of E.H.T., and a doubler circuit using two metal rectifiers MR1 and MR2 (STC type K3/100) will produce up to about 13 kilovolts for the tube final anode. Control of E.H.T. depends upon C51 across the line coils, and for 12in. tubes requiring 9 kilovolts, a reduction is readily effected by increasing the capacity of this component.

V14 is an efficiency or booster diode, and when used in conjunction with the specified transformer and scan



A three-quarter side v

coils develops 95 volts boost across C50. The H.T. available for the line output anode is therefore effectively about 380 volts. The blocking condenser C52 is necessary to keep the D.C. component out of the line scan coils.

A separate winding is provided on the line transformer for control of picture width ; a plunger form of control L19 is used in conjunction with this winding and when adjusted, exercises negligible effect on either linearity of the scan or the value of the E.H.T.

On the frame side of this section of the receiver the blocking oscillator (triode part of V15) develops a sawtooth waveform at frame frequency across C55, and this is passed to the frame output amplifier V16, which is a strapped double-triode. The frame scan coils are transformer coupled from the anode by T4, and linearity of scan is ensured by voltage feedback through the network C57, R57, VR8 and R56. The cathode resistance of this stage is fairly critical and requires careful adjustment to correct the extremes of the raster from cramping or foldover. The height control is VR7.

Power Unit

The A.C. mains supply is fed to the auto-transformer T1, which is overwound to give a H.T. output of 275 volts at 250 mA., and two heater windings on the component supply respectively the main rectifier V18, and the cathode-ray tube, a tap on this latter winding providing for either 2 volt or 6.3 volt tube supplies.

Main smoothing is carried out by reservoir C61 (40 μF. 425 volts) and a 3H. 250 mA. choke L20. Additional smoothing and decoupling is provided by R63, C65 for the vision-sound chassis, R65, C63 for the sound output amplifier, and R64, C64 for the frame time-base. The voltages to be expected on these various lines are indicated in the figure.

The heaters of all other valves are wired in series

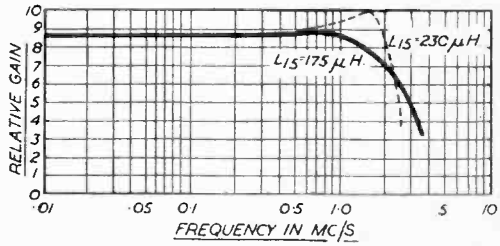


Fig. 3.—Video response curve.

and all valves are of the 0.3 amp. type with the exception of V12, which has a 0.15 amp. heater. This valve is consequently shunted with a suitable resistance R71 to bypass the excess current. The order in which the valves are wired is indicated, and decoupling condensers (C67 to C70) are connected across some of the vision heaters.

A thermistor element CZ1 is wired in series with the heater chain to overcome any initial surges, and the main dropper R69 is used to reduce the mains voltage to the total of about 150 volts required by the heater chain. The valve chain takes about three minutes to reach operating temperature, but the maximum rise in H.T. across C61 due to the faster-heating rectifier in this period does not exceed 320 volts and, therefore, cannot damage the electrolytics.

A fuse is included in the rectifier anode circuit and the double-pole on-off switch is part of the front panel Brightness control.

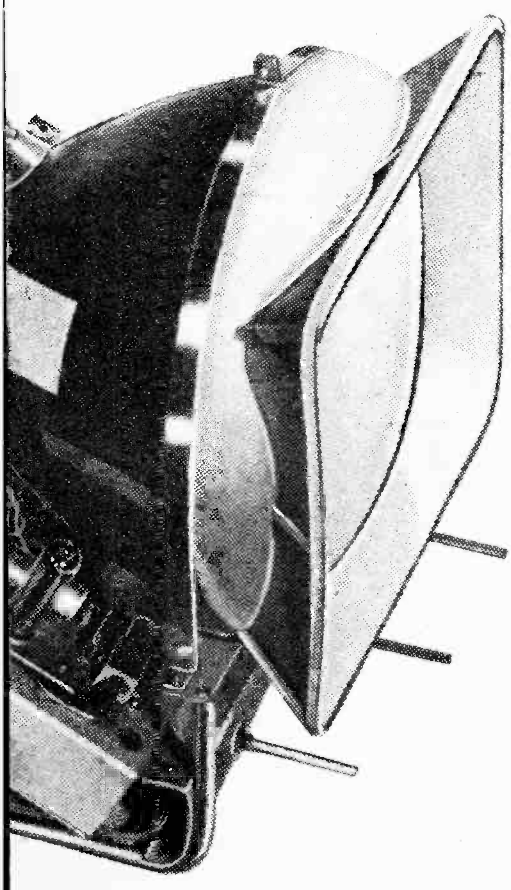
Performance Curves

The individual and overall response curves of the vision I.F. stages are shown in Fig. 2. This figure should be referred to when the receiver is being aligned.

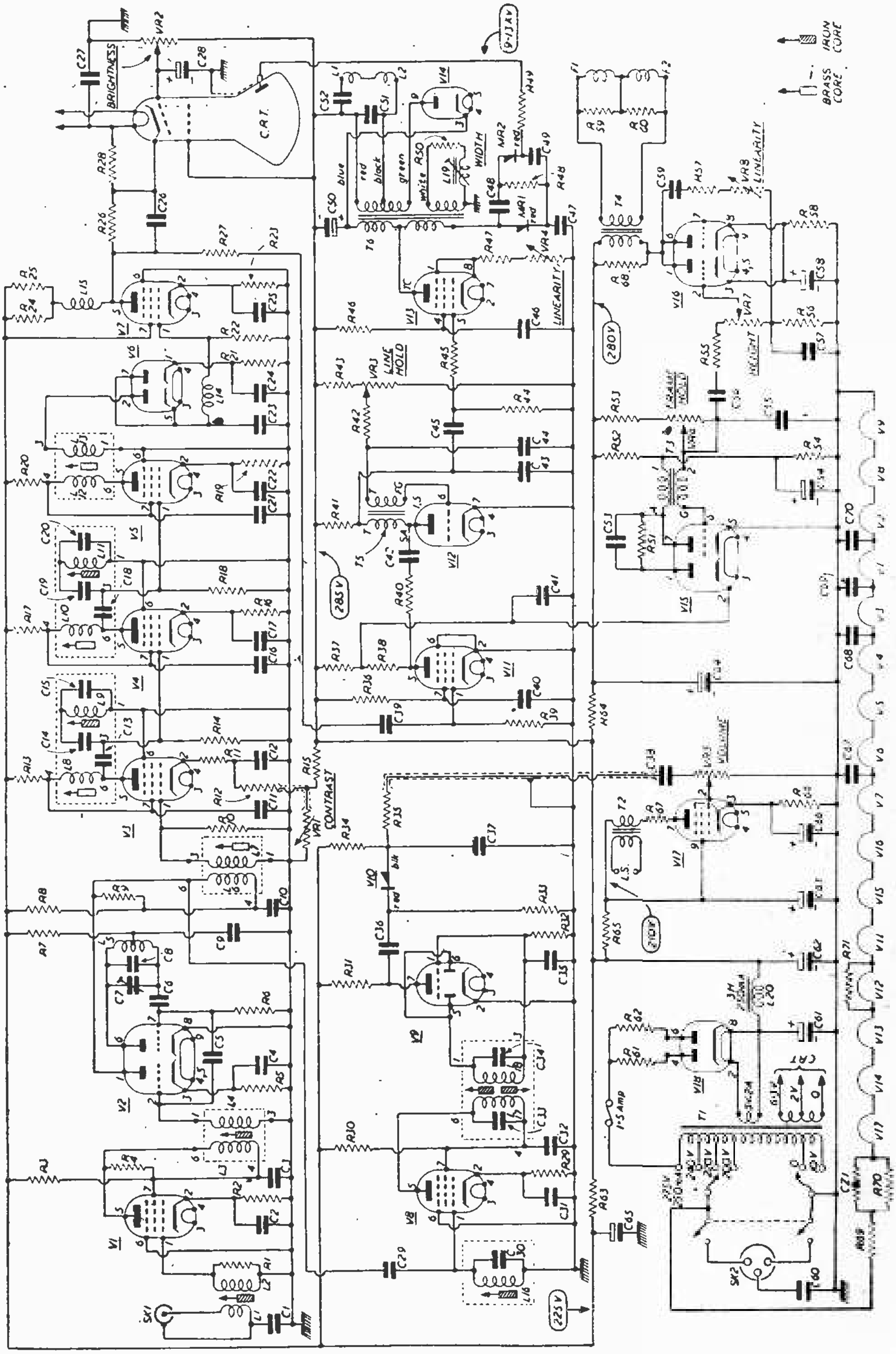
The video-amplifier response to high frequencies is given in Fig. 3, where the effect of changing the inductance of L15 is illustrated. The full line curve is that of the stage when the coil has an inductance of 175 μH, but top lift can be obtained as sketched in broken line by inserting an Aladdin $\frac{3}{8}$in. type iron-dust core centrally in the former. An inductance of about 230 μH. is then obtained, but the stage is over-compensated. The curves were taken with the circuit fully wired, the total shunt capacity being about 15 pF.

Constructional Work

So much for the description of the actual circuit, and reference to the illustration on our cover, on p. 564 and on the left, will show that the layout is, as has already been mentioned, unusual. With the usual form of chassis in the shape of an inverted tray, most of the wiring becomes inaccessible when a tube is mounted on the upper surface, and it is not a simple matter to place the complete equipment in any kind of firm position for



...w of the Lynx.



Theoretical circuit of the Lynx receiver. A full list of parts will be found on the opposite page.

LIST OF COMPONENTS

CONDENSERS.—All below 0.005 μF are Hunt's Moldseal type W99, unless otherwise stated.

C1, C13, C18, C44—500 pF 350 v.

C2, C4, C12, C17, C22, C31, C67, C68, C69, C70 } .01 μF 150 v.

C3, C37, C41, C43—.001 μF 350 v.

C5, C14, C19—3.3 pF Erie G.P. Ceramicon.

C6—33 pF Erie Ceramicon.

C7—3-30 pF Phillips Trimmer.

C8—See text.

C9, C10, C11, C16, C21, C32—.005 μF 350 v.

C15, C20, C30, C33, C34, C35—100 pF 350 v. Hunt's (L4/30)

C23, C25, C42—10 pF Erie Ceramicon.

C24, C26, C27, C39, C46, C55, C56, C57 } 0.1 μF T.C.C. paper 350 v. type 346.

C28, C50, C54—T.C.C. type, 2 μF 350 v.

C29—5 pF Erie Ceramicon.

C36, C38, C40, C59—0.01 μF T.C.C. CP32N.

C45, C53—0.05 μF 350 v.

C47, C48, C49—.001 μF 6 Kv. T.C.C. CP55QO.

C51—See text.

C52—0.5 μF T.C.C. CP47N.

C58, C66—50 μF 25 v. T.C.C. Micropack.

C60—.01 μF 600 v.

C61 + C64—40 + 40 μF, 425 v., B.E.C. CE825.

C62 + C63—100 + 60 μF 350 v. Dubilier C.T. or T.C.C. CE37LE

C65—8 μF 350 v. T.C.C. CE11L.

RESISTANCES. All Morganite ½ w. "T" unless otherwise stated.

R1, R14, R22—4.7 K Ω.

R2, R16, R19, R29,—150 Ω.

R3, R8, R13, R17, R20, R30—1 K Ω.

R4—2.2 K Ω.

R5—680 Ω.

R6, R7, R9, R27—10 K Ω

R10—6.8 K Ω.

R11—33 Ω.

R12—120 Ω.

R15—100 K Ω (1 w.).

R18—5.6 K Ω.

R21—8.2 M Ω.

R23, R45, R59, R60—470 Ω.

R24, R25—10 K Ω (1 w.).

R26, R31, R44—220 K Ω.

R28, R57—100 K Ω.

R32—39 K Ω.

R33, R36—1 M Ω.

R34—3.3 M Ω.

R35—47 K Ω.

R37—82 K Ω.

R38, R40—22 K Ω.

R39—680 K Ω.

R41, R42, R53—330K Ω.

R43—56 K Ω (1 w.).

R46—4.7 K Ω (2 w.).

R47—68 Ω.

R48—2 M Ω (6 x 330 K Ω).

R49, R55, R56—470 K Ω.

R50—47 Ω (2 w.).

R51—2.2 M Ω.

R52—47 K Ω (1 w.).

R54, R68—27 K Ω (1 w.).

R58—330 Ω (1 w.).

R61, R62—47 Ω (6 w.).

R63—680 Ω (6 w.).

R64—500 Ω (6 w.).

R65—1.5 K Ω (6 w.).

R66—390 Ω.

R67—100 Ω.

R69—See text.

R70—250 Ω (6 w.).

R71—41 Ω (2 x 82 Ω paralleled).

CZ1—Brimistor.

B7G Holders & Cans } 11 OFF.
B9A Holders & Cans } 1 OFF.
B9A Holders less Cans } 3 OFF.
Int. Octal Holders } 2 OFF.

Tube Holder } (To suit tube).
1 Set Coils, Formers, Cans, Side Wires, Cores etc. } Haynes Radio Type G2.

Line Osc. Transf'mer—Haynes type TQ223.
Frame Osc. Transf'mer—Haynes type TA6.
Line O/P Transf'mer—Haynes type T34.
Frame O/P Transf'mer—Haynes type TK10/41
Scanning Coils—Haynes type S27.

Sound O/P Transformer—"Standard" Pentode type (50 mA).

Mains Auto-Transformer, 3H, 250 mA Choke } MorleyTransformers Ltd., Parsons Road, Croydon.

VR1—2 K Ω Colvern Wirewound CLR 3001/15.

VR2—500 K Ω Carbon with D.P. switch Morganite.

VR3—20 K Ω Colvern Wirewound CLR 3001/15.

VR4—75 Ω Colvern 1106/13S.

VR5—500 K Ω Carbon. Morganite.

VR6, VR8—250 K Ω Carbon. Morganite.

VR7—1 M Ω Carbon. Morganite.

V1, V3, V4, V5, V7, V8, V11 } EF91, Z77, 6AM6.

V2, V16,—12AT7, ECC81.

V6—EB91.

V9—6AT6, DH77.

V10—GC4C, XTAL.

V12—6C4, L77.

V13—PL38.

V14—PY80.

V15—EAC91.

V17—PL82.

V18—5Z4M.

C.R.T. (12") Mullard MW31/16.
Brimar C12FM, C12B.
Mazda CRM121, CRM121A, CRM123.

MR1, MR2—S.T.C. type K3/100.

Focus Magnet } Elac. (to suit tube).
Ion Trap } Elac. (ditto.)

Width Coil—Plessey or WB/110.

Aerial Socket & Plug—Belling-Lee Co-Axial type.

Mains Socket & Plug—Bulgin 3-pin type P463.

Fuse & Holder—Belling-Lee.

Tag Boards { 1 double 7-way, 1 double 14-way, 4 single 6-way.

MISCELLANEOUS:

Lengths of coaxial cable, single screened lead.

6 & 4 B.A. nuts and bolts, washers, etc.

1 Polystyrene length of ⅜in. rod, 4in.

2 ½in. diam. paxolin formers, 2in. long.

Sheet of ⅛in. thick paxolin sheet, 3in. x 14in.

Sheet of 1/32in. thick paxolin sheet 3in. x 14in.

Sheet of 1/16in. thick paxolin sheet 2¾in. x 4½in.

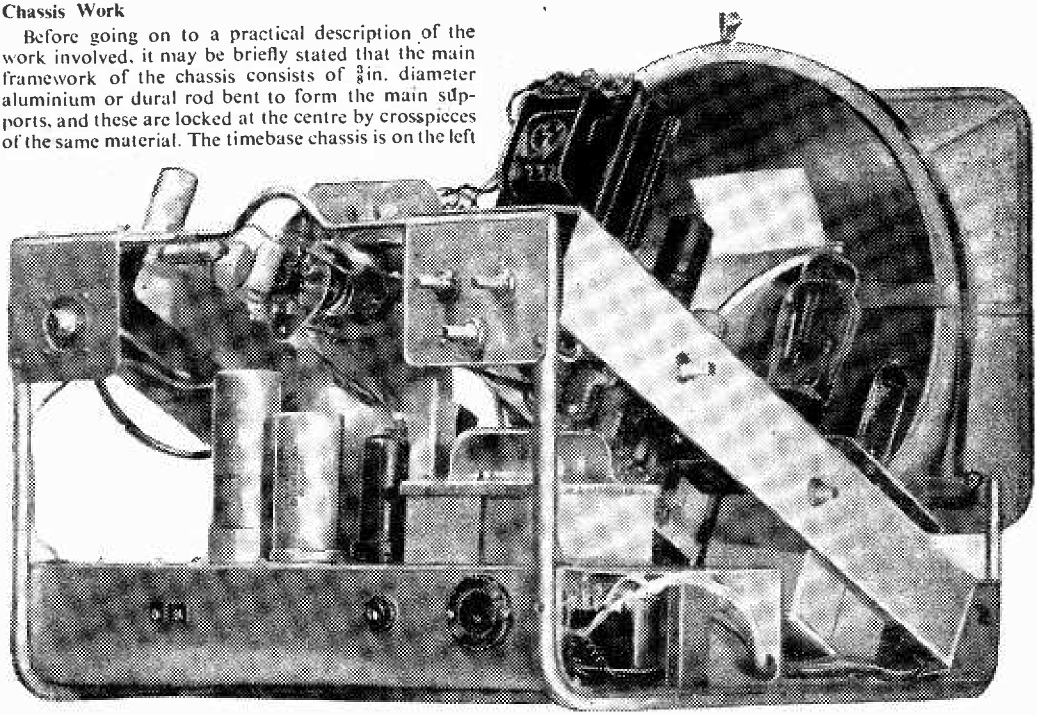
Aluminium ¼in. and ⅜in. rod, and 16 S.W.G.—18 S.W.G. sheet for chassis work.

servicing or testing. In addition, to accommodate the various sections on a single chassis, the overall dimensions become rather excessive. In this design the separate sections are all built on their own chassis, and these are combined in a rigid framework so that the overall dimensions are satisfactorily reduced, and the final form is rigid and may be laid on any side for testing without any risk of twisting or distortion. In addition, the description which will follow is to accommodate a 12in. round glass tube, but the design is such that the front tube-mounting section may be modified as required to take a rectangular tube. This modification will in no way affect the rest of the assembly, and although the tube mounting is part of the main chassis assembly, various modifications can be made to it without difficulty.

Chassis Work

Before going on to a practical description of the work involved, it may be briefly stated that the main framework of the chassis consists of ⅜in. diameter aluminium or dural rod bent to form the main supports, and these are locked at the centre by crosspieces of the same material. The timebase chassis is on the left of the tube, and the vision and sound strip on the right. The lower chassis at the rear carries the power supply section and the sound output stage, whilst the E.H.T. components are on a small sub-chassis mounted in the front beneath the front of the tube. There are three main controls on the front—Brilliancy and combined on/off switch, Contrast, and Volume, whilst the various timebase controls are mounted on one side and the rear, as they are more or less pre-set and only require occasional adjustment. The cabinet which has been designed for the receiver by Messrs. Tallon has a lift-up front portion which enables the tube face and protecting glass to be cleaned and certain adjustment to be made if required, without the necessity of removing the entire receiver from its cabinet.

(To be continued)



A rear view of the Lynx showing underside of timebase chassis.

Radio and TV Sales and Stocks

B.R.E.M.A. Index

TELEVISION sales to the public in the last quarter of 1952 totalled 341,000 sets, the highest yet recorded, more than double the number sold in the previous quarter and 18 per cent. up on the last quarter of 1951.

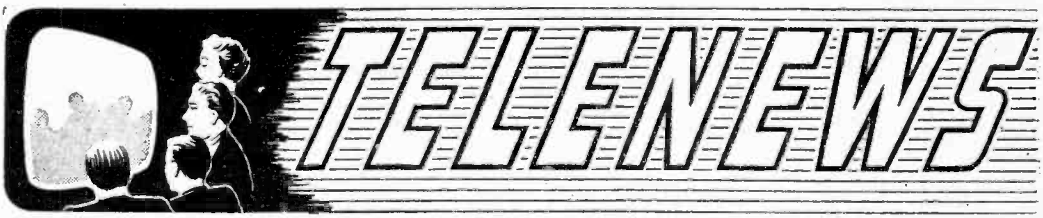
Radio receiver and radiogram sales were 29 per cent. higher than in the same quarter of 1951 and the highest since the second quarter of that year. Radio receiver sales showed an increase of 35 per cent. ; radiogram sales were up by 9 per cent.

Stocks Held

The figures are given by the British Radio Equipment Manufacturers' Association in its survey of dealers' stocks.

Dealers held lower stocks of radio receivers and radiograms at the end of December last than at any time since the base date of the index, September, 1947. The index figure was 105, compared with 145 at the end of September, thus continuing the fall in stocks since the peak of 183 in March, 1952.

Dealers' stocks of all types of television receivers at the end of the year are estimated to have been 160,000 compared with 198,000 at the end of September and 12 per cent. higher than at the end of 1951.



Biggest Picture?

MR. W. R. WALKER and Mr. J. Bremner, two Glasgow technicians, have completed a projection receiver which, they believe, produces the largest picture yet.

The screen covers 48 square feet and is the result of four months of experimenting with a standard projection receiver.

Schools Television

IT is reported that the Education Ministry has been approached by the Schools Broadcasting Council to install big-screen receivers in 500 secondary schools.

The educational programmes for the schools would be on the normal wavelengths so that adults at home could see the programmes also.

Television Licences

THE following statement shows the approximate number of television licences issued during the year ended February, 1953. The grand total of sound and television licences was 12,867,898.

Region	*Number*
London Postal	705,021
Home Counties ...	237,673
Midland	453,547
North Eastern	226,777
North Western	263,329
South Western	59,051
Welsh and Border ...	71,465
Total England and Wales	2,016,863
Scotland	55,614
Northern Ireland ...	503
Grand Total	2,072,980

Venezuela Station

TELEVISION equipment for the first television station in Venezuela, the site of which is in Caracas, the capital, left this country by 'plane recently.

It is believed that this was the largest single consignment of TV equipment ever air-freighted from this country. It was rushed to Caracas for the opening of the new station in April and consisted of almost a ton-and-a-half of equipment, including telecine apparatus and studio lighting.

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

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

Engineering Appointment

MR. C. DUDDINGTON has been appointed Engineer in Charge of the low-power television transmitting station at Glencairn, near Belfast.

Mr. Duddington joined the Corporation in February, 1946, at the Lisnagarvey station, transferred to the television service at Alexandra Palace in August, 1950, and has since served at the Sutton Coldfield and Holme Moss stations.

Children Copy Baby Talk

IT is reported that children listening to the BBC's "Flowerpot Men" on Thursday afternoons are copying the double-talk used by the characters and hold long conversations in the language, thus retarding their education.

Miss Freda Lingstrom, head of Children's Television Programmes, has called for a special investigation into the matter.

British War Films

THE BBC is to prepare a series of war films in the same style as the "Victory at Sea" films made by the Americans.

Some viewers have protested that the half-hour American "Victory" films emphasise too much the part played by America in the last wa

Television equipment, destined for Caracas, Venezuela, is loaded into the "Flying Dutchman" at Bovingdon Airport.

and not enough of Britain's effort. Now the R.A.F., Admiralty and Army have lent their war-film shots to enable the BBC to compile a thirteen-week series of films of the British Services.

Signal Too Strong

VIEWERS on Tees-side found recently that atmospheric conditions caused a 50 per cent. increase in the signal received from Holme Moss which ruined picture reproduction.

Commercial TV Inquiries

MR. L. D. GAMMANS, Assistant Postmaster-General, said in Parliament recently that 46 inquiries on commercial television broadcasting licences had been received and approximately 26 on time allowed to sponsored programmes.

Replying to Mr. Ness Edwards, he said that the BBC licence did not permit commercial broadcasting except with the Postmaster-General's permission.

New South Coast Station

THE temporary low-power station sited at Truleigh Hill, 3½ miles north of Kingston-upon-Sea, will be in operation in time for the Coronation, the BBC has announced.

This will improve greatly the pictures received in Brighton, Worthing, Hove and Shoreham.

"Fringe" Problem

THE Television Society will hold its annual summer meeting in June at Bedford, half way between Alexandra Palace and Sutton Coldfield.

This has been arranged so that the Society may study the difficulties presented to a viewer "on the fringe," Bedford being one of the worst reception areas in the country.

TV City Grows

SPEEDY progress is being made on the £10 million radio-and-television city at White City, London.

The first section to reach completion will be the scenery block where all properties, scenery and background cloths are to be made. The city will contain seven large studios, one 120ft. long and 60ft. high. Cameras are expected to move in this summer.

Norway Prepares

A COMMITTEE has been formed in Norway to conduct experimental TV transmissions in preparation for a national television service.

Tests begin in Oslo later in the year and equipment manufacturers in Britain and the United States have been invited to submit estimates to the committee.

Life in North-east

A FILM concerning the way of life in the north-east of England has been shot in the Northumberland and Durham area in time for the opening of the Pontop Pike transmitter.

This half-hour documentary takes in shots of coal-mines, shipyards, steel works and farmlands and is produced by John Elliot, documentary head of the BBC Television Film Service.

Wired Service

BECAUSE a relay company has merged with another and a new board has to make fresh considerations, the installation of a wired television and radio service for Kingston and Surbiton, Surrey, has been delayed indefinitely.

Coal Under Mast

WORKMEN from Stanley Urban Council, who are laying a road leading to the Pontop Pike Station, have discovered a 3ft. seam of good quality coal running under the main buildings and steel mast.

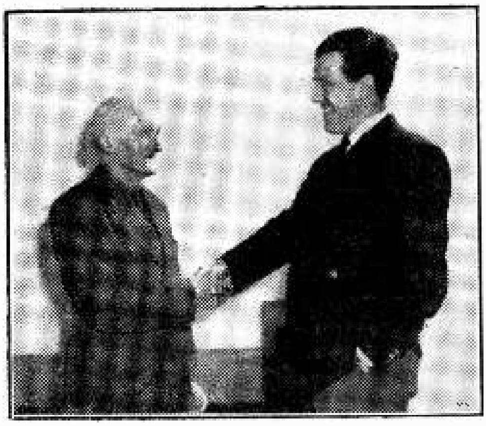
Hospitals Hire Sets

IN order that patients in four hospitals may watch the Coronation, a hospitals management committee is to pay £300 to a Wandsworth firm for the hire of twenty receivers.

This makes a fee of £15 for hiring one set only.

Ban Lifted

BEFORE Giannella de Marco, aged eight, the Italian girl conductor, could appear on Henry Caldwell's "Shop Window" programme, the ban on children under 12 appearing in front of a television camera had to be lifted by the Home Office.



(Left) Eamonn Andrews, chairman in the "What's My Line ?" programme, congratulates the 71-year-old office-boy of Television Mainstal, Ltd., of Hounslow, on his success in beating the panel. They guessed no nearer than "messenger." (Right) Patrick Troughton, who plays Robin Hood in the serial play on Children's Television, puts in some archery practice in Battersea Park, watched by an interested group of young admirers.

R.E.C.M.F. EXHIBITION, 1953

THE TENTH RADIO COMPONENT SHOW TO BE HELD AT GROSVENOR HOUSE, APRIL 14th-16th, 1953

LIST OF EXHIBITORS

Firm	Stand No.
A.B. Metal Products, Limited	64
Advance Components, Limited	56
Aerialite, Limited	12
Antiference, Limited	50
Associated Iliffe Press, Limited	106
Associated Technical Manufacturers, Limited	75
Automatic Coil Winder and Electrical Equipment Co., Limited	105
Bakelite, Limited	74
Belling and Lee, Limited	52
Bird, Sydney S., and Sons, Limited	78
Birmingham Sound Reproducers, Limited	15
Bray, Geo., and Co., Limited	89
British Electric Resistance Co., Limited	70
British Insulated Callenders Cables, Limited	73
British Mechanical Productions, Limited	66
British Moulded Plastics, Limited	114
Bulgin, A. F., and Co., Limited	45
Bullers, Limited	5
Carr Fastener Co., Limited	25
Clarke, H., and Co. (Manchester), Limited	87
Collaro, Limited	19
Colvern, Limited	51
Connollys (Blackley), Limited	76
Cosmocord, Limited	59
Daly (Condensers), Limited	99
Dawe Instruments, Limited	32
De La Rue, Thomas, and Co., Limited (Plastics Division)	108
Diamond "H" Switches, Limited	3
Dubilier Condenser Co. (1925), Limited	68
Duratube and Wire, Limited	46
Edison Swan Electric Co., Limited	62
Egen Electric, Limited	79
Electro Acoustic Industries, Limited	40
Electronic Components	93
Electrothermal Engineering, Limited	83
English Electric Co., Limited	95
Enthoven Solders, Limited	34
Erg Industrial Corporation, Limited	112
Erie Resistor, Limited	26
Ever-Ready Co. (Great Britain), Limited	103
Ferranti, Limited	37
Fine Wires, Limited	118
Garrard Engineering and Manufacturing Co., Limited	69
General Electric Co., Limited	100
Goodmans Industries, Limited	31
Gresham Transformers, Limited	98
Guest, Keen and Nettlefold, Limited	101
Hallam, Sleigh and Cheston, Limited	85
Hassett and Harper, Limited	111
Hellermann, Limited	71
Henly's, W. T., Telegraph Works Co., Limited	2
Hunt, A. H. (Capacitors), Limited	22
Igranic Electric Co., Limited	6
Imhof, Alfred, Limited	38
Jackson Bros. (London), Limited	4
London Electric Wire Co. and Smiths, Limited	110
London Electrical Manufacturing Co., Limited	44
Long and Hambly, Limited	11
Magnetic and Electrical Alloys, Limited	63
Marconi Instruments, Limited	96
Marrison and Catherall, Limited	104
McMurdo Instrument Co., Limited	58
Micanite and Insular Co., Limited	113
Morgan Brothers (Publishers), Limited	102
Morganite Resistors, Limited	47
Mullard, Limited	20
Mullard, Limited (Valves Division)	120
Mullard Overseas, Limited	115
Multicore Solders, Limited	41
Murex, Limited	13
Mycalex Co., Limited	86
Neill, James and Co. (Sheffield), Limited	116
N.S.F., Limited	55
Painton and Co., Limited	24
Parmeko, Limited	21
Partridge Transformers, Limited	57
Plessey Company, Limited	42
Plessey International, Limited	72
Pye, Limited	94
Reliance Electrical Wire Co., Limited	10
Reslosound, Limited	29
Rola Celestion, Limited	36
Salford Electrical Instruments, Limited	49
Scharf, Erwin	77
Scott, Geo. L., and Co., Limited	84
Simmonds Aerocessories, Limited	82
Stability Radio Components, Limited	33
Standard Telephones and Cables, Limited	27
Standard Telephones and Cables, Limited (Valve Division)	67
Static Condenser Co., Limited	92
Steatite and Porcelain Products, Limited	35
Suflex, Limited	8
Supply, Ministry of	97
Swift, Levick and Sons, Limited	107
Symons, H. D., and Co., Limited	91
Tannoy Products, Limited	65
Taylor Electrical Instruments, Limited	1
Taylor Tunnicliff (Refractories), Limited	117
Telegraph Condenser Co., Limited	48

Firm	*Stand No.*	*Firm*	*Stand No.*
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Telephone Manufacturing Co., Limited	14	Wego Condenser Co., Limited	30
Thermo-Plastics, Limited	9	Welwyn Electrical Laboratories, Limited	54
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Truvox, Limited	61	Weymouth Radio Manufacturing Co., Limited	16
Tucker, Geo., Eyelet Co., Limited	119	Whiteley Electrical Radio Co., Limited	18
		Wimbledon Engineering Co., Limited	81
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United Insulator Co., Limited	7	Wireless Telephone Co., Limited	43
		Woden Transformer Co., Limited	60
Vactite Wire Co., Limited	109	Wolsey Television, Limited	88
Vitavox, Limited	39	Wright and Weaire, Limited	17

Some New T.C.C. Condensers

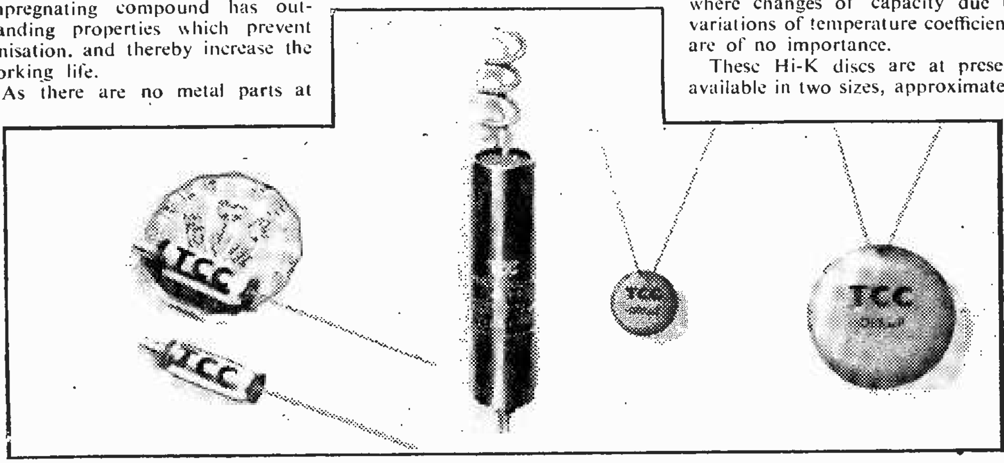
T.C.C. announce the introduction of several entirely new and interesting condensers. Amongst these are the following, illustrated below:

High-voltage Type CP561

This is a new range of paper dielectric condensers, which is intended for use in E.H.T. supplies for the largest cathode-ray tubes.

The unique construction includes a moulded case, stud mounting and a flexible connection. The special impregnating compound has outstanding properties which prevent ionisation, and thereby increase the working life.

As there are no metal parts at the high potential end of the condenser, corona losses due to external discharge are virtually eliminated.



Some of the new condensers referred to above.

Sub-miniature Electrolytics for Use in Hearing Aids

These diminutive tubular condensers are the smallest electrolytics ever made and have been specially designed for use in miniature hearing aids where every component is of necessity scaled down to the smallest possible size.

The improved construction has resulted not only in a spectacular reduction in size but also in an efficient condenser which has successfully undergone a series of very extensive and stringent tests over a long period.

Only two capacity values are available at the moment, 6μF for 3-volt D.C. working and 8μF for 6-volt D.C. working, but more will be added as and when the demands of manufacturers become apparent.

A feature of the construction is the plug-pin which forms one of the terminations, enabling them to be incorporated quickly and easily into an assembly.

Hi-K Ceramic Disc Condensers

This new addition to the existing range of Hi-K ceramic condensers has several uses, including decoupling in television receivers and spark suppression in small electrical apparatus. They can also be used as alternatives to the ordinary mica condensers in positions where changes of capacity due to variations of temperature coefficients are of no importance.

These Hi-K discs are at present available in two sizes, approximately 10 and 20 mm. diameter, and in a range of values from .001μF to .02μF at working voltages from 500 volts D.C. to 4,000 volts D.C. A special non-cracking, heat-resisting protective coating is applied as a standard finish.

Metallised Polystyrene Condensers

The excellent electrical properties of the plastic film condenser are already well known, these condensers being unsurpassed for high insulation resistance and low power factor.

T.C.C. have now developed a method of metallising Polystyrene film which enables the size of a condenser to be reduced to a point where it compares favourably with its paper counterpart whilst retaining the excellent electrical characteristics associated with the plastic film condenser.

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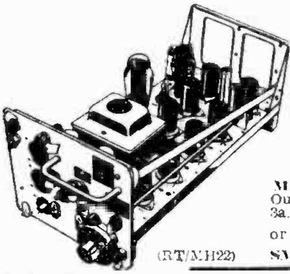
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IN FAIR USED CONDITION **19/6** POST
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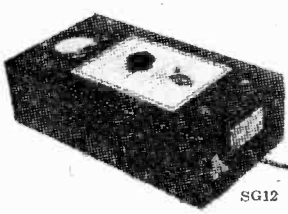
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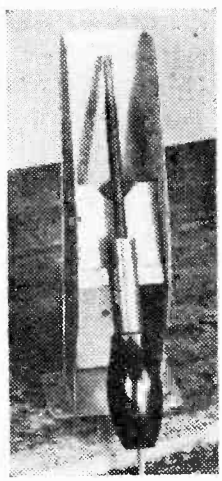
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350-0-350 v 100 ma, 6.3 v 4 v. 4 a C.T. 0-4-5 v 3 a 23 11
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350-0-350 v 160 ma, 6.3 v 6 a, 6.3 v 3 a. 5 v 3 a 45 9
350-0-350 v 250 ma. 6.3 v 6 a, 4 v 8 a. 0-2-6 v 2 a, 4 v 3 a. for Electronic Engineering Televisor 67 6
425-0-425 v 200 ma, 6.3 v 4 a, C.T. 6.3 v 4 a, C.T., 5 v 3 a, suitable Argus Televisor, etc. ... ... 51 -

FILAMENT TRANSFORMERS

All with 200-250 v 50 c/s Primaries: 6.3 v 2 a, **7/6**; 0-4-6.3 v 2 a, **7/9**; 12 v 1 a, **7 11**; 6.3 v 3 a., **9/11**; 6.3 v 6 a, **17/9**; 0-2-4-5-6.3 v 4 a, **17/9**; 12 v 3 a, or 24 v 1.5 a... ... 17 9

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Standard Pentode, 5,000 to 3 ohms 4 9
Standard Pentode, 8,000 to 3 ohms ... 4 9
Push-Pull 10-12 watts to match, 6V6 etc., to 3-5-8 or 15 ohms 16 9
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All with 200-250-250 v 50 c/s Primaries; 0-9-15 v 1.5 a, **13/9**; 0-9-15 v 3 a, **16 9**; 0-9-15 v 6 a, **22 9**; 0-4-9-15-24 v 3 a 22 9

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CHASSIS (16 s.w.g. Aluminium) Receiver Type.—5-3½-1½in., **2 6**; 7½-4½-2in., **3/3**; 10-5½-2in., **3/9**; 11-6-2½in., **4 3**; 12-8-2½in., **5 3**; 16-8-2½in., **7/6**; 20-8-2½in., **8 11**; Amplifier type (4-sided) 12-8-2½in., **7 11**; 16-8-2½in., **10/11**; 14-10-3in., **13 6**; 20-8-2½in., **13/6**.

P.M. SPEAKERS. — All 2-3 ohms 5in. Plessey **13/9**; 5in. Goodmans, **14 9**; 6½in. ELAC, **15 9**; 8in. Plessey, **15/9**; 10in. Plessey, **18/11**; 10in. Rola, **31/-**.

M.E. SPEAKERS (2-3 ohms). 6in. Rola, 700 ohm Field, **12 9**; 8 in. R.A., 600 ohm Field, **12 9**; 10in. R.A., 600 ohm Field, **23/9**.

EX-GOVT. CONDENSERS.—Block Paper (Mansbridge type), 4 mfd 500 v. **2/9**; 8 mfd. 500 v. **4/9**; Bak. Tubular, .02 mfd 5,000 v, **2 9**; .05 mfd 3,500 v. **3 6**.

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SILVER MICA CONDENSERS.—5, 10, 15, 20, 25, 30, 35, 50, 60, 100, 120, 150, 180, 200, 230, 300, 340, 400, 470, 500, 1,000 (.001 mfd), 2,000 (.002 mfd), **5d.** each. **3/9** doz. 1 type.

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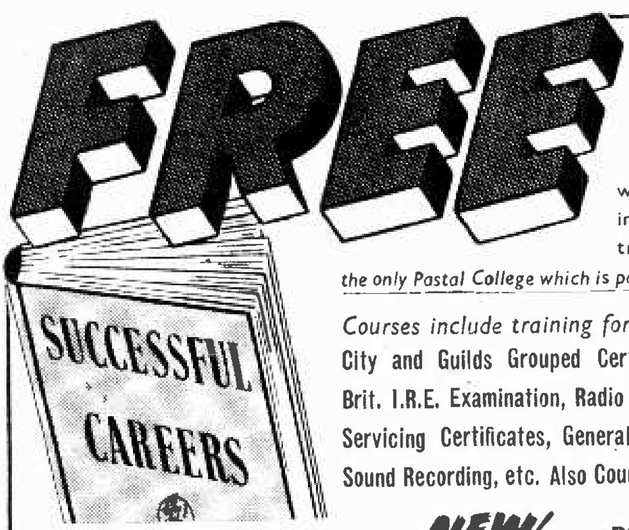

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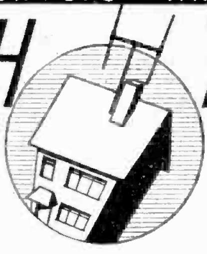
TELEVISION PICK-UPS AND REFLECTIONS

UNDERNEATH THE DIPOLE



By Iconos

THEATRICAL hooks recall with nostalgic phrases the appeal that Shakespeare had for the public of fifty years or so ago. Rival " Hamlets " or " Henry V's " played simultaneously at West End theatres in the opulent age of the great actor-managers, nearly all of whom were ready at any time to put on one or other of the eight most popular of Shakespeare's works. Provincial theatres followed suit with the Bard's plays performed by resident repertory companies or by touring companies. Smaller towns and even villages were given their doses of Shakespeare in corn exchanges and village halls, put on by " fit-up " companies of actors who travelled proscenium and stage fitments as well as scenery. But, in the course of time, the " tip-up " replaced the " fit-up " and in all except the largest towns the early flickering " bioscope " took the place of flesh-and-blood histrionics. For the time being, and except for specialised audiences, the great Bill was superseded by Bronco Billy in " horse operas " or by " Clutching Hand " serials.

THE TAINT OF THE " THIRD "

TIME marches on. Those not living in populous areas had little chance of seeing Shakespeare performed by professional actors. Sound radio prepared the way for a revival of general interest in Shakespeare's plays, but the medium had insufficient impact to retain the attention of the popular public. True the Third Programme has often featured Shakespeare—but its very appearance in such eclectic environs was sufficient to damn it, so far as the ordinary man-in-the-street was concerned. Shakespeare has had to wait for TV to remove the " Third " taint. TV sound and picture, riveting the attention of the viewers, have carried the golden words back into the towns and villages again, and the arm-chair has, in turn, replaced the " tip-up." Once more, all the world's a stage—or rather, two million British TV sets are stages for a rapidly increasing audience for Shakespearian drama. The TV boys are doing it well, but it is strange that " As You Like It " is possibly the turning point. Campbell Logan's production was a delicate piece of work, but it was Margaret Leighton's Rosalind which captured all hearts. Good production and casting are essential to success with Shakespeare, but it is always the individual performance of an artiste which carries it to triumph. In spite of the anonimity of players frequently insisted upon by many stock company managers, Shakespeare must have appreciated the value of the star system. Each play contains at least one part which gives scope for the player to convey every little shade of dramatic interpretation. There is no particular need to hurry with TV production, and no particular necessity for streamlined restless cutting from shot to shot, montages, or chase sequences, as on films. Tempo can be slower on TV, enabling the producer to dwell on individual shots for long periods—providing the shots are really worthy of such prolonged attention. At last we have a medium which can exploit the full virtuosity of the " star " characters in Shakespeare's plays. Encore !

IRISH PLAYS

FOR some reason or another the Irish play has always had an attraction for TV producers. I have often tried to account for it, because with a few notable exceptions, stage plays or films in dialect (excepting when in Scottish) seem to have a limited appeal. Nevertheless, viewers must have revived happy memories of the notable productions of Fred Donovan and George More O'Ferrell when Andrew Osborn presented "The Goldfish in the Sun." All the characters were handled sympathetically and Fred Johnson was very convincing as the retired bo'sun who is caught in the threads of his early life when he comes home to live in Cork. Noteworthy were the settings of Roy Oxley and coupled with imaginative camera work, they gave the play " visual depth " if not precisely 3-D !

Here again the tempo was on the slow side, but not to the detriment of the story. There was one long tracking shot, though, which was repeated too many times. I found myself waiting for it ! A good trick can often be ruined by repetition.

A GLASGOW RELAY

IT is not often that references to religious programmes appear in these columns, perhaps because seldom has TV been able to transmit the spiritual uplift present in a sound broadcast. The two relays from Glasgow Cathedral were admirable—particularly in the Epilogue, when the beauty and serenity of St. Mungo's was apparent to all viewers; and what a perfect choir. In view of the land-line relay, the clarity of the sound on this transmission was praiseworthy as was the excellence of the pictures.

TV GLOOM

LAY press critics of plays and films are notoriously out of touch with public taste if the box office results are an indication. But their opinions are valued by the managers, especially during the first few weeks of a run. Plays which are frankly " popular " in their appeal usually rely upon word of mouth recommendation, and audiences increase week by week. Thus, "Worms Eye View," " Reluctant Heroes " and the Novello musical plays gradually built up their success over a long period. There is not the same incentive for television producers who look to the rapidly growing band of TV press critics for their appreciation. The vast popular TV public are not in the habit of sending frequent postcards of appreciation or otherwise. Perhaps this accounts for the growing highbrow aspect of many of the features put on the TV programmes lately. I am not referring to Shakespeare, but to the batch of depressing features about pain, to the morbid modern plays such as " Shadow of the Vine," by Beverley Nichols. After this depressing little season let us hope we have another taste of the Crazy Gang and slapstick as an antidote.

News from the Trade

The Johnson "Chorehorse"

TELEVISION with definition equal to first-class mains is now available to all those without mains supply through the use of a "Chorehorse" A.C./D.C. power unit. This is a motor-operated generator, illustrated below, and having the following specifications :

Engine : The engine is a side-valve, blower-cooled type, $2\frac{1}{2}$in. by $1\frac{3}{4}$in, bore and stroke. Ignition by flywheel magneto, fully compensating carburetter with adjustable main jet. Especially sensitive built in governor, and large diameter outside flywheel to maintain constant voltage. A pulley is fitted for cord-starting if required.

Generator : The generator, of very ample dimensions, has four-pole windings : 1,800 r.p.m., self-excited, self-contained unit with a rated output of 250/300 watts at 220/250 volts A.C. Single phase, 50/60 cycles, plus 12/15 volts, 300 watts charging output. A self-starting circuit is also incoporated. The rated output is well on the conservative side.

Controls : On the instrument panel are mounted 100-300 A.C. voltmeter, 30-0-30 D.C. ammeter, starter button, D.C. terminals, A.C. output detachable plug, cut-out, rheostat, auto A.C. voltage control box, etc.

Assembly : The engine and A.C./D.C. generator are close-coupled and fully suppressed against interference ; they are mounted in the approved "Chorehorse" manner, on a hollow base plate which forms the petrol tank. The set is protected from damage by light tubular framing.

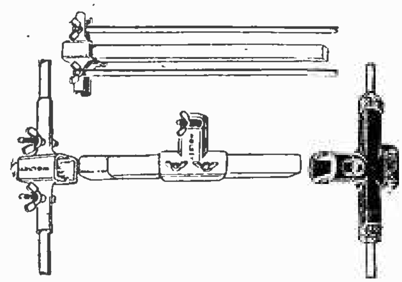
Size and Weight : Overall dimensions, 17in. × $15\frac{1}{2}$in. × 14in. high. Weight complete, 124 lbs.

Price : £47 10s. 0d. plus delivery U.K. 10s. Packing case returnable.—Teddington Engineering Co., Ltd., 29, 31, High Street, Teddington. Middx.

Wolsey Aerial Improvement

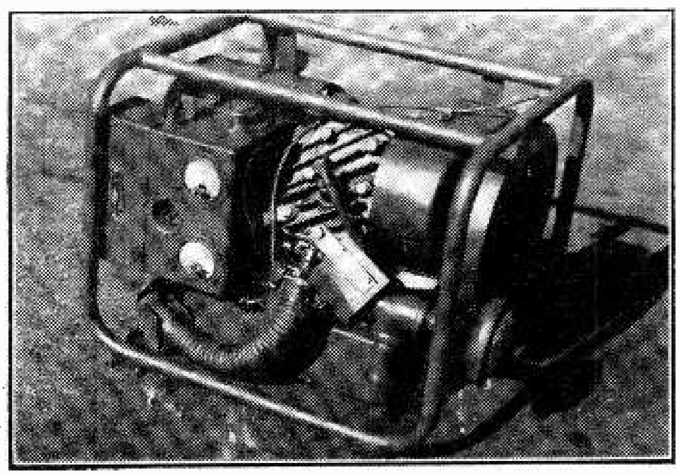
ALL concerned with TV aerial erection will at once recognise the step forward in design presented by the new Wolsey square fitting cross-arm. They will know that on all makes of aerials having the conventional round cross-arms the elements are very apt to get out of alignment, and the entire aerial to move out of the vertical through the force of the wind. Wolsey's new square fitting makes this impossible. The square fitting of the junction box, reflector clamp and central T bracket ensures automatic and positive alignment, and the aerial cannot move round the cross-arm. For orientation, slots in the T bracket and stand-off arm allow ample swing. Further, it will readily be obvious that this new square fitting considerably reduces the time required to assemble the aerial.

The square fitting reflector clamp is pre-assembled at the works and supplied with the rods actually fitted folded against the cross-arm for convenience in packing and transit. All the erector has to do is snap the rods into position and by finger tightening the two wing



Details of the new Wolsey aerial.

nuts, quickly and firmly secure rods to the cross-arm. The end of the cross-arm is, of course, fitted with an effective insulator.—Wolsey Television Ltd., 75, Gresham Road, London, S.W.9. Brixton 6651 (PBX). Established 1934.



The Johnson "Chorehorse" referred to above.

New American TV Rectifier

A MINIATURE cathode type high-voltage half-wave rectifier, Type 6V3, is now being produced by the Radio Tube Division of Sylvania Electric Products, Inc., Emporium, Pa.

The 6V3 has a coated unipotential cathode and is designed for use as a damping diode in television receivers. In new equipment applications the Sylvania 6V3 when used within its maximum ratings is capable of withstanding a peak inverse voltage of 6,000 volts and a steady state peak current of 600 mA.

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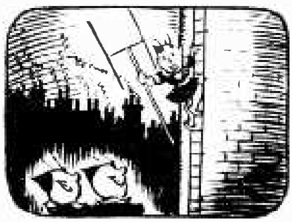

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CORRESPONDENCE

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

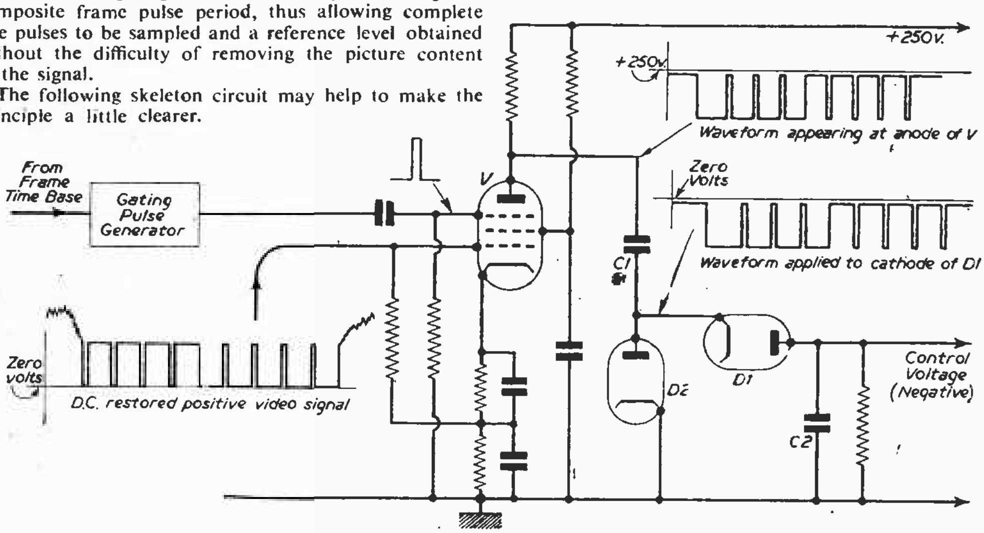
AUTO-CONTRAST CONTROL

SIR,—In connection with your article on "Automatic Contrast Control" which appeared in the February issue, in the circuit (Fig. 1) suggested by the author the diode will not conduct during any part of the signal, as the anode of the video valve can never become negative. This means that there will be no control voltage developed across CR, and therefore the circuit will be ineffective.

Using the BBC system of positive picture modulation, any attempt to make use of the line sync. pulses to obtain a control voltage is bound to be very difficult, because during the pulse itself the transmitter output is zero, and hence the voltages appearing at any point in the video circuits will be independent of the peak or even the mean power output of the transmitter. One way to obtain a reference level is by the use of a circuit which will operate in accordance with the actual amplitude of the pulse, by the use of the front and/or back porches. This is necessarily difficult, owing to their short duration, which would mean that the equivalent of the condenser "C" would require many pulses before it became fully charged, which would render the circuit very "sluggish" in operation.

A simpler and more satisfactory method is found in the use of a gating circuit which opens during the composite frame pulse period, thus allowing complete line pulses to be sampled and a reference level obtained without the difficulty of removing the picture content of the signal.

The following skeleton circuit may help to make the principle a little clearer.



Skeleton circuit of the control suggested by Mr. Henk.

The valve V, which should be a high-slope pentode, is normally cut off at the suppressor grid, and by the application of gating pulses during the frame flyback period, derived from a gating pulse generator synchronised to the frame timebase, the frame sync. pulse is made to appear at the anode, together, of course, with the D.C. component of the H.T. supply. This is removed by C_1, and the top of the waveform brought to zero level by D_2, which acts as a D.C. restorer. The waveform is now applied to the cathode of D_1, and the control voltage is developed across C_2R. This voltage varies partly as the strength of the video signal and partly as the amplitude of the suppressor grid pulses, so the general contrast level may be altered using the pulse amplitude control as a contrast control.—A. J. HENK (Leeds).

RE CAGE AERIALS

SIR,—It is with some reluctance that I embark upon yet a further letter on this subject, but I am afraid that in his efforts to discredit what I have said Mr. H. B. Gregory has strayed into the dizzy realms of fantasy.

His remarks concerning my purloining of statements from the Belling-Lee book are utter nonsense, and the accusation that I have quoted therefrom without acknowledgement is possibly actionable. Mr. Gregory should exercise great care before he ventures to consign such statements to print.

For Mr. Gregory's information I did not attend last year's Radio Show, nor have I seen or even heard of the publication he mentions. I am too old in the tooth so far as journalism is concerned to plagiarise another's work or even to attempt to quote *ad verbatim* the copyright details without obtaining the necessary permission and making the necessary acknowledgements.

The one interesting fact which has emerged from this correspondence is that Mr. F. R. W. Strafford has carried out some experiments with thin wire aerials and has proved it possible to obtain sufficient bandwidth with an aerial of this type. Previous data has suggested the necessity for the broader dimensioned arrays and this point has been stressed in quite recent works. However, the proof of the pudding is in the eating and I would suggest that the serious experimenter should try out the thin wire arrangement for himself, in the same way that I suggested the trial of the cage aerial.

The last word has not yet been said on aerial design for TV and there is much room for experimental work. Personally I am very much in favour of the simplification in aerial systems and look forward to the day when all these fantastic contraptions which now adorn our chimney stacks will be abolished. In TV we now appear to be in the same phase which accompanied the early days of sound radio, and it is to be hoped that new developments in valve design and circuitry will enable us to regard our present arrays with the amused tolerance we now give to the older double and triple wire aerials of early sound radio.—ERG.

SIGHT STRAIN

SIR,—As an optician, and a regular reader of PRACTICAL TELEVISION, may I offer a few comments on the article entitled "Television Sight Strain," in the April issue?

With no wish to be less than just to the author, I cannot but feel that he is the victim of a number of fears and fallacies concerning human eyes which would be better dispelled, rather than propagated by his article.

In the conduct of my daily affairs, the fact about the human eye which most astonishes me is its immense tolerance; the ability to work for long periods under the most adverse conditions of illumination and focus, without permanent detriment.

Most of my colleagues would, I know, refute your contributor's bland assumption that modern conditions are causing deterioration in the eyesight of the nation.

Whilst it is true that more spectacles are worn now than hitherto, the reason is simply that people are more concerned with visual efficiency nowadays, and follow both occupations and pleasures (of which television is a case in point) which demand critical rather than casual vision, and thus reveal small errors of focus which would not be apparent under less exacting conditions.

Television is a pleasure which demands fairly intensive visual concentration and which is likely, *ipso facto*, to cause some visual fatigue. Just how much fatigue depends on a number of circumstances, some of which may be enumerated as follows:

(1) Conditions of viewing, i.e., room illumination; screen brilliance: posture, etc., all of which have been helpfully discussed in these pages.

(2) Refractive condition of viewer, i.e., whether or not spectacles would be of assistance.

(3) Physical stamina of viewer. With conditions (1) and (2) as good as possible, some people tire more easily than others, just as some can walk or run farther than others before becoming tired.

(4) Use. It has come to my notice that a small proportion of newcomers to television suffer an initial period of ocular discomfort, which disappears after a week or two.

The analogy is obvious: probationer nurses not infrequently suffer from aching legs and feet until use enables them to cope adequately with the conditions of their new life.

Your contributor's reference to moles seems to me a little inapt; changes due to evolution, taking thousands of years, are scarcely comparable with the effects, real or imagined, of occupations involving a small proportion of each day during a single lifetime. The confusion here is between heredity and behaviour, though it might be accountable if the author of the article has been thinking, say, about the occupational disease "miner's nystagmus." Here again, comparison between the conditions under which coal is hewed, and television viewed, seems unprofitable.

Conditions under which intensive vision is considered detrimental are progressive myopia and measles.

My own suggestion is, therefore, that unless you are afflicted with progressive myopia or measles, go ahead and enjoy television to your heart's content.

You may get tired eyes or a frontal headache. If you do, several courses are open to you.

(a) Check that the conditions of viewing are as good as you can make them.

(b) If the pleasure is greater than the pain, put up with it.

(c) Find out whether or not a pair of spectacles (not green ones!) would help.

(d) Switch off, and give your eyes a rest before going on again. (Sound broadcasting still has much to offer, you know.)

But—and this is the main point of my writing and upon which I would place some emphasis—you may rest assured that you are most unlikely to be doing your eyes any permanent damage whatever, and the possibility of blindness ensuing from such a cause is even more remote than that of the abolition of purchase tax.—D. G. PERKINS, F.S.M.C., D.Orth. (Liverpool).

YAGI AERIALS

SIR,—In answer to "Erg's" reply to the Rev. Davies re Yagi aerials, may I also say I agree with Mr. Davies as regards the information (re aerials) being as accurate as possible.

Readers of PRACTICAL TELEVISION have gleaned much valuable and expert opinion from writers of articles.

But I am puzzled as to why "Erg" is convinced that the close-spaced array is the better proposition.

In the PRACTICAL TELEVISION issue of January, 1951 (page 353), Mr. E. Roulton, describing various aerials and polar diagrams, says: With closely-spaced arrays, a slight variation in spacing—such as that caused by wind flexing the elements—may cause considerable changes in signal strength, and the result is a certain amount of picture flutter. As closely-spaced aerials have other disadvantages—poor gain and overall bandwidth—the best way out of the trouble seems to be a widely-spaced array.

"Erg" states that close-spaced give maximum gain.

Mr. Roulton states they give poor gain and overall bandwidth, and may cause considerable changes in signal strength. Mr. Roulton gives his opinion and figures on Yagi aerials. "Erg" differs in his opinion!

As a reader of PRACTICAL TELEVISION, I feel we are likely to be put "off the beam" on a question like this. So perhaps Messrs. Knight, West, Thomasson, etc., can help on this question?—J. R. HARDY (New Malden).

THE "TELESQUARE"

SIR,—I should like to thank you for the recently-published design on the Telesquare which has enabled me to service my receiver after considerable difficulty. Perhaps your talented contributors could design a similar type of instrument which, instead of giving just lines in each direction could produce a pattern similar to the Test Card "C." Incidentally, I have not seen such an instrument on the market, and there may be a reason why this cannot be done. If a card of that type is not possible, could not a geometrical design similar to some of the U.S.A. station signals be made which would give a large number of tests with the minimum of trouble? I believe some time ago the BBC used a new card which was known as Test Card "F." Perhaps they will tell us what has happened to this.—H. HOOKEY (Esher).

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A.C./D.C. TELEVISOR

I have completed the A.C./D.C. televisor described in your July, 1952, issue. The set works quite well, but it has two faults, and I should be glad if you could suggest remedies for these.

First, there is a $\frac{3}{8}$in. overlap at the top of the raster which cannot be cured by any adjustment of the frame timebase controls: alterations to the frame linearity control either distorts the picture unbearably or widens the overlap. I have tried various resistance capacity networks across the connection to the frame coil, but to no avail. In fact, the only thing which appears to affect the waveform is a large (1 μF) condenser across the frame transformer primary, which improves the overlapping but effectively lengthens the flyback time. I have not left this condenser in circuit for I cannot be sure whether or not its insertion seriously changes the operating conditions of the frame amplifier valve.

Secondly, the receiver always seems to require slight readjustments on each separate occasion that it is used. Does this fact point to some misalignment in the R.F. stages ?—H. D. Blakelock (Hillingdon).

You should try altering the values of the following components in the A.C./D.C. televisor to overcome the top frame foldover: shunt R51 with a condenser in the range 0.005 to 0.1 μF; increase R53 up to 300 ohms; reduce R52 down to 1 K Ω. You should also experiment with R47 and the components of the timebase oscillator, as a pip may be appearing on the sawtooth at this point. A cathode resistance of up to 1 kW in the cathode of V18 may help. A condenser across the frame coil can do no damage, but if it increases the flyback excessively there is little point in using it.

CHECKING NOISE LIMITERS

In my recently completed "View Master," although I have a satisfactory picture in the main, there is the following snag.

The set suffers from ignition interference on both sound and vision, and I should like to know if there is some method to determine whether the interference circuits are working as well as they should.—W. L. Newberry (Dewsbury).

The only method of checking whether the ignition interference circuits are operating correctly is to disconnect the vision suppressor and note whether there is any difference, whilst with the sound receiver the suppressor rectifier MR1 may be short-circuited, and again note if there is a difference. If the vision suppressor is not operating correctly it can only be that either MR5 is faulty or C52 is disconnected, whereas if sound suppression is poor then it may be due to a fault in a component or to the sound receiver having too narrow a bandwidth with a restricted frequency response.

In the first place we suggest checking R36, C33 and MR1, and if these are considered satisfactory, then we suggest making the following changes:

Delete C25.

Reduce the value of R32 to 47 K Ω.

Reduce the value of R30 to 47 K Ω and use only low-capacity screen sleeving for volume-control leads.

Finally check that there is no instability in the sound receiver and connect a 47 K Ω resistor across V6 anode coil.

DIRTY BACKGROUND

I would like your help concerning my receiver which has developed a fault. I find that when I turn up the contrast control to its proper setting, I get a dirty picture, rather like the effect of rain, but the focusing is O.K.

When I remove the aerial and turn up the contrast I get a number of streaks of white pulling out on each side of the raster. I have checked the aerial, and it is O.K., also on the sound I get a rushing noise with sound, and when I disconnect the aerial it is still there.

Also, the raster is short either side on screen by about $\frac{1}{2}$in., and that is with width control set to give maximum width without extending left side of picture.—W. C. Birks (Sidcup).

The trouble here is probably due to a trace of instability in the vision receiver or a noisy valve. The rushing noise on sound may be due to the same cause, and it is obviously internal as the effect is apparent with the aerial disconnected. The common R.F. amplifier stages should therefore be suspect, and a change in the valves may effect a cure.

Again, a poorly seated valve or a noisy resistance can lead to this effect, and the circuit should be checked for such a fault. If the trouble cannot be located in this part of the circuit, check on the possibility of a slight H.T. leak through a decoupling or smoothing condenser.

The loss of width may be due to an ageing line-output valve, but a H.T. leak as above may be causing an excessive drop. Check the main rectifier.

LINE TROUBLES

I am writing for your advice re my Premier Magnetic Televisor London Model, with 12in. Brimar tube C12B. I recently had a breakdown of the condenser C19 on the vision receiver. I replaced this with a new one, same value, etc., but could only get a very dull watery picture covering two-thirds of the screen. The picture being then wrong way round and also upside down. I cannot understand this as I changed nothing else. I reversed the wires on the scanning coils and brought the picture correct, i.e., right way up and right way round, but still very weak as before. I have tried changing different components, i.e., resistors and condensers, etc. and I accidentally paralleled R15 anode feed 470 K on V5 of line time base. This brought the picture back almost perfect in fact, better than ever before; the resistor was was the same value as R15. I have replaced R15, but with the same results, i.e., watery, two-third size picture until I put another in parallel again. I have run the set for two to three hours at a time since and there does not seem to be any harm done, although it does not seem correct to me.

One more point. The picture is a little stretched on the left about 2in. and slightly misty if I try to close it in by line linearity R34. The R35 resistor gets extremely hot and starts smoking, but cools down when I turn it back to minimum, can you explain this.—E. Miller (Aylesbury).

If the picture suddenly reversed in both directions, you must have had the scanning coils off at some time and replaced them the wrong way round. Changing a condenser in the vision strip and nothing else would not produce this effect.

The trouble seems to be associated with the line oscillator stage; this is functioning incorrectly and the poor picture is probably the result of low E.H.T. If the picture is normal with the anode load of this stage reduced by a parallel component, then one of the charging condensers is probably leaky; you should check on all parts associated with this stage.

Increase the wattage rating of R35 to overcome the heating problem.

CONDENSER TYPES

In "Practical Television," dated June, 1951, you stated that the modification for the View Master, the C45b, 0.001 μF, T.C.C. type should be CP56VO.

Whereas in the View Master, Model C, Holme Moss area. The number and letters are, CP55VO.

Will you please state which is the correct one.?—R. Johnston (Manchester).

The correct condenser for use on C45b position is the T.C.C. Type 56VO, though if the CP55VO was ordered the correct condenser would probably be supplied.

COIL DATA

I am building the vision and sound sections of the television receiver described by S. A. Knight. Vision in "Practical Wireless," page 66, February, 1949. Sound section, page 150 "Practical Wireless," April, 1949. You advised me some time ago as to the modifications required to the coils, etc., to receive the Wenvoe transmission.

Will you please tell me the name of a reliable firm who can supply me with all the coils required for the sound and vision sections.

I note that in the articles the author recommends, "Midco Radio" Wellingborough, but I cannot find their advertisement in recent numbers of "Practical Wireless" or "Practical Television," so I wondered if they were still in existence.

Now for one other item relating to the coils, namely the I.F. coils in the sound section (page 153, "Practical Wireless," April issue). In Fig. 3, showing details of coils L3, L4, L5, L6 (I.F. coils), they are shown as having two even layers of 25 turns each, yet in the diagram showing how they are mounted there are only two leads. Is this a mistake in the description of the windings or is a length of wire folded in the middle so as to enable 25 turns to be put on doubled so that actually there would be 50 turns, this would, of course, still have only two ends or leads to the windings. I hope you can enlighten me on this point.—L. H. Miles (Taunton).

Midco Radio (of 19, Newcomen Road, Wellingborough), can probably still supply the coils you require, and you should write to them to check on this. If they are no longer supplying these coils, you may be able to obtain them from Messrs. Bel Sound, of Marlborough Yard, Archway, N.19.

The coil formers and cores are Aladdin ⅜in. types and are readily available from most advertisers; the full winding instructions were given in the article in question.

The I.F. coils are wound in two layers; first 25 turns are wound on evenly, and the next layer is simply carried on in the *same direction* over the top of the first layer. There are then, of course, only two ends to each complete coil, and a total of 50 turns.

REFLECTED IMAGE

I live in a bad TV district, so I made a double H anti-ghost aerial for Holme Moss (the two H's were constructed out of one of your last year's books, "Wood, Dural Tubing," etc.). I put it on a pole in the garden, and when the dipole was right for Holme Moss, the picture broke up. I received a much better picture with the reflectors facing Holme Moss, but a lot of ghosts.

Would you be so kind to inform me if the following might work: 2ft. 4in. between dipole and reflector, and 4ft. 8in. between the two H's, and if it needs a balancing transformer for co-axial lead-in?—G. Barron (Sheffield).

It would appear that you are receiving a strong reflected signal from some building or other structure behind your locality, and so you receive a better picture when your aerial is facing away from the transmitter. The distance between the two H systems you mention should be half-wavelength, and the two connecting cables can be paralleled at the mid-point connection. No transforming system is necessary.

A.C./D.C. TELEVISION RECEIVER

Could you please inform me if the timebase of the above set, running with the equivalent A.C. valves in the circuit, is capable of scanning the 15in. Cossor tube 85K?

This is the tube I have, and I am wondering if extra H.T. (of which I can supply up to 500 volts) or a different scanning coil is needed for full scan of the tube.—N. Walsh (Hull).

If the tube is narrow angle, the timebases in the A.C./D.C. receiver would probably scan it, but the brilliance would be inadequate. You should run the timebases at 350 volts on the H.T. line and use an E.H.T. doubler for the tube supply in order to be sure of adequate brilliance and full scan. In the circumstances, therefore, it would probably be as well to obtain the scanning components as designed for wide angle work, and sufficient scan will then be assured.

The remainder of the circuit need not be changed; that is, the vision-sound unit and the wiring up to the sync separator.

MODIFYING CHANNEL 2 "VIEW MASTER"

I have been running for some time now a "View Master" on Holme Moss, but as I am removing to an area which is covered by the Wenvoe Transmitter I was wondering whether you could give me the full details of conversion to this particular station.—H. G. Peers (Manchester).

It should certainly be possible to modify your Holme Moss "View Master" for reception of Wenvoe and the simplest and most economical way is to remove three turns from each tuning coil except L110 and L112 which should only have one turn removed; L109 may be deleted entirely. It will, of course, be necessary to realign the receiver and this may be done on the transmitted signal.

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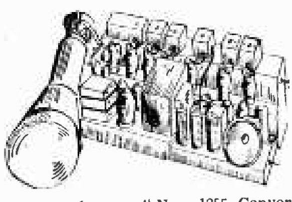

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