PROJECTION TV

PRACTICAL TELEVISION

AND TELEVISION TIMES

EDITOR F. J. CAMM

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A NEWNES PUBLICATION

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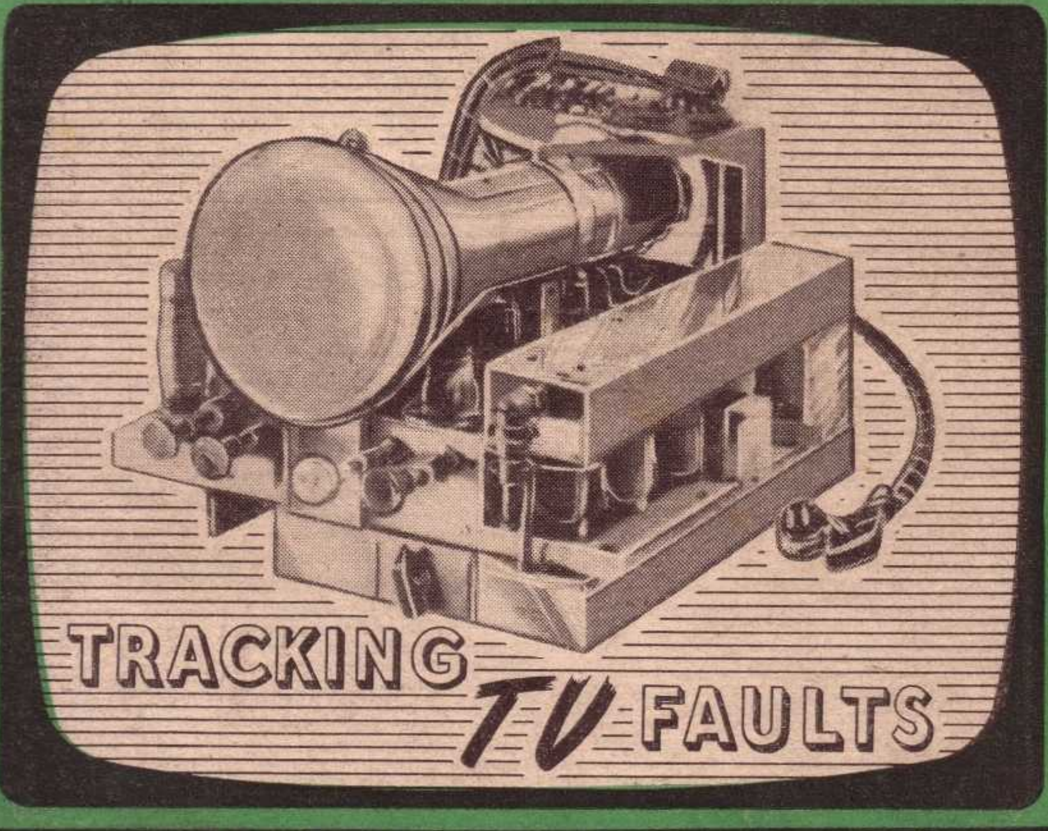

FEATURED IN THIS ISSUE

- Better Pictures
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- Phosphors and Colour TV
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PRACTICAL TELEVISION
& "TELEVISION TIMES"

Editor : F. J. CAMM

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TELEVIEWS

Television on Tape

THE Radio Corporation of America recently gave a demonstration of television from a tape recording—a new technique and a most important contribution to television, for it supplies a link in the electronic chain which has been missing since television was invented. We are aware, of course, that disc recordings of thirty-line transmissions were available over twenty years ago.

The new method is similar in most respects to the tape recording of sound. It is, indeed, a system of electronic photography or video recording. If someone could now devise a means of amplifying light two of the major problems connected with television would be solved. The difficulty with projection television is that as the size of the picture is increased the light is correspondingly reduced. The new system can be employed for the motion picture and theatre industries, for education and for home entertainment. It provides the television industry with a practical and cheap solution to programme recording, immediate playback and rapid distribution. Magnetic tape requires no chemical processing and the recorded pictures can be viewed the moment they are taken. An unlimited number of copies can be made quickly and they can be preserved indefinitely for historic reference ; or they can be electronically erased and the tape, of about newsprint thickness and half an inch wide, used again.

As video tape recording technique develops, other possibilities will open up. Small portable television cameras are already in wide use in industry, in stores, in banks, in schools and colleges. Low-cost television cameras that work like satellites off home television receivers are ultimately possible.

It would seem that the cost of recording a colour television programme will be only about 5 per cent. of what it costs to put it on colour film.

In the demonstration a colour television programme originating in NBC Studios in Radio City, New York, was beamed by radio microwave across the 45-mile span to RCA's David Sarnoff Research Centre at Princeton, New Jersey.

This programme was seen as it arrived. At the same instant, RCA's tape recording system recorded the television picture on tape. During part of this transmission, both the live programme from the microwave radio relay and an immediate play-back of the magnetic tape recording were shown.

As soon as the tape reel was rewound it was played back and the recorded television pictures appeared on two RCA colour television receivers which were viewed by a large group of press representatives who witnessed the demonstration.

In the first part of the demonstration, previously recorded magnetic tapes were run through the equipment. This phase included the reproduction of both black-and-white television pictures and colour television pictures that had been beamed over the same New York to Princeton micro-wave link at an earlier date.

Up to the present time television programmes have been recorded on film, a costly and rather bad method in which the pictures pass from the television camera through most of the television system to be reproduced on a small picture tube. A special motion picture camera then photographs the programme on motion-picture film. The film must be chemically processed and, usually, a print made before the pictures can be reproduced.

Super-Visor Blueprints Now Ready

FULL size blueprints of the Super-Visor, recently described in this journal, are now available at 7s. 6d. for the three sheets. A reprint of the constructional data is included with every set.—F. J. C.

NEXT MONTH!

FREE BLUEPRINT OF THE "SIMPLEX"

A free blueprint of our latest TV receiver for constructors—the SIMPLEX—will be included with every copy of next month's issue on sale February 22nd. It may be built for about £16.0.0, and is an ideal set for beginners. It makes use of the popular VCR97 6in. tube.

TELEVISION IN EIRE

SOME NOTES ON RECEPTION CONDITIONS AND HINTS FOR HOME CONSTRUCTORS

By L. B. Moore

ALTHOUGH the Irish Republic has not yet a television service of its own there are quite a few enthusiastic viewers in that country. The majority of these viewers are home constructors, although commercial receivers are used in conjunction with pre-amplifiers and high-gain aerials.

The BBC station at Belfast will provide a usable signal to counties near the border when it is on full power and a serviceable picture should be obtained in the counties of Louth, Monaghan and most of Cavan.

It may be possible to get a serviceable signal in the counties of Meath and Dublin and we have had reports of the sound channel being received in Dublin itself at quite good strength under favourable conditions, from the low-powered temporary transmitter.

In the main, Southern Ireland will depend upon the existing high-powered stations in Britain.

Fig. 1 shows a map of the conditions and gives approximate distances of the main towns from the nearest TV transmitter.

The reports so far received indicate that Holme Moss is the main station received in the Dublin area. It is about 180 miles distant, but much of this is across the sea where attenuation of the signal is at a minimum.

Sutton Coldfield is not received so successfully due, probably, to the Welsh hills.

Waterford is in a difficult situation, as both Holme Moss and Sutton Coldfield are well over 200 miles away. Wenvoe is the most favoured station at this point and good reports have been received.

Cork relies on Wenvoe and although 230 miles separates the two places, good pictures have been received under favourable conditions.

Limerick is in a particularly poor position so far as reception is concerned. We have not received reports from this area to date but it would appear that Wenvoe should provide the best signal.

Fig. 1.—Approximate distances of some Irish centres from the BBC Transmitters.

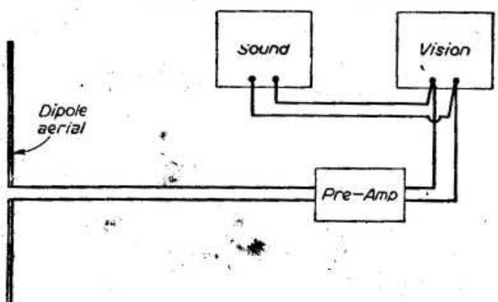


Fig. 3.—Block diagram of two separate receivers with a common pre-amplifier.

TV Receivers

For long distance reception such as in Eire it is necessary to use a superhet. It is possible to receive pictures in the localities mentioned by use of R.F. amplification only, under favourable conditions, but a minimum of six stages is required and such an arrangement is difficult to set up.

The amateur constructor relies mainly on the R1355 and this is one of the very best units for the job, if used with an RF26 or RF27. The RF24 or 25 unit does not give anywhere near the same amplification of signal.

Where Holme Moss is received, then the RF26 should be used. The frequency covered by this unit is not low enough for both vision and sound channels, but it can be very easily modified by the insertion of iron dust cores in the coil forms of the R.F. mixer and oscillator stages. The cores should be set level with the tops of the formers and when the station is tuned in on the dial they can be adjusted for maximum response.

A one-valve pre-amplifier can be used in conjunction with the R.F. unit. It is possible to use a two-valve pre-amplifier but the increased gain is offset by the increased noise.

Where a one-valve pre-amp. appears insufficient then a low noise pre-amplifier can be added in front of the existing one. A suitable type which is very easy to set up was described in the November, 1952 issue of PRACTICAL TELEVISION ("Low Noise Pre-Amplifiers,") and the circuit is reproduced in Fig. 2.

For maximum results the video output valve of the R1355 unit can be replaced with an EF50 and the cathode can be decoupled by a 50 μF 25 v. working condenser.

Separate Sound

It will be found better to use two separate receivers for sound and vision rather than to try to compromise by taking the sound off from some section of the vision receiver.

Two 1355 receivers with RF26's will work quite happily together, one on the vision and one on the sound. The two aerial input sockets can be connected in parallel as shown in Fig. 3.

Under normal conditions it will not be necessary to use all five I.F. stages for the sound channel; generally, four stages will be quite sufficient. The simplest way to modify the receiver is to take out the second I.F. valve and connect its grid cap connection directly to the third I.F. valve.

The R1355 has been mentioned in detail as it has been proved to be one of the most useful units for long-distance reception. Other suitable units are the R3084 and the R3170.

If a straight receiver is preferred, then the 194 strip is most useful as it possesses six R.F. stages, and a pre-amp can be added.

Where a televisor is built to a standard superhet circuit, then an improvement in gain can be obtained by restricting the bandwidth to just below 2 Mc/s. It will be found that a satisfactory picture can be obtained under these conditions. It is better to receive a picture that has lost some of its fine detail than to have one whose fine detail (and, indeed, most of the detail) is obscured with "snow."

One difficulty associated with reception at long ranges is that of arranging a compromise between vision and sound. Most superhets take the sound signal from the first or second vision I.F. stages and the oscillator has to be so adjusted that the picture signal is set 6db down on the carrier. This means an apparent loss of half the power of the vision signal; moreover, the R.F. and mixer inputs have to be adjusted to compromise between vision and sound.

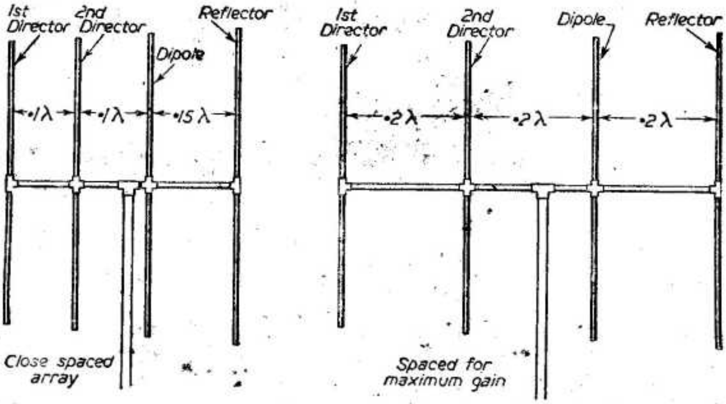


Fig. 4.—Two types of multi-array. Spacing depends on the frequency.

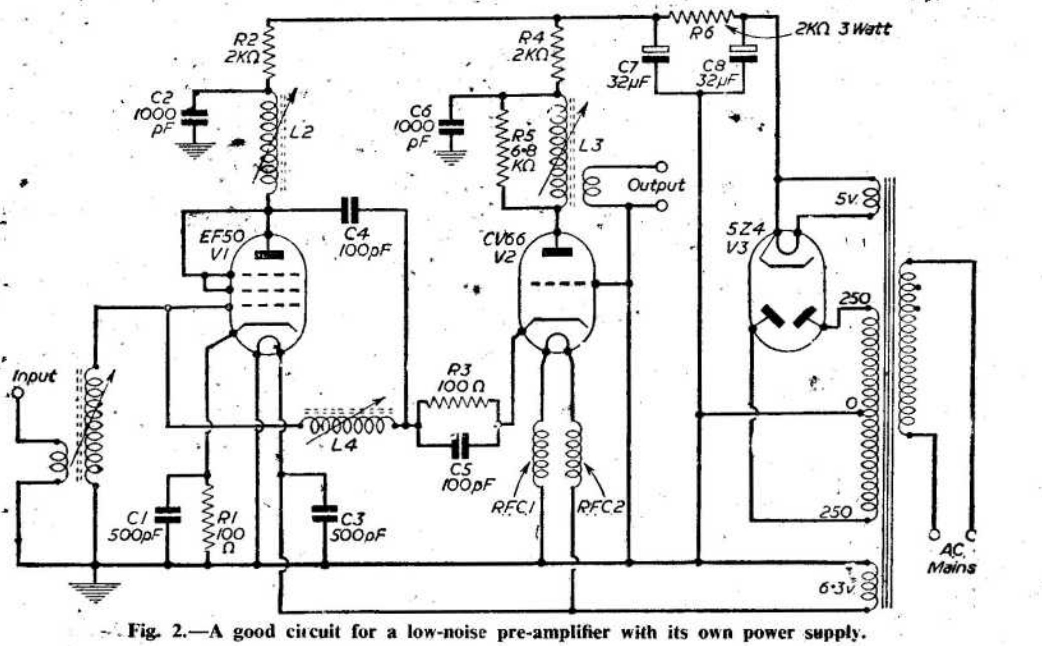


Fig. 2.—A good circuit for a low-noise pre-amplifier with its own power supply.

The difficulty can be overcome by the construction of a separate sound receiver, the existing receiver being peaked up on the vision signal so as to obtain the best quality combined with quantity. The existing sound section of the receiver can be ignored.

Aerials

This is undoubtedly one of the most important parts of the equipment. A high-gain aerial is a *must*

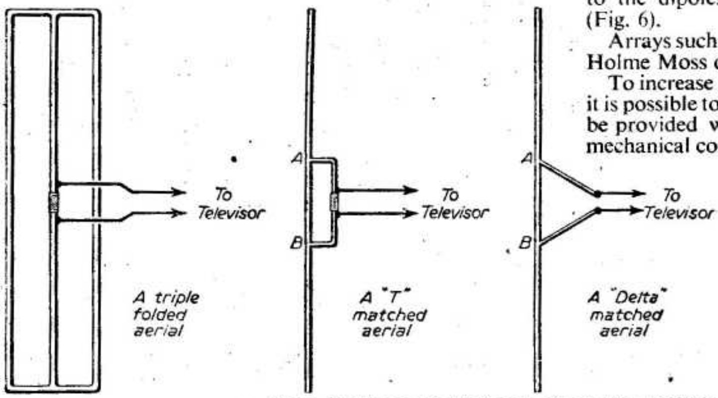


Fig. 5.—Folded aerials and methods of matching.

for Eire. The minimum array which will perform satisfactorily is the Yagi array comprised of a dipole, director and reflector.

A better array is the dipole with two directors and reflector. Maximum gain will be obtained with all elements spaced at 0.2λ and such spacing is quite suitable for the reception of Wenvoe. For Holme Moss, however, the array is inclined to be too bulky and spacing of the directors at 0.1λ and the reflector at 0.15λ is recommended (Fig. 4).

The aerial must be matched to the cable and to do this the dipole can be folded (double or triple according to the array) or a Delta or T match employed (Fig. 5.)

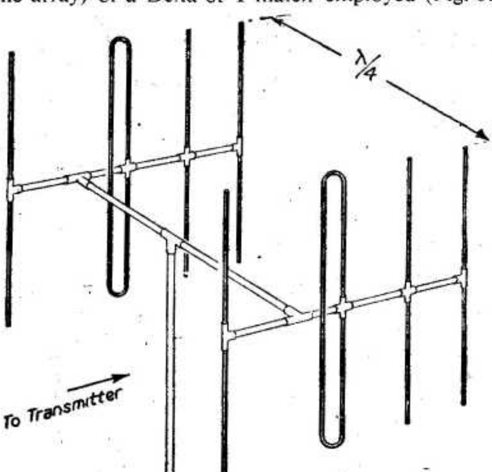


Fig. 6.—For areas of very weak signal strength an elaborate array of this type is not only desirable but, in many cases, essential.

Very good results can be obtained by use of a double array comprising two Yagi arrays with 0.1λ, 0.1λ, 0.15 λ spacing. This array is about the maximum which can be erected with safety without going to heavy expense in providing a suitable mast, etc. The two sections are spaced at 0.25λ and the coaxial connections from each dipole are connected in parallel to the down feeder, in the centre of the cross-boom. It is important that the two lengths of cables to the dipoles are of *exactly* the same length (Fig. 6).

Arrays such as these have been found to receive Holme Moss quite well in the Dublin area.

To increase the gain of a Yagi array still further it is possible to add more directors. The aerial can be provided with six or more directors, but the mechanical construction of such an array is likely to become rather a problem. Vertical polarisation does not lend itself readily to the stacking of arrays with multi-directors, such as is used in other types of V.H.F. reception.

It is almost unnecessary to remark that the arrays should be erected as high as possible and that the connecting cable to the receiver should be of the fringe type coaxial so as to reduce losses to a minimum.

Fading

Fading is a real nuisance when receiving at long distances. It is a simple matter to fit A.V.C. to the sound section in a similar manner to that employed in the normal broadcast receiver, but the vision receiver presents a more difficult problem.

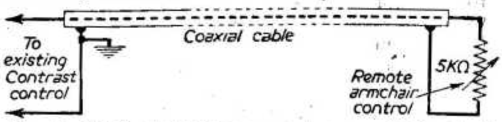


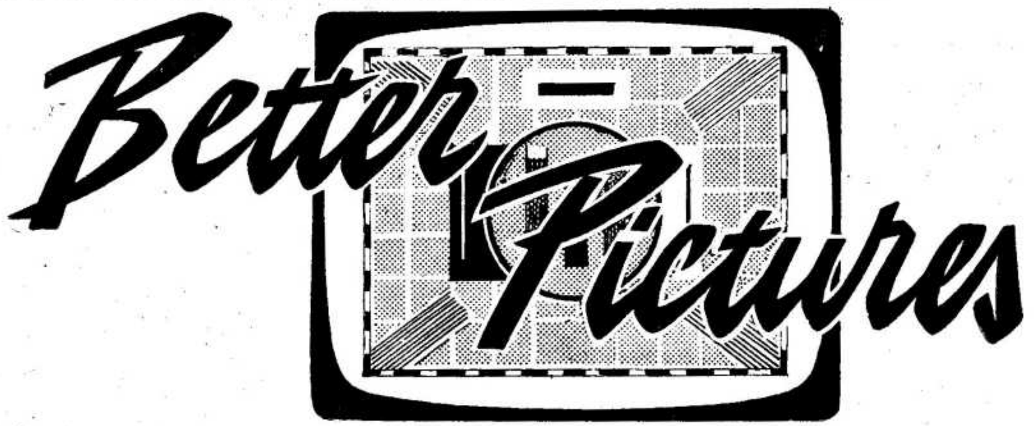
Fig. 7.—Method of fitting a remote or armchair control.

The easiest solution is, perhaps, to rely on a manual control fitted as an armchair contrast control.

Such a control can be fitted very simply. All that is needed is a length of coaxial cable and a 5 KΩ potentiometer ; one end of the coaxial is connected across the existing contrast control in the televisor, the outer braiding going to the earthed terminal on the control. The other end of the coaxial cable is connected to a 5 KΩ potentiometer which is mounted in a small box. The control in the televisor is set at minimum contrast and picture-fading counteracted by the remote control (Fig. 7).

The measures outlined above should assist in the reception of British TV in Eire until such time as Eire has its own TV system.

When that happy day arrives we shall, perhaps, reverse the process and equip our own televisors for long-distance reception, in order to receive programmes from Eire.



Better Pictures

SOME HINTS ON METHODS OF IMPROVING RECEPTION, WITHOUT DRASTIC MODIFICATIONS

By W. J. Delaney (G2FMY)

HAVING built a television receiver, many constructors are content to leave well alone—provided, of course, that there are no important difficulties such as failure to interlace, unstable timebases, etc. As a result, many amateurs are looking at pictures which are by no means the best which could be obtained on their particular receivers and there are several things which may be done to improve matters—without going to the trouble of re-building or making drastic alterations. First of all, what is a good picture? Many viewers, even those with commercial receivers, fail to make properly the necessary adjustments, and regard the picture which they receive as a good one, or perhaps think that, although it is not as good as a picture seen at the cinema, it is the best which can be obtained on a television receiver. If possible, therefore, one should visit a really good demonstration and see just what high quality is really obtainable from the BBC transmissions. Failing this, it may be stated that the picture should range between a really good black and a really bright white, with good fine detail all over. A picture which seems to be slightly " fuzzy "—not exactly out of focus, but without really sharp outlines, and where the blacks are slightly grey, and dirty whites, is by no means necessary. Some of these faults result from bad adjustment of the controls and therefore we will deal first with those faults—assuming that the receiver has been properly lined up and is a good sound design.

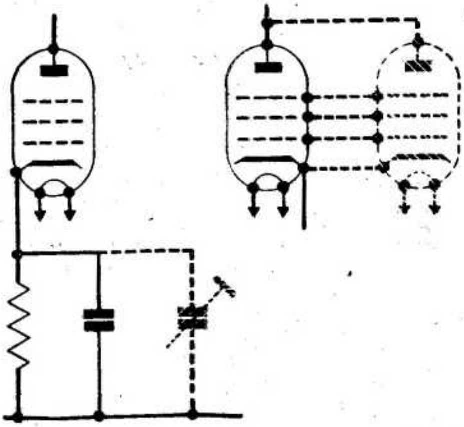
Bandwidth

It has already been explained in these pages that for good detail an endeavour should be made to receive the maximum bandwidth, and this will vary according to the type of receiver. If the correct coils are used, and a published design is followed the receiver will, therefore, accept the maximum bandwidth, but this is of little use if the aerial system is unsuitable—either because it is cut for another channel or because it is home-made and lacking in good insulation, or because it is mismatched due to the use of the wrong type of lead. An aerial input circuit in a television receiver may be designed either for a coaxial or a twin-feeder, which may or may not be of the screened type. It is essential, therefore, to use the type of feeder which is called for, or to alter the input circuit so that the feeder you use is correctly matched. Furthermore, the aerial should be accurately cut to the dimensions which the local channel calls for, and if it is not correct it should be cut down, or lengths of rod added to make it correct. If this is not done then it is useless to expect the receiver to accept a suitable waveband.

Next comes the question of the tuning, and if, due to some faulty wiring or difficulty in trimming, it is not found possible to obtain both maximum sound and vision, an attempt should be made to receive maximum vision and then to try and improve sound by some external means—such, for instance, as using a separate sound receiver. Never compromise in an endeavour to improve the sound. In the same connection, there may be sound traps in the vision circuits and if these are not adjusted correctly they will affect picture quality. In some cases it may be preferable to short-circuit these whilst making the vision adjustments, and then to remove the short-circuits and re-trim slightly if necessary. This will, of course, depend upon the position in the circuit which the sound-traps take up. A similar remark applies to any interference limiter which is fitted. In the majority of cases the limiter merely cuts off above a certain level to prevent the interference spot from becoming large and defocussed, but if the values of components used are incorrect, it will cut off at a sufficiently low level to prevent maximum whites from being obtained, giving a dirty effect to the picture. If, therefore, the limiter is of the type having a fixed resistor and condenser associated with a diode, it may be found worth while replacing the fixed resistor by one of half the value, and making up the remainder of the value by either a variable or two or three fixed resistors in series, a plug and socket being used to tap off one or more, so that the whites are improved. In some areas it may be found worth while to cut out the limiter entirely in the interests of better whites.

Contrast

Most receivers have a contrast control, and in some models there is an additional control usually labelled sensitivity. In the majority of receivers both of these are merely R.F. gain controls, although in one or two commercial models the contrast control may be found to be a normal L.F. control preceding the video stage. This control, no matter where it is situated, must be operated in conjunction with the brilliance control, and it adjusts the strength of the signal. If set too far back, the picture will be watery unless the brilliance control is turned back so far that the picture can only be seen comfortably in a dark room.



Two Video Amplifier Improvements—an adjustable bias by-pass condenser and a paralleled output valve.

As the contrast is turned up, or in other words as the strength of the signal is increased, the brilliance may also be turned up, until a stage is reached where the picture in full black and white can be viewed in a normally lighted room—provided, of course, that the light does not fall directly on the tube face. There is, however, a balance between the contrast and brilliance which it is most essential to retain. If one or other is too far, then some transmissions will be found too dark and others too bright—especially in the newsreels, for instance, where the lighting is varied and not under the control of the operator. If you find, therefore, that during a newsreel transmission you have to keep adjusting brilliance, then it is most likely that your contrast control is wrongly set. Unfortunately it is not possible to give an exact indication of the best setting, in view of circuit differences, but a good idea of the correct adjustment may be gained by the following procedure. Remove the aerial lead, turn the contrast (and sensitivity control if fitted) and brilliance right back. Switch on and when the receiver has warmed up, advance the brilliance control slowly. This procedure should be carried out in a semi-darkened room, or at least with the tube face screened from direct light. As the brilliance is advanced a point will be reached where the illuminated raster will become visible. The adjustment must be made very slowly so that there will be no backlash which might occur in some circuits. The moment the raster may be seen stop and wait a moment and see if it disappears ; if so, advance the control a little further, and wait again. When a stationary raster may just be seen, turn back the control until it just vanishes. Again this should be done very slowly in case there be any circuit components which hold a charge or otherwise give a delayed action to the control. As soon as the raster has disappeared, plug in the aerial and then very slowly advance the contrast and/or sensitivity controls. In some circuits one or other of these may have to be turned fully on before the other comes into effect, whilst in others they may both work together. In any case, one or both of these controls should be turned until the desired picture is obtained. If it is found that with the setting previously made with the brilliance control a picture cannot be obtained with the contrast control fully up, then a pre-amplifier is called for. If, on the other hand, directly the aerial is plugged in, the picture is too bright, then an attenuator should be fitted as the signal is too strong. A final *slight* adjustment may afterwards be made to the brilliance control, but it should be very little.

Video Stage

The video stage is the most important part of the receiver, and sometimes a picture may be improved by an adjustment of the by-pass condenser connected across the bias resistor. If this is $.002\mu F$ or greater some attempt should be made to improve the tuning of earlier stages. A low value is preferable in this position, and again a fixed component may be removed and replaced by a fixed of half the present value with a pre-set of equal value in parallel as shown in the illustration. Adjustment of this pre-set will give a good indication of the conditions in the video stage. It will probably be found that at a low value the picture is not sharp, but as it is increased the image sharpens up until a stage is reached where all the objects are outlined in white. This is bad, and the control should be backed off until the outline disappears and if the picture is then not sharp, the tuning circuits need attention, and/or any peaking chokes or circuits in the video stage should be attended to. In many cases the valve used in the video stage is too small to deliver a signal capable of fully loading the picture tube being used, and an improvement may easily be effected in such a case by adding a further similar valve in parallel. Provided that the mains section will deliver the necessary extra H.T. and L.T. current, simply mount another valveholder as close as possible to the existing video stage and wire similar pins together. This has the effect of halving the impedance of the stage, and therefore it may also be possible to add a similar anode resistance in parallel with the existing one—the lower the anode load the straighter the frequency response. Instead of adding a valve in parallel an alternative valve may often be used, again, provided that the existing power unit will deliver the necessary extra load.

Weather Report and Forecast

THE daily weather report and forecast took a new shape as from January 11th.

Two meteorological experts, T. H. Clifton and George Cowling, both from the Air Ministry Meteorological Office, deliver the daily report and forecast. They appear in rotation, each taking two or three days at a time.

The experts will appear every night in vision, and with the aid of maps, show the current weather trends.

T. H. Clifton, 43, has been forecasting weather for fifteen years. During the war he was attached for this purpose to the R.A.F. Bomber Command for four years. George Cowling, 35, joined the Meteorological Office in 1939 and was also a meteorological officer in the R.A.F.

Pages from a TELEVISION ENGINEERS Notebook

13.—AUTOMATIC BRIGHTNESS SYSTEMS

IN modern TV systems where the average brightness of the studio scene is radiated as a variation in the carrier amplitude, the effect is equivalent to the transmission of the D.C. component of the scene. Since, however, the D.C. is not conveyed as such through the entire system, it is necessary to recover or reinsert the D.C. component at the receiver, such recovery providing a form of automatic brightness control.

Consider Fig. 1 (a) where a grid-modulated picture tube is fed through a resistance-capacity coupling CR1 from the anode of the video amplifier V1. A constant bias is given to the grid of the tube by the positive potential of the cathode derived across the potentiometer R2, the bias value being Eg as indicated. The condenser coupling from the video stage permits the vision signal appearing across R1 to swing about the *average* level of the waveform at any particular instant, this average level being such that *equal areas* of the vision waveform are developed on either side of the average level line.

In Fig. 1 (b) the Ia-Eg characteristic of the tube is shown with two widely differing vision signals applied to its grid. The first of these represents a predominantly white picture, while the second is predominantly black. Considering for the moment the application of the white signal, the tube bias Eg will be adjusted so that the sync pulses swing the tube beyond beam-current cut-off. The average level of the signal will centre about the bias point and the peak-white level of the signal will be near that part of the tube characteristic corresponding to zero bias. With this setting of the bias (brightness control) the peak-white picture will produce a beam current Ia as the figure shows. During the sync pulses the tube is cut off and at peak white level the bias is reduced to near zero

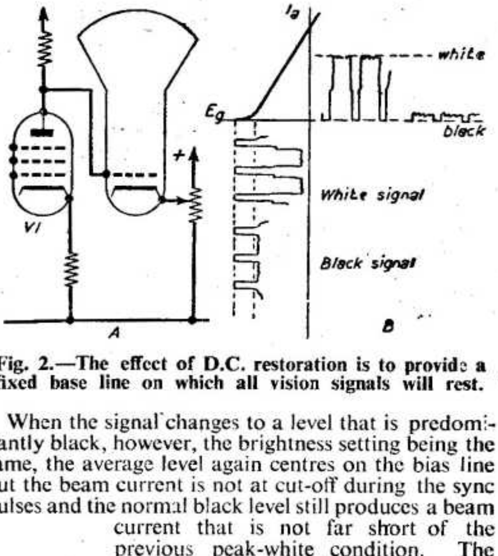


Fig. 2.—The effect of D.C. restoration is to provide a fixed base line on which all vision signals will rest.

When the signal changes to a level that is predominantly black, however, the brightness setting being the same, the average level again centres on the bias line but the beam current is not at cut-off during the sync pulses and the normal black level still produces a beam current that is not far short of the previous peak-white condition. The result is that the flyback lines are plainly visible and the general raster brightness is not far below maximum. It is seen, therefore, that the simple fixed bias operation of the tube fed through a condenser coupling is not satisfactory due to the serious distortion of contrast values and the appearance of flyback lines on most types of picture. For proper operation, the black level of all vision signals must be maintained at approximately tube cut-off and the bias level will then be set also at this point. The problem then is to get the vision signal to "sit" *on* the tube bias line, so that all degrees of brightness lift the beam current successively higher up to the limit of peak white or near-zero bias. It is

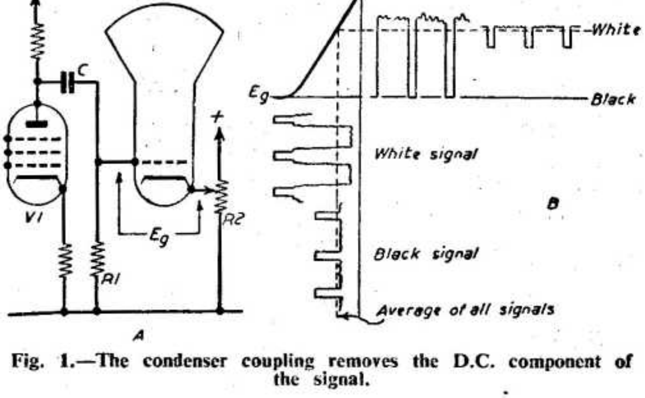


Fig. 1.—The condenser coupling removes the D.C. component of the signal.

assumed in the following notes that the video output is positive-going in phase and that the tube is grid modulated.

Direct Coupling

By using direct coupling between the video amplifier and the picture tube, the D.C. component is retained and the black level is maintained at a fixed point on the tube characteristic. This form of coupling therefore provides a simple form of automatic brightness. Fig. 2 (a) shows a basic system and with minor changes (usually concerned with the response characteristics of the amplifier) this circuit is now used on most commercial receivers.

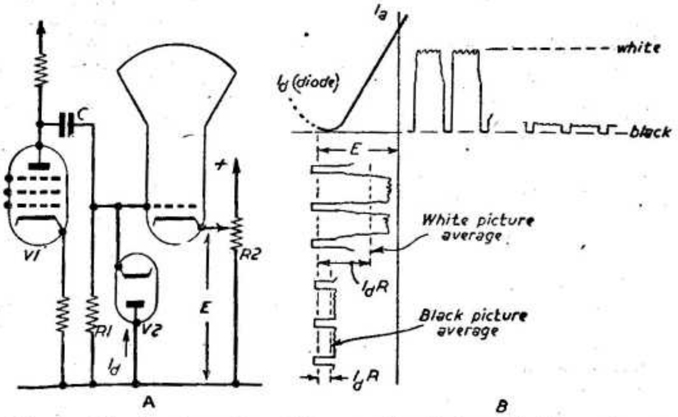


Fig. 3.—Showing the action of the restoring diode used with condenser coupling.

The vision signal of full white and predominantly black pictures is again shown on the grid characteristic at (b), and it is seen that the bottoms of the sync pulses are now held (or clamped) at the same level for both inputs. The resulting beam current is then seen to produce the proper contrast values above the cut-off line, and the sync pulses effectively increase the bias beyond cut-off during the periods of flyback. A disadvantage of this system is, of course, that if the video amplifier fails or the signal is cut off, the grid of the tube is carried beyond the cathode potential (positively) and there is the danger of damage. This can be easily overcome by modulating the tube cathode with a negative-going signal, or the insertion of a cathode follower between the video amplifier and the tube. The latter requires the insertion of a coupling condenser, however, and the D.C. component then has to be restored in the manner about to be described.

Diode Restoration

The use of a diode to bias the tube in accordance with the vision signal level appearing at the tube grid is well known and is a method of operation having several advantages for the home constructor who does not like the risk of direct coupling.

The basic circuit is shown in Fig. 3 (a), the coupling condenser C again being present. The tube bias now consists of two components, that due to the fixed cathode potential developed across the potentiometer R2, and a voltage generated by the diode wired across the input resistance R1. Consider again the application of the vision signals previously drawn ; the conditions are shown in Fig. 3 (b).

The fixed bias Eg from R2 is normally set to a point just beyond beam-current cut-off. The average level of the signals (shown dotted) would centre about this bias as previously described if the diode were absent, but due to the action of the latter valve, another bias is developed, equal to IdR1, and nearly equal to the peak value of the signal, in opposition to the fixed bias Eg. The result of this action sets the vision signals so that the bases of the sync pulses just draw a diode current Id to make up the normal leakage through R1 during the line intervals, i.e. near peak rectification of the vision signals.

The beam current produced by the all-white signal is shown in the figure with the peak-white level near to tube zero-bias and the sync pulses below cut-off.

With the same setting of the brightness control R2, the predominantly black p cture still draws diode current on the bases of the sync pulses, but to a smaller degree than for the white picture, producing a positive bias proportional to the negative peak amplitude of the signal. The figure shows the operating condition, the beam current during the line scan being just above black level, and cut-off during the flyback period. This method of coupling is quite safe, for the video amplifier failure referred to above cannot affect the fixed cut-off bias of Eg.

A further advantage of diode restoration is that with normal values of the leak resistance (R1) the bias developed by the signal rectification is a linear function of the peak amplitude of the vision signal.

Design Considerations

Before proceeding to other systems of restoration, a few notes will be made on the design points of the diode method latterly mentioned.

The exact amount of bias developed by the diode depends upon several factors, and Fig. 4 (a) and (b) should be studied in connection with what is to follow. The video amplifier is considered as a generator producing a voltage e and having an internal impedance

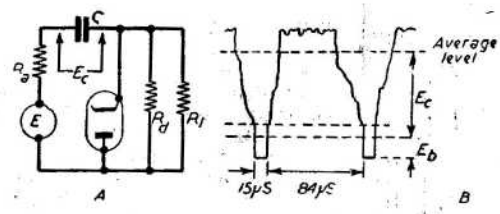


Fig. 4.—Diagram used for calculating design factors for the diode restorer circuit.

Ra, driving the diode through the coupling CR1. Rd is the diode resistance during conduction and will be a matter of some 500 ohms for the miniature valve types now available. When the diode is cut off, of course, Rd, may be taken as infinite.

The vision waveform of Fig. 4 (b) is that of the standard form of the present 405-line system.

The sync pulse width, in time, is about 15 μsecs., while that of the active line scan, operating at 10,125 cycles per second, is roughly 84 μsecs. If the diode is to charge condenser C during the period of one sync pulse, the time of charge will obviously be 15 μsecs., while the period of discharge will be 84 μsecs. In the figure, the voltages ec and eb represent respectively the voltage appearing across C in the form of bias and the voltage that permits the charge to be maintained. If the system is to remain in equilibrium, the quantity of charge supplied to C during the sync pulse must equal the quantity of charge lost through leakage during the active line scan. From this, the ratio of ec to eb may be determined.

Consider the time-constant of C and RaRd in series, the charging state. If this is large compared with the discharge period of 84μsecs., say 0.1 sec., the discharge current may be taken as a linear function of time equal to eb/(Ra+Rd). Further, if C (Ra+R1)—the discharge circuit—is large compared with the sync pulse charging period of 15μsecs., say 350 μsecs., then the charge current may assumed to be constant also, and will be equal to ec/(Ra+R1). For constant current, Q=It, therefore for a state of balance

$$Id \times 0.85 = Ic \times 0.15$$

(percentages of line scan and sync pulse being taken here) where

$$Id = \frac{eb}{Ra + Rd} \text{ and } Ic = \frac{ec}{Ra + R1}$$

From this $\frac{ec}{eb} = \frac{15}{85} \cdot \frac{Ra + R1}{Ra + Rd}$

Taking Rd=500 ohms, Ra=3,000 ohms, R1 = 1 mΩ, and C=0.1 μF, we get

$$\frac{ec}{eb} = 17$$

Turning back to Fig. 4, it will be seen that the sum of ec and eb is equal to the peak value of the vision signal in the direction of the sync pulses. From this the bias ec may be found in terms of the peak value, and in the present case is 85 per cent. The signal of Fig. 4 (b) is predominantly white, but the above analysis as a function of the peak value applies equally well to a signal that is predominantly black. A white signal might, as an example, have a peak value of 40 volts which would produce 85 per cent. of bias (34 volts), while a black signal with a peak value of, say, 5 volts, would produce a bias of 4.25 volts.

Further systems of D.C. restoration and automatic brightness control will be described next month.

Making a Cage Aerial

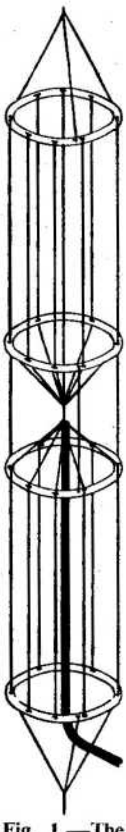


Fig. 1.—The Cage Aerial.

SEVERAL articles dealing with the subject of aerials have appeared in previous issues of this paper. Whilst most types have been dealt with, the cage dipole seems to have been somewhat neglected. Excellent results can be obtained with this particular type of aerial. No other gives a wider bandwidth. This is a most important factor. No matter how good the receiver, high-definition pictures cannot be obtained if the aerial has insufficient bandwidth.

The aerial is simple to make, inexpensive and easy to erect. Experiments indicate that it is probably more efficient than the slot aerial, takes up considerably less room, and can be made directional by the addition of a reflector.

Construction

All that is required to construct the dipole are four wooden rings, 3in. to 4in. in diameter, plus some seven-stranded copper wire. This can be bought quite cheaply at the popular stores, a 50ft. coil costing 2s. It is built to form a cage, as shown in Fig. 1. The length of wire needed can be calculated from Table I. It will, of course, vary according to the particular channel. Referring to Fig. 1, it will be seen that the dipole is made up of two sections each comprising eight wires equally spaced around the rings. Before the wires are fixed into position it will be found advantageous to drill eight small holes in each ring to enable the wires to be securely anchored. When this has been done the construction of one section of the dipole can be commenced. Table I shows the length of each half of the dipole. For instance, Channel five requires eight wires, each 3ft. 7in. in length for each half of the dipole. So, for the complete aerial 57ft. 4in. of wire would be required. Each one of the eight wires should be firmly secured to one of the rings. The other end of each wire is then threaded through its respective hole in the other ring, secured, and a sufficient length of wire left so that all eight wires can be soldered together, as shown in Fig. 1.

The other half of the dipole is made up in exactly the same way. Next comes the assembly, including the fixing of the co-axial cable. The inner wire of the co-axial should be soldered to the top half of the dipole. The braiding should be soldered to the bottom section. The gap between top and bottom of the dipole should be about half an inch. Three pieces of stout string should be used to keep the two sections correctly spaced. The whole aerial should then be firmly secured to the top and bottom beams in the loft.

For those who wish to add a reflector, details are given in the table below. The addition of a reflector increases the forward gain of the array and reduces the pick-up of noise from behind the aerial. The reflector differs from the dipole in that it is made up of one section only. It has no connections made to it, and it is so positioned that the dipole is directly between it and the transmitter. (P. DODSON.)

DATA FOR ADDING REFLECTOR

Channel	Dipole (each half)	Reflector	Spacing
1	**5ft. 5in.**	**11ft. 2in.**	**3ft 5in.**
2	**4ft. 8in.**	**9ft. 8in.**	**2ft. 10in**
3	**4ft. 3in.**	**8ft. 10in.**	**2ft. 8in.**
4	**3ft. 10½in.**	**8ft. 0½in**	**2ft. 5in.**
5	**3 ft. 7in.**	**7ft. 5½in.**	**2 ft.1½in.**

ALTERNATIVE PROGRAMMES

By S. Simpson

SOME aspects of the question of providing a second and, perhaps, a third alternative television programme appear to have been overlooked during the recent discussions regarding alternative TV, and in this article the writer hopes to bring these points forward, illustrate their difficulties, and mention what might have been a solution to many of the problems.

That there is a need for alternative entertainment cannot be denied; not everyone likes ballet, and there are probably a lot of viewers who find no amusement in "Café Continental." All of us, however, pay a licence fee and many of us pay a fair amount for maintenance insurance. Quite rightly, viewers expect the maximum of entertainment from television; the development of the commercial TV question has interested them not a little.

The possibility of the introduction of alternative programmes, outside the existing BBC channels, raises a number of interesting problems, some of which are discussed here by our contributor. It would be interesting to know whether any manufacturers have yet attacked the technical problems raised.

Aerial Problems

As a first consideration of the problem, it is difficult to determine how reception is going to be achieved satisfactorily on frequencies greatly different from those now in use by the BBC while using a directional aerial tuned and oriented to the local BBC television transmitter. Harmonic reception will not provide a satisfactory answer since the reflector spacing which, for optimum reception, should be quarter-wave, approximately, cannot be readily altered, and certainly not in the middle of a dull BBC programme!

Other aspects of the aerial question arise; if more than one aerial is necessary—even a short U.H.F. dipole—what is to be done in the matter of obtaining permission from landlords to erect a multiplicity of aerials? In some areas, even at this stage of advancement of television throughout the country, it is quite difficult to obtain permission for the erection of *one* aerial, and that sanction itself costs a fair sum. What reaction to a request for a number of aerials can we expect?

Another matter which, perhaps, is not quite so evident, nevertheless, may soon pose a sticky problem is the question of technical staffing of "alternative" transmitters, whether under the direction of the BBC, the Government, or the private companies. Regarded from a national point of view, TV is still a very new form of entertainment and therefore has not the same technical "pool" from which to find its staff. Now, if the new programmes are going to hold the viewer's interest up to the introduction of the advertiser's products, the transmission and the setting must be of the highest quality. That is a simple statement of fact. It is not so simple to state where the men who can put over such high-quality performances are to be found. Keeping in mind the limited "pool," does this mean competition between the BBC and the proposed new Association for the services of the finest engineers and studio technicians? And, what of the manufacturers? Are they to see their "key" men enticed away?

Fees

When one considers the nation-wide advertising available from TV, it is hardly to be expected that the advertisers will stint high fees, either for staff or artists, and here also looms a possible source of friction. How is the BBC to find the finances to compete with the new Association? The latest information tells of a BBC "request" for permission to increase the licence fee to £3 "or more"; in the same news review, we hear that the new Association may not have to depend on advertising income for the financing of *their* stations. Provided one lives quite close to a new transmitter *and* a BBC transmitter one should be in line for first-class entertainment from one side or the other.

Lack of Enterprise

Looking back over the last 12 months during which alternative programmes have been mooted, it is rather puzzling to the writer why no attempt has been made to forestall most of the problems outlined above by allowing sponsored programmes to be radiated from BBC transmitters outside normal BBC television hours. Admittedly, a great deal of re-arranging would have been necessary to permit of maintenance and rehearsals, etc., but would the problems have been anything like as difficult as they now appear? At least two hours could have been available in the early evening, and Sunday afternoon, still "dead" time with the BBC, could have been a most profitable session for the advertisers. In these circumstances, aerials would remain unchanged and no additions made thereto. Expensive converters to be added to existing televisors would be unnecessary. The threatened "licence" for commercial reception would never have been mentioned, and it is perhaps not too much to think that the revenue from advertising might largely have offset the heavy financial burden borne by the BBC, and which now seems, in part at least, about to fall on the long-suffering single-outlook televiewer.

FAULT SYMPTOMS

THE CAUSES OF COMMON FAULTS, AND METHODS OF CORRECTION

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

(*Continued from page 352 January issue*)

SOME television receiver designers seem to prefer the use of a resistor capacitor combination, instead of the usual transformer, to couple the coils to the frame amplifier. Such an arrangement, used in Ultra V710 series receivers, is illustrated by Fig. 24 in the January issue. Here it will be seen that the 4.7 KΩ resistor R1 and the 24 μF electrolytic capacitor C1 perform the function of coupling. For linearity correction a degree of N.F.B. is introduced into the stage by virtue of the un-bypassed cathode resistor, and also the value of which is selected to provide maximum linearity-compensating due to the curvature in the characteristic of the UL46 output valve. This receiver does not employ an adjustable form of linearity correction, and in practice a tolerable degree of frame scan distortion is evidenced, but this is quite normal and has no adverse effect on the entertainment value of the reproduction.

It will be observed here, however, that, since no transformer is used, high impedance scanning coils are demanded to facilitate a valve/coil impedance match, and for this reason the peak voltage developed across the windings during the flyback is in excess of that developed across the low impedance type. From the servicing aspect, the uncertain factor—the frame output transformer—is eliminated, and severe distortion of the kinds described is almost certain to be due to scanning coil failure.

It is important to remember, however, that the values of the coupling components are very critical, and any slight deviation from their original values is almost bound to result in scan distortion coupled with a reduction of picture height. Since a " leak " in C1 would allow a passage of current through the coils, producing a steady magnetic field across them, it is essential that the insulation of this component be of high standard. The effect of a steady magnetic field, due to a capacitor defect of this nature, for instance, would be to deflect the raster off centre in the vertical sense, and the magnitude of deflection would, of course, be dependent on the leakage resistance of the capacitor.

Certain television receiver manufacturers economise in timebase by utilising back coupling between the scanning coils themselves to produce a sawtooth waveform, and thereby avoid the use of a separate generator stage and output transformer. Some pre-war Baird receivers adopted this principle, and it has also been used with a degree of success in Germany and the U.S.A. With the Baird receivers both line and frame timebases embodied such design, but a recent Murphy receiver employs it only for the frame timebase.

Fig. 27 depicts the old style Baird arrangement. Here the time constant comprises the inductance of the scanning coils and the sum of the resistances of the coils and the valve. In order to obtain a fairly linear scanning stroke the rise of current through the coils, to correspond to a full scan, is limited to the region of 10 per cent. of its final value (see Fig. 28).

The regenerative action of this circuit is quite simple to follow, and it is best to first consider the function during the frame flyback. For then the back E.M.F. developed across the grid winding L3 is such that the grid is made heavily negative with respect to cathode, and the valve is held beyond current cut-off.

As the current in the anode winding of the scanning coils collapses from maximum to zero (during the flyback) the grid potential becomes less negative, and is held at a value determined by the resistive element of the cathode circuit. The rate of consequent anode current rise through L1/L2 is controlled by the time constant of the network ; and due to the changing anode current a back E.M.F. is set up across L1/L2 which opposes and lowers the anode potential. Similarly, an E.M.F. is developed across L3, the polarity of which is such that the grid is driven positively. A cumulative action ensues ; for as the grid is driven more positively more anode

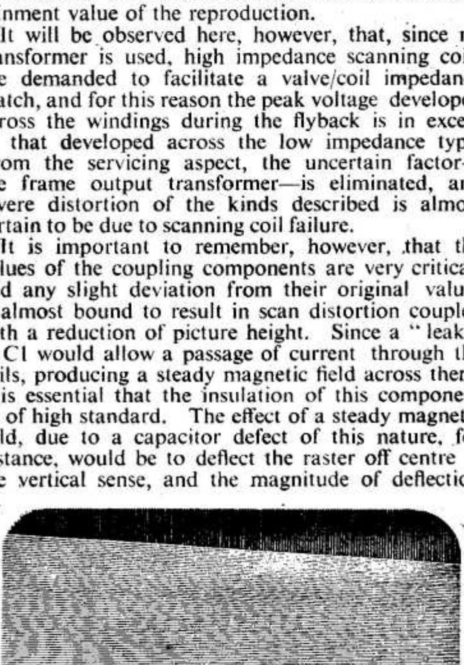


Fig. 25.—A wedge-shaped raster and foldover due to defective frame scanning coils.

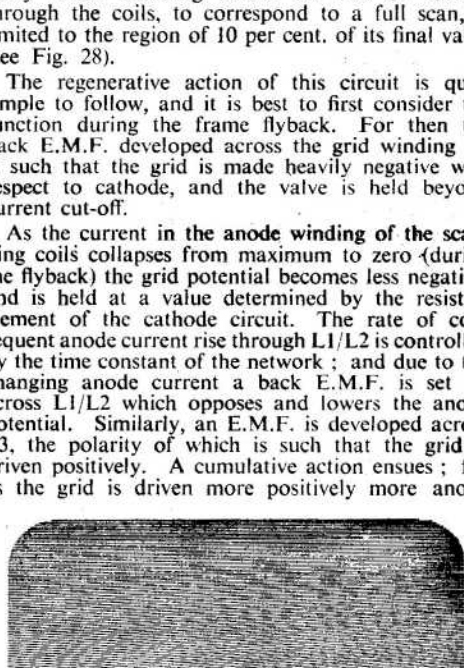


Fig. 26.—The effect when one frame coil breaks down.

current flows, and the resulting increase in rate of current change through L1/L2 tends to drive the grid even more in the positive direction.

As the rate of anode current change begins to fall off (towards the final current value) less voltage is induced in the grid winding, and the grid potential becomes less positive — this aggravates a further decline in the rate of anode current change. Again, this action is cumulative until eventually the induced voltage across the grid winding is reversed in sign so that the grid is driven negatively, and the frame flyback is initiated.

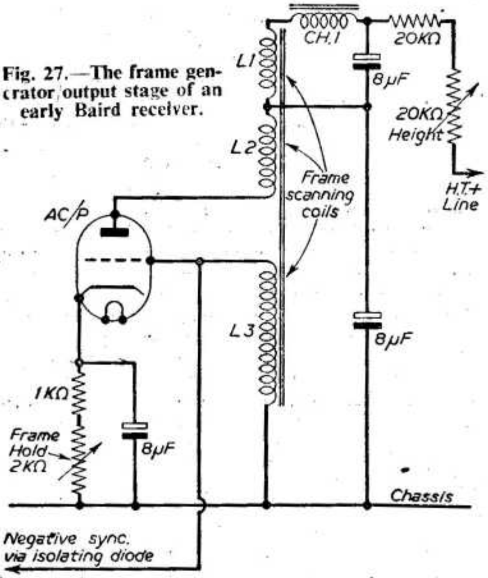


Fig. 27.—The frame generator output stage of an early Baird receiver.

From the foregoing it is apparent that, in the free running state, the generator is not initiated to fly back until the final (or nearly) anode current value has been reached. This, as we have already seen, causes an exceptionally non-linear current change in the scanning coils, and thus a distorted frame scan. When synchronisation is effected, however, conditions are somewhat altered, for a negative going sync pulse is applied to the grid before the generator would fly back of its own accord, and in practice only about 10 per cent. of the total current rise is employed for a complete scanning stroke. The effect of a sync pulse lowers the grid potential and hence the anode current, and the second section (the flyback) of the operative cycle is externally provoked.

Although the mean D.C. currents in L2 and L3 are more or less equal, their ampere-turns are, of a necessity, unequal, and to overcome the asymmetrical magnetic effect on the scanning coil core, therefore, an additional winding L1 is included. This electromagnetic balancing is necessary to obtain a raster in the geometrical centre of the picture-tube screen, for without such a feature the asymmetrical field would tend to deflect the raster vertically off the screen centre.

A more recent representation of a single valve frame timebase system is depicted by Fig. 29, and it is that used in Murphy V134C series receivers. The circuit, as will be observed, is much more involved than the Baird counterpart, and embodies many refinements. A regenerative action takes place by virtue of the scanning coil windings L1, L2, which are wound on a large laminated core forming a closed

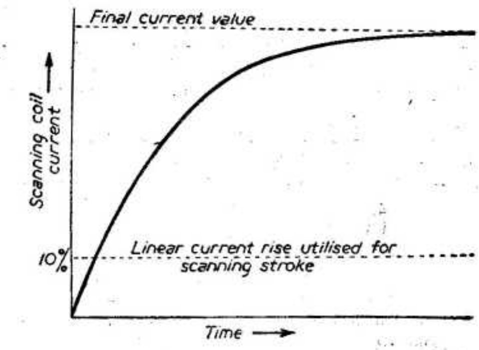


Fig. 28.—Rate of current rise through scanning coils.

magnetic circuit round the picture-tube neck.

In order to produce the desired symmetrical transverse scanning field across the tube axis, a closed circuit coil L4 is also included on the laminated core. A further coil L3 provides a counteracting effect to the steady direct current in L1, L2, the action of which is similar to the coil L1 of Fig. 27. By allowing a variable control of current through this coil, facilitated by the 200Ω variable resistor R1, a control of vertical picture shift is provided.

It is worthy to note that the energising current for L3 is taken not from the whole of the receiver current but from the current of seven valves only.

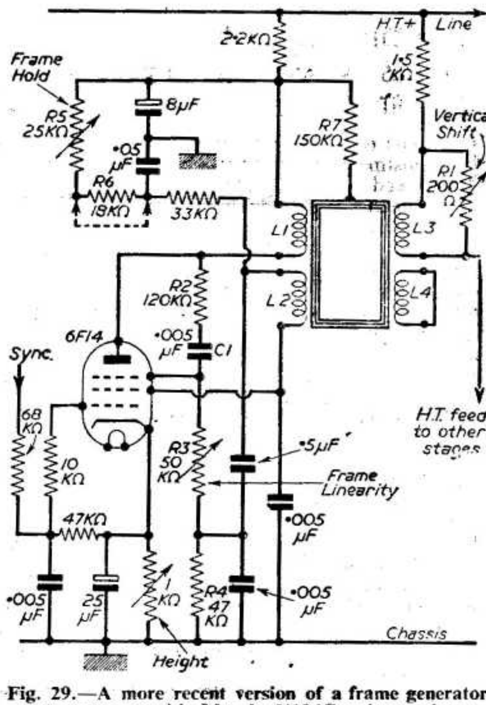


Fig. 29.—A more recent version of a frame generator output stage used in Murphy V134C series receivers.

Knowing this can expedite servicing of the receiver generally, because, for instance, should a fault develop which apart from its normal symptom also tends to shift the picture vertically on the screen, a lot of circuit diagnosis can be avoided. The valves affected are as follows : First vision amplifier (6F13) ; video output (6F13) ; sync separator (6D2) ; two sound R.F.s (both 6F13s) ; sound interference limiter (6D2) ; and the screen grid circuit of the sound output valve (6P25).

Inductive coupling exists between L1 and L2, which are in circuit with the anode and screen grid of the valve, and the feedback circuit is maintained through R2, C1, R3, and R4. A control of linearity is provided by the damping effect of R2 and C1 in the anode circuit, in association with the variable control R3. A coupling is introduced into the suppressor grid circuit to give a further degree of linearity correction, particularly towards the bottom of a picture.

Height control is effected by adjusting the cathode potential, and a variable resistor is appropriately included for this purpose. The frame hold control R5 varies the screen grid voltage, and hence the time constant of the charging circuit. It sometimes happens, however, that the characteristics of the oscillatory circuit are somewhat altered by component changes, particularly if the valve itself is replaced. This, as we have already seen, tends to put the correct timebase operating frequency outside the range of the hold control. For this reason, therefore, an additional fixed resistor R6 is included in series with the time constant circuit ; this can be short circuited if it is found necessary to increase the frequency of the generator—if R5 reaches the end of its travel in this direction.

The 150 KΩ resistor R7 merely serves to maintain the scanning coil laminations at the same potential as the coils themselves ; this, it is said, tends to minimise the effect of an electro-chemical action, which might otherwise result in premature coil failure. When making adjustments to this section of the circuit it is therefore advisable to " kill " this exposed potential by temporarily short circuiting the laminations to chassis—the resistor itself need not be disconnected, for the short circuit current is diminutive.

No Sync—or Weak " Holds "

We have already considered the possibilities of a poor line or frame hold due to a time constant alteration in the charging circuit of the generator, which makes it necessary to set the appropriate control to the limit of its range. It is often found, however, that an approximate midway setting on the controls may provide the correct generator frequency, and yet picture stability is still far from satisfactory. It is probably observed that slight interference tends to provoke picture " rolling," or tearing horizontally, and that frequent adjustments are demanded during a programme sequence to hold a picture at all.

Symptoms such as these are generally indicative of weak sync pulses, although it should be pointed out that " noisy," or in some way defective, hold controls themselves can give rise to similar effects, which are, however, fairly obvious owing to the " touchy " nature of the control concerned. Nevertheless, the possibility of this cause should not be overlooked during initial investigation.

(To be continued)

Automatic Width Control

DETAILS OF AN INTERESTING AMERICAN CIRCUIT

By P. Dodson

IN some receivers the picture size varies with the adjustment of the brightness control. It is more marked in some sets than others. Poor regulation of the E.H.T. supply is, usually, responsible.

When the brightness is increased, the bias of the C.R. tube is reduced. This increases the load on the E.H.T. supply, the high voltage drops, and the picture tends to expand since the reduced velocity of the electron beam makes it easy to sweep over a large area.

When the bias is increased, giving a less bright picture, the load on the E.H.T. supply is decreased and the high voltage rises, giving a smaller size of picture.

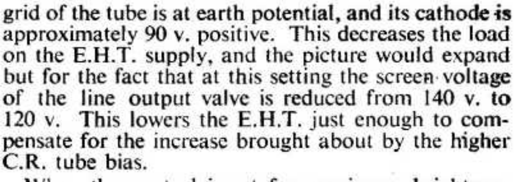
The remedy is, of course, to have a supply that has perfect regulation. This is not always possible. Much depends on the type of E.H.T. supply used, some circuits giving better regulation than others.

Some American TV. receivers use a special type of circuit which tends to keep the picture width constant whatever the setting of the brightness control. Fig. 1 shows the circuit used in some recent Philco models.

It will be noticed that the grid and cathode of the C.R. tube and the screen of the line output valve are supplied with voltages from two voltage dividers connected in parallel across the H.T. supply. Both dividers return to earth through the arm of the brightness control.

When the brightness control is adjusted for minimum brightness, i.e., maximum bias on C.R.T., the grid of the tube is at earth potential, and its cathode is approximately 90 v. positive. This decreases the load on the E.H.T. supply, and the picture would expand but for the fact that at this setting the screen voltage of the line output valve is reduced from 140 v. to 120 v. This lowers the E.H.T. just enough to compensate for the increase brought about by the higher C.R. tube bias.

When the control is set for maximum brightness the screen voltage of the line output valve is increased to about 140 v., which compensates for the drop in E.H.T. which occurs when the bias is reduced.



The auto-width control circuit.

Phosphors and Colour TV

SOME INTERESTING DETAILS OF THE CHEMISTRY OF PICTURE TUBES

By "Physicist"

As television becomes more and more commonplace we are apt to overlook the one thing without which television would be impossible, viz., the cathode-ray-tube screen material, and it is but little realised how much research has been carried out and what progress has been made in the search for suitable screen materials.

More especially, now that colour television is about to be commercially exploited, has this new field of science been the focus of intense activity, as the development of screen materials which can give a full coloured picture is being rapidly pursued. At least one system of colour television, which will be described later, has gone a long way towards producing naturally coloured pictures on one composite screen made from carefully selected and blended fluorescent materials.

Phosphors and Luminescence

Suitable screen materials, known as phosphors, are those which emit visible light when bombarded by a beam of electrons and in which the intensity of the emitted light is proportional, both to the velocity of the electrons and the intensity of the beam.

Not long ago the only available phosphors were a few naturally occurring minerals such as Willemite (zinc orthosilicate) and a few impure alkaline earth sulphides, e.g., calcium, cadmium and zinc sulphides.

Research investigations have shown that the property of luminescence in inorganic substances is caused by the introduction of a small quantity of "impurity" or activator, which during fusion at high temperature enters into the crystal structure of the material, introducing what are. known as "lattice defects," in which the regular arrangement of the atoms within the crystal are periodically disrupted by the atoms of the "impurity."

As a result of these "lattice defects," the material is endowed with the peculiar property of being able to absorb energy from incident radiation, which it re-emits as visible light, Fig. 1. In most phosphors, the emission is instantaneous and is called fluorescence, but a few substances are capable of emitting light long after the incident radiation has ceased. This effect is called phosphorescence, or persistence.

The precise mechanism of luminescence in inorganic crystals is not yet fully understood, but the processes described in Fig. 1 show diagrammatically how a single atom can absorb energy in one form and emit it later in another. For a single atom it is postulated that the incident energy is taken up by the atom in discreet amounts and causes one or more of the electrons which surround the nucleus of the atom to change their orbital paths (i.e., the path which the electrons describe in space about the nucleus). In so moving the electrons absorb the incident energy and the atom is said to be in an excited state.

For the most part the atom can only remain in this state for an exceedingly short interval of time, before most but not all of the energy which was taken up is given out and the electrons return to their normal orbits. The interval of time is so very short that the effect can be considered to be instantaneous, but because some of the incident energy is used up in the process the emitted light has a longer wavelength than that of the incident radiation.

The mechanism is best accounted for quantitatively by a rather involved mathematical analysis, known as the Quantum Theory, which predicts that the light emitted by a single atom will be virtually monochromatic, i.e., light of one wavelength. Where several energy states exist the light will consist of a few selected wavelengths distributed according to known laws throughout the visible spectrum. One justification of the Quantum Theory is that single atoms (e.g., gas discharge) under electron bombardment emit several monochromatic rays of light.

Although the absorption and emission of energy by a single atom can be described in such comparatively

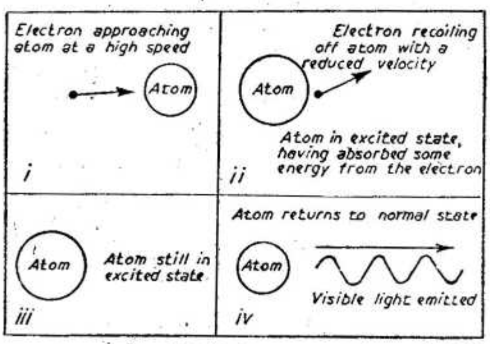


Fig. 1.—Much simplified representation of light emission by an atom after collision with an electron. This particular effect is usually only found in gaseous discharge. In phosphors, the energy which is absorbed from the electron is associated with the molecule rather than an individual atom, and when re-emitted covers a range of wavelength.

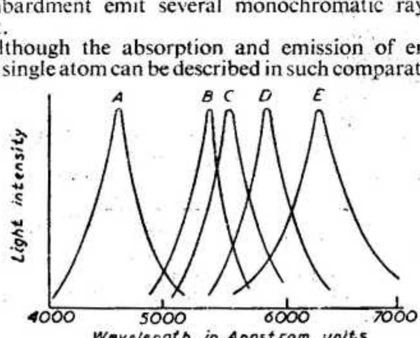


Fig. 2.—Light intensity—wavelength plot for five widely used phosphors, viz.:

(a) Zinc sulphide activated with silver [ZnS : Ag] blue colour.

(b) Zinc orthosilicate activated with manganese [thom. Zn_2SiO_4 : Mn] green colour.

(c) Zinc orthophosphate activated with manganese [$\alpha Zn_3(PO_4)_2$: Mn] green colour.

(d) Zinc sulphide activated with manganese [hex. ZnS : Mn] red colour.

(e) Zinc orthophosphate activated with manganese [$\beta Zn_3(PO_4)_2$: Mn] red colour.

Phosphors a, b and e are widely used in colour television.

simple terms, the emission of light by complex aggregates of atoms, such as crystals, is an exceedingly complex phenomenon. That the effect is spread over several rather than one single atom is clearly brought out by the profound effect which the "impurity" or activator has on the nature of the emitted light.

It is therefore only to be expected that in place of the few discrete orbits which the electrons of a single atom can occupy, the energy levels of an aggregate of atoms will be neither clear cut nor sharply divided. Consequently, we must look upon the energy of the incident radiation as being shared by several associated atoms, and when emission occurs we cannot expect to get the clear-cut monochromatic radiation obtained from a single free atom.

The colour of the light emitted by a crystalline phosphor is characteristic of the main substance and the activator and covers a wide range of wavelength, Fig. 2. The extent of the influence which the activator can have upon the range of wavelength

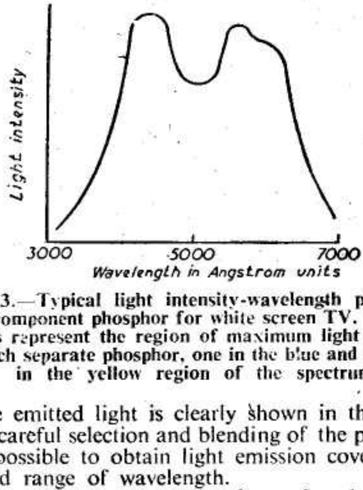


Fig. 3.—Typical light intensity-wavelength plot of a two component phosphor for white screen TV. The two peaks represent the region of maximum light emission of each separate phosphor, one in the blue and the other in the yellow region of the spectrum.

of the emitted light is clearly shown in this figure.

By careful selection and blending of the phosphors it is possible to obtain light emission covering any desired range of wavelength.

Although the activator is often referred to as the "impurity" this is somewhat of a misnomer; in practice the materials have to be of a very high degree of purity, and the activator is added in a minute yet definite amount (for some phosphors, as low as one part in a million of activator is sufficient).

For use as cathode-ray-tube screens the phosphor is prepared as a fine powder, which is coated uniformly on the inner surface of the tube face and held in position by an organic cement which bonds it to the glass. The electron beam is focused into a spot on this screen and modulated by the "picture signal," whilst timebases, suitably connected to the deflecting system of the cathode-ray tube, move the spot over the screen surface in some regular manner.

Uses of Cathode-ray Tubes

Cathode-ray tubes have found important uses in (1) electron microscopes and electron diffraction cameras; (2) radar systems and oscilloscopes; and (3) television. For each application new and specific phosphors have been formulated and developed.

Thus for the electron microscope one important factor is the definition of the image, and the light conversion efficiency is deliberately sacrificed to get high image resolution by using a thin layer of very finely divided phosphor. Phosphors which have been used in this application include: (*a*) a fused mixture of zinc and cadmium sulphides activated with silver (6ZnS, 4CdS:Ag), which gives a yellow image; and (*b*) a physical mixture of zinc sulphide activated with silver (ZnS:Ag) and a fused mixture of zinc and cadmium sulphides activated with silver (1.3ZnS,CdS:Ag), which gives white light.

For rapidly occurring events a short persistence is desired, and zinc orthosilicate activated with manganese ($ZnSiO_4$: Mn) which gives a green colour is often used. This material is similar to that used in the VCR97 tube, which has proved highly satisfactory in many home-constructed television receivers.

Long persistence is sometimes obtained by building up the screen from layers of different phosphors. A layer of short persistence zinc sulphide activated with silver (ZnS : Ag) which fluoresces blue is spread over a thin layer of a long persistence, yellow emitting zinc cadmium sulphide activated with copper [(ZnCd)S : Cu] to give a screen characterised by a bright blue image and a less pronounced yellow afterglow. Some readers will have had experience of this type of screen in some VCR517 type tubes.

Zinc sulphide activated with copper (ZnS : Cu) has proved a versatile phosphor having a long persistence, which can be curtailed to any desired extent by progressively replacing the zinc atoms by cadmium.

Phosphors of varying persistence have proved

Name	Activator	Formula	Colour	Uses
Zinc Sulphide ...	Copper	ZnS : Cu	Yellow	Radar Screens Long Persistence
Zinc Sulphide ...	Silver	ZnS : Ag	Blue	TV Radar Short Persistence
Zinc Sulphide ...	Manganese	ZnS : Mn	Red	Colour TV Short Persistence
Zinc Cadmium Sulphide	Silver	(ZnCd)S : Ag	Yellow	TV Radar Short Persistence
Zinc Cadmium Sulphide	Copper	(ZnCd)S : Cu	Yellow White	TV Radar Variable Persistence
Zinc Ortho-Silicate	Manganese	Zn_2SiO_4 : Mn	Green	TV Radar Short Persistence
Calcium Tungstate	—	$CaWO_4$	Blue	TV
Zinc Ortho-Phosphate	Manganese	$Zn_3(PO_4)_2$: Mn	Red	Colour TV Short Persistence
Zinc Beryllium Silicate	Manganese	$(ZnBe)SiO_2$: Mn	Yellow to red	TV Short Persistence

Fig. 4. Table listing the Properties and Uses of some of the more widely used phosphors.

pre-eminently suitable in radar, where the low frequency of the signal repetition necessitates the formation of a persistent image to prevent flicker. It is now possible to formulate a screen composition to suit any given repetition rate.

The demands of mono-colour television are far more exacting than for radar and oscilloscope screens, for above all else the colour must be pleasing to the eye. Attention here has been devoted to discovering screen materials which give a good black and white image of reasonably short persistence and with a fair resolution and long stability under electron bombardment.

Various phosphors which have been used are listed in Fig. 4. They are invariably a blend of two or more phosphors, one having maximum light emission in the blue region of the spectrum and the other in the yellow region. Amongst the more popular phosphors are a mixture of zinc and cadmium sulphides and a mixture of zinc and beryllium silicates which is sometimes used in projection tubes, Fig. 3.

To increase the brilliance of the picture the layer of phosphor is often covered with a very thin film of aluminium which, whilst letting the electron beam through, reflects in a forward direction a high proportion of the light which would otherwise be lost in the interior of the tube.

Colour Television Screens

Basically, the problems of colour television in respect of true colour rendering are similar to those encountered in colour photography. Three images, each in a primary colour, have to be superimposed to reproduce the picture. Originally, when the choice of screen materials was limited, it was widely believed that colour television would only prove possible by using a scanning disc which carried three coloured light filters, through each of which the screen was viewed in turn as the disc was rotated in synchronisation with a similar disc attached to the television camera.

The difficulties inherent in maintaining perfect synchronisation of the two discs proved virtually insuperable, and in addition the colour rendering, even with the best "white" screen, left much to be desired.

The subsequent development of tri-screen receivers using either three cathode-ray tubes, each with a different screen material selected to give one primary colour, or the later modification in which the three tube assemblies and screens were sealed in one glass envelope, have all been described before and therefore need not be dwelt on here. They suffered a serious disadvantage, in that to see the three images correctly superimposed the observer had to be in a fixed position with respect to the set and this disadvantage could only be overcome by a projection system. Triple projection equipment is so costly that the technique is usually reserved for large screen television in cinemas, etc., and is never likely to prove an economic proposition for the private viewer.

R.C.A. Single Screen Coloured TV System

A notable step forward has been made in the R.C.A. colour television system which uses a special screen, built up from a mosaic of three different phosphors, each selected so that it will give a primary colour.

Three electron gun units, one for each primary

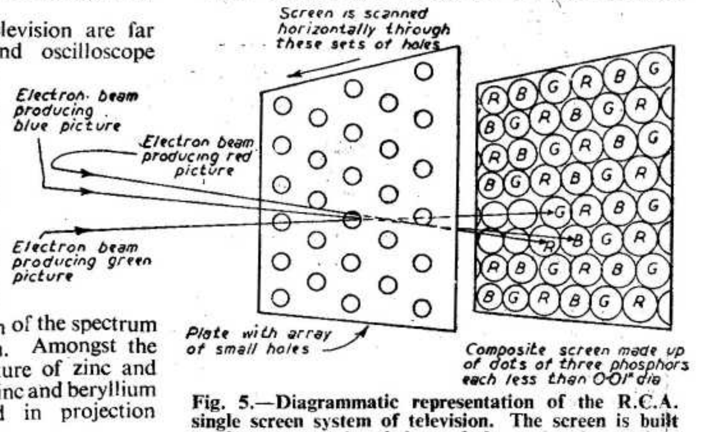


Fig. 5.—Diagrammatic representation of the R.C.A. single screen system of television. The screen is built up from a mosaic of dots of three phosphors, viz.: (1) Zinc orthophosphate, activated with manganese $(BZn_3 (PO_4)_2 : Mn)$ which gives a red colour. (2) Zinc sulphide activated with silver $(ZnS : Ag)$ which gives a blue colour. (3) Zinc orthosilicate activated with manganese $(Zn_2 SiO_4 : Mn)$ which gives a green colour. The three electron guns, one for each primary colour, are assembled in such a manner that the beam from each falls only on the dots of one phosphor throughout each complete scan.

colour picture, are employed and arranged in such a manner that the electron beams after passing through the same tiny hole in a metal plate fall one on each of three areas of phosphors of different colour. These phosphors are arranged on the screen in such a manner that the beam corresponding to each primary colour picture falls always on a phosphor which emits light of that colour.

The picture is built up by inducing the three beams to scan horizontally across the metal plate, thus passing in turn through every hole on each row of the plate.

The Screen

The screen is made up as shown in Fig. 5, and the phosphors used are, (*a*) for the blue image, zinc sulphide activated with silver $(ZnS : Ag)$; (*b*) for the green image, zinc orthosilicate activated with manganese $(Zn_2SiO^4 : Mn)$; and (*c*) for the red image, zinc orthophosphate activated with manganese $(Zn_3(PO^4)_2 : Mn)$. The actual size of each one of these areas of each phosphor is less than 0.01in. in diameter.

In this system the electron gun assemblies are mounted in the same glass envelope, and although alignment of the electron gun, scanning plate and screen is a tricky operation this is done during manufacture and therefore presents no problem to the viewer.

In this article, it has only been possible to mention the more widely used phosphors. There are many more and new ones are being evolved almost daily—in fact, the science and manufacture of these valuable materials is now reaching the stage where they can be made to specification, covering any desired range of wavelength and with any degree of persistence.

PROJECTION T.V. SCREEN

Made from plastic and precision-milled on both sides to give a reflectionless surface. The cost of these from the manufacturers was **30/-** each, but through a company going into liquidation we are able to offer these at **17/6** each. Size is 17 x 14in. but easily cut to suit cabinet opening. A limited quantity only, of course, is available.

PLASTIC TELEVISION MASK

This is a Mask and Implosion Guard combined, made for 12in. tube from moulded perspex and internally sprayed bronze. It is the type of mask which fixes on the inside of the cabinet and is thus suitable for the amateur-cut hole. It is the latest type of mask as fitted to most modern televisors. Brand new and perfect at less than manufacturer's price, viz., **15/-**, plus 1/6 carriage and insurance.

BUILD THIS FINE INSTRUMENT FOR 29/6

T.V. SIGNAL AND PATTERN GENERATOR

This generator has been carefully designed and although it can be built and used by any beginner it is at the same time a most useful instrument for the more advanced worker.

It can be tuned to the vision channel and will produce a pattern on the face of the C.R. tube. Alternatively, if tuned to the sound channel it will produce an audible signal in the loudspeaker.

Thus its owner will become independent of B.B.C. transmissions and can fault find or test at any time. It operates entirely from A.C. mains and is quite suitable for use with superhet or straight receivers.

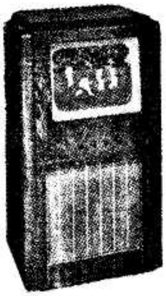
A complete kit of parts (in fact, everything except the cabinet), with full constructional and operational data will be supplied for **29/6**, plus 2/6 post and insurance; alternatively, data is available separately, price 2/6 (credited if you buy the kit later).

NOTE.—Cabinet as per the illustrated prototype will be available shortly.

SOMWEAVE

This really lovely loudspeaker fabric we offer at approximately a third of to-day's cost. It is 42in. wide and our price is 12/- per yard or panels 12in. x 12in., 1/9 each. This is also very suitable for covering plain wooden cases, for portable radio amplifiers, etc.

A FEW REMAIN



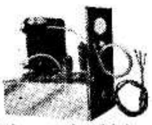
This cabinet is offered below cost. It is suitable for a televisor using tube sizes varying from 12in. to 17in., its overall dimensions being 3ft. 5in. high, 1ft. 4in. deep, 1ft. 10in. wide. It is complete with plywood back and "Bowler Hat." Originally made for a very expensive televisor, and really good quality. Unrepeatable. Offered at **£7/5/0**, carriage, packing, etc., **12/6**.

NOTE.—These are cut for 12in. tubes, but the holes for the controls are not drilled.

RINGING CHOKE E.H.T.

This unit gives 2½ K.V. and is highly suitable for working the Government Tubes VCR97, etc. It will take the place of the E.H.T. transformer and has the advantages not only of being very much cheaper but should anything break down then replacement parts cost very little. We can offer a complete set of parts, including valves SP61 and VU120, ½ meg. pot., ½ meg. resistor, .001 mfd., 3 K.V. condenser, 2 valve-holders, metal chassis and E.H.T. transformer from 1335 receiver. Price **16/-** for the complete outfit.

THE ELPREQ E.H.T. GENERATOR



This is a made-up unit working on the blocking oscillator overwound amplifying stage principle. It is of moderate power consumption (6.3 volt. 8 amp filament and approx. 59 mA. H.T.) and contains three B.V.A. valves. Output obtainable ranges from 6 kv. to 9 kv. with normal H.T. rail input, but somewhat higher outputs can be obtained with higher H.T. supply. Valve rectification is employed in the output stage. The dimensions are 6¼ x 4¾ x 7in. Price **69/6**, post, packing, etc., 5/-.

A RADIO UNIT FOR SUPERIOR 15

A circuit for a suitable radio unit to fit into our Coronation Console Cabinet has now been completed and thoroughly tested. All the parts are available. The total cost is **£5/19/6**. Data is included free with orders for parts, or can be supplied separately; price **2/6**.

NOTE.—This radio unit incorporates T.V. control and is also highly suitable for fitting into other televisors. The addition of a radio unit to a televisor is not only worthwhile, but is essential where the televisor is kept in a room away from the main radio. The Corner Cabinet is also available now in light oak, or medium oak to suit your furnishings, and it really does look impressive. The price is **£18**, plus carriage. H.P. terms, **£6** deposit, balance over 12 months.

About the Superior 15 itself, if you have not already ordered your set of parts for this, be advised and do so immediately. We are definitely getting down to the last batch of the 15in. tubes and once these are gone the Superior 15 T.V. cannot be repeated. At **£37/10/-** for all the parts (including 15in. Cossor Tube) this represents the finest value ever offered to the home constructor. If you doubt your ability to make it then send 7/6 for the data and study this first. Don't forget, we guarantee to help you to get perfect results and, if necessary, for a nominal charge, will take in your televisor, completely check over your work, and return it to you in perfect order.

VIEW MASTER OWNERS

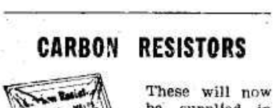
You probably know that a 15in. tube gives approximately 3 times as many square inches of actual picture as does a 9in. tube. You may not know, however, that without any modification at all your View Master will scan the 15in. Cossor type 85 K. which we offer for cash or on H.P. If you would like to go over to the big 15in. picture, the easy way is to send for "View Master Big Picture Parcel" as follows:

1. 15in. type tube 85K.
2. Moulded rubber mask.
3. Tube clamping ring.
4. Special ion trap.
5. Sundries, plug, etc.
6. Blueprint showing connections, and method of fixing tube, ion trap, etc.

We offer the above six items at less than what a new 9in. or 12in. tube alone would cost, namely, **£16**, cash with order, or **£5/6/6** deposit and balance over 12 months. Limited quantity only at this price, so order by return.

CONNECTING WIRE SNIP

P.V.C. insulated 23 s.w.g. copper wire in 100ft. coils, **2/9** each. Colours available: Black, Brown, Red, Orange, Pink, Yellow, White, Transparent. 4 coils for **10/-**.



Complete kit comprises H-craft 40 watt control unit, starter lamp, lamp holders, clips and wiring diagram. Price less tube **22/6**, plus 1/6 post. With tube **30/-**, carriage and insurance 3/6. Tubes **7/6** each, carriage free, minimum quantity 6 tubes.

CARBON RESISTORS

These will now be supplied in individual packets, with the value and wattage clearly indicated.

Prices:

½-watt, 5d. each; 1 watt, **6d.** each.

SILVER MICA CONDENSERS

All sizes from 5 pf. upwards, **6d.** each or 100 assorted, **30/-**.

ELECTRONIC PRECISION EQUIPMENT
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The Plessey Multivibrator Circuit

A DESCRIPTION OF ITS WORKING AND A USEFUL MODIFICATION

By B. L. Morley

THE frame timebase of the Plessey chassis given in the November issue of PRACTICAL TELEVISION (Servicing TV Receivers), has a rather interesting and unusual feature. This is the use of a multivibrator for the frame oscillator.

Most commercial receivers employ some form of blocking oscillator for both frame and line timebases, and the use of the multivibrator has been rather neglected—in this country at least; it is much more popular in America.

This form of oscillator (sometimes called the

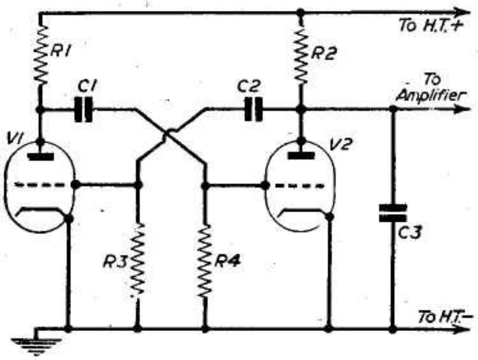


Fig. 1.—Basic circuit of the multivibrator.

"flip-flop") is capable of generating a square waveform rich in harmonics.

The type used in the Plessey chassis is known as the anode-coupled multivibrator as the coupling between the two halves of the duo-triode is effected by capacitors between the anode of the one valve and the grid of the other.

Fig. 1 gives the basic circuit of the anode-coupled multivibrator. It functions in a very simple manner.

Assume, for the moment, that the grid of V1 is made slightly more negative; this will cause the current through V1 to fall and hence the current through R1 will fall and the voltage drop across it will become less than it was before.

In other words the anode of V1 moves in the positive direction. The movement in the positive direction is communicated to the grid of V2 via the coupling capacitor C1, and as this grid moves positive more current flows through V2 and hence through R2.

Current through R2 increasing means that the voltage drop across R2 increases, or in other words the anode side of R2 becomes more negative than it was before. This movement in the negative direction is communicated to the grid of V1 via the capacitor C2, and this still further reduces the current through V1 and hence the voltage drop across R1.

It will be apparent that the effect is cumulative and the current through V1 is rapidly cut off while that through V2 rapidly increases until V2 is driven to the point of saturation when grid current will flow.

When this point is reached V1 is completely cut off and the charge on C2 will leak away via the grid leak R3 and through R2, and the negative potential built up on the grid of V1 will fall until V1 starts to pass current.

As soon as this condition is reached then current will start to flow through R1 and hence the voltage drop across R1 will commence to increase. In other words the anode of V1 will start to move in a negative direction and the negative movement is communicated to the grid of V2 via C1.

V2 grid being made negative will cause the current through V2 to be reduced, hence the voltage drop across R2 will fall, or in other words the anode of V2 will move in the positive direction. This positive motion is communicated to the grid of V1 via the coupling capacitor C2 with the result that current through V1 (and therefore R1) is further increased and V2 grid is driven even more negative.

The effect is cumulative as before and V1 quickly reaches saturation point while V2 is quickly cut off.

Time Constants

From the foregoing it will be seen that the two valves will alternately pass heavy current and then be cut off and it only remains for the time constants of the coupling circuits to be adjusted, to enable a

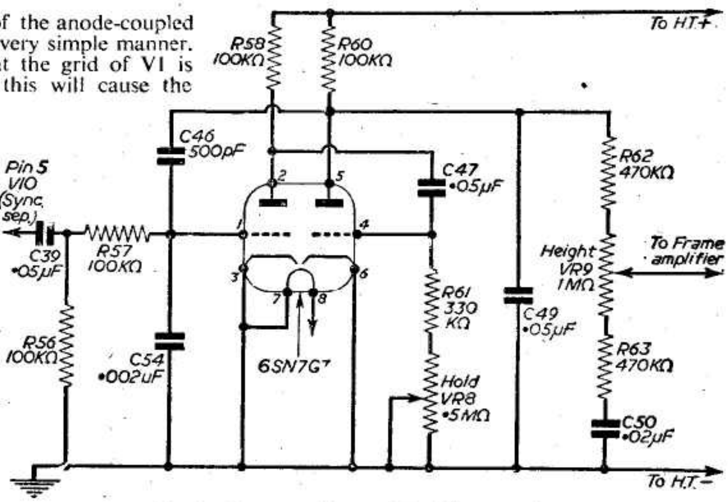


Fig. 2.—Frame oscillator of the Plessey receiver.

sawtooth waveform to be developed. The time constants are so arranged that one valve works during the scanning period and the other during the flyback.

In Fig. 2 is reproduced the frame oscillator of the Plessey chassis and the reader should be able to follow the operation of the circuit from the details given above. The leakage path of C47 is made variable (VR8) and as this controls the scan the potentiometer is labelled "Frame Hold."

The output is taken from the voltages built up across C49.

"Distant" Control

One rather important feature of the Plessey circuit is that the oscillator is "distant controlled." By this we mean that the circuit is static until the arrival of the negative sync pulse which initiates the commencement of the "flip-flop" cycle as it drives the grid heavily negative. Each "flip-flop" cycle is directly under the control of the sync pulse and no sawtooth waveform is produced without it.

The practical result of such a scheme is that the frame circuit is inoperative until the picture signal is received; no raster is obtained on the C.R.T., only a straight horizontal line from the line timebase.

Free Running

It is possible to make the circuit "free-running," by a simple alteration to the time constants of the coupling network.

When the circuit is free-running the "flip-flop" process commences as soon as the timebase is switched on and the anode currents differ to a small degree due to their structure. No sync pulse is necessary to initiate the oscillation and a complete raster will, therefore, be available on the screen for inspection or testing.

The Frame Hold control functions as before and the sync pulse is applied during receipt of picture intelligence in order to keep the oscillator frequency in line with the vision signal.

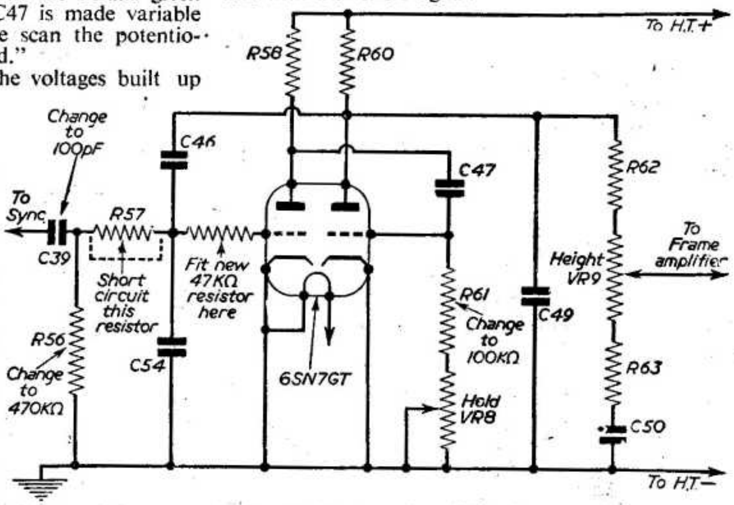


Fig. 3.—Modified version of Fig. 2.

The modifications are as follows: (See Fig. 3)

C39 is changed to 100 pF.

R56 is changed to 470 KΩ.

R57 is short-circuited.

R61 is changed to 100 KΩ.

The junction of C46/54 is disconnected from the grid of V1 and reconnected via a 47 KΩ resistor.

There is no difficulty in applying the modifications and it will be found much easier to service the televisor if a complete raster is available during periods when no transmissions are taking place.

TV Transmitting Station in the I.o.M.

THE Postmaster-General announced on July 2nd that the Government had authorised the construction of a television transmitting station in the Isle of Man. Special efforts were made by the BBC to find a site and instal the equipment so that a low-power temporary station could be working in the island before Christmas. A site was chosen on the south-western outskirts of Douglas.

The temporary station will serve the town of Douglas and its immediate neighbourhood and part of the south-east coast of the island—probably from Clay Head to Castletown. The transmitter works on the same channel as the existing stations at Wenvoe and Pontop Pike, the frequencies being 66.75 Mc/s for vision and 63.25 Mc/s for sound. The asymmetric side-band method of transmission is used, with vertical polarisation.

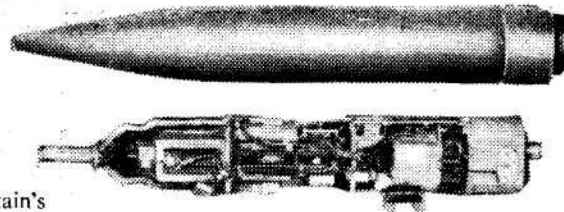
The temporary station will remain in use until the permanent station is completed. The latter will be erected on a site not yet selected and will have higher power and greater range; it will use the same channel as the temporary station so that receivers will not have to be altered.

A Compact Pulse Modulator

THE Mullard High Power Pulse Modulator is basically a device for generating microsecond pulses of high energy for the operation of magnetrons. It is based on a design for use with linear accelerators, and is suitable for other applications such as testing magnetrons and operating very high-power radar ground stations. The equipment is made to order.

The modulator in its normal form generates two microsecond pulses of the exceptionally high peak power of 5 megawatts. Other pulse lengths may be obtained by using alternative delay lines. Pulses for triggering the modulator are provided internally by a generator which gives pulse repetition frequencies of 100, 200, 350 and 500 pulses per second. The modulator can be triggered externally at any p.r.f. between 10 and 500 p/s. The output power can be varied by a single control, the actual power control mechanism being a motor-driven transformer which regulates the input to the three-phase mains transformer feeding the power rectifiers. The D.C. supply thus obtained can be varied between 6 kV and 12 kV. A magnetron filament supply of 9 amps at 18 volts is built into the modulator.

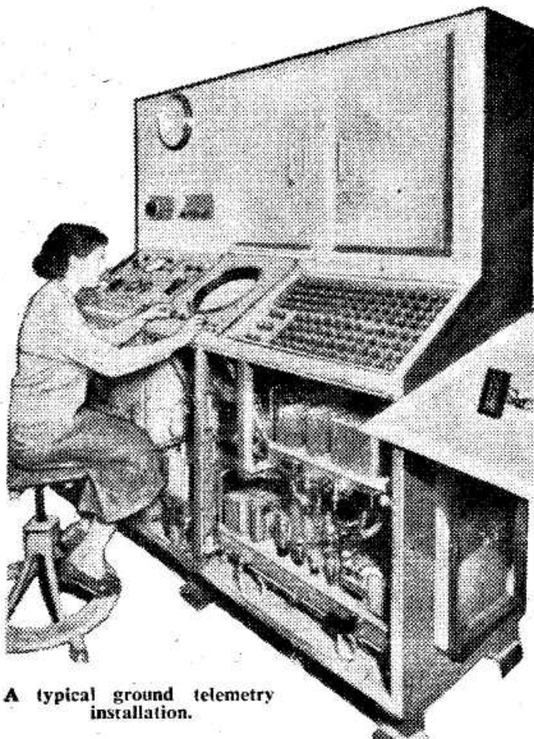
TELEMETRY



A shell and the equipment which it contains.

DETAILS OF TWO SYSTEMS DEVELOPED FOR THE GUIDED MISSILES PROGRAMME

ONE of the most important tasks in Britain's guided weapons programme has been the development of efficient telemetry equipment. Much information on the behaviour of missiles in flight can only be obtained by the firing of test rockets carrying equipment which transmits data by radio to ground stations.



A typical ground telemetry installation.

Failure of such telemetry equipment during a flight means that the test missile has been wasted, with the consequent loss of a good deal of money and productive effort, and that the compilation of important information is delayed.

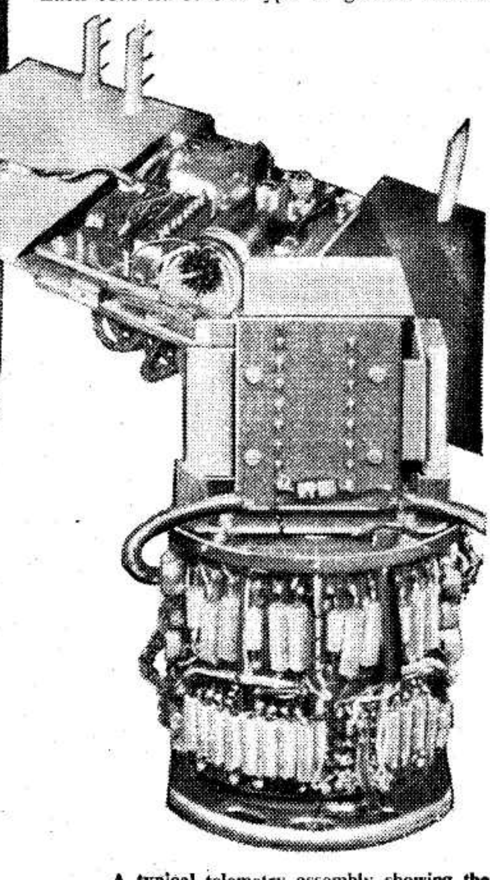
Apart from a high standard of efficiency and reliability the main requirements for airborne telemetry transmitters are high power output, good frequency stability against power supply run-down and mechanical stress, low weight and small volume and—since the life of the equipment is short—economy in cost.

Two Systems Required

Two main types of equipment are needed. For the measurement of aerodynamic properties such as control surface positions, strains, pressures, and torques, the " time multiplex or sharing " system is adequate. This provides a large number of separate channels for the transmission of data, each with a low frequency response.

For measuring the wave forms occurring in electronic equipment carried by a missile, however, channels with a high frequency are required, for which the P.P.M. (pulse position modulation), and time division systems are usually employed.

Two systems fulfilling these requirements have been evolved by Ministry of Supply scientists and are at present in quantity production. Each consists of one type of ground receiver



A typical telemetry assembly showing the compact nature of the installation. Note the use of tag-boards.

with several varieties of airborne transmitter equipment.

These two sets provide adequate and largely complementary coverage for frequency response up to 200-230 cycles. The first system provides 23 channels for the transmission of data, a further channel being reserved for synchronisation. The second set gives up to 20 higher frequency channels any one or any number of which can be sub-commutated to give lower frequency channels.

If necessary, and if sufficient space is available, both sets can be installed in a missile, or two of the first systems and one of the second can be fitted to provide 46 lower frequency and 20 higher frequency channels.

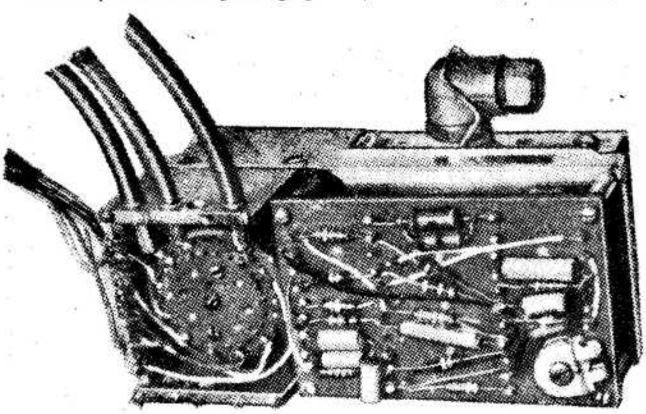
Time Multiplex System

The great advantage of this system is that it provides a calibration channel, enabling the accuracy of the equipment to be checked throughout its life.

The basis of the airborne transmitting section of the system is a rotating sampling switch, the contacts of which are connected to pick-ups which convert the physical data required into electrical variations.

The switch samples the pick-ups in turn and allows each to send its particular message to the ground for a small percentage only of the total time. This, coupled with the mechanised switch speed, accounts for the low frequency response of the system.

The output from the pick-ups passes, via the switch,



Another interesting piece of equipment. Its size may be judged from the coaxial plug.

to a modulator. This generates a sub-carrier whose frequency is directly related to the voltage, or inductance fed into it by the switch wiper. The resultant time multiplexed frequency modulation is used to amplitude-modulate an R.F. oscillator.

At the ground station the final records obtained are in two forms: a main low-speed record on which any channel or desired combination of channels is separately displayed; and a high-speed or histogram record from which all the possible information transmitted by the sender can be ascertained by analysis.

Transmitting Equipment

Since the set must be fitted to projectiles of varying sizes, from 3in. diameter upwards, flexibility is an important factor in its design. The components of the sending set have therefore been designed as standard units which can be arranged on various sizes of chassis.

The dimensions of the smallest chassis yet fired were 5¼in. × 3¼in. × 2½in. (telemetry chassis) plus a power-supply chassis measuring 4½in. × 3in. × 2¼in.

Pick-ups

Both the voltage and inductance types of pick-ups used in the system are produced in a variety of types and ranges.

Inductance pick-ups available include linear and angular accelerometers, pressure pick-ups and linear and angular movement pick-ups.

Voltage pick-ups usually take the form of a resistance potentiometer device. A number of such designs in the form of pressure pick-ups, general movement pick-ups from control surfaces or temperature pick-ups have been designed.

The Switch

On the speed of the switch unit depends the channel frequency response of the system.

Three models of the switch, with speeds of 120, 80 and 40 c.p.s. respectively have been designed.

The switch itself consists of a miniature motor, working from 6.3 v. D.C., driving a four-finger nickel silver brush assembly in a 2-way commutator, moulded in "Araldite." "Break before make" contacts, to avoid momentary coupling between channels, are made from the centre of the brush assembly. A small felt pad, serving the dual purpose of lubrication —with a specially-developed oil—and the collection of brass dust, is mounted diammetrically opposite the brush fingers.

To make wiring easier and facilitate rapid switch changing a 24-way socket, moulded in nylon-loaded bakelite and using B7G valve base type clips as contacts, is included in the switch unit. When pushed into position it is clamped to the commutator by two screws.

Modulator Circuits

Three types of modulator are in use with the system, one accepting inductance inputs only, one voltage inputs only and one responding to both types of input.

Built on both sides of a bakelite board, all are compact and easy to service.

In the case of the inductance responsive modulator a normal triode oscillator is used, the pick-up providing the variable inductance of the tuning circuit. The output of the oscillator is then amplified to give the power needed to modulate the R.F. oscillator.

In the second modulator, responding to voltage inputs only, the frequency of oscillation of a tuned grid triode oscillator is controlled by a conventional reactance valve which forms part of its tuned circuit, the output frequency being again amplified to modulate the R.F. oscillator.

Dual-purpose Modulator

To provide a combined circuit responding to both voltage and inductance inputs, these two circuits are combined in a four-valve version. The first valve acts as an oscillator for inductance inputs, the second as an amplifier which locks the third valve frequency to that of the first. The fourth valve is a straight amplifier.

In the case of voltage inputs the first valve is rendered passive by the damping of its tuned circuit and the voltage applied to the input to the second valve, which, acting as a reactance valve, determines the frequency of oscillation of the third valve. The fourth valve is, again, a straight amplifier.

In all cases the range of frequencies generated is 130-160 kc/s which in the case of voltage inputs is covered by a change of 6 volts.

Oscillators

To provide adequate power for all ranges, while keeping the direct current supplies needed as small as possible, three oscillators were designed for use in the system, with outputs measured on a C.W. basis of 0.2, 1 and 8 watts respectively. The earliest version was the 0.2 watt oscillator, built in the form of a push-pull tuned plate, tuned grid oscillator, using a CV858 (6J6). This is now obsolescent and is being replaced by the 1-watt version which has a similar circuit arrangement but is built around a specially developed sub-miniature valve.

The larger 8-watt unit, used for longer ranges, consists of tuned-anode, tuned-grid oscillator built around the CV397a disc sealed triode.

As the modulator, unaided, cannot control this oscillator, a driver-unit, supplying the necessary power, is included in this model.

Both the 1-watt and 8-watt oscillators can be arranged to work either C.W. or pulsed, the choice depending largely on the avoidance of interference with other R.F. circuits associated with the oscillators in missiles.

The fact that these oscillators must be easily controlled in frequency and permit coupling to whatever aerial system is available, and at the same time be stable over a wide range of temperatures and pressures, involved major problems of design. This was particularly the case with the high power oscillator, where high voltages combined with low pressures necessitated considerable development work to prevent flash-over.

As a by-product to this work the design of R.F. power-measuring and impedance measuring equipment at these frequencies had to be developed from scratch, as no suitable units existed for testing purposes.

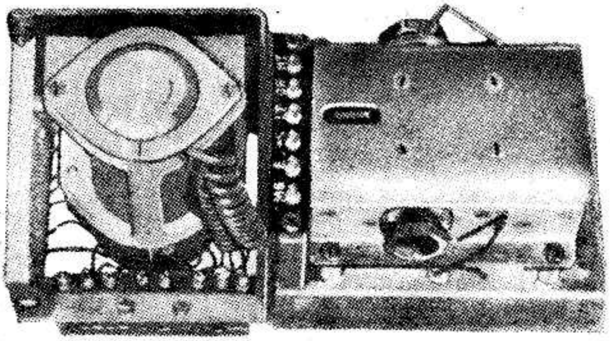
The ground equipment of the system provides two records, a histogram (i.e., high-speed record) and the main record.

Ground Station

For the latter the signal received from the airborne sender, after demodulation, is changed to a series of direct current levels and the step function thus produced is applied simultaneously to the Y plates of 15 cathode ray tubes.

From the output of the R.F. receiver a filter separates out the synchronising signal, which is then used to generate the time base for a large monitor tube and also to produce strobes coinciding with each channel. These pulses are used to brighten the traces on the 15 cathode ray tubes. Any number of them can be connected to each of the display tubes so that any channel or any combination of channels can be displayed on any of the 15 tubes. The whole 15 tubes are photographed side by side on a moving film 24in. wide.

Timing pips at each tenth of a second arer ecorded on each tube, as also is the firing pulse. On the completion of each firing short calibration lines from a crystal frequency generator are added to the record.



An assembly ready for installation.

Histogram Recorder

The histogram recorder is designed as a self-contained unit for producing records from single channel senders or histogram traces from multi-channel senders. It contains a receiver and discriminator similar to those used in the main equipment and is fed from a separate helical aerial. The display consists of three cathode ray tubes, one large and two small, which are photographed simultaneously by a continuous 35 mm. camera.

The large tube displays the single channel record or the series of 24 direct current levels corresponding to the channels in the sender. One of the small tubes is used to display a time scale, the lateral position of which is calibrated in terms of field strength, and the other small tube indicates any radio frequency deviation throughout flight.

The P.P.M. System

In this system channel information is given by the time interval between the trailing edge of a reference pulse (about 50 micro-seconds long) and the incidence of a one-micro-second channel pulse.

The carrier frequency is pulse modulated by the reference pulse and the channel pulses, the recurrence frequency of the complete pulse train being between 2,000 and 5,000 per second, according to the number of channels in the sender.

Up to 20 channel pulses, each of which can vary over a range of 400 micro seconds, can be accommodated between successive reference pulses. Normally, however, groups of pulses are confined to consecutive intervals of 80 micro-seconds, the range of time displayed on each of the five cathode ray tubes in the ground equipment.

Each channel is arranged to produce, either directly or via a transducer, a variation of voltage or a variation of capacity which is used to control the time interval between the trailing edge of a reference square wave and the generation of the respective channel pulse.

Airborne Sender

The airborne transmitting equipment of the set, the main parts of which are a modulator and an oscillator, is made in the form of a cylinder with a diameter of 4½in. and an overall length of 6¼in. for a 12-channel set.

For ease of manufacture and servicing, the modulator is split into sub-units, built around sub-miniature valves, consisting of a square wave generator and a number of four-channel blocks. Sub-units, each of which is " potted " in marco-resin, can be assembled to form modulators for 4, 8, 12, 16 or 20 channels.

The wave form generated by the modulator consists of a wide pulse of approximately 40 micro-seconds width, the trailing edge of which is the time reference for the system, followed by a number of narrow pulses of 1 micro-second width.

The wide pulse generator consists of a screen coupled phantastron. From the screengrid of this valve the pulse, negative in direction, is generated and fed to the grid of a feedback amplifier which inverts it and applies it to the grid of a cathode follower driver. The load of the cathode follower is taken to the bias line so that in the absence of the positive pulse the oscillator grid is cut off.

To derive the trigger for the narrow pulse generators the screengrid waveform of the phantastron is also differentiated and applied to the grid of a cathode follower, which cuts off the negative pips so that at the cathode a positive trigger pulse appears which corresponds to the trailing edge of the wide pulse.

This trigger pulse is the A.C. coupled (D.C. in later versions) to the suppressors of a number of phantastrons through individual diodes which act as D.C. restorers to the negative line through suppressor resistors.

In the absence of trigger the suppressors are held negative, so that no anode current flows. The screen grids are at a low potential due to the fact that the screens are taking the cathode current. When the trigger occurs the anodes begin conducting, starting their negative voltage excursion due to the Miller action of the circuit. This negative excursion is fed to the grids by the anode—grid feed-back capacitors tending to cut off the valve current. When this occurs the screen potentials begin to rise. Due to the capacity coupling between screen and suppressor this rise is fed to the suppressors and tends to drive them more positive and hold them there. This feed-back makes the screen waveform edge very sharp.

The valves remain in this condition until the Miller action ceases, i.e. until the valves " bottom ." This occurs at different times due to the different components and inputs controlling the rate of anode run-down.

When a valve " bottoms " its anode can draw no more current, but as the grid tends to go positive the screen commences drawing current so that its potential falls. When this happens a sudden change-over of current occurs between anode and screen, due to the suppressor screen coupling. The anode remains in this condition because the suppressor is cut off by the screen waveform. The circuit then remains in this condition until the next trigger pulse arrives.

The screen waveforms are then differentiated so that a series of negative pulses are produced which correspond to the various " bottoming " positions of the valves. These pulses are normally arranged in sets of four, each pulse having an excursion of 80 micro-seconds for full-scale deflection, the groups being constrained to occupy the time scales of 80-160, 160-240, 240-320, 320-400 and 400-480 micro-seconds —the time intervals required for full-scale deflection of the five display tubes of the ground equipment.

The pulses are then applied to the grid of the feed-back amplifier together with the wide pulse, so that the output at the anode is the wide pulse followed by the narrow pulses. This waveform is used to modulate the oscillator.

The oscillator normally used is a 2-watt (rated on C.W.) model, but for longer ranges an 8-watt oscillator similar to that used in the time multiplex system has been produced. With varying direct current supplies this meets all requirements from 2 to 8 watts.

A greater number of information channels can be obtained by introducing a time division switch on any one or more channels with the corresponding sacrifice of frequency response. Standard switch wafers at present in use have eleven contacts which can be arranged in a number of different ways, four capacity and four voltage channels or eleven voltage channels with the same voltage excursion being typical assemblies.

As these channels may be arranged to overlap, and up to four may be interlaced, some method of identification is needed. This is provided by the identification switch which runs at a low speed connecting each input to a fixed voltage, usually earth, in sequence so that once one channel has been identified all the rest follow in order.

Ground Equipment

The ground equipment of the P.P.M. system produces a maximum of five displays depending on the number of channels in use.

The time scales mentioned above—80-160, 160-240, 240-320, etc.—are used as the Y time bases for five separate cathode ray tubes, the channel pulses being used as brightening pulses for these traces. Each tube is photographed by a continuous 35 mm. camera, the speed of which can be varied from 2 to 120 inches per second.

To achieve this the signal is received on the ground, and after demodulation by a sensitive receiver the resultant train of pulses is fed into a voltage circuit box unit. Here the pulses are limited and the reference square wave is separated from the channel pulses.

A trigger pulse is then generated from the trailing edge of this square wave, and goes to each of the five time base generators, where two phantastron delay circuits are used to develop the appropriate Y axis time base for each display tube. At the same time the channel pulses, after further amplification and limiting in the voltage circuit box, pass through a pulse forming channel and are used as brightening strobes for the cathode ray tubes.

Before each firing the time-bases are set up accurately and checked by means of a built-in crystal calibrator, which is fed into the voltage circuit box and the scan on each tube adjusted accordingly.

A timing trace, obtained from the range master timing system, is displayed on a small cathode ray tube by the side of each of the channel recording tubes so that this is photographed simultaneously on the 35 mm. film. On firing, a pulse from the firing switch is arranged to displace this trace and indicate the instant of firing.

SOME DETAILS OF THE PROBLEMS INVOLVED AND OF MODERN PROJECTION UNITS

By "Erg"

(*Concluded from page 362 January issue*)

THE tube operates with a final anode voltage of 25 Kv. and the glass face is specially toughened and treated so that it is not affected by the soft X-rays generated by the tube. The construction of the tube is shown in Fig. 11.

In front of the tube is placed a spherical mirror, the image being further reflected by the flat mirror which encloses the tube. The natural tendency of the spherical mirror to pin-cushion distortion is counteracted by the slight barrel distortion introduced in the picture on the tube by the special design of the deflector coils.

The deflection angle of the tube is only 38 deg. as compared with the 50 deg. for the 12in. tube and the 70 deg. for larger tubes; this low deflection angle enables full scanning to be obtained with the 25 Kv. E.H.T. with only a 25 per cent. increase in the scanning power required for a 50 deg. tube.

The flat mirror reflects the picture through the correcting lens which is the essential part of the Schmidt optical system.

This section of the optical system is built as a self-contained unit, the focus and deflection coils being contained within the unit. It is completely enclosed and is dustproof.

From the correcting lens the picture is projected on to a mirror which is silver surfaced, and from this mirror to the special translucent screen. The complete system enables a compact, self-contained televisor to be constructed.

Projection for the Cinema

For projection in cinemas the Schmidt optical system is used on a larger scale and the tube is designed to operate with a final anode voltage of about 100 Kv.

The screen can be made of white material with a smooth finish. It is possible to obtain a greater degree of contrast with a silver beaded screen though the brightness of the resultant image falls off rapidly with the angle of view.

Protection Circuits

The high E.H.T. is generated by an R.F. unit, but although the screen of the tube is protected against ion burn by a backing of aluminium particles, failure of either the line or frame time bases would result in a horizontal or vertical line being burnt on the screen.

In order to avoid this condition a special protective circuit is introduced into the time bases so that in the event of either of them failing the tube becomes heavily biased and thereby blacked out.

The elements of such a protective system is given in Fig. 12. A portion of the applied mains voltage is tapped off the dropping resistor and is applied to the cathode of V1. From the anode a negative potential is derived, being built up across the condenser C1. This negative potential is applied to the grid of the tube via R1 and the brightness potentiometer; it is at the same time applied to the grid of the line output valve V2.

Now assume that V3, the frame output valve, is functioning (being fed with a sawtooth waveform from the frame oscillator), then a small proportion of the output is taken via C2 to the anode of V4a. At the cathode of this valve will appear a positive potential developed across C3. This positive potential is applied to the suppressor and control grids of the

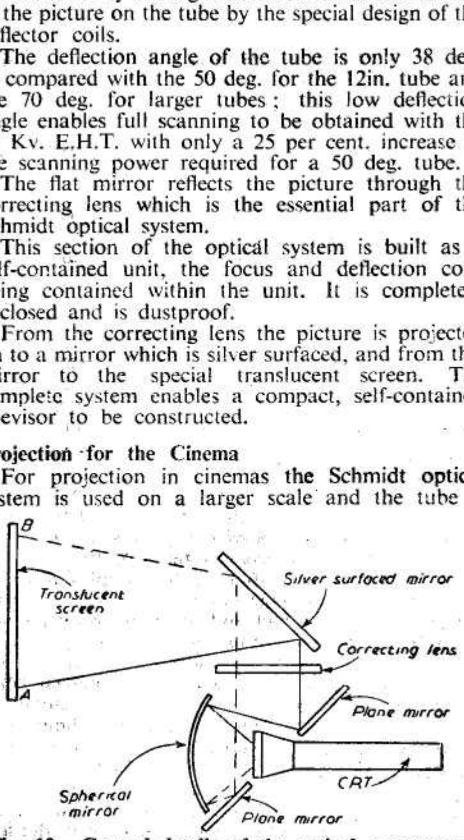


Fig. 10.—General details of the optical arrangement used in the projection system.

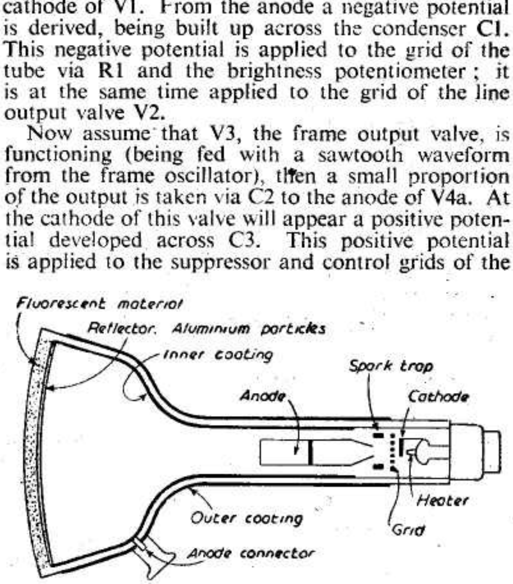


Fig. 11.—Details of the tube used for projection.

line output valve V2 which cancels the existing negative voltage developed by V1. The line output valve will therefore operate and pass the sawtooth waveform to its output transformer T. A small portion of this output is developed in the secondary winding Sb and is applied to the anode of V4b. A positive potential is thus developed across C4 in the cathode circuit of this valve and is applied to the grid of the CRT. The positive potential thus developed cancels the negative potential gained from V1 and the tube will pass current ; the raster or picture will be seen.

Now we can have two conditions of failure : if the line oscillator output ceases due to a failure of the line oscillator or the output circuit then no voltage will be developed across the transformer T and its secondary Sb, hence no positive potential will be found across C4 and the grid of the tube, to cancel the existing negative potential on it.

If the frame oscillator or output valve fails then no positive potential will be developed across C3 and hence suppressor grid and control grid of V2 ; as there is an existing negative potential on the grid of V2 from V1, V2 will cease to function ; no output is developed into Sb and therefore no positive appears across C4 to counteract the negative existing on the grid of the tube from V1.

Failure of either line or frame circuit will therefore black out the tube.

Projection and Colour

Of the two systems—projection or directly viewed tube—projection lends itself most readily to colour conversion.

A mechanically driven colour disc using the three primary colours can be rotated in the path of the image to produce a coloured picture on the screen. A system on these lines has been developed by the C.B.S. company of America, a cup-shaped colour wheel being fitted between the tube face and the spherical mirror. Fig. 13 shows the scheme.

The colour wheel is synchronised by the incoming signal so that correct colour reproduction is obtained.

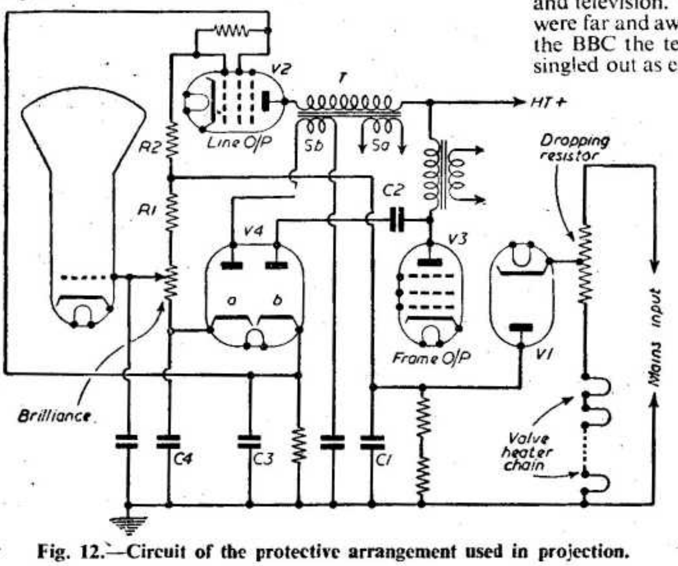


Fig. 12.—Circuit of the protective arrangement used in projection.

It should be possible to fit a similar system to existing projection televisors, when colour comes to this country, without drastic modifications in the layout of the televisor. There is sufficient room in the cabinets for the inclusion of such an item.

Projection and the Home Constructor

The optical unit developed by Mullard has been made available to manufacturers of television sets but has not as yet been made available to the home constructor.

The main secret of the system is in the production of the special corrector plate, and while the mirror system could undoubtedly be reproduced it would be a very difficult task for the home constructor to make such a plate.

For the time being, then, the system is not for us. Perhaps it is just as well because the tube develops a certain amount of soft X-rays which can be dangerous when it is viewed directly without its protective optical unit.

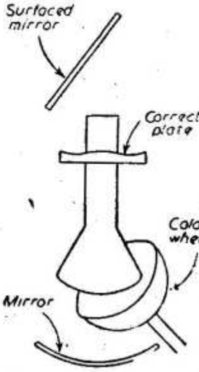


Fig. 13.—One suggestion for projection in colour.

Service engineers are advised not to view the screen of the tube closer than 40 in. when it is not of its optical unit without the insertion of a lead glass shield. The equivalent lead thickness of the glass shield should be 0.5 mm.

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9in. Blue picture. Heater volts 4. Anode 4 Kv. In manufacturer's original carton.

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5½in. screen. 4 volt Heater. This Electrostatic Tube is recommended as eminently suitable for Television, **15/-** plus **2/6** Pkg., Carr. and Ins. *Data sheet supplied.*

Ex. W.D. STEEL AERIALS

Also ideal for fishing rods—BRAND NEW 12ft. 3 4ft. sections of copper-plated steel highly flexible tapering ½in. to ¼in. Brand new in container. Plug-in type, **6/9**; Screw-in type, **7/9.** Packing and carriage, **1/6.** Insulated Base **3/-.** Webbing waterproof carrying case with shoulder-sling, **2/6.**

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E.H.T. Pencil Type S.T.C.

Type	K3/25	650 v.	1 mA. ...	4/7
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„	K3/45	3.6 kV.	1 mA. ...	8/2
„	K3/50	4 kV.	1 mA. ...	8/8
„	K3/160	12 kV.	1 mA. ...	21/6

H.T. Type S.T.C.

Type	RM1	125 v.	60 mA. ...	4/-
„	RM2	125 v.	100 mA. ...	4/6
„	RM3	125 v.	125 mA. ...	5/6
„	RM4	250 v.	250 mA. ...	18/-

L.T. Type. Full Wave.

6v. 1 amp. ...	4/-
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12 v. 2 amp. ...	10/9
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T.V. WHITE RUBBER MASKS (CORRECT ASPECT). We can supply a specially designed White Rubber Mask for 6in. C.R. tubes at **8/6** each. 9in. White Masks, **9/6.** 12in. White Masks, **16/11.** For Round or Flat faced Tube.

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The New Time Base may be used with existing Premier Televisors to convert them to the latest type of picture tubes. All the individual components may be purchased for a total cost of **£31/19/7** (less tube).
Data booklet, 3/6 post paid.

TERMS OF BUSINESS:—CASH WITH ORDER OR C.O.D. OVER £1
Please add 1/- for Post Orders under 10/-, 1/6 under 40/-, unless otherwise stated.

More Detector Vans

THE Post Office intends to increase its big drive in locating viewers who have not taken out licences.

Until now, only two G.P.O. detector vans have been employed in finding houses where TV receivers are in operation, but within the next year there will be eleven. Not only will they be able to trace receivers to individual houses, but also to the actual room in which the set is working.

Television Licences

THE following statement shows the approximate number of licences issued during the year ended November, 1953. The grand total of sound and television licences was 13,216,644.

Region	*Number*
London Postal ...	848,500
Home Counties ...	315,386
Midland	570,433
North Eastern... ...	359,671
North Western ...	385,290
South Western ...	113,109
Wales and Border ...	129,616
Total Eng. and Wales	2,722,005
Scotland	117,360
Northern Ireland ...	6,862
Grand Total	2,846,227

TV Aids an Editor

THE editor of the *Glasgow Evening News* supervises the layout and make-up of his newspaper with the aid of television.

A camera and receiver, which work on a closed circuit, have been installed by Pye Telecommunications, Ltd., the camera in the printing room and the receiver in the editor's office where he is able to check the layout and see the printers setting the type into position.

Engineering Division Appointment

THE BBC announces the appointment of Mr. L. Evans as Engineer-in-charge of the low-power television transmitting station near Douglas, Isle of Man.

Mr. Evans joined the BBC in 1941 and has served at a number of the Corporation's sound and television transmitting stations. He served with the Royal Corps of Signals from 1943-46 and was transferred to the BBC television transmitting station at Sutton Coldfield in 1949 and to the television transmitting station at Wenvoe in 1952.

Users Must Pay

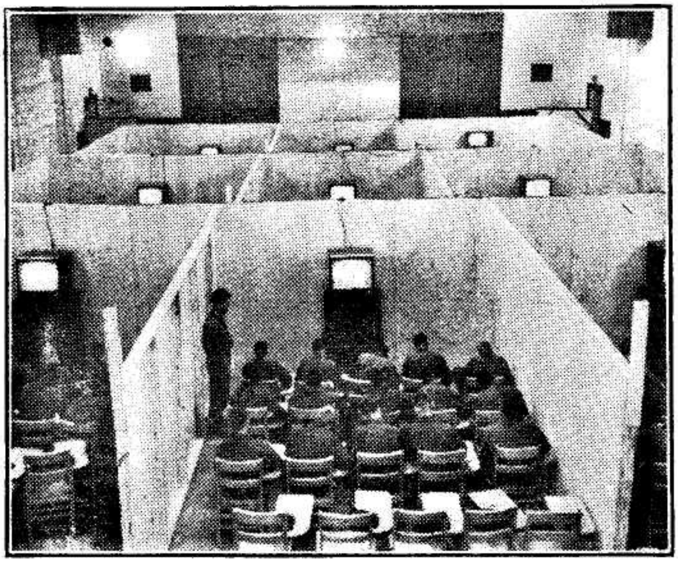
THE Housing Minister has stated that when a master television aerial is erected on top of a block of flats the cost must be met by the residents in the form of increased rents.

These increases, he adds, should not fall on the people in the flats who have not been able to afford or have not wanted receivers but on the viewers themselves.

Norwegian Service

ACCORDING to the director of Norwegian broadcasting, Hr. Kaare Fostervoll, an experimental television service is due to begin in Norway early this year.

As many technical difficulties exist with equipment and techniques, the cost of each pro-



A view of the nine television classrooms as seen from the control room in the rear of a theatre on an army post. Here, the U.S. Army Signal Corps is conducting experiments to test the merits of military instructions by television.

gramme is likely to be high. Licences will probably be around £5 a year but at the moment no advertising is contemplated.

Filling the Breach

WHEN New Yorkers spent a long period at the end of last year without their usual big newspapers, TV stepped in and efficiently filled the breach.

The day-long edition included large photographs and captions which were shown to viewers. The pages were turned over automatically to the accompaniment of music.

Record Output

AN all-time production record was set up in November, 1953, by the British radio and television industry, when 140,000 television sets were manufactured.

The trade had set a target of a million receivers by the end of December but this figure was reached by November, compared with 811,000 sets for the whole of 1952.

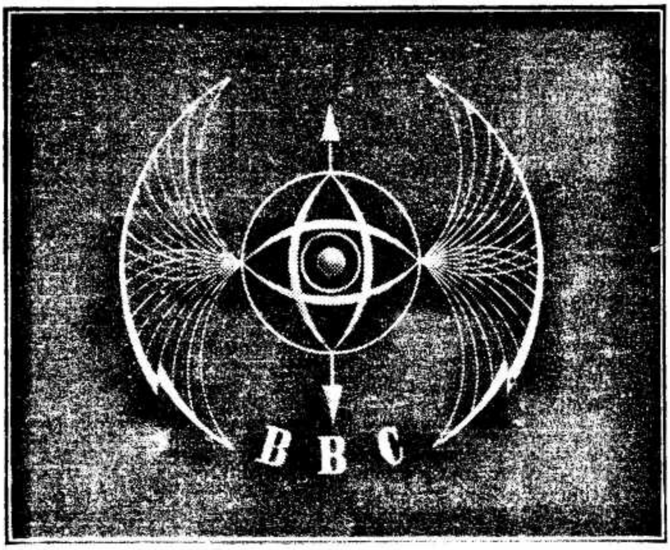
Half a million have been sold in the four months following the Radio Show.

Warfare of the Future

EXPERIMENTS are proceeding at the Signal Corps Pictorial Centre, Long Island, New York, in the use of television.

At the battlefront, the U.S. Signal Corps Mobile Television Section is carrying out the experiments and is a mobile, self-contained and self-powered television system capable of televising and controlling presentations from three field cameras, an airborne camera and an iconoscope film chain.

The present equipment used by the Mobile Television system is not considered to be tactical in nature, but the unit has pointed the way toward the development of the best types suited for tactical use.



The new BBC Television symbol which viewers see at the beginning of every transmission.

Fees for Footballers

WHEN commercial television is introduced in this country, it is probable that viewers will see a great deal of sport, including association football which hitherto has not been seen very often because of its ultimate effect on gate takings.

Mr. J. Guthrie, chairman of the Soccer Players' Union, is anxious that when commercial backing does enable big matches to be televised, the professional soccer men themselves will receive some financial benefit and is asking on behalf of the union that a fixed fee be paid to all players taking part in televised games.

BBC Symbol

WE understand that a colour film has been made of the new BBC television symbol as well as the normal black-and-white copy which viewers see at the beginning of every transmission.

The symbol is of an abstract pattern, consisting of two intersecting eyes which scan the globe from east to west, symbolising vision and its power. Flashes of lightning on either side represent electrical forces, the whole form taking the shape of wings which suggest the creative possibilities of television broadcasting.

Island Reception

IT is revealed that the Isle of Wight TV transmitter will probably be operating by October or November.

A 200ft. temporary mast is to be erected by the BBC with transmitting aerials at the top. Half-way down the mast will be a receiver to receive vision, which will be beamed from Golden Pot, near Alton. A land-line will carry the sound direct from Alexandra Palace.

Free-lancer

MAX ROBERTSON, well known to the TV public as a top sports commentator and his introduction of "Panorama," has left the BBC to take up duties as a free-lance.

No Scope Here ?

IN a written reply on coin-in-the-slot TV, which enables the viewer to insert a coin and choose his own programme, Mr. L. D. Gammans, Assistant Postmaster-General, has stated that there would be no scope for the system in this country.

Pye Industrial TV for Export

RADIO ITALIANA are to be the first overseas buyers of the new Pye Industrial Television. Recently, Pye supplied the Italians with the most up-to-date outside broadcasting unit for Turin. They are now to be the first television service to use miniature cameras—for caption scanning. The industrial cameras, more than £100 cheaper than their American counterparts and with a much better picture quality, are likely to prove a great attraction to Britain's export customers.

Capable of being run off ordinary power points, these cameras have been designed for industrial purposes ranging from the remote viewing of dangerous processes to security work and advertising.

TELEVISION PICK-UPS AND REFLECTIONS

UNDERNEATH THE DIPOLE

By Iconos

ARTY-CRAFTY

MANY years ago a well-known stage producer wrote: "Lighting is the most important of the accessories of the stage, because lighting makes acting visible." He also stressed that audiences paid their admission money to hear as well as to see, and that the mumbling and throwing away of lines was unforgivable. The association of sight and sound is important from the point of view of intelligibility. Actors are sometimes nearly as bad on TV as on stage and screen, so far as the mumbling of lines is concerned. The last word or so of sentences are frequently "thrown away" at the request of the director, who is striving to achieve a so-called natural effect. The limit was reached recently when an actor played a scene with a girl, who was talking at such a low level that he couldn't hear her and took his cues from the moment her mouth remained closed! On the whole, diction was above normal in *Britannia of Billingsgate*, a comedy with a somewhat contrived story about a woman cleaner at a film studio who becomes a star overnight. The story hinges upon the reaction of her family to the sudden acquisition of wealth, and Lana Morris and Vi Stevens gave creditable performances. Nothing too arty-crafty about this play anyway! I must say that when I see all the facilities now available at Lime Grove Studios I wonder just how the producers ever managed to put over such good play productions at the Alexandra Palace two or three years ago. Or were we less critical then?

PARLOUR GAMES

TV Parlour Games come and go, but "What's My Line?" seems destined to be with us for ever. And why not? This feature has had its ups and downs, but with the interesting personalities recently presented and the admirable guidance of Eamon Andrews in the chair it seems all set to achieve a new high in viewer appreciation. The womenfolk on the panel have a big responsibility: their make-up, hair styles, jewellery and dress are having, through the medium of TV, a tremendous influence on the trend of feminine fashions. These courageous ladies—Lady Barnett, Barbara Kelly, Patricia Medina and others—sit there, enduring the searching scrutiny of lengthy close-ups while they coolly put their questions to the "victims" or the unknown celebrity. One recalls the high standard of elegance for the female element of the panel set by Elizabeth Allan, and ever since then our pleasure has been enhanced by gazing upon these smart women.

PATRICIA MEDINA SCORES

PATRICIA MEDINA made an immediate hit on "What's My Line?" when she stood-in for Barbara Kelly. Starting nervously, this charming actress held our attention as she tried vainly to guess the "victim's" line—and how glad we all were when she eventually succeeded in guessing the occupation of Mrs. Blogg, the signalwoman! The BBC's make-up department are the backroom boys (or girls) who play an important part in making this feature such a success, but there are times when they should pay a little more attention to participants other than those who sit on the panel. Joan Collins, for instance, was an "unknown celebrity" who played her part well, despite a pair of make-up eyebrows which would win the approval of George Robey. She talked quite a lot about her new colour film, *Our Girl Friday*, without mentioning its name! Another stand-in who scored an immediate success was Robert Morley, who took the place of Gilbert Harding while he was indisposed.

PICTURE RECORDING

DURING November RCA gave further demonstrations in Hollywood of their colour TV system and also announced that they had perfected a method of recording or reproducing colour or black-and-white pictures on magnetic tape. The RCA tape is ½in. wide, plastic-base coated with iron oxide and travels at 200ft. per second compared with a TV tape system developed by Bing Crosby Enterprises which is 1in. wide and travels at 100ft. per second. It is envisaged that in due course magnetic recording from electronic cameras will displace photographic methods in both television and motion picture studios. It is even contemplated that magnetic recording tape systems will be available for home recording of television pictures from either black-and-white or colour sets. But the prospects of these magnetic developments are not viewed with enthusiasm in many quarters. One man from the film industry was heard to remark, "This is the end!" But American TV manufacturers and dealers are also not too happy about the newest developments of colour TV or magnetic recording methods; complicated new techniques and increased costs of colour operation are scaring the TV producing companies and sponsors. The only people who seem to be wholeheartedly in favour of these new systems are the cinema newsreel companies which consume millions of feet of photographic film base at present. They visualise the wiping and re-use of magnetic film recordings of news events after the very short life each edition has before it becomes stale news. The time factor and costs of film stock and processing have prevented the newsreel makers from using colour except for special events, such as the Coronation. Magnetic recording of colour pictures from electronic cameras would enable them to give colour news speedily and cheaply. However, it may be two or three years before such a proposition can be tackled.

HIGH DEFINITION FILMS

MEANWHILE Norman Collins' High Definition Films electronic camera system has made much progress. The Highbury Studios are now fully fitted out with lighting equipment and all the other accessories of normal film production, and commencing in February a regular output of films for American—and possibly British—commercial television will be maintained. At a recent trade luncheon Mr. Collins spoke of the progress of the system. With three TV cameras and a mixer, he said, it is possible to record on both 35 mm. and 16 mm. film, thus making simultaneously negatives suitable for retransmission on British or American television. He claimed that with the electronic cameras, 45 minutes of programme material could be recorded each day, which compares with the three minutes a day achieved by the normal means in a film studio. The High Definition Co. employs a fine team of ex-BBC TV engineers, including T. C. Macnamara, Kemp, Spooner—all specialists in one or other of the complicated techniques involved. Mr. Kemp's contribution to the development of teleciné recording cameras is well known and Mr. Spooner was a pioneer with "inlay," "overlay" and other trick processes now in regular use. These systems offer great possibilities for photographing real "exterior" scenes indoors by a travelling matte process. The actors, lit with yellow or incandescent light, play their parts 15ft. or 20ft. in front of a blue backcloth, which is illuminated with arcs. Colour separation by beam-splitting or other methods provides a subsidiary silhouette picture, which actuates an electronic changeover switch to a filmed background picture. To put it more plainly, the actors can be superimposed upon a filmed picture of any exterior scene, without resorting to back projection methods. Thus, they can stagger towards the cameras in the Highbury Studio stage, appropriately perspiring (perspiration supplied by make-up department), covered with desert dust (supplied by prop. department) and their efforts can be made composite with a background picture filmed on the real Sahara Desert (obtained from a film library). What tricks it is possible to achieve!

SUNDAY NIGHT GLOOM

UNTIL the advent of TV, Sunday night used to be radio night. Pleasant, popular, easy-to-listen-to music of the Palm Court Orchestra type from Grand Hotel and elsewhere filled the bill nicely. Nothing to offend anybody and yet the fare was sufficiently light and pleasant to fortify the listeners for the cold douche of Monday morning. I don't know whether the Head of BBC Television has the same worthy objective, but if so his programme planners have been very wide of the target. *Wuthering Heights*, *Rope* and *Once in a Lifetime* were Sunday night plays which left many viewers in a state of acute pessimism, quite inappropriate for facing up to the rigours of Monday morning. I am not advocating the presentation of crazy comedy or revues on Sunday night, or the entire elimination of serious drama. *Wuthering Heights* is pretty grim and hardly suitable for a rewrite as *Wuthering Heights on Ice*. *Once in a Lifetime* was a satirical comedy of 20 years ago which failed to induce many laughs because it was not old enough to be a "period" piece and yet was too old to be anything but "dated." Harry Green gave a tempestuous portrayal of Herman Glogaver, a Hollywood film magnate, which seemed to me to have more of the traditional broadness of farce rather than the straight and serious interpretation which seems so necessary for satire. Colin Gordon gave a sound performance as Laurence Vail, a frustrated playwright, and he alone of the players seemed to convey the true satirical atmosphere. The rest of the cast, which included some fine players such as Paul Carpenter, Michael Balfour, Margaret McCall and Elaine Dundy, did their best with lines which, in the course of time, seem to have lost a great deal of their humour. Perhaps in another 10 years, with 3-D and other innovations sweeping over the cinema, this comedy of the early days of "talkies" will once again carry the humorous appeal of its first presentation as a stage play over 20 years ago.

HERE AND THERE

The "Zoom" Lens

THE BBC is to fit the "zoom" lens to all outside broadcast cameras. The lens, which is manufactured by a British optical company, can focus on a man in a crowd from a mile distant. Its most successful use was in the Coronation broadcasts last June.

East Anglia Waits

ALTHOUGH Sir Ian Jacob, Director-General of the BBC, had forecasted that East Anglia would be "on the map," as far as TV coverage was concerned, within the next two years, it is now understood that this period is likely to be longer.

A BBC spokesman has said that there are seven other stations to be completed before work can begin on the transmitter for the Eastern counties. The proposed site for the station is near Tacolneston, nine miles south-west of Norwich, covering Norfolk and East Suffolk.

Sponsored in Italy ?

IT is reported that Italy is planning a sponsored television service and that an American company is bidding for the rights.

At present a licence for the normal programmes from Milan and Rome costs the Italian £8 15s. a year.

Trouble over Church Relay

MINISTERS and elders of the Church of Scotland are angry over the televising recently of a Communion service from the parish church at Dunbarney, near Perth. The ministers are indignant because only the vicar of the church was approached for permission instead of the Church authorities. At a Perth Church meeting, the Rev. W. Drummond Hunter said: "A stunt is the very life-blood of the BBC. If the BBC had been present at Sinai with one of their recording vans, I have no doubt they would have pursued Moses into the Holy of Holies."

BBC Expenditure

IN 1952-53, the BBC spent £4,334,474 on television of which £1,679,000 was covered by viewers' licence revenue and the rest by reserves and other sources.

If the BBC had to rely on the money received from licences alone, the present £2 licence would have to be increased to £3 10s.

Projection for Commons

THE Members' television room at the House of Commons has recently been equipped with a projection receiver.

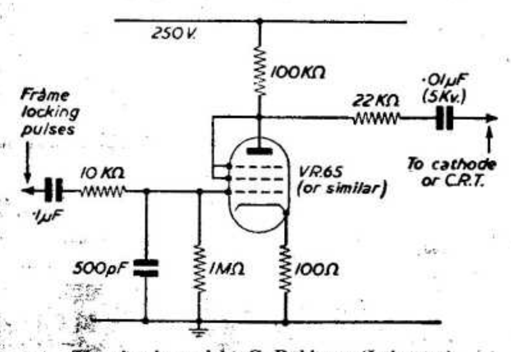
A picture of 3ft. by 4ft. now affords comfortable viewing for 60 to 100 Members at a time.

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).

FLYBACK SUPPRESSION

SIR,—I have read with interest the article in the December issue on "Flyback Line Suppression," and am prompted to send you details of a circuit I have been using for the past 18 months on my 6in. TV. I would point out that I modulate my tube on both the grid and cathode and therefore require a rather large pulse to suppress the flyback lines.



The circuit used by C. Robinson (Leicester).

From the circuit you will see that the driving voltage is obtained from the frame locking pulses (in my case from the highly successful two pentode stage sync separator) and applied to the grid of a VR65 (or any similar valve) which is strapped as a triode. The lengthened frame locking pulses are taken from the anode and are applied to the cathode of the tube through a .01μF (5KV.) condenser. The current taken by this valve is about 2 mA. and will have no effect on picture quality or locking of the frame time base whilst making flyback lines a thing of the past.—C. ROBINSON (Leicester).

W.A. "VIEW MASTER"

SIR,—May I be permitted to thank you for the advice given in the current number of PRACTICAL TELEVISION to a correspondent from Glasgow in trouble with an alteration of a View Master to W.A. tube.

The correspondent is recommended to try re-aligning his coils and exchanging R21, the resistor which with C18 forms the C.R. value in the sync separator anode lead.

My View Master had been in trouble for a long while with flyback lines, which I could not remove by any artifice known to me; with frame rolling over and line lock of almost uncontrollable "touchiness."

A 6d. resistor substituted for the original 3.3 MΩ has cured the trouble after I had spent much time and money in substitution of most components save the right one, which I never suspected, and which did not reveal its weakness under resistance meter test, due presumably to lighter load conditions. Many thanks. It has been a long road.—A. E. COBILL (Bexleyheath).

"THREE-ELEMENT AERIAL"

SIR,—I should like to point out that the "Three-element Aerial" (PRACTICAL TELEVISION, June, 1953) has been built *partly* from material provided by a local engineer, and with *all* the properly dimensioned vertical elements obtainable from Gladstone Radio (formerly Rebus Electric Ltd.), and has been in constant use at this location for the last three months for receiving the Kirk o' Shotts transmissions, conservatively estimated to be 116 miles away.

The aerial is erected on a 25ft. pole, and the whole array can be taken down to ground level and re-erected in a very few minutes. The feeder is 80Ω twin cable and seems to give a very slightly better gain than 80Ω coaxial. Reception is very satisfactory except when transmissions are reduced to half-power and even then the signal isn't entirely lost. The receivers are the conventional R1355s and RF26 units for sound and vision, plus the 208A pre-amplifier, but noticeable improvement has been effected by the modification of the R1355 vision receiver to conform to the output circuit of Fig. 5(b) ("An Inexpensive Receiver," PRACTICAL TELEVISION, November, 1953).—THE REVEREND J. RODGER (Aberdeenshire).

"H" AERIALS

SIR,—The article by Mr. Harknett on the relative merits of "H" type aerials and multi-element types was read with considerable interest, by me at least. I could not agree more with his final comment.

However, I cannot agree with his figures or his reasoning.

When measured in free space a quarter-wave spaced dipole and reflector (H type array) has a gain of 3.0/4.3 db. and an impedance of 60 ohms. These figures may be slightly modified by minor adjustments of rod lengths.

Similarly, the gain of the average three-element array is 7 db. to 7.5 db. The impedance of this type is of the order of 15 ohms (excepting folded dipole types).

Thus, it will be observed that Mr. Harknett's figures were on the high side; however, the 3 db. difference is maintained.

Mr. Harknett is correct in assuming that there is a loss due to mismatch when using multi-element arrays, as experience has shown that the anticipated 3 db. extra gain is not always evident, if ever.

This is not because a three- or four-element array cannot be produced with, or matched to an impedance of 60 or 70 ohms. It is not at all difficult by means of a folded dipole to match to any impedance between 50 and a 100 ohms as required.

The mismatch occurs upon erection. The impedance figures refer to an array in free space. These figures are considerably reduced when the array is placed within one wavelength of earthed objects such as supporting metal mast, roofing and chimney stack, and lead flashing, etc. The relative phasing between elements is also affected.

This applies to any aerial array, but since multi-element arrays have more supporting structure, more elements, and the fact that the mast is commonly in close proximity to the driven element, the effect is more pronounced. Some manufacturers can and do take these effects into account when determining their matching arrangements.

However, as conditions differ considerably between aerial sites there is unavoidably a serious mismatch in many instances.

I estimate that this results in a loss of one to two dbs. This gives the three-element array a possible extra gain of one db. over the conventional quarter-wave "H" type. Unless a receiver is working at maximum gain this is not noticeable.

Finally, although agreeing that a perfectly balanced system is to be preferred, there is nothing to be gained in using twin feeder if the receiver is designed to accommodate co-axial feeder.

The use of unscreened twin feeder may seriously increase the amount of interference. On the other hand, screened twin feeder is no cheaper than co-axial feeder and has increased losses.

I trust that the foregoing remarks do not detract from the main theme of Mr. Harknett's article, that is, the "H" aerial correctly installed is difficult to beat.

Summing up, I would say that up to 80 miles at least the "H" type aerial is satisfactory; if not, the receiver design is at fault, in which case a possible db. or two extra will not materially assist. I have proved this by experience and by experiment.—H. W. Critchley, A.M.Brit.I.R.E., C.G.I.Telecomm. (Scarborough).

SIR,—On reading Mr. M. R. Harknett's recent notes concerning "H" and multi-element array aerials, one is rather inclined to the view that the arguments employed are specious. It is surely not difficult to secure good matching conditions to an aerial; alternatively, by employing a mast head amplifier as part of the aerial system, ideal matching conditions are readily secured. It is also to be noted that the ideal pure resistance of 70 ohms to which Mr. Harknett refers is rarely present in an aerial and in any event only over a relatively narrow frequency range. Mr. Harknett also mentions that the use of a twin feeder provides an almost perfectly balanced system, thereby providing cancellation of interference picked up on such a feeder. Unfortunately, this is only the case when the input circuit of the receiver is also perfectly balanced. This is a very difficult condition to achieve, and it is probably for this reason that very few receivers employ such input circuits. There is, however, a point concerning multi-element arrays which Mr. Harknett does not mention, and it is a rather important one because it provides an explanation for the disappointing results often provided by such arrays. The addition of elements to an aerial will improve the directivity characteristics of the assembly. There is thus secured an increased effective gain together with an increase in the front/back ratio. This change in the directivity characteristics tends also to occur in the vertical plane so that the vertical acceptance angle of the assembly becomes restricted.

This is an undesirable state of affairs, for the fringe viewer has to orient his aerial for optimum reception in two planes, the vertical one probably varying with reception conditions in any case. The optimum arrangement for the fringe viewer would appear to be an aerial having elements employed to reduce unwanted interference rather than to secure extra gain, and to arrange these elements so that the aerial is not excessively directional in the vertical plane above the horizontal. In addition, the inclusion of an amplifier as part of the aerial proper will effect a substantial improvement for three reasons. First, it is easy to secure maximum transfer of signal to what becomes the first stage of the receiving system, secondly, the first stage of the receiving system picks up less direct interference due to its elevated position, and thirdly, the gain provided by the amplifier unit renders innocuous any interference picked up on the feeder.—S. West (Gt. Yarmouth).

SIR,—Mr. Flude's criticisms of my article "H Versus the Multi-element Array" call for an explanation of the points which he did not appreciate.

First, while it is admitted that manufacturers would adjust their aerials for the best possible match, a multi-array (being undisputedly superior for narrow band requirements) is impossible to match correctly over the wide band required for television. This means that a compromise has to be sought which results in an impedance which is far from 70 ohms over the whole band.

Secondly, the impedance of a quarter-wave spaced "H" aerial is usually given as 60 ohms and in any case an impedance of 50 ohms is quite a reasonable match. Values of 10 and 20 ohms are quite common for multi-arrays.

Thirdly, for nearby objects to affect the twin feeder they must be close in relation to the spacing of the wires. A coaxial feeder is by no means perfectly screened, as it is only earthed at one point. At distances of odd quarter wavelengths from this point, the impedance to earth can be very high, and unless special precautions, such as cutting the cable to an exact length, are taken, serious interference pick-up can result.

Fourthly, a multi-array, being inherently very critical in adjustment, is much more easily upset by the metal pole. Also, the pole is usually placed at the centre of gravity of the array for mechanical reasons and thus comes very near to the element being fed in the case of the multi-array.

Fifthly, when the minimum detectable signal level is determined, as it is in fringe areas, by a general background of external noise, i.e., galactic and man-made noise, and not by valve noise as was once supposed, then the number of noise sources in range of both polar diagrams will be the same to a first approximation since the areas covered will be the same. Even in the case where a nearby point source of interference is giving trouble, the "H" is still favoured for eliminating this, as it has a definite null in its polar diagram opposite to the direction of propagation, whereas in the case of the multi-array there are parasitic lobes extending backwards which will easily pick up interference.

Finally, I would like to say that I do not consider Northampton with its 500 micro-volt per metre signal from Sutton Coldfield to be a fringe area, and therefore do not feel that Mr. Flude is writing from practical experience. In the area where I have been conducting experiments, the signal strength is less than 50 micro-volts per metre.—M. R. Harknett (Hants).

TELEVISION SPECIALS

LASKYS RADIO

WIDE ANGLE FOCUS MAGNETS. Suitable for all types and makes of C.R. tubes with 38 mm. neck. Fitted with vernier and picture shift control. By Goodmans. 25/-.

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OVERDRIVEN VALVE

I have bought a second-hand Murphy V114 television set, but it has developed a fault in the line time base. The second grid in the Pen46 valve glows red when the set is turned on and stops the horizontal scanning lines from filling the tube face, also the two resistors get very hot which are connected to the base of the Pen46. I had the valve tested but have found it perfect. I have checked the circuit but can find nothing wrong. Could you please help me ?—W. M. Broadey (Basildon).

Insufficient saw-tooth drive to the line output valve may be responsible for the over-run grid, and in this connection you should investigate the frame generator and associated coupling circuits. Try replacing the relevant T41 valve, and ascertain that the coupling capacitor possesses adequate insulation. If the smaller components appear to be up to standard, however, you should suspect the line output transformer for short-circuited turns.

FRAME FOLDOVER

I have had my " Argus " televisor working for some time and get an excellent picture, but with one exception ; this is right across the top of the picture I get a bright band, which is approximately ½in. to ¾in. wide or deep. The artists, etc., get their heads into this, and completely spoils the picture. Some scenes are worse than others. I will be very pleased if you will tell me cause and give me the cure.—G. A. Peers (Newton).

Your trouble is due to foldover at the top and the simplest cure is to reduce C44—a value of 0.002 μF is suggested.

VISION ON SOUND

I am troubled with bad hum that comes in on picture signal. No trace of hum at all when speech only is being transmitted, i.e., between items, or when picture is finished at night and news is being read out. Picture is quite good. Set is now just two years old and has always had a certain amount of same trouble. Extra mains smoothing makes no difference at all. At times, volume of hum is not too bad, but at other times volume has to be kept at a whisper to be bearable. Set has been tried on different aerials, several miles apart. I would be pleased if you could help. Set is a G.E.C. model 5145—A. W. Branson (Cosby).

This trouble is caused by the vision signal breaking into the sound section of the receiver. It can be cured by carefully adjusting—with an insulated trimmer tool—the two air-spaced trimmers positioned on the top of the sub-chassis for minimum vision break-through. In extreme cases it is also necessary to adjust the first core in horizontal line with the chassis connecting socket for maximum sound.

"VIEW MASTER"—PICTURE SIZE

I am still having trouble with my picture size on my " View Master " 12in. screen. I have increased the E.H.T. to 9.3kv. with good results and I wonder if a further reduction of value of R60 would improve things.

Another spot of bother I have is picture slip after one hour of viewing ; a slight adjustment of R59 and it is all right until the next time.—W. Coleman (Birtley).

There is no reason why the value of R60 should not be reduced further to increase picture height, or alternatively R56 could be reduced slightly.

Regarding picture slip, this may be due to R21 being too high in value or to the vision receiver alignment being incorrect, particularly those coils in the V3, V4 circuits.

FOLDOVER

I have a Marconiphone VT73DA on which the first inch of picture (left-hand side viewing tube face) seems to fold over on itself. Whereas this portion is a little brighter than the rest of the screen, it is not too noticeable until sideways movement takes place on the picture, then this position becomes a revolving mass, but the rest of the picture stays O.K. Also to lock the picture the line hold has to be at its limit, and even this sometimes fails to hold, consequently too much gain has to be turned up to make it lock, thus giving a very contrasting picture.—W. Schaefer (Cannock).

Sometimes low H.T. line voltage causes a form of foldover to the left-hand side of a picture on your receiver. This is probably the case if it is necessary to use a maximum setting on the picture width control in order to obtain a full horizontal scan. On the other hand, the U35 reclaim diode may be low in emission to cause the symptom. Also check, by substitution if possible, the B36 (line/frame generator valve), and the KT36 line output valve.

A faulty B36 valve may also be provoking the line hold control defect. Another cause in this respect is the 0.33 megohm resistor connected to the slider of the horizontal hold control going high in value.

MAINS SECTION BREAKDOWN

I should value your opinion on the following :

I have a Kolster Brandes television set, console model EV40B, purchased in 1950. This set broke down at the end of a show : the picture faded out normally, along with the sound, then the set went dead. On looking in at the back of the set, smoke and sparks were seen ; the set was immediately switched off. On examination it was found that both fuses on the set had blown, the reservoir and smoothing capacitors had failed, a resistance of 470 ohms connected at anode of line output valve had dropped to a few ohms. Line valve was tested and was found to have dropped in emission.

A new valve resistance and fuses and capacitors were inserted, set switched on, result being no sound or picture. A test for H.T. voltage was made at either side of smoothing choke, but no H.T. was registered ; the choke was tested and found O.K. Valve and tube heaters light up, which makes me think that the auto-transformer is O.K. Rectification is by metal rectifiers of which six are used, centrecell type RM3.

I am wondering if these rectifiers have failed. If so, is there any method I can try to test same as they are easily removed from set? — A. R. Baker (Sheffield).

The 10 ohm wire-wound resistor connected from the mains transformer to the A.C. input side of the rectifier bank may have gone open circuit due to the short circuit across the electrolytic capacitors. Try to obtain the use of an A.C. voltmeter to measure the mains input to the rectifier bank. If this is normal and still no D.C. exists across the reservoir capacitor you should suspect the rectifiers. There is no simple test for these, and in any case it is not advisable to replace just one RM3. The complete bank should be discarded and a single RM4 should be used in place.

AERIAL SELECTION

My television aerial is a horizontal "X" mounted on a 10ft. pole. I live about 8 miles from Pontop Pike station and about 80 yds. off the road. I get a lot of white spots on my Bush screen when motor-cars and motor-cycles are passing. Will a wide-spaced "H" aerial with balanced twin-feeder clear the white spots? — Wm. Scott (Ryton-on-Tyne).

We cannot advise you on the best type of aerial to use in your location, for experience of the local reception conditions is the only guide in this respect. We would point out, however, that buildings can successfully be used as screens against ignition interference, but the best position for the aerial must be found by trial and error, and it is frequently one in which the aerial placing is most unorthodox. The use of screened balance feeder is generally considered desirable in high interference zones.

SOUND ON VISION

I have a Regentone "Big 12" television (Holme Moss), two years old, and recently a fault developed which I think may be sound signals breaking into vision. The picture shakes according to the volume of sound, and very loud signals momentarily break up the picture. I have cut the dipole aerial rods to tune in to vision wavelength and this seemed to improve but not cure it. I would be grateful if you could tell me what I can do to cure the trouble. Also, if you can (as I have only had experience with sound radio, and have no wiring diagram) give me instructions to identify the faulty parts.—C. E. Pickvance (Bolton).

Sound on vision is almost certainly the cause of this trouble. The cure is generally quite simple, and adjustment to the local oscillator trimmer for maximum sound output consistent with minimum sound on vision is all that is necessary. The oscillator tuning adjustment takes the form of a threaded brass rod protruding through the R.F. chassis. Looking at the chassis from the rear of the cabinet a 6F1 valve will be observed positioned at the far end of the chassis, in line with the contrast control. The oscillator adjustment is directly behind this valve.

VARYING BRILLIANCE

I have a G.E.C. TV set, model BT4542 (identical in circuit to table model BT5145), which gave good service for nearly two years. Recently a fault has developed which I would like to remedy. At intervals of about half an hour and sometimes much longer the brightness of the screen rapidly increases to an extremely high level and then suddenly drops again to the original value or even less and then performs normally for another long interval. Can you help me to find the cause? Another trouble with the appearance of the picture is a cramping at the bottom of the picture which cannot be satisfactorily corrected by the linearity control.—G. W. Gordon-Smith (Teddington).

This trouble may be caused by an intermittent heater-to-cathode short in the vision interference limiter diode, or in the picture tube itself. The D77 diode concerned is positioned on the main chassis to the left-hand side of the focusing unit when viewing chassis from the rear of the cabinet. The picture cramping vertically is often provoked by one (or sometimes both) of the frame timebase valves altering in characteristics. The valves in this section are the L63 (frame generator), positioned on the main chassis to the left of the deflector coils, and the N37 (frame output), positioned in the far left-hand corner of the main chassis, adjacent to the frame blocking oscillator transformer.

"ARGUS" VOLTAGES

I have just completed building an "Argus" as per your blueprint and instructions.

I am having difficulty in getting my sound and vision units to function. I get a good-sized and proper-proportioned raster, so I think my tube and time-base units are O.K. When I connect up my vision unit it does not seem to have any effect on the raster at all. It does not seem to make any difference if the aerial is connected or not. I have tested this on a friend's aerial as well; in fact, I have had a neighbour's set working on my aerial, so I think my aerial is O.K.

I have a cheap voltmeter with an 0-240 v. and 0-12 v. scale. I have taken readings on the vision strip as follows:

V1 and V2 anodes 80 volts L.T. 6 volts.

V3 and V4 anodes 120 volts on all valves.

I have checked my meter against a high-class meter at my works and I think it is reading about 5 per cent. low.

I am very much an amateur and have not attempted anything like this before, but I have been reading up your journal and judging by some of the readings for some of your other designs these figures seem low to me. I checked my H.T. connections for sound and vision in power pack and I get a full reading there and I am thinking some components are at fault.—C. R. Young (Worthing).

You are losing a lot of voltage somewhere and this must be checked. Typical voltage readings were published in PRACTICAL TELEVISION, April, 1953, issue. V1 screen and anode should be 180 v., V2 anode and screen 170 v., V3 200 v., V4 210 v. and V5 200 v. anode, 240 v. screen.

The most likely source of loss will be leaky condensers and these should be checked, by connecting the condenser in series with H.T. and a voltmeter, the other side of voltmeter to earth; no reading beyond an initial kick should be obtained.

When the voltage readings are nearer the figures mentioned above, tune in the vision signal as given in the data and peak each coil; a turn can be added or subtracted from any coil which does not peak, to overcome stray wiring capacitances.

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News from the Trade

SINGLE UNIT, FORWARD PROJECTION RECEIVER

WHAT is claimed to be the first 4ft. x 3ft. forward projection receiver to be completely housed in a single cabinet, is now being produced by Nera of England, Ltd. This new model is designed to meet the demand from hospitals and institutions for a self-contained, transportable, large screen television receiver, which may be safely locked up when not in use.

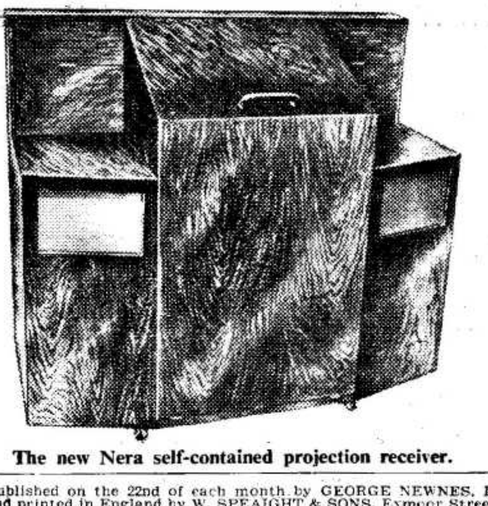
The cabinet, which is mounted on castors, is comparatively small in size when closed, enabling the receiver to be moved easily through narrow doorways and to negotiate awkward corners. In operation, the screen is raised from the back of the cabinet and the centre panel lowered. In this position the screen locks into place giving it a most convenient height and angle for viewing by a large audience. Since both optical focus and screen position are fixed, no mechanical adjustments have to be made, and the folded beam arrangement has the additional advantage of reducing the length of throw required to about half that of a normal projector.

On closing the cabinet, the action of lowering the screen automatically switches off the receiver, and after closing the centre panel the cabinet may be locked so that the receiver can neither be switched on nor tampered with by unauthorised individuals.

This new instrument, Model C 48, is constructed to the same high standard as the other Nera models, and employs interchangeable chassis for the R.F., timebase and power supply units, a method which facilitates rapid servicing, since a complete chassis may be changed in a matter of minutes should a fault occur. The standard Nera remote-control panel is fitted, giving complete control over contrast, brilliance, focus and sound volume. This remote control is normally supplied to operate at any distance up to 20ft. from the receiver, but this distance may be extended to order, as required. The special activated screen enables the equipment, when correctly positioned, to give a brilliant picture under normal room lighting conditions, an important factor when used in hospitals and public rooms. Ample sound volume is obtained from a push-pull output stage feeding twin speakers.

The dimensions of this model are: Closed, 24in. deep, 45in. high, 51in. wide; open, 56in. deep, 77in. high, 51in. wide.

The list price is £187, in stained and polished cabinet, and £198, in attractively veneered cabinet. Both prices are tax free.—Nera of England, Ltd., Jeffries Passage, High Street, Guildford.



The new Nera self-contained projection receiver.

NEW MEDIUM POWER TX VALVE

A HIGH-FREQUENCY tetrode valve with an anode dissipation of 3 kW. and a maximum frequency rating of 220 Mc/s has recently been introduced by the Communications and Industrial Valve Department of Mullard, Ltd. The new valve, designated type QY5-3000A, will deliver approximately 2.5 kW. of R.F. power when operated as a grid modulated class "C" amplifier for television at its maximum frequency of 220 Mc/s. It is therefore ideal for medium power television stations in band three.

Type QY5-3000A is a ring-seal tetrode of glass and metal construction. It has an external finned anode designed for forced-air cooling. An anode dissipation of 3 kW. is achieved in a comparatively small valve, the overall height and diameter being only 172 mm. (6.75in.) and 92 mm. (3.6in.) respectively. In common with other tetrode valves, type QY5-3000A has the advantages of high power gain and low output capacity. These features are particularly valuable at very high frequencies and video bandwidths.

While its power and frequency ratings make this new valve an obvious choice for medium powered V.H.F. transmitters, it has other applications as a driver, frequency multiplier, or modulator.

TWENTY-FIRST ANNIVERSARY OF AERIALITE, LTD.

HIGH spot of the evening at the Annual Staff Christmas Party of Aerialite, Ltd., on December 21st, was the presentation of a gold wristlet watch and strap to the Managing Director, Mr. L. S. Hargreaves, on the occasion of the Company's Twenty-first Anniversary. In thanking the staff for the gift, Mr. Hargreaves referred to the company's successful record up to the present time and stated that continued success would be ensured by the team spirit which existed throughout the company. To mark the occasion a two-tier cake was cut by Mr. L. S. Hargreaves.

QUERIES COUPON

This Coupon is available until February 21st, and must accompany all Queries.

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