SLOT AERIALS

PRACTICAL TELEVISION

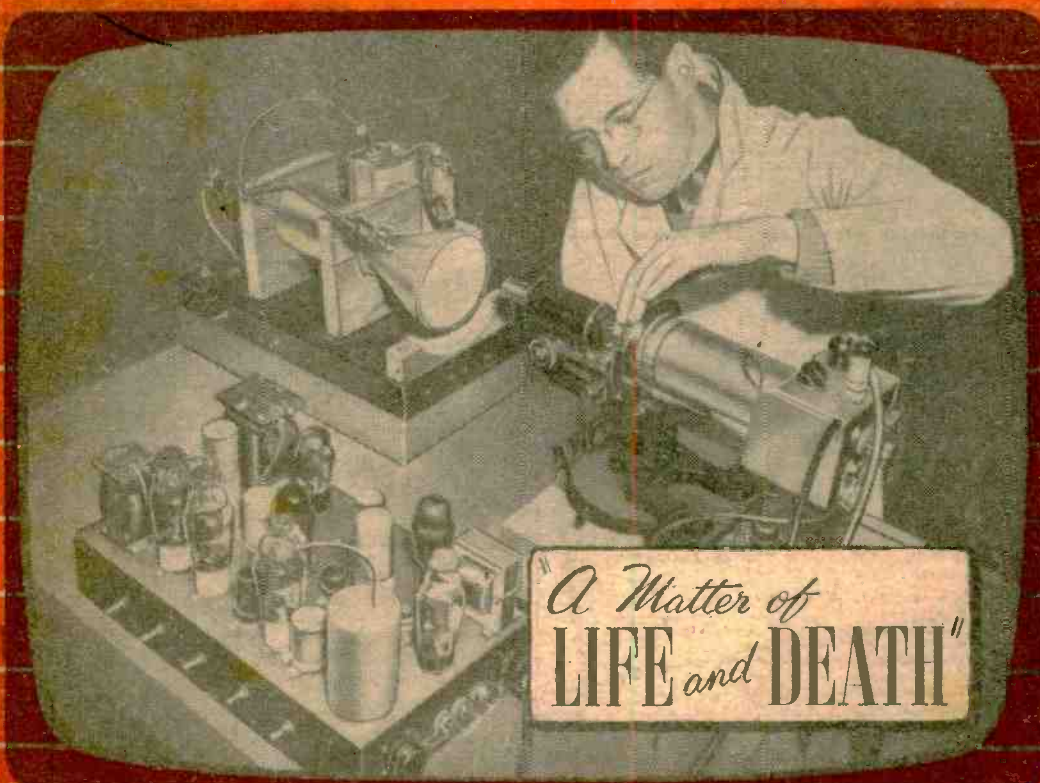
EDITOR F. J. CAMM

1/-

& "TELEVISION TIMES"

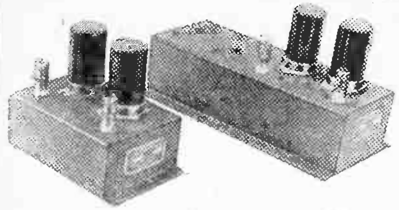
Vol. 1 No. 11 APRIL 1951

A NEWNES PUBLICATION



IN THIS ISSUE

Television at 200 miles



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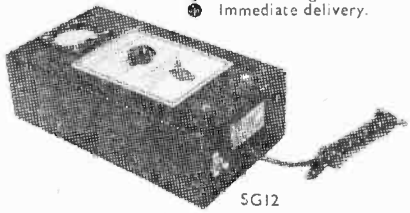
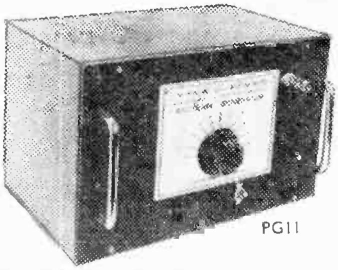


SG12



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PRACTICAL TELEVISION
& "TELEVISION TIMES"

Editor: F. J. CAMM

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Televiews

On to the Million!

DURING the month of January the number of current television licences increased by nearly 72,000, which is a larger increase than in any month since the B.B.C. television service was renewed in 1946. Of the total number of licences as at January 31st., 1951, amounting to 12,322,150, no less than 657,950 are for television.

When this journal was launched during March, 1950, the total number of television licences was 285,500, so there has been an increase during the year of 372,450.

The opening up of the Sutton Coldfield station undoubtedly acted as a fillip, and pending the opening of Holme Moss in September will give a further lift to the licence figures.

At the present rate of progression the million mark should be reached during 1951. The new service is rapidly establishing itself, and in a few years sound broadcasting must take second place.

Technical developments can be expected to advance in consonance with the increase in the number of viewers. The increased revenue, we hope, will be ploughed back for this purpose for the next five years, so that we can regain some of the ground we have lost to America in technical advancement.

Experts who have visited America have reported to us that the U.S.A. is in advance of Great Britain in many directions. It would be a pity if Great Britain, which pioneered the new science, should have to take second place to America.

These remarks are made on the presumption that we shall not have another war for some time to come, for that would mean the automatic closing down of all stations. In view of the urgency of the matter it seems a pity that the Government has not yet found time to debate the Beveridge Report, for there are many recommendations therein which cannot be implemented until the Government has given final approval.

Indeed, as a result of the debate the recommendations may be augmented or possibly reduced in view of the rearmament programme. The trade reports an ever-growing demand for television receivers and our correspondence shows that many thousands of constructors are building television receivers, as the sale of our book on the building of the television receiver designed and produced in our laboratories proves.

It is estimated that at least four people look in to each television receiver, so at the moment of going to press $1\frac{3}{4}$ million people are viewers. When installing television sets viewers should not wait until their 20s. sound licences have expired but should purchase a £2 television licence, which also includes sound. A rebate on the unexpired portion of the sound licence should be claimed from the Post Office.

THE 1951 RADIO AND TELEVISION SHOW

The 18th National Radio and Television Exhibition will be held this year at Earls Court from August 28th to September 8th. The patrons will be H.M. Queen Mary and H.R.H. Princess Elizabeth, and the first day is to be Invitation Day for overseas and other special visitors. It is hoped that Earl Mountbatten will open the exhibition to the public on August 29th.

Thus passes the name "Radiolympia," so long associated with the Radio Show. The larger floor space available at Earls Court will eliminate one of the main criticisms of previous shows, namely, the cramping of the stands and the jostling caused by the narrow gangways.

In addition to the exhibits from the radio and electronic industries, this year will include gramophones, records and accessories, electro-medical equipment, electronic scientific instruments and test gear, and dealer aids. Services and Government Departments will be represented by the Army, the Royal Air Force, the Board of Trade, Ministry of Civil Aviation, and the Department of Scientific and Industrial Research.

The B.B.C. has promised full co-operation, and as a result of the experience gained at the last three National Radio Shows visitors will have a better view than ever before of the television studio and of the artists and technical personnel in action. There will be better facilities for comparing the makes of television receivers in the 250ft.-long gallery. The control of the distribution of sound and vision throughout the exhibition will provide an exhibit of great technical interest.—F. J. C.

LINING UP YOUR SUPERHET

Hints on Trimming without the Use of Costly Test Gear

By BERNARD BARNARD

THERE is a very widely held belief that the superheterodyne television receiver should be avoided by home constructors unless they are the fortunate possessors of fairly elaborate test gear, including, at the very least, a good signal generator. This belief has been fostered by many technical textbooks and publications, and the phrase—"a signal generator is essential"—is one which many have quoted but few seem to have taken the trouble to examine.

This is a great pity because the superhet has several important advantages in the fringe and near-fringe areas and I am convinced that many enthusiasts have avoided building one because they were convinced that they could not hope to line up the set correctly without undertaking the prohibitive cost of test equipment.

I have always taken the view that a superhet is no more difficult to tune up than a multi-stage straight set, and to prove this, I have just completed the work on a home-constructed set using no more elaborate equipment than a pair of headphones, voltmeter, milliammeter and a lot of patience. The set was not constructed by myself so, at the start, I was unfamiliar with it and much of the patience that I have mentioned was used up in putting right the usual crop of minor faults that always exist when the constructional work is first completed.

The final result was excellent as far as picture quality is concerned: I will not claim that some improvements could not be made by using a signal generator, and certainly the work would have been quicker. But against this we can certainly set the advantage that the experimenter will certainly know a great deal more about his set when he has lined it up by the method that I am now going to describe.

The Method

A "block" diagram of the receiver is given on page 486, and I think it will be found that this is very similar to the majority of home-constructed superhets in circuit layout, but the instructions which follow may be applied to other circuits which differ in various respects.

Before going into detail, I would like to deal with two general cases which may be applied to this block diagram. The first is the case where the I.F. amplifier is an ex-Govt. I.F. strip, such as the R.3515, and the other, of course, is that in which the amplifier is home-constructed.

In the first case, I can see absolutely nothing to deter the home-constructor from building a superhet because the lining-up procedure is extremely straightforward, and he is almost certain of obtaining really good results with a minimum of trouble. The vision I.F. is decided for him beforehand and the requisite bandwidth is already there (providing, of course, he can resist the temptation to tamper with the I.F. strip trimmers). In theory—and, very nearly, in practice—all that he has to do is to swing the frequency—changer oscillator condenser until the vision signal is seen on the C.R.T. and adjust the time-base speeds to give a picture. The sound I.F. trimmers are then adjusted to bring the sound in on the loudspeaker. In practice, there will probably be the usual run of minor snags, but in spite of this there is no reason why the job should be beyond the powers of any reader who has had some experience with ordinary broadcast receivers.

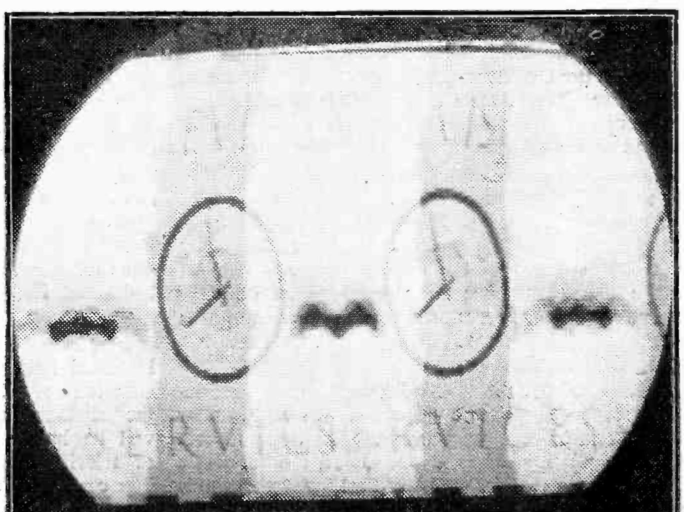
The second case, however, is the one with which I want to deal in some detail.

Vision First

We will start by assuming that we have just completed the constructional work; beyond the fact that we have built the set to a reliable specification we have no knowledge at all as to what frequency the various tuned circuits are set. In other words, we are starting the business of tuning from scratch. I shall assume, of course, that there are no wiring faults or faulty components but, from time to time, we will see that the effects of tuning the various circuits will suggest minor circuit alterations.

We commence by completely ignoring the sound circuits and concentrate on the vision part of the receiver. The first process is to connect a pair of high-resistance phones in circuit with the vision detector (in series or parallel with the load resistor, it makes very little difference which) and to tune the vision receiver until we hear either the vision or sound signal in the phones.

Before doing this, however, we take the obvious precaution of *disconnecting the E.H.T. power unit.* If this is transformer driven, disconnect both primary leads from the supply. There is absolutely no point in taking risks by leaving the E.H.T. on during the preliminary tuning, and as we shall not be interested in the tube face for some time, it is a good plan to remove



In this picture is seen the effect of the line time-base running too slowly.

the tube from its holder and put it away in a safe place.

We are left, then, with a perfectly straightforward V.H.F. superhet with a pair of phones across the detector, and the first job is to tune this receiver to give maximum signal strength on the vision signal.

Rotate the oscillator condenser very slowly and listen carefully for the faintest indication of either the sound or vision signal ; it is best at first to concentrate on the sound signal as this is more easily identified. The vision signal sounds rather like an outboard motor-boat engine, and when weakly received may easily be confused with various forms of interference.

If you do not hear the signal, try a different position of the R.F. trimmers and continue until the signal is picked up. This may take some time and patience and involve trying various adjustments to the I.F. trimmers as well as the R.F., but eventually—if there are no faults in the set—the signal will be heard.

Adjust all trimmers roughly to give a strong signal on the sound frequency and then rotate the oscillator condenser a few degrees in the "reduce capacity" direction to bring in the vision signal.

The next step is to make sure that all our tuned circuits will tune above and below the vision frequency, and to do this we rotate each trimmer or "slug" in turn and see that the point of maximum signal strength can be reached and passed in each case. If any particular coil will not do this, it is necessary to add or remove turns from it. If you are using iron slugs and the maximum cannot be reached by screwing the slug right in, *add* a couple of turns ; with brass or copper, *remove* two turns. These figures apply to I.F. coils with a nominal frequency of 13 Mc/s ; in the case of R.F. coils, remove or add half a turn at a time.

Instability

Also, at this time, we should note that none of the slugs give critical tuning and that there is no tendency to self-oscillation. It should be possible to detune each trimmer by at least two complete turns without completely losing the signal. If one of the circuits is critical, it may be due to positive feedback—more commonly known as reaction—in that particular stage. This can be caused by imperfect screening or by grid and anode leads being over-long and running close to each other. Whatever the cause of the trouble, it is essential to cure it at this stage or it will cause serious difficulties later on.

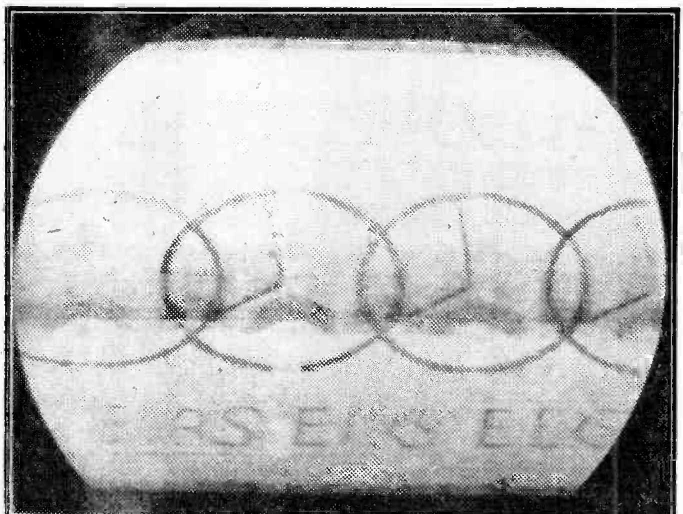
Tune all trimmers to give the loudest vision signal in the headphones. It should be uncomfortably loud even with the 'phones across the detector, and unless you can get this sort of strength you will have to look around for some fault that is keeping the overall gain down.

It is important to realise the nature of the vision signal as reproduced in the headphones. Most of the noise that is heard is due to the frame synchronising pulses which cause the characteristic low-pitched buzzing noise. Over and above this, however, you will note a somewhat higher sound which varies as the picture content varies. This, of course, is only a small fraction of the total picture modulation which extends beyond 2 Mc/s and, therefore, no matter what adjustments we make, we shall never be able to hear most of this modulation. What we have now to do is to adjust the trimmers so that the entire range of modulation frequencies is admitted by the receiver to the detector ; since we cannot hear them, the 'phones cannot help us any more and it is time to reconnect the C.R. tube and E.H.T. supply.

The signal supplied to the tube at present consists largely of those vision frequencies that fall within the audible range, and all that we shall see on the tube face is a flickering jumble of horizontal dark lines.

Before attempting any more tuning it is now necessary to adjust the time-base speeds to approximately the correct values. The frame speed is easily adjusted by setting it so that the dark hum bar which falls horizontally across the screen and which will be moving either upwards or downwards is stationary. The line speed is not always quite so easy to adjust, for there are several positions of the speed control that look as if they are correct but which turn out to be either multiples or sub-multiples of the correct speed. The effect as you turn the speed control is that the horizontal bands produced by the signal appear to turn upon themselves and take up a vertical position and so form a steady pattern. Two illustrations are given showing too fast and too slow speeds, so that readers will be able to recognise these effects. With the Miller time-base, where the speed of scan depends to a large extent on H.T. values, it is sometimes impossible to get the correct speed using specified values, and it is then necessary to add to or reduce the grid resistance in the oscillator valve, at the rate of about 10KΩ at a time, until the right value is found.

With the scan speeds correctly set, the display on the tube should now be a definite pattern which will flicker a great deal, but now and then will probably form a just-recognisable picture. It is highly improbable that either time-base will synchronise at this stage ; a very common symptom of lack of sync. is that a dark bar flicks up from the horizontal to vertical position across the picture—this is the bar which separates the picture frames, and its habit of jumping about the picture space has puzzled many earnest experimenters.

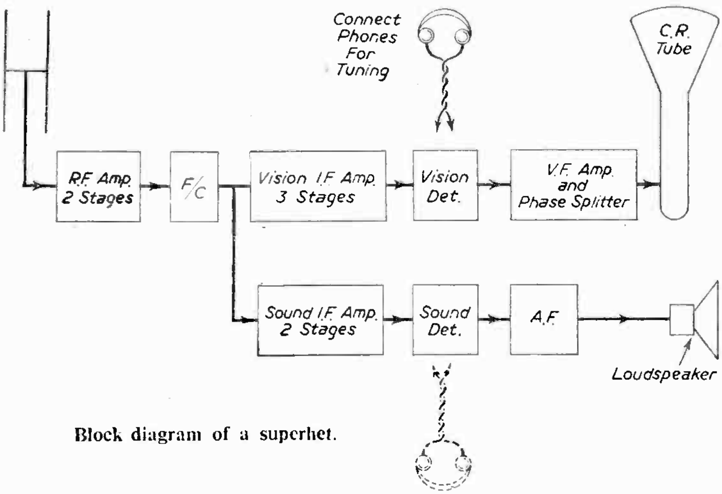


This is the result of a line time-base running too fast.

Final Adjustments

We have now to undertake the final tuning. Start by *slowly* rotating the oscillator condenser a few degrees either side of its present position and note the effect on sync. and tube display (which I shall from now on refer to as the " picture "). You will find that there is a fairly critical position at which the picture is obviously less jumbled—there will, in fact, be discernible areas of light and shade—and at which the flickering is much less rapid. Leave the condenser at this position.

We can ignore the R.F. trimmers and concentrate on the I.F. circuits ; these have to be " staggered," that is to say, they have to be detuned to various frequencies above and below (below, only, for single sideband working) the actual I.F. in order to allow passage to the wide band of modulation frequencies.



Block diagram of a superhet.

Commence with the last I.F. slug and set it to a higher frequency by offsetting the slug two turns (IN for copper or brass, OUT for iron). Then adjust the others about half a turn at a time, screwing one in half a turn and its neighbour out by the same amount. Watch chiefly for improvements in sync. for this is more easily assessed than slight improvements in picture quality.

If you lose the picture altogether during this process it is advisable to disconnect the E.H.T. and put the 'phones back into circuit and once again tune for maximum signal ; as I said earlier, patience is needed and there are no short cuts other than spending a lot of money on a signal generator.

Faults

There is no golden rule to be followed in adjusting the trimmers—you must experiment with various settings and make the resulting deductions. Here, however, are some of the likely effects and their causes :

A " plastic " image, or as many as three separate images slightly displaced from each other—due to at least one tuned circuit tuning too sharply. Increase damping across appropriate coil.

" Pulling on whites "—in extreme cases this may take the form of long white " tails " pulling out from any white object in the picture—lack of H.F. response and probably due to several tuned circuits being set to much the same frequency. The cure is to stagger still further the tuning.

A white flare covering certain parts of the picture—lack of bandwidth. Stagger the tuning still further.

White flare all over the screen—self-oscillation in I.F. or R.F. stage.

You will find that all these troubles can quite easily be overcome providing you take the trouble to recognise them and discover their cause. But it is quite useless to turn the trimmers blindly in the hope of producing a good picture. You must be methodical and have a definite object in making each adjustment so that you can draw the proper conclusions from the result.

As the quality of picture improves it will be necessary to make each further adjustment progressively smaller until you will be moving a trimmer about one-eighth of a turn at a time. The work is best done, of course, on the morning Test Card transmission but, as few of us are able to be at home at these times, we have perforce to rely on the normal programme transmissions. On these it is necessary to be wary or you may easily ascribe an effect to a certain adjustment when, in fact, it is due to a change in transmission such as a fade-out between programmes. Such, however, is the hard lot of the impecunious experimenter !

Sound

When you have obtained a good picture with perfect sync., it is time to attend to the sound section. This should not present any serious difficulties, but it is necessary to bear in mind the fact that in our method of tuning we have fixed the vision I.F. arbitrarily and it may therefore be appreciably different from the nominal I.F. for that particular set. The sound I.F. will be out to the same extent, and for that reason it may be necessary to alter the number of turns on the I.F. coils.

Connect the headphones to the sound diode and search for the signal. It will probably be found quite easily, but if nothing is heard after trying various relative positions of the trimmers, the oscillator condenser may be swung slightly above and below the vision setting until the sound is heard. If it is found necessary to increase the oscillator frequency to get the sound signal, then turns should be removed from the sound I.F. coils and vice versa. The oscillator condenser must, of course, be returned to its original setting.

It will be noticed that alteration of the first sound I.F. trimmer has an appreciable effect on picture quality and, when the sound section has been satisfactorily lined up, a further final adjustment to the first vision I.F. is necessary to bring the picture back to its original quality. The degree to which this effect is present varies with different designs and the method of tapping off the sound signal from the frequency changer ; it should in no case be sufficient to render necessary major readjustment to the vision I.F.s.

Slot Aerials for V.H.F.

Details of the Latest Type of Aerial as Used at Sutton Coldfield and Wrotham

By R. E. B. HICKMAN

INFORMATION and photographs recently released by the B.B.C. on the Wrotham Hill V.H.F. transmitting station have attracted much attention to the new type of aerial which is being used for the F.M. transmissions. It has been remarked also that the same type of radiator is included on the Sutton Coldfield television station mast. The aerial is what is known as a " slot " aerial and some details of this type of radiator are now given.

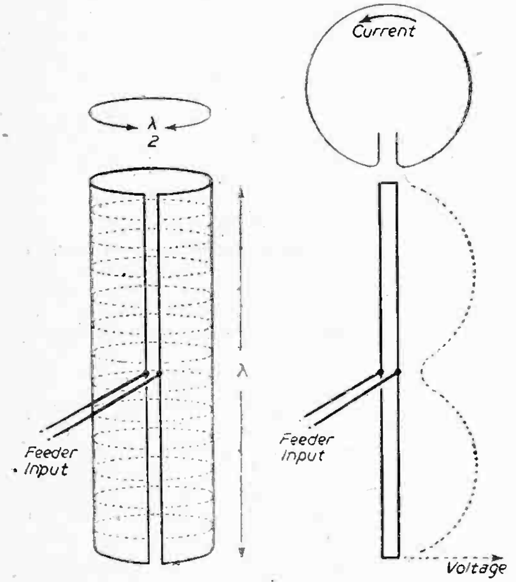


Fig. 1 (left).—Diagrammatic representation of make-up of a slotted aerial, and Fig. 2 (right).—Current flow and voltage distribution.

In its simplest form a slot aerial consists of a metal cylinder, which may be rolled from a single sheet of metal, having a narrow slot running from top to bottom. This cylinder may be terminated at each end by a cast base giving it great mechanical strength and rigidity and providing a means of connection to a supporting tower or to other similar sections.

The operation of a slot aerial may best be understood by considering the edges of the slot as an open wire transmission line which, when suitably excited, drives the cylinder as the radiating portion of the structure. In the simple example considered the slot will be approximately a wave-length long and the cylinder will be approximately half a wave-length in circumference. The aerial may be visualised as being built up from an infinite number of half-wave circular radiators as shown in Fig. 1. When an R.F. voltage is impressed across an element of such dimensions a current will flow in it and radiation will take place. Since the voltage is impressed on the radiating element all along the length of the slot, the whole length of the cylinder will radiate. Fig. 2 shows diagrammatically the currents flowing in the cylinder and the voltages across the slot.

Alternatives

Although the half-wave-length circumference cylinder described above represents the simple case, other dimensions may be used according to the transmission characteristics required. The cylinder diameter is intimately connected with the resultant polar diagram of the aerial, and also determines the optimum slot length for resonance at a chosen frequency. The width of the slot can be used to vary the input impedance of the aerial. The horizontal radiation pattern of a simple single slot aerial is shown in Fig. 3. It will be seen to have a slight directional characteristic. By an arrangement of staggered slots a nearly circular horizontal pattern may be achieved. The B.B.C. slot aerial uses four slots symmetrically spaced.

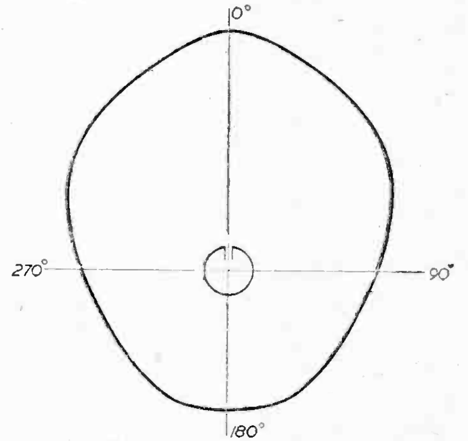


Fig. 3.—Horizontal radiation pattern of a simple slot aerial.

By using several slotted sections stacked one on top of the other it is possible to reduce the wasteful sky-wave radiation and increase the power radiated in the horizontal plane (see Fig. 4). Power gains of as much as 12 times may be readily achieved by such means.

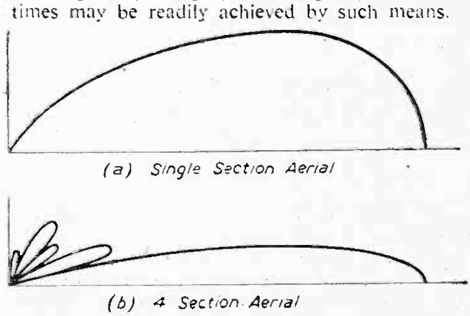


Fig. 4.—Reduction of sky wave radiation by stacking slot aerials.

C.-R. Tube Conservation

Some Everyday Factors Affecting the Life and Efficiency of a Cathode-ray Tube

THE modern cathode-ray tube as used for television reception is hardly any more delicate an object than is the present-day radio valve. True it is that, in view of a certain lack of familiarity on the part of many television set owners, the interior of a C.-R. tube, so far as it can be seen, may appear to be full of complexities. Nevertheless, a cathode-ray tube such as is utilised for modern television reception is fundamentally a simple structure. In a sense, it is a structure which is based on the radio valve, although it is itself a little older in conception than the valve.

This, however, is not the occasion to enter into the details of the cathode-ray tube's anatomy. What we are more concerned with at present is the many practical factors which are able to crop up and influence the actual working life of the tube, and it is to such factors that this article will be devoted.

You often hear these days the question, in regard to a television tube, "how long will it last?"; and, again, "does it wear out?"; "can it be reconditioned?"; "will it break?" There are quite obvious answers to all such questions you may aver if you have studied and got down to the engrossing subject of practical electronic and television working, but you must always remember that such subjects are seldom obvious to the individual who is entirely new to the techniques of television.

Naturally, your reply to any such questioning is to the effect that a cathode-ray tube or any other electronic device *will* wear out in time. Indeed, what mechanism is there, electrical or mechanical, which, given ordinary usage, will not come to an end sooner or later? Wear and tear are the twin evils which lie in wait everywhere about us. Sooner or later everything succumbs to their attentions, our own selves not excluded. So having, in this television matter, accepted the fact that even the best of television tubes will not last for ever, let us give rather more detailed thought to the various ills which may affect a tube and which may result in its final demise.

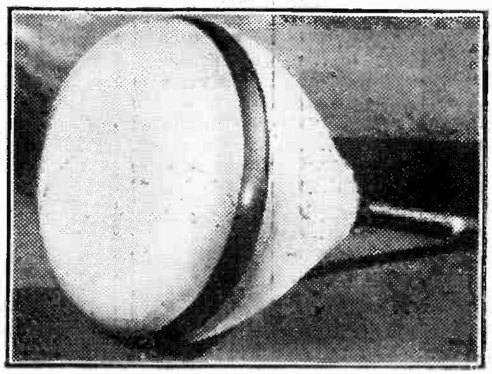
Implosion !

"The working life of a cathode-ray tube depends on the treatment which is given to it." You get that sort of statement in the textbooks. It is a wholly truthful statement, of course, but it is a very bare one. If you happened to drop such a tube on to a hard floor, its life would probably terminate immediately, owing to the implosion of the tube. Note the word "implosion." It is quite a correct one. It implies the opposite of explosion. When something explodes, it generates an outwards force which tends to shatter everything in its path. An implosion, on the other hand, results from an object being shattered by external forces.

During the early days of the cathode-ray tube a lot of these implosions happened in experimental laboratories. There is such a high degree of vacuum within a tube of this nature that any mechanical defect or lack of strength in the tube walls will result in the external pressure of the atmosphere (some 14 lb. per sq. in.), crushing the tube. That is why comparatively thick glass is nowadays used for making these tubes, glass which is strong enough, if we might use the expression, to stand up against the pressure of something on nothing, or, in other words, to resist the external atmospheric pressure which tends always to collapse the tube.

Incidentally, it is for the same reason that the television tube screen always curves off at its sides and thus departs severely from a flat surface. If the tube screen were given a perfectly flat surface all over, its edges would be especially weak and the tube would simply collapse under atmospheric pressure.

Television tube life under average suitable working conditions is normally assessed at 1,000 hours, like that of a radio valve or an ordinary electric filament lamp. But as many valves become veritable Methuselahs in relation to this nominal 1,000-hour life, so also will a carefully used television tube commonly be found very considerably to outlast its allotted span.



A Cossor large screen C.-R. Tube

Apart from mechanical damage, resulting drastically in an implosion of the tube or in the fracture or dislodgement of some of its internal parts, a television cathode-ray tube may gradually fail owing to two distinct sets of circumstances, which circumstances, fortunately enough, are more or less under the direct control of the owner of the receiving set. The life of the tube (to say nothing of its efficiency), can be seriously shortened at both its cathode end and at the screen end, trouble at the latter area being obviously more readily noticed by the viewer.

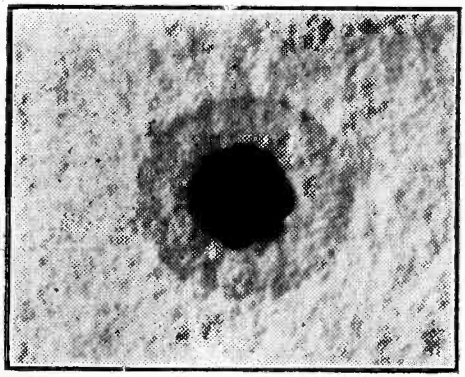
The Cathode End

Let us, however, deal with the cathode end of the tube and see just exactly what may go wrong there in the course of the day-by-day operation of the tube. The filament (or "heater") of the tube is normally of the dull-emitter type. It consists of a short loop or coil which is coated with an activated metallic oxide capable of emitting a satisfactory electron stream at a relatively low temperature. Usually, in a modern cathode-ray receiving tube, the filament current will not exceed 1.2 amps. Often enough it will not be more than, say, 0.6 amp., which means that a comparatively small current suffices for the filament or heater element which constitutes the source of the electron flow within the tube.

On the contrary, because the positive potential on the anode or "gun" of the tube speeds up the velocity of the electron stream from the filament and thus imparts energy to the electron flow, it follows that a high anode voltage is necessary. Compared with a maximum filament current (in amperes) of 1.2, the anode potential (in volts) may be given a maximum of as much as 5,000, or even more.

Now the greater the filament current, the greater the number of electrons which find their way to the television screen. The greater, too, the anode voltage, the greater is the energy of the electrons as they furiously hurl themselves on the screen. Consequently, the greater the brilliance of the screen fluorescence, in other words, of the transmitted picture.

It would seem quite simple, therefore, to turn up the filament current to its maximum and to push up the anode voltage so as to get a plentiful supply of high-speed electrons, and, consequently, to produce a really brilliant picture. It is, indeed, a temptation to which



A close-up of a burn on the fluorescent screen of a picture tube.

all television operators may be subjected, and, for a time at any rate, no obvious harm results from its indulgence.

"Forcing" the Tube

But there is a hidden snag in this policy of "forcing" the screen picture in the above manner. In the first place there is usually a little gas in the tube (commonly the inert gas, argon). By collision with the high-speed electrons, the argon atoms become stripped of some of their electrons. They become, as it were, partially dismembered atoms. They are relatively heavy entities, and, owing to a sequence of events too complicated to explain here, they wander about in the tube and set up a sort of atomic bombardment of the cathode. This bombardment decreases the effectiveness of the active coating on the filament. To produce the same number of electrons as before, the filament must be raised a little in temperature. As more electrons are produced, the number of gas ions tends to increase, and so the whole thing becomes still another example of a vicious circle.

One might ask whether, in view of the deleterious effects of these gas ions (dismembered argon atoms), it would not be better to make the tube entirely vacuous and not to admit even the least traces of an inert gas into it. In theory there is a lot to say for this, but in practice there is much against it. In the first place, a tube *cannot* be made 100 per cent. vacuous. There are *always* some residual particles of air left in it. Then, again, if a tube is made too "hard" (i.e., too highly evacuated) a considerably increased anode voltage must be used, a voltage, say, of up to 8,000, which is, of course, a very positive disadvantage to ordinary television working. So, normally, the average receiving tube is made very slightly "soft."

The matter, however, does not finish at this point. We remember that the anode voltage acts by attracting the flying electrons from the filament and by imparting to them a greater velocity. Now the luminosity of the cathode-ray tube screen is caused by the bombardment of the screen by the high-speed electrons. The greater the electron velocity the greater the luminosity, other things being equal. But greater electron velocity brings about a greater proportion of gas ions within the tube, and the greater the number of gas ions, the greater their deleterious effect on the cathode surface. So that in this matter of cathode-ray tube reception we cannot have it both ways. If we increase the anode current so as to get better illumination of the screen, better brilliance of the picture, we ultimately increase the ionic bombardment of the filament surface. The filament deteriorates in consequence of the "wear" of its coating. To emit the same number of electrons it needs a higher current. The higher current which is necessary usually calls for a greater anode potential, which means, ultimately, more gas ions, and so the deterioration of the tube goes on progressively.

The First Symptom

A very usual symptom of the onset of this state of affairs within the tube is the failure of the receiver to focus the picture accurately. The operator finds, however, that he can get the average focusing by increasing the filament current a little. And all goes well for a time. But the early symptom has set in, and, having done so, it will, in time, bring others in its train. Perhaps, at the present time, we may regard this sequence of affairs as the approach to the natural end of any cathode-ray tube. Such an inference certainly smacks of defeatism, but, none the less, a lot of first class tubes are capable of contracting this type of trouble. In every case, however, we can at least greatly postpone the onset of this progressive deterioration if we will only refrain from "forcing" the tube. Good, effective, saving practice is to work the tube with the smallest possible amount of filament current. Always operate the receiver as near as possible to the lower limit of cathode or filament current. At the same time keep a watchful eye on the anode voltage, keeping this as low as practicable. It is true enough that a relatively low anode voltage will mean a picture of decreased luminosity or brilliance, but such may usually be compensated for by viewing the picture in a darkened room, or in a more light-subdued corner of the room. There are sets which will give a fairly clear picture even in bright light, but these imply the use of maximum anode voltages, inevitably, therefore, curtailing the effective life and utility of the cathode-ray tube as a whole.

Screen Material

There is, too, another important aspect of the matter. This concerns the life of the screen material. This active material which is applied to the inside of the screen in the form of an enamel or lacquer, consists of an inorganic or mineral-like compound (or a mixture of these) which has been made with the very highest of chemical precision and which can be guaranteed to develop a full luminosity when it is new. But the luminescent material is liable to a few troubles of its own. The commonest of these is that known as "burning." The outward symptom is a round brown spot on the screen, which area refuses to display full luminescence or even fails to luminesce at all. It can be brought about by a number of causes, the only one, however, affecting the television set owner being the prolonged action of the ray spot (particularly at high cathode voltages) on the screen.

It is most undesirable, indeed, for a set owner to leave the ray spot focused continually on one area or point of the screen for any length of time. Here, indeed, is a fruitful cause of "burning." The higher the intensity of the spot (or, in other words, the higher the anode voltage and/or filament current) the greater the liability to this trouble. What actually happens in a case of "burning" or screen discolouration we do not know for certain. It is, however, much more than a mere fatigue effect. It seems to be caused by an actual molecular disintegration of the active material of the screen, the "burned" material literally becoming "dead" and permanently refusing to function and to light up when the stream of cathode rays impinges on it. There is, of course, no cure for the trouble. It is one of those matters in which, more, perhaps, than in many other directions, one has just "had it"!

The ray-spot or electron beam moving, even at its highest intensity, over the screen as in normal television working will not induce "burning" in the active material. It is only when the ray stands still so that one particular spot or area of the active material receives the full blast, as it were, of the ray's energy that discolouration, insensitivity, or "burning" sets in with its consequent partial or complete deadening of the affected area.

Light Action

It is not usually considered necessary to harbour a normal television screen from the effects of light. The luminescent materials which are being produced nowadays are much more robust than were the older materials. It is possible, however, that prolonged exposure of a screen to ultra-violet light in the form, say, of sunlight, would very definitely affect the screen material injuriously, bringing about a general, although mild, species of "burning" and resulting in the decreased sensitivity of the screen as a whole. After all, ultra-violet rays have a very potent and energetic action on many substances. They will render a luminescent material strongly luminescent of its own accord and, in the instance of television screen material, U.V. iridation would affect the "after-glow" and thus cause unsatisfactory definition.

The whole subject and the possibilities inherent in it could be taken to greater lengths. Suffice it, however, to say that it is inadvisable to allow direct sunlight to shine for a continuous period on a television screen, although ordinary light seems harmless enough. To be well on the safe side, however, it would not be a waste of care and attention to provide an opaque cover or draping for the television receiver screen so that light need not fall upon it when it is not in use. Incidentally, in this connection the reader will before now have observed that some makers of television receiving sets fit doors which close over their screens.

Screen Yellowing

Actual detachment of particles of the active material from the interior glass surface seldom occurs nowadays. In the earlier days of the cathode-ray tube it was quite a common phenomenon caused by inadequate methods of cementing the particles of active material to the glass. When a cathode-ray tube has been in use for a long time a slight yellowing of the screen all over its surface may be noticed in some instances. This, the writer considers, is due to the varnish or binding medium of the active material and not to the material itself. As such, it does not decrease the general luminosity of the screen, although it might slightly alter the all-over colour of the picture. The effect is akin to the well-known yellowing of oil paintings after they have been exposed to strong light for a number of years. It is the surface varnish (usually of gum mastic) which has acquired the discolouration, but when the varnish is removed the underlying picture is seen to be as fresh as ever it was.

The synthetic resin binding media which are now being increasingly used for screen coating of all kinds are supposed to be highly resistant to yellowing under ultra-violet and other forms of iridation. If such is really the case, then a minor television trouble will have departed.

Just one or two final notes about the care of a cathode-ray tube. Do NOT turn on the high-tension (anode) current of the receiver before switching the filament current. And, conversely, always switch the filament on before you put on the H.T. If this precaution is not observed, the filament coating becomes strained because the filament, when warming up, is unable to deliver the full complement of electrons required by the high positive potential on the anode. There is, in consequence, a sort of positive pull on the filament, an effect which is harmful to its delicate coating.

Always turn off the H.T. current when the television set is not actually being used. This prevents any chance of a stationary spot being present on the screen and so setting up discolouration or "burning" of the latter. If it is not convenient to do this, apply an extra voltage to one of the deflecting plates of the tube. This will pull the ray spot completely off the screen on one side or the other and thus prevent harm being done to the screen.

Do not, one may repeat, "force" the cathode-ray tube in any way. Do not overpower it with too great a filament and/or anode current. Beware of the stationary light spot on the screen. Keep the set away from serious vibration. Do not unduly expose the screen to strong light. These precautions constitute, on the whole, the best recipe for giving long life and efficiency to the cathode-ray screen.

British Radio Components Show

Preliminary Details of This Year's Exhibition of Spare Parts

THE eighth annual private exhibition of British radio and electronic components, to be held by the Radio and Electronic Component Manufacturers' Federation at Grosvenor House, London, from April 10th to 12th, gives every sign of being as successful as the 1950 exhibition, which was attended by over 20,000 visitors from 21 countries.

Over 100 firms have arranged to take part in the exhibition, which has been carefully arranged to give an improved layout of the stands and better provision for the comfort of visitors.

The expansion in television receiver production during 1950 is reflected in the number of components of various types now available, and the important contribution made by the industry to Britain's defence programme is borne out by the display of special components and apparatus made to conform to Service requirements. Valves are again included in the exhibition.

The following components and apparatus are being shown for the first time.

Capacitors

New moulded casings, giving complete protection against moisture, have been developed by A. H. Hunt Ltd. (Stand 20) and by the Telegraph Condenser Co. (Stand 44). These new types of sealing have been applied to ceramic, tubular foil, and silvered mica capacitors and a complete range is available.

The Telegraph Condenser Co. have also improved their "Plastapack" plastic film capacitors, which are particularly suitable for use in electronic counting circuits and computors.

Resistors

The high stability carbon resistors introduced last year by Painton & Co. (Stand 62) have been improved in the higher ohmic values to give greater stability, and are now available up to 1.0 megohms in half-watt rating. A new type of compact audio-frequency fader resistor is now being made.

An outstanding new development of the British Electrical Resistance Co. (Stand 59) is a hermetically-sealed potentiometer particularly intended for use in severe atmospheric conditions and in corrosive atmospheres. This is rated at 5 watts with resistances up to 50,000 ohms, and conforms to Service standards.

A sealed potentiometer of the midget type (Code GS) has also been developed by the Morganite Resistor Co. (Stand 54), who are noted for their range of very small diameter variable resistors.

Erie Resistor Ltd. (Stand 24) have produced the first fully-insulated grade 1 resistor of high stability cracked carbon, suitable for operation under tropical or other severe conditions. It is made in three ratings: $\frac{1}{2}$, $\frac{1}{4}$ and $\frac{1}{8}$ watt, and in the usual range of values from 10 ohms to 3 megohms.

Other Components

A. F. Bulgin (Stand 21) are introducing a new range of control knobs suitable for high-quality radio cabinets, together with small lever and dial knobs for special apparatus.

A new mains voltage signal lamp for panel fitting uses a standard 15-watt sign lamp in an all-insulated holder behind a moulded glass lens.

A new vibration-proof combined screw and lock-washer is marketed by Guest, Keen and Nettlefold (Stand 106), in which the washer cannot become detached from the screw but is nevertheless free to operate effectively.

An inexpensive plug and socket for twin feeder cable is now available from Belling & Lee Ltd. (Stand 12). This can be adapted for chassis mounting or for fixing on the skirting board of a room and is a useful addition to the range of television components made by this company.

Test Instruments

Taylor Electrical Instruments Ltd. (Stand 1) are exhibiting three new models in their range of test instruments. Types 72A and 77A are universal test meters in the moulded cases with overload protection. The design of the meters was undertaken by a firm of industrial designers, and the result is a pleasing and efficient appearance. Type 88A is a larger type of test meter in a wooden case with a single linear scale for all ranges.

An interesting exhibit is the quartz crystal activity test set manufactured by Salford Electrical Instruments Ltd. (Stand 35), which in addition to measuring the activity of crystals, can also measure the dynamic resistance of parallel-tuned circuits, giving a direct indication.

Dawe Instruments Ltd. (Stand 49), whose range of test equipment is well known, are showing a new high-speed level recorder (Type 1406), which provides a means

A group of the new Pye miniature temperature controlled quartz crystal units.

of rapidly recording response characteristics with an accurate logarithmic scale. This is particularly suitable for amplifier testing. Another new instrument is the peak strain gauge for determining the maximum strain imposed on mechanical structures.

An outstanding new apparatus for direct indication of the polar curves of television aerials has been developed by Belling & Lee, based on the Servograph recorder manufactured by Fielden (Electronics) Ltd. This test equipment operates at a frequency ten times higher than the normal television frequency, thus enabling the work to be done on scale models of the aerials. The aerial is energised from a transmitter and rotated synchronously with the recording chart. The radiated signal is picked up and after rectification is applied to the recording pen, which thus traces out the polar diagram on the chart in correct relationship to the aerial rotation.

Other Items of Interest

New types of television aerial for long-distance reception, and a combined television and F.M. aerial are shown by Antiference Ltd. (Stand 68), who also supply outlet boxes for feeder connections, mains suppressors and aerials of all types.

A new type of magnetic high-fidelity pick-up—the "Minuette"—is shown for the first time by the Edison Swan Electric Co. (Stand 38). This company also shows a range of cathode ray tubes with aluminised screen 12in. and 15in. diameter, and a selection of valves for special purposes, including pulse amplifiers, tetrode stabilisers, thyratrons, and special valves for radar circuits.

The Telegraph Construction & Maintenance Co. (Stand 50) manufacture a new type of air-spaced coaxial cable, having a helical membrane applied edge-on to the conductor. This construction is robust and results in an effective dielectric constant of 1.08. The cable is particularly suitable for wide-band transmission. Other new developments include "Permendur"—a special alloy with the highest known magnetic induction (24,000 lines), and a nickel-copper alloy substitute LM.326.

The production of zirconium on a commercial scale has recently been attained by Murex Ltd. (Stand 100), and it is now available in rod, sheet or wire form. It has a high melting point and excellent corrosion resistance, and is particularly suitable as an alternative for tantalum or molybdenum in certain applications.

CLUB Reports

BRITISH TELEVISION VIEWERS' SOCIETY

Hon. Sec.: L. G. Pace, 140, Fairlands Avenue, Thornton Heath, Surrey.

MR. CECIL MADDEN, formerly B.B.C. Programmes Organiser, addressed members of the British Television Viewers' Society at their monthly meeting at Kennard's Restaurant, Croydon, recently.

In his present capacity as Acting Head of Children's Programmes, Mr. Madden was well suited to explain the working of this very important side of television. He described in detail the planning of the week's programmes day by day for children and mentioned the encouragement he was receiving from parents and the children themselves on his work.

Mr. Madden's talk included also reminiscences of his early days in the Television Service—incidentally, he was privileged to produce the first television show from the Alexandra Palace in 1936.

As might be expected, a man of Mr. Madden's long and vast experience was in a position to speak very authoritatively on his subject, and members present showed their appreciation to him in no uncertain manner.

Technical Branch

The inaugural meeting of the Technical Branch of the Society took place at the West Thornton Community Centre, Croydon, later.

Mr. Walters (Belling and Lee, Ltd.) described the various types of aerials used for television reception, several of which were on exhibition in the hall. He also referred to the "ghost-image" so familiar to many Croydon viewers and explained the cause of its appearance on the screen.

The black screen was demonstrated and its use and reason for its introduction fully explained by Mr. Harris (Ferguson Radio Corporation). Comparisons were made between sets with and without this filter.

Mr. Addie (Philips Electrical, Ltd.) took for his subject "Projection Television," and those present were enabled to witness a projection model in operation and also see actual projection of part of the evening's television programme on a silver screen erected in the hall for the purpose.

The speakers used lantern slides and film strips in the course of their talks and this meeting of the Technical Branch may well be counted as one of the most interesting and successful yet arranged by the Society. Arrangements are being made for further meetings in the near future.

TELEVIEWERS' ASSOCIATION

Hon. Sec.: Televiewers' Association, 1, Carlton Mansions, Belle Vue Road, London, N.W.4.

THE Televiewers' Association, which now incorporates the South Coast Televiewers' Association, following the success of the Lancing, Worthing, Eastbourne, Hove and Brighton Branches' mobile interference detector units, is now well ahead with its plans to establish similar equipment in other areas, in a determined effort to stamp out picture interference.

The G.P.O. have supported the plan, and have given it their blessing.

The Association is now receiving applications for membership from all parts of the country, and this organisation is extending its activities to cover the country as a whole. In a circular which is forwarded to enquirers they give the following information:

MEMBERSHIP SERVICE

Free technical advice.
Free operational service.
Unbiased opinion on installation and repair estimates.
Cathode-ray tube replacement advice and enquiry service.
Free advice on TV interference problems.
Free advice on suppression of apparatus likely to interfere with viewing.
Representation to the B.B.C. on programmes. (Viewer's likes and dislikes.)

The Association is a non-political body organised for the sole purpose of protecting and furthering the televiewer's interest.

It is entirely unconnected with any trade or manufacturing organisation.

It is sponsored, maintained and managed by viewers for viewers.

Membership fee 5s. per annum.

Anyone interested in this problem, or associated matters, should communicate with the Hon. Secretary at the above address.

PROJECTION—A WARNING

X-ray Caution and Precautions.—Service engineers may, on occasion, have to adjust or set up the optical unit of projection receivers, which may entail the viewing of the picture or test card on the small tube face proper and not the screen. By doing so he may put himself in the direct path of the radiations of soft X-rays, which are dangerous to health. Direct viewing of the tube face should, therefore, be done with the brightness control set at a minimum. If, however, full brightness is essential for focusing, linearity or centring, a lead glass screen as specified for X-ray protection of operators must be employed. The X-rays radiate quite 40 inches or so from the C.R. tube face. Protection screens thus become another "must" for the TV maintenance technician. (*I.P.R.E. Journal.*)

LIST OF EXHIBITORS AND STAND NUMBERS

Exhibitor	*Stand No.*
A.B. Metal Products, Limited	36
Acoustic Products, Limited	56
Advance Components, Limited	73
Antiference, Limited	68
Associated Iliffe Press, Limited	112
Associated Technical Manufacturers, Limited	74
Automatic Coil Winder and Electrical Equipment Co., Ltd.	86
Belling and Lee, Limited	12
Bird, Sydney S., and Sons, Limited	8
Birmingham Sound Reproducers, Limited	66
Bray, Geo., and Co., Limited	111
British Electric Resistance Co., Limited	59
British Insulated Callenders Cables, Limited	57
British Mechanical Productions, Limited	27
British Moulded Plastics, Limited	88
British N.S.F. Co., Limited	61
British Rola, Limited	48
Bulgin, A. F., and Co., Limited	21
Bullers, Limited	75
Carr Fastener Co., Limited	60
Clarke, H., and Co. (Manchester), Limited	105
Colvern, Limited	51
Cosmocord, Limited	71
Daly (Condensers), Limited	81
Dawe Instruments, Limited	49
Decca Record Co., Limited	94
De La Rue, Thomas, and Co., Limited (Plastics Div.)	96
Diamond ' H ' Switches, Limited	3
Dubilier Condenser Co. (1925), Limited	29
Du Bois Co., Limited	2
Duratube and Wire, Limited	40
Edison Swan Electric Co., Limited	38
Egen Electric, Limited	26
Electro Acoustic Industries, Limited	58
Electrothermal Engineering Co., Limited	102
English Electric Co., Limited	95
Enthoven, H. J., and Sons, Limited	47
Erie Resistor, Limited	24
Ever Ready Co. (Great Britain), Limited	82
Ferranti, Limited	9
Fine Wires, Limited	108
Garrard Engineering and Manufacturing Co., Limited	69
General Electric Co., Limited	93
Goodmans Industries, Limited	18
Guest, Keen and Nettlefold (Midlands), Limited	106
Hallam, Sleigh and Cheston, Limited	104
Hellermann Electric, Limited	42
Hunt, A. H., Limited	20
Igranic Electric Co., Limited	72
Imhof, Alfred, Limited	89
Jackson Bros. (London), Limited	37
London Electric Wire Co. and Smiths, Limited	76
London Electrical Manufacturing Co., Limited	39
Long and Hambly, Limited	16
Magnetic and Electrical Alloys, Limited	33
Marconi Instruments, Limited	97
McMurdo Instrument Co., Limited	70
Measuring Instruments, Limited	109
Micanite and Insulators, Limited	41
Morgan Bros. (Publishers), Limited	85
Morganite Resistors, Limited	54
Mullard Electronic Products, Limited (Components)	31
Mullard Electronic Products, Limited (Valves)	101
Multicore Solders, Limited	17
Murex, Limited	100
Mycalex Co., Limited	83
Oliver Pell Control, Limited	25
Painton and Co., Limited	62
Parmeko, Limited	32
Partridge Transformers, Limited	55
Permanent Magnet Association	84
Plessey Co., Limited	64
Plessey International, Limited	65
Pye, Limited	107
Reliance Electrical Wire Co., Limited	22
Reslosound, Limited	23
Salford Electrical Instruments, Limited	35
Sangamo Weston, Limited	87
Scharf, Erwin, Limited	52
Scott, Geo. L., and Co., Limited	103
Simmonds Aerocessories, Limited	30
Stability Radio Components, Limited	78
Standard Telephones and Cables, Limited (Components)	10
Standard Telephones and Cables, Limited (Valves)	7
Static Condenser Co., Limited	77
Steatite and Porcelain Products, Limited	28
Sullex, Limited	6
Supply, Ministry of	92
Symons, H. D., and Co., Limited	110
Taylor Electrical Instruments, Limited	1
Taylor Tunnicliffe (Refractories), Limited	5
Telegraph Condenser Co., Limited	44
Telegraph Construction and Maintenance Co., Limited	50
Telephone Manufacturing Co., Limited	45
Thermo Plastics, Limited	14
Truvox Engineering Co., Limited	19
Tucker, Geo., Eyelet, Limited	4
Vitavox, Limited	43
Walter Instruments, Limited	80
Walter, J. and H., Limited	79
Wego Condenser Co., Limited	34
Welwyn Electrical Laboratories, Limited	11
Westinghouse Brake and Signal Co., Limited	13
Weymouth Radio Manufacturing Co., Limited	46
Wingrove and Rogers, Limited	53
Wireless Telephone Co., Limited	63
Woden Transformers, Limited	67
Wright and Weaire, Limited	15

Some Interesting Experiments with Aerials

Long-range Reception Tests and Results

AN icicle and a piece of string (wetted) may be quite suitable as an aerial for those who live close to the transmitter, but fringe area viewers have to erect something much more elaborate.

Experimenting with different types of aerials can be a frustrating and expensive business—frustrating because the signal varies from day to day and even from hour to hour, and expensive because of the high cost of the arrays.

The information given here describes some experiments made and the results obtained with different types of array, 80 miles from Sutton Coldfield, and it is hoped that the information may provide a short cut for those who wish to erect an aerial suitable for fringe area reception.

The amount of data available for V.H.F. array is stupendous, ranging from simple dipoles to full rhombics, but the number of types suitable for experiment were limited, as the greatest height available was a 16ft. pole on a chimney 30ft. from ground level; the greatest length obtainable was a back garden 90ft. long which fortunately faced the Sutton Coldfield transmitter. The house is situated at almost sea-level.

A standard "H" array with quarter λ spacing was used at first and subsequent arrays were compared with this aerial.

Rhombic

Where space is available the data suggests that the greatest gain is obtainable with a rhombic aerial. As the signal is vertically polarised it was not possible to erect a full rhombic so a "half rhombic" was tried instead. The mast on the chimney formed the centre point of the rhombic and under these conditions it was possible to make the "legs" of the rhombic only $3\frac{1}{2}\lambda$ long. Compared with the "H" aerial signal strength was about a quarter, though the array was correctly matched with a matching stub. The poor results were possibly due to the screening effect of the house on the back half of the aerial.

Tilted Wire

To avoid this screening effect the half rhombic was replaced with a simple tilted wire (also matched). This was made 6λ long with a tilt angle of 21 deg. The gain was about one-third that of the "H" though the directivity was improved—unfortunately, the sharpest point was in direct line with the main road with all its interference from traffic!

The tilted wire was abandoned.

Wire Reflector

Next, a simple dipole with a chicken-wire reflector spaced at $\frac{1}{4}\lambda$ behind and covering an arc of 150 deg. was tried. It gave the same results as the "H" aerial (both at the same height). The front-to-back ratio was very good, but as the main source of interference is in front, the chicken wire was abandoned.

Spacing Effects

Variation of the distance between the dipole and reflector was then tried and the best signal was obtained between 1.2 and 2.0 wavelength. The variation between these two points was not very great, but as the point of greatest gain is generally considered to be at 1.5 the reflector was finally fixed at that point. It proved slightly better than the original "H."

Director

A director was added and placed at 0.1λ in front, the aerial being matched by folding the dipole. This was a very noticeable improvement. The improvement obtained being demonstrated by the following:—

The "H" aerial was connected and the picture adjusted for correct contrast. The contrast control was then turned down until the picture just disappeared. The "H" aerial was replaced with the new array and a good picture was produced, the controls not being touched. Both aerials were at the same height.

The best results were obtained with two directors, the dipole being triple-folded to match correctly the array. The spacing used was directors 0.2λ and 0.2λ and the reflector 0.15λ.

However, this array was abandoned, mainly due to its bulk, and the final choice was the one with 0.1λ director and 0.15λ reflector with folded dipole. The estimated gain is 8db. over a dipole and it makes a neat array.

It was noticed that a variation in height of 6ft. made no observable difference in the signal strength. Tilting the array was also tried, and, although it made little difference at chimney height, an angle of 20 deg. was found to be the best position at 20ft. from the ground.

The main defect of the array is that flutter takes place in high winds, but this is offset by the thought that it is a light array ($\frac{1}{2}$in. duralumin tube) and is not a strain on the chimney.

Books Received

RADIO LABORATORY HANDBOOK.
By M. G. Scroggie, B.Sc. M.I.E.E. 430 pp., 216 illustrations. Published by Iliffe & Sons, Ltd., Dorset House, Stamford Street, S.E.1. Price 15s.

THE RADIO LISTENERS' WEEK-END BOOK.
By John Pringle. 288 pp., illustrated. Published by Odhams Press Ltd., Long Acre, London, W.C.2. Price 9s. 6d.

TELEVISION RECEIVING EQUIPMENT.
Third Edition. By W. T. Cocking, M.I.E.E. 374 pp., illustrated. Published by Iliffe & Sons, Ltd., Dorset House, Stamford Street, S.E.1. Price 18s.

OXFORD JUNIOR ENCYCLOPÆDIA.
(Vol. IV—Communications.) 495 pp. Published by Oxford University Press. Price 30s.

Alignment Indicator

A Useful Aid for Trimming Television Receivers

By JAMES S. KENDALL, A.Brit.I.R.E.

IT is essential in aligning modern radio receivers and television sets to have an accurate means of determining when a circuit is tuned to resonance. This unit can be made out of war surplus for about 10 shillings. It is very simple, and can be built as a separate bench unit or incorporated in the same case as a signal generator. The load it exerts on the circuit under test is very low but capacitive.

The parts required are:

A piece of aluminium or copper 6in. x 1½in.
One International Octal valveholder.
Two 6 B.A. screws and nuts.
One 10 MΩ resistor (½ watt).
One 1 MΩ resistor (½ watt).
One 100 pF capacitor.
One 6U5G "Magic Eye" tuning indicator.

Construction

The bracket consists of a piece of metal 6in. x 1½in., with two right-angle bends (see Fig. 1). These two bends require a little care. It must be remembered that the marking-out must be done on the inside of the fold. If it is done on the outside of the bend the metal tends to split down the scriber mark; this not only gives an untidy finish but weakens the bracket. The holes to take the two 6 B.A. screws for fixing the valveholder are drilled with a ⅛in. drill. The best way to take out the 1¼in. hole for the valveholder is with either a tank-cutter or with one of those very excellent Q-Max cutters.

After the bracket is finished, the valveholder is fixed to it. The components are connected direct to the valveholder as shown in Fig. 2. Pin number six on the valveholder is used as a fixing tag for the A.C. end of the 100 pF capacitor (which should be of mica and about 500 V.D.C. working). In the case of mounting the unit on an existing signal generator, a 1in. hole is made in a convenient place on the front, two fixing holes made (⅛in. diameter) and the unit mounted by them. The amount of power used by the unit is 4 mA at 250 volts and 0.3 amps at 6.3 volts. Three plug sockets should also be mounted close to the unit to facilitate connection to the set under test.

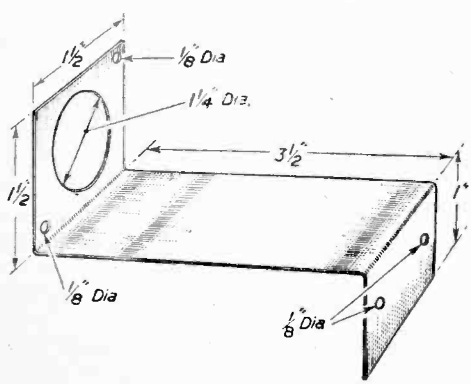


Fig. 1.—Details of the mounting for the unit.

If the unit is to be used apart from a fixed power supply, the power can be obtained from the set under test providing, of course, the set has 6.3 volt valves. The heater power is then obtained by connecting the heater leads across the heater of one of the valves in the receiver. The H.T. is obtained by connecting the cathode of the tester to the chassis of the receiver, and the H.T. positive lead to the smoothing condenser or other convenient place.

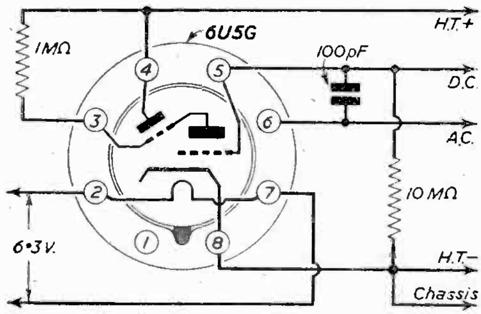


Fig. 2.—Circuit of the indicator.

Application

To use the indicator for aligning a radio or television receiver using a diode detector, connect the D.C. socket to the diode load and tune the relevant trimmers for a maximum shadow on the indicator; this can best be done by using an unmodulated signal. In the case of an anode bend or infinite impedance detector, the A.C. socket is used and a modulated signal must be used; the tuning is again carried out for as large a shadow as possible.

The unit can also be used for fault-finding by the signal tracer method by using a probe (an ordinary lead will do) connected to the A.C. socket. A modulated or unmodulated signal can be fed into the aerial socket and the signal traced through the set by touching the probe on first the grid then the anodes of the various valves, starting with the valve nearest to the aerial; the shadow will get larger and larger as progress is made through the receiver. This is due, of course, to the amplification of the various stages. The fault is in the components between the last point you get a "shadow" and the first point you do not. It is also possible to test whether or not the oscillator section of the frequency-changer valve is functioning by touching the probe on to the oscillator grid; a large shadow on A.C. indicates that the section is working.

Are We Watching Another World ?

The Controversial View of a Reader Who Asks for More Rapid Progress!

WITH acknowledgment to Gerald Heard's investigation into the flying saucer mystery, I take the liberty of reforming his question to probe the TV. mystery. Are we watching another world? It is certain that what most of us look at on our receivers is not of this world—nor is it a glimpse of the celestial. It is in fact like nothing on earth.

To begin with, how long are we going to put up with these miniature screens? Most of us are content with 10in. to 15in. tubes, a few of us with a back-projected picture which is slightly larger. We have been told that such pictures are big enough for the average room—that a bigger picture would make us uncomfortable. *We* surely know whether we want to watch insect-size actors or not, and we can decide for ourselves how far we must sit from the set in order to see in comfort. We would not buy a pair of shoes a size too small just because the shop had nothing bigger in stock and the assistant assured us that anyway a bigger size would not be comfortable. . . .

Yet with TV. we are mugs enough to believe the shop—namely, the television manufacturer and the B.B.C. They have got nothing bigger in stock so they say very cleverly that even if they had we wouldn't like it. They even draw diagrams to prove it. They prove that if you had a picture which made Sylvia Peters as large as life, you would have to open the lounge door and move your armchair out into the hall to view her in comfort. If she were actually in the room would you find normal proximity intolerable? Would you have to move back for comfort—visually speaking, of course? . . . You know you wouldn't. Yet as a member of the viewing public you accept this sort of nonsense.

Too Small ?

The truth is that the present home pictures are much too small, and if we accept the industry's clever propaganda they won't get much bigger for a very long time. It is our duty to be intolerant of the Lilliputian players at whom we are expected to peer. The B.B.C. can produce a transmission with more lines, therefore a picture that can be enlarged without getting too coarse, if it cares to, and if it finds the money. Since it is mostly our money, why shouldn't we have it if we want it? The manufacturers would soon follow suit; in fact, they realise that one day they will have to, but not before they have covered the country with midget receivers which will become redundant and therefore create a new universal demand.

Colour

And while we are about it, we might as well insist on colour. Our world is a world of colour; why should we be content to watch life in monochrome? The cinema gave us a bad training in this respect, but it is rapidly becoming colour conscious. The films, after all, were only, in my opinion, a step towards television in the evolution of entertainment. Now that we have reached the TV. age, there is no need to repeat the faults of the cinema's pioneering days. If, of course, colour doesn't matter to our generation, let's be consistent. If we do not want coloured "pictures," do we want colour in our fabrics and furnishings, homes and gardens? We could save an enormous amount of time and money if we gave up our efforts to achieve it. But we know that without it life wouldn't be the same—and we want our TV. to be the same as life. So let us insist on colour there, too—and the three-dimensional image—everything, in fact, that science makes possible, but commerce retards! Apart from the size and "properties" of the picture, what sort of a world are we viewers looking at? Watchman, what of the programme? First, it is a world that stirs in its sleep in the forenoon, wakes for a brief hour in the afternoon, goes to sleep again till about eight, then retires to its puritanical couch finally at the not very adult hour of 10-15 p.m. To remind us how short is its day, it frequently shows us a clock. (Now, we have a clock, and we get very little thrill out of seeing one forty miles away. It still looks like a clock!) We want longer programme hours. But not, we beseech, till there is a plentiful and continuous flow of things worth looking at.

Studio Out !

If I knew exactly what people like looking at, and if I could afford to take a ridiculously low salary for knowing, I would be just the person to be a TV. programme director. Alas, I only know some very elementary facts about people looking. I know that since the garden of Eden human beings have liked to watch things happening—tournaments in the lists, cock fights, processions, battles, courting couples, or a craftsman at work in a hole in the road! I also know that people like to see other people they have heard about. Does this over-simplify our programme requirements? It suggests that TV. should concentrate on outside broadcasts on the one hand, and individual studio appearances on the other. If there are difficulties in the way of getting the cameras to the more interesting events, everything, including Acts of Parliament, should be used to sweep these difficulties aside. And every sort of persuasion to bring celebrity to the studio. Is there then no place for the studio performance? Frankly, I think, and dare to say, there is not. If we want a play, let's televise a film or go to a theatre and televise a stage play. Why try to create a so-called "new art" of television production to prune life to the size of a postcard. Television's strength lies in its ability to show us life as it is happening . . . to let us watch our own world, not another restricted and artificial studio world.

Television progress is as inevitable as was the growth of radio from the cat's whisker and earphone days to the present high-fidelity radiogram. It will burst out of the little box in which it is now confined, but do not let us, out of loyalty to the B.B.C. or the manufacturers, or out of respect for the still very recent miracle of the thing itself, keep on watching their other world with too much patience. Let us insist on seeing our own infinitely interesting and brightly coloured world, large as life and as soon as possible!

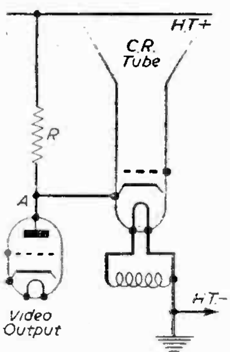
Picture Tube Connections

Video Output Arrangements and Precautions which Should be Taken

By W. J. DELANEY (G2FMY)

THE picture tube is the most expensive accessory in the modern television receiver and accordingly some care is necessary in its use. Apart from the normal precautions of handling it carefully, and protecting it against falling tools, etc., the experimenter or serviceman must also be on his guard against small details which might lead to the destruction of the tube, from an electrical point of view. As will be shown later it might be possible to ruin a tube, or at least to reduce considerably its life, merely by pulling out the video valve in the receiver.

Let us see first how a tube may be damaged. There are three main factors to be watched with any make of tube, tetrode or triode. First, there is a maximum heater-cathode voltage which it is unsafe to exceed. Secondly, the grid must on no account be permitted to go positive in relation to the cathode. And, thirdly, as with any ordinary valve, the anode current must not be permitted to exceed a certain value. Owing to the difficulty of obtaining the E.H.T. voltage there is little likelihood of exceeding a safe value. The other two details are, however, very easily missed and an experimenter or serviceman must be on his guard whilst making rough hook-ups or carrying out a service or breakdown test routine.



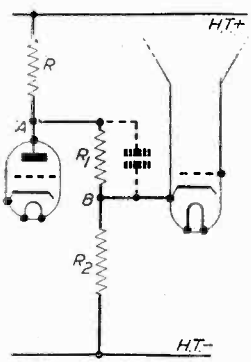
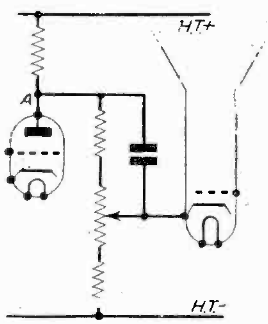


Fig. 1 (left).—Illustrating the heater-cathode potential difference. Fig. 2 (right).—How to reduce the cathode potential.

Heater-cathode Insulation

It is unsafe to permit more than a certain voltage to exist between cathode and heater and the exact voltage will vary with the make of tube. The majority of circuits to-day utilise cathode modulation of the tube, and this means that the cathode is at some voltage positive to the earth line. If, therefore, the heater of the tube is fed from a winding on a mains transformer which is common to the valves in the receiver, it is a fair assumption that one side of such a winding will be earthed, and thus the tube heater is at earth potential (zero voltage from a H.T. point of view). If, now, the cathode is joined direct to the anode of the video output valve (as it is in some circuits) this will mean that the cathode is at a positive H.T. potential of upwards of 100 volts. In Fig. 1 a circuit in skeleton form of this type of feed is indicated. If everything is working satisfactorily there will be a voltage drop through R dependent upon the bias on the valve and the type of valve which is used. The H.T. positive line will be 250 volts or more, and thus, should the bias circuit fail, or the valve be removed from its socket, point A will assume the same potential as the H.T. line, namely, 250 volts or more. Obviously, this will be injurious for the tube, and therefore an arrangement such as this is undesirable. It is true that a user or service engineer could be trained not to remove the valve, but there is nothing to ensure that the bias resistor will not fail in the ordinary receiver. How can this difficulty be overcome? Fortunately, it may be tackled in two different ways.

The first, and the simplest, is not to use a common heater winding for the tube supply. If there is no available separate heater winding on the transformer, a separate transformer may be made up, or in some cases it may be possible to overwind a suitable heater winding on the existing transformer. This tube winding must be left "floating," that is, connected only to the heater pins on the tube holder. Some designers recommend the connection of a high resistance between the cathode and one side of the heater, but we have not found this necessary and have run tubes for considerable periods with the floating winding without apparent ill effect. An alternative idea which avoids the extra winding and



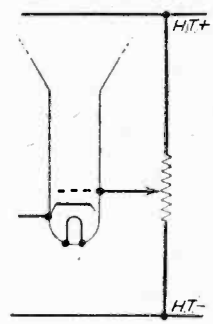


Fig. 3 (left).—An experimental arrangement for adjusting the cathode potential. Fig. 4 (right).—Brilliance control.

enables the heater to be tied to "earth" is to reduce the voltage on the cathode, but this must not be done at the expense of the video stage. The commonest way of doing this is to fit a potentiometer between the point A in Fig. 1 and the earth line, and to feed the cathode from a tapping on this potentiometer. There are one or two points here to be remembered. First, the potentiometer is in effect in parallel with the video load resistance R and thus the signal appears across it. As the tapping point B is moved toward the earth end obviously the H.T. potential on the cathode is lowered, but so is the signal potential. This is, however, a very handy experimental circuit and it is instructive to wire up the arrangement shown in Fig. 3, where two small resistances (say 50 kΩ each) are wired on either side of a 100 kΩ potentiometer. This may then be adjusted from one end to the other and the effect on the signal noted, and at the same time the potential existing between the cathode and heater may also be measured. The condenser joined between point A and the tube cathode may be varied over quite wide limits and it will be found that considerable improvements in the effects of aeroplane flutter may be obtained with certain combinations of resistor and condenser.

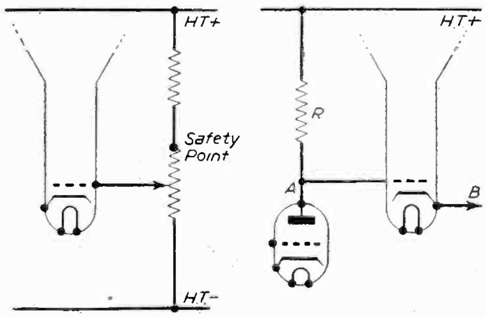


Fig. 5 (left).—Avoiding over-running a tube by a series resistor. Fig. 6 (right).—Grid modulation. Compare with Fig. 1.

Grid Potential

The next point is the grid potential and this must always be negative with respect to the cathode. In the circuits just shown we have seen that the cathode may be at from 100 to 200 volts positive and therefore it must be arranged that the grid is less than that by the value recommended for the particular tube in use. Again this is fairly simple to arrange, but a safeguard must be provided. Fig. 4 shows a potentiometer across the H.T. supply with the slider taken to the grid. When the slider is at the lower end the cathode will be (in the examples just shown) 100 to 200 volts positive, and thus the grid will be that amount negative. In this condition the beam will be cut off, and as the slider is taken up towards the positive end the beam current will rise and this thus affords a satisfactory "brilliance" control. But if it is carried too far (before the tube has reached emitting temperature after switching on, for instance) excessive current will flow until the slider is taken back. Therefore the safeguard here is to insert a resistor at the positive end, of such a value that the slider can never be taken to a point positive with respect to the cathode. In actual practice probably the best arrangement is again to use two fixed resistors, one on either side of the potentiometer, arranging the values so that at one end of its travel the beam is just cut off and at the other it is only very slightly positive—not enough to harm the tube, but enough to spoil picture quality.

Grid Modulation

The arrangements just dealt with only concern cathode modulated tubes, but some designers prefer grid modulation, and it does offer certain advantages. The main drawback, however, is that the conditions in Fig. 1 are reversed, that is, the point A, being at 150 volts or more positive, renders it necessary to take the cathode, point B, up to a voltage in excess of that so that the necessary negative potential will exist on the grid. (See Fig. 6.) With some types of tube (aluminised especially) this may mean that when point B is taken direct to the H.T. positive line the tube may still be insufficiently biased. It may, however, be possible to remedy this by taking the brilliance control potentiometer chain up to the E.H.T. booster line or to some other high-voltage point. The conditions of Fig. 5 are, of course, reversed when using grid modulation, the series resistor now being required at the earth end of the control potentiometer, the slider being taken up to H.T. positive maximum for cut-off. Figs. 1 and 6 should now be compared by the serviceman, and it will be obvious why it is essential to study a circuit before making indiscriminate tests.

It is wise, therefore, to make it a rule never to remove the video valve unless the tube has been disconnected, but wherever possible a circuit diagram should be obtained before making any tests on an unfamiliar receiver.

Central Aerials

THE problems of flat-dwellers, and residents in hotels and similar large buildings in regard to the satisfactory reception of television, has been overcome to a large extent by the use of central aerials. Devised by the relay section of the E.M.I. organisation it consists of a roof-mounted aerial set up on the top of the building in the most open position, and obviously as far from any interference source as possible. The output from the aerial system is taken to time-controlled amplifiers which are switched on when programmes are available.

The signals are then fed to a single coaxial cable taken down through the building and fed in to the various rooms or flats to special output sockets. These are provided with a pair of terminals for aerial and earth, to be used in conjunction with any all-wave radio receiver, and a standard coaxial socket for use with a television receiver. It is claimed that this provides at each output point a signal equal to that obtained at the aerial.

The system is very flexible and is actually available in three separate types. The first is an all-wave system for reception of radio stations on 15-60 metres, 200-545 metres and 800-2,000 metres. This utilises one aerial suspended between two masts. The second system is for television only and utilises only one aerial and one mast. As with the former system amplifiers are fitted at roof level to raise the signal lever and overcome any losses introduced by the feed to the various outlet points. The third system is the combination of these two, but only two masts are needed, the television aerial being mounted on one of the masts.

Aerial Construction–2

Details for Making Up "H" and Multi-element Aerials for the London and Midland Transmissions

MATERIALS required for the addition are as follows (for Sutton Coldfield frequency):

One length 7/8in. diameter aluminium or dural tube 3ft. 9 7/8in. long.

Two lengths 3/8in. diameter aluminium or dural tube 7ft. 9in. long.

Two lengths 3/8in. bar aluminium or dural tube (square or round).

One-eighth in. paxolin or bakelised fabric sheet (4in. x 8in. approx.).

Mast (see text).

The two additional elements are plugged at each end and are fitted by paxolin insulators to the 7/8in. crossbar, which is then bolted on top of the existing crossbar 6½in. from the centre of the reflector. The plan view in Fig. 9 makes this clear.

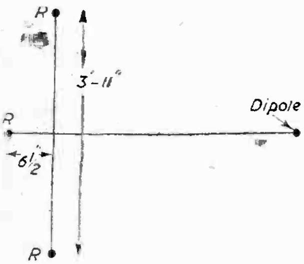


Fig. 9.—General arrangement of the complete aerial system.

A simplified fitting for the reflectors of this array has been devised and can be used for the original reflector, if desired, with a saving of both labour and weight. This fitting has functioned perfectly, even when snow-covered, and is thus quite as efficient as the one previously described. The dipole itself, of course, must be left as before. The exploded view in Fig. 10 explains the construction, whilst Fig. 11 gives additional information. As will be seen, the paxolin fastens inside the crossbar instead of outside as before, is only 1/8in. thick instead of 1/4in., and the packing between the element and this is dispensed with. Note (Fig. 11) that the edges of the paxolin are rounded to fit snugly into the crossbar. It is important that these fit tightly. Mechanical strength is ample for 3/8in. light alloy tubing.

The paxolin T-pieces should be fitted to the crossbar first, but not drilled or bolted. They should be tight enough to stay in position when the 3/8in. bar packing is in position between them. The elements can now be fitted to these T-pieces by the two 4 B.A. bolts, fitting one bolt before positioning the reflector exactly at right-angles to the crossbar and drilling the second fixing hole. Note that the T-pieces are *not central* but 7/8in. off centre, as the assembly lies above the existing 7/8in. crossbar.

This done, the T-pieces can be correctly positioned to give 3/8in. gap between reflector and the end of the crossbar and drilled and bolted in position by 4 B.A. bolts, taking care when fixing the second that it is perfectly in line with the first. The fitting of this structure to the H array follows and is the most tricky part of the assembly, particularly where no bench drill is available. However, if the following procedure is followed, accuracy is ensured.

First drill a small hole (1/8in. diameter is suitable) in the centre of the new crossbar in line with the reflectors and perfectly upright. Screwing the vice to a pair of step-ladders is a useful tip in view of the possibility of damage to the elements. A piece of 1/8in. rod inserted will enable the accuracy of drilling to be checked by set-square and sighting with the reflectors, and a small round file can correct errors in opening the hole to take a 1/4in. bolt 2¼in. long. Similar accuracy and methods are necessary in drilling the H array 6½in. forward of the centre of the reflector.

The new assembly should then be bolted in position, the longer ends of the reflectors downwards, and the nut tightened just sufficiently to hold the assembly rigid. If its natural position is such that it tilts in any direction, correction is still possible. The 1/4in. bolt will be found to have a square on the underside of the head which must be accommodated, and the enlarging of the topmost hole to take this enables faults to be corrected.

Many methods will be obvious to prevent pivoting about this bolt, but surfaces for the wind to play upon should be avoided. Use is therefore made of two-L-shaped steel plates from the local sixpenny store, arranged about the 1/4in. fixing bolt and between the two tubes, the ends being fixed by 3/16in. bolts with the two tubes at right-angles. Fig. 12 is an underside view of the junction.

Mast

The original mast is too flexible for the additional weight. Several alternatives are open: first, a larger diameter mast, about 2in. should be sufficient, but this

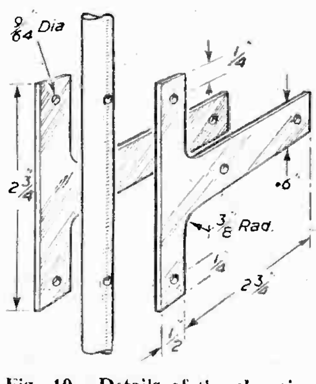


Fig. 10.—Details of the clamping pieces.

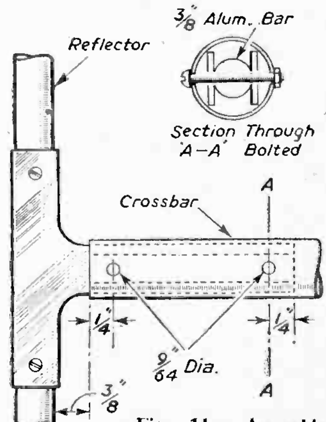
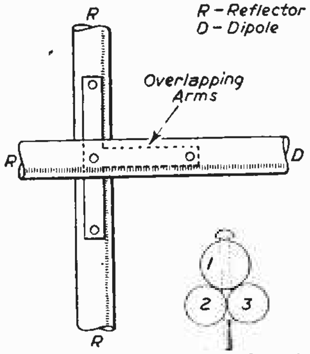


Fig. 11.—Assembly details for reflector support.

was not readily available. Second, a steel mast, which raises problems of weight and weatherproofing. The third alternative of a wooden mast was also rejected from the angle of weight and less secure fixing points.



Figs. 12 and 13.—Underside view of the junction and mast strengthening arrangement.

The final alternative is the composite mast, which proved simple and strong as well as light.

Two additional tubes of light alloy 1in. in diameter and of the same length as the mast are bolted to the existing mast along its full length, cut away to fit close up to the mast fixing plates at the H crossbar and bolted with a ¼in. bolt through both the fixing brackets and the ⅞in. tube. Fig. 13 shows the existing mast section (1) and the new tubes (2) and (3). Beginning at the bottom of the mast, these are bolted together by ¼in. bolts in the following order : (2) to (3), (3) to (1), (1) to (2), and so on at 15in. intervals. This assumes that the line of the aerial lies at right-angles to the tangent to (2) and (3), or sufficiently so to enable slight packing to correct the lie of the array when bolted. If not, choose the tubes which are to lie against the chimney bracket and bolt these together first, continuing as before. With care in drilling the cable need not be withdrawn.

The existing chimney bracket, using a single band about the chimney, has proved quite sufficient to hold this assembly perfectly rigid, and the results have been surprisingly effective, about a 50 per cent. increase in signal strength resulting, with sharp rejection of ignition behind the aerial over a wide angle. Using a VCR97, the 2 Mc/s bars are perfectly reproduced, and the 2.5 Mc/s with reduced intensity, bandwidth therefore being adequate.

Sound Unit for R1355

An Addition to a Popular ex-Government Vision Unit

By B. L. MORLEY

THIS sound unit can be used in conjunction with an R1355 receiver which has been modified for use as a vision receiver, with any of the R.F. units normally used with the receiver. It can also be used with the simple superhet converter, described in a previous issue of PRACTICAL TELEVISION.

Fig. 1 shows the theoretical circuit. Two stages of I.F. amplification using SP61s (VR65) are followed by a 6H6 diode detector, the second half of which forms a noise limiter. An SP61 is used as 1st L.F. valve and is followed by a 6V6 power output valve.

It will be seen that the unit forms a simple I.F. strip ; the sound I.F. is obtained from the R.F. unit used in the R1355. The principles of operation which follow apply to both the London and Birmingham transmitters, though for the purpose of illustration the Birmingham case only is considered.

The R1355 operates on a frequency of 7.5 Mc/s and as the vision frequency of Sutton Coldfield is 61.75 Mc/s the oscillator in the R.F. 26 unit will be adjusted to 61.75+7.5=69.25 Mc/s. In other words, if the oscillator in the R.F. unit operates at a frequency of 69.25 Mc/s it will produce an I.F. of 7.5 Mc/s when beating with the vision frequency. This I.F. is passed on to the R1355 in the usual way.

Now the sound signal operates on 58.25 Mc/s and this, beating with the oscillator frequency of 69.25 Mc/s, will produce an I.F. of 69.25 − 58.25 = 11.0 Mc/s. The bandwidth of the R.F. unit should be wide enough to pass vision and sound frequencies together. (The bandwidth of the unit can be increased, if required, by connecting 4.7 KΩ resistors across the tuning coils in the unit.)

We have, therefore, two I.F.s at the anode of the mixer valve ; the vision (7.5 Mc/s) is passed on to the R1355 and the sound (11.0 Mc/s) is passed on to the sound unit (Fig. 1).

Fig. 2 shows how this is done. An additional coil L(a) is inserted in the anode circuit of the mixer. It consists of 35 turns of 34 S.W.G. S.C.C. wire wound on a standard Aladdin former. The sound I.F. is tapped off via a 40 pF. condenser. An additional Pye socket can be mounted on the front panel of the R.F. unit and connection made to it from the condenser with coaxial cable.

The sound unit can be built on a simple chassis,

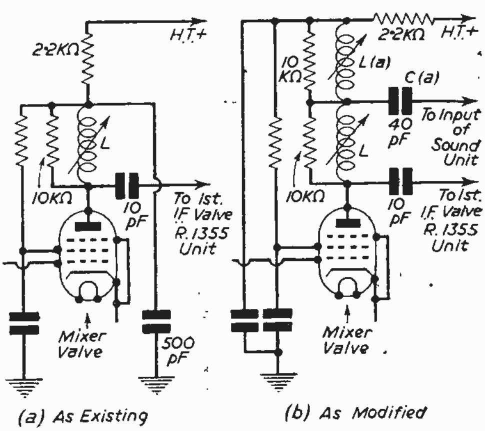


Fig. 2.—I.F. transformer and modification.

15in. x 3½in. by 1½in. A suggested layout is shown in Fig. 3. Screening is important and screened leads and caps should be used to feed the grids of the SP61s. The grid stoppers R4 and R11 should be mounted inside the screening caps.

The three coils LR1, 2 and 3 comprise 35 turns S.W.G. S.C.C. wire wound on standard Alladin formers. The rest of the components are straightforward and can probably be found in the spares box.

volume on the sound signal. The final adjustment is to La (Fig. 2) for max mum vision and sound.

If, due to stray capacitances, it is not possible to obtain a peak position on the coils (a) with cores screwed right in, or (b) with cores right out, it can be corrected, in case (a) by adding 5 turns to the coils, or in case (b) by subtracting 5 turns.

One word of warning: it will probably be possible to receive the vision signal at two positions on the oscillator trimmer in the R.F. unit; only on one of these will it be possible to produce sound and vision simultaneously. This will be the minimum capacity position, so if you fail to receive the sound signal, alter the trimmer to its second position.

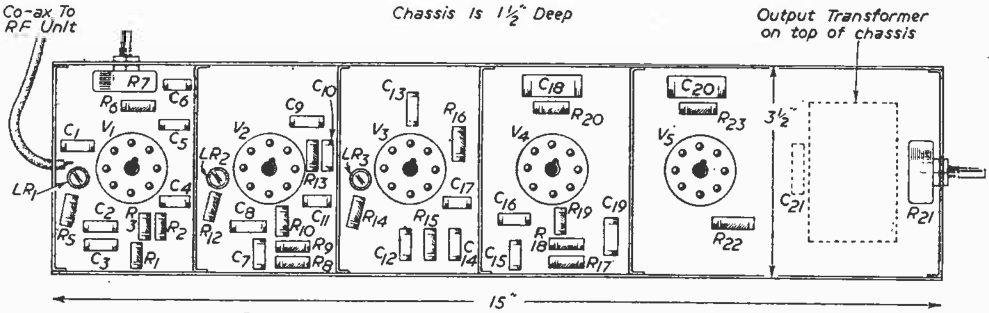


Fig. 3.—Layout of the parts.

Alignment

Having previously adjusted the R.F. unit to receive the vision channel via the R1355, connect the input to the sound unit via coaxial cable, to the condenser Ca (Fig. 2). LR1, 2 and 3 are then adjusted for maximum

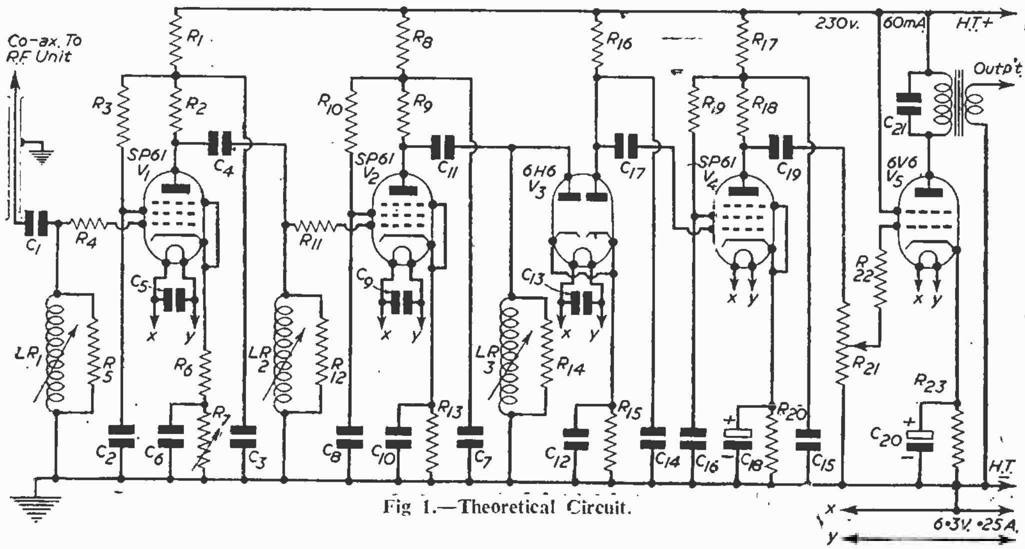


Fig 1.—Theoretical Circuit.

LIST OF PARTS

R1, 8, 17=2.2 kΩ.
R2, 9=5.6 kΩ.
R3, 10, 19=15 kΩ.
R4, 11=40 Ω.
R5, 12, 14=10 kΩ.
R6=10 Ω.
R7=2 kΩ variable.
R13=180 Ω.
R15=4.7 kΩ.
R16=2.2 MΩ.
R18=7.5 kΩ.
R20=220 Ω.
R21=0.5 MΩ variable.
R22=50 kΩ.
R23=250 Ω.
C1=40 pF.
C4, 11=100 pF.
C12=35 pF.
C14=1,000 pF.
C17=0.01 μF.
C18=25 μF.
C19=0.05 μF.
C20=50 μF.

Remaining condensers are all 500 pF.

"Matters of Lif

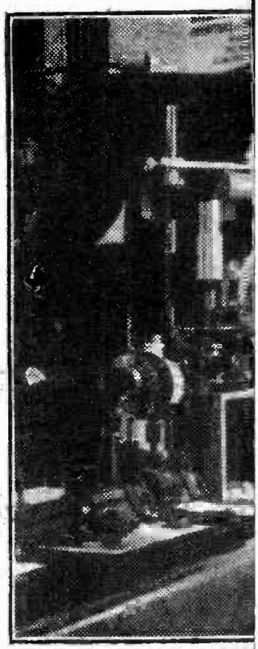
How this Popular Series was

By ANDREW M

TO give the public what was thought to be good for it as well as what it wanted has been the B.B.C.'s interpretation of its responsibilities since the days of its first Director-General. What the public wants, as any box-office showman will tell you, is entertainment. A series of programmes on medical subjects could hardly, on the face of it, be regarded as entertaining and therefore, when the idea was first submitted, the case was argued on the grounds of public benefit. Such a series, in making known the latest advances in medicine, would help not only the medical profession by increasing public confidence but also the layman. He would benefit, either by having his groundless fears dispelled or, where there was cause for anxiety, by consulting his doctor in time for something to be done. The idea was accepted because it was thought to be worthwhile. It was not expected to be wildly popular. Audience research has shown, however, that the public occasionally likes what the B.B.C. considers good for it. The eleven programmes which have been presented under the title " Matters of Life and Death " have proved to be more consistently popular than plays, hitherto regarded as the most acceptable television fare apart from the Newsreel and Muffin the Mule.

What are the reasons for the popular appeal of these programmes? In the first place, they are concerned with the greatest common denominator in the human race—the body. The majority of people desire good health above all things, and anything which helps them to achieve it is bound to be of absorbing interest. That is their subjective appeal. The objective appeal lies in the fact that the body is fascinating in its complexity. The wonder is not that it goes wrong, but that it goes at all. Programme by programme we are able to learn, in easy stages, how the various organs of the body function from the lips of men who have devoted their lives to the study of their particular subject. The intimate contact which television gives with distinguished men of the medical profession is another reason for the apparent success of the programme, as is also the authenticity of the demonstrations. Nothing is staged. There is no make-believe. The patients are real patients. When, as in the Diabetes programme, a patient is injected with insulin, the patient is a diabetic and the injection is actually given. In the Tuberculosis programme, a patient's lung was collapsed by artificial pneumothorax *in the studio*. There was no need to describe how painless these minor operations were. The audience could see for themselves.

This business of seeing makes medical programmes on television vastly more complicated than a medical talk or a scientific feature on sound radio. It is not even a question of illustrating a talk but of telling the story, as far as possible, in pictures. Scenery and properties must be authentic to the last degree, acceptable not only to the lay viewer but above reproach to the many doctors and nurses among the audience and, most important, to the medical men taking part in the programme. This is comparatively easy, although it entails considerable organisation on the part of the producer's secretary. For Modern Surgery, equipment for operating theatre, anaesthetic room, sterilising room, wards and pathological laboratory had to be located and brought to Alexandra Palace. The list of properties ranging from large items such as operating tables, scialitic lights, anaesthetist's trolleys, examination couches, hospital beds and incubators, down to sterilising pans, swabs and dressings, ran into four pages of foolscap. This was only background, interesting enough in itself as affording a glimpse behind the scenes, but of little help in demonstrating, for example, the need for asepsis. A surgeon can be shown scrubbing up for ten minutes by the clock and words can explain why, but that will not be as effective as letting the audience see a comparison of incubated swabs taken from the hands of a surgeon after scrubbing up and from hands that have been washed in the normal way.



Microscope with horizontal camera by Ro

Dr. R. D. Lawrence illustrating a detail in the Diabetes programme.

A Demonstration

To demonstrate this point, we arranged for swabs to be taken 24 hours before the programme and incubated in nutrient jelly. Then, by means of the microscope, it was possible to see that the dish containing the sample from the surgeon's hands was almost clear, while the other dish was teeming with bacteria.

e and Death"

Conceived and Produced

LLEER JONES

Television Microscope

The television microscope has been of great value in the series. By its aid we have been able to detect the difference between cancerous and healthy tissue, to see how blood is grouped, and to learn how the body renews itself by the miracle of cell division. The microscope is accepted to-day by regular viewers as a piece of normal television equipment, but the problem of getting a camera to look through the eyepiece took some time to solve. Owing to the shape of the cameras at Alexandra Palace, and the distance of the mosaic behind the lens aperture, it seemed impossible to get the eyepiece near enough to fill the screen. After many experiments, Robin Weston devised an ingenious optical system which overcame the difficulty without serious light loss and enabled the microscope to be used with a horizontal stage. This meant that liquids, as well as prepared slides with fixed specimens, could be used.

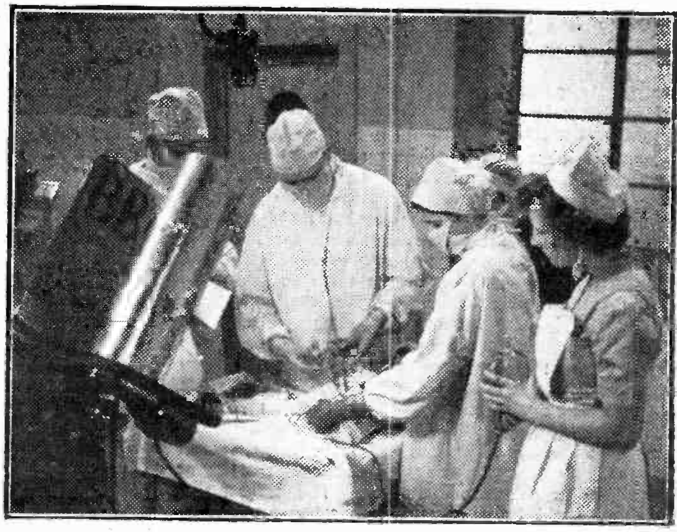
stage adapted to Emitron
bin Weston.

Problems

Each programme has its own special problem. So many things have to be done for the first time. In Diseases of the Eye we wanted to fill the screen with a single human eye so that various conditions such as cataract and scarred cornea could be seen. Knowing that this would be impossible with the Alexandra Palace cameras, we arranged to use the Lime Grove studios where the cameras have a greater depth of focus and are fitted with turrets containing lenses of different focal length. During experiments conducted prior to the programme, it was found that the only lens which would produce pictures of the required size had to be so close to the eye that it was impossible to direct enough light on to the subject to produce a picture. This time it was the medical supervisor of the series, Dr. Brian Stanford, who solved the difficulty. Dr. Stanford, who had been faced with similar problems when making films of operations where, for obvious reasons, the camera could not approach the operation area for close-ups, suggested using a long-focus lens fitted with an extension tube. A 12in. lens was tried with a tube improvised from an old caption card, and a picture of the required size was obtained with the camera some 4ft. away from the subject. At this distance the focus was critical; half an inch either way was enough to blur the image. As we wanted to show the result of a corneal graft on the eye of a lady of 80, we had to devise means of ensuring that she kept her head still while the camera was being lined up and while it was on the air. This was done with an optician's head and chin-rest and, after a metal extension tube of precise dimensions had been made, excellent pictures were obtained. In future, it will be possible to televise objects as small as the human eye as a matter of routine.

X-rays

Less successful was the attempt at using X-rays. In making an X-ray for clinical purposes, the exposure can be adjusted to suit the density and thickness of the part of the anatomy to be penetrated. In television, it is not possible to vary the exposure, since the cameras are designed to transmit precisely 25 pictures every second. With the sensitive cameras at Lime Grove this means, in fact, an exposure of 1/25 of a second, though at Alexandra Palace the exposure is only 1/250 of a second owing to the smaller sensitivity of the cameras in use there. Lime Grove was, therefore, chosen for the X-ray experiment whose object was to demonstrate how the stomach, an organ composed of soft tissue not normally discernible by X-ray, could be registered when filled with a meal of barium which is opaque to X-rays. A number of volunteers from the studio staff drank their glass of barium meal and were screened by X-rays. Although the power was stepped up to the limit of safety, there was insufficient light to produce a picture on the television screen. It was possible, however, to see the meal, very faintly, as it passed down the gullet and it was thought to be just good enough to include in the programme on Peptic Ulcers. Viewers living in a strong signal area whose sets were properly adjusted were able to see the barium as it was swallowed. The X-ray demonstration which preceded it could be seen by everyone. First a hand was X-rayed and the bones and joints were clearly visible. Then the radiologist showed



A demonstration by a famous surgeon, with a model in the studio, of bloodless surgery.

how he protects his own hand by wearing a glove made of lead. This appeared on the screen as a silhouette of solid black. The power of barium to interrupt X-rays was demonstrated by comparing two glasses, one filled with milk and the other with barium. To the unaided eye and to the television camera, they were similar in appearance, but under X-ray one became transparent while the other remained opaque. The interest in this particular " first time ever on television " lay not so much in the demonstration itself but in the possibilities which it opened up for living X-rays of the body in the future. We now have data to work on. We know what degree of sensitivity will be necessary for success and have every hope that the latest cameras to be installed at Lime Grove will prove suitable.

An Operation

Not all the problems of illustration are technical. " If you can't show it, don't talk about it," may be a rough and ready rule in television but it is often possible to devise ways and means of showing things which, on the face of it, seem incapable for a variety of reasons of being seen. How, for instance, could the technique of an operation for appendicitis be made clear. Obviously it was impossible to do an actual operation in the studio. An outside broadcast from a hospital theatre permanently equipped with a television camera for the instruction of medical students was a practical possibility but would have proved too frightening to many viewers at home. Even a film of an operation, impersonal and belonging to history rather than the present, was considered too charged with emotional associations to be used. Nevertheless, a programme on modern surgery without showing operation technique would have been like " Hamlet " without the prince. The difficulty was overcome by means of a model consisting of a piece of chamois leather stretched over a square box filled with gauze and thin rubber tubes containing dark fluid. The stages of the operation were explained by diagrams and the technique of cutting, clipping, tying off and stitching demonstrated on the box. Thus we avoided upsetting the sensibilities of all but the most squeamish without having to omit the climax of the story.

Great use is made of special models and moving diagrams and a technique has been developed by Alfred Wurmser whereby many of the effects of animated film are produced at a fraction of the cost. Outstanding examples of his work were to be seen in the programme on tuberculosis for which he made a working model of a portion of the lungs showing healthy, sick and calcified cells, and a two-dimensional moving diagram showing what happens when a lung is collapsed by artificial pneumothorax. The doctors taking part in the " Matters of Life and Death " series are so much impressed with these models that they invariably ask for them afterwards for use in their medical schools.

So much for some of the problems of visualisation which have been tackled in the series. Their solution has, to some extent, contributed to the interest of the various programmes but the success of the series is due, in large measure, to the authority and personality of the chief speakers. Men eminent in the medical profession like Sir Heneage Ogilvie, Sir Alexander Fleming, Dr. R. D. Lawrence, Dr. R. R. Trail and Professor H. J. Seddon, to mention only a few, have spent much valuable time and energy in preparing the programmes and have put up with the inconvenience of coming to Alexandra Palace and spending a day in the studio in order to make known the latest advances of medical science. Their message of hope and reassurance is all the more effective because, thanks to television, it reaches us individually in our homes.

A Cheaply Constructed Television Lens

THOSE who have a television set using the VCR97 6in. tube, can add a lens at a cost which need not exceed two or three shillings. A lens of 10in. diameter constructed by the writer was found to add considerable interest to the relatively small picture, especially in sporting events.

Chemical laboratory furnishers supply at a cost of about a shilling each articles known as clock glasses which are shallow dishes obtainable in diameters up to 10in. or 11 in. Two of these are required and these must be picked out so that no obvious irregularities in the surface are seen. No difficulty will be found in doing this, but it is as well to purchase these personally to avoid disappointment. Some types of clock glass are quite unsuitable, however, and this will easily be seen the moment the glasses are handled. The best plan is to pay a visit to the showroom of the largest laboratory furnishers in one's district and see whether the stock is of a satisfactory type. This is a clear glass uniformly thick (about ⅛in.) over the whole surface and a section of a sphere in shape. This can easily be seen by viewing the edge. Small irregularities in thickness and figure do not appear to cause distortion. The largest size available should be purchased. A small amount of Plasticene, which may be obtained from a multiple store, is required and this is worked by the fingers until soft, and drawn out into lengths. The glasses are cleaned and placed together convex sides outwards and the strips of Plasticene pressed into the edges all round. This should be done carefully so that no breaks occur between the lengths, the Plasticene being smoothed over. Two holes are now made at diametrically opposite points with a pointed match and the glasses then immersed in a bucket of water with one hole uppermost when the lens will fill. When full the Plasticene is smoothed over both holes. In the one constructed no leaking occurred while the lens stood on edge for many months, and in fact it will be found that two holes must be made, one at the top, and one at the bottom, to cause leaking.

Focal Length

The focal length of the lens is about a foot and a bracket must be made to hold it in front of the screen at a distance which gives best results. The magnification increases as the lens is moved out from the picture and the limit is decided when distortion begins to occur at the corners of the screen.

With large magnifications, i.e., about double, the field of view is restricted to two persons, and while this is the chief drawback it was found that those viewing preferred the lens.

Other Fluids

No other fluids were used for filling but the use of liquids having a higher refractive index would produce the same magnification but with the lens closer to the screen.—J. C.

Low Noise Factor Pre-amplifier

A Two-valve Unit for the Fringe Viewer

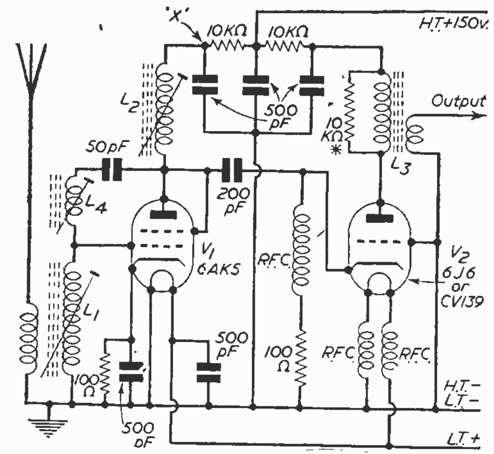
By T. M. RODWELL

THOUGH many commercial receivers have adequate sensitivity to produce a picture in areas of low signal strength, the picture is often marred by noise, which shows itself up on the screen as "snow" or "grain." This is due to the poor noise factor of the radio-frequency amplifying stage of the receiver.

The author has found that for the proper enjoyment of a programme "grain" should, if possible, be absent from the picture. This article is written for the amateur constructor who lives in an area of low signal strength and who would like to improve the quality of his picture. It is proposed to describe a pre-amplifier using all triode valves, with a resulting very low noise factor.

The Circuit

Reference to the circuit diagram will show that the "Wallman" cascode feature is employed as developed in America during the war for use in wide-band amplifier circuits in radar receivers. This circuit uses two valves, the first being a pentode connected as a triode and the second being a triode connected in the "grounded grid" mode. This circuit has an exceptionally broad band-width and a low noise factor, and is ideally suited for use in television receivers. Miniature valves are used throughout. For the first there is no finer valve than the 6AK5 strapped as a triode, for the second the reader has the choice of many of the miniature triodes which may be operated in the "grounded grid" mode. The CV139 is excellent, and the writer has also used the following valves in this stage with good results: 6J6, 6C4, 9002. There is no substitute for the 6AK5.



Theoretical circuit of the Pre-amplifier. The 10kΩ resistor across L3 is optional. If the signal is very weak it should be omitted. The 500pF condenser should preferably be T.C.C. Micadiscs.

Layout

The actual layout of the pre-amplifier and the size of the chassis used is left to the builder's choice; but in the author's case the pre-amplifier was built up on a chassis of about 5in. x 3in., the coils being wound on Aladdin ¼in. diameter formers, with screening cans and dust iron cores, the windings specified being for the Sutton Coldfield transmitter. Those living in the London area will, of course, wind coils for that frequency.

COIL WINDING DATA

L1	8 turns Aladdin ¼in. former. 2 turn link		No. 26 d.c.c.
L2	9 ,, ,, ,, ,,		
L3	9¾ ,, ,, ,, ,, ,, ,,		
L4	28 ,, Aladdin ¼in. former, 28 enamel.		
RFC	50 turns 26 d.c.c. on 1 watt resistor of high value.		

V1=6AK5. V2=CV139 or 9002 or 6J6 or 6AB4.
(CV139=Mullard EC91).

Tuning

Tuning of the pre-amplifier is extremely simple. The first coil (L.1) is tuned to 61.75 Mc/s; the anode coil of the 6AK5 R.F. stage (L.2), is tuned to 58.5 Mc/s; the anode coil of the "grounded grid" stage (L.3) is tuned to 61 Mc/s. After this has been done it will be necessary to neutralise the 6AK5 R.F. stage. This is effected by removing the H.T. from this stage at the point marked X in the circuit diagram, and by feeding into the aerial circuit a strong signal at 61 Mc/s, and adjusting the neutralising coil (L.4) for minimum response. If the reader does not possess a signal generator the sound signal may be used just as easily; the tuning of the coil L.3 will be found to be very broad.

Results

The writer has been using one of these pre-amplifiers at a distance of eighty miles from Sutton Coldfield with excellent results, with the receiver adjusted for the full band-width of 3 Mc/s. A picture of excellent contrast is obtained without the slightest trace of noise. The circuit is extremely stable and not the slightest trouble should be experienced in getting it going.

Receiver Coupling Unit

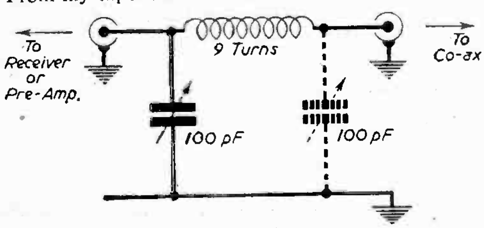
Matching Device for Aerial to Receiver or Pre-amplifier

By H. CROSS

IT is often overlooked that the co-axial lead ought properly to match the receiver input as well as the aerial. As a rule, a good deal of trouble is given in ensuring a good aerial match with folded dipoles, carefully cut elements, and meticulously correct spacing, but the matching at the receiver end is usually left to chance.

In a site of low signal strength, however, it is astonishing what a difference can be made if a little care is taken with this end matching. In my own case, some 70 miles from Sutton Coldfield and shadowed by a 500ft. hill, it means all the difference between pictures blemished and torn by background noise, and clean, clear-cut viewing.

From my experience with the dozen cases so far tried, I have found the actual matching method required varies slightly according to the length of co-axial lead, type of co-axial, and receiver input. But in all cases a worthwhile improvement resulted.



Circuit of the coupling unit.

The items required are two variable condensers not more than 100 pF. maximum each, and a length of tinned copper wire suitable for coil winding.

To quote my own case first, I achieved optimum results with a coil of nine turns, ½in. diameter, 1in. winding length, self-supporting. This was connected between the end of the co-axial and the receiver input, and only one condenser proved necessary, connected between the receiver input and earth. Fig. 1 shows the very simple connections.

Matching

To simplify wiring I used a metal plate about 4in. square fitted with an input and output co-axial socket between which the coil was connected. The variable condenser was mounted under the output co-axial socket and the plate bolted to my pre-amp. A short length of co-axial was made up to connect the unit to the pre-amp.

The best match is found by starting with, say, ten or eleven turns, and shorting a turn at a time whilst adjusting the condenser. Tuning by connecting a microammeter in the video diode matching can be made absolutely accurate. However, it is quite possible by watching the picture itself to judge the correct setting.

I found, with a preliminary adjustment giving 150 microamps on a meter in the video diode, that the reading could be increased to 210. Also, surprisingly enough, the matching resulting in an appreciable increase in sound-level showing that the matching was quite broad.

My own aerial installation consists of a folded dipole, close spaced (20in.) to a director with 70-ohm, semi-air-spaced co-axial connected to an EF54 pre-amp., with simple coupled coil input to the first tuned circuit.

As mentioned before, other installations may require slightly different treatment. In two cases I have found that a variable condenser connected directly across the end of the co-axial without any coil gave best results, whilst in other cases, the second condenser shown dotted in Fig. 1 was necessary.

This comparatively simple unit is definitely worth while in any area where a slight gain in signal strength makes just that bit of difference.

Holme Moss

THE B.B.C. had hoped that the new television station at Holme Moss would be opened by the middle of 1951. However, it was always realised that this would depend to a large extent on the weather and o[illegible]he prompt delivery of materials and equipment. W[illegible]n the 750ft. mast, which is on a very exposed site over 1,700ft. above sea level, has in fact been delayed by the weather and difficulties are occurring with the completion of equipment. Subject to there being no further unavoidable delays it is hoped to start preliminary transmissions on medium power in July.

These medium-power transmissions will not, of course, give the full coverage which will later be obtained on full power, and reception will be more susceptible to interference. They are intended mainly to assist viewers and radio dealers in the setting-up and adjusting of receivers.

It is hoped that transmission of normal programmes on full power will begin towards the end of September, but this must depend on completion dates being fulfilled by the contractors concerned.

Our Cover Subject

DR. FRANK ROBERTS, brilliant 36-year-old scientist, has invented the world's first television microscope. This device, half microscope, half television set can, unlike other television microscopes, magnify *living* tissues up to 25,000 times. When fitted with an extra device, the TV microscope will also be able to count minute objects like blood cells, measure them, and record exactly how many of each kind are on the slide. This has never been possible before. The first big job scheduled for the new invention is to count and sort out the total number of cells in the human brain. Doctors using it will be able to watch the exact behaviour of living disease germs when being attacked by chemicals—an advance which should speed the discovery of new drugs. The picture on our cover this month shows Dr. Frank Roberts inserting a slide into the microscope. In foreground (left) is a display unit (time base for synchronising the scanner and TV set). Also in picture is the scanner and magic eye. See also the article on pages 504 to 506, and the illustration on the centre pages.

RECEIVER 3457

These cost over £100 each to build, they contain 15 valves type EF50 and one each of VR56, VR55, VR92, and 2 of types VR116 and VR54. These contain a host of valuable pot'meters, motors, relays, gear box, and components of all descriptions, and in addition they contain the famous "Pye" 45 Mc/s television strip. Brand new in transit boxes. Price £5/19/6.

ELECTRON MULTIPLIER

Type 931A. Direct equivalent of the 27M, can be used for warning systems, locating foreign bodies, burglar alarms, etc., etc. Complete with base and a special lightproof chamber and resistance network. Price 27/6 each.

T.V. CONSTRUCTORS

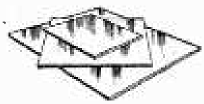
This is your last chance to secure the lowest priced T.V. parcel ever offered. It comprises an ex-Govt. unit which among a host of other parts contains 11 valves, all 6.3 v. mostly h.f. pentodes, also this unit contains a fine wide bandpass I.F. strip. With this unit we give without extra charge all the data showing how a really good T.V. receiver can be made using this unit. Extra parts are needed of course, but with the main unit at this low price the total cost should not exceed £10. Price of the unit which while not being new is nevertheless in quite good condition, complete with the eleven valves and the data is only 22/6, plus 2/6 postage, etc. Send to-day or you may miss this super bargain.

TRANSFORMER SNIP

A Universal replacement by a very famous maker. Standard mains input secondaries: 350-0-350 at 80 mA. 6.3 tapped at 4 v. 4 amp. and 4 v. at 3 amps. Special price for one month only 13/6 plus 1/- post. Note this is a half shrouded drop through type.

THIS MONTH'S SNIP

Due to a very large purchase, we are able to offer you 8 mfd. 600 v. working electrolytic condensers, aluminium can, upright mounting, made by one of our most famous Companies. These condensers will stand high surge voltages, and the normal list price is 7/- each. All are unused, and in perfect working order but outside cases may be soiled. Price only 1/9 each or 10/- per half dozen. Order by return because obviously once we have sold these we shan't be able to repeat.



PAXOLIN PANELS

Ideal for making up special tag boards, front panels for instruments, etc., the thickness of the panels varies a little, but on the average is 1/16in.

Size 6in. × 6in., 1/- each. Bin K20D.
Size 12in. × 8in., 2/6 each. Bin K20C.
Size 12in. × 12in., 3/6 each. Bin K20B.
Size 24in. × 12in., 6/- each. Bin K20A.

B7G PLUG

With hard rubber body, fits into standard B7G valveholders, ideal for joining small chassis, etc., 1/4 each.

Orders under £2 add 1/6, under £1 add 1/-. Postable items can be sent C.O.D., additional charge approx. 1/-. Good stock of all items at time of going to press. List 6d. Closed Wed. afternoon, open all day Sat.

ELECTRONIC PRECISION EQUIPMENT (5) ELECTRON HOUSE, Windmill Hill, RUISLIP MANOR, MIDDX.

THE AMATEUR RADIO SERVICE
Moorside Mills, Lomax Street, Bury

VALVES.—VR136, 6/-; VR91, 4/6; VR65, 3/-; VR92, 1/-; VU111, 3/-; VU39, 5/-; 5U4G, 6/-; 6V6, 7/-; 1625, 3/-; 12J5, 1/3; VR150/30, 7/-; 6J5G, 2/-; EL32, 4/-; 6Q7, 5/-; 866A, 11/-; 6AK5, 7/-; KT66 brand new and boxed, 7/6; 6K7M brand new and boxed, 5/-.

NEON STABILIZERS.—3-CV71 with brass midget double contact batton type holders on bakelite bracket, 5/- per unit.

METAL RECTIFIER, Type LU735A.—700 volt 20 ma in very good condition, size 5/8in. diam. x 5¼in. long, 4/6 each.

ELECTROLYTICS.—8 mfd. 500 volt working, 1/9 each. 6 for 10/-. Tested. 60 mfd. 12 volt D.C., 6d. each. 2 mfd. 350 volt, 6d. each.

CONDENSERS.—.25 mfd. 2 KV., 6d. each.

VALVE HOLDERS for EF50 valves, B9G ceramic bases, 6d. each, 5/- per doz.

INTERNATIONAL OCTAL VALVE HOLDERS, clip type fastening, new, 4d. each, 3/- per doz.

1 ma **INSTRUMENT RECTIFIERS**, new and unused, 6/- ea.

VHF MODULATOR, unit type 169, containing Klystron type CV67 together with M motor type MKX remote control tuning arrangement. Many other components used for VHF experimental work, including valve type CV85. Housed in metal case, 9in. x 8in. x 18in., in brand new condition, 10/- each, plus 3/- carriage.

RECEIVER TYPE R601, useful for component contents, including over 50 resistors, various types. 10 Pye plugs and sockets. 16 valve holders of various sizes. Various valve top caps. Completely screened and detachable R.F. and I.F. stage. Many other components, including transformers, switches, pots, group boards, etc. All housed in metal 9in. x 8in. x 18in., 12/6 each plus 3/- carriage.

Will customers please note that we cannot enter into correspondence about the last two units.

MIDGET POTS, 1 meg. 1¼ soft, 1/- each. Also 10K Morgan type screwdriver, adjustable, 3d. each.

TEST SET TYPE 74, as previously advertised, suitable for conversion to G.P. oscilloscope. 230 volt power supply using VCR139 Tube—(not supplied), 5-VR65, 1-5Z4, 1-VU120, 1-6J5, 1-VR92, overall dimensions of case 12in. x 9in. x 18in., all controls brought out to front and rear panel. Price £3 plus 5/- carriage.

Please include sufficient to cover Postage and Packing. Thank You.

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TRANSFORMERS AND CHOKES for TELEVISION

The **QUALITY** Components for the home constructor

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Modified 6046/6050 Unit

A Pre-amplifier for London or Midlands Areas

By "ELECTRON"

THERE are various government surplus units readily available which are easily convertible to television pre-amplifiers, but the 6046/6050 units are perhaps the best proposition both as regards final performance and initial ease of modification.

The unit comprises two stages of R.F. amplification, using VR91 (EF50) type valves and it can be completely modified in something like half an hour—or slightly longer for the Midlands version. The completed circuit after modification appears at Fig. 1.

General Modifications

It is necessary to remove two components. First, the small R.F. choke at the aerial input circuit—in compartment one—which is simply clipped off and scrapped. It will be necessary gently to lever the metal cover to remove it in order to obtain access to the under-chassis components.

Secondly, the 0.1 μF capacitor, which is connected between the negative 150 v. tag and the earth tag at the rear tag-strip can be dispensed with. It is worth noting that this component may not be present on certain units available; but if it is present it should be removed completely. The general layout diagram of Fig. 3, will enable these, and other components, readily to be identified.

It is now necessary to insert a 2,000 ohms (1 watt) resistor in the common screen-grid feed line and this is wired between the positive 330 v. tag and the screen tag. An 8 μF decoupling capacitor is also required and can be wired in with the resistor. Since the positive 330 v. tag is directly connected to the top of the end resistor on the side component assembly, the arrangement shown in Fig. 3 makes for neatness.

The components not required (those in the negative 150 v. and negative 300 v. network) may be removed or may be retained. It is, perhaps, hardly worth while removing them since their presence will not upset the functioning of the remainder of the circuit as they are isolated. It is preferable, however, to remove the 'phone

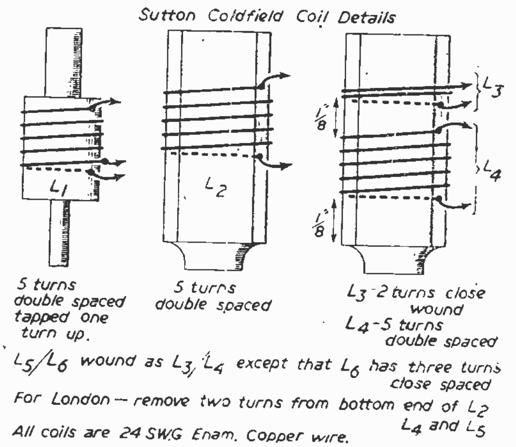


Fig. 2.—Coil-winding details

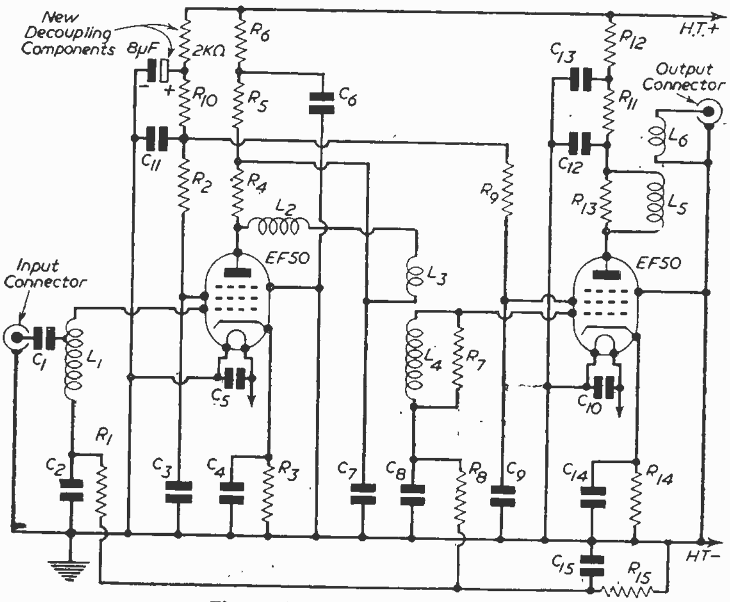


Fig. 1.—Modified circuit diagram.

LIST OF COMPONENTS

R1 —220 ohms.
R2 —33,000 ohms.
R3 —30 ohms.
R4 —4,700 ohms.
R5 —330 ohms.
R6 —330 ohms.
R7 —3,300 ohms.
R8 —330 ohms.
R9 —330 ohms.
R10—330 ohms.
R11—330 ohms.
R12—330 ohms.
R13—2,200 ohms.
R14—30 ohms.
R15—1,800 ohms (may be made up of two resistors —1.5 KΩ and 300 ohms—in series).

C1, C4, C14-50 μμF.
All others 0.001 μF.
V1, V2. VR91 (EF50).

New components required are one 2,000 ohms (1 watt), resistor and one 8.0 μF capacitor. These are marked in value in the circuit on the left.

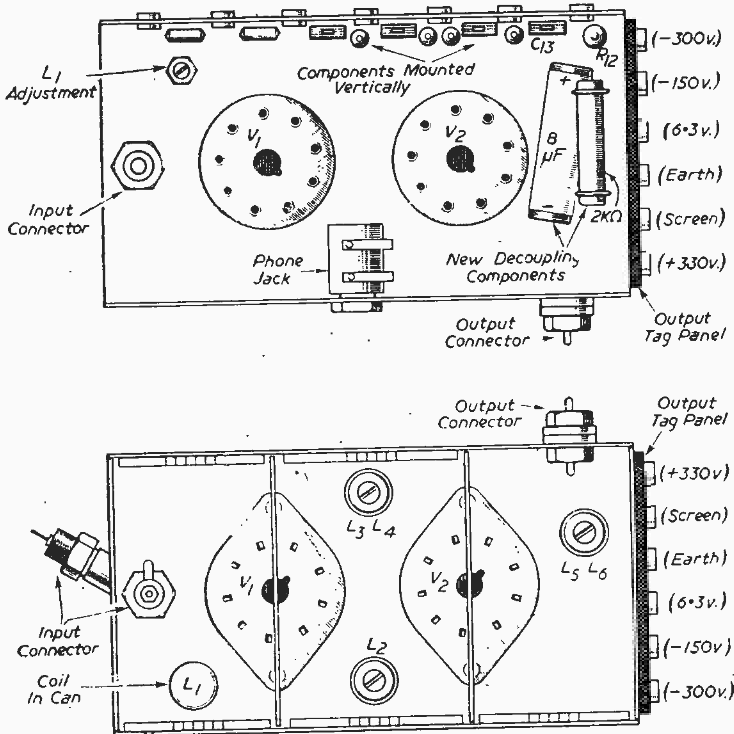
jack on the size of the unit as this will facilitate modifications to the coil L3/L4.

London (Channel One) Reception

For Alexandra Palace reception, coils L1, L3 and L6 require no modification, since the aerial input coil and the coupling windings can be left as found. However, coils L2, L4 and L6 each require altering; two turns are removed from each winding. This can be done with the coils *in situ*, but it is perhaps more convenient (especially with L4) to remove the coils to facilitate the removal of the turns—which must, incidentally, be taken from the *bottom* of the coils.

To remove each coil it is necessary to turn the unit up and slacken off the fixing bolt. With the coil free, unsolder the appropriate lead (refer to Fig. 2), and remove the two turns. Note that each final winding is taken through small holes contained in the ribs of the former to allow rigid fixing. If the formers are unbolted to allow modification, care must be taken when rebolting that the former be kept from rotating when tightening up—otherwise the connecting leads will undoubtedly become tangled and broken off.

The unit is then modified for reception of Channel One. Notes on connecting up and so forth are as for any other unit of this type.



Figs. 3. & 4.—Above and below chassis details.

Midlands (Channel Four) Reception

More drastic modifications to the coils are necessary for the reception of Sutton Coldfield signals. The aerial input coil L1 is removed by unbolting the fixing nuts holding it to the chassis. The metal screen over the coil (this is the only one with such a shield), can be removed and discarded, and the complete winding removed.

The former will be seen to have a small diameter at the top and a larger (ribbed) diameter at the lower end. Over the *larger* section wind on five turns of 24 s.w.g. enamelled copper wire, evenly spaced, passing the ends through the small holes existing in the ribs of the former.

Valve and Circuit Noise

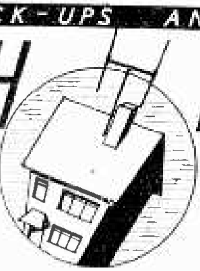
A SURVEY of the existing knowledge of the subject of valve and circuit noises in electronic equipment, and of outstanding problems in this field, has been published by H.M.S.O. for D.S.I.R., price 9d. (by post 10d.).

Noises originating in the valves and circuits of television sets and other electronic equipment have become of greater importance as the sensitivity of receivers and instruments has increased. The efficiency of any electronic device depends in part on the ratio of the intensity of valve and circuit noises to the strength of the signal desired. "Noise," in this sense, means by effect, whether audible, visible or otherwise observable, which tends to prevent the correct interpretation of the signal sought.

Circuit and valve noise in radio sets has now been reduced to negligible proportions and does not present serious research problems. In other fields the efficiency of television cameras, television links at very high frequencies, radar ranging equipment and infra-red detectors is limited by noise in circuits and electronic equipment. The present publication, in addition to dealing with valve noise and thermal noise in electronic circuits, covers noise in photo-electric cells, semi-conductors, crystal rectifiers, gas discharges and magnetic field devices.

TELEVISION PICK-UPS AND REFLECTIONS

UNDERNEATH THE DIPOLE



By Iconos

LIGHTING for television is a much divided responsibility. Usually, there are two or three cameramen in a studio, each operating a TV camera under the supervision of a lighting technician, who is aided and abetted by several electricians and three or four "rack" engineers in the adjacent amplifier control rooms. In film studios, the lighting cameraman takes the praise—or blame—for the photographic quality of a picture, and consistently good results bring him financial rewards equivalent to a Cabinet Minister's salary. The gentle flattery of the Still photographer's retouching brush cannot be used on movies, but the skilled cameraman is able to manipulate his lights, gauzes, diffusion discs and lenses to add or subtract years from the face of an actress, to underline the mood of a scene or to play the most fantastic photographic tricks.

SHADOWS

THE most important common denominator of TV, film or Still photographic portraiture is the effective use of shadows. Flooding the face of the "victim" with light will certainly give photographic results of sorts, but it is in the effective placing of spot lights for creating highlights and shadows on the features, which gives character. The film and Still cameramen have an advantage over their opposite number in TV, working as they do with one camera—and one point of view. Nevertheless, they are only too glad on occasion, when photographing a subject with a long nose, pointed features or hollow cheeks, to resort to the use of a preponderance of soft front light to flatten out the unflattering facial contours. Artistes requiring this treatment are sometimes referred to as "frontlight babies."

In television, the lighting men are very keen on these front lights, and the B.B.C. engineers have devised a special front light of great softness which is an effective lighting unit for use with multiple TV cameras. It comprises a $2\frac{1}{2}$ kW high-pressure mercury compact light source lamp, housed in a special lens fitting which directs the light rays evenly over the surface of a large white reflector. No direct light from the lamp is allowed to illuminate artiste or scene, and the light reflected from the white surface is sufficiently diffused to eliminate shadows.

THE NORTHLIGHT

THE use of reflected artificial light is an old dodge in portraiture. Most of the Bond Street photographic "salons" of 40 years ago possessed elaborate electric Boardman "Northlight" lighting units which enabled them to secure results at all times of the day or night, independent of daylight. These comprised four pairs of carbons mounted side by side in a fitting which directed all light on to a large flat reflector. The unit was entirely hand operated and was mounted on a heavy stand. The idea was good, but the performance of the four pairs of carbons was somewhat erratic and noisy, requiring constant attention. This new B.B.C. Northlight fitting is quiet and cool in operation, and absolutely constant in its light output. Its disadvantages are the elaborate starting circuit necessary for striking the mercury arc, the four minute initial "warming-up" period before the lamp reaches its full photographic value and—last but not least—the high cost of the compact lamp bulb. Soft lighting has a special value for TV, reducing lighting problems for multiple cameras and getting rid of objectionable microphone shadows.

FLUORESCENT LIGHTING

IN the last 12 months great progress has been made with fluorescent lighting, especially in applications for theatrical purposes. Formerly, this type of lighting could not be used for the stage on account of delayed starting, accompanied sometimes by flickering, caused by the element heating up the electrodes. Instant starting is now possible and what is more remarkable is the fact that fluorescent lamps can be faded in or out on a dimmer control, or lit up at any point on the dimmer. This has caused quite a sensation in theatrical circles, and already a number of theatres have been fitted with fluorescent footlights, floats, wing floods and cyclorama lights. With four-colour circuits available, it is possible to obtain most remarkable effects in colour lighting. These results have so far been obtained only on A.C., but circuits have been devised for obtaining instant starting—if not dimming—on D.C. The direct current development may lead to the adoption of fluorescent lighting for special purposes in TV studios. Fluorescent tubes operating on A.C. cannot be used in film or TV studios owing to stroboscopic effect sometimes—but not always—obtained, which gives rise to flickerings and fluctuations, depending whether the frequency of the mains is in step with the film camera shutter or TV scanner. D.C. operated fluorescent tubes would put an end to this uncertainty and give the lighting men yet another soft light with which to flatter (and flatten) the faces of their victims.

U.V. LIGHTS

FLUORESCENT paint and powders are much in evidence on poster boards and also in spectacular stage shows these days. The poster paint fluoresces in daylight, giving a sparkling luminous quality which catches the eye. Fluorescent paints, powders and dyes are also used on scenery and dresses to give dazzling transformation effects under special ultra-violet stage lighting. This remarkable luminous effect is photographable too, and has recently been used for the first time in a new film, "The Man in the White Suit," which deals with the fantastic invention of a new synthetic yarn. This yarn is supposed to be unbreakable, repellent to dirt and luminous. I cannot recall any occasion when U.V. lighting has been used by the television boys; but if the luminous effect can be photographed, it can certainly be picked up by a television camera, and a new range of TV camera tricks is opened up. Suits walking about on "invisible men" have been contrived in the past by laborious means, which make this particular kind of illusion difficult for television. Ultra-violet light can be provided by a number of 125-watt "black light" bulbs or by 1,000 watt high-pressure mercury bulbs filtered with sheets of Wood's glass placed in front of the lamp fittings. Wood's glass absorbs all visible light rays and only allows ultra-violet light to pass through it. So here is another useful type of lamp which should be made available to the producers at Lime Grove and Alexandra Palace.

REVERBERATION

IF I seem to have concentrated on the lighting side of television this month, it is due to the succession of new lamps and techniques which I have seen during the past two or three weeks. This does not mean that the future of TV is bound up with vision only! The sound side of television tends to be thrust into the background. One of the greatest problems for sound is to obtain first-class musical quality in studios which are acoustically treated for giving the best results for speech. The reverberation period of a "speech" studio is as low as possible, which usually means about half a second; whereas a studio designed for music would have a reverberation of at least 1.5 seconds. In the Vic Oliver Show, for instance, the orchestra sounds almost as if it was playing in the open air. There is a deadness and lack of warmth reminiscent of the old studios in Savoy Hill. One remedy would be to make artificial echo readily available for plugging on to musical shows transmitted from acoustically dead studios.

Another method would be to provide heavy wood acoustic reflectors at one end of a large studio stage, leaving the opposite end dead. The musical sequences of show would take place at the "live" end, and the sketches and dialogue at the "dead" end. Unfortunately, dialogue doesn't come over at all well when the reverberation is high and, under these conditions, the microphones have to be very close to the artistes, which is not always possible when several cameras are in simultaneous use.

Variable acoustics have been tried, but without much success. Reverberation is then controlled by fitting large heavy wooden panels on the walls, one side of which has affixed to it slabs of slag wool. Turn the panel one way, and the hard curved surfaces reflect sound; turn it the other way, and the slag wool absorbs sound. Unfortunately, it would not be easy to vary the acoustics during the progress of a show. On the whole, artificial echo provided by carefully designed echo rooms seems to be the answer to the problem. There are plenty of dungeons in the basement at Lime Grove which would suit the purpose!

News from the Trade

Pattern Generator

YET another pattern generator for the alignment of television receivers is now on the market. This model is designed for A.C. operation, incorporates seven valves, and is provided with a calibration chart for all channels. Modulation is provided on both sound and vision. The pattern produced on the picture tube consists of one horizontal and two vertical bars, and there is a full range of controls.

J. V. Radio Co., 84, Embankment Road, Plymouth.

Edison Swan Electric Co. Ltd.

EDISWAN announce that on and from March 1st, 1951, all Morganite resistors, suppressors and volume controls, for which they are sole distributors to the wholesale and retail trades, will unavoidably be increased in price. Deliveries of these items on and after this date will be invoiced at the increased prices.

The Edison Swan Electric Co, Ltd., 155, Charing Cross Road, W.C.2.

R.G.D.

RADIO GRAMOPHONE DEVELOPMENT CO. LTD. announce that the list price of their television receiver model 2351T is to be reduced as from March 1st, 1951, to 115 guineas plus £27 9s. 5d. purchase tax. Total, £148 4s. 5d.

Radio Gramophone Development Co. Ltd., Bridgnorth, Shropshire.

Redifon Board Changes

MR. PAUL ADORIAN, M.I.E.E., M.Brit.I.R.E., A.F.R.Ae.S., assistant managing director of Broadcast Relay Service Ltd., has been appointed chairman of Redifon Ltd. in succession to Sir Ronald Matthews.

Mr. Adorian joined the Rediffusion Group in 1932 and has been largely responsible for the development of its manufacturing company Redifon Ltd.

Mr. Adorian is president of the British Institution of Radio Engineers.

Radar TV Tester

RADAR regret that, owing to recent considerable increases in the cost of materials and components, it has been found necessary to revise the price of the above instrument to £48 nett trade. This advance represents only part of the rising costs, but every effort is being made by increased production efficiency to keep the price at a reasonable level for as long as possible.

Radar Radio and Television, 26, Oakleigh Road, New Southgate London, N.11.

Brimar Valves

MR. R. BUCKLEY, publicity manager for Kolster-Brandes, Ltd., and Kent Mouldings, is now also appointed as publicity manager for Brimar Valves and the Industrial Supplies Division of Standard Telephones and Cables Ltd.

Duddell Magnetic Oscillograph

DESPITE the introduction of the cathode ray oscillograph there is still a considerable demand for the Duddell magnetic type, and considerable developments have recently been made in these instruments for switchgear testing and other purposes. Details of these latest instruments are given in a newly issued list, No. 118A, obtainable from the makers.

Cambridge Instrument Co. Ltd., 13, Grosvenor Place, London, S.W.1.

Ekco Radio Sales Manager

MR. KENNETH H. WILLIMAN has been appointed to fill the vacant position of radio sales manager of E. K. Cole. Ltd. He commenced his duties at Southend on March 1st.

Mr. Williman has had a long association with the radio trade and will be remembered by many dealers from his pre-war activities for Roberts Radio. Joining the R.A.F. as a volunteer in 1940, Mr. Williman reached the rank of squadron-leader, and on release became sales manager of Tannoy. Later he made a business trip to Canada, and on returning took over export sales for Bonochord Ltd.

CHOOSING A RECEIVER

A Technical Review of the Main Features of the Majority of Commercial Receivers

AS many readers are interested in the main technical details of commercial receivers which are available, we published last year an abridged specification of the majority of models. This proved very popular, and in response to many requests we are again giving the same details, but in respect of this year's models. This list is not complete, but is of those manufacturers who have supplied such details up to the time of going to press.

In the table the second column indicates the maker's model number; the third indicates whether the model is a Console or Table set; the next column indicates whether the set is designed for AC or DC or AC/DC operation; the next column gives the tube size; the next number of valves; next the type of time-base oscillator—i.e., Thyratron or Hard valve; the type of focusing is indicated by the next column, EM denoting an electro-magnetic focusing coil and PM a permanent-magnet: next is the total EHT applied to the tube, followed by the method of obtaining this voltage. FB indicates the use of the fly-back voltage generator, M that the EHT is derived from the normal 50 cycle mains supply and RF that the voltage is generated in a special RF oscillator circuit. Finally the last two columns show the rated sound output and the price. It should be remembered that some of the receivers incorporate normal broadcast tuning in addition to the television circuits.

Manufacturer	Model No.	Table or Console	AC or DC	Tube size (in.)	No. of Valves	Time base	Focusing	Tube EHT (kV)	EHT Supply	Sound Output (Watts)	Price (Ex. Tax) £ s. d.
Alba Radio (A. J. Balcombe), 52-58, Tabernacle Street, E.C.2	T372	T	AC/DC	12	15	HV	PM	8.5	FB	1.8	52 10 0
	T472	C	AC/DC	Specifications as above							60 18 0
Ambassador Radio (R. N. Fitton, Ltd.), Princess Works, Brighouse, Yorks.	TV1	C	AC	12	18	T	EM	6.0	RF	4	85 19 0
	TV2	C & T	AC	12	15	H	EM	7.0	FB	4	60 19 8C. 49 0 3T.
	TV4	C & T	AC	12	16	T & H	EM	9.5	FB	4	63 16 11C. 52 7 9T.
	TV5	C	AC	15	16	T & H	LM	11.0	FB	4	94 2 8C.
Beethoven Electric Equipment, Ltd., Chapel Lane, Sands, High Wycombe, Bucks.	TV50	C	AC	12	19	T	PM	6.5	RF	4.5	62 gns.
Bush Radio, Ltd., Power Road, Chiswick, W.4	TV22	T	AC/DC	9	15	*H	PM	8.0	FB	1	36 0 2
	TV24	T	AC/DC	12	15	*H	PM	8.5	TB	1	46 6 0
	TUG24	C	AC/DC	12	15	*H	PM	8.5	FB	1	62 11 0
	TRG24 combined televisor and 4-valve radiogram		AC	12	15 Tel.	*H	PM	8.5	FB	1	119 11 0
Champion Electric Corpn., Champion Works, Seaford, Sussex	"Adelphi" 720	C	AC	12	14	H	PM	6.0	FB	2	80 0 0
	764		As above,		plus	radio	gram				147 0 0
E. K. Cole, Ltd. (Ekco), Southend-on-Sea	T141	T	AC	12	17	†T & H	PM	7.0	FB	1.5	47 0 11
	TU142	T	AC/DC	12	16	H	PM	8.0	FB	1.5	47 0 11
	TC138	C	AC	12	17	†T & H	PM	7.0	FB	1.5	53 0 8
	TRC139	C	AC	12	17	†T & H	PM	7.0	FB	1.5	61 11 9
	TC140	C	AC	12	16	†T & H	PM	8.0	FB	1.5	63 8 8
	TSC113	C	AC	15	19	H	PM	12.0	M	1.5	124 0 8
Cossor, A. C., Ltd., Highbury Grove, London, N.5	916	T	AC	10	17	H	PM and EM	7.0	FB	2	42 0 3
	917	C	AC	10	17	H		7.0	FB	2	51 8 11
	918	C	AC	10	20	H		7.0	FB	2	58 6 1
	919	C	AC	12	17	H		8.0	FB	2	58 6 1
	920	C	AC	12	20	H		8.0	FB	2	66 17 6
English Electric Co., Ltd., Queens House, Kingsway, W.C.2	1550M	C	AC	16	24	HV	EM	9.0	RF	3	94 10 0

* Frame:—Block Osc. Line:—Form of multivibrator. † T for frame, and H on line.

Manufacturer	Model No.	Table or Console	AC or DC	Tube size (in.)	No. of Valves	Time base	Focusing	Tube EHT (kV)	EHT Supply	Sound Output (Watts)	Price (Ex. Tax) £ s. d.
Hale Electric Company Ltd. (Etronic), Talbot Road, West Ealing, W.13	ECV1523/-	C	AC	10	15	H	PM	7.0	FB	1.5	48 6 0
	ECV1527/-	C	AC	12	15	H	PM	7.5	FB	1.5	61 14 8
	ECS2231/-	C	AC	Proj. 2½	21	H	EM	25.0	Trip.	2	120 0 10
"His Master's Voice," Hayes, Middlesex	1807A	T	AC/DC	10	14	H	PM	5.5	FB	1	41 1 2
	1808	C	AC/DC	10	15	H	PM	5.5	FB	1	49 12 3
	1806	C	AC	15	19	H	EM	7.0	M	5	128 6 2
	*1851	C	AC	15	22	H	EM	7.0	M	5	156 10 9
Invicta Radio Ltd., Parkhurst Road, N.7	T105	T	AC/DC	9	18	H	PM	6.0	FB	2	45 3 0
	T108	T	AC/DC	12	15	H	PM	6.0	FB	1	43 11 9
	T110	C	AC/DC	12	15	H	PM	6.0	FB	1	60 0 5
McMichael Radio, Ltd., 190, Strand, W.C.2	512	C	AC	12	13	H	PM	6.5	FB	4	67 14 9
	512R	C	AC	12	14	H	PM	6.5	FB	1	75 9 1
	TM51	T	AC	12	14	H	PM	6.5	FB	1	Price not yet fixed
Marconiphone Co., Ltd., Hayes, Middlesex	VT53DA London	T	AC/DC	10	14	H	PM	5.5	FB	1	39 2 0
	VC53DA London	C	AC/DC	10	14	H	PM	5.5	FB	1	48 17 7
	VT55A London	T	AC	12	14	H	PM	7.0	FB	3	54 19 10
	VC55A London	C	AC	12	14	H	PM	7.0	FB	3	65 3 5
	*VRC54DA London	C	AC/DC	10	19	H	PM	5.5	FB	1/R4	57 16 10
Masteradio, Ltd., 10-20, Fitzroy Place, N.W.1	T612	C	AC	12	17	H	EM	6.0	FB	4	64 14 6
	T852	T	AC	12	15	H	PM	6.0	FB	4	51 15 7
	PT50	C	AC	2½	18	H	PM	25.0	RF	4	142 7 11
Murphy Radio Ltd., Welwyn Garden City	V150	T	AC	12	15	H	PM	5.8	FB	—	43 15 8
	VU150	T	AC/DC	12	15	H	PM	5.8	FB	—	45 0 0
	V176C	C	AC	15	20	T	PM+EM	12.0	M	—	120 0 0
	V178C	C	AC	12	18	T	PM+EM	9.5	FB	—	84 0 0
	V180C	C	AC	12	17	T	PM+EM	8.0	FB	—	60 16 3
Mullard Electronic Products, Ltd., Century House, W.C.2	MTS501	C	AC/DC	12	19	H	EM	9.0	FB	2	65 3 3
	MTS684	T	AC/DC	9	19	H	EM	9.0	FB	2	42 17 5
Philips Electrical Ltd., Century House, W.C.2	1502U	T	AC/DC	12	19	H	EM	7.0	FB	2	—
	†600A	T	AC	2½	25	H	EM	25.0	S†	2	—
	†704A	C	AC	2½	25	H	EM	25.0	S†	2	—
	†1800A	C	AC	2½	25	H	EM	25.0	S†	2	—
Pilot Radio Ltd., Park Royal Road, N.W.10	TM54 (5 channel receiver)	T	AC	12	14	H	PM	7.5	FB	4	50 11 8
Radio Gramophone Development Co., Ltd., Bridgnorth, Shropshire	L1700 (London) B1700 (Birmingham) H1700 (Holme Moss)	C	AC	12	17	T	PM	7.0	FB	3.5	89 5 0
	B2351T (Birmingham) H2351T (Holme Moss)	C	AC	12	23	T	EM	7.0	RF	3.5	136 10 0
	L2351T (London)	C	AC	12	21	T	EM	7.0	RF	3.5	136 10 0
Regentone Products, Ltd., Eastern Ave., Romford, Essex	T15L	C	AC	12	14	H	PM	7.0	FB	3	
	T15B	C	AC	12	14	H	PM	7.0	FB	3	59 3 1
	T15H	C	AC	12	14	H	PM	7.0	FB	3	
	BIG12L	T	AC	12	14	H	PM	7.0	FB	3	
	BIG12B	T	AC	12	14	H	PM	7.0	FB	3	54 0 3
	BIG12H	T	AC	12	14	H	PM	7.0	FB	3	
Thorn Electrical Industries, Ltd. ("Ferguson"), 105-109, Judd Street, W.C.1.	908T	T	AC/DC	12	14	M	M	9.5	LOT	1.5	43 14 7

* Radio and television.

† (The three marked models are projection models using 2½ inch diameter tube with 25 kV. E.H.T. from blocking oscillator type special generator. Picture sizes in *diagonal* dimensions are as follows:—600A—17in., 704A—23in., 1800A—17in.)

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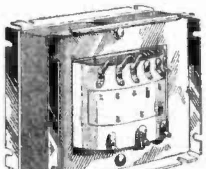

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Correspondence

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

SPOT WOBBLING

SIR,—May I answer a letter in your column from a correspondent who could not understand why a wobbler should, in fact, improve a picture. He expressed the view that the wobbling of the spot should have the same effect as defocusing. I was for a time puzzled as I could see no reason why the correspondent should not be right.

However, consider a single line of the picture. The wobbler causes this line to become a small amplitude sine curve.

At the frequencies employed the sine curve appears to the eye as a spreading of the line. The apparent effect is to spread out the spot in a *vertical* direction so that it, in effect, becomes a narrow rectangle.

Since the spot is not spread out horizontally, the horizontal definition is unaltered. The vertical definition is also unaltered since the increase in spot size only serves to fill up formerly blank spaces. In fact, horizontal definition is improved for now we can employ extra focusing where before such focusing would have ruined the picture by bringing into prominence the line structure. By the way, would not a slight H.F. ripple in the vertical scanning plates have much the same effect as a wobbler ?—F. KONOPASEK (Cambridge).

D.C. RESTORATION

SIR,—Replying to G. Smedley's query on the D.C. component in January's issue of PRACTICAL TELEVISION, if the D.C. component is retained by direct coupling between the demodulator diode and the grid of the video output, the video cathode bias resistor having no bypass condenser, the voltage at the anode will be an amplified replica in opposite phase to that on the grid, i.e., if the no signal grid voltage is −2 and the grid of the tube is being modulated, the video grid voltage will vary from −2 to, say, −5 volts, but never going more positive than −2 volts. At the anode there will be a variation from 200 volts to 230 volts (taking possible values) on a bright picture. If condenser coupling only is used to the grid of the tube a negative voltage of 10 to 15 volts will build up at the tube end of the condenser, and the brilliance has to be adjusted to overcome this. Now if the picture content changes and a dark picture is transmitted, the mean voltage at the tube grid may drop from −15 to −5 volts and the brilliance has to be turned down to compensate. (The reverse is the case if the cathode is being modulated.) This is explained by Mr. Barnard in February's issue.

If, however, a 60,000 ohm resistor is joined across the condenser a steady bias will be applied to the grid or cathode, whichever is being modulated, and the brilliance will be adjusted to this bias whatever the picture content. If the D.C. component is not retained, that is by using resistance capacity coupling between two video stages and no D.C. restorer, the video output grid will now have a varying voltage dependent on the voltage building up on the coupling condenser, which in turn depends on the picture content. In the anode circuit of the video output there will now be a voltage variation either side of the no signal voltage of 200 volts, and with condenser coupling only to the tube, the mean voltage at the tube will be zero, so that the same brilliance setting will do for any picture content. The disadvantages being that the video output valve has to handle a greater swing and sync separation is more difficult.

I said the cathode resistor is not by-passed but, of course, a .001 μF. or less is commonly used. Of course, you can go to the other extreme ; it is possible to use a condenser of not less than 250 μF. microfarads and obtain more gain.—R. PINKNEY (Fareham).

SIR,—I would like to offer the following criticism of some loose ideas of fundamental electrical thinking in the article "D.C. Restorer," by Bernard Barnard, in the February edition.

(a) Page 389 : ". . . electron flow is from anode to cathode." This should be current flow, or, electron flow from cathode to anode.

Again, ". . . the diode generates a voltage . . . ." First, as per recent article an "e.m.f." is generated not a "voltage."

Secondly, the idea that a valve generates an e.m.f. is quite erroneous.

(b) Fig. 4. "The arrows show direction of current flow when the diode conducts."

In the valve branch the arrow is in the wrong direction, or it is intended to show the direction of electron flow.

The arrow shows current flowing in a closed circuit and yet there is no possible source of e.m.f. in this circuit to produce current. Since the valve and resistor are in parallel and contain no e.m.f., the current through both branches must be in the same direction through both (or in antiphase in the closed circuit).—J. C. HOWELLS (Tonypandy).

SIR,—I answer Mr. Howells' points in the order in which he raises them in his letter :

(a) The complete sentence of which he complains reads : "When the diode conducts the direction of electron flow is from anode to cathode, making the separator grid positive with respect to its cathode." The context makes it obvious that it is the external circuit *of the diode that is being referred to. Readers of* PRACTICAL TELEVISION *do not have to be reminded that electron flow is from cathode to anode* inside *the valve and anode to cathode* outside *the valve, every time a valve action is referred to.*

"The diode generates a voltage." I do not accept Mr. Howells' correction that this should read e.m.f. To be precise, it should read "Potential Difference," since (and again the context makes it quite clear) the text refers to a diode passing current through a load resistance.

I entirely agree that a valve cannot generate an e.m.f. —but it can, and does, cause a P.D. to be developed across its load.

I used the word "voltage" because this is an accepted synonym for "Potential Difference," and is less cumbersome.

(b) I confirm that the arrow in Fig 4 indicates electron flow. It also correctly indicates Anode Current *flow through the load resistance. It seems to me that the only possible criticism of this circuit and its arrow must come from those who still adhere to the generally discarded theory that current flows from a positive point to a negative point. But, if you accept this idea, the polarity markings across the resistor are still correct, so it does not get us anywhere.*

In regard to the last paragraph, there is, of course, a source of e.m.f. It is the signal, which causes the diode to conduct. It is applied across the points marked "V.F. Input."—BERNARD BARNARD.

VIDEO L.F. RESPONSE

SIR,—I would like to make a correction to my letter about the above in the February issue, two noughts having carelessly slipped in my calculation. The second sentence of the second paragraph should read : "Therefore, .005 μF. in conjunction with 1 megohm will produce less than two per cent. distortion, and the usual combination of .1 μF and 1 megohm is 20 times better than this !"

The experiment with the .001 μF. condenser referred to was actually made and only proves how adequate the usual values are, the validity of my general point remaining unchanged.—P. H. MORRIS (W.9).

VCR140

SIR,—In a recent issue of PRACTICAL TELEVISION I read that two readers were asking for opinions regarding tube type VCR140. The VCR140 is advertised for sale as having a blue trace, but with a E.H.T. of about 5 to 7 kV., as in my set, it gives a white trace. Also regarding the trace I would like to mention that the tube is of medium persistence and it is better to keep the brightness control a little higher than usual to avoid getting a yellow afterglow. In my opinion this tube is quite suitable for television and is well worth the money.

In my set I am using the Premier deflector coils and a permanent magnet focus unit type ELAC R17/3, and obtain very good focusing.—W. R. G. AXTON (Balham)

SIR,—This tube has two disadvantages electrically and one mechanically. The picture is blue, and owing to the low Va max. is not really bright enough. Also it is very long. I personally am using the CV254. The size is 9in., the picture brilliant, the colour being pale yellow/white. There is a slight afterglow but this is not noticeable if the viewing takes place in daylight or artificial light. In artificial light the picture appears perfectly white. The one big snag is that electrostatic focusing is employed. I found this no disadvantage, however, as I found it easy enough to tap off the required voltages from the E.H.T. even using R.F. or flyback E.H.T. as I am. I used 60 MΩ in all in the resistor chain which at 6 kV. keeps the current down to 100 μA. The first anode requires 1,000 v. and the second 1,000-1,500 (focus). I used a 2 MΩ pot. for focus, but 5 MΩ would be better if obtainable. The cost of the CV254 is only half that of the VCR140 and, of course, one saves the expense of the focusing coil/magnet. I found the focusing reasonably uniform over the face of the tube—certainly no difference is visible at normal viewing distance. Incidentally, although the base is octal, connections do not follow normal practice.—"SCANNER" (Chester).

LONDON/BIRMINGHAM CONVERTER

SIR,—I noted with much interest the comments put forward by Mr. West regarding the conversion of a London television receiver for the reception of the Sutton Coldfield signal. I have been using a single mixer system as described by Mr. King for quite a few months, and have been experiencing very good results. Test card "C" shows fair resolution of the 2.5 Mc/s bars, but with reduced sound output. An additional pre-amplifier increases the sound output with unnoticeable sound distortion, the amplifier also helps to reduce pattern effects that are sometimes noticeable on the screen at certain oscillator settings..—HUBERT A. SEATH (Oxford).

SIR,—I was very interested in the comprehensive analysis submitted by Mr. West regarding the reception of the channel 4 television transmission on a channel 1 receiver. I agree with your correspondent ; the term "double converter" or "double mixer" is indeed a very ambiguous way of expressing such a mode of functions ; it was mentioned in my article, however, to indicate the fact that such an arrangement had been experimented with, but it was eventually decided that to produce such a converter increased the price of the conversion to a similar level as a complete modification of the tuned circuits in a channel 1 receiver. The small additional complication referred to by Mr. West to change a single converter unit to a device, using two very high frequency oscillators to produce two intermediate frequencies appears to be a little more than complicated, but rather expensive. since to reduce sound drift the oscillator used for sound conversion will have to be a very stable generator if the effects produced by an asymmetrical sound response curve due to local oscillator drift, as pointed out by your correspondent, are to be avoided. The lower local oscillator frequency as used in the single converter can be made very stable at a low cost, although, as suggested, a certain amount of distortion of the picture could ensue. As is well known, the channel 4 station radiates vestigial side band signals, causing partial elimination of the upper side band. Thus. with a single oscillator operating on 16.75 Mc/s, the frequency characteristics of the channel 4 vision transmissions will be reproduced at the output of the converter, but with a carrier frequency of 45 Mc/s. To avoid over-emphasis of the lower modulation frequencies the ideal receiver should have a response 6 db. down at the carrier frequency, if this is not so a certain amount of phase distortion will result, giving the effect of a smudging to the right of the darker shades of the picture.

This phenomena can be greatly minimised in practice by increasing slightly the frequency of the local oscillator, although it will not be practicable to arrange the vision response to have a 6 db. attenuation at the carrier frequency due to excessive sound detuning, but a compromise between the two can produce very good results. Most channel 1 receivers use a sound band width of 100 kc/s or more, thus a useful deviation from the nominal oscillator frequency is possible before the quality or the sensitivity of the sound channel is unduly affected. The inclusion of an R.F. amplifier to the converter renders second channel interference negligible. This converter was designed to enable channel 1 viewers to take advantage of the better reception that may be offered by the channel 4 station without involving a great deal of expense, and without extensive adjustments to the receiver. If picture quality was the criterion, then a simple realignment of the sound channel may be the answer to a reasonable-priced conversion, but in most cases I have found this to be unnecessary.—GORDON J. KING (Oxford).

"FLYING-SPOT MICROSCOPE"

SIR,—Regarding an article I recently read by Professor Young on the construction of a flying-spot microscope based on established television principles ; it would be of great interest to some of us if a contributor could be found who would translate this scheme into practical directions for construction, especially for using surplus war apparatus and C.R. tubes.—D. A. STANLEY, M.D., B.Sc. (Leicester).

[*Can any reader supply such details ?*—ED.]

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DURING January, 1951, the number of current television licences increased by nearly 72,000, a larger increase than in any month since the B.B.C. television service was resumed in 1946.

Approximate number of licences on January 31st was 12,322,150, of which about 657,950 were for television.

Dutch TV

THE proposed Dutch television service is reported to be adopting a 625-line picture at 25 frames (interlaced) per second. The picture ratio is to be 3 : 4, single side-band, negative modulation, with sound using F.M. Polarisation will be horizontal, and the total bandwidth is to be 7 Mc/s.

Educational Programmes

SEVEN major groups of educational establishments are urging the American authorities to adopt educational broadcasts. They are requesting that at least 20 per cent. of the proposed U.H.F. bands and at least one V.H.F. channel be reserved for non-commercial educational use.

Colour Developments

IT is now reported that large colour pictures on the C.B.S. system are available, using a device called a "colour drum." This revolves round the picture tube lengthwise and has been used with screens as large as 17in. The disc has, of course, hitherto limited the size of tube which could be employed on the C.B.S. system. The colour tube and drum are in a separate cabinet and are linked to the main receiver. The tube is set well back in the cabinet to permit the drum to come down in front, and a large glass-window permits of wide-angle viewing.

Central Aerial Installation at Pimlico

FOUR blocks of flats in Clifford's Row, Pimlico, London, are being equipped with an E.M.I. Central Aerial System.

All of the 109 flats in these four blocks are being wired for this service which provides aerial connections for both television and all-wave radio signals by the system described on page 498.

Third Cuban Station

THE third station for Cuba is under construction and is expected to start operations shortly. It will be operated by Telenews, a Cuban firm, and the equipment is being supplied by the Radio Corporation of America. The site will be in Havana.

Brit.I.R.E.

THE next Graduateship Examination will be held on Wednesday, Thursday and Friday, May 16th, 17th and 18th, 1951, at 38 centres throughout the world. Entries from home candidates must be lodged with the institution by April 1st, 1951.

Arrangements have already been made for 234 *overseas* candidates at centres in Australia, Canada, Guatemala, India, Malaya, New Zealand, Pakistan and South Africa.

Further details and specimen examination papers may be obtained on application to the secretary, 9, Bedford Square, London, W.C.1.

TV Sets for Nurses

A STUDENT-NURSES' home at Greenwich is to be brought up to date by fitting television receivers. This home, which is at Woodlands on the slopes of Vanbrugh Hill, is on the lines of a good country hotel and has radio installation, quiet rooms, etc., and now, to provide not only relaxation but also for following the various medical broadcasts which are made, two television receivers are to be installed.

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

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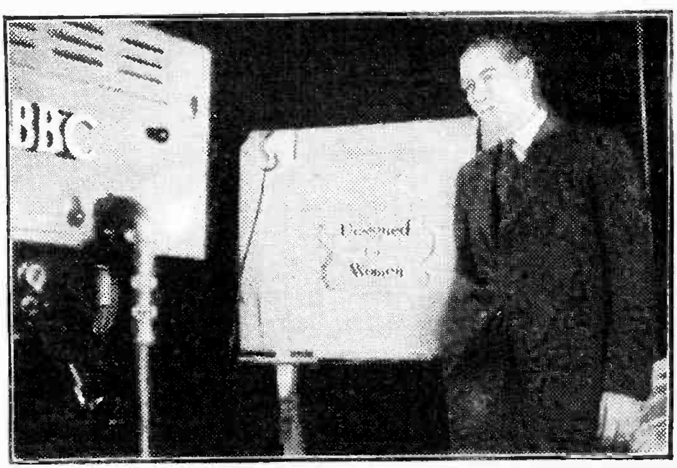

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YOUR Problems SOLVED

VOLTAGE TESTS

"I built the television receiver described in your booklet, and was making some preliminary tests before putting in the tube. When I put my meter to the V14 there was a small flash and a crack, and my meter seems to have burnt out. Is it safe to put in the tube, or does this indicate there is something faulty in the circuit?"—D. Slane (Thrapston).

There may be nothing wrong in the circuit, but you should not have used an ordinary meter to measure the voltage on the anode of the valve—which is, in fact, the line output valve. The D.C. voltage on this anode is less than 300 volts, but there is present at this point a very high A.C. voltage produced by the fly-back and this is of the order of 2,000 volts or more. A V.T.V.M. or special meter must, therefore, be used, if you wish to measure this particular stage, but it is not essential to do this, as the adjustment of the horizontal scan will enable you to check this stage.

VIEWMASTER

"I have just finished building this receiver, but the picture is much too big. No adjustment of the controls will cut it down, and it looks as if it will fill a fifteen-inch tube. Is it possible to say what is wrong, and how I can correct this? Will it do any damage to leave it on?"—G. Whiteway (Cricklewood).

The trouble is almost certainly caused by reversed leads to points Y and Z on the tube mount. You have probably used ordinary twisted flex from the transformer and have failed to note the run of the wiring. Change over the connections at Y and Z (Chart 6) and you will find that the circuit will function normally.

SCREEN FLARE

"My receiver has been in use for two or three years without trouble, but there is now a fault which is troubling me not a little. Some evenings everything performs satisfactorily, but at other times soon after switching on the tube lights up. It is very bright and although the raster area as a whole is illuminated there are no scanning lines and the picture is only just discernible as very faint shading. No controls will alter the result and I have to switch off. After five minutes or so I switch on and things may be all right for the rest of the evening or even for two or three. Can you diagnose the trouble from these notes?"—A Harding (N.W.7).

There are two definite faults which can cause such trouble, and quite a number of subsidiary faults which might lead to it. The most frequent cause of the "flare" is a faulty tube—the cathode-heater insulation having broken down or being in process of doing so. The extra brilliancy which results causes defocusing on whites and thus the scanning lines and picture vanish. Usually when the tube is at fault you will find on switching on one day that the tube will fail to light up and a replacement will be needed. The second most likely cause, alternative to the above, is oscillation in the video receiver. A component or valve has developed a fault and at certain signal voltages or mains fluctuation one or more stages burst into oscillation giving the high video current, causing tube-flare. A rapid test may be made for the latter, if the chassis is removed from the cabinet, by short-circuiting each stage in turn working from the aerial end. Short each grid to earth, and when the tube brilliancy returns to normal you will know that the oscillation is occurring in the stage just passed. The usual care must be exercised concerning the high voltages present in a television receiver.

DEFOCUSING ON WHITES

"Although my receiver has been apparently satisfactory since installation, I have now developed a critical eye and comparisons with some modern new receivers have revealed that my picture quality is not all that I thought. The main fault seems to be that of the picture structure, that is the lines forming the scan are not even across the picture. You can see the dark spaces between the lines here and there but not consistent right over the raster. When I turn on before the transmission starts they are perfect and I can bring them up sharply with the focus control, but when the picture is on they appear to break up."—G. Matthews (Guildford).

We think your fault is defocusing on whites. If the scanning form is satisfactory with no picture input and even focus is obtained all over the tube face, there is little likelihood of anything affecting this when a picture is received. What can happen, however, is that poor regulation of the E.H.T. supply causes the E.H.T. to vary with the overall brilliancy of the received picture, and on peak whites the beam is defocused and thus the broadened scanning line masks the dark space between adjacent lines and destroys the sharp details in the lighted area. The only way to improve this is to use an E.H.T. supply with improved regulation, or improve the existing regulation, and the manner of doing this will depend upon the type of unit you are using.

FRAME SLIP

"My receiver has been in use for a long time but has repeatedly been serviced. One thing after another has been replaced, but now I should like to try my own servicing. The trouble this time is that after the set has been on for half-an-hour or so the picture starts to run downwards. I turn the frame hold till it stops and before I can sit down it starts to run the other way and we cannot keep it properly for the evening. Can I do anything about this?"—S. T. Whitlock (Rickmansworth).

The trouble is obviously due to lack of, or a weak frame synchronising pulse. This can arise either at the sync separator or at some subsequent point, and in most cases of this trouble which we have come across it has been due to a faulty coupling condenser, either being leaky or open-circuited. You would therefore need a good capacity bridge to examine each condenser in the sync separator and frame timebase stages.

H.T. SMOOTHING

"In my recently-built receiver I am unable to get the picture in one single piece. There is a black line across the screen and the picture is reversed into the two halves, the bottom half appearing at the top and the top half at the bottom. Sometimes I can get it to jump into a correct picture, but we cannot use it as it won't stay right."—J. Rushden (Nottingham).

If all components are of the correct value the most likely cause of your trouble is an inadequately smoothed H.T. supply to the frame time-base. The 50-cycle mains ripple is triggering the time base (at 100 cycles if you are using full-wave rectification), and this ripple takes charge rather than the synchronising pulse. Try a large reservoir condenser across the H.T. supply, as near to the frame H.T. line as possible. Your present smoothing condenser may, of course, be open-circuited.

VISION BREAKTHROUGH

"I have recently completed a sponsored television receiver design, and whilst I get a good picture there is a terrible noise on the sound. It is hard to describe, but it is something like a high-pitched mains hum superimposed on the normal hum sometimes experienced on ordinary broadcast receivers. I have noticed that if the picture is dark it is not so bad, but if the picture contains a lot of light area it is more noticeable and I, therefore, think it is vision breaking through on sound. Could you confirm this please?"—S. Simpson (Maidstone).

It would certainly appear that your diagnosis is correct, and if you have access to a signal generator you could confirm this by connecting the input to the aerial socket of the receiver and sweeping the generator over the vision band only. You should hear nothing on the speaker, even with volume control turned fully up. You will obviously have to re-trim the sound circuits to eliminate the trouble if you find this is the cause, and you may have put insufficient wire on one or more of the coils. Remember that sound for the London transmitter is *lower* in frequency than vision and make adjustments to the coils according to the cores which are fitted.

CHANGING A TUBE

"My old home-made receiver is fitted with a 9in. tube and I was thinking of getting a 12in. when I read about the new 16in. metal tube. Would the same conditions still apply for replacement? That is, I know I could put in the 12in. tube without making any modifications, but would anything have to be done to take the 16in. tube?"—H. C. S. (N.W.9).

The new tube calls for a different deflection angle and consequently a new set of deflection or scanning coils would be needed. In addition, we doubt whether the power available in the line time base would be sufficient to fill a 16in. screen. Finally, the tube calls for an E.H.T. of 9 kV or more.

TESTING A NEW SET

"I have built a receiver in readiness for Holme Moss, but wish to test the set before inserting any valves. Am I in order in switching on and then testing H.T. and L.T. points without any danger of damaging any condensers, etc.? Will you also explain the connections to a single dipole aerial using coaxial lead?"—F. Wood (Mossley, nr. Manchester).

Provided you do not leave the transformer on very long, you can switch on to make preliminary tests without inserting the valves, but you must bear in mind that as you are drawing no current, peak voltages will be obtained in every part of the set. This may lead, in some cases, to condensers being overloaded or damaged, depending on the circuit arrangements you have adopted. There will be no voltage drop across anode resistances, for instance. The inner lead of the coaxial is joined to the top half of the dipole, and the outer screening braid to the lower half.

AERIAL LEAD EXTENSION

"I want to transfer my set from one room to another, and had fitted an extension aerial lead between the two rooms. The sketch (not reproduced) shows the relationship of the two positions and the window where the lead-in comes through. When I use the set in Room A everything is O.K., but in Room B I get only a faint picture and it is sort of double, just like two pictures side by side. Have you any idea what this is due to, and can you tell me how to get the same results in Room B as in Room A?"—T. Askew (Harlesden).

The sketch shows that the two positions are on each side of a party wall separated by only about 6ft. or 8ft. We assume that you have merely added that length of aerial lead to the terminating point in Room B in which apparently the set was first installed. When in Room A you use the full length of lead and this will not affect the loading or matching. When, however, you transfer to Room B you presumably connect to the original end and the extra length of lead is left connected. This means that you have a matching stub effect similar to that used in transmitting aerial technique. The length is such that mismatching takes place giving the reduced signal strength, and an echo is reflected giving the double image. The remedy is simply to make some form of plug and socket arrangement in Room B so that when using that room the extra length of aerial lead may be disconnected, plugging it in when you wish to transfer to Room A. This should overcome the difficulty.

PLASTIC

"I have just completed my televisor and carefully trimmed the coils, but am unable to get rid of a 'lining-out' effect. Round the edges of faces, etc., there is a line of light, not very white, but enough to make all the figures look as though they are cut out and stuck on. In the relay from the Ice Rink, recently, all the figures were surrounded by a black line and stood right out from the tube. Can you suggest a reason for this?"—J. Burton (Wembley).

The effect is generally referred to as "plastic." In a small degree it is not objectionable and does, in fact, sharpen up the outlines of objects, especially where the bandwidth of the receiver is rather narrow. It may be due to one or more tuned circuits being too sharply tuned, or to the use of incorrect values of correction components. In the tuning circuits a large value resistance should be shunted across each circuit in turn to see if this will improve matters. If you have two or more video correction chokes, short-circuit one of them and see if that cures the trouble. If negative feedback is employed in the video stage this may be modified (by changing the value of the bias by-pass condenser, for instance).

SCREENING EF50

"I am interested in the EF50 valves and am making a receiver incorporating these. I notice in your own television design you connect pins 5 and 8 to the centre spigot and to earth, and I wonder why it is necessary to connect both of these as I have tested the valves with a meter and find that they are internally connected to the screen also."—G. H. E. Renfrew (Leicester).

The outer metal screen is connected to the spigot but not to the internal screen. This is inserted inside the glass valve which is inside the metal casing and it is connected to pins 5 and 8.

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