TV FOR THE BEGINNER

PRACTICAL TELEVISION

AND TELEVISION TIMES

1/-

EDITOR
F. J. CAMM

A NEWNES PUBLICATION

Vol. 3 No. 35 APRIL, 1953

FEATURED IN THIS ISSUE

Cascodes in Cascade
VR65 Video Stage
Aircraft Interference
Pages from an Engineer's Note-book
A Beginner's Receiver

PRACTICAL TELEVISION

& "TELEVISION TIMES"

Editor : F. J. CAMM

Editorial and Advertisement Offices: "Practical Television," George Newnes, Ltd., Tower House, Southampton Street, Strand, W.C.2. 'Phone: Temple Bar 4363. Telegrams: Newnes, Rand, London.

Registered at the G.P.O. for transmission by Canadian Magazine Post.

Vol. 3 No. 35 EVERY MONTH APRIL, 1953

TELEVIEWS

More than 2,000,000 !

IN February the Post Office announced that over 2,000,000 television licences were then current, and that the largest increase recorded in any month—110,617—brought the number in force at the end of January to 2,003,449. Thus, in the comparatively short space of three years, the number of licences has increased by nearly 1,750,000. The rate of increase now quickens and within another year it seems reasonably probable that the 3,000,000 mark will be approached. If in April the Chancellor of the Exchequer makes his contribution to trade revival by reducing Purchase Tax and increasing the purchasing power of the public by reducing income and other taxes, we may even pass the 3,000,000 mark by the time this journal celebrates its fourth birthday.

Events have followed the lines we forecast in our first issue, and TV is now catching up with broadcast receiving licences, which in January totalled 12,868,183, this figure including 179,544 licences for sets fitted in motor cars. It would seem that absorption point for broadcast licences is somewhere between 12,000,000 and 13,000,000. Whether it has reached its apogee and will suffer a declension as TV licences increase cannot be forecast with any accuracy. There is no reason why it should, for TV is ancillary to it and can never replace it. The number of £2 television licences issued (this licence also covers sound reception) is on the increase. Viewers should remember when taking out TV licences that they can claim rebates at the rate of 1s. 8d. per month on the unexpired portion of their £1 sound licence.

BBC MONOPOLY TO END !

IT was stated in Parliament that it is the intention of the Government that the BBC monopoly in television should end as soon as possible. That time, of course, is not yet, but in view of the attitude it adopted over the televising of the Grand National it cannot be long delayed. Of course, the BBC is right in endeavouring to drive a reasonable business bargain when dealing with those who own rights in national spectacles. It must, however, at the same time realise that the owners of those rights cannot be expected to stand great financial loss because the BBC has a duty to present such spectacles on TV screens. That would presuppose that owners of rights are actuated entirely by altruistic motives. The plain fact is that in all such events the profit motive is the *raison d'etre* and in their bargaining the BBC should make financial offers which are worth consideration. It cannot be said that the fees offered by the BBC err on the generous side. In many cases, indeed, they are mean, considering the large sums of money it has at its disposal. It is of no concern to the owners of the Aintree racecourse whether the Grand National is televised or not. Thousands of people who otherwise might visit the course would be prepared to watch it in the comfort of their own homes—and probably see far more of the race than they would if actually on the course. This same argument applies to other large spectacles such as boxing matches, tennis championships and cup finals. These are ready-made events for the BBC and their only expenses in connection with televising them are comparatively small.

It is now known that this year BBC expenditure will exceed income, but we suggest that this is because the whole fabric of the BBC is in need of overhaul. Like the Civil Service, it is overstaffed, and a judicious rearrangement would make it more efficient and, at the same time, less costly. It cannot be blamed for its inefficiency, for when the existing controllers took over they found that in many directions it was in such a tangle that it is practically impossible to disentangle it. Up till that time it had been staffed by large numbers of highly paid and incompetent people, many of them without business experience.

Whilst its present attitude is a refusal to share profits with promoters, it yet finds itself able to make a present to the United States and to the American radio networks of complete coverage of the Coronation *free of charge*. It is likely to cost about a quarter of a million pounds.

Of course, sponsored television, when it arrives, will bring its own solution, for the BBC will then be compelled to bid against commercial interests. When it does come there can be no doubt whatever that fees for artists and promoters will go up. It is known that the BBC is anxious to hang on to its monopoly and, that being so, it should make offers at least comparable to those which private enterprise can make. There will also be competition for the services of the television engineers—a point which the BBC must also watch.—F. J. C.

VR65 VIDEO STAGE

OBTAINING MAXIMUM RESULTS BY MEANS OF A VARIABLE ANODE LOAD

By J. S. Hopwood

IT is well known that to get the best television picture it is essential to amplify equally a range of frequencies from approaching zero to about 2.5 megacycles per second at the video stage.

The ideal method of attaining this object is to have a low video anode load resistor which, in conjunction with the following blocking condenser, results in a time constant that favours an even response over the above range of frequencies. It will be found, however, that with a VR65 a load of say 1,000 Ω in conjunction with a blocking condenser of 0.1 microfarad does not give sufficient output to the tube.

Special video valves (EF55, 6AG7), are available, which have a high slope and a maximum anode current of up to 40 mA., and these valves with a 1,000 Ω load will modulate fully any cathode-ray tube. These valves, however, cost much more than VR65's even on the surplus market, and it is doubtful whether the increased detail and tone value resulting from frequencies much higher than two megacycles per second can be appreciated with a VCR97 even with a very high E.H.T. (i.e. small spot). Certainly at 2 kV. the 2.5 megacycle bars on Test Card C are not distinguishable on a properly proportioned picture, and can only be seen by pulling out the picture horizontally by means of the line amplitude control.

It will, in practice, be found that an excellent picture may be obtained by using a higher load than 1,000 Ω, and the circuit in Fig. 1, is given as that which fully exploits the use of a single VR65 (the use of two VR65's in parallel is mentioned later in this article).

R1 is low in order to preserve the correct time constant in conjunction with the detector circuit capacities. C2 is a mica condenser and is included in parallel with C1 to offset the impedance, at high frequencies, of C1 owing to its inductance.

The anode load is a 5,000 Ω potentiometer with non-metallic housing to keep stray capacities to a minimum. A setting of 1.6 to 2.5 K Ω gives the best results, but consideration of gain from the entire receiver may have to result in a compromise between initial signal strength and best picture.

It may not be necessary to decouple through R2 C1/C2 but, if omitted, interaction with other points on the receiver is liable to occur (especially with a T.R.F. type), giving ragged edges to the objects in the picture, especially with low setting of VR1.

Grid Modulation

R3, C4 are the values to use for grid modulation of the tube, the output from the detector V1 being negative. Grid modulation is probably the most straightforward and best method, and the risk of damaging the tube through failure of components can be overcome by using a cathode follower V4 and taking the output from R5.

The potentiometer is mounted close to the VR65 valve base with the spindle projecting upwards through the chassis. It is preferable to have the centre-tap connected to one end tap and to the junction of R2 and C1, for then there will be no difficulty during adjustment owing to radiation picked up or emitted through the spindle when touched, as this end of the potentiometer is then at earth potential as regards A.C.

On varying the anode load from 5 KΩ downwards, increasing at the same time the contrast control of the receiver, it will be noticed that the picture detail and tone value are vastly improved (assuming, of course, that the previous stages of the receiver are adjusted for correct bandwidth). Eventually there comes a point where the loss of gain due to low value of potentiometer setting cannot be made up by increasing the gain of the receiver as the picture will go negative.

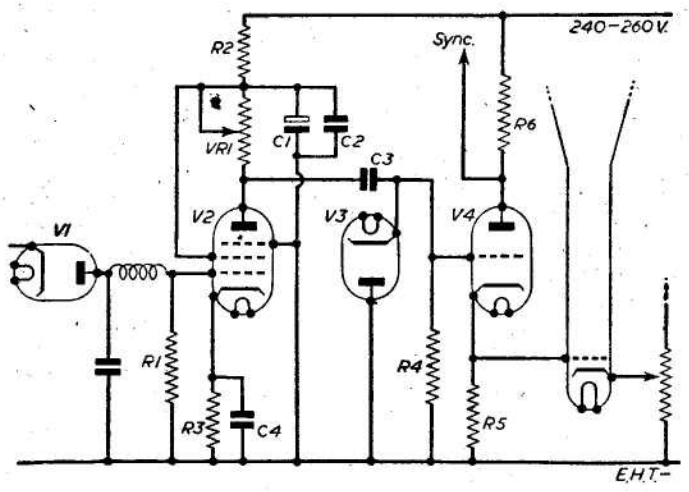


Fig. 1.—Video output stage for maximum performance with a single VR65.

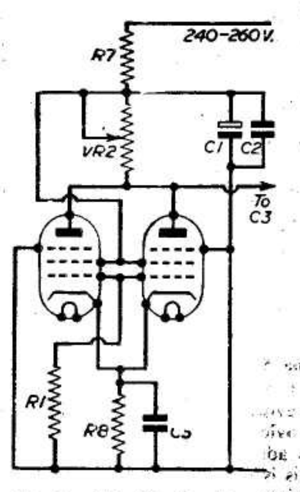


Fig. 2.—Modification for the use of two VR65's in parallel.

A slightly higher setting of the potentiometer will then give the best result, the gain control being turned back to a little before negative picture point.

If the above is tried on Test Card C, the final adjustment of VR1 must be made on a live picture transmission, otherwise there is a likelihood of not allowing enough contrast.

With still lower settings of VR1 (leaving gain control alone), the picture detail is improved further but contrast is lost owing to loss of gain. This effect is best seen on Test Card C.

Increased Contrast

If it is thought worth while to take advantage of this increase in detail the contrast can be increased as mentioned earlier by using a special video valve or, more cheaply, by putting another VR65 in parallel with the existing one as shown in Fig. 2. An extra 0.6amp. heater current and an extra 10-15 mA. H.T. current is required.

This circuit will definitely reach the limit of definition of a VCR97 and incidentally give a really excellent picture with magnetic tubes.

COMPONENTS

R1 2.2 K Ω ¼ w.	VR2 2 K Ω potentiometer
R2 2.2. K Ω 2 w.	C1 8 μF 450 v. electrolytic
R3 33 ohms ¼ w.	C2 0.01 μF 450 v. mica
R4 1 M Ω ¼ w.	C3 0.1 μF 500 v.
R5 5 K Ω 1 w.	C4 0.02 μF
R6 10 K Ω 1 w.	C5 0.05 μF
R7 2.2 K Ω 4 w.	V1 VR92
R8 15 ohms ¼ w.	V2 VR65 (CV118)
VR1 5 K Ω potentiometer	V3 VR54
	V4 6J5 or 6C5

Television Sight-strain

A CONTROVERSIAL POINT OF VIEW—By H. Stoneley

WOULD you like to be blind? A silly question? You are given the chance to please yourself about it, anyway. If you like television and constantly view, then, whether you like to be blind or not, you possibly go the right way to become so. Even if you feel your eyes are so good that blindness will not come your way, it is possible that those good eyes of yours may, as the result of over-viewing, become affected with the result that you would suffer.

And this is no widely strained idea of the optical services desirous of obtaining a little extra in addition to your national health contributions. Let us get down to the foundation. One assumes that you are not only a regular viewer, but that you take your viewing seriously. They are not always the same thing. If serious, you will devote quite a slice of your time before the television screen. To get the best viewing (for, in spite of the great strides made in television during the past year or so, the best viewing is made in the dark, or in semi-darkness), you do so either with the curtains drawn, or when the room is in total darkness. Now that is how the mole went blind, or nearly so, if my informants, the leading scientists, are correct. Once they, the moles, lived on top of the earth, and went about their daily toil in the full light of day. They were driven, of dire necessity, to carry on their pleasures in darkness or semi-darkness.

So we have the set of our choice, the programme of our desire, and the screen provided, which in the end, as regards eyesight, means pretty much the same. We have experimented with all types of sets and viewed with and without aerials. We have sat enthralled before this or that programme, and have noted that the screens, by the fact of dire necessity, are pretty much the same anyway.

The Viewer

It would appear to some of us at the receiving end of television that all the makers have done so far is to provide efficient television sets for reception. Let us admit, and readily and generously also, that so far this is all that could be expected of the makers of television sets. But now that they have achieved this efficiency of reception is it not time that they spared a thought or two to the question of the viewer? So far the only thoughts apparently spared in that direction have been, "How much is he likely to pay?" Agreed, they do not put it so crudely, for we have suggested that they are business men, at least in the way of the production and marketing of their sets. The honest viewer will admit that there is a terrific amount of strain in viewing at present. But it is a pertinent question to ask why, and we hope to supply the answer before we write finis to this article. Part of the strain comes from the fact that though experiments must have been made to obtain the best type of telescreen, few experiments have been made about the material and its impact on the human eye. What has taken the greatest amount of experiment so far has been the efficiency of the sets, and their ability to register the pictures thrown at it, not to mention on to it, from the studio, or from whatever place the pictures come. Experience, and experience of viewing only, has brought up the question of eye strain. If you doubt this question ask anyone who has not done much viewing to spend a night before your own particular screen. At the end note their eyes. See for yourself if there is not strain. But that is a point about which there can be little or no argument. There is strain in watching a cinema show in the dark. We are informed by opticians that the great incidence of spectacles for so large a proportion of the population can be placed at the large amount of cinema-going. Now on the weak eyes of such nations comes the television miracle, with the majority of folks desiring either to be able to own their own sets or to be allowed to view at the screens of their more fortunate neighbours. This darkness, or semi-darkness, plus the already strained eyesight of the majority, plus once more the material of present telescreens is the cause of the threatened strain, and worse, to the human eye. We do not desire to become moles. Or do we? We must agree that television has come to stay. It will be improved. Indeed, it has been improved out of all recognition from its early efforts, but has there been any change in the screens themselves?

Suitable Colours

Now opticians, indeed biologists, indeed anyone with knowledge of the human eye will tell you certain things with regard to eyesight, human type of course. One is that where we obtain a vision of actual colours in *daylight* the strain is slight. Another fact agreed to by most, if not all, who know anything about eye-sight is that where the human eye can view anything in a green tint, then there is no strain. Now, it is possible that we could have colour television. One is informed that this is only a question of cost for the general viewer. Yet let us not forget that even colour vision will take place in the dark, or in a darkened room, for years before we have found out how to get equal results in full daylight. So it appears that for all practical purposes our television viewing will have to be pretty much as now in darkened rooms, or nearly so, staring at a bright light which, in spite of all experiments so far, has not cut out the dazzle or the flashings which are so great a strain on the human eye.

Why not experiment so that the reception is made with green or near green on the telescreen? Surely the fact that we get the light to show on the screen at all is proof that there is a possibility of doing something in this direction? We get light and shadow. Indeed, we get more. We get light and bright light, and shadow and deep shadow, all on the screen at the same time. Of course we do, or there would not be any picture to view, for it is the differences in depth or in the quality of the shadows and the brilliance or otherwise of the light on the screen which make the pictures. Think that out for a moment or so and you will see how true it is. It is for this reason that in taking a photograph you do not face the sun with your camera. You let the light and the shadow fall on the object you wish to photograph. Let us whisper that it is just this light and shadow on the object which allows any photograph to be taken. Failing sunlight, we use flashlights or other illuminations as substitutes. Make no mistake, it is this reproduction of light and shadow on the screen which is viewed by the human eye.

Ground for Experiment

Now, for the sake of the pictures we view, we do not desire to do anything with the light and shadow at the photo end. We desire our pictures as clearly taken by the camera as possible. Which seems to add up to the fact that experiments will have to be made at the screen end of the waves. It might be possible to experiment, at least in the studio, with green lights, but one hardly assumes that these would produce the best effects. There are, however, two other factors which could be taken into consideration about this question of tele-eyestrain. The screens could be made in such a manner and with such type of material that they would take the pictures for indoor programmes, thrown on to them from the studio, and for pictures of outdoor events. This would apply to colour or ordinary pictures also. Or and this may be an even easier—and cheaper method —the magnifiers which are now supplied in a variety of shapes and sizes could be experimented with in a shade, or varying shades, of green, according to the eye requirements of the various viewers. Just as we choose different spectacles for varying types of eyes, according to their efficiency, or their amount of affection, so we could put on the market different magnifiers, or screens, with light tints, or deep tints preferably of green, which give less strain to the human eye, and in this way this threatened blindness, or semi-blindness through television viewing, be checked. The set complete with magnifier could be chosen at the time of the choosing of the set itself. With this added advantage, that with a set of such magnifiers, these could be changed from time to time as the eyes grew weaker or stronger.

If you doubt the necessity of this idea, at the end of any television programme when the news comes on and the house lights are switched up again take a look at the eyes of those who have sat in the dark. Note how they blink . . . see how they rub their eyes. Remark how there is that obvious strain even on the eyes of the young, which last, is a menace to public health and national efficiency for later years. So that it appears only too well proved that at the receiving end of television there is need, and urgent need at that, to experiment in this direction.

Beyond Dispute

That there is eye-strain in viewing television is beyond dispute. That it is caused at the receiving end is quite self-evident. And that this eye-strain in many cases is severe, and that it is the result of all types of screen for television now on the market, is a statement of fact, and fact alone, which we deny, or refuse to accept at our peril in achieving the best in this wonderful medium of education and entertainment. These things are beyond dispute, so . . . what about it scientists, television set producers, and all who desire that which is best for British products?

We want television, but believe me, we desire even more, our eyes. We earn our daily bread, and what little butter goes with it these days, with our eyes. We reckon them at the top of the list of life's most precious things. Which they are, you know, which is why we desire to preserve them so much. Even though we love to view, and admire, and criticise . . . television.

Automatic Picture Control

ONE of the new Pye Automatic Picture Control TV receivers was demonstrated in London recently to members of the Press.

Automatic Picture Control is something quite new in commercial receivers, and at the demonstration it was shown what a great advantage this would make to viewing in all parts of the country, especially in fringe areas.

In many TV areas to-day a certain amount of signal fading occurs. Some places are far worse than others, but in many districts, at some time during an evening's entertainment, controls have to be re-set due to a change in signal strength. It is claimed that Automatic Picture Control will give a steady picture of constant contrast and brilliance, even though signal strength varies by as much as 10 to 1.

This was proved convincingly at the demonstration, and although the picture blacked out completely on an ordinary TV receiver due to signal fading, the Automatic Picture Control set was not noticeably affected.

A further advantage with this new set is the "Interference Damper," a device which makes for a considerable reduction of "snowstorm" interference. In the bright areas of the picture streaks of interference stay white, but in dark areas where they have shown up white before on the screen they now become grey and are practically invisible.

Cascodes in Cascade

A NEW IDEA IN PRE-AMPLIFIER DESIGN

By Edwin N. Bradley

THE constructor who employs a cascode pre-amplifier and who requires a little more gain than can be obtained from a single unit has probably given some consideration to the placing of two cascode circuits in cascade—and reluctantly decided against the idea. Not only is it more difficult to maintain stability over the double circuit, bearing in mind that four valveholders with a considerable amount of extra wiring are involved, but the valve bill becomes rather formidable.

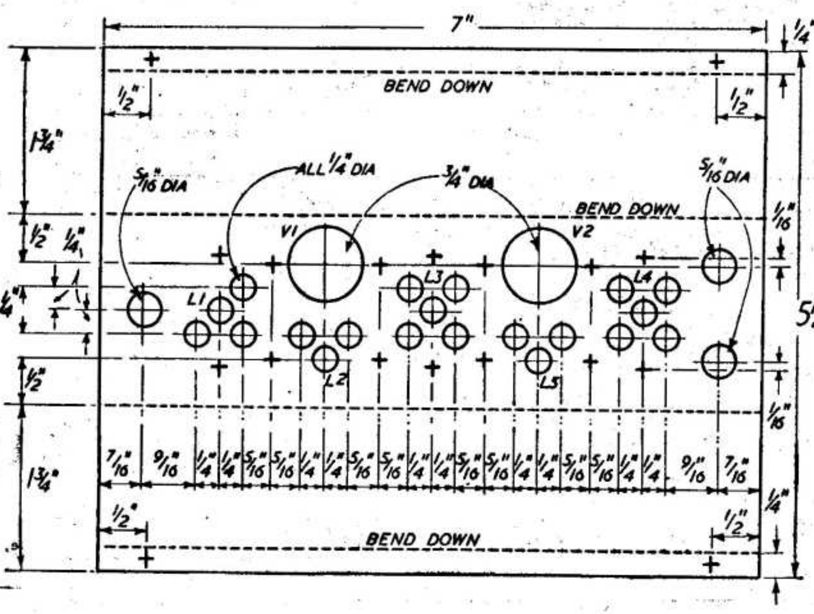
There are various solutions to the problem but it is thought that the one offered in the circuit diagrams of Figs. 1 and 2 possesses at least the virtues of simplicity and novelty. Each cascode is built up round a double-triode of the 12AT7 type and the two cascodes are coupled in a manner which depends basically on the available H.T. supply. The cascodes themselves are of a type requiring no neutralising coil and direct coupling between the two triode sections is employed, placing the triodes in series between the H.T. lines and ensuring excellent signal transfer.

A normal input circuit, L1, feeds into the first triode section of V1, the cathode of this valve being biased as usual by a resistance-capacitance circuit R1, C1. The anode of this first triode section is directly coupled to the cathode of the second section through L2, which forms a tuned circuit with the capacitance to earth of the cathode of the second triode. The coil is thus series-tuned so presenting only a very low impedance between the anode and cathode, at the same time bringing the anode-to-earth impedance of the first triode section to a low value. As a result signal transfer between the two valve sections is good, whilst feedback from the first anode to the first grid is practically an impossibility. The grid of the second triode section is grounded for R.F. by a capacitance to earth, C2, and held at a suitable D.C. potential by R2, a grid leak between the grid and cathode.

The one-valve cascode circuit so formed may be used by itself if so desired, with an output transformer in the second anode circuit modelled on that at L4 in Figs. 1 and 2.

High H.T.

Where a relatively high H.T. supply is to be used it is possible to employ series coupling between the two cascodes in the manner shown in Fig. 1, the coupling being similar to that first described by the writer in "A 'Personal' Televisor," PRACTICAL TELEVISION, November, 1952. The output anode of V1 is directly connected to the input grid of V2, the anode load being identical with, and provided by, the grid coil L3. The anode supply circuit is completed by the cathode of the first section of V2, all four triodes being in series, whilst by-passing is accomplished by C3. The coupling between the two sections of V2 is similar to that employed in the case of V1, and the final output from the circuit is drawn from a low-impedance loop wound beside the final tuned circuit L4. Double output sockets are mounted on the original model to serve separate vision and sound channels, but in the majority of cases a single socket will suffice. The particular advantages of direct coupling—stability, very fair amplification, reasonable constancy of the gain factor despite changes of valves and broad bandwidth—make this type of circuit particularly suitable for cascode pre-amplifier use. No outstanding benefits over the more usual 6AK5-EC91 combination are



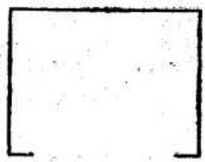


Fig. 3 (left).—Full details of the chassis cutting, bending and drilling and, above, the finished shape of the chassis.

claimed, but the double-triode circuit is certainly more simple to build and adjust.

Whilst gain would be further increased by using an H.T. supply of more than 300 volts with the series-coupled circuit of Fig. 1 this should not be done since then there would be a considerable likelihood of heater-cathode insulation breakdown. The valve heaters are held at the chassis potential whilst the cathode of the second section of V2 is approximately 150-225 volts positive to earth, depending on the actual H.T. voltage. No greater strain than this should be placed on the heater-cathode insulation.

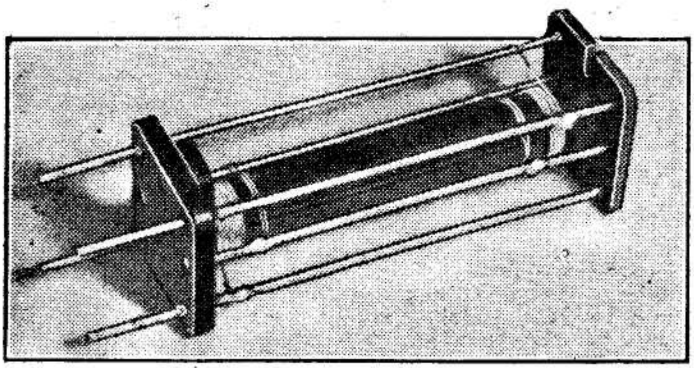
Low H.T.

Where it is required to employ a lower H.T. supply line, of 150-200 volts, the series circuit would hardly give sufficient gain due to the low H.T. across each triode section. Under these conditions it is a simple matter to split the two cascodes for the supply of power using a normal coupling between the output anode of V1 and the input grid of V2. Choke capacitance or simple transformer couplings might be utilised, or the link-transformer coupling employed by the writer and shown in Fig. 2 at the L3 position. This coupling gives good signal transfer with but little capacitance coupling between the two coils, and is very easily arranged when all the inductances are wound on Haynes type formers. The anode coil of L3 is placed at the bottom of the former, the grid coil being placed at the top so that a wide space separates the two coils. Using the centre side wires of the former a 1-2 turn loop is wound on close to the anode coil and a similar loop is placed close beside the grid coil, both loops being sweated to the one pair of wires. The loops then form a link coupling, leaving both coils tunable by separate cores, a more desirable state of affairs than winding both coils together over a single core.

The original pre-amplifier was required for an experimental televisor where the vision and sound channels were completely separate and where an L.T. and an H.T. supply were already available, so that only a small U-shaped chassis, as shown in Fig. 3, was necessary as a mounting for the circuit. The layout shown could be modified to suit an existing chassis, or the U-type chassis could be lengthened to take a small half-wave power supply where it is desirable to fit the pre-amplifier with its own power pack, but the general lines of the layout should be retained. It may prove necessary to modify the drilling dimensions to suit the co-axial sockets used by the constructor.

The earth returns of each separate stage should be made to an earthed point reserved for that stage alone, the most convenient point being the central earthing tube of each valveholder. (The two triode sections are here regarded as constituting one stage.) This tube can be connected, via tag No. 9, to earth by means of a soldering tag bolted down under the nearest mounting bolt to tag No. 9.

Connections to the coils must be arranged for the shortest possible leads, and the coils wound to make this possible. L1, for example, has only three leads protruding through the chassis, that nearest the input socket being the lead to the aerial coupling coil and so on. Four side wires may be used inside the Haynes type cans, but in the case of L1 the unused fourth wire should be clipped off flush with the base of the coil former. Obviously the earthy sides of both the main and coupling windings are taken to a single side wire. In the same way only two holes are drilled for the leads to L2 and to L5, the series tuned coils, though again four side wires may be utilised in building up the coil formers. The unused side wires are then cut off flush with the coil base—the method is shown in the illustration of the



View of the coil former, side wires and general construction.

COMPONENTS LIST FOR THE PRE-AMPLIFIER OF FIG. 1

- C1, C2, C3, C4, C5, 0.001 μF mica, 350 v. w.
- R1, 150 ohms, ½ watt.
- R2, R4, 330,000 ohms, ½ watt.
- R3, 4,700 ohms, ½ watt.
- 2 Valves, 12AT7.
- 2 Noval (B9A) valveholders.
- Chassis, cut from sheet aluminium as Fig. 3.
- Input and output coax. sockets.
- Coils as data.
- Wire, sleeving, nuts, bolts, soldering tags, etc.

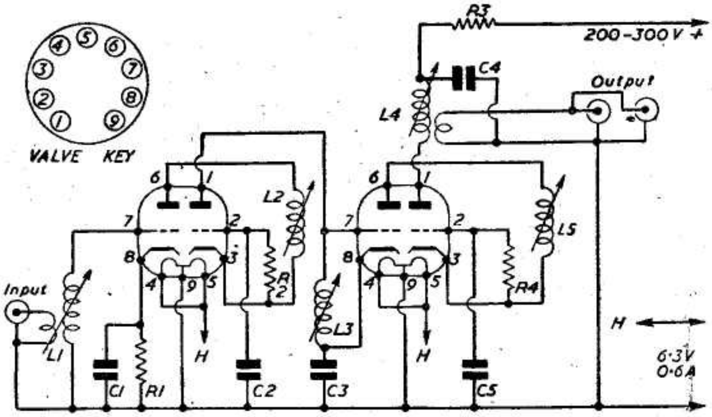


Fig. 1.—The double cascode circuit with direct coupling.

windings of the transformer type L3. The side wires forming the coupling link are here employed within the coil can, but have no connections with external circuits and are clipped off so that they do not short-circuit against the metal chassis when the coil former is bolted down.

Coil Mounting

The coil sizes given will hold good only for Haynes type formers and for construction methods which ensure that stray capacitances are held to a minimum. The neatest method of mounting Haynes coils is to drill the chassis to suit the two 6 B.A. tapped holes in the coil base, bending the can tags inwards so that they are trapped below the coil base when the whole assembly is bolted down, but the writer prefers to bend the can tags outwards providing them with their own bolt holes in the chassis. It is then a more simple matter to remove the can and to adjust the coil windings, should this prove necessary, and there is less likelihood of damage to the can tags.

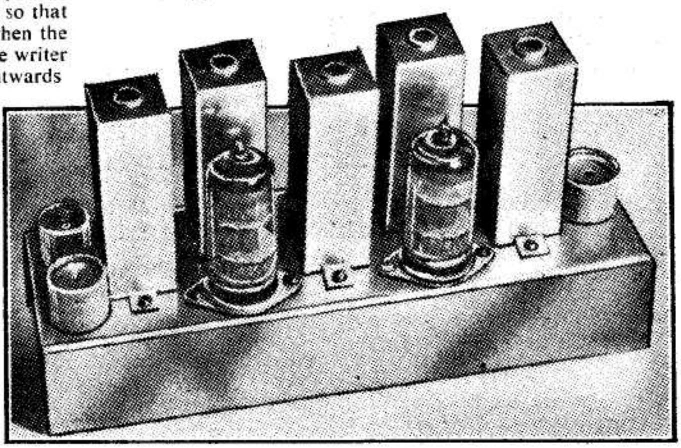
Where, as in the original, the pre-amplifier is to draw its heater and H.T. supplies from some other source the supply leads should be anchored to a small soldering tag-board which can be mounted below the chassis and secured by one of the fixing bolts of L4. The leads to the tag board should be kept clear of the leads to the output sockets. A three-way board, with one of the ways directly earthed through the fixing bolt, is all that is required.

The prototype was employed for long-distance reception and was therefore tuned sometimes to the vision signal, sometimes to the sound signal, and sometimes to the mid-point for vision and sound reception. In order to keep the gain high no damping resistors were incorporated, but in the majority of cases it will probably be possible to damp L1, L3 and L4 for better bandwidth. The resistances to be used should be found by trial, though 6.8 KΩ will be a suitable starting point.

Tuning the pre-amplifier is a straightforward process. It should pass sufficient signal, when first connected to the receiver with which it is to be used, to give an indication on the tube or in the loudspeaker, when it remains only to tune for best results, working from L4 back through L5, L3, L2 and L1. In a poor reception area it is advisable to connect headphones in place of the C.R. tube for the first trials, tuning the pre-amplifier and receiver by sound rather than vision.

Coil Data

All coils wound on Haynes type formers with screening cans, formers 0.3 in. diameter, 2 in. winding length approx.



View of one of the pre-amplifiers completed ready for use.

L1

Channel 1, 11 turns 32 D.S.C. spaced by wire's own diameter.

Channel 2, 9 turns 32 D.S.C. spaced by wire's own diameter.

Channels 3 and 4, 8 turns 32 D.S.C. spaced by wire's own diameter.

Channel 5, 6 turns 32 D.S.C. spaced by wire's own diameter.

Coupling winding, 2½ turns for Channels 1 and 2.
1½ turns for Channels 3, 4 and 5.
Wind close beside L1.

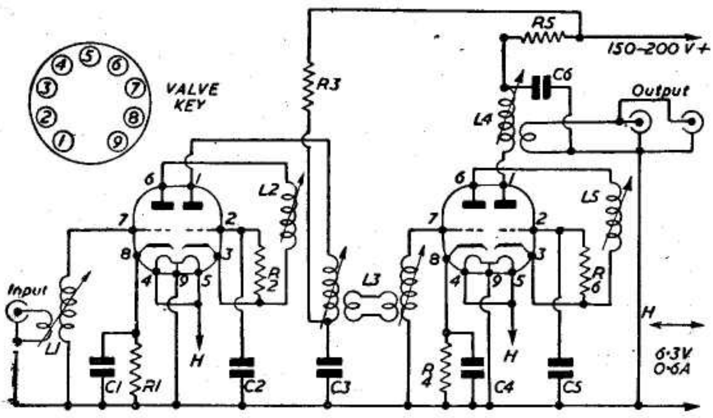


Fig. 2.—In this version transformer coupling is employed.

COMPONENTS LIST FOR PRE-AMPLIFIER OF FIG. 2

C1, C2, C3, C4, C5, C6, 0.001 μF. mica, 350 v. w.
R1, R4, 150 ohms, ½ watt.
R2, R6, 330,000 ohms, ½ watt.
R3, R5, 4,700 ohms, ½ watt.
2 valves—12AT7.
2 Noval valveholders.
Chassis, cut from sheet aluminium as Fig. 3.
Input and Output coax. sockets.
Coils as data.
Wire, sleeving, nuts, bolts, soldering tags, etc.

L2, L5

Channel 1, 22 turns 32 D.S.C. close wound.

Channel 2, 20 turns 32 D.S.C. close wound.

Channels 3 and 4, 18 turns 32 D.S.C. close wound.

Channel 5, 15 turns 32 D.S.C. close wound.

L3 (Fig. 1)

Channel 1, 8½ turns 32 D.S.C. spaced by wire's own diameter.

Channels 2 and 3, 6½ turns 32 D.S.C. spaced by wire's own diameter.

Channels 4 and 5, 5½ turns 32 D.S.C. spaced by wire's own diameter.

L3 (Fig. 2)	Anode	Grid	Links
Channel 1	13 turns	10 turns	2 turns
Channel 2	11 ,,	8 ,,	2 ,,
Channels 3 and 4 ...	10 ,,	7 ,,	2 ,,
Channel 5	9 ,,	5 ,,	1 ,,

All windings close wound, 32 D.S.C.

L4

Channel 1, 13 turns 32 D.S.C. spaced by wire's own diameter.

Channel 2, 11 turns 32 D.S.C. spaced by wire's own diameter.

Channels 3 and 4, 10 turns 32 D.S.C. spaced by wire's own diameter.

Channel 5, 9 turns 32 D.S.C. spaced by wire's own diameter.

Output link—2 turns in each case, wound close beside L4.

RANDOM TOPICS

Interference Suppression

THE British Standards Institution has just issued a revised edition of the standard which was first published in 1939. It has been revised to take account of the latest knowledge in the technique of radio-interference suppression as applied to motor vehicles and internal combustion engines. The revision is of particular interest in view of the recent publication of the Wireless Telegraphy (Control of Interference from Ignition Apparatus) Regulations, 1952.

The standard (B.S. 833 : 1953) specifies the maximum permissible magnitude of the interference-producing electric fields generated in the frequency range of 200 kc/s to 150 Mc/s by vehicles, boats, machines or equipment embodying internal combustion engines and their associated equipment.

Degree of Suppression

The degree of suppression necessary for compliance with the standard is intended to be sufficient for the protection of radio services, including television, at such distances from the source of interference as are likely to occur on normal road traffic routes and in urban areas. It should also contribute towards preventing interference with vital radio services on which the safety of life may depend.

The degree of suppression is not, however, primarily intended to be sufficient for the interference-free reception of all radio services on a vehicle or boat which is itself a source of interference, though in general it is sufficient in such circumstances for the reception of ordinary broadcasting on the long and medium wavelengths.

The standard gives also the ratings and certain requirements for general components (resistors, inductors or chokes and capacitors) used in making up radio-interference suppression devices for use with the ignition systems and other electrical equipment of vehicles and internal combustion engines.

Copies

Brief descriptions of the origin, nature and magnitudes of the interference and the main characteristics of a suitable measuring set are given in the appendices to the specification.

Copies of this standard may be obtained from the British Standards Institution, Sales Branch, 24, Victoria Street, London, S.W.1. Price 3s.

Additional Television Test Transmissions

FROM March 16th to June 1st inclusive the BBC's morning test transmissions for the trade will be extended by one hour, and will run from 10 a.m. to 1 p.m. continuously on weekdays. The extra hour's transmission from 12 noon to 1 p.m. will consist of a picture of Test Card C with 440 c/s tone on the sound channel.

The purpose of the extra transmissions is to help the radio industry and the trade to adjust and install television receivers for new viewers in time for the Coronation.

Visit of the Swedish Television Commission

THE Swedish Minister of Communications has appointed a Commission to study the possibility of introducing a television service in that country. The Commission has the following members :—

Mr. O. Sehlstedt, Member of the Swedish Parliament.

Mr. E. Esping, Director of Department of the Board of Swedish Telegraphs.

Mr. A. Berger, Permanent Secretary of the Swedish Ministry of Communications.

Mr. E. Mattsson, Manager of the AB Radiotjänst.

Mr. H. Nyström, Manager, Swedish Electrical Manufacturers' Assoc.

Secretaries : Mr. H. Hahr (AB Radiotjänst) and Mr. T. Rosenlund (Board of Swedish Telegraphs).

The Commission is now visiting this country. The members will study the British Broadcasting Corporation's Television Service ; they will also see British television equipment being manufactured.

"Little Red Monkey"

THE very effective theme music of the recent television serial "Little Red Monkey" was composed by Jack Jordan, who conceived the idea whilst in a public house near the Lime Grove Studios and wrote down the score in three minutes over a pint of beer. The tune has had an immediate success and is fast becoming the rage, both in this country and the U.S.A. The theme was played during the transmission of the play on Saturday evenings, by the composer, on a new type of instrument, a clavioline, a miniature electronic organ which is synchronised to a piano.

HUM IN TV RECEIVERS

IDENTIFYING THE SOURCE OF HUM AND RECOGNISING ITS EFFECTS

By W. J. Delaney (G2FMY)

IN a normal broadcast receiver, hum, unless very weak, makes its presence obvious, and is fairly simple to cure. In a television receiver, however, it is possible for hum, due either to inadequate smoothing or interaction between certain leads and others carrying A.C., to give many troubles and poor performance which may be taken to be due to other causes. First, it is important to bear in mind that different receivers will be affected in different ways, merely on account of the method of feeding the H.T. positive potentials. In some receivers, for instance, a simple mains unit is employed and the usual smoothing choke and condensers used, the smoothed output being taken to the various sections with no further smoothing. At the other extreme, smaller smoothing condensers may be used (the output feeding direct to the sound amplifier), and each section of the complete receiver then being provided with additional smoothing circuits—generally a resistor of fairly high value and a single condenser. The advantages of this system are that, should trouble be experienced due to inadequate smoothing, additional condensers may be added at low cost, as the H.T. voltage at that part of the circuit will not be so great as in the main power section.

Hum Effects

First let us see what effects a poorly or inadequately smoothed H.T. supply can give. In the sound section the results will be the same as in a normal broadcast receiver—a low vibrating background *of constant pitch.* It is important to remember the latter point in order not to be confused with a background due to vision signal breakthrough. In certain circuits this will resemble hum, but may be distinguished from it by a variation in pitch, either rapidly all the time, or periodically. For a certain check, the sound input valve should be removed (except in an A.C./D.C. receiver with series-fed heaters), and if the hum is due to poor smoothing it will persist. If due to vision breakthrough it should cease. This assumes that the sound section is adequately screened from the vision section and that there is no very bad layout which is causing the trouble.

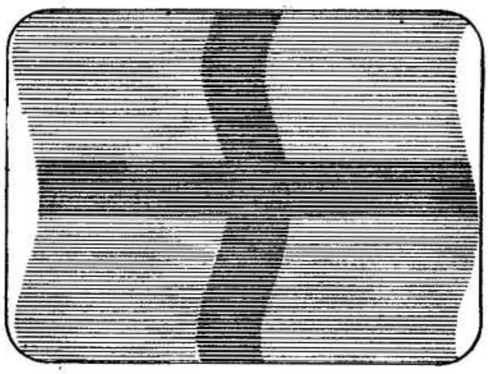
Hum in Timebases

If the sound background is satisfactory it may not indicate that the H.T. is adequately smoothed, as mentioned above, due to separate H.T. supply rails. If the supply to the timebases is rough, there are several faults which will be apparent. The most obvious is produced by hum in the line section. The result is that the entire picture will wave slowly from top to bottom. Stationary vertical lines will thus ripple from top to bottom, and the illustration on the right shows how the artificial bars signal (which is radiated for some 20 minutes or so before each programme) will appear. In the frame section, however, the results may be more serious. The correct frame frequency is 50 c.p.s., the same as the mains frequency, and at the transmitter the section is actually locked to the mains. It is thought by some that to have an artificial mains lock in the receiver frame base would overcome all interlacing and frame locking troubles, but unfortunately it is not possible normally to ensure that the receiver will be in step with the transmitter, and although it will lock (and remain locked if the receiver happens to be on the same mains supply as the transmitter), it will probably lock out of step. This is, then, the main trouble which mains hum will introduce in this part of the circuit. If the frame sync pulse is weak due to a circuit fault or an initially weak signal, the hum will take charge of the oscillator stage and hold it out of step, with the result that there will be a horizontal dark bar across the picture with the two halves transposed, or with the top half of the picture at the bottom and the lower half at the top. In very bad cases it may be found impossible to shift this bar without switching on and off. This will bring in the receiver at a different phase of the mains cycle and the line will appear at a different position on the screen, or alternatively it may actually lock it in the correct position. But, as mentioned above, unless the mains are actually on the same supply, the picture will not remain accurately positioned and will eventually drop to some point where the dark horizontal line is visible. In some cases the frame pulse may vary due to circuit or component faults and the oscillator may be triggered at times by the pulse and at others by the hum ripple with the result that the picture keeps slipping and it will be found impossible to set the frame hold control to obtain a steady picture. Although a fault of this nature may be due to many causes, that mentioned above is a very common one which is often overlooked.

Hum in Tube Circuits

With an electrostatic type of tube, hum on any of the electrodes will result in the picture or raster being shifted, and a similar effect to that mentioned earlier (waving) may be obtained, or in some cases the entire raster may be shifted bodily, the direction depending upon the particular plates which are receiving the rough supply. In the case of the normal electro-magnetic type of tube, hum on the auxiliary anode (in the case of the tetrode tube) or in the E.H.T. supply, will result in a stationary

(*Concluded on page* 528)



A raster with the artificial bars signal as it would appear in a receiver in which hum is present in the line timebase

Aircraft Interference

WHY AIRCRAFT CAUSE FLUTTER AND FADING, AND SOME REMEDIES

By J. A. Hutton, B.Sc.

TO many viewers, aircraft "interference" is the most distressing of all the influences which disturb television reception. The effect, which is well known to most of us, is a slow or rapid variation in picture brightness which may, in the case of violent fluctuation, cause loss of synchronisation.

The cause of the trouble is that aircraft reflect a proportion of the radio signal which is incident on their wings and fuselage. Usually the field strength of the television signal in the vicinity of the aircraft far exceeds that at the receiving site, and consequently the reflected wave may well be of similar strength to the direct wave. Although these reflections are a considerable nuisance to viewers, they have their brighter side in that they have given us radar and its consequent benefits.

Since the aircraft is moving, the total length of the path of the reflected wave is, in general, changing, whereas the direct wave path from transmitter to receiver is, naturally, constant. The phase of the reflected wave will therefore vary with respect to that of the direct wave at the receiver. When the waves are in phase we get a brighter picture than usual, when they are out of phase, a darker one.

Short of grounding aircraft, we cannot prevent these reflected signals from appearing, but this does not mean that the situation is irremediable. There are two things that we can do: firstly, we can make our receiving aerial relatively insensitive to the signal which has been reflected from the aircraft and, secondly, we can modify the receiver so that the unwanted signal causes less disturbance to our enjoyment of the programme.

Aerial Effects

The first method of tackling the problem—by means of the aerial—is clearly the better way, since any relative reduction in the reflected wave signal will reduce the effects on the picture accordingly. As will be shown later, the receiver can never eliminate completely the effects of the interfering signal once it is supplied by the aerial. In other words, from the receiver point of view, prevention is better than cure. It must be borne in mind, however, that the aerial improvements are likely to be considerably more expensive than the receiver modifications.

It is clear that if an aerial has a narrow vertical acceptance angle—that is, is insensitive to signals coming from the sky—only very low-flying aircraft will affect reception. Unfortunately, such a polar diagram is not easily obtained, since it implies having an aerial of large vertical dimensions and consequent mechanical difficulty, particularly in the case of vertically polarised signals.

If, on the other hand, we choose an aerial with a narrow acceptance angle in the horizontal plane—that is, an aerial which is insensitive to signals arriving from the sides or back of the receiving site, we shall have reduced considerably the proportion of sky in which an aircraft must be present in order to produce an interfering signal. The situation is considerably better than might appear at first sight, since aircraft which are situated near the line joining receiver and transmitter (the direction in which the receiving aerial must be sensitive) contribute, in general, far less signal than aircraft at the back or side of the site and the same distance from the receiver.

To illustrate this point, imagine the aircraft to be a simple mirror which is moved round the receiver but maintained at constant distance from it. At all points let it be turned in such a direction that the signal is reflected from the transmitter to the receiver. Fig. 1 shows a mirror in several such positions.

It will be seen that the effective area of the mirror as seen from the transmitter alters as the mirror is moved round the receiver, so that the amount of power which is incident on the mirror also varies, being zero on the line joining the receiver and transmitter, and maximum directly behind the aerial. If this is not quite clear it will be obvious that a mirror in position A will throw a smaller shadow than in position B and has therefore a smaller effective area. The more power which the mirror receives, the more it can reflect, so we can plot a polar diagram, such as Fig. 2, of the amount of signal received by reflection from the mirror according to its position on the circle round the receiver.

From this rough analysis, we deduce that with a non-directive aerial we should be more disturbed by aircraft at the sides and back of the receiving site than at the front, so that an aerial with good rejection of side and back signals will be better than we might expect. In view of the fact that aircraft have complicated shapes and preferred directions for optimum reflection, the results predicted here cannot be expected from experiments except after an examination of a large number of aircraft flying in random directions.

It must be remembered that the polar diagram drawn in Fig. 2 is only applicable to aircraft flying near the

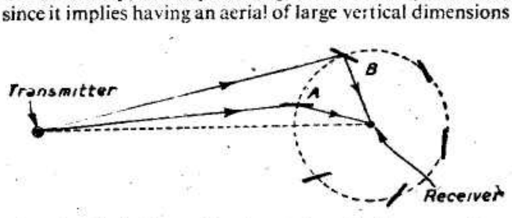


Fig. 1.—To indicate the change in effective area of a mirror as it is moved in a circle round the receiver and rotated for maximum reflection.

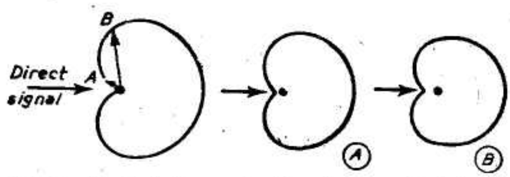


Fig. 2.—(Left) A diagram to show the amount of signal reflected from a mirror according to its position on the circle (see Fig. 1). The lengths of the arrowed lines represent the amplitude of signals when the mirror is in positions A or B. Fig. 3.—(Right) Diagrams showing the modification to Fig. 2 when the aircraft is not at ground level, B represents a higher aircraft than A. Note that signal is now received from a reflector in a forward direction.

ground. Fig. 3 shows the sort of polar diagram which might be expected at different heights.

Receiver Modifications

If we rely upon the aerial alone to reduce the effect under consideration we shall find that some of the worst types of "interference" persist, namely the low-frequency brightness flutter. Fortunately, this is more easily removed by receiver modification than the higher frequency beats.

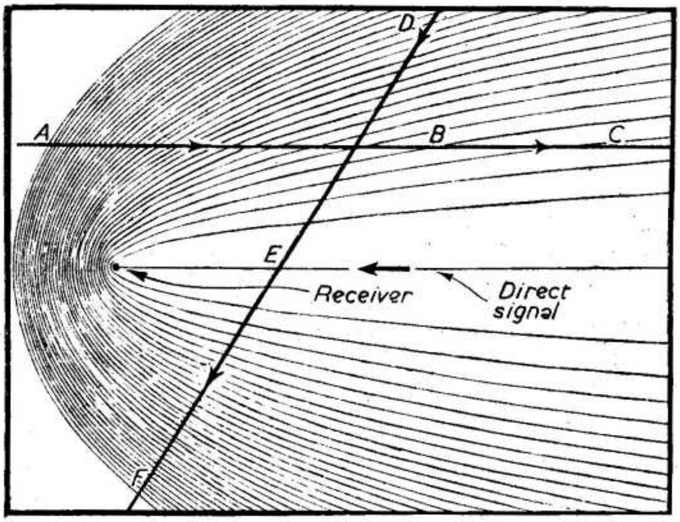


Fig 4.—A map of the area near the receiver. When a reflecting object is on one of the elliptical lines the reflected signal will be in phase, causing a bright picture.

In order to explain why it is to be expected that aircraft in front of the receiving aerial give rise to lower frequency brightness flutter than aircraft at the sides or rear, let us examine the family of ellipses shown in Fig. 4. This diagram may be considered as a map which is drawn so that any reflecting object situated on one of the elliptical lines produces a picture which is in phase with the direct signal (bright picture condition). At points roughly half-way between lines, the reflected signal will be in antiphase with the direct signal (dark picture condition). The rate at which an aircraft crosses the lines determines the frequency of flutter.

If an aircraft were to fly along one of the elliptical lines, we should have no brightness flutter. This example serves to show that not all low-frequency flutter is obtained from aircraft in front of the receiving site. Fig. 5, however, shows the frequency of flutter which would be caused by aircraft following the paths A-C and D-F in Fig. 4. The frequency scale used in these examples is relative only since it depends upon the speed of the aircraft.

Since the lines in front of the receiver are farther apart than those behind, the rate at which an aircraft can cross the lines is lower and the resultant beat frequency is lower.

If an aircraft flies from the receiver in the opposite direction from the transmitter, it will give rise to beat frequencies which are higher than along any other path. The distance between the lines in this case is half the wavelength of the signal, and the frequency of flutter obtained may be calculated from the aircraft speed. Table 1 shows these maximum frequencies for various television channels, calculated from an aircraft speed of 300 m.p.h.

One last point about Fig. 4 is that it applies only to aircraft at ground level, and incidentally neglects any change in phase on reflection. Fig. 6 shows a family of ellipses which applies to an aircraft flying at about 5,000 feet, and although the shape is slightly different the same general remarks and conclusions apply.

If we assume that the aerial has considerably attenuated the reflected signals which produce the higher beat frequencies (say above 5 cycles/second) —and incidentally a good proportion of the signals producing lower beat frequencies—it is left to the receiver to deal with the remaining interference.

Before discussing the type of circuit modification to be adopted, it is necessary to consider what is the effect of mixing the direct and reflected signals.

In the case of a sound modulated carrier, the mixture of the signals causes a simple increase or decrease in the amplitude of the resultant signal according to the phase difference, but with television the process is complicated by the scanning method by which pictures are transmitted. In addition to the phase difference between the two signals, there is also a serious time lag inherent in the reflected wave due to its having travelled farther than the direct wave. The extra time (up to perhaps 50 micro-seconds) is so short as to be unimportant in the case of sound modulation, but with television, the reflected wave is supplying picture detail which the direct wave gave much earlier. Meanwhile, the spot of the cathode-ray tube has moved perhaps inches, so that the reflected wave shows picture detail which is displaced to the right of the direct wave picture. The reflected wave picture is usually referred to as a ghost image.

Automatic Gain Control

Automatic gain control, which is quite effective for controlling variations such as these on a sound modu-

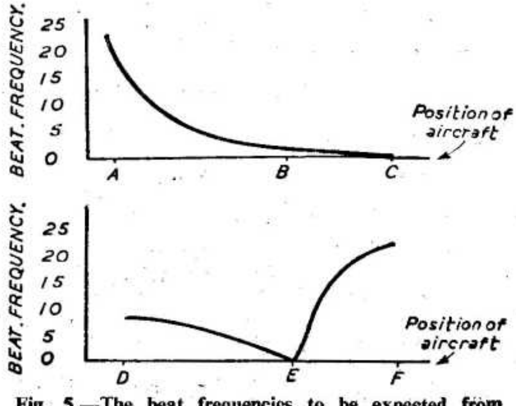


Fig. 5.—The beat frequencies to be expected from aircraft following the paths A - C and D - F in Fig. 4.

lated carrier, is not suitable for controlling television. The effect of television a.g.c. would be to alter the contrast of the picture, but it is not the contrast which is affected by the superimposition of the ghost image. In fact, a.g.c. does apparently help a little for reasons too lengthy for discussion here, but in view of the complexity of the a.g.c. circuit it is not to be recommended in view of the much more simple anti-flutter circuits which will be described. This does not imply that a.g.c. is not a very desirable feature for a television receiver, but its advantages lie in directions other than the reduction of aircraft flutter.

The lowest frequency in a television signal is 25 cycles/second. A steady voltage (the D.C. component) which can be extracted from the complete waveform is present, usually, when the signal is fed to the tube, since this voltage regulates the mean brightness of the picture. What we can do, therefore, to stop changes in mean brightness is to remove their D.C. component. In fact, if we remove all frequencies below, say, 5 cycles/second we shall remove mean brightness changes which occur at rates below 5 cycles/second. This can be accomplished by connecting the video output valve to the cathode-ray tube by means of a D.C. blocking condenser and grid leak as indicated in Fig. 7. Resistances R_1 and R_2 are included in order to restore the D.C. bias to the cathode-ray tube which was previously supplied by the video output valve and its anode load.

This scheme has the disadvantage that the mean brightness of the picture remains unchanged even though the transmitted signal indicates that a change is required. Dark scenes will appear lighter and bright scenes darker than normal although the contrast will be relatively unaffected. To help to get rid of this deficiency, we should try to suppress frequencies below, say, 5 cycles/second without removing the D.C. component of the television waveform. A circuit which attempts to do this is indicated in Fig. 8.

In conclusion let it be stated again that while it is not possible to remove completely the effects of aircraft "interference," the most efficient way of reducing it is via the aerial since receiver modifications cannot remove the ghost image. The question then arises, what sort of aerial?

It is difficult to give a precise answer to this since the answer depends upon how elaborate and expensive an array is considered to be a feasible proposition. Probably the best that can be used without embarking upon a major project is a slot aerial made of wire netting, with a reflector, although sometimes the installation of such an aerial presents difficulties. If an outside aerial is used, it will generally be found that the higher it is erected the better, since a greater direct signal will then be obtained.

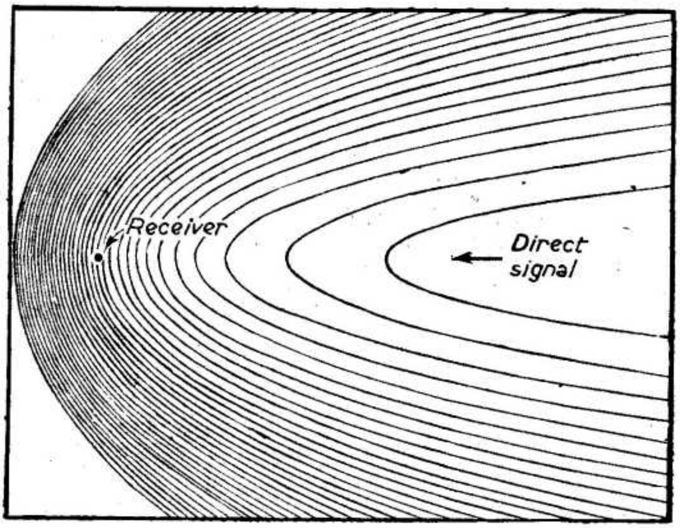


Fig. 6.—A map equivalent to Fig. 4, for use when aircraft are flying at 5,000 feet instead of near the ground.

TABLE 1.

Channel number	Maximum lines/ Kilometre	Maximum Beat Freq. (300 m.p.h.)
1	299	40.5 c/sec.
2	344	46.5 "
3	377	51 "
4	411	55.5 "
5	444	60 "

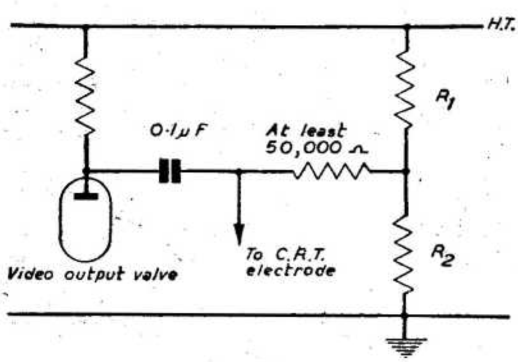


Fig. 7.—Simple circuit for removing the low-frequency and D.C. component to remove brightness flutter.

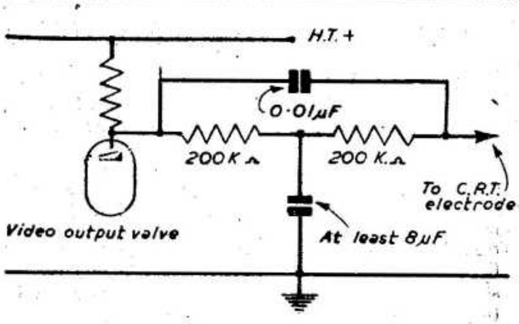


Fig. 8.—A circuit which removes the low-frequency components but passes the D.C. component.

The Technique of Film Transmission

A DETAILED EXPLANATION OF THE BBC SYSTEM

By D. C. Birkenshaw, M.B.E., M.A., A.M.I.E.E.

Introduction

WHEN the British Television Service opened in November, 1936, it was realised that film transmission would be an important part of the service and would fall into two categories :

(a) Transmission of films which constitute programme material in themselves, i.e., newsreel, documentary and feature films.

(b) Film sequences introduced into live productions in order to depict situations which would be technically less easy to achieve in the studio.

For a short period the sole method of transmission was to employ an intermittent projector in conjunction with a standard Emitron (the E.M.I. equivalent of the American standard iconoscope). The image of the film frame was flashed on to the mosaic during the frame-suppression period, the charge image being then scanned in the normal way, during which time the film was moved on.

It was never considered, however, that this method gave a very good picture and after a few months it was replaced by a continuous motion system, and it is interesting to note that from this time the continuous motion principle has in one form or another been employed in all 35 mm. telecine apparatus designed for the British Broadcasting Corporation. It provides the inestimable advantage of completely side-tracking the two notable difficulties associated with an intermittent motion telecine system.

(1) If an intermittent motion system is to be used, the film should ideally be moved on one frame in each alternate frame - suppression period. In the British system this would mean that the film would have to move on three-quarters of an inch in 1.4 milliseconds. The resulting wear-and-tear on the mechanism and film is considered an unsatisfactory operational risk.

(2) Alternatively, if the optical image be flashed on to the tube target in the frame-suppression period and the mosaic then scanned in darkness, the picture suffers from degradation due to factors associated with the camera tube, such as imperfect insulation of the target.

Mechau/Camera Tube Telecine Installations

The method employed in the first application of the continuous motion principle was to make use of the German-designed Mechau cinema projector. The Mechau projector may really be termed a frame speed transformer. Its function is to generate a steady optical image from a film continuously moving at any speed between zero and 40 frames per second. It consists basically of a system of eight rotating and rocking mirrors which are interposed in the optical path, and so controlled as to cancel the steady blurring of the image which would occur if a piece of film were continuously drawn through the machine without their intervention. In operation the film is passed through the machine at the rate of 25 frames per second and the steady image is directed into a standard television camera. When setting up a studio telecine equipment, it is obviously convenient to associate the Mechau projector with a camera channel of the type with which it is proposed to equip the studio. Any type of tube is suitable for use with the Mechau projector so long as it does not suffer from appreciable shading distortion. Thus, it may be associated with the C.P.S. Emitron (a low-velocity bombardment scanned tube), or it may be used with a tube of the image iconoscope type. Two equipments employing the Mechau/C.P.S. Emitron arrangement are in use at present, one in Studio "D" at Lime Grove, Shepherds Bush, London, from which studio are televised all the BBC's television drama productions, and the other in Studio "H" in the same building, from which the Children's Hour programmes emanate. This equipment is illustrated in Fig. 1. One Mechau/image iconoscope equipment is in use in Studio "G" at Lime Grove, which is the light entertainment studio. The use of Mechau machines confers the great operational advantage of a very quick run-up. The picture is normally available one second after the starting button has been pressed. The usefulness of a Mechau/image orthicon combination has not been tested in the British Television system, however, since there is no British

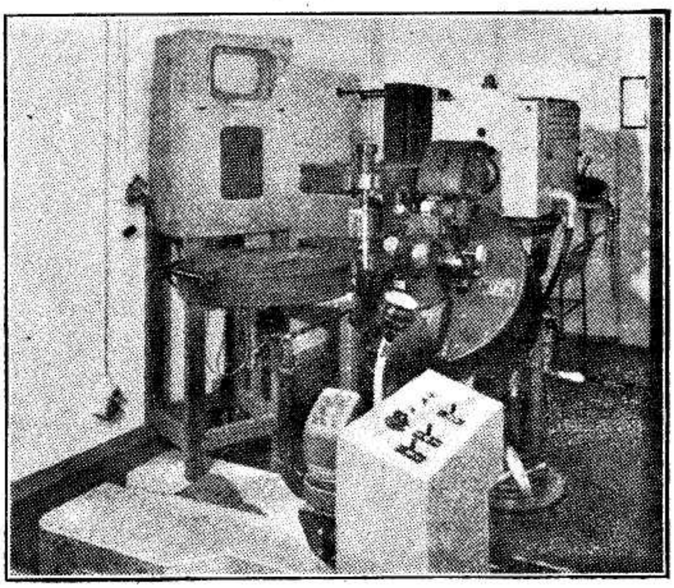


Fig. 1.—General view of the Mechau machine, the C.P.S. Emitron control, picture monitor and control pedestal.

studio fitted with image orthicons and therefore no such telecine combination is required.

Flying-spot Telecine Installations

When television resumed in England in 1946, the only type of camera tubes available were of the iconoscope and large image iconoscope type, and consequently the Mechau/camera tube telecine equipments were not satisfactory, and it was decided to ask British television equipment manufacturers to make a determined attack on the problem of telecine transmission on the British television standards. Two firms, Messrs. Cinema Television, Ltd., and Messrs. Electrical & Musical Instruments, Ltd., designed and made apparatus which commenced work in May, 1949, at Alexandra Palace and achieved a quality of transmission of a very high order. Both manufacturers employed as their basic principle continuous movement of the film associated with flying-spot scanning, but from the practical standpoint the two sets of apparatus are widely different. Fig. 2 shows the equipment provided by Messrs. Cinema Television, Ltd,, and Fig. 3 that installed by Messrs. Electrical & Musical Industries, Ltd.

The basic principle is as follows. Upon the screen of a cathode-ray tube is developed an unmodulated, bright, precision-scanning raster containing 405 lines, twin interlaced at 50 frames per second and having an aspect ratio of 4 : 1.5. This aspect ratio is half the standard aspect ratio of the system, viz., 4 : 3. A dual optical system, consisting of two lenses one above the other, produces images of this raster in the plane of the film. In this plane there are these two optical images, "L" and "I" (standing for "Lace" and "Interlace" respectively) one above the other. In the optical path is interposed a shutter which permits only one of the optical images to be incident on the film at any given instant. The design of the shutter mechanism is vastly different as between the two sets of equipment. In the E.M.I. equipment the shutter is interposed between the lenses and the film, and moves upwards, while the film moves downwards. In the Cintel installation, however, the shutter is interposed between the scanning tube and the lenses, and consequently moves downwards and the film also moves downwards.

The action of the scanning process is as follows. Assuming that the shutter starts by obscuring the lower image "I," the upper image "L" is directed on to the film, which is thus scanned by a moving spot of light in, for example, the odd lines. During the time that the film moves down by half a frame pitch, the scanning spot moves up by half a frame pitch because of the deliberately halved aspect ratio of the raster on the end of the cathode-ray tube. Thus, at this stage the film frame has been scanned in one frame of lines which we are assuming to be the odd lines. The shutter now operates to reveal image "I" so that the film frame in its new position commences to be scanned through the lower lens by the even lines. During the downwards movement of the film for the second half of its frame pitch, it is scanned by the even lines, which similarly take up their proper relative position on the film frame due to the half value of the aspect ratio on the cathode-ray tube. Thus, by the time the film has moved down one complete frame pitch, it has been accurately scanned by a steady spot of light in the full number of lines of the system.

Behind the film in both systems is a multiplier cell which generates a video signal corresponding to the light passing through the scanned film.

This is as far as it is possible to take a description of the basic principle on a joint basis for the two installations and it will now be of interest to consider their practical differences.

E.M.I. Telecine Installation

The tractor mechanism is driven by a motor which is speed controlled from the television system frame frequency. The three-phase stator is energised from the mains and the three-phase rotor is energised by a frequency which is the difference, if any, between the mains frequency and the television frame frequency. During normal operation this difference is zero so that the rotor and stator fields both rotate at the common mains/system frequency and the machine, therefore, maintains absolute synchronism. Any difference which tends to develop will result in the appearance of a different frequency which, fed to the rotor, advances or retards it appropriately. The whole of the tractor mechanism is made with the highest standard of mechanical accuracy and incorporates a specially designed mechanical filter system designed to ensure absolute constancy of speed in the film tractor mechanism. The performance of the machine is greatly dependent on the sprocket design. The hubs and side discs are chromium plated and the film is pressed on to the hub by a rubber roller. The tooth design and pitch is arranged to cope with both standard films and those which have shrunk considerably. The shutter is of rotary, multi-blade, radial construction, and each of the two lenses is a Cooke triplet, having an aperture of f/3.5 and focal length of 4in. Automatic compensation for film shrinkage is provided by an interesting method. The length of the film between the two sprockets situated respectively above and below the film gate is measured electrically and error signals resulting from this measurement are translated into the form

Fig. 2.—The control desk for the two Cintel scanners, one of which may be seen on the right.

of a frame-shift signal which is applied to the raster on the scanning cathode-ray tube during the scanning of every other frame. The two sprockets drive two 25-cycle A.C. generators associated with phase-discriminating circuits; a difference in the length of film between these sprockets will consequently alter the phase relationship of the generator outputs and from this information is produced a 25-cycle square wave, the amplitude of which is proportional to the film shrinkage. This signal is appropriately mixed into the scanning waveforms.

The E.M.I. equipment provides for a number of other important operational features. It can transmit:

(1) Negative film. This is achieved by an appropriate circuit alteration.

(2) 16 mm. film. For this purpose a separate 16 mm. traction unit is provided on the opposite side of the cathode-ray tube structure to the 35 mm. traction unit, and by means of a rotating mirror the raster can be projected towards the 16 mm. unit instead of towards the 35 mm. unit.

(3) Unmarried 35 mm. photographic sound track.

(4) Unmarried 35 mm. magnetic sound track.

(5) Unmarried 16 mm. photographic sound track.

(6) Unmarried 16 mm. magnetic sound track.

(7) A stationary frame. In order to achieve this the equipment must be reset in four ways:

(a) The aspect ratio of the raster is increased to 4 : 3.

(b) The lower image is obscured by applying a mask to the lower lens.

(c) The raster is repositioned by adjusting the shift voltage.

(d) The rotary shutter is readjusted so that it changes from 24 slots of half frame height which are required for normal telecine operation, to 12 slots of film frame height. This is necessary because in its 24 slot form it would obscure part of the image derived from a 4 : 3 aspect ratio raster.

All these four operations are adjusted instantly by one switch.

The electronic equipment which forms part of this installation is naturally of special design. It commences with the multiplier cell which is an 11-stage assembly having venetian blind dynodes, the gain is of the order of 10^7 and the output is controllable by adjusting the H.T. supply which, therefore, becomes the main video level control of the system. Variable gamma correction is available and it is usual to operate the circuit in a state where the gamma is in the region of 0.4. Clamping is at line frequency with special arrangements for the case where negative film is being produced, a situation which causes a peak white signal to be generated during the line black-out period.

The equipment is assembled in two channels, each controlled by one operator, but for the continuous performance of a long feature film the change-over from one machine to another can be accomplished from one control desk. The illustration on our cover shows the operator at his desk and a picture monitor is displaying an image of Miss Sylvia Peters, one of the announcers of the BBC Television Service.

Cintel Installation

In this system there is similarly a close control of synchronism between the tractor mechanism and the frame pulses of the television system. The traction mechanism is fundamentally driven by a three-phase induction motor with squirrel cage rotor provided with power from the mains. In series with the stator windings are the primary windings of transformers and the secondaries are associated with the anode cathode paths of the triodes. Thus the power input to the motor depends on the standing grid voltage of the three valves. In addition, the traction mechanism drives a small 50-cycle generator which is compared in phase with the synchronising signals of the television system, the difference frequency being used to control the aforementioned triodes. This synchronising system is so adjusted that when the machine is stationary, maximum power will be available for starting. It is thus possible to obtain a transmittable picture within five seconds of pressing the starting button.

The design of sprockets has received very great care, and recognition has been made of the fact that the sprockets are of two separate kinds:—

(1) Feed sprockets which drive the film; and

(2) Hold-back sprockets which are driven by the film.

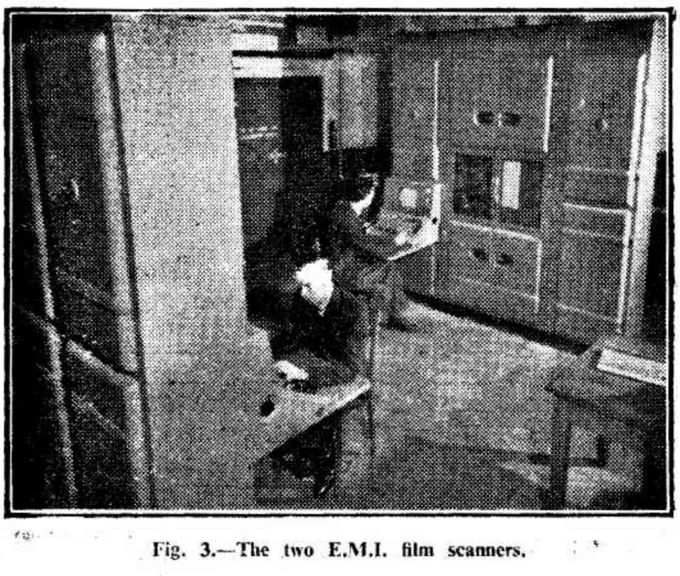


Fig. 3.—The two E.M.I. film scanners.

The feed sprockets are designed for unshrunk film, i.e., with a comparatively slightly increased diameter, while the hold-back sprockets are correspondingly designed for film which has shrunk about $1\frac{1}{2}$ per cent. so that they should have a slightly decreased diameter.

Correct for film shrinkage is accomplished mechanically by adjusting the distance between the two lenses. A film shrinkage of 1 per cent. requires a relative lens movement of approximately, $\frac{3}{1000}$in. A loop of film about $15\frac{1}{2}$in. long is provided when loading the film and is lightly tensioned by a spring-loaded roller. Variations in the length of the loop resulting from shrinkage will move the roller, which movement is transferred to the lenses. The two lenses are of the Speed Panchro type, having an aperture of f/3. They are corrected and bloomed for the blue end of the spectrum since the light from the cathode-ray tube is in the blue region. The image spacing which would be produced by the lenses alone would be too great. Two mirrors and a prism are interposed between the lenses and the film in order to place the images in the desired positions.

An elaborate mechanical filter is used to control the short-term stability of the film velocity and it incorporates heavy flywheels driven by the film. There is relative slipping during the starting period of rather less than five seconds, but no slipping thereafter. In normal running, therefore, the flywheels increase the inertia of the film by a substantial amount.

The electronic circuits are elaborate. The photo cell multiplier has a single stage and the first amplifier is therefore designed with some care as regards amplifier noise. The video bandwidth of the system is level to 2.8 Mc/s., above which frequency a sharp cut-off is provided. Such a characteristic, of course, necessitates phase correction. Another important feature of the circuit is the provision of correction for the after-glow of the tube. It is, of course, inevitable that the spot of light generated on the cathode-ray tube will not die away instantaneously; it is not even negligible after one line period, or approximately 100 microseconds. The effect is equivalent to that which would be produced if the signal had been passed through a low pass filter, and the upper frequency loss must be equalised. It is only fair to say that phosphors possessing considerably reduced after-glow periods are now available, and an early opportunity will be taken to modify the installation to employ a tube having more modern after-glow characteristics. Gamma correction is applied, but is not at the moment variable, being fixed at the value of 0.4.

The installation was designed to be a high-grade telecine system for absolutely standard film and was not intended to have any auxiliary features. It does not provide for the televising of a stationary film, 16 mm. film, negative film or magnetic sound tracks, but is shortly to be modified so as to provide the last two of these features. Control of both machines is effected from one desk, as will be clear from Figure 2. Figure 4 illustrates the technical layout of the equipment in more detail.

These two installations will eventually be reinstalled at the BBC's new television studio centre at Lime Grove, Shepherds Bush, London, as part of the wholesale transference of studio and associated activities to Lime Grove. The move will take place in two stages, the E.M.I. equipment being set up there in March, 1953, and the Cintel installation about a year later.

Fig. 4.—Close-up of one of the Cintel scanners.

Television in Japan

ON February 1st Japan opened its first public television service, when the Government-owned Japanese Broadcasting Corporation began operating seven television relay stations linking Tokyo with Osaka—a distance of about 300 miles.

At that date it was estimated that there were about 3,000 to 4,000 television sets installed in the area, practically all of American make as Japanese sets were not expected off the production lines in any numbers until April. The Ministry of International Trade and Industry estimates that by the end of this year the number of TV. sets will increase to about 25,000, while the half-million mark will be reached by 1956.

The present price of sets in Japan is about £110 for a 10in. screen and £200 or more for a 17in. screen or larger. A monthly subscription fee of 4s. is charged for the service. In order to popularise television Japanese manufacturers are being recommended to build smaller sets with screens of 7in. to 10in. which should be marketed at £60 to £90 at first and in time will be cut to £30.

The television fever hit Tokyo in earnest with the start of the service and departmental stores and radio shops quickly cleared their stocks. In Kawasaki City one enterprising promotor installed a 20in. screen in a theatre and charged 30s. admission to view. Some constructors are using small home-built receivers assembled at a cost of £13 for components.

Four hours of programmes are transmitted daily, from noon to 1.30 p.m. and from 6 p.m. to 9 p.m. The close down at 9 p.m. being in order that "it will not interfere with the children's sleep"!

Last summer Mr. Tetsuro Furugaki, the president of the Japanese Broadcasting Corporation, visited the U.S.A. to study television technique there and he engaged the services of an American expert as consultant to the corporation.

The programmes include sporting events, such as Sumo (Japanese style wrestling), puppets and other classical arts, ballet, variety shows, dressmaking courses, Japanese versions of panel groups such as "Twenty Questions" and "Information Please," and newsreels.

A commercial organisation has a licence to carry out experimental television transmissions, but its transmitting facilities are still under construction.

ALPHA RADIO SUPPLY CO.

SPEAKERS

Loudspeakers : Elac 2½in. square type, 15 ohm speech coil, type 2/02, **11/6** ea. ; Plessey 3in. round type for Personnel Portables, 3 ohm, **12/9** ea. ; Elac 3½in. square type, 3/09, 3 ohm, **13/6** ea. ; Goodman's 5in. round type, 2 to 3 ohm, **13/6** ea. ; Plessey 5in. round type, 2 to 3 ohm, **13/6** ea. ; Waterhouse 5in. round type, 2 to 3 ohm, **13/6** ea. ; Lectrona 5in round type, 2 to 3 ohm, **13/6** ea. ; Plessey 6½in. lightweight, 2 to 3 ohm, **14/6** ea. ; Goodman's 6½in. lightweight, 2 to 3 ohm, **16/9** ea. ; Elac 6½in. type 6/19 2 to 3 ohm, **14/9** ea. ; Truvox 6½in. standard with output transformer, **16/6** ea. ; Truvox 6½in. wafer, 1½in. deep, **25/-** ea. ; Plessey 8in. lightweight, 2 to 3 ohm, **16/6** ea. ; Elac 8in. type 8/37, 2 to 3 ohm, **17/6** ea. ; Plessey 10in. lightweight, 2 to 3 ohm, **19/6** ea. ; Rola 10in., 2 to 3 ohm, **32/6** ea. ; Truvox 12in. heavy duty model, 15 ohm speech coil, **£6/6/-** each.

SLEEVING (INSULATED)

Bright colours. Regret it has to be our choice at these special prices. 1 mm., **1/-** per doz. yds. ; 2 mm., **2/-** per doz. yds. ; 2½ mm., high voltage type, black only, **2½d.** yd.

KNOBS

Engraved Knobs, 1½in. dia. for ¼in. spindles. Available Cream or Brown, as follows : "Focus," "Contrast," "Brilliance," "Brightness," "Brilliance On/Off," "Wavechange," "On/Off," "Tuning," "Volume," "SML Gram," "Tone," "Vol. On/Off," "Radio-gram," "Bass," "Treble," "Record-Play." Also Plain Knobs to match, **1/6** ea.

3 WAY MOUNTING TYPE MAINS TRANSFORMERS

MT1
Primary : 200-220-240v. Secondarys : 250-0-250v. 80 M/A 0-4v. 5 amp. 6.3v. 4 amp. 0-4-5v. 2 amp., **17/6** each

MT2
Primary : 200-220-240v. Secondarys : 350-0-350v. 80 M/A 0-4v. 5 amp. 6.3v. 4 amp. 0-4-5v. 2 amp., **17/6** each.

MT2A
Primary : 200-230-250v. Secondarys : 350-0-350v. 80 M/A 6.3v. 4 amp. 5v. 2 amp., **16/-** each.

AUTO TRANSFORMER

0-10-120-200-230-250v. 100 watts, **17/6** each.

MT3
Primary : 200-220-240v. Secondary : 30v. 2 amps. Taps at 3v., 4v., 5v., 6v., 8v., 9v., 10v., 12v., 15v., 18v., 20v., 24v., **17/6** each.

EX EQUIPMENT TRANSFORMER

Secondarys : 350-0-350v. 80 M/A 2, 6.3v. Windings 4 amps. 5v. 2 amps. Tapped Primary Surface Mounting. Waxed Dipped. All connections to Tag Panel on top, **19/6** each.

Postage on all above, **1/6**

"WHANDA" WIRE AND CABLE STRIPPER, 5/- each.

"COLLARO" RECORDING MOTORS

Left and Right Hand Drive, **63/-** per pair.

COLLARO AC37 MOTOR

Variable speed 0-100 r.p.m. 100/130 v., 200/250 v., spindle 1½in. long, ¼in. dia., 4 pole shaded pole, **32/6** ea., post 1/6.
As above, complete with 10in. EMI type turntable, **46/-** ea., post 1/6.

PANELS

Mixed Resistor and Condenser Panel. 36 items. All values ... ... **2/6** each
Resistor Panel 15 Resistors. Some wire wound on a panel. 10in. x 3½in. ... ... **1/9** each
Paxolin Sheet. 6in. x 6in. x 1/32in. ... ... **1/-** each

VALVES

Guaranteed new and boxed.
Majority in makers' original cartons.

OZ4	7/-
1A5GT	8/-
1C5GT	8/6
1G6GT	7/-
1L4	8/-
1LD5	6/9
1R5	8/6
1S4 (DL91)	8/6
1S5 (DAF91)	8/6
1T4 (DF91)	8/6
1U5	10/6
215SG	4/-
2X2	5/6
3A4	9/-
3D6	8/6
3S4 (DL92)	10/-
3V4	9/-
4D1	4/-
42	8/6
5U4G	9/-
5Y3G/GT	8/6
5Z4G	9/-
5Z4M	9/-
6AC7	6/6
6A8	10/-
6B4	8/-
6B8	7/-
6C4	8/6
6C5	7/9
6C6	7/6
6D6	7/6
6F6G (KT63)	8/-
6F6M	9/-
6G6G	7/-
6H6	4/6
6J5GT	5/6
6J7G	6/6
6J5M	6/-
6K6GT	8/-
6K7G/GT	6/6
6K8G	10/6
6L6	10/6
6L7	7/6
6N7	7/9
6Q7G/GT	10/-
6SA7GT	9/-
6SG7	9/-

6SH7	6/-
6SK7	7/-
6SL7	9/-
6SN7GT	10/6
6SQ7	9/6
6V6G/GT	8/6
6V6M	9/-
6X5GT	7/9
6AM6(EF91)	9/6
6AL5 (EB91)	8/6
7B7	8/6
7C5	8/6
7C6	8/6
7Y4	8/6
30	9/-
807	10/-
8D2	3/-
954	2/-
955	5/-
956	3/6
9D2	3/-
12K8	9/6
12SH7	5/6
12SK7	7/6
15D2	4/-
9001	6/6
9002	6/6
9003	6/6
12A6	5/9
12C8	9/6
12H6	5/-
25A6G	9/6
35Z4GT	9/6
35L6GT	10/-
50L6GT	9/-
AC6PEN	5/6
CV188(E1436)	3/9
DH77 (6AT6)	8/6
EBC41	11/6
EL41	11/6
FW4/500	9/6
HL23DD	8/6
KT33C	11/6
KT61	10/6
KTW61	8/9
KTZ41	6/9
MH4	5/6
UCH42	11/6
12AT7	10/-
12J5	6/-

12K7	9/6
12Q7	9/6
12SJ7	7/9
12SQ7	10/-
12SR7	7/9
12SG7	5/6
EBC3	10/-
MS/PEN	5/-
6BE6	11/6
PEN25	8/6
PEN46	8/6
PEN220A	4/9
PL82	11/6
PM202	4/6
TP25	8/6
UCH42	11/6
UL41	10/6
UY41	10/-
VR53 (EF39)	7/6
VR54 (EB34)	3/6
VR55 (EBC33)	8/-
VR56 (EF36)	7/6
VR57 (EK32)	8/-
VR65 (SP61)	4/-
VR65A (SP41)	3/6
VR91 (EF50)	6/6
VR91 (EF50) Sylvania	8/-
VR92 (EA50)	2/6
VR116 (V872)	4/-
VR119 (DDL4)	4/-
VR123 (EF8)	6/6
VR136	7/-
VR137	5/-
VT52 (EL32)	8/-
VP23	8/-
VU39 (MU12/14)	9/-
VU111 (V1907)	3/6
VU120A	3/6
X18	9/-
Y63	9/-

ENAMELLED COPPER WIRE

All 4oz. reels.

S.W.G.	Price	S.W.G.	Price
16	1/11	30	3/1
18	2/1	32	3/3
20	2/3	34	3/5
22	2/5	36	3/7
24	2/7	38	3/11
26	2/9	40	4/2
28	2/11	14	1/9

CONDENSERS

Dubilier BR 850, 8 mfd. 500 v., **2/9** ea. ; Dubilier BR 1650, 16 mfd. 500 v., **3/6** ea. ; Dubilier BR 501A, 50 mfd. 12 v., **1/9** ea. ; Dubilier BR 505, 50 mfd. 50 v., **2/3** ea. Metal Tubular, with wire ends. .1 mfd. 350 v., Sprague, **9d.** ea. ; .01 mfd. 1,000 v., Sprague, **9d.** ea. ; .001 mfd. 1,000 v., Sprague, **4½d.** ea. ; .02 mfd. 750 v., Sprague, **9d.** ea. ; .05 mfd. 350 v. T.C.C., **9d.** ea. ; .5 mfd. 350 v. T.C.C., **6d.** ea. ; .01 mfd. 750 v. T.C.C., **9d.** ea. ; .05 mfd. 500 v. T.C.C. Metalmite, **1/-** ea.

CONDENSERS SILVER MICA

PF Sizes available.

1	18	47	190	500
2	20	50	200	610
3	25	58	246	680
6	27	68	300	750
7.5	30	100	330	1,000
8	33	120	360	1,200
9	35	150	370	1,600
10	39	175	375	10,000
15	45	180	470	

All by well known makers, 3½d. each.

CERAMICONS BY ERIE

5. PF.	12 PF.	50 PF.
6.8 PF.	39 PF.	190 PF.

All **6d.** each.

CONDENSERS MOULDED MICA

.0001	.0002	.0003
.0004	.0008	.00027
.0005	.001	.002
.003	.005	.01
50 PF.	20 PF.	

All 4½d. each.

CONDENSERS HIGH VOLTAGE

.01 mfd. 5kv. Can Type ... ... **1/6** each
.02 mfd. 8 kv. Can Type ... **2/6** each
.1 mfd. 1,000v. Moulded Bakelite Case ... ... **1/-** each
.01 mfd. 4kv. Moulded Bakelite Case ... ... **1/6** each
.25 mfd. 800v. Moulded Bakelite Case ... ... **1/3** each
.001 mfd. 4kv. Moulded Bakelite Case ... ... **1/-** each

TINNED COPPER WIRE

24 s.w.g., **1/6** per ½ lb.

METAL RECTIFIERS

L.T. 12v. ½ amp. ... ... **1/6** each
L.T. 12 volt 1 amp. ... ... **4/9** each
L.T. 12 volt 5 amp. ... ... **18/6** each
H.T. 250v. 45 M/A ... ... **6/9** each
14D36 for Viewmaster. Retail **11/6** each
Our Price **8/7** each
H.T. 250 v. 75 M/A ... ... **7/6** each
L.T. 2 to 6v. 1 amp. ... ... **3/-** each
RM1 S.T.C. 125v. 60 M/A ... **4/-** each
RM2 S.T.C. 125v. 100 M/A ... **4/9** each
RM4 S.T.C. ... ... **16/-** each
L.T. S.T.C. Half Wave Selenium 16.5 volts 300 M/A ... **3/-** each

SINGLE P.V.C. COVERED WIRE

Various colours : Red, Blue, White, Green, Yellow, etc. **5/6** per 100 yds.

INDICATOR UNIT TYPE 6

Brand new with VCR97 tube, EF50 valves, wire wound col. controls, resistors and condensers, **72/6**, carriage 7/6.

INDICATOR UNIT TYPE 233

Complete with VCR97 and 10 Mazda valves, **70/-** ea., carriage 7/6.

TERMS : Cash with order or C.O.D. **MAIL ORDER ONLY.** Full Illustrated List available ; send 6d. in stamps.
Postage, 6d. to 10/- ; 1/- to 20/- ; 1/6 to £2 ; 2/- to £5. Minimum C.O.D. and postage charge 2/3.

5/6 VINCES CHAMBERS, VICTORIA SQUARE, LEEDS, 1

Pages from a TELEVISION ENGINEERS Notebook

4.—FOLDED DIPOLES

THE folded dipole is frequently encountered in practice, and quite a lot has been written about it in various technical magazines. Very little has appeared, however, concerning the design of such an aerial to give a particular impedance at its centre or feed-point, most articles being content to state that the "normal" impedance is four times that of a simple dipole, i.e., about 280 ohms. When a wire is bent (as shown in Fig. 1), a current I flows at the feed-point and also, in the same phase, in the closed half of the system. If the two halves are put so close together that at all points in space their radiations effectively add together, the field everywhere is doubled and the power is multiplied by four. But as the radiation resistance of a dipole aerial is proportional to the radiated power, the resistance of the folded dipole is four times that of the simple dipole.

When such a folded dipole is used with a reflector and director, the impedance is reduced below this theoretical value of some 280 ohms, and it is not unusual so to arrange the spacing of the other elements, especially when three or more are used, that a good match to 70 ohms cable can be made directly from the centre of the dipole. This method is not always satisfactory, however, particularly where only an additional reflector is involved, and it is desirable to be able to change the impedance of a dipole without the introduction of other elements.

Varying the Impedance

The impedance of a folded dipole can be modified by making the vertical elements of unequal diameters and also by adjusting the spacing between them ; and it is this aspect of the matter that normally received so little attention. The change in impedance that results in this way is brought about by the fact that the aerial current flow does not divide equally between the two conductors as was assumed in the above simple analysis. To calculate for other impedances when different conductor diameters are assumed, a knowledge of normal parallel-wire transmission line theory is necessary. This subject has been thoroughly covered in other articles, and it is not proposed to cover this ground again ; however, it is only necessary for the present purpose to state the following : the characteristic impedance Z_0 of a parallel-wire line made up of two equal wires of diameter d, spaced distance D apart (both d and D being in the same units) and separated by air (Fig 2) is

$$Z_0 = 277 \log \frac{2D}{d}$$

(the logarithm being common). Thus, for wires 0.1in. in diameter, spaced 0.25in. between centres, the characteristic impedance is

$$Z_0 = 277 \log \frac{0.5}{0.1}$$

$$= 277 \log 5 = \mathbf{190\ ohms.}$$

Now this relationship can be applied to the design of a folded dipole in the following way.

The impedance R_0 of a folded dipole is given to a close approximation by the equation

$$R_0 = 70 \left[1 + \frac{Z_1}{Z_2}\right]^2$$

where Z_1 is the characteristic impedance of a parallel-wire line made up of two conductors *having diameters equal to the diameter of the fed conductor* of the dipole, and *spaced apart by the same distance* as the two conductors of the dipole ; and Z_2 is the characteristic impedance of a parallel-wire line similarly made up and spaced, but of conductors *having a diameter equal to the diameter of the continuous section* of the dipole. The constant term 70 in the equation is, of course, the normal value of impedance for the simple dipole.

The above statement may be a little difficult to grasp at the first reading, but it is perfectly simple to use once it is understood. Consider the folded dipole of Fig. 3, for example ; here the fed conductor is ¾in. diameter, the

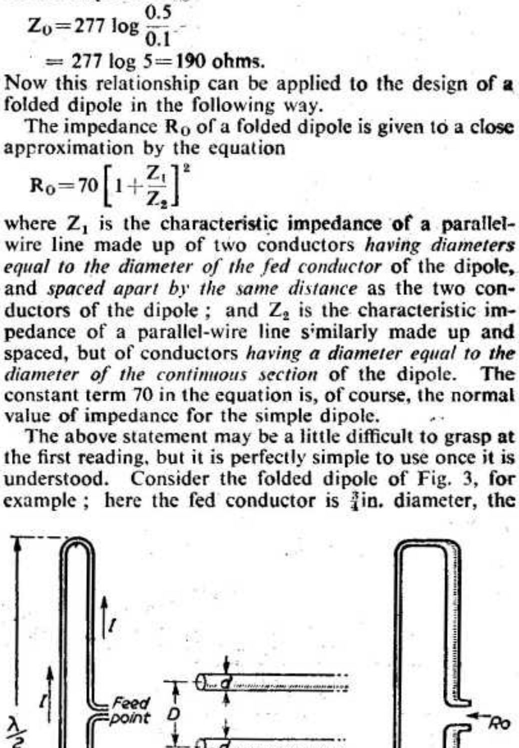


Fig. 1.—Current flow in the folded dipole when the conductor diameters are equal.

Fig. 2.—Parallel-wire line dimensions necessary to calculate Zo.

Fig. 3.—A folded dipole whose impedance has to be calculated.

continuous conductor is $\frac{1}{4}$in. diameter, and the spacing, centre to centre, is 3in. Required, the impedance of the dipole.

First of all, work out Z_1 which is the characteristic impedance of a line made up of two $\frac{3}{4}$in. diameter wires spaced 3in. apart, that is

$$Z_1 = 277 \log \frac{6}{\frac{3}{4}}$$

$$= 277 \log 8 = 250 \text{ ohms.}$$

Similarly, work out Z_2 which is the characteristic impedance of a line made up of two $\frac{1}{4}$in. diameter wires spaced 3in. apart, that is

$$Z_2 = 277 \log \frac{6}{\frac{1}{4}}$$

$$= 277 \log 24 = 380 \text{ ohms.}$$

Inserting these values in the main equation gives

$$R_O = 70\left[1 + \frac{250}{380}\right]^2$$

$$= 190 \text{ ohms}$$

to slide-rule accuracy. This is the impedance of the folded dipole required.

We note from the formula that $Z_1/Z_2 = 1$ when the conductors are of equal diameter, and R_O is then $70 \times 4 =$ 280 ohms. It is of interest to note that the spacing has no effect on this particular result, although a small distance is chosen in practice for the reason already outlined. R_O will only be less than 280 ohms when Z_1 is less than Z_2, that is, when the fed conductor is of greater diameter than the continuous section. When this construction is reversed, the impedance becomes greater than 280 ohms.

The effect of changes in the spacing has not such a marked effect on the impedance of the folded dipole as has changes in the element diameters. In a practical design, it is advisable to keep the conductor spacing reasonably small, say, below 4in. or so, and the vertical sections are then strapped across at top and bottom with suitable conducting clamps. The continuous element may be fixed to the cross-arm without insulation, thus easing the problem of mechanical strength.

Our "Argus" Televisor

Voltage Readings

IN response to repeated requests, we give below a list of the main voltage readings of this televisor. It should be noted that these readings are *average* values; actual readings will vary with the type of power equipment used, and even more than this they will vary with the type of meter used.

It will be appreciated that a cheap meter will take quite a large current to operate the needle, and this will be reflected in the voltage reading obtained; the higher the meter current the lower the voltage at the point of test.

For this reason we have endeavoured to strike a compromise and have given readings obtained with an inexpensive Avominor. On the higher voltages your readings may be plus or minus 10 volts from those given, provided the H.T. rail voltages are similar.

Vision Receiver

	H.T. rail 240 v.			
	Anode	Screen	Cathode	
V1	180	180	1.1	
V2	170	170	0.4	
V3	200	200	1.6	(contrast at max.)
V4	210	210	1.6	
V6	200	240	0.8	

Sound Receiver

	H.T. rail 210 v.			
	Anode	Screen	Cathode	
V7	200	200	2.0	
V8	180	180	0.4	(sensitivity at max.)
V10	15	15	0.7	
V11	205	210	10	

Time-base

	H.T. rail 425 v.			H.T. rail 425 v.	
	Anode	Screen		Anode	Screen
V13	380	380	V16	80	260
V14	340	20	V17	160	240
V15	130	260	V18	60	260

O.B. Unit for the West

THE West of England and Wales are now able to contribute outside broadcast programmes to the television service by means of a new mobile unit which will be shared between these two BBC regions. The unit will be based on Whitchurch, near Bristol, and will enable events and ceremonies taking place in Wales and the West to be brought within range of the television cameras and broadcast from the national television network.

The technical equipment is installed in an articulated vehicle fitted out as a control room to accommodate the engineers, producer and other members of the production team.

The equipment is designed to handle the outputs of three television cameras which are linked to it by flexible cables. These cables may be up to 1,000ft. long, giving the cameras a wide field of action. The cameras are fitted with Image Orthicon pick-up tubes which, even under very poor lighting conditions, are capable of producing a satisfactory picture. Each camera is equipped with a four-lens turret into which can be fitted lenses of different focal lengths. The turret can be rotated to bring the required lens into use and a particular feature of interest is that the rotation of the turret, and also the focus and iris adjustments for the camera, can all be remotely operated from the control room if desired.

The equipment directly associated with each camera, which includes amplifiers, power supplies and waveform generators, is mounted in separate, specially designed frameworks. Vision monitors are provided so that the production team can see the picture being produced by each camera and also the picture being sent out from the control room. Changes from one camera to another are made by the producer by means of a mixer panel. A second mixer panel enables the various microphones to be faded in and out as required. Talk-back facilities are provided enabling the producer to give instructions to the commentators, cameramen and sound crews. Although the equipment is normally used in the vehicle it can be removed and set up elsewhere.

The cameras and the associated equipment in the mobile unit were manufactured by Pye, Ltd., of Cambridge.

A BEGINNER'S RECEIVER—2

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

By B. L. Morley

(*Continued from page* 462 *March* 1953 *issue*)

THE spot limiter employs a crystal diode B.T.H. type CG6, and the limiting level is set by the operation of the bias control VRS, which can be mounted directly on the chassis base.

Should the reader desire to use one of the cheaper magnetic tubes which have cathode-heater shorts, then grid modulation must be employed and the heater of the tube fed from a separate source of supply.

The Sound Receiver

Input to the sound receiver is obtained from a coupling from L7 in the mixer anode circuit. A coaxial cable link is used to carry the signal to the primary of L16. It will be noted that the secondary of L16 is not directly earthed except via the switch S2 (Fig. 8). This switch acts as a simple local/distant switch which can be used to vary the gain of the sound section to avoid overloading when signal input is high.

V10 is normally biased by the cathode resistor, but a small amount of positive bias is introduced into the grid circuit from the potentiometer network used in the noise-limiter section. Under normal conditions, the bias is not effective because the voltage is shorted to earth via S2 (local position). However, when some extra gain is required, S2 is opened and the overall bias on V10 is reduced and its gain increased.

The same effect could, of course, have been obtained by making the bias resistor of V10 variable and labelling it "Sound Sensitivity," but this would have involved another potentiometer, while the method which has actually been used requires expenditure on a 1 MΩ ½ w. resistor only; the switch is already available in the unit.

The output of V10 is fed to the second sound I.F. valve V11 via the tuned grid circuit and the output from this valve is fed to the detector valve, an EA50. Noise limiting is effected by the crystal diode, a B.T.H. CG6, and the output is taken to the first L.F. valve via the potentiometer VR2 which forms the volume-control.

This control contains the on/off switch, though the constructor may, if he desires to save on the cost, use an ordinary potentiometer and employ another switch (which will be made surplus from the unit) for switching on and off.

V13 is an EF50 strapped as a triode; this valve was used simply because it was already available and the valveholder was surplus to the unit. It is at this point that the constructor may depart from the specified design, if he wishes, by employing any suitable valve he may have to hand such as an EF39. The circuit will, of course, require modification according to the valve used; the beginner is strongly urged to adhere to the specification.

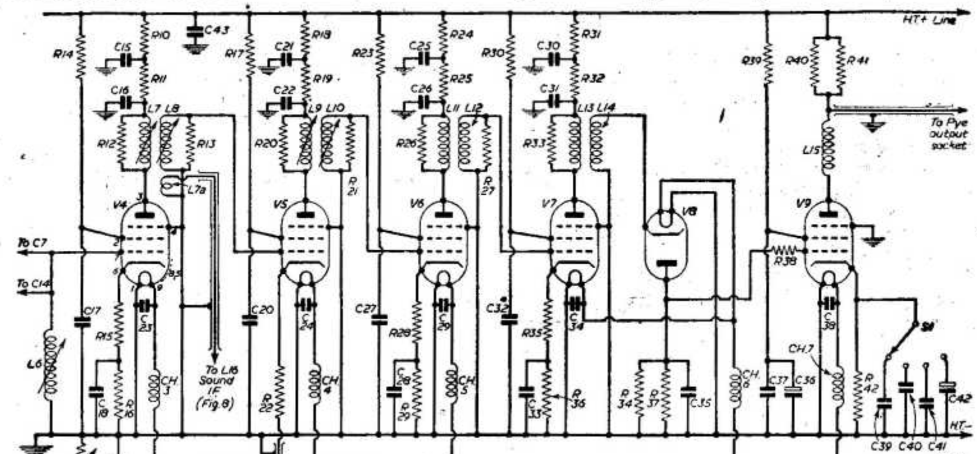
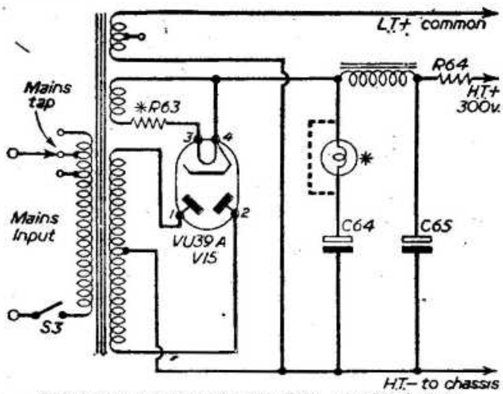


Fig. 6.—Circuit of vision receiver.

LIST OF COMPONENTS FOR FIG. 6.

R10—1 K Ω	R21—10 K Ω	R32—1 K Ω	C15—500 pF	C27—500 pF	C38—1,000 pF
R11—1 K Ω	R22—18 Ω	R33—10 K Ω	C16—500 pF	C28—500 pF	C39—500 pF
R12—18 K Ω	R23—1 K Ω	R34—100 K Ω	C17—500 pF	C29—500 pF	C40—0.01 μF
R13—22 K Ω	R24—1 K Ω	R35—18 Ω	C18—500 pF	C30—500 pF	C41—0.25 μF
R14—100 K Ω	R25—1 K Ω	R36—150 Ω	C19—500 pF	C31—500 pF	C42—50 μF 25 v. wkg.
R15—18 Ω	R26—10 K Ω	R37—5.6 KΩ	C20—1,000 pF	C32—500 pF	
R16—150 Ω	R27—10 K Ω	R38—390 Ω	C21—1,000 pF	C33—500 pF	C43—1,000 pF
R17—1 K Ω	R28—18 Ω	R39—1 K Ω	C22—500 pF	C34—500 pF	VR1—5 K Ω
R18—1 K Ω	R29—150 Ω	R40—10 K Ω 2 w.	C23—500 pF	C35—20 pF	V4. 5. 6.7. 9—EF5
R19—1 K Ω	R30—1 K Ω	R41—10 K Ω 2 w.	C24—500 pF	C36—8 μF 250 v. wkg.	V8—EA50
R20—10 K Ω	R31—1 K Ω	R42—68 Ω	C25—500 pF		(Note: L7-L15 and CH.3-CH.7 are *in situ*.)
(All R's ½-watt unless stated otherwise.)			C26—500 pF	C37—1,000 pF	

The output valve is a 6V6 and the output transformer is mounted on the chassis. If it is intended to use a loudspeaker which has the transformer incorporated in it, it is wise to take the transformer from the speaker and mount it in the chassis; the reason for this is that should the loudspeaker become accidentally disconnected while the circuit is working, then extremely heavy current will flow in the auxiliary grid of the 6V6, thus damaging the valve. If the transformer is wired permanently in the circuit then this cannot happen.



* R63 is not required if type 5U4G rectifier is used.
Lamp can be omitted if desired

Fig. 9.—Circuit of power pack.

If a reduction in the high-note response is required to reduce the "hiss" or to make the tone more mellow, an 0.005 μF condenser can be connected across the primary of the output transformer.

The Power Supply

The main difficulty in the design of the power supply was to find a transformer and smoothing choke which was easily available commercially and which would fit into the limited space available. Such a transformer and choke were eventually unearthed, being found available from Clydesdale's Supply Co.

One snag was the heater supply for the rectifier valve and a transformer which would meet all the requirements supplying 6.3 v. for the valve heaters and 4 v. for the VU39(A) rectifier was not available. The nearest approach was a 5 v. rectifier heater supply.

At the time of going to press advice has been received from Clydsdale's that a new transformer, as specified, is available with a 5 v. rectifier heater tapped at 4 v. This will overcome the problem of using the VU39(A).

In the prototype, the VU39 was not used, rectification being obtained with a 5U4G which was to hand. However, for the sake of economy there are two methods by which the VU39 can be employed with the transformer specified.

The simplest method is to insert a dropping resistor in series with the heater supply. A value of $\frac{1}{2}$ Ω is suitable, but it should be remembered that the resistance must carry nearly 3 w.

A suitable resistance for this purpose was found on the ex-Govt. market. It is a 2 Ω resistance on a mica former, code number 10W/8176. The wire was unwound

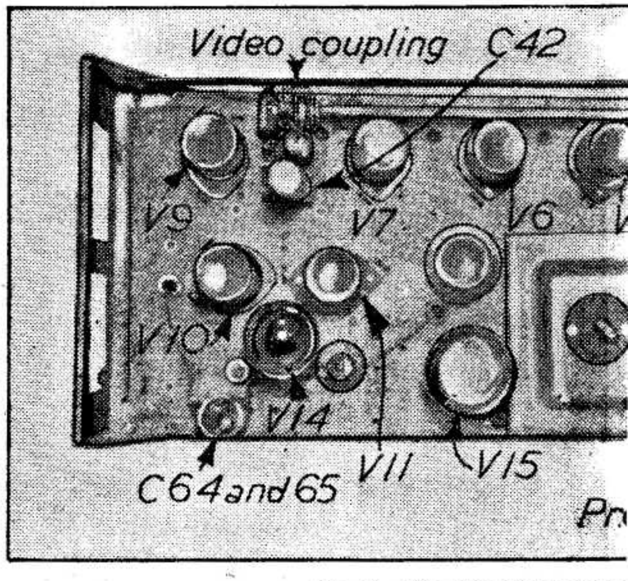


Fig. 12.—Plan view of the conver

from the former and three-quarters of the total length of the wire was cut off, the remaining quarter length ($=\frac{1}{2}$ Ω) being wound back on the former.

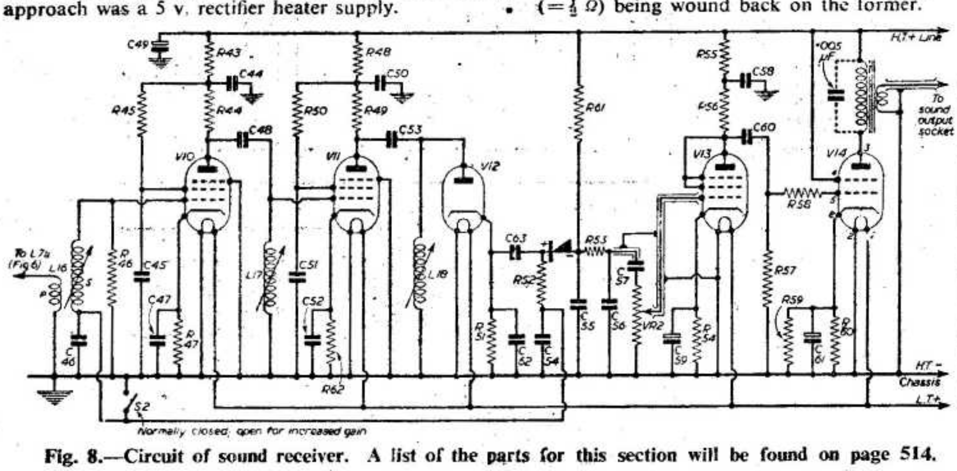


Fig. 8.—Circuit of sound receiver. A list of the parts for this section will be found on page 514.

LIST OF PARTS F

R63—0.5 Ω 3 w.
R64—350 Ω 10 w.
C64—16 μF 500 v.
C65—16 μF 500 v.

SMOOTHING CH
Type W/B104W.

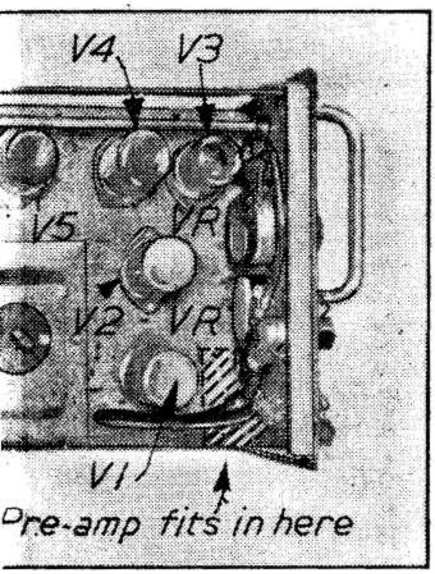
MAINS TRANSFOR
350-0-350—150 mA
6.3 volts—4.5 amps.
5 volts—3 amps.

Another method is to take the 5 v. windings from the transformer, carefully counting the number of turns, and then multiplying the total number of turns by 4/5. The result gives the number of turns which must be wound back on to the transformer. The biggest snag with this method is that the normal 6.3 v. windings will have to be taken off first and rewound after.

The small bulb adjacent to the smoothing condenser seen in the photograph is merely one of the author's foibles and can be ignored if desired. It is simply a 6 v. dial light bulb inserted between the H.T. rail and the first smoothing condenser C64. It was used as a safeguard for the 5U4G in the event of a complete breakdown of the condenser during the experimental stage.

R64 is a 350 Ω resistor, minimum rating 10 w.

Fig. 9 shows the complete circuit.



nverted unit.

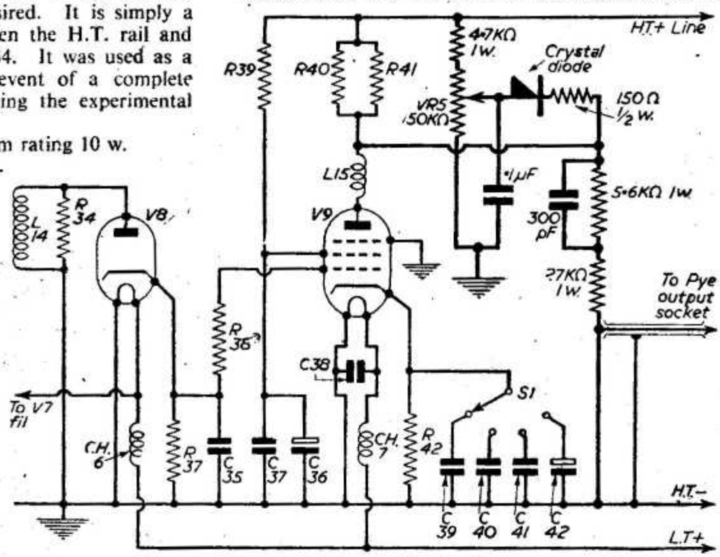


Fig. 7.—Circuit of the modified video stage.

Constructional Details

Before actual construction is undertaken some dismantling must be done. In order to assist the novice, two photographs have been prepared, the first one showing the underside of the chassis as bought, and the second one as when rewired. (Figs. 10 and 11.) If used in conjunction with the plans no difficulty should be experienced in arranging the layout. Fig. 12 shows the layout on top of the chassis.

For the novice a detailed step-by-step analysis is given but the more experienced constructor can skip these sections.

Construction has been divided into sections and the sequence of operations should be followed as some components are difficult to get at, at a later stage.

Preparing the Unit. Section I

For the advanced worker : See Figs. 1 and 10. Remove all valves ; remove sub-chassis on top of main chassis and dismantle components ; remove high-cycle transformers and dropping resistors ; remove E.H.T. condenser and VU111 valveholder ; remove paper smooth-

S FOR FIG. 9

Hunts
Capacitor
HOKE :
ORMER :
mA.
mps.

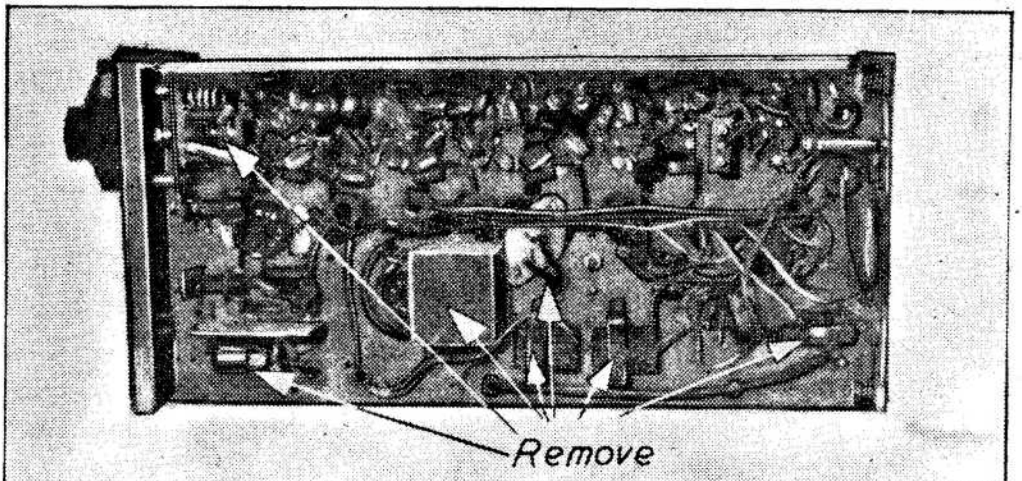


Fig. 10.—View of the underside of the unconverted chassis.

ing condenser. Under Chassis: Remove 1+1 μF block condenser; remove small chokes; remove all unwanted components around V1, V2, V3, V10, V11 valv-eholders. Remove neon bulb; remove ganged condenser; take windings from the horizontally-mounted coils adjacent to the front panel; remove EA50 holder from back of chassis and fit between V11 and V13 (this becomes V12); fit EF50 valve-holder removed from sub-chassis to V13 position; cut chassis to accommodate drop-through portion of mains transformer and fit the transformer; remove all unwanted components from the front panel; do not touch any part of the vision receiver except for the removal of components associated with the video coupling switch; the 50 μF condenser should be retained in its present position; now move to Section II.

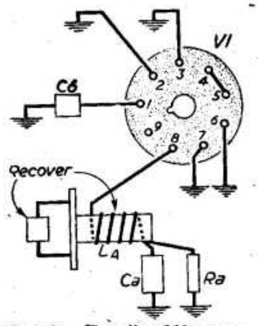


Fig. 13.—Details of VI stage.

For the novice. Remove: all valves; spikes at rear of chassis; high cycle transformers and wiring; coaxial cable and Pye plug going to front panel; second coax cable; wiring from front panel, top of chassis; fixtures on front panel holding the 5 KΩ control; multipoint sockets: 0.5 μF condenser CA; 0.01 μF condenser CB; complete sub-chassis; 1+1μF. under chassis. Now recover red wire on centre of video coupling switch; recover white wire from second tag and reconnect it to the centre tag of the switch; recover black wire going from last tag on top of switch to tag 3 on adjacent tag strip; run new wire from last tag on switch to tag 2 on tag strip.

Underneath the chassis: Remove ceramic valveholder and wiring; L.F. chokes; tuning knob and engraved plate (this gives access to tuning condenser). Unscrew moving condenser from its mount by taking off the coupling piece and undoing three screws at the front; leave the coil but disconnect other wires attached to the condenser.

LIST OF PARTS FOR FIG. 8

R43—1 K Ω	R58—330 Ω	C51—500 pF
R44—5.6 K Ω	R59—470 Ω	C52—500 pF
R45—1 K Ω	R60—470 Ω	C53—100 pF
R46—1 M Ω	R61—3 M Ω (or	C54—0.05 μF
R47—180 Ω	2.2 + 1.0 M Ω)	C55—300 pF
R48—1.8 K Ω	R62—180 Ω	C56—0.001 μF
R49—8.2 K Ω	(All ½-watt)	C57—0.1 μF
		C58—0.1 μF
R50—1 K Ω	C44—500 pF	C59—25 μF 25v.
R51—33 K Ω	C45—500 pF	C60—0.05 μF
R52—1 M Ω	C46—500 pF	C61—50 μF 25 v.
R53—33 K Ω	C47—1,000 pF	C62—35 pF
R54—1 K Ω	C48—100 pF	C63—.001 μF
R55—22 K Ω	C49—8 μF 250 v.	VR2—500 K Ω
R56—47 K Ω	wkg.	Crystal diode :
R57—470 K Ω	C50—500 pF	B.T.H. CG6

NOTE.—S2 normal position closed. For increased gain switch is opened.

Take diode out at rear of unit; take off holder of neon tube and associated clips feeding neon. Recover coil La (Fig. 13); leave Ca and Ra for cathode bias; leave Cb.

Recover Cg (Fig. 14), Lb; Ci; Cj. Recover windings on Lc and Ld. Disconnect 8 pF from top of big oscillator coil. Recover 490 Ω resistor from cathode to earth on V3 and recover 22 K Ω from grid to cathode.

(To be continued)

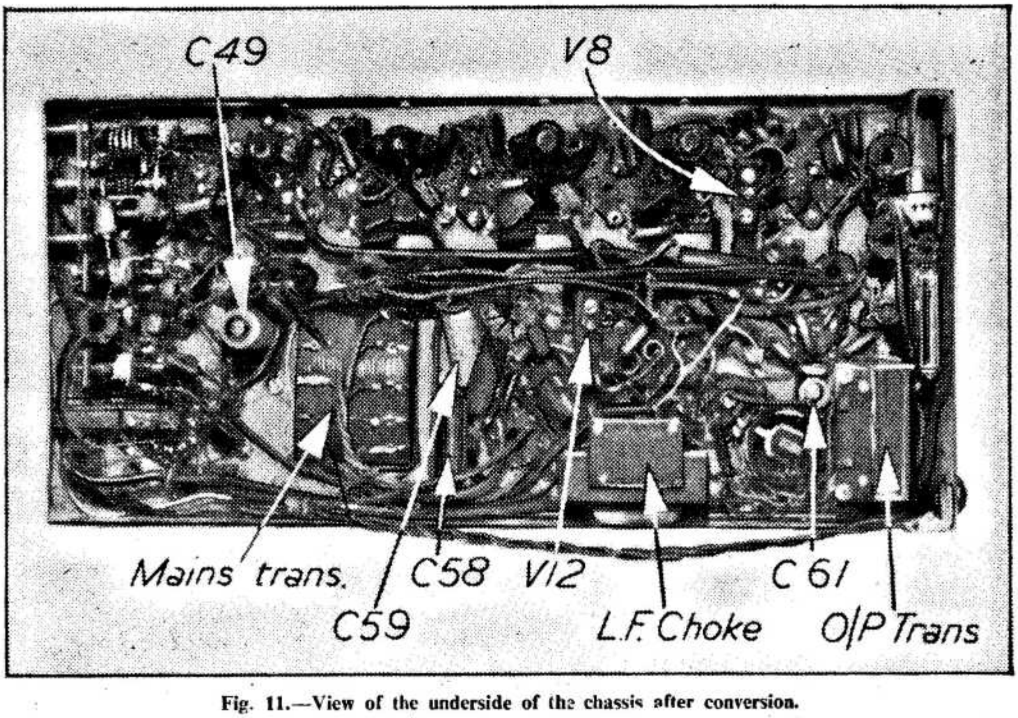


Fig. 11.—View of the underside of the chassis after conversion.

TELEVISION PICK-UPS AND REFLECTIONS

UNDERNEATH THE DIPOLE

By Iconos

3-D v. TV

A YEAR or so ago I referred in this column to the possibilities of achieving stereoscopic pictures on TV. Various methods of achieving the third dimensional effect had been considered by leading TV engineers, including the late Captain A. G. D. West, but the problem never arrived at a practical stage. And now the boot appears to be on the other leg! The counter-attraction of TV in America has forced the cinema exhibitors to supplement their programmes with novelties which vary from balloons to bearded ladies, from wide-screen panoramas to three-dimensional scenes. By all accounts, some of the technical effects are startling, though they will not be new to patrons of the Telekinema at the Festival of Britain. That remarkable show did indeed give an accurate forecast of the shape of things to come, with its big-screen television, its stereo techniques, 3-D films and its stereophonic sound reproduction.

It remains to be seen whether 3-D will tear the viewer away from his television receiver, thereby restoring good health to an ailing box office. At the moment, the thundering barrage of press comment gives almost any kind of stereoscopic or "pseudoscopic" system a novelty value. The system which seems to be the least expensive to exploit is that which requires every member of the audience to wear polarised spectacles, which sort out what the right eye and the left eye should see. In the cinemas, two projectors are used, simultaneously, projecting through polarising filters set 90 deg. out of phase. On television, the 3-D films could be projected, appropriately polarised, through alternate frames from each of the twin stereo films and viewed through the usual polarised spectacles. But would it be worth while? Stereoscopic films are best seen on a fairly large-screen and would hardly be worth the complication with a screen size 10in. by 8in.

"OUR MARIE"

MICHAEL MILLS gave viewers another winner with his production of "Our Marie"—the life and loves of Marie Lloyd. The greatest of the music hall giants in the early years of this century, Marie Lloyd's story was also full of dramatic situations—in particular her three marriages. One perhaps felt that this "private" side of her life was stressed too much, and that instead of the numerous playbill insertions it would have been better to have been given glimpses of the other top-liners of Marie's day—Chirgwin, Little Titch, the Great Carlton and others. Pat Kirkwood, with nearly 50 costume changes, was excellent as Marie—and her renditions of those evergreen comic songs showed how superbly she had absorbed the Marie Lloyd style. Peter Bull as George Ware, Marie's first agent, could not have been bettered. His dry "Can't promise anything" in a radio series would undoubtedly become a catch-phrase. This also helped to make him appear a very human character, though I am told he did far more for his artiste than his counter-part of to-day! The TV characterisations of the three husbands were clear cut—Courtney, the stage-door Johnny who could not understand the hold that the halls had on her; Alec Hurley, a fellow artiste who could not reconcile himself to the fact that Marie could only work alone; and Bernard Dillon, who married her for her money.

Michael Mills, with rapid cutting and frequent use of film inserts to enable Miss Kirkwood "to age," whetted the viewers' appetities for more features about the hey-day of the "halls."

MUSICAL ILLUSTRATIONS

HOW often have people in their mind's eye fitted their own picture to a famous composer's tone poem. Vic Oliver's presentation of his idea of what Tchaikowsky visualised for his Fantasie Overture, "Romeo and Juliet," was excellent. As Vic Oliver said in his introduction, ballet and mime can make even so-called high-brow music of universal appeal. Michel de Lutry's choreography was, as always, superlative, and slick presentation, interlacing shots of the British Concert Orchestra and the characters, maintained the interest.

Most viewers know that Robert Helpmann is becoming as well known for his character acting as he

PROFESSOR BOFFIN

"With my latest set even soccer fans can enjoy taking the baby out."

is for his dancing. In "Box For One" he vividly conveyed the fear and arrogance of Vic, a small-time crook hunted by other crooks. The entire action took place in a telephone box, but Mr. Helpmann seemed to have an inexhaustible supply of pennies—perhaps Vic had robbed a gas meter!

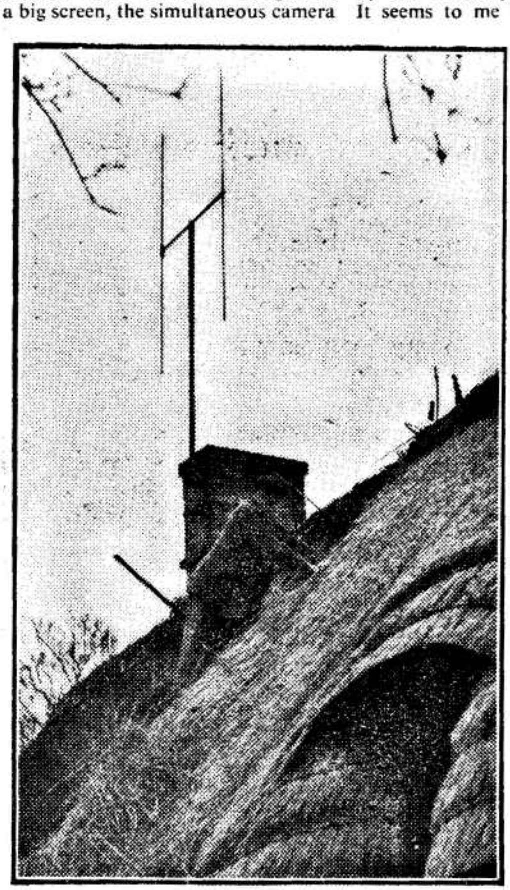
MULTIPLE "ANGLES"

THE technical problems of filming an entire playlet in a telephone box would, under normal film studio circumstances, have required all the walls and roof to be detachable so that each camera angle could be lit to its best advantage. Later, each shot is put together to form a composite whole, in continuity. On TV, three cameras covered the angles simultaneously, and by tracking in enabled the producer to cut from shot to shot at the appropriate moment. If the same little play were being filmed for television, which method would be used? Judged on a big screen, the simultaneous camera method gives photographic results which are inferior to the lighting and shooting of each individual angle separately. On the other hand, would such photographic improvements show up on the average home receiver and justify the additional cost? I suppose that in the long run it will be the sponsors who have the say.

WHO PAYS?

THE enormous increase in revenue from TV licences during the last couple of years may have been gratifying to the BBC but has failed to catch up with the terrific cost of maintaining the BBC TV service, quite apart from the capital cost of new installations. Costs are likely to rise still more with the competition from a number of small sponsored TV transmitters in certain built-up areas. Under these circumstances, the BBC's desire to recover the proportion of revenue retained by the Treasury is understandable. It seems to me that the BBC's TV service could recover some of its huge production costs by exporting telefilm recordings. After all, there are now about a dozen companies operating in England whose sole object is to make television films for America and Canada. Shortly their markets will be increased by Australia, where TV is likely to be on a competitive basis with national and sponsored TV side by side. TV films are being made in England, using normal film camera methods, but it will not be long before High Definition Films put into operation their high quality electronic camera system.

Big-screen television is receiving the expected boom for the Coronation, and Cinema Television Ltd. are dealing with many really large-screen installations. Tests have also been made by radio dealers and others of small projection receivers normally capable of dealing with pictures up to about 6ft. wide. If the auditoria are kept quite dark and a highly directional front reflection screen is used, quite a remarkable increase in brilliance and contrast can be obtained. Screens which fulfil this requirement can be of the silvered type, but are preferably subjected to a treatment which divides the surface into tiny ridges which reflect separately. I have seen extraordinary results with screens made up of tiny little glass beads, like the "hundreds and thousands" sweets that used to be so popular with the kids. These beads are stuck on the screen and give a specular reflection which intensifies the highlights to an extraordinary degree. On the other hand, this type, or the silver screen for that matter, tends to narrow down the viewing angle. There is a big fall off of illumination when the viewer is at the side of the auditorium. The fact is, the ordinary plain matt white screen reflects evenly in all directions, including where reflection is not wanted. A screen which has some kind of specular reflection can, to a large extent, be controlled to suit the shape of the particular auditorium. The nearer the screen approaches the characteristics of a mirror, the more directional will be the reflection.



A sign of the times. A TV aerial on a thatched roof.

TALK AT CROYDON

TELEVISION'S "Music Hall" formed the subject of an interesting talk given to members of the British Televiewers' Society, at their monthly meeting at Kennard's Restaurant, Croydon, on Monday, February 2nd. The speaker was Mr. Richard Afton, producer of this particular feature and he was accompanied by his wife, Miss Gillian Blair who, incidentally, is a member of the famous dancing team, the TV Toppers. Mr. Afton spoke at length on the preparatory work necessary before Music Hall is presented on Television and gave a lucid description of the building-up of the programmes from the initial booking of the acts to the final stage performance.

Miss Blair was asked questions relating to the dance turns in Music Hall and the audience were deeply appreciative of the very fine performances given by the expert and versatile Toppers who are, without doubt, supreme in this particular sphere of entertainment.

TELEVISION COLOUR FILTERS. For 10in. screens, **6/6.** For 12in. screens, **8/3.** For 15in. screens, **10/9.**

TELEVISION LENSES. Magnifies the picture 1½ times. Best quality manufacture. For 8in. and 9in. screens, **55/-** ea. For 10in. and 12in. screens, **75/-.** Tinted a pale blue for Daylight and Anti-glare viewing, **5/-** extra. Post and pack., **2/6.**

RADIO-GRAM CHASSIS. Brand new model built for the Export Market. Medium and five Short bands. Six position tone control. Negative feed back. Fly-wheel tuning. Line-up 6BE6, 6BW6, 6AT6, 6BA6 and 6X4. All complete (less speaker) and in working order. OUR PRICE **£15/15/-,** and carriage FREE. Also the Home Market model, Long, Medium and Short bands, otherwise similar. OUR PRICE, **£10/17/6,** carr. **4/6.**

WALKIE-TALKIE SETS. Brand new. Model UF/1. Made by Jefferson Travis (U.S.A.). Never been unpacked. Visual range, 53-75 mc/s. Hand-set operation. Works from complete set of batteries, or vibrator power pack from 12-volt supply. SPECIAL OFFER, **£9/17/6** (less vibrator), or **£18/19/6** per pair. Carr. **5/-** each.

TRANSFORMERS. Clearance sale. Mains (salvage). 250-0-250. 6.3 v. 3 A., and 6.3 v. 1.5 A. Tapped 250, 210, 110. Load 80 m/A. Wire ended. Tested, resprayed and guaranteed. ONLY **9/9.** Post, **2/-.** Also O.P. transformers, to match all normal O.P. valves to 2-3 ohm speech coil. PRICE SLASHED TO **1/9.** Post, **1/-.**

VALVES

SALE PRICE OF **8/9** EACH. (Reg. post, **1/-** for **2.**)

6AB8	PM25	GT1C	UU3	20D1	20F2	PL81	PL82	PL83
PY80	PY82	EAF42	5X4	5Y1	5Y3	6BE6	6B8	6G6
6BW6	6V6	10P13	12AT7	12K8	EF80	X65	X66	KT8
50L6	6X4	1T4	1S4	1S5	1R5	3A1	24XX	3S4
6AK5	EF91	EF36	10F1	EF50	EY51	SP4	ECC91	N17
6SA7	ECC35	EL32	KTZ63	KTW61	6L18	42	3D6	6B4

CONDENSERS. Store soiled, but unused and tested. Two-gang, .0005 mfd. Standard and half size. All at **2/9** each, or special offer, 3 for **7/-.**

MICRO SWITCHES. Brand new, latest American midgets. 250 v. 3 A., **5/-** each.

INSULATING TAPE. Brand new and wrapped. ¾in. wide. In ½lb. rolls. **1/6,** post **6d.**

PERSONAL RADIO. 4-valve TRF kit. Excellent reception on Long and Medium bands. Full wiring details and assembly instructions. Plastic or wooden cabinet. Complete for **£5.19.6,** carriage **3/6.** Assembled ready for use, **20/-** extra.

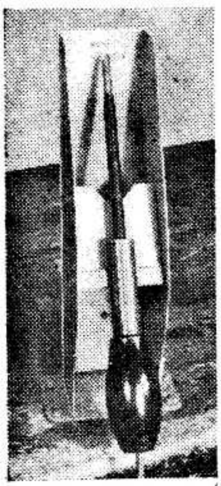
Stamp for 1953 List.

C.W.O. or C.O.D. **DUKE'S** **621, Romford Road, London, E.12.** *(Grangewood 6677)* **Money Back Guarantee**

ADCOLA

PRODUCTS LIMITED

(Regd. Trade Mark)



SOLDERING INSTRUMENTS

FOR

SUCCESSFUL HOME CONSTRUCTION AND ALL SOUND EQUIPMENT SOLDER JOINTING

"STANDARD MODEL" AS ILLUSTRATED 25/6

Any volt range supplied, 6/7 to 230/250

3/16" dia. bit Standard Model

Equally suited to daily or intermittent use

Made in England

Registered Design

(British, U.S.A., Foreign Patents)

Export Enquiries Invited

Shields as illustrated **10/6** extra.

WRITE DIRECT TO

ADCOLA PRODUCTS LTD.

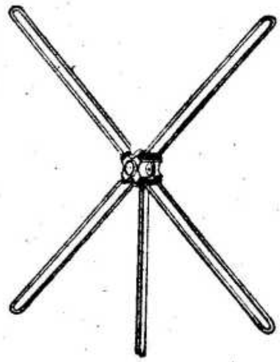
Sales, Offices & Works : CRANMER COURT, CLAPHAM HIGH ST., LONDON, S.W.4. *MACaulay 4272*

. . picture perfection

with the Aerialite **DUBLEX**

Because It Has

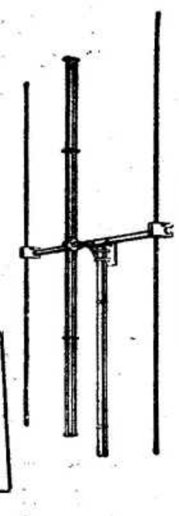
- **HIGH GAIN**
- **BROAD BANDWIDTH**
- **CORRECT MATCHING**
- **HIGH MAX/MIN RATIO**



these features, PLUS excellent mechanical design, ensure that you get the best performance from your receiver. Moreover, the Dublex is moderately priced at **£4.8.6** (7ft. mast complete with brackets, etc.); **£7.15.0** (10ft. x 2in. mast complete with double lashings, etc.).

. . other quality aerials

in the comprehensive Aerialite range include the AERFRINGE and AERA-DOOR models : **8.0dB** forward gain, sharp directivity for interference elimination and broad bandwidth for greater detail. Model 63A complete with 10ft. mast, double lashings, etc., price **£13.15.0.** The room-mounting AERA-DOOR model 65 has a telescopic top element and is suitable for all channels. Price **£1.12.0** complete.



See us at the
R.E.C.M.F.
Component Exhibition
at Grosvenor House, Park Lane, London, W.1
STAND 12.

Aerialite LTD.

CASTLE WORKS STALYBRIDGE CHESHIRE

TV for the Beginner—1

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

By "Alpha"

THERE is a vast number of newcomers to the fascinating field of television, and those of us who are used to dealing with such terms as "velocity factors," "integrators and differentiators," etc., are sometimes apt to forget that we, too, had to start somewhere, and the various expressions which roll off our tongue may be so much gibberish to the novice.

The more experienced worker will therefore forgive us for using some of the space in this journal, as he is adequately catered for in other sections. Here we will deal with TV from the constructor's point of view in a "down-to-earth" fashion, and it is hoped that the basic principles expounded will enable the novice to enjoy fully his new-found hobby, and to be ready at the end of the series to tackle the more technical aspects.

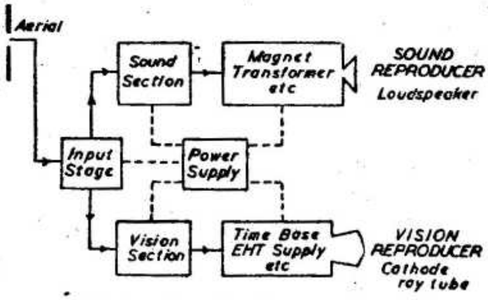


Fig. 1.—Block schematic diagram of a television receiver.

This is not a series on the theoretical side of TV; the information given will be essentially practical, and the point of view of the amateur constructor will be kept in mind the whole time.

Use will be made of block diagrams to explain the various functions of parts of the television circuit, and detailed theoretical diagrams will not be used—this branch of TV technique has been adequately catered for elsewhere.

It is our intention to make the series as useful as possible, and if you have any suggestions to make regarding the items you would like discussed, then please let us have them; we will give them every consideration.

Let us emphasise once again that the subject will be dealt with purely from the practical aspect. As a guide on what to expect we shall be dealing with the following items: Analysis of the functions of the parts of a television receiver; vision and sound receivers; straight sets and superhets; cathode-ray tubes (types and requirements); timebases; power supplies; use of ex-Government apparatus; tubes and valves; I.F. strips; display units, etc.; suitable types for conversion; availability of data; coils and coil winding; chassis construction and materials; wiring technique; soldering technique; common faults in vision receivers, sound receivers and timebases, etc.

The Television Receiver Analysed

The television set consists of certain essential parts, each of which has its own specialised function. First, we have the aerial which collects the vision and sound signals together and feeds them into the first common stage of the televisor. From here the two signals are separated into their respective channels, the sound going to the sound section and the vision signal to the vision section (see Fig. 1).

The sound signal, having been amplified and filtered in its section, is passed on to the sound reproducer which consists of a loudspeaker. The loudspeaker itself consists of a magnet, a transformer, a coil to which the cone is attached, and the signal simply makes the cone move backward and forward to agitate the air and to reproduce the sounds.

Commercial receivers seem to favour the use of a permanent magnet for the loudspeaker instead of one energised from the power supply, and the connection between power supply and loudspeaker section indicated by the dotted line is not then required.

The vision signal, separated from the sound, is passed to the vision section where it is amplified and filtered and finally passed on to the vision reproducer which is a cathode-ray tube. Instead of the cone used in the loudspeaker we have a fluorescent screen; instead of the speech coil we have a beam of electrons and deflector coils; instead of the energised (or permanent) magnet and transformer we have several transformers and some valves. The fluctuating beam moves across the screen and the picture is seen.

Aerials

Of the making of aerials there seems to be no end; the constructor is confronted with a bewildering array of types, and when the new stations are opened their number will be doubled. Some practical advice on the construction and erection of aerials will be given later; at this point we are only concerned with the relation of the aerial to the televisor.

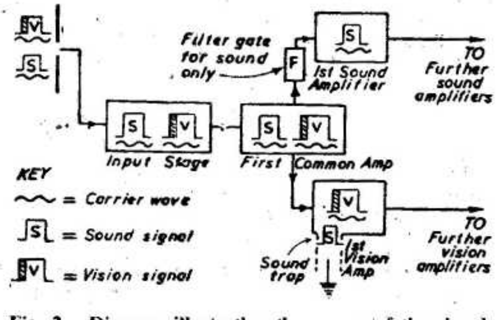


Fig. 2.—Diagram illustrating the course of the signals through a straight receiver.

The function of the aerial is to collect the signal, and its ability to do this job depends upon its design. The vision signal is broadcast on one wavelength and the sound on another, but as the two are very close they are picked up equally as well and are passed down the connecting cable (the transmission line to give it its correct term) to the televisor.

The Video Signal and Bandwidth

Let us clear up a little point regarding frequency and wavelength first.

These two are directly related to each other. The electromagnetic wave which is sent out from the broadcasting station is said to have a certain wavelength. On the normal broadcast bands we say the Light programme is broadcast on 1,500 metres, and this means that the distance from the top of one wave to the top of the next is exactly what it says—1,500 metres long. We could say with equal accuracy that the frequency of the wave is 200 times per second, or, if you like, 200 cycles per second.

The product of these two equals the speed of light.

If the frequency increases, then the wavelength decreases, as the product always remains the same. We define a transmitter as broadcasting on a wavelength of so many metres, or we can say it broadcasts on a frequency of so many cycles per second.

When we come to the very low wavelengths on which television is broadcast, then it becomes a little difficult to define accurately the wavelength of the different transmitters. For example, the wavelength of Wenvoe is 4.62 metres: it is much easier to give it in terms of frequency which is 65 megacycles (mega = million), or abbreviated 65 Mc/s: moreover, it is easier to pin-point the actual carrier frequency in relation to the bandwidth, as we shall see later.

Now let us for a moment consider sound. A high note on a piano is due to the string vibrating very rapidly, the vibration being communicated to the air; a low note is caused by a string vibrating very slowly. In the one case we have a rapid vibration-rate or frequency, and in the other a lower vibration-rate or frequency.

When a broadcast is made we must be able to hear the high notes and the low notes; in practice we do not include the highest of the high notes but strike a compromise and transmit those up to about 4,700 cycles per second. This means that the electromagnetic wave which is carrying the music to our receivers must be 4,700 cycles wide so that all the notes we wish to hear are included in it. We say, therefore, that the bandwidth of the electromagnetic wave (called the carrier wave) must be 4,700 cycles wide.

With vision, a much wider range of frequencies is catered for, and to transmit information from dead black to highest white we require a bandwidth of 3,000,000 cycles (= 3 Mc/s). If any part of our vision circuit will not allow this wide range of frequencies to pass through it, then the quality of the picture will suffer. The original designer of the televisor has carefully calculated the values of the components so as to allow this wide band to pass through; it behoves us, therefore, to bear this fact in mind in our wiring so that we can reap the full benefits of careful design.

We have made no mention of single and double sideband transmissions, but as most of the TV channels are single sideband working we will assume that the circuits are designed for this type of reception. The practical side of single and double sideband working will be discussed later when we are dealing with alignment.

The bandwidth of the televisor's input circuit has to be made wide enough to include the sound channel as well as the vision. Usually the first amplifying stage will include both signals, but from this point separation takes place by means of filters (specially tuned circuits) to separate the sound and vision.

Look at Fig. 2. You will see a diagrammatic explanation of the method of sound and vision separation. Sometimes the sound is separated at the input stage. More often, it is separated after the first amplifier, and sometimes the two signals are kept together up to the output of the second amplifying valve.

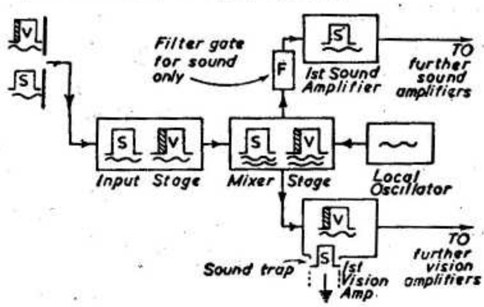


Fig. 3.—Diagram as Fig. 2 but for a superhet receiver.

Another point to note is that it is sometimes difficult to get rid of the sound from the vision circuits, and generally filters are fitted in subsequent stages to filter off any residue of the sound signal which penetrates past the first trap.

The superhet follows somewhat similar principles but appears a little more complicated. Fig. 3 shows the scheme. The carrier frequency which carries the vision is beaten against the frequency which is generated by a local oscillator; the result is that the frequency which carries the signal is altered to a lower figure, making it more easy to handle. The same process takes place with the sound signal.

The beating together and mixing takes place in the mixer valve and usually this valve provides no amplification at the very high frequencies used in television—quite often, in fact, the stage provides a loss instead of a gain!

The filter is actually an inductance and capacitance which is tuned to the sound channel. In the coupling between the first sound stage and the common stage, the filter acts as a gate which allows the sound only to pass. In the vision stage the coil and condenser take the form of a trap or rejector and is termed the sound rejector, or sound trap.

(To be Continued)

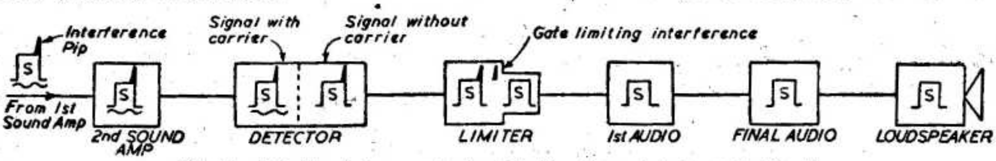


Fig. 4.—Details of the sound channel after the point shown in Fig. 3.

THE P.T. "ARGUS" TELEVISION RECEIVER

Although this televisor costs only about £20, it does not involve the conversion of ex-Government units, and has been designed for construction by the novice.

We can supply the 21 valves, C.R. Tube and all the resistors and condensers for **£20.10.0.** H.P. terms are available, deposit being **£6.17.6**, balance 12 monthly payments of **£1.9.9** each. Carriage and packing **10/-** extra.

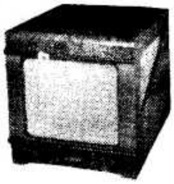
Constructor's envelope giving full details and blueprints **5/-**, returnable if you think you can't make the set.

SIX INCH TUBE LOOKS LIKE NINE

The illustration shows the "Argus" fitted into an ordinary console cabinet, using our internal magnifier system, which is equally applicable to any Television using a 6in. tube. The outfit, which comprises magnifier, mask, veneered front and four secret head fixing screws, is available at **39/6**, plus 2/6 post.

ONLY A FEW LEFT.

A 12-in. console TV fitted **with castors** and front flap for controls. Size 19in. x 35in. x 15½in. deep. Price **£7.10.0**, plus 10/- carriage. Or **£2.10.0** deposit.



A **12-in. Table Model** complete with armour-plate glass and surround as illustrated **£3.17.6**, plus 7/6 carriage and insurance.

PARCEL OF METAL WORK, for Table Model (easily adaptable for console) is as follows: Punched and prepared metal chassis, punched out-rigger, valve plate, spacers, Tube clamping ring, tube rear support, brackets, etc., etc. Price **25/-**, plus 2/6 post. Included free with this parcel is circuit diagram of 5-Channel 12in. TV to use with this chassis.

CORONATION CONSOLE

We are now taking orders for this very handsome cabinet which will put your TV into the £200 class.

The Tube cut-out is designed for the standard 15in. Tube, e.g., the Cossor offered below.

The storage space at the top if desired can be used for an auto-changer or tape recorder, and the sloping panel at the top can be used as a control panel or for a pre-set radio.

The cabinet is 47in. wide, 31in. deep, to the corner, and 50in. high, it is already polished and supplied flat for you to screw together; price is **£18**, plus 10/- carriage and insurance, or you can buy it on Hire Purchase if you wish, the deposit is £6, then 12 monthly payments of **25/-**.

COLLARO. 3-Speed Auto-record changer with pick-ups, for long playing and standard records, few only left at special concession price of **£11.11.0**, plus 7/6 carriage and insurance.

SEND ONLY 4 GNS.

For 15in. Magnetic Television Tube

By famous maker, as used in many popular Television receivers (list on request). Specification Blue-White screen 9 Kv. ion trap triode, heater 6.3 v. at .55 amp., 50 deg. deflection. New, with written guarantee offered at approximately half price, **£12.10.0** each, plus, 10/- carriage and insurance. H.P. terms **£4.4.0** deposit and 12 monthly payments of **18/3**. Limited quantity so order immediately.

ELECTRONIC PRECISION EQUIPMENT DEPT. 5
42-46 WINDMILL HILL, RUISLIP, MIDDLESEX • 152-3 FLEET ST. LONDON E.C.4.

Let I.C.S. perfect YOUR knowledge of radio and T/V

THOSE who wish to supplement their existing knowledge with a sound technological background or pass qualifying examinations, can do so by means of I.C.S. Home Study Courses. These include **T/V TECHNOLOGY · RADIO SERVICE ENGINEERING · RADIO ENGINEERING · ELEMENTARY ELECTRONICS · RADAR · ADVANCED SHORT WAVE RADIO** and training for the following examinations: **C. & G. RADIO SERVICING CERT. (R.T.E.B.) · B.I.R.E. · C. & G. TELECOMMUNICATIONS · C. & G. RADIO AMATEURS · P.M.G. CERT. FOR WIRELESS OPERATORS, etc., etc.**

Students are coached until successful. Fees are moderate and include all books required.

GENEROUS DISCOUNT TO H.M. FORCES.

Dept. 172C, I.C.S., 71 Kingsway, W.C.2

CUT HERE

WRITE TODAY for FREE BOOKLET describing complete facilities for the successful study of T/V technology and Radio.

INTERNATIONAL CORRESPONDENCE SCHOOLS LTD.
Dept. 172C, International Buildings, Kingsway, London, W.C.2

Please send Booklet on subject ....

Name .... Age ....
(Block letters please)

Address ....

Temporary Television Stations

AS announced, the BBC is to install temporary low-power television transmitters at Pontop Pike and near Belfast before the Coronation. It is now proposed that these transmitters shall use the single sideband system of transmission, and not, as first announced, the double sideband system. This change will not affect receivers of the types now normally manufactured.

Large Screens in Birmingham

ARRANGEMENTS are being made by Hadley Bros., of Smethwick, in association with the *Birmingham Post* and *Birmingham Mail*, to enable more than 2,000 people to watch large screen television in two of Birmingham's biggest public buildings on Coronation Day.

Philips projection models, giving a 4ft. by 3ft. picture, will be installed in the city's Town Hall and in the neighbouring Midland Institute. Three will be positioned on the stage of the Town Hall, sited so that the images on their screens will be clearly visible to people seated on the ground floor of the hall.

Canadians Order Transmitter

THE Canadian Broadcasting Corporation has ordered British television transmitting equipment for Ottawa. This will be the third station in a network the Corporation is planning to build across the country, of which the Toronto and Montreal stations have been working since September.

Ottawa will have a 5-kilowatt vision transmitter and a 3-kilowatt sound transmitter, with all associated monitoring and control equipment.

TV Instrument in Hospital

THE life of a prominent American lawyer was saved in Connecticut recently by a new instrument, the Cardioscope, which indicates the condition of a patient's heart and pulse rate by means of a jagged line flashed on to a screen.

Should the pulse rate cease to be normal the instrument sounds an alarm and the surgeon waits until the pulse regains its natural beat before continuing.

Society Fellow

MR. J. C. G. GILBERT, head of the department of radio and musical instrument technology at the Northern Polytechnic, Holloway, London, has been elected a Fellow of The Television Society.

The Passing Years

AMONG Henry Hall's guests in "Face the Music" recently were Elsie and Doris Waters.

They appeared in his very first "Guest Night" on sound radio on March 17th, 1934.

Flood Victims Recovering

SPENCER-WEST, of Great Yarmouth, report that although the town suffered considerable destruction during the recent floods, their premises sustained only slight damage.

Flood water came within 3ft. of the main shop and some employees were rendered homeless but production is now almost back to normal.

National Warning System

THE Government and the BBC are to devise a new national warning system in which television will be used to give gale warnings and publicise official announcements in cases of flood danger.

This would not mean programme interruptions as the announcements could be made between items and the text of the warning shown on the screen.

A television camera is mounted on a "Stacatruc," manufactured by Industrial Truck Development Ltd., during a recent BBC visit to the Austin works, at Birmingham.

£200,000 Salvage Scheme

IT is possible that in salvaging the *Empress of Canada*, which caught fire in Liverpool Docks recently, a television set costing £7,000 may be used to examine the ship.

Ten divers working on the liner have to take special care that none of the fine mud at the bottom of the dock is disturbed or visibility becomes impaired.

The whole salvage scheme, the largest ever attempted in Britain, costs over £200,000.

Television Licences

THE following statement shows the approximate number of television licences issued during the year ended January, 1953. The grand total of sound and television licences was 12,868,183.

Region	*Number*
London Postal	690,833
Home Counties	231,794
Midland	442,965
North Eastern	217,277
North Western	250,730
South Western	54,623
Welsh and Border ...	66,109
Total England and Wales	1,954,331
Scotland	48,688
Northern Ireland ...	430
Grand Total	2,003,449

Educational Broadcasts

TV receivers are to be installed in two Newport, Glamorgan, schools as part of a BBC experiment in educational broadcasts.

The series of closed-circuit transmissions to six schools in London last spring is considered as having been a success and is to be repeated next year.

Extra Testing Hour

FROM March 16 to June 1, BBC test transmissions for the trade begin at 10 a.m. and continue until 1 p.m. instead of twelve noon.

This is in anticipation of an increase in receiver buying in time for the Coronation and will be welcomed by the trade when adjusting and installing the extra demand for sets.

Dearer Sport

SOUND and television broadcasts on the forthcoming Test series between England and Australia and the Wimbledon tennis championships will be covered only by the BBC.

Fees, however, are expected to be higher not only for cricket and tennis but Rugby Union matches as well. The Football Association announces that a fee of £1,000 has been agreed for the Cup Final and it is probable that the old rate of £500 a Test cricket match will be doubled this season.

Swedes Study Our Methods

THE Swedish Minister of Communications has appointed a special commission to enquire into the possibility of beginning a television service in Sweden.

Members of the commission are now in this country to study methods employed by the BBC.

Australian Transmission

IN Australia, a hundred applications have been received for television transmission licences.

This number includes radio stations, political parties and several religious bodies.

Coronation Programme Details

IT is expected that television on June 2nd, Coronation Day, will begin at 10.15 a.m. lasting until 5 p.m., during which time viewers will see the procession and the ceremony in the Abbey.

During the evening the Queen will broadcast to the Commonwealth, but will be heard on sound only on TV. At 10.30 p.m., the showing of a grand firework display is planned.

More Sales in North

DURING 1952, more television receivers were sold in Lancashire and Yorks than anywhere else in the country. Next came the Midlands, served by the Sutton Coldfield station, and then London and Home Counties where sales were only average. In Wales and Scotland, sales were particularly small, especially in the latter.

It has been estimated that a total of 64,000,000 man-hours are spent each week in Britain watching television.

Abbey Tests

THE BBC reports that tests in Westminster Abbey, to see how television cameras would react under the special lighting system which has been installed, have proved "satisfactory."

It had been thought that although the lights would not be too strong for film cameras, TV camera lens might have to be filtered slightly.

Loss of Visitors

BOGNOR REGIS Chamber of Trade, who are pressing for the erection of a TV station on the Isle of Wight, complain that unless reception in the town is improved before June, they will lose 50 per cent. of their visitors during Coronation week.

Death on Their Screens

THE "New Yorker" reports that during last year alone 16,932 men, women, children and animals have died on American television screens, nearly all of them in a violent manner.

Three-dimensional Pictures

A TEAM of engineers, headed by Norman Collins, are engaged on a new method of showing three-dimensional pictures on television screens.

Details of these "deepie" pictures are to be kept secret.

Ronnie Waldman, chief of Television light entertainment and well-known for his "Puzzle Corner" in "Kaleidoscope," is seen with his actress bride, Lana Morris, at their recent wedding at Caxton Hall, London.

23803

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).

YAGI AERIALS

SIR,—I suppose there are thousands of people like myself who read your most interesting paper and glean a lot of useful information from it. It is vitally necessary, however, that such information be as accurate as possible, otherwise the public will lose faith. "Erg," in your January issue, has told us quite a bit about the measurements of aerial elements, for which we are duly thankful. But his statement that close-spaced arrays give maximum gain—" The arrays C and D are close spaced for maximum gain "—is quite wrong. It is possible to improve the gain of any multi-element Yagi aerial by *increasing* the spacing between the elements and the dipole up to a maximum of approximately .22 wavelength, not decreasing the spacings.—Rev. J. E. DAVIES (Carlisle).

[The power gain of Yagi arrays is very difficult to estmate and figures given by designers and manufacturers are usually based upon measurements made during the experimental period. These figures do show that under ideal conditions with correctly tuned elements and correctly matched transmission line, then with all elements spaced at 0.2λ an increase of about 1 db is obtained over the closer-spaced array, which I recommended in my article.

This 1 db represents a just perceptible change in the strength of the picture—a negligible amount ; the difference in bulk, however, is considerable. On channel 1 (for instance) the 0.2λ array has an overall spread of approximately 12ft., while the closer-spaced array would be approximately 7ft. across.

It appears to me that one extra db is not worth the increased bulk and unwieldiness of the array. One disadvantage of the closer-spaced array is that it is liable to cause picture flutter in high winds, but taking all these factors into consideration I am convinced that the closer-spaced array is the better proposition.—" Erg."]

THE CINEMA AND TV

SIR,—The panic in the cinema trade on television seems to be growing. I understand from a local dealer that it is easier to get a whole string of civil servants through the keyhole of Gilbert Harding's house than to get a television advertisement on the cinema screen. It seems that while cinemas are still prepared to accept any advertisements for radio or radiograms, in many cases the word " television " is absolutely taboo.

If this be true, surely it is a short-sighted policy. Would it not be better for all concerned if the film profession followed the lead of Hollywood and prepared to cash in on television by providing suitable films, thereby making the best of both worlds.

Television has come to stay, films or no films, and this dog-in-a-manger attitude will get British cinemas nowhere.

One often sees film posters in a record shop ; what, then, in the name of sanity is wrong with TV adverts on the screen ?—B. E. HUNT (Bristol).

REFILLING MAGNIFIERS

SIR,—Many years ago, my prospect was dimmed with tummy trouble. Liquid paraffin was prescribed. I detest the darned stuff, but it certainly lightened a dark subject. Little did I realise how it would brighten my view and reduce financial fog in later life.

My set is a console model, with a 9in. tube. The only one I could obtain over five years ago. (That tube still gives perfect pictures.) Shortly after purchasing, I decided on an enlarger, and got one with absolutely no distortion. By fitting forward 1½in., it reveals a screen 11in. by 10in.

Father Time had left his mark on the oil, which had yellowed off badly. I followed the advice of Mr. Andrews, of Headington (December, 1951, issue), and refilled with B.P. (tummy protector) liquid paraffin. But, really, I must say that he could have saved himself a lot of messy trouble :

(1) That it is *not* necessary to wash out and fill the drains with filthy, frothy detergent. Simply pour out the old and put in the new. (And don't swear at the tiny, bubbling hole.) Leave the usual half-crown bubble of air.

(2) Whilst it is preferable to obtain the same grade of B.P. liquid paraffin, it is not essential. I took the chemist's word and did not bother. After I had refilled, I had a shock. The picture could have been a repeat of Science Review. In anger I shook the darned thing, and took my sergeant-major's advice and let myself go verbally. Some hours after the storm, the oil had calmed a little. After a few days' battle, the enlarger cleared perfectly—to my great relief.

(3) With regard to quantity. Mr. Andrews must have been filling a microscopic enlarger with two 14-oz. bottles. Mine took seven and a half, at a cost of 15s.

Why should a pensioner, even with his half-crown rise, burst his precarious bank balance by fitting a 12in. tube, when he can get perfect pictures of the same size with a 9in. ? And—what price replacements?—CHARLES HASSELL (N.11).

IN PRAISE OF THE MILLER-TRANSITRON

SIR,—One frequently sees reference in the pages of your journal to the alleged non-linearity of a Miller timebase.

May I crave space to state categorically that both on theoretical grounds and in my own practical experience, the Miller-transitron is far and away the most highly linear form of sawtooth generator in normal use. If any non-linearity is noticeable in a television receiver using this type of timebase it will certainly be due either to defective components or to a badly designed output stage.

I have built a set based on the " £9 Televisor " and carried out a great deal of experiment with the timebases in order to improve the interlace and increase the scan. I have found that component values may be altered over a very wide range, producing increased or reduced scan, with or without foldover, but at all times the linearity of the forward trace remains excellent.

I have only discovered two ways of introducing non-linearity with this circuit. One is to use a leaky charging condenser between anode and grid of the oscillator. The other is to use a wrong value of condenser to supply feedback between anode and grid of the paraphase valve. The value required here is critical.

If any intending constructors should be discouraged by the comments of your correspondent in the March number of PRACTICAL TELEVISION, I would urge them none the less to go ahead and build a timebase of this type with every confidence. It's cheap, it's simple, and it works. You may or may not achieve interlace, but if you stick to the design and use only good components you will invariably achieve linearity !—JOHN H. REE (Wallasey).

AERIALS

SIR,—I am puzzled at the viewpoints expressed in the recent correspondence re aerials. Being one of the few who struggled in the early days to receive Alexandra Palace direct in Lancashire, given a receiver with fantastic gain I experimented with all the aerials known to me at the time and I feel sure that if I were interested, by use of one of the modern multi-rod aerials real results could be obtained.

When Sutton Coldfield was our nearest station I received quite well with a standard H, but purchased a new outfit with folded dipole, reflector and director all on a 15ft. pole.

The first test was to compare this new aerial on its pole at ground level with the H on the chimney stack. Immediately the dipole showed vastly improved gain, and on mounting it on the stack an attenuator had to be fitted to keep the controls as previously set.

From previous correspondence in this paper it will be known that I do not blindly support manufacturers, as I consider many unsuitable and shoddy products are offered, but I do believe that the polar diagrams issued by reputable aerial manufacturers are honestly computed, and the evidence is clear proof of additional gain on multi-rod aerials.

Naturally, I have now dismounted all outside aerials as signal strength in Manchester renders them unnecessary.—N. W. LAYTON (Urmston).

BOSTIK

SIR,—In your January issue you included an item by T. H. Howells on "Making an Adaptable Aerial," and in the penultimate paragraph he refers to "Bostik," of which we are the manufacturers.

We should like to take this opportunity of pointing out that "Bostik" is our brand name, and covers some hundred different grades of adhesives and sealing compounds. Perhaps you could pass this information on to your contributor and state that it would help your readers if he could state the grade of "Bostik" he recommends for this job. From the outline given on the use of this material, we should say that "Bostik" Sealing Compound No. 692 is the correct grade.—F. D. CAMERON (Sales Department).

SLOT AERIAL

SIR,—There has been much written recently concerning the slot aerial, but nothing has been published, so far as I can find, concerning the technical method on which this functions. The operation of the standard dipole, or even a folded version of this, can be satisfactorily explained, but the slot does not seem to cover any of the standard methods of working. What picks up the signal—the netting or the slot? The dimensions of the slot correspond approximately to the dipole length, and therefore it seems that the slot resonates. I have tried out the scheme and it works, but I cannot understand how. Perhaps you will let us have an article on this subject in due course.—R. BAKER (Stanmore).

BLACK LEVEL

SIR,—A problem with which I am most concerned at the moment is the change of general lighting from scene to scene—especially when one is taken from the studio to a film or outside relay. I have a home-made set and have tried a number of circuits but it appears to me that the whole problem is in the feed to the picture tube. You described some time ago a black level clamp and I tried this with little success. After considerable experimenting I have formed the conclusion that the direct-coupled form of feeding the tube is not satisfactory. I know this will call down a storm on my head from the technical experts of the main manufacturing firms, but it appears that this does not discriminate between the background intensities as does a straightforward D.C. restorer.

Do the BBC maintain a really straight black level on all transmissions, or is the black level clamp circuit particular to cameras? Is the clamp in the film projector separate, or does the transmitter take care of all signals passed to the aerial? These are some of the questions I would like to see explained by a BBC engineer, and perhaps one who is experienced in this sphere could tell me, and no doubt many other experimenters, how one can ensure a constant picture level and so avoid this variation in dark and light pictures.—G. HOUGHTON (Wembley).

A PORTABLE E.H.T. GENERATOR

SIR,—I should like to thank you for the article in the December issue, which has enabled me to obtain improved results on my home-made set. I was previously using a mains-fed E.H.T. supply which I thought was quite satisfactory—except for the difficulty of the residual spot. I read the article on the R.F. unit, and made it up without success. After writing to you you pointed out the omission of an H.T. feed to the L2 circuit and when this was put in, the unit worked. It gives me higher voltage than the mains unit and a much cleaner background due to the smooth supply which this generates. Thank you again.—F. T. RUSSELL (Highgate).

Hum In TV Receivers

(Continued from page 499)

dark section on the screen. If half-wave rectification is employed, one dark line will be seen, and in full-wave rectification two lines. If, therefore, the receiver employs a full-wave mains section, with the usual half-wave E.H.T. circuit, and two dark bands appear across the screen, the trouble is in the mains H.T. supply, not the E.H.T. Conversely, a single dark bar under such conditions would be due to a very poor E.H.T. supply. The latter is, however, not very common, and is more likely to be due to a fault in the E.H.T. supply circuits rather than to inadequate smoothing.

Hum in Vision Receiver

Hum in the vision receiver will generally result in vertical lines in the picture having small, wavy edges as distinct from the large wave produced by hum in the line timebase, but if the hum is induced in the video stage only, either by A.C. carrying wires running near the grid or the lead carrying the video signal to the tube, then a stationary hum bar or bars will be given as already mentioned. Unfortunately, there are so many different types of circuit employed in television receivers that it is not possible to make definite statements concerning effects such as those given by a poorly smoothed H.T. supply, but the above details may be taken as a general guide and should enable this type of trouble to be identified and cured.

HENRY'S

EXCEPTIONAL VALVE OFFER

Ten EF50 Brand New (Ex-Units)...	55/-	Set
6K8G, 6K7G, 6Q7G, 5Z4G, 6V6G (or KT61)	42/6	..
1R5, 1S5, 1T4, 1S4 or (3S4 or 3V4)...	32/6	..
TP25, HL23/DD, VP23, PEN25 (or QP25)	27/6	..
6K8G, 6K7G, 6Q7G, 25A6G, 25Z5 or 25Z6G	42/6	..
12K8GT, 12K7GT, 12Q7GT, 35Z4GT, 35L6GT or 50 L6GT	42/6	..
12SA7GT, 12SK7GT, 12SQ7GT, 35Z4GT, 35L6GT or 50L6GT...	42/6	..

Complete set of specified valves for "P.W." Personal Rec. 5 6AM6, 2 6AK5, 1 6J6, 1 6J4, 1 EA50, and 3BP1 C/R. Tube with base, **£5/12/6**.

"WEYMOUTH 3-WAVE BAND COIL PACKS."

Short, Med. and Long with Gram. Switch.
Brand New Miniature type complete with circuit. **19/6.**, P.P. 1/6; absolute bargain.

CATHODE RAY TUBES:

VCR97. Guaranteed full picture, **40/-**, carr. 5/-.
VCR517. Guaranteed full picture, **40/-**, carr. 5/-.
3BP1. Suitable for 'scopes and Tel., **25/-**, carr. 3/-.
MU-METAL SCREEN for VCR97 or 517, **12/6**.
VCR139A (ACR10) **35/-**. Brand new. P.P. 3/-.

P.M. SPEAKERS (Inc. Tax)

Plessey 2½in. with Trans....	15/-	Rola 10in. with Trans.	30/-
Celestion 5in. with Trans...	16/-	Goodman's 10in. with Trans.	30/-
Rola 5in. less Trans. ...	12/6		
Plessey 5in. less Trans. ...	12/6	Electrona 10in. with Trans.	25/-
Plessey 6½ L/T	15/-		

Postage and packing 1/- extra.

INDICATOR UNIT TYPE 182A. This unit contains VCR517 Cathode Ray 6in. Tube, complete with Mu-metal screen, 3 EF50, 4 SP61 and 1 5U4G valves, 9 wire-wound volume controls and quantity of Resistors and Condensers. Suitable either for basis of Television (full picture guaranteed) or Oscilloscope. Offered BRAND NEW (less relay) in original packing case at **79/6**. Plus 7/6 carr. "W.W." Circuit supplied Free.

INDICATOR UNIT TYPE SLC5

This Unit is ideal for conversion for a "Scope" Unit or basis for Midget Television. It contains C/R Tube type ACR10 (VCR193A) complete with holder and cradle also earthing clip. 1-VR66, 2-VR65, 24mfd. 550v. wkg. condenser, potentiometers and a varied assortment of resistors and condensers. These Units are in a new condition and packed in wooden transit cases. The C/R Tube will be tested before despatch. Dimensions 8½in. x 6½in. x 11½in.
57/6 plus 5/- carr.

WEARITE MAINS TRANS. Input 110/250v. output 325-0-325, 80 m/a., 6 v. 2.5 amp., 5 v. 2 amp., **£1 1/-**.
PLESSEY MIDGET TYPE, 200/250 output, 230-0-230, 50 m/a, 6 v. 2.6 amp., **12/6**, P.P. 1/-.
IFT's, Wearite 501A and 502, 465 kc/s, **10/-** pair, P.P. 1/-.
,, Plessey 465 kc/s Permeability, **8/6** pair, P.P. 1/-.

VCR517C BLUE AND WHITE 6½in. TUBE.

This Tube replaces the VCR97 and VCR517 without alteration and gives a full Blue and White picture.
Brand new in original crates, **45/-**, plus 5/- carr.

T/V PRE-AMPLIFIER FOR LONDON AND BIRMINGHAM. Complete with 6AM6. Ready to Plug in to your Set, **27/6**. P.P. 2/6.

SEND POSTAGE FOR NEW 1953 COMPREHENSIVE 28-PAGE CATALOGUE:
Open Mon.-Fri., 9—5.30. Sat. 6 p.m. Thurs. 1 p.m.

5, HARROW ROAD, PADDINGTON, LONDON, W.2. TEL.: PADDINGTON 1008/9, 0401.

CITY & RURAL

Offer Immediate Delivery FROM STOCK:

VIEWMASTER. Specified Components. (London—Sutton Coldfield—Holme Moss—Kirk o'Shotts—Wenvoe—Newcastle—Belfast). Complete Kits, Stage-by-Stage, and Single Components supplied. Send for Stage 1 now—**£3 . 2 . 3** post free. Construction Envelopes (all areas), **7/6.** Technical Advice—Free.
LANE TAPE TABLE, Mk. 3. £16.10.0 plus 10/- carr. & pkg.
TRUVOX TAPE DESK MARK III. £23 . 2 . 0 plus 15/- carriage and packing. (Details of an easily-constructed Amplifier supplied free of charge with each desk purchased.)
LANE TAPE AMPLIFIER KIT. (Including valves, and complete down to the last nut and bolt.) **£13 . 0 . 0.** Stage-by-Stage Construction Envelopes, **5/6** post free.
LANE TAPE AMPLIFIER. A Record/Playback Amplifier — ready-built and tested. **£15 . 10 . 0.**
RONETTE MICROPHONES. Suitable for use with above amplifiers, **52/-.**

Extensive stocks New and Surplus Components. List 2½d. stamp.

For Attention—Advice—Service, write

CITY & RURAL RADIO,
101, High Street, Swansea, Glam.
Telephone: Swansea 4677.

The "Fluxite Quins" at Work

"Thank FLUXITE, our job's nearly through,
Just one bit of soldering to do.
Hoist the wire from below.
What's this!" exclaimed OH.
"Now there'll be a fine hullaballoo!"

See that **FLUXITE SOLDERING PASTE** is always by you—in the house—garage—workshop—wherever speedy soldering is needed. Used for over 40 years in Government works and by leading engineers and manufacturers. Of all ironmongers—in tins, from **1/-** upwards.

FLUXITE

SOLDERING PASTE

A Staunch Companion to Fluxite Soldering Fluid.

SIMPLIFIES ALL SOLDERING

Write for Book on the Art of "SOFT" Soldering and for leaflets on CASE-HARDENING STEEL and TEMPERING TOOLS with **FLUXITE.** Price 1½d. each.

FLUXITE Ltd., Bermondsey Street, London, S.E.1.

THE MODERN BOOK CO.

Television Engineers' Servicing Manual, edited by E. Molloy. **42s. 0d.** Post 1s. 0d.
Amplifier Circuits, by N. H. Crowhurst. **2s. 6d.,** post 3d.
A.R.R.L. Radio Amateur's Handbook, 1953 edition. **30s. 0d.,** post 1s. 0d.
The Cathode Ray Oscillograph in Industry, by W. Wilson. **36s. 0d.,** post 1s. 0d.
The Oscilloscope Book, by E. N. Bradley. **5s. 0d.,** post 3d.
Television and Radar Encyclopaedia, edited by W. MacLanachan. **30s. 0d.** Post 9d.
TV Fault Finding, compiled by "The Radio Constructor." **5s. 0d.** Post 3d.
Time Bases, by O. S. Buckle. **32s. 0d.,** post 9d.
Television Principles and Practice, by F. J. Camm. **25s. 0d.,** post 9d.
Television Simply Explained, by R. W. Hallows. **9s. 6d.,** post 6d.
Encyclopaedia on Cathode-Ray Oscilloscope and their Uses, by Rider and Uslan. **75s. 0d.,** post 1s. 0d.
Radio and Television Receiver Troubleshooting and Repair, by A. Ghirardi and J. Johnson. **54s. 0d.,** post 1s. 6d.
Radio Receiver Servicing and Maintenance, by E. Lewis. **10s. 0d.,** post 6d.
Radio Valve Data, compiled by "Wireless World." **3s. 6d.,** post 3d.
The Amateur's Guide to Valve Selection, by Mullard. **1s. 6d.,** post 3d.

We have the finest selection of British and American radio publications in the Country. Complete list on application.

19-23, PRAED STREET, (Dept. T.4), LONDON, W.2
PADdington 4185.

YOUR Problems SOLVED

Whilst we are always pleased to assist readers with their technical difficulties, we regret that we are unable to supply diagrams or provide instructions for modifying surplus equipment. We cannot supply alternative details for constructional articles which appear in these pages. WE CANNOT UNDERTAKE TO ANSWER QUERIES OVER THE TELEPHONE. The coupon from p. 535 must be attached to all Queries, and if a postal reply is required a stamped and addressed envelope must be enclosed.

FAULTY E.H.T. CIRCUIT

I purchased a receiver twelve months ago, and I have had trouble since, very little at first but aggravated since by poor maintenance. It has been returned twice to the shop for repair, but since October, the last time it was repaired, I have had a decent picture, but it's had a very annoying fault. When I switch on the picture takes rather a long time to appear. When it does it more often than not flashes off and there's quite an audible whistle from the line output transformer. To get the picture back I have to switch off and then on again sometimes two or three times. When it has warmed up it will be O.K. for the rest of the evening, with the exception that when they change the cameras there is a very quick fold of about an inch or two from the top of picture. When I have tried the raster it is quite bright but flickers.—W. T. Bebb (Yardley).

From the symptoms it appears that the E.H.T. circuit is at fault. An intermittent short circuit in this section —or in the reclaim diode circuit—often produces an extra-loud timebase whistle owing to the additional load imposed on the line amplifier.

Short-circuited turns in the line output transformer or scanning coils could, of course, be responsible; but substituting the reclaim diode should first be attempted. The E.H.T. rectifier in this receiver sometimes develops a short circuit between heater and anode, resulting in a fault of similar nature. Due attention should, therefore, be given to the whole of the E.H.T. network.

The quick fold-over at the top of a picture is initiated by the frame circuits—an incorrect frame-hold setting may prompt the symptoms mentioned.

LOSS OF FRAME AMPLITUDE

I have recently modified my Viewmaster to increase the E.H.T. to 9 Kv. This has greatly improved the picture, but has increased a difficulty that has always been troublesome, namely, fold-over at the bottom of the picture. When the set was built 15 months ago the frame scan was about 3in. using the specified values of components. I got a full scan by making R60 510,000Ω and R61 270,000Ω. In order to improve linearity I have made R46 and R56 variable, a tip I got from you. I have tried and rejected a number of modifications suggested by my dealer, such as making V12 into a pentode. The linearity was poor. He also suggested taking the H.T. on V12 from the 325 boost point. This improved the frame linearity at the expense of the line, giving a trapezium shaped scan. It seems to me that V12 (a KT61) is not up to its job under the conditions that it has to operate under, possibly due to the cathode being at 50 volts above chassis. I have tried swapping V12 and V8 without much result. May I have your comments and suggestions?—R. Noel Green (Brighouse).

Some increase in frame amplitude may be obtained by connecting a 1 pF condenser between the junction of R60 and R57 and C48, then reducing R66 to 330Ω and readjusting R65 and R64. It is, of course, possible that your frame transformer or scanning coils are either faulty or inefficient, and some improvement may be obtained by replacing.

LOSS OF WIDTH

I have a table TV and have had a good picture for the last two years. During the past three months I have been slowly losing "width" in my picture. I have tried all new valves, and as many as six B36's without success. I know the valves are O.K. as I happen to work at the place where they are made. I have the service sheet and find on test I am very near the voltage of the valves, and that my meter is within 5 per cent. I have asked at work about this problem, but no one seems able to help me. I know my supply voltage is between 232-240 volts A.C. as I have had a recording volt-meter across the mains. I have tried a 0.001 μF mica condenser across the line coil and find I get my width. I do not like using the set with this extra condenser in circuit, as I feel there is something likely to break down any time. I myself have a feeling that the trouble lies in the H.T. circuit but cannot find anything. —A. Dykes (W.14).

The loss of width may be due to a rise in E.H.T. or a general loss of normal H.T., although the scanning coils themselves are sometimes responsible. When you connect a .001 μF across the line coils you effectively reduce the E.H.T. (flyback) and so width is obtained; this process is quite in order and can do no damage to anything.

Check particularly the grid resistance of the line output valve (this may be high), the cathode resistance and screen dropper of this stage.

FRAME KINK

I have recently purchased a second-hand television receiver. It gives an excellent picture except for one fault which I cannot understand.

There is a horizontal band about ¾in. wide, slightly below the centre of the screen, in which the lines are closer together than elsewhere. This is not noticeable on normal pictures except for a very slight increase in brightness, but is very obvious on sloping lines or moving objects such as titles, etc.

The effect is not changed by frame linearity or height controls (which work quite normally) and I cannot understand how it can be caused, or cured. Presumably it is some non-linearity in the frame scan generator or amplifier. In the circuit diagram, which I have obtained, these appear to be quite straightforward except for the use of a "push-pull" output transformer. I presume this is used simply to balance to some extent the output pentode's D.C. anode current by the charging current of the timebase condenser.

Would you please enlighten me on the above point and assist me as far as possible in locating the fault I have described?—W. B. Jago (Morden).

The fault you mention is nearly always due to the frame output valve, a small kink being present in the frame scan due to anode current disturbances. You should replace the valve or, alternately, change it over with the sound output which is of a similar kind.

"VIEWMASTER" DIFFICULTIES

I have built the Viewmaster and I am having a bit of trouble with it. First of all, No. 15 resistor burnt out and then No. 16 did the same, but did not blow the fuse.—H. N. Tighe (York).

If R15 and R16 are burning out, then it is due to a short-circuit on either C11, L107 or V3 anode; it should be a simple matter to find this fault.

PROTECTING A SET

The problem is a TV set on a very variable D.C. supply, 190 to 230 volts. The set is rated at 150 watts.

In the January issue there was a neon stabiliser which would deal with smaller loads. Is there any simple automatic and cheap similar circuit which would deal with this load, keeping the variation down to 10 volts, say?—R. Baker (Chatham).

The problem of voltage variations of D.C. mains is one which, unfortunately, cannot be solved without involving considerable expense.

Employing a barretter in place of the normal voltage dropping resistor in the receiver heater chain may yield a degree of assistance. An article in this connection will be appearing in a future issue of the PRACTICAL TELEVISION.

ARGUS PROBLEMS

Once again I must ask for your advice. I will put them under three headings: Raster, picture and E.H.T. network.

Wenvoe is now on full power and results with pre-amp. are good.

Also, I have key of my VCR97 tube to the right of set to give me full width. I have two tubes and both of these give same fault.

On my 5in. × 4in. mask the width is O.K. With the condensers C43 and C44 in the frame osc. this gives a full height raster, but raster lines far apart. This raster will blank out evenly as the brilliance is turned back, but with a picture on (same raster) with frame and line controls set is only half a picture, stretched by altering C43 and C44 to get correct picture size. The raster is reduced in height to about 1½in., this is with the raster just visible.

With the 1½in. raster just visible, the picture modulation increases this to about half the tube's height, so I get a very good half picture. This may be the top half or bottom with the rest of screen blank. If the bottom part of picture locks in, I can change this to the top half by changing around the plug to E.H.T. transformer primary. With only one half of picture on screen, if I increase brilliance the picture starts to show in the blank part of screen with all the F.B. lines with the previous half picture too bright.

I have changed all smoothing condensers, bleeder network chain and bias resistor on plates, but still no luck. The spot I can focus, move up or down, but the spot is no bigger than a small pea with a flat on the right of one side. It will focus to a pin-point. With it unfocused, and the brilliance up a little, a bar comes on from each side of spot. Also, when switching on the full raster shows on the screen for a second before blanking out.—W. G. Rice (Lyme Regis).

The absence of a sharp spot is due to hum voltages either on the timebase supplies or being picked up directly on the plates. You should try a mu-metal screen round the tube or, if this has already been fitted, remove all transformers and A.C. components to other positions.

The picture blanking is due to extreme hum voltages on the grid or cathode of the tube; you will have to check on the wiring and screening associated with this part of the circuit to clear this. You will probably find the two faults are related, and an elimination of the hum will clear both difficulties.

USING LARGER TUBE

I should be pleased if you could advise me with my Philips television Type 383A, which I have had for three and a half years, and which employs a 9in. Mullard tube MW22-7.

The tube has now failed and I should like to replace with a 12in. tube if this is possible. I realise, of course, that structural alterations will be necessary to the cabinet, but I can manage this satisfactorily. Will you please let me know if the circuit is suitable for a 12in. tube and if so would any alterations be required to the EHT voltage; also could I employ a tube with an ion trap?—P. F. Hayes (Cambridge).

Theoretically little difficulty should be experienced in changing over from a 9in. to 12in. picture-tube since the scanning angle is constant. It is possible, however, that the picture will lack brilliance owing to the increased length of scanning beam, and an increase in E.H.T. will be called for. This in turn will demand additional scanning power, which may necessitate time base modification.

A 12in. tube incorporating ion-trap facilities should be preferred to one having an aluminised screen, in view of the greater E.H.T. needed by the latter.

MAINS FUSE

I am constructing a "View Master" TV receiver which has a "Belling-Lee" mains connector unit L707, which is fitted with two Belling-Lee fuses L1055.

I have studied the "View Master" booklet and diagrams but am unable to find what current value these fuses should have.

I should be greatly obliged if you would let me know what value these should be.—R. L. Archibald (Stanmore).

The correct fuses for use in the Belling-Lee connector should have a 2 amp. rating, this is because of the heavy initial surge which would prevent the use of a lamp fuse.

CONVERTER FOR THE SOUTH

Before very long the BBC will be operating a temporary TV transmitter, using the Kirk o'Shotts frequencies, and covering the district Brighton to Worthing. My receiver (home built), 12in. T.R.F., is, of course, operating on the A.P. frequencies. Coil re-winding, or utilisation of brass slugs instead of existing iron dust type is not a practical proposition. Could you, therefore, kindly suggest a circuit and coil data for a frequency changer unit which I could install prior to my receiver, using the receiver's existing frequencies as the I.F.s? Any other matter relating to this would be appreciated.—A. P. Carter (Sompting).

With slight coil modifications the converter described in the December, 1951, issue of PRACTICAL TELEVISION should be suitable for this function. It is suggested that the coils be altered as follows: L1 5.75 turns close-wound, tapped at 1.5 turns at the earthy end; L2 5.75 turns close-wound; L3 eight turns close-wound, tapped at 1.5 turns at the earthy end. L4 and L5 should be wound as per the article, for the slight reduction in oscillator frequency can be catered for by adjusting the spacing between the windings on the oscillator coils.

ALL NEW GOODS.—Condensers, 25/25 can, **1/9**; 8/450 can, **3/-**; 8/350 W.E., **3/-**; 8/450, **3/4**; 8/500, W.E., **3/6**; 16/450 can, **3/6**; 8/16/450 can, **5/3**; 32/500 W.E., **5/9**; 16/16/450 can **6/4**; 16/32/350, **6/6** 16/32/32/350. **6/10**; 32/32/450, **7/-**; 100/60/350, **7/-**; 125/350, **8/6**. T.C.C. Tub. Midget, W.E., .01, .05, **7d.**; .001, .002, **6d.** W.B. 103 Mains Trans., **42/-**. 12in. Cream Masks, **21/6**; 9in. Masks (shallow), **8/6**. Scanning Coils by Scanco, H.I.Imp. Frame, **24/6**. R.17 Focus Magnets, **22/6**. 36 E.H.T. 100, 8kv., **28/-**. RM4, 250v, 250 ma, **18/-**. Heater Trans., 6.3v, 1.5 A, **6/9**. Glass Fuses, 1, 1½, 2 amp., **6d.** ½ Meg., s.p. V/C, **3/6**. .0005 Twin Gang Midget, **6/9**. Xtal Diodes, W.E. **3/-**. T.R.F. Coil Packs, midget iron core, M. and L., **14/6**. 5 H 250 ma, Chokes (ex-W.D.), **8/6**; IOH, 25 ma, **3/-**. Plessey Record Players with P.U. (boxed), **£4/10/-**; P. and P. **3/6**. THE TELETRON. CO., 266, Nightingale Rd., London, N.9. (HOW. 2527). Terms, C.W.O., add 1/6 p.p.

TELEVISION Aerial Mast Brackets, all types or manufactured to your design; competitive prices; immediate delivery. Also enquiries invited for Sheet Metal and Press Work. C.B.F. INDUSTRIES, LTD., Watts Lane, Teddington.

BARGAIN. £5 Parcel Chokes, Conds., Res., Valves, etc., for **£1**; Filter-units, small weatherproof box, 1ft. Co-Ax. Coils, etc., suit aerial pre-amp, etc., **2/6**; 2in. White Dials, **6d.**; all post free by return. AUTO-RADIO, Bath Drive, Bath Rd., Wolverhampton.

12AT7, 12AU7, 12AX7, 6J6, 6CH6, 6BW6, **9/-**; 6AM6, 6BA6, 6X4, **7/6**; 6AL5, **6/6**; EF92, EAC91, 6C4, **6/-**. SKILLMAN, Franchise St., Weymouth.

SPECIAL OFFER.—New, surplus 0.1/500v D.C.W. Tubulars, **3/6** doz.; post 6d.; 4 doz., **10/6**; post paid; quotes for quantities. MELHUISH, 315, Ewell Rd., Tolworth, Surrey.

LOOK! Condensers: Card. Tub., 32/32 mfd, 350vw, **2/6**; 50/50, **2/-**; 25/25, **1/6**; 16/24, 350v, **3/6**; Philips, 16/450v, **3/-**; 8/500v, **3/-**; 16/500v, **3/-**; small Mica, 100, 500pfs, **5/-** doz.; larger .0047, **3/-** doz.; Beehive Trimmers, 30pf, or ceramic, **9d.** Variables: Twin, 500pf, **4/-**; with Drive, **5/6**; 3- or 4-gang, **8/6**; Twin, 75pf, **4/-**; D.E. Single, 75pf (as RF26), **2/-**; Min. 25, 50 or 75pf, spindled, **1/6**; Muirhead Dials, 2 types, **7/6**; R1355, **35/-** (carr. 6/-); RFU's 24, **21/-**; 25, **25/-**; 27, **45/-**; Indicators with VCR97 (f.p.) and 11 valves, **65/-** (5/- carr.); Type 6E ditto; Mu-metal Screens, **5/6**. Terms: c.w.o.; immediate delivery; post extra; s.a.e. for lists, enquiries. W. A. BENSON, 308, Rathbone Rd., Liverpool, 13.

CHROM. INSTRUMENT HANDLES. Give that scope a professional finish with these. "Eddystone" type, 5¼in. between centres, stand-off 2in., **1/6** each; Ex-Gov. 6SH7s, guaranteed, **4/6**. We still have a few 6 valve short wave Battery Receivers, type TR9D, at **19/6** (post and pkg. 2/-). Don't forget we make blank Ali. Chassis to your spec. cheaper than ready made ones. Write for details and free catalogue. SERVIO RADIO, 156-8, Merton Rd., Wimbledon, S.W.19. (LIB. 6525.)

VALVE BARGAINS: 6J6, 6AK5, EF91, EC91, **9/-**; EL91, **8/6**; 12AT7, 6F33, 6SN7, **9/6**; EF92, EAC91, **6/6**; 6C4, 6AG5, **6/-**; EA50, **2/-**; 185BTA, **12/6**; Electrolytic Condensers, 8+16 mfd, 450v, can type, **3/-** each or 4 for **10/-**; Volume Controls with switch, ½ meg., **4/-**; postage 9d. on orders under £2. All components stocked for "Tele-King," "Viewmaster" and "Argus" Receivers. ELECTRAD RADIO, 69, High St., Belfast, N.I.

RATES: 4/- per line or part thereof, average five words to line, minimum 2 lines. Box No. 1/- extra. Advertisements must be prepaid and addressed to Advertisement Manager, "Practical Television," Tower House, Southampton St., Strand, London, W.C.2.

"VIEWMASTER" Valves exact to specification, guaranteed new and boxed, comprising 5 EF50, 1 6P25, 1 KT61, 1 EBC33, 1 EB91, 2 6K25, 1 6P28, set of 12, **£6/2/6**; with EY51, 10/- extra (post and insurance 2/-). "Tele-King" 16in. Receiver, complete set of 17 valves, exact to specification, **£9/9/-**; 6AM6, EF91, 6F12, Z77, 8D3, W77, EF92, **7/9**; EB91, 6AL5, HVR2A, **6/9**; 1S5, 1R5, 1T4, 3S4, 3V4, 1S4, 6V6G, Pen46, EF39, EC91, EF8, EF50, 7C5, 7C6, 7B7, 7H7, 7S7, 7Y4, **7/6**; 5Z4G, 5U4G, MU14, U22, U78, 6P6, DH77, 6AT6, EBC33, 10F1, 6F15, **8/6**; PZ30, PL38, EL38, GZ32, **17/6**; N78, **16/6**; 6K25, 6P25, UL46, **13/6**; ECC91, EF42, UF42, EBF80, UBF80, U37, R16, PL83, DK32, 1A7G, 20L1, 6C9, **12/-**; PL81, PL82, PY81, UAF42, 10F9, 10LD11, 6LD20, 10C1, **11/-**; ECL80, EF80, EY51, 6K8GT, 12K8GT, UBC41, UCH42, EL41, KT61, 6F14, 10P13, **10/6**; 25Z6GT, PY82, EZ40, UU9, EF41, ECH42, EBC41, DL35, 1C5G, DAC32, 1H5G, **10/-**; 6SN7GT, 12AT7, 12AU7, 12AX7, EL91, 6AM5, N77, 6Q7G, 12Q7GT, 12K7GT, **9/6**; U50, 5Y3G, 80, 25L6GT, 35L6GT, 50L6GT, 35Z4GT, 6V6GT, U404, UY41, UF41, **9/-**; 6K7G, **5/9**; all new and boxed. Postage 4d. per valve extra. READERS RADIO, 24, Colberg Place, Stamford Hill, London, N.16.

"VIEWMASTER" Valves, set of 12, new, boxed, as specified, **£6/2/6**; EB91, **7/6**; EF91, **8/6**; EY51, **9/6**; 6F6, **9/-**; SP61, **5/6**; SP41, **5/6**; EF50 (red), **9/-**; EBC33, **9/6**; PL38, **13/6**; PZ30, **15/-**; PY80, **9/-**; PY81, **10/-**; 6K8, **11/-**; 6V6, **8/9**; 1T4, 1S4, 1S5, 1R5, 3S4, 3V4, 1H5, **8/9** each; 5Z4, 5U4, 5Y3, **9/-** each; 6AK5, 6J6, U14, U50, **9/-** each; Line/Out trans. for V/master, **30/-**; Fil./trans., **36/6**; Frame/trans., **23/6**; V/master Coils, complete set, incl. choke, **17/6**; Non-mag. P.M. Speakers, 6in., **15/-**; 10in., **22/6**. New lists available. RADIO UNLIMITED, Elm Rd., London, E.17. (Phone: KEY 4813.)

WINWOOD FOR VALUE.—Dubilier Drilitic Conds., 500vw., 8 mfd, **2/6**; 16, **3/-**; 8 x 16, **4/-**; 8 x 8, **3/9**; 32, **4/6**; Bias, 25/25v, **1/6**; 50/50, **1/9**; S.M. P.F.s, all values, **6/-** doz.; Fil. Trans., 6v-1.5A, **6/6**; 3A, **9/6**; P/pull O/trans., 10,000-5 ohms, **7/9**; Goodmans 10in. P.M., with trans., **34/6**; Valves, Viewmaster, set of 12, **£6/2/6**; EB91, **7/3**; EF91, **8/3**; 6K7, 6K8, 6Q7, 6V6, 5Z4, set of 5, **45/-**; 10F1, 10LD11, 10C2, 20L1, EF39, EF36, 6C4, **8/-** each; V/cntrls., all values, **3/-**; SP/sw, **4/3**. Stamp list. R. WINWOOD, 12, Carnarvon Rd., Leyton, E.10. (Mail only.)

ARGUS CONSTRUCTORS. — Build your "Argus" for **7/6** weekly; s.a.e. details; free list of all parts, except tube, at reduced prices; free booklet, "Fundamentals of Television Servicing for Beginners," sent with each list. R. E. HOPE, 6, Grange Road, Thornton Heath, Surrey.

TELEVISION COMPONENTS
for the
"Practical Television Receiver"
TELE-KING
VIEWMASTER, E.E. TELEVISOR
and VM wide angle modifications in STOCK
Price Lists available on request.
J. T. FILMER,
Maypole Estate, Bexley, Kent.
Tel.: Bexleyheath 7267

SURPLUS 465 kcs iron dust cored aligned and sealed IFTs (marked red, green, yellow, black), perfect + twin 500 per gang condenser, **6/-**, post 1/-; American and British resistance boards, 2lb. parcel, **2/6**, post 1/-. New list of radio bargains (incl. valves) available, s.a.e. THE RADIO SERVICES, Lr. Bullingham, Hereford.

50 SECONDHAND Televisions always for sale; famous makes. TOMLINS, 127, Brockley Rise, Forest Hill, S.E.23. (FOR. 5497.)

VIEWMASTER KITS, new specified parts, less speaker, focus ring, **£24/10/-**; assembled, **£28**. BETTS, 53, Mirfield Grove, Hull.

TELEVISION.—P.T. AC/DC Coilsets, complete, **63/-**; Synchrolock Transformers, **52/6** (P.T., Sept., '52); ⅜in. canned cored Formers, **2/3**; 89/100 Mc/s FM Receivers, kit as WW design, complete, **£7**. BEL, Marlborough Yard, N.19. (ARC. 5078.)

NEARLY completed TV with VCR97, sound O.K., **£10**; Homelab. Sig. Gen., new, **£6**. GARTH HOUSE, Brickfields Lane, Hayes, Mddx.

PREMIER 12in. Mag., H. Moss, built up, unused; new 12in. Mullard, bargain, **£30** also Timebase Kit, **£8**; Power Pack, **£5**, new, unpacked. H. DAVIES, 15, Roxby Rd., Winterton, Scunthorpe, Lincs.

CAN YOU SOLDER? That's all you need to make a really good radio or tape-recorder from guaranteed Osmor components. Send 5d. (stamps) today for free circuits and lists. Dept. PTC1, OSMOR RADIO PRODUCTS, LTD., Borough Hill, Croydon, Surrey. (Croydon 5148-9.)

BOOKLETS: "How to use ex-Gov. Lenses and Prisms." Nos. 1 and 2, price **2/6**. Ex-Gov. Optical lists free for s.a.e. H. ENGLISH, Rayleigh Rd., Hutton, Brentwood, Essex.

"DIRECT T/V REPLACEMENTS" enables you to purchase all your components, valves and T/V books from one supplier. Largest stock of manufacturers and home constructors components. Spares Manual and Supplement, **9d.** 134-136, Lewisham Way, New Cross, S.E.14. (TIDeway 2330 and 3696.)

ARGUS: complete, less speaker, Holme Moss. Needs adjusting; offers? Box No. 146, c/o PRACTICAL TELEVISION.

HOLME MOSS: Viewmaster 12in. Console, new tube; cheap; any offers? Box No. 147, c/o PRACTICAL TELEVISION.

WANTED

WANTED, 6in. Television Chassis; Holme Moss; working order. 324, Prince of Wales Rd., Sheffield, 2.

NEW VALVES WANTED, small or large quantities, 3Q4, 6V6, 5Z4, ECL80, EF80, KT66, KT61, 6L6N, VR150/30, 5R4, 80, etc., etc. Prompt cash. WM. CARVIS, 103, North Street, Leeds, 7.

EDUCATIONAL

FREE! Brochure giving details of Home Study Training in Radio, Television, and all branches of Electronics. Courses for the Hobby enthusiast or for those aiming at the A.M.Brit.I.R.E., City and Guilds Telecommunications, R.T.E.B., and other Professional examinations. Train with the College operated by Britain's largest Electronic organisation. Moderate fees. Write to E.M.I. INSTITUTES, Postal Division, Dept. PT28, 43, Grove Park Rd., London, W.4. (Associated with H.M.V.)

TRADE NOTES

Southern Instruments Phase Meter

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

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

As the scale is very cramped between 90 degrees and 180 degrees, the meter is calibrated from 0 to 90 degrees only, measurements between 90 degrees and 180 degrees being taken by inverting one of the inputs as described.

Brief Specification

Accuracy : ± 3 degrees from 20 c/s to 20 kc/s. ± 8 degrees from 5 c/s to 100 kc/s.

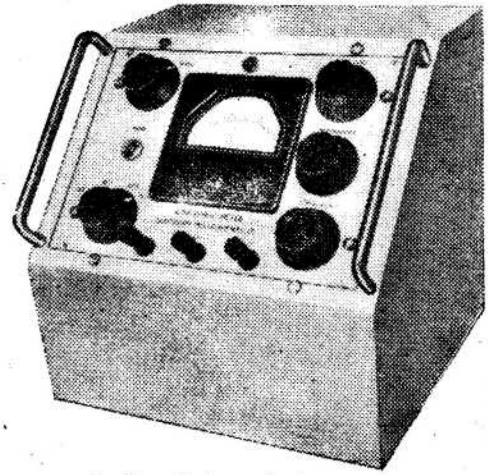
Input Impedance : 2 megohms.

Input Waveform : Must contain less than 3 per cent. harmonics.

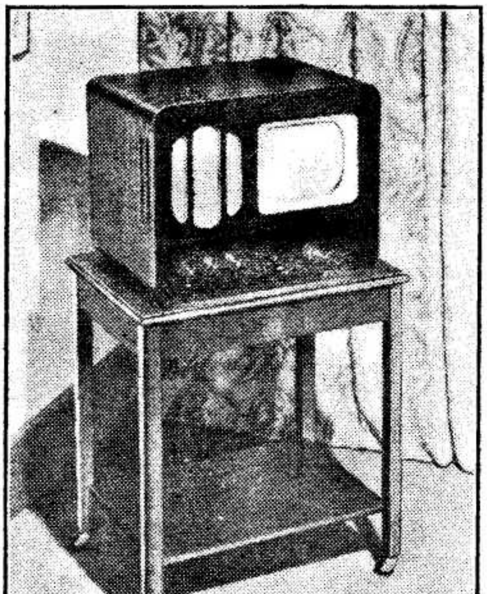
Input Amplitude : Between 1.5 and 10 volts.

Weight. 14½ lbs. *Price :* £45.

—Southern Instruments, Ltd., Hawley, Camberley, Surrey.



Southern Instruments phase meter.



A useful trolley table by Whiteley Electrical.

W/B Trolley Table

THE new item from the famous " Stentorian " works is an ideal trolley for every TV table receiver. It enables the set to be quickly arranged, or moved from room to room, so that everyone can see the programme at correct viewing height. The lower ledge has many uses, and may be used to accommodate a radio receiver.

Of ample dimensions (1¾ft. x 2ft. x 2ft. 1 in. high) and sturdily made from finest materials, it is finished in highly polished walnut veneer that will harmonise well with present-day furnishing schemes. The table is supplied packed flat ready for instant assembly, simply by inserting four concealed bolts. Price 87s. 6d.—Whiteley Electrical Radio Co., Ltd., Mansfield, Notts.

New EKCOvision Console

E. K. COLE, LTD., announce the introduction of a new 15in. tube (132 sq. in. picture) console receiver, the TC196, which incorporates all the circuit refinements of the more expensive TC178. The new set, priced at 100 gns. (List £72 3s. 3d., plus P.T., £32 16s. 9d.), has a walnut cabinet without doors and incorporates " Spot-wobble " and the EKCO " Triple-Link " chassis. It gives pictures 13¼in. x 10in. on a wide-angle aluminised grey-filter tube. —E. K. Cole, Ltd., Southend-on-Sea, Essex.

Forrest Picture-tube Transformer

WE are asked to state that the price mentioned for this component in our March issue is the wholesale price. Retail, the transformer costs 15/4d.

QUERIES COUPON

This Coupon is available until April 15th, 1953, and must accompany all Queries.
PRACTICAL TELEVISION, April, 1953.

Published on the 22nd of each month by GEORGE NEWNES, LIMITED, Tower House, Southampton Street, Strand, London, W.C.2, and printed in England by W. SPEAIGHT & SONS, LTD., Exmoor Street, London, W.10. Sole Agents for Australia and New Zealand : GORDON & GOTCH (A/sia), LTD. South Africa : CENTRAL NEWS AGENCY, LTD. Subscription rate including postage, for one year : Inland and Abroad 13s. 6d. (Canada 13s.). Registered at the General Post Office for the Canadian Magazine Post.