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EDITO[R]
F. J. CAMM

A NEWNES PUBLICATION

Vol. 5 No. 51 AUGUST, 1954

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- Line Linearity
- TV in The Channel Islands
- Aerials for the Simplex
- Valves at U.H.F.
- Fault Symptoms

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Televiews

EUROVISION—A CRITICISM

THE linkage of several countries by what has come to be known as Eurovision is one of the greatest technical achievements since the inception of television. The technical problems which had to be anticipated and overcome, apart from the known difficulties, were enormous. Every viewer has now had an opportunity of examining the results of many months of diligent work on the part of the BBC engineers and their foreign collaborators. It marks a new era in television, and it may pave the way eventually for world-wide standardisation of television transmission systems. The problem was made unnecessarily complicated by the fact that most of the continental systems which took part in the experiment transmit vision on 625 lines, whereas our system is 405 lines. The problem was solved by photographing the pictures to be transmitted from the end of a receiving tube. Whilst that is a solution it is not the best solution. It is indeed tele-cine. Great praise is due to the British television engineers for their part, and we have no criticisms to make of their work.

From the point of view of the material selected for this broadcast, we have some critical comments to make. We do not think it should have been made the occasion for a broadcast by the Pope, thus giving undue prominence and publicity to a particular religion. It must not be construed from this that we are expressing any disfavour of Roman Catholicism.

Our criticism would have been made irrespective of the denominational chief selected for such a broadcast. The public does not like religion mixed with what was intended to be entertainment, a fact of which the BBC is well aware from the criticisms of those mournful Sunday programmes for which Reith was responsible. It was a snub to the dozens of other religions also having world-wide adherents. Religion and politics do not mix with science. We hope those responsible will heed these remarks. The programmes, whilst we cannot expect them to please everybody, should endeavour to please the greatest number. A large number were offended by this particular part of the broadcast, a point which they could have anticipated and avoided.

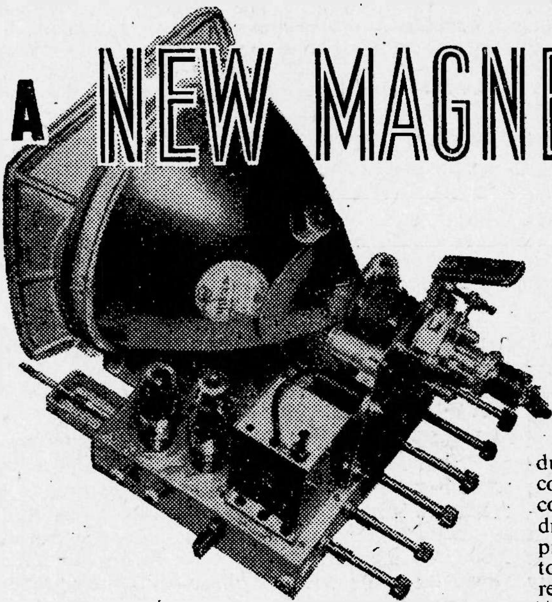
TV IN THE CHANNEL ISLANDS

ALTHOUGH the BBC decided five years ago that Jersey, Guernsey, Alderney and Sark were beyond the range of even fringe area TV reception it has recently been demonstrated that it is possible. A relay company who serve about 3,000,000 listeners and viewers throughout the world by wired network direct into their homes has solved the problem, one of great magnitude, for the very-high-frequencies used by television are a straight line emission and do not follow the curvature of the earth's surface and normally cannot be received except under freak conditions by any set or station which is out of " sight " of the transmitter. The islands, therefore, by virtue of their distance from English transmitting stations and the curvature of the earth were well beyond the fringe area. Seventy miles is considered the average distance over which television can be received. The company concerned made use of tropospheric propagation, a condition which reflects the V.H.F. waves, and these were " caught " when they came to earth at a spot considerably beyond seventy miles. It is upon this fact that the new Channel Islands stations have been able to operate. The BBC admits the success of this effort on the part of private enterprise and they have built a pilot unit in Guernsey to pick up transmissions from Wenvoe and later from the transmitter which is to be erected at North Hessary Tor in Devon. The company will monitor these transmissions from Jersey for the BBC. Fuller details of the installation will be found on page 117. Other developments will follow.

CAREERS IN RADIO

THE Radio Industry Council has recently issued an illustrated booklet entitled: " Careers in Radio and Electronics," copies are being circulated by the Ministry of Labour to public schools and grammar and technical schools. It is available from the Secretary of the R.I.C., at 59, Russell Square, London, W.C.1. —F. J. C.

A NEW MAGNETIC RECEIVER



CONSTRUCTIONAL DETAILS OF AN ECONOMICAL RECEIVER UTILISING SURPLUS COMMERCIAL RECEIVER COMPONENTS

By J. Cook

(*Concluded from page 58, July issue*)

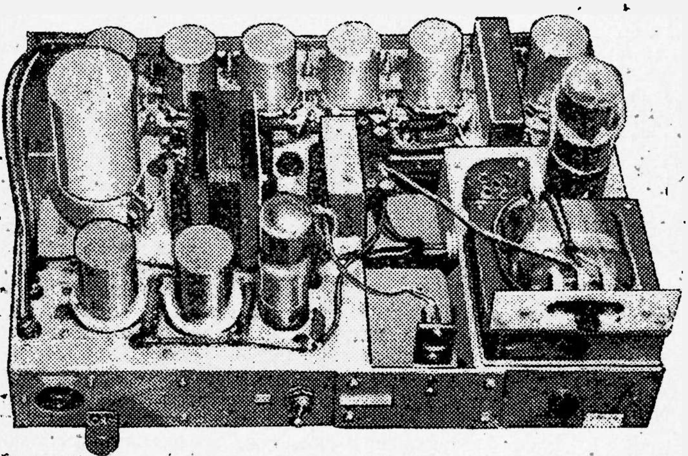
THE difficulty of using a Tetrode tube has been surmounted by rectifying direct from the 300 volt tap of the auto-transformer with a small pencil rectifier and supplying the resulting 350 volts through a smoothing circuit to the first anode. The smoothing resistor (R32) may seem unduly high, but it should be remembered that the current consumed by the first anode is so extremely low as to be insignificant. The condensers C33 and C34 are good quality condensers placed across the mains input to the earth terminal (insulated from chassis) to filter out mains-borne interference. The earth connection is not essential, but it improves the general screening of the equipment. Direct connection of the earth terminal is, of course, precluded by the mains connection to the chassis, but R.F. coupling is effected by C35 which, like the filter condensers above, should possess reliable insulation. Two fuses in the mains supply input and one in the rectifier circuit protect the equipment—the latter fuse is especially valuable in protecting the rectifier and transformer if there is any trouble with the electrolytic condensers. This is always a distinct possibility when condensers have been in stock for some time and require "reforming." In this connection it is probably good practice to break in a new electrolytic on a low voltage source, such as a small H.T. battery, before putting the normal working voltage across it.

Decoupling of the sound and vision strips is effected by R9 and C4, which keeps the voltages down below the maximum ratings of the valves concerned. The sound output stage is the exception and has a separate decoupling arrangement R50 and C36 to avoid, as far as possible, voltage fluctuations of the H.T. supply caused by any overload in the sound output valve. Focus is effected by a permanent magnet rather than by the focus coil (which is supplied with the line transformer set) because of the unavoidable loss of H.T. volts which would occur by using the coil, and also there is some difficulty in obtaining comparable focus stability due to the I and R heat changes which occur in the coil. Nevertheless, if it is decided to use the focus coil, compensation can be applied to counter focus drift. Since the coil is not specially designed, probably the simplest method of doing this would be to use a series thermistor resistance with an ordinary resistance in parallel with the thermistor. The value of this resistance is carefully chosen to compensate exactly for the increase in resistance of the coil over the temperature required.

Construction

Although it is not the intention of this article to give precise stage-by-stage details for construction, it may, nevertheless, be helpful to make some general remarks on recommended layout and construction. Once beyond the R.F. and video side of the receiver, the length of wiring and layout become much less critical and the requirements are similar to those applying in audio amplifier design. But it is wise not to take undue liberties, and the line oscillator and output components should be kept to one side of the chassis with the frame components on the opposite side. The line transformer, being in a heavy screening box, is mounted near the edge to relieve stress on the chassis. The sync separator could be in the middle of the chassis together with video output and vision limiter valve and components, the latter being mounted beneath the chassis. Three eight-way tag boards are located near each valve socket and carry the principal components as illustrated at Fig. 3. As there is only one valve on the line timebase side, the sound output stage with associated volume/on/off control is arranged on this side. Cables connect this chassis to the power pack and, in particular, care should be taken to ensure that the 6.3 volt heater supply cables are of sufficiently heavy gauge to carry the 4½ amps. without any significant drop.

The 10in. by 14in. aluminium chassis, which is the largest recommended in this material in the interests of rigidity, has a quarter hoop cradle affixed to a 3in. outrigger extension. The front of the 12in. picture tube rests in this cradle and a thin brass band from ½in. to 1in. wide clamps the tube down by the rubber mask which cushions the tube against shock. If a 9in. tube is used, the outrigger extension is unnecessary and the cradle is mounted on the edges of the chassis. In both cases the rear mounting bracket is an aluminium plate parallel with the edge of the chassis. The tube neck, which passes through it, rests on one of the special 35 mm. grommets made for the purpose; this grommet should bear up against the rear of the deflector coils and is thus interposed between coils and magnet. This gap should be about 1in. for optimum results with the tube used; a smaller distance may produce inter-reaction between the two components whilst a greater distance will produce a slightly more even focus, but with a larger spot. It is profitable to experiment, because the position for best results is critical. The deflector coils are slipped on the tube with the lettering facing the tube, i.e., with the lettering upside down when viewed from the rear. F2 and E are joined and should be at about two o'clock. In soldering particular care is advised with the line transformer, and any connections which will have high voltages present should have nicely rounded blobs of solder without any roughness in order to avoid corona troubles. Condenser and resistor types are not specified, so something should be said about them. Whilst war surplus resistors are generally quite usable, if in good condition, it can only be said that war surplus condensers of the paper variety are most ill-advised things to use, especially in the all-important timebase circuits. In the writer's experience more often than not these condensers qualify better as resistors! Paper condensers of the ex-manufacturer category generally seem to be all right, and oil filled, mica and ceramic of all types can usually be relied upon. In any case, trouble taken in testing all parts before assembly will be well repaid. With the complexity of a TV circuit it is no easy matter to trace faulty components in a newly built set which may well have wiring faults in addition.



Vision/sound strips and power pack. Front left: Sound receiver with main H.T. smoothing components. Front right: Power pack. Rear: Pye vision strip.

Operation

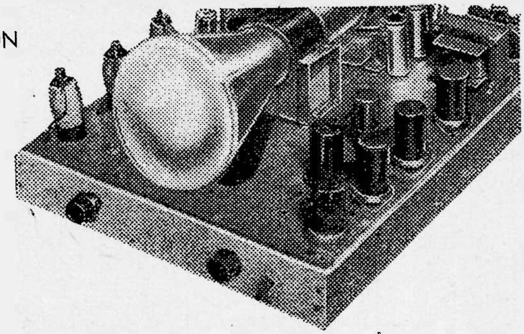
The contrast and brilliance controls should be advanced until some sort of modulation pattern is seen on the screen when it should be easily locked with the appropriate hold controls and, after focusing the lines, the height and width controls can be adjusted to fill the screen in conjunction with picture centring controls. The characteristics of the multivibrator frame timebase may cause alarm and despondency to those unfamiliar with it. Without the presence of a sync. pulse, due to no signal being received or extreme lack of gain (contrast), the raster, if such it can be called, comprises a series of haphazardly spaced lines building up to a closely spaced section in the middle of the picture which shows up as a bright band. This all sorts itself out as soon as the sync. pulses are present, except for the adjustment of linearity, which may stretch the top of the picture out considerably. In the first instance Lin. 1 should be adjusted. It will be found that this mainly influences the central portion of the picture and is adjusted for the even spacing of the lines. Lastly Lin. 2 is adjusted and this will correct any deformity at the top of the picture. There is only one linearity control in the line circuit and it will be found that adjustment of this will have some influence on the synchronisation of the line oscillator, and the picture which will probably no longer hold towards the extremes of adjustment and the setting up is thereby a little more complicated. The coarse line hold may seem a little sensitive to adjust, but in actual fact it is normally capable of holding its adjustment indefinitely once set to the mid-position. The frame hold is very definite and should hold throughout most of its range, but some occasional readjustment will pay dividends in improved interlace. A final adjustment of the contrast, brilliance and vision limiter (adjusted so that it limits just before peak white level), to obtain the best gradation of whites through greys to blacks, as observed on the test card, should complete the adjustment.

If an ion-trap tube such as the MW31/16 is used, the appropriate magnet must, of course, be fitted. Instructions on the adjustment of ion-traps have already appeared in this magazine, so they are not repeated here.

Modifications

Since the publication of the first part of this article Messrs. Lasky have disposed of the specified frame transformer. They have, however, stocks of an alternative type which we have tested and find suitable with slight modification to three of the components which form part of the linearity arrangements. These new values are: R40 100kΩ, C27 .1μF and C26 .01μF. These two condensers should be of the 250 v.w. type. A further change is required in R40 in the case of the original transformer. In the list of parts in the June issue this was given as 470kΩ but this has been found rather high and a reduction to 270kΩ is recommended.

Making an Aerial for the SIMPLEX RECEIVER



SOME DETAILS FOR THE HOME CONSTRUCTION OF INEXPENSIVE AERIALS

SINCE the publication of the blue print of our £16 television receiver we have had many requests for details of the construction of an inexpensive aerial to accompany it.

Before dealing with the constructional work it would be useful for the newcomer to be given some idea of the type of aerial required. It is not possible for us to specify exactly what type of aerial is suitable for any particular locality ; local conditions affect the signal and it is quite possible to get poor results at points well within the service area of the transmitter. Our advice then, must be of a general nature ; the best guide is to be governed by the type in general use in the locality.

In order to simplify construction we have compiled details for three types of aerial—a dipole, double-vee and a yagi.

The dipole is for use within the service area up to a radius of about 20 miles in the case of the high-powered transmitters ; this distance will vary according to the actual local conditions in the immediate vicinity, but if the aerial should prove too weak then it can be easily converted into a double-vee type.

The double-vee aerial is for use in localities up to about 45 miles from the transmitter. Normally, it should be mounted at as great a height as is practical, though under favourable conditions it can be fitted in the loft. It is about equivalent to an " H " aerial, but is more convenient, mechanically.

The yagi is composed of two directors with dipole and reflector and can be used up to 80 miles from the transmitter. It must be understood that reception cannot be guaranteed at any distance ; a lot depends upon local conditions. It should be remembered that a straight receiver has not the " pulling " power of a superhet and a further pre-amplifier may be necessary.

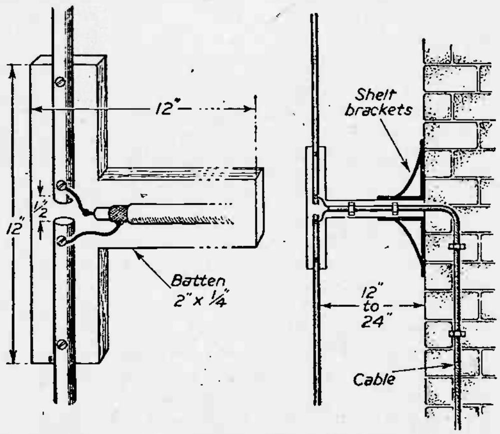


Fig. 1 (left).—Suggested mounting for the dipole. Fig. 2 (right).—A method of wall-fixing.

The Dipole

The key point of a television dipole is the insulator ; the commercial type used by manufacturers is rather difficult to construct without the aid of a lathe. The insulator is rather important because it not only performs the mechanical function of holding the aerial to the mast or cross-boom, and the electrical function of shielding the connections from the weather, but it also has a material effect on the characteristics of the dipole itself.

The centre impedance of a dipole cut to half a wavelength and in free space is about 70 to 80 ohms. However the aerial must be supported and the introduction of the support alters the characteristics of the aerial. It is possible to counteract the alteration by " tuning " the dipole which, in practice, amounts to shortening it by five per cent. When this is done the aerial will be tuned to the desired frequency and the centre impedance will be back to between 70 and 80 ohms when the insulator is fitted.

It will be seen, therefore, that the insulator must be kept as small as possible and although the method of mounting the dipole given in this article means that the " insulator " is longer than that used commercially, there will be no deleterious effect if the measurements given in the table are adhered to.

The main purpose of the insulator is to provide a fixture for the rods and to preserve the terminations from the weather. When copper wire (such as is used in coaxial cable) is connected to the rods the action of the damp atmosphere on the dissimilar metals is to cause corrosion ; this would result in creating a high resistance joint between the two and, in the secondary stage, cause the copper wire to corrode and eventually to fracture.

Where the aerial is mounted in a dry position, such as a loft, then the simple termination shown in Fig. 1 can be used. It consists of a " T " shaped piece of batten 2in. by ¼in. to which the rods are bolted, each rod having two bolts. The bolts can go right through the rods and the wood. The coaxial cable is brought along the main member of the " T " and is cleated to it, and the inner conductor is connected to the upper rod under the supporting bolt, while the outer braiding of the coaxial cable is connected to the bottom rod.

The lengths of the rod are given in Table I for the different channels. Where horizontal polarisation is used the rod must be mounted horizontally and turned so as to receive the best signal. With vertical polarisation the rod must be kept in the vertical direction.

Note that if the rod is mounted in the attic or loft it may be beneficial to erect it at an angle to the plane of reception, and it is often worthwhile tilting it in order to pick up the best signal. A further point to note is that pick-up conditions are liable to vary within the roof-space and if satisfactory results are not obtained then a search should be made for a better position—an alteration of only a few feet often makes an appreciable difference in the strength of the received signal.

The aerial should be kept clear of electrical wiring circuits in order to keep mains-borne interference at a minimum.

A simple dipole as described can be used out of doors. All that is necessary is to plug the ends of the rods with wooden plugs and to fit some sort of cover over the central connections. A small wooden box can be built where the cross member of the "T" joins the main member, or an electric junction box of the round plastic type can be employed.

In order to prevent corrosion due to moisture, Chattertons compound can be applied to cover the terminals and the end of the coaxial cable.

TABLE I

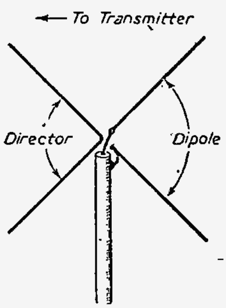
Dipole Lengths

Channel	Length
1	10ft. 10in.
2	9ft. 4in.
3	8ft. 6in.
4	7ft. 9in.
5	7ft. 3in.

The diameter of the rods used is governed partly by the insulator. By using the method described in the foregoing paragraphs the diameter should be ⅜in. Rod which is smaller than this is inclined to whip and thereby cause picture flutter.

It is not strictly necessary to use ⅜in. diameter rod; in the attic ¼in. diameter can be employed, while for an outside aerial up to 1in. is practicable.

Duralumin or similar tubing is the best kind as it is light in weight yet mechanically strong and has good electrical characteristics. If difficulty is experienced in obtaining it locally, then it can be got from H. Rollet and Co., 6, Chesham Place, London, S.W.1, or from Fringevision, Ltd., Angel Yard Works, Marlborough, Wilts, who both are advertisers in PRACTICAL TELEVISION.



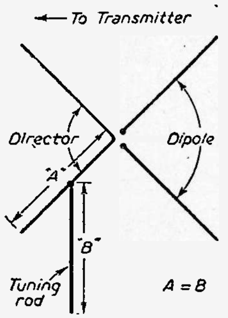


Fig. 3 (left).—Double-vee circuit. Fig. 4 (right).—A reactance tuner for double-vee aerial.

Fringevision, Ltd., will supply insulators and chimney lashings if required.

It is an easy matter to mount the dipole on a wall

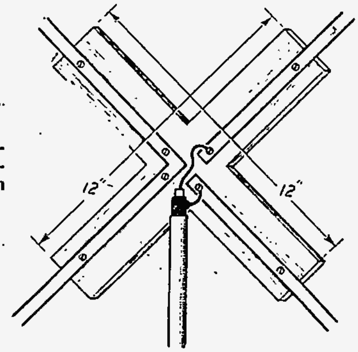


Fig. 5.—Mounting of the double-vee aerial shown in Fig. 3.

or chimney. Simply extend the main member of the "T" piece so that it is between 18-24 in. long and then, by the use of shelf brackets, it can be fitted directly at right-angles to the brickwork (Fig. 2). The coaxial cable is run along the main member of the "T" and down the wall.

The aerial should be erected as high as is feasible and care should be taken to keep it clear of metal guttering and down pipes.

The Double-vee Aerial

This aerial has quite a good pick-up having a gain of more than 3 db over a normal dipole. It is light yet mechanically strong and requires no special matching devices.

The "circuit" of the aerial is given in Fig. 3 and element lengths in Table II. It consists of a dipole which is bent into the form of a "V" lying on its side and a director also formed like a "V." The director is not connected to the dipole in any way. It is pointed at the station being received while the dipole points *away* from the station. This is the reverse to the conditions of an "H" aerial which should have the dipole pointed *towards* the transmitter.

It is possible to mount the aerial in the roof but it is preferable to mount it outside, well clear of walls, etc. If it is mounted in the attic some trouble from mismatch may be experienced; it can usually be tuned out by the following method: connect a length of stiff wire (or an additional rod) to a sliding connection on the lower member of the director. A metal clothes-peg can be used for the slide. The wire should equal the length of this section; it should hang vertically and be slid along the director rod until the best picture is obtained on the screen. It can be finally bolted in that position.

This method of tuning out mismatch due to nearby objects is much simpler than the cut-and-try method with quarter-wave stubs.

Mounting

A method similar to that employed with the dipole can be used for mounting the rods. Two pieces of batten 12in. long are formed into an "X"; they should be jointed in the centre so that the back and front faces are flush. The rods are bolted on to the "X," two bolts being used for each rod, and the dipole rods should be separated at the centre by ½in. The director rods should be continuous, though bent at an angle of 90 deg., but if separate rods are used then they should be electrically bonded together.

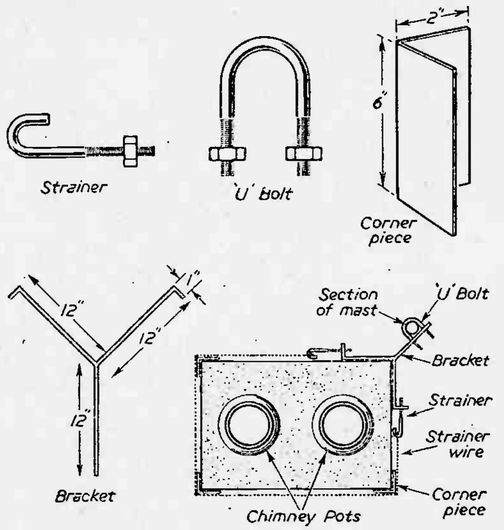


Fig. 6.—Details of chimney-lashing.

The arrangement can be mounted in the attic as it is and the bottom rods stood on the floor. The aerial should be aligned approximately on the transmitter; there is very little difference in signal strength received over an arch of plus or minus 20 deg.

Where the transmitter is horizontally polarised then the aerial will, of course, have to be mounted horizontally.

External Fixture

If the aerial is to be fitted externally then the ends of the dipole with their connections to the cable must be boxed in and a method similar to that explained for the normal dipole can be used.

For mast fitting the wooden "X" portion can be bolted to a metal or wooden mast. In the case of a metal mast the coaxial cable should be bound to the mast with adhesive tape. A generous supply of tape should be used at intervals down the mast.

It is not recommended that the cable be brought down inside the hollow metal mast. If the mast is of any length the cable will vibrate against the inside and cause a noise which can be a real nuisance at night.

Fixing to the Chimney

The home construction of chimney mountings is dependent on the facilities and material available and many constructors will prefer to buy these. For those who wish to construct their own the details in the following paragraphs are given.

Two sections of wrought iron or mild steel 1in. wide and ¼in. thick are required to be shaped into a "Y." The angle between the upper arms of the "Y" should be 90 deg. An inch of the end of each short arm should be turned over to form an angle of 90 deg. and should be drilled to take a strainer bolt. It is preferable to use the "U" ended strainers with a diameter of about ⅜in.

Six corner pieces will be required to prevent the straining wire from cutting into the chimney and they can be made from sheet iron of about 14 gauge.

Two "U" bolts are required made of about ⅜in. diameter mild steel whose overall diameter is the same as the external diameter of the mast.

Two holes should be drilled in the long arm of the "Y" to take the "U" bolt.

TABLE II

Double-v ee

Channel	Director	Dipole
1	5ft. 4in.	5ft. 10in.
2	4ft. 9in.	5ft. 3in.
3	4ft. 4in.	4ft. 9in.
4	4ft. 0in.	4ft. 4in.
5	3ft. 8in.	3ft. 11in.

Note that the above are the lengths of the individual elements. For example, Channel 1 has a director consisting of two arms, each of which is 5ft. 4in. in length and a dipole, each arm of which is 5ft. 10in.

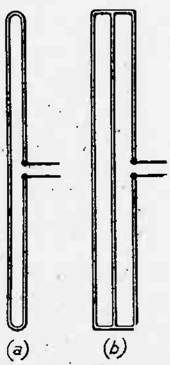
Straining wire of about 7/14 strands will be required.

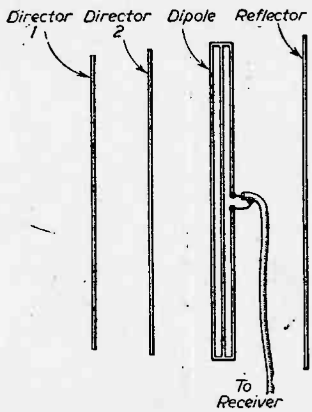
Fig. 6 shows the various items and gives a plan view of the fixing.

For a short mast up to 6ft. the mast can be made of duralumin tubing 1in. in diameter. For a mast up to 16ft. in length the tubing should be 2in. It is possible to use iron or steel tubing but is not recommended because of the increased weight.

Suitable tubing can be obtained from the advertisers mentioned previously.

When mounting the aerial externally it is not necessary to get it strictly in line with the transmitter. There will be no noticeable fall off in gain over an arc of plus or minus 20 deg. It is better to





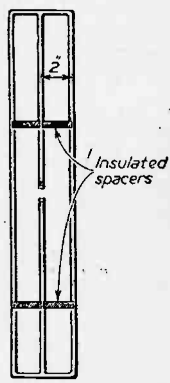


Fig. 7 (left).—Folded dipole aerials. Fig. 8 (centre).—Folded dipole with directors. Fig. 9 (right).—A triple-folded dipole.

try the aerial for a week or so before deciding its final orientation so that it can be rotated away from any source of interference.

Yagi Array

The yagi array described here has two directors, a dipole and a reflector. It does not give the highest gain possible with such a combination but makes a near approach to the problem. The highest gain obtainable with two directors and a reflector is when all elements are spaced at 0.2 wavelength. In this array we are using a spacing of 0.1 wavelength for the directors and 0.15 wavelength for the reflector, which gives a gain of about 1db less than that with 0.2 spacing, but the array is much lighter and more compact.

TABLE III
Yagi

Channel	Director 1	Director 2	Dipole	Reflector
1	10ft. 0in.	10ft. 5in.	10ft. 10in.	11ft. 2in.
2	8ft. 8in.	9ft. 0in.	9ft. 4in.	9ft. 8in.
3	7ft. 11in.	8ft. 2in.	8ft. 6in.	8ft. 10in.
4	7ft. 2½in.	7ft. 5½in.	7ft. 9in.	8ft. 0in.
5	6ft. 9in.	6ft. 11½in.	7ft. 3in.	7ft. 5½in.

The spacing between directors and reflectors for each channel is given below.

Channel	Directors	Reflector
1	2ft. 2½in.	3ft. 0in.
2	1ft. 11in	2ft. 10in.
3	1ft. 9in.	2ft. 8in.
4	1ft. 7in.	2ft. 5in.
5	1ft. 5in.	2ft. 1½in.

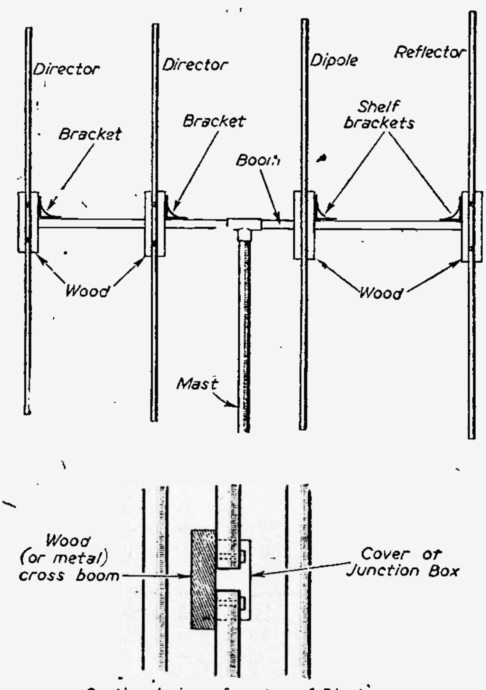


Fig. 10.—"Yagi" array and details of gap in dipole.

One of the difficulties associated with high gain arrays is in matching the aerial to standard 80Ω cable. The addition of the other elements causes the centre impedance of the dipole to fall to about 8Ω with the close spacing recommended and some form of matching device is essential. There are various forms of matching methods such as the Delta, "T" match, transformer and the use of folded dipoles; we have chosen the latter as being the simplest and offering no difficulties in cut-and-try methods.

The centre impedance of a dipole increases by folding the dipole. Fig. 7a shows a double-folded dipole. The centre impedance is the square of the number of elements used, so that the dipole in Fig. 7a has an impedance of four times the dipole without the fold. In Fig. 7b we have a triple-folded dipole and the centre impedance is therefore $3^2=9$ times.

We have seen that the centre impedance of our yagi array is in the region of 8Ω, therefore if the dipole is triple folded the impedance will become $8\times9=72\Omega$, which is a good match to 80Ω cable.

A further advantage gained is that folding the dipole widens the bandwidth. When directors are used to increase the gain not only is there an increase in the signal picked up by the aerial, but the array becomes more directive (the signal rapidly falls off as the angle between the direction in which the aerial is facing and the direction of the transmitter is increased), but the bandwidth of the aerial is reduced.

Fig. 8 shows the "circuit" of the yagi and Table III gives lengths of elements. It will be noted that neither the directors nor the reflectors are connected to the aerial electrically. They are "parasitic" elements, and it is unnecessary to make direct connection.

The folds in the dipole should have a centre-to-centre measurement of 2in. Direct metallic connection is made at each end and bonding bars can be used for this purpose. It is as well to insert strengthening insulators halfway between the end and centre of the dipole (top and bottom half) to strengthen it and to maintain correct spacing. Paxolin blocks or Tufnol rod suitably shaped can be used, or even well-painted hardwood.

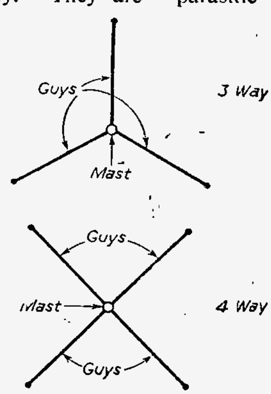


Fig. 11.—Method of guy in a heavy mast type aerial.

The dipole can be mounted at right angles to, or in line with, the other elements but care must be taken to ensure that the metal boom (if used) does not short-circuit the dipole elements.

The method shown for the ordinary dipole can be used to fix and house the centre dipole rod, but account must be taken of the extra weight of the dipole.

The cross-boom should be of hardwood or aluminium alloy, and for strength coupled with lightness a material of 1in. diameter would be suitable.

Specially made reflector and director rod holders can be employed or the rods can be bolted to strips of 2in. batten, which is, in turn, bolted to the cross-boom and kept in position by shelf brackets.

Fig. 10 shows the scheme.

The mast, if fitted on the chimney, should not exceed 18ft. in length, and in windy localities guy wires should be used. The guys can be either three or four in number set at 60 deg. or 45 deg. angles respectively (Fig. 11).

It is important that the guy wires have no direct relationship in length to the aerial rods, and insulators must be inserted to break up the wires into elements which are neither one quarter nor one half of a wavelength. If one third wavelength sections are used then there should be no trouble.

Avoiding Humming

Yagi arrays (and even the simpler types of aerial) are inclined to vibrate when the wind is in a certain direction. The humming is communicated through the mast to the chimney and can thus be mechanically amplified and sound throughout the house.

To mitigate this nuisance the rods should be filled with dry sand or fine granulated cork and the ends thoroughly corked and sealed. If the mast is first wrapped with a layer of sheet lead or thick rubber, which, in turn, is surrounded by a hardwood block before being bolted to the mast, no trouble from this source should be experienced.

Extreme Ranges

Where signal conditions are difficult the yagi array should be used, and it should be erected as high as possible. If the distance from the dipole to the receiver is likely to exceed 60ft., then the use of low-loss fringe-type coaxial cable should be considered.

Under such conditions the use of a mast-head type of pre-amplifier is often worthwhile.

BBC TELEVISION CENTRE (WHITE CITY)

THE first concept of the proposal involved the planning of just over half the 13-acre site for the needs of the television service, the remainder of the site being left unplanned in any detail until the BBC was in a position to judge how it should be developed to meet the demands of the service in the light of later experience.

The architectural conception of the half-site scheme had, however, to take into account the development of the site as a whole. The curvilinear " tail-piece " seen in the plans illustrating the scheme provided that measure of flexibility necessary for the planning of the second half of the site when requirements had been decided.

It is now envisaged that the " tail-piece " shall provide, in addition to further studios, a large garage, a block of rehearsal-rooms, and possibly a roof " heliport."

Scenery Block

This building, which covers approximately one acre, is the first part of the project to be completed. It has been designed to take its place as a unit in the general architectural conception. Extensive workshops are provided for carpenters, property-makers, scenic-artists and others engaged in the making of scenery for studio productions. There is also a high (26ft.) setting-space where scenery is assembled together with large areas in which scenery and properties, suitable for re-use, can be stored.

The scenery block building contains in addition 200 offices for the use of administrative staff, producers, designers, etc., also, temporarily, a canteen for use of occupants of the block until such time as the main block is built.

Main Block

This block will consist of a multi-storey " ring " providing accommodation for dressing-rooms, wardrobe-service, engineering and offices, around a garden of 150ft. diameter. Radiating from the " ring " will be television production studios and their ancillaries, together with two " presentation " studios (where announcements, captions, etc., are inserted), telecine and telerecording areas and a central control-room.

The outer periphery of the studios will be enclosed by a continuous runway, along which units of scenery, properties, etc., can be conveyed from the scenery block direct to the studios, these services being thereby segregated from areas allocated to artists, etc.

Canteen Block

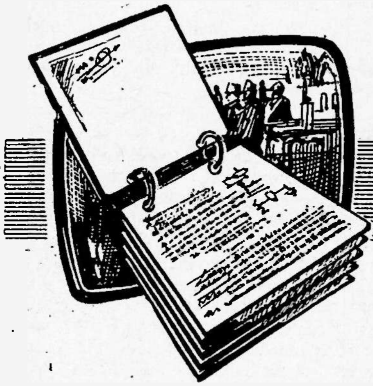
Work has just commenced on this block. Initially, it will be divided and used for rehearsal purposes, but when the main block is occupied this block will be equipped as a canteen to serve 750 diners at a sitting. It will later be connected with the main block by a tunnel and by a bridge across the road outside the scenery runway.

Works Block

The works block will house the workshops for the maintenance and repair of technical equipment and an experimental laboratory where lighting and optical effects can be tried out. It will also provide accommodation for staff engaged on building maintenance.

Road Traffic

The centre will have its main entrances on Wood Lane and a secondary entrance on Frithville Gardens —which leads to the BBC Television Studios in Lime Grove. Parking space will be provided within the curtilage of the site for all cars using the centre.



Pages from a TELEVISION ENGINEERS Notebook

19.—HEATER WIRING IN A.C.-D.C. RECEIVERS

IT has become general practice to operate television receivers from an auto-transformer which also carries a heater winding or windings for the valves and tube after the fashion shown in Fig. 1. This system has much to recommend it, for not only does the auto connection do away with the necessity for an expensive transformer having a separate primary and double (centre-tapped) secondary for the receiver H.T. supply, but the valve heaters can still be conveniently wired in the usual A.C. parallel arrangement. Further, a separate heater winding for the tube itself is readily provided.

The rectifier can, of course, be either metal or valve, the former being in general more common. If a valve is used, a further heater winding is necessary, but this is no serious drawback in the general simplicity and cheapness, to say nothing of physical size, of the system. It has only one disadvantage, if it may be called that, and that is in the design of a D.C. or A.C.-D.C. receiver, where obviously any sort of transformer is ruled out. The set must then be built to run directly from the mains without step-up, and the valve heaters must be run in series. The loss of any actual voltage step-up is of small consequence in modern techniques where booster diode circuits, R.F. or fly-back E.H.T. and other special valve systems can be brought into play; in fact, even with the auto-transformer circuits just mentioned, the step-up seldom exceeds some 250 volts A.C. It is in the necessity for series heater connections that some thought and care is necessary, and this will be the subject of the present discussion.

The Series Circuit

In any series circuit (assuming resistive components) the voltages are additive, but the current is the same throughout each element. Consequently, for the series valve circuit, all the valves must normally take the same heater current. If, for example, a 0.3 amp. heater line is decided on all the valves used in the set must take (or be made to take) 0.3 amp. The voltage ratings of the valves is not particularly important provided that the total voltage required by them does not exceed the voltage supply available. Let us look at this by means of a simple example.

Suppose a receiver is to use six EF91's in the vision and sound strips, a UB41 limiter and detector, an ECC81 as line and frame oscillator, a PL33 and PL38 as frame and line amplifiers, a PY80 as booster, an EL42 as sound output, and a MW31/74 tube. Fig. 2 shows these valves wired in a series system, with their respective voltage and current ratings marked off beside each of them. It will be noted at once that, though all current ratings are not the same, the bulk of the valves require 0.3 amp., and that the others are rated *lower* than this value. We are not concerned at the moment with the order of the valves, although this is quite important, as we shall see later on.

Adding up the voltages of the valves we find this to be 143.7 volts; therefore, assuming a mains voltage of 220 volts, a total of (220−143.7)=76.3 volts must be lost in the resistance R. The value of this dropper is now easily found to be 254.3 ohms, say, 250 ohms, and it must consequently dissipate 22.5 watts, which is quite a lot of heat. Now, two of the valves are rated

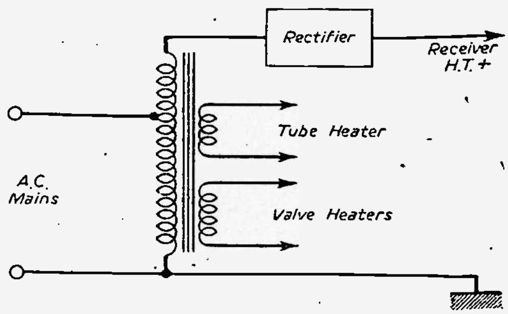


Fig. 1.—The familiar auto-transformer system of H.T. and heater supplies used on modern A.C. receivers.

lower than 0.3 amp. heater current; the EL42 takes 0.2 amp. and the UB41 takes 0.1 amp. In order that these valves will work without damage, the excess currents of 0.1 amp. and 0.2 amp. respectively must be bypassed in suitable parallel resistances shown in the diagram as R1 and R2. The calculation of such resistance values is quite simple; for the EL42 the voltage across R1 (and the heater) is 6.3 and the current through R1 has to be 0.1 amp., making its value 63 ohms at a wattage rating of 0.63 watts; and for the UB41, a current of 0.2 amp. at 19 volts gives 95 ohms at a rating of 3.8 watts for R2. In practice, a 1 watt 68 ohms resistance would be used for the EL42 shunt, with a 91 ohms 4-watt type for the UB41 shunt.

It is very important when making up a series valve line in this way to check from the valve manufacturer's lists all heater ratings and ensure that no ratings lower than the main line current (0.3 amp. in the example above) are left unbypassed by a proper shunt. Failure to do this will result in the heater being considerably overrun, and actual damage may well result. Shunt values are not usually critical, and the nearest preferred resistance value of adequate wattage rating will serve.

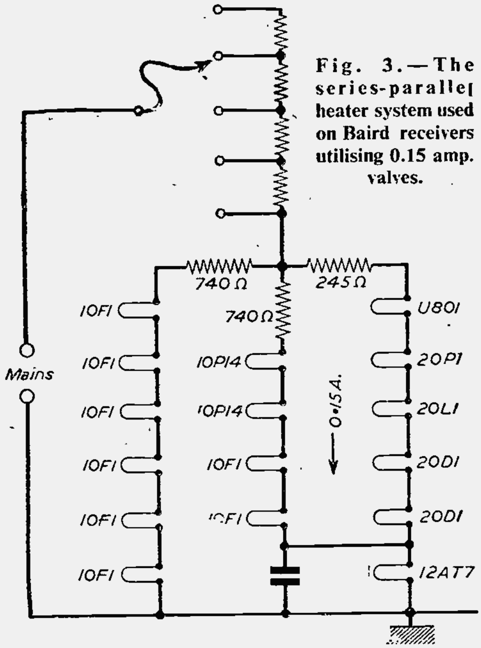


Fig. 3.—The series-parallel heater system used on Baird receivers utilising 0.15 amp. valves.

It must be noted also that valves with heater currents *greater* than 0.3 amp. cannot be used in a circuit such as that above ; shunts cannot be used in such a case, and if wired up a valve will be under-run, which is often as bad as over-running. Further, as the total valve voltage chain adds up to 143.7 volts, the supply cannot be less than this, the greater the excess, the greater being the value of R to drop it.

Other Methods of Connection

We have seen that the wattage dissipation of R in the example above is 22.5 watts. Now such a dissipation means great heat, and in practical design such a component would have to be of a generous size and well spaced away from other parts ; in addition, good ventilation would be necessary. If a series circuit can be made to do away with such a large resistance as dropper, or if several resistances of much lower rating can be used, the design of the set becomes easier, and ventilation problems are eased.

This can be done if valves having high voltage and low current heaters are used. Such valves come under the 0.1 amp. ranges of the various manufacturers and some examples are the Mullard UF42 high slope R.F. pentode, with a 21-volt heater, the UB41 double diode with a 19-volt heater, the UL41 output pentode with a 45-volt heater, and the UL44 line output pentode also with a 45-volt heater. If such valves are used in a series chain of the average television receiver, the total voltage chain can be made to come very close to that of the mains supply figure, with the result that very little voltage has to be lost in a dropping resistance such as R. In addition, the low current of 0.1 amp. reduces the wattage rating considerably, and problems of heat dissipation are easily overcome.

Fig. 3 shows the heater system used in the Baird P167 and similar models. This is a series-parallel arrangement, with a common dropper tapped at points to permit of various mains inputs, and then each valve chain has a separate dropper, of 10 watts rating, these components being easily obtained and quite small in physical size. Notice how the 12AT7 is made to carry the currents of both parallel lines of the other valves, so making its rating of 0.3 amps. correct.

The constructor intending to design his own A.C.-D.C. receiver should bear these points of series heater connections in mind, and select his valves accordingly.

Order of Wiring

In wiring valves in a series line, the valve nearest the dropper resistance has its heater at a fairly high potential (perhaps some 200 volts) above chassis or cathode, while the valve at the other extreme of the chain is earthed. Obviously, it is important to ensure that the valve heater-cathode potential rating will withstand such voltage differences, and a valve with a rating of, say, 50 volts, will not be used at the dropper end.

The order shown in Fig. 2 is a fairly typical one, the line output valve, booster diode and other " insensitive " types being wired at the high voltage end of the chain, while the R.F. pentodes of the vision and sound strips, the tube and the detector

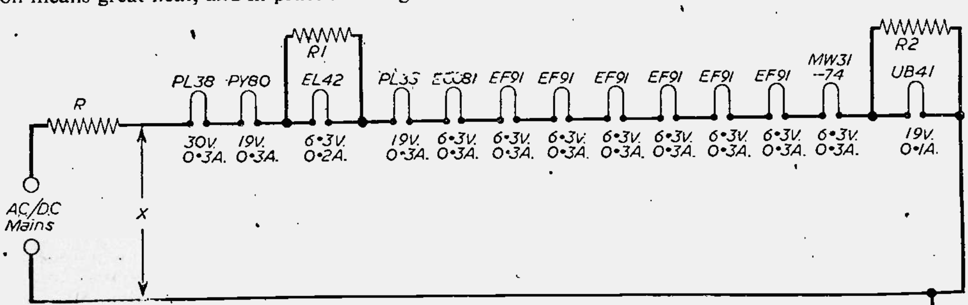


Fig. 2.—A typical 0.3 amp. rating series heater chain.

are kept towards the earthy end. The valve manufacturer's lists should be studied in respect of the maximum permissible heater-cathode potential, and the valves arranged accordingly. One other point, however, is the matter of keeping valves such as detectors, low-level R.F. amplifiers, etc., somewhere near earth on their heaters as the possibility of hum induction into the cathode or grid is eliminated. The heater circuit of the A.C.-D.C. receiver described in the May, 1952, issue and the Lynx (which uses a series heater line although a transformered H.T. and tube heater supply is arranged), described in the July, 1953, issue, where all the above points will be illustrated, should be studied.

It is important that a valve in a series chain is never unplugged when the set is switched on. Suppose, for example, that one of the EF91's in the circuit of Fig. 2 is removed when the supply is on; all the valves go out, of course, but the heaters of those on the left of the removed valve immediately rise to the level of potential of the point X, perhaps 200 volts and more. The danger of a breakdown in the heater-cathode insulation of those of lower rating than this is, therefore, evident.

When a valve heater fails in such a chain, of course, all the valves are extinguished, and when such a fault is suspected, it is absolutely essential to switch off at once and then test each valve heater for continuity out of the set.

The Brimistor

The Brimistor, or thermistor element, is used in series chains to prevent heavy surges when first switching the current on to cold valves. It is usually wired in series with the main dropper R and is usually shunted with a resistance (about 5 watts rating) of some 250-300 ohms, to reduce the warming-up period. The resistance of the thermistor is very high to begin with, but falls as its temperature rises, finally reaching a steady state of some 40 ohms. This resistance must be allowed for in calculating the total dropping resistance required in any particular case.

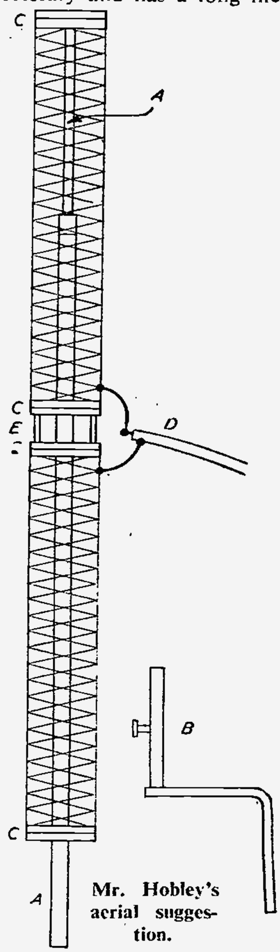
There are several types of such thermistors, each designed for a particular current chain, 0.1 to 0.3 amp. and the proper type should be used.

Queries from readers sometimes show that a thermistor is often confused with a burned 1-watt resistance. The physical resemblance is very close, but the thermistor is unpainted and is normally black. It runs very hot in practice, and when cold will give a high ohmmeter reading. When such a component is noted in a heater line it is almost certainly a thermistor; a 1-watt resistance would not be a very likely component in such a position.

An Improved TV Aerial

By J. W. Hobley (G2VU)

THIS aerial marks a radical departure in design and theory, and is the result of much experimenting to provide an aerial which is compact, more efficient, and which can be made for a quarter of the cost of a metal rod aerial. It weighs only 4½ lbs., does not moan or whistle, renders chimney bands, wires, etc., unnecessary and has a long life.



Mr. Hobley's aerial suggestion.

It is based on the theory that a straight half-wave dipole aerial is fundamentally efficient and correct, and that aerials are merely collectors or radiators of energy, and I have, therefore, abandoned the use of such terms as "gain" in favour of "pick-up." Reflectors, etc., are not required.

The larger, within certain limits, the metallic surface presented to the transmitter the greater the "pick-up." In my opinion what little increased "pick-up" is obtained by adding rods to a dipole is due mainly to the additional metal surface obtained thereby.

By using wire netting of suitable length and mesh and rolling it into cylindrical form, I have found that by using two such cylinders as a dipole, the "pick-up" is increased by at least 50 per cent. as compared with a rod aerial, and that no advantage is gained by using gauze, perforated or expanded metal. These results relate to tests, etc., at 51 miles from Sutton Coldfield.

As will be seen from the drawing, the two cylinders are supported by a central wooden rod A, the lower end of which is extended to fit into an iron bracket B for attaching to the bottom of a chimney or under the eaves at which height, in the majority of cases, the "pick-up" equals that of a rod aerial mounted on a chimney.

Each cylinder is fitted with ends C of treated wood or the like and the inner ends are spaced and insulated at E as in an ordinary dipole. The inner wire of the co-axial cable D is soldered to the top section and the braiding to the bottom section. Twin feeder can also be used. Both vertical and horizontal forms are covered by patent applications. The latter type is not fitted with a central wooden rod, the cylinders being self supporting.

FAULT SYMPTOMS

THE CAUSES OF COMMON FAULTS, AND METHODS OF CORRECTION

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

(Continued from page 76, July issue.)

IN some Ferguson's a Metrosil resistor functions as a rectifier on the line flyback pulses taken from a tapping on the primary of the line output transformer, and produces across C1 about 200 volts above the H.T. line potential.

If all voltages on the tube appear normal, and the setting of the ion-trap magnet has been checked, the fault may lie in the scanning circuits. It is frequent practice to couple the frame deflecting coils to the output valve by means of a resistor capacitor network (see Fig. 55). Should C1 develop a short-circuit a very heavy current would be permitted to flow through the scanning coils, and since the coils used in this type of circuit are of high impedance the resulting magnetic field may be of sufficient magnitude to deflect the electron beam right off the fluorescent screen. To determine whether such a fault is responsible for our blank screen we can momentarily open-circuit the frame deflecting coils, when a single horizontal line should appear across the screen.

Very rarely are the line deflecting coils coupled in this way. Invariably, a transformer is employed, the insulation of which has not been known by the writer to break down in such a way as to cause a heavy current to flow through the line coils.

Having arrived at this latter check with still no sign of screen illumination we can assume with reasonable safety that the tube has died in some way.

A Blank Screen (Mainly Projection Receivers)

In all types of projection receivers, and in certain sets of the directly-viewed type, facilities are embodied to cut off tube beam current should one of the timebases cease to function. The symptom of a blank screen on such a receiver might, therefore, be due to one of the faults we have already considered, while, on the other hand, a timebase failure may be responsible.

Projection television receivers demand the formation of an intensely bright picture on the small 2½-inch diameter tube face, and for this reason very high final anode potentials are essential. Standard Mullard projection units use 25,000 volts, obtained from a "ringing" choke E.H.T. generator and a three-stage voltage multiplier, and in some directly-viewed sets final anode potentials in excess of half this figure are now commonplace.

Such high potentials subject the screen phosphors to damage by local heating should either of the timebases stop working, and as this is a contingency that might arise in any receiver, so-called tube protection circuits are introduced to eliminate the possibility of tube damage from this cause.

Most directly-viewed receivers employ a flyback E.H.T. system. With this type of circuit an automatic tube protection feature is provided so far as line timebase failure is concerned for, obviously, if this section fails no E.H.T. is generated. Even so, in certain circuits of this type the occurrence of an open circuit in the line deflecting coils may have but little affect on the generation of E.H.T. It is, therefore, advisable to bear this point in mind when making adjustments to the picture-width tapping—which allows the selection of a suitable tapping on the line output transformer secondary to the deflecting coils—found in certain sets instead of the more conventional control. Moving the link from one socket to another while the set is working may render the deflecting function of the timebase inoperative—whilst still providing perhaps an even enlarged E.H.T. potential—for sufficient time to burn a vertical line on the screen.

From the frame timebase point of view, this danger from burning exists in most directly-viewed sets. Turning the brightness control down as low as it will go may only appear to cut off screen illumination, while the beam is being deflected normally, though it must not always be assumed that under this condition beam current is non-existent, for with a stationary

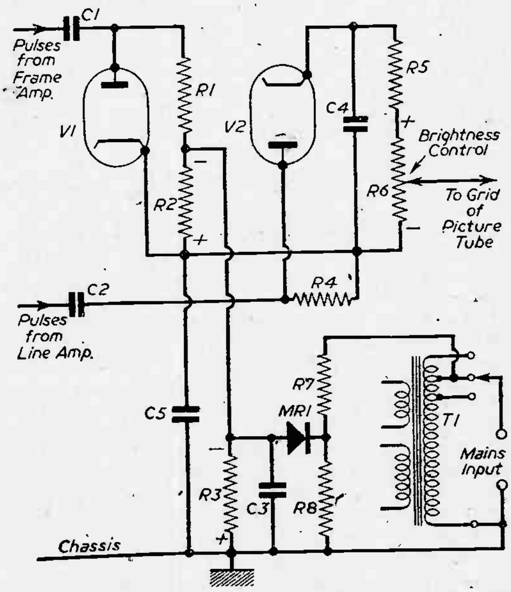


Fig. 56.—Picture-tube protection circuit used in the directly-viewed Ekco Model TC165.

beam, or with one which is being deflected in one plane only, the bombardment of the screen by very high velocity electrons in the resulting small area may, in certain cases, be sufficient to warrant concern.

To a large extent, of course, this reasoning depends upon the style of tube biasing arrangements adopted, and somewhat upon the characteristics of the tube; certain tubes possess a lower beam cut-off potential than others, and, as we have already seen, the resistive element of the brightness control is not always returned to chassis.

The directly-viewed Ekco TC165 is one receiver that may fail to give a raster due to a timebase defect. This set uses a mains derived E.H.T. system, and the tube protection section under discussion is shown in Fig. 56.

Referring to the circuit we can see that the mains voltage across the primary winding of the mains transformer T1 is applied across a potential divider, consisting of R7 and R8. The resulting potential across R7 is rectified by MR1, and bled by R3 :. C3 being the reservoir capacitor, across which a potential in the region of 120 volts negative with respect to chassis is developed. This potential is applied through R2 and R6 to the grid of the picture-tube, making this electrode much more negative than the cathode, and, therefore, holding the tube well into beam cut-off.

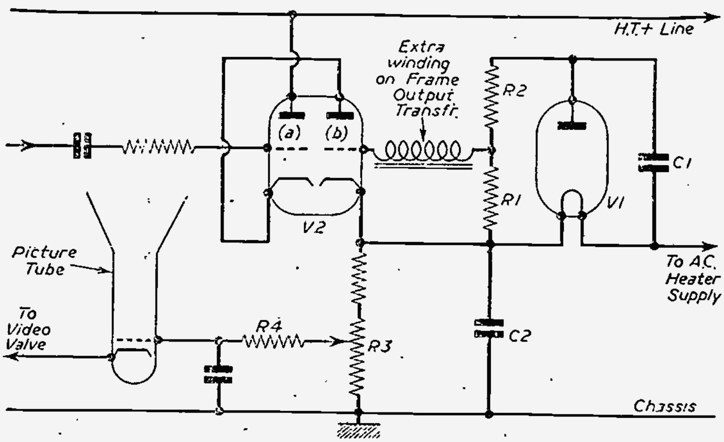


Fig. 57.—Protection circuit used in Philips' projection receiver, Model 799A.

Frame and line pulses, taken from across the appropriate deflecting coils, are applied to the anodes of diodes V1 and V2, via C1 and C2, respectively. Under these conditions both diodes conduct and a D.C. potential corresponding to the line pulses is set-up across R5 and R6, making the cathode of V2 positive. Similarly, the frame pulses are rectified and correspond to a D.C. potential across R1 and R2, and again the cathode of the valve V1 goes positive.

It can be seen, therefore, that the sum of the potentials developed across R2 and R6 is applied in positive sense. via the brightness control R6 slider, to the grid of the picture-tube.

The positive potential so derived tends to outweigh the cut-off potential across C3. and the component values are so arranged that with the cathode of the tube connected to the anode of the video amplifying valve in the usual way, R6 has the normal potential range for a brightness control.

Clearly, then, if both timebases fail, no positive potential exists across R2 or R6, and the full negative bias across C3 is applied to the tube grid to hold it well within the cut-off region. If the line timebase fails only, the resulting loss of positive potential across R6 is sufficient to upset the normal biasing arrangements, and the tube is held within beam current cut-off, although not quite to the extent of the full potential across C3. Similarly, if the frame timebase fails the potential at the tube grid falls less positive. In this case, however, the potential loss is less severe, and the tube is not cut-off completely, nevertheless beam current is limited to a safe value.

A Circuit by Philips

Another tube protection circuit evolved by Philips, Ltd., and in use in the Philips Model 799A projection receiver, is shown in Fig. 57. Here the alternating voltage present across the valve heater supply line is taken to the cathode of the diode V1. A D.C. potential is thus developed across the reservoir capacitor, C1 and the potential divider R1 R2. The potential existing across R1 is negative with respect to V1 cathode, and is applied to the grid of triode V2(b) through an extra winding on the frame output transformer. Since the cathode of this valve is in direct contact with the cathode of the diode, V2(b) is, therefore, held at anode current cut-off.

Because triode (a) of the V2 is connected in series with triode (b), triode (b) is also held at cut-off. As a result of this no potential is developed across the brightness control R3. Under such a condition the grid of the small type picture-tube is heavily negative, for the cathode is maintained positive from the anode of the video amplifier valve in the usual way.

This, then, is representative for conditions of no line or frame drive, and only when both triodes are fed from their respective sawtooth generators do they conduct and cause a current flow through R3, and a resulting volts drop which then allows the potentiometer to function as a brightness control as is standard practice.

It should be mentioned that there are a few variants of this system, though in most cases the basic function is similar, and once the general principle of the artifice has been established, its mode of function can be readily assimilated.

A legion of faults—in addition to those intended—can cause protection circuits to operate and give rise to a blank screen. This can prove rather bewildering for the experimenter, but, nevertheless, systematic and judicial circuit analysis should soon reveal the defective section. In the first place it is desirable to ascertain that operation of the protection circuit is definitely responsible for the blank screen, and if it is, then extreme care must be taken to ensure that the produced paralysing bias is not inadvertently taken from the picture-tube due to a short-circuit or component by-pass during the process of analysing.

It is almost a certain fact that operation of the tube protection circuit is the cause of the blank screen if—after allowing a few minutes for the set to warm up properly—the receiver is switched off, when, provided E.H.T. is reaching the tube anode, a patch of diffused light appears in the centre of the screen. This is a simple and, in most cases, a rapid and reliable test.

Assuming the E.H.T. to be correct, a check for tube cathode potential is signified, for fault conditions may be indicative in this connection, when checking procedure as described previously in this series should be adopted. If the potential at the cathode is not abnormally high a check for grid potential will, without much doubt, reveal it lacking.

Arriving at this point we can be fairly certain that a fault in either the line or frame generator—or maybe in the protection circuit itself !—is responsible.

The most likely cause will be a failure of one of the timebases. These can be checked by employing a pair of headphones as an indicating device. If, on the other hand, it is found that the timebases are working satisfactorily, it now remains to check meticulously all components in the protection circuit proper, unless it is possible to isolate the faulty section by potential checks.

Other Faults Associated with Protection Circuits

Although tube protection circuits yield nearly one hundred per cent. safeguard they are not entirely foolproof. For instance, it has probably been observed from the circuits described that a deflecting coil going open-circuit would affect very little the action of the protection system, and that a fault of this nature would give rise to a damaging brilliant horizontal or vertical line on the screen of the tube.

Should this symptom suddenly appear, and if one is quick switching the set off, it may be possible to save the tube, though, generally, the damaging feature of this symptom is not readily recognised by the less technically minded members of the family, and many minutes may elapse in bewildered gaze before it is decided that the transmitter is not to blame and the set is eventually switched off. Unfortunately, by this time, apart from the open-circuited deflecting coil, the picture-tube also is in need of replacement.

Certain line output valves, such as the PL81 type, when employed in a self-oscillating line timebase circuit, continue to oscillate at a much reduced amplitude should the screen grid H.T. feed resistor (generally a wire-wound component) become open-circuit. This sometimes prevents satisfactory operation of the protection circuit, and allows the display of a very bright vertical band of light on the tube face which, within a few seconds, can easily ruin the fluorescent phosphors.

To eliminate this possibility a 100,000-ohm ½-watt resistor should be connected in parallel with the existing screen feed resistor. This ensures that sufficient line amplitude will be available under such a fault condition to prevent damage to the tube face. In particular, this protective modification applies to the Ferranti projection receiver Model T1625.

Faults in the timebases which may have little effect on the general performance of a set not embodying a tube protection circuit tend to provoke a secondary disturbance in projection receivers, via the protection circuit, and thus on to the picture-tube grid.

An interesting symptom to illustrate this point is shown in Fig. 58. Although normal in all other respects, the raster depicted (modulated or unmodulated) resolved with a gradual fall-off in brilliance in the vertical direction; the projection receiver concerned was a Decca Model 131. The symptom was eventually found to be caused by a ripple voltage at the grid electrode of the picture-tube. A further test revealed that the ripple was superimposed on the D.C. potential across the brightness control and was, in fact, originating from the frame generator (using a T41 valve) and gaining admittance to the brightness control circuit through the protection network. Replacing the relevant T41 solved the problem without any further trouble.

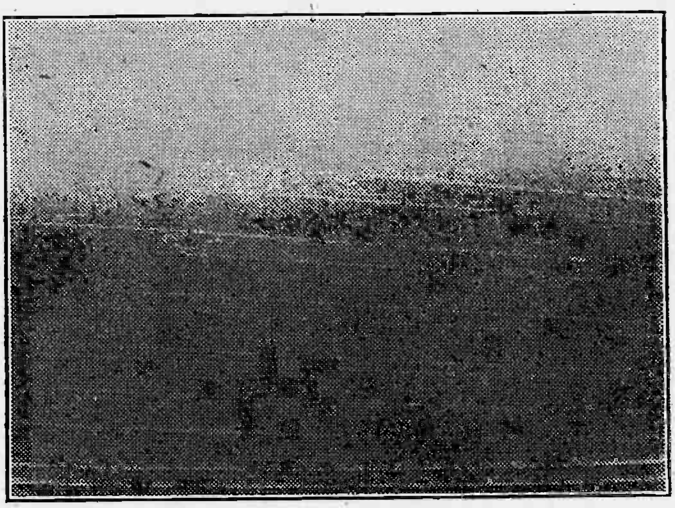


Fig. 58.—A raster of uneven brilliance on the picture-tube of a Decca projection receiver, Model 131, caused by a fault in the frame timebase.

A Dim Picture

Unlike a definite symptom, such as complete lack of raster or picture, the actual cause of a dim picture can sometimes be a little tedious to establish, since numerous factors may contribute to the general effect. In the main, however, a dim picture is caused either by (a) insufficient video drive or (b) a defect preventing the picture-tube from emitting its maximum intensity of light, even when unmodulated.

In case (a), low sensitivity of the video chain as a whole is essentially responsible. This may be due to either deterioration of one or more of the valves associated with the vision section or an alteration in the overall response (alignment) of the vision section as a result of an alteration in the value of a capacitor or a shift of tuned-circuit adjustment ; vibration from the loudspeaker may, for instance, quite easily disturb the setting of an iron-dust tuning core.

Furthermore, an alteration in valve characteristics, which often accompanies a reduction in emission, frequently upsets or modifies the loading of an associated tuned circuit. This is why it is generally considered advisable to check tuned circuit alignment after replacing a valve in the more critical section of the vision amplifier.

Apart from defects arising in direct connection with the tuned circuits proper, as above, the tuned frequency is also controlled to a large extent by shunt capacitances formed by the circuit wiring and the input and output capacitances of the valves.

(To be continued.)

VALVES AT U.H.F.

THIS ARTICLE DEALS WITH VARIOUS TYPES OF KLYSTRON, RESNATRON AND THE TRAVELLING-WAVE GUIDE

By S. Simpson

IN the March issue of this magazine the trend of development of valves for use at U.H.F. was reviewed, and the position was dealt with up to the Klystron. The present article completes the review and deals with the various types of Klystron and the Resnatron. The article ends with some notes on the new travelling-wave tube.

In the "straight" Klystron tuning is quite a difficult procedure and the tube has the disadvantage of rather a narrow frequency pass-band before the power drops to half the value at the working frequency. This mitigates against the use of the tube on television links and multi-channel communication systems. To overcome this difficulty the "Reflex" Klystron was produced in which a much wider control over tuning and improved bandwidth characteristics are available.

The Reflex Klystron

In this tube, a typical version of which is seen in Fig. 1, the electron stream is acted upon in much the same manner as in the straight Klystron, but the tube differs in having only one resonator which has an exit gap opposite to the entry gap. Bunching occurs between the gaps, and the electrons emerge from the resonator only to find a negatively charged electrode opposing their further progress. They are returned to the resonator by this "repeller" and pass back into the gap in pulses which are timed to assist the oscillations in the resonator.

The advantages of the Reflex over the Klystron are twofold, apart from the need for only one resonator, and are brought about by the inclusion of the repeller. Rough tuning, as in the Klystron, is effected by altering the cavity dimensions, but transit time of the electron also has a great deal to do with the development of reasonable power at very high frequencies. The transit time in the Reflex depends mainly on three things: the gap between repeller and anode, the velocity of the forward current to the repeller, and the velocity of the returning current to the resonator or anode. The latter depends largely on the potential of the repeller, and herein lies one answer to the problem of easier fine tuning and of extended tuning range. Electronic tuning is now added to the mechanical tuning outlined above by variation of the standing potential on the repeller.

A second advantage of the repeller is its facility for providing a means of frequency modulation by application of the modulation voltage to that electrode. This type of modulation is fast becoming the recognised method in the communications applications of U.H.F., and it will readily be appreciated that the advent of the Reflex Klystron has opened a new line of approach to the subject.

Frequencies available from the Reflex are extremely high, even for U.H.F., experimental results having been obtained at ranges around 30,000 Mc/s. The output, however, is low and the tube finds its greatest use as a low-power oscillator or in test equipment designed for use on centimetric projects. In an attempt to keep the valuable properties of the Reflex as an amplifier, another version of the Klystron has been developed, known as the three-cavity Klystron.

The Three-cavity Klystron

In this version, which again may be magnetically focused, there is a buncher resonator and a catcher resonator. Mid-way between them lies a third resonator, which can be regarded as replacing the drift-tube. Its action is to accentuate the bunching before passing the stream to the catcher, with a resulting increase in the power delivered because of the higher peaking of the stream. This version of the Klystron is used as a power amplifier with efficiencies ranging from 30 per cent. to 40 per cent. The possible gain is approximately 25 db.

F-M Drift-tube Klystron

Possibly the latest development in Klystron technique is that in which the drift-tube of the early Klystron reappears in a new form, isolated from the walls of the resonator and therefore capable of having a voltage applied to it which will vary the transit time of the electron. In effect, it replaces the frequency modulation action of the repeller, which, in some circles, has fallen into disfavour because of the defocusing effect of the repeller on the returned electron stream and the resulting inaccuracy of transit back through the gap of the resonator. There is also a belief that the repelled stream may be returned so violently as to reach the vicinity of the cathode and interfere with the

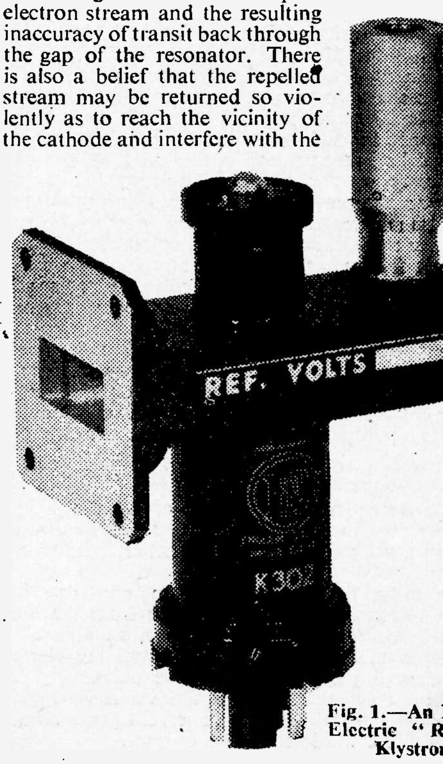


Fig. 1.—An English Electric "Reflex" Klystron.

normal bunching occurring near that electrode. On these points it is claimed that the isolated-tube Klystron has the advantage, and there is a better phasing of the repelled electrons which serves to increase still further the efficiency obtainable in this type of Klystron tube.

The Resnatron

All the above tubes work on the principle of "velocity modulation," i.e., the velocity of the travelling electron is varied due to "modulation" by the R.F. oscillations.

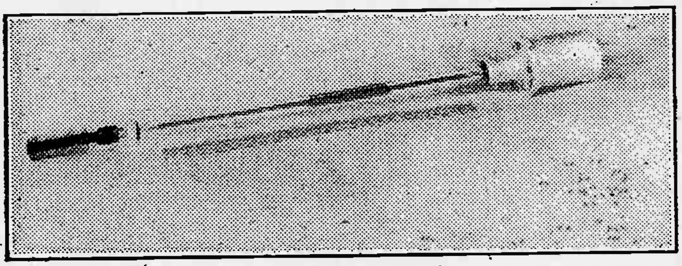


Fig. 2.—A travelling-wave tube such as is now in use in the Manchester-Edinburgh TV link.

A second method is that of "density modulation," in which the electron stream is acted upon in such a way as to produce variations in the mass, or quantity, of electrons passing through the electrodes at any instant. Chief among these is the new Resnatron, also produced in a "straight" or a "reflex" version.

In form it comprises a cathode surrounded by a shield formed by part of the input cavity resonator, in which the density modulation occurs. The electrons then pass through a grid in the cavity and enter an output cavity by means of a similar grid. From this point the electrons pass on to meet the repeller, as in the Reflex Klystron, and are returned to the output resonator to sustain the oscillations existing there. In much of its make-up and operation the Resnatron seems very similar to the Klystron, but in the Resnatron the repeller is introduced *into* the output cavity and increases the efficiency of the tube as a frequency modulator. A second difference is the use of two tuned resonators instead of one.

The tube was produced in an effort to increase the available power from the reflex action, and typical figures—30 kW pulsed power at 420 Mc/s with 75 per cent. efficiency—would indicate that the efforts of the development engineers have been reasonably successful. The valve is capable of 60 kW output power, is water cooled and has a continuously operating pump to maintain the vacuum while in action.

Travelling-wave Tube

Perhaps the most promising of all the U.H.F. tubes so far produced is the T-W tube, now in use with so great success in the Manchester/Edinburgh TV Link.

This tube differs greatly from any described hitherto. The tube derives its name from the interaction between a helix, clearly seen running along the length of the tube in Fig. 2, and the electron stream passing axially through the helix.

An input signal at R.F. is fed via a wave-guide and coupled to the helix, so creating an electromagnetic field within it.

The electric field, which is axial to the helix, causes bunching of the electron stream. This bunching, in turn, creates a second wave on the helix, which then reacts on the stream, and in this manner the R.F. cycle is maintained in progresive steps along the helix.

Three types of wave exist on the helix. The required wave is partly determined by the diameter of the helix, and the developed wave is then picked up by the output wave-guide located at the end of the helix remote from the cathode assembly.

Because of the length of the electron path the technique of electron stream production is largely akin to that of the cathode-ray tube. Focusing and accelerating anodes are placed near the cathode, and magnetic fields are applied throughout the length of the flow within the helix, apart from the vicinity of the waveguides. Accurate alignment of cathode and helix is essential, and cooling of the collector at the "target" end is also provided.

The tube is sensitive to variation of beam current and helix voltage; the gain alteration is rapid for any change in these figures, and a stabilised circuit has been found desirable. Approximate helix voltage is around 3,000 volts.

On the question of bulk perhaps the T-W tube may be criticised. It is larger than most tubes, requires a power supply for magnetic focusing, and a source of E.H.T.

On the other hand, one tube will give a gain over input which cannot be met by less than three or four stages using other types of tube. The pass-band of the tube is wide at high-gain levels, a point very much in its favour in multi-channel communication systems.

Development work is still proceeding on the T-W tube with the object of reducing the bulk of auxiliary apparatus, the E.H.T. voltages required, and of increasing still further the output power available at the frequency range around the 4,000 Mc/s mark.

Apart from the tubes already mentioned, others are still in process of development, and there seems little reason to doubt that the little glass valves we know so well, and which have served so faithfully at the lower frequencies, will soon have little or no resemblance to their new and highly efficient successors.

TV in The Channel Islands

HOW PRIVATE ENTERPRISE ATTACKED AND SOLVED THE PROBLEM OF RECEPTION BEYOND THE NORMAL RANGE

THE British Broadcasting Corporation decided five years ago that Jersey, Guernsey, Alderney and Sark were beyond the range of even "fringe" TV reception. The challenge was taken up by Broadcast Relay Service, Ltd., the parent company of the Rediffusion group of companies—who serve about 3,000,000 listeners and viewers throughout the world with daily sound or television programmes by wired network direct into their homes, and either broadcast or relay in over 20 foreign languages or dialects.

It was a problem of the greatest magnitude, for the Very High Frequencies used by television are a "straight line" emission. They do not follow the curvature of the earth's surface and therefore cannot be received—except under freak conditions—by any set or station which is out of what we might term the line-of-sight of the transmitter. The Channel Islands, by virtue of their distance from the English transmitting stations and the natural curvature of the earth, were well beyond the ultimate point at which BBC transmissions could be normally received.

Seventy miles—cited as the average distance over which television could be received, had hitherto decided who would or would not receive TV transmissions anywhere in the world.

Fortunately, Rediffusion have on their staff a number of peculiarly unconventional engineers. On the principle that physical laws, at any rate, are made to be broken, they set out to find the loophole in this one.

And they succeeded. No one can say who was responsible for the first idea that the freak broadcast could be resolved to normalcy, but it was decided that atmospheric conditions which had hitherto caused solely annoying interference could be disciplined to give service.

Tropospheric propagation, which arises where the layer of warm and cool air meets at a height of from one to three miles, is a condition which reflects the Very High Frequency waves used by TV. Rediffusion's technicians endeavoured to "catch" the reflected waves where they come to earth at a spot considerably beyond the "line-of-sight" distance.

Aerial Billiards !

The success of the attempts caused these experts to indulge in a rare form of celestial billiards—and their preliminary work was done in so unlikely a place as the files of the old Channel Island newspapers. If TV signals from England were to be caught in their "freak" form against the tropospheric cushion and neatly pocketed in Jersey, it was necessary to make sure that the "cushion" would be a stable one—and only meteorological information could determine the question.

Fortunately, such conditions between England and Jersey were excellent—and the great experiment bore its first fruit on June 2nd, 1953, when all the pageantry of the Coronation was brilliantly received in Jersey on the 110 sets specially installed in the Island by Rediffusion.

New and very special aerials, together with other equipment, had been designed, partly by Rediffusion's engineers at the London laboratories and partly by the technicians of the associated company in Jersey, Television Research, Ltd.

Work began on the construction of Rediffusion's Jersey Station—including the setting up of the biggest receiving unit in Britain—and the station was formally opened on June 24th, 1954. The special aerials play a key part in the working of the station, and one of them is set up to pick up the TV programmes radiated from Paris, 200 miles away!

What have been the BBC's reactions to this private pioneering in a field where the Corporation has a monopoly? It has been quite objective. There has been no question of reluctance on the part of the Corporation in acknowledging that Rediffusion's "first there" in the Channel Islands has done what might not otherwise have been done for a long time, if at all.

Senior BBC officials have seen for themselves the quality of reception on the Rediffusion screens in Jersey; one of them said "We are extremely interested, particularly in the standard of picture obtained from such weak and variable signals."

Now the Corporation has made concrete acknowledgment of Rediffusion's success by asking the Company for co-operation in the establishment of the BBC's own direct Channel Islands Service.

A pilot BBC unit has been set up in Guernsey to pick up all transmissions from Wenvoe and later from the newest transmitter which it is proposed to erect at North Hessary Tor in Devon. At the same time, Rediffusion will monitor these transmissions on Jersey for the BBC. On the result of these co-operative experiments by Rediffusion and BBC engineers will rest the development of the Corporation's service.

Meanwhile, the Rediffusion Group of Companies are not standing still. As soon as the new French TV transmitters—now being built near the French coast are—in operation, Rediffusion will give its Jersey viewers the first-ever alternative programmes. By turning a knob the subscriber will be able to select either the British or the French programmes—and the Commercial broadcasts as well when they come into being!

The choice will be available every day and is a notable step forward from the present rare and complicated "Eurovision" programmes.

Just how good is Jersey's Rediffusion service?

A Jersey hotelier who subscribes to the Rediffusion TV service complained that the reception was not as good as he thought it ought to be . . . but a visiting holidaymaker from Britain silenced his complaints for ever.

"Why," said the visitor, "it is much clearer than we get at home—and we are only 15 miles from the Sutton Coldfield transmitter!"

Technical Data

The first cable laid used for TV signals was 12 gauge unscreened quad in sections with two 22 gauge quads for the sound (four programmes). On test the 22 gauge cable failed completely owing to mechanical damage.

For subsequent demonstration purposes the television signals were fed to Bouley Bay over a two quad (16 gauge) cable unscreened for a distance of 1½ miles. Carrier frequency was 45 Mc/s and four Baird amplifiers were employed with long time constant automatic gain control fitted to these amplifiers. The same method is still used, not the synchronised pulse scheme, and has been found quite satisfactory, and it is understood that the Development Department are now using the same method for some repeaters.

The variation of attenuation with weather was too great at 45 Mc/s, and one cable was replaced with 18 gauge aluminium quad and this is still working. The signals were fed at the carrier frequency at 45 Mc/s for a period of 12 months. Carrier frequency was then changed to 9.72 Mc/s and this frequency was used for the Coronation demonstrations.

Vision signals were fed on one-pair of the screened cable and the mains supply for four repeaters working at 45 Mc/s phantomed over the quad. These repeaters operated at a 30db gain. Each pair of each cable carries an A.F. programme at 45 volts, one programme being TV sound.

Vision signals are now fed at 9.72 Mc/s with only one three valve repeater with the mains supply phantomed.

With regard to the tilted wire aerial arrays, these were in two sets, one for Sutton Coldfield Station and one for Alexandra Palace Station, and automatic diversity reception was employed. Interference was so strong, however, from continental transmitters, that the scheme of automatic diversity reception proved unsatisfactory and the switching was then done manually. The present installation comprises three sets of tilted wire arrays beamed on Alexandra Palace, Wenvoe and Paris.

Diversity was originally at 45 Mc/s with a converter to change the 61.5 to 45 Mc/s.

Repeaters

For feeding the signals to St. Helier, repeaters were designed and used similar to the scheme employed at Thanet where the carrier frequency is now 9.72 Mc/s.

The repeaters for the seven mile link were designed with negative feedback in the output stages and not only gave a bandwidth of at least 7 Mc/s but enabled the output stage to function at its optimum load and be independent of quite wide variations of the 12 gauge unscreened cable characteristics. This cable is buried in ground which is literally lying in water at certain times of the year and at others in completely dry earth.

The variations in the magnitude of characteristics impedance are from 53 to 90 ohms with a considerable variation in the phase angle.

At the aerial there are two A1.54 low-noise amplifiers in cascade for each signal followed by an RG109 frequency changer. A power output stage made in Jersey design provides 16 volts into the link. There are seven repeaters, the last of which is in Colomberie Close.

The link is built up as follows :—

To first repeater—2,000 yds. underground 12 gauge aluminium.

To second repeater—1,600 yds. underground 12 gauge aluminium.

To third repeater—600 yds. 12 gauge unscreened joined to 900 yds. of 18 gauge screened.

To fourth repeater—1,200 yds. of 12 gauge unscreened.

To fifth repeater—1,200 yds. of 12 gauge unscreened.

To sixth repeater—1,760 yds. of 18 gauge screened.

To seventh repeater—1,760 yds. of 18 gauge screened.

This link was used throughout for the Coronation demonstration. The penultimate 1,760 yds. was laid in a sewer, and the last 1,760 yds. partly in a brook and partly under the street in a duct.

Since the Coronation, mechanical faults have developed on 1,200 yds. of the first 12 gauge section, and since Rediffusion was not allowed to dig up the road it has been replaced with a catenary supported overhead 18 gauge copper squad mounted on the Electricity Company's poles.

The overhead cable allows for feeders to other parts of the island also for subscribers' connections *en route* to Colomberie Close. The Carrier scheme had been abandoned. A 22 s.w.g. quad will be added to the squad for country areas, and the four A.F. programmes amplified in the subscribers' units.

For distribution in St. Helier it was eventually decided to use unscreened squad for the drop-ins, and also for sections of the network, while for other parts copper screened quad would be used

The feeder repeaters are TV31s—a 3 valve small repeater in a housing giving 4-watts output. These cost £36 including power pack, housing and sound by-pass units.

For unscreened drop-ins the signal has to be 100 millivolts, and for screened drop-ins 20-40 millivolts at the subscribers unit. All the terminal units have only one I.F. valve. In St. Helier the sound distribution is at audio.

A four programme unscreened network was in existance so a squad was added to the quad. At the ends of spurs lengths of up to 200 yds. of existing unscreened squad were used for the TV feed. Chokes were not put in for the non-TV subscribers, who just had the "D" programme drop-in disconnected. By using this method there was a considerable saving in cost of blocking chokes.

All the inserts were designed and made locally. The terminal units are made by Felgate Radio modified to the Jersey design on 9.7 Mc/s, 100 of these with 12in. tubes were used for the Coronation, while 14in. and 17in. diameter tubes also from Felgate will be used in the future.

Outside St. Helier, all the cabling is to be run on the Electricity Company's poles using an amplified audio system. The network consists of one 22 s.w.g. quad and one squad. As feeders of up to 12 miles length are needed, audio is amplified in the subscribers' unit.

It is anticipated that there will be three Rediffusion programmes and two TV sound programmes. Four of these will be at audio, and one either phantomed or using a 50 Kc/s carrier. The terminal units for this scheme are now being designed, and a high gain vision repeater has been designed for pole mounting with A.G.C.

A SIMPLE T·V "Scope"

DETAILS FOR THE CONSTRUCTION OF AN INEXPENSIVE OSCILLOSCOPE FOR TV

By B. L. Morley

AN oscilloscope is one of the most useful test instruments which the TV constructor can possess, indeed for the experimenter a first-class multimeter and an oscilloscope can be regarded as essential.

It is not necessary to have an elaborate instrument; provided the linearity is good, amplification is sufficient to cater for the voltage waveforms usually found in TV, and the range of frequencies covered extends from below the frame frequency to above that of the line, nothing more is required.

The instrument described here possesses all these features and has the added advantage of being quite inexpensive. If every item has to be bought, then the total cost should not be much more than £7 and by use of the spares box and ex-Government equipment it can be lower than this.

Factors Governing the Design

When designing the instrument the points mentioned previously were considered and it was decided to keep the cost as low as possible, so that the instrument would become available to as many as possible. This feature has not been achieved by sacrificing efficiency and the constructor will find that it is quite capable of doing all that is required. Linearity is good and also the amplification, yet only two valves are employed with a 6in. C.R.T.!

The prototype employed a VCR97, but a VCR517 could be used equally successfully. There are available a number of 3in. C.R.T.s on the ex-Government market, but it was decided to use the 6in., first because there are many constructors who have started TV work with this type of tube and now, having changed over to magnetic working, have a spare tube, and secondly because there are quantities of VCR97 tubes which suffer from cut-off and which cannot therefore be used for TV but can be used in a 'scope.

The prototype was constructed from an Indicator unit type 6H simply because it was available. The Indicator is not strictly necessary and, provided the general layout scheme is adhered to, any form of chassis can be employed.

The use of the Indicator can reduce the cost because they can often be purchased, less valves and C.R.T., very cheaply; the prototype was bought for 2s. 6d., but this was, of course, exceptional. As only two EF50 valves are required and a cut-off type of tube can be used, it is clear that a very cheap instrument can be built.

So much for the economic considerations: another important factor ruling the design was simplicity of circuitry and construction. Every effort has been made to cut out superfluities; the result is what one might term a basic oscilloscope: it performs its functions adequately but is devoid of frills. Each component pulls its full weight and nothing has been left in which can possibly be left out.

The beginner has not been forgotten. Quite often it is he who requires an oscilloscope most, and in order to assist him wiring diagrams have been given.

In order to simplify the printing of wiring diagrams in a small space, the various sections have been separated and each can be built as a complete section in its own right.

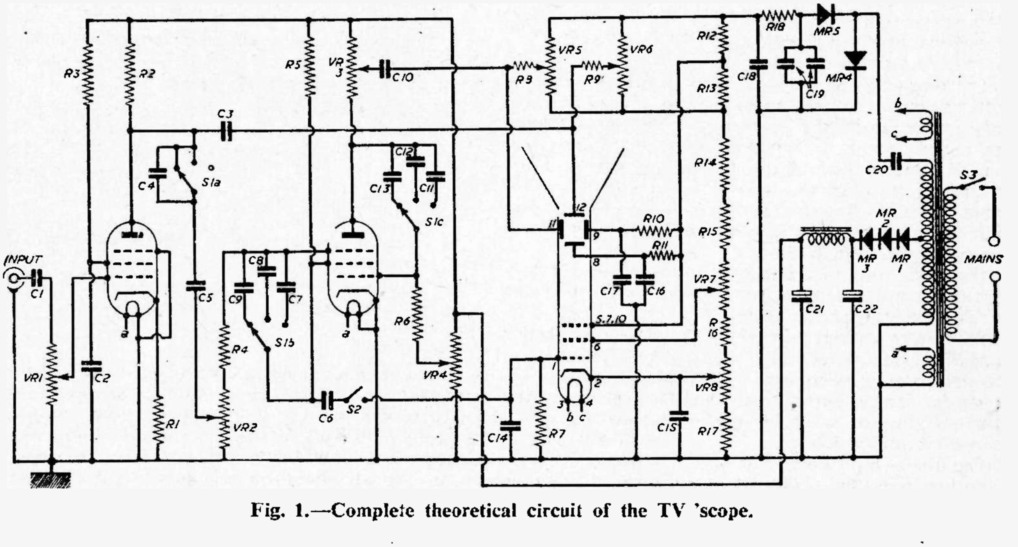


Fig. 1.—Complete theoretical circuit of the TV 'scope.

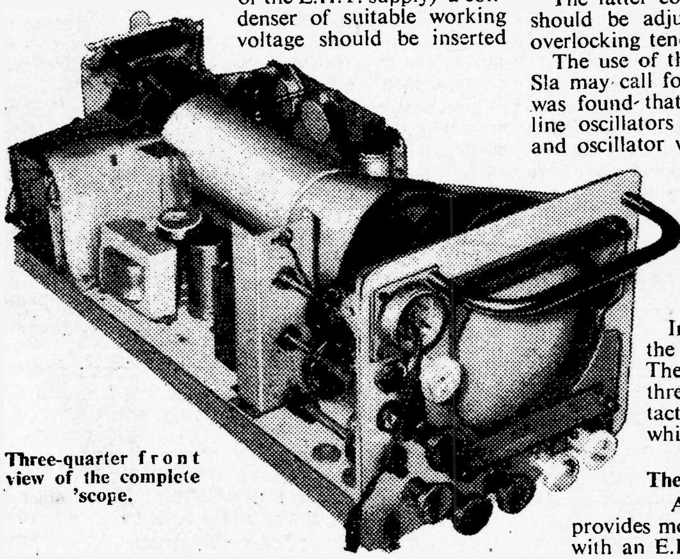
The Circuit

Fig. 1 shows the circuit diagram.

It can be analysed into four sections—the amplifier, the oscillator, the C.R.T. network and the power supply, and they will be dealt with in that order.

The input to the 'scope is made via a Pye socket feeding into a potentiometer via the coupling condenser C1. The condenser will be found suitable for the three ranges covered by the 'scope, but other values can be added in series with the lead, if desired.

An important point to note is that when testing high voltage circuits (such as examining the ripple of the E.H.T. supply) a condenser of suitable working voltage should be inserted in series with the input lead. C1 has been given a working voltage rating of 450 volts and this should be suitable for most requirements.



Three-quarter front view of the complete 'scope.

VR1 is the amplitude control and the signal input to the amplifier valve V1 is fed through it. The control will cater for most inputs found in the TV receiver, but if it is found that the control is crowded at one end, then suitable attenuators can be applied prior to the input.

V1 is an EF50 and is used because it was available. The constructor is advised to use one of the British type as an expensive red Sylvania is not really necessary here.

The bias resistor R1 is left undecoupled and provides an improvement in the linearity by reason of negative feed-back. It will be found that the linearity is very good.

Note that screened cable (a short section of coaxial will do) is used to couple C1 to the control, and the control to the grid of the valve. This should not be omitted.

The coupling condenser to the deflector plate C3 has a working voltage of 1.5 Kv. and this is the minimum working voltage allowable.

V2 is the oscillator which provides the horizontal sweep ; in order to effect synchronisation between the circuit being examined and the oscillator, a sync control has been fitted. It is accomplished by taking a portion of the output from the amplifier valve V1 and injecting it into the suppressor of V2 via the variable control VR2.

The latter control serves to lock the sync and it should be adjusted so that the trace just locks ; overlocking tends to distcrt the trace.

The use of the condenser C4 in conjunction with S1a may call for comment. As the circuit stands it was found that on the higher frequencies covering line oscillators the coupling between the amplifier and oscillator was too great, resulting in distortion of the trace. The coupling is, therefore, reduced by C4 which comes into series with C5 when the coarse frequency control is in its highest frequency position. As S1 is the coarse frequency control, the operation becomes automatic.

In the prototype (using the indicator) the existing switch provides this facility. The switch in these units is a two-pole, three-position type of Yaxley and the contacts above the chassis were used for S1a while those below were used for S1b and c.

The Oscillator

A standard Miller oscillator is used and provides more than adequate scan in this circuit with an E.H.T. of over 1,500 volts. In order to obtain full width it is important to adhere to the component values given.

The frequency is controlled by the coarse control which may be referred to as a band selector, dividing

COMPLETE LIST

Condensers

C1—0.1 μF 450 v.
C2—0.1 μF
C3—0.1 μF 1.5 kV.
C4—100 pF
C5—0.001 μF
C6—50 pF
C7—300 pF
C8—3,000 pF
C9—0.05 μF
C10—0.1 μF 1.5 kV.
C11—100 pF
C12—0.001 μF
C13—0.01 μF
C14—0.001 μF
C15—0.01 μF
C16—0.01 μF 1.5 kV. (or 2.5 kV.)
C17—0.01 μF 1.5 kV. (or 2.5 kV.)
C18—0.01 μF 2.5 kV. (or 3 of 0.03)
C19—(2) 0.03 μF, 2.5 kV. (or 1 of 0.1)
C20—0.1 μF, 750 v. minimum.
C21 } C22 } 32+32 μF 450 v. wkg.

All condensers 350 v. wkg. unless stated otherwise.

Resistors

R1—180Ω
R2—10 k. 1 w
R3—10 k.
R4—27 k.
R5—47 k.
R6—470 k.
R7—220 k.
R8—2.2 m. 1 w.
R9—2.2 m. 1 w.
R10—2.2 m. 1 w.
R11—2.2 m. 1 w.
R12—100 k.
R13—100 k.
R14—470 k.
R15—2.2 m. 1 w.
R16—220 k.
R17—100 k.
R18—470 k. 1 w.

All resistors ½ w. rating unless stated otherwise.

VR
VR
VR
VR
VR
VR
VR

the frequency range covered by the instrument into three bands. The control operates on the forward stroke by C11, 12 and 13, and on the flyback by C7, 8 and 9. A fine control over the selected frequency is effected by VR4.

The operation is to select the frequency band by S1 and to use VR4 to select the actual frequency within that band.

Frequencies covered in each band will depend to some extent on the tolerances of the components used, but the range will be approximately: Position (1), 10-60 cycles per second; Position (2), 50-2,500 cycles per second; Position (3), 2,250-12,000 cycles per second.

Overlapping takes place in each band, therefore both line and frame frequencies of the TV receiver are covered.

One disadvantage of the circuit is that the simplification has introduced a little non-linearity on the bottom of each band covered; however, as overlapping takes place the top portion of the preceding band should be used and this will be found to be perfectly linear. As an example, the top of Band (1) will give one complete cycle of the frame oscillator and a true representation of the waveform is obtained; the bottom of Band (2) will also give the same conditions but the trace is a little distorted. No distortion takes place beyond the overlapping portion of each band.

Coupling from the oscillator to the deflector plate is made via C10; as in the case of C3 the working voltage quoted is the minimum and a higher-rated component can be used.

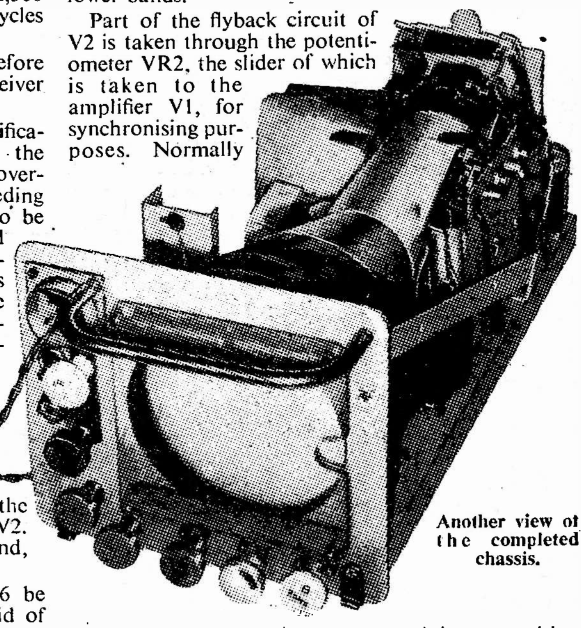
The signal to the deflector plate is taken from the slider of VR3 which is the anode load resistor of V2. This alters the amplitude applied to the plate and, therefore, becomes the width control.

Note that under no circumstances must R6 be omitted or full H.T. may be placed on the grid of the valve.

A small coupling condenser C6 has been fitted to the suppressor grid of the oscillator and the grid of the C.R.T., the connection between the two points being made via a switch S2. This provides an additional negative pulse to the C.R.T. during the flyback period and has a useful cleaning up effect on the trace when using the highest band.

It would have been possible to provide the facility for each band covered by arranging further condensers to be switched by an extra section on the coarse frequency control, but this was not considered necessary as no trouble was experienced on the lower bands.

Part of the flyback circuit of V2 is taken through the potentiometer VR2, the slider of which is taken to the amplifier V1, for synchronising purposes. Normally the control should be kept at the minimum position and only used to lock the trace.



Another view of the completed chassis.

OF COMPONENTS

Potentiometers

.1—Amplitude, 1 M. carbon
.2—Sync, 25 k. ww. or carbon
.3—Width, 100 k. carbon
.4—Fine freq., 2 m. carbon
.5—Shift U/D, 100 k. carbon, pre-set
.6—Shift L/R, 100 k. carbon, pre-set
7—Focus, 500 k. carbon
Brilliance, 100 k. carbon

Valves and Rectifiers

V1—EF50
V2—EF50
MR1—SenTerCel K3/40
MR2—SenTerCel K3/40
MR3—SenTerCel RM1
MR4—SenTerCel RM1
MR5—SenTerCel RM1

Miscellaneous

Mains Transformer: 350-0-350 v. 30-80 mA. 6.3 v. 1-4 A.
Lasky MBA/3—5 v. tapped 4 v. 1.5-3 A. (Minimum and maximum current ratings)
Smoothing Choke—10 Henry, 30 mA. minimum
Cathode Ray Tube—VCR97, VCR517 (can be types with cut-off)
Yaxley Switch—3-way, 3-pole, 3-bank
Two on/off toggle switches
One Pye socket and plug
7 Knobs.
2 B9G valveholders
One C.R.T. holder
10-Way resistance panel
One 3-way tag strip
Two 2-way tag strip
Two yards twin flex for mains, 2 yards coax cable, wire bolts, etc.

C.R.T. Network

The network follows standard principles and employs E.H.T. with negative earthing. Some oscilloscopes employ a positively earthed system so that the deflector plates are available for external connection. It was decided that such a facility was not necessary in this instrument and the simplification obtainable with negative earthing was the more important factor.

Centralising of the trace on the screen is accomplished by the two shift controls VR5 (up/down) and VR6 (left/right). Some oscilloscopes bring these controls out to the front panel but it was not considered necessary in this model, so pre-set controls were used.

The constructor may, if he desires, bring the controls out to the front panel but care must be taken thoroughly to insulate the wire.

C16 and 17 balance the vertical and horizontal scans and greatly assist in preventing the trace from creeping with the operation of the brilliance control.

The Power Supply

The power supply has been so arranged that standard components can be used.

The key-piece is naturally the transformer and while the current requirements are small the voltage is high. The minimum requirements are 350-0-350 at 30 mA, 6.3 volt 0.6 amp and 4 volt 1.5 amp. A transformer meeting these requirements exactly is not available so a near substitute must be employed.

There is H.T. current and heater current which is above the requirements but this makes no difference to the operation of the circuit.

Other makes of transformers can be used provided that current outputs are at about these figures and the voltages are as specified.

The 5-volt winding is tapped at 4 volts and is normally used for the rectifier; and in this circuit we use it for the C.R.T. heater. The 350-0-350 volt winding is used for H.T. and E.H.T. in the same manner as the "Simplex" televisor, using half-wave rectification for the normal H.T. and a Cockroft-Walton multiplier section for E.H.T.

The H.T. is rectified by three SenTerCel RM1 rectifiers in series and the current is smoothed by the 10 Henry choke and C21/22. The choke must be rated at 30 mA minimum and the one specified for the "Simplex" can be used.

C21/22 can be a combined condenser, although separate condensers can be used if desired. A working voltage of 450 volts is recommended so as to ensure that they will absorb the surge voltage when the instrument is first switched on.

There are available some 350-volt metal rectifiers on the ex-Government market and these can be used if desired.

It is also possible to use a valve rectifier and this method was employed in the prototype, a transformer from the junk box being modified to provide the extra heater winding.

E.H.T. is obtained from the multiplier circuit using two rectifiers, SenTerCel K3/40.

The smoothing condensers in this part of the circuit may call for some explanation. There is a shortage of the popular 0.1 μF 2.5 kV condensers which are usually employed in this class of circuit, and so the use of alternatives was considered. The condenser C19 was made up of two 0.03 μF 2.5 kV condensers in parallel, while C18 was a metal-cased 0.1 μF 2.5 kV. Three 0.03 μF 2.5 kV can be used in parallel if desired.

Construction

Construction is not at all difficult, and although an Indicator Type 6 was used in the prototype, the 'scope can be built up on a new chassis.

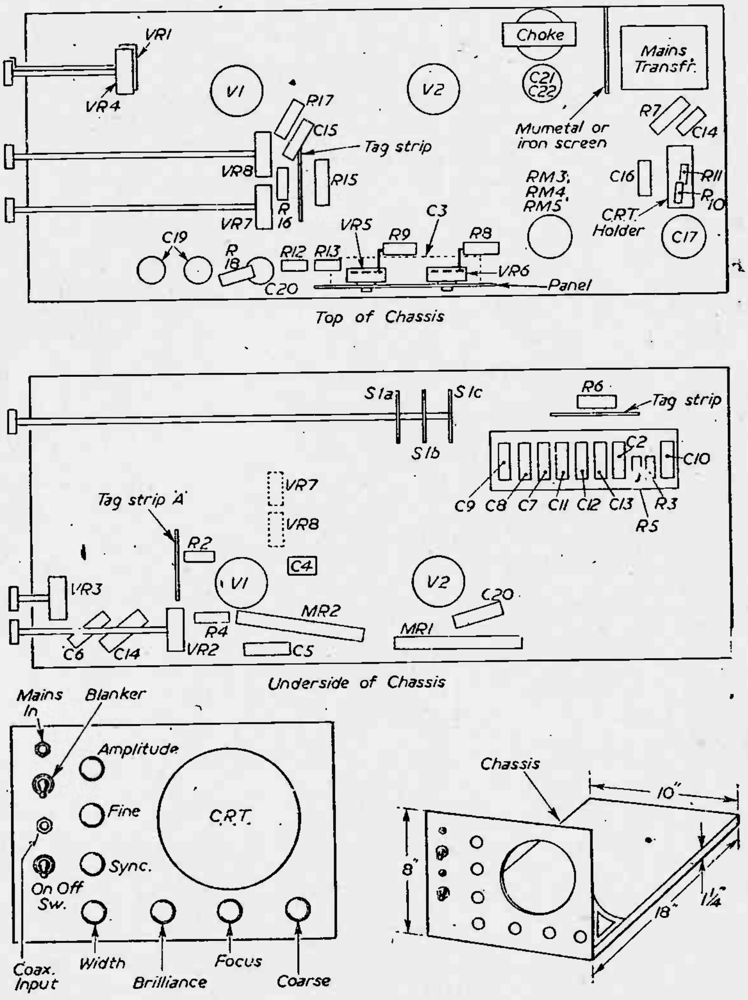


Fig. 2.—Details of the layout and positions of the main components.

THE NATIONAL RADIO SHOW

August 24th to September 4th

List of Principal Exhibitors in Alphabetical Order, with Stand Numbers

Name	*Address*	*Stand No.*
Aerialite, Ltd. ...	Castle Wks., Stalybridge, Cheshire	64
Antiference, Ltd.	Southern Rd., Bicester Rd., Aylesbury, Bucks.	34
Argosy Radio-vision, Ltd.	Argosy Wks., Hertford Rd., Barking, Essex	8
Associated Technical Mfg., Ltd.	Vincent Wks., New Islington, Manchester, 4	25
Automatic Coil Winder & Elec. Equip. Co., Ltd.	Winder House, Douglas St., S.W.1	61
Balcombe, Ltd., A. J.	52, Tabernacle St., London, E.C.2	35
Belling & Lee, Ltd.	Cambridge Arterial Rd., Enfield, Middx.	67
Bowmaker, Ltd. ...	Bowmaker Hse., Lansdowne, Bournemouth	47
British Broadcasting Corporation	Broadcasting Hse., London, W.1	200
Brown Bros., Ltd.	Browns Bldgs., Gt. Eastern St., E.C.2	91
Bulgin & Co., Ltd., A. F.	Bye Pass Rd., Barking, Essex	99
Bush Radio, Ltd.	Power Rd., Chiswick, W.4	86 & 89
Chald Products, Ltd.	184, Low Rd., Leeds, 10	26
Champion Elec. Corp.	Champion Wks., Drove Rd., Newhaven, Sussex	33
Cole, Ltd., E. K.	Ekco Wks., Southend-on-Sea, Essex	22 & 92
Collaro, Ltd. ...	Ripple Wks., Bye Pass Rd., Barking, Essex	11
Co-operative Wholesale Society, Ltd.	Exhibition Section, 99, Leman St., E.1	106
Cosmocord, Ltd.	700, Gt. Cambridge Rd., Enfield, Middx.	44
Cossor, Ltd., A. C.	Cossor Hse., Highbury Grove, N.5	57
Decca Record Co., Ltd.	1-3, Brixton Rd., London, S.W.9	39
Dubilier Condenser Co. (1925), Ltd.	Ducon Wks., Victoria Rd., North Acton, W.3	83
Dynatron Radio, Ltd.	The Firs, Castle Hill, Maidenhead, Berks.	103
E.M.I. Sales & Service, Ltd.	Head Office, Hayes, Middx.	9 & 73
Econasign, Ltd. ...	92, Victoria St., London, S.W.1	23
Edison Swan Elec. Co., Ltd.	155, Charing Cross Rd., W.C.2	37
Electric Audio Reproducers, Ltd.	17, Little St. Leonards, Mortlake, S.W.14	49
English Elec. Co., Ltd.	Marconi Hse., Strand, W.C.2	85
Ever Ready (G.B.), Ltd.	Hercules Place, Holloway, N.7	66
Ferguson Radio Corp., Ltd.	105, Judd St., London, W.C.1	14
Ferranti, Ltd. ...	Hollinwood, Lancs.	58 & 76
Fitton, Ltd., R. N. (Ambassador Radio)	Princess Wks., Brighouse, Yorks.	41
Garrard Eng. & Mfg. Co., Ltd.	Newcastle St., Swindon, Wilts.	71
General Elec. Co., Ltd.	Magnet Hse., Kingsway, W.C.2	68
Gibbs, Ltd., Herbert E.	First Ave., Montague Rd., Edmonton, N.18	20
Goodmans Industries, Ltd.	Axiom Wks., Wembley, Middx.	63
Gramophone Co., Ltd.	Head Office, Hayes, Middx.	10
Hartley Baird, Ltd.	Lancelot Rd., Wembley, Middx.	88
Hobday Bros., Ltd.	21, Great Eastern St., E.C.2	78
Hunt (Capacitors), Ltd., A. H.	Bendon Valley, Garratt Lane, S.W.18	90
Iliffe & Sons, Ltd.	Dorset Hse., Stamford Street, S.E.1	45
Invicta Radio, Ltd.	Radio Wks., 79, Parkhurst Rd., Holloway, N.7	94
J.B. Mfg. Co. (Cabinets), Ltd.	86, Palmerston Rd., London, E.17	18
J. Beam Aerials, Ltd.	Cleveland Wks., Weedon Rd., Northampton	31
Keith Prowse & Co., Ltd.	159, New Bond St., London, W.1	1
Kolster - Brandes, Ltd.	Footscray, Sidcup, Kent	70
McMichael Radio, Ltd.	190, Strand, London, W.C.2	72
Marconiphone Co., Ltd.	Head Office, Hayes, Middx.	13
Masteradio, Ltd.	10/20, Fitzroy Place, N.W.1	62
Mullard, Ltd. ...	Century Hse., Shaftesbury Ave., W.C.2	56
Multicore Solders, Ltd.	Multicore Wks., Maylands Ave., Hemel Hempstead, Herts.	100
Murphy Radio, Ltd.	Welwyn Garden City, Herts.	40

Name	Address	Stand No.
Nera of England, Ltd.	Jefferies Passage, High St., Guildford	208
NEWNES, LTD., GEORGE	**Tower House, Southampton St., W.C.2**	51
Pam Radio & T/V, Ltd.	295, Regent St., London, W.1	84
Peto Scott Elec. Insts., Ltd.	Addlestone Rd., Weybridge, Surrey	60
Philco (Overseas), Ltd.	Romford Rd., Chigwell, Essex	36
Philips Elec., Ltd.	Century Hse., Shaftesbury Avenue, W.C.2	96 & 97
Pilot Radio, Ltd.	31/37, Park Royal Rd., N.W.10	59
Plessey Co., Ltd.	Vicarage Lane, Ilford, Essex	28
"PRACTICAL WIRELESS" & "PRACTICAL TELEVISION"		51
Pye, Ltd. ...	Radio Wks., Cambridge	4 & 95
Radio Gramophone Dev. Co., Ltd.	Eastern Avenue West, Mawneys, Romford, Essex	93
Regentone Radio & T/V, Ltd.	Eastern Avenue West, Mawneys, Romford, Essex	38
Roberts' Radio, Ltd.	35/37, Creek Rd., East Molesey, Surrey	102
Rola / Celestion, Ltd.	Ferry Wks., Summer Rd., Thames Ditton, Surrey	3
Rudman, Darlington (Electronics), Ltd.	Wednesfield, Staffs ...	207
Simon Equipment, Ltd.	48/50, George St., Portman Square, W.1	104
Sky-Masts ...	Beadon Garage, Beadon Road, W.6	30
Sobell Industries, Ltd.	Langley Park, nr. Slough, Bucks.	12
Standard Tel. & Cables, Ltd., (BRIMAR)	Footscray, Sidcup, Kent	6
Standard Tel. & Cables, Ltd., (SenTerCel)	10, Essex St., London, W.C.2	82
Stella Radio & T/V Co., Ltd.	Oxford Hse., 9/15, Oxford St., W.1	55
Taylor Elec. Insts., Ltd.	419, Montrose Ave., Slough, Bucks.	54
Telegraph Condenser Co., Ltd.	Wales Farm Rd., North Acton, W.3	101
Telemechanics, Ltd.	3, Newman Yard, Newman St., W.1	81
Telequipment, Ltd.	1319A, High Rd., Whetstone, N.20	80
Telerection, Ltd....	Antenna Wks., St. Pauls, Cheltenham	5
Trix Electrical, Ltd.	1/5, Maple Place, Tottenham Court Rd., W.1	65
Ultra Electric, Ltd.	Ultra Works, Western Ave., Acton, W.3	69
Valradio, Ltd. ...	New Chapel St., Feltham, Middx.	29
Vidor, Ltd. ...	West St., Erith, Kent	87
Waveforms, Ltd.	Radar Wks., Truro Rd., N.22	75
Westinghouse Brake & Signal Co., Ltd.	82, York Way, King's Cross, N.1	2
White - Ibbotson, Ltd.	52A, Goldhawk Rd., Shepherd's Bush, W.12	98
Whiteley Elec. Radio Co., Ltd.	109, Kingsway, London, W.C.2	105
Wolsey Television, Ltd.	43/5, Knight's Hill, West Norwood, S.E.27	16
Wright & Weaire, Ltd.	131, Sloane St., London, S.W.1	74

The G.E.C. Micro-wave Radio Television Link

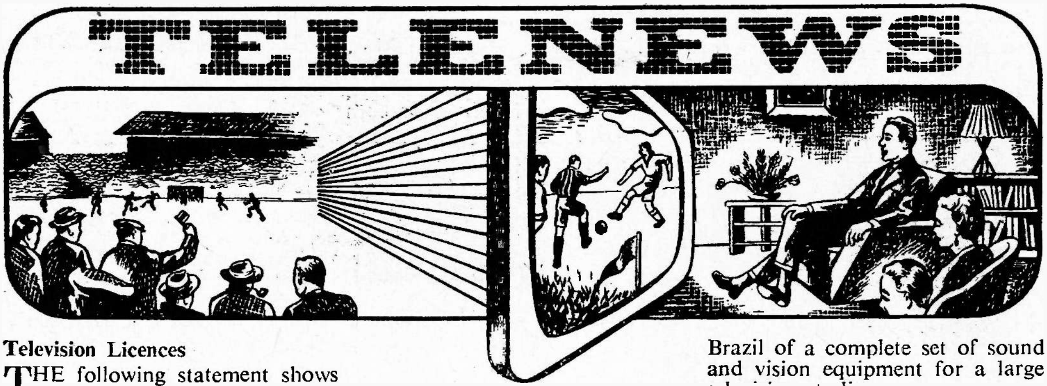
ONE of the most outstanding technical achievements in the recently inaugurated European television tie-up is the micro-wave radio link spanning the Alps. This link, 125 miles long, runs from Chasseral in northern Switzerland, through a relay station located high up the 15,000ft. Jungfrau, to Monte Generoso in southern Switzerland, and it is the only link between the Italian and German television networks.

The equipment used was supplied throughout by the Coventry Telephone Works of The General Electric Co., Ltd. The order was placed in January by the Swiss firm, Hasler S.A., acting on behalf of the Swiss Post Telegraph and Telephone Administration, and the equipment was installed jointly by the G.E.C. and Hasler S.A. in time for the preliminary Eurovision tests at the end of May.

For the extension of the television network in Switzerland, Hasler S.A. has received an additional order for identical equipment to provide a radio link between Uetliberg, Chasseral, Romont and Dôle, and the equipment for this project will be made by Hasler S.A. on behalf of the G.E.C.

The link provides a one-way reversible television channel handling television signals with a bandwidth extending to 5.5 Mc/s so that it is suitable for 625-line pictures. It comprises a terminal transmitter and receiver at Chasseral, a relay station on the Jungfraujoch, and a terminal transmitter and receiver at Monte Generoso. The relay station situated 12,000ft. above sea level on the Jungfraujoch is 60 miles from Chasseral and 65 miles from Monte Generoso. The stations are so high that towers are not required.

The system is frequency modulated and operates in the 1,700-2,300 Mc/s band, the two frequencies used in this instance being 1,776 Mc/s and 1,848 Mc/s. Two frequencies are necessary because reception and transmission at the relay station have to take place on different frequencies in order to prevent feedback from the transmitter to the receiver. The link, which is a permanent installation, has been designed so tha it requires the minimum of maintenance.



Television Licences

THE following statement shows the approximate number of television licences issued during the year ended May, 1954. The grand total of sound and television licences was 13,479,308.

Region	*Number*
London Postal ...	963,754
Home Counties ...	363,461
Midland	650,729
North Eastern... ...	449,406
North Western ...	472,726
South Western ...	146,006
Wales and Border ...	166,512
Total Eng. and Wales	3,212,594
Scotland	154,346
Northern Ireland ...	12,426
Grand Total	3,379,366

Sets From Shrewsbury

HARTLEY-BAIRD LTD., the new company formed by the merging of the Shrewsbury firm of Hartley Electromotives Ltd. and Baird Television Ltd., have started production of television sets in one of the recently built factories in Shrewsbury.

Radar Spots Waterspout

AN unusual report has been received by The Marconi International Marine Communication Co. Ltd., concerning the "Radiolocator IV" radar installed on board the 12,340-ton tanker *Caltex Tanganyika*.

On a recent Atlantic crossing an echo resembling that given by a squall was observed on the radar screen at a distance of seven miles, although the weather was fine and clear with no cloud in the area to warrant any squalls. The explanation was seen about half an hour later when a waterspout was observed to be forming in the position where the supposed squall had originally been plotted.

That Extra Pound

THOUSANDS of licence holders received a shock when they tried to renew their licences on the last day in May.

G.P.O. counter clerks informed them that new licences could only be taken out on the day following expiration, so that licences expiring on May 30th could be renewed on May 31st at the old rate of £2, but those expiring on May 31st were not due for renewal until June 1st, when the additional £1 was charged. Hundreds of complaints were received at the Post Office headquarters about the manner in which the scheme had been handled.

Brazil Buys Equipment

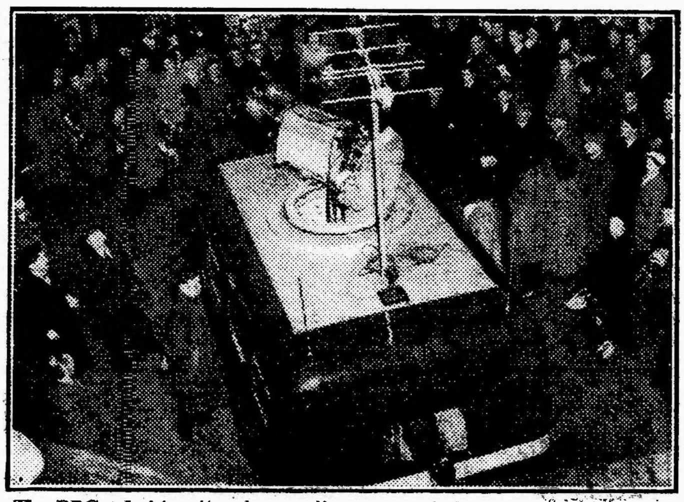
BRITISH progress in the South American television market has taken another important step forward with a recent shipment to Brazil of a complete set of sound and vision equipment for a large television studio.

The equipment, which includes four television camera channels, a vision mixer and associated equipment, was consigned by Marconi's Wireless Telegraph Co. Ltd., to Radio Televisao Difusora in Sao Paulo, the main industrial centre of Brazil.

"Stars at Blackpool"

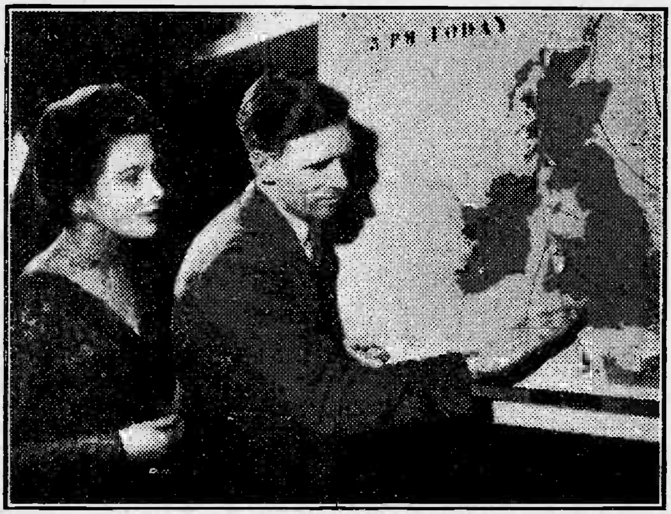
THE second programme to be televised this summer under the above title will be on September 15th under the production of Barney Colehan.

The broadcast offers many hazards because when the TV programme is being presented between 8.25 and 9.25, all the artists taking part are appearing in one of the 14 current shows in Blackpool. It is necessary, therefore, to juggle with the running order to put the artists on when they have a free period from their



The BBC television "roving eye" camera unit is seen on another of its journeys round London, bringing pictures of crowded streets and bright shop window displays to the viewer at home by the fireside.

own theatre. It is not unusual for one artist to be appearing in the television show while another is arriving and a third still performing at his or her own theatre.



Forecast Officer T. H. Clifton, of the Air Ministry Meteorological Office, one of the forecasters who appear each evening and, with the aid of maps, show the current weather trends. With him is Noëlle Middleton, television announcer.

Television's Hollywood

MR. D. GAMMANS, Assistant Postmaster-General, told the House of Commons recently that he foresaw "tremendous developments" in the field of television and had visions of Britain becoming the "Hollywood of the television world."

"There is so much talent in this country," he continued, "that if we do not adopt a too restrictive attitude and do not try to protect British films because they are British films, we have our opportunity."

Transatlantic Agreement

THE British Broadcasting Corporation and the National Broadcasting Company have concluded an exclusive exchange agreement concerning Television News film. The agreement will come into operation on December 1st next.

Band III Reception

R.E.C.M.F. and B.R.E.M.A. have jointly agreed to recommend the standardised use of a single input of 75 ohms for both Band I and Band III. This follows technical discussions between the two associations.

It is recognised that this single input is a long-term standard to which both receiver and aerial manufacturers will work, but that in the interim period there will be some installations for which two inputs will be necessary.

Bells Cause Interference

LUTON buses have all had television suppressors fitted to their windscreen-wipers following three years of experiments by Post Office engineers.

A new problem has been brought to their attention, however, by television viewers living along bus routes in the town who complain that every time a bell is rung on a bus, their TV sets emit a buzzing noise and a flash appears on the screen. This is certainly a real problem for the G.P.O. technicians; they find that it's hardly practicable to fit a suppressor to every single bell.

Manchester Studios

WE learn that the BBC intends to adapt premises in Dickenson Road, Manchester, to serve as television studios for the North Region.

The studios are the first to be situated outside London and will be used until new headquarters are built. All cameras and control equipment will be of the mobile type until permanent equipment becomes available.

Isle of Wight Station

THE Rowridge television transmitter on the Isle of Wight is expected to come into operation some time in November. As soon as the mobile transmitter and cameras become available it is hoped that outside events on the island can be televised including many of the yachting fixtures at Cowes.

Big Screen at Luncheon

LARGE-SCREEN TV was used at a recent big Harrogate luncheon to enable guests at one end of the large banqueting hall to see and hear speakers at the top table as if they were seated but a few yards away.

The luncheon was held at the Majestic Hotel for over 700 people. The closed circuit transmission projected a picture on to a 12ft. by 9ft. screen by arrangement with Cintel, Ltd.

"Coin-in-the-slot" Receivers

IT is possible that "coin-in-the-slot" television receivers will arrive on the British market this year.

The first of this type of set has been installed in a California home. It offers the viewer a list of films together with the charge that is being made to view them. The customer selects the film he wishes to see and inserts the necessary money in a slot on the side of the set.

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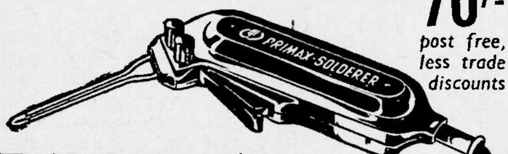

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EB34	2/-	EA50	2/-	6J5	5/-	6SN7	9/-
6J5(M)	6/-	6H6(M)	4/6	6SH7(M)	5/-	6SK7	5/-
EF36	4/6	EF8	7/6	EF54	5/-	EF39	7/-
EC52	5/-	EC54	4/6	EL32	7/-	EL33	12/-
EBC33	7/6	EK32	7/-	6AM6	7/6	6AL5	7/-
6BW6	8/6	6BW7	8/6	9BW6	8/6	R19	13/-
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VU39	8/6	5Z3	8/6	5Z4	8/6	5U4G	9/-
6X5	7/6	FW4/500	8/6	807	6/-	HL2	2/6
Pen220	3/-	CV188	6/-	CV173	9/6	VU111	3/-
VU133	3/-	U22	7/6	6K8	11/-	6K7	6/-
6Q7	8/6	6V6	8/6	VR116	4/-	35L6	8/6
50L6	8/6	35Z4	8/6	12A6	7/-	1299A	6/-

Condensers.—Electrolytic. 450 volt working. 8 mfd., 2/3. 8+8 mfd., 3/9. 16+16 mfd., 4/6. Dubilier 500 volt working, 20 mfd., 3/-. 32 mfd., 5/-. Bias, 25 mfd. 25 volt, 50 mfd. 50 volt, 2/- each.

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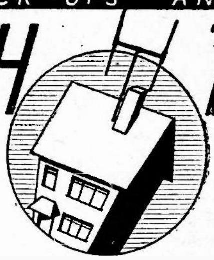

By Iconos

MULTIPLE TRACK RECORDINGS

MULTIPLE sound track recordings are the order of the day for all kinds of purposes, using both photographic or magnetic recording, and though much of the detail equipment design is quite unsuitable for picture recording, the pioneer work has been valuable. Triple magnetic track recording on film has been used in Hollywood for some years for re-recording dialogue, music and effects tracks on to a final photographic track for theatre release. The same equipment has been used for television films production, which also occasionally make use of ¼in. magnetic tape using twin tracks. One track is used for recording the sound for the television picture and the second track is used for a time-base recording. When reproducing or transferring to another track (such as a 30ft. per second magnetic TV picture tape) the original timebase is scanned on a C.R. tube against a 50 or 60 cycle reference to ensure that synchronisation is maintained. Multiple track recordings are also used for all kinds of other purposes, from prospecting for oil to research on atom bombs. But that is another story altogether!

THE MANCHESTER STUDIO

TV follows the film! At any rate, the siting of the BBC's "new" television studios seem to follow the trails blazed by film pioneers. Alexandra Palace and Lime Grove were both sites of early British cinema studios, the homes of Big Ben and Gaumont films respectively. And now, the acquisition of the first provincial TV studio is announced — at Manchester. Following what seems to be the usual precedent, the studios where "Mancunian" films were made have been taken over by the BBC for its Manchester TV studio.

This is situated in Dickinson Road, Rusholme, and has been operated for about eight years by Film Studios (Manchester) Ltd., which is closely associated with the Mancunian Film Corporation, a producing and distributing organisation which has been in existence for over twenty years. John E. Blakeley, the managing director, has carried out a policy of "what Lancashire thinks to-day —London will think to-morrow," and it must be admitted that in many ways he has been right. Aiming at the tastes of the cinema audiences of Lancashire and Yorkshire, which account for about one-third of the cinema seating capacity of the British Isles, he has ignored the jaded tastes of the London film critics. Finding that the British and American films he was handling did not quite meet the regional requirements of these counties, he started making films on broad comedy lines, featuring comedians well known locally and at Blackpool, Morecambe, Scarborough and other seaside resorts. He put George Formby, Jnr., into his first film, a modest effort called "Boots! Boots!" which broke records all over the two counties and was well received elsewhere. Enlisting the services of Arthur Mertz, the most prolific music hall "gag" writer in the northern counties, he launched upon a series of broad slapstick comedies of the Crazy Gang type, featuring Duggie Wakefield, Frank Randle, Norman Evans, Nat Jackley, Tommy Fields, Betty Jumel and others. Blakeley's earlier films were made at studios in London, but after the war he acquired a disused chapel with buildings adjacent in Manchester. He spent a great deal of money fitting them out and equipping them with lights, cameras and sound apparatus, not to mention all the other necessities such as workshops, scene docks, a theatre, property rooms, dressing rooms and offices. There are two nice stages, No. 1 being 100 ft. x 55 ft. widening to 80 ft. and No. 2 measuring 50 ft. x 40 ft. Power supplies are from the local mains, cameras are by Newall, lights by Multiple H.D. Industries and Mole-Richardson with sound by Visatone and G.B.-Kalee. In other words, the BBC have acquired in one piece something which would have taken them quite a long time to assemble. John Blakeley, who directed most of the films made by Mancunian, plans to continue making his films especially for Lancashire and Yorkshire—but they will be once more made in London studios.

FUTURE TV CENTRES?

WHERE else will the BBC look for provincial studios? If they follow precedent and acquire studios or premises already established in the provinces, there are a surprising number of possible sites. Close to Torquay, old film studios, now disused, are situated at Watcombe Hall, Babbacombe and at Oldway, Paignton. The latter studio was established just as the British film studios faced a slump. The only film wholly made at the Oldway Studio was one intended for American Television! The equipment, by Western Electric, Mitchell, Mole-Richardson and others, was first-class and there were excellent and well-fitted cutting-rooms. The equipment has gone, but the premises and, I believe, the sound proofing are still there. Perhaps this ill-fated local enterprise will yet revive in the interest either of BBC or sponsored television. Other early film studios existed in Sheffield, Hove, Brighton, St. Annes (near Blackpool), Lancaster, Holmfirth (Yorks), Bradford, Macclesfield, Liverpool, Rochester, Shoreham and Hastings. Some of the "studios" were of the early glass-house or open air type. Bamforth comedies were made by a Yorkshire firm which also specialised in religious lantern slides and seaside post cards! Their studio at Holmfirth was quite a centre of local activity in the heyday of the silent film. The St. Annes Studios was a huge plant, converted from an old aeroplane hangar. Brighton and Hove had several well-equipped studios. Indeed, there is a modern and very active studio there now in St. Nicholas Road, Brighton, with two stages and a full schedule of film productions ahead. Most of these places are far better and more commodious than the BBC's original studios at the Alexandra Palace.

TV COMPETITION

THE passage of the Television Bill through the House of Commons has been stormy, but at last it is through and goes on to "the other place," the Lords. Activity in sponsored television enterprises will now be intensified, particularly by those companies engaged in the making of films for television. Norman Collins' High Definition Films at Highbury and Douglas Fairbanks' Company at Elstree are particularly active and many other companies will now enter the field. Already there are said to be at least six hundred technicians engaged upon making films for television. Some of these have been working on films for American television for some time, of course, but now the demand will be for local I.T.A. programmes in addition. There will be competition for staff, too, and it is possible that quite a few BBC TV producers and engineers will change over to sponsored TV or to the film companies specialising in this work. The Highbury Studios of High Definition are fully fitted up for electronic shooting, using television cameras and recording the pictures on specially designed tele-cine cameras made by Moy to High Definition's specification. The TV method of shooting does enable a large footage of finished product to be achieved in a remarkably short time. Pictures viewed on the TV monitor are of wonderful quality and give one an idea of the quality and definition it is possible to achieve under ideal circumstances.

VISTAVISION

TO meet the competition of improved quality TV, both from BBC and sponsored sources, the film industry have produced yet another gimmick to improve presentation at theatres. Under the name "Vistavision," special motion-picture cameras photograph the negative horizontally along the film, as with a Leica "still" camera, one frame of picture covering the space formerly occupied by two. This means that the picture area of negative is over two-and-a-half times as large as the standard type of negative, and the inherent grain size and other blemishes on the negative are correspondingly reduced. The negative film travels at twice normal speed, but the wide negative is exposed at the usual 24 frames per second. Prints are made by optically reducing this large negative and at the same time twisting the picture 90 deg. into its normal size on a standard print. Quality and definition are improved to an extraordinary degree, especially on the enormous screens now in use. This is another effort—and a most impressive one—to draw viewers back from their armchairs to the plushy tip-ups of the cinemas.

16mm. TV RECORDING

OF course, the consumption of film stock and the amount of processing required for the negative will be doubled when Vistavision type negatives are photographed. This rules it out as a method of recording large photographic negatives of TV material along the lines of the High Definition or other tele-film systems. For TV recording, the tendency is towards smaller negatives which are quite capable of giving sufficient resolution for most purposes. 16mm. film is being used experimentally both by the BBC and High Definition and is in general use in the U.S.A. Good quality results are achieved with much less cost. Accuracy—or, rather, insufficient accuracy of perforations of standard commercial 16mm. film — is one of the main problems. Research departments engaged upon development in this field are unperturbed by the report of successful magnetic recording of pictures on tape. "An interesting laboratory experiment," they comment, and turn back to their flying-spot scanners.

New TV Tower at Crystal Palace

IT is now possible to give some details of the aerial tower which British Insulated Callender's Construction Co. Ltd. are to design and erect for the BBC to their detailed specifications of structural requirements, wind loadings, etc., at their new London Television Station at Crystal Palace. This station will eventually replace the existing transmitting station at Alexandra Palace.

The new tower is to be a self-supporting lattice-steel structure, 640ft. in height, and will have a base width of 120ft. For the first 440ft. it will taper after the manner of the Eiffel Tower and from this point until it reaches the height of 600ft. will be of square construction with parallel sides of 9ft. 6in. square section. The top 40ft. of the tower, which is also to be of square section, will have parallel sides of 2ft. 6in. face width.

The structure will be designed to resist wind pressures varying from 27 pounds per square foot at the base to 55 pounds per square foot at the top. Allowance has been made for icing in bad weather and the tower will resist these wind pressures even when all its members are coated with a half-inch thickness of ice.

Between the 440ft. and 660ft. levels, eight stacks of four dipole aerials will be mounted and at 440ft. provision will be made for the installation of dish-type receiving aerials for picking up outside broadcast transmissions.

The foundations of the tower are being specially designed to provide for the possibility of future underground extensions of the transmitter buildings beneath the structure. The tower itself will be provided with an electrically-operated hoist to carry two passengers or a goods load of five cwt. to a height of 440ft.

The whole structure will be of bolted construction and will weigh approximately 370 tons. All structural members and connections will be hot dipped galvanised at the works of Messrs. Painter Bros., at Hereford, who will fabricate the steel work.

British Insulated Callender's Construction Co. Ltd. were responsible for the supply and erection of the existing 750ft. high masts at the BBC's high power television stations at Sutton Coldfield, Holme Moss, Kirk O'Shotts and Wenvoe, and are to provide masts for three of the medium power television stations now to be built. These are at North Hessary Tor (Devon), where a 750ft. mast is to be erected, and at Pontop Pike (Newcastle) and Rowridge (Isle of Wight), where 500ft. masts are to be installed.

BUILDING THE "SIMPLEX"?

Thousands of enthusiasts are building the "Simplex" Televisor, now being featured in "Practical Television." WHY NOT YOU? **CONSTRUCTOR'S ENVELOPE** containing full constructional details and Blue Print, additional notes and suggestions, and Query Service form, sent for ONLY **5/-**. All components available ex stock as follows:

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TRANSFORMER.—250-0-350 v. 150 m.a. 6.3 v. 5 a., 5 v. 3 a. tapped at 4 v., ONLY **32/6**. (Postage 2/-.)

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RECTIFIERS.—RM3 **5/-** ea., K3/40 **6/-** ea.

VALVES.—EF50 **6/6**, SP61 **4/-**, 6SN7 **9/-**, 6J5 **5/6**, EB34 **3/6**, EA50 **3/6**.

VALVEHOLDERS.—B9G/(EF50) **10d.**, I.O. and M.O. **6d.**, Diode (EA50) **6d.**, VCR97 **2/6**.

VCR97 TUBE.—Tested full screen, **42/6**.

CONDENSERS.—Electrolytics 25 mfd. 25 v. **1/10**, 16 x 8 mfd., 450 v. **5/6**, 32 x 32 mfd. 450 v. **6/-**, .1 mfd. 2,500 v. **4/6**. Mica, silver mica, and tubulars, 350 v. **6d.** each.

POTENTIOMETERS.—All values, preset **1/9** each, long spindle **3/-**, with switch, **4/6**.

RESISTORS.—¼ watt **4d.**, ½ watt **5d.**, 1 watt **6d.**, 1.5 K. 5 watt, **1/6**.

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6AK7	9/6	12SR7	7/6	EF36	6/6
6B4	7/6	28D7	7/6	EF39	6/6
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CORRESPONDENCE

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

NORTHERN POLY CLASSES

SIR,—Our new classes commence on September 27th, 1954, and will be of interest to your readers, and I should be most grateful if you could spare some editorial space to announce them.

I have received the most generous material assistance from all the manufacturers of Band III and F.M. equipment, and the governing body of the Northern Polytechnic are spending a considerable sum on new test gear.

There is no doubt that the future of Band III television and F.M. broadcasting principally lies in the hands of the installation and servicing engineers, and it is with this in mind that we are trying to encourage as many people as possible to study the problems associated therewith.—JOHN GILBERT (Head of Departments of Telecom. Engineering, Northern Polytechnic, N.7).

"H" VERSUS THE MULTI-ELEMENT ARRAY

SIR,—I am, of course, aware of the published figures of galactic noise in relation to wavelength, but I disagree with Mr. Harknett's interpretation of this data.

To give a readily appreciated example, Mr. Harknett would have us believe, if I understand him, that the signal/noise ratio is determined entirely by the magnitude of galactic noise. Thus by implication it appears that a television receiver having, say, as a first stage a mixer (i.e., no R.F. stage) connected to a conventional "H" aerial, will give the same performance, so far as noise is concerned, as one possessing an effective R.F. stage connected to an efficient directional aerial. That this is not the case is readily demonstrable both practically and theoretically.

If I may venture a personal opinion, I feel that Mr. Harknett has over-generalised his arguments in pursuit of support for what was an original false premise, namely the superiority of an "H" aerial over a more elaborate array.—SPENCER-WEST (Gt. Yarmouth).

ARE M/cs NECESSARY?

SIR,—In the July issue of your magazine there appeared an article entitled "Are the 3 Mc/s Bars Necessary?" I do not agree with the author's result of approximately 2.4 Mc/s bandwidth for equal horizontal and vertical definition. Similar results have been obtained by authors in other technical publications.

The author has obtained the figure of 96,700 cycles of black and white elements in each complete picture, but in multiplying this by 25 to obtain the frequency in cycles per second he has overlooked the fact that these 96,700 cycles must be resolved in less than 1/25th second. The frequency will be greater the lower proportion of the total frame time the active line elements occupy. For instance, if half the frame time was occupied in transmitting pulses and black levels, then the 96,700 cycles would have to be transmitted in 1/50th second and the maximum bandwidth would be 96,700×50, or 4.835 Mc/s.

The correct bandwidth required in our 405-line system to give equal horizontal and vertical definition will therefore be:

$$97{,}700 \times 25 \times \frac{\text{Total frame lines}}{\text{No. of actual lines}} \times \frac{\text{Total line aerial}}{\text{Actual line aerial}}$$

$$= 97{,}700 \times 25 \times \frac{405}{377} \times \frac{99\,(\text{approx.})}{84\,(\text{approx.})} \quad 3{,}061{,}000\text{c/s}$$

or just over 3 Mc/s.

This may be checked from an accurate photograph of Test Card C by measuring the active time rate and comparing with the frequency gratings. It will be seen that the closest comparison is given by the 3 Mc/s grating.—W. RUSSELL (Coventry).

INTERLACING

SIR,—I have followed recent articles on interlacing etc., and have listened to a number of club members discussing this point, but I fail to see just what all the fuss is about. I do not make receivers, being content with a commercial model, and I do not know whether this interlaces or not. What does it matter? The picture looks good, and when I have been shown sets with a so-called bad interlace, they look just as good—unless of course, the lines are paired. After all, it was recently stated in the article on 3 Mc/s definition that the correct distance for viewing is where the lines just merge. Surely, then, at such a distance the picture will look good with all but the most atrocious interlacing. Another point is this 3 Mc/s business. Surely, at the normal viewing distance anything above 2 Mc/s looks all right, as there are few details in the average "telecast" which are fine enough to be produced by 3 Mc/s and then, as the article mentioned pointed out, you can't see them if you are not sitting right on top of the set. Aren't we all getting too critical about the last detail in various aspects of TV? Surely, it is on a par with sound broadcasting where the "experts" tell us that the ordinary set is no good—you must have a Hi-Fi with twin speakers in acoustic cabinets and suchlike. That is all very well for the real fans, but over 90 per cent. of the listeners are satisfied with commercial sets with 5in. speakers, superhet circuits and other aids to poor quality, and I think that a similar proportion are satisfied with non-interlaced, 1½ to 2 Mc/s tele sets.—G. BORDON (N.W.9).

SOUND QUALITY

SIR,—I should like heartily to endorse the remarks made by K. S. Barr, in last month's correspondence column.

He pointed out that the sound track of a televised film was of a poorer quality to that of the sound system of a cinema or the normal sound reception of a television broadcast. I could not agree more with him. I have just returned from a business trip to the States and had many opportunities to view the American programmes. A large percentage of these are of course "canned" or, as we say, filmed and the continuous use of these films meant continuous bad sound reception. So much so, that I eventually refused to watch any kind of TV programme but the "live" kind. Not only is the sound "crackly" but it is also very faint compared with the background noise that goes with it.

TV and the cinema must both keep their respective places and play their own parts. Films for the cinema and live transmissions for TV.—J. BARWELL (Haywards Heath).

Line Linearity

HOW LINEARITY IS CONTROLLED ON THE HORIZONTAL SCAN AND COMMON FAULTS EXPLAINED

By W. J. Delaney

LAST month we dealt with the problems of frame linearity, as in our experience this is one of the most troublesome faults in receivers. On the line or horizontal side, however, the trouble is not quite so serious, occurring less or being less noticeable. On the frame side any non-linearity results in figures being made grotesque—with either big heads or small heads and big bodies. On the horizontal side, however, any distortion results only in figures on one side of the screen being disproportionate to those on the other. In "panning" shots this may be noticed by a figure suddenly growing stouter or thinner as it passes off the screen, or in lettering changing in size, but it is not nearly so troublesome and, in fact, in many cases almost passes unnoticed. In other words it is possible to use a screen and obtain worth-while enjoyment from it with distortion in the horizontal direction, whereas it is not possible to tolerate it in a vertical direction. Owing to the much higher frequency at which the line or horizontal scanning section operates it is possible to obtain a much better waveform, but many of the previous remarks on the frame section still hold good. For instance, the load resistor for the oscillator will still affect the output from the oscillator and the line output valve will still have to be adjusted to obtain a correction of any distorted output.

One of the most common of linearity controls met with in older circuits consists of an R/C combination across the scanning coils, and adjustment of either R or C or both results in a correction of the waveform.

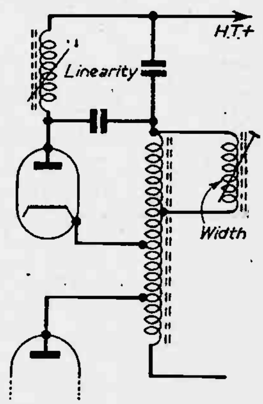
It should be borne in mind at this stage that at the high frequency of the horizontal scan there is generated a back E.M.F. or surge from the scanning coils and this is, in fact, employed in modern receivers for the E.H.T. supply. This back E.M.F. exercises a correcting influence on the waveform of the line circuits and simplifies to some extent the problems arising from a non-linear scan.

Saw-tooth Waveform

It will be remembered from last month's description of the combined oscillator and output valve that the oscillator delivers a distorted form of saw-tooth and the output valve is made to deliver an output so distorted that it acts as a corrective to the input wave and thus delivers a straightened form of saw-tooth. One way of effecting this in the modern horizontal timebase is not to employ all of the saw-tooth output from the oscillator, but to use only one half of it, and to arrange for the output stage plus the recovery diode to add the second half. The second half of the oscillator output is usually "bent" whilst the first half of the recovery circuit is bent, and thus by combining the good portions of each a tolerable saw-tooth is delivered to the scanning coils. It should again be emphasised that in order to avoid complications and make it easier for the beginner to follow these explanations certain liberties are being taken, but the broad principles are covered for the purposes of following the general arrangement.

Auto-transformer

Most modern line timebases make use of an auto-transformer in which losses have been reduced by using one of the latest types of iron core. These are much smaller than older types of transformer and actually give greater efficiency, with the added advantage that linearity and width adjustments may be made easily by varying the values of certain parts of the transformer winding. This is usually accomplished by shunting a part of the winding by another coil with adjustable core or using a series arrangement of the same type of circuit. For the linearity control a very common arrangement, and one which is used in both the View Master and the Supervisor, is shown in the accompanying illustration. A diode is connected between the anode of the output valve and the H.T. line, and this is also included across part of the winding of the auto-transformer. To some it may appear that this prevents H.T. from being applied to the output valve as there is no apparent direct connection to the anode. Actually, of course, H.T. passes through the diode at certain periods, and this diode fulfils another function. From the diagram it will be seen that an iron-cored inductance is included between the diode anode and the H.T. line and on each side of this choke is a small condenser. This will be recognised by most readers as a filter circuit such as is found in a normal H.T. supply and in fact it functions in a very similar manner. The circuit is rendered conducting over the major portion of the saw-tooth and during this period the condensers charge up. When the diode is non-conducting they discharge, and thus the anode of the output valve is provided with H.T. when the diode is not conducting.



Typical line linearity circuit as used in the View Master and Supervisor.

The surge or back E.M.F. from the scanning coils is also fed to this part of the circuit and the additional 50 or so volts produced is added to the normal H.T. line. The linearity adjustment operates in the following manner: during the first half of the trace period the voltage across one of the condensers rises due to the rectified E.M.F. from the coils. During the second half of the trace the voltage falls due to the drain of the line output valve. From this it will be seen that the rise and fall across the filter will be in the form of a ripple voltage at the same frequency as the saw-tooth. This ripple voltage will be present on the H.T. supply to the line output valve, and by adjusting the phase of the ripple (by varying the value of the inductance) the linearity may be modified

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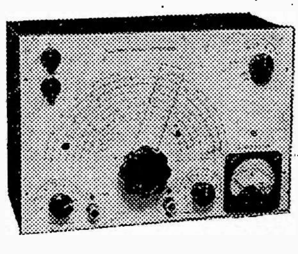

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YOUR Problems SOLVED

Whilst we are always pleased to assist readers with their technical difficulties, we regret that we are unable to supply diagrams or provide instructions for modifying surplus equipment. We cannot supply alternative details for constructional articles which appear in these pages. WE CANNOT UNDERTAKE TO ANSWER QUERIES OVER THE TELEPHONE. The coupon from p. 143 must be attached to all Queries, and if a postal reply is required a stamped and addressed envelope must be enclosed.

TUNING CIRCUIT ALIGNMENT

I have a Vidor TV CN369A, four years old. My trouble first started with sound on vision 18 months ago. The set has been out for repair twice since then with the same trouble. The last time it had not been on 10 minutes when both sound and vision cut out. On inspection I found it was the aerial trimmer faulty. I managed to get a new one with the same capacity (3/30 pF) and fixed it in. Now all is well if I could get a little more volume. I think the service engineer must have cut down the sound to minimum in one of the cores to stop sound on vision when the faulty trimmer was in. Could you please give me instructions to identify same ?—J. D. Staniland (Gillingham).

The only real solution to this problem lies in having the receiver realigned. It is not possible for us to advise on the adjustment of a tuned circuit, which will provide an increase in sound sensitivity without upsetting the balance of the circuit generally.

BOOST FOR TUBE

Recently I fitted a 25 per cent. boost transformer to the C.R.T. (CRM92A) of my Baird portable. The resulting picture is definitely an improvement, and I told my friends.

As one of them has a similar tube in his set (an Ekco TS105) and which is giving a rather dim picture, he was interested in making the same improvement, so I got him one of these little transformers.

He complained that in his case his picture was worse with the boost, and was emphatic that he had made the right connections. Thinking there might have been something wrong with the transformer, I took it home and replaced my own with it. I can find nothing wrong with it.

I suggested a bad soldered joint or the use of too long leads of thing gauge wire was the reason of my friend's disappointment, so he had another try, mounting the transformer as close as he could (he said) to the tube base and using stout flexes. The result was again a dull picture which was slightly improved only when the transformer was discarded in disgust.

Can you give us some idea why this boost transformer should have such opposite effects on two similar tubes ?—J. W. Day (N.1).

The success of the treatment described depends upon a number of factors which the experimenter cannot check, and it is a hit-and-miss operation from the practical aspect. In the case cited we feel that the tube emission might well be up to standard, but that the dim picture may be caused by deterioration of the screen phosphors, and in this case, of course, nothing at all can be done to enhance the brightness.

FAULTY TUBE ?

My Baird television receiver portable T164 has developed a fault, and I hope you can help me.

If I advance the contrast control to obtain a good picture the whites tail off to the right, giving a fuzzy appearance ; this happens also when brightness control is advanced. It seems very much like flaring, but I am not quite certain. I have a circuit diagram of this set.—G. Taylor (E.6).

Since you mention that the symptom can be provoked by advancing the *brightness* control as well as by advancing the contrast control, we feel that a fault may exist either in the E.H.T. section or in the tube itself. Your remarks indicate, of course, that a form of instability occurs when the tube beam current increases beyond a certain figure. This may originate in the E.H.T. circuit when called upon to provide more power ; suspect the E.H.T. transformer and E.H.T. rectifier. On the other hand, an illusive tube defect sometimes gives rise to a similar symptom.

INTERACTION OR HUM ?

I am building the Beginner's Timebase as described in "Practical Television" at the end of last year. I am having trouble with the frame circuit, and I would be much obliged if you could help me.

With V6 and V7 inserted and the frame hold at almost maximum value I get on the screen two vertical lines that are straight at one end and appear to come together and then move about 1½in. apart. In the middle they cross and then take the form of an "S" at the other end. At most other settings of the frame hold there appears a mass of similar lines moving rapidly, the "S" part moving down the screen. At nearly minimum setting of the frame hold three lines appear reasonably steady and similar to those mentioned before.

If I change the frame coupling to the tube from C11 and C10 to C8 and C9 (disconnecting the line) and obtain a horizontal line from the frame, I get exactly the same effect as before.

I do not think the proximity of the transformers and the choke can be the cause, because turning the tube round slightly makes no difference to the distortion of the lines.—J. Cartwright (Horley).

It is possible for the fault to be in the paraphase valve V7 or the oscillator itself. This point can be checked by working with V6 while V7 is out of circuit. If the wavy line persists, then the trouble is likely to be in the flyback circuit, and may not affect the raster when the picture is received. Check C14, 12, 15 for leakage and the components around this part of the circuit.

Some VCR97 tubes are more sensitive to external influence than others and you may be picking up some hum. If you find the edge of the raster is curved like an elongated "S," then hum is getting into the timebase from the E.H.T. network. Try the effect of connecting an 0.3 μF 2.5 Kv between the cathode of the C.R.T. and chassis.

If the edge is like a double "S" (one on top of the other), then hum is getting through from the main power supply and the smoothing arrangements must be checked.

INTERMITTENT C.-H. SHORT

I have an Echo television set Model T141.

For two and a half years I have had excellent results, until recently.

The picture now becomes slightly misty and flickers to an extent that it hurts the eyes to view it even for a short time.

I can obviate this by turning the contrast control: the picture then appears to be perfect; this lasts for a short time until I get double lines. I again adjust the contrast control.

I have also noticed that the changing of cameras at the studio affects my picture, or this is a coincidence?—Thomas Gibbs (E.16).

From the clues you have given to us we feel that the trouble may be due to an intermittent heater to cathode short in the picture-tube itself. In the first place, therefore, you should have the tube tested in this respect. Should a short prove to be the case, and if the emission of the tube warrants it, a low-loss tube heater isolating transformer could be employed to obtain a further lease of life from the defective tube. See "Operating With a Heater to Cathode Short," PRACTICAL TELEVISION, May, 1953.

SOUND REJECTOR CIRCUIT, CHANNEL 3

Would you please let me know the correct values for C1 and C2, also the number of turns of wire, as enclosed, for "L," on former ¼in. outside diameter tuned by 0 B.A. either brass or iron dust core slug (whichever you prefer)?—O. W. Kingsley (Hove).

You desire the circuit illustrated to resonate at 53.25 Mc/s—assuming, of course, that the receiver to which it is to be included is of the T.R.F. type. It would be a simple matter for us to compute an inductance value in the form of so many turns, and then work out the value of capacitance needed to produce a circuit that would tune to 53.25 Mc/s. This would be of little assistance to you, though, for it is essential to take into consideration the capacitive elements of the general circuit in order to discover the precise C.R. values of the rejector circuit.

These, of course, depend on the total value of valve, wiring, and circuit capacitances existing at the point at which the rejector circuit is to be installed. The way the associated valves are operating, and thus the Miller effect, will also have a governing factor on the precise values.

Generally speaking, a high "Q" circuit is desirable for the sound rejector. With this in mind, therefore, it may be desirable to form the inductor with six turns of 18 S.W.G. tinned copper wire—making it self supporting, and bringing it into resonance with a 30 picofarad air-dielectric trimmer. So far as the experimenter is concerned, this method of rejector circuit design is to be preferred. See "Sound Rejection," PRACTICAL TELEVISION, June, 1952, and "TV For the Beginner—Coil Winding," PRACTICAL TELEVISION, December, 1953.

TUBE FLASHOVER

I would be pleased if you could assist me in locating a fault which has developed in my home-constructed television set. The model in question is the one advertised by the Electronic Precision Equipment Co. in your journal, using the Cossor 85K 15in. tube. I enclose circuit diagram for your guidance.

The set has given reasonable reproduction for several months, but has now developed the following fault:—

On switching on, after the usual warming-up period a sharp crack is heard, similar to that heard on the discharge of a large condenser, at the same time a spark can be seen inside the tube, but not apparently on the tube face. The discharge (?) can be brought about at will by advancing brilliance control and also occurs on switching off when the raster collapses. The flash seen is of a pinkish hue and is sometimes accompanied by faint fluorescence of the screen.—R. Dodson (Mexborough).

We feel that this symptom is caused by a fault inside the picture-tube itself. Sometimes the inner aquadag coating flakes, a section of which reduces the flashover distance between the final anode and a lower potential electrode.

FAULTY OSCILLATOR WAVEFORM

Could you please help me with a fault I have in my View Master?

The trouble is almost non existent E.H.T. with the consequence that the tube doesn't light up. The voltage at the anode of V10 is only approximately 240 v. I have nil volts at anodes of V9 and V11. Also no boost volts across C51 and neon lamp doesn't light up.

Voltage at the mains choke is O.K. Also all valves have been checked. C51, C53, C54, all O.K. C55 was found to be dud and was renewed with no results.

MR4 was also changed but without success.

Sound is quite O.K.—W. J. Banner (Bromsgrove).

You have not given sufficient information to enable us to advise you with any accuracy, but from your description it is quite evident that thyratron V9 is not producing a sawtooth voltage for driving V10 and we suggest that you closely examine the wiring and components of the V9 stage and the input to V10.

E.H.T. RECTIFIER FAULTY

I would welcome your advice regarding trouble I am having with my Vidor model 391, 9in. receiver. The trouble is in the E.H.T. section and causes the E.H.T. rectifier (EY51) to arc as soon as the line whistle is audible.

I have had the EL38 checked and have replaced odd resistors and electrolytics in this section also the EY51 itself.

Outward appearance of the line transformer appears quite good with no signs of melted wax, etc. As a reader of your commendable journal since number one, I referred to issue No. 16, where you give the circuit of Vidor CN4207, which is very similar to my set, except for the E.H.T. section. However, are the values quoted (resistance) for the scanning coils, etc., the same as in the CN391? Hoping you will be able to assist me in this direction. Thanking you in anticipation.—D. G. Mathew (Birmingham).

This system is almost certainly caused by a deterioration of insulation in the heater circuit—E.H.T. line—of the EY51 valve. Disconnect the E.H.T. feed wire from the valve and switch on the set. If the flashover continues, suspect a short-circuit between the heater winding in the line output transformer. If, on the other hand, the flashover ceases, check the E.H.T. smoothing capacitor and picture-tube anode for a short to chassis. Check by removing from circuit each component in turn.

There are slight deviations of the resistance values of inductive elements between the different Vidor models.

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.

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The Radar "405" signal generator.

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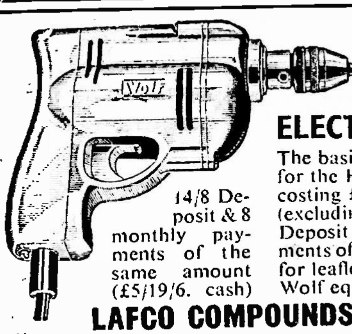

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