LONG-RANGE RECEPTION

PRACTICAL TELEVISION

AND TELEVISION TIMES

1/-

EDITOR
F. J. CAMM

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COLOUR TELEVISION

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PRACTICAL TELEVISION

& "TELEVISION TIMES"

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TELEVIEWS

Transistor Developments

THE announcement by the Radio Corporation of America that they have constructed a battery-operated television receiver which is valveless except for the picture tube is of the highest importance, for it marks a new development not only in television technique but in electronic applications generally. Transistors are made from tiny pieces of germanium crystal and the transistors themselves, in most cases, are not larger than a pea. In the demonstration they were shown operating radio sets, loud speaker systems, miniature transmitters, parts of electronic computors and many other pieces of electrical apparatus. It is true that the receiver demonstrated was experimental, but it was a portable single channel receiver with a 5in. screen, housed in a case no larger than that of a portable typewriter case—12in. x 13in. x 7in. Complete with batteries it weighs 27lb. and it produced a satisfactory picture when operated off its self-contained loop aerial five miles from a transmitter on the Empire State Building, and from a small external aerial it received pictures fifteen miles from a transmitter. This experimental receiver has 37 transistors and its total power consumption is 14 watts, or rather less than one tenth that of a standard table model set.

They were also incorporated in a demonstration of a personal radio receiver. The circuit made use of only one converter valve but transistors in all other circuits and it maintained the performance of a standard all-tube receiver. Their use has enabled a one third reduction in the size, weight and cost of the batteries needed, without reduction of the standard 100-hour operating life.

Also shown was a portable F.M. receiver covering 88/108 Megacycles. It uses eleven transistors. An automobile radio exhibited had push-button tuning and made use of eleven transistors. No valves whatever are employed and an important feature of it is the elimination of the high voltage power supply common to present car radio receivers. This power supply, consisting of a vibrator, transformer and rectifier, is not necessary in a transistor receiver because the transistors operate directly off the car battery. It uses one tenth of the current of present radio sets.

R.C.A. also demonstrated a tiny radio transmitter employing one transistor and a few simple omponents. This fed the signal from a phonograph pick-up to a standard A.M. receiver. The overall volume of the receiver was only 2 cu. in. The power supply is about the size of a coat button and consists of a 1.35 volt battery with an operating life of 3,000 hours.

Another application was a transformerless power amplifier consisting of four transistors mounted on a small valve socket. It would appear that such a device can perform many of the functions that now require two or more valves, a phase inverter, an output transformer and other components to amplify the audio signals.

We foresee that within a few years transistors will transform the design of radio and television sets, not only reducing their cost but also the amount of servicing required, and their size.

Car Suppression Compulsory

As from July 1st, 1953, all new motor cars, motor cycles (including motorised bicycles) and motor boats must be fitted with suppressors. This is stated in new regulations laid before Parliament by the Postmaster-General. It is well known that cars are the chief source of interference with television reception and it may be that lesser causes such as vacuum cleaners, electric motors, hair dryers and electrical apparatus will be compelled by law to be suppressed by the makers before sale.

The new regulations do not, unfortunately, apply to old cars and, considering the hundreds of thousands of old cars which are still in use because of the price of new cars and the difficulty in obtaining them, we think that the regulations should have been all-embracing, especially as the cost of suppression is only about half-a-crown or so. The manufacturers are carrying out experiments to see what they can do to prevent such interference being picked up but the problem is difficult because the interfering signal radiated from the ignition leads to the sparking plug is fundamentally similar to the television signal and, therefore, difficult to sift out in the receiving apparatus.

Although it is denied that suppressors interfere with the starting of motor cars, especially in cold weather, it is our experience that they do. No doubt new motor cars will have a different coil ignition system which will make good the loss caused by suppression.—F. J. C.

The Commercial Aspects of Channel Changing

ADAPTING CIRCUITS FOR ANY OF THE FIVE BRITISH TELEVISION TRANSMITTERS

TO facilitate the manufacture of television receivers suitable for operation in any part of the country, the general trend in current design is to embody a simple means of channel changing. Such facilities demand the superhet method of reception, where, in general, the only circuits requiring modification for different channels are limited to three. A stage of R.F. amplification is invariably included in front of the mixer ; therefore, the circuits affected are :—The aerial input circuit ; the tuned coupling from the R.F. stage to the mixer ; and, of course, the local oscillator.

Both sound and vision intermediate frequencies are unaffected, for a study of the frequencies selected for different channels will reveal, in each case, a 3.5 Mc/s vision/sound separation. Further, the lower sideband frequency characteristic of the vision signal is identical for channels 2 to 5, although channel 1 (London) still radiates the old double sideband transmissions. It is, therefore, necessary for the I.F.s to respond only to the bandwidth radiated by the transmitters of channels 2 to 5, and in this way the frequency characteristic of channel 1 is altered and arrives at the vision detector in single sideband form.

Single Sideband Working

This will be better understood by referring to Fig. 1, where at (a) and (b) respectively the frequency characteristics of London and " other channel " transmissions are shown. It will be seen in the " other channel " case only part of the upper sideband is transmitted. The partial elimination of one sideband permits the use of receivers with reduced I.F. bandwidths for given video responses, as opposed to the old double sideband systems.

In order to avoid over-emphasis of the low modulation frequencies, the I.F. channel of a single sideband receiver must have a response which is 6dB down at carrier frequency. This is clearly illustrated by (c) and (d), which show also that the receiver response is identical for either system of transmission. Therefore, provided the I.F. channel is precisely aligned for this mode of functioning, channel changing merely involves mutation of the carrier frequencies.

The importance of retaining correct separation between the sound and vision I.F.s now becomes apparent, for it would be a simple matter to tune the local oscillator for maximum sound, and yet be grossly off the mark so far as the 6dB down carrier is concerned. This, of course, would give rise to the usual manifestations associated with maladjusted tuned circuits in the vision channel (see " Picture Distortion Analysed," P.T., March, 1952).

A Two-channel Conversion System

During the period when only two channels (London and Birmingham) were in operation, the General Electric Company led in the field of conversion by including double windings on the appropriate tuned circuits and additional shunt capacitors for the aerial and oscillator circuits in their then current models. Channel changing proved to be quite a straightforward operation, and was performed by the repositioning of five links located in accessible parts of the circuit.

The basic circuit of this method is shown in Fig. 2. Starting from the aerial and changing from, say, London to Birmingham (a lower to a higher frequency), first of all necessitates changing the aerial capacitor C1 to that of C2, the setting of C1 can thus be left undisturbed, and the modified aerial loading adjusted by C2, this, as shown, is accomplished by link (a). Link (b) is positioned so the coil, L1, is in shunt with the secondary of the aerial transformer. The circuit will, therefore, tune to a higher frequency, for it will be remembered that two inductances in parallel produce a lower overall inductance, the value of which follows the well-known reciprocal formula : $L = \left(\frac{L1 \times L2}{L1 + L2}\right)$ and is analogous to resistors in parallel. Thus, the value of L1 is such that when connected in conjunction with the aerial transformer the frequency is altered from London to Birmingham.

The same reasoning applies to the coupling transformer, where links (c) and (d) shunt the primary and secondary with additional inductors L2 and L3.

The foregoing tuned circuit modifications, therefore, change the signal frequency and permit its amplification before application to the mixer valve. It is now necessary to shift the local oscillator frequency, so that added to the signal frequency the desired intermediate frequencies will result.

This is accomplished by removing the extra trimmer C3 from across the oscillator coil by means of link (e), and thus increasing the generated frequency.

It remains now finally to adjust the frequency of the local oscillator by altering the capacitance of the variable trimmer C4. At this point, however, it is worthy of mention that adjustment of C4 may not correspond to maximum sound, but a compromise between sound and *minimum* sound on vision may be necessary. This is because the sound rejector circuits are adjusted for

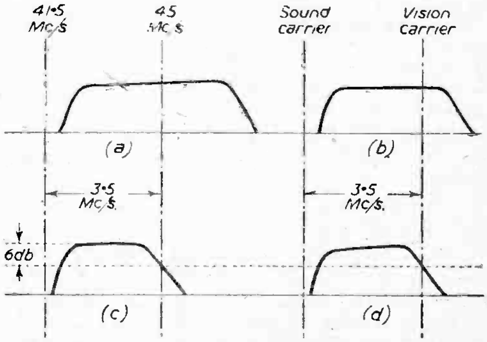


Fig. 1.—Showing the frequency characteristics of channel 1 at (a) and other channels at (b), while (c) and (d) show the receiver response for single sideband working.

attenuation at sound intermediate frequency, and in order to keep the converted vision carrier 6dB down, the oscillator frequency for both conditions does not quite correspond.

A T.R.F. Model

With current models of The General Electric Company the superhet mode of reception has been dropped and the T.R.F. method adopted. This, of course, renders channel changing, as previously described, an impracticable proposition, since such procedure would entail the alteration of at least 12 tuned circuits, but, nevertheless, channel changing has been catered for in these models also.

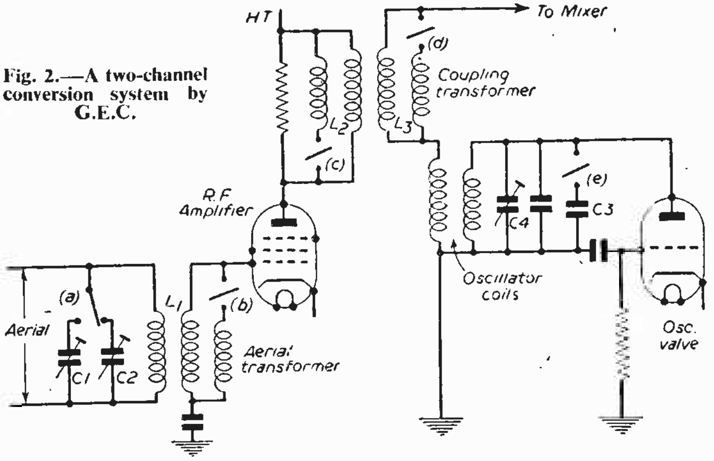


Fig. 2.—A two-channel conversion system by G.E.C.

The chassis is divided into two decks, the sub-deck comprises the sound and vision detectors, video, and R.F. stages, and is designed for operation on one particular channel only. Channel conversion is carried out by fitting replacement sub-deck. Such decks are factory aligned for operation on the desired channel, and may be obtained on an exchange basis through a G.E.C. dealer. They are secured to the main chassis by means of two bolts; and the interconnecting cables are in plug and socket form. Thus, their removal and refitting is both simple and rapid since no further adjustments are usually necessary.

Five-channel Conversion

An enlargement on the old style of G.E.C. channel conversion is that employed by Pilot Radio in their five-channel television receivers. The basic circuit is shown by Fig. 3a, from which will be observed that four additional shunt coils may be arranged in conjunction with the aerial, coupling and oscillator coils. Changeover links located on the channel selector panel, Fig. 3b, are provided for rapid channel changing.

The main coils L1, L2 and L3 are tuned to channel 1 by means of iron-dust cores. Coils a, b, c and d are individually pre-tuned by the same method, but so that when connected in shunt with the main coils the tuned frequency is altered and corresponds to channels 2, 3, 4 and 5 respectively.

The advantage of this system is that all five channels may be pre-adjusted initially to their correct frequencies. Therefore, channel changing is reduced to the mere operation of rearranging the three selector links. Not much imagination is required to appreciate that the circuit lends itself admirably to channel selection by means of a five-position rotary switch, performing the analogous function of the wave-change switch in a broadcast receiver!

A Popular Method

By far the most popular method of altering the tuned frequencies is by capacitive and inductive means, as opposed to reducing the coil inductance by additional coil shunting. Usually the aerial and coupling coils are designed to cover the frequency spectrum of the whole band, and each channel is individually selected by the setting of an iron-dust core.

The local oscillator frequency, however, is shifted by a trimmer across the oscillator coil. A circuit after this nature is depicted by Fig. 4. A noteworthy feature of the oscillator circuit, and one invariably adopted in most designs, is created by the shunt capacitors C1 and C2.

These capacitors not only assist in tuning the oscillator to the desired frequency, however, but they also minimise frequency drift. This is because one has a positive temperature co-efficient, while the other a negative, thus the effect of heat will increase the capacitance of one, and reduce the capacitance of the other in the same ratio. Therefore, any detuning effect due to a change in temperature (i.e., as the internal temperature of the receiver rises) will be neutralized, and the generated frequency will remain constant.

In modern receivers channel changing is further

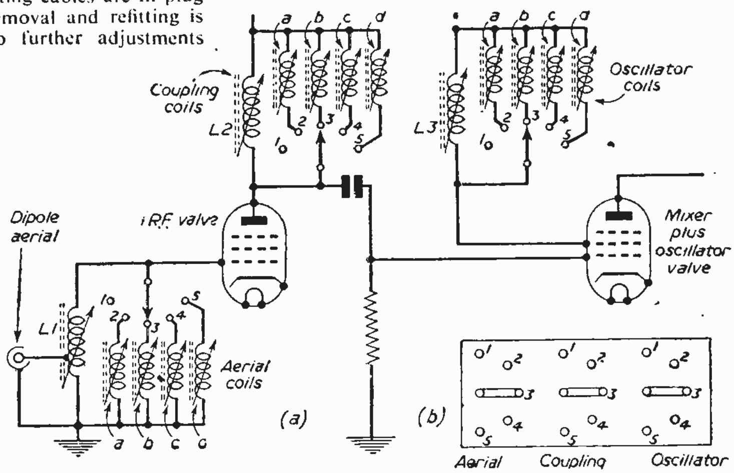


Fig. 3.—A five-channel conversion system by Pilot Radio.

facilitated by extending the tuning controls and bringing them to an accessible position at the rear of the receiver, where, in certain receivers, they are given a rough calibration, thereby indicating visually the channel to which the receiver is tuned.

The system of channel changing used in Cossor five-channel receivers is somewhat similar to the above, apart from, perhaps, the local oscillator, which also relies on the core method of tuning.

The actual cores in this model are worthy of mention, for instead of being wholly iron dust they are divided into two sections—the lower section comprising an iron-dust core, while the upper section is made of brass. Both cores are secured to a threaded rod and are easily adjusted from the top of the coil can by means of a thumbscrew (see Fig. 5).

This rather unusual core arrangement enables a coil of given inductance to tune a frequency range greater than would be attained by a wholly iron-dust, or brass, core. This, of course, is because the iron-dust core has the effect of increasing the inductance of the coils, while the converse effect is created by the brass section of the core.

Other Methods

Other methods of catering for reception on other channels have from time to time been employed. Murphy Radio, for instance, designed the aerial and coupling coils in their popular V114/118 series receivers so that with an iron-dust core they were readily tuned to the frequency of London, while if replaced with brass cores the frequency was increased to that of Sutton Coldfield.

An additional tap on the oscillator coil provided a means of increasing (or decreasing) the oscillator frequency.

Stella Radio cater for alternative channels in their current models, but a fair amount of work is involved, since it is necessary to change the three coils/transformers affected, plus the aerial loading capacitors and three damping resistors.

Pye and Invicta have tapped coils facilitating a change of frequency by altering connections; whereas with Ekco the adjustment is made in the factory, and the receivers are supplied to the dealer for operation on one channel only.

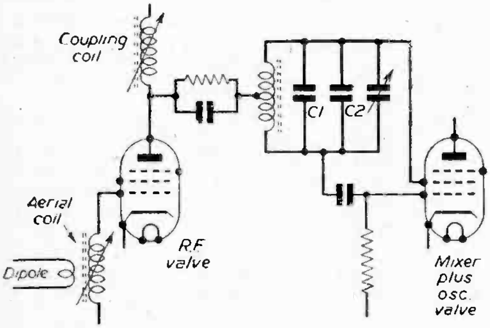


Fig. 4.—A popular method of channel conversion.

Philips Radio adopt plug-in coils (aerial, coupling and oscillator) which are pre-set in the factory, and one set can be plugged-in in place of another without further adjustment.

Similar to G.E.C., some firms make signal and oscillator sub-units which can be replaced if operation on a different channel is desired.

Whichever method is adopted the general trend is a standard design facilitated by arrangements for adjustment to the requisite channel. At a future date channel changing may be an essential feature of all television receivers, for who knows, our potential five channels may be radiating simultaneously different programme material!

To anticipate queries regarding coil changing to cover the proposed new commercial stations, it may be stated that the frequencies will be well displaced from the present BBC channels and as a result changing coils will probably not function. In these cases it will almost certainly be necessary to use a converter.

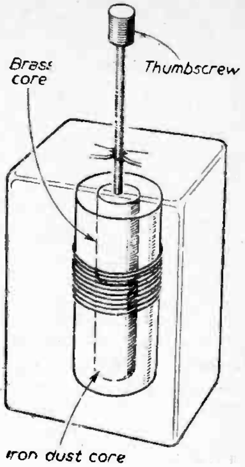


Fig. 5.—The coil construction used in Cossor receivers.

New Multicore Products for Specific Uses

IN addition to the standard range of six tin/lead alloys in nine gauges and a variety of packings already available to manufacturers and the trade, Multicore Solders, Ltd., announce the introduction of many new products, each designed for specific uses.

Prominent among these are the following, extra details of which are readily available from the manufacturers.

At the special request of trade friends Multicore Solders are now producing, in large quantities, an economy pack for television engineers. Packed in the yellow and black Multicore carton is a 1 lb. reel of 50/50 alloy 18 S.W.G., containing approximately 167ft. of Ersin Multicore Solder, retailing at 15/- under catalogue ref. R. 5018.

Ersin and Arax liquid fluxes, hitherto only manufactured by special request, are now generally available in a variety of packings. Liquid fluxes are particularly recommended for dipping purposes and other processes where it is not convenient to use Ersin and Arax Multicore solders. A 10 oz. tin of Ersin liquid flux retails at 6/-.

Ersin Multicore solder, which has for many years been supplied to manufacturers in gauges to 22 S.W.G., is now supplied to special order on ½ lb. reels in even gauges between 24 and 34 S.W.G. Comparative lengths per pound for 60/40 alloy are approximately 98ft. of 16 S.W.G., and 5,040ft. of 34 S.W.G. All gauges, even to 34 S.W.G., contain three cores of flux.

Manufacturers are invited to write for samples of any of the new lines or to consult the Technical Service Department of Multicore Solders, Ltd., on any problem in connection with soldering.

Multicore Solders Ltd., Multicore Works, Maylands Avenue, Hemel Hempstead, Herts.

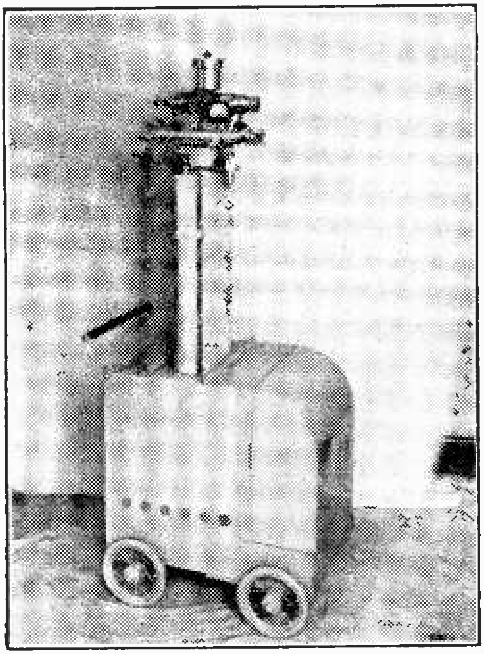
Colour Television—A New System

DETAILS OF A NOVEL IDEA WHICH DISPENSES WITH THE CATHODE-RAY TUBE

IN accordance with our policy of presenting all information relative to television to our readers, we give below details of a novel idea which has been suggested by a Mr. Charlton, and on the cover of this issue we show the receiver and below the transmitter which is used in this equipment. We have not had an opportunity of seeing a demonstration of this equipment. From time to time suggestions have been made for systems to be adopted which dispense with the cathode-ray tube as this is naturally bulky, and there is some limit to the size, even adopting the metal construction which is now increasing in popularity. Going back to the early days of mechanical scanning it was at one time thought that the answer to modern television would be the modulation of a light cell which, in its turn, controlled the projected ray, directed on a normal cinema type of screen through the medium of mirrors.

Mirrors

Various mechanisms were in use based on this idea, the mirror-drum and mirror-screw being two of the most popular which were available to the home-constructor. These, of course, were only suitable in their existing forms with low-definition systems as the mirrors were used to trace a band of light corresponding to each line of the picture, and complications such as interlacing had not then been adapted. For colour, such a system would be further involved by the incorporation of rotating filters, etc.



This is the trannsmitting portion of the apparatus. The receiver is shown in the illustration on our cover.

The Charlton System

In Mr. Charlton's proposed system the transmission of vision in colours without scanning is made possible by a special gas that is made partly from various metals to give the different colours. The molecules of the gas are formed so that the metal atoms are insulated from each other, thus allowing the atoms giving red and green, for instance, to spin side by side without running into each other.

The Principles

The colour-vision modulator is gas-filled, and oscillates by internal capacity and external inductance and the gas discharge at the rear. The "object" modulates the oscillation at the front, being focused by the lens on to a metal electrode, working on the principle of "the absorption of gas by metal one atom thick" and the colours of the "object" discharge the like-coloured atoms within the gas against the metal electrode. By this means the vision will be registered composite on every other half-wave, as the oscillation causes the metal electrode to attract and repel. Or to put it another way, the all-colour charge of an atomic micro-picture appearing in front of the metal electrode will modulate the oscillation. The output will be amplified and transmitted.

Wavelengths

Medium- and long-waves can be used ; short-waves are unnecessary for high definition, as the vision modulation will be composite every other half-wave.

The Receiver

The receiver has twin valves which amplify the sound and vision at high frequency. As the sound is "rectified" the vision will re-appear within the small colour-vision receiving valve and be projected on to the screen.

The set shown and used in early experiments is to be remade with the latest valves and a small modified vision receiving valve.

Adaptability

The designer claims that a modified version of the modulator could be used for healing T.B. and cancer by projecting a selected colour ray through the part or person requiring treatment. The ray will not normally be visible.

MAKING AN ADAPTABLE AERIAL

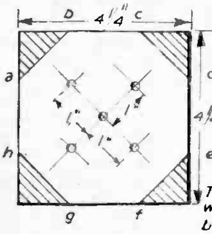
A SIMPLE DESIGN WHICH CAN BE USED IN MANY FORMS

By T. H. Howells

GOOD reception depends to a great extent upon an efficient aerial carefully arranged to suit the location.

In the course of various installations, where signal strength is good but difficulties arise owing to " reflections " and/or interference, there seems to be a need for some form of aerial capable of being easily and quickly adjusted for trial to find the best possible results.

Such an area as the Rhondda Valley, where conditions vary considerably from site to site, e.g., ghost images caused by the hills in the winding valleys and interference



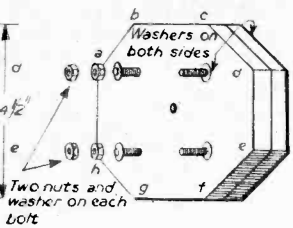


Fig. 1 (left).—Diagonals are drawn and 1in. corners cut off. Fig. 2 (right).—Four bolts are added to accommodate two nuts.

in some locations, calls for a great deal of trial on each site.

Though originally designed for use in the western area, indoors up to twenty miles of the transmitter, measurements are also given for working any of the five channels. Later a more permanent " job " can be made.

The idea is to use the aerial at first as an experimental one, to find the most suitable arrangement for a particular site. Then the suitable arrangement is made a more permanent one.

Out of doors, of course, the range is considerably increased and, owing to its construction, quick changes can be tried from one channel to another in those areas on the fringes of two transmitters. All that is needed to change channels are extra duralumin rods, cut to the required channel length.

To make the aerial, four duralumin rods either ⅜in. or ½in. diameter are required; two of lengths A, and two of lengths B. In the table the lengths A and B are given to suit particular channels.

Component Parts

Two ½in. or ¾in. thick pieces of wood are cut to make 4¼in. squares. The diagonals are drawn on each, and one inch corners are cut off (Fig. 1). The two pieces of wood are now laid together and five holes are drilled through both pieces. Four of these are 1in. from the centre on the diagonals, while the fifth is in the centre. The four outside holes are to accommodate four bolts which hold the two pieces of wood together and also act as terminals to connect the coaxial cable. Thus the bolts should be long enough to project at least half an inch beyond the two blocks of wood, i.e., the two thicknesses plus half an inch. This (when washers are also placed each side of the wood) will be to accommodate two nuts—one to fasten the bolt and the other to fix cable connection (Fig. 2).

The bolts are now withdrawn and the two pieces of wood clamped together or held in a vice while holes are drilled from the edges ab, cd, ef, gh (Fig. 3) in the direction of the diagonals. These holes proceed half an inch beyond the bolt holes. [*Note.*—1. Bolts are removed before drilling. 2. A chalk mark 1¾in. up the bit when drilling will give a guide to the required depth of hole.]

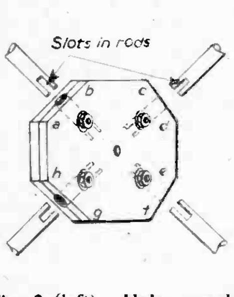
The diameter of these holes will depend upon the diameter of duralumin rods used. If the rods are ⅜in., holes should be ⅜in., if the rods are ½in., then holes should be ½in.

Slots are now cut in one end of each rod the same width as the bolts' diameter, but ⅜in. long.

The two pieces of wood are now placed together, a washer under the head of each bolt, and the bolts then passed through their holes in the wood. A washer and nut is then screwed on the other side. The duralumin rods are now slipped into the edge holes as required—so that the slots pass over the bolts between the blocks of wood. Press well down to make good contact and then tighten up the nuts to hold the whole firmly.

If another nut is screwed on each bolt it will act as a convenient point for connection to the cable, i.e., a terminal.

Now all that remains is to experiment on a particular



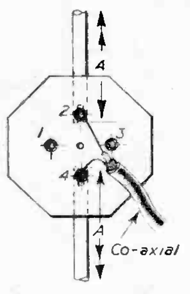
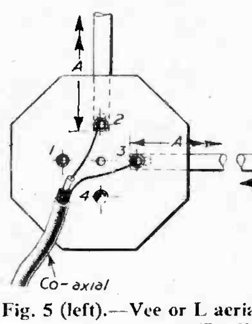


Fig. 3 (left).—Holes are drilled from corner edges in direction of diagonals. Fig. 4 (right).—Shows the dipole.



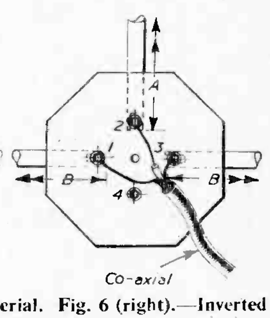


Fig. 5 (left).—Vee or L aerial. Fig. 6 (right).—Inverted " Tee " aerial.

location for the best possible results. Some uses and arrays easily and quickly made are now given. Terminals are numbered for easier explanation.

1.—Dipole (Fig. 4)

Two rods only are used, both lengths A (see table).

Lengths are inserted opposite each other, pressed well down and all nuts tightened to make good contact. The connections to the coaxial cable lead are made now —inner wire of cable to the top rod (terminal 2) and outer sheathing to the bottom (terminal 4).

Temporary fixing can be made by using the holes not used, one or both, or centre hole.

In some areas a dipole may give better results inclined at an angle (found by trial) and/or shielded by netting or even a house a quarter-wavelength behind.

2.—Vee or L Aerial (Fig. 5)

Two equal rods only are used, length A, as used in the dipole, but inserted to form a right angle. Nuts are tightened for firmness and good contact.

The connections to the coaxial cable are—inner to the top (terminal 2) and outer sheathing to the other (terminal 3).

This form of aerial may be rotated through the whole 360 deg. horizontally and vertically; and also inclined at an angle until position of best results found.

Temporary fixing can be made by using holes 1 and 4 or centre hole.

Lengths	Channel 1	Channel 2	Channel 3	Channel 4	Channel 5
A	5ft. 4½in.	4ft. 8in.	4ft. 3in.	3ft. 10in.	3ft. 7in.
B	5ft. 7½in.	4ft. 11in.	4ft. 6in.	4ft. 1in.	3ft. 10in.

3.—Inverted "Tee" Aerial (Fig. 6)

Three rods are used, the vertical length A and the two equal horizontal lengths B. Connections to the cable are made by joining inner of cable to terminal 2, while horizontal terminals 1 and 3 are joined together to the outer sheathing.

This type of aerial is directional; rotation and inclination can be tried for best results.

Temporary fixing by centre hole or terminal 4.

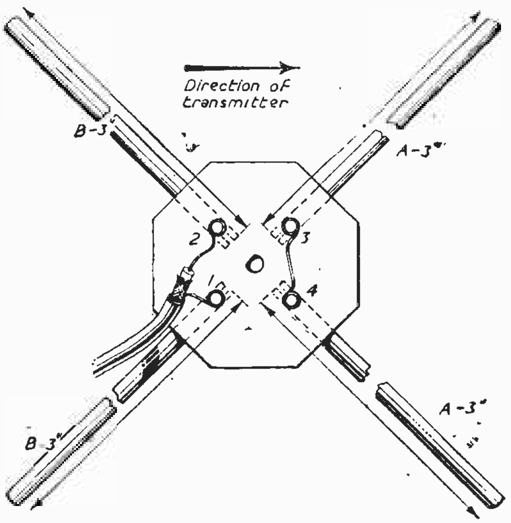


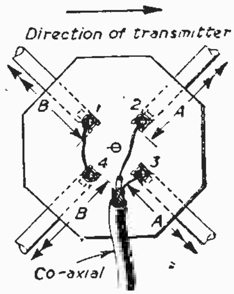
Fig. 9.—Type 3 connection.

4.—"X" Aerials (Fig. 7)

All four rods are used here. Lengths A fit into holes to terminals 2 and 3 and lengths B to terminals 1 and 4.

Three types of connections can be tried here:

(a) *Type* 1.—Connections—inner of cable to terminal 2, while the outer sheathing goes to terminal 3. Terminals 1 and 4 are connected together.



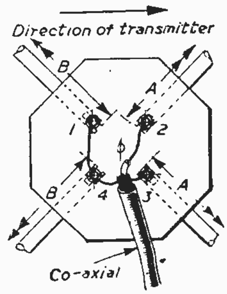


Fig. 7 (left).—"X" aerial. Fig. 8 (right).—Type 2 connection.

This aerial is directional and best results may be found by rotation. Notice that back pair of rods are only connected together and to nothing else. Thus they act as a reflector. Temporary fixing is made by using centre hole.

(b) *Type* 2 (Fig. 8).—Connections—inner of cable to terminal 2, while the outer sheathing is connected to all three terminals 1, 3 and 4.

This aerial is directional so best results must be found by rotation. The centre hole is used for temporary fixing.

Finally:

(c) *Type* 3 (Fig. 9).—Connections are made by joining inner cable to terminal 2 and outer sheathing cable to terminal 1.

Terminals 3 and 4 are connected together, and to nothing else.

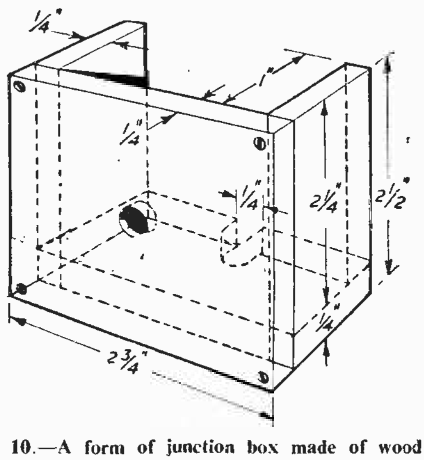


Fig. 10.—A form of junction box made of wood or paxolin.

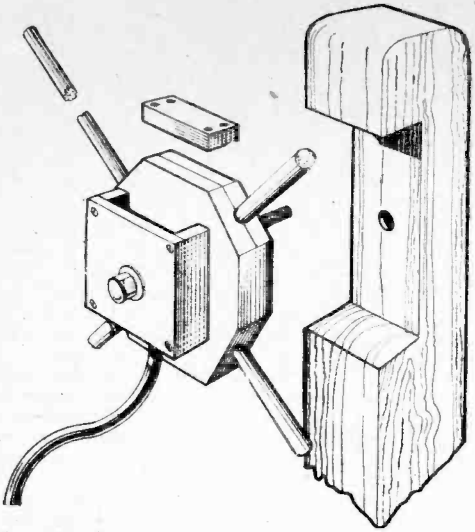


Fig. 11.—Sunk aerial base to prevent rotation.

Notice here that all four rods should be shortened by 3in. as the back pair is the aerial proper, while the front pair acts as directors.

Temporary fixing is made by means of the centre hole. This aerial again is directional so best results must be found by rotation.

Greater freedom from interference and images should be obtained from the "X" type aerial, but the above aerial form should give the opportunity for a thorough investigation into different types of aerial arrays quickly erected and altered easily.

Once the most satisfactory array for a given site has been determined upon, means must be found to make this array into a more permanent one. If the signal strength is good enough, any of the aerial forms as they stand can be secured by the centre hole in loft or attic, with merely the addition of a metal clip screwed over the coaxial cable to take the weight of the cable strain from the terminal connections.

However, if the array is to be used out of doors, the wooden base must be afforded protection from the weather, together with some sort of cover for the terminals and connections themselves.

A form of junction box (Fig. 10) can be made from ¼in. wood or paxolin, consisting of three sides. 2¼in. by 1in., and lid. This is fastened over the terminals on the wooden base by means of a bolt passing through the lid, through the centre hole of the base.

A ¼in. tunnel must be cut in the bottom of the box for the coaxial cable. The top of the box consists of a piece of ¼in. paxolin or wood, 2¾in. by 1¼in., which is not put in place until last of all.

The bolt as well as passing through junction box and central hole of wooden base must also be long enough to pass through a piece of wood or metal support, length depending upon whether mast or chimney lashing is to be used. If support is made of wood the aerial base can be sunk (Fig. 11) to prevent rotation. When junction box is tightened on support, molten pitch (from old H.T. batteries) or molten beeswax should be poured in to totally cover connections and terminals.

When hard, the top of junction box should be screwed down and the whole gone over with a generous application of Bostik—especially the cracks all around the two layers of the base, where the rods enter the base, and all around the cracks in the junction box, not forgetting the coaxial cable exit and the head of the supporting bolt.

When all Bostik is dry the aerial and all woodwork should be given three coats of paint before erection.

Picture Tubes with Tinted Glass Faces

ANOTHER major step forward in providing high contrast, daylight viewing has been made possible through the introduction, by Mullard, Ltd., of television picture tubes with grey-tinted glass faces. Using these tubes, a picture of extremely good contrast and low glare can be obtained even under conditions of normal room lighting.

The reason for this improvement can be seen from consideration of the screen as it appears to the eye. With no picture signal—black picture content—the colour of the screen is dependent on the amount of ambient light that is reflected from the screen to the viewer. The higher the ambient light intensity, the lighter grey the screen appears. With a picture signal corresponding to peak white, the screen presents a picture that is dependent on the brightness produced by the electron beam and also on the reflection of the ambient light from the screen to the eye. This means in effect that, with a clear glass tube under ambient light conditions, a composite picture which should have all shades from "peak white" to dense black will only have from "peak white" to "dark grey," and the brilliance of the peak white will have to be increased to give contrast.

Results

Tinting the tube face greatly reduces the reflected light thus giving a denser black. A certain amount of the emitted light will be lost, due to the glass tinting, but this emitted light only passes through the glass once, whereas any ambient light has to pass through the tinted glass twice—as an incident ray and a reflected ray—thereby doubling the transmission losses. The net effect is a marked reduction in the glare usually associated with high brilliance.

The tinting of the new tubes is carried out during the making of the glass and is therefore an integral part of the tube face. At present tubes of this type are available in two sizes: the 12in. round picture tube MW31-74 and the 14in. rectangular MW36-24.

A "PERSONAL" TELEVISOR

BUILDING A PORTABLE RECEIVER WITH 3IN. TUBE FOR TESTING OR PERSONAL USE

By E. N. Bradley

(*Concluded from page 295, December issue*)

BEFORE trimming the vision circuits, short-circuit L3 by the shortest possible length of wire. Turn R9 to the full gain position, turn up the brilliance control until the raster is just visible (working in a fairly dim light) and adjust the focus control to give sharp lines on the screen. There is generally sufficient residual hum in the circuit to make it possible to set the frame timebase very close to the correct frequency by observing the slight " rock " along the edge of the raster ; the line timebase control can be set roughly to give a good number of horizontal lines.

Before the final tuning process, a choice of the values for R2 and R6 must be made. The resistances used in these positions damp the tuning coils for wider response (not to obtain stability, which should be inherent in the circuit with no damping resistors fitted). In a really good reception area, within a mile or two of the transmitter, quite low resistances can be used for R2 and R6—say, 2.7 or 3.3 KΩ, when it would be as well, too, to reduce R10 to, say, 4.7 KΩ. Generally speaking, however, higher resistances than these will have to be used. In good and normal areas R2 and R6 might well be 6.8 KΩ each, rising to 10 KΩ as the receiver is employed farther from the transmitter. In areas of low signal strength (i.e., so far as this receiver is concerned) it may be possible to obtain results by omitting R2 and R6 altogether, peaking the coils to pass only a narrow bandwidth.

If in doubt commence by making R2 and R6 6.8 KΩ in value, increasing the resistance to 10 KΩ if the picture is poor in contrast.

If the coils have been pre-tuned by the use of a grid-dip meter, it is possible that a picture will be received immediately in a good reception area. If the coils are not pre-tuned, however, it will be necessary to proceed by trial and error tuning, commencing with the core of L4 and working back to the aerial coil. In a poor reception area it is of considerable help to black-out the tube and to use headphones for the preliminary tuning, connecting these between the anode of V4 and earth via a capacitor. The capacitance value should be about 0.01 μF and should be between the V4 anode and one side of the 'phones which should be of the high-impedance type. A weak signal can be heard clearly long before it will modulate the C.R. tube, and the adjustments to the tuned circuits can thus be more readily made.

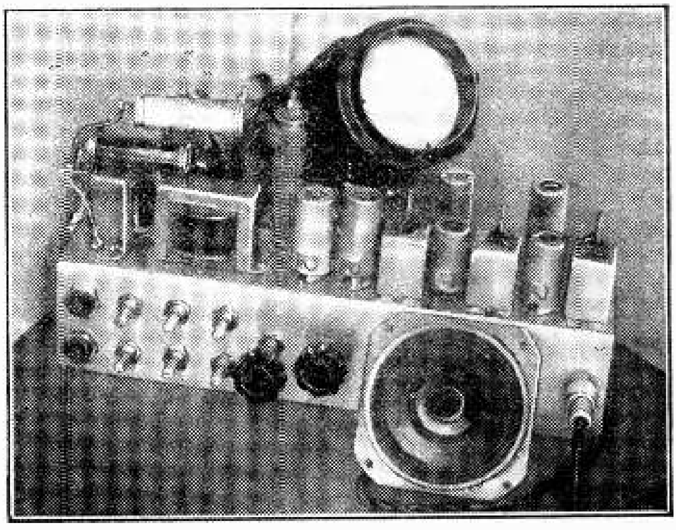
As soon as the tube is modulated the timebase controls can be set to give the correct scanning speeds, R41 being rotated to give line locking and R32 for frame locking. Adjustment of picture size should be left for the time being.

In areas other than London the tuning can now be continued to give the best possible picture : generally speaking, this means broadening the tuning to obtain the best detail that can be used on the small screen—until sound-on-vision interference is seen. This interference generally takes the form of dark bars which appear horizontally across the picture and which vary in time with the sound from the loudspeaker. Another form of this interference appears as a web or mesh of fine lines across the picture. Do not confuse sound-on-vision effects with hum, which gives a single, broad, dark band across the locked picture ; if this fault is found, some attention and checking should be given to the power pack. A small amount of hum is usual, especially in view of the fact that only half-wave rectification is employed ; serious hum will practically black out half of the picture.

In the London area the tuning can be broadened sufficiently for good detail without causing sound-on-vision interference by tuning over the higher sideband of the vision signal.

In the weaker reception areas (apart from London) it may be found that broadening the tuning causes fading of the picture before sound interference is encountered. In such a case try the effect of reducing the capacitance of C16 in an endeavour to obtain a better input to the vision strip, readjusting the core of L5 to keep the sound-signal tuned. It should be a simple matter to find a point where sound and vision results are balanced. If there is still no sound interference on the picture, this tuning point must be accepted as final and the sound trap, C5, L3, can be removed.

In areas where the sound interference is received, the



The " Personal " Televisor ready for installation in a cabinet

sound trap can now be tuned to the correct frequency. First slacken the tuning screw of C5 completely out, then remove the short-circuit across the trap. Slowly tighten the tuning screw of C5 with an insulated trimming tool to increase the capacitance; at some point the trap will come into tune with the vision signal which will either fade or, more probably, dissolve into a flaring pattern due to the setting up of instability within the R.F. amplifier. Continue to increase the capacitance of C5 so that the picture is restored; within a further small adjustment of the capacitor the sound bars or mesh over the picture should fade and vanish.

With the trap set on frequency, the vision tuning coils and L5 may be given a last adjustment and the cores locked by a touch of wax or cement if the receiver is to be treated as a portable set.

The picture may now be studied for synchronisation and dimensions, together with linearity of the frame scan. If the frame locking is poor, increase C15 experimentally until a suitable value is found, then, if desirable, vary the value of R29 till the picture is linear over its height. The size of the picture should not be altered, should this seem necessary, until synchronisation and linearity are satisfactory. The final picture will be smaller than the raster due to the areas lost to the sync signals. Increasing R34 and R39 will increase the height and width respectively; reductions to the dimensions are, of course, made by decreasing the values of these resistors. An alternative method of control over the frame height is given by varying the value of R35.

Instability

No feedback troubles were encountered in the original receiver, but it was found essential to earth the iron-dust cores within the tuning coils L1, L2 and L4 for complete stability. The Spire nuts used to fasten the coil necks into their screening cans have core-earthing lugs fitted to them, and care must be taken to ensure that these lugs make good contact both with the core adjusting screw and the screening can. If instability is encountered in any receiver constructed to these plans it will almost certainly be the result of over-long wiring or the misplacing of components; if no cause can be found it may prove helpful to by-pass the heaters of V1, V2 and V3 with 500 pF capacitors mounted directly across the appropriate valveholder tags.

Warning

Remember that the televisor is operated from a half-wave power pack in direct connection with the mains and is not separated from the supply lines by a mains transformer. Unless the connections are made as in Fig. 1 the chassis will, therefore, become "live" to earth and consequently most dangerous to touch.

As a result, the mains lead of the televisor should be colour-coded and should terminate in a three-pin plug, even if no true earth is employed. Make sure that the leads are correctly connected within the plug; the three pins will prevent the connections from being reversed and the chassis will then remain connected with the neutral mains line. A 500pF or .001μF capacitor from the anode of V9 to earth may be needed for hum reduction.

Meter Readings on the "Personal" Televisor

Whilst too much reliance should never be placed on meter readings (which will vary with the type of meter used, component and valve variations within tolerance limits, and fluctuations of the mains supply voltages) readers may care to have for their reference the voltage checks of the original receiver. These were taken with a signal applied (from a test generator) and with a mains input of 235 volts. The meter employed had a sensitivity of 2,000 Ω per volt.

V1—Anode, 100 volts. Screen, 100 volts.
V2—Anode, 200 volts. Screen, 200 volts.
V4—Anode, 190 volts. Screen, 225 volts.
V5—Anode, 75 volts. Screen, 80 volts.
V6—Detector anode, variable 0-30 volts. A.F. anode, 100 volts.
V7—Anode, 200 volts. Screen, 225 volts.
V8—Anode, 100 volts. Screen, 125 volts.
V9—Anode, 90 volts.
V10—Anode, 100 volts. Screen, 110 volts.
Decoupled point, feed to C.R. tube, 150 volts.
Main H.T. line, 225 volts.
Total consumption via Rec. 1, 47 mA.

New Ekco Receiver with Novel Feature

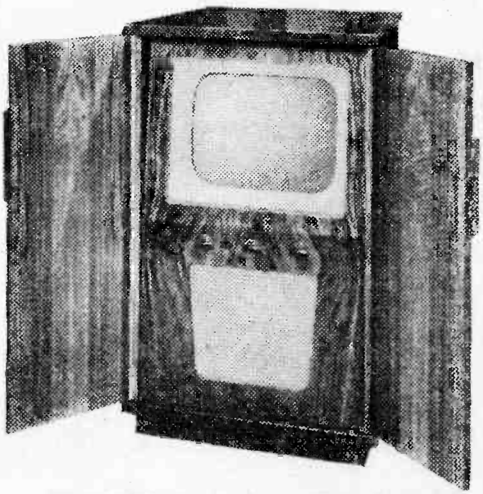
E. K. COLE, LTD. announce the introduction of the TC178, a new 15 in. tube console, which incorporates a lighting socket at the rear controlled by the receiver on/off switch, which is intended to supply a lamp for room illumination on, or by, the set. Since the supply to the socket is controlled by the receiver switch the lamp also acts as a pilot, and should prevent the set being left on inadvertently.

This new "with-doors" console incorporates the successful Ekco "Triple-link" chassis and "Spot-wobble," and has an all glass wide-angle grey-filter aluminised tube, giving pictures 13½ in. x 10 in. (132 sq. in.), which is protected by an armoured glass screen. The C.R.T. operates on 13½ kV E.H.T.

The superhet circuit is readily adjustable to any of the BBC television channels. It incorporates automatic interference limiting on both sound and vision. The vision limiter has two ranges and automatically provides the selected degree of spot limiting for all settings of the contrast control.

The cabinet, when closed, has a particularly pleasing appearance, as the upper and lower halves of the full-length lockable doors are in contrasting straight grain and figured walnut veneers.

Price of the TC178 is 130 gns. (£93 16s. 3d. plus £42 13s. 9d. purchase tax).



The new Ekco receiver has protecting doors

AERIAL DATA

MEASUREMENTS OF AERIAL ELEMENTS FOR ALL CHANNELS

By "Erg".

IN the recent article on "Aerials for Wenvoe" published in the October issue of PRACTICAL TELEVISION, actual measurements for the different arrays were not given for the reasons stated in the article. However, in response to requests a complete list of aerial measurements has now been compiled and is given in this article.

The aerials have been divided into three classes as follows :—

(a) Standard aerials.
(b) X aerials.
(c) Slot aerials.

Standard Aerials

In this section data is given so that an aerial can be built up from a straight dipole to a complete Yagi array. Fig. 1 shows the different arrays for which data has been prepared and Table I gives the measurements of the elements together with the channel number and transmitter locations. Those transmitters whose name is followed by an asterisk thus (*) require *horizontal* aerials while the unmarked ones require a vertical aerial ; the constructor can therefore be prepared for any station which may come into service for the Coronation.

The use of the data can be explained by the following examples :—

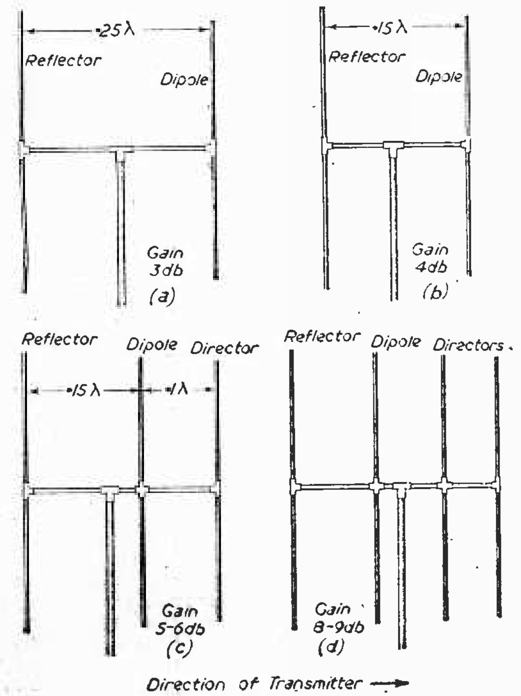


Fig. 1.—Commonest types of television aerial.

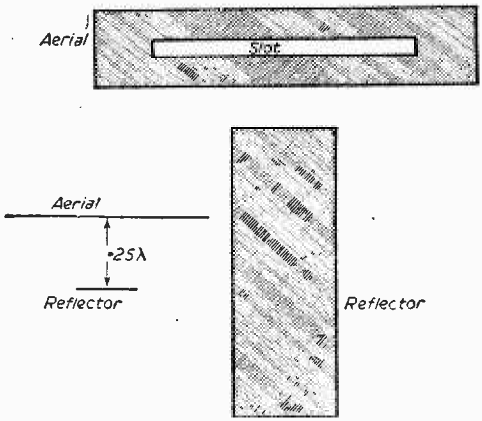


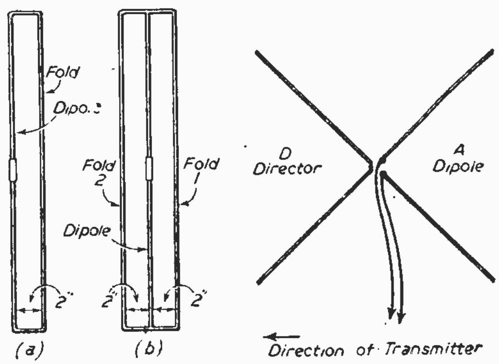
Fig. 4.—The "slot" aerial—made from wire netting.

(i) Supposing a dipole aerial is required for Pontop Pike ; by looking at Table I we find Pontop Pike is channel 5 and the overall length of the dipole is 7ft. 2⅜in. and that the dipole will have to be mounted horizontally.

When constructing aerials it should be remembered that the dipole should be in two halves, the two being separated in the centre by about ½in. In our imagined case the overall length is 7ft. 2½in. and the length of each half will therefore be. 3ft. 8¼in. It is not necessary to bother about the odd ¼in. if one is in an area of good signal strength.

(ii) Suppose we want an aerial with a good gain but not too bulky for Kirk o' Shotts. Inspection of Fig. 1 shows that the "C" array will meet the case and consultation of Table I shows the measurements to be : Dipole 8ft. 6in. (4ft. 3in. each half), reflector 8ft. 10in. and the director 8ft. 2in. The reflector should be spaced 2ft. 10in. behind the dipole and the director should be spaced 1ft. 9in. in front of the dipole (column C).

(iii) A high-gain aerial is required for South Devon. Fig. 1 shows that "D" array will give a gain of about 9db and consultation of Table I shows that the dipole should be 9ft. 4in. long (4ft. 8in. each half), the reflector should be 9ft. 8in. long, the first director 9ft. 0in. long, and the second director 8ft. 8in. long. The reflector must be spaced 2ft. 10in. behind the dipole ; the first director 1ft. 11in. in front of the dipole ; the second director 1ft. 11in. in front of the first director. The



Figs. 2 and 3.—Folded dipoles and the popular "X" aerial.

asterisk indicates that the array must be mounted horizontally.

The figures given are based on the midpoint of the frequency range between the vision and sound channels.

The spacings in column "A" for channels 1, 2 and 3 are given as the same length. This is because the true .25λ spacing would make the array too wide and unwieldy.

The arrays C and D are close-spaced for maximum gain, and arrays of this type may "flutter" the picture in a strong wind. As an alternative the reflector can be spaced at .25λ instead (that is the spacing given in column "A"), if trouble of this nature is experienced, though the gain will not be quite so high as with the closer spacing.

It is not necessary to insulate the reflector or director(s) from the cross boom.

For matching purposes the dipole in case C can be folded, i.e., another rod of the same length as the dipole is connected to it at both ends (Fig. 2a). Case D should be triple folded as shown in Fig. 2b.

TABLE I ("H," etc.)

Channel	Station	Element lengths	Element Spacings A	B	C	D
		ft. in.	ft. in.	ft. in.	ft. in.	ft. in.
1	**Alexandra Palace and Belfast***					
	Reflector	11 2	4 6	3 5	3 5	3 5
	Dipole	10 10	—	—	—	—
	Director 1	10 5	—	—	2 2½	2 2½
	Director 2	10 0	—	—	—	2 2½
2	**Holme Moss and South Devon***					
	Reflector	9 8	4 6	2 10	2 10	2 10
	Dipole	9 4	—	—	—	—
	Director 1	9 0	—	—	1 11	1 11
	Director 2	8 8	—	—	—	1 11
3	**Kirk o' Shotts and South Hants***					
	Reflector	8 10	4 6	2 8	2 8	2 8
	Dipole	8 6	—	—	—	—
	Director 1	8 2	—	—	1 9	1 9
	Director 2	7 11	—	—	—	1 9
4	**Sutton Coldfield and Aberdeen***					
	Reflector	8 0½	4 1	2 5	2 5	2 5
	Dipole	7 9	—	—	—	—
	Director 1	7 5½	—	—	1 7	1 7
	Director 2	7 2½	—	—	—	1 7
5	**Wenvoe and Pontop Pike***					
	Reflector	7 5½	3 9	2 1½	2 1½	2 1½
	Dipole	7 2½	—	—	—	—
	Director 1	6 11½	—	—	1 5	1 5
	Director 2	6 9	—	—	—	1 5

TABLE III (SLOT)

Channel	Slot length	Overall dimensions	Reflector dimensions	Reflector spacing
1	10ft. 10in. × 1ft.	14ft. 9in. × 5ft. 0in.	3ft. 0in. × 11ft.	5ft. 0in.
2	9ft. 4in. × 1ft.	13ft. 6in. × 5ft. 0in.	3ft. 0in. × 10ft.	4ft. 11in.
3	8ft. 6in. × 1ft.	11ft. 2in. × 4ft. 6in.	2ft. 6in. × 9ft.	4ft. 6in.
4	7ft. 9in. × 1ft.	9ft. 9in. × 4ft. 0in.	2ft. 0in. × 8ft.	4ft. 1in.
5	7ft. 3in. × 1ft.	8ft. 6in. × 4ft. 0in.	2ft. 0in. × 7ft.	3ft. 9in.

TABLE II (X)

Channel	A	D
1	5ft. 10in.	5ft. 4in.
2	5ft. 3in.	4ft. 9in.
3	4ft. 9in.	4ft. 4½in.
4	4ft. 4½in.	4ft. 0in.
5	3ft. 11in.	3ft. 8in.

X Aerials

The design of X aerials is given in Fig. 3, and the measurements in Table II. The number of the channel of a particular transmitter can be obtained from Table I, and mode of mounting (horizontal or vertical) can also be checked.

Example: An X aerial is required for Belfast, what are the dimensions?

From Table I we see that Belfast is channel 1 and the aerial will have to be mounted horizontally. From Table II we see each arm of the dipole (A) will have to be 5ft. 10in. long and each arm of the director 5ft. 4in. long.

Slot Aerials

The data is given for a reflector spacing of .25λ mounted *vertically* for those stations not marked with an asterisk in Table I and *horizontally* in the other cases.

Fig. 4 shows the form of construction and Table III gives the measurements. Chicken wire netting of ½in. mesh can be used. Details of the actual construction of an aerial of this type were given in the February, 1952, issue of PRACTICAL TELEVISION.

Conclusion

Many readers are puzzled by the different lengths given for the elements in different articles. The reason for this is that they are based on different parts of the channel spectrum.

Some designers advise an aerial resonant at the vision carrier frequency, while others incline more towards the sound carrier. The figures given here provide an aerial designed on the midpoint of the band, with the vision carrier at one end and the sound carrier at the other.

In difficult areas the constructor may wish to emphasise the vision carrier at the expense of a slight loss on the sound and so can take 1in. to 2in. off the total length of each element.

Detailed construction data has not been given as this has already been given in previous articles. Standard type of aerials were described in the June issue and "X" aerials in the November, 1951, issue of PRACTICAL TELEVISION.

Televisor Interference

CAUSES OF INTERFERENCE BY TELEVISION RECEIVERS, AND SUGGESTED REMEDIES

By E. N. Bradley

ALTHOUGH a considerable literature exists on the subject of interference with television receivers from ignition and similar sources, less attention is paid to the televisor which itself interferes with neighbouring broadcast and television sets. Considerable annoyance can be caused by a televisor, however, and it is only correct that an effort should be made to cure such effects.

Interference with Broadcast Receivers

The most common form of broadcast interference is a high-pitched whistle superimposed on the required programme. This is caused by radiation from the televisor line timebase, whose output valve, generally running into Class B conditions, supplies a wide band of harmonics. At the same time transient oscillations can occur during the flyback. The whistle, the frequency of which is 10,125 c.p.s., may be picked up as a modulated radio signal on the broadcast aerial and so injected into the receiver; it may be picked up directly in the broadcast receiver I.F. stages, or it may be induced directly into the receiver sound section, possibly as a modulated signal which is grid-detected in a triode stage or in some similar manner. Probably the first method of injection is the most common. The area over which the effect is noticeable will vary; in most cases the interference will be confined to the neighbouring house or rooms, although in apartment dwellings this can give rise to a sufficiently serious state of affairs.

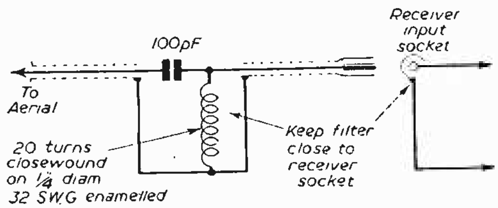


Fig. 1.—A simple high-pass filter.

In a few cases it may be found that line timebase harmonics are appearing on the televisor feeder system and so are conducted to the aerial. Check for this by disconnecting the aerial from the televisor and removing it well away from the set, listening to the interference meanwhile on the affected broadcast receiver. If it abates to any degree when the televisor aerial is removed, fit a filter between the feeder and the television receiver, using the circuit shown in Fig. 1. This should give some relief, though probably there will still be some interference left with which to deal.

It is generally a simple matter to decide whether or not the interference is entering the broadcast receiver through its aerial circuits—tuning the set over the medium waveband will show up the interference as a great number of modulated carriers spaced 10 kc/s or so apart in this case, whilst switching from waveband to waveband will also cause noticeable changes in the interference level. A whistle unaffected by tuning the receiver indicates that the interference is entering the I.F. or audio sections direct. This may sometimes be checked by removing the aerial from the affected broadcast set; if this causes an abatement in the interference it is more likely that it is being injected as an I.F. signal.

If the interference is being picked up in the aerial or I.F. tuned sections of the broadcast receiver the interference must be eliminated at the televisor itself. If the pick-up is direct into the receiver audio section then the televisor must be corrected, but at the same time some work should be carried out on the broadcast receiver to improve the audio section and make it less liable to receive extraneous signals in this way.

Screening

The interference must be eliminated at the televisor by screening. The practised constructor may shield the offending circuits themselves, making copper boxes for the enclosure of the line timebase components with due attention to ventilation, which must be provided by gauze-covered apertures in the boxes, but the newcomer to practical television will do well to confine himself to a complete screening of the televisor chassis. This is done, of course, by screening the interior of the cabinet, using thin sheet copper or copper gauze, taking care that the metal does not approach any live circuit. The screening must be carried under the televisor chassis by means of a bottom plate bonded with the wall screening and the rear of the cabinet should also be screened, using gauze to permit full ventilation. It is possible for interference to emanate from the face of the cathode ray tube; this, naturally, cannot be screened but turning the televisor, or placing it in a new position, might help very considerably.

To prevent interference leaving the televisor by way of the mains lead it is as well to provide filtering on both sides of the supply line. This is done by by-passing both leads of the supply to chassis through 0.001 μF. mica capacitors rated at 1,000 volts working. At the same time resonance peaks can be set up in the associated wiring of the line timebase between the output transformer and the deflection yoke, and if the interference is stubborn it is as well to screen both this wiring and the wiring to the frame deflection coils from the frame timebase. The frame circuit will not set up interference on its own account, but might re-radiate line interference induced in the frame wiring. If the leads are difficult to screen they might be replaced by co-axial leads of suitable insulation, the outer conductor being earthed in each case. The lead run should be kept short and direct.

Other nearby leads, such as heater wiring, loudspeaker leads and the like, might also pick up and re-radiate interference and so should be removed from the vicinity of the line timebase components, especially where these are not separately screened. In televisors where the tube has a conducting coating connected to the chassis the springs or other connectors providing the contact should be checked for suitable pressure. It need hardly be said that care must be taken in carrying out these suggestions, the televisor being switched off and the E.H.T. circuits discharged after each trial and before further screening or wiring changes, etc., are added.

Where the interference in the broadcast receiver is being induced directly into the audio circuits the televisor should be screened in the manner described above, but the broadcast receiver itself also needs treatment. Screening grid leads or long wires in the audio section is not really sufficient ; if the signal leads are sufficiently long, or so run that they are liable to pick up interference, they should be replaced with shorter and more direct leads. These also should be screened. A point to which particular attention should be given is the way in which earthed leads belonging to a single stage are taken to the chassis—re-wiring earth leads using television R.F. stage technique, all the earthed leads being taken to a single point right beside, or on, the appropriate valveholder, can sometimes provide a cure not only for interference but also excessive hum. Every earthed lead should be so treated within the stage, not forgetting the earth returns of volume controls and the leads sometimes sweated to the metal covers of volume controls. In this way the formation of wiring or chassis " loops " is prevented and interference entering the treated circuits is taken straight to earth instead of being allowed to set up voltages between points which should be at the same potential.

Another source of interference on any radio receiver waveband, though especially the long and medium wavebands, is a faulty R.F. E.H.T. power pack. Such a pack contains a self-excited power oscillator with a high output, so that if the screening of such a unit becomes bad for any reason strong interference can be expected. The result will be a number of steady carriers on the long and medium wavebands, possibly heterodyning the required signal, each carrier bearing a harmonic relation to the next. The fundamental frequency of such a unit might be between 50 and 300 kc/s so that it is quite possible for the fundamental carrier to appear on the long waveband—a steady heterodyne on all stations tuned in on the radio set would indicate fundamental, second or third harmonic interference on the receiver intermediate frequency. Across the medium waveband the carriers would be picked up spaced by the fundamental frequency one from the other, and probably diminishing in amplitude as the radio receiver is tuned upwards in frequency.

The only cure for trouble of this type is to correct the fault in the R.F. pack. If the screening appears to be in order a check on the pack smoothing and by-passing should be made, in case the interference is being carried by power or output wiring. Electrical rather than mechanical trouble might be indicated by the interfering carriers being unsteady, or by their having a " spitting " modulation. The fault will generally be nothing more than poor bonding of the screening, however—possibly the tightening of a few bolts will effect a cure.

Televisor-to-televisor Interference

Besides interfering with broadcast receivers it is possible for a televisor to interfere with a neighbouring televisor, or even with itself. With the advent of the modern all-channel receiver with tunable oscillator and high-frequency I.F.s the possibilities of oscillator harmonic interference are increased, and under some conditions the running of different televisors close together may lead to the setting up of interference patterns on one of them. The trouble will soon be located since it will coincide with the switching on of the offending receiver, ceasing when this receiver is again switched off. The interference may, in some cases, be caused by direct coupling from the offending oscillator into the R.F. section of the second receiver, but in other cases the oscillator power may be reaching the feeder line and aerial by means of capacitive coupling through the receiver R.F. stage. The first check, therefore, should be to remove the feeder from the offending televisor to see if this causes an abatement or cessation of the trouble. If it does, some form of filtering is needed between the receiver and aerial, and this is probably provided most easily by a simple pre-amplifier circuit without too much gain. A grounded-grid pre-amplifier of the type shown in Fig. 2 should serve—gain should be kept down for it must be presumed that the televisor was chosen to suit the location and has sufficient gain already.

The isolation provided by the pre-amplifier, which is link-coupled by a low-impedance line to the receiver, should prevent oscillator power from reaching the aerial. Any remaining interference must be cut out by screening of the oscillator itself, if this has not been done by the manufacturer of the set. Experienced constructors can add extra screening to the stage, and might even screen the oscillator coil if this is of the open type (remembering that too small a screening can well cause a serious frequency shift), but the newcomer to practical television should limit himself to screening the set as a whole within the cabinet in the manner already described.

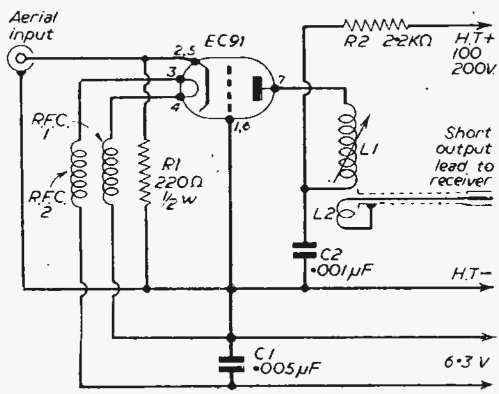


Fig. 2.—Isolating pre-amplifier.

R.F.C. 1 and 2 each have 25 turns of 28 S.W.G. enamelled wire close wound on ¼in. diameter former.

L1 :—Channel 1...11 turns
,, 2...10 ,,
,, 3... 9 ,,
,, 4... 7 ,,
,, 5 7 ,,
} 24 S.W.G. enamelled on ⅜in. dia. former. Turns spaced by wires own diameter.

L2 :—3 turns of 24 S.W.G. enamelled and cotton-covered wire wound over earthy end of L1 and insulated by single layer of tape.

Oscillator harmonic interference can also arise within a single receiver—a harmonic of the oscillator frequency feeds into the receiver input stage and passes through the receiver as an unmodulated carrier. The fault is clearly avoidable by making the oscillator frequency higher than the signal frequency.

Oscillator harmonic interference should not be confused with harmonic feedback from intermediate-frequency stages. This trouble arises chiefly in home-constructed receivers with poorly screened I.F. stages or an incorrectly chosen I.F. As an example, suppose that a receiver designed to receive the 45 Mc/s signal has an I.F. of 15 Mc/s instead of the conventional 13 Mc/s—

the third I.F. harmonic could feed back into the first stage of the receiver as an interference signal. Careful screening could prevent the trouble but it is far more desirable to choose an intermediate frequency which cannot cause the effect at all. It will be understood, of course, that this type of interference is self-produced, i.e., it affects only the receiver in which it originates.

Checking

Strips or bands appearing vertically on the left-hand side of the picture are a sign of line timebase interference generally set up within the receiver on which the effect is seen, although line timebase harmonic radiation can cause trouble in neighbouring televisors. Vertical strips can be set up by a ringing or non-linear effect in the line timebase, so that the first check must be to ascertain whether the lines are caused by actual radiation from the timebase, with consequent R.F. or I.F. pick-up, or whether they are caused by velocity modulation of the spot. (If the line scan is momentarily slowed as a result of non-linearity the reduced writing speed will cause a bright-up, subsequent bright-ups in following lines finally producing a bright strip right down the raster.) As a check run the televisor with a reasonably bright raster on the screen at a time when only sync. bars are being transmitted (just after the television carrier comes on), short-circuiting the video amplifier output line to earth through an 0.1μF capacitor so that no picture intelligence can reach the cathode-ray tube. If the bright strip or strips remain they must be caused by non-linearity in the timebase and they can be removed by attention to the damping circuits. If the strips disappear when the picture intelligence line is shorted they must be due to interference picked up on the aerial, feeder line or the receiver R.F. or I.F. stages. The test can, of course, be conducted with a picture on the screen but a blank raster is preferable for easy visibility if the strips are faint. It is necessary in making the test to ensure that the sync. supply line is not also shorted out since then the raster will break up or tend to do so, and the vertical strip, if produced by outside causes, will break up also and disappear.

In some receivers very faint strips will be noticed on a blank raster with no effect visible when a normal picture is displayed. These lines are due to leakage inductance effects in the line output transformer; they cannot be cured nor do they need treatment.

If vertical strips are found to be due to radiated interference a check should be made to ascertain whether they are caused by normal line timebase harmonics or to Barkhausen-Kurz oscillation in the line output valve. These oscillations are caused by electrons travelling between the screen and anode of the valve being attracted back to the screen as the anode potential falls below the screen potential due to the sawtooth input to the stage. Before the electrons reach the screen the valve grid goes sharply negative, the anode potential thus rising and causing the electrons to resume their normal direction of travel. The circling electrons set up oscillations in associated wiring, frequency depending on lead lengths, etc., and the vertical line on the left of the raster caused by interference from these oscillations may be irregular, and may show more clearly when signal strength is low.

One test for B-K oscillations is to present a small magnet to the line output valve (the set working normally), the magnetic field breaking up the electron orbits and so changing the time of transit between the screen and anode. If the magnetic field effects a cure an ion trap magnet can be clipped on to the output valve, positioned by trial, and left permanently in place. Other cures are to change the line output valve for another of the same type, or to add screen and anode suppressing resistors to the circuit commencing with low values of about 10 ohms. Barkhausen-Kurz oscillation is much less common than interference caused by line timebase harmonic radiation, and to cure vertical lines due to this effect the line timebase must be shielded and its leads screened in the manner already described.

Club Reports

Television Actors at Croydon

TELEVISION and film actor Sydney Tafler and his wife, Joy Shelton, addressed members of the British Televiewiers' Society at their monthly meeting at Kennard's Restaurant, Croydon, on Monday, November 3rd.

Miss Shelton spoke on the matter of rehearsal procedure in the case of radio features, such as "P.C.49," in which she plays an important part.

Mr. Tafler, among other matters, drew a comparison between film and television acting, and expressed his views on sponsored programmes.

The meeting was noteworthy for the very considerable number of questions, far greater than at any previous meeting, which were put to the guest speakers by members. These questions were of a varied nature and were welcomed by Mr. and Mrs. Tafler.

At the close of the meeting the chairman, Mr. G. H. Warren, thanked the speakers for their kindness in being present.

N.W. Centre for TV Society

THE inauguration meeting was held in February, 1952, when it was unanimously agreed to form a local centre. Since that date the following meetings have been held:

March 10th.—Lecture: "Some Aspects of line T.B. design," by J. Greenhalgh, B.Sc.

April 10th.—Lecture: "The Manufacture of C.R. tubes for TV," by J. A. Darbyshire, M.Sc., Ph.D., F.Inst.P., M.I.E.E.

May 1st.—Lecture: "The Design of a Simple TV Pattern Generator," by G. T. Clack, Esq.

June 16th.—Works Visit: To radio and television department of Ferranti, Ltd.

July 12th.—Summer: Visit to Holme Moss Television Station. Meeting, followed by an informal tea.

July 15th to 18th incl.—A stand was on view at the Institute of Electronics' Annual Exhibition, Manchester.

It will be seen from the above list that the local centre has made a very good start. The membership is approximately 50.

The programme for the coming session is at the moment being finalised. Meetings will be held at the College of Technology, Sackville Street, Manchester, at 7 p.m. on the last Wednesday of each month.

The local secretary is Mr. K. B. Pontin, 11, Chadwick, Road, Eccles, Salford, Lancs.

New Club—Tees-side

A NEW club has been formed in Tees-side and it will make available test equipment, give hints and advice, lectures, etc. to club members. Headquarters are in Stockton-on-Tees, and any interested persons can obtain details from the secretary, Mr. C. W. R. Elsner, 101, High Street, Yarm-on-Tees.

Remote Control of a Receiver

FIRESIDE ADJUSTMENT MAY BE PROVIDED AS EXPLAINED HERE

By H. Garlick

ALL television receivers have at least one control on the front of the cabinet intended to provide adjustment of the brightness or contrast of the picture. Either control can be used to alter the light output from the tube face, and once the picture tone has been set (using the graded bars down each side of the clock transmitted before the commencement of the evening programme) the controls should not require further adjustment.

Unfortunately, this state of affairs does not hold good for long, for various reasons. A change in mains voltage, for instance, quite a regular occurrence these days, can reduce the brightness a noticeable amount. Climatic conditions can affect the signal strength where the receiver is located a considerable distance from the transmitter, with the result that the brightness of the picture is affected.

A considerable change in brightness can sometimes be observed when a scene changes from an outdoor to an indoor one, and is particularly noticeable during the Newsreels. Even a change from one camera to another can vary the tone of the picture, making a change in the setting of the controls desirable.

In order to carry out this change conveniently, it is necessary to provide a control which can be adjusted from the viewing position.

One method of achieving this is to wire the remote control into the circuit to work in conjunction with the receiver controls, and one manufacturer has now made this provision.

To modify an existing circuit is, however, rather a difficult task.

An alternative method of adjusting the contrast of the picture is to provide an attenuator in the coaxial line to the receiver, and details of a device to enable this adjustment to be carried out from the viewing position are here given.

The Circuit

The attenuator consists of a tuned circuit in parallel with the receiver input and provided with a variable condenser.

When the tuned circuit is in resonance with the vision signal some of the signal is absorbed, reducing the input to the receiver. The circuit is damped by a resistor to provide attenuation over the whole of the vision band.

The tuned circuit can best be mounted in a small metal box, the original model being an I.F. can from a surplus radar chassis and measuring 4½in. by 2in. by 1¾in. deep.

The coil consists of four turns of 24 S.W.G. on a ¾in. diameter former, having a tap at one turn from the earth end.

The variable condenser across this coil is of very small capacity and too big a value will make the adjustment too sensitive. The condenser used was of a type very popular in radar circuits with vanes measuring about 1in. across. The moving vanes can easily be removed one at a time until the correct capacity to give linear control through 180 deg. of rotation is found. In the writer's case the condenser has two moving vanes.

The circuit is wired as shown and is provided with a suitable length of ¼in. diameter coaxial cable. The most suitable type for the job has a multi-strand core, as this has greater flexibility and is better able to withstand constant handling.

To connect the remote control to the receiver a junction box is required, and can be fitted in a convenient position anywhere in the coaxial down-lead. The box is again an I.F. can measuring 3½in. by 1½in. by 1¾in. deep.

If a jack plug and socket are provided at the junction box, the remote control can easily be disconnected when not in use.

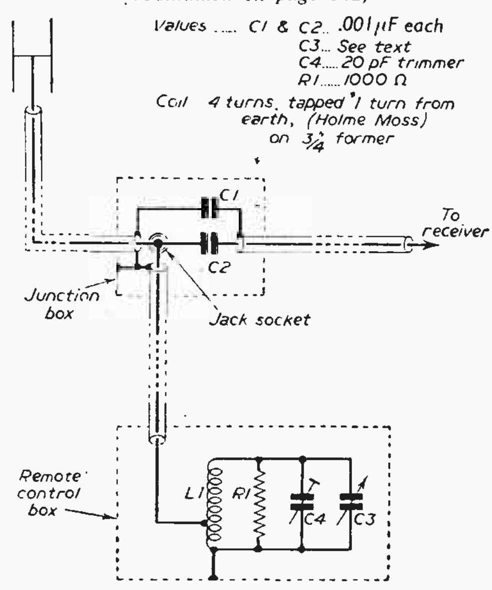
In order to isolate the unit from the receiver chassis in cases where this may be "live," condensers should be inserted in the coaxial lead to the receiver, and these can be mounted in the junction box.

In order to prevent attenuation of the sound channel it is necessary to adjust the circuit so that the condenser is at maximum capacity when the circuit is in resonance with the vision signal. Movement of the condenser towards minimum moves the resonant frequency above the vision carrier, and as the sound carrier is below the vision no attenuation takes place.

Adjustment

To adjust the tuned circuit the variable condenser should be at maximum capacity and the trimmer condenser adjusted until minimum signal is indicated by a reduction in the brightness of the picture. Operation of the variable condenser will now increase the signal strength, and the receiver controls should now be set

(Continued on page 362)



Details of the scheme described above.

PRE-DETECTOR STAGES—3

INTERMEDIATE FREQUENCY APPLICATION

A VISION I.F. of 13 Mc/s will, for instance, give rise to a sound I.F. of 9.5 Mc/s, although in this example it should be borne in mind that the frequency of the local oscillator would need to be lower than the signal frequency, or 45 minus 13 Mc/s. A higher signal frequency local oscillator (45 plus 13 Mc/s) will have the effect of making the sound I.F. higher than that of the vision, which as will be realised, depicts a quick method—when exploring an unfamiliar commercial receiver—of determining whether the local oscillator is, in fact, higher or lower than the incoming signals. To tie up with the above example, a higher local oscillator frequency will produce a sound I.F. of 16.5 Mc/s, but more will be said about this later.

Having obtained a sound I.F., however, the sound signal voltage is conveyed, via a suitable coupling, to the grid of the first sound I.F. amplifier. Apart from a much wider sound pass-band, the remainder of the circuit follows very closely normal broadcast technique. The reasons for the extra wide pass-band—which is usually between 100 to 500 Kc/s—are twofold. First, such a wide pass-band prevents any serious mistuning, which might otherwise occur due to local oscillator drift ; and secondly, it assists the suppression of sound interference. This is because the modulation envelope of impulsive interference contains large components of frequencies greatly exceeding those carrying the audio signal, and unless the I.F. channel is capable of transmitting these without distortion, little will be gained by the inclusion of sound suppression circuits (see "Interference Suppression," PRACTICAL TELEVISION, November, 1951).

Often one, or in some commercial receivers, two I.F. stages are made common to both sound and vision, although, when this is the case it is usually found sufficient to employ no more than one sound I.F. amplifier owing to the extra sound signal voltage acquired through the common channel.

At this stage it should be mentioned that the same reasoning applies to T.R.F. receivers. Usually two or three first stages handle both the vision and sound signals ; sound pick-up is achieved by a coupling circuit resonating at sound frequency, and additional amplification is provided at this frequency.

Two typical sound pick-up circuits are depicted by Fig. 10 (a) and (b). At (a) the sound pick-up is taken from a common I.F. valve, and as will be seen the circuit is capacitively coupled. L1 is the tuned I.F. coupling, which, if stagger tuning is adopted, will be resonating at a predetermined frequency in the vision pass-band. The sound signal is coupled, via C1, to L2, C2 comprising the first sound tuned circuit, the signal across which is tapped from a suitable impedance point to the grid of the first sound I.F. valve.

The circuit at (b) shows a mixer valve which has two tuned circuits in series with the anode. The load L1 L2 is a band-pass coupling used to couple the vision signals to the first I.F. amplifier, whilst the sound signal is developed across L3, C1 and taken to the grid of the first I.F. valve through C2.

Selectivity

Now that we have five television channels operating, the problem of selectivity is not only one of minimising the vision channel response to its accompanying sound signal, and vice versa, as it has been hitherto. But now it is necessary also for us to ensure that the sound signal of an *adjacent* channel will not break through, and cause interference to our *local* vision signal. Such a source of interference is very real, especially in fringe

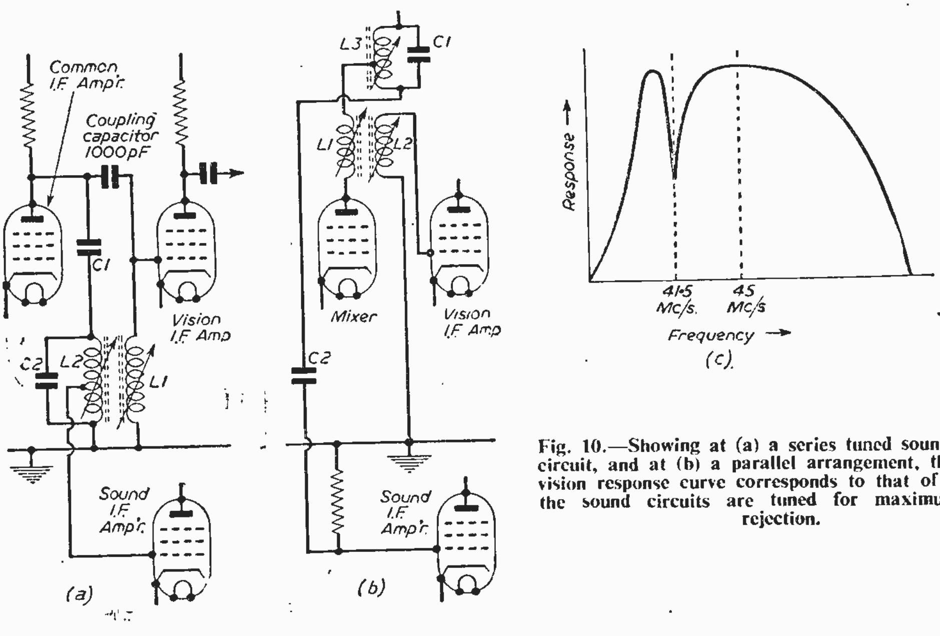


Fig. 10.—Showing at (a) a series tuned sound pick-up circuit, and at (b) a parallel arrangement, the overall vision response curve corresponds to that of (c) when the sound circuits are tuned for maximum sound rejection.

areas where two channels may be received with little to choose between their respective signal strengths.

This can be illustrated by considering, say, the sound frequency of channel 5, in comparison with the vision frequency of channel 4. The sound signal in this case, 63.25 Mc/s., is separated from the high frequency side of the vision signal, 61.75 Mc/s, by only 1.5 Mc/s, and unless a sharp drop in receiver response is realised slightly above 61.75 Mc/s, the receiver, in certain locations, may manifest interference typical to that associated with ineffective sound suppression. The interfering signal is always the sound accompaniment

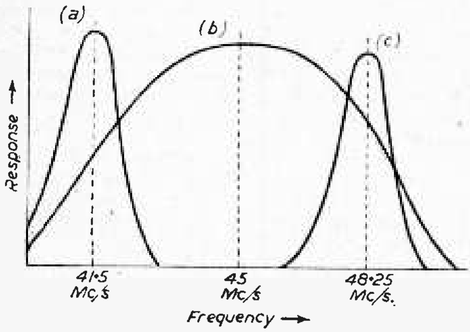


Fig. 11.—A vision channel response without rejection at (b) embraces the accompanying and adjacent sound signals at (a) and (c) respectively.

of a channel one stage higher in frequency, therefore, while channels 1 to 4 may be effected in this way, channel 5 being the highest in frequency will—at least for the time being—remain unaffected from this source.

In order to secure a vision channel response which will be unaffected by the accompanying sound signal on the low-frequency side, and adjacent channel sound on the high-frequency side, and yet retain the requisite vision pass-band characteristics, additional tuned rejector circuits will need to be included in the networks comprising the vision channel. This is mainly because bandwidth and selectivity are closely related, and it becomes an impracticable proposition with television to enlarge the number of tuned circuits to confer an advantage in selectivity—as is often practised in sound receiver circuits. A typical response curve may represent that of Fig. 11 unless modified by the use of rejector circuits.

On the low-frequency side of the curve a degree of modification is created by the sound pick-up circuit. The fact that L2, C2 of Fig. 11 (a), or L3, C1 of (b) is tuned to the sound carrier produces a trough in the overall response curve at this frequency, and by *slightly* detuning the sound pick-up circuit, so that the trough corresponds to the sound carrier, a useful degree of sound rejection is achieved (see Fig. 10 (c)). The slight sound attentuation which ensues is easily counteracted in proceeding stages, and in any case, the sound rejection derived far outweighs this loss (see "Sound Rejection," P.T., June, 1952).

Extra sound rejector circuits must be embodied in the vision circuitry to provide a rejection ratio in the region of 100 : 1. This usually necessitates, at least, the inclusion of two more tuned circuits in appropriate sections of the vision channel. Two methods are available to this purpose : one is to place a series tuned circuit in parallel with the signal path, and another is to insert a parallel tuned circuit in series with the signal path, so that in either case the sound channel is filtered relative to the vision signal.

The sound pick-up circuit of Fig. 10 (a) depicts the series tuned arrangement, and extra circuits of this type may be applied across following couplings. Here C1, L2 comprises the series circuit, which at resonance presents a virtual short circuit to the vision coupling it shunts, whereas off-tune its impedance increases so that it affects very little the vision coupling. The capacitor C2 provides an added feature to this circuit, which if chosen to cause L2 to resonate at a frequency corresponding to the lower edge of the vision pass-band, the high resonant impedance of this parallel circuit imposes little shunting across the tuned coupling. As the frequency reduces towards the sound carrier, however, the parallel circuit swings predominately inductive, and in association with C1 resonates to form a series circuit of low impedance across the coupling coil L1, resulting in a very desirable deep trough in the overall response curve at the sound frequency.

The combination L3, C1 of Fig. 10 (b) depicts the parallel arrangement connected in series with the signal path. At resonance the circuit shows maximum impedance across its terminals, and if extra circuits of this nature, tuned to the sound carrier, are included in series with following tuned couplings, or in the cathode circuits, the necessary rejection ratio is easily obtained.

A single circuit after the style described, and tuned to the adjacent sound channel, is usually sufficient to prevent adjacent channel interference. It must be remembered, of course, that when we are dealing with a superhet the rejector circuits will be tuned to the sound I.F., and adjacent sound channel I.F. respectively.

Owing to the smaller bandwidth, and the resulting better selectivity of the sound channel, less vision rejec-

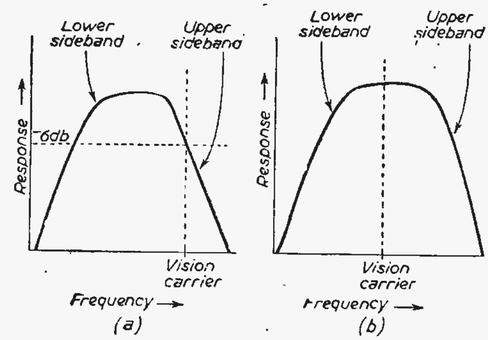


Fig. 12.—The characteristics of the vision transmissions at (a) single sideband (channels 2 to 5), at (b) double sideband (channel 1 only).

tion is needed. Often a single circuit tuned to the vision carrier, or vision I.F., is sufficient for this purpose. Such a circuit may take the form of either the series or parallel mode, and inserted in the sound channel in a way similar to that of the sound rejector.

Single Sideband Working

It has so far been assumed that our receiving equipment would be for double sideband working. This practice, however, is very rarely, if ever, used in modern receivers. In the first place, Alexandra Palace (channel 1) is the only channel radiating this mode of signal. Channels 2 to 5 transmit only a small portion of the upper sideband and, therefore, are known as single, or vestigal-sideband transmissions (see Fig. 12 (a)).

Such transmissions demand that the receiving circuits are adjusted so that the carrier falls on the sloping side of the response curve, at a point where the relative response is minus 6 db. It is not essential, however, to adjust a channel 1 receiver for double sideband working as shown by Fig. 13 (b), where the carrier frequency falls

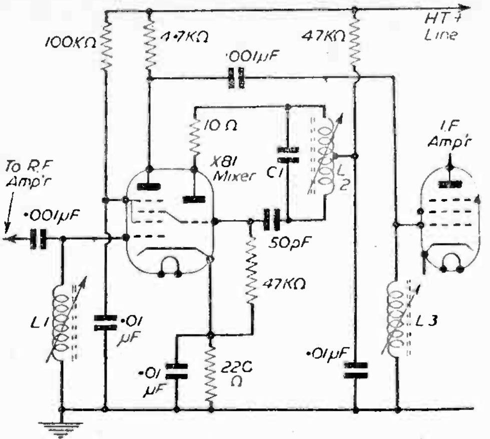


Fig. 13.—A frequency changer circuit styled round a triode-hexode valve.

in the centre of the response curve, it is quite in order to adjust the receiver for single sideband working even though the transmission may contain both sidebands.

First, then, single sideband reception facilitates the manufacture and adjustment of 5-channel receivers; secondly, since it is required to receive only a single sideband, the bandwidth problem is considerably eased; and thirdly, the gain of each stage is nearly doubled due to the reduced bandwidth. Theoretically, when only a single sideband of a double sideband signal is accepted by a receiver the signal power is halved, but this is more than made up for in practice, by the fact that the gain of each stage may be doubled.

Single sideband reception is easier to achieve with the superhet style circuit, than with T.R.F.: it would be pointless, anyway, to adjust a channel-1 T.R.F. receiver for single sideband working, especially now that very-high-slope television pentodes are available, unless, of course, single sideband working will help from the interference, or noise aspect.

The most important point to remember with single sideband working is that at the vision carrier frequency the response must be 6 db down to obtain a level response. Should this condition not be fulfilled, phase or amplitude distortion is bound to ensue, resulting in the familiar manifestations of black after white, flaring, plastic, or indistinguishable tonal gradations, making the picture appear flat (see "Picture Distortion Analysed," P.T., March, 1952).

Single sideband working does not, unfortunately, ease the sound rejection problem because the sideband retained is that nearest the accompanying sound carrier, although it does help the rejection of adjacent channel sound. Owing to the extra overall gain derived by this style of reception the general lay-out must be arranged for stable operation, giving due attention to screening, and using 0.01 μF. capacitors for I.F. decoupling.

Apart from the wide band characteristics required of the frequency changer section of a television receiver little functional difference is evident from that of a normal broadcast receiver. In fact, the circuitry involved is similar in all respects—apart from the ganged tuning system—to its broadcast counterpart.

Until comparatively recently the practice of employing two valves—one for the production of oscillations, and the other for the actual mixing process—appeared to be favoured by designers. The two valves were frequently in a single envelope, the triode-hexode being a popular choice, for this single valve enabled two independent electron streams to be utilised for each process.

Another idea adopted by, at least, one manufacturer being the employment of diode valves working as high-frequency mixers in conjunction with a high-stability triode oscillator. Double-triode valves have also been employed for frequency changing at television frequencies—or even higher frequencies; this idea appears to be popular in America. In modern equipment, however, it is becoming progressively more common to use a high-frequency pentode as a self-oscillating frequency changer.

Whatever method is finally decided on it is most important to achieve: one, a high degree of oscillator stability; two, a high conversion amplification, and three, a low noise factor—this to an extent is very much related to condition two.

Frequency Changer Circuits

A typical triode-hexode circuit is shown in Fig. 13. In this case the signal grid is capacitively coupled to the R.F. amplifier, L1 being the tuned coupling. The triode section of the valve is used for the generation of oscillations, and in conjunction with L2, C1 forms a conventional Hartley oscillator. The inclusion of the 10 ohm resistor in series with the anode circuit is a preventive of parasitic oscillations. Capacitive coupling is also used from the hexode anode to the control grid of the I.F. amplifier valve, and the desired signal (signal frequency minus oscillator frequency, or oscillator frequency minus signal frequency) is selected by the grid coupling coil L3.

(*To be continued*)

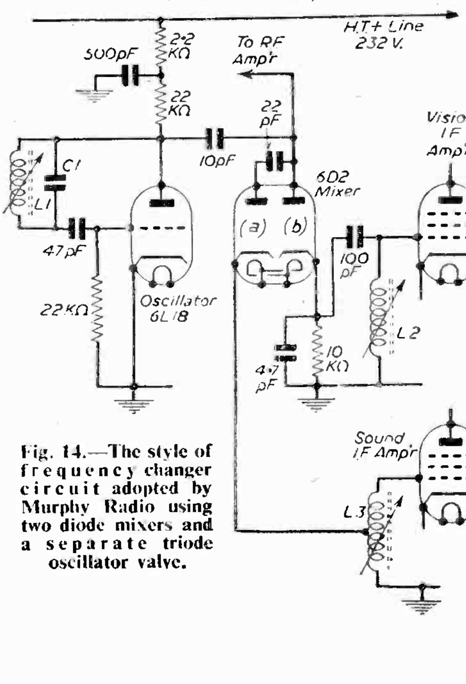


Fig. 14.—The style of frequency changer circuit adopted by Murphy Radio using two diode mixers and a separate triode oscillator valve.

Long-distance

SOME PRACTICAL ADVICE

B

THIS is *not* about freak reception at long distances but some practical advice for those viewers who are well beyond the accepted fringe areas. The main difficulties that such viewers have to face are valve noise evident as "snow" on the screen: loss of synchronisation; man-made interference; fading.

Except for the fading the troubles are due to weak signals and the obvious remedy is to increase the signal input to the televisor as much as possible.

There are several methods of doing this; they are :—

(a) improving the aerial array.
(b) use of low-loss transmission lines.
(c) use of pre-amplifiers.
(d) narrowing of the bandwidth of the vision receiver.
(e) reduction of losses in the wiring.

Of these the most important is the aerial, and the greater the amount of the signal picked up by the array the less will be the need of other remedial measures.

The Aerial

The subject of aerials has been dealt with quite thoroughly in previous issues of PRACTICAL TELEVISION, though it is a field in which much work remains to be done. Here are a few pointers in aerial technique devoted to the long-distance arrays.

A reflector added to an ordinary dipole improves its forward gain and increases its front-to-back ratio so that interference coming from directions other than that to which the aerial is pointed are minimised.

The forward gain can be increased by means of directors; the greater the number of directors fitted then the greater the gain of the array. However, a limit is set to the number of directors which can be fitted as each element adds to the bulk of the array. Not only may it have to withstand winds of gale force, but also the structure to which it is attached will be subjected to strain.

An aerial erected on a normal chimney should not have more than two directors and its mast should not be higher than 16ft. Of course, if the stack is very substantial, greater heights can be used with heavier arrays. The mast must be stronger accordingly, and should be fitted with stays in three directions as shown in Fig. 1. Each stay should be at an angle of 120 deg. to its neighbour.

It is important that the length of the stay wires should not bear any relation to the wavelength of the aerial, and insulators should be inserted at the upper ends in order to break up the continuous wire. It is advisable to make the distance between insulators about 18in. less than half a wavelength long.

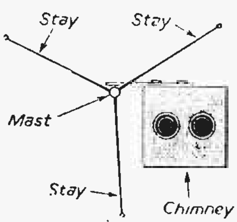


Fig. 1.—Strengthening a mast by 3 stays.

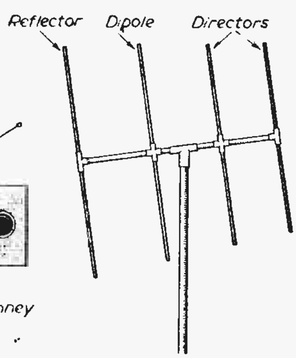


Fig. 3.—A good long-range aerial.

Example: supposing the array was for Sutton Coldfield, the dipole being 7ft. 6in. long; then each insulator should be inserted at 6ft. from the top of the mast and another 6ft. below this. The rest of the wire should not have any material effect on the array.

Seven-strand steel wire is best with a minimum gauge of 14. This type of wire could also be used for the chimney lashing.

The chimney bracket should be ¼in. thick and made of mild steel.

It is advisable to reduce vibration by fitting thick rubber shock absorbers between the mast and the chimney bracket. The hollow elements can also be treated against vibration by filling them with sawdust and sealing the ends.

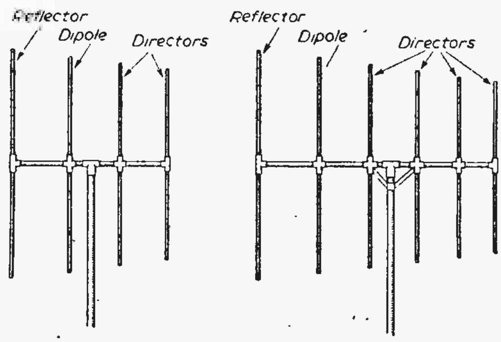


Fig. 2.—Different forms of long-range aerials.

If extra directors are fitted the position of the mast can be altered so as to balance the array. Fig. 2 shows the method.

Increasing the number of elements in an array does two other important things; it sharpens the directivity and lowers the impedance of the dipole. As an example of decreased impedance consider an array with reflector and two directors all spaced at 0.2 λ. The dipole by itself will have an impedance of approximately 75 ohms at its centre, but with the added elements the impedance will drop to about 15 ohms. Under these conditions a mismatch would result if an ordinary 80-ohm cable were used to connect the aerial to the receiver.

To correct the mismatch a folded dipole can be used. If the dipole is two-fold, the centre impedance is increased by four times; if the dipole is three-fold, an increase of nine times is obtained. In the example quoted a 15-ohm impedance can be transformed into a $15 \times 4 = 60$ ohm impedance by employing a two-fold dipole; this would be quite a good match to an 80 ohm cable.

For those who wish to construct their own arrays here is a simple formula for calculating the lengths of the various elements:

Length of dipole in feet = 468 ÷ frequency in megacycles.

The reflector should be 5 per cent. longer than this and the first director 4 per cent. shorter. Each added director should be 4 per cent. shorter than its predecessor.

TV Reception

FOR REMOTE AREA VIEWERS

By "Erg"

Spacing

The spaces between the respective elements calculated for maximum gain are :—

Reflector ... 0.15λ
Director ... 0.1λ
additional directors 0.1λ from each other.

A close-spaced array of this nature is liable to suffer from "flutter" in high winds and should be made of ½in. tubing. This array can give about 9db gain over an ordinary dipole. One arrangement which does not suffer from flutter is to have all elements at 0.2λ ; the gain is about 8db.

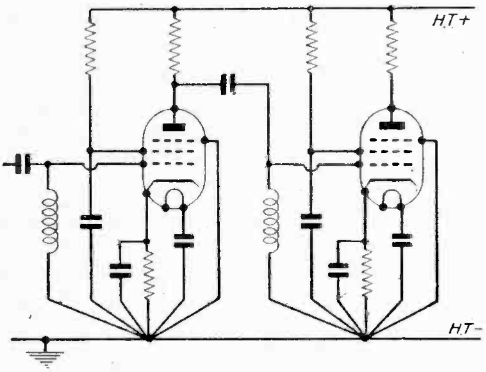


Fig. 4.—Common earthing points aid efficiency.

A useful array for long-distance reception was described in a recent article in PRACTICAL TELEVISION entitled "Your Aerial for Wenvoe." This comprised two Yagi arrays each being composed of reflector, dipole and two directors, the two arrays being mounted 0.25λ from each other and connected to the televisor by equal lengths of transmission line.

There should be no need to mention that the height of the aerial should be the maximum attainable. Some benefit is also obtained by tilting the aerial so as to take advantage of any malformation of the polarisation which may have taken place in the signal, on its long journey from the transmitter. (Fig. 3.)

Several commercially produced aerials are fitted with tilting arrangements. It should not be necessary to tilt the array more than 5 deg. from the horizontal.

Aerial Boosters

An aerial booster or pre-amplifier is a useful addition to an aerial where the receiver is located in a noisy district. The transmission line will pick up noise on its way to the televisor : if the signal is boosted up at the aerial then the ratio of signal to noise at the receiver end will be much greater.

Details of the construction of such a booster have been given recently in PRACTICAL TELEVISION. They are also available commercially, a new one produced by Belling-Lee being a feature of the recent Radio Show.

Transmission Lines

The principles and practice of aerial feeders (transmission lines) have been adequately dealt with in a recent article ; it is only necessary here to point out that the use of low-loss cables is well worth while for long-distance reception.

Ghosts

The production of ghosts on the screen (a duplicate or even triplicate picture on the screen slightly displaced to the right of the main picture) is one of the troubles which the fringe viewer may experience. In certain areas the problem is very difficult and rather beyond the scope of the present article.

Where only one ghost exists it can usually be eliminated by re-orienting the aerial which, although it may result in some loss of gain, is preferable to the interference on the screen.

In some cases it will be found that the ghost provides a stronger picture than that provided by direct signal pick-up and the aerial can be directed towards the source of reflection and not towards the transmitter. Care must be taken, however, for quite often the ghost picture is of much poorer quality than the weaker direct signal.

Pre-Amplifiers

There is no doubt that a pre-amplifier provides useful gain in signal strength, but a limit is set to the amount of pre-amplification which can be applied. This limit is the noise generated in the valves themselves and manifests itself on the screen in the form of "snow."

When using R.F. pentodes the limit is a 2-valve pre-amp, because beyond this point the gain obtained by extra valves is offset by increased valve noise.

The use of low-noise pre-amps working on the grounded grid mode has much to recommend it, and one of the best combinations is such an amplifier followed by a single R.F. pentode stage, before the televisor.

Long-distance Televisors

For really long distance work the super-het is undoubtedly a better proposition than the straight set. One of the best items on the market to-day is the R1355 receiver used with an RF26 or 27 unit.

The RF26 unit is the most useful, as it can be adapted very easily to any channel. As bought it will cover Sutton Coldfield and Kirk o' Shotts. By adding iron-dust cores to the three coils it will tune over the Holme Moss and the Alexandra Palace frequencies, whilst brass coils will enable Wenvoe to be tuned in.

The R1355 has one major snag, and it is the break-through which is liable to occur at intermediate frequency. If a pre-amp is used the trouble is usually eliminated,

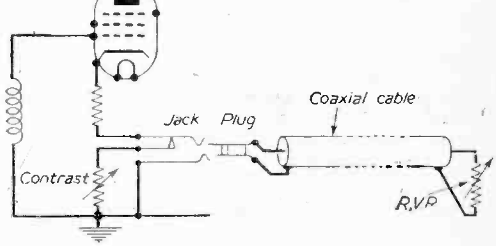


Fig. 5.—Remote control can be fitted as shown here.

but if the unit is used without a pre-amp then a wavetrap tuned to about 7.5 Mc/s should be inserted between the aerial and the unit. The trap should be completely screened.

It is possible to use two of these units, one for vision and one for sound, though it will be found that the sound receiver will require fewer I.F. stages; three is a useful number. All that is necessary to modify the unit for this purpose is to take out two of the I.F. valves and to bridge grid cap connection between the missing stages with a short length of coaxial cable.

The vision receiver will be found to have a very restricted bandwidth; this can be overcome by slightly stagger-tuning the I.F. circuits. The R.F. unit should be tuned for maximum signal and then the oscillator trimmer adjusted towards the sound channel. Test Card C provides a useful guide for this operation.

The R3170A is another useful unit for long-distance reception. The I.F. is 30 Mc/s, and EF50 valves are used throughout. The bandwidth is adequate for TV and the gain of the unit can be made greater than that of the R1355. (Data for the conversion of this unit is in preparation.)

Bandwidth

Surprisingly enough, it is possible to obtain a picture of quite pleasing quality with a bandwidth of less than 2 Mc/s. By decreasing the bandwidth of the vision receiver gain is materially increased. This principle is employed in commercial receivers, the Baird "Countryman" being an example.

The restriction of the bandwidth is well worth while. It is better to obtain a picture with somewhat reduced detail but which is quite clear, rather than one in which the extra detail obtained by the broader bandwidth is lost by the increased interference and snow effect.

It should also be noted that distance itself appears to have some effect on the quality of the picture, because on some evenings it is possible to have a fairly strong signal, though the quality of the picture leaves much to be desired.

Straight Receivers

Where straight sets are used losses should be kept at a minimum. Wiring should be very short and direct; components should be mounted close to the valve-holders: earthing of each stage should be brought to one central point (Fig. 4).

The amateur constructor is advised to use the single-ended type of valve such as the EF50 and EF54 rather than top-cap grid connected form such as the SP61 (VR65).

Four R.F. stages are about the maximum that can be made to work satisfactorily, though if great care is taken with the wiring and layout, five stages can be used. It is advisable to make the sound receiver a separate unit, providing it with three R.F. stages.

A good unit for long-distance reception is the 194 strip. It employs 6 R.F. stages, is easy to modify, and can be used with a two-valve pre-amp if care is taken in the pre-amp design.

Another useful unit is the Pye 45 Mc/s strip, but neither of these two units provide as much gain as R1355 or R3170A.

Interference

The answer to interference troubles is mainly in the aerial system, and the remarks under this heading should reduce man-made static to a minimum; good height, directive array, careful orientation, low-loss screened feeders are the main points to observe.

Where it is possible to erect screens between the source of interference and the signal, the use of a corner reflector has much to recommend it.

Synchronisation

The loss of synchronisation is mainly due to weak signals. In this respect, perhaps, hard valve oscillators in the timebase are an advantage, as they do not generally require a high amplitude of sync pulse for their operation. The use of flywheel methods of controlling the oscillator frequency has also much to recommend it: the circuit was described in these pages quite recently.

Fading

There is no simple answer to the fading problem, though some recent experiments in connection with applied A.V.C. have had some encouraging results.

The most satisfactory method evolved so far is to project the contrast control as a remote armchair control so that the brightness of the picture can be manually adjusted without getting up to adjust the controls on the televisor.

Fig. 5 shows the scheme whereby the remote-control can be plugged in as desired. The remote-control (R.VR) should be of the same value as the existing contrast control. Coaxial cable is used as a link to the televisor.

Where a two-valve pre-amp is used it is better to insert the control in the cathode of the second R.F. valve. This will ensure that the early stages of the televisor are not overloaded when the signal is good.

Of the many vicissitudes with which the long-distance experimenter is beset, perhaps the most annoying is the varying signal strength. The constructor should ensure that any experiments he makes are given an extended trial, as the immediate results obtained may not be due to the new circuit arrangement but due to the altered signal strength.

Keeping in mind that the signal will not only vary from day to day but even from hour to hour, care should be taken in inviting guests. The best signals will usually be obtained either on a nice foggy night in winter or in wild, rainy weather in the summer.

Remote Control of a Receiver

(*Continued from page* 354)

to give a normal picture when the variable condenser is set at mid-position.

This permits the brightness to be adjusted either way and if the unit is placed near the viewing position it will be found unnecessary to alter the receiver controls during the programme.

Sound

Control of the sound carrier could no doubt be carried out in a similar manner, although in the writer's case control of the volume has not been found necessary. The damping resistor would not be required, and the resonant frequency would need to be adjusted to give minimum volume with the variable condenser set at minimum capacity, i.e., the opposite procedure to the vision circuit.

Both circuits could be mounted in the same box, but some means of identification of the control knobs should be adopted.

The use of dissimilar knobs would identify the circuits in the dark, but perhaps a better method would be to mount the sound channel control on the side of the box.

Pages from a TELEVISION ENGINEERS Notebook

1.—RADIO-FREQUENCY CIRCUITRY

IN the usual form, the radio-frequency circuit of many commercial and home-constructed television receivers consists of a single-tuned circuit loaded with resistance to provide a broad response. When considering the circuit as a means for transferring the vision and sound signals from the aerial input terminal to the grid of the first amplifier valve, however, such a simple arrangement does not always produce the necessary gain and bandwidth, or the selectivity beyond the edges of the passband which is necessary to prevent large, unwanted signal voltages from interfering with the required channel. Interference on the Birmingham frequency from Wenvoe, for example, can be experienced by viewers situated roughly midway between these transmitters, and vice versa.

A practical system of R.F. circuitry is the band-pass or coupled circuit arrangement, and this has the advantage, when correctly aligned, of a much greater useful bandwidth than is possible with the resistance-loaded single circuit for a given degree of selectivity against adjacent signals.

The basic circuit is shown in Fig. 1, with a typical response curve for the London and Birmingham frequencies in Fig. 2. It will be seen that the response is substantially flat over a frequency range of 4 Mc/s, with a fairly sharp fall away on either side of the passband. The circuit can, of course, be used on any of the present five television channels and the response curves will be very similar to those shown in the other cases.

The coils are tuned by capacitors, these being of the air-spaced types with earthed moving plates, thus making tuning a simple matter. The maximum capacity in a system of this sort must be large compared with the stray circuit and valve capacity, but this, in turn, reduces the L/C ratio of the circuit and consequently results in a low circuit impedance. This, in turn, leads to low overall gain, since the gain is essentially a function of the ratio of the input and output impedances of the circuit. These factors point to the desirability of limiting the actual tuning capacities as much as possible, while keeping in mind the value of the stray and valve capacities and the frequency to which it is desired to tune.

It is possible to use a twin-gang condenser as the tuning unit in a coupled circuit of this type, in which case the coupling between the circuits is achieved in the common impedance of the condenser shaft and decreases as the frequency increases, since the current through the condensers and the circuit-distributed capacities does not flow through the coupling impedance. It is better in practice, however, to use separate condensers for tuning and permit the coupling to take place through a small, fixed condenser, wired across the live ends of the circuits as the figure shows. Resistance loading is used on each circuit and is calculated to provide just sufficient damping to reduce the tendency to pronounced double-humping at the ends of the passband.

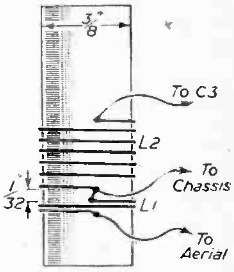


Fig. 3.
Details of the coils.

In the design of such circuits, the characteristics of the aerial system and the feeder must be taken into account, and both the impedance matching and the loading effect of the feeder must be well considered. The curves of Fig. 2 were taken with a simple dipole-reflector H-type aerial cut to the sound frequency of the channel concerned and having 0.2 λ spacing between the elements, and the feeder was nominal 70 ohm. quarter-inch diameter coaxial cable. The amplifier valve was an EF91,

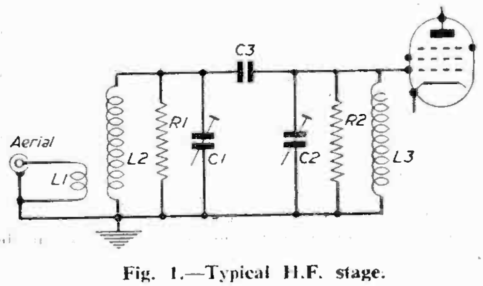


Fig. 1.—Typical H.F. stage.

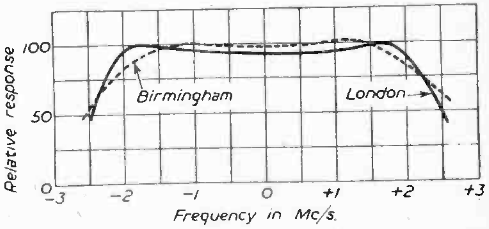


Fig. 2.—Typical response curve for the circuit in Fig. 1.

operating with cathode bias control in a conventional circuit.

Suitable design details are as follows and, though these are for the London frequencies, the small modifications necessary for the other channels are not difficult to work out. Referring to Fig. 1, coil L_1 has two turns, L_2 and L_3 have each six turns on $\frac{3}{8}$in. diameter bakelite or Tufnol formers (no cores), and the tuning capacities are each 50 pF maximum air-spaced trimmers. The coupling condenser is 5 pF. The coils are wound on separate formers with 26 s.w.g. enamelled wire, slight spacing between the turns, and Fig. 3 shows the construction of L_1 L_2. R_1 is 2.2 k Ω and R_2 is 3.3 k Ω. The coils must be so disposed that there is negligible inductive coupling between them.

The tuning of coupled systems is not difficult, and for the amateur constructor consists of peaking the individual circuits to the required frequencies at the limits of the passband. In practice the interaction of the circuits makes the procedure more difficult than would be the case for a simple circuit, but if a signal generator is to hand, L_2 should be peaked at 41.5 Mc/s and L_3 at 44.5 Mc/s, assuming lower sideband reception. As the generator is swung through the required band, the output of the stage (metered in the usual way) should be equal at these two frequencies, and should be substantially constant between them.

A similar circuit can be used between the R.F. amplifier and the mixer in a superheterodyne circuit, but the coupling capacity should be reduced to about 1 or 2 pF in this case.

Compulsory Car Suppressors

THE Postmaster-General on November 27th laid Regulations before Parliament which will enable him to ensure that suppression devices are fitted to the ignition systems of new cars, motor-cycles, motor-boats, and the like, sold after July 1st, 1953, which radiate sufficient energy to interfere seriously with television reception. The Regulations have been made on advice received from an advisory committee set up under the Wireless Telegraphy Act, 1949. The committee comprises persons, nominated by the President of the Institution of Electrical Engineers, who were able to express the views of those likely to be affected by the Regulations. Members of the committee able to speak for the motoring organisations, the radio and motor industries and the motoring public were agreed on the requirements prescribed in the Regulations.

New Cars Only

The Postmaster-General will be able to require assemblers and importers of motor-vehicles and the like to ensure that the interference radiated from their products is below a certain amount which is specified. The Post Office will collaborate with manufacturers of ignition apparatus in advising those assemblers and importers on how the requirements can be satisfied and in making such tests as might be required to ascertain whether the requirements are being met.

New cars, motor-cycles, etc., assembled after July 1st, 1953, will remain within the scope of the Regulations after delivery. But the owner of a car, motor-cycle, etc., that has been fitted with suppressors by the manufacturer or importer will be considered to have satisfied the requirements if he has kept the suppressors fitted and in serviceable condition. This valuable concession will mean that the motorist who maintains his car in good order will have no reason to fear that action will be taken against him.

Older Vehicles

For vehicles already in use, the Postmaster-General will continue for the present to rely on the voluntary collaboration of owners. Many motorists have already done what is necessary to prevent their vehicles causing television interference (usually by fitting a suppressor, costing 2s. 6d. or so, at the distributor end of the lead from the ignition coil). The Postmaster-General hopes that the remaining motorists and motor-cyclists, when they realise what trouble they are causing, will bring their own vehicles and machines up to date by fitting suppressors, and that the question of compelling them to do so will not arise. A single suppressor at the distributor will usually suffice. Alternatively, suppressors incorporated in each sparking plug, lead suppressors, or resistive leads between the distributor and the plug might be used.

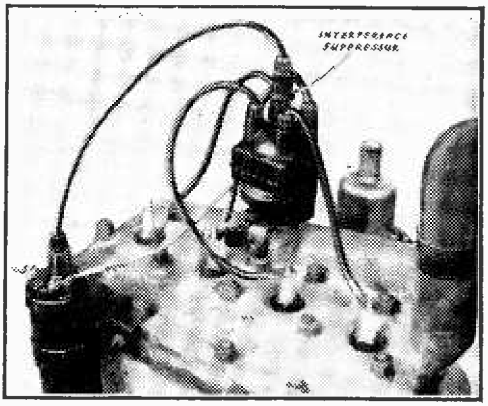
The Regulation will mean that there will be a very great reduction in interference from new cars to television reception.

The following statement was issued on behalf of the Radio Industries Council after the announcement :

" Confronted with a legal requirement that his car must be provided with interference suppressors, some motorists take the attitude—' Why should I have to do anything about interference—let them cure it at the receiving end.'

" Assuming that the motorist who says this is a good citizen and willing to do something to help his neighbour, it is worth inquiring how much the nuisance of interference must be cured by the motorist, and how much can be cured at the receiving end. . . .

" Everything has been done in the majority of television receivers to protect it against this interference. It is obviously very difficult, because the interfering signal is fundamentally similar to the television signal, and therefore difficult to sift out in the receiving apparatus. It must be reiterated that the ' interference ' is just as much a radio signal as are the radio and television signals with which it interferes. Such differences as there are between the interfering signal and the wanted signal should be exploited by the receiver, so that it may accept one and reject the other. . . ."



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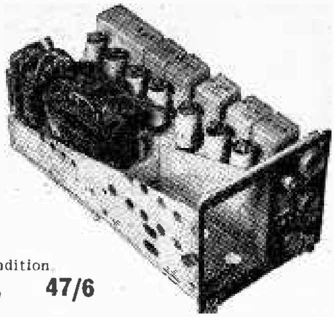

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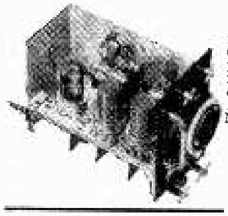

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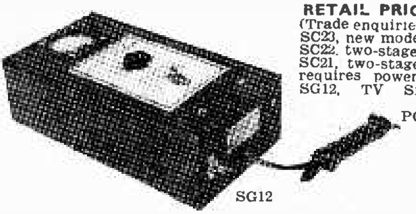

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Surgical Interference

STRANGE sources of interference continue to be unearthed.

At Grimsby, television dealers began investigations after receiving many complaints from set owners. Their enquiries led them to doctors' surgeries where electrical apparatus for heat treatment was found to be in need of suppression.

The doctors concerned co-operated with the manufacturers in screening the machinery effectively.

Projection in Street

DISCUSSIONS have been held between the Walsall Corporation's Entertainments Committee and local radio experts to consider the possibility of providing projection screens in the streets to enable the public to see the Coronation.

The snags, according to one committee member, would be probable traffic hold-ups through crowding on street corners and the viewing conditions, which are at their worst in broad daylight.

New Devon Tests

THE BBC has announced that tests are to be carried out at Shaugh Moor in Devon in an effort to find an alternative site for the erection of a television mast.

The Dartmoor Preservation Association had protested strongly when the 1,800 ft. high North Hessary Tor had been named as the location of the mast but would not particularly object to Shaugh Moor which is farther south on Dartmoor's edge. The new station will serve Torquay, Plymouth, Exeter and parts of North Cornwall.

Announcer's Advice

WHEN he opened a radio exhibition at Park Lane, Croydon recently, BBC announcer MacDonald Hobley told radio and TV fans that they should have no fear of buying a television receiver thinking they might become obsolete after two or three years through the introduction of colour transmissions.

Colour would not be introduced, he said, before everyone had access to black and white viewing. Mr. Hobley gave the year 1962 as the latest when colour programmes would be transmitted.

Cinema's Policy

IN their efforts to draw the public back to the cinema, film makers have continued with their "open air adventure" policy, leaving drawing-room plays for TV to produce.

The idea appears to be paying dividends, as four of the biggest money-making pictures during 1952 were all set with the skies, countryside or jungle as a background. They were "Quo Vadis," "The African Queen," "The Sound Barrier" and "Ivanhoe."

Early Viewing

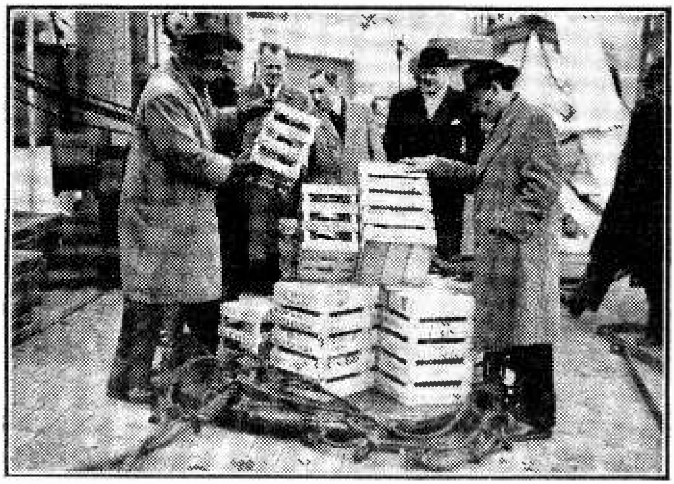
MR. JOHN PROFUMO, M.P. for Stratford-on-Avon, found during his recent visit to the United States that the number of television-viewing hours over there differs considerably from that in this country.

Mr. Profumo made his TV debut while in America and was interviewed in front of the cameras at 7 a.m., watched by an audience of at least 5,000,000.

Engineers' Rise

AN award of 15 shillings a week has been granted by the Industrial Disputes Tribunal to radio and television engineers, bringing the new minimum wage to £6 5s.

The new electric glass cooker being demonstrated in a recent TV programme.



Senor Jose Maria de Ayarra, Chief Engineer of Television Venezolana S.A. (Televisa),—right—with shipping officials watching the loading at London Docks of the first consignment of television equipment from Marconi's Wireless Telegraph Co., Ltd., for Caracas, capital of Venezuela. Senor de Ayarra recently completed a six months' visit to the company in which he has gained experience of the equipment.

Television Licences

THE following statement shows the approximate number of television licences issued during the year ended October, 1952. The grand total of sound and television licences was 12,870,101.

Region	Number
London Postal	633,743
Home Counties	208,657
Midland	399,923
North Eastern	169,480
North Western	203,708
South Western	37,954
Welsh and Border ...	48,099
Total England & Wales...	1,701,564
Scotland	31,128
Northern Ireland ...	190
Grand Total	1,732,882

Church Services

THE Presbytery of Dunoon recently approached the BBC on the subject of church services that are televised at the normal Evensong hour, thus enticing people with receivers to stay at home for their worship, leaving churches emptier.

Cooker for Demonstrations

A NEW type of electric cooker made its appearance at the Alexandra Palace studios recently.

Specially made for television by the Jackson Electric Stove Co., Ltd., the oven has glass back, front and sides to enable the studio lights to illuminate the interior, permitting viewers to see food in the actual process of cooking. It has so far been featured in two programmes and is expected to be used many more times by the TV cookery experts, Marguerite Patten and Philip Harben.

Eviction Order

BECAUSE he erected a television aerial without the County Council's consent, Mr. William Kirk, a 33-year-old foreman engineer, of Hallfield Gardens, Kennoway, Fife, was served with an eviction order.

The County Clerk stated that the tenant was warned in June that an application and an inspection charge of one guinea were necessary but no effort had been made to pay the fee.

Mr. Kirk claimed that a Council clerk had told him there would be nothing to pay.

Record Sales

PROVISIONAL figures of production and manufacturers' sales of television receivers last October are the highest ever. Nearly 85,000 sets were produced, the previous highest figure being 72,000 in February last. Sales to the trade exceeded 100,000, compared with 75,000 in September, the previous record.

A forecast at the time of the Radio Show that sales would take a definite upward turn, particularly because of public anticipation of seeing a large part of the Coronation on television, has thus been fully borne out.

Ban on Rugby Final

THE Rugby League Council has been asked by its secretary to refuse permission for the televising of the Rugby League Cup Final at Wembley on April 2nd.

The secretary, Mr. W. Fallowfield, said that as the final was being played such a distance away from the area where it was most popular, television was more likely to affect the attendance and that although there were no figures to prove that television had affected gate receipts in the past, adversely nothing showed that any beneficial effect was to be gained.

Popularity

ONLY 250 spectators could be accommodated in Motherwell Swimming Baths recently when the Scottish Television O.B. Unit televised the Motherwell Amateur Swimming Club's Gala, at which famous Scottish and English swimmers were competing against each other. Bathmaster David Crabb wanted a much larger Motherwell public to see the show, and three leading dealers arranged a mass TV demonstration in the Motherwell Town Hall by giving a free view of the transmission of the Gala.

Philips Television receivers, both projection and direct view types, were used throughout, and large crowds visited the Town Hall to enjoy the programme.

Philips receivers were also installed in the dressing-rooms for the benefit of competing swimmers.

Television for Siam

BRITISH equipment will be used by the first country in S.E. Asia to install television. A contract, for two installations each complete from camera to receivers, has been agreed with Marconi's Wireless Telegraph Co., Ltd., by the Department of Public Relations, Government of Thailand.

Each installation consists of a Marconi Image Orthicon television camera, camera control, together with low-power sound and vision transmitters and associated equipment. Range of signals at this power is limited approximately to line of sight ; in exposed country this may be up to 30 miles, i.e., to the horizon, in urban areas a reduced range. Both systems will operate on a 625-line standard.

The contract also requires a supply of 16in. metal-tube domestic receivers for each installation. These will be supplied through the English Electric Co., Ltd.

HENRY'S

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

PYE 45 Mc/s STRIP. Size 15in. x 8in. x 2in. Complete with 45 mc/s Pye Strip, 12 valves, 10 EF50, EB34 and EA50, volume controls and hosts of Resistors and Condensers. Sound and vision can be incorporated on this chassis with minimum space. New condition. Modification data supplied. Price **£5**, carriage paid.

★ A COMBINED SIGNAL TRACER AND AUDIO OSCILLATOR ★

An easy-to-build unit that can be used for I.F. and Audio signal tracing, without any switching or tuning, including variable output oscillator, for amplifier checking. Highly sensitive, responds to signals picked up from an ordinary receiving aerial. The circuit is that of a high-gain 2-stage, resistance-coupled audio frequency amplifier, employing 3 miniature 1.4 valves, with a 3in. speaker in the output of the Power Amplifier Stage. An added advantage being that as this Unit is " All-Dry " it can be used with safety on A.C. or A.C./D.C. mains and Battery sets. The complete Kit with portable cabinet (size 6in. x 7in. x 6in.) and battery weighs only 4 lbs. We shall be pleased to supply a complete Kit for the construction of the above, right down to the last nut and bolt, including 2-1T4 and 1-1S4 Valves, 3in. Speaker and Portable case and All-Dry Battery for **£4/19/6.** Concise instructions and circuits supplied. If preferred, circuit and instructions only can be supplied for **1/6.** If required this Unit will be assembled and tested for an extra charge of **15/-.** This is a highly efficient instrument, and a MUST for every radio man.

WALKIE-TALKIE TYPE " 46 " complete with 6 valves, 2VP23, HL23, DD, QP25, TP25 and ATP4, aerial rods, I.F. trans., 1.6 mc/s. mike trans. in new condition, but less transmitting components and coils removed by M.O.S., **35/-**, carr paid. (Less Valves, **12/6.**)

CATHODE RAY TUBES :
VCR97. Guaranteed full picture. **40/-**, carr. 5/-.
VCR517 Guaranteed full picture. **40/-**, carr. 5/-.
3BP1. Television or scopes, **25/-**, carr. 3/-.

STROBE UNITS. Brand New, in sealed cartons, these contain SIX EF50s, five EA50s, one SP61, a host of condensers, resistors, transformers, chokes, relays, switches, seven pots and five smoothing condensers. Size 18in. x 8½in. x 7½in. Only **67/6,** plus 5/- carriage.

SPECIAL VALVE OFFER

TEN EF50. Brand New (ex-units), 55/- set.
SET OF 5 MAINS VALVES
6K8GT, 6K7GT, 6Q7G, 5Z4, 6V6G or KT61, 42/6 Set.
SET 5 A.C./D.C. VALVES
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12K8GT, 12K7GT, 12Q7GT, 35Z4GT, 35L6GT or 50L6GT, 45/- Set.
SET 5 A.C./D.C. VALVES
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SET 5 A.C./D.C. VALVES
6A7G, 6D6, 6C6, 43, 25Z5, 45/- Set.

SET OF 4 BATTERY MINIATURE 1.4 v. VALVES
1R5, 1S5, 1T4, 1S4 or (3S4 or 3V4), **32/6** Set.
SET OF BATTERY VALVES 2 volt MAZDA TYPES
TP25, HL23/DD, VP23, PEN25 or QP25, **27/6** Set.
COMPLETE SET OF 10 SPECIFIED VALVES FOR " PRACTICAL TELEVISION " PERSONAL REC.
5-6AM6, 2-6AK5, 1-EA50, 1-6J6, 1-6J4, and 3BP1 C.R. Tube in case, **£5/12/6** Set.
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The output is continuously variable between 8 to 12 kV. at approximately 500 micro-amps.

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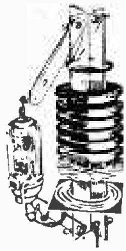
The unit is completely wired and tested ready to switch on, requiring only H.T. and L.T. connections. Ample shielding is provided to prevent radiation and interference to Broadcast receivers. The coil with rectifier incorporated may be purchased separately. Full instructions and data supplied.



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100,000 ohms—1,000 ohms	1 mfd.—.01 mfd.
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HAYNES. — Scanning Coils, S914, S914H, S112, 42/-; S27, 45/-; Osc. Trans. TQ132, 13/-; TQ135, 18/6; Feed Chokes LUS8F, 23/-; LUS6L, 18/6; Line Trans., TW6 126, TW5 109, 42/-; Frame Trans., TK10/41, 38/-; E.H.T. Line Trans., T27, 132/6; T34, 50/-; Amp. Control, VL5, 12/6; Tuning Coil Kit, 20/-; P/pull Output Trans., TK12/61, 38/-.
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COILS.—All Wearite "P" Coils stocked, 3/- each. All Weymouth Coils stocked: "H," 3/9; "K," 4/9; CT2W2, 10/6 pair; CS3W3, 12/6.
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are designed to match the above Transformer and to give a 70 deg. Scan.

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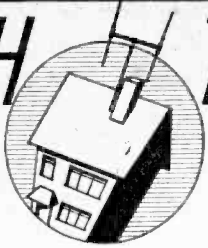


By Iconos

SATIRE

SATIRE and burlesque come over very well on TV, and I must say that I enjoy the occasional presentations of intimate revues. TV will truly have attained a grown-up status when it can afford to guy itself and its devotees. Eric Barker's burlesques of "In the News" and "Picture Page" clicked home, even if other items in his show fell a little flat. Perhaps some day the Outside TV Department will take us to the Annual Dinners of the Vaudeville Golfing Society or the Stage Golfing Society, where burlesque and satire are seen at their best in speeches and in cabaret. Naturally, such shows would be preceded with a Censor's "X" certificate!

TOP PRIORITY

LONG-RANGE preparations for putting the Coronation on TV are now in full swing. The newsreel editors, TV feature producers and sponsored television promoters are vying with one another in thinking up new methods of reporting and presentation. Demands for new technical facilities are cropping up almost daily and the back room boys of the BBC Research Department and also of the radio, recording and TV manufacturers are feverishly trying to cope. In turn, they pass some of their problems on to other industries with an insistence on "top priority." Some of the problems might have taken years to materialise—but the Coronation has speeded the pace of development to an extraordinary degree. There is no doubt at all that there are many technical surprises in store for viewers.

THE ZOOM LENS

ONE of the greatest and most important of the new Coronation devices will be a super Zoom lens, the product of the great British optical firm of Taylor, Taylor and Hobson of Leicester. Detailed particulars are not yet available but it is a fact that the pick-up angle of the lens can be narrowed from a vast long-shot down to a close-up of one individual. For instance, the lens might embrace, from a high viewpoint, the whole of a football field. Turning a handle at the side of the lens, the angle narrows and narrows until it becomes a very long focus telephoto lens, concentrating upon the single figure of the referee. Zoom lenses are not entirely new, but their range of variable focal length has been restricted, their size bulky and their cost excessive. The demand from several sources for an improved Zoom lens has spurred the optical makers on to achieve what seemed to be the impossible, and the unavoidably high development charges can be spread over several orders. Nevertheless, I don't suppose the cost will be much less than £1,000 each, which was somewhere about the cost of the much less spectacular pre-war Zoom lens, results of which are often seen on TV.

OPTICAL PROGRESS

THE legend of the superiority of German lenses dies hard. At one time, even American optical manufacturers using German names seemed to be preferred to the less glamorously sounding names of Ross, Beck, Wray or Cooke. Dallmeyer was the only British firm whose name seemed to suggest the magic of Jena, home of Zeiss and the "secret craft" of lens polishing. But the original anastigmatic patents taken out by Cooke, an Englishman, and were developed by Taylor, Taylor and Hobson. Since World War I, the British Optical firms have forged ahead with camera lenses, binoculars, range finders—and now, television camera lenses. Today, 90 per cent. of the lenses used in Hollywood film and TV studios are of British manufacture. American TV cameras (as distinct from TV-film cameras) use lenses made in U.S.A. at the moment, but I think it will not be long before the new British lenses replace them. Here's another valuable dollar-saving export in the TV field!

The Coronation will be responsible for accelerated progress in many other fields connected with TV, and the BBC have placed (or are placing) very large contracts for new and original devices besides the super Zoom lenses. There will be new and improved telefilm recording cameras, incorporating magnetic recording for sound; new picture cameras for the BBC newsreel; new radio links and relay stations and a great increase in personnel. In addition sponsored television interests and the cinema newsreels will be straining their resources to secure film records of the Coronation, including colour films. I haven't yet heard that stereoscopic picture recordings will be made—but I expect they will be in evidence, too, though not under the jurisdiction of the BBC. Stereoscopic films still require viewers to wear coloured or polarised spectacles or similar devices which isolate the right eye's viewpoint from the left. I suppose that the projection on TV of alternate film frames from each aspect at the rate of 25 frames a second, polarised, and viewed with appropriate polarised glasses would give true stereoscopy on television. But, what discomfort for viewers without polarised spectacles!

SQUARE DANCING

THE craze for American Square dancing is spreading like wildfire through London, suburbia and the provinces. True, "Olde-tyme Square Dancing" has been popular for some years, but it has derived from the Scottish and Outer Islands dancing, together with the Lancers of English dancing. TV, more than anything else has introduced the American (or, to be strictly correct, Canadian) flavour to the proceedings and David Miller has set the example to the new (or rather, "olde") calling of "caller." His easy, friendly manner, his sense of rhythm and his pleasant voice guide the good-looking youngsters who perform the intricate dance patterns on TV. The smoothness of the David Miller presentations gives one the idea that it is all very easy, and many a household ornament must have been knocked over by young viewers trying to imitate the experts while watching the TV screen. Anyway, David Miller is now the big star Caller, and huge audiences of Square Dancing enthusiasts attend the galas over which he presides. TV has been responsible for the increased public appreciation of dancing of all kinds, ballet, tap, exhibition and now, square dancing.

The Film in Television

By Philip H. Dorté, O.B.E., A.M.I.E.E.

A paper read by the Head of BBC Television Films to the Kinematograph Group of the Royal Photographic Society of Great Britain

(*Concluded from page* 311 *December* 1952 *Issue*)

THAT a company has already been formed in England to make telefilms this way we already know. What we do not know, of course is whether the telefilms which they will make will be for television broadcasting as well as for the cinema.

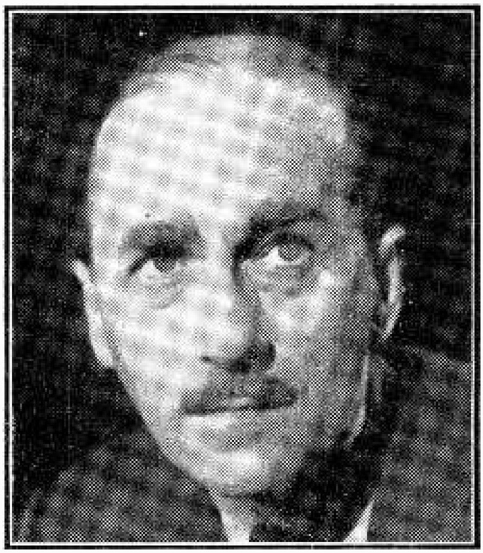
And we do not know as yet if there is to be a future in recording *vision* on magnetic, instead of photographic, film. The Americans are actively working on this problem and, if they succeed, they will have achieved a very important step indeed towards the goal of economy. For, whatever the method used for making telefilms or films for television, every economy *must* be exerted, and there is no such thing as precedent. Continually we remind ourselves of this, and constantly we encourage each other to exploit ingenuity to the full in the quest of saving time and money. Long ago we gave up making married prints as a matter of course—this because both time and money can usually be saved if one televises picture and sound from separate films. The obvious development from that was not to have the sound-track printed, and it almost automatically followed that if one recorded sound on magnetic instead of photographic film, no sound processing at all would be required and the sound-film could subsequently be wiped and used again. Equally, it followed that if one was prepared to forgo the advantages of picture grading which only printing can provide, one could save more time and more money if one loaded picture-negative on the film-scanning equipment and, by reversing phase electrically, could feed a positive picture to the actual transmitters. This is now frequently done, and the next step is so to modify the film-scanning equipment that, say, printing-clips inserted in the picture negative will alter the electrical gamma of the system and thus do during transmission more or less what the grader now does earlier in the laboratory.

Economies can, I assure you, be endless. With the advance in film stocks, the resolution of 16mm picture can today be almost as good as 35mm, assuming always that it is not going to be projected on a screen the size of, say, that at the Empire, Leicester Square. There is little likelihood of *television* screens being that size in the immediate future, so an obvious "next move" is for us to follow the precedent of American television and make a lot of our television films on 16mm. The difficulty here is the degradation that would occur in sound, but a solution lies in recording the sound in synchronisation on full-size magnetic film.

Costs

I cannot close this lecture without demonstrating what I regard as ingenuity at its very best. The bare film stock and processing costs of making a telefilm on 35mm film are around £130 an hour. The cost of doing the same thing on 16mm is £74 an hour. It is frequently desirable to make a telefilm not for re-transmission but for post-mortem purposes, so that the producer, the technicians, and the artists can sit back quietly the next day and get some idea of what they had broadcast the previous night. To make this possible at a moderate cost, one of my staff, Mr. Donald Smith, devised a system which records on 16mm film operating at a speed of $16\frac{2}{3}$ frames per second. The film costs work out at less than £30 an hour by this method, and the result is more than adequate for the purpose for which it is intended. Here is an excerpt from a recording made in this manner—a recording that is not, incidentally, "closed-circuit" but which was actually made off the air in Mr. Smith's home in London. It is from the television programme, "What's My Line?" [*Film projected.*]

Lastly, I would like to show you an example of a film which is not conspicuous for production economy, but which is an example of the need for the preservation



Philip Dorté, Head of Television Outside Broadcasts, Films.

of almost every foot of film shot for television, even though that means that already the BBC Television Film Unit Library houses upwards of eight million feet and that it is now growing at the rate of several million feet each year. I refer to the "Retrospect" films which we make at the end of each year—films which recall the highlights of the year as seen through the lenses of our television outside broadcast cameras and of our television film cameras. To demonstrate this, I have selected the last reel of "Retrospect 1950" which, like its predecessors and its successor, is a six-reel film containing some 150 items carefully selected from the 1,000-odd Newsreel and Telefilm stories which were eligible for inclusion. In point of fact, the major part of this reel covers the 1950 campaign in Korea, and it is ironical that in some ways it is so dated but that in others it is still so highly topical. [*The film was projected and this concluded the lecture.*]

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).

HOME-MADE FILTER

SIR,—I have a suggestion for making a filter for a television receiver to enable better viewing in daylight.

This can be constructed quite cheaply as follows: Obtain two pieces of thin glass (I used picture frame glass) of a size suitable for covering the front of the viewing aperture, and between these place a piece of coloured Cellophane (I used blue). Any colour will do to suit individual requirements, and this can be obtained quite cheaply from most stationers.

The edges of the glass are now bound with Cellotape, which effectively holds both the glass and Cellophane together.

The filter can be attached to the set either by a strip of Cellotape, or by means of four suction cups, of the type used for holding soap dishes to tiles, etc. These can be arranged to hold the filter along the top and bottom edges.—R. HUNTER (Morecambe).

"ARGUS" HINTS

SIR,—Herewith a few "Argus" modifications which may be of interest:

(1) All H.T. transformer leads terminated on tag strips; this helps to prevent fractured leads and facilitates testing.

(2) Fuse in H.T. secondary earthed centre tap; prevents damage to transformer or rectifier in the event of a capacitor failing (omission of this fuse proved costly when a capacitor broke down on my televisor).

(3) One recommended transformer (U.E.I. Corp.) has centre tapped L.T. windings which might perplex a novice constructor; both feeds, of course, must be insulated and the centre point earthed.

(4) The first 16 μF capacitor is 500 v.w. to withstand initial surges of which it takes the full brunt.

(5) For convenience, the "Argus" has been assembled as two main units, T.B. and C.R.T. chassis comprising one, and power, audio and video components the other (they can be bolted together or stood side by side); a five-way recessed socket carries the power to a chassis mounting plug and the signal is via a Belling Lee coaxial plug and socket.

(6) Vertical and horizontal shift controls are mounted on a small sub-panel and adjusted through holes in rear of main chassis; this obviates projecting controls at rear of cabinet.

(7) All cores and trimmers are accessible through holes in top of panels. The convenience justifies the extra work involved, mounting the items on insulated supports.

(8) Ebonite rods are used for brightness and focus extensions, as these fit standard couplings and make for safety.

(9) Wood blocks ¾in. thick support the C.R.T.; the blocks are metallic painted. Valveholders 14-15 and 17 on blueprint do not show pin 6 earthed; earthing the metallising helps stability. Although the "Argus" will only be my stand-by televisor, the reliability of PRACTICAL TELEVISION circuits is well known. —A. C. DEVERELL (Rickmanworth).

A 10-INCH VCR97?

SIR,—For the many viewers who are using a VCR97 cathode-ray tube with the much advertised 25s. magnifying lens, I am sure the following notes will be of interest.

By sliding a larger lens into suitable brackets, made so that the rear surface of the larger lens just misses the curved surface of the smaller lens, you will be surprised at the excellent results obtained by the double magnification.

My own family have been enjoying for over a year this much enlarged picture comparable to a 10in. direct-viewing tube. The larger lens was 50s. at the time of buying. It is well worth it when you think of a larger tube and the cost involved in alterations to timebase and power circuits plus replacement costs should the tube become faulty. In fact, it is a "must" for all viewers who long for a larger picture but cannot afford a larger tube.—B. J. ALEXANDER (Birmingham).

TWO LOW-NOISE PRE-AMPLIFIERS

SIR,—May I point out an error in Fig. 1, page 299, of the December issue. I corrected this figure in the proof stage, but it has apparently been overlooked.

The earth should go to the earth line where the grid of the valve joins the common earth. A 500 pF condenser is inserted between this point and the point where the H.T. via the 10 KΩ resistor is fed to the base of the second coil. The second coil is not earthed. —B. L. MORLEY (Bristol).

HOME-CONSTRUCTOR RESULTS

SIR,—Thank you for your letter of September 8 which encouraged me to construct a Viewmaster. The results compare favourably with the local commercial receivers.

And I would like to mention the excellent service given me by Mr. L. F. Hanney, of Bath, with whom I got in touch from his advertisements in PRACTICAL TELEVISION.

It seems a pity that the BBC do not put on Test Card C at some stated time after, say, 6.30 p.m. for about half an hour. It would help amateurs. I notice that your correspondents with problems seldom refer to the card, because, no doubt, they are at business at 10 a.m.— G. LEE EVANS (Dorset).

LONG-DISTANCE RECEPTION

SIR,—Mr. R. Parfrey, of Portsmouth, whose query re long-distance reception was answered in your November issue, may be interested to know of my experience in the matter.

Anxious to be first in the district to receive TV on a home-built set, I purchased an R1355 together with an R.F.25 unit, but subsequently found that reception was ten times as good when the tuning unit was dispensed with and the I.F. strip was converted to a superhet circuit, in which a frequency-changer is substituted for the *second* valve, the remaining I.F. coils being unaltered. —HAROLD E. HENLEY (Isle of Wight).

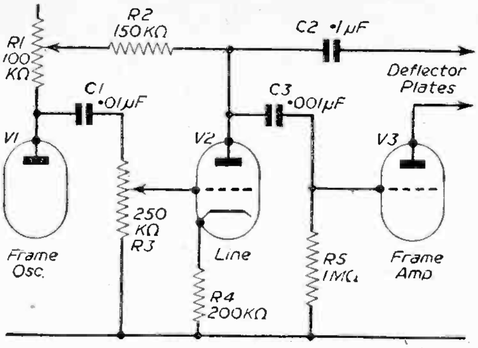
TIMEBASE HINT

SIR,—I have no doubt that many home constructors have been disappointed, as I have, with the linearity of the Miller timebase, especially at frame frequency.

Having had much trouble in this respect, I evolved the following circuit which I have found most effective.

I trust that the circuit will be found almost to explain itself. I have found it to be most effective in use, although some loss in frame oscillator output results.

The output from V1 is fed from V1 via R1, R2 to the anode of V2 and one deflector plate, whilst the output from V1 is low (i.e., at the beginning of the sawtooth wave-form). R2 presents little resistance to the coupling due to the high bias on V2 caused by R4. However, as the slope " ascends " and the voltage becomes higher, the



An improvement on the Miller timebase as suggested by Mr. Williams.

bias on V2 is overcome by the voltage applied to the grid of V2 via C1, and the valve conducts, causing a drop in volts at its anode and cancelling out some portion of the frame oscillator output. For V2 I use a VR65 with the anode ; screen and suppressor grids strapped together to obtain triode working.

Hoping this may be of some little help to someone. —G. WILLIAMS (W.14).

CAGE AERIAL

SIR,—I notice some correspondence in your December issue between Mr. H. B. Gregory and " Erg " on the subject of bandwidth of TV receiving aerials and the reference to my I.E.E. paper. " Erg." in his reply to Mr. Gregory, suggests that my figures for the bandwidth were based solely on theory. This is incorrect. The paper derives the bandwidth based upon theory and goes on to describe measurements which show that the bandwidth is slightly in excess of the calculated value. The excess is probably due to (a) the influence of the feeder on the aerial, and (b) the losses due to imperfect soil conductivity.

I can only support Mr. Gregory in this case.—F. R. W. Strafford (E.4).

LOW-NOISE PRE-AMPLIFIERS

SIR,—In the last paragraph of my previous letter on this subject, I said that it would appear that a misprint had occurred and that EF91 was intended whereas EF95 was quoted. I hereby hang my head in shame, for almost alongside my letter in the Correspondence columns the Mullard EF95 is reviewed in " News from the Trade ! " However, as the review mentions that this valve is similar in characteristics to the American 6AK5, I assume that my error is not so great after all, for as I pointed out in my letter the 6AK5 suppressor grid is internally connected to cathode. If the EF95 electrode connections are the same as for a 6AK5, then my suggestion that an EF91 is the right type is substantiated. I must confess that until I saw the review of the EF95 I was not aware that such a type existed.

It may be of interest to other readers to have a report of how the circuit in question turns out in practice. A few days after Mr. Thomson's article appeared I made up a unit to the circuit in Fig. 2, using EF.91's triode connected. The layout suggested in the article was not strictly adhered to, though the usual precautions of inter-stage screens, short wiring, and proper placement of components were observed. The coils were wound with 34 s.w.g. D.S.C., except the coupling windings, which were wound with 23 s.w.g. P.V.C. insulated wire. The capacitors used were Hunts W.99 miniatures. In operation, this pre-amplifier was found to tune broadly, and there is ample gain with a very low noise level. It was not found necessary to depart from the value of 6.8 KΩ for the damping resistor across the tuned winding of L3. A built-in power supply unit uses a 6X5 fed from a 250-0-250 winding on the small mains transformer, smoothing being attained with a 5 KΩ 5 watt resistor and two 32 μF electrolytics. With these values, there is 180 volts on the H.T. rail, though the unit seems to work just as well with only 150 volts.

This pre-amplifier has produced the following results. The commercial television receiver used in the test is not a fringe model—it has four EF.50's in the T.R.F. vision strip. Without a pre-amplifier, with contrast and sensitivity controls " full bore," and connected to an antiference three-element array through a properly matched feeder, a picture can be resolved provided that signal conditions are average for this locality. Sound is not good, for if speakers talk quietly or " confidentially " much of what they say is lost. The milky picture needs only slight fading to make it break up or roll, due to loss of sync. With the pre-amplifier in use, and given the same average signal conditions, an excellent picture is regularly obtained with the contrast set right back and the sensitivity control backed off. The brilliance control also has to be set back. The sound volume control need only be turned about half-way up to obtain ample volume.

If the contrast is turned half-way up, the picture goes negative, and turning this control beyond that point causes the R.F. stages in the receiver to break into self-oscillation, though the pre-amplifier remains perfectly stable. There is some grain, but this is not caused by the pre-amp.

When one considers the location, which is far outside the so-called fringe area, and the house is in a hollow, I feel this is adequate proof that this pre-amplifier is doing a good job of work.—W. E. THOMPSON (St. Leonards-on-sea).

15in. VIEW MASTER

SIR,—Being a regular subscriber to your magazine I wonder why no one has mentioned the fact that an Emiscope TA15 tube will make a View Master 15in. in size without alteration, except for a separate filament supply of 4 volts. I have been using one for the past 12 months with perfect results. The length of neck means an extension of focus magnet, but being rated at 7 kV no alteration of E.H.T. is necessary and scan coils are O.K. Trusting this information will be of assistance. —D. SHALLCROSS (Chester).

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. 383 must be attached to all Queries, and if a postal reply is required a stamped and addressed envelope must be enclosed.

TUBE FAULT

I am writing to ask your advice on a problem that has arisen with my set. After switching on the picture is perfect, but will jump in and out of focus every few seconds. Can you advise ?—F. Austin (N.16).

From your description we suspect that your cathode ray tube has developed an intermittent heater-cathode short and will therefore have to be replaced.

LINE TEARING

I have built your "View Master" and have been had it operating for some months and have been very pleased with results, other than one fault which I cannot overcome and remedy. I have re-aligned coil slug settings time and time again with no response to rectifying fault. The picture appears to partially tear away in some places varying at times from top, middle and bottom. If it occurs at bottom it gives appearance of person with legs broken in several places. I have looked back for several months in your "problems" section as I am a regular reader of "Practical Television," and I cannot see any query from any reader relating to this problem. I have changed line and frame generators over, also EF50's. I have also removed spot suppressor circuit, as it rather seems to me as a case of pulling on whites, but with no effect.—J. F. Gifford (Kensal Rise).

The fault you describe may be caused by C18 or R21 giving an incorrect time constant, and we suggest these components be replaced. Also check R20, R53, C37, R43 and R42.

VCR112 DETAILS

I am in possession of a type VCR112 tube, and would be greatly obliged if you could furnish me with information regarding the base connections, and the values of a suitable E.H.T. chain for this tube.—(Liverpool 11).

The following characteristics and base connections refer to the VCR112 tube :—

Heater : 4 volts, 1 amp.
VA_1 = 250 volts
VA_2 = 560 volts for focus
VA_3 = 3,000 volts
Vg = −60 volts for cut-off
X-sensitivity = 0.25 mm/V
Y-sensitivity = 0.14 mm/V

Basing : 7 pin as follows :

1	2	3	4	5	6	7
G	H–K	H	A_1	A_2	X_1	X_2

with side contacts for A_3, Y_1 and Y_2. Note that heater and cathode are strapped to pin 2 and so grid modulation must be employed with a separate heater winding.

LINE OSCILLATION ?

Will you please help me with this fault ?

There is a light band, about ¼in. wide, running down the picture 3in. from the left-hand side, only really noticeable when something dark is on the screen. It will vanish when the line-hold is in a certain position, which moves the picture to the right, but the setting is so critical it will not stay put. Inside the set are eight coils, seven on top in cans, and one underneath, open; I'm told it's the oscillator. Moving this will get rid of the line, but leaves bad sound on vision—in fact, there is always some sound on vision.

Also, the horizontal lines making up the picture will not hold steady. At the anti-clock end of steady picture on framehold the lines are steady, but an increase of picture brightness (transmitted) will make picture roll. Also, advancing the contrast control does the same. Contrast control and framehold control both affect horizontal lines forming picture. So for a locked picture I have to turn framehold clockwise, and then the lines are like a bag of worms :—Jack Pickard (Greasby).

The light band on the picture is due to undamped resonances on the line output stage, and in normal circumstances can be cleared by adjustment of the line linearity control used in conjunction with the width control. If these controls have no effect, then a fault has developed in one of the components making up the line output circuit (most probably the damping section), and it is this part of the circuit that must be checked for the fault.

HIGH-NOTE RESPONSE

My trouble is hissing on speech. I have tried a new N37 sound output valve, but this does not cure the trouble. I may add that a loud hum is caused when the contrast control is turned clockwise to lighten the picture. I would be grateful if you could give me some information on the set-up of this G.E.C. model.—N. V. Hollingworth (Liverpool).

The hiss on sound may be the result of the normally extended frequency response found in television receivers, and, unless some top cut is provided, the effect can be objectionable to a listener used to normal sound broadcasts. A 0.01 μF condenser is wired from the output sound valve anode to earth already in the G.E.C. receiver, but this may be low in value and another should be tried. If the trouble then persists, you should check on the setting of the interference limiter.

The hum on sound when the contrast is turned is due to frame frequency breakthrough, and the above hiss may be the line pulses breaking through in the same way : this indicates an incorrect oscillator tuning setting, and a careful readjustment may cure the fault. Faulty H.T. line decoupling to the sound receiver can also be responsible.

E.H.T. SUPPLY

I have rather an annoying fault with my projection set, which up to the present I have been unable to rectify. Could you advise me as to what is likely to be the trouble ? Following are the symptoms :

The picture keeps going out of focus and at the same time getting smaller or larger. The contrast control has to be turned right down. This goes on sometimes all night, then all of a sudden it gives a "plop" and everything is all right.—L. Bennett (Sheffield, 2).

It would appear from your remarks that the fault lies in the E.H.T. supply to the tube, as the variations in the picture size and focus are characteristic of this. The E.H.T. in this receiver is derived from a R.F. oscillator system, which in turn draws its own H.T. supply from the normal power unit. A valve or component may be failing in this oscillator, but it is also possible for a fault on the normal H.T. line to lead to the effect. The "plop" you mention could be the result of a failing electrolytic, and you should therefore check on all smoothing condensers used throughout the set.

It is not easy to check the actual E.H.T. supply to this receiver, as this is developing about 20 kV, but if you can adapt an electrostatic meter or an instrument (drawing only a microampere load) you might check for variations during the programme.

FLY-BACK FAULT

Having built a TV, I am puzzled by these faults.

The tube in use is a Brimar C12B with 10 kV on the anode, modulation is push-pull to grid and cathode.

First, I cannot get rid of scanning lines visible at the top of the screen on all dark pictures ; reducing brilliance makes the picture too dark, and increasing contrast brings up the lines again.

Secondly, flicker, or a scintillating effect on the whites.

Thirdly, is there a measured position for the focus coil, or has this to be found by experiment ? I am using constant current, i.e., focus coil in series with the sound output transformer, and find that focus drifts towards the right of the screen. Picture shift is operated electrically, both horizontally and vertically.—P. C. Whittingham (St. Albans).

Scanning lines which appear at the top of the picture are either due to extreme non-linearity, or are the result of a foldover, the flyback time being incorrect. A critical setting of the framehold control will sometimes correct this fault, but generally an examination of the frame sync separator circuit is necessary, as incorrect values are chosen for the integrator and a time delay is occurring in the network. A "pip" sometimes leads to this trouble if Miller timebases are being used on frame, and the use of a cathode resistance in the oscillator stage (about 1,000 ohms) will sometimes correct the fault.

Usually, the position of a focus magnet is not critical, but generally the gap should be arranged to lie just in front of the grid electrode of the tube. Uneven focus in an energised type of coil may be due to an irregular gap or an actual fault in the iron used in the ring ; you should try the magnet in the main H.T. line as an experiment, as current drift in the output sound stage may be responsible for the fault.

VCR97 FOCUS DRIFT

November issue, vide Mr. G. J. King, deals excellently with magnetic tube focus and faults. I am very disappointed that electrostatic focus was not included along with magnetic.

I built a Premier 6in. two years ago. I have had, most fortunately, only focus trouble twice, which I have corrected via resistors. Would like advice dealing with this. —F. Brereton (Stoke-on-Trent).

Drift of focus with VCR97 tubes is generally due to ageing of the tube itself, and up to a point this is correctable by alteration of the resistances making up the focus control and the bleeder chain generally. A point is reached, however, where such correction is no longer possible, and the tube then has to be replaced.

H.T. FAILING

My 15in. tube set functioned satisfactorily until nine months ago, when the E.H.T. transformer burned out. This was replaced by a Westeht metal rectifier voltage tripling unit from line flyback. This worked fairly well for a short time and then I was troubled with the following faults :

1. Fluctuation in brilliance and focus.

2. Stretched L.H. side on picture.

3. Erratic fluctuations in contrast and sound volume.

4. Distortion on sound (bass distortion).

5. Worsening of all faults except No. 2 which is now slightly improved.

6. Hum on sound only (similar to hum from open circuit gram. pick-up, but not so loud).

I have checked for dry soldered joints, loose connections, etc., also line output valve has been replaced (42 M.P.T).

I am wondering whether the trouble could arise from some fault in the sound output valve.

Could you suggest the possible cause or some general line of action ?—D. Hobson (Leighton Buzzard).

All the faults you mention have something in common ; and the fault would, therefore, appear to be on the common H.T. line feeding the receiver. A failing H.T. rectifier or more likely on account of the hum on sound, a faulty electrolytic, is indicated, and you should concentrate on this line of approach rather than attempt to examine individual stages.

E.H.T. RECTIFIER FAILING

For some time, until recently, after my set was switched on the picture would gradually get darker. I used to turn up the contrast to get the picture bright again. Then someone would switch a light on in the flat and it would go too bright. Eventually I used to switch a light on and off when the picture began to fade, to bring it back to normal. Well, one night I could not get anything on the tube at all. I tried switching on and off the set and lights, but it made no difference. On one or two occasions before when I did not get a picture when I switched on, I switched off then on again, when the picture came on. However, on this occasion I could get nothing only sound. I looked over the line circuit checking voltages, resistances, etc., from the service sheet which I have. I drew a blank. Everything appeared in order with the exception of the E.H.T. which I had not a suitable voltmeter to test, so I connected 100 MΩ in series with a 0-1 milliammeter from tube anode to chassis, and after switching on the needle did not move even slightly, which led me to believe the E.H.T. wasn't there. The whistle from the line output transformer was quite audible.—L. Carron (Finchley).

It would appear from your remarks that the E.H.T. rectifier is failing ; this is a small EY51 valve lit from the line flyback voltage, and you will find it mounted inside the output transformer can. If you replace this, the trouble will probably be cured. You should check on the line output valve at the same time.

CHANGING LINE OUTPUT STAGE

I have recently purchased a secondhand TV set. Removing the chassis to clean the tube and cabinet I was rather puzzled to find the line output valve was a Cossor 61SPT. My friend happened to have the same model so I checked on his and found that the line output valve was a Mazda 6P28. The set works very well and the line output circuit does not seem to have been modified. I would be very much obliged if you could give me an explanation to this.—F. C. Banks (Chingford).

The Cossor 61SPT is a very similar valve to the 6P28 and its use in your receiver is quite in order. There will be no ill effects from its use.

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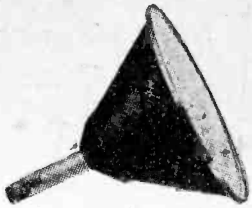

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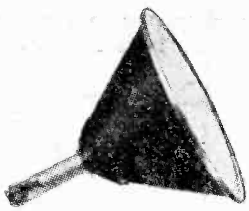

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