Timebases Simply Explained

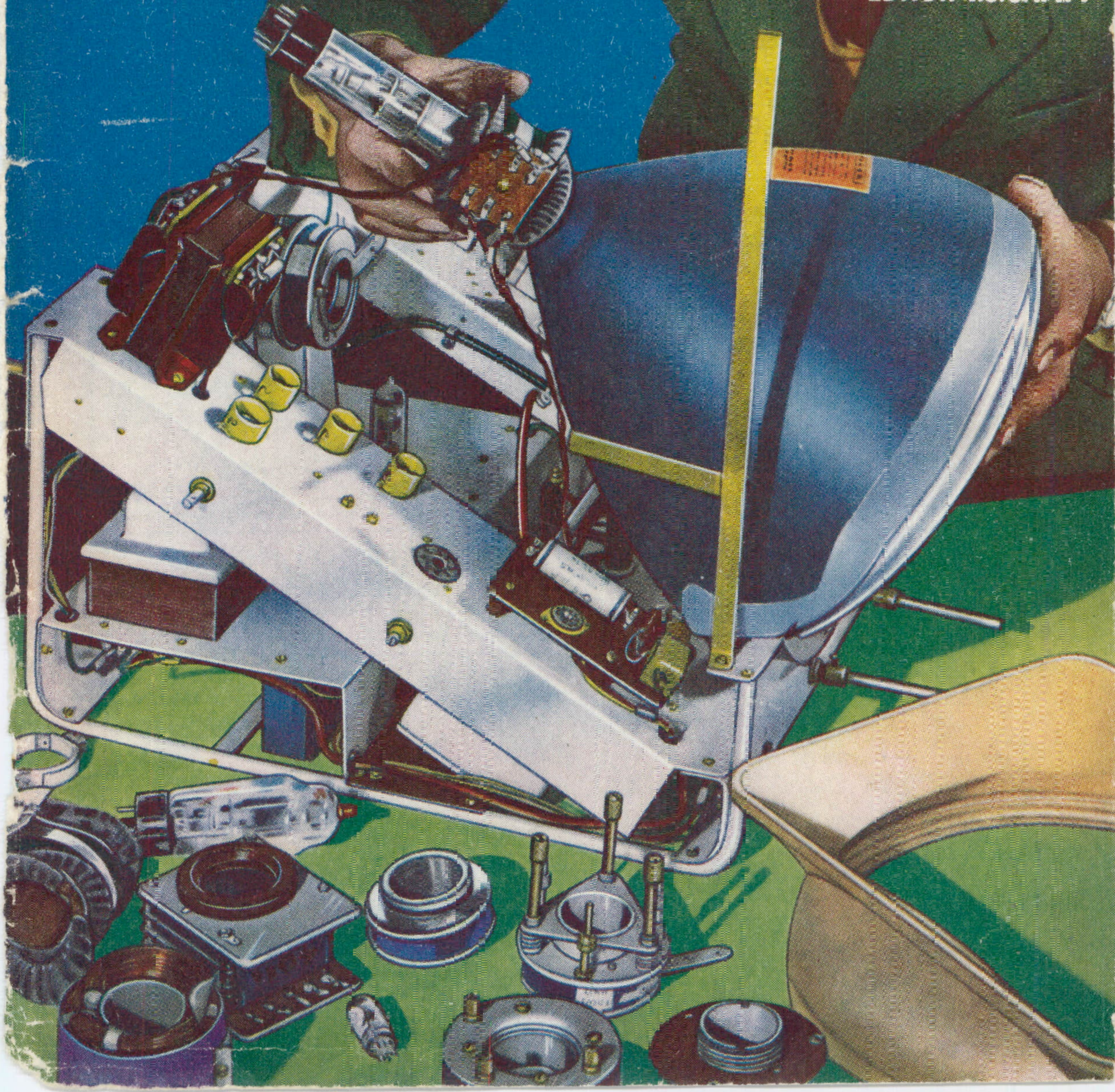
Practical Television

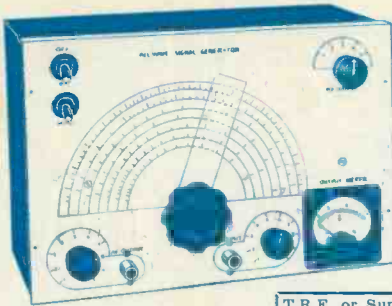
1'3

JUNE 1956

AND TELEVISION TIMES

EDITOR: F.J.CAMM





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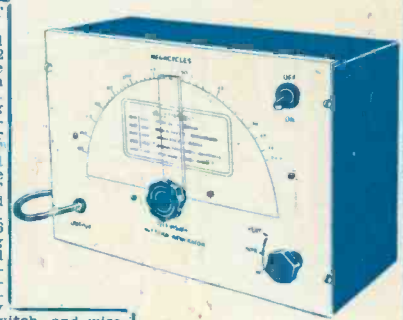

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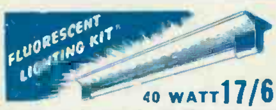

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Televiews

C.R. TUBES—A NEW PRINCIPLE

DOCTOR D. GABOR, of the Department of Electrical Engineering, Imperial College, has (as noted elsewhere in this issue) developed an entirely new form of cathode-ray tube which must, eventually, give rise to a fundamental change in the design and layout of TV receivers. Although the tube has a 21in. screen, it can be as short as 4in. in length, by virtue of the fact that the electron gun is situated at the top of the tube and projects an electron beam vertically to the bottom of the tube, where it is bent by means of an electrostatic lens through an angle of 180 degrees. The beam is then tipped by means of an electrostatic deflecting field so that it impinges on the side of the tube where the fluorescent screen is located. Aberration, both spherical and otherwise, is pre-corrected before the beam arrives at the lens. Any line required for a television picture can thus be traced on the screen. The line is provided by the deflection of the beam, and the frame by the adjustment of the electrostatic field.

One of the disadvantages of the present C.R. tube is that the receiver is of an unwieldy depth to accommodate its length. It is true that the introduction of the wide-angle tube has provided some shortening, but there are limits to which this can go. The new tube is obviously the answer, and so within a few years we may expect TV receivers of a "flatness" making it possible to suspend them on a wall like a picture.

The new tube has distinct possibilities in connection with colour television, for three separate beams can be propagated in the manner described. These beams will, of course, be deflected through different angles when passing through the electrostatic field, but the actual separation, as viewed on the screen, will be small. The system makes it possible to overcome, at least partially, the register difficulty experienced.

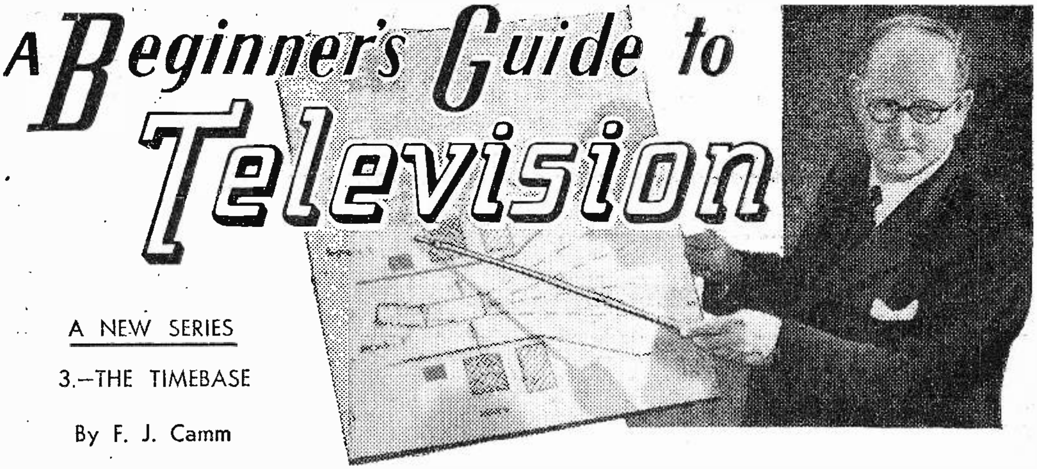
COLOUR TELEVISION

SIR IAN JACOB, in an address to members of the International Radio Consultative Committee, reviewing the position of colour television in this country as far as it relates to the BBC, pointed out that the BBC is using all the five channels in Band I, and that 97 per cent. of the population will be within reach of their television service by the end of this summer. There are at present nearly six million television receivers in use, which means that about 40 per cent. of the total population have television receivers. This leaves us eight million short of saturation point, which is considered to be 14 million. The BBC, whilst desirous of starting a second television network in Band III, is not able to do so because of economic reasons. The Government is not disposed to sanction a second television programme by the BBC or anybody else, but proposes to reconsider the matter in two years' time, when we shall be able to see much more clearly how colour TV can be woven into BBC plans.

The BBC has conducted and still is conducting a series of technical tests on colour TV, and they have been demonstrated in the research laboratories. The NTSC system of colour television, developed by the American radio industry and adopted by the Federal Communications Commission for public use in the United States, has been adapted to the British 405-line television standards and is being employed in the tests. The object of the tests is to determine whether this system gives a satisfactory colour picture without degrading to any noticeable extent the black-and-white picture which will be picked up on an existing receiver. In fact, the tests should show whether or not a compatible colour system could be introduced into Band I and similarly into Band III. Later experiments may be made with other systems, because the BBC is in no way committed to any particular one.

If the tests show that a system on 405 lines is satisfactory, it will mean that programmes in colour could be transmitted over the whole of the existing network. If the tests do not prove this, then there may not be an alternative solution suitable for adoption in Bands I and III.—F. J. C.

A Beginner's Guide to Television



A NEW SERIES

3.—THE TIMEBASE

By F. J. Camm

IN the previous article it was explained that timebases were employed in a TV receiver to produce the saw-tooth wave-form. It is important to state that with electro-static deflection a saw tooth voltage wave is required, and a saw-tooth current wave with electro-magnetic deflection.

The deflection of an electron beam of a cathode-ray tube is dependent on the magnitude of the current flowing in the deflector coils, and for electromagnetic scanning it is necessary, as we have seen, to produce a saw-tooth current wave-form. Now the deflector coil possesses inductance as well as resistance, and therefore when a saw-tooth waveform is applied to the deflector coils, the saw-tooth effect is destroyed by distortion, and to correct this, the wave-form must be such that when it is applied to the deflector coils the required saw-tooth form is produced. Let me briefly explain how the scanning spot is caused to scan the fluorescent screen by a combination of horizontal and vertical timebase systems and (refer to Fig. 11) commencing with the spot in the top left-hand corner of the tube a saw-tooth wave-form is applied to the horizontal deflector plates, with a frequency equal to the number of lines required per frame, multiplied by the number of frames per second, and a saw-tooth current wave-form is passed through the vertical deflecting coils at a frequency equal to the number of frames required per second.

The lined area on the end of the tube on which the picture appears is called the raster.

The triggering of each timebase in synchronism with the scanning of the transmitter will be dealt with later on.

Now the image received on the end of a cathode-ray tube is the counterpart of the pulses (line and frame synchronising) produced by the scanning system at the transmitting end. When received they control the scanning devices so that the spot on the frame of the received image is in precisely the same position as the picture element being scanned at the transmitter. There are many methods of generating synchronising pulses, but that most frequently employed is a control multi-vibrator associated with the scanning system of the television camera. No matter what system is employed, however, its purpose is to mark the end of each line and each frame. The frame pulse is, of course, of longer duration, so that it is possible to distinguish between them, and the receiver separates them by this difference in duration. They are transmitted with the vision signal.

When the receiver picks up the combined signal

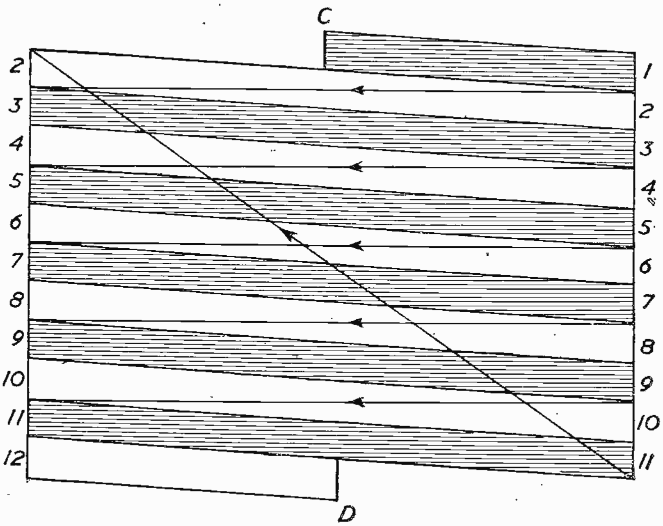


Fig. 11.—The spot movement during a complete frame scan. The spot starts at point C and traverses the lines shown shaded—that is, the odd numbers. At the end of the single scan, or first part of the interlace, when the spot arrives at the end of the line marked 11, it flies back to the point indicated by the beginning of line 2. It then scans the unshaded line, the even numbers, until it arrives at point D, when it flies back to point C, and the sequence commences again. There are, of course, considerably more than 12 lines, but the small number has been used to make the procedure clear.

and synchronising pulses it must separate them, and this is done by taking advantage of what is known as a difference in amplitude. This means that a valve is biased beyond cut-off to provide maximum signal current, and the synchronising pulses, being of greater amplitude than the signal current, raise the bias enough to permit the valve to conduct and to pass to the anode circuit free from signal variations. The pulses are then passed to a network separating the line and frame pulses.

Of course, timebases are not only used in connection with television; they are used in connection with oscilloscopes and other electronic measuring devices, and the simplest timebase of all is that which makes use of a neon tube. A neon tube timebase consists of only a capacitor, resistor, neon lamp, and a source of direct current. The principle of this simple timebase is the same as that of the more complex valve-driven circuits. It operates by virtue of the fact that if the voltage across a neon tube is gradually increased from a low value, a point will be reached when the lamp suddenly lights and passes a heavy current. This is known as the striking voltage, and if this voltage is now reduced the tube will remain alight until at some considerably lower value it suddenly goes out. This is known as the extinguishing voltage.

Suppose that a condenser C is discharged and that D.C. is applied to the input terminal of the circuit and the condenser begins to charge up through a resistance. When the E.M.F. or voltage across the condenser reaches the striking value, the neon lights and conducts heavily, thus placing a virtual short-circuit across the condenser, which discharges rapidly through the lamp, causing the voltage across it to fall rapidly. When the extinguishing voltage is reached, the lamp will go out and cease to conduct, thus removing the short-circuit from across the condenser which commences to charge again. This cycle of operations is repeated, and the frequency of repetition depends upon all the circuit constants, but in practice is usually controlled by altering the value of the resistance or the condenser, both of which govern the rate of charge.

The amplitude of the output voltage depends upon the characteristics of the neon, and will be equal to the difference between the striking voltage and the extinguishing voltage.

The Thyratron

In what is known as the thyratron timebase, a gas-filled triode or thyratron is used, and it has certain characteristics similar to those of the neon lamp. For instance, if the anode volts are increased from a low value, a point is reached where the valve suddenly conducts heavily. This is called the firing point, and if the anode volts are decreased from this value, a point is reached when the valve, as with the neon, stops conducting. The thyratron, however, has some advantages over the neon lamp. The firing point can be varied by changing the negative bias on its grid. Also, once conduction has started, it remains until the anode volts have dropped to a very low value, say between 10 and 20 volts ; whereas the neon lamp stops conducting at 100 volts, approximately. This means, in essence, that a much higher output can be obtained from a thyratron. When connected in circuit, the action of the thyratron is precisely the same as for a neon.

Thyratrons, like neons, are not generally used to-day in connection with TV receivers.

The Puckle timebase is a well-known system still much in use. Its action is as follows. When the condenser is beginning to charge up through the charging resistor, there is only a small voltage across it, and it follows that nearly all of the H.T. voltage is across the resistance. Therefore, the filament of the valve which is connected with a junction of the condenser and resistance will be near the H.T. positive line. At

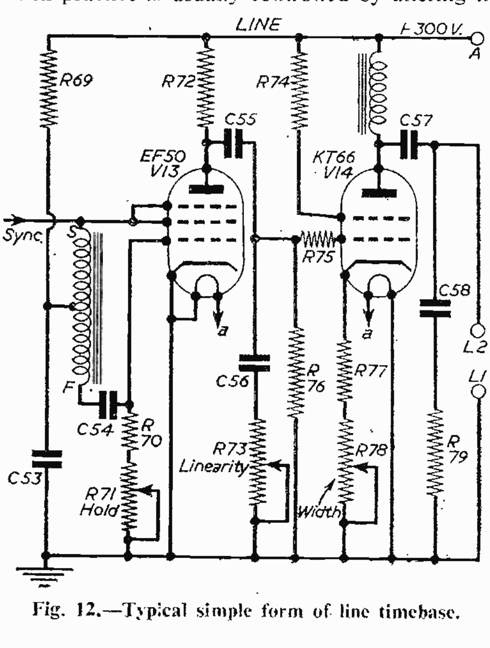


Fig. 12.—Typical simple form of line timebase.

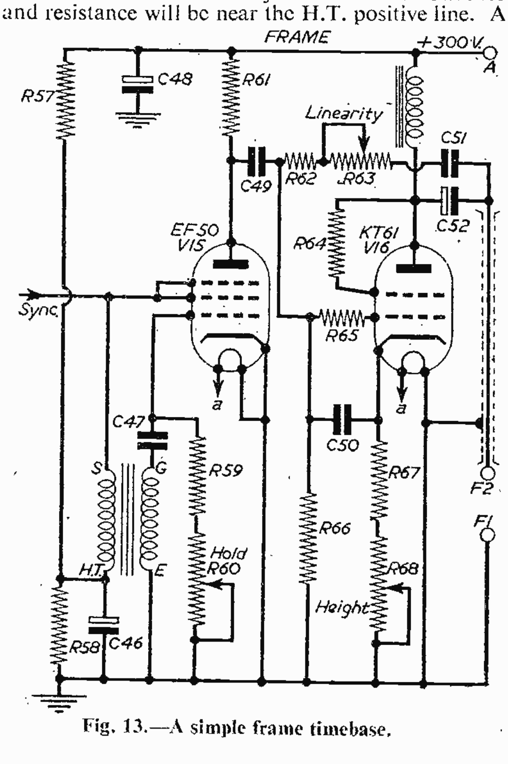


Fig. 13.—A simple frame timebase.

the same time another valve is conducting heavily and, therefore, its anode together with the grid of the first valve is near earth. Thus, the grid of V1 is very negative with respect to its cathode and the valve is at cut off point; but as the condenser charges up, the voltage across it increases, giving rise to an equivalent voltage decrease across the resistance. When the two electrodes are nearly at the same potential the first valve begins to conduct, and the consequent voltage drop across the second resistance appears as a negative pulse causing V2 to be less conductive.

Consequently, the plate of the second valve begins to rise towards the H.T. positive line, and this rise is communicated as a positive-going pulse directly to the grid of the first valve, which thus is made to conduct more heavily. In turn, this makes the plate of the first valve fall still nearer to earth potential, and the suppressor of the second valve more negative and, therefore, still less conductive. This drives the first valve grid even more positive and so on until it is conducting heavily, and V2 is driven to cut off. There are many other timebases in use to-day, but the foregoing briefly explains the operating cycle of them all.

Summarising then, a timebase is simply an oscillator in which a condenser is arranged to charge up slowly and discharge rapidly, or in some cases to charge up rapidly and discharge slowly. The resultant voltage output taken from across the condenser and applied to the plates or deflection coils of the tube causes the spot to be drawn slowly across the screen and then to return rapidly to the beginning of its stroke, when the cycle is repeated. The terms "slowly" and "rapidly" are only used here in a comparative sense. They mean that while one part of the cycle is very slow compared with the other, the whole action takes place in a minute fraction of a second. The actual time, in fact, is determined by the constants of the circuit, and can be arranged to give a repetition frequency of from a few cycles per second up to 250 k/cs or more.

The Complete Scan

In the complete receiving and transmitting system, first the image is scanned by the television camera, producing a series of varying currents which are the counterparts of the changes in light intensity along the scanning line. These varying currents are fed to a video-frequency amplifier, the output from which is passed to a limiter and pulse-generating system. The purpose of the limiter is to obviate the overloading of later stages and to limit the peak amplitudes of the combined signal and synchronising pulses to about 50 per cent. more than black. The triggering impulses are provided by the pulse generator, and it also superimposes the synchronising pulses on the signal currents, proceeding from the first video amplifier. Further amplification takes place after the limiter stage and the currents are then used to modulate the carrier wave generated by the oscillator. The modulated carrier is passed on to the aerial arrays by means of a radio-frequency power amplifier.

The aerial system picks up the signals from the transmitter and they are passed through a series of radio-frequency stages which are heavily damped in order to handle the necessary frequency band. The output is mixed with that of a local oscillator, and the intermediate frequency which results is then amplified by a series of I.F. stages of from 8 to 10 Mc/s. The I.F. stages are sometimes stagger-tuned. By this is meant that each stage is tuned a megacycle or so above and below the actual I.F. to obtain the desired response over the wide range being handled.

We have already seen that in order to comply with the principle of persistence of vision, which gives the appearance of moving pictures, the television screen must be scanned a regular number of times every second. If the frequency of this scanning is not sufficiently high, flicker will result as in some of the early cinematograph pictures. As is well-known with the cinematograph about 24 frames per second, sometimes many more, are projected on to the screen. This does not entirely avoid flicker. The purpose of the shutter system in the cinematograph is two-fold—to cut off the light between frames and to obscure the middle period of each frame. In the result there are two distinct light projections for each frame, giving the illusion of 48 frames per second.

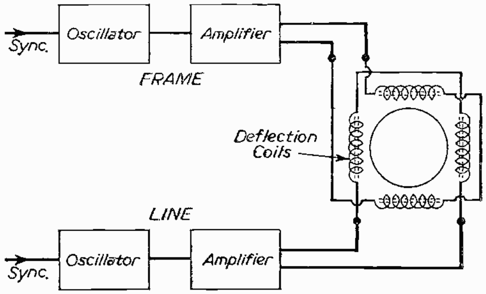


Fig. 14.—This block diagram shows how the two timebases are connected to the scanning or deflection coils in order to move the spot in two directions.

A repetition frequency of about 48 frames per second is also necessary with television if flicker is to be reduced to the minimum. This repetition frequency is also necessary to avoid, as far as possible, frame-ripple caused by stray fields created by the power circuits of the receiver and associated apparatus. If the frame frequency is not an exact sub-multiple of the mains frequency this trouble is likely to occur, manifesting itself in the form of irritating ripples upon the viewing screen. If a frame frequency, in the case of 50-cycle mains, of about 25 is employed, ripple is considerably reduced. On 50-cycle power systems it is theoretically necessary to employ at least 50 frames per second to reduce flicker and mains ripple. This is, indeed, a high frame frequency calling for a wide frequency band during transmission and from this point of view alone it is undesirable.

(To be continued)

Long-distance Band III Reception

PRACTICAL HINTS ON OUT-OF-AREA RECEPTION By B. L. Morley

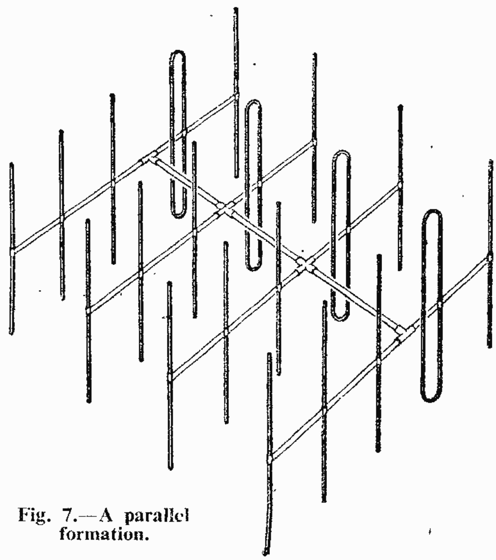


Fig. 7.—A parallel formation.

THE ITA on Band III has been received at some phenomenal distances, phenomenal because they were so completely unexpected prior to the opening up of the transmitter. The reports received have encouraged many amateurs to attempt reception far beyond the normal accepted range of the transmitter; in some cases good results have been obtained, whilst in others results have been very disappointing.

Band III signals differ from Band I only in the fact that they are radiated at a much higher frequency. Under normal conditions for a given transmitter power the coverage of a Band III signal is much less than that of a Band I.

The reason for this is that the higher frequencies are not refracted so much by the atmosphere as the lower ones. It is a well-known fact that signals at TV frequencies normally radiate in straight lines from the transmitting aerial, and under theoretical conditions it is possible to receive the signals at points that are within sight of the transmitter. These are termed "line-of-sight" conditions.

Fortunately, the radiations are affected to some extent by atmospheric conditions, and a certain amount of bending of them takes place. The result is a slight tendency for the waves to follow the curvature of the earth, and so it is possible to receive them at points beyond the horizon.

The amount of refraction depends mainly upon two things; the first is the atmospheric conditions obtaining at the time, and the second is the frequency of the radiated signals.

Atmospheric conditions vary, especially in the United Kingdom! And the result is a variation in the distance from the transmitter, at which reception is possible.

On Band I it has been observed that unsettled stormy weather during the summer period enhances fringe reception, while an anticyclone giving settled, calm weather will result in poor reception in the distant areas. This appears contrary to what would normally be accepted.

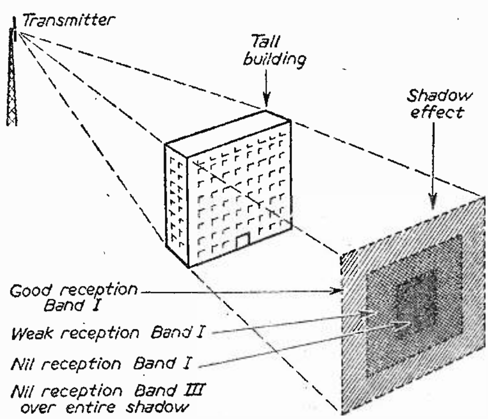


Fig. 1.—An illustration of the shadow effect.

A curious fact is that during the winter period settled, calm conditions giving rise to fog, etc., means enhanced reception in the fringe, and the very best conditions obtain when fog stretches from the transmitter to the receiving point. Stormy weather during the winter, however, results in Band I fringe reception being below par.

The Band I conditions during winter, i.e., good reception during calm, poor reception during storm, is what should be the normal reception conditions in summer or winter. This fact is found to be true in the case of Band III, and good reception at long distances depends very greatly upon calm, settled weather.

We have been blessed during the autumn and early winter with very settled periods of weather and this has given rise to a false promise—that Band III signals reach out further than Band I. It is not argued that such could not be the case—it is an improbability; and until observations have been made over an extended period it will not be possible to say what the true conditions are likely to be.

A second factor which distinguishes Band III reception against Band I is that, by reason of the higher frequencies used, absorption is much greater. By absorption we mean that the signals appear to be absorbed by surrounding objects making up the local terrain much more than is the case with Band I. This factor tells against long-distance reception of Band III.

A third factor which is closely linked to the above is that the higher frequencies of Band III are much more prone to reflection than those of Band I and "shadow" effects are much greater. The higher the frequencies, the more nearly do they conform with the conditions obtaining with light, and shadows become very distinctive.

The effect is shown in Fig. 1. The shadow thrown by the tall building is much less defined in the case of Band I and there is a spreading of signal round the object. At a certain distance from the object there may be only a small area where the reception is nil, and this will be surrounded by a large area where reception is possible though rather weak. This will be surrounded by a still larger area where reception, though not first class, is quite good.

The thickness and material of the structure materially affects these conditions. A few brick walls like those of an average house will not have as much effect as a wide multi-storeyed building built of thick reinforced concrete.

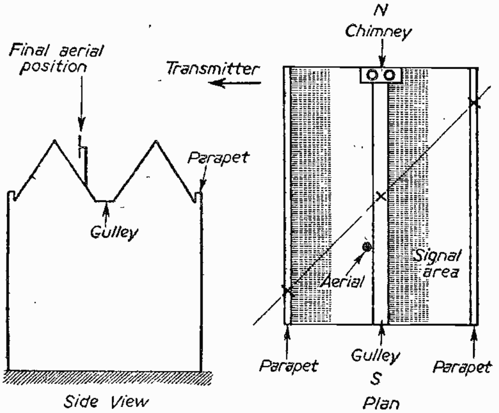


Fig. 2.—Illustrating the final positioning of an aerial.

In the case of Band III the "stopping" effect of the building is much greater as shown by the diagram. Because of this, it is possible to be within a very short distance of the transmitter and yet be unable to obtain signals. The shadowing is very marked indeed at some points, and where reception does not come up to expected standards, it is a good idea to probe the area with the aerial in an effort to find a better spot.

A Practical Case

An example of this shadow effect was recently encountered. The position where the TV receiver was to go was well known as a poor area, though well within the service range of the transmitter. An elaborate aerial comprising two directors, folded dipole and reflector was erected on the chimney on a 16ft. mast (Fig. 2). The result was no signals at all.

Fortunately, the house, which was an old one, was admirably designed for probing tests. It had a parapet followed by a sloping roof running down to a gulley in the centre of the roof area, followed by a second roof to a second parapet.

A large hill lay between the house and the transmitter, the base of the hill being a matter of a few hundred yards away.

A dipole aerial was used as a probe. It was found that a usable signal could be picked up on the south end of the house and when the dipole was moved towards the north end the signal disappeared. The points of disappearance are marked in the figure by "X." A line drawn through these points gave the dividing line between signal and no signal areas. The division was distinctive and it was obvious that the choice of the original aerial site on the chimney was the worst position!

Repeated tests eventually proved that a simple dipole erected in the position indicated (most of the aerial elements being actually below the apex of the roof) gave the very best signal.

It will be seen that by careful experiment it is actually possible to plot the shadow thrown by a large object, in the path of the signal.

At the fringe, where the Band III signals are naturally weaker, the effect of shadow is likely to be much greater and must be taken into consideration when endeavouring reception.

Tropospheric Reception

Some mention was made of this type of reception in a previous article (TV DX). Briefly it can be said that certain atmospheric conditions favour the formation of "ducts" in the upper atmosphere which will carry the signals far beyond their normal range. It is undoubtedly due to these ducts that reception of Band III signals at phenomenal range have been reported. Often it is worthwhile attempting reception in what may be considered impossible condition in the hope that duct reception is possible.

Where duct reception is obtainable really remarkable results have been obtained, and the author has seen the Test Card of the I.T.A. from London at 120 miles distance received equally as well as Test Card C from the local transmitter!

Admitting the possibility of reception of the I.T.A. at good distances from the transmitter there are several points which must be observed in order to enhance the chances of success. These may be classified as the aerial system, the feeder system, and the receiver.

Aerials

Band III aerials are shorter than Band I aerials and therefore present a smaller "front" to the signals. The pick up of a similar type of aerial is therefore likely to be less on Band I than on Band III.

Against this must be set the fact that because of

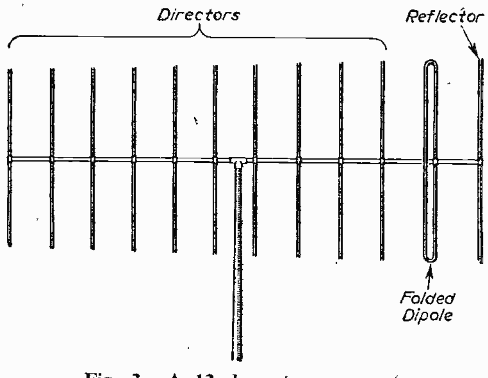


Fig. 3.—A 12-element array.

the smaller dimensions far more elements can be arranged in a Band II system than is physically possible in Band I.

For Band III an aerial with 10 directors is a practical proposition and the spacing for optimum results 0.2 wavelength can be employed (Fig. 3).

One defect of such an arrangement is the resistance given to winds at right angles to the array. For this reason an array using less elements, but doubled is often favoured. One type is increasing in popularity is the five element array comprising three directors, dipole and reflector (Fig. 4).

The gain of this array is about 10 dB. An extra

3 dB can be obtained by simply doubling the array, i.e., to use two such arrays side by side. The scheme is shown in Fig. 5.

Several commercial firms have designed aerials on this principle and it is possible to buy units and to built them up if the necessity arises.

One ingenious arrangement is two five-element arrays arranged with a slot aerial in skeleton form being used to couple the two dipoles and to effect matching.

Matching arrangements are very important and the matching must be reasonably accurate or the increased gain obtained by the use of extra elements will be more than offset by the losses due to mismatch.

These double arrays can be again "doubled up" to improve signal pick up. In Fig. 6 we have such an array, the two doubled sections are arranged one above the other, the spacing between the crossbars being a quarter of a wavelength. In Fig. 7 a parallel formation is shown. The latter has been known to give better results than that in Fig. 6, possibly because all elements are at the same height above the ground. Under practical working conditions the array in Fig. 7 was found to give about 3 dB greater gain than that of Fig. 6.

In the parallel array each section was mounted at a quarter wavelength from its predecessor. All arrays mounted in line makes the overall horizontal length of the array equal to one wavelength, which at Band III frequencies is nowhere near as bulky as may be thought; at the lowest frequencies the length is only about 5ft.

In all cases the aerial must be mounted at a very good height, and it is better to endeavour to attain

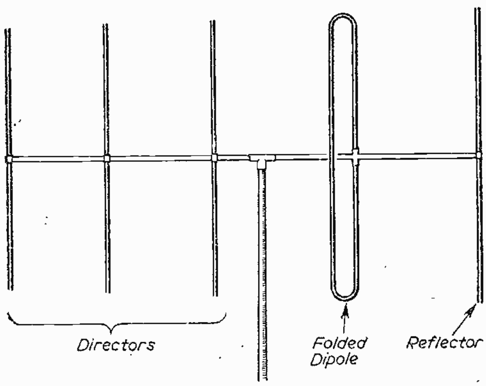


Fig. 4.—A five-element array.

a greater height than is the practice with Band I arrays. The smaller elements and hence the lightness of the array makes this more practicable than is the case with Band I.

It will be remembered that the refraction of the Band III signals is much less than that of Band I and they therefore follow a much smaller curvature of the earth. Receiving points situated at a high level therefore stand a much greater chance of obtaining satisfactory reception.

The receiving point mentioned previously 120 miles from the transmitter is situated at about 350ft. above sea level. At a point a mile away standing only 50ft. above sea level no trace of signal could be obtained.

This is a general rule and it will be found that those reports of reception of programmes which are of entertainment value are mostly from places situated on high ground. This natural feature coupled with a good aerial system, is the main ingredient of success.

The Feeder

The feeder from the aerial to the receiver plays a very important part in long distance reception. A few figures will show this.

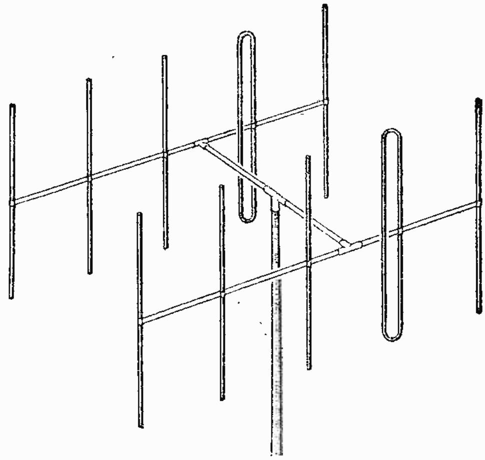


Fig. 5.—A double array.

A typical manufacturer's coaxial cable has a loss of 2.5dB per 100ft. at 45 Mc/s (note all losses will be quoted as for 100ft.). At 60 Mc/s (channel 4 approx.) the loss has increased to 3.1 dB but at 200 Mc/s (in Band III) the loss has increased to 6.2 dB. This is an appreciable figure and represents a considerable loss.

Previously we stated a case for making the aerial system as high as possible and this naturally entails a long feeder. It is quite usual therefore, to have cases where 100ft. of coaxial feeder cable is a necessity. The losses become real.

The case for balanced twin cable is even worse. A typical balanced twin cable will give a loss of 3.8 dB at 45 Mc/s, of 4.35 dB at 65 Mc/s while the loss at 200 Mc/s is 8.0 dB.

Where screened feeder of the balanced twin variety is used to overcome interference effects then, the losses are greater, typical figures being 4.5 dB at 45 Mc/s, 5.4 dB at 65 Mc/s and 10.0 dB at 200 Mc/s.

When it is realised that a change in signal strength of 1 dB can be seen on the screen then it is obvious that losses must be kept as low as possible.

Fortunately there are special low-loss cables available some of which have been especially developed because of Band III conditions.

Some typical figures for this low-loss cable are 1.2 dB at 45 Mc/s, 1.5 dB at 60 Mc/s and 2.6 dB at 200 Mc/s.

These figures are for coaxial cable with a semi-airspaced core. Note that for this cable the loss is 2.6 dB against 6.2 dB, for ordinary coaxial.

The cost of this type of cable is rather more than that of ordinary coaxial, but this is well worth while when it is considered that the gain obtained by a double array, an extra 3 dB, can be more than lost by use of ordinary coaxial cable.

Matching

Another important point in connection with feeders is that matching must be such that the standing-wave ratio on the feeder is not more than 3 : 1. This means that the mismatch of impedance values between aerial and feeder must not exceed 2 : 1.

To effect matching it is common practice to insert a quarter-wave matching section between aerial and feeder. The methods of calculating the impedance of the matching section have been dealt with before in these pages. It is sufficient to point out here that matching section in the region of 100 ohms are quite common and low-loss cable of this impedance can be bought from most dealers.

Where balanced twin cable is called for then low-loss types can be obtained. There is also available a cable of 100 ohms impedance and also a low-loss cable of 300 ohms balanced-twin, where the receiver calls for this class of cable.

Diplexers

Matching units for combining aerials of Band I and Band III into a single cable are available under various trade names such as a Diplexer etc. These units effect impedance matching between the two types of aerials but they usually introduce some loss and for fringe area reception it is considered better to employ an entirely separate cable.

It should be noted that it is often possible to use a Band III aerial on Band I and this is better practice for the fringe Band III area where there is a local Band I transmitter, than to attempt to use a Band I aerial for Band III reception.

One point which should not be overlooked is that the radiation pattern is probably changed with the frequency, and it may be found that this practice causes undue interference pick-up on Band I.

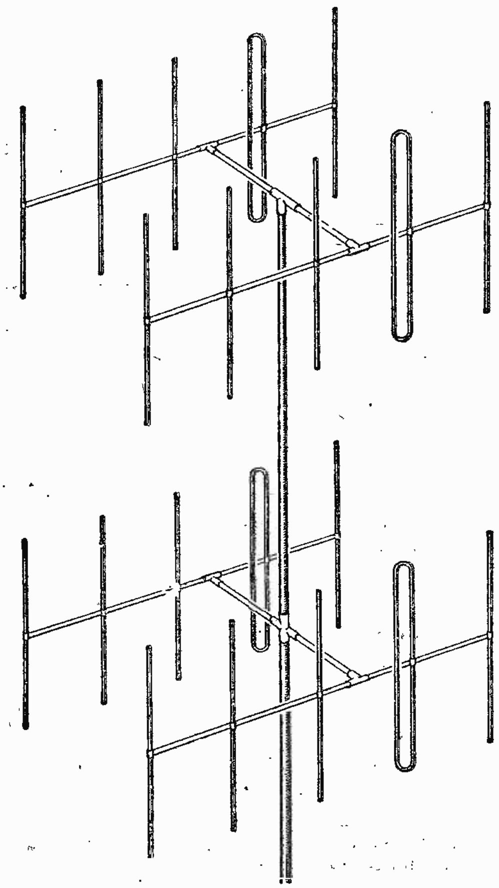


Fig. 6.—A doubled-up array.

Practical Feeder Arrangements

Where low-loss feeders are used it is important to realise that the cable is a lot more fragile than ordinary coaxial. In the latter case the polythene core is solid and the cable will withstand quite a deal of bending ; in the case of the low-loss feeder, however, the core is largely of air and if the cable is bent sharply then the air spaces will be crushed. This means that the actual characteristic impedance may be altered at the point of crushing and the cable will exhibit losses and reflections from the point of damage. Sharp bends should be avoided and the cable should be treated with the greatest of care. It should be kept clear of drain pipes, etc., and any overhead wiring, electrical or telephone.

The Receiver

Practical experience has suggested that, at the moment, receivers fitted with channel changing facilities integral as part of the receiver give better results at long distance on Band III than most convertor arrangements. The latter are generally spoiled by excessive noise.

Receivers themselves vary from one to another, and some will be found to give quite exceptional results. Both home-constructed and commercially built convertors have been tried and they all seem to fail more or less, in this respect. A good turret-tuned model takes some beating !

Pre-amplifiers

It has been proved that the signal can be boosted by the use of pre-amps and those of the low-noise type are generally favoured.

Where conditions are really difficult because of noisy local man-made static then a high aerial system with a masthead pre-amplifier has much to recommend it. Pre-amplifiers using R.F. pentodes are not generally favoured, but quite a good combination is a pre-amp comprising a cascode stage followed by a R.F. pentode stage. The advantage of the R.F. stage with the pentode is that it prevents re-radiation at intermediate frequency, this can be really troublesome where convertors are used.

Weather

It has been noticed that at extreme ranges, a really good signal can be enjoyed for a considerable period but the first few drops of rain will cause the signal to vanish without trace ! If no results are obtained at first then wait for more favourable weather conditions.

Although it is unwise to be dogmatic about the subject it does appear that it is the local weather conditions which have the greatest effect. A rainstorm at the transmitter area will have but little effect at the fringe but those few drops of rain at the fringe exert a tremendous effect.

COLOUR TELEVISION

THE SECOND OF A NEW SERIES DEALING WITH THE PRINCIPLES AND PRACTICE OF MODERN TELEVISION IN COLOUR

2.—THE VARIOUS SYSTEMS

By C. Grant Dixon, M.A.

IT was in 1926 that J. L. Baird first gave a demonstration of the transmission of a living image by television. Few people realise that only two short years later, in 1928, he also demonstrated television in colour to a meeting of the British Association. Of course, the definition was poor, but it is a striking tribute to the advanced outlook of this television pioneer. The system which he employed depends on the fact that the eye blends together images which are presented in rapid succession. This effect is called persistence of vision and is, of course, the means whereby we can view a normal television image. It will be recalled that to transmit a coloured television image it is necessary to transmit colour information in each of the three primary colours: red, green and blue. Baird transmitted a complete image in each of these colours in rapid succession, a process known as frame sequential scanning. In those early days scanning was performed by means of a rotating Nipkow disc, and Baird's colour disc had three sets of spirally placed holes with appropriate colour filters mounted over them (Fig. 1). Each revolution of the disc caused the picture to be scanned three times, once for each colour, and at the receiver a similar disc built up a coloured image.

Frame Sequential System

Subsequent work on colour television followed Baird's early experiments and as the television image became better in quality due to the use of an increased number of lines, so the colour image became better, too. In 1938 Baird demonstrated colour pictures in a London theatre on a screen 12ft. by 9ft. A 120-line picture was used and the scanning was effected by means of a combination of a mirror drum with a slotted disc. In the post-war period the CBS in America developed a frame sequential system which was provisionally adopted by the FCC, but which was later rejected in favour of an all-electronic system. The CBS system transmitted 24 complete colour pictures a second using a 405-line interlaced raster similar to that used in this country. The frame timebase was set to run at 144 cycles/sec., two vertical scans produced a fully interlaced picture, and this was repeated three times to produce a complete colour picture. The colour change took place 144 times a second, however, so the scanning sequence was as follows:

1st frame: Odd lines scanned in red.
2nd frame: Even lines scanned in blue.
3rd frame: Odd lines scanned in green.
4th frame: Even lines scanned in red.
5th frame: Odd lines scanned in blue.
6th frame: Even lines scanned in green.

The camera for this system was a normal television camera with modified timebases and a disc of colour filters mounted immediately in front of the photocathode. This disc was driven by a motor whose speed was controlled by the frame timebase. At the receiving end, a similar disc was rotated in front of the screen of a normal television set (Fig. 2) and maintained in exact synchronism with the camera disc by a system of electronic control of the motor speed. Thus, when the red filter was in front of the camera, a signal corresponding to the red component of the picture was transmitted and actually viewed as red light through the receiver filter. This use of an electric motor was obviously not a very satisfactory solution to the problem of colour television for the home viewer, but for closed circuit industrial television it has proved useful, and Messrs. Pye, of Cambridge, have developed the same system in this country and demonstrated it both here and on the Continent. The system is capable of giving very good quality pictures, but it suffers from the disadvantage, that rapidly moving objects occupy successive positions which are laterally displaced and this gives an annoying colour-fringing effect. In the U.S.A. care had to be taken with the elimination of hum as the frame frequency was not related to the frame frequency of 60 cycles per second. In this country Messrs. Pye used a frame frequency of 150 cycles per second, which could be locked to the British 50 cycle mains, but, even so, the presence of any hum on the raster would have given a similar colour-fringing to that mentioned above and careful magnetic shielding was necessary.

Line Sequential System

Another process was developed in the United States by Color Television Inc., in which the colour elements were lines, and the system is usually called the line sequential system. Clearly, the mechanical

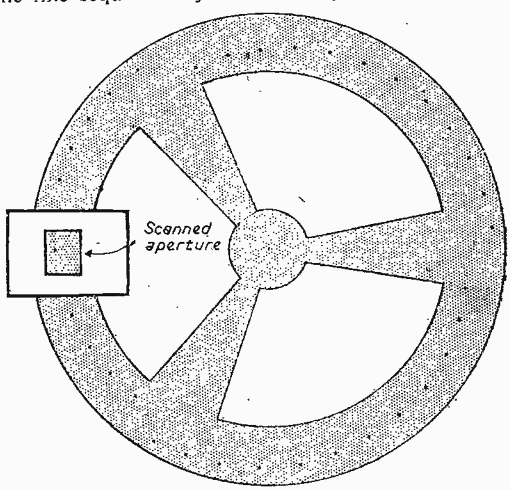


Fig. 1.—Showing the principle of Baird's original colour disc scanner which used three spiral sets of holes, one set for each colour.

movement of filters at line speed is out of the question, so this system is entirely electronic. At the transmitting end the camera lens has a group of mirrors behind it which produces three images side by side on the camera photocathode (Fig. 3). By using special mirrors known as dichroic filters, which reflect light of one colour and transmit all other colours, it is possible to get the three images in the three primary colours. If the camera photocathode is now scanned from one side to the other, the spot will traverse one line of the red image, one of the green image, and one of the blue image before it reaches the other side. The camera line frequency must, therefore, be a third of its normal value, and if this reduced line frequency is used at the receiver three images will be formed side by side on the cathode-ray tube. These images may be given the three primary colours by the use of suitable filters or by making a cathode-ray tube the screen of which will fluoresce in the three colours in adjacent areas. Of course, three images are no good as they stand and they must be combined optically to form a complete coloured image; this is usually done by using three projection lenses and projecting on to a translucent screen. It should be noted that in the frame sequential system both the line frequency and the frame frequency have to be raised, but in the line sequential system the frame frequency remains the same as for black and white. This is because the green image has a much higher luminosity than the red or blue, and a flicker is produced at the reception rate of the green. In the frame sequential system, therefore, it is necessary to ensure that the repetition rate of the green frames is sufficiently high to avoid this flicker. In the line sequential system the repetition rate is already very high and the question does not arise in this form; the luminosity of the green lines gives rise, however, to an annoying line-crawl. Another disadvantage of the system is the difficulty of registration of the three images which demands almost 100 per cent. linearity in the line timebase both in the camera and in the receiver.

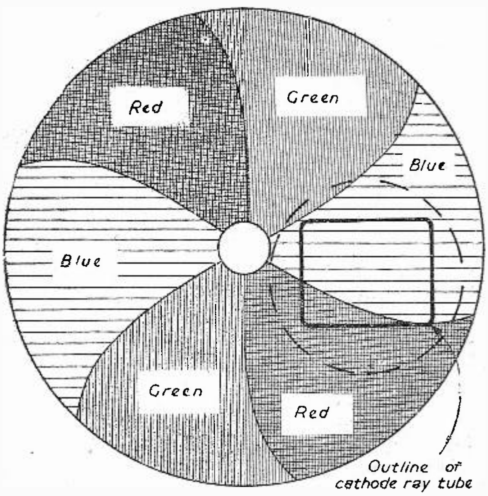


Fig. 2.—The actual shape of the colour filter disc used in the CBS frame sequential system depends on its position with respect to the cathode-ray tube. It must be over twice the diameter of the tube, and projection tubes were often employed on account of their small size.

Dot Sequential System

A third system was proposed by the RCA in which the colour sampling rate was increased to about 3.58 Mc/s, thus giving a dot sequential system. Flicker was eliminated by the use of this high frequency, and with the problem of flicker solved it became possible to consider much brighter pictures at the receiving end. A number of difficulties were introduced by the choice of this very high rate of

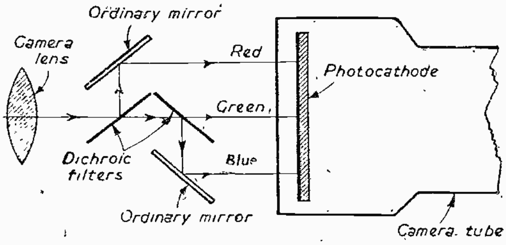


Fig. 3.—Showing how the three images are produced side by side for the line sequential system.

colour sampling, not the least of which was the synchronism of the receiver sampling circuits with those at the transmitter. Several important features of this system have been carried over into the present American system, so it is not proposed to discuss the dot sequential system in detail.

Compatible Systems

In 1949 and 1950 the American FCC held an inquiry into the various colour television systems with a view to giving official approval to one system which would then be adopted nationally. After hearing the claims of the three systems outlined above, the FCC licensed the CBS frame sequential system, which undoubtedly was the simplest from the technical point of view and was capable of giving very good pictures. Nevertheless, it was felt in many quarters that it was an unwise decision for two reasons: first, an all-electronic system would be preferable; and second, a compatible system would be preferable. The phrase "compatible system" implies that the colour system must transmit pictures which can be resolved as black and white pictures on a normal receiver. The line and frame timebases must be run at the same frequencies as for black and white reception, and the colour information has to be transmitted by some means or other leaving the luminance signal to give a black and white picture. Thus it was that in less than two years the FCC had withdrawn its licence and called for a complete shut-down to all colour television production. Following this, as a result of co-operation amongst the radio and television manufacturers, a new system was evolved in which the chrominance signal was sorted from the luminance signal and transmitted on a special subcarrier within the same channel as the normal black and white television. This simultaneous system was approved by the FCC and is now the standard colour television system in the U.S.A. A modification of this system has been developed in this country to fit in with the British 405-line picture and the BBC have been making engineering tests of this modified system as was reported in the February issue of PRACTICAL TELEVISION.

(To be continued)

Servicing Television Receivers

No. 19.—FURTHER NOTES ON CATHODE-RAY TUBES

By L. Lawry-Johns

IN the January issue we itemised some of the faults which occur in cathode-ray tubes and gave some practical means of overcoming the more common of these defects. A reader has taken us to task for not being more comprehensive and for making a misleading statement. This was in reference to a fault which often happens on Mullard tubes in particular, where an internal short produces a "no raster, no E.H.T." condition.

We said that in the event of an internal breakdown there was little which could be done and that the tube would have to be replaced. In some cases this is quite true, and, indeed, some time ago it was so in nearly every case. This particular defect, happily, does not seem to occur so frequently now, however, and in the majority of cases the tube can be saved. It should be understood that the following procedure is applicable to Tetrode and Pentode tubes, as shown in Fig. 1, and not to triode tubes at all, for obvious reasons.

Usually, the defect shows in the receiver as an E.H.T. fault where no spark is available from the anode cap of the C.R.T. or from the E.H.T. rectifier heater. However, when the anode cap is removed from the tube, the E.H.T. immediately comes to life and vigorous sparking results when the cap approaches any metallic body or human body! It should be understood that an upset in the receiver circuits could cause this condition. If the grid voltage is in excess or even is slightly under that of the cathode, in some cases the effect is simulated. In the majority of cases, however, it will be found that the fault is usually met where a tetrode or pentode tube is employed, and the usual cause is a leak or short between the cathode and grid of the tube.

The base holder is usually of the duodecal type, and the connections are shown in Fig. 2.

The valve pins are numbered from the spigot in a clockwise direction. Thus pin 1 is a heater, pin 2 is the control grid. Now on some bases only half of the base is used so that it appears semi-circular. Base tags are still numbered the same. 1 and 2 to the left of the spigot, 12, 11 and 10 to the right. This represents a tetrode base and all up-to-date bases employ the complete circle of tags as pin 7 may be required for a pentode tube. In some cases this may be found shorted to pin 11 (cathode) and in others a separate lead may be taken to it. Even where a tetrode tube is in use, pin 7 may be shorted to 11 to provide for the fitting of a pentode tube at a later date. Taking an example, a PAM 14in. model was examined for a "No Picture" fault. The customer stated that the picture would appear at odd intervals, and then vanish again. The set was switched on, allowed its usual three minutes to warm up, and the fact that the line timebase whistle was not of normal pitch was noted.

No EHT was present at the tube anode.

The EHT connection was removed and immediately the line timebase whistle became normal and the

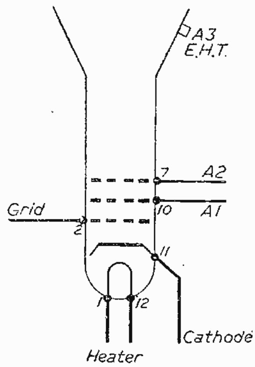


Fig. 1.—Showing pentode base and internal connections.

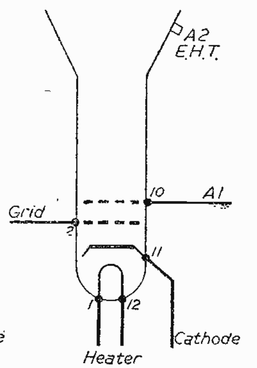


Fig. 1a.—Showing tetrode base and internal connections.

EHT sprang to life, with healthy sparks and the usual "unconnected" hiss. Upon replacing the connection, the screen lit up momentarily and the EHT once more disappeared.

The tube was a tetrode with tag 11 shorted across to tag 7 which was, in this case, an unconnected pin. The shorting lead was removed from tag 7 and connected to tag 2. The lead to tag 2 was then removed and placed on to tag 10. The usual A1 connection was removed from tag 10 and taped up. The set was tried again and the customer could detect no difference between the displayed picture and the original with the A1 lead connected. The writer noticed a fall off of "attack" and general brilliance but the result was extremely gratifying and a really good test card could be resolved.

The customer was particularly pleased as he could now advance his brilliance control without the picture losing width and focus upon approaching maximum. This was, of course, due to the emission of the tube being lower and thus it was not tending to overload the EHT supply at excessive brilliance.

This was a case where a cathode-to-grid short in a tetrode tube was overcome by using the A1 grid as the control grid and strapping the cathode to the control grid permanently. The A1 supply lead was left disconnected.

In another case the receiver was a Ferranti 17K5. Similar symptoms were noted and the tube base showed that tag 10 was strapped to tag 7. Pin 7 was actually in use, the tube being of the pentode type. In this case, the strap was removed from between 7 and 10, the lead to 10 was taken to 7 and the grid lead to 2 was taken to 10. Then a shorting lead was wired across from 11 to 2. The result was that the tube functioned in every way as good as before the short occurred.

In this case the wiring had been arranged so that the tube continued to operate as a tetrode.

It is stressed that the emission of the tube must be basically good if a reasonable picture is to be resolved on a tetrode tube, such as an MW31/74 and others in the 14in. and 17in. range as the loss of voltage on the first anode is considerable, and the tube is really functioning as a triode which it was never intended to be.

An example of what is meant was the case of a small Bush TV22. The picture had been quite satisfactory until it became uncontrollably brilliant and failed altogether. The tube was an MW22/16. A

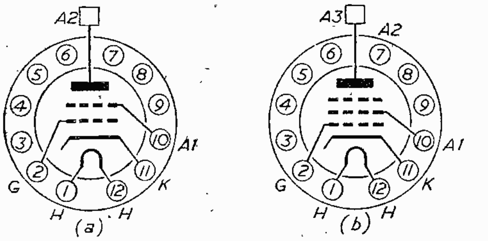


Fig. 2.—Showing tetrode base (a) and pentode base (b).

grid-to-cathode short was diagnosed and the tag wiring was duly modified. The result was an extremely poor picture. A new tube was fitted, using the base holder still wired for the fault condition, and a very reasonable picture was obtained. The point having been made, the proper wiring was restored and the picture was still further improved. Thus, before the letters commence to pour in ! A worn tube is unlikely to operate satisfactorily with rearranged base wiring, unless it is of the pentode type and is rewired as a tetrode. Another tube fault which was touched upon in the January issue but which merits further comment is that ot a partially shorted heater. When a tube suddenly displays symptoms which indicate a soft or low emission condition the receiver being of the A.C./D.C. type, a glance at the rear of the tube neck will often show that the heater is glowing a dull red rather than the more usual healthy yellow. A voltage check with a meter will indicate that the volts drop across the heater pins is approximately half of what it should be. Another point which may be noticed is that the tube is of the Ion Trap type, where a small magnet is employed to straighten out the electron beam.

Now the effect of this magnet upon the tube heater is not generally realised.

If the tube neck is examined, a painted line will be seen which indicates the approximate position for the Ion Trap magnet's initial alignment. Also on the magnet itself is a small arrow. When the magnet is aligned with the arrow toward the tube face it will be approximately on the line. If the magnet is rotated 180 deg. to the other side of the tube neck the tube will not illuminate due to the electron beam being thrown completely out of line.

If, however, the Ion Trap is reversed so that the arrow points to the rear, correct operating conditions are obtained with the magnet on the opposite side of the neck to the line.

This may be very elementary stuff for many of the readers, but it is none the less essential for the not-so-well-informed to be clearly briefed upon this point.

This is the reason : in a large number of cases where a partially shorted heater exists, movement of the Ion Trap magnet will cause the fault to clear and recur as the magnet rotates about its optimum setting.

Quite often, by completely reversing the position of the Ion Trap magnet, i.e., so that it is rotated through 180 deg. *and* the direction of the arrow is reversed, a fault condition can be cleared. If possible, rotation of the tube itself may help initially to clear the short although a slight tap on the neck of the tube will often perform the same function.

In an earlier article in this series it was mentioned that rotation of a tube is often beneficial. This is particularly valuable where an internal short exists and it is not convenient to install an isolating transformer.

In a large number of cases a heater-to-cathode short can be cleared by this means, at least temporarily. Also, before leaving this heater-to-cathode short subject, the fault condition of no EHT can quite easily be caused by this defect. If a tube heater is in an A.C./D.C. chain, and is the last heater to chassis, as is usual, an internal short will result in the cathode being virtually taken to chassis potential, leaving the grid biased positive. Thus the condition of heavy beam current is provoked and the EHT supply may be overloaded.

The golden rule, therefore, is to check the tube base voltages before taking any action.

COMMERCIAL TELEVISION IN THE NORTH

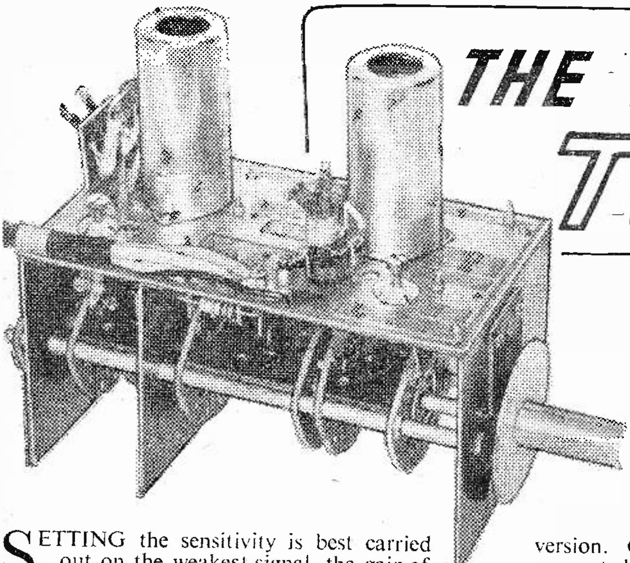
On May 3rd Winter Hill, the Independent Television Authority's first station in the North of England, came into programme service.

This marked the climax to seven months' intensive work by Marconi's Wireless Telegraph Co., Ltd., who have been responsible for building the entire station.

Some idea of the task involved may be gathered from the fact that before constructional work could begin a layer of peat of up to 7ft. in depth had to be removed before a solid foundation was reached. The severity of the past winter was an additional handicap.

The Marconi vision and sound transmitters installed are 7½/10kW and 2½kW respectively. The outputs from these are combined and fed to a 16-stack aerial, producing an effective radiated power (vision) of 100 kilowatts (see illustration on page 515).

The aerial tower is 445ft. in height and the station is sited at a height of 1,440ft. above sea level.



THE V.M. TV Tuner

DETAILS OF A 3-STATION TUNER DESIGNED FOR THE VIEW MASTER, BUT WHICH MAY BE USED WITH OTHER RECEIVERS

(*Concluded from page 442 May issue*)

SETTING the sensitivity is best carried out on the weakest signal, the gain of the tuner being at maximum when C5 is connected to chassis and the I.F. amplifier gain control adjusted to give a picture having the correct degree of contrast. If now the tuner is switched to another channel with a stronger signal the variable resistor connected to SW5 is then readjusted, in which case the gain of the I.F. amplifier is reduced and the picture contrast remains constant. This is the preferred arrangement where the receiver is located anywhere but in a transmitter swamp area.

An Alternative

An alternative arrangement where the receiver is located close to a transmitter is to set the I.F. amplifier contrast control to the correct setting on the weakest signal with SW5 connected to C5 on the tuner and then taken direct to chassis so as to obtain the maximum sensitivity on the tuner. Then switch to the alternative channel which will be the strongest and adjust the variable resistor which will be connected to C5 via SW5 to give the correct gain and contrast. Switching from one channel to another should now enable a picture having satisfactory sensitivity to be obtained without necessitating further readjustment.

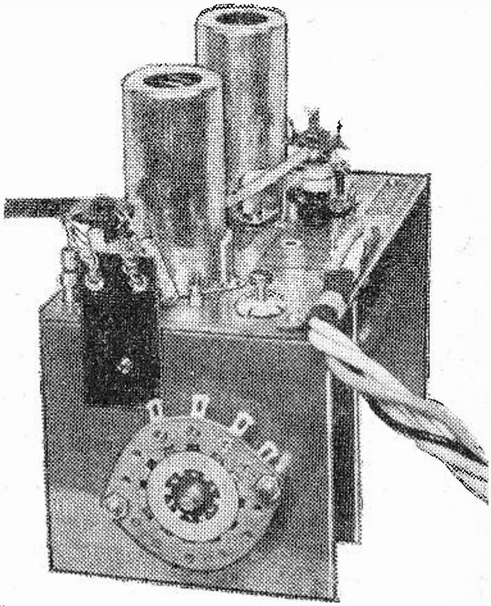
Models for Channels 2-5

Some confusion appears to have arisen in the minds of those View Master owners whose receivers operate on Channels 2-5 as they appear to be under the impression that the modification details given in the December, 1955, issue relate only to the Channel 1 View Master intended for reception of Alexandra Palace.

The instructions which were published did, of course, relate to all View Masters irrespective of the Channel for which they were originally designed, but on those receivers operating on Channels 2-5 it will now be necessary to remove the existing sound rejector circuits as they are no longer required. The modified bridge "T" rejector being used instead.

The one other point leading to confusion is condenser C6 shown on Fig. 4, page 296 of the December issue, as this condenser only appears in the Channel 1 version. C6 has a capacity of 2 pF and must be connected as shown from the anode of V1 direct to the grid of V6. The grid coil of V6 is specified as having 9½ turns, and in parallel there must be a 10 pF condenser. The combination of the two condensers and one inductance thus operates to "suck off" the sound I.F. from the combined sound vision output to V1.

Finally, it may be repeated that, although referred to as the View Master Tuner, and it was, in fact, designed primarily for that particular receiver, it may be used with any I.F. strip designed for 34.65 Mc/s vision, and 38.15 Mc/s sound. The only point to note is that the input arrangements should follow similar lines to those adopted in the View Master.



This rear view of the V.M. Tuner clearly shows switch SW5, referred to last month.

The New London Transmitter

ADJUSTING TELEVISION RECEIVERS TO THE NEW SYSTEM

By "Erg"

THE London television transmitter at Alexandra Palace was the first television transmitter in the whole world to radiate regular television programmes. Since its opening in 1936, new techniques have been evolved and advantage is being taken of these developments, in the opening of the replacing transmitter at Croydon.

The London transmitter operated on principles similar to those used in normal broadcasting. Amplitude modulation was employed and each sideband was used—termed double sideband modulation.

With present-day techniques it has been found practical to radiate on one sideband only, and this is the common method employed to-day. But for this system we should not be able to accommodate so many transmitters within the frequency spectrum allotted to television.

Although the system is quite often commonly referred to as single sideband this is not a true description; the more correct term is vestigial sideband.

The Two Systems

Fig. 1 shows the double sideband method of transmission such as has been used from Alexandra Palace. The vision carrier is set at 45 Mc/s and radiation takes place for 3 Mc/s each side of the carrier to cater for the full vision signal. The sound transmitter is radiated on a carrier 3.5 Mc/s from the carrier, i.e., at 41.5 Mc/s.

In the case of transmissions as shown in Fig. 1, the method used at the receiver was to adjust the R.F. and I.F. stages to receive both sidebands; thus the R.F. and I.F. sections needed a bandwidth of 6 Mc/s.

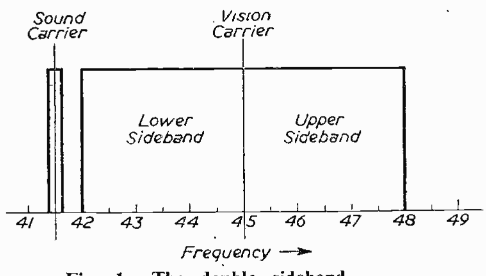


Fig. 1.—The double sideband.

The vestigial sideband method is shown in Fig. 2. The sound is set on its carrier at the same position as before but the vision has part of the upper sideband suppressed. It is not practicable completely to suppress the upper sideband—a small proportion remains unsuppressed and this is transmitted.

In practice the upper sideband is transmitted up to 0.75 Mc/s.

Now it is obvious that it is not practicable to effect transmissions which cut off dead as shown by the straight vertical lines in Fig. 2. Actually severe attentuation takes place above 0.75 Mc/s above the carrier and at 2.75 Mc/s below the carrier and the result is more like that shown in Fig. 3.

Further inspection of Fig. 3 shows that this will not give a true result as, although correct response will be obtained for the higher frequencies, at the lower frequencies we still have double sidebands. This means that if our receiver was adjusted in this manner the output of the lower frequencies would be doubled.

The effect on the screen is over-emphasis of the lower frequencies and the picture would appear smeary especially in the blacks, black portions having long tails to the right of them.

To overcome the problem, the response of the receiver should be such that the carrier is set at half-way down the slope (6db down). The detector will now respond correctly and the small portion of double sideband will be added to that attenuated below the carrier and correct conditions will be obtained.

It is important therefore to ensure that the response of the receiver is adjusted so that it is 6db down on the carrier.

Classes of Receivers

Sutton Coldfield transmitter was the first of the single sideband television transmitters to be constructed in this country and at this time a change-over began to take place in the design of receivers. Until the advent of Sutton Coldfield most receivers were of the "straight" type R.F. amplification being used throughout. A superhet was something of a rarity.

These straight receivers built for the London transmitter were mostly tuned so that both sidebands were covered. The superhets began to become more prominent mainly because of manufacturing processes.

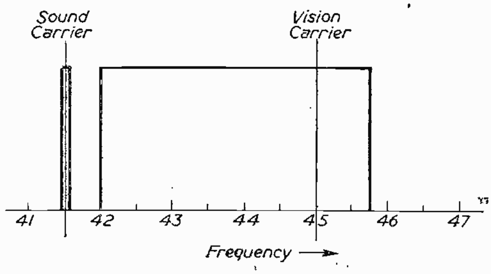


Fig. 2.—Vestigial sideband.

A straight receiver was quite efficient but where different channels were being used, a different receiver had to be built for each channel. To avoid a lot of duplication and to ease production difficulties, superhets came to the fore and these were mostly designed for lower sideband operation.

At first two classes of superhets were made, some designed for Sutton Coldfield and some for London. For the Midland transmitter single sideband operation was required and this was effected in the I.F. stages, rejector coils being fitted to cut the sound channel from interfering with the vision.

The London receivers were either double sideband, or in some cases, upper sideband reception for vision. This latter method enabled the receivers to be operated without the need for rejectors on the vision strip, to cut the sound from the vision.

Nowadays, with multi-channel receivers, all commercial receivers are arranged to operate on the lower sideband.

Straight Receivers

Where straight receivers are employed, then two troubles may arise from the new transmitter. The first is sound on vision, and the second is a deterioration in quality of the received image, the pictures appearing less sharp.

To remedy the first trouble two or more sound rejectors may be required. These can be made quite easily by winding about 9 turns of wire on a ⅛in. diameter coil form and tuning with an 0-30pF condenser. In some cases a 22pF condenser can be connected across the coil and the coil tuned by using the core.

There are two methods of connecting the rejector. One is by grid insertion and this is shown in Fig. 4. The coil is tapped at two turns up from the bottom as shown and connected in the grid circuit.

The second method is by cathode insertion and this is shown in Fig. 5. The coil is connected directly in series with the cathode of the R.F. valve.

The placement of the coils will be determined by the number of R.F. stages and where the sound is tapped from the R.F. circuits. As a guide, a four valve I.F. strip (4 I.F. valves) could have one rejector at valve 2 and one rejector at valve 4.

Under normal circumstances two rejectors should be sufficient especially if they are made high-Q using 22 s.w.g. wire and low-loss coil forms.

The best method of adjustment would be to retune all R.F. stages to peak to the vision signal and then to adjust the rejectors so that there is minimum sound breakthrough. Having done this then the R.F. circuits should be stagger tuned for the best possible quality, and this is best done on Test Card C.

By careful adjustment it should be possible to get a picture of the same quality that was obtained previously from Alexandra Palace.

Double Sideband Superhets

In the case of a double sideband superhet somewhat similar results may be noticed. This is some interference from sound, and some loss of picture quality. (The sound interference will not, of course become noticeable until the alteration of the televisor to single sideband is attempted.)

To cut the sound from the vision will require two or more rejectors which should operate at sound I.F. As the I.F. of receivers vary there may be some necessity to experiment. As a guide an I.F. of about 9.5 Mc/s can be used and a coil comprising about 22 turns 34 s.w.g. enamelled wire on a ⅜in. diameter coil form, tuned with an 0-30 pF trimmer, should work in most circuits.

Great care must be exercised in placing these rejectors; they must be screened and must not cause loss of quality through destruction of the existing pass band.

To tune the receiver it will be necessary to retune the R.F. sections to the lower sideband; if instruments are not available much care and patience will be required.

Having done this then the rejectors should be tuned to cut the sound on vision effects but the quality of the picture must be guarded. Some variation of the oscillator is permissible, but this is best done on Test Card C.

If it is found that the use of the traps seriously affects the quality of the picture, then the coupling between the traps and the circuits can be loosened. In the case of a grid rejector this is most easily done by inserting a small condenser of say 5 pF between the coil tap and the grid of the valve.

Upper Sideband Superhets

Some superhets have been made to operate on the London Frequency on the upper sideband. This was to ensure that no sound interference was experienced and the object was accomplished without the use of sound rejectors.

These receivers are those which are particularly difficult to get working in Band III with the aid of converters.

One important point is that it is still possible to get a picture through without modification in some cases, because there is still 0.75 Mc/s of the upper sideband included in vestigial sideband transmission. The quality of the picture will, however, be rather on the poor side.

The alteration of such receivers should not be undertaken lightly; the success of the operation will depend much upon the skill and knowledge of the person doing the job.

For success a signal generator is almost essential and this is not the equipment of the average amateur.

Failing the use of such an instrument, some patience is called for.

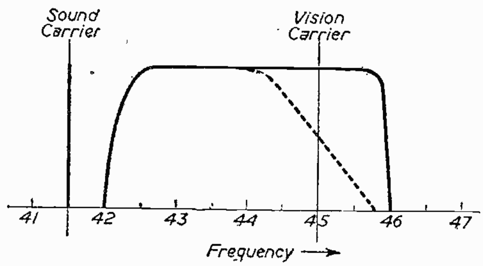


Fig. 3.—Typical response curves.

The first step is to retune the R.F. stages to the lower sideband, and then to make and insert the rejectors. If sound on vision is not experienced the rejectors can be left to later if desired.

The oscillator should be tuned for maximum sound and then the vision I.F. stages must be tuned for maximum vision, without altering the oscillator from maximum sound position. Ignore the sound on vision to start with and continue tuning for maximum picture.

When this stage is reached the sound rejectors can be inserted so as to cut the sound from the vision.

Now detune the oscillator towards the vision, away from the sound and then retune the vision stages to maximum picture. Retrim the oscillator to the sound channel and note the loss of picture. The aim is to adjust the vision I.F. stages so that when the oscillator is swung to maximum sound the "volume" of the picture signal is cut by half. This gives the correct position for the oscillator, which is 6db down on the vision carrier.

The remainder of the work is best carried out by using Test Card C and the vision I.F.'s should be very carefully adjusted for maximum quality. The

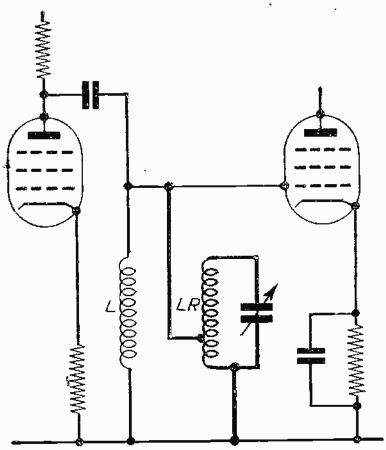


Fig. 4.—A grid rejector.

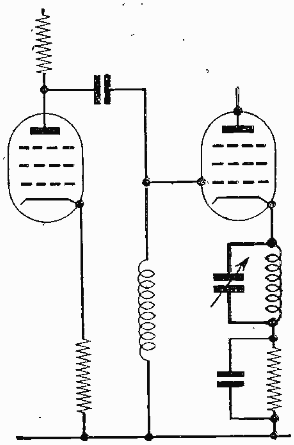


Fig. 5.—A cathode rejector.

oscillator should not be moved from the position obtained by the previous process or the whole alignment will be upset.

However, by very careful and patient work it should be possible to obtain quite good results.

Another important point to note about this process is that it can be applied to receivers which have not worked with Band III converters. Indeed, when a receiver has been adjusted for the new transmitter then it should be capable of being worked with most of the Band III converters which are available on the present market.

One point which must not be overlooked is that in very many cases the I.F. coils will be found to have the cores practically sealed in position by some method. Great care must be exercised when dealing with these cores so as not to break them; a spot of methylated spirit is often of value.

All trimming must be done with an insulated trimmer. A metal trimmer such as the blade of a screwdriver will give false results.

Aerials

There should be no need to alter the aerial systems except where highly directional arrays are employed. In these cases it may be found necessary to alter their direction somewhat.

Where the receiver is located near the new transmitter it may be found that the signal is too strong. In this case attenuators can be fitted in the aerial circuit. A simple attenuator is shown in Fig. 6.

A simple attenuator of this kind should be found suitable for most cases, and can be wired directly into the aerial circuit within the receiver chassis.

A point worth observing is that it is generally better to fit an attenuator to the aerial system, than to reduce the efficiency of the aerial by replacing it with one of lower quality. A poorer aerial will reduce the signal to noise ratio—an attenuator still retains that ratio.

When the new transmitter gets into its stride many people will feel the benefit of its increased range and power.

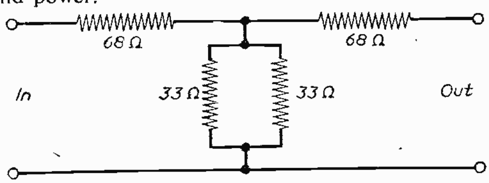


Fig. 6.—Circuit of an attenuator.

L. C. Jesty Honoured by I.R.E.

THE Institute of Radio Engineers, New York, has honoured Mr. L. C. Jesty, of Marconi's Wireless Telegraph Co. Ltd., by electing him a Fellow of the Institute. The citation reads :—

Mr. L. C. JESTY

"For leadership and personal contributions in the development and evaluation of television systems."

L. C. Jesty, B.Sc., M.I.E.E., F.Inst.R.E., F.T.S., F.B.K.S., is Chief of the Television Research Group at the Marconi Research Laboratories, Great Baddow, in which capacity he joined the company in 1949. In recent years he has been closely connected with research into, and evaluation of, colour television systems, and has done much pioneer work on Anglicised versions of the N.T.S.C. system, with one of which the BBC is now conducting experimental transmissions.

First Radar Tube

Mr. Jesty, after graduating from University College, Southampton, was appointed to the staff of the G.E.C. Research Laboratories at Wembley, Middlesex, in 1927, and was for some time engaged in research on electric lamps. In 1933, however, he started and built up a cathode ray tube research group. He was responsible, among other things, for developing the "safe" bulb shape (which made large tubes possible), and the rigid concentric electron gun assembly, which subsequently satisfied airborne radar requirements in withstanding vibration, so contributing materially to the first radar tube to be used in aircraft—the VCR97.

In 1938 he commenced specialist work on radar applications of cathode ray tubes. Wartime radar personnel will recall the VCR84, the first 12in. tube with a double-layer long-afterglow screen, for which his team was responsible. In 1944 he was promoted to the leading scientific staff of the laboratories.

A 'View Master' Conversion

HOW TO MODIFY THIS POPULAR RECEIVER FOR SINGLE SIDEBAND WORKING

By L. D. Stuart

IT is now fairly common knowledge that all British television is now transmitted using a single sideband. The London BBC transmission on its transfer to the Crystal Palace fell into line with other stations and now operates on the lower portion only of the band which it previously employed.

This subject has been adequately treated in articles in PRACTICAL TELEVISION, the most recent being that entitled "Alignment of T.V. Receivers" in the November and December issues of 1955. It is only necessary here, therefore, to emphasise how the change affects the performance of the London version of the View Master.

This stalwart, estimated (see PRACTICAL TELEVISION, November, 1955) to number 10,000, was designed to receive vision on the upper sideband. That is, on the half of the double sideband which has now been lost to us. The consequences of this are two-fold. In the first case, many converter units are designed for insertion between aerial and set to render it capable of receiving ITA transmissions without further modification. These will not perform properly on a View Master tuned to the upper sideband. Secondly, an unmodified View Master will no longer receive vision satisfactorily.

I took the opportunity of making a few quite simple modifications and this article describes my not unsuccessful efforts at conversion to single side-band working by re-tuning after adding a few simple components.

Not unsuccessful, because the receiver has returned to the custody of a small son who blithely selects either the BBC or the ITA programme as the fancy takes him. I am at present using a commercial version of the "R.F. pentode followed by a self-oscillating pentode mixer" type. The converter with cascode R.F. stage described on page 120 of the August, 1955, issue of PRACTICAL TELEVISION works equally well and has higher gain, which has advantages in certain circumstances to which I will refer later, while the PRACTICAL TELEVISION converter should be suitable at greater distances. Separate H.T. and L.T. supply for the converter is desirable—the View Master has none to spare, as we all know.

Details

It was obvious that the original design chose upper sideband working in order to dispense with the complication of sound traps, and that tuning the coils down to the lower vision sideband would necessitate the employment of one or more traps. Previous successful experience in another connection inclined me towards using the very effective method described by J. S. Hopwood in the September, 1953, issue of PRACTICAL TELEVISION. This applies traps to the "grid" ends of the grid coils of an R.F. amplifier.

Inspection of the View Master circuit diagram (usually depicted as in Fig. 1) was encouraging in that these "grid" ends seemed to be unencumbered. Inspection of the actual vision strip soon dispelled this idea. The R.F. grid connections on the actual receiver (which I built to the wiring instructions—and so, I expect, did you) proved to be not a bit like the published circuit diagram. The coupling turns to the preceding anode coils are in the "grid" ends of the grid coils of the second and third R.F. valves (not the "earthy" ends), and are adjacent to the "anode" ends of the primary windings. Rather like Fig. 2, in fact.

This makes the employment of Mr. Hopwood's method difficult, but we can see that it would be simple to add sound traps coupled to the *anode* coils, which are automatically effectively coupled

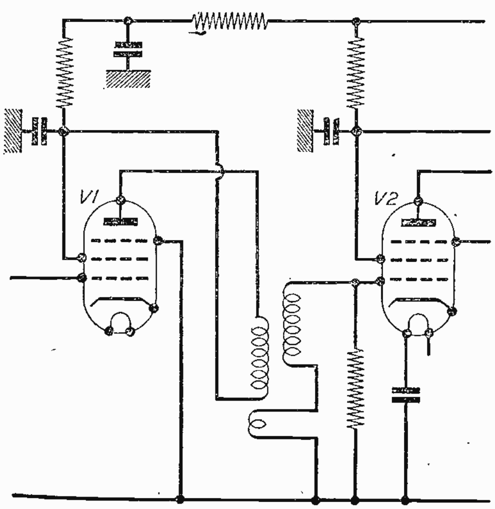


Fig. 1.—Circuit of the I.F. coil as originally published.

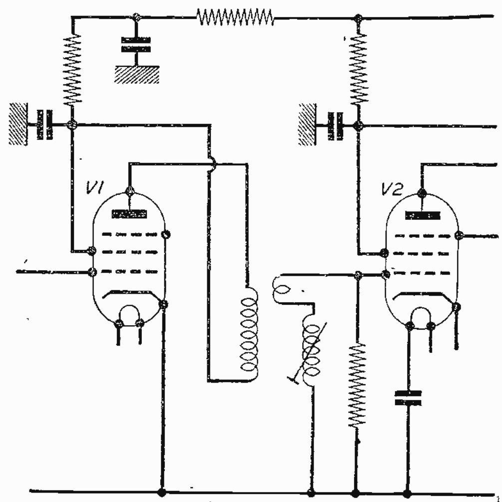


Fig. 2.—The coupling coil at the "top" of the grid coil.

to the "grid" ends of the following grid coils. It would simply mean winding the coupling turns of the sound traps round the tops of the anode-coil formers. (Note: "tops" here refers to the ends remote from the chassis-deck—we are inspecting from below).

These trap coils can be similar to that designated L11 in the original circuit. The tuning capacity required is, however, greater—there is no EF50 grid-cathode capacity to assist. Two traps are necessary, but I have added a third which serves to make the tuning of the first trap less critical with advantages to be described later. One notes, however, that the coupling turns of the diode input coil are, in fact, in the "earthy" end. This is probably why the tuning of the third trap is uncritical.

The location of the three trap coils, together with the number of coupling turns is shown in Figs. 3 and 4. A simple modification of the input circuit, to adapt it for co-axial feeder, is also shown. This modification is not necessary if only the BBC programme is desired: but is probably essential if the receiver is to be used with an ITA converter not specially adapted for balanced output. The diagram also shows the sound coupling where the 2 pF coupling condenser in the original receiver is dispensed with in favour of a simple link coupling, consisting of a single turn of 5 amp. fuse wire between the first trap and L11.

A Warning

These conversion instructions will not suffice to make a bad View Master into a good one. A prerequisite is that the receiver be carefully aligned according to the View Master book, particularly as to the vision R.F. grid coils which should be peaked at 45 Mc/s. That is, to maximum brightness of picture. There should be two positions of the tuning slugs producing maximum brightness—with darkness each side of each position. If this is not so the inductance of the non-co-operative coil (or coils) is too high, and shorter slugs should be obtained and fitted or the bottom turn loosened, or (as in my own set) removed entirely, thus shortening the winding by one turn. If your coil formers are of the type having an internal lip preventing the slug from projecting at

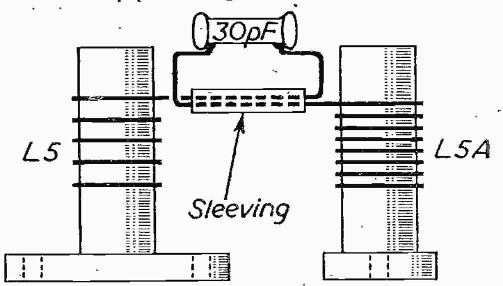


Fig. 5.—How the coupling condenser between L5 and L5A is arranged.

the end remote from the coil base the second tuning position may not be attainable even though the coil is correctly sized. Make sure the slug is not exactly central when at maximum picture brightness.

Alignment

With this tuning, and that of the sound strip completed, the traps may be fitted in the positions shown using, if you are lucky enough to have them, holes intended for coils used in the provincial versions of the View Master.

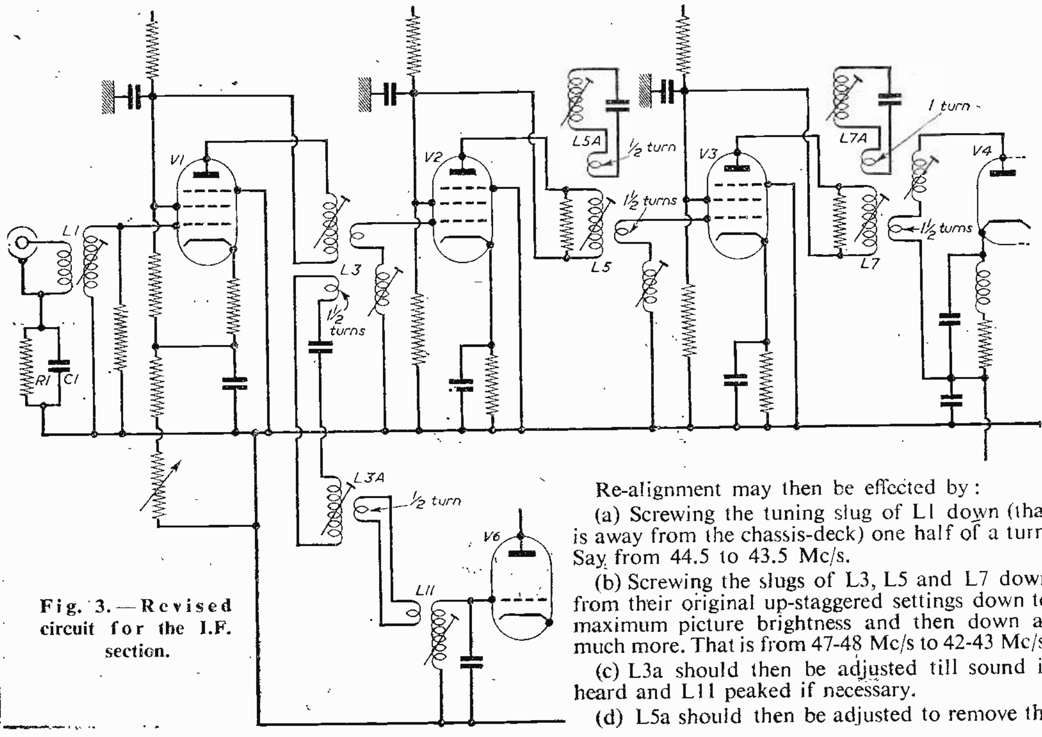


Fig. 3.—Revised circuit for the I.F. section.

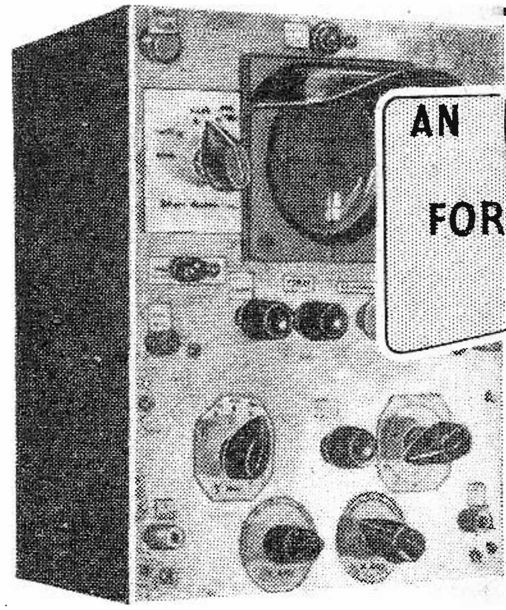
Re-alignment may then be effected by:

(a) Screwing the tuning slug of L1 down (that is away from the chassis-deck) one half of a turn. Say from 44.5 to 43.5 Mc/s.

(b) Screwing the slugs of L3, L5 and L7 down from their original up-staggered settings down to maximum picture brightness and then down as much more. That is from 47-48 Mc/s to 42-43 Mc/s.

(c) L3a should then be adjusted till sound is heard and L11 peaked if necessary.

(d) L5a should then be adjusted to remove the



AN Oscilloscope FOR TV

A VALUABLE SERVICING AID

By J. Hillman

(*Concluded from page 459, May issue*)

CONTINUING the constructional data, connections to the C.R.T. holder are by means of ordinary single flex, and the condenser C9 and resistor R13 are mounted direct on the Perspex holder by drilling small holes to allow their wires to pass through and support them.

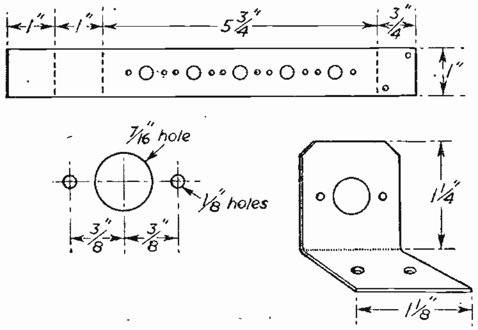
Rubber grommets are used for all wires passing through the chassis. A slot is cut in the C.R.T. bracket to allow the coaxial leads to pass through easily.

The L.F. choke is mounted on the back panel underneath the mains transformer. The fuse-holders are mounted close beside the 2-pin main input socket. All heater wiring is run away from other wiring and kept close to the chassis, and the chassis is used as a return wire.

The circuit diagram is pasted inside the bottom plate for reference.

Operating Details

After checking all the wiring, switch on the brilliance control and wait for a few seconds. Then advance this control until a spot or a trace is seen on the screen. Use the focus control to get the sharpest image at the centre of the screen; defocusing may be noticed at the edges, but the centre is the main thing to get in focus. Make sure the X and Y shift controls work smoothly, shifting the trace smoothly from left to right and up and down; one should be able to put the spot anywhere on the screen by means of these controls.



Figs. 14 and 15.—Details of the potentiometer bracket.

Next connect a lead from 50∿ test to Y out socket, and with coarse frequency switch at Range 1, beam blanking hard, beam switch on Y amp. low, sync int. and X int., a trace should now appear on the screen if the Y amp. is advanced enough. The trace will probably be moving rapidly, but by operating the fine frequency control a point will be found where it moves slowly. Now advance the sync control until the trace remains stationary. The length of the trace can now be adjusted by the X amp. control.

To set the beam-blanking adjust preset R2 until the flyback lines just blank out.

The lengths of the traces on the various ranges can be adjusted by means of the presets R19, 20, 21, 22, 23.

The linearity control R26 is set up on Range 1, and by adjusting the fine frequency control until about 5 cycles are shown then by adjusting R26 and R23 the 5 cycles can be made equal to each other. This control R26 only affects Range 1 as the time-base is linear on the other ranges. One word of warning regarding the use of the sync control: If this is advanced too much it will distort the trace, so only advance it sufficiently just to lock the trace.

To calibrate the controls, roughly stick squares of paper under the knobs and mark off in 10 divisions

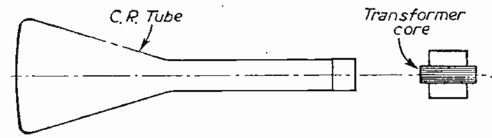


Fig. 21 (Top).—Positioning the transformer and tube base.

Fig. 22 (Bottom).—The trace, affected by radiation.

using Indian ink, and use the 50∿ test socket to get the position for 50∿. That will be when one complete cycle is seen on the screen. Similarly, 2 cycles on the screen will indicate 25 cycles frequency.

Other Frequencies

Similarly, by using a 300 or 400 cycles audio test signal from a signal generator, further calibration points can be obtained up to 800 cycles, and by using the R.F. range of an Avo Wide Range Signal generator 50 Kc/s, 100 K/cs and upwards to 300 K/cs can be calibrated, and by expanding the trace fully by means of the X amp., up to about 20 cycles can be counted quite easily.

For the frequencies in between 800 cycles and 2.5 K/cs, an audio generator would be required and the writer used a home-made one and it does not need to be very accurate. The 100 cycles can be calibrated, and then, leaving the oscilloscope set at 100 cycles, a wave of 800 cycles or more can be reset on the audio generator; this can be carried out again at 1,600 cycles and will thus cover the gap.

Line Transformer Testing

First a lead is connected between the line output test socket and the Y output socket. Next, a test

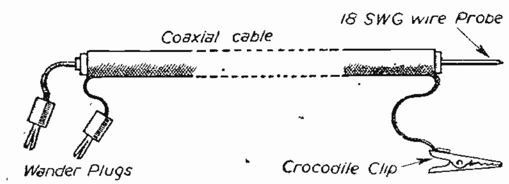
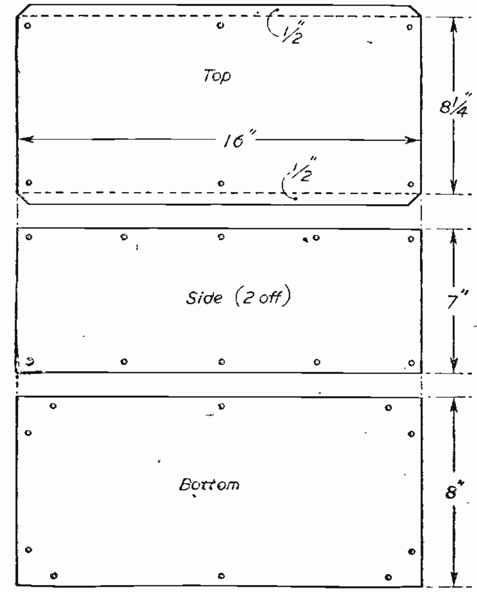


Fig. 20.—Details of the test lead.

lead is connected from the Y output socket and earth socket to the primary of the line output transformer under test. Usually the easiest points to connect the leads to are between the top cap of the line output valve and chassis.

Now set sync control at zero, Y amp. switch to high, Y amp. about one third from off and X amp. about half-way, range switch at 3, fine frequency about a third.

A trace should now appear on the screen as in Fig. 23A if transformer is all right, and B if transformer has any shorted turns. A point to note, however, when trace B is obtained is that it can also be due to faults in any other coils in that part of the circuit, e.g. scan coils or width coil, so that a further



Figs. 17, 18 and 19.—Top, sides and bottom of chassis.

check must then be made by disconnecting these coils one by one.

The oscilloscope can also be used to check heater/cathode leaks in valves.

First set up the controls to give a 50-cycle trace on the screen, then with the probe touch the cathode of the valves one by one and any leakage will show

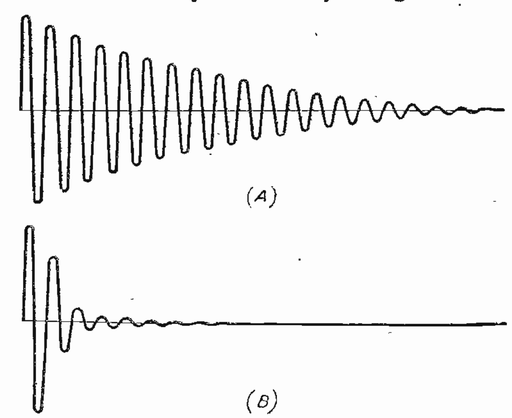


Fig. 23 (A and B).—Response curves with sound and faulty line transformers.

up as a 50-cycle trace. The action of the sync separator can also be checked by first getting a trace from the video input to the sync valve and then checking at the anode or screen where the sync pulses are taken off and no trace of the picture context should be present, just the sync pulses.

MISCELLANEOUS PARTS

14 metal wander plug sockets	6 Int. octal valveholders	Coaxial cable—as required (7/.036 type)
6 insulated wander plug sockets	1 B36 valveholder	Nuts and bolts as required
1 socket and wander plug combined	1 B5 valveholder	Solder tags 4BA as required
3 Wander plugs	1 twin fuseholder	Wire and sleeving as required
1 crocodile clip	2 500 mA fuses	2 group panels
1 grid cap Int. octal	7 small round coloured knobs	Polystyrene rod as required
1 two-pin plug and socket, polarised	3 small pointer knobs	Rubber grommets as required

Radio Components Show

DETAILS OF SOME OF THE MOST IMPORTANT TELEVISION EXHIBITS

THE most noticeable feature of this year's show was the large expansion of the use of printed circuit technique. This has resulted in the introduction of many new components designed expressly for the use of this type of circuit, and as a result not only has the overall size been reduced, but different fixing methods have been introduced. For instance, as readers who have followed the details of the new tuner for the View Master in these pages will have seen, the valveholders are now supplied ready for direct insertion in the printed circuit plate, the projecting lugs of the sockets being soldered on the underside to the copper coating.

Among many examples of printed circuits shown by T.C.C. was a complete “ front-end ” of a TV set, with a tuner for Bands I and III, an F.M. tuner, a portable radio set with self-contained battery, several hi-fi amplifiers and transistor computer panels.

B7G, B8A and B9A stand-off type valveholders for printed circuits made of moulded woodflower or natural nylon-loaded P.F. with pen-nib contacts and optional skirts for screening cans were shown by McMurdo Instrument Company.

B9A and B7G holders in high-grade phenolic mouldings designed for rapid and reliable dip soldering were exhibited by Carr Fastener Company.

Egen Electric showed special resistors for printed circuitry and Electro-Methods had connectors suitable for 1/16th cards up to a maximum of 22 ways moulded in melamine with U-shape sockets of gold-plated phosphor bronze.

Capacitors

Miniature electrolytic condensers, specially designed for printed circuits were shown by Daly Condensers Ltd., Plessey, T.C.C., L.E.M., Dubilier, Hunt, etc.

Special type condensers are also made for fluorescent lighting, photo-flash equipment and mine exploders.

Sub-miniature polystyrene capacitors, measuring only 10 mm. x 4 mm. varying in capacity from 5-330 pF and designed to work up to 125 volts D.C. were shown by Suflex.

For automatic assembly in printed circuit production, Plessey miniature capacitors are mounted on a paper strip wound on a drum.

Test Instruments

New test instruments included a TV waveform generator, combined with an A.M. and F.M. signal generator and sweep oscillator, suitable for use on British, American and C.C.I.R. systems (Taylor Electrical Industries).

An F.M./A.M. signal generator covering a range of 10-470 Mc/s in five bands with a tuning system allowing small frequency changes to be read from a directly calibrated meter suitable for all carrier frequencies (Marconi Instruments Ltd.). A portable D.C. voltmeter, made by British Physical Laboratories, had a resistance of 1 megohm per volt. It covers nine ranges up to 500 volts.

Avo models 7 and 8 are now available in pan-climatic versions. These instruments have passed Government tests for use in tropical climates. They will withstand high temperature, humidity and the cases are fungus resistant.

Valves and C.R.T.s

The G.E.C. type KT55 tetrode is a new beam type output valve for D.C./A.C. equipment with the limited H.T. available from 220 volts D.C. mains. Two of these new valves in push-pull will give an output of 25 watts—double that hitherto obtained from British valves.

New valves introduced by Edison Swan include a range of 12 types of 0.3 amp TV valves for series heater connection and also a variable mu H.F. valve for F.M. sets. The CRM93 is a 9in. cathode ray tube incorporating all the latest developments and suitable for the new portable TV sets. It is also thought that it might be welcomed for use in receivers designed to reduce the hire purchase deposit.

For the first time Ferranti were showing a range of ceramic valves.

Resistors

Egen Electric have produced an inexpensive version of sub-miniature potentiometer of the pre-set type in three forms. One is for chassis mounting with tag connectors: another has wire terminations and the third type is of the plug-in variety for use in printed circuits.

A new development, known as Pin Assembly Circuits, was shown by Erie. Designed to replace the conventional components with a tangle of wiring, the P.A.C. units are in such compact form that 15 components occupy only one square inch of chassis space. These are particularly suitable for printed circuits and other methods of automatic assembly.

The P.A.C. units consist of resistance and capacity elements 1/8in. diameter and 5/8in. long, varying in number from 3 to 4 to 90—and all connections are embodied in the moulded assembly. These elements terminate in special spill-type pins for insertion in the holes or eyelets of printed circuits ready for dip soldering.

The same firm is showing a hi-fi output transformer for use with G.E.C. KT66 valves in “ Ultra Linear ” connection and handles an audio power of 25 watts in the frequency range of 25 cps to 25,000 cps.

For the “ distributed load ” version of the Mullard 5-10 amplifier there is a new Partridge hi-fi “ C ” core output transformer.

Aerials

Many types of aerials, including arrays with up to 10 elements for V.H.F. and TV Bands I and III, in both indoor and outdoor forms, were shown by Antiference. A printed circuit is used in the “ Y ” connector box which enables a single aerial feature cable to be used with aerials for both bands.

Belling and Lee showed types for Bands I, II and III.

The Aerialite “ Multiway ” aerial elements can be arranged in 18 different ways through angles varying from 0 degrees to 350 degrees.

sound-on-vision ripple which should now be seen on the tube. This tuning should be commenced with the slug at the bottom of its coil—bottom being the end remote from the chassis-deck in this instance. A “ bright picture ” position will be passed through en route to the correct position.

Residual ripple may be removed by adjustment of the third trap L7a but this may be deferred till later.

These are initial settings only and may be effected on a normal transmission. As with the original View Master, close adjustments are made on Test Card “ C,” and the making of these is a matter of individual experiment (and experience). The adjustment of L3a is critical as regards resolution of the higher frequency line-squares. Where critical adjustment introduces sound ripple, adjustment of L7a will clear it. *The use of a signal generator is not necessary!*

PARTS LIST

3—7½ turn coils on ⅜in. Aladdin formers. With 6 mm. or 0 B.A. “ iron ” cores.
1—25 pF High K miniature condenser (or 2—50 pF in series).
1—30 pF High K miniature condenser (or 1—25 pF paralleled by a 5 pF).
1—40 pF silver ceramic.
5in. of 5 amp fusewire. 2in. of 1½ mm. sleeving.
A few inches of plastic tape.
Note.—Low capacity condensers are rather variable and it is useful to have an odd 5 pF to parallel to locate a low one. Or the 2 pF removed from the original circuit may serve.

Referring to the statement that the conversion cannot make a bad set into a good one it may, however, be stated that if your receiver resolved, say, the 2.5 Mc/s lines before adaptation, it will do so rather more easily afterwards. It was the experience of most of us that the tuning of an upper sideband View Master was a “ throw-away ” technique whereby gain was sacrificed for definition, the limit being reached when line-tearing commenced. With lower sideband tuning staggering may be continued till the vertical lines on Test Card “ C ” suffer without the exhibition of weak sync and line slip which would have resulted before adaptation. One can also use “ better ” EF50's than an upper sideband View Master will carry without instability. My own set will just resolve the 3 Mc/s lines though this may be in part due to some other minor modifications which I may perhaps have an opportunity of describing at a later date. I was not able to achieve this with the original circuit.

Apart from the conventional Parts List and some notes on the mounting of the coils and condensers there is little more to add. Two friends of whom one has been abroad a year since last handling a View Master found no difficulty in “ lining ” my set.

Method of Mounting Coils

If your vision chassis is of the universal type with lots of extra holes intended for use with other channels you may be able to fix L3a, L5a and L7a without drilling. If this is not the case the positions may be marked out from the dimensions given in Fig. 4 which serve to locate the centres of the coils.

With the coils in position take the free lower end of L3a and wind it counter-clockwise round the lower end of L3 for 1½ turns. This involves threading the wire between the L3/L4 coupling turns and chassis. Thread on a ⅜in. length of sleeving, draw tight, and secure the coupling turns with a spot of shellac varnish. (Don't use cellulose or polystyrene cement—it is apt to soften the coil former.)

L5a is coupled to L5 in a somewhat similar manner, but a half turn only is taken round L5 and it can be at the top of L5.

L7a is coupled to L7 in the same way except that, to achieve a single turn, the turn round 7a is reverse wound and the finish crosses the start.

Mounting the Condensers

This is shown in Fig. 5. The method is unscientific, contrary to all the best teachings of R.F. circuitry, but entirely satisfactory. It consists in threading the free ends of each coil through the short length of sleeving already passed over the other end, turning each end up after drawing tight, then baring and scraping the wires and soldering the appropriate condenser in position. In particular, it permits the condenser to be changed or added to without disturbing the coupling.

Sound Take-off

This consists in a single turn of 5 amp fusewire wound round the centres of L3a and L11 on top of a protecting strip of plastic tape wrapped round the existing winding of each coil. This constitutes a simple link with a half turn around each former. The ends of the bare wire should be twisted together and touched with solder.

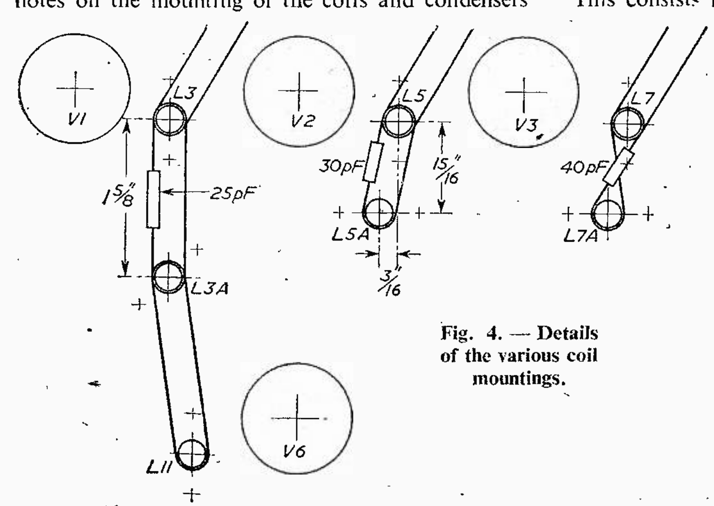


Fig. 4. — Details of the various coil mountings.

IMPROVING ITA CONVERTERS

ADDING A FURTHER TUNED CIRCUIT TO IMPROVE SELECTIVITY AND GAIN

By P. J. Evans

MANY readers living outside the primary service area of their local Band III transmitter, or in areas of poor reception, will have found that some increase in the gain of certain converters would be an advantage. This relates particularly to the P.T. and similar designs. In fact, any constructor who feels that more gain is desirable will find that the following modifications will be well worth the time spent in making the changes. In the result, the bandwidth is more than adequate; there is even less noise; break-through patterning from the Band I transmitter is reduced to negligible proportions; and at the same time the overall gain is increased by some 5 dB.

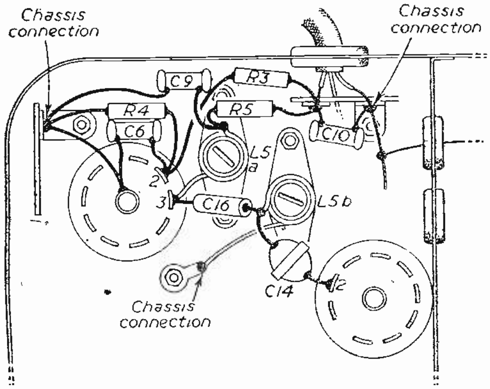


Fig. 1.—Location of the new coil L5a and new position of existing components in the P.T. Converter.

In one particular case with the original circuit it was necessary to turn the contrast control right up to produce an acceptable Band III picture—even then it was difficult to obtain sufficient sound. But with the modified arrangement the same control can be turned down hard against its stop with ample sound and better results on the screen than before.

The fundamental change is made in the coupling between the two valves. Instead of the single tuned-anode coil in the second cascode triode, a band-pass coupling circuit is incorporated with top-capacitive coupling. In addition to the capacitive coupling the coils are physically spaced so that there is a useful degree of inductive coupling as well. Some increase in gain can also be achieved by modifying the turns on the aerial input coil, as well as by experiment with the value of the capacitor in the bottom or earthy end of the neutralising bridge network.

Modifications

To make the coupling changes the following procedure is recommended, the details relating specifically to the October blueprint design. An additional coil former has to be provided between V1 and the existing coil L5; in order to make space for the new former, the screen between V1 and V2 must be removed. To do this, the earth busbar running through the screen from the central earthing point of V1 to the 3-way tag strip in compartment B should be taken out. Condenser C6 is earthed to the common point on V1; C10 is reconnected to earth on the tag strip; and C9 can be removed completely for the time being.

The connection from pin 2 on V1 valveholder to the junction of R3 and R4 is removed, and the other end of R4 is disconnected from the tag strip in compartment A and pulled through the screen. C14 is unsoldered from L5, and L5 disconnected from pin 3 of V1.

The screen can now be removed and discarded. At this stage it simplifies matters if coil L5 is removed

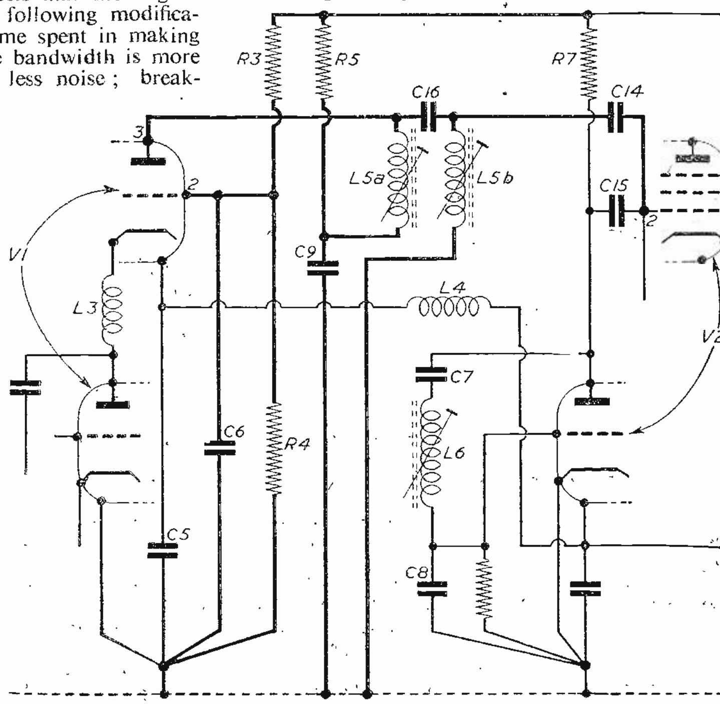


Fig. 2.—Modifications to the P.T. Converter shown in heavy lines.

from its former and its feed resistor R5 is also taken out of the chassis.

There should now be plenty of room for mounting the additional coil former between the L5 former and the valveholder of V1. Its precise location is not critical except that the centres of the two formers should be about ⅝in. apart. No drilling dimensions are specified as it is easier to mark out the holes direct from the coil former after determining the

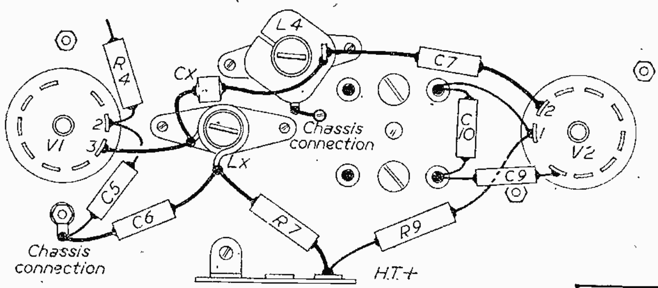


Fig. 3.—Modifications to the Teletron Converter. Note new position of L4.

best position. A former that mounts completely under the deck is preferable to the type that projects partly through the chassis—otherwise difficulty may be encountered because of the projection fouling the valveholder.

Resistors R3 and R4 can be repositioned and connected as shown in the diagram, Fig. 1.

The new coil L5a consists of 3½ turns of 18-gauge tinned copper wire with the turns spaced approximately twice the diameter of the wire. This is placed on the new former and the bottom of the coil goes to pin 3 of V1. The top is connected to H.T. through a 1 KΩ resistor (use R5) and decoupled by a 1,000 pF condenser C9, as shown in Fig. 2.

On the former used for the original coil (L5) is wound a new coil of 4½ turns similar to L5a. The new coil is designated L5b. It is important that both L5a and L5b are wound in the same direction and it is advisable to wind them in anti-clockwise direction, as shown in the diagram.

The bottom of L5b (the end nearest the chassis) is earthed at the nearest convenient place—a tag under the adjacent fixing screw of V1 valveholder is probably best—and the top end is connected to pin 2 of V2 through C14 (10 pF). The top end capacitive coupling between the two coils is arranged by connecting a small condenser from the top of L5b to pin 3 of V1. A ceramic type is recommended for this new condenser which need not be greater than about 2 pF.

Neutralising

In the author's case, an increase in value of the condenser in the bottom end of the aerial input coil (C2) resulted in a useful increase of signal output. It was necessary to increase the value to 17 pF for maximum gain.

Aerial Input Coil

This was changed to four turns of 20 s.w.g. tinned copper wire spaced approximately twice the diameter of the wire with two turns of 24 s.w.g. double-cotton covered for an aerial coupling coil wound on at the earthy end.

Other Designs

This simple modification to the form of coupling the two valves appears to be applicable to other similar circuits. In the case of the Teletron Mk. II arrangement for instance, the same useful increase in gain can be achieved. The changes for the Teletron are somewhat simpler to incorporate as ample room already exists under the chassis for the additional components.

The revised chassis layout showing the new arrangement is shown in Fig. 3 and the theoretical circuit is given in Fig. 4.

Here again the spacing between the coupling coils L4 and Lx can be about ⅝in. to ¾in. L4 supplied in the coil kit is used as the grid coil and a new coil Lx is connected in the anode circuit of V1. Lx consists

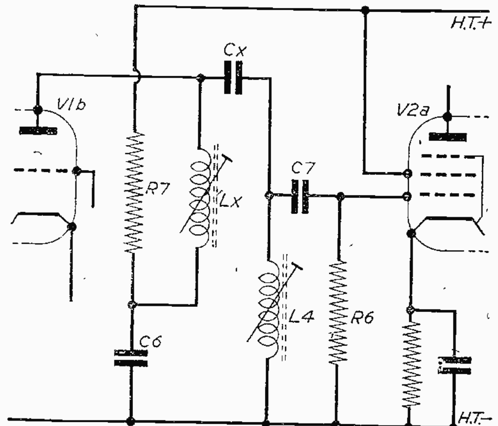
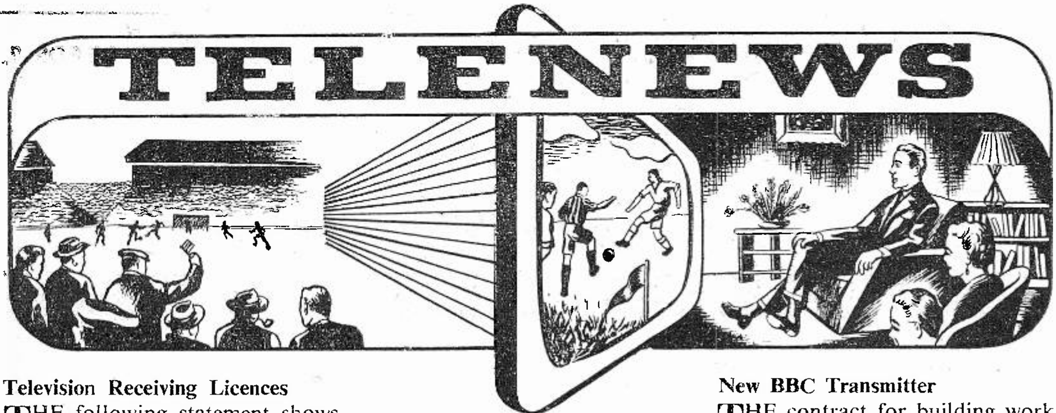


Fig. 4.—Circuit of the modifications to the Teletron Converter. Cx is 2 pF, and Lx consists of three turns widely spaced.

of three turns of 18 s.w.g. tinned copper wire with considerable spacing between the turns so that the coil occupies the whole of the former.



Television Receiving Licences

THE following statement shows the approximate number of Television Receiving Licences in force at the end of March, 1956, in respect of receiving stations situated within the various postal regions of England, Wales, Scotland and Northern Ireland.

Region	Total
London Postal	1,296,020
Home Counties	654,174
Midland	993,223
North Eastern	873,564
North Western	830,161
South Western	381,627
Wales and Border Counties ...	320,466
Total England and Wales ...	5,349,235
Scotland	348,152
Northern Ireland	42,206
Grand Total	5,739,593

During March the number of television licences increased by 90,327.

14,261,551 broadcast receiving licences, including 5,739,593 for television and 293,459 for sets fitted in cars, were current in Great Britain and Northern Ireland at the end of March, 1956.

U.S. Set Replacements

AN interesting sidelight on American policy is revealed by some recent figures of set replacements. The G.E.C.'s tube market research manager stated that sets are scrapped when they need tube replacements, and a boom is expected in set replacements this year. It is suggested that nearly all of the 3,533,000 sets sold in 1948-49 will be eligible for replacement this year. In 1954 1,630,000 sets were scrapped, and in 1955 2,370,000 were replaced.

Television Band III Converters

THE Post Office has found that in some cases where Band III television programmes are taken by means of a "converter" added to a Band I set, viewers are liable to cause interference to others.

It is a condition of the receiving licence that the set shall not cause interference to other wireless (including television) users. Having consulted the British Radio Equipment Manufacturers Association the Post Office advises users of Band III converters which cause interference to ask their radio dealers about the most suitable steps which should be taken to stop the interference. The Post Office regrets that it cannot itself undertake the work of curing the interference.

Air-to-ground TV Tests

REPRESENTATIVES of Scotland Yard and senior Army officers recently watched a demonstration in Bristol of air-to-ground television by means of a helicopter. The system could be used by police in manhunts or for traffic control.

A helicopter took off from Filton and flew at heights of 500ft. to 1,000ft. A camera mounted in the plane transmitted pictures to a screen on the ground. Tests lasted half an hour.

New BBC Transmitter

THE contract for building work for the new Scottish Television Transmitting Station at Rosemarkie, about 12 miles N.N.E. of Inverness, has been placed with Alexander Hall & Son (Builders) Ltd., of Granitehill Road, Northfield, Aberdeen.

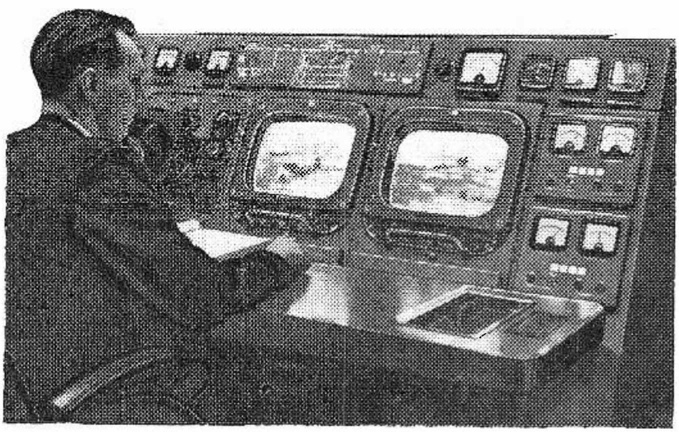
The contract includes the construction of the transmitting station building and of the access road.

Work on site will start almost immediately and it is expected that the building will be sufficiently far advanced for the installation of plant to begin during the late summer this year.

Croydon ITA Station

IT is reported from ITA's London television station at Croydon, that up to December 28th the Marconi vision and sound transmitters installed there had been radiating for a total of 1,333 hours, of which 700 hours had been taken up by programme time.

During the whole of this period



Mr. Cutler, of Norbury, at the main control desk of the new BBC transmitter at Crystal Palace. Only a temporary Mast Aerial is being used for the time being. The permanent Tower will come into use later in the year.

the vision transmitter has been "off the air" due to breakdown for only 23 minutes 13 seconds, and the sound transmitter for 12 minutes 40 seconds.

Expressed as a percentage, vision transmitter breakdowns amount to only .029 per cent. of the total hours of radiation, while sound transmitter breakdowns represent .016 per cent.

Colour TV Award

FROM Philadelphia comes news that English-born Frank Bingley has been awared the 1956 Vladimir K. Zworykin Television Prize for outstanding contributions to the development of colour television. The annual winner is selected by the Institute of Radio Engineers and the award is made at the annual meeting of the I.R.E. in March.

Mr. Bingley, Executive Engineer of Philco Research Laboratories, received the award for his exhaustive and penetrating study of the relationship between the science of colourimetry and the compatible colour television signal developed by the National Television System Committee and approved by the Federal Communications Commission.

Born in England where he was graduated from the University of London, he joined the Philco Research Laboratories in 1931, where he has since been engaged in the development of electronic transmitting and receiving equipment, as well as television-systems engineering. At the moment he is actively engaged on Philco's intensive research programme on research on colour TV.

Behind the Scenes

VIEWERS of the BBC Television programme "Science Review" on April 4th had a "behind the scenes" view of how the most important component in their TV set is made.

During the programme a filmed sequence of some interesting aspects of the production of cathode ray tubes was featured. What to the viewer is a flattish, oblong screen was seen to be just part of a highly complex piece of scientific apparatus.

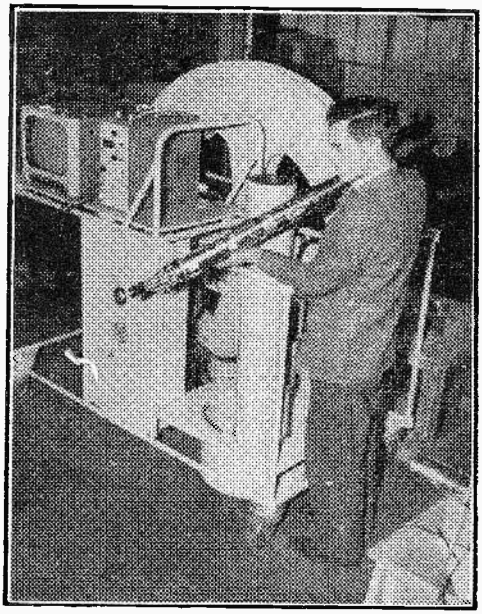
The film sequences were adapted by Norman MacQueen—who produces the programme jointly with James McCloy—from the Mullard film "Made for Life."

Pye Atomic Camera Authority

AFTER demonstrating industrial television to the Atomic Energy Authority last year Pye Limited were given a contract to design a special camera capable of being used inside an atomic reactor at the Authority's Cumberland factory. This has now been completed and has been delivered to Harwell for tests prior to its use at Calder Hall.

The camera, which is based on Pye's normal industrial television equipment, has had to conform to certain very rigid specifications, and as a result of the experiments which were carried out at the Authority's premises it was found that special materials had to be used. The work which has been done by the engineers can be regarded as a triumph of mechanical engineering, particularly in view of the complex problems of design. For ease of manipulation the camera carries its own source of illumination, consisting of a series of four small but powerful bulbs grouped around the camera's lens.

As the camera is liable to be exposed to temperatures of up to 200 deg. C., the control cables leading to the camera head are enclosed in a flexible hose through which carbon dioxide is pumped to cool the cables and camera. Radioactive dust can be removed from the camera, after its withdrawal from the reactor, by washing down.

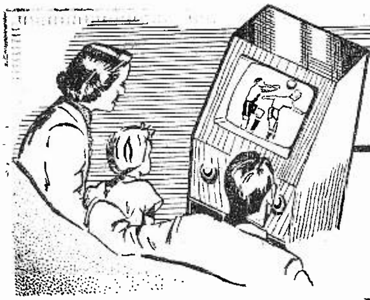


View of the atomic camera which is held by Mr. W. L. Cruickshank, Development Engineer, with the controls and receiving set—mounted on a portable trolley.

Russia Buys British

MARCONI'S WIRELESS TELEGRAPH CO., LTD., are to supply the U.S.S.R. with a large quantity of television equipment. Amongst the main items in the order are included two three-camera television outside-broadcast vehicles, two mobile petrol-electric trailer power units and a comprehensive supply of spares.

Marconi Mk. III cameras fitted with 4½in. English Electric Image Orthicon pick-up tubes are incorporated in the O.B. vehicles. Facilities in the latter include sound and vision mixing equipment, duplicated synchronising generators and comprehensive intercommunication and commentators' panels.



UNDERNEATH THE DIPOLE

TELEVISION PICK-UPS AND REFLECTIONS

By Iconos

TV NEWS AND NEWSREELS

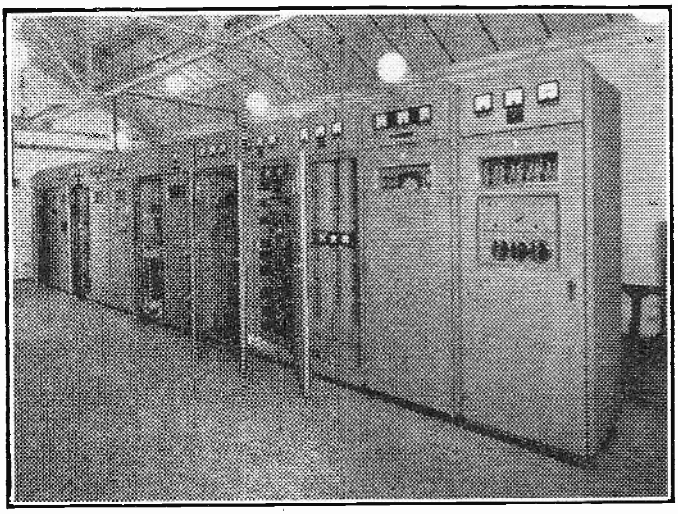
EVER since the BBC abandoned their original newsreel format viewers have taken less and less interest in the news items on TV. At one time most viewers took care to switch on for the newsreel, and if they missed any special item looked forward to the week-end hour's newsreel saga of events of the week. This was produced in the well-tried cinema newsreel style, with musical background almost throughout, sub-titles to sequences—and commentary when required. The sound-only repeat of the radio service news bulletin at the end of the TV programme seemed to be quite adequate. Then came the revised system of "News and Newsreel," which changed the style from cinema "magazine" presentation to the factual documentary stuff with newsreaders, diagrams, stills, short film sequences and other odds and ends. It was a thorough mess, at first, and the editorial board still seem unable to strike a format which interests viewers. The ITA have made the same mistake, and in addition make much use of speedily processed 16 mm. film sequences which are of poor quality. It was only natural that ABC-TV, with all the newsreel resources of the Pathé organisation behind them, should hesitate before taking IT News items which had probably been adequately covered by the 35 mm. cameraman of the Pathé Newsreel, in any case. This storm will probably die down and, in due course, the IT News will take a new shape, presented in an entertaining manner and not as a pale imitation of the evening doses of news put out by the BBC. Viewers prefer their news pills to be sugar coated! The advertisers on ITA quickly found that the BBC's News and Newsreel, even in its much improved form, had not cured the viewers of switching off!

MOVIE MUSEUM

ONE of the most interesting film series put on for a long time by the BBC is "Movie Museum," an American series which presents entertainingly some of the early efforts of film-making by D. W. Griffiths and other giants of the silent days of the cinema. Incidentally, the photographic values of some of these early films seemed to be very good, in spite of the fact that the print must have been made from a "dupe" negative—certainly not from the original negative. Perhaps the American film laboratory which processed this film specially for television has corrected some of the imperfections. By the way, this accurate judgment of TV print requirements is seen in many other American film importations, such as the "Burns and Allen Show," "I Love Lucy" and "Inner Sanctum," though the last named series is sometimes marred by poor sound.

SOUND ON TV

I SOMETIMES think that the golden rule for TV producers is to look after the picture and let the sound take care of itself. This especially seems to apply to many of the "commercials," which have good ideas and pictorial presentation but badly recorded or badly spoken dialogue or music. Advertisers would be well advised to make use of 35 mm. film for picture with magnetic sound. Occasionally, the ITA's telefilm sound apparatus is at fault and the optical scanning light can be heard scanning the edges of the film perforations. This results in a faint "harmonicy" 100-cycle buzz. Careful checks and tests should take care of this trouble and in the meantime the possibilities of using a magnetic strip for carrying the sound in the normal sound track position should be investigated. An alternative is to use entirely separate magnetic film, electrically interlocked with the picture film.



Marconi Vision and Sound Transmitters as used at ITA London and Winter Hill. The $7\frac{1}{2}/10$ kW vision transmitter occupies the first seven panels from the right; the $2\frac{1}{2}$ kW sound transmitter the remainder.

Live TV sound is also occasionally below par. This is often due to bad microphone placing or sound mixing. Dialogue is frequently drowned by music or effects. Too often are actors allowed to clatter tea cups or slam doors as they say their lines, thereby covering important key words with the extraneous noise. Close-ups of instrumentalists in orchestras are shown—with the sound of the particular instrument faintly heard or not heard at all. I must say that this criticism does not apply to the transmissions of the Hallé Orchestra by AR-TV. This is usually excellent from the sound point of view, but not always as regards picture quality. Once again, Image Orthicon cameras demonstrate their crisp ability to add ten years to the age of Sir John Barbirolli and every member of his orchestra. When these TV cameras are good they are very, very good, but when they are bad they are horrid!

Destined to be known as "The Thing," this mobile hydraulic platform, mounted on a Bedford chassis, can raise a cameraman and camera up to heights of 40ft. or more. It is an Associated Rediffusion acquirement. Its main advantage is that it obviates the necessity for erecting scaffolding when a high angle camera position is needed.

BBC STUDIOS

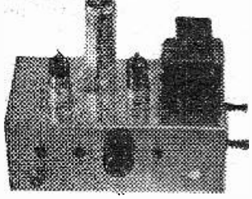
AT one time the sole BBC sound studio in London was a smallish room on the top floor of Marconi House, next to the 2LO transmitter. Every single item was sent out from this studio, from news announcements to orchestral concerts, the latter frequently performed under suffocating conditions. Two or three crude solid-back Post Office type carbon microphones were used. After a few months the BBC studio premises were removed across the Strand, to 2, Savoy Hill, where three sound studios sufficed for a very long time, supplemented by enterprising outside broadcasts from the adjoining Savoy ballrooms! Then came a rapid expansion of facilities, first at Savoy Hill, then at Broadcasting House and at many outside halls until to-day there are no fewer than ninety-seven BBC sound studios in the London area.

BBC REAL ESTATE

THE same geometric progression of real estate and leasing operations seems now to be taking place in the television field. The primitive facilities which did duty for such a long time at the Alexandra Palace have been superseded by a growing list of fully equipped and sound-proofed TV studios, with specialised stages for plays, talks, music, filmed features and shows with audiences. Including the two stages at the Alexandra Palace (which are still in use), the BBC now have sixteen permanent TV (or TV film) studios in London, plus two television theatres and numerous rehearsal rooms. Some of these premises have taken months from the date of acquisition to their recommissioning and fitting out for TV purposes. Major structural alterations, refitting, rewiring and replumbing seems to have been the rule before BBC operations could start. Two or three of the stages are still not in operational use. This was not the case, however, with the acquisition of the Ealing Studios premises, which was carried out with lightning rapidity. The last scenes of Ealing's feature film "The Long Arm," starring Jack Hawkins, were shot on Friday, 20th January. There was an auction sale of surplus equipment and furniture on the following Tuesday and Wednesday. The BBC officially took over the premises on the Saturday of the same week and on Monday, 30th January, they actually commenced shooting their own films there. On this day alone—their first day—they shot sixteen camera set-ups for film sequences in "Jesus of Nazareth," the series part-live and part-filmed, which has been so beautifully and reverently treated by the producers and actors. The BBC had wisely purchased a great deal of the Ealing film equipment, including power plant, lighting, camera and sound equipment, stage "props," some of the furnishings and even a large "street" open air set on the lot, which had been used in "The Ladykillers" and "Who Done It?" the Benny Hill film. Needless to say, the speedy transference of the premises was made possible by the close co-operation of BBC and Ealing executives, assisted by their respective technicians. Within a few days theatres were changed over to the 25 frames per second speed necessary in British television work, while Ealing carried on for a time with the final dubbing and editing of their last films made at that studio in their final "beach-head," the sound-recording block. Operation "Walpole Park Studios" had been painlessly carried out and the Ealing Films banner had been hoisted at the M.G.M. British Studios, Elstree. Congratulations all round!

BAND 3 T/V CONVERTER—183 Mc/s-196 Mc/s

£2-5-0 post free.



Suitable for London, Sutton Coldfield and Northern Transmission.

This Unit, comprising drilled chassis, 7in. x 4in. x 2½in., two miniature valves and met. rect., wound coils, res., conds., etc., is a slightly modified version incorporating variable oscillator tuning of the circuit shown in *Wireless World*, May, 1954. It has proved itself highly successful—over 4,000 sets have already been sold to buyers all over England. We invite you to visit us and see it in operation for yourselves. Suitable for most types of T/V Sets. T.R.F. or Superhet. Blueprint and circuit details will be sent on application by return of post, 1/6, post free. Supply voltages required 200-250 v., 20 mA H.T. 6.3 v. 1 a. L.T. Power pack components to fit chassis as illustrated, 30/- extra. Complete set wired, tested and aligned ready for use 20/- extra. Band 1, Band 3 Ae switching can now be added, switch kit, 6/6. Full range of Band 3 aerials in stock. Adaptors from 7/6 per set, dipoles—indoor 6/6, outdoor with cable 13/9. **Band 1-Band 3 Cross-over filter unit. from 10/6.**

B.B.C. BREAK-THROUGH FILTER. Tunable filter unit for B.B.C. pattern rejection, 8/6.

Volume Controls

Midget Ediswan type. Long Spindles. Guaranteed 1 year. All values 10,000 ohms to 2 Megohms.

No Sw.	S.P.Sw.	D.P.Sw.
3/-	4/-	4/9

COAX PLUGS ... 1/2
SOCKETS 1/-
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80 ohm CABLE COAX

STANDARD ¼in. diam. Polythene insulated. GRADE "A" ONLY.

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SPECIAL. — Semi-air spaced polythene, 80 ohm Coax ¼in. diam. Stranded core. Losses cut 50% **9d. yd.**

TWIN FEEDER, 80 ohms, **6d.** yd.; 300 ohms, **8d.** yd.
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50 OHM COAX CABLE 8d. per yd., ⅛in. dia.

TRIMMERS, Ceramic, 4 pf.—70 pf., **9d.** 100 pf. 150 pf., **1/3**; 250 pf., **1/6**; 600 pf., **1/9.** **PHILIPS** Beehive Type—2 to 8 pf. or 3 to 30 pf., **1/3** each.

RESISTORS.—Pref. values 10 ohms 10 megohms.

CARBON

20% Type. ¼ w., **3d.**; ½ w., **5d.**; 1 w., **6d.**; 2 w., **9d.**
10% Type, ½ w., **9d.**;
5% Type, ½ w., **1/-.**
1% Hi-Stab. ½ w., **2/-.**

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5 w.	25 ohms—10,000 ohms	1/3
10 w.		1/6
15 w.		2/-
5 w.	15,000—33,000 ohms	1/9
10 w.		2/3

WIRE-WOUND POTS. Pre-Set Min. T/V. Type. Knurled Slotted Knob. All values 25 ohms to 30 K., **3/-** ea. 50 K., **4/-.** Ditto Carbon Track 50 K. to 2 Meg., **3/-.**

3w. LAB COLVERN, Etc. Standard Size Pots. 2¼in. Spindle. High Grade. All Values. 100 ohms to 50 K., **5/6**; 100 K., **6/6.**

W/W EXT. SPEAKER CONTROL. 10 Ω, **3/-.**

CONDENSERS.—Mica or S. Mica. All pref. values. 3 pf. to 680 pf., **6d.** each. Ceramic types, 2.2-5,000 pf., as available, **9d.** each. **Tubulars,** 450 v. Hunts and T.C.C., .0005, .001, .005, .01, .02 and .1 350 v., **9d.**, .05, .1 500 v. Hunts Moldseal, **1/-.** .25 Hunts, **1/6.** .5 Hunts, **1/9.** .1 1,500 v. T.C.C. (Simplex). **3/6.** .001, 6 kV., T.C.C., **5/6.** .001 12.5 kV., T.C.C. **9/6.**

SILVER MICA CONDENSERS.—10%. 5 pf. to 500 pf., **1/-.** 600 pf. to 3,000 pf., 1/3. 1% 1.5 pf. to 500 pf., **1/9.** 515 pf. to 5,000 pf., **2/-.**

ALUMINIUM CHASSIS.—18 s.w.g. Plain, undrilled, folded 4 sides and riveted corners lattice fixing holes. Strong and soundly constructed with 2½in. sides. 7in. x 4in., 4/6; 9in. x 6in., 5/9; 11in. x 7in., 6/9; 13in. x 9in., 8/6; 14in. x 11in., 10/6; and 18in. x 16in. x 3in., 16/6.

CARBON MIKE INSERT.—Superior quality type 2½in. x 1in. Brand new and boxed only, **3/3** each.

BRIMISTORS.—CZ1 for .3a heater chains, **3/6.** CZ2 for .15 a., or .2 a., **2/6.** CZ3 (Pilot Lamp), **1/6.**

COPPER ENAMEL WIRE.—¼ lb. 14 to 20 s.w.g., **2/-**; 22 to 28 s.w.g., **2/6**; 30 to 40 s.w.g., **3/3.**

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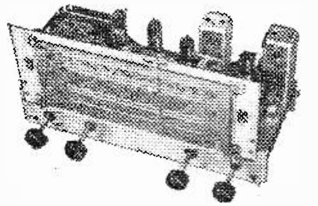
With variable Tone and Volume controls, 3 Midget B.V.A. valves. 4 watts output. Neg. feedback. Chassis isolated from Mains. A.C. 200/250 v. A quality amplifier at an economical price. **PRICE £3.19.6.** Carr. 2/6. Wired and tested, **15/-** extra. Circuit and instr., **1/6,** free with kit.



ALL WAVE RADIOGRAM CHASSIS
THREE WAVEBANDS. FIVE VALVES.

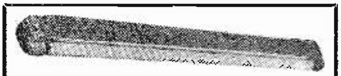
S.W. 26 m.—50 m.
M.W. 200 m.—550 m.
L.W. 800 m.—2,000 m.

LATEST MIDGET B.V.A. SERIES.

Brand new and guaranteed. A.C. 200/250 v. 4 pos. W/C sw. S.Med.L.Gram. P.U. connections. High Q dust core coils. Latest circuit technique, delayed A.V.C. and Neg. feedback. Output approx. 4 watts. Chassis 13½in. x 5½in. x 2¼in. Glass Dial—10in. x 4½in. horizontal or vertical type available, lit by 2 Pilot Lamps. 4 knobs supplied, walnut or ivory to choice. Aligned and calibrated ready for use. Chassis isolated from mains. Carriage and Insurance, 4/6. **PRICE £9. 15. 0**

8in. or 10in. speakers to match available.

New Available. DE LUXE 7 VALVE push-pull version of above chassis, £12.10.0, carr. ins. 5/-.



QUALITY FLUORESCENT FITTINGS

Ideal for home or workshop. 4 ft., 220-250 v., complete with tube, ballast unit, etc., ready for use. Famous manufacturer's surplus offered at approx. half price. Starter switch type, **42/-.** Quick start type, **47/6.** Carr. and ins., 7/6 extra.

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6H6M	3/6	ECC83	12/6	EL41	11/6	PY82	10/-
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SPECIAL PRICE PER SET
1R5, 1T4, 1S5 and 3S4 or 3V4 ... ... 27/6
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SPEAKER FRET. Expanded Bronze anodised metal 8in. x 8in., **2/3**; 12in. x 8in., **3/-**; 12in. x 12in., **4/3**; 12in. x 16in., **6/-**; 24in. x 12in., **8/6**, etc.

TYGAN FRET (Murphy pattern).—12in. x 12in., **2/-**; 12in. x 18in., **3/-**; 12in. x 24in., **4/-**; etc., etc.

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8+8/500 v. Dub.	4/6	16+16/450 v. Dub.	6/-
8+16/450 v. Hunts	5/-	32/350 v. B.E.C.	4/-
16/450 v. B.E.C.	3/6	32+32/450 v. B.E.C.	6/6
16/500 v. Dub.	4/-	60/350 v. B.E.C.	6/6
16+16/450 v. T.C.C.	5/6	60+100/350 v.	11/6
32/350 v. B.E.C.	4/-	60+250/275 v.	12/6
32/500 v. Dub.	5/-	64+120/275 v.	11/6
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ENGRAVED CONTROL KNOBS for ¼in. Spindle. 1½in. diam. Walnut or Ivory. Gold filled. 16 Standard engravings, **1/6 ea.** Plain knobs to match above, 1½in. **10d. ea.**, 1¼in. dia., **8d. ea.** Walnut or Ivory, 1½in., **1/- ea.**; 1in. **9d. ea.** Pointer Knobs Black with White Line **9d.**

WEARITE "P" TYPE COILS. All ranges. 1 to 7, **2/6** ea. Osmor Q Series Coils. Slug tuned. All ranges from **3/6.** Full range popular Coil Packs.

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Brand new ex-manufacturer's midget I.F.T., size 2½" x ¾" x ¾", dust core tuning, Litz wound coils, High Q. Bargain offer, **7/6** pair.

MAINS TRANSFORMERS.—Made in our own Workshops to Top Grade spec. Fully interleaved and impregnated. **RADIO AND AMPLIFIER TYPE.**—250 v., 60 ma. F.W. sec., 5 v. or 6.3 v. 1 a. rect. 6.3 v. 2.5 a. set Htrs., **21/-**, etc. **C.R.T. HTR., ISOLATION TYPE.**—Low leakage with or without 25% sec. boost voltage. Ratio 1:1 or 1.25, 2 v., **10/6**; 4 v. **10/6**; 6.3 v., **10/6**; 13.3 v., **10/6** Ditto with mains primaries 200/250 v., **12/6.** Specials to order.

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LOUDSPEAKERS P.M. 3 OHM. 5in. Celes., **17/6**; 6in. Celes., **18/6**; 7 x 4in. Goodmans Elliptical, **18/6**; 8in. Elac., **20/-**; 8in. Goodmans special, **21/6**; 10in. R. and A., **25/-**; 12in. Plessey, **35/-**; 8in. M.E. 2 k. ohms field. tapped O.P. trans., **24/6.**

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Listed above are only a few items from our very large stock. Send 3d. stamp today for Complete Bargain List.

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Terms. C.W.O. or C.O.D. Kindly make cheques, P.O.s, etc. payable to T.R.S. Post/Packing up to ½lb. 7d., 1lb. 1/1, 3lb. 1/6, 5lb. 2/-, 10lb. 2/9

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MULLARD 3-VALVE 3-WATT AMPLIFIER
Gilson Output trans., **25/6** ; Mains trans., **35/-** ; Resistor pot kit, **25/-** ; Condenser, **20/-**. Send for full list.

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Osmor coilset with IF's and RDT, **58/6**. J.B. type U.102 variable, **14/6**. ERIE condenser and resistor kits, low-loss valveholders and valves. Full list available.

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Chassis set, **7/6** ; Coilset, **11/9** ; 10.7 Mc/s IF's, **6/-** each ; Ratio discrim. trans., **12/6** ; Phase discrim. trans., **9/-** ; Technical Bulletin giving circuit, point-to-point wiring, etc., **1/9** P.F.

COILPACKS. DENCO CP 4/L and CP 4/M, **35/-** ; CP 3/370 pf. and CP 3/500 pf., **44/9** ; OSMOR "Q" HO, **50/5** ; LM, **40/-** ; Batt., **50/-** ; TRF, **40/-** ; HF stage for HO pack, **20/-** ; We stock COILS by Weymouth, Osmor, Wearite, Denco and R.E.P.

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ERIE resistor kits, **27/-** ; TCC condensers, **45/-** ; Elstone mains trans., **36/-** ; Elstone output trans. (state 6,000 or 8,000 ohms), **45/-** ; Partridge components (loose leads). Mains trans., **65/6** ; output trans., type PPO (state 6,000 or 8,000 ohms), **85/6** ; smaller version type P.3667, **55/6** ; Denco drilled chassis, **19/6** ; Denco printed panel, **6/6**. Full list available.

DENCO WIDE ANGLE COMPONENTS. Magnaview chassis set, **37/6** ; Supervisor chassis, **51/6** ; Magnaview coilset, **41/2** ; scan coils WA/DCA1, **43/-** ; focus coil WA/FCA1, **31/-** ; width and line/lin. controls WA/WC1 and WA/LC1, **7/6** each ; frame trans. WA/FMA1, **21/-** ; line trans. WA/LOT1, **42/-** ; frame blocking osc. trans. WA/FBT1, **16/-**.

Send stamp for lists. Please add postage 2/- to all orders under £3. (Excess refunded).

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VIEW MASTER CONVERTER

All items for the View Master Converter as described in "Practical Television" can be supplied from stock. Full details are given in our special list which is available free upon request.

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SWITCH ASSEMBLY. Denco. Complete switch with fine tuner and coil platforms. **27/-**.
CONDENSER AND PRINTED CIRCUIT KIT. TCC. Contains all the condensers, printed circuit and valve holders. **43/-**.
RESISTOR KIT. We make up this kit with the specified LAB resistors. All labelled with value and position. **8/-**.
GAIN CONTROLS. Colvern CLR901 5,000 ohms. Three required. **3/3** each. Panel for mounting three controls, **1/-**.
VALVE SCREENS. Carr Fastner. Skirt and screen. Two required. **1/3** each.
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VALVES. Mullard PCC84 **24/4**. Surplus **13/6**.
Mullard PCF80 **25/9**. Surplus **13/6**
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SUNDRIES KIT. Contains all nuts and bolts, flex, wire co-axial cable, copper foil and spring wire. **8/-**.
COMPLETE KITS. All above items supplied at one time.
KIT A. With new Mullard valves. **£9.4.0.** Credit Terms: Deposit **£1.6.9** and seven monthly payments of **£1.6.9.**
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PLEASE NOTE. These kits do not include the items needed for conversion of the View Master Sound/Vision Chassis. We can supply the chassis conversion kit for **£2.0.0.** Full details in our list.
SET OF TWIST DRILLS. Complete set of the correct size twist drill for drilling the Printed Circuit Panel. **10/-**.

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IC.55

A TEN-ELEMENT BEAM

A LIGHTWEIGHT AERIAL FOR THE NEW TRANSMISSIONS ON BAND III

By E. H. Trowell, G2HKU

HAVING built a Band III Channel 9 converter and discovered that aerials suitable for this Band were in short supply and unobtainable locally, the writer decided to make a temporary lightweight beam for erection in the loft. The results obtained 50 miles from London with this aerial have proved extremely satisfactory over the past month, so much so that the idea of buying a ready-made aerial has been dropped. In case it is thought that the writer's house has a good location, it may prove of interest to state that it is located 6ft. below sea-level—the aerial being 22ft. above sea-level.

All elements are made from 12-gauge copper wire and the general layout may be seen in Fig. 1. A bamboo cane, as straight as possible, is drilled to take the elements, each of which is secured and joined to its neighbour as in Fig. 2.

Connecting the Feeder

The folded dipole aerial is not, of course, joined to any of the directors or the single reflector. The directors C to J should be mounted and wired together, as in Fig. 2, and then the folded dipole constructed and mounted on its Perspex or Polythene block, shown in Fig. 3. The feeder connections are provided by bending the ends of the dipole at right-angles and passing them through the Perspex block; the feeder then being soldered to the protruding ends. The block should then be pushed over the bamboo cane and set in position with Perspex cement 6in. from director C, as shown in Fig. 1.

Reflector A should then be mounted and connected by the common wire, as shown in Fig. 2, to the directors.

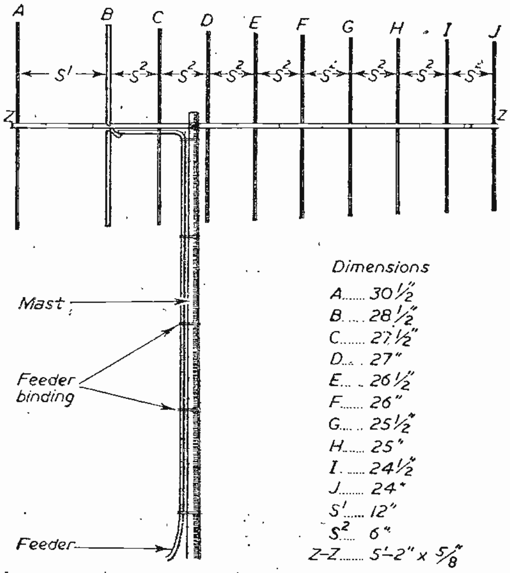
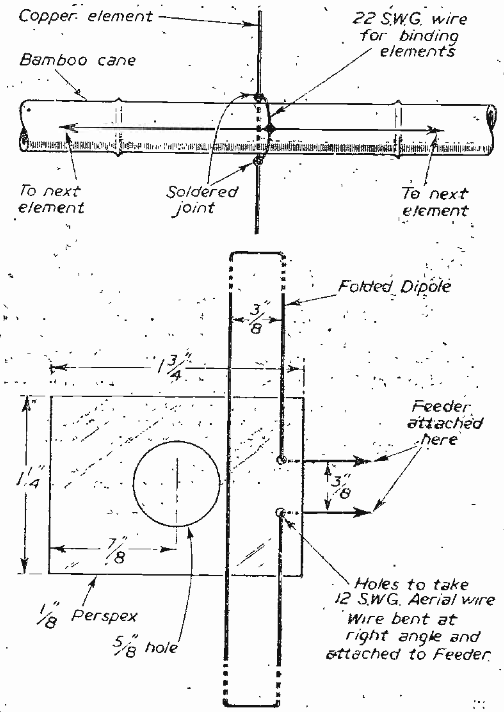


Fig. 1.—Details of the 10-element beam aerial described here.



Figs. 2 and 3.—Method of connecting up the elements, and the folded dipole mounting block.

Mounting

The method of mounting on a mast is left to the individual constructor, since force of circumstances, such as loft space and proximity of any electrical wiring or water storage tanks, will be the deciding factors. The Beam could, of course, be suspended from the roof supports or, as in the writer's case, attached to a paxolin tube which was lashed to a rafter. Due to its extreme lightness no special precautions are required in mounting, and since it is not exposed to the weather there is no fear of damage, either to the aerial or property.

The high gain of this aerial gives an acceptance angle of only a few degrees at short distances. In other words, at a long range it will be necessary to position the aerial with accuracy, preferably whilst the television receiver is receiving a signal. An inch either way will make a good deal of difference to the picture at extreme range.

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).

TUBE "SALVAGE"

SIR,—L. Lawry-Johns, in your January edition under "Servicing Television Receivers," states that tubes such as the MW31/16, MW31/74, etc., having grid to cathode shorts, would have to be scrapped and new tubes bought to replace them. This is not quite true, as these tubes can be given a fresh lease of life by connecting them as triodes. The first thing to do is to join the grid and cathode together at the base, then remove the first anode connection. Disconnect the grid connection and reconnect to the first anode. (These connections are for negative drive; for grid drive reverse the order.) The first anode lead is then taped back and put out of the way. Under this system I have, as a service engineer, cleared many a tube trouble and saved customers the price of a new tube.—S. W. INGRAM (Ilford).

THE CINEMA AND TELEVISION

SIR,—As a regular reader of PRACTICAL TELEVISION herewith some observations for what they may be worth.

In view of the opposing interests which exist between the cinema and television perhaps it would be possible for cinemas to be wired up to houses on the slot meter principle; this might well be compared to the public call box and the private telephone. All advertising could then be confined to its rightful place in the cinema, and the BBC operating their own and the present ITV on the basis of a "Home" and "Light" programme which appears to be becoming badly needed.

The above could possibly lead to the present cinema being used half for those who do not wish to stay at home for their "recreational entertainment" and half for "educational entertainment," the latter being really what the "below average" youth may be looking for, but for want of it is finding an outlet in the "Teddy" approach.—J. I. SOMERS (Portsmouth).

TEST CARD C

SIR,—I would like to draw your attention to the test card on TV. Like thousands of amateurs interested in TV I will have to give up this interesting hobby because of the time of the test card, 10 a.m. to 1 p.m.; us chaps who are away working all day cannot test out our home-made sets when we come home in the evening because we are interfering with other people's viewing. Is it not possible to have a test card, say, after the day's viewing, from about 11 p.m. to 1 a.m. to give us amateurs a chance. If there is nothing done I am afraid thousands of amateurs will have to give up this hobby.—ALEX BARTON (Glasgow, C.5).

COLOUR EFFECT

SIR,—G. F. Remmett asks, in your December issue, for an explanation of the multicolour effects seen on his VCR97 tube. If Mr. Remmett reads a book entitled "The Living Brain," by Dr. Grey Walter, he may well find his question answered in the chapter dealing with the effects of flickering light on the human brain.

Mr. Remmett noticed in a particular television programme that the images of revolving planets appeared in various colours. This is exactly what one might expect given the right circumstances, and for the following reasons:

The brain itself produces complex electrical waveforms which under harmonic analysis are found to consist mainly of basic frequencies varying from 1 to 36 cycles per second. Flickering light is sometimes used experimentally to stimulate by resonance individual brain frequencies, the flicker being a bright electronic flash of variable repetition rate. At certain frequencies of flicker which differ from one person to another, the most brilliant colours and changing patterns are seen. These are not due to the light itself, but are evoked solely by the flicker frequency.

These conditions would be closely simulated by your correspondent's viewing conditions for that particular programme where the only light would be the spot images of the planets recurring at the television frame frequency. If this frequency happens to coincide with Mr. Remmett's own critical frequency for the colour-from-flicker effect, he would most certainly expect to see coloration effects.

An interesting point is that brain frequencies of the order of 10 to 14 per second are definitely related to human vision since they disappear when the eyes are opened and return strongly when the eyes are closed. It is possible that these brain waveforms are part of a scanning system by which human vision is accomplished.—A. W. ELPHICK (Bath).

"VIEW MASTER" IMPROVEMENTS

SIR,—With reference to your contributor's article on "View Master" improvements in the May issue, I too have quarrelled with C55. It is not, however, necessary to use such a large component, as a resistor can be inserted between the negative side of resistor R70 (C53, transformer, etc., junction) and C55 negative. Values of 10 k. for the resistor and 4 μF for C55 are suitable, although any values giving a similar minimum time constant can be used. I wrote to "View Master" on this point in May, 1952, and they agreed with this measure, but stated that on their prototypes some variation in brilliance was noted on first switching on, "hence the present arrangement was adopted." Nevertheless I have never noticed any adverse effect.

The one major change I have incorporated in my receiver—or at least the one with the major effect—concerns the coupling between L107 and L108. Some two years ago when re-lining, I noted that slight pressure with the time-honoured filed knitting needle resulted in marked variations in brilliance. This proved to be due, not to stray capacity but to the mechanical position of the coils which must be critical. Instead of moving the coils I added a turn to the coupling winding on L107 former and the result was an increase in gain, greater in fact than that obtained by adding the pre-amplifier. Consequently it was possible to align the tuned circuits for maximum quality—with no consideration for gain—and connect V5 cathode to earth via a non by-passed resistor of 68 ohms. The latter may help picture quality; it reduces the loading on the detector and assists the expectation of life of V5 which was previously about a year.—E. C. DYSON (Beeston).

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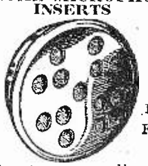

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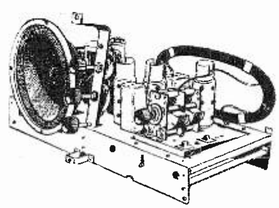

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K.B. EV30B

The height control will not control the picture, which closes up from the bottom. On operation of this control, the picture then extends to the top and bottom, which tops and tails the characters on the screen. Can you tell me what the cause can be?—V. Moore (Bristol, 3).

If the frame linearity control does not correct this fault (this should be adjusted in conjunction with the height control), then a fault should be suspected in either the 6SN7GT oscillator valve or the 6V6G frame amplifier valve. If these valves prove to be up to standard, however, check the components related to the linearity control and, if possible, substitute the frame blocking oscillator transformer with one of known goodness.

MURPHY V.150

I would be glad if you could help me with Band III conversion.

I wish to build the " Practical Television " Converter and would be glad if you can tell me if the U.801 rectifier on this set will stand the extra load, if I connect H.T. as Fig. 25, page 264, November issue.

Also, since this model uses A.C./D.C. technique, in that a heater chain is used, I wish to use a separate heater transformer, with a separate mains switch to same, to conserve current to the convertor when it is not in use.—L. Wilton (Tamworth).

Your set is working fairly heavy under normal conditions and we would not advocate that you feed a Band III converter from its power section. Your best plan would be to build a small power unit, using an RM3 metal rectifier and small mains transformer with a separate 6.3 volt heater winding ; in this way you will also be able to energise the valve heaters, which is quite in order.

G.E.C. BC7092

I have a G.E.C. BC7092 combined television and radio set, the radio side of which is perfectly all right, but the picture at intervals of about five minutes suddenly has a white flash across it and the picture almost immediately blacks out. If left alone it will right itself in about one minute. The picture can be restored at once by use of the brilliance control, although then the control has to be backed off over about one minute to compensate for increase of brilliance. This fault can be simulated by switching the room light on or off. Could you please help me, as my local dealer has refused to service this set on the grounds of overwork.—A. D. Marchant (Farnborough).

The fault described is caused by an electrical connection somewhere in the vision section which is intermittently defective at radio-frequencies. Often the fault lies in a coupling or decoupling capacitor, or even in a coil, but sometimes a poor connection between a valve pin and the corresponding socket on the valveholder provokes the effect. In this case, the effect can usually be stopped and started by moving the offending valve in its holder.

H.M.V. 2807

I could not get the frame hold to lock in my receiver. I changed V7 (B36) and the transformer ; also R55. The voltages and condensers in this circuit appear to be O.K.

Now, with height and framehold controls at maximum I get a steady picture, but the height is an enormous length. Slight movement from maximum of the height control reduces the picture to about 2in.—width O.K. In order, therefore, to reduce the amplitude I changed cathode resistor in the frame amplifier V15 (KT33C) to 5,000Ω, still keeping height control at maximum. This helped to close up the picture, but head and shoulders are normal, legs twice their normal length. Your advice to correct this would be greatly appreciated.—C. Blundell (North Kensington, W.11).

First put the circuit back to normal, and then check the condition of R54 and C36. Almost certainly you will find that one or other of these components has altered in value.

MARCONIPHONE VT53DA

At present the picture is lacking in height (1in. short top and bottom of screen) and any attempt to increase same by means of the height control sends the picture " flying " vertically (not a slow roll) and as the vertical hold is at the end of its tether, the only way I can obtain a steady picture is by decreasing the height control. This has been going on for some time, but I have to adjust the height control periodically with a consequent further reduction in picture height.

I have, in turn, replaced B36, KT33C and Z63 valves, also reduced the values of R32 and R47.

I should mention that the mains voltage here is low, 200 volts, and I am using a transformer (outside the set) to step the voltage to 230, but as I am getting full width I do not think it can be lack of H.T.—F. Sullivan (Bayswater).

Change R41, 3.3 MΩ frame hold series resistor. This is located under the chassis on the long tag strip near the B36 and KT33C valve bases. It is concealed by a flat type .0039 μF capacitor.

PHILIPS 1700A

My Philips projection model has just commenced to give trouble with frame slip. I have renewed the frame oscillator and output valves, also the blocking transformer and resistors R106 and R101, which put matters right for a few days, after which it started to slip again, and I found the fault in the R101 resistor, which I

renewed, and which put matters right for about a week, then it went again. In all I have renewed this resistor about three times. Is there anything else that will cause this resistor to keep going high, or have I got a poor lot of resistors, which I got all at the same time ?—J. Riley (Oldham).

There is no reason why R101 (1.5MΩ) should require frequent replacement if when the receiver is working the frame scan is reasonably linear. You have not stated the wattage of the resistors used. We should recommend ½ watt. It is possible that long storage under unsuitable conditions may have effected a deterioration in the group of resistors which you purchased. Therefore it would be advisable to purchase a new one from a dealer's new stock.

PHILCO BT1410/B

I have a Philco BT1410/B converted to Holme Moss, which has been working on this station for five years.

However, six months ago the receiver stopped working suddenly and I tested all the valves and voltages and condensers and found them O.K. Still no signals, so I started to substitute all valves in turn and condensers, but still no signals.

Having no signal or pattern generator I was lost, so by accident I tried the coupling condensers from R.F. transformers L2 and L3 to V2. However, when I tried C5 100pF in parallel with the other condenser in circuit signals came through and reception was, as before, very good; so I tried the condenser in place of the old one, but no signals. This was queer as I saw on the service data that it is 100pF, so I put two 100pF in parallel and the receiver worked satisfactorily and still does. The receiver is a Plessey Mark I chassis.

The reason for asking you why this receiver is working O.K. in this condition is that I have tried several Band III converters and cannot receive any signals of sound or vision. I have tried multi-arrays, checked cable E.T.C., but no results. The latest 13-channel receivers receive the Band III channel 8 and 9 O.K.—D. G. Johnson (Cheshire).

We would suggest you check the following points:

That R6 is 22KΩ.

That, with C5 at 100 pF, L3 is properly tuned.

That R7 is 100KΩ and R8 1.5 KΩ.

It would appear that a minimum signal of a certain amplitude is necessary in order to operate the V2 mixer/oscillator. Therefore if C5 and R6 are correct and L3 is properly aligned, suspect the V2 stage, R7 and R8 being suspected in the first stage of the fault finding.

BAIRD T165

I recently bought a Baird portable, secondhand.

On switching it on some sparks flew out, so I dismantled it and found the picture width control burnt out, also the one next to it, that is, the horizontal hold. I replaced these; now I get a resistor at the base of valve 20P1 very hot, also a 10F1 valve all aglow at the base. May I state that previous to the 10F1 glowing I got a rather good picture, but now I get no picture, but horizontal rasters.

I have had plenty of experience in radio, but nothing much in television; also I am unable to get a service sheet.—E. Mayers (Oldham).

It would help us if you could let us know to which tag of the 20P1 valve base the resistor which is overheating is connected. We are inclined to think that you mean the screen dropping resistor, which normally does run rather warm, but will overheat if the line time-base is not functioning properly. Also we would like to know which 10F1 is "aglow." The video amplifier will do this if the contrast control is advanced beyond its normal setting so that excessive signal strength results.

Again oscillation in the vision stages will cause the effect and thus the decoupling arrangements should be checked.

FERGUSON 988T

My problem is that I cannot view my set in daylight because I cannot get the picture bright enough.

It gives a good picture with a 60 watt table lamp on the top of the set in a dark room with these exceptions : not quite full width (about ½in. each side) and faint dark lines ½in. thick with half-normal picture in between (four in all).

I have a new tube fitted, a 12XP4, in place of the old one because it was four years old.

When I turn up the brilliance control the whites go whiter and the blacks just gradually fade out as it is advanced.

The sound is normal and clear, and I am miles off the road as to interference.—R. W. Marjoram (Norwich).

Check the condition of the vision detector. This is a germanium diode type CG5 situated inside the final vision I.F. transformer can. Also check the condition of the 220K resistor and 0.01μF capacitor in the first anode circuit of the picture tube. Check the video amplifier valve EF80 and associated components.

EKCO TS114

My set is an EKCO, type TS114, 12in., and is developing signs of trouble with frame slip (vertical). I have no circuit diagram and should, therefore, appreciate particulars of the valve controlling the "frame hold" and its position in the set. The control is adjusted as far as possible.—F. C. Vincent (Uxbridge).

The 6K25 (there is only one on the chassis) is the frame oscillator valve, in the cathode circuit of which is the frame hold control. Connected between the control grid and cathode is a 2.2K resistor ; ensure that this is of correct value. Also check the condition of the valve and the 500pF. capacitor which is connected between the grid circuit (pin 5), via a 5.6K resistor, and the anode circuit of the sync separator valve (SP61).

P.T. BAND III CONVERTER

I have carried out the suggestions made by you, but still find that the only way I can receive a picture is by shorting L2 to earth. I have not been able to check V1 as I do not possess a valve tester, but the voltages are O.K.

I would be satisfied with the picture as it is if only I could get a bit more strength as I cannot get rid of the fly-back lines.—E. Gubbins (Hampton Hill).

It is obvious that the first section of the double-triode valve is not tuning properly. This, as we have already suggested, may be caused by a faulty associated capacitor. If you are unable to get these tested or check them by substitution remove C3 from the circuit and short-circuit C2. If the unit now functions normally the capacitors concerned should come under suspicion.

Make certain that L2 has the shortest possible lengths of wire to connect it in circuit, and also make sure that the bottom end (that is normally C2) is connected to a common earthing point as shown on the circuit diagram.

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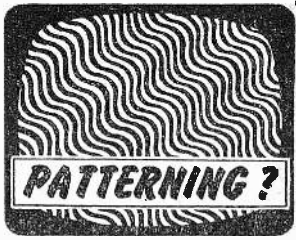

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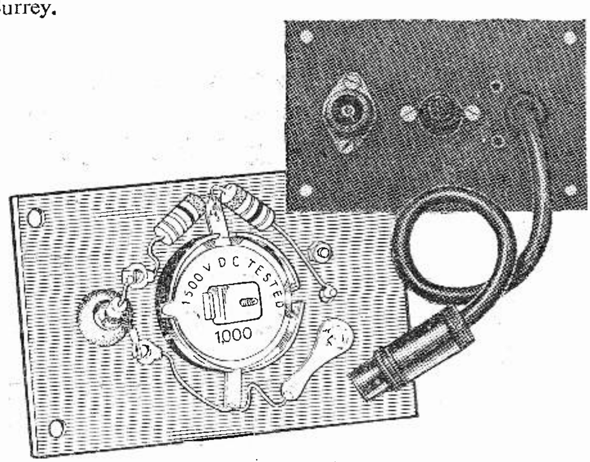
News From the Trade

NEW MULLARD LINE OUTPUT PENTODE

THE Mullard PL36 is an output pentode primarily designed for the line timebases of television receivers using picture tubes with a deflection angle of 90 deg., and 16 kV. E.H.T. The new valve is octal based, and has a 25 v., 0.3 A. heater, suitable for series operation. A new half-wave power rectifier valve for use in television receivers with series-connected heaters has also been produced and is known as the PY32. The valve has a maximum rated output current of 275 mA., a typical D.C. output voltage being 190 v. when the valve is supplied di ect from A.C. mains, 200 v.—Mullard, Ltd., Century House, Shaftesbury Avenue, W.C.2.

OSMOR ATTENUATOR

WHAT is claimed to be the only attenuator of the constantly variable type is now available from Osmor and is illustrated below. Designed for an 80-ohm input, and with a constant output impedance over the complete attenuation range, this component has a variable adjustment from 2 to 1 to 10 to 1 by single control. The price is 15s.—Osmor Radio Products, Ltd., 418, Brighton Road, S. Croydon, Surrey.

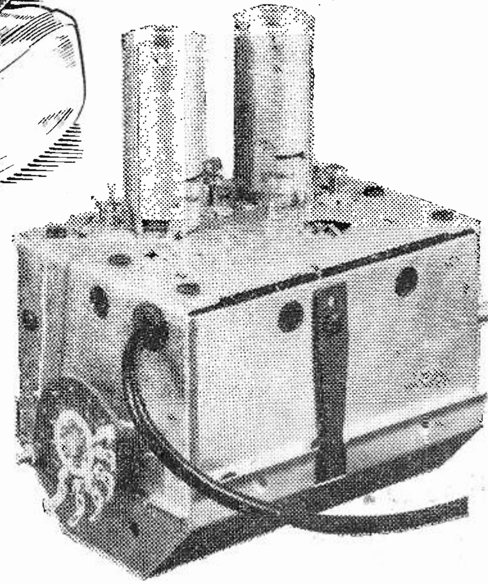


The New Osmor Attenuator

PLESSEY TUNER

A NEW 12-channel tuner unit is being manufactured by The Plessey Co., Ltd., for domestic television receivers.

This tuner is constructed on the turret principle. Each channel is pre-set by a set of coils designed for optimum performance at that particular frequency. These coil circuits are all mounted within a drum which can be rotated for frequency selection by a simple switch.



Plessey's 12-channel Tuner

In addition to its prime function as a tuner for new sets now in production, the unit can be used to replace the input circuit of a receiver designed for Band I only, and will give peak performance on both Band I and Band III by use of the latest low-noise valves. It may be connected to the frequency changer circuit of the receiver, in which case the frequency changer serves as an extra I.F. amplifier, and power supplies for the converter may be obtained from this valve socket or that of the now redundant R.F. stage. Alternatively, the converter may be connected to the first I.F. stage of the receiver.

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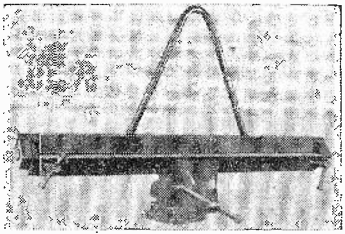

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