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PRACTICAL TELEVISION

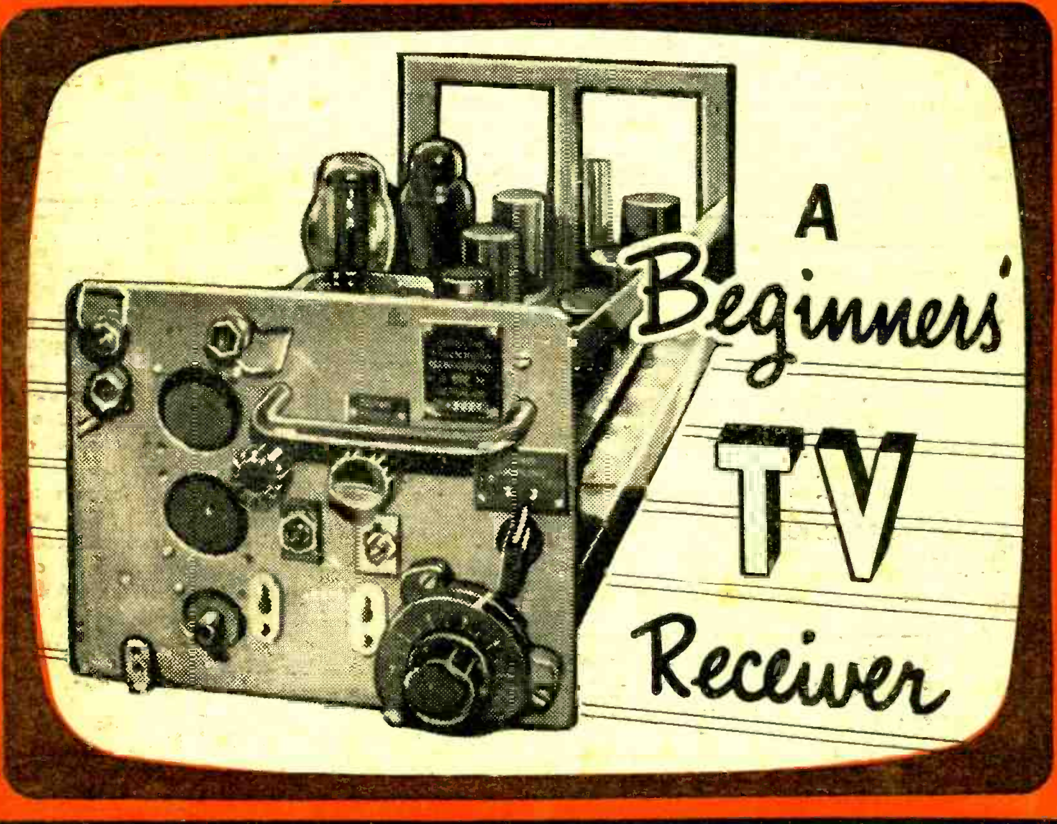
AND TELEVISION TIMES

1/-

EDITOR
F. J. CAMM

A NEWNES PUBLICATION

Vol. 3 No. 34 MARCH, 1953



FEATURED IN THIS ISSUE

NTSC Colour System
Hints and Tips on Tuning
TV Society's Exhibition
Making Sound I.F. Transformers
The Wenvoe Transmitter
A Question of Phase

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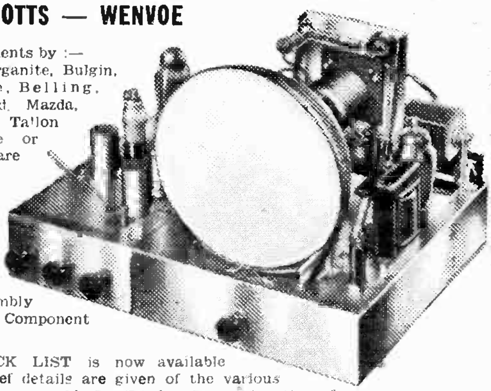

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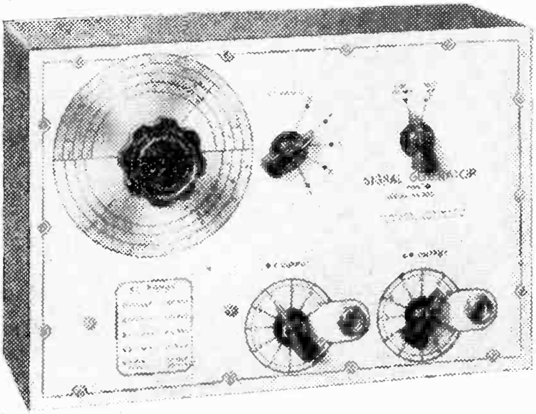

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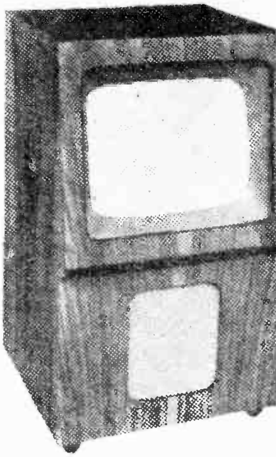

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INSULATION : 0.1 megohm to 1,000 megohms.

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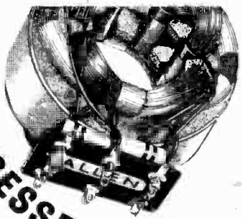

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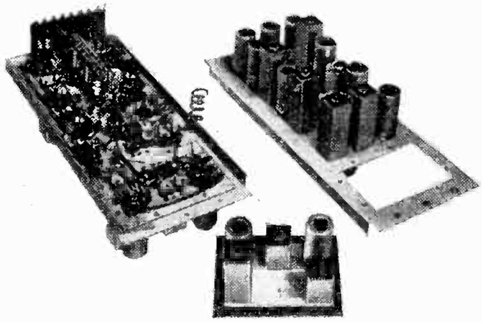

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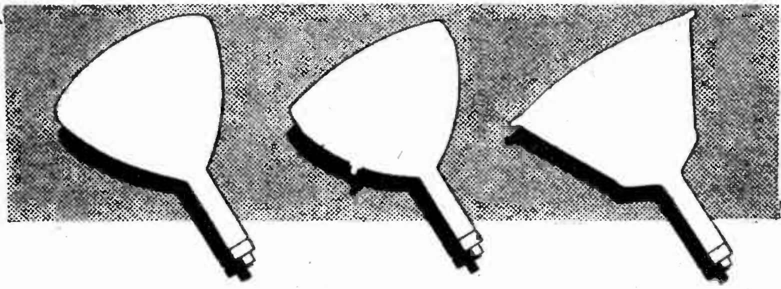

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MVM 206

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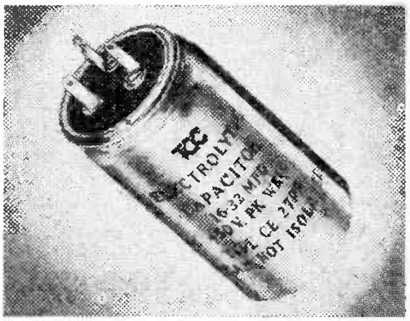

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Cap. μF.	Wkg.	Dimensions		Type
		Length	Dia.	
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12	50	$1\frac{3}{4}$ in.	$\frac{1}{2}$ in.	CE32D
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PRACTICAL TELEVISION

& "TELEVISION TIMES"

Editor : F. J. CAMM

Editorial and Advertisement Offices: "Practical Television," George Newnes, Ltd., Tower House, Southampton Street, Strand, W.C.2. 'Phone: Temple Bar 4363.
Telegrams: Newnes, Rand, London.
Registered at the G.P.O. for transmission by Canadian Magazine Post.

Vol. 3 No. 34 EVERY MONTH MARCH, 1953

TELEVIEWS

Recorded Television

THE Chairman of R.C.A., Brigadier-General David Sarnoff, over a year ago issued a challenge to his scientific staff to make two vital contributions to television. He asked them first to produce an electronic amplifier of light that would provide brighter pictures for television which could be projected in the home or theatre on a screen of any desired size. In other words, he was asking for a light amplifier, as with radio we have amplifiers for sound. He coined the word " Magnalux " for the projected system. Everyone is agreed that a true photo amplifier that could produce bigger and brighter pictures in fine detail would greatly enhance television in the home, but it is particularly needed for theatres and industrial purposes. It is equally well known that the present optical system cannot accomplish it. We can enlarge pictures optically, but in the process light is lost and the pictures become dimmer instead of brighter. No news, however, has come from R.C.A. that their scientists have been able to forge one of the two missing links in television.

The second missing link is a television picture recorder that would record the video signal on a tape or disc machine as music and speech are now recorded on a disc or tape. Such recorded television pictures could be reproduced in the home, theatre or elsewhere at any time. That such a videograph must eventually come is beyond all doubt. It would enable recordings of expensive productions to be made for repeat transmissions and save the enormous amount of money now necessary when an expensive production needs to be put on a second time.

To-day when a television programme is recorded the pictures pass from the camera through the television system and are reproduced on a picture tube. Another and special camera, placed in front of the tube, photographs the programme on motion picture film. That, however, is costly, time-consuming and limited in its application, because the pictures pass through all the possible hazards of the television system and suffer all the losses of the photographic process. The recorded picture, therefore, suffers in quality. The instantaneous recording of the actual television signals on tape or discs would be more economical, save processing time and would simplify problems of distribution. Such tapes could be copied in the ordinary way.

It is known that experiments along these lines have been going on in this country for several years with highly promising results.

PROGRESS

HAD such a system been available the showing of the Coronation ceremony on the cinema screens of this country would have been greatly simplified. The BBC is taking this programme as far as Dover for European distribution and we learn that a large European hook-up has been arranged to include Germany and Scandinavia. There is also talk of five new French stations, so that after the Coronation we may expect more frequent continental relays.

It is also known that the BBC is taking delivery of the new telefilm apparatus which is a great improvement on the old. Norman Collins has offered to provide television for the larger towns of this country, probably because he has discovered that there is available a number of 5 kw. transmitters left over from the war.

In Canada more stations are being planned, although they have encountered the difficulty of supplying sufficient quality programmes for a small population. A large percentage of the programmes are quizzes, and the programmes are recorded on telefilm. Four more Canadian stations are being planned with extra studios at Toronto.

Australia is now pressing for television and pressure is being brought to bear on the Australian Government. It will possibly commence with private stations.

From this brief résumé it can be seen that the world has become television conscious and that progress will be accelerated as the known snags are overcome. As reported in previous issues, transistors have already solved some difficulties and they are bound to exert a profound influence on the future of electronics and communications.

Progress has been made in colour television and the development of the tri-colour tube which dispenses with the rotating discs which hitherto have been used.

Within five years it is expected that there will be at least five million television receivers in operation in this country, and that within ten the number of television licences will equal radio licences.—F. J. C.

The NTSC Colour System

THE LATEST DEVELOPMENTS IN COLOUR COMBINE THE BEST FEATURES OF SEVERAL METHODS

By Edward Sieminski

We are indebted to our American contemporary, "Radio Electronics," for permission to publish the following article on the latest colour television developments in the U.S.A.

A YEAR or so ago anyone who expressed a preference for a particular colour TV system was likely to find himself in the centre of a heated argument. Now, at last, time and technical progress are clearing the air, and a new system—NTSC—has emerged out of the confusion.

Named after its sponsor, the National Television System Committee, the new system is the joint development of a broad cross-section of the radio-television industry.

NTSC Background

NTSC was created in 1940 by the Radio-Television Manufacturers Association (then called the RMA) to assist the FCC in developing and formulating a set of standards for black-and-white television. These standards are now the basis of the present American TV system.

The committee was reactivated in the late 40's when the FCC was holding hearings to establish standards for U.S. colour television. Its new purpose was to gather background information on the general problem.

In 1950 the famous "Ad Hoc" (single-purpose) Committee was set up under Dr. W. R. G. Baker for a concentrated study of the state of the art. It examined the work of several laboratories working on various systems of colour transmission with the idea of deciding if one or more of their methods offered promise as a *compatible* colour system. On the basis of the *ad hoc* report, the RTMA reorganised NTSC into nine panels made up of prominent engineers. In the spring of 1951 these panels launched an intensive and extensive programme of organising, selecting, and testing the best features of all colour-television systems. The panels will set up system standards based on the results of these tests, and NTSC is expected to embody these in a formal proposal to the FCC in the near future. The work being done by NTSC has become an outstanding example of engineering co-operation and achievement.

Before going into the complexity of NTSC transmission let us first review the current status of colour TV in the United States.

Field-sequential Colour TV

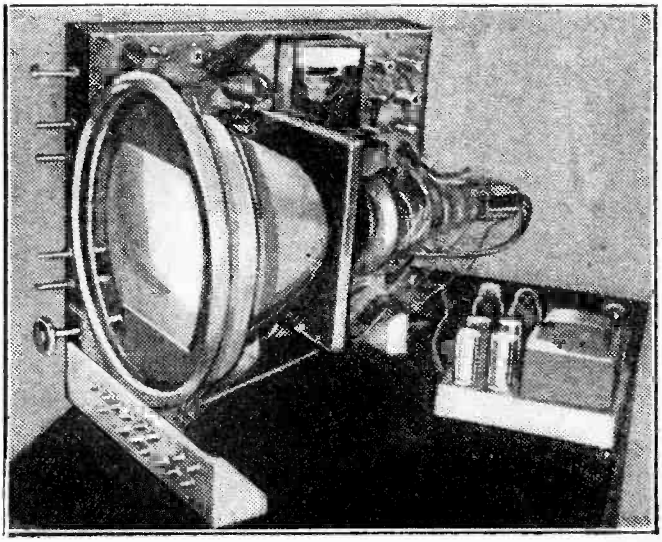
The present U.S. standard system—the only one permitted for commercial colour-TV transmissions—is the *non-compatible* field - sequential system sponsored by CBS. A programme transmitted by this method cannot be displayed either in monochrome or in colour on a standard television receiver without extensive circuit modifications (especially in the horizontal and vertical sweep sections). There is practically no audience for these colour programmes. This lack of a large audience discourages sponsors. Lack of sponsors discourages station construction. Without stations, there will be no audience, and without a prospective audience there will be no receiver production. As yet, no way has been found to break this vicious circle.

Engineeringwise the field-sequential system suffers fundamental handicaps. Briefly, it transmits *three* complete pictures in sequence : representing first the red, then the green, then the blue light picked up by the camera televising a colour scene. However, the 6 Mc/s band-width of a regular television channel is just enough to carry only *one* such picture in full detail. The necessity for trimming all three colour signals to crowd them into this meager channel space results in degraded picture detail, objectionable flicker, and colour instability with fast motion.

The field-sequential method *does have* excellent colour rendition and very desirable simplicity. Belabouring it here for its weaknesses is done only to indicate the room for improvement.

NTSC Colour TV

NTSC transmission was born in the same ideas that inspired RCA's *dot-sequential system*, but the NTSC system is not sequential. It is a *simultaneous* system, since the three primary colours in the picture are encoded electrically, not one after the other, but *all three continuously*. Many independent laboratories have contributed to its development.



A typical American chassis of a receiver developed for colour reception on the NTSC system.

It is a high-efficiency system, in which the equivalent of a 12-megacycle-wide picture (4 Mc/s for each colour) is transmitted within a 6-megacycle-wide channel, the same bandwidth used for conventional television.

In a nutshell, the new system transmits an ordinary black-and-white television picture, to which is *added* a modulated sub-carrier signal conveying information about the colouring in the picture. From that viewpoint it could be called "coloured" television. Although a colour receiver is needed to display the *coloured* picture, the system is compatible; that is, it will reproduce the picture on an ordinary television set in black-and-white (monochrome) without altering the set in any way.

Most of us have been taught that for a circuit to carry more information in a unit time the bandwidth of the circuit must be increased (provided the information is

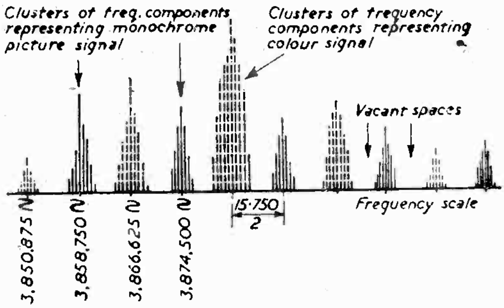


Fig. 1.—Black-and-white TV signal side-bands form clusters, separated by 15,750-cycle gaps. NTSC colour-TV system uses these blank spots to send colour signals.

sent strictly in its original form, as in standard AM broadcasting).

How does the NTSC overcome this rule? Theoretical analysis provides the answer. It shows that any conventional television scene, when translated into a video signal occupying a given channel, does not fill that channel space completely. In fact, there is a regular series of vacant intervals in the transmitted frequency band. If the same theoretical analysis is applied to the *colour* information of the televised scene, it, too, is revealed as a regular series of discreet frequency components separated by uniform gaps.

Obviously the gaps in the black-and-white picture signal can be utilised for transmitting some other kind of information. Why not the frequency components of the colour signal? The monochrome signal and the colour signal are then said to be "interleaved." Fig. 1 shows a small slice of the frequency band of the channel, indicating how frequency components of the picture signal and of the colour signal are spaced over the same channel bandwidth.

To utilise this method it is necessary only to select a colour sub-carrier frequency which is calculated by multiplying half the horizontal line frequency by any odd number. At the present time the NTSC subcarrier frequency is:

$$\frac{15{,}750}{2} \times 495 = 3{,}898{,}125 \text{ cycles.}$$

On paper the idea may look fine, but does it work in practice? The answer is that it does—not perfectly, but quite acceptably. A fine grain crawling checkerboard-like pattern is noticeable to anyone standing close to the picture tube and looking for it. The usual viewer does not see it, hence this interference is described as "low-visibility."

There is nothing quite as good as a block diagram for examining a complicated system. Fig. 2 is a simplified outline of the transmitter half of the system.

Colour Encoding

In Fig. 2, the camera supplies electrical signals **G**, **R** and **B**, which correspond to the green, red and blue components of the light in the televised scene. These separate colour-signal voltages are combined in the proportions shown, to make up the *luminance* signal **Y**. The proportions of **G**, **R** and **B** are based on the relative sensitivity of the human eye to those colours.

All information about variations in brightness—that is,

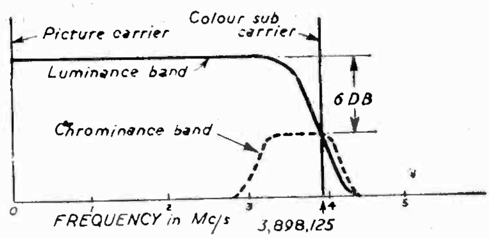


Fig. 3.—Relative positions of the picture carrier and the colour sub-carrier in the upper sideband of transmitted signal. The vestigial lower side-band and the sound carrier have been omitted.

the *detail* in the televised scene—is wrapped up in the *luminance* signal. All information concerning the *colour* in the scene is restricted to the *chrominance* signal.

Now for the encoding of the colour. (1) The R, G and B voltages are fed through low-pass filters which cut down the bandwidth, passing the equivalent of three degraded single-colour pictures.

(2) Two of these, R and B, are added electrically to the *luminance* signal Y, whose polarity has been inverted to −Y, thereby creating *colour-difference signals* R−Y and B−Y. A similar manipulation to obtain G−Y turns out to be superfluous, for the following reasons: G information already exists in the Y signal. We transmit R−Y and B−Y, and can easily extract G−Y from these signals at the receiving end. Therefore there is no

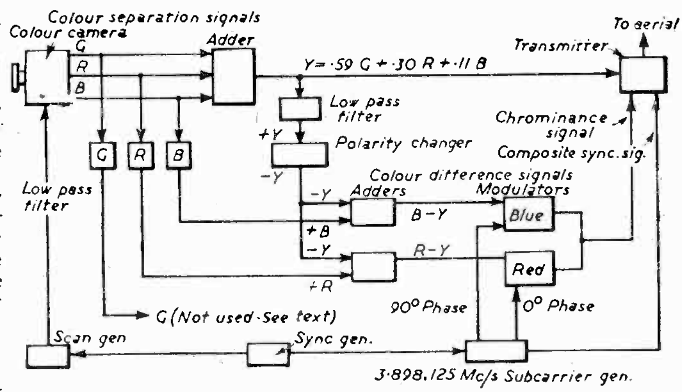


Fig. 2.—Block diagram of the NTSC non-sequential colour-TV transmitter.

point in handling G — Y, since it is already present (although not apparent) in the transmitted intelligence.

(3) Continuing with Fig. 2, R — Y and B — Y modulate two sine-wave voltages which have exactly the same frequency but are 90 deg. out of phase. The combined result, the *chrominance* signal, becomes a two-phase sub-carrier, with each phase amplitude-modulated by picture-colouring information.

Our video signal is now complete, the *luminance* and *chrominance* signals providing all the information needed to reconstruct the colour scene. A station transmitter handles it substantially as it would any normal black-and-white picture. Fig. 3 shows the make-up of the transmitted frequency spectrum.

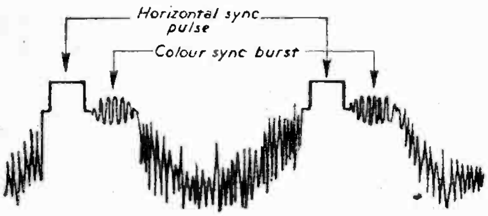


Fig. 4.—Colour-sync bursts consisting of nine cycles of the 3.898125-sub-carrier are sent on the unused " back porch " of each regular horizontal sync pulse.

The synchronising signal is the same as the one used for monochrome television, except that a colour-sync signal is inserted on the " back porch " of each horizontal sync pulse (Fig. 4). In the receiver this burst synchronises the local " colour oscillator," which is used to demodulate the colour signals.

The Receiver

At the receiver (Fig. 5) all circuitry up to the output of the picture detector is conventional.

Let us start with the bandpass filter. This *rejects all* frequency components of the signal *except* the region containing the *chrominance* signal (see Fig. 3). The output of the bandpass filter feeds separate red and blue *chrominance demodulators*. The colour-difference signals R — Y and B — Y are extracted by reversing the process of sub-carrier modulation at the transmitter. The local *colour oscillator* supplies two sine-wave signals having exactly the same frequency and phase as the sub-carrier which was used for encoding at the transmitter. (These oscillators are synchronised with the colour sub-carrier by the bursts mentioned above.) The demodulation is a zero-beat form of heterodyning sometimes called " synchronous detection."

In the *matrix-circuit* block the R — Y and B — Y signals are mixed in the pre-determined polarities and proportions to produce the G — Y signal.

Finally, the three decoded *colour-difference* signals are combined with the main *luminance* signal to reproduce the G, R and B colour signals which originally left the camera of Fig. 1. For example, adding R — Y to Y leaves R alone. The R, G and B voltages are applied separately to the tricolour picture tube to recreate the scene.

Colour Reproduction

The great advantage of the NTSC system lies in its economical handling of colour information. In Fig. 1 we noted that the R, G and B signals were each limited to a bandwidth of about 1 Mc/s, implying the transmission or a limited amount of colouring information. The *luminance* information (picture detail) occupies the full 4 Mc/s bandwidth.

This bandwidth relation makes sense when you understand how the eye sees. Visible light produces three separate and distinct sensations: *brightness* (relative intensity or luminance), *hue* (recognition of red, orange, yellow, etc.), and *purity* or *saturation* (the degree to which the colour is off-white, ranging from *zero saturation*, or white, to 100 *per cent. saturation*, meaning a deep, vivid colour, a pure *hue*.) The human eye is extremely sensitive to brightness variations but surprisingly insensitive to changes in hue. The NTSC transmits picture information only to the extent that the human eye appreciates.

One more puzzling question, *colour mixing*, deserves attention. The tricolour picture tube operates on the principle of *additive* colour mixtures. A good example of this is a cluster of partially overlapping coloured *lights*, as in Fig. 6. The overlapped areas show some examples of *additive* mixing. Mixing coloured paints, or looking through superimposed colour *filters* are examples of *subtractive* colour mixing.

The phenomenon of colour sensation is in direct contrast to the sense of hearing. Most of us can identify the instruments being played from the general character of the sound, and a trained musician can even recognise the individual notes which make up complex musical tones. The eye has no corresponding ability to recognise the individual components of a colour mixture. The eye perceives only the *overall result* of the mixing. With the proper set of primary colours, such as the red, green and blue used in NTSC, we are able to reproduce practically the entire range of colours.

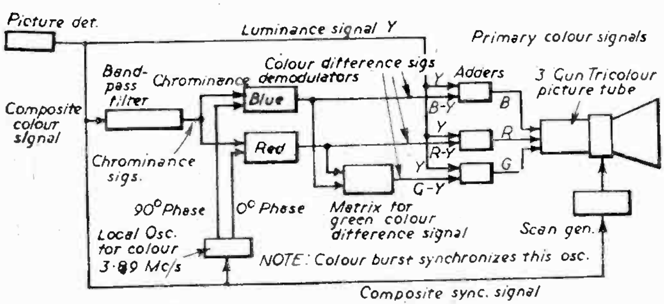


Fig. 5.—Block diagram of the receiver colour circuits. All sections of the receiver in front of the colour unit are conventional.

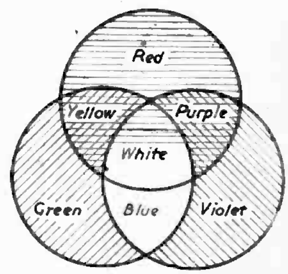


Fig. 6.—Colour combinations produced by blending coloured lights. This is known as *additive mixing.*

Hints and Tips on Tuning

GETTING MAXIMUM RESULTS FROM A HOME-MADE OR COMMERCIAL RECEIVER

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

THE final connection has been carefully soldered in position. The continuity—or ought we to say "insulation?"—check between the H.T. rail and chassis proves satisfactory; yes, surely quite in order to apply mains. This is, indeed, the moment the home constructor has been fervently working for. Good! The valve heaters are glowing, and the comforting 10 Kc/s whistle indicates that all is well with the line timebase.

Generally speaking, the majority of home-constructed receivers examined by the author produce, on first test, some sort of raster—at least—on the picture-tube screen; although very much unmodulated, quite out of focus, and usually well out of centre—that is to say, large corner shadows appear to give the raster, or the diffused patch of light, a new moon effect. Such a combination of easily remedied (usually) defects can be extremely disconcerting to the constructor, especially if he is new to the art of TV. construction.

Cleaning the Raster

The constructor should take heart, for the cause of the deranged raster is not often as bad as the picture-tube first shows it. It is advisable, first of all, to get the raster in some sort of order, after which the constructor can then concentrate on receiving sound and vision. The aerial taken out, or the Contrast control turned to minimum is the best way to start. Next, the raster should be brought to some form of focus; this will give it a clear edge, and indicate its boundaries so that centring is facilitated.

Receivers primarily designed for home construction may specify either electro-magnetic focusing or, as is more usual, a focusing magnet. In the former case, alteration of the external focusing control should do as it indicates—it may to a degree, but more than likely hard over on one of its "stops" the raster just starts to focus. Should this occur, all is well, for it simply means that the focus coil is not quite correctly positioned on the tube neck.

The focus coil—or magnet—and the electron beam can be considered analogous to an optical lens and light rays. We all know, for instance, that to focus the sun's rays to a point of maximum heat on, say, a piece of paper the optimum point, or point of focus, is determined by the position of the lens relative to the paper, and also by the focal length of the lens. A convex lens from a pair of ordinary spectacles will need to be held much farther away from the paper to focus the sun's rays than, say, a watchmaker's lens, which has a much shorter focal length than the spectacle lens.

Now, with electro-magnetic focusing we energise the focus coil by passing a certain current through it as determined by the setting of the focusing control. This allows the focus coil to behave with an electron beam as a lens does to light rays; the electron beam is brought to a point of focus on the screen by modifying the *focal length* of the coil. Clearly, then, the coil must be correctly positioned on the tube neck in the first place so that the approximate midway setting of focusing control will effect a perfect focus of the electron beam.

Fig. 1(a) and (b) illustrates the general method of focus coil mounting: a circular bracket drilled to take the neck of the picture-tube is secured to the chassis. The bracket carries three threaded bolts, which line up with holes drilled in the focus coil cowling. Three compression springs provide loading for the coil, and three nuts allow its axial movement. With the focusing control set to its midway position, and the coil set as far as possible towards the tube base, the three adjusting nuts should be given equal clockwise turns (about one complete turn at a time) and the raster noted. A position will be reached where the horizontal scanning lines are clearly defined on the tube face, although it is possible that the raster may be well out of centre with its corners cut off.

At this point the picture width and height controls should be adjusted so that the raster occupies about two-thirds of the screen area. It is then an easy matter to centre the raster by slight readjustment of individual nuts, the correct nuts and direction of adjustment being readily found by trial and error. Should it be found that, instead of the raster being wholly in focus, the centre is very sharp, but deteriorates towards the side and corners, correction may be effected by moving the coil very slightly along the neck of the tube towards the screen. The final centring and focusing adjustments must be done with the aid of test card "C" in conjunction with the settings of the horizontal and vertical linearity controls.

With permanent magnet focusing, the field strength along the tube neck, and thus the virtual focal length, is adjustable by means of a soft iron sleeve, which can be made to traverse the tube neck in such a way that it gradually by-passes the focusing field as it enters the magnet. The magnetic gap is sometimes adjustable by three screws, which, apart from focusing the raster, also act as a picture shift. Adjustment of this arrangement may be followed by the method recommended for the focus coil, although the optimum focus adjustment must be performed by this means as no external focusing control is available to facilitate this function.

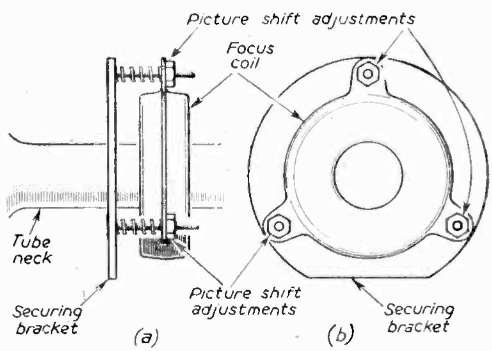


Fig. 1.—Illustrating a method of focus-coil mounting.

Finally, it should be remembered that it is pointless to perform these adjustments, to an optimum limit, if the picture tube is not securely fixed to the chassis, for only a slight alteration in the position of the tube when it is fitted into the cabinet will be sufficient to necessitate further adjustment.

Shadowing

This fault has several variations, since the shadows may be no more than slight shadings at one or more of the corners; or there may be complete blackout of the corners with clearly defined edges. Adjustment of picture shift screws or nuts probably tends to prevent shadowing, but only when the raster is well out of centre. In the end the exasperated constructor realises that it appears impossible to have it both ways—no shadowing and a perfectly centred raster—by the mere adjustment of the picture shift screws, so a compromise is usually aimed at.

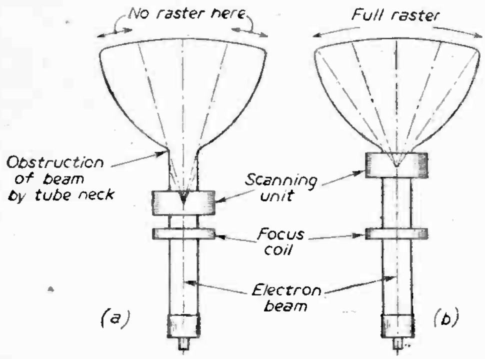


Fig. 2.—Showing how a wrongly positioned scanning unit can cause corner shadow.

Little is said in construction manuals about this type of fault, although it can present quite a headache to the builder. The fault is, of course, produced by an obstruction of the electron beam, where the deflection is greatest, by the glass envelope of the tube. Fig. 2(a) clearly illustrates how such a fault could occur. The scanning unit, as will be noticed, is not as far as possible up the tube neck, and deflection is taking place about one third of the way down, resulting in sharply-defined corner shadows. It is, therefore, essential that the scanning unit be well up to the top of the neck of the tube as shown by Fig. 2 (b).

Sometimes the corner shadows are less clearly defined, which generally means that the electron beam is not coming up to centre of the tube. This fault is usually indicative of bad alignment of the tube in relation to the focus unit. The mechanical mounting of the tube should be such that the tube axis passes centrally through both the scanning and focus units. With home-constructed equipment special attention should be given to this very important point.

Slight misplacement of the gun electrodes in the tube itself can be responsible for corner shadowing, and more than one such instance can be remembered by the author. It is frequently possible to avoid shadowing by rotating the tube into a different position, and then re-setting the shift adjustments. Apart from changing the tube—if it is still under guarantee return it to the dealer—little more can be done. Care should be taken if the tube is rotated, to provide adequate clearance between the E.H.T. connector and chassis.

External fields, either electro-static or electro-magnetic, can distort a raster and give rise to corner shadowing. The electro-static charges develop on the tube and associated mask; usually due to slight dampness. A complete dry-out is the answer coupled with a coating of anti-static tube polisher.

Magnetic, or electro-magnetic fields arise mainly from the loudspeaker magnet, transformers, or smoothing chokes which carry a large current, orientation of the offending component is the only real cure, although a degree of success is usually had by reversing the leads on the smoothing choke, and thus reversing the direction of its field.

Hints on Receiving Sound

Having successfully achieved a clean raster our attention must now be focused on obtaining sound and vision. If the receiver is home constructed, then, without much doubt, the construction data will provide adequate circuit alignment instructions. This article will, therefore, mainly concentrate on various snags, which have been known by the author to result during the process of deriving sound and vision, and which are not often included in the instruction book.

It is frequent practice to align, first of all, the sound circuits; but as the constructor rarely possesses accurate instruments, he has to rely on the eye, the ear, and the transmitted signal. The following hints will, therefore, cater for such a constructor.

Constructors located within the fringe area have the benefit of a strong signal for tuning purposes, and tentative adjustment to coils nearest the sound detector should be sufficient to bring in the sound signal. Although at first the sound will be very faint, the chief problem, that of tuning at least one circuit to the sound frequency, will be solved. It now remains to follow up with the rest of the sound coil adjustments for maximum output. Fringe area constructors will find that a pair of 'phones, suitably isolated by coupling capacitors, connected across the loudspeaker, are a boon when first endeavouring to establish the sound frequency.

The threaded iron-dust cores used to tune the coils are often very slack in the formers, which makes it extremely difficult to get the final maximum setting; a piece of elastic—from a thin elastic band—inserted in the former, before the core is fitted, successfully takes up the slack, and allows a solid adjustment.

Instability

As the subsequent tuned circuits are adjusted the sensitivity of the sound channel increases, and there arises a distinct possibility of the channel going unstable. A large percentage of home-constructed receivers adjusted by the author have been prone to this effect. The results being that, everything is progressing satisfactorily when, after a certain coil—usually the one

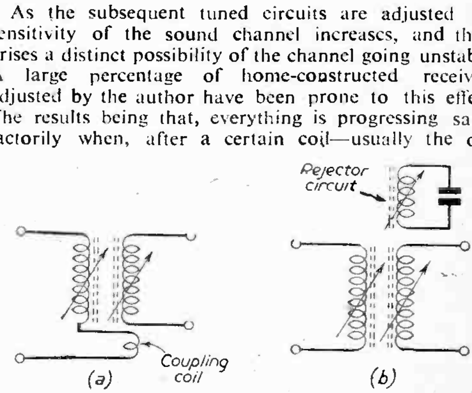


Fig. 3.—(a) Band-pass coupling with separate coupling coil, and (b) coupled rejector circuit.

nearest the aerial—is adjusted a distinct " plop " emits from the loudspeaker and the sound goes completely dead. Readjusting the coil brings the sound back again, but it appears obvious that the circuit is not correctly tuned, because the volume of sound increases as the coil is adjusted up to the point of instability.

Such a fault can be very difficult to trace, but it must be rectified before further alignment is attempted. Special attention should be given to the screening between coils or stages. Mechanically it may be perfectly sound, but from the R.F. point of view, probably, sadly lacking. Frequently, screens and shields of this nature are secured to the main chassis by B.A. nuts and bolts, and so far as R.F. is concerned this method of fixing is totally inadequate. In fact, in certain cases, where the screen is also employed to earth decoupling capacitors, etc., the receiver would probably behave better if the screen were omitted altogether!

This is because R.F. voltages induced into the badly-secured screen are fed back again, via the capacitors, to the valves, and if these voltages are of the right phase conditions for positive feed-back are developed. First of all, then, make absolutely certain that any R.F. shielding is really doing its job—and where possible solder all round any mechanical joint, especially where the shield is making contact with the main chassis—dozens of cases of tricky instability problems have been so cured by the author.

Decoupling capacitors must be returned direct to a common point, for the stage in question, and not to random sections of the chassis as is unfortunately very common practice. The circuit of Fig. 3 illustrates the arrangement which should be adopted. Grid and anode leads must be kept as short as absolutely possible, and it is essential to earth the metal centre portion of the valve base, since this acts as a screen between grid and anode pins of the valve.

Coils not Tuning

It may be found that when tuning for maximum sound—or vision—an optimum point is not apparent on one or more of the coils. Sometimes the core is unscrewed and the sound volume is still on the increase when the core is out as far as possible; taking the core right out of the coil may increase the volume slightly more. If the core is iron-dust, then this effect means that the coil inductance is too great, for taking the core out completely reduces the inductance, but not sufficiently. A reduction in the number of coils turns should correct this, although other factors may be responsible. For instance, should the number of turns on the coil be that stipulated in the construction data, it may be advisable to investigate the other possibilities first.

If the circuit employs a band-pass coupling with an additional one- or two-turn coupling coil, or a coupled rejector circuit, as shown in Fig. 4 (a) and (b), it is possible that the coupling is too tight. A reduction in coupling will result if the coupling coil is moved slightly away from the anode (or grid) end of the main coil—towards the earthy end if the coupling coil is wound on top of the main coil.

Another factor to bear in mind is that of valve capacitance, for it is this in conjunction with the coils, which forms the tuned circuit. Now, the Miller effect determines to a large extent the valve capacitance under working conditions, and this is readily altered with control or suppressor grid bias, or even the screen potential has a certain effect. Clearly, then, a wrong value cathode or screen grid resistor may so modify the capacitance across the coil that, unless its inductance is modified also, it will not tune to the desired frequency.

It may be that the coil is still not peaked when the core is fully screwed into the former. In this case coil coupling may *not* be tight enough, or incorrect electrode voltages may, again, be the cause. If the tuning appears flat throughout the whole range of core adjustment, a brass rod temporarily inserted into the coil former usually determines whether the inductance is too high—or too low, remembering, of course, that brass reduces the inductance.

Hint on Receiving Vision

In the service area, no doubt, some sort of modulation will appear on the screen with tentative core adjustments and it is usually a straightforward matter to peak the vision coils—making the stipulated adjustments for band-width. In the fringe area, however, the situation is different, and much time can be spent in trying to locate the vision signal. A pair of 'phones, suitably isolated, and connected to the video amplifier anode (picture-tube cathode, or sometimes grid) and chassis can assist considerably.

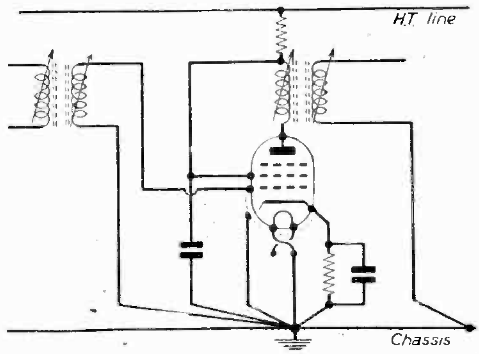


Fig. 4.—Single-point wiring is carried out as shown here.

Very often a faint vision signal can be heard in the 'phones, though not indicated on the picture-tube, even if the cores are well out of adjustment. It is a simple matter to enlarge on this, starting from the vision detector end, and tuning the cores, first one way and then the other, for maximum volume of the vision signal in the 'phones.

Using 'phones so connected is, by the way, very convenient when adjusting the sound rejector circuits. During the latter period of the sound only news transmission, after the vision carrier is switched off, the rejector coils are easily adjusted for *minimum* sound signal in the 'phones.

Pattern Manifestations

Owing to the wider band-width of the vision channel the instability problem is less aggravating in this section; nevertheless, certain home-constructed receivers tend to be very "touchy," especially as the tuned circuits nearest to the input are brought into resonance, and where the receiver is of single side-band working. Generally speaking, instability in the vision circuits will effect very little the sound reproduction—apart from, perhaps, giving the reproduction a slight edge. The converse is true where instability originates in the sound channel; although it may be noticed that, instead of the picture being built of clearly defined scanning lines, the lines tend to break up, and the picture appears to be composed of a series of dots.

The early stages common to both sound and vision channels are more likely to develop instability than later stages. Both loudspeaker and picture-tube will respond violently to instability here, and in extreme cases a microphonic howl may build up in the loudspeaker accompanied by an uncontrollable brilliant screen. In less severe cases the loudspeaker may go conspicuously quiet, and all valves appear microphonic if gently tapped ; at the same time herring-bone or wire netting patterns come and go on the screen, and alter in form as the contrast control is adjusted.

To quickly determine the actual stage which is unstable (oscillating) a valve current check can be taken. A volt-meter connected across the cathode resistor of each valve in turn will indicate an abnormal reading across the resistor of the valve which is oscillating. After locating the unstable stage attention should be focused on its associated wiring, decoupling, and shielding arrangements.

A latter stage connecting lead which has inadvertently been displaced so that it is within coupling distance of a valve or coil in the first stages would almost certainly cause the early stage to go unstable. High-resistance contacts to the valve pins frequently give rise to instability, which can often be started and stopped by wriggling the offending valve in its holder—miniature types and the EF 50 variety are particularly prone to this trouble. The valve pins should be carefully scraped clean, while the sockets may be beneficially treated with carbon-tetrachloride.

Although non-inductive decoupling capacitors should be employed in the R.F. and I.F. stages, some constructors use ex-Government components of dubious characteristics. In certain parts of the circuit such components may be suitable, but for R.F. or I.F. decoupling they usually do the opposite to what is required of them. A quick way to make an inductive capacitor non-inductive is by shunting it with a 50-100 pF good quality mica capacitor.

The aerial feeder in close proximity to the mains lead has been known to produce conditions for instability. It is, therefore, advisable to keep these two leads as far as possible away from each other, particularly during the process of tuned circuit adjustments.

Little has been said concerning the timebases and synchronising circuits in this article, but as a large majority of constructors follow a tested circuit design, little can go wrong provided he observes stipulated component values. And for constructors who desire to evolve their own circuits many excellent articles in this connection have already been published in this journal. In conclusion, therefore, it is hoped that this article will be of assistance to the many constructors, who, although fully realising the problems associated with radio construction, have so far had little experience with television construction.

The BBC and Films

THE BBC and the British Film Producers Association recently made the following announcements.

An extended report of the meeting between the BBC and the British Film Producers Association, which took place on January 1st, has been drawn up as follows :

A meeting took place at Broadcasting House on January 1st between representatives of the BBC and the British Film Producers Association. Present as observers were representatives of the Association of Specialised Film Producers, Ltd., the Cinematograph Exhibitors Association of Great Britain and Ireland, and Kinematograph Renters Society, Ltd.

The discussion was entirely exploratory and aimed at meeting the request of the film producers for information on the BBC's use of feature and short films and the extent to which the British film industry might be able to produce filmed programmes for television in this country. No offers to supply films were made by the film industry's representatives, nor did the BBC declare that it would be able to meet any particular scale of fees.

The BBC stated that in the past year it had used 66 feature films of old vintage, only four of which had appeared in the evening programmes.

There were also 52 Westerns and serials used in the children's programmes and about 250 shorts at various times.

Asked by the producers to estimate their future requirements of films, the BBC representatives said that if the timing and pattern of the television service remained as at present they would like to have access in 1953 to 12 feature films for evening transmission, 26 features for afternoons, 26 films suitable for children, and shorts at the rate of two a week.

The BBC's interest in films was governed by their age, quality and suitability for television, and by the cost of hiring The BBC emphasised that higher rates than they were accustomed to pay could only be contemplated if much more modern and better quality films than at present offered were made available. The BBC's representatives said that it was conceivable that hiring fees in the range of £750 to £1,000 might be considered for feature films which were thought to be particularly suitable for television and which had only recently completed their general release.

No formal offer of any kind whatsoever was made in this connection by the BBC.

The producers asked if the Corporation would be interested in hiring programmes specially produced for television by the film industry. The BBC replied that their policy was to consider films from all available sources, but again had to take account of quality and cost.

Amateur Cinematograph Trophy

A NEW award, the Television Amateur Cinematograph Trophy, will be presented to the maker of the best amateur film on the result of a nation-wide vote by television viewers.

Beginning in April, a number of films chosen by the British Amateur Cinematographers' Central Council will be transmitted in a series of three programmes. Some of these films have already won awards.

This series of programmes is an experiment designed to put television viewers in touch with the country's growing amateur film movement. The installation of 16 mm. film-scanning equipment has made it possible for the BBC to transmit the amateur type of film.

In each programme the films shown will be discussed and voted on by a panel of three judges in the studios. The panel will consist of a chairman, a professional film-maker, and an amateur film-maker. The chairman, who will have the casting vote, will be Dr. Roger Manvell, film critic and director of the British Film Academy.

The panel's choice of the three or four best films will be repeated in a fourth programme, and at this point viewers will be asked to write to the Television Broadcasting Service of the BBC stating their choice. The film which viewers like best will be awarded the Television Amateur Cinematograph Trophy.

Television Society's Exhibition

THIS YEAR'S PRINCIPAL EXHIBITS BY MEMBERS AND MEMBER FIRMS

THE annual exhibition of equipment related to television design and production, was held this year at 155, Charing Cross Road, on January 23rd and 24th. It was well attended (admission being by ticket only) and the following are brief details of the items which were exhibited. They will serve to give readers some idea of the most interesting lines of development which are being followed, and particular interest was paid to the spot wobbler circuits, A.G.C. and flywheel sync, about which there is so much difference of opinion among the experts.

AERIALITE LTD., Castle Works, Stalybridge, Cheshire. This firm showed a display stand designed to illustrate the most suitable type of aerial for operation at given distances from the transmitter. Other exhibits included R.F. feeders, coaxial plugs, television, broadcast and car aerials.

ALLARD, L. S., of G. E. C. Ltd. Research Laboratories. A demonstration of electron beam plotting in cathode ray tubes—the size and path of an electron beam in a special tube can be noted and deflection defocusing properties of deflection coils assessed from changes in locus of beam focus.

A. J. BALCOMBE, LTD., Tabernacle Street, London, E.C.2. Here was shown one of Alba's latest 17 in. tube receivers operating with an E.H.T. of 17.5 kV., designed for 5-channel operation of A.C. or D.C. A finished production chassis was also on show for inspection purposes.

AREN (RADIO & TELEVISION) LTD., High Street, Guildford. As specialists in the manufacture of projection sets, this company exhibited a 4 ft. x 3 ft. projection console with remote control, and a number of interesting mechanical and electrical features.

BEDFORD CENTRE. Two items of test gear interest were shown.

BELLING & LEE, LTD., Gt. Cambridge Road, Enfield. A television field strength measuring set—utilising the received BBC frame sync pulses for amplitude measurements, thus enabling the "true" directional response of an aerial to be determined even in the presence of "ghost" reflections was exhibited.

BBC TELEVISION. This exhibit consisted of:

1. Representative selection of sketches by television scene designers and artists.

2. A servo-assisted panning head for television cameras. Prototype developed by the BBC's engineering design department to meet the problem of slow, smooth panning at race-courses and similar events.

B.R.E.M.A., 59, Russell Square, London, W.C.1. This was an exhibit designed to illustrate precautions needed to reduce the line timebase radiation to small proportions. Three forms of interference considered are: electrostatic, electromagnetic and mains-borne.

BUSH RADIO LTD., Power Road, Chiswick, W.4. In addition to still pattern signals for 525 and 625 line production testing, a subjective test is secured by mixing BBC's 90 Mc/s. FM and 45 Mc/s. TV signals to produce a negative modulated carrier with FM sound on any television channel for intercarrier receiver testing.

CINEMA TELEVISION LTD., Sydenham, S.E.26. At this exhibit was seen a selection of tubes for television purposes and a demonstration of measurement of projectile velocity using miniature range and model gun firing a ball. Measurement accuracy of 1 micro-sec. to 0.005%.

DECCA RECORD CO. LTD., Brixton Road, S.W.9. A projection model television receiver giving a picture 4 ft. x 3 ft., was shown here.

EDISWAN ELECTRIC CO. LTD., Charing Cross Road, W.C.2. Three demonstrations were given, using C.R. tubes under working conditions to illustrate (a) the effect of aluminising, (b) the spiral path of a magnetically focused electron beam and (c) the removal of halo by use of a liquid layer.

E. K. COLE, LTD., Southend-on-Sea, Essex. A demonstration of the applications of "spot wobble" to large screen direct-viewed domestic receivers. Two identical receivers were shown, one of which had "spot wobble" in operation.

E.M.I. LTD. & E.M.I. (SALES & SERVICE) LTD., Hayes, Middx. In addition to a range of equipment, including two waveform monitors and production television receivers, the television distribution equipment shown was being used to relay either BBC or local camera signals throughout the exhibition.

FERRANTI LTD., Moston, Manchester. A back projection receiver employing a 2½ in. tube with 25kV. was shown here. Designed for operation on all channels and employing a two-valve paraphase video circuit for maximum contrast range.

GILBERT, J. C. G., Northern Polytechnic. A high intensity monitor developed solely for use under high ambient light conditions, as met with in studio work, was shown here.

DAVIS, C., Hallam, Sleigh & Cheston, Ltd., showed component parts in readily assembled form for unique framework construction for radio communication, test gear and allied equipment.

A. H. HUNT (Capacitors) LTD., Garratt Lane, Wandsworth. In addition to a wide range of capacitors for many uses and conditions of temperature and humidity, this exhibit included a working demonstration of production winding of miniature capacitors.

LELAND INSTRUMENTS, LTD., Millbank, Westminster. A wide range of precision ceramics and precision ceramic capacitors, together with standard laboratory equipment, instrument cases and panels for industrial equipment, were shown.

MARCONI'S WIRELESS TELEGRAPH CO. LTD., Chelmsford. An optical demonstration of (a) the effects of restricted colour definition in colour television systems (photographs by courtesy of Ilford Ltd.), (b) flicker in constant luminance television systems, and (c) working model of "ideal" filters with linear phase shift.

Also shown was a complete working Image Orthicon Camera Channel, capable of operating down to as little as 1 ft. candle incident illumination.

McMULLAN, D., Cambridge University, showed a light meter with current feedback, keeping the photo-

(*Continued on page* 447.)

The Question of Phase

HOW VARIOUS CIRCUITS CAN DIFFER, AND THE DIFFICULTY OF MAKING CERTAIN COMBINATIONS

By W. J. Delaney (G2FMY)

AN increasing number of inquiries have been received lately asking how a certain portion of one receiver may be used with a section of another. For instance, a number of vision and sound strips have been sold recently as manufacturer's surplus, and some readers have wanted to include these in a receiver which they possess and which is giving unsatisfactory results. We have repeatedly pointed out that unless one is fully aware of the implications and modifications called for in combining sections of different designs it is best not to make the attempt. Provided one knows sufficient about the subject, however, it is quite possible to carry out such modifications, and, therefore, some idea of the difficulties met with will now be given.

First, there is the all-important question as to the method of feeding the heaters of the valves. Obviously all sections of the completed receiver must be fed in the same way—either parallel connected and fed from a transformer winding, or series connected with the necessary modifications made to any series dropping resistor which may be needed due to the different load imposed by the replaced or changed section. There may be other changes called for in the power supply connections, but it will be assumed that the reader is aware of these, which will follow normal radio practice. In a television receiver, however, there is one thing met with which does not worry the radio man That is the question of phase. You can call this polarity, if you choose, but it is most important in a television receiver that the phase or polarity of the signal is known at every stage after the vision detector.

Audio Signals

In a radio receiver the audio signal is in the form of an alternating current, and this is applied to the reproducer (loudspeaker) which, to explain matters in a simple way, moves backwards and forwards. Now it does not make any difference whether the cone of a speaker is driven backwards or pushed forwards—the ultimate movement of the air will be the same, and, therefore, it does not matter whether we use one L.F. stage or two (or more). But in a television receiver it is most important to know just whether the impulses with which we are dealing are positive-going or negative-going.

In Fig. 1, is shown the normal type of vision diode detector, less the various filters and similar items which may be associated with it, and which do not concern us at the moment. If the last R.F. coil is connected to the anode of the detector the result will be a positive-going signal at the cathode. Alternatively, if the cathode is connected to the R.F. coil, then the signal will be negative-going. The sync pulses, however, in the present BBC signal are arranged on the carrier in such a manner that they are of opposite polarity to the picture signal, and thus a positive-going picture signal will carry negative-going sync pulses, and vice versa.

Picture Tube Connection

Now when the signal is applied to the grid of the video amplifier the effect is to produce at the anode an outgoing signal of opposite polarity, and this, in fact, applies to all amplifying stages, whether in a straight radio amplifier or in a timebase or other apparatus. Therefore, the connections to the picture tube must be considered in conjunction with the design of the vision strip, i.e., whether the detector delivers a positive or negative-going picture, and whether there is one stage or two of subsequent video amplification. A positive-going picture at the grid of a single video amplifying stage will call for the output to be connected to the cathode of the picture tube, and a negative-going signal at the grid will call for grid modulation of the tube. This is the first point which will have to be considered if a change in vision strips is contemplated.

Sync Pulse

As a negative picture signal is found at the anode of a video stage fed from the cathode of a video diode, this means that positive sync pulses are present, and it is important to remember that the cathode of an amplifying valve is carrying a signal of polarity opposite to that in the anode. Therefore, if negative sync pulses are required in the arrangement just described they could be obtained from the cathode, but it is necessary to bear in mind that they will be very much weaker than the pulses in

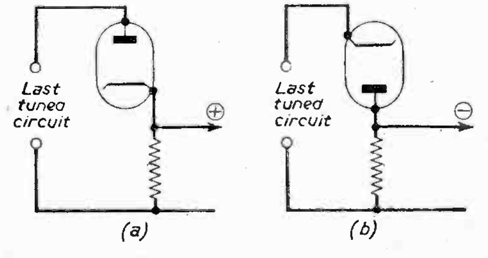


Fig. 1.—The Video detector can produce a positive or negative signal as shown here.

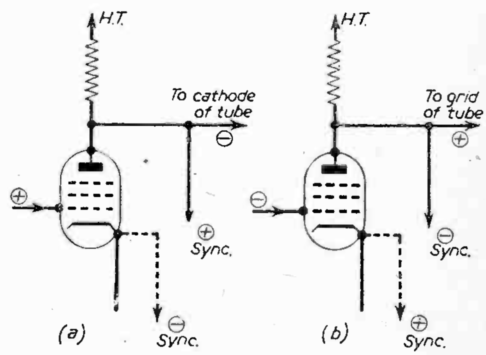


Fig. 2.—The output from the Video stage can be of either polarity, and the tube must be correctly connected.

the anode circuit. It is not proposed to go into the question of the brilliancy control which will, of course, have to be connected to the grid or cathode of the tube according to which electrode is modulated, as this does not come within the scope of " phase," but it may call for some complication, as to maintain the grid negative with respect to the cathode, with the grid fed from the anode of a video stage (making it probably nearly 200 volts *positive*), this may mean that the brilliancy control will have to be at a very high voltage which may not be obtainable from the normal H.T. rail.

We have now seen that we may have a positive or a negative sync pulse available from our video stage, and before use can be made of it it is necessary to know what arrangements are used in the timebase. The sync separator may be ignored for the moment, but it should be remembered that the phase may be reversed, as already described by passing it through a simple L.F. amplifying stage.

Blocking Oscillator

The blocking oscillator is probably the most common form of circuit met with and has replaced the thyratron in most receivers. If the circuit utilises a thyratron, then usually a positive sync pulse is called for. In the case of a blocking oscillator, however, we can use either a negative or a positive pulse. If the sync pulse is negative it is applied to the anode of the oscillator if this is of the simple triode type. If an H.F. pentode is employed, the pulse may be applied to the screen grid, but it will still have to be of the negative-going form. If the sync pulse is of the positive-going form it will have to be applied to the grid of the oscillator. These remarks are, of course, generalisations, and some commercial receivers may have modified forms of oscillator to which these general remarks do not apply, but sufficient has been said to show that it is

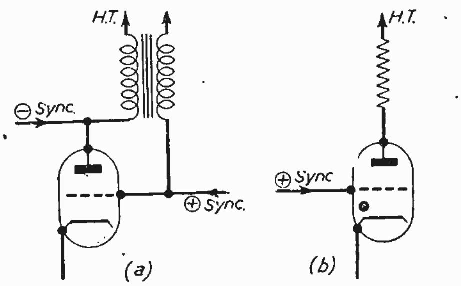


Fig. 3.—The sync pulses are applied to different electrodes, according to their polarity.

impossible for us to be able to inform a reader whether or not a certain tuner can be included in a different receiver without knowing exactly what circuits are employed in both pieces of apparatus, and that it is quite possible that the alterations called for may be so extensive that it would be easier to make up the section which is to be changed. As a general rule such a mixed combination should not be attempted.

Television Society's Exhibition

(*Continued from page* 445.)

multiplier output current constant for very wide ranges of light intensity. Contrast range greater than 100,000. (10^{-6} to at least 10^{-1} lumens incident on photocathode.)

MULLARD LTD., Century House, Shaftesbury Avenue, W.C.2. This exhibit comprised a selection of cathode ray tubes designed for television purposes, a display of Ferroxcube for scanning and focus applications and a back-projection television receiver.

MURPHY RADIO LTD., Welwyn Garden City, Herts. A V204 receiver was shown specially modified for fringe reception and employing a G.E. 24 in. direct view tube at 17 kV. Extra features in this receiver included slow-acting AGC, anti-flutter, flywheel sync., black spotter and optional spot wobble.

PEACHEY, H. J. Experimental tele-still equipment, designed for the home constructor, were shown.

PHILIPS ELECTRICAL LTD., Century House, W.C.2. Amongst a number of items manufactured by this company the composite pattern generator shown was used with local camera signals to produce a composite television signal at 45 Mc/s. for distribution throughout the Exhibition.

POOLE, R. B., showed an experimentally constructed model showing C.R.T. design.

REGENTONE TELEVISION & RADIO CO. LTD., Romford, Essex. One of a large range of domestic television receivers made by Regentone was on demonstration with local camera and BBC signals. A typical production chassis, detailing the design, was also available for inspection.

STANDARD TELEPHONES & CABLES, LTD., Aldwych, W.C.2. The main exhibit was a large scale contour map showing both cable and radio links, from London to all terminal points. Sections of typical multi-way cables were exhibited, together with the specialised test equipment used for associated measurements.

TELEGRAPH CONDENSER CO. LTD., Acton, W.3. Here was seen a D.C. ionization detector for testing dielectrics. This apparatus applies a test voltage to the test capacitor, and any ionization discharge is monitored visually and aurally. " Visconol " capacitors were exhibited together with a working model of the " View Master."

TELEQUIPMENT LTD., Whetstone, N.20. A type WG/4 television pattern generator and a Monoscope equipment designed particularly for factory production use were shown.

THORN ELECTRICAL INDUSTRIES, LTD., Ferguson Radio. This exhibit consisted of a receiver, operating alternatively with and without fly-wheel sync under weak signal input conditions, with superimposed artificially generated ignition and C.W. to simulate fringe reception.

TOWNSEND, G. B., of G. E. C. Research Laboratories. A G. E. C. table model receiver employing aluminised 16 in. tube at 12 kV., and incorporating a video diode spot limiter and modulation following suppression on the sound channel, was shown.

T. KILVINGTON, of Post Office Research Dept., showed a television monitor with line broadening effected by modifying the p.m. focusing device to produce an elongated spot instead of a circular spot.

20th CENTURY ELECTRONICS LTD., West Norwood, S.E.27, exhibited a number of single and double gun C.R. tubes with perfectly flat faces, and characterised by extreme precision of electrode alignment during production.

THE TELEVISION SOCIETY. This exhibit consisted of a television transmitter designed for propagation tests at 427 Mc/s, using the standard 405 line video waveform.

The Wenvoe Transmitter

SOME INTERESTING TECHNICAL DATA OF THE LATEST BBC STATION

THE BBC high-power television transmitters at Wenvoe were brought into service on 20th December, 1952 and replaced the medium-power transmitters which have carried the programme since 15th August, 1952.

General

The station is situated on a site of approximately thirty acres close to the Cardiff/Swansea road some five miles to the west of Cardiff. It is 400 feet above sea-level, and the transmitting aerials are located on the top of a 750-foot mast which brings the total height to over 1,100 feet. This is an important factor in securing the greatest possible service area, particularly in the hilly country of South Wales.

The vision transmitter operates on a frequency of 66.75 Mc/s (4.495 metres) and the sound transmitter on 63.25 Mc/s (4.745 metres).

The vision programme is received at the station over the G.P.O. distribution network which consists of a ⅜ in. tube coaxial cable system from London via Reading, Bath, Bristol and Cardiff.

The sound programme reaches Wenvoe over specially equalised G.P.O. telephone circuits similar to those used for other B.B.C. transmitting stations.

THE NEW TRANSMITTERS

High-power Vision Transmitter

This transmitter, manufactured by Electric and Musical Industries, Ltd., is similar to that installed at the Kirk o' Shotts station. Low level modulation is used, and a block-schematic diagram of the essential units in the new transmitter is shown in Fig. 1.

The design has not only enabled a considerable reduction to be made in the physical size of the transmitter, but it offers increased overall efficiency with a consequent saving in power consumption.

The incoming vision signals are fed from the vision Lines Termination room to the modulation amplifier. This consists of (a) a three-stage D.C. input amplifier using receiver-type valves exclusively and having a cathode-follower output, (b) a linearity correction amplifier and (c) a pre-modulation v.f. amplifier, also with a cathode-follower output, feeding the grids of the modulated amplifier. The black level is finally clamped at the input to the pre-modulation amplifier. The fact that this clamping has to be separated by a considerable number of stages from the transmitter output could introduce variations in the transmitted black level unless special precautions were taken. This possible difficulty is overcome by the inclusion of a black level r.f. feed-back circuit which monitors the black level at the transmitter output and injects a suitable correcting signal into the vision circuits. A further advantage of this technique is that it tends to reduce any mains hum introduced by the class "B" R.F. amplifiers forming the later stages.

The modulation is applied to the grids of a pair of ACT.27 air-cooled triodes which operate as an earthed grid push-pull modulated amplifier having an output of approximately 600 watts peak white. This stage is preceded by a pre-modulation R.F. amplifier, a frequency multiplier and the crystal oscillator stage.

The modulated amplifier output is fed to a chain consisting of three push-pull earthed-grid class "B" linear wide-band R.F. power amplifiers in series. The first employs a pair of ACT.27 air-cooled triodes and produces an output of 3 kW.; the second is fitted with ACT.26 air-cooled triodes and has an output of 12 kW., whilst the third uses a pair of BW.165 water-cooled triodes. The transmitter will be operated with an output power of 50 kW.

From the outputs of the modulated amplifier, inter-stage couplings of the wide-band three-stage coupled-circuit type are used, and these are so tuned that their pass-band centre frequency is about 0.7 Mc/s below the carrier frequency. The two side bands are thus not symmetrical—the upper one being slightly attenuated—but a filter is used to obtain the final asymmetric side-band condition. A further three-stage coupled circuit is used at the anodes of the output amplifier and this is arranged to change from a balanced to an un-

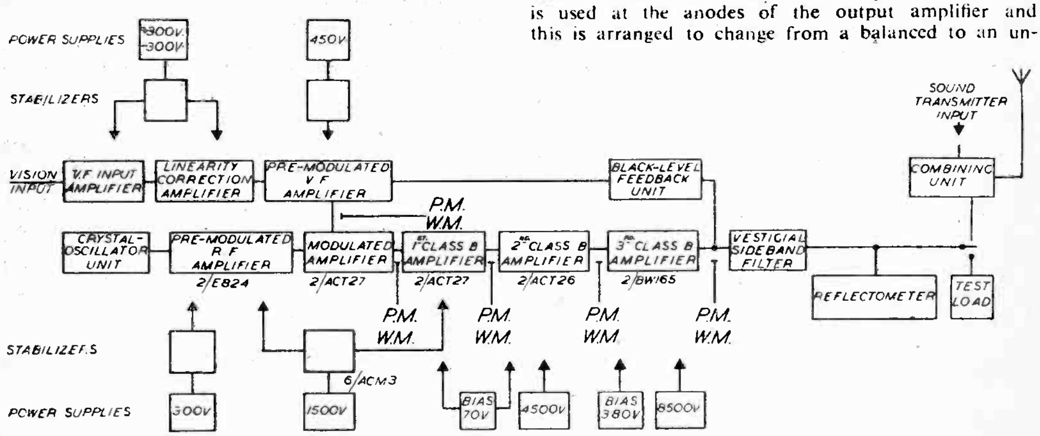


Fig. 1.—Block diagram of the essential units of the new transmitter.

balanced load to feed the coaxial output tranmission line.

The high-voltage D.C. supplies for the high-power stages are provided by oil-cooled metal rectifiers; one of the advantages of this type of rectifier is that the control circuits are simpler than those associated with the hot cathode mercury vapour type of rectifier which has been used in previous stations.

Air for cooling the valves in the earlier stages of the transmitter is drawn from outside the building, filtered and blown through the cooling ducts at the rate of 3,000 cubic feet per minute. Two blowers of the centrifugal fan type are used for this purpose, one delivering filtered air to the transmitter and the other exhausting it by suction. By this means the air pressure in the cubicles is equalised and air leakage and noise are considerably reduced. Another improvement in this direction is that the design of the vision transmitter permits the air duct being led in from below; the connecting ducts to the cooler room are therefore run under the floor. The blowers are driven by V-belts at approximately 1,000 r.p.m. and produce an air speed in the main ducts of between 1,500 and 2,000 feet per minute. An arrangement of dampers is incorporated in the system whereby the air, after leaving the valves, can either be exhausted to atmosphere, or circulated in the building for heating purposes.

Distilled water is used for cooling the valves in the final stage. Three tanks are provided, the main tank with a capacity of 50 gallons, a 100-gallon reservoir tank and a 15-gallon expansion tank. The water is circulated by a centrifugal pump from the main water tank through a multi-tube radiator, where it is cooled by means of air from a separate air-blower, to the valve jackets in the transmitter and back to the main tank. Except for the air-blown radiator, the components are mounted together to form a self-contained unit. No ferrous metal is used in the construction of the water-cooling system which operates as a closed circuit to exclude air. Water expansion is taken up by the 15-gallon expansion tank in which the space above water level is filled with nitrogen at approximately 5 pounds per square inch above atmospheric pressure. The normal water flow required to cool a pair of BW.165 valves is 18 gallons per minute. The flow in the system is electrically metered. Contacts are provided in the main inter-lock circuit, to ensure that the transmitter cannot be powered until the water flow is correct. Conversely, a failure of the water-cooling system would close down the transmitter.

High-power Sound Transmitter

The high-power sound transmitter, manufactured by Standard Telephones & Cables, Limited, is of the conventional high-power class "B" modulated type. Modulation is applied at the anodes of both the penultimate and the final R.F. stages. The transmitter uses air-cooled valves throughout and will be operated with a carrier output power of 12 kW. There are five push-pull stages in the A.F. chain, the first two using 4074A double triodes; the third is a class "A" stage and uses a pair of 5C/450A pentodes. This is followed by a cathode-follower-driven stage having a low output impedance and employing four 5C/450 A pentodes. The final class "B" stage uses two 3J/192E air-cooled triodes. Negative feed-back, derived from the primary of the modulation transformer, is applied over the A.F. chain. The R.F. side of the transmitter is composed of an R.F. exciter comprising a crystal-controlled oscillator followed by a buffer stage, two stages of frequency trebling and an output amplifier. The first stage of the transmitter proper uses a single 4H/180E air-cooled tetrode; the penultimate and final amplifiers each employ a single 3J/261E air-blast-cooled triode. Variable inductive coupling is used between stages. The filaments of the three R.F. power amplifiers and the class "B" modulator valves are supplied with heating current from metal rectifiers equipped with current-limiting reactances to control the current supplied to the filaments when starting. The remaining valve filaments are A.C. heated. The main high-tension supply is derived from a 6 kW. three-phase full-wave bridge-connected rectifier of the hot cathode mercury vapour type. A half-voltage half-wave output is taken between the star point and negative in order to supply the first earthed-grid R.F. amplifier and the A.F. driver stages. The equipment is grid-controlled, giving high-speed overload protection, together with automatic restoration of voltage and smooth increase of output voltage from zero on starting, as well as a substantially constant output voltage between plain carrier and fully modulated conditions.

The main blower of the air cooling system provides 3,300 cubic feet per minute to the base of the power amplifiers. Discharge air is drawn from the tops of the transmitter cabinets by a smaller exhaust blower. All the power equipment is housed in a separate enclosure, one compartment of which contains the power supply and distribution control contactors and protective circuits, whilst the other accommodates the high-tension rectifier and main modulation equipment.

Output and Combining Circuits

The output of the vision transmitter is passed to the vestigial side-band filter which consists of a constant-resistance filter of the transmission line type. It is composed of two complementary networks, the high-pass section being terminated by a constant resistance

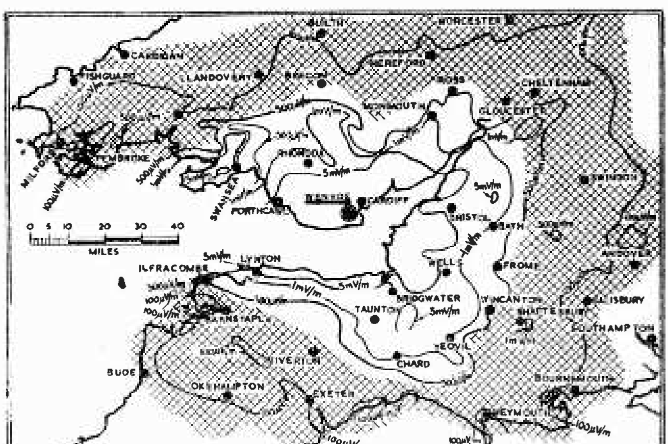


Fig. 2.—Approximate service area of Wenvoe. Considerable fading may be experienced in the shaded area.

absorber load and the low-pass section by the aerial system.

The filter is constructed from coaxial copper tube transmission line having an outer diameter of 5in., but with the diameter of the inner conductor varied to obtain the required impedance for the various stubs. The output of the low-pass section is taken to a change-over switch enabling the shaped output to be fed either to the combining unit and aerial or to the test load.

The combining unit into which the outputs of both the vision and sound transmitters are fed consists of a "sound-pass/vision-stop" filter inserted between the sound transmitter and the common output, and a "vision-pass/sound-stop" filter between this point and the vision transmitter output.

The mechanical construction of these filters is similar to that of the vestigial side-band filter.

Masts, Aerials and Transmission Lines

From the output of the combining unit the signals are fed to the common aerial at the top of the 750-ft. mast. The transmission line used for this purpose is of the coaxial type having an outer conductor of 5in. diameter copper tube and an inner conductor consisting of high conductivity copper wires which form the outer layer of a locked coil steel wire rope. This rope, together with the outer tube, is suspended pendulum fashion from the top of the mast and the rope is connected at the base of the mast to a loading machanism so arranged as to apply a tensioning force of approximately two tons. Correct location of the inner conductor within the outer tube is effected by small rod insulators, spaced at 120 deg. which project from the inner surface of the tube at suitable intervals. This type of transmission line has a very high degree of electrical uniformity which is a necessary characteristic of lines intended for wide-band television transmission. The method of suspending and loading the transmission line results in its electrical uniformity tending to increase towards the end remote from the transmitter. This is a useful feature, as it reduces the formation of echoes; these have the greatest time-delay when the irregularities producing them are at the greatest distance from the transmitter.

The mast, which is built to the BBC's detailed specification of structural requirements, carries an aerial system designed to accept the full power from the main transmitters. Both the mast and aerial system are generally similar to those already in use at Sutton Coldfield, Holme Moss and Kirk o' Shotts. The supporting lattice-steel mast is 600ft. high and is triangular in section, each face being 9ft. across. This is surmounted by a cylindrical section, 110ft. high, having slots cut in its surface which may eventually form a very-high-frequency aerial for sound broadcasting should this system be installed at Wenvoe in the future. Surmounting the cylindrical section is a 40ft. steel tower carrying the combined sound and vision aerial. This consists of two tiers of four vertical dipoles, each fitted with an electric heater, controlled from the ground, to prevent the formation of ice on the dipoles which would upset their characteristics. The structure is stayed at four levels by sets of three locked coil steel wire ropes spaced equidistantly around the mast. The stays range in circumference from 4⅞in. to 6in. The longest stay is 860ft. All stays together weigh over 21 tons, and have breaking loads up to 210 tons. The mast is designed to withstand wind velocities of 80 miles an hour at the base, rising to 120 miles an hour at the top, under which conditions the total wind load is 80 tons. With this loading the masthead would move 7ft. 6in. from the perpendicular. In calculating the loading, allowance has been made for a half-inch thick coating of ice distributed over all members and weighing some 23 tons. The mast weighs 140 tons and the total down-thrust on the concrete base including that due to the stays and ice, is 336 tons.

A separate 150ft. mast carries the emergency aerial system for use in the event of a breakdown of the main aerial or transmission lines. The emergency aerials are separately fed and switches are provided to enable a rapid change-over to be made from the main to the stand-by system.

Power Supply

Power for operating the station is taken from the South Wales Electricity Board's system. Duplicate 500 kVA. transformers fed from a 6,600 volt feeder provide a supply of 415-volts three phase 50 c/s. In addition, a 240-volt single-phase stand-by supply is available to provide mast lighting and other essential services if the E.H.V. feeder has to be disconnected for maintenance purposes. The H.V. switchgear, metering equipment and main L.V. switchgear are located in the annexe building, the transformers being mounted on an adjacent raft.

The Service Area of Wenvoe

The range within which consistently good reception of the programmes broadcast by Wenvoe can be expected depends upon many factors, the chief of these being the presence or absence of high ground between the station and the reception point, the height of the receiving aerial, and the amount of electrical interference. A map is given (Fig. 2) showing the estimated field-strength contours for the 50-kW. high-power transmitter; it will serve as a rough guide to reception conditions in the area, though there will be local variations. Reception is usually possible at a field strength as low as 100 microvolts per metre, although it depends on the degree of local interference, especially that produced by motor-cars.

The 1953 Radio Show

THE provisional dates previously announced for the 20th National Radio Show, Earls Court, London, 1953, are now confirmed.

The Show will be open to the public from Wednesday, September 2nd, to Saturday, September 12th, from 11 a.m. to 10 p.m. daily. The Exhibition will be closed on Sunday, September 6th.

There will be a pre-view on Tuesday, September 1st, from 11 a.m. to 6 p.m. Admission on this day will be by special invitation ticket from the Radio Industry Council, dealer's season ticket or by Press ticket. There will be no public admission on the pre-view day.

The planning of the Radio Show by the Exhibition Organising Committee, Radio Industry Council, is now well advanced. Mr. Ian Jeffcott, A.R.I.B.A., is again the Exhibition Architect and a new lay-out has been approved. BBC participation is assured, and in addition to the usual representative exhibits of radio and television receivers, components and valves, there will be an increased number of electronic demonstrations, an enlarged training exhibit and demonstrations by the Services.

Organisers are the Radio Industry Council, 59, Russell Sq., London, W.C.1 (Secretary, Mr. R. P. Browne; Deputy Secretary, acting for Mr. Browne at present, Mr. G. B. Campbell.)

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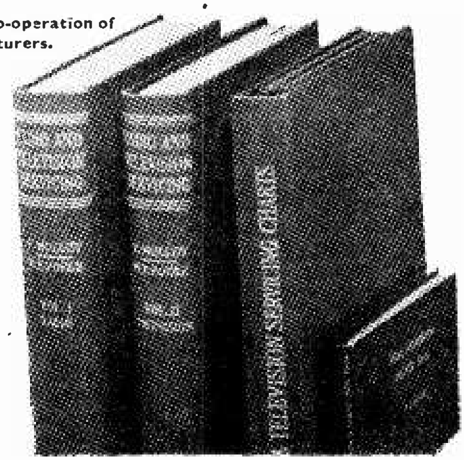

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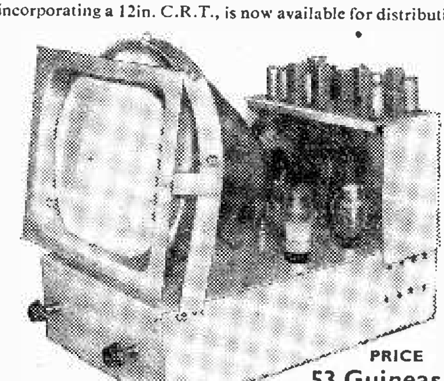

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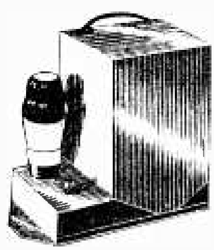

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Obtaining a Good Interlace

SYNC SEPARATORS AND INTERLACE FILTERS EXPLAINED AND ANALYSED

By M. Lock

A GOOD interlace is not a feature very commonly found in the more popularly-priced commercial receivers, a fact which causes some dismay to amateur constructors, although it is true that the amateur can, with the exercise of a little care, usually produce a superior result since his problem is confined to one set only. It is hardly necessary to dwell upon the importance of good interlace, particularly in the case of a well-focused 12in. picture, which even if not being in the extreme case of giving 202-line picture (100 per cent. pairing) is still very unpleasant to watch if bad pairing or a drifting of interlace is produced. Assuming that these matters need be laboured no further, we must find the most common causes of bad interlace to appreciate what we have to cure.

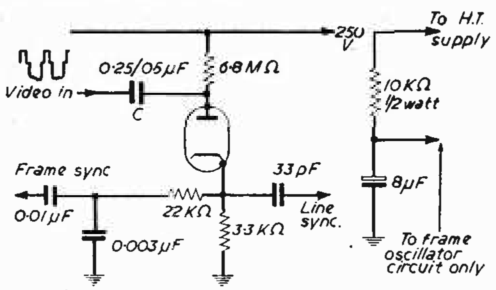


Fig. 1 (left).—Condenser C in this circuit must be of high quality. Fig 2 (right).—Additional decoupling circuit.

Required Accuracy of Synchronising

It is useful to know the minimum standard to which we must work. The author has found that with a 12in. tube closely viewed no disturbance of interlace can be detected unless the time-difference between the start of alternate frame scans is at least between 5 and 10μs. Therefore, to aim at closer limits is normally a waste of effort. This still imposes a strict limit on the apparatus, bearing in mind that a single-frame pulse lasts 40μs. Of course, we are committed to synchronising on the same frame pulse for every frame scan. This must invariably be the first one of the block; this will be dealt with in detail later.

Causes of Non-interlace

Let us first of all dispose of a common fallacy; stray pick-up of 50 c/s hum, or such hum introduced in any way into the timebase, whether thyratron or hard valve, does not cause interlace trouble. It will, under certain circumstances, cause many other troubles, particularly in regard to odd linearity defects and difficulty in maintaining really solid synchronising, but it will not be the cause of non-interlace.

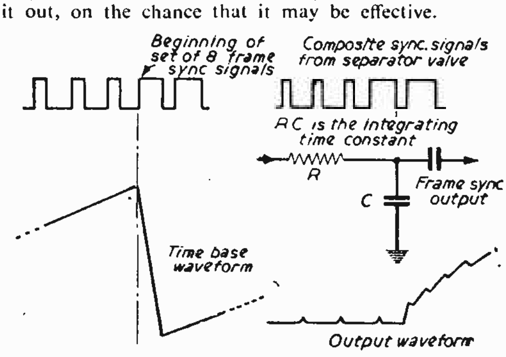
Another puzzle that sometimes occurs is of practical importance, but difficult to do much about. That is the effect observed on some picture tubes of interlace changing with the prevailing humidity! This does appear true since breathing on the tube face may cure the pairing which seems to be present, although in fact the trouble is caused by screen charge on the C.R.T. and an examination of the frame timebase, by means of an oscilloscope, would naturally show interlacing *all* the time!

Having tried to avoid the obstacles, we now come to the real cause, which is line-pulses in any form getting into the frame timebase by any means whatsoever. In fact, as a cut-and-dry method particularly useful in the older types of frame timebases using a thyratron and consequently a very small synchronising pulse, it is often effective to experiment with a 0.1μF condenser by trying its effect from the cathode of the frame output valve to earth, the thyratron cathode to earth or even across the H.T. supply actually on the timebase chassis. In this respect, it may be desirable to add a further stage of decoupling to the H.T. supply to the frame timebase to ensure that no line-pulses are being coupled in via the H.T. supply. Again, if a synchronising circuit is being used which relies upon the picture separation taking place due to a large time constant and a diode, the condenser C in Fig. 1 should be of excellent quality (low-leakage), otherwise many synchronising troubles will be experienced.

There are, of course, three main ways in which line-pulses get into the frame:

1. Via the H.T. line (as the H.T. supply acts as a common coupling impedance), or the heater supply.
2. By stray pick-up of pulses at line repetition frequency, generated in the line timebase, and sync valve.
3. True line synchronising pulse *or* pulses emanating from any heavy discharge pulse in the line oscillator valve finding their way through the synchronising separator to the frame oscillator valve.

The first two causes can be overcome without recourse to much that is special. In case No. 1, if the power supply is A.C./D.C. the smoothing condenser will usually be about 200μF, which will be effective so long as it has no appreciable inductance. In cases of doubt, the effect of an extra stage of resistance decoupling to the frame oscillator valve only can be tried as a temporary measure to see if it is necessary (Fig. 2). In the case of normal H.T. supplies, where the voltage rail is of 300/350 volts, it is usually advisable to decouple the whole frame timebase separately. However, in the case of a single receiver problem, it is always worth while trying it out, on the chance that it may be effective.



Figs. 3 & 4.—Frame pulses and waveform from sync separator.

If the frame timebase H.T. supply is obtained from the " boosted H.T. rail " of a line timebase circuit of the efficiency-diode type it may again be necessary to use extra frame oscillator decoupling as in Fig. 2, but in the author's experience this is not often the case. These expedients, however, should always be tried when trouble with interlace is experienced. In the case of the heater supply being suspected as a cause of coupling in the line-pulses, it should suffice to try a 0.1 μF from one side of heater to earth. This, by the way, is a fairly unusual cause of trouble.

In case No. 2, all that is required is to keep frame components and wiring well away from all parts of the line timebase where large pulses are found, particularly

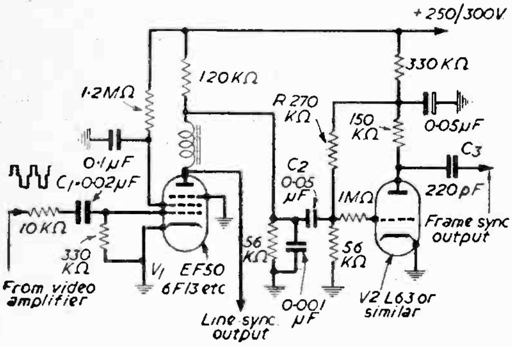


Fig. 5.—Sync separator and triode interlace valve.

the line scan transformer. Also keep the frame synchronising lead short, or pick-up will almost certainly occur. If this cannot be done, the lead carrying the frame synchronising pulse should be screened, as is usual with a gramophone pick-up lead.

Finally, in this respect we must not overlook the possibility of magnetic coupling inducing line frequency pulses into the frame circuit. This can happen most easily if the frame oscillator blocking transformer (where one is used) has been mounted so as to be in the leakage field near the line output or even the line blocking transformer. It may even be necessary, in extreme cases, to screen the frame oscillator transformer if it is too inconvenient to shift it. In this case a high-permeability material such as mu-metal should be used for the screening can. It is even possible, although less likely, that a large loop of wire associated with the frame oscillator circuit may have line-pulse currents induced in it, but this can easily be avoided by more compact wiring, and, above all, keep the frame oscillator circuit well separated from the line output components, then no trouble of this nature will be encountered.

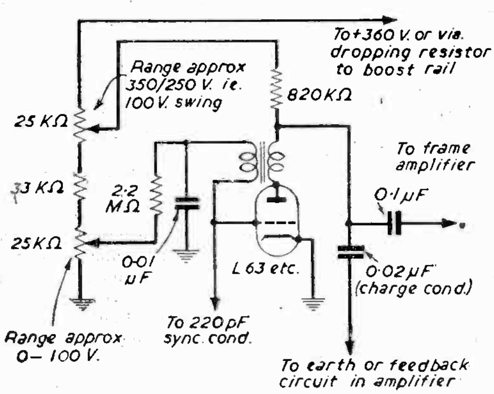


Fig. 7.—Frame blocking oscillator for use with sync circuit of Fig. 5.

Synchronising Circuits for Good Interlace

Whatever types of timebase circuits are used, even if all the precautions detailed are taken, it is still impossible to achieve the desired result unless the synchronising

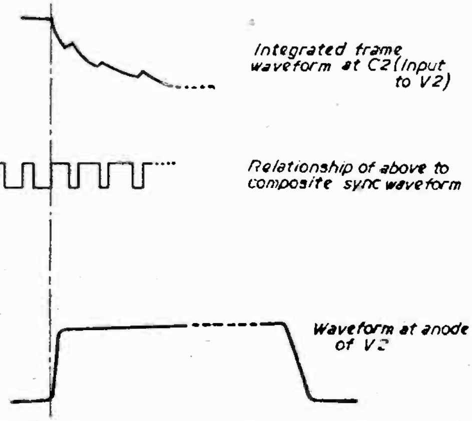


Fig. 6.—Frame pulse as integrated by the Fig. 5 circuit.

circuit is providing accurately timed pulses. This can be done in many ways, but those shown are very effective.

The object is to produce a pulse which will always initiate the discharge of the frame oscillator at the beginning of the block of frame pulses (Fig. 3), and there must be excellent discrimination between line and frame synchronising pulses. It is clearly not easy to obtain accurate timing with the simple integrating circuits which give a slowly rising pulse by integrating all the eight frame pulses, the slope being such that triggering may take place over a much wider time-range than the 5 to 10 μs, which we have specified, and any alteration in the frame speed controls will certainly alter the interlace (Fig. 4). It is also an advantage to render the valve supplying frame synchronising signals inoperative when only line synchronising pulses are being transmitted. This not only keeps out line synchronising pulses, but all pulses at line frequency generated by the line oscillator which may find their way into the synchronising circuit

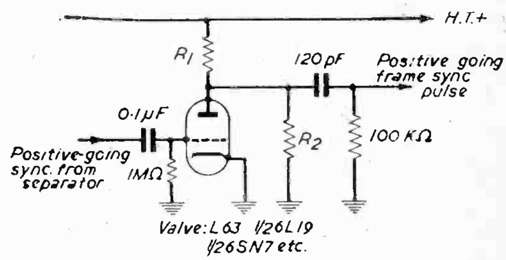


Fig. 8.—Positive pulse producing interlace stage. R1 and R2 depend on valve used.

are likewise prevented from getting through. This can be achieved in the first circuit described.

We require two valves, one for separating synchronising from picture, and the second for separating frame from line and at the same time producing a suitable type of waveform from the frame synchronising signals to fire the timebase.

The exact form which the circuit of the first valve V1 (Fig. 5) takes is not important; its function is to

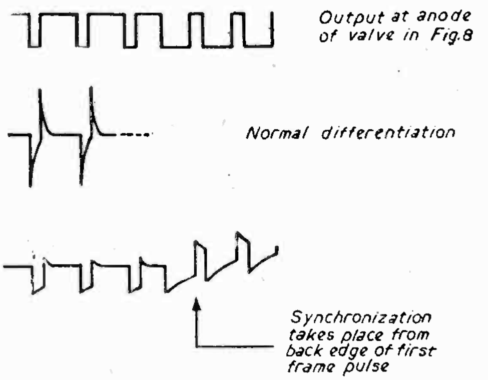
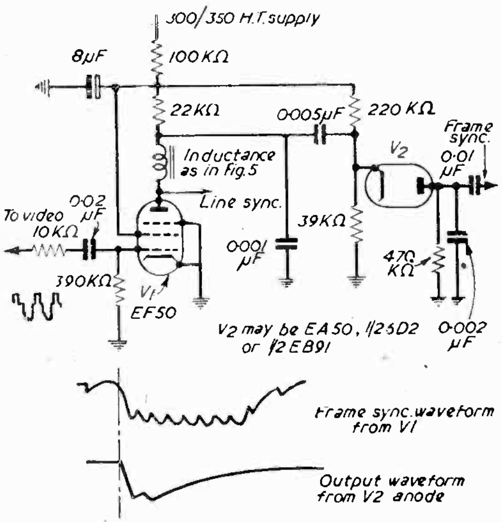


Fig. 9.—Frame pulses in which the back instead of the leading edge is used.

produce synchronising pulses free of all picture, which are passed on to V2 which produces an accurately timed single pulse for the frame and gives no output during the remaining time (i.e., it is " dead " to all line synchronising pulses).

In Fig. 5, the only unusual component is the choke in the anode of V1. It is an advantage to use this circuit in place of the more common resistive load for several reasons, not the least of which is that it prevents a disturbance of line sync amplitude during the frame synchronising period. Such an inductance can readily be constructed by winding between 500 and 1,000 turns of 40 s.w.g. enamelled wire on a small former about



Figs. 11 & 12.—A circuit for producing a negative pulse and the waveforms associated with it.

¼in. to ⅜in. dia., and using mu-metal laminations reclaimed from ex-surplus components (e.g., a small microphone transformer or something similar). The precise inductance is not important. It would also be possible to find a wave-wound single section from an R.F. choke of about the correct number of turns and remove it, if suitable laminations can be found to fit it. The core should be assembled as a transformer, i.e., interleaved and not choke fashion.

The action of V1 is obvious. The valve takes grid current, being fed with positive-going synchronising pulses, and the grid acts as a D.C. restorer, a steady potential being maintained across C1. The valve is operated at very low screen volts so that it has a short grid-base (i.e., a small excursion of voltage in a negative direction will cut off the anode current entirely), and with the grid-current bias used, only a small part of the synchronising pulse is effective in producing anode current. Thus all the picture signal has been supressed, and since the positive tips of the synchronising pulses cause the grid current to flow (which means, of course, that the grid of V1 presents a very low impedance during that time) the " noise " present on the synchronising pulse tips is removed as well; this gives a clean synchronising output to start with.

We will not consider the line synchronising as it does not come within the scope of this article, but simply

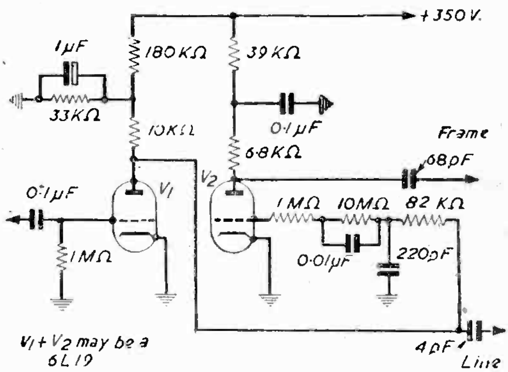


Fig. 10.—Two triodes are used in this positive pulse circuit.

take the frame synchronising signals as they arrive at the grid of V2. This valve is made to pass grid current by connecting the grid to H.T. via a high resistance. When a frame synchronising signal arrives it has already been partially integrated (Fig. 6).

Until the arrival of this frame waveform, the grid current has been flowing and the valve has been conducting, but as soon as the first frame pulse arrives, the grid is carried negative by an amount exceeding its grid-base, and the anode current ceases. As the time-constant of the grid circuit components of V2 is arranged to make each of the eight-frame pulse negative tips reach about the same (negative) level, V2 will remain cut off for the whole of the block of eight frame pulses. As soon afterwards as is permitted by the time-constant of the anode components, current will again flow in the anode of V2 since the large negative signal has been removed from the grid and the connection to H.T. via R is supplying once more a positive bias more than sufficient to overcome any line-pulses arriving at the grid of V2. We now have a waveform whose leading edge may be used to synchronise a blocking oscillator or thyratron b applying it via C3 to the grid of the oscillator. If desired, in cases where only a very small synchronising pulse is needed and great accuracy of synchronisation required, the waveform obtained may be differentiated and the positive pulse obtained used to fire the timebase. There is, however, a limitation to the use of this circuit in the case of blocking oscillator timebases. It cannot be used if the charge condenser is in the grid circuit, but only when it is in the anode, as is more usual when high H.T. voltages are being used. In A.C./D.C. type sets with H.T. supplies of 160-200 volts only, the charge condenser is usually put in the grid circuit and under such circumstances the circuit just described will give the appearance of slow flyback (i.e., folding over at the top of the picture), due to the 400 μs block of frame pulses from the synchronising circuit coming to an end before the grid current pulse of the blocking oscillator, and disturbing the action of the oscillator. The cure is to use the circuit of Fig. 7 at all times when a blocking oscillator is used, and if insufficient H.T. is available due to A.C./D.C. technique then the "boosted H.T." from the efficiency diode circuit, always present in such a low-voltage receiver, will have to be utilised.

The other circuits shown can only be touched upon briefly, and though they may represent slightly less foolproof designs for the home-constructor working without an oscilloscope to see just what is happening, they may readily be adjusted to give good results. Fig. 8 gives the circuit of a frame interlace valve which will give the same polarity of output synchronising pulse, but works off a positive input instead of negative. This apparent contradiction is explained as follows: the frame output pulses at the anode are in fact negative going, but the back edge of the first one is used as the synchronising pulse. This is achieved by employing a partially differentiating output circuit which tilts the waveform. The line pulses do not get tilted much, due to their short duration, but the frame pulses, being longer, are tilted more and have much less time (in between pulses) to sink down again, so they stay up (Fig. 9). The valve may be any triode (L63, 6J5, etc.) or triode-connected pentode.

Next, there is an interesting circuit also giving positive synchronising output (Fig. 10), but using two triodes for the whole synchronising circuit. It may be convenient to use a double triode such as the ECC32, 6L19, 6SL7, etc., or two separate triodes or triode connected EF50's or VR65's.

We need positive-going synchronising signals from the video amplifier which are applied to V1 which has low H.T. and thus a short grid-base. Hence, the picture is removed and only the positive synchronising pulses cause the valve to draw current; in addition the tops of the synchronising pulses are cut off, due to the heavy grid current flow that they cause. V2 acts very much as V2 in the first circuit described (Fig. 5) and is normally conducting. The synchronising waveform at the grid is likewise affected by a time-constant such that the frame is raised above the line, and the output from the anode is obtained only when the frame pulses arrive. If this result should not be achieved, the H.T. potential at the anode of V1 may be too high, causing the grid base to be too long, which would result in insufficient separation of picture. The second likely need for adjustment would be to the time-constants in the grid circuit of V2, mainly the 82KΩ and 220 pF.

It will be evident from the foregoing that we have described only those circuits which give a very accurately timed synchronising pulse which will ensure that the frame timebase is fired on either the leading or back edge of the first of the eight-frame pulses in the transmitted synchronising waveform. There are many variations of the described circuits, and one in particular must be mentioned. This is commonly used and quite effective when properly adjusted. In contrast to the previous circuits this one gives a negative output pulse and, therefore, if a blocking oscillator is used, the synchronising pulse must be applied to the anode. It is also very useful for Miller-integrator types of circuits. The circuit values of Fig. 11 are given for an EF50 valve in the position of V1, but it will be appreciated that this is essentially the same as V1 in Fig. 5, so that the two may be interchanged. The operation will, therefore, only be mentioned in reference to the diode. The coupling time-constants between V1 and V2 partially differentiate the waveform (the components joined to the diode cathode are those concerned). Two of these components, the 220 KΩ and 39KΩ resistors, bias the diode such that it will not conduct unless the amplitude of the waveform reaching the cathode is greater than that of the line pulses. This means that the diode will only conduct on frame pulses (which have, as with the circuit of Fig. 5, already been raised above the line pulses at the anode of V1). It should also be observed that when the diode conducts, that the anode components are placed in parallel with the cathode components, which causes a slow decay to the frame synchronising pulse. The amplitude of the negative synchronising pulse obtained is approximately 10 volts.

A final word may be useful on the choice of the main separator valve. This is normally a pentode, and for maximum output voltage, easy achievement of separation, and a short rise-time for the output pulses a high-slope, short grid-bias valve, such as an EF50, EF80, 6F12, etc., is desirable. When this is not convenient, the compromise in results caused by using less suitable valves (of the low-slope, audio output type) is by no means disastrous. So long as the screen voltage is kept down to 10 or 15 volts by the use of 1.5 MΩ to 2.2 MΩ screen resistors, and a small amount of experimenting is done with the value of anode load around a value of 100 KΩ or so, perfectly good results are obtainable. These remarks apply, of course, to any of the circuits described.

TELEVISION PRINCIPLES AND PRACTICE

By F. J. CAMM

CONTENTS: The BBC Television System; The Television Camera; From Transmitter to Receiver, Projection Receivers; Stereoscopic and Colour Television; Time Bases; DC Receivers; Aerials: A London-Birmingham Converter; Servicing; Interference; A Pattern Generator; Choosing a Receiver; The Beveridge Report; Dictionary of Television Terms.

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Flyback E.H.T. Booster

OBTAINING HIGHER VOLTAGES WITH INCREASED SCAN

By P. Dodson

FROM an economy point of view, and considering the excellent performance obtained, it is not surprising to find that the majority of commercial manufacturers prefer line flyback E.H.T. to all other systems. Outputs up to 15 kV. with good regulation can be obtained from the line output valve passing only 60/70 mA. on a 300 volt H.T. supply, providing a modern line output transformer with ferroceramic core is used.

The main disadvantage to the flyback method is that line scanning and E.H.T. are closely interlocked. Any modification in the line output stage will affect both amplitude (scan) and E.H.T.

Metal Rectifier Circuit

Fig. 1 shows the usual arrangement for obtaining E.H.T. from the line output stage, using a metal rectifier. This is similar to the "View-Master" circuit. The pulse at the anode of the line output valve which is in the region of 2.5 kV. (it will vary from one receiver to another) is stepped up by an overwind on the transformer, ratio, say, 2 : 1 to 5 kV. It is then rectified to form the E.H.T. supply to the C.R. tube.

If it is desired to fit a larger C.R.T. of modern design an increase in E.H.T. will be necessary: 12in. tubes require 9 kV. on the final anode, 14in. 10/14 kV. Increasing the E.H.T. voltage to suit the larger tube would result in too small a picture unless the amplitude was also increased in the ratio $\sqrt{V2/V1}$ where V1 = original E.H.T. voltage, V2 = augmented E.H.T. voltage. Most line output stages will give some increase in amplitude over present requirements by raising the H.T., but care must be taken that the normal rating of the valve is not exceeded.

In order to obtain ample scan for a larger C.R.T. it is essential to modify the stage. Line output valves, such as EL38 or 6P28 will give sufficient scan for a 14in. tube on a 300 volt H.T. supply, providing a modern line transformer with ferroceramic core is used. The "Haynes," type T.34, E.H.T. line output transformer is eminently suitable. This transformer is for use with metal rectifiers, has a ferroceramic core, and is designed for use with 12-14in. narrow or wide angle C.R. tubes. It is suitable for scanning all types of magnetic tubes from 9in. to 14in.

No Damping

The circuit in Fig. 2 shows the line output stage, efficiency diode and E.H.T. supply. No damping is shown across the secondary windings, as this has not been found necessary with the transformer specified. If, however, any vertical markings are visible on the left of the raster these can be suppressed by shunting one of the line coils with 100/200 pF condenser in series with a 470Ω resistor.

Linearity should be correctly established in the line oscillator stage.

Adjustment of width control affects neither E.H.T. nor linearity.

The screen and cathode potentiometers should be set so as to reduce the anode and screen current to a minimum for the output required.

The efficiency diode serves a dual purpose. It rectifies

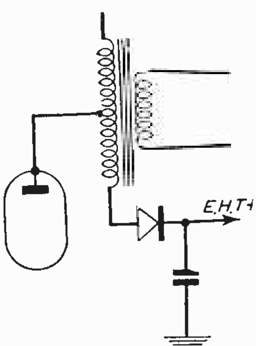


Fig. 1.—The usual circuit of an E.H.T. supply from the line output stage.

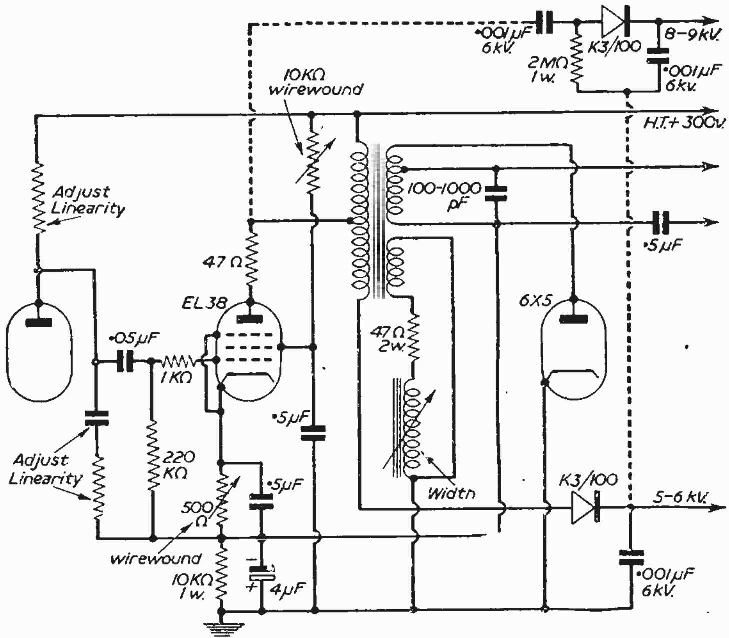


Fig. 2.—Line timebase with efficiency diode, showing various controls which are required.

the oscillations set up in the output transformer secondary during flyback; obviates, or reduces, the amount of damping necessary; provides the initial scanning current while the line output valve is cut off, and at the same time sets up a bias voltage which is effectively added to the anode supply of the output valve.

When the E.H.T. output is taken from the overwind on the transformer, using only one K3/100 rectifier, 5/6 kV. is available.

A Multiplier

Shown in dotted lines is a one and a half times multiplier, which should be wired into the circuit when a 8/9 kV. output is desired. The pulse at the anode is used to supply the boost rectifier, the output of which is added to that obtained from the transformer overwind, resulting in an increase of about 40 per cent. in E.H.T. voltage.

The same two metal rectifiers and three .001 μF condensers may be wired into the circuit, as shown in Fig. 3, to form a voltage doubler, giving an output of 12/13 kV.

The components comprising the booster should be mounted on a small piece of bakelite near the line output valve.

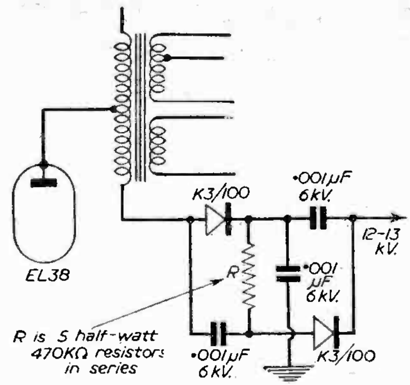


Fig. 3.—In this circuit the same two metal rectifiers are employed as a voltage doubler.

A reduction in E.H.T., with or without multiplier in circuit, may be had by shunting the line coils with a fixed condenser, value 100 to 1,000 pF.

New RCA Tubes

THE RCA Tube Department has announced a small TV camera tube intended for industrial television applications. Its small size and simplicity facilitate the design of the camera and associated equipment as compared with camera equipment required by larger types of camera tubes.

Utilising a photoconductive layer as its light-sensitive element, this new camera tube, designated as the RCA—6198 Vidicon, has a sensitivity which permits televising scenes with 100-200ft. candles of incident illumination on the scene. The photoconductive layer has a spectral response characteristic approaching that of the eye.

The 6198 provides 400-line resolution, employs magnetic focus and magnetic deflection, and operates with relatively low D.C. voltages.

Measuring only about 1in. in diameter and 6¼in. in length, the 6198 lends itself to use in light-weight, compact television cameras. The size and location of the photoconductive layer permit a wide choice of commercially available lenses.

A series of components designed especially for use with the 6198 is planned for commercial availability this coming autumn, according to an announcement from the RCA Tube Department. The series will include a deflecting yoke, focusing coil, alignment coil, horizontal-deflection output transformer, and vertical-deflection output transformer.

A technical bulletin on the 6198 can be supplied on request to RCA Photophone Ltd., 36, Woodstock Grove, London, W.12.

RCA-6199 Multiplier Phototube

A new, small, 10-stage multiplier phototube of the head-on type has been recently introduced by the RCA Tube Department. Designated as the RCA-6199, this new multiplier phototube is intended for use in scintillation counters, and in other applications involving low-level, large-area light sources. Because of its small size, the 6199 is especially suited for portable and fixed equipment where space considerations are important.

The spectral response of the 6199 covers the range from about 3,000 to 6,200 angstroms with a peak value at approximately 4,000 angstroms. The 6199, therefore, is highly sensitive to the blue-rich light emitted by excited organic phosphors such as anthracene and inorganic materials, such as thallium-activated sodium iodide.

Design features of the 6199 include a semi-transparent cathode, having a diameter of 1¼in. on the inner surface of the face end of the bulb; a face with a flat surface 1in. in diameter to facilitate the mounting of flat phosphor crystals in direct contact with the surface; and 10 electrostatically focused multiplying stages.

The relatively large cathode area permits very efficient collection of light from excited phosphor crystals, such as are employed in scintillation counters.

A technical bulletin on the 6199 can be supplied on request to RCA Photophone Ltd., 36, Woodstock Grove, London, W.12.

MULLARD VALVE DATA

THE popular wall chart and pocket book has been brought completely up to date and now includes data for germanium crystals and the new rectangular picture tubes MW36-22 and MW36-24.

The distinguishing feature of this year's wall chart is the new yellow cover designed by Ronald Ingles, M.S.I.A. Finished in a heavy high-gloss varnish, the cover will withstand the most constant handling and yet remain as conspicuous as ever.

Other Mullard innovations of previous years, such as the "step ladder" presentation of the title pages and the metal hanger inset in the spiral binding, have, of course, been retained.

Other contents of this year's wall chart are shown under the following headings: List Prices; Base Diagrams; Battery Types; Series Operated Types; 4-Volt Types; 6.3-Volt Types; Television Tubes; Stabilisers; Germanium Crystals; Flash Tubes; Photo-cells; Substitutions for Non-current Mullard Valves; Direct Equivalents; Near Equivalents.

Mullard Valve Data is again available in pocket booklet form. Like the wall chart, this year's edition of the pocket book has a bright yellow cover.

A BEGINNER'S RECEIVER

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

By B. L. Morley

IT is generally agreed that at and beyond the fringe areas a superhet is more desirable than the straight receiver by reason of its signal-getting properties. Unfortunately, there are very few superhet circuits which have been designed for the home constructor ; it is hoped that the details given here will enable even the novice to enjoy the advantages of this type of circuit.

The set comprises a sound and vision receiver complete with power pack, built together on a single chassis. It is, therefore, entirely self-contained, and can be used with any form of timebase and CRT. The details given here are for a sound and vision receiver only ; it is hoped at a later date to produce data for (1) a timebase and CRT network for an electrostatic tube (VCR97) complete with power supplies on a single chassis ; (2) a timebase and CRT network for an electromagnetic tube (standard type) complete with power supplies on a single chassis. The completed televisor, whether using VCR97 or normal magnetic tube, will, therefore, occupy two self-contained chassis.

The receiver unit can be operated either horizontally or vertically and can, therefore, be accommodated in a prefabricated cabinet of the types which are available to the amateur constructor.

As the unit is complete in itself it can be used in conjunction with any timebase and CRT unit which the reader may have.

The basis of the receiver is an ex-Government unit—the R3170A, but don't let that fact put you off ; as you will see from the photographs, the appearance of the chassis is quite pleasing. Moreover, really detailed instructions are given so that the novice need not hesitate to tackle the job. The more advanced constructor who can quite happily wire up directly from a theoretical diagram is advised which parts of the data he can skip !

We are all interested in costs these days, but the author is not going to fall into the trap of giving a detailed price list ; the cost of various components rises and falls with each issue of PRACTICAL TELEVISION, due to the fluctuating supplies, and this is particularly true where ex-Government apparatus is used. Suffice it to say that this combined vision and sound unit can be built for round about £10 and the electrostatic tube unit for about another £10, making £20 in all. If a magnetic tube is used, then the cost will be a total of £30-£35.

In order to assist the constructor two lists of components have been made ; one is the shopping list and will enable the current cost to be easily assessed and at the same time provide an easy reference table, and the other is a complete list of components and values.

There is no difficulty in obtaining the R3170A, which is available from several regular advertisers in this journal.

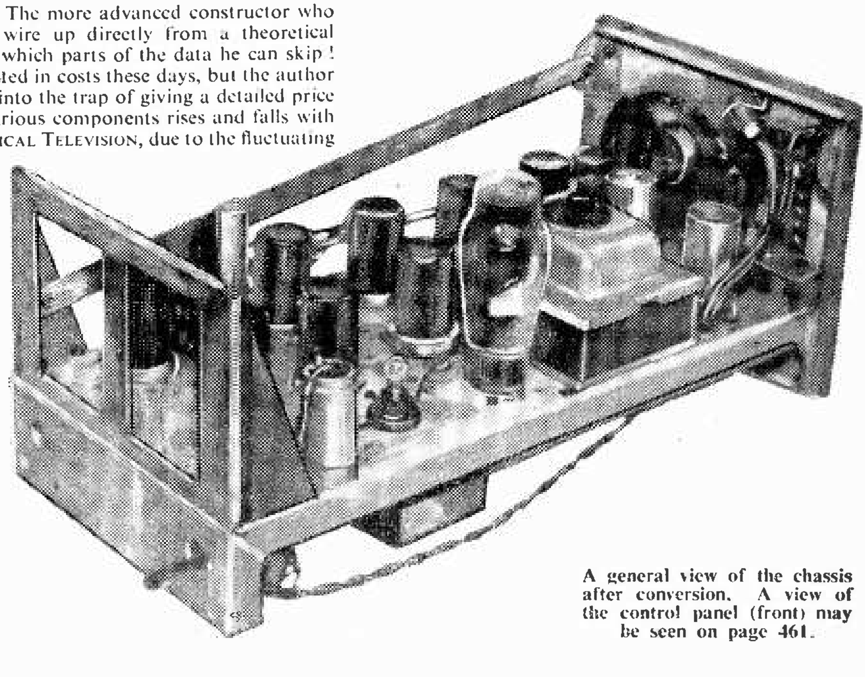
Although some of the coils must be home-made, they are very simple to construct, detailed instructions being given.

Provided the data is carefully followed, there should be no difficulty in aligning the receiver without the aid of a signal generator ; the vision I.F.s need no alignment as this has been arranged in the unit ; the bandwidth has been given as 4 Mc's.—under test the unit enabled the 2.5 Mc/s. lines to be resolved 80 miles from Sutton Coldfield, which is more than sufficient for long-distance reception. For those luckier people nearer the transmitter there is no reason why this cannot be improved upon.

The R3170A

This is the unit on which the complete vision and sound receiver is based. It is a handsome job with a very neat layout and contained in a chassis which measures 7½in. by 8½in. by 19in. overall. Fig. 1 shows a view of the layout.

The valves supplied with the unit are as follows :—8 of EF50 (red Sylvania type), 2 of CV66 (EC54), 1 of VR137 (EC52), 1 of VU111 (HVR2), 1 of VU39 (MU14), 2 of VR92 (EA50) and 1 of CV118.



A general view of the chassis after conversion. A view of the control panel (front) may be seen on page 461.

Neither the VU111 nor the CV118 is used in the modified version, though the former valve can be used as an EHT rectifier for the VCR97 tube.

An I.F. section at 30 Mc/s. is incorporated, and this portion is used for the vision section.

without having to get up from one's chair to adjust the contrast control.

A manual control is provided to vary the oscillator frequency within certain limits; this enables any frequency drift due to heating effects to be counteracted

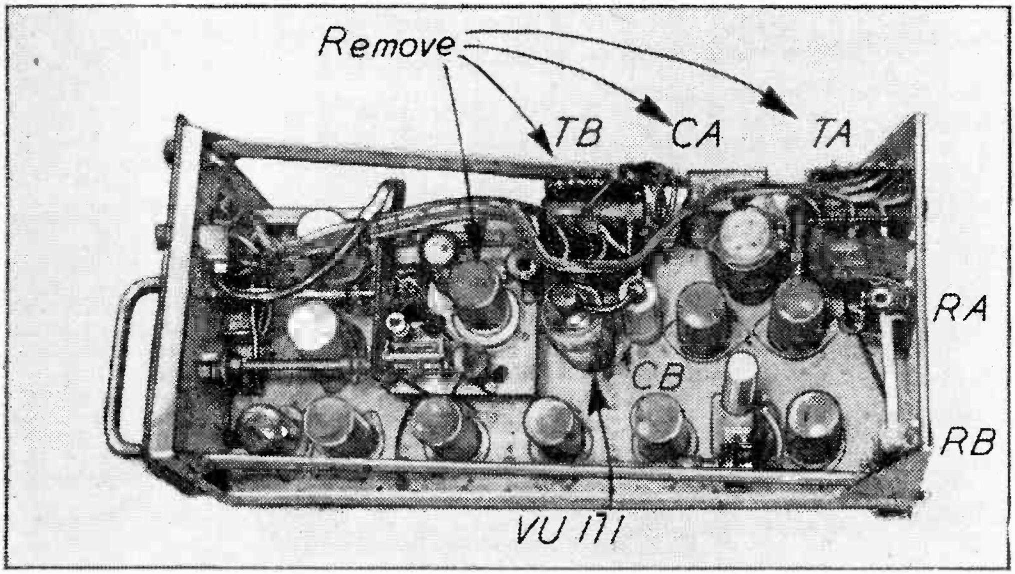


Fig. 1.—General view of the unit as purchased.

Special Features

The completed receiver incorporates several unique features in order to increase its efficiency at extreme ranges.

Variable video coupling is incorporated so that the balance between quality and quantity of the signal can be manually adjusted. A local-distance switch is fitted on the sound section, and the contrast control is supplemented by a jack so that an armchair control can be used. By this method fading can be counteracted

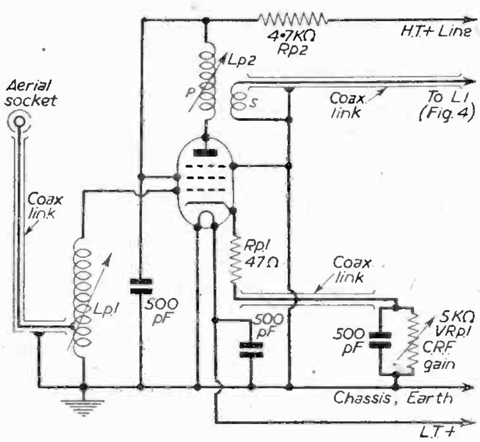


Fig. 3.—The pre-amplifier stage. Coil-winding data will be given next month.

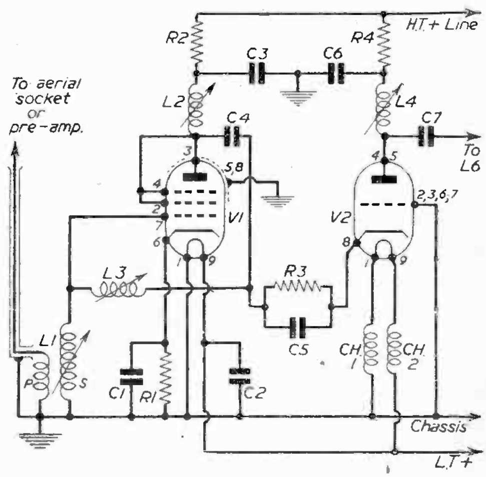


Fig. 4.—The first two R.F. stages.

R1—150 Ω, R2—8.2 Ω, R3—100 Ω, R4—2.2 K Ω } ½w.

C1—500 pF.
C2—100 pF.
C3—500 pF.
C4—100 pF.
C5—100 pF.
C6—500 pF.
C7—100 pF.

V1—EF50 (VR91).
V2—EC54 (CV66).

CH1, 2—See text.

and also enables a greater gain to be obtained on the vision channel on those nights when reception is particularly weak.

Fig. 2 shows a view of the top of the converted chassis.

The Circuit

So that the circuit can be followed easily even by the novice, it has been divided into six sections. They are the pre-amplifier (only required at extreme distances), the R.F. stages, the oscillator, the vision section, the sound section and the power pack.

The Pre-amplifier

This has been freely adapted from that given for the " Argus " in the August issue of PRACTICAL TELEVISION, because of its compactness ; it fits into the only space which is available for a pre-amplifier.

It may be found that the pre-amp. is not necessary except in the very remote areas, and the constructor is advised to leave this section until he has tried out the receiver without its aid. If it is then found that extra gain is required the pre-amp. can be constructed and fitted in position.

The circuit is quite straightforward and needs no explanation beyond the arrangement of the cathode circuit. (Fig. 3.) It will be seen that a 5 KΩ variable resistor is used in this position and forms a pre-set gain control ; one of the ex-Government pre-set potentiometers can be used in this position. The control is fitted on the front panel. RP1 provides a small degree of negative feedback to assist in counteracting the detuning effect of the gain control.

The valve used is a Mazda 6F12.

Twenty-two s. w. g. wire is used for the coils and for the wiring.

The R.F. Section

The circuit is shown in Fig. 4, and has been freely adapted from the excellent circuit given by A. Thomson in the November issue of PRACTICAL TELEVISION. The reason why this circuit was used is that it has been found very easy to set up and the novice should experience no difficulty with it ; also it makes use of one of the CV66's which is already in the unit.

V1 is an EF50 with screened grid, suppressor grid and anode strapped together to form a triode and used in a neutralised triode circuit.

V2 is the CV66 (EC54), a valve especially designed for operation as a grounded-grid triode. As will be seen, the grid (which is actually brought out to four pins at the valve base) is taken directly to earth ; the input to the valve is made via the cathode from the anode of the EF50 and the output is taken directly to the mixer valve.

L3 is the neutralising coil for V1 and will be found quite easy to adjust.

The Oscillator

The circuit is shown in Fig. 5. It employs the existing VR137 though the circuit is different from that used in the original unit. L5 is existing and can be used as it is, for Wenvoe and Sutton Coldfield ; for the other channels it is better to wind a new coil.

Tuning is effected by the 0-30 pF condenser C10, which is actually a Pye airspaced concentric type removed from another part of the unit.

C11 forms a vernier control over the frequency of the oscillator to give the facility mentioned in an earlier paragraph. It is an airspaced variable condenser which is removed from the sub-chassis and fitted in this new position.

The output from the oscillator is taken to the grid of the mixer valve via a 2 pF condenser. It is important that this value is adhered to or trouble may be experienced in aligning the receiver.

The Vision Section

This section includes the mixer valve, I.F. stages detector and Video output valve. Fig. 6, shows the circuit.

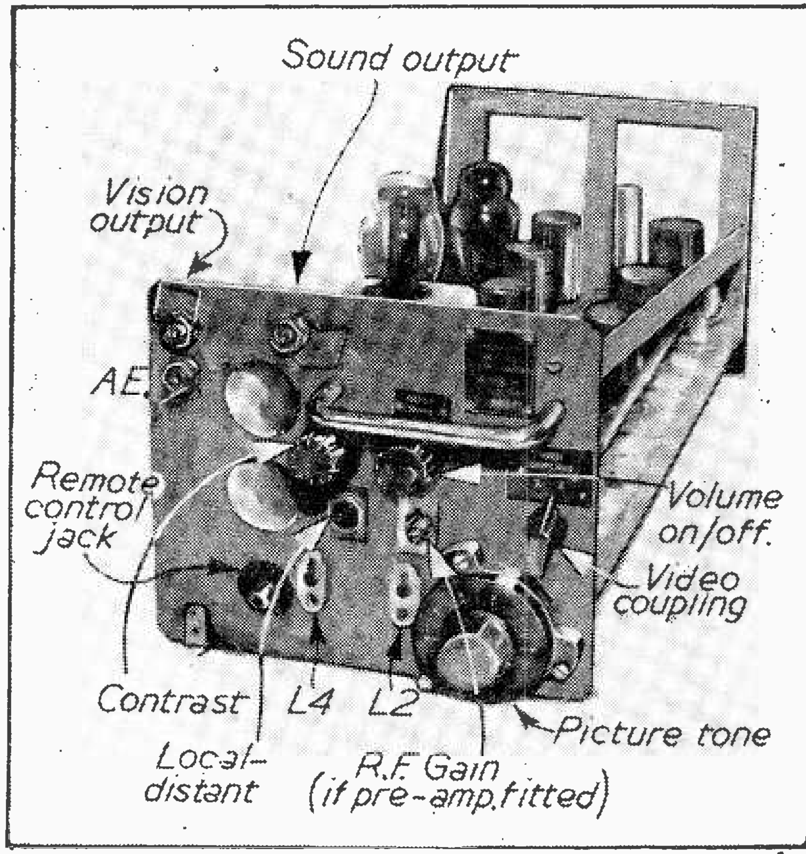


Fig. 2.—View of the front panel with all items identified.

The output from V2 in the R.F. section is fed to the grid of the mixer V4; the output of the oscillator is also fed into the grid. At the anode of the mixer will appear the vision signal at a frequency of 30.75 Mc/s and the sound signal at a frequency of 34.25 Mc/s.

The vision signal is transferred to the first I.F. valve, V5 via the transformer L7, 8. The sound signal is taken from L7 by means of the small coupling coil L7 (a).

Output from V5 is fed via the transformer L9, 10 to V6 and from here to the last I.F. valve V7 via the transformer L11. 12.

From L13, 14 the signal is passed to the detector V8, which is shown connected in the diagram for grid modulation. For cathode modulation the anode and cathode of the EA50 must be reversed.

The video signal is passed to the video output valve V9 which has a correcting choke L17 in its anode circuit. The output shown in the diagram is for grid modulation and can be fed directly into a timebase which caters for this form of circuit; this output could be fed directly into the input of the "Argus" timebase, for example.

It will be noted that the decoupling of the cathode is controlled by the switch S1 which varies the value of capacitance across the bias resistor. The greater the value of this capacitance then the greater will be the gain of the valve though the quality of the picture will be reduced as the correcting effect (due to negative feedback across the cathode resistor) becomes reduced.

The actual setting of the switch is one for personal choice and on nights when the signal strength is good, then the minimum position is suggested as being the best.

No spot limiter circuit is shown in the circuit because use of a small tube such as the VCR97 does not really justify the use of such a device. The usual method of supplying EHT from a mains transformer for this type of tube means that the regulation of the supply is quite good and one does not get the defocusing effect on interference spots such as is so pronounced with flyback EHT.

Where it is desired to employ cathode modulation, the circuit must be modified slightly. As this is now the general method of feeding electromagnetic tubes, the new circuit arrangement (given in Fig. 7) includes a spot limiter. It should be noted that the anode and cathode of the detector valve must be reversed and the bias resistor of V9 must be increased.

(To be continued)

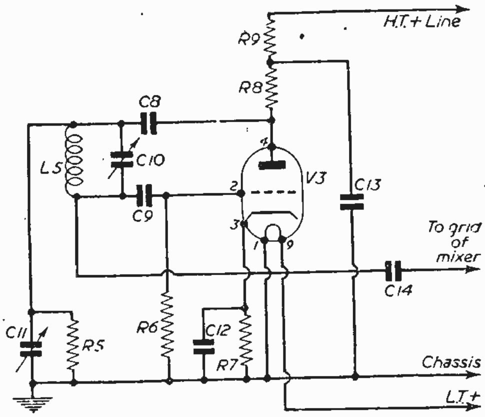


Fig. 5.—The oscillator stage.

R5—100 K Ω, R6—10 K Ω, R7—100 Ω, R8—4.7 K Ω, R9—47 K Ω } ½ w.

C8—100 pF, C9—8 pF, C10—0.30 pF, C11—0.45 pF, C12—500 pF, C13—500 pF, C14—2 pF } approx

COMPLETE SHOPPING LIST

(This comprises all components which have to be bought)

ONE R3170A UNIT
Four ⅜in. coil forms with iron-dust cores.
One International Octal valveholder.

OSCILLATOR SECTION
One 100 Ω, one 150 Ω ½-watt resistors.
Two 500 pF, one 100 pF, one 2 pF condensers.

V2 CIRCUIT
One 22 K Ω, one 100 Ω ½-watt resistors.
Three 500 pF condensers.

VISION CIRCUIT
One 0.01 μF (350 volts wkg. min.).
One 8 μF Dubilier Drilitic 500 volts.
One jack for remote contrast control if required.
One 5 K Ω potentiometer, ditto.
Additional items if cathode modulation used (see text).
One each of 4.7 K Ω, 150 Ω (½-watt) and 5.6 K Ω, 27 K Ω (1 watt).
150 K Ω potentiometer, B.T.H. crystal diode type CG6.

SOUND RECEIVER
Resistors: Three 1 K Ω, two 180 Ω, two 33 K Ω, two 1 M Ω, one 3 M Ω (or one 1 M Ω plus one 2 M Ω), two 470 K Ω (all ½-watt). One 500 K Ω with switch; one 4-point tag strip, one 6V6; one EF50.
One B.T.H. crystal diode type CG6.
Condensers: Four 500 pF, one 100 pF, one 33 (or 35) pF (can be one 25 pF and one 10 pF in parallel), one 300 pF.
250 volt wkg.: 0.1 μF, 0.01 μF, 0.05 μF.
25 volt wkg.: 25 μF, 50 μF Dubilier Drilitic.
500 volt wkg.: 8 μF.
One loudspeaker transformer to suit loudspeaker with pentode output.

POWER SUPPLY
One transformer. Outputs: 6.3 volt 4.5 amp., 5 volt 3 amp, 350-0-350 150 mA, half-shrouded dropthrough. (Available Clydesdale Supply Co.)
One smoothing choke type W/B 104 W.E.R.C. 150 mA. (Clydesdale Supply Co.)
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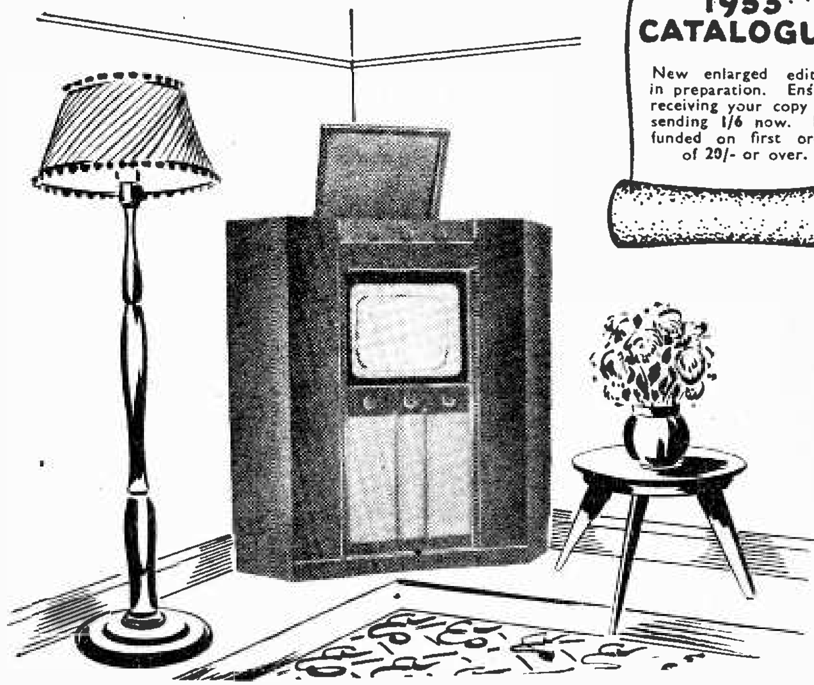

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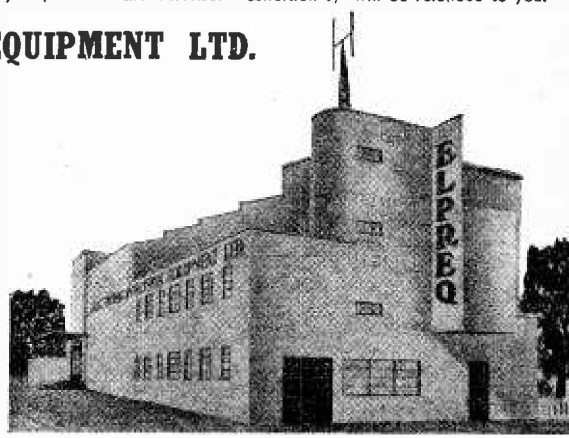

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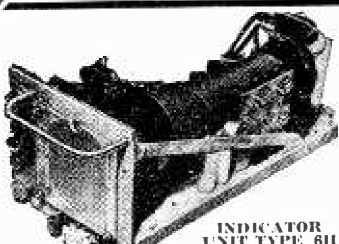

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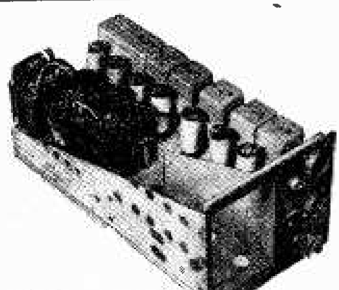

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Pages from a TELEVISION ENGINEERS Notebook

3.—DOUBLE-TRIODE MIXERS

IN home-constructed television receivers it is most usual for a mixer stage to consist of a pentode with a separate triode (or strapped pentode) oscillator. Such a system is much preferable to a single valve arrangement employing a triode-hexode of the 6K8 class, but circuits using double-triode valves are not often encountered.

A triode frequency-changer is better than a pentode because it has a lower noise figure, and, in many cases, a higher conversion gain is obtained. A typical circuit of a mixer-oscillator of this type is shown in Fig. 1, and a valve of the 12AT7 class is considered to be employed. The left-hand triode forms the actual mixer, and this section is biased by resistance R_1, by-passed to earth with C_1. The input signal appears across the tuned circuit L_1, either directly from the aerial or, more commonly, from the anode circuit of an R.F. amplifier stage. The anode load of the mixer consists of a damped tuned circuit L_2 and this is resonant at the intermediate frequency; this winding may well be the primary of a coupled-circuit transformer, the secondary of which would be tuned and damped to provide the requisite pass-band.

The right-hand triode of the circuit is the oscillator, and is shown as a Hartley, although variations are many in the actual possible designs. The frequency of the tuned circuit L_3C_4 is adjusted so that it is tuned above (or below) the input signal frequency by the I.F. It is usual to tune below the signal frequency to assist in obtaining more stable operation.

Oscillator Voltage

The oscillator voltage is coupled to the grid of the mixer by condenser C_2, but in a valve having a common cathode (such as the 6J6) coupling can take place across the cathode load. Mixing results because of the non-linear characteristic of the grid-voltage/anode-current relationship, which is brought about by the biasing voltage across R_1. This is arranged to bias the valve back close to cut-off.

The efficiency of such a mixer depends upon the amplitude of the oscillator voltage at the mixer grid, the I.F. output increasing as the oscillatory voltage increases. Suitable design values for the various components will now be calculated, together with an outline of the method for setting the oscillator amplitude.

Design Values

Consider Fig. 2. This is the I_a/V_g characteristic for the mixer section of the valve for a particular value of anode current. Let the cut-off bias voltage be $-V_c$ and let the anode current at zero grid voltage be I_o. If now the valve is normally biased just to cut-off and the oscillator voltage is adjusted so that the peak input just causes an anode current of I_o to flow, then the average current over a half-period is—

$$I_{ave} = \frac{1}{2\pi}\int_0^{\pi} I_o \sin\theta . \, d\theta$$
$$= \frac{1}{2\pi}\Big[I_o(-\cos\theta)\Big]_0^{\pi}$$
$$= \frac{I_o}{\pi}$$

The value of the cathode resistance R_1 should therefore be.

$$R_1 = \frac{V_c}{I_{ave}} = \pi\frac{V_c}{I_o}$$

If the valve used is a 12AT7, therefore, working with

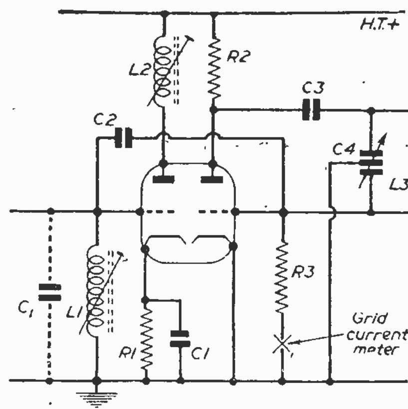

Fig. 1.—The basic double-triode mixer circuit from which design values are calculated.

an anode supply of 200 volts, the maker's figures give an anode current of 22 mA with zero bias. The grid cut-off voltage is about −6 volts. From the above equation, then,

$$R_1 = \pi.\frac{6 \times 1{,}000}{22} = 860 \text{ ohms},$$

say 820 ohms to take a preferred value.

Further, the anode current (D.C.) is

$$I_a = \frac{I_o}{\pi} = \frac{22 \times 10^{-3}}{\pi} = 7 \text{ mA}$$

and the R.M.S. value of the oscillator voltage is—

$$V_{osc} = 0.707\,V_c = 4.25 \text{ volts.}$$

Conversion Gain

The conversion gain of a triode operating essentially close to cut-off is given by the equation :

$$V_{if} = \frac{\mu R V_s}{\pi (R + R_a)}$$

where V_{if} is the I.F. voltage developed. R is the anode load impedance, V_s is the signal voltage, and R_a and μ have their usual meanings.

The 12AT7 operating under the previous conditions has a R_a of 9,800 ohms, and a μ of 55. If the anode load impedance is 2,500 ohms, therefore, the conversion gain will be

$$\frac{V_{if}}{V_s} = \frac{55 \times 2.500}{\pi (2,500 + 9,800)} = 3.5$$

which, is a typical figure.

The value of C_2, the coupling condenser from the oscillator to the mixer grids, has not been mentioned. This depends upon the amplitude of the oscillator voltage, the amplitude required at the mixer grid, and the effective input capacity C_i of the mixer. The value is given by the equation

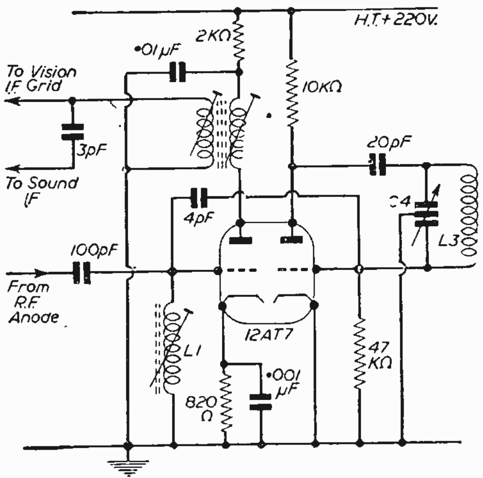

Fig. 3.—A practical mixer circuit.

$$C_2 = \frac{C_i}{\left\{\frac{V_x}{V_{osc}}\right\} - 1} \text{ (approx.)}$$

where V_{osc} is the voltage across C_2 and V_x is the oscillator amplitude.

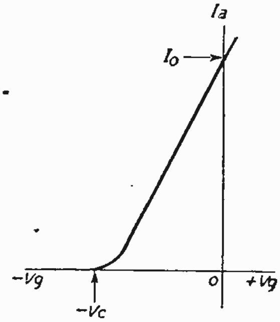

Fig. 2.—This is the operating characteristic of the triode mixer section.

Thus, if $C_i = 10\text{pF}$, $V_x = 15$ volts, and $V_{osc} = 4.25$ volts as obtained above,

$$C_2 = \frac{10 \times 10^{-12}}{3.5 - 1} = \frac{10^{-11}}{2.5} = 4 \text{ pF}$$

The oscillator amplitude V_x can be readily determined by measuring the change in grid current through the grid resistance R_3 that occurs when the valve passes from a non-oscillating condition to an oscillating condition. In general, the grid current is so small when the valve is not oscillating that it can be ignored, and a measure of the normal oscillating current is sufficient. The grid current in microamperes multiplied by the value of R_3 in megohms gives a figure which is roughly 80 per cent. of the oscillator amplitude. Thus, with a value for R_3 of 47 kΩ (0.047 MΩ), the current must be about 250 μ amps to give the above required amplitude of 15 volts. The amplitude actually obtained depends largely upon the coil L_3 and especially upon its diameter, as well as upon the value of C_3. This condenser should not be too large, however, and a maximum of 20 pF is a useful design figure. The coil should be wound with 20—22 gauge enamelled wire on a half-inch former and tuned to cover the required frequency band. Adjustment of C_3 will then set the grid current to the approximate value required.

A complete circuit with component values is given in Fig. 3, together with a method of coupling off the sound. An alternative circuit using a 6J6 (ECC91) was described by the author in the July issue of PRACTICAL TELEVISION for 1951.

New Ground Radar Trainer

THE production design of an entirely new type of ground radar trainer designed by the Ministry of Civil Aviation is now being developed by Marconi's Wireless Telegraph Co., Ltd., and manufacture will shortly begin. First models will be ready for delivery to Commonwealth and other overseas countries by the end of 1953.

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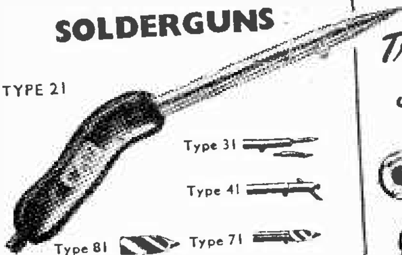

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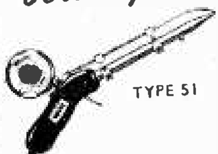

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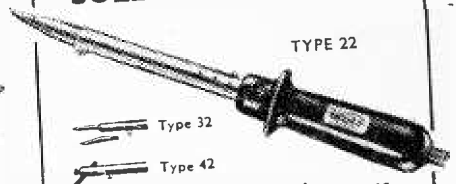

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Making Sound I.F. Transformers

CONSTRUCTIONAL DETAILS AND A SUITABLE CIRCUIT IN WHICH THEY MAY BE USED

By Gordon A. Symonds

FOR those constructors who find enjoyment in making components which lend themselves to home-construction, this article deals with the making of I.F. transformers for the sound section of a superhet television receiver. They are extremely simple and require the minimum of skill to make, but are, nevertheless, a very efficient means of intervalve coupling.

There is, of course, nothing new in their design, being merely an H.F. version of the type of I.F. transformer found in most broadcast receivers.

Fig. 1 indicates a suitable circuit for use with these transformers and from it will be seen that they consist of a pair of inductively-coupled coils each shunted by a fixed capacitor and tuned by a dust-iron core. In all, five coils are employed, including the sound input coil, and as can be expected a very high degree of selectivity is obtained, thus preventing any possibility of vision breakthrough. In point of fact, a degree of selectivity much higher than is necessary for this purpose is possible and much more than desirable from other aspects, namely those of local oscillator drift and interference suppression.

Local oscillator drift (which should not be excessive) has the effect of shifting the intermediate frequency by an amount equal to the drift of the oscillator. If, therefore, the drift is greater than the I.F. passband, the sound will be completely lost. A bandwidth of about 200 kc/s is usually sufficient and is obtained by slightly over-coupling the coils. This bandwidth also allows the peakiness of ignition interference to be retained, thus enabling the noise limiter to operate more effectively.

Turning again to Fig. 1, it will be seen that two I.F. amplifiers are employed plus detector, noise limiter and A.V.C. diode. Sufficient output is obtainable from the detector to drive a sensitive output valve such as the KT61, but as constructors will doubtless have their own ideas about the A.F. section, this has been omitted.

The component values given are suitable for such valves as EF50, EF54, SP61, EF91, and equivalents for the pentodes, and EB91, EB34 and equivalents for the detector and noise limiter. The A.V.C. diode can be an

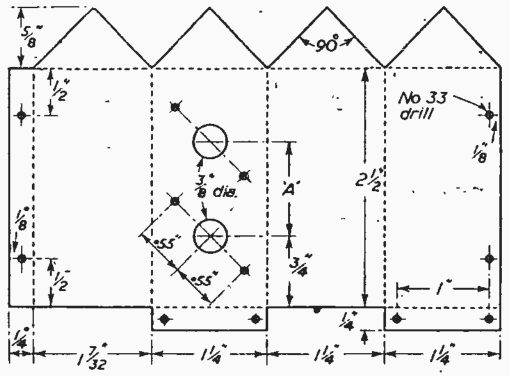


Fig. 2.—How to drill and cut the aluminium before bending.

EA50 or a suitable germanium crystal diode. Other pentodes could be used if attention is paid to bias resistors, and screen droppers included if necessary.

Construction

In the interests of stability the coils are placed inside screening cans. The grid coil being mounted at the top so that in the event of a valve with a top cap grid being

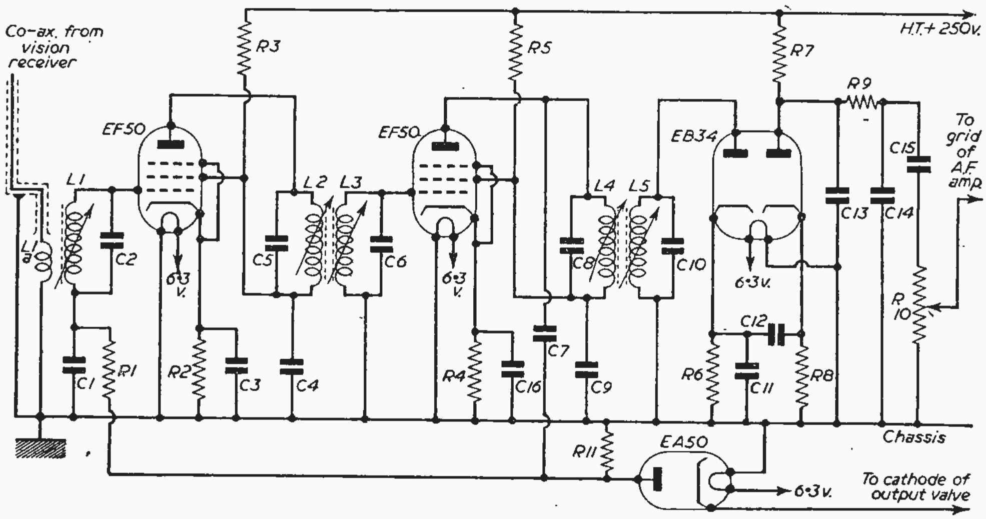
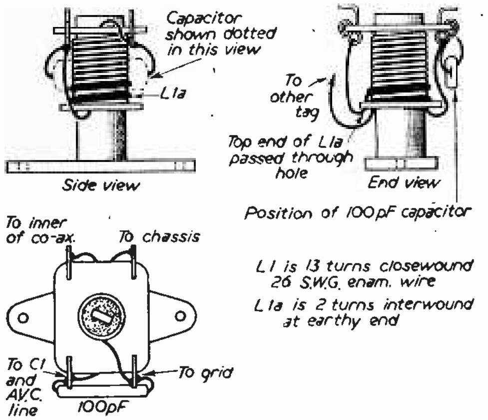


Fig. 1.—Suggested circuit for use with the I.F. transformers.

used, the grid lead can be conveniently brought out at the top of the can. The transformer cans are made from 22 s.w.g. aluminium cut to the dimensions given in Fig. 2. All holes should be drilled before bending. If a piece of hardwood 1¼in. square is at hand, the cans can be bent around this, greatly facilitating the work. The



top of the can is closed by bending over the four triangular shaped pieces and two fixing flanges are bent out at the bottom.

Aladdin formers, type F804 (approximately ⅜in. diameter) are used on which to wind the coils. Five of these are needed, one wound as in Fig. 3a and four as in Fig. 3b. The number of turns given is for a frequency of 10 Mc/s, other frequencies being accommodated by suitably altering the number of turns. The simple formula $\frac{13\times10}{F}$ (13 and 10 being the number of turns and frequency in Mc/s respectively of the coils described, and F the required frequency) will be found to be sufficiently accurate over the usual range of intermediate frequencies employed in TV sound receivers. The 100 pF capacitors must be used in all cases ; 26 s.w.g. enamelled wire is used for all coils, the turns being retained in position by washers made from 1/16in. thick paxolin sheet to the details given in Fig. 4. These must be a tight fit on the formers. Soldering anchors on which are mounted the 100 pF capacitors and to which the lead-out wires are connected are provided on the upper washer by passing 1/16in. by ½in. split-pins through holes provided and retained by bending one leg over.

The sound input coil which, incidentally, also serves as a sound rejector coil for the vision I.F. amplifier, is fed with signal from the frequency changer anode coil. A two-turn loop on this coil picks out the signal, which is then carried by a length of co-axial cable to the two-turn loop on the input coil.

Alignment

Although it is easily carried out, the alignment is not quite so straightforward as with critically coupled pairs of coils.

Assuming this sound section has been built into a complete television receiver, the procedure is as follows. Stop the local oscillator by removing the valve or disconnecting its H.T. supply if it is in the same envelope as the mixer. Short to chassis the A.V.C. line, and connect the signal generator across the second I.F. amplifier grid coil. Inject an A.F. modulated signal of 10 Mc/s and tune L4 and L5 to resonance. This should be done with the volume-control set at maximum and an A.C. voltmeter connected across the loudspeaker speech coil to indicate resonance. Reduce the signal generator output, transfer to grid of first I.F. amplifier, and tune L2 and L3 to resonance. Next, connect a 0-1 milliammeter in series with vision detector load resistor and transfer the signal

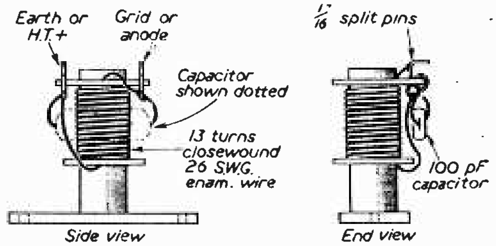


Fig. 3a (left).—Three views of the sound input coil. 3b (above).—Two views of L2-5 inclusive.

generator to the grid circuit of the frequency changer. With the output still at 10 Mc/s, tune L1 to show *minimum* response on the milliammeter. While doing this it will be found necessary to increase the signal generator output and to turn down the volume-control.

The coils will now be roughly aligned, but the passband will not be symmetrically placed about the intermediate frequency. The coils L2, L3, L4 and L5 should now be re-tuned as follows.

With the signal generator remaining connected across the grid coil of the frequency changer, inject an A.F. modulated 10 Mc/s signal. Connect across L2 a 5 KΩ

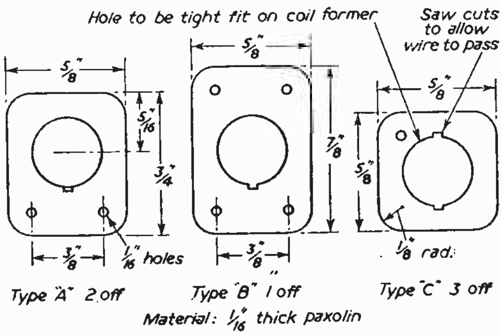


Fig. 4.—Details of paxolin washers.

resistor and tune L3 to resonance. Transfer the resistor L3 and adjust L2. Repeat the procedure with L4 and L5, connecting the resistor across one coil while the other is being tuned. The passband will now be correctly placed and the cores may be sealed with a spot of wax. For frequencies other than 10 Mc/s, substitute the required frequency at all references to 10 Mc/s.

COMPONENT VALUES IN FIG. 1

R1, R11,—.5M Ω (¼w).	C1, C3, C4, C9, C12, C16,—.01μF (500v Paper).
R2, R4,—150 Ω (¼w).	C2, C5, C6, C8, C10,—100pF Silver Mica (±5%).
R3, R5,—3.3K Ω (¼w).	C7,—10pF (Silver Mica).
R6, R9,—33K Ω (¼w).	C11,—25pF (Silver Mica).
R7.—2.2M Ω (½w).	C13,—300pF (Silver Mica).
R8,—1M Ω (¼w).	C14,—.001μF (Mica).
R10,—5M Ω Volume Control.	C15.—.1μF (500v Paper).

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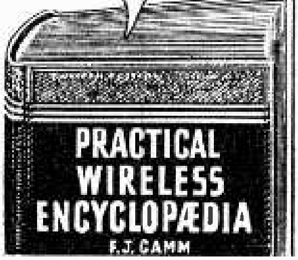

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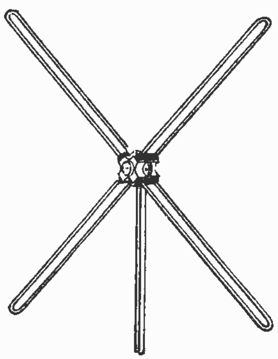
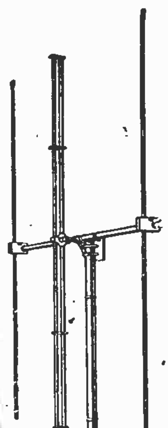


these features, PLUS excellent mechanical design, ensure that you get the best performance from your receiver. Moreover, the Dublex is moderately priced at **£4.8.6** (7ft. mast complete with brackets, etc.); **£7.15.0** (10ft. x 2in. mast complete with double lashings, etc.).

.. other quality aerials

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



NEWCASTLE and BELFAST TRANSMITTERS—
the Dublex is available with a special horizontal mounting bracket for reception of these stations and most other Aerialite aerials can be used without modifications.

Aerialite LTD.

CASTLE WORKS STALYBRIDGE CHESHIRE

The solder for all HOME TELEVISION CONSTRUCTOR SETS

Designers of television constructor sets know that the efficiency of their equipment depends on the solder used by the constructor—that's why they recommend Ersin Multicore for trouble-free, waste-free soldering. Ersin Multicore, the only solder containing three cores of extra-active, non-corrosive Ersin Flux, is obtainable from all leading radio shops. Ask for Cat. Ref. C.16018, 18 S.W.G. 60/40 High Tin Television and Radio Alloy. The size 1 Carton contains 47 feet of solder, costs 5/-.

Ersin Multicore Solder

In case of difficulty in obtaining supplies, please write to :

MULTICORE SOLDERS LTD. MULTICORE WORKS, MAYLANDS AVE., HEMEL HEMPSTEAD, HERTS. • Boxmoor 3636 (3 lines).

Television at 200 miles

NEW MODEL SC23 TV PRE-AMPS. ALL CHANNELS

- High gain and low noise.
- Customs built to the highest standards.
- Ample bandwidth for good definition.
- Ideal for the "difficult" fringe and ultra fringe areas.
- Each pre-amp. supplied guaranteed to have been "air tested" and to have received both vision and sound at 200 miles using a standard commercial superhet receiver.
- Models SC22 and SC23 have self-contained metal rectifier power supply. 200/250 v. A.C.
- 12 months' guarantee.
- Immediate delivery.

RETAIL PRICE LIST
(Trade enquiries invited)
SC23. new model. **£5.5.0.**
SC22. two-stage. **£8.10.0.**
SC21. two-stage. **£6.6.0.** requires power supply.
SG12. TV Sig. Gen., **£6.19.6.**
PG12. Patt. Gen., **£19.19.0.**

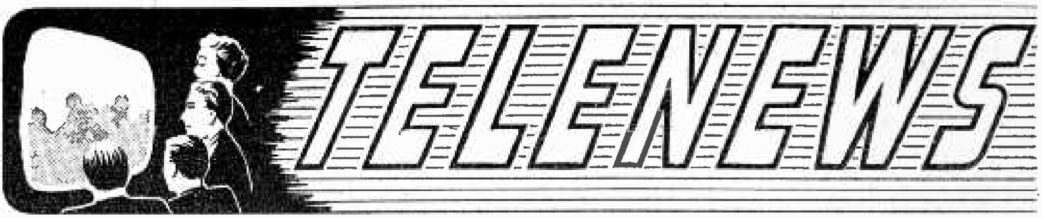
SG12

TELEVISION SIGNAL GENERATOR

- Frequence range 40/70 M/cs.
- Calibration chart for all Television Channels.
- Modulation on sound and vision optional.
- Sensitive meter fitted for use as grid dip oscillator.
- Ideal for service engineer and experimenter.
- Measures coil. aerial frequencies, etc.
- The only one of its kind on the market.
- Self-contained power supply. 200/250 v. A.C.
- 12 months' guarantee.
- Immediate delivery.

J. V. RADIO CO. 25, WILLIAM STREET, PLYMOUTH.

Manufacturers of Television Equipment. Tel. 4797



Germans Use British Equipment

PYE, LTD., of Cambridge, announce that the German authorities have decided to use British equipment in the German Television service. Orders have been received for the installation of television cameras and their associated equipment by the Bayerische Rundfunk and the Nordwestdeutscher Rundfunk at Munich and the Nordwestdeutscher Rundfunk at Hamburg.

Cricket Again

THE M.C.C. have decided that the sound and vision broadcasting of Test and county cricket matches will be again permitted during this year's season, but fees may be slightly raised.

Free Baby Sitters

"WANT a free night out?" was the title of a publicity campaign launched by J. W. Dargavel Ltd., Glasgow dealers in Ekco radio and television receivers.

The firm offered free transport and a baby sitter to parents wishing to spend an evening out at a TV demonstration, but although the free transport offer was accepted by quite a few no one appeared to require the services of a nursemaid.

Commercial Service

A COMPANY providing a commercial television service for advertising agencies has been formed under the name of Feature Programmes Ltd.

Its staff includes Mr. John MacMillan, ex-deputy to the Controller of the BBC Light Programme, and its main features will be script preparation, casting and direction.

Ediswan Replacement

MR. SIDNEY WEBSTER has taken the place of Mr. A. B. Carnell as specialist radio representative in the Ediswan Birmingham District Office area, covering Warwickshire, Worcestershire, Staffordshire, Herefordshire and Shropshire.

He is thoroughly conversant with all aspects of the radio trade, particularly those concerning valves and cathode-ray tubes.

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

Owing to the rapid progress in the design of radio apparatus and to our efforts to keep our readers in touch with the latest developments, we give no warranty that apparatus described in our columns is not the subject of letters patent.

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Cossor Research

MR. B. C. FLEMING-WILLIAMS, Cossor director of research, and Mr. K. E. Harris, research manager, recently left this country by air on a visit to the U.S.A. and Canada. They will be contacting subsidiary companies in both America and Canada and generally keeping in touch with current electronic developments in the New World. Their visit will last some two months.

Underwater Camera

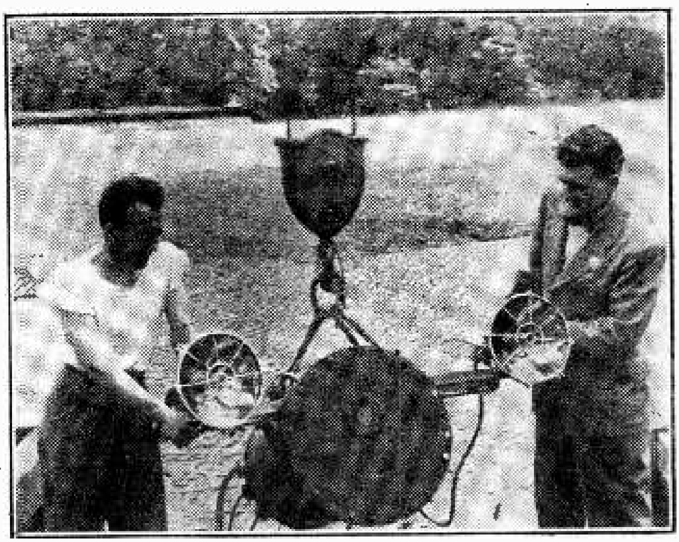
A NEW underwater television camera, developed by the Bureau of Ships, Department of the U.S. Navy, is being used as a "seeing eye" for Navy divers.

It electronically records a picture which is transmitted to a television screen on the ship. Engineers can either check the scope as it records or a film can be taken of the action and used as a permanent reference. The camera is manipulated entirely by remote control.

Development Down Under

THE Australian Government has given permission for the development of television by private as well as State enterprise.

The television development plan was halted at one time because of Australia's rearmament programme.



Engineers adjust the floodlights on one of the U.S. Navy's new underwater television cameras before lowering it to the ocean bed.

Television Licences

THE following statement shows the approximate number of television licences issued during the year ended December, 1952. The grand total of sound and television licences was 12,859,473.

Region	*Number*
London Postal	664,248
Home Counties	222,131
Midland	426.045
North Eastern	199,771
North Western	232.335
South Western	47,750
Welsh and Border ...	58,529
Total England and Wales	1,850,809
Scotland	41,699
Northern Ireland ...	324
Grand Total	1.892,832

Wales Keener than Scotland

SPEAKING in Aberdeen recently, Sir Ian Jacobs. Director-General of the BBC, said that the number of television licences taken out in South Wales far exceeded the number issued in Scotland, although the Wenvoe transmitter came into operation after the Kirk o' Shotts station.

He said that this was probably due to the natural caution of the Scots concerning the reduction of purchase tax on receivers.

Temporary Station in N. Ireland

THE BBC proposes to instal a temporary low-power television station in N. Ireland before the Coronation. A site has been acquired 2½ miles from the centre of Belfast. The station will be known as Glencairn and will serve the city of Belfast and its immediate surroundings.

Glencairn will share the same frequencies as Alexandra Palace, vision 45.0 Mc/s and sound 41.5 Mc/s. The double side-band system of transmission will be used.

High-Frequency Convention

MR. H. J. FINDEN, M.I.E.E.; of Plessey Ltd., read a paper on Developments in Frequency Synthesis at the High Frequency Measurements Convention in Washington.

It described a development carried out on a British Ministry of Supply contract for Telecommunications Research Establishment. A method of generating any single frequency out of a possible 100,000 in the spectrum 1 kc/s-100 Mc/s locked in terms of a frequency standard was explained.

Royal Patronage for the Show

THE Radio Industry Council announces that H.M. Queen Mary has graciously consented to be patron of the National Radio Show to be held in London in September. Her Majesty has been patron on each occasion since the war.

Provisional dates for the Radio Show are September 2 to 12, with a pre-view for overseas visitors and other special guests on September 1.

Footballers Want TV

MR. J. GUTHRIE, 42, Chairman of the Football Players' Union, has asked the BBC for programme time in which professional footballers will be allowed to state their views on the position concerning the televising of soccer matches.

Mr. Guthrie contends that players should be paid a fee of about three or four guineas for each game and would like to have televised a discussion forum between the Football Association, the Football League and club managers under an independent chairman so that viewers might see that the ban is not the fault of the players themselves.

Camera Sites Fixed

WHEN the Coronation is televised in June, viewers will see almost two miles of the Queen's journey to the Abbey.

Cameras will be stationed at the Victoria Memorial, outside Buckingham Palace, on the Colonial Office overlooking the west door of the Abbey and inside the Abbey itself.

Special "long-range" lenses will enable the cameras to pick up pictures when the procession is a quarter of a mile away, allowing for any kind of weather conditions.

Closed Circuit Only

COMMERCIAL television on a closed circuit only will begin in New Zealand next year.

The transmitter is to be built by a British company

French Tele-clubs

FORTY villages in France have formed "Television Clubs," each village collectively owning a receiver which is installed in the public hall or local school.

Members pay a small admission fee to see an evening's programme, usually 20 francs which goes towards the payment for the set. Chief aim of such clubs is the advance of educational standards as well as providing entertainment.

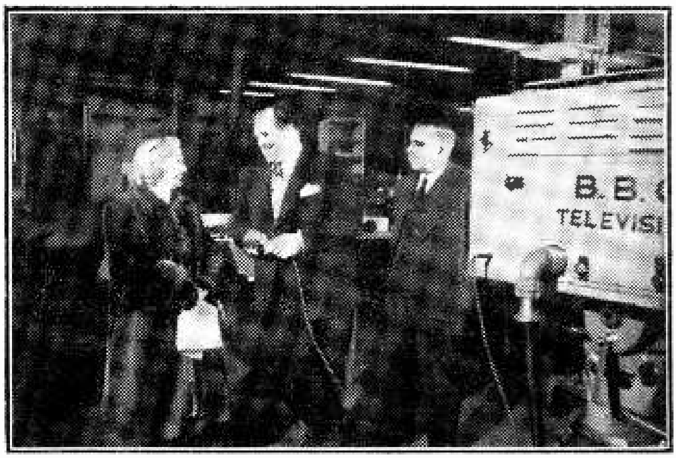
TV in Workshop

THE *Literary Gazette*, a Russian magazine, states that TV is to be used in Russian factories so that managers can watch progress and developments without their having to leave their office desks.

170 Sacked

ON the grounds of redundancy, 170 employees have been discharged from a Hayes, Middlesex, radio and television factory.

Each was given an extra week's wages.



BBC commentator chosen to cover the Coronation for television is Richard Dimbleby, who is seen here in one of his many interviews before the camera.

ALPHA RADIO SUPPLY CO.

MAINS TRANSFORMERS
MTI PRIMARY. 200-220-240 v.
SECONDARIES. 250-0-250 v., 80 m.a., 0-4 v. ; 5 a.-6.3 v. ; 4 a. 0-4 v.-5 v. 2 a. 17/6 each
MT2 as above, but with 350-0-350 H.T. winding ... ... 17/6 each

ERIE CERAMICONS
6.8 Pf., 5 Pf., 12 Pf., 50 Pf., 180 Pf., **5d.** each

INDICATOR UNIT TYPE 233
Complete with 10 valves and VCR97. **70/-** each, carriage 7/6 each.

INDICATOR UNIT TYPE 6
Very good condition. VCR97 Tube. EF50 valves, etc. Wire wound vol. controls and a Host of Resistors and Condensers. **72/6** each, carriage 7/6.

WIRE WOUND VOL. CONTROLS
5Ω, 200Ω, 10 kΩ, 20 kΩ, 25 kΩ, 50 kΩ ... ... **2/6** each
400Ω, 1 kΩ, 2 kΩ, 5 kΩ, 15 kΩ, 300Ω, 50Ω ... ... **2/6** each

LOUD SPEAKERS
All 2 to 3 ohms, these prices are less purchase tax. Buy now while stocks last
3in. round type, **12/9** each.
3½in. Elac. square type, **13/6** each.
5in. units by Goodmans, Plessey, Waterhouse and Lectrona, all **13/9** ea.
6½in. units by Elac, Plessey, **14/6** each.
8in. units by Elac, Plessey, **17/6** each.
10in. Rola, **32/6** ; 10in. Plessey, **19/6** each.
Truvox 6½in. with output transformer, **16/6** each.
Goodmans 6½in. latest type, **16/-**.
Truvox wafer speaker 6½in., **25/-** each.
Truvox heavy duty 12in., 15 ohms speech coil, **£6.6.0** each.

P.F. SILVER MICA CONDENSERS
150, 35, 120, 2, 100, 30, 20, 610, 9, 18, 500, 10, 300, 180, 375, 680, 15, 25, 370, 27, 39, 330, 245, 470, 1.5, 1,600, 750, 1,200, 3, 7.5, 8, 6, 33, 200, 1,000, 175, 360, 190, 47, 58, 50, 68, 45. All **3½d.**

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GUARANTEED NEW AND BOXED.
MAJORITY IN MAKERS CARTONS.

6P26	10/-	6AK5	8/6	6F6G	8/-
6SL7	9/-	6AJ5	8/6	6G6G	7/-
6SN7	10/6	6BA6	8/6	D63	4/6
6V6G/GT	8/6	6AG5	8/6	807	10/-
6AL5	8/6	EL42	11/6	6J5GT	5/6
6AM6	9/6	UAF42	10/-	6J5M	6/-
6AT6	10/-	EF41	11/6	6J7G	6/6
6BE6	11/6	UY41	10/6	6K7G/GT	6/6
6C4	8/6	VR136	7/-	6K8G/GT	10/6
6LD20	11/6	VR137	5/9	6L6G	10/6
6L18	11/6	EF50	6/6	12A6	5/9
6L19	11/6	EY51	15/-	12C8	9/6
12AT7	10/-	R12	13/6	6SQ7	9/6
KT61	10/6	ECH42	12/6	6SS7	8/6
N37	10/-	5V4	9/6	KT33C	11/6
20D1	11/6	VU120A	4/-	MS/PEN	5/-
20L1	11/6	VU111	4/6	PEN25	8/6
7S7	8/6	OZ4	7/-	25A6G	9/6
7Y4	8/6	IC5GT	8/6	25L6G	9/6
PL82	11/6	IR5	8/6	PEN220A	4/9
AC6/PEN	5/6	IS4	8/6	TH30C	9/-
AZ31	10/-	IS5	8/6	TP25	8/6
10LD11	11/6	IT4	8/6	UR3C	9/6
U22	9/-	3S4	10/-	4DI	4/-
U403	8/6	2X2	5/6	9D2	3/-
UB41	9/-	6Q7G/GT	10/-	8D2	3/-
UCH42	11/6	6SK7	7/-	15D2	4/-
UF41	12/-	42	8/6	Y63	9/-
UL41	10/6	5U4G	9/-	ECH21	11/-
EAF42	11/6	5Y3G/GT	8/6	12SH7	5/6
EB41	10/6	5Z4G	8/9	PEN46	8/6
EBC41	11/6	6X5GT	7/9	Z63	5/9
6AK5	8/6				
6J6	8/6	6C6	7/6	VR101	5/6

RESISTORS ¼ and ½ watt.
We send whichever rating is available at this price :
3.3 kΩ, 1.5 kΩ, 68Ω, 2.2 meg.Ω, 100 Ω, 12 meg., 330Ω, 10 meg., 27 kΩ, 470 kΩ, 2.2 kΩ, 22 kΩ, 150 kΩ, 6.8 kΩ 5.6 kΩ, 600 Ω, 39 kΩ, 120 kΩ, ½ meg. Ω, 10 kΩ, 330 kΩ, 15 kΩ, 220 kΩ, 33 kΩ, 5 meg.Ω, 1 kΩ, 51 kΩ, 30 kΩ, 1.8 meg.Ω, 33Ω, 20Ω, 1.8 kΩ, 15 meg.Ω, 270Ω, 220 kΩ, 350Ω, 40 kΩ, 47 kΩ, 60 kΩ, 100 kΩ, 18 kΩ, 270 kΩ, 68 kΩ, 680 kΩ, 25 kΩ, 23 kΩ, 5 kΩ, 150Ω, 250Ω, 200Ω, 22 kΩ, 50Ω, 4.7 kΩ, 680Ω, 56 kΩ, 56Ω, 470Ω, 4 kΩ, 47Ω, 50 kΩ, 150Ω. All **3½d.** each.

RESISTORS 1 watt
1.5 kΩ, 15 kΩ, 6 kΩ, 390 kΩ, 3.3 kΩ, 620 kΩ, 350 kΩ, 5.6 kΩ, 75Ω, 8.2 kΩ, 2.5 kΩ, 20Ω, 680Ω, 1 meg., 5 kΩ, 250Ω, 100Ω, 40 kΩ, 150Ω, 6.8 kΩ, 9 meg.Ω, 8 meg.Ω, 7 meg.Ω, 4.7 kΩ. All **6d.** each.

SINGLE P.V.C. COVERED WIRE
Various colours : Red, Blue, White, Green, Yellow, etc. **5/6** per 100 yds.

METAL RECTIFIERS
12 v., ½ a., **1/6** ; 2 to 6 v., 1 a., **3/-** ; 12 v., 1 a., **4/9** ; 250 v. 45 m/a., **6/9** ; 250 v., 75 m/a., **7/6** ; 12 v., 3 a., **18/6** ; RM1, **4/-** ; RM2, **4/6** ; RM4, **16/-** ; 12 v. 2 a. **10/6** each.

ALLADIN COIL FORMERS
¼in. and ⅜in., complete with iron dust cores. **9d.** each.

CONDENSERS
METAL-CASE TYPE ELECTROLYTICS
8 mfd., 450 v., **1/11** each ; 16 mfd., 450 v., **3/3** each ; 16 x 16 mfd., 450 v., **4/9** each ; 16 x 8 mfd., 450 v., **4/6** each ; 8 x 8 mfd., 450 v., **4/-** each ; 25 mfd., 25 v., **1/3** each ; 32 mfd., 350 v., **1/9** each ; 32 x 32 mfd., 350 v., 25 mfd., 25 v., **5/3** each.

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

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

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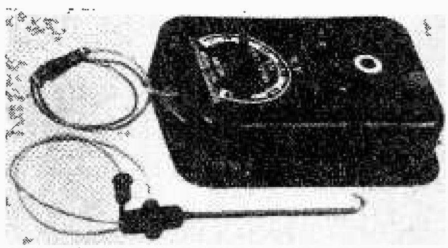

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HENRY'S

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

2 Gang .0005 Condensers Midget	5/-.	
2 ,, .0005 ,, ,,	with Trimmers.	**6/6.**
2 ,, .0005 ,, ,,	with 4-way Push-Button.	**8/6.**

WEARITE MAINS TRANS. Input 110/250v. output. 325-0-325, 80 m.a, 6 v. 2.5 amp., 5 v. 2 amp., **£1 1/-.**

PLESSEY MIDGET TYPE, 200/250 output, 230-0-230 50 m/a, 6 v., 2.6 amp., **12/6,** P.P. 1/-.

IFT'S, Wearite. 501A and 502, 465 kc/s, **10/-** pair, P.P. 1/-.
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EXCEPTIONAL VALVE OFFER

Ten EF50 Brand New (Ex-Units)	55/- Set
6K8G, 6K7G, 6Q7G, 5Z4G, 6V6G (or KT61)	42/6 ,,
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12K8GT, 12K7GT, 12Q7GT, 35Z4GT, 35L6GT or 50L6GT	42/6 ,,
12SA7GT, 12SK7GT, 12SQ7GT, 35Z4GT, 35L6GT or 50L6GT	42/6 ,,

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

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

BLUE & WHITE VISION

VCR517C Tubes. Brand New and crated. Guaranteed full picture. These Tubes replace the VCR97 and VCR517 without alteration and give a Blue and White picture. **45/-** plus 5/- carr.

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

6in. ENLARGER LENS, 18/6, p.p., 3/-.
45 mc/s Two Stage Pre-Amplifier containing 2-VR91. Completely wired. Requires slight modification and coil adjustments for any area. **22/6** complete. 3/- p.p.

P.M. SPEAKERS (Inc. Tax)

Plessey 3in. with Trans.	15/-	Rola 10in. with Trans.	30/-
Celestion 5in. with Trans.	16/-	Goodman's 10in. with Trans.	30/-
Rola 5in. less Trans.	12/6		
Plessey 5in. less Trans.	12/6	Electrona 10in. with Trans.	25/-
Plessey 6½ L/T	15/-		

Postage and packing 1/- extra.

1355 Complete Brand New in Case, **55/-.** RF24, 25, **25/-.** RF26 and 27. **59/6.**

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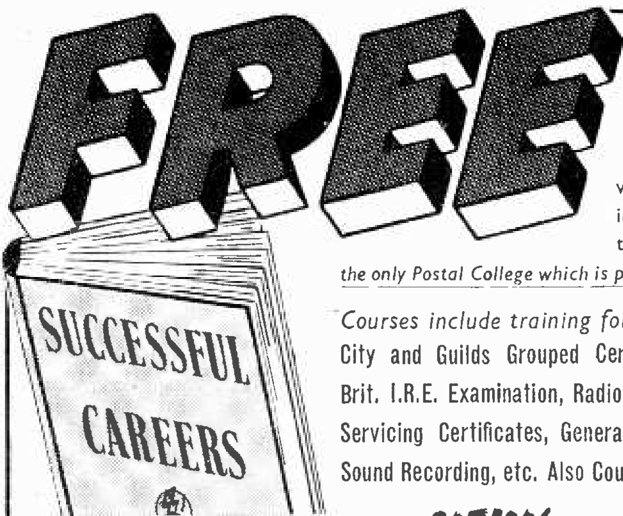

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CORRESPONDENCE

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

THE "MIRACLE"

SIR,—I have a five-year-old model television set which has, unfortunately, been in the hands of service engineers far too often. When one depletes savings to the extent of £100 for purchase, and a further £25 in the next four years it makes one a little canny.

As I have now retired on a small pension, it became necessary to do my own servicing, as far as possible. For the past year I have been quite successful, with the exception of occasional vertical turns of the picture when warming up. (None of the service engineers has been able to do much about this.)

Last week I determined to have another attempt. On being unbolted, the chassis slides down a slope. I worked it gently forward, because I did not wish to unsolder loudspeaker leads, for complete removal. I turned as an interruption came in the form of a ring on the doorbell. To my amazement, the chassis slid from its grooves and crashed 24in. to the floor. The young lady upstairs came rushing to see what all the noise was about and gasped.

I carefully lifted the chassis and, apart from torn loudspeaker leads, could find no damage. (The chassis weighs about 50lb.) Not one of the 20 or more valves was disturbed. The tinkles heard were valve covers falling off.

On replacing the set and connecting the loudspeaker, I retuned line and frame holds and was overjoyed to find that width and height of the picture were more satisfactory than they had ever been and reproduction was perfect.

But for the witness upstairs I almost feel that this has been a bad dream, from which I must awake and chase those elusive vertical turns. Anyway, I am ensuring that only *one* miracle like this can happen in my lifetime.—CHARLES HASSELL (New Southgate, N.11).

LOW-NOISE PRE-AMPLIFIERS

SIR,—Owing to my enthusiasm to keep a previous letter brief and so conserve your space when it appeared in the December issue, I seem to have fallen into the trap of omitting a qualifying statement when saying that the 6AK5 was not suitable for triode connection. Had I added the words "as shown in the diagram" after "triode connection" in line five, your correspondent Mr. E. D. Frost might not have been moved to question my statement.

However, I did at least explain in the next sentence that a comparatively low-resistance path would be formed across the H.T. supply if the 6AK5 is connected *as shown*. Mr. Frost seems to have missed the import of this. I cited the EF91 because like the EF50 shown in the diagram it has its suppressor grid isolated; it can, therefore, be connected as shown with anode, screen and suppressor all tied together. Do the same with a 6AK5 and it will cease to function in the triode manner intended by Mr. Thomson, and due to the anode and cathode components being placed directly across the H.T. supply, something is going to get mighty warm! Mr. Frost will, I am sure, agree that the 6AK5 cannot be triode-connected *as shown* in the published diagram.

I quite agree with him that the 6AK5 can be triode-connected by strapping screen to anode, and I also concede his point that this valve has a very low-noise factor. Nevertheless I am well satisfied with my ex-Govt. EF91's and *their* low-noise factor when triode-connected, even in this down-the-drain signal area.

Since we can mutually agree that the EF95 is an exact equivalent to the 6AK5 my remarks above can be applied to both valves.—W. E. THOMPSON (St. Leonards-on-Sea).

CAGE AERIALS

SIR,—I would like to thank Mr. F. R. W. Strafford for writing in support of my views regarding the Cage Aerial controversy. I had, of course, observed "Erg's" assumption that Mr. Strafford's bandwidth figures were purely theoretical, whereas I had been at pains to point out that they had been verified by practical measurements, which showed that in fact they were 15 to 20 per cent. less than the actual bandwidth.

I did not immediately take "Erg" up on this point since I was temporarily blinded by the science displayed in his reply, but I have subsequently discovered the source of his highly-technical dissertation upon bandwidth, and am now somewhat less impressed than I was at first! I, too, have now read the article on page 7 of the Radio Show Edition of "Belling-Lee" Bulletin, and I think it a pity that when quoting therefrom (without any acknowledgment) he did not also quote the penultimate paragraph, which states that any television receiver capable of resolving 3 Mc/s will do so when connected to any "Belling-Lee" television aerial correctly installed. This, surely, answers the suggestion that a rod aerial of normal dimensions is incapable of giving adequate bandwidth.

I would hasten to assure "Erg" that he is not by any means the first to make this suggestion. No less an authority than Dr. Lee de Forest, to whose early work on triode valves we owe so much, recommends the use of iron drain-pipes (of suitable length) to ensure adequate bandwidth, in his "Television To-day and To-morrow," published in 1945!

The only reason for my embarking on this controversy was that I had just read Mr. Strafford's paper prior to reading "Erg's" article, and I was immediately struck by the contradiction. Obviously, the question can only be settled to the satisfaction of the individual by a practical test, and in this connection I warmly support Mr. G. Lee Evans, whose letter in your January number asks why the BBC cannot radiate Test Card C at a time when amateurs who are otherwise engaged on every morning of the week (including Saturdays) can make use of it for bandwidth and linearity tests, which cannot be carried out during a normal programme. Would it not be possible for an approach to be made to the BBC by you, sir, in this matter, in the name of the thousands of amateurs who would welcome such a move?

I must also congratulate "Erg" for his timely article in the January issue, which remedies the shortcomings of his previous article by giving the actual dimensions of aerial elements. This is of real practical value.—H. B. GREGORY. (Birmingham).

[*We have approached the BBC on more than one occasion in this connection, but they put forward various reasons why it cannot be done. Perhaps, now, that the main network has been completed, and the band of amateur experimenters reached such large proportions, they will reconsider the matter again.*—EDITOR.]

VCR517

SIR,—I wonder if anyone in my part of the world has built a set incorporating a VCR517 tube? If so, then I would very much like to get into touch with him. I myself have just completed a set using such a tube with the Pye 45 Mc/s strip for vision with only moderate results. I am using, roughly, 2.5 kV on the tube, and though the raster is bright enough the picture, alas, is not. Perhaps the fault lies not in the tube, but in the alignment of the vision strip? Anyway, I would like to see what really can be done with this tube. Can anyone oblige, please?—J. B. PHILLIPS (20, Pentlands Close, Mitcham, Surrey).

SIR,—Re my letter on non-focus of VCR517. I must thank all those who wrote to me, and the problem is now solved. For those interested, the voltage on A_1 should be $\frac{2}{3}$ of that on A_3 for correct focus. Incidentally, the base connections are reversed on my tube!

Now I have another problem. Is the heater transformer on the 62 (or 95) unit a 50 c/s model?—B. GILBERT (Bournemouth).

TELEVISION AERIALS

SIR,—The letter signed "Dealer, Bristol" in February issue of P.T. is interesting if only to reveal how the buyers have been "sold."

During 1950 I constructed every conceivable type of TV aerial including a large circle, but never achieved much gain over the conventional "H" type, despite proper matching—at the time I was receiving Sutton Coldfield, approximately 80 miles away, on a Pye TRF receiver.

"Dealer" says: "You are still left with some pretty nasty joints to protect from the weather." Again experiment has proved that the dipole terminals can be left exposed to rain, snow, etc., with no deterioration of signal strength—indeed, my dipole consists of two suitable lengths of dural tube in a 6in. length of paxolin tubing.

Two screws driven through the paxolin and dural act as terminals, to which the 80 ohm twin wire screened feeder is soldered. No weather protection whatsoever and even a covering of snow or ice has no effect on signal strength.—A. ASHCROFT (Ormskirk).

SPOT WOBBLE

SIR,—Some time ago you gave a circuit for a spot wobble unit and I passed this by as being some new "stunt." Later I noted that a well-known manufacturer had introduced this feature and I thought perhaps there may be something in it. I therefore turned up my old copy and made up the unit. When I tried it out I found that it certainly worked, but have spent a number of evenings lately experimenting and I should like to give my opinion as to the results obtained. On most transmissions (except certain Lime Grove ones, such as Café Continental and certain sections of the news-reels) the quality of the picture is so variable that slight defocusing gives just as good results. On the really high-quality transmissions (which are few and far between) when the camera is properly focused, the sharp image which results is spoilt by the spot wobbler or defocusing, and I personally prefer the slightly noticeable line structure. I might mention that I am using a 16in. metal tube, with as near perfect interlace as I can obtain. The unit has been left in position, but is switched off most of the time and the focus is set just off optimum, and this satisfies us and prevents us from noticing too clearly the variable focus which unfortunately attends most transmissions.—G. WATTS (London, N.W.).

SURPLUS COMPONENTS

SIR,—I know you don't advise using ex-Service parts, but you often specify ex-Service tubes, especially the VCR97, and I should like to add a word of warning about this. I bought one locally and made up a unit as described by you, with very bad results. I had given it up as a loss and actually stopped taking your paper as I thought the circuit had not been tried. One day a friend came in and I happened to mention the set and he looked at it and offered to try to get it working. We went over the circuit together and he brought some meters, etc., and to cut a long story short we finally found the tube was at the root of the trouble. After two or three nights we took a chance and removed the base of the tube and checked the actual leads. We then found that they were joined up all over the place on the base and we managed to sort them out and connect them as shown, when the set worked perfectly. There was nothing wrong with the circuit, but someone had had a game with the tube, and this was probably in the Service before being disposed of. Perhaps some other constructors may experience the same trouble.—G. E. RENDELL (Watford).

TIMEBASE HINT

SIR,—Referring to the article "Timebase Hint," by Mr. G. Williams in your January issue, and being one of the many home constructors who have been disappointed with the Miller timebase, I would like, in addition, to suggest a simple cure for the linearity problem in these timebases, especially the one used in the £9 televisor which I myself use.

I have no doubt also that some home constructors must be using the timebase with non-linearity existing in the frame output.

After arduous experimenting I also evolved a circuit built round the charging condenser which is really split into two components having the same value and the centre connection taken to a potentiometer wired into the discharging network.

The height of the frame also suffered in this timebase and I compensated for this by increasing the capacity of the .003 μF. condenser in the suppressor grid circuit to .01 μF.

By this method I produced a *variable* linearity control which opened the lines out alternately on both top and bottom of the frame, having an intermediate effect which was, or near, perfect.—R. CUMMING (Edinburgh 3).

VALVE FAILING

SIR,—I have not seen any hints in your paper on the subject of valve failures. I have had a set now for just over three years, and have replaced six valves. But these have not cost me anything, as I have merely changed them round with others in the set. They were EF50's and were employed in, I think, the sync stage. As I am not aware of the circuit and have never taken the set to pieces, I am not certain and only go by the fact that the trouble which developed resulted in both line and frame slipping. I took out a valve which I thought was the one and changed it with another EF50. By doing this several times I eventually found which was causing the trouble and have done this six or seven times since, each time with an improvement in the trouble. I have now stuck small labels on the valves to indicate which have been used! The hint may perhaps be of use to others.—G. WATT (Shrewsbury).

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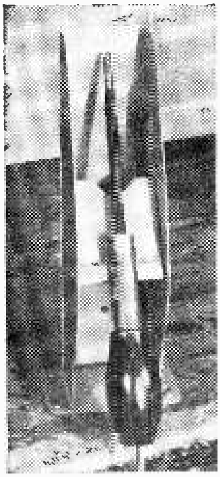

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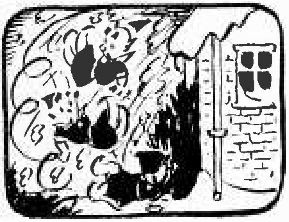

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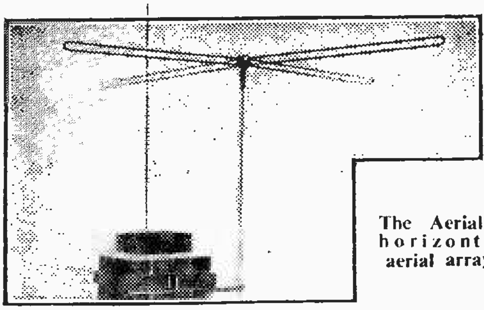
TRADE NOTES

Aerial for Pontop Pike

A DUBLEX aerial for the new horizontally polarised stations at Pontop Pike and Belfast are announced by Aerialite.

The aerial has the features of high gain, excellent maximum/minimum ratio, broad bandwidth. The construction is novel in that the folded elements are cross-connected, giving a highly directional array of robust mechanical construction.



The Aerialite horizontal aerial array.

This model has the advantage that the mast and the aerial can be earthed as a precaution against damage by lightning to the receiver.

The price complete for the Dublex, with a 7ft. mast chimney bracket, etc., is £4 18s. 6d.; other models are available.—Aerialite, Ltd., Castle Works, Stalybridge, Cheshire.

Hunt (Capacitors)—'Phone Change

THE telephone number of Messrs. Hunt, at Wandsworth, has been altered to Battersea 1083-7.

New Mullard Double Tetrode

A NEW high-performance double tetrode, especially suitable for use on the new U.H.F. wave-bands, recently allocated for business radio, radar-sonde and television-link equipment, is now being marketed by the Communications and Industrial Valve Department of Mullard, Ltd. It is the QQV03-20, and is intended for wide-band operation as an R.F. Class "C" power amplifier or multiplier in low-power mobile transmitters working at frequencies up to 600 Mc/s. At 200 Mc/s the new valve is capable of providing a power output of 42 watts. Under reduced input conditions, 22 watts can be obtained at 400 Mc/s and approximately 12 watts at 600 Mc/s. As a result of new and important design features the QQV03-20 has the outstanding advantages of high anode efficiency, excellent power gain, low filament consumption and small physical dimensions. In addition, being of the all-glass technique, it does not require the complex circuitry that is normally associated with existing U.H.F. valves of this class. Its small size and low power consumption makes the new valve of particular value for use in compact mobile communications equipment. It is constructed on the B7A base. Technical data is available from Mullard, Ltd., Century House, Shaftesbury Avenue, London, W.C.2.

Magnavita Television Magnifier

METRO PEX announce a new low-price Magnavita oil-filled magnifier. The Magnavita gives perfect enlargement over a wide field of view, and is available in 9in., 12in. or 15in. sizes, clear, or filter at no extra cost. It is complete with straps enabling it to be easily fitted to any make of television receiver. 12in., 65s.; 9in., 45s.; 15in., 85s.—Metro Pex Ltd., 42a, Denmark Hill, London, S.E.5.

Forrest Picture-tube Transformer

H. W. FORREST, of Shirley, have produced a transformer to overcome cathode-to-heater shorts.

The transformer is for 230 volts input and is available for 2, 4, 6.3, 10 and 13 volts (voltages to be stated when ordering).

The secondary is specially wound to give a small capacity to the primary and core to retain good definition, and special "booster" transformers are also supplied on similar core assemblies, either with or without tag board. Price, 11s. 6d.—H. W. Forrest, 349, Haslucks Green Road, Shirley, Birmingham.

Airmec, Ltd.

WITH reference to the note in our February issue, it should be noted that the name of the company referred to is Airmec, not Airmex.—Airmec, Ltd., High Wycombe, Bucks.

Catalogues and Publications

T.C.C. TECHNICAL BULLETIN

BULLETIN No. 27 deals with Hi-K ceramic receiver condensers which have pure silver electrodes fired on to a ceramic of the barium-titanate group giving high capacity with small physical size. Copies are available on application to the T.C.C. (Radio Division), North Acton, London, W.3.

MULTICORE TECHNICAL SUMMARY M.52

THIS deals only briefly with the many Multicore products, but it contains a large quantity of information generally required by planning and production engineers. In addition to the more well-known Multicore Solders, there is information available on fluxes, fluid solders, solder rings, tape and preforms. The summary is available, free of charge, from Multicore Solders Ltd., Hemel Hempstead, Herts.

KABI TERMINAL BLOCKS

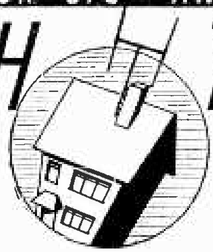
A LEAFLET describing an interesting range of terminal blocks is available from Precision Components (Barnet) Ltd., 13, Byng Road, Barnet, Herts. These blocks range from 2-way to 12-way and are capable of carrying currents up to 30 amps. The mouldings are in phenolic material and the insets and screws are of nickel-plated brass.

HOMELAB INSTRUMENTS

SIGNAL General Type 10, a Checktest and a calibrated variable condenser are described in the latest Homelab leaflet. The Checktest is a collection of resistors and capacitors with a socketed engraved panel by means of which it is possible to obtain over 400 combinations of parallel, series-parallel condensers or resistors or both. A wire-wound resistor calibrated 0-500 ohms and rated at 3 watts is included, as well as an 8μF electrolytic condenser for rapid and accurate substitution tests. Copies of the leaflet are available from Homelab Instruments Ltd., 617, High Road, Leyton, London, E.10.

TELEVISION PICK-UPS AND REFLECTIONS

UNDERNEATH THE DIPOLE



By Iconos

BIG SCREEN CORONATION TV

BIG screen television has been a practical proposition in this country for such a long time that M.P.s (and many of their constituents) seem to have taken it for granted. They assumed that the mere granting of permission by the Postmaster-General for public relays would result in the Coronation television being available in hundreds of cinemas, theatres and municipal halls. Readers of this journal are well acquainted with the technical details of big screen TV installations, and are not surprised that the costs of each equipment is in the neighbourhood of £10,000. Unless, therefore, a reasonably frequent service of suitable items is available, either from the BBC or by sponsored TV (or on "wired" TV), the large capital expenditure is scarcely justified.

TWENTY YEARS ON

UNTIL recently there has seemed to be little possibility of any special TV transmission frequencies being available for the cinema circuits or advertising sponsors. Over the last few years manufacturers of big screen TV in Britain have had little to encourage them to market their products and as a result American makers have been slowly catching them up, encouraged by the success of big screen TV for relaying American boxing and other big sporting events to large, paying audiences. The equipments have been expensive, but, in America, have turned out to be worth while. In Britain there have been very few installations made to date, but experimental big screen equipments have been fitted in a few cinemas in London and the provinces, one such installation being as far north as Doncaster. In London, Coronation big screen TV is likely to be available at the Odeon, Leicester Square, and at cinemas in Hammersmith, Temple Fortune and Bromley. Other cinemas may also take part, and I shouldn't be surprised if one of the cinemas in the Victoria district takes part. It was at the Metropole Cinema in Victoria on Derby day, 1932, that the first big-screen relay took place of the finish of the great race—and a packed audience watched Tom Walls's horse, April the Fifth, romp home to win. That was in the days long before high-definition television, on the old Baird mechanical system.

"THE GAY LORD QUEX"

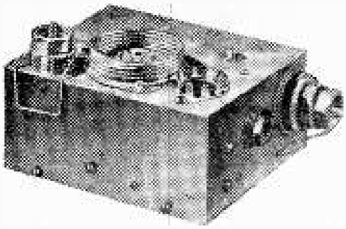
THE more I see of television plays the more I am convinced that the most effective technique is that which imitates as little as possible the restless camera movement of the cinema. When the subject matter is taken from a stage play, such as Pinero's comedy, "The Gay Lord Quex," there is little excuse for constant cuts from camera to camera. Economy in camera cuts was the technique used by Royston Morley for his TV production of that play, and I must say that it put over most successfully the famous boudoir-bedroom scene, highlight of so many stage and film versions of this famous old play. At no time was one conscious of the camera, there was no frantic panning and tracking —in fact, the literally "creaking" camera track technique was conspicuous by its absence.

THEATRICAL KNIGHTS

THESE old plays—or some of them—make reasonably good television material, and have the advantage that many of them are free of copyright—known, I believe, as "in the public domain." I am told that the copyright exists until 50 years after the death of the writer, hence the interest of the BBC play producers in the stage plays which were produced in the 'nineties. That was the heyday of the actor managers —Herbert Tree, Cyril Maud, George Alexander, Henry Irving, Squire Bancroft and John Martin Harvey, all of whom received knighthoods. I suppose, in due course, we shall have a few knighthoods arising from television, if not from television plays. At any rate, these theatrical knights always selected plays which had "meaty" parts for themselves and their leading ladies. Some of the plays have "dated," but Pinero, Henry Arthur Jones, Oscar Wilde, Sardon, Barrie and several others wrote many magnificent stage plays. Only when the plays took on a melodramatic vein have they failed to retain their appeal. The fact of the matter is that well-written dialogue, well delivered, was the essence of a play in the days when actors took pride in the audience hearing every word. Too often, these days, lines are lost through slurry, slipshod diction. In the old days the villain of the melodrama, when he saw the game was up, wrung his hands, gritted his teeth and hissed out "Foiled!" In this day and age, he shrugs his shoulders, offers the detective a cigarette and coshes him without a word.

THE OLD SILENT FILMS

OPPOSITION of the film trade to early showing of current film releases is understandable. The commercial life of an average film is at least three years, at which period it had "graduated" to the dignity of Sunday night showings. Sometimes, if the film is particularly good, it is re-issued again for general release—and in this case a film might have a revenue-earning life of five years. If the BBC are unable to obtain films newer than five years old, then they should take a leaf out of the book of the National Film Theatre, which is showing programmes of silent films dating up to 40 years old vintage. It seems that the full-blooded melodrama was then in the ascendant, and the lurid titles "The Road to Ruin," "Passions of Men," "Trapped By London Crooks" and "A Message From Mars" were typical top-liners of the pre-Kaiser's war era. If the stage melodramas of the 1900's don't click home on television, these old films should. I have seen "The Road to Ruin" and, aided with a remarkable piano accompaniment, I found it a highly interesting and amusing 50-minute entertainment. The dream of a very elderly undergraduate warns him of the perils of strong drink and gambling, and he passes through a series of adventures remotely reminiscent of Hogarth's "Rake's Progress." If the BBC shows any of these old silent pictures they should be run at the then correct speed—16 frames per second.



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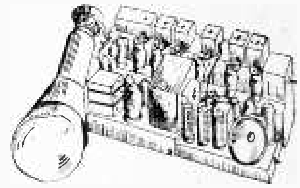

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"VIEW MASTER" VOLTAGE CHECKS

I thank you for your communication of the 12th ult. I have remedied the faults by carrying out your instructions. C.29 seemed to be causing most of the trouble on the sound channel.

I have one other fault with the line time-base, which is non-linear on the right side, causing my picture to be under-scanned by ¾in. The left-hand side is reasonably good, falling short of full scan by less than ¼in.

I have checked the voltage at the output of 14-A-86 MR.4, and it is 259 volts, the mains input voltage at that time being 230 volts. I have measured boost volts across C.42 to be at 19 volts. I have tried increasing the drive to the line amplifier valve by decreasing R.46, but that did not remedy the fault. Adjustment of width and R.52 does not improve this condition.

Another point—my WB.103 mains heater transformer is, as you know, only tapped for 200, 220 and 240 volts input. I am on a 230-volt supply and am connected to the 240-volt tapping. Do you think this would have any detrimental effect on the operation of my televisor ?

I might add I am situated close to a sub-station and my supply is constant 230 volts. I feel if I were to connect to the 220-volt tapping I should run a risk of overloading my equipment.—A. V. Badman (Bristol).

You are correct in using the 240-volt tapping on your W.B. transformer if your voltage is normally 230 volts. As you are only developing 19 volts across C.42 it would appear that there is a fault in this circuit and we suggest carrying out voltage measurements particularly at the screen G.2 of V.10. Also check wiring of L.14, R.52, C.43 and note whether by shorting out L.14 there is an appreciable increase in amplitude.

CATHODE-HEATER SHORT

In three and a-half years three tubes have gone faulty after approximately 12 months' use, the same fault developing with each tube. Perfect reception for a minute or so and then the picture flicks approximately ¼in. to the left and smudged.

A light tap on the base of tube puts the matter right for a few seconds.

A separate transformer for tube heater stops the flick-over of picture, but gives the impression of a black smoke being blown across the picture.

With a 2 v. accumulator for heater the tube works absolutely satisfactorily.

In your opinion, could any fault on the set be the cause of this tube trouble, or is it just bad luck with three tubes?—J. L. Perrie (Nr. Rotherham).

An intermittent heater-to-cathode short in the picture-tube is responsible for the effect. Usually the result is uncontrollable brilliance, but since the receiver in question employs an isolated winding for supplying power to the heater of the picture-tube, the effect is manifested in the form of picture distortion. This is prompted by attenuation of the higher video frequencies owing to the capacitive effects of the heater winding.

The use of a separate heater transformer—unless a special low capacitance component—yields little assistance. With an accumulator, however, the losses are minimised and good definition results.

The heater voltage and cathode to heater potential on the picture-tube should be checked to make sure that the manufacturer's ratings are not being exceeded.

E.H.T. TRANSFORMER CONNECTIONS

I bought an E.H.T. transformer and there were two secondary leads, one black denoting 0 volts and one red lead denoting +1,000 volts, the black lead being earthed to the transformer.

If I wish to obtain −1,000 volts for a cathode-ray tube, do I connect the +1,000 volts red lead to the E.H.T. rectifier cathode and use the anode as −1,000 volts, leaving the 0 volt black lead earthed, or do I unearth the 0 volt black lead, connect it to the E.H.T. rectifier cathode using the anode as −1,000 volts, and earthing the +1,000 volts red lead ?—A. Van Hoof (Blackburn).

It is necessary to apply a *positive* potential (relative to cathode) to the anode of a cathode-ray tube under any condition. An earthed positive potential for the final anode relative to −1,000 volts at the cathode is normal C.R.O. practice.

In this case, the black secondary wire must be disconnected from the transformer earthing tag, and connected to the *negative* end of the potentiometer chain which produces the various control potentials. The red wire should be connected to the anode of the rectifier, the cathode of which should be taken to the positive end of the potentiometer network, which should also be earthed.

INTERFERENCE

My receiver was installed three months ago and, I must add, the quality of picture received, when viewing is possible, has been excellent.

Unfortunately, we are on D.C. mains and during a programme five or six 1in. lines appear on the screen, blotting out the picture.

The G.P.O. has been working trying to find the trouble for several months without success.

The same interference is also being experienced by fifteen other viewers in the same area using different models.

Can you suggest anything to reduce this interference? I have tried, without success, an advertised mains filter—two chokes, decoupled by condensers.—G. W. Hunt (Milford Haven).

From your remarks it appears that interference is arriving at your receiver through the aerial system—mains-borne interference should be minimised by the inclusion of the filter. But since you have not commented on the type of interference—impulsive or R.F.—it is difficult to make suggestions.

Aerial repositioning may help to reduce the magnitude of interference, and give a rough indication of its direction, but the only successful way to obtain complete elimination is by adequate suppression at the source.

D.C. IN SCANNING COILS

In my home-built "Practical Television" receiver, a fault developed in the line scanning circuit which was

located as a short circuit in the line scanning coils. I am using a 12in. C.R. tube at 7 kv. E.H.T.

After asking your advice I decided to change the circuit to that shown in Haynes Technical Publication No. 38 circuit 23 with transformer output but without V3 the efficiency diode. The best results I have been able to get give a raster that is pulled to the left-hand side of the tube, leaving a space of about 2in. on the right-hand side.

No adjustments to the controls will improve the position and I should be grateful if you could advise me what to do.—O. L. Keys (Chester).

You have D.C. in the line coils, which is pulling the raster to one side. Connect a 1 μF condenser in series with one of the scan coil leads to see if this corrects the matter. You do not state whether you have tried centring the raster with the focusing magnet. This may be severely displaced.

R.F. INTERFERENCE

I have a table model which has given good service since purchasing a year ago, but which has now developed a kind of curtain or grille of black diagonal lines in front of picture, which behind this is good.

By altering the oscillator unit underneath set we almost get rid of them, but the sound goes and the car interference marks become blobs and noisier.

It does occasionally fade out, but only for a matter of seconds and then returns. I had a new E.H.T. fitted a week ago.—E. Ripley (Sedgefield).

The acceptance of radio-frequency interference by the vision channel of the receiver is the most likely cause of the effects. This may be a spurious signal on the same frequency as the vision signal, and can usually be proved by finding out whether other viewers situated nearby are experiencing the same trouble. On the other hand, the interference may be gaining admittance to the receiver via its second channel. In this connection local mobile transmitting services often produce pattern manifestations of the kind you describe.

A quarter-wave stub cut for 90 Mc/s. frequently assists in minimising second channel pick-up. Faulty tuned circuit alignment is prone to give rise to similar effects, but in this case the patterns do not tend to fade.

CIRCULAR AERIAL

I cannot use an outdoor aerial on my TV set, as the only place to put it has overhead cables running very close. I have no attic to use an indoor type.

At present I am using a "Vee'd" piece of flex on the wall, but it is unsightly.

Can I make an aerial with two rods bent into a circle, mounted on swivels for direction, to place on top of the TV? If so, can you tell me the sizes and distances, etc., for it? I am 14 miles from Sutton Coldfield's transmitter and in a very good reception area.

If this type of aerial is not possible, can you suggest anything that I can fit into a room?—Walter Holston (Cannock).

If you make up an aerial of two rods bent into the form of a circle, these should each be about 6ft. in length, the cable connecting in at the bottom of the O, and a small gap being left between the ends at the top. For strength this can be bridged with an insulator. A reasonable signal should be picked up on this arrangement when the aerial 0 is broadside to the transmitter. The diameter of the circle will be only a matter of some 4ft. Alternately, a compressed-type dipole can be bought from Messrs. Aerialite which is designed for mounting in small spaces.

LINE LINEARITY

Will you please help me to cure this fault on my home-made television?

The picture is too wide, the left-hand side being behind the mask while the right side just reaches the mask. By reducing the width a black border appears on the right-hand side and any adjustment of the focus magnet only makes matters worse.

I found by accident that by reversing the line connections on the scanning coil this fault was corrected but, of course, the picture was reversed.

Will you also advise me which is the correct position for the ion trap? I have it set for the brightest picture but find that by altering the position of the focus magnet the ion trap must also be altered.—H. Newton (Co. Durham).

A non-linear current change through the line scanning coils is the cause of this common fault. Most receivers—home-constructed and commercial—incorporate a horizontal linearity control, which functions by altering the width of the left-hand side of the picture relative to the right-hand side.

Unless your receiver is so featured obtaining correct linearity will be extremely difficult. Various methods are in current use. but as no mention is made of the type of receiver built little advice can be given.

The ion-trap magnet should be positioned for *maximum* picture brightness.

FRAME LOCK

I am having trouble with a commercial model which although giving a reasonably steady picture for some time has now developed a frame-slipping antic.

It slowly revolves upwards and, although the speed can be controlled and direction reversed by operation of frame-hold knob, it will not "lock."

By adjusting carefully I think I have achieved this, but after standing still for a minute or two the "flyback" lines appear and slowly the picture slips upwards and continues to do so.

All valves associated with sync separation and frame have been changed but with no improvement.—George Booth (Bradford).

An unsatisfactory frame lock on this receiver is sometimes brought about by a reduction in efficiency of the small rectifier which is shunted by a 2.2 megohm resistor, and located between the anode circuit of the sync separator valve and the *pink* connecting wire on the frame blocking oscillator transformer. A 0.047 μF capacitor is also connected in this circuit, which can develop a D.C. leak and give rise to similar trouble.

A substitution test is desirable in this circuit ensuring, of course, that the replacement components are in good condition.

QUERIES COUPON

This Coupon is available until March 18th, 1953, and must accompany all Queries.
PRACTICAL TELEVISION, March, 1953.

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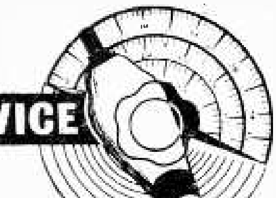

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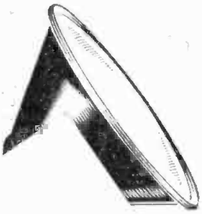

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