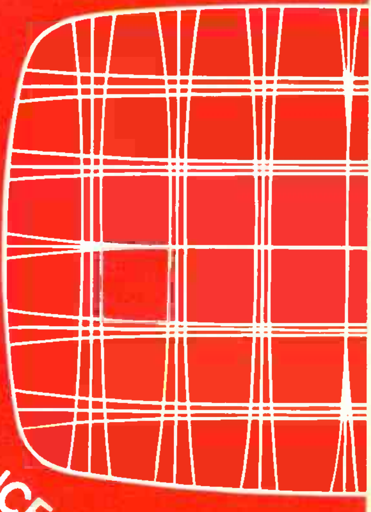
Practical TELEVISION

NOVEMBER 1968

2/6

COLOUR CONVERGENCE ADJUSTMENTS



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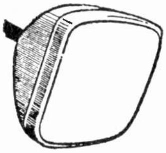

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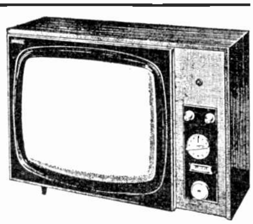

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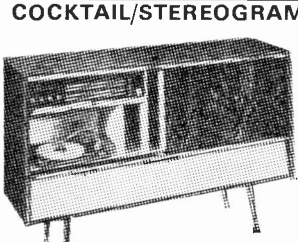

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Practical Television

NOVEMBER 1968
VOL. 19 No. 2
issue 218

SCHOOL TV

A HUGE closed-circuit television network which will eventually link-up thirteen hundred schools and colleges in the London area came into operation in September. During the next twelve months, the remaining thousand schools and colleges in the inner London area will be brought into the network to make this the largest closed-circuit educational television service in the world.

We salute this important breakthrough in communications methods, but ask ourselves if the Inner London Education Authority has taken the right decision in using staff teachers to make the video-recorded programmes?

The Authority has a three-month intensive training scheme for coaching educationalists in the arts of television, but from the trailers shown at the formal inauguration it was evidently clear the teaching courses should be much longer—or killed. The samples lacked the polish we now take for granted in the educational programmes put out by the BBC and the ITV companies.

Obviously it is necessary for teachers and students to be involved in the planning of programmes, but why should classroom teachers filled with enthusiasm make good camera operators, or for that matter producers and directors of television programmes?

Would the BBC and ITV companies offer such high salaries if they could "produce" men and women with sufficient expertise during a three-month course? We doubt it.

Setting-up this huge project has cost £800,000 and we are told that by 1971 the annual running costs will exceed £350,000. A dozen or so professional TV cameramen, directors and producers to form the backbone of the service, which already employs over forty technical and admin. people as well as forty-five seconded teachers, would add approximately £50,000 to the annual bill.

Wouldn't this be worthwhile? Half the teachers seconded to the service could go back to the classroom—where they are certainly needed—and then the Authority would have a chance of exporting its films and make the service self-supporting.

Fuller details of this project appear on page 87.

W. N. STEVENS.—*Editor*

THIS MONTH

THE NEXT ISSUE DATED DECEMBER WILL BE PUBLISHED ON NOVEMBER 22

TELETOPICS

AMATEUR COLOUR TRANSMISSIONS

AMATEUR TV enthusiasts Tony Jacques, G6ACW/T, and Gordon Sharpley, G6LEE/T, claim to have made the first PAL colour transmission for amateurs. Mr. Jacques modified his modulator to accept negative modulation and fed it with the output of a Philips PAL colour pattern generator. At Mr. Sharpley's end a 70cm transistorised converter was modified to 38Mc/s i.f. to suit the colour receiver. The colour receiver consisted of a much modified G.E.C. model fitted with a transistor decoder. The path length between the two sites was 1½ miles and an "eight over eight" antenna was used at both ends.

First a chequerboard pattern was received then colour bars followed, both being quite satisfactory except that transmitter losses had reduced the saturation to rather pale colours. Burst lock was quite good.

PLESSEY U.H.F. TV TRANSPOSERS

THE Radio Systems Division of Plessey Electronics Group exhibited at the I.B.C. exhibition two versions of a u.h.f. television transposer. The PT378 and PT478 television transposers are designed for use in areas of poor reception on Bands IV and V occurring because of obstacles in the optical path from the main transmitter.

The equipments are fully automatic in operation and have been designed for use at unattended sites. The transposers receive on a channel in Band IV or V a complete television transmission, transpose the frequency, amplify the signal and retransmit it on another Band IV or V channel. Any existing or projected colour system can be accommodated.

SOLDERING HINTS FROM WELLER

WITH every Weller 'Expert' soldering gun comes a useful booklet on soldering hints and tips. This booklet is fully illustrated and shows the many applications that the 'Expert', produced by Weller Electric Ltd., can be put to. A comprehensive chart is included that shows the correct flux for various base metals, and this is followed up with the six golden rules of soldering.

Illustrations show the 'Expert' in use on wiring, transistors, plastic, metal sheet, jewellery, model trains and track, leather and wood, thermoplastic and floor tiling. The booklet also lists and illustrates the various accessories that are available for the 'Expert' and heavy-duty guns.

U.H.F. AERIALS AT CRYSTAL PALACE

ON 17th August, 1968 a new u.h.f. transmitting aerial was brought into service on the BBC 645-foot tower at Crystal Palace. This new aerial, designed and supplied by EMI Electronics, now radiates BBC-2 programmes and will later transmit the BBC-1 service duplicated in the u.h.f. band. A similar aerial currently being installed at Crystal Palace for ITA programmes duplicated in the u.h.f. band will be brought into service concurrently with the start of the BBC-1 service.

The aerials are mounted co-linearly on a 63-foot extension to the 645-foot tower and enclosed in a 5-foot diameter glass-fibre reinforced plastic cylinder. Each aerial consists of four tiers of three Emislot panels mounted on a lattice spine. This arrangement produces an omnidirectional radiation pattern and a nominal aerial gain of sixteen.

ALL ABOUT THE RRE

THE Ministry of Technology's Royal Radar Establishment at Malvern, Worcs., is the largest centre for electronics research and development in Great Britain. It is the Ministry's aim to encourage collaboration between industry and the Government research establishments to find solutions for technological problems and RRE has set up an Industrial Applications Unit to provide a consultancy service for industry with experimental and research backing on a wide range of subjects.

The Establishment has now produced a booklet entitled *RRE Activities Guide* giving an overall view of the programme of work at Malvern from basic physics research to the development of advanced electronic equipment. Copies of the booklet are available free of charge from Industrial Applications Unit, Royal Radar Establishment, Ministry of Technology, St. Andrews Road, Great Malvern, Worcs.

EMI COLOUR VIDEO TAPE

THE main feature from EMI Tape at this year's I.B.C. was a comprehensive demonstration of the performance available from EMITAPE 625, a new video tape developed and tested specifically to meet high-band colour recording requirements.

BRIGHTER COLOUR

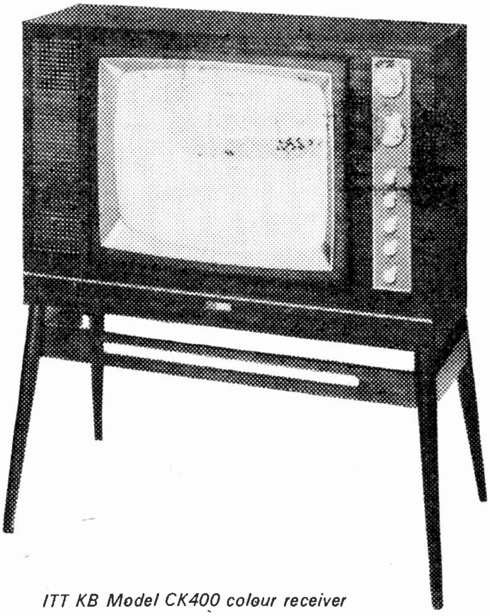
BUCKBEE-MEARS CORP., a US manufacturer of metal shadowmasks for colour receiver tubes, have suggested a relatively simple way to achieve a 10% increase in colour tube brightness without changing phosphor formulations or sacrificing resolution. Their proposal is to make the holes in the shadowmask hexagonal rather than round thereby making the mask more transparent to electron beams.

HAND-WIRED 19in. COLOUR RECEIVER FROM ITT KB

LAST of the major TV setmakers to introduce a colour TV receiver is KB who revealed their colour chassis type CVC1 at the recent trade shows. First model to use the chassis is the CK400, a 19in. receiver (tube type (A49-11X) announced at 275 gns. The chassis is a hand-wired, dual-standard hybrid one to the PAL-D specification, with a complement of 11 valves, 38 transistors, and 34 diodes and rectifiers.

Features include automatic tint adjustment between colour and black-and-white, a two-stage automatic brightness limiter circuit to preserve tube life, a preset tint control, and silicon tripler e.h.t. rectifier with v.d.r. stabilisation (the v.d.r. also provides the focus potential). The luminance output stage is transistorised whilst valves are used for the colour-difference signal output stages.

Features of the decoder include: PAL alternate line R-Y signal inversion in the signal path by means of a ring modulator controlled by the ident amplifier stage; separate burst gate pulse generator for accurate burst gating; colour killing in the R-Y and B-Y preamplifier stages; and the use of buffer amplifiers between the reference oscillator and the synchronous demodulators. The automatic colour-monochrome tint adjustment feature is achieved by means of a special grey-scale shift circuit which operates on the colour-difference preamplifier stages.



ITT KB Model CK400 colour receiver

ITA FELLOWSHIPS FOR 1968-69

THE Independent Television Authority announces the award of the first six of its twelve School Teacher Fellowships in Educational Television for 1968-69. The Fellowships are tenable for one academic term at universities participating in the scheme and are open to practising men and women teachers under 30 years of age. The names of the teachers so far appointed, the schools at which they teach and the universities to which they will be attached are as follows: Miss M. Thomson, Moatbridge School, S.E.9 (University of Birmingham); Miss M. Jackman, John Burns Primary School, S.W.11 (University of London); Mr. C. R. Bell, Arbury Junior School, Cambridge (Cambridge Institute of Education); Mr. R. J. Clay, Beckenham and Penge Grammar School for Boys (University of Leeds); Mr. B. P. Kerr, St. Aloysius Special School, Belfast (The Queen's University, Belfast); Mr. D. K. Thompson, Koldo Senior Secondary School, Kampala, Uganda (University of Leicester).

Six universities have yet to appoint Fellows for 1968-69.

BOXING DAY RACING

BY special arrangement the BBC will cover Kempton's premier National Hunt event, the King George VI steeplechase, on Boxing Day.

TV SCIENCE CONFERENCE

THE first TV science conference organised by the BBC and sponsored by the European Broadcasting Union was attended by delegates from 19 countries. The conference was held at the Royal Society, London.

B & O COLOUR TRAINING

A PROGRAMME of training courses has been specially arranged for all Bang and Olufsen dealers who will be stocking the new Beovision 3000 colour TV receivers.

The course will acquaint dealers with all the details of the Beovision 3000, enabling them to give an informed and comprehensive sales service to their customers. It will provide a concise technical service training for engineers.

PERISCOPE TO AID COLOUR TV TECHNICIANS

PHILIPS have introduced a new device to assist technicians when making static convergence adjustments at the rear of colour TV receivers. As extremely careful observation of the exact centre of the c.r.t. is necessary to check the effect of these adjustments it is obvious that some sort of periscope is required and Philips new Static Convergence Periscope has been designed for this purpose.

Apart from considerably reducing setting up time, the instrument also incorporates these features: optically flat mirrors to give an undistorted image; shrouded optics to avoid unwanted reflections and make unnecessary the darkening of the room; an adjustable lower mirror to accommodate a wide variety of cabinet styles and tube sizes; a weighted support arm to ensure good stability; and complete portability, the support arm acting as a lid when the instrument is not in use and protecting the mirrors in transit.

Made from lightweight yet robust plastic, the Static Convergence Periscope costs £3 10s. (net trade) and is available through Combined Electronic Services Ltd., Queensway, Waddon Factory Estate, Croydon.

PRINCIPLES OF CONVERGENCE

T. JOHN

FOR correct colour and monochrome displays the beams from the three guns in a shadow-mask tube must converge, i.e. come together, at the shadowmask. After passing through the holes in the shadowmask the beams then diverge slightly to strike the green, red and blue triads of phosphor dots on the screen. If the beams do not converge the result is colour fringeing on outlines in the picture. This is because the three beams are modulated simultaneously so that if, for example, one beam lags behind the others then the information it carries will not change at the same point on the screen as the other two beams, causing a colour error wherever there is a change of colour in the scene being reproduced on the screen. This type of error must be clearly distinguished from purity errors which result in patches of incorrect colour over parts of the screen.

The basic reason why convergence correction is necessary is that the three beams come from different positions, though as we shall see there are several additional complications. Looking from the front of the tube, the three electron guns are mounted in a triad formation, the blue gun being at the top, the red gun below left and the green gun below right, as Fig. 1 suggests. The aim is to superimpose the beams for correct

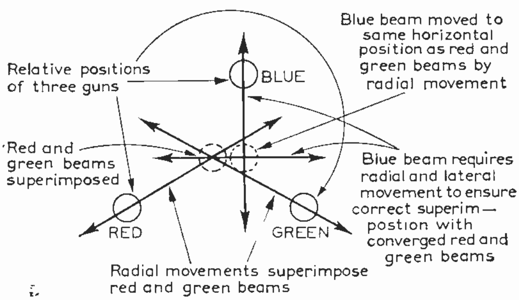


Fig. 1: Principle of static convergence.

convergence and this is done by applying magnetic fields which deflect the beams from their initial positions. As Fig. 1 shows magnetic fields which produce radial movements of the red and green beams will superimpose these two beams. With the blue beam we come to the first complication: it is most unlikely that radial movement alone of this beam will move it to the same point where the other two beams are superimposed. For this reason provision is made to move the blue beam in two directions, radially so as to move it to the same horizontal position as the converged red and green beams, and sideways to ensure that it can be correctly superimposed upon the other two beams. This is the reason for there being two convergence assemblies on the neck of a shadow-mask tube. The large assembly just behind the deflection coils provides radial displacement of the three beams, and in addition an assembly called the blue-lateral convergence assembly is mounted at the rear of the tube neck and provides horizontal displacement of the blue beam.

Each convergence assembly is provided with permanent magnets which can be rotated to obtain movement of the beams along the lines just described. However this is just the beginning of the story. These permanent magnets are adjusted to converge the beams at the centre of the screen: adjustment of these magnets is termed *static convergence* adjustment. But for two main reasons the three beams will still not be correctly converged towards the edges of the screen.

This is firstly due to the geometry of the tube. The problem is illustrated in Fig. 2. If the screen of the tube was spherical, as shown by the broken curve, with respect to the deflection centres—the points at which the beams are deflected by the scan coils—then the convergence as set by the static convergence magnets would be substantially correct over the whole face of the tube. We'd get a most unsatisfactory picture, however! Modern tubes, both colour and monochrome, have a fairly flat face and this means, as can be seen from Fig. 2, that the three beams must converge at a different distance from the deflection centres at different points over the face of the tube, the distance being greatest at the corners and least at the centre.

This problem is overcome by applying continuously varying convergence correction—or *dynamic convergence* as it is called—to the beams in addition to the static convergence provided by the permanent magnets previously mentioned. This dynamic convergence is obtained by incorporating in the convergence assemblies electromagnets fed with correction waveforms at line and field frequencies.

Figure 3 brings out the fact that the dynamic convergence correction required is least at the

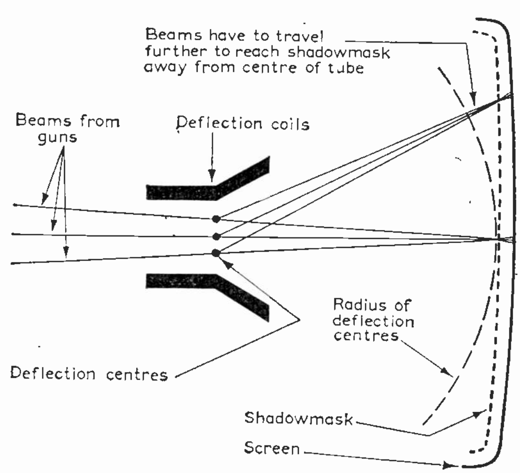


Fig. 2: The basic reason why dynamic convergence is necessary is because the geometry of the shadowmask and screen differs from the radius of the beam deflection centres.

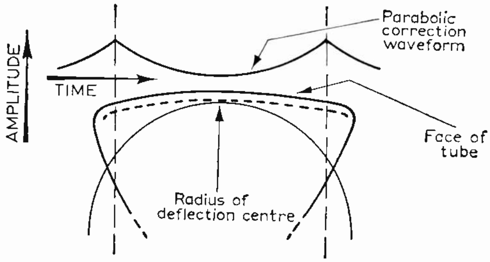


Fig. 3: The basic correction waveform required to compensate for the difference between the geometry of the tube face and the radius of the deflection centres is the parabola.

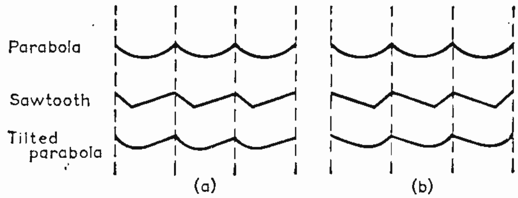


Fig. 5: Tilting a parabola: (a) Parabola tilted by a negative-going sawtooth waveform; (b) Parabola tilted by a positive-going sawtooth waveform.

centre of the screen and greatest at the edges. It also shows the basic dynamic convergence correction waveform needed, the *parabola*. Thus the radial convergence assembly is fed with what are basically parabolic correction waveforms at field and line frequency in order to obtain correct dynamic convergence, the blue-lateral assembly being fed with a basically parabolic correction waveform at line frequency. These waveforms, being at field and line frequency, can be conveniently obtained from the line and field timebases and produce varying magnetic fields in the neck of the tube to provide the required dynamic convergence correction.

The situation however is complicated by the fact that the three guns are mounted, as we have seen, at different positions relative to the axis of the tube. This is the second main reason why static convergence alone is inadequate. The result of this is that the beams will tend to trace out rasters of slightly different shape. The effect, in exaggerated form, is shown in Fig. 4. This shows how the shapes of the three uncorrected rasters differ and the effect of this difference on the centre horizontal and vertical lines of the picture.

To overcome this problem the basic parabolic dynamic convergence correction waveforms need further modification. The basic technique used is to *tilt* the parabola (we can now see why many of the convergence controls are labelled parabola and tilt controls). As shown in Fig. 5 this can be done by adding a sawtooth component to the parabolic waveform. Clearly by adjusting the shape and amplitude of the parabolic and sawtooth waveforms we have a very versatile system of obtaining dynamic convergence correction.

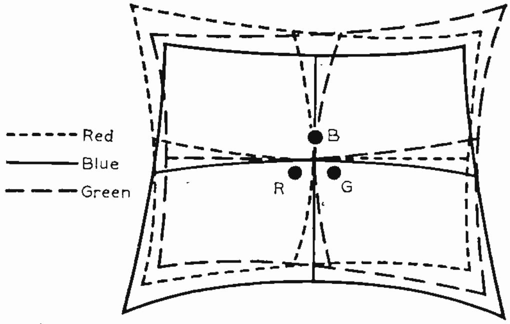


Fig. 4: Because the three guns are mounted in different positions relative to the axis of the tube the three rasters they trace out are of different shape.

The basic approach just outlined is generally used to obtain the field frequency convergence waveforms. A suitable parabolic waveform is available at the cathode of the field output valve and sawtooth components can be taken from an additional winding on the field output transformer. However it is equally possible to go about things the other way round, that is to start with a sawtooth waveform at the required frequency and to shape this until we have the required parabola/sawtooth correction waveform, and this is basically the technique used to obtain the line frequency dynamic convergence correction waveforms. We still find ourselves confronted with parabola and tilt controls of course since what we are doing is basically the same thing.

It may seem that a parabola amplitude and tilt control is required at field and line frequency for each beam (with a separate blue-lateral adjustment), i.e. some twelve controls. Things however are both more simple and more complex! To take the simplification first, the technique of *matrixing* the red and green convergence controls has been found to assist adjustments considerably. With this system the red and green controls are arranged so as to produce simultaneous vertical and horizontal red and green beam movements instead of individual radial beam movements. With matrixed red and green convergence controls we frequently find common R/G tilt and parabola controls along with an R/G differential control. The added complication arises because of shortcomings in the deflection system: to provide compensation here symmetry controls are generally featured to balance the line and field deflection coils so as to ensure that the red, green and blue rasters register overall.

We have now covered the basic convergence techniques (considerable difference in design detail between models will however be found). Before going on in the following article to how convergence adjustments are made two related points should be mentioned, picture centring and pincushion distortion correction. In black-and-white receivers these two features are provided by means of adjustable magnets. On a colour receiver however alternative techniques must be used since such magnets would interfere with the purity and convergence of the picture. Centring is effected by feeding an adjustable d.c. through the deflection coils. The level of the d.c. is set by a shift control and a plug-and-socket system enables the direction of picture shift to be changed. Pincushion distortion correction is achieved by modulating the field scanning current at line frequency and the line scanning current at field frequency. Circuitry linking the field and line deflection coils is used for this purpose. ■

INSTALLING and SERVICING COLOUR RECEIVERS

PART 2

P. G. ALFRED

MAKING CONVERGENCE ADJUSTMENTS

MOST colour receivers on the market use the same basic convergence circuit techniques but there are detail differences in the way that these are applied. It is therefore not practicable to give comprehensive guidance about how to converge each and every receiver. However the basic approach is the same for all, and if the right principles are used in a systematic way the art of converging a receiver to a high standard can be learnt by anyone who is prepared to spend a few hours practising. The differences between individual models are then of very little significance. It is simply a matter of becoming accustomed to the different knob layouts and the odd adjustment which is present on one model but not on another.

First a word about general principles. Convergence errors fall into two categories—*static* and *dynamic*. If any misconvergence is present at the *centre* of the screen there is a static convergence error. Under normal conditions this can be corrected *only* by adjusting the static convergence magnets on the convergence yoke behind the deflection coils. If, when these have been adjusted and there are no errors at the centre, misconvergence occurs anywhere else, and especially in the corners, *dynamic* convergence errors are present. These can be cured *only* by dynamic correction applied by passing a.c. waveforms of the appropriate parabolic and sawtooth shape through the R, G and B gun convergence coils on the convergence yoke. The amplitude and shape of these currents are adjusted by means of variable inductors and potentiometers, each of which has a clearly defined effect on the picture.

Once the difference between static and dynamic convergence errors is understood it is possible to identify them at a glance, and you know immediately whether to adjust the magnets or the preset controls. This enables convergence adjustments to be broken down into two logical sequences and the operation begins to make sense. Indeed this process is essential for quick and efficient working.

The goodness of convergence can be assessed on any monochrome picture that contains suitable detail all over the screen area, but beware of tennis courts, test matches, and nice pastoral scenes with lots of sky. The errors will not show up clearly, and the excitement of a fine straight drive for six will probably distract your attention anyway! Test card F has been designed to show up convergence errors, but in all cases it is far better to use a crosshatch pattern from a local crosshatch generator. In any case do not try to *adjust* convergence on anything but a crosshatch pattern. You simply cannot do it adequately on a picture. It may just pass muster temporarily, but this is not the standard of workmanship that will satisfy the skilled engineer (or the customer for long).

Most pattern generators also provide a dot pattern as an alternative to the crosshatch. Although a few engineers prefer the dots, it is suggested that the crosshatch is a better pattern to use because it is more suited to the basic procedure of convergence, as we shall see later.

Static Convergence

Let us assume that we have a crosshatch pattern displayed on a colour receiver which has been carefully tuned and adjusted to give thin clear lines of only moderate brightness on a black background. Avoid turning up the contrast to the point where defocusing occurs, because fuzzy lines obscure the convergence errors that we are trying to analyse.

The receiver should be in the workshop dark area with very low ambient lighting. Complete darkness is tiring to the eyes, and it is a good plan to have a bench light switched on and aimed away from the receiver to give subdued background lighting. The receiver itself should have been switched on earlier so that it has had about a quarter of an hour in which to warm up and become more or less stabilised.

With all three guns switched on, it will be possible to see at a glance if any static errors are present. If so they will be of the general form shown in Fig. 2. Fig. 3 shows how they can be corrected by means of the three radial magnets on the convergence yoke (one each for red, green, and blue) and the blue lateral magnet on the blue lateral assembly on the tube neck behind the convergence yoke. Note that the red and green beams can only be moved diagonally, while the blue beam can be moved up and down and also sideways. All four adjustments are necessary in order to be able to converge all three beams from any of the positions that they can occupy.

When looking at convergence errors always make a point of not merely seeing them in general terms but of analysing them in detail. In the case of static errors ask yourself: does red need to be moved up or down its diagonal path in order to converge on green? Similarly, does green need to be moved up or down its own diagonal to converge on red? When red and green have been converged will blue be above

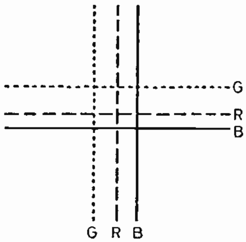
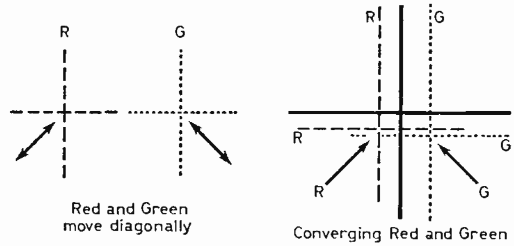


Fig. 2 (left): Typical static convergence errors (magnified).



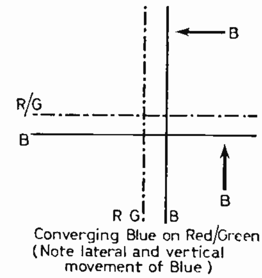


Fig. 3: Procedure for correcting static convergence errors. First converge the red and green horizontal and vertical centre lines. This is achieved by diagonal movements. Then converge blue on the converged red and green (yellow) lines. Vertical and lateral movement of the blue beam is required for this.

or below red/green, and will it be to the left or to the right of red/green?

This analytical approach tells you quite clearly how much movement, and in which direction, is needed of each beam. It is then quite a simple matter to adjust the magnets to get the required result. Generally speaking it does not help much to use a mirror. It is better to dodge about between the front and back of the receiver alternately adjusting a magnet and looking at the picture. Only adjust one magnet at a time and then observe the result, as otherwise you are liable to get confused about cause and effect.

Always adjust the red/green convergence first because this is a little tricky, and it is easy to converge blue afterwards. It usually helps to switch off blue whilst doing red/green so that the misconvergence can be seen more clearly. Note that you are trying to get red/green into one of the positions shown in Fig. 4 so that one more touch on the appropriate magnet will complete the process.

When you have got the red and green images coincident at the centre of the screen you then turn on the blue gun and move the blue beam up and down and sideways until all three beams are nicely converged at the centre. However, some of the magnetic field surrounding the blue gun also inevitably passes through the red and green guns, and so their convergence will be slightly upset if the blue beam needs appreciable adjustment. This effect may well pass unnoticed because the operation is normally carried out in a series of repetitive steps.

It is perhaps worth emphasizing that static convergence refers *only* to a very small area in the centre of the screen. It is a good plan to choose the crosshatch intersection nearest to the centre and to work on that alone, ignoring the whole of the rest of the picture.

If you are going to adjust the dynamic convergence afterwards do not spend too much time on static because you will have to do it again anyway. Adjustment to the nearest millimetre or so is adequate. The final adjustment later should be carried out very carefully in order to achieve perfect registration.

Dynamic Convergence

Having achieved satisfactory convergence over a small area at the centre of the screen by adjusting the magnets, the next operation is to converge the red, green, and blue images over the rest of the picture area by means of the preset dynamic controls. Note that in the case of dynamic convergence all production receivers are fitted with matrixed circuits that cause the red and green images to move up and down, or sideways, relative to each other instead of diagonally as with static convergence. This simplifies the process considerably and makes it much easier to analyse what needs to be done.

The first thing to do is to read the manufacturers' instructions and to identify the various controls and become thoroughly familiar with their action. Look for any special instructions about differences in procedure between 405- and 625-line convergence adjustments. The dynamic field and all the static magnet adjustments are common to both line systems but the dynamic line controls are usually, but not always, duplicated on both 405 and 625 and have to be adjusted separately. The dynamic convergence operation, therefore, falls into two parts; field and line on one system, and then line again on the other making sure that you do not inadvertently touch either the field or the static magnet controls again.

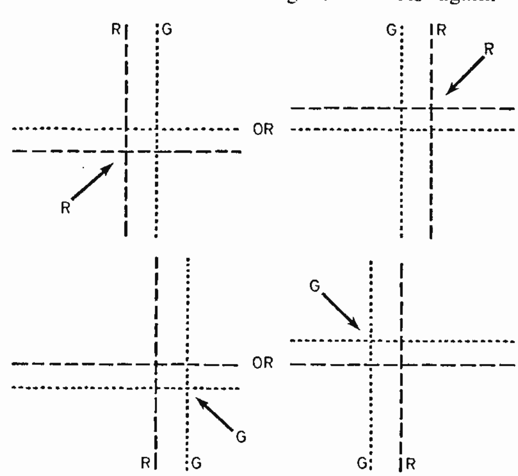


Fig. 4: Static convergence of the red and green beams—the final move.

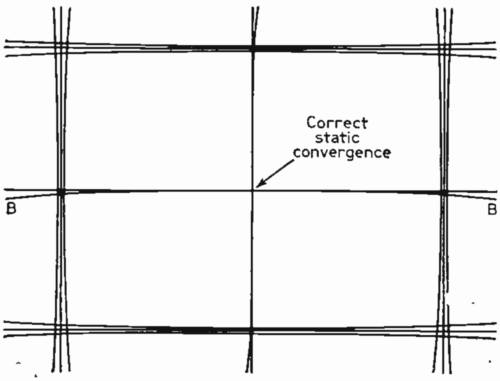


Fig. 5: Typical dynamic convergence errors.

As we mentioned before, different makes of receiver have slightly different combinations of controls, but in all cases the same basic *functions* have to be carried out. Let us go through a typical sequence of operations in order to establish the principles of dynamic adjustments.

Tune in and adjust a 625-line crosshatch pattern carefully, and then set the focus control to get clean white lines on a black background. Now look at the pattern and analyse the convergence errors. They will probably appear as in Fig. 5. At this stage of the game you are interested *only* in the quality of convergence on, and across, *the horizontal and vertical centre lines of the picture. There are no controls for adjusting convergence properly in any other part of the picture.*

Dynamic R/G Field Convergence

Switch off the B gun and study the R/G errors more closely (on the horizontal and vertical centre lines). Now concentrate on the field convergence, which means errors on the vertical centre line, and find the field controls. There will probably be R/G parabola and tilt controls having the effect shown in Fig. 6. (The names of the controls are not important. They are used only for purposes of identification.) Learn to adjust the controls simultaneously (one in each hand if possible) or repetitively in turn, so that you can quickly and and easily converge R/G to get them neatly superimposed or parallel to each other over their whole length. Note that you can use the static magnets at any stage of the dynamic convergence operation in order to make parallel lines become superimposed. Indeed this is the normal technique. Make the lines parallel, and then use the static magnets. This point should be taken for granted throughout. Now identify the R/G parabola balance and tilt balance controls which operate as shown in Fig. 7. Again the drill is to adjust them simultaneously, or in turn, to get good convergence of all the horizontal R/G lines at the points where they cross the vertical centre line of the picture (ignoring what happens in the corners) using the static magnets as well if needed. You should now have a zone of good convergence in all directions up and down this centre line.

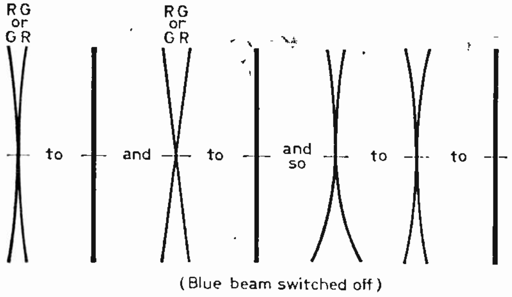


Fig. 6 (above): Dynamic convergence of field R/G vertical lines.

Dynamic R/G Line Convergence

Now turn to the line convergence controls and adjust the R/G parabola control to get the R and G lines nicely superimposed along the horizontal centre line of the picture as shown in Fig. 8. Next adjust the R/G tilt balance control to get good convergence of all the vertical R/G lines at the points where they cross the horizontal centre line (again ignoring the corners), Fig. 9. You should now have a zone of good convergence in all directions along this centre line.

Dynamic B Field Convergence

Having achieved good R/G convergence, exactly in accordance with the procedure inherent in the choice of circuitry, switch on the blue gun and analyse the B-R/G errors on the vertical centre line. The errors will probably be similar to those shown in Fig. 10. Using the B field controls obtain good B-R/G convergence up and down the vertical centre line in the same way as for R/G. See Fig. 11.

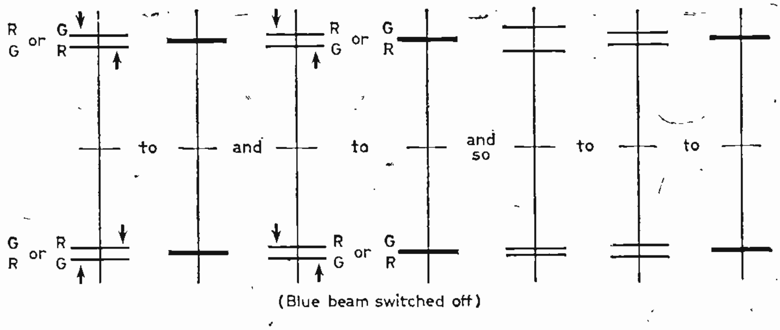


Fig. 7 (right): Dynamic convergence of field R/G horizontal lines.

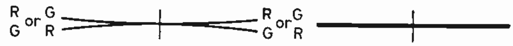


Fig. 8: Dynamic convergence of line R/G horizontals.

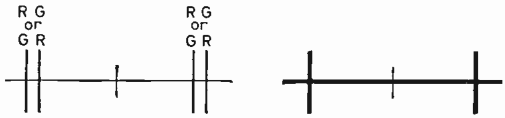


Fig. 9 (above): Dynamic convergence of line R/G vertical lines.

Fig. 10 (right): Typical B-R/G field convergence errors.

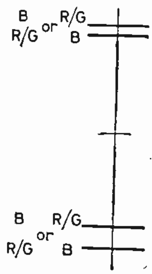
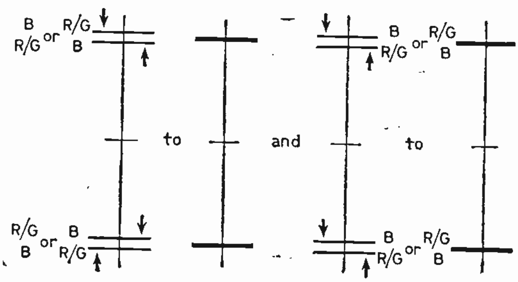


Fig. 11 (below): Dynamic convergence of field B on R/G lines.

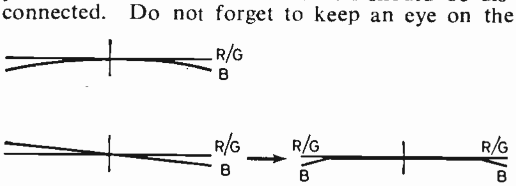


Dynamic B Line Convergence

The pattern is now familiar. We are trying to superimpose all the blue lines on all the R/G lines on and across the horizontal centre line of the picture. However, there is a difference. The horizontal B line will seldom be straight and parallel to the R/G. Use the B line controls to get B as parallel to R/G as possible, and then adjust the B static magnet to superimpose B on on R/G. See Fig. 12.

Now turn to the B lateral errors. See Fig. 13. Adjust the B lateral (line) control for best convergence of B on R/G. If you cannot get good convergence but the errors are about equal at each end of scan it will either be because the correction is in the wrong sense or because none is needed. In the first case it is necessary to reverse the connections to the blue lateral coil assembly on the c.r.t. neck behind the convergence yoke. In the second case the coil should be disconnected. Do not forget to keep an eye on the B convergence at the middle of the screen, and to adjust the B static magnet in the B lateral coil assembly as necessary.

If you can get proper convergence at either end of the scan but not both together, cure the asymmetry by rotating the whole convergence yoke a few degrees in the appropriate direction. (It is clamped in place by a screw.) This adjustment will alter the R/G convergence slightly and may also affect the purity. If necessary readjust the purity now.



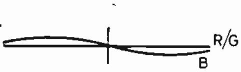


Fig. 12: Dynamic convergence of line horizontals—B on R/G.

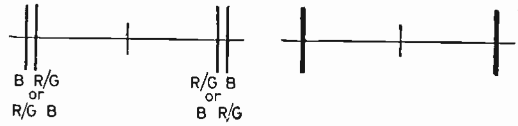


Fig. 13: Dynamic convergence of blue laterals.

The Complete Routine Procedure

We have now covered the basic convergence adjustments in their proper order, but we have only been through them once. In most cases it is good practice to make a quick adjustment first

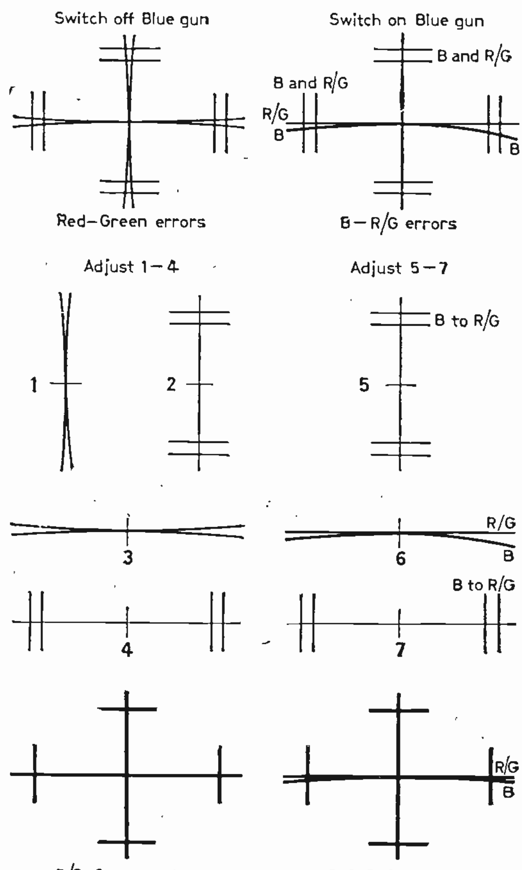


Fig. 14: Complete dynamic convergence procedure step-by-step. Adjust each error in sequence 1-7.

to remove the major errors, and then to go through it again carefully to get a high standard of convergence on the two centre lines. Repeat if necessary.

When described on paper the process seems rather laborious, but it is surprising how quickly it can be carried out by an experienced operator. Just to put things in perspective, the sequence of operations is summarised diagrammatically in Fig. 14. If it is always carried out in this order the procedure will become habitual and you will not have to fumble about trying to find the right knob.

Correcting Residual Errors

When the basic static and dynamic convergence procedure has been completed there will still be some residual errors. What can be done to correct them and just how good should the convergence be anyway?

These are probably the most difficult parts of the problem facing the beginner. The difference between a good operator and a bad one is not so much in the quality achieved, although there will certainly be a difference, but in the time taken to do the job. The experienced man knows when to stop: the beginner goes on for ever (or so it seems!) and finally makes it worse. It is all a matter of practice and methodical working.

So, how good should it be? It will not be perfect because this is simply not possible on a shadowmask c.r.t. However at normal viewing distances the misconvergence should be barely perceptible. In the extreme corners of the picture the errors may be up to 3mm. but are more commonly about 1-2mm. They vary from corner to corner and depend upon the particular combination of deflection coil and c.r.t. and the skill of the operator.

The key to efficient working and to the problem of improving the residual errors lies in knowing which errors can be corrected and which cannot. To establish the point clearly, let us say again that there are no controls for adjusting the convergence in the corners of the picture. Furthermore although controls are sometimes provided for curing crossover on the horizontal and vertical centre lines of the picture there are no means of doing the same thing near the outer edges of the picture. This is because crossover is inherent in the three-dimensional geometry of the c.r.t. and the spatial distribution of the magnetic fields from the deflection coils. Once good convergence has been obtained on the two centre lines of the picture all that can be done to improve matters is to redistribute the errors *slightly* so that they are spread more evenly around the outer edges. Note that in nearly all scenes the critical area is the central foreground, as shown in Fig. 15, and

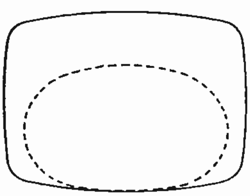


Fig. 15: The central foreground of the picture must be carefully converged.

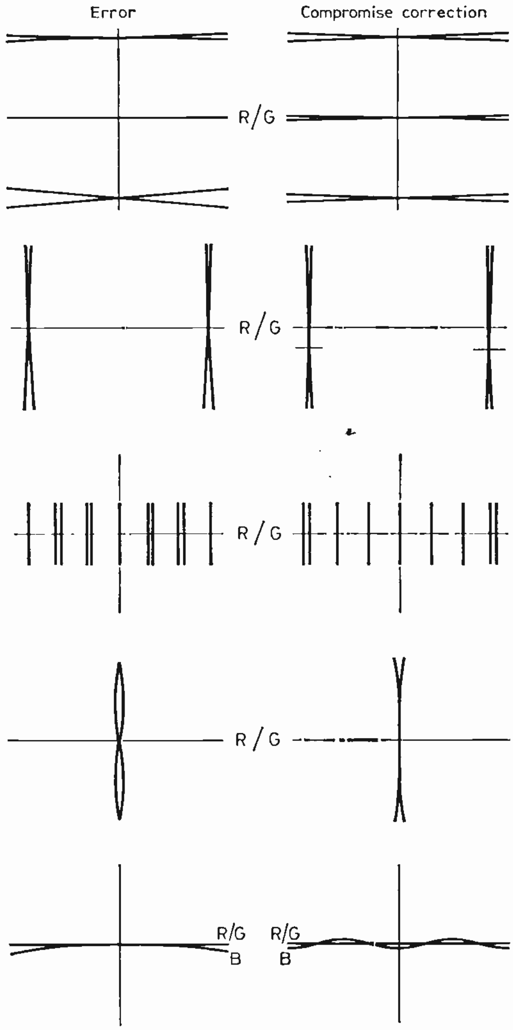


Fig. 16: Spreading the residual errors to produce a better overall effect. Only a small amount of compromise is permissible.

particular care should be used to get this right. Bear in mind however that only a *small* amount of compromise is permissible.

Fig. 16 shows on the left some typical errors which will be familiar to anyone who has tried to converge a picture. In most cases an improvement can be made to the overall effect by the techniques illustrated on the right-hand side of the diagram. In order to do this it is essential to have a clear understanding of what each control does, and if you are not too sure be prepared to return each control to its original setting. Do not let go of the knob until you are satisfied that you have, in fact, made an improvement. This is a sound principle in all convergence operations.

Another compromise which occasionally has to be chosen concerns static convergence. Having

continued on page 76

THE INTERNATIONAL BROADCASTING CONVENTION 1968

ICONOS REPORTS

THE International Broadcasting Convention 1968 was a big success. The event was fathered by the Royal Television Society and developed in conjunction with the Electronic Engineering Association and the Institution of Electrical and Electronics Engineers, UK and Ireland. For 1968 the collaboration was expanded to include the Institution of Electronic and Radio Engineers, the Institution of Electrical Engineers, and the Society of Motion Picture and Television Engineers of USA.

The result was the organisation of an event which was bigger and better than the IBC Convention of 1967. It was the most interesting technological convention I have attended, even including the splendid technical conferences in New York and Los Angeles organised by the American Society of Motion Picture and Television engineers in 1967 and 1968.

The convention was confined to people in the television and film industries, for the exchange of ideas and opinions. Quite a high registration fee was paid by delegates, even though they may be interested only in individual sections, specialising in particular fields such as: studio and origination equipment; propagation equipment including aerials, transmitters and transposers; signal distribution and wire relay; receiving equipment; recording, films and v.t.r.

Two lecture halls were set up at Grosvenor House Hotel to deal with the presentation of about 100 papers, and it was unfortunately not possible to be in two places at the same time. However, the allocations of subjects were cleverly worked out to one theatre or the other to minimise clashes of different individual interests. In addition there was a practical and elaborate exhibition of equipment, including at least three small television studios with associated demonstrations of colour television better than has ever before been seen under one roof.

The year's improvement in the quality of colour results from live TV cameras, video tape, transfer to film, telecine, vision mixers, sound tape, etc. has been colossal. It was altogether a fine example of the importance of the engineer in this age of technology. Incidentally the Convention occurred at the same time as the opening of the Inner London Educational Authority's TV studios and closed-circuit network, a happy and possibly significant coincidence: engineers clearly now have a say in the trends for the future.

SATELLITES

It is only possible to mention a few of the excellent lectures presented. A splendid opening (and an indication of things to come) dealt with *The Use of Satellites for Television Programme Distribution*, presented by J. Hodgson and J. K. Howett (GPO Telecommunications HQ). This disclosed methods proposed for dealing with areas, large or small, on the earth's surface. With a satellite at 350,000 miles a 2° beam could just about cover the British Isles for relaying via TV organisations to viewers or, much further in the future, for direct broadcasting to homes. *Digital System for Satellite Links* was put forward by L. S. Golding (Satellite Labs., USA), while W. T. Brandon (Mitre Corporation, USA) explored details of the educational application for such links in Africa and South America.

Dr. Theile (Rundfunktechnik, Munich, Germany) gave a splendid survey of TV systems from the early development to the present time. Further detailed study in the changes from monochrome to colour was dealt with by K. Blair Benson and R. S. O'Brien (CBS Network, USA). The Columbia System's engineers presented several important papers during this convention consolidating the fine impression they made on British delegates who had attended American conventions last year. BBC Research Department's first of many contributions dealt with *An Advanced Form of Field Store Standards Conversion*, the success of which was spurred on by unofficial competition between differing methods within their own organisation. This paper revealed TV cameras with a digital integrated target as a pure instrument of photography.

STUDIO AND ORIGINATION EQUIPMENT

Studio equipment has always been a controversial subject because of the differing points of view of engineers and television producers. These were clearly dealt with in a general survey study by Dr. H. Schönfelder (Fernseh, Darmstadt, Germany) and later in a detailed paper by J. L. E. Baldwin (ITA London). Coders and decoders for the NTSC, PAL, and SECAM systems were covered by several authors, this subject involving colour video master controls, switching, special effects and propagation.

The BBC came up with valuable assessments of acoustic materials for scenery in television studios which Mr. N. N. Burd illustrated with excellent slides of reverberation tests, the only acoustic subject in the Convention. Thames Television returned to a controversial field in the matter of coded forms of television pulse distribution, for which many different methods were put forward in papers by a good many different authors. Mr. Bryan's approach was extremely concise and convincing, as was (from another point of view) A. N.

Heightman's timing pulses along a single distribution cable.

TV studio planning depends upon the equipment currently available at the time the building is constructed—and, conversely, the equipment fits itself into the shape of the studio. Layouts of studio stages and the concealed iceberg-like ancillary premises have consequently changed with the years. Conversions of theatres, music halls and churches to television studios are *out*: purpose-built studio complexes are *in*. BBC Engineers, notably Messrs. Longman, Ward, Parker, Castle and Ackerman, had logical views on various aspects of studio layouts, pet subjects of every executive in the television industry, artistic, administrative or technical. The person who probably has the least to do with it all is the lady or gentleman who lays the foundation stone.

RECEIVERS

Naturally, everyone expected a new angle on black-level clamp circuitry from P. L. Mothersole (Mullard), whose influence in improving monochrome television pictures has always received admiration except among those TV receiver manufacturers who cut the tonsils, adenoids, appendices and all other parts of the body of a TV set without actually killing it. Mothersole's paper dealt with the future period when 625-line sets (minus 405-line facilities) will be with us. He even mentioned the thoughts we all have about a re-allocation of frequencies in the v.h.f. band. It was all good sound sense, following in the steps of BBC's D. C. Birkinshaw.

Concerning receiver design it was not surprising that Bernard J. Rogers (Rank-Bush-Murphy) had a number of constructive points of view to make. He warned the audience that he was not proposing to read the written paper included in the Convention's thick volume of pre-prints. Instead he gave a delightful off-the-cuff lecture on *A Colour Decoder Using Integrated Circuits in a TV Receiver*. Integrated circuits have been used widely in electronic circuitry elsewhere but are distinctly novel in television receivers. The integrated circuit described provides R, G and B outputs to drive the colour picture tube cathodes. Apart from improved definition (as was seen on an exhibition stand), this improvement makes "tweaking" adjustments easier and more positive, thereby easing maintenance.

TELECINE

The presentation of films of all types amounts to about 80% of the programme time in the USA said J. A. Flaherty (CBS Television, New York) in an interesting survey on *Recording and Play-off Methods*. In view of the recent improvement in colour v.t.r., this was surprising; until, that is, one realises that the major TV networks use v.t.r. for re-transmitting the same programmes three hours later from their West Coast transmitters.

Several other authors put their own points of view forward, backed by technical logic. Commercial considerations however seemed to call for 16mm. and/or 35mm. colour film prints, inasmuch as every TV station has facilities for playing film off. All can cope with black and white, and a growing number are now able to deal with colour. J. Roisen of Ampex Inc. (USA) and Clarence Boice (Visual Electronics, USA) both gave fascinating papers on slow-motion video recording, including the use of magnetic disc equipment. *Tone Reproduction* was dealt with by Dr. G. B. Townsend (Thames Television), referring to tonal values in colour, not sound.

The inevitable rival claims of flying-spot and vidicon (photoconductive) telecine play-off machines each had supporters. H. N. Kozanowski (RCA, USA) naturally spoke strongly in favour of the vidicon type, bearing in mind the difficulties in the USA due to the mains supply being 60c/s. However, N. N. Parker-Smith and D. A. Pay of Marconi referred to the advantages of Plumbicon cameras for use on colour telecine. Engineers from both ITV companies and the ITA itself seemed to favour the flying-spot method for colour, and the excellent results seen on the exhibition stands supported this point of view.

EXHIBITION

There is little space left to refer to the ambitious exhibition of equipment display on 44 stands, the most spectacular being presented by EMI, Rank Taylor Hobson, Marconi, English Electric and RCA. All stands were crowded, even during lecture sessions, particularly Ampex, Hayden Laboratories, Evershed Power Optics, Leevers Rich and Tektronix. After all there were no less than 740 delegates, 163 being from abroad, with large contingents from the USA, Japan and Russia. The wives of many visiting delegates were catered for by organised visits to some of the stately homes of England. The ladies attended the crowded banquet on the Wednesday evening, joining their husbands again on the Friday, which was entirely devoted to visits to studios, equipment factories and film-processing plants. The Officers of the joint technical societies who organised and ran this big-scale Convention must have felt worn out by the end of the week. But their hard work was well worthwhile. ■

fault finding FOCUS

PART 6
VISION DETECTOR

BY S. GEORGE

ON first thought it might seem that vision detector circuitry is the simplest part of a television receiver, being basically a half-wave power rectifier modified to cater for the high frequencies involved. This is of course perfectly true, but the factors which determine component values plus the various ways in which current designs cater for both positively and negatively modulated carriers, provide intercarrier sound take-off points and overload protection on u.h.f. means that the detector stage affords a real insight into modern receiver design and functioning. The thermionic or semiconductor rectifier used in the basic half-wave rectifier circuit should have minimum forward resistance to minimise I^2R losses, maximum reverse insulation or non-conductivity for high efficiency, and an anode-cathode insulation able to safely withstand the peak inverse voltage.

When we come to rectify a high-frequency signal, i.e. the v.h.f. i.f. at 34·65Mc/s or the u.h.f. i.f. at 39·5Mc/s, however, circuit stray-capacitances and the rectifier anode-cathode capacitance become vitally important. We should all be aware that in a video circuit handling up to 3·5Mc/s on v.h.f. and up to 5·5Mc/s on u.h.f. the stray-capacitance across a load resistor whether associated with the detector or the following video pentode is of significance and the value of the load resistor must not exceed a few thousand ohms if we want a reasonably linear frequency response up to these top figures. Typical values for such load resistors are 3·9kΩ on v.h.f. and 2·2 to 3kΩ on u.h.f. This means that as the forward impedance of the valve or semiconductor diode is in series with this load across the last i.f. transformer secondary (see Fig. 22) it must be of low value so that most of the signal will be developed across the load resistor.

With valves low a.c. resistance mainly implies close anode-cathode spacing which in turn means high interelectrode capacitance. This in turn brings further disadvantages for at the high i.f.s involved such capacitance has a small reactance so that on the negative half-cycles when the valve gives zero actual conductance there is a considerable capacitive feed across the electrode spacing resulting in low efficiency. For example the anode-cathode capacitance of an EB91 is close to 3pF and if the stray load capacitance is 6pF as these two capacitors are virtually in series nearly one third of the negative half-cycle will be developed across the load when ideally there should be zero signal.

When two capacitors are in series an applied voltage is distributed across them in inverse proportion, so that by making the valve interelectrode capacitance smaller or the load capacitance greater we can reduce the effect of this unwanted "feedthrough". Clearly we do not wish to greatly increase the load shunt capacitance, although there must be some value present to act as a reservoir capacitor and to filter out the i.f. component of the rectified signal. For this reason miniature diodes of the OA70 type are now almost universally used as vision detectors since their internal capacitance is only about one third that of the EB91/6AL5 type of valve diode. The reverse resistance of such germanium diodes is not nearly so high as that of valves, but in the low-impedance circuits involved this factor is of no real significance.

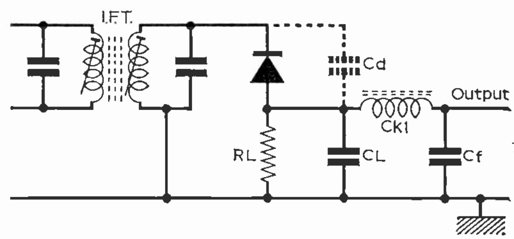


Fig. 22: Basic signal rectifier circuit. For high detection efficiency diode forward resistance must be low compared to R_L and its internal capacitance must be low compared with C_L.

The need for low detector loads therefore demands a rectifier with low forward resistance to avoid undue signal loss during conduction and a low rectifier capacitance to maintain high efficiency and reduce the i.f. carrier component. The frequency of the i.f. carrier compared to the highest modulating frequency also introduces another problem, for this ratio is only 34/3·5 or nearly 9/1 on v.h.f. and 39/5·5 or just over 7/1 on u.h.f., making it difficult to secure adequate i.f. filtering without impairing top-end video response. As a comparison radio receivers with

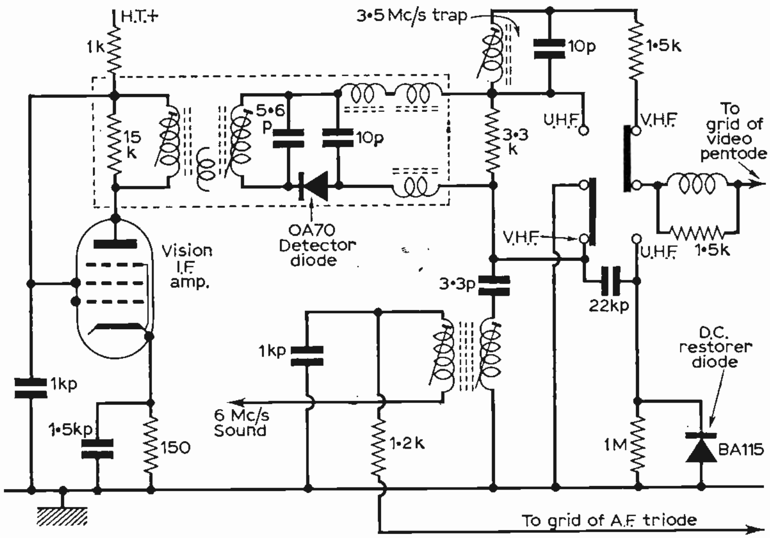


Fig. 23 (left): Typical single diode dual-standard vision detector circuit. This example is taken from the Philips Style 70 series of receivers. The output is direct coupled to the video amplifier grid on v.h.f. On u.h.f. however a.c. coupling is used, with d.c. restoration by the BA115 diode.

an i.f. of 465kc/s and with an assumed audio response of 10kc/s have a carrier to modulation frequency ratio of 46·5/1, making filtering so much easier.

I.F. Filtering

To remove this i.f. component in radio receivers a simple *RC* filter is employed, but in television receivers to maintain efficiency and a good h.f. response a more sophisticated approach is used by including small coils or chokes in the immediate post-detector circuit. These resonate with the stray-capacitances and act as a rejector to the i.f. carrier. In many designs they also resonate with the input capacitance of the video amplifier at the top end of the video range to boost response in a similar manner to the use of peaking coils in the anode circuit of the video valve.

Of course the significance of this stray-capacitance depends on the resistance of the circuit in which it is present. If it was possible to use detector loads much lower than the generally accepted norm of 3-4kΩ the stray-capacitance would have proportionately less effect, but the output efficiency of the circuit would be correspondingly reduced.

Component Values

A further point to be considered is the effect of the value of detector load resistor on the preceding i.f. stage. The lower the resistor ohmmage value the greater the damping imposed and therefore the smaller the stage gain. The choice of component values must always be a compromise between the conflicting requirements of high detector efficiency, adequate i.f. filtering and maintenance of video-frequency response. Furthermore when selecting capacitor values the designer must allow for variations in stray-capacitance from model to model and endeavour to swamp this to some extent so that individual receiver performance is fairly constant. For this reason when replacing components in the vision detector stage it is vital to use exact replacements and to take care not to displace wiring. When components of the order of 2pF, 3·3pF and 5pF are used, as is commonly the case, even small displacements in their position can materially alter the total circuit capacitance and therefore the response of associated tuning coils.

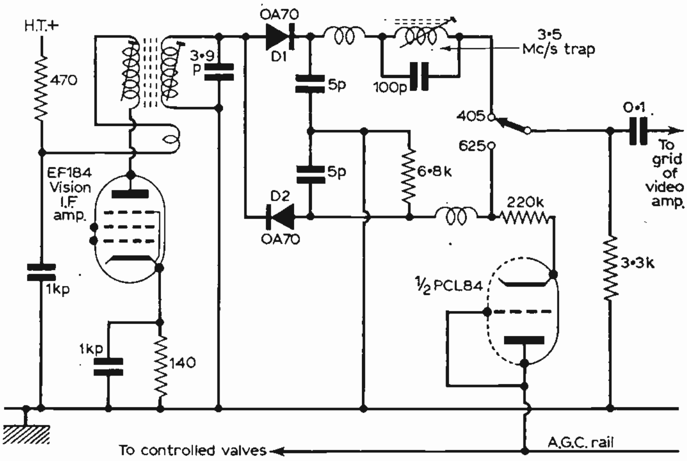
Finally, as the level of signal strength at the detector reaches quite a high figure, 5V being an average value, the whole stage must be well screened to prevent radiation to other sections of the receiver and to prevent the ingress of sound i.f. and other frequencies which could well cause patterning effects. To this end the vision diode is generally mounted inside the last i.f. transformer can, while in older receivers employing an EB91 this valve is always fitted with a screening can.

Time Constants

So far we have regarded the detector load as a resistor shunted by a capacitor of quite low reactance to the frequencies involved, but the combination of these two components and their relative values can also be viewed in terms of their mutual time constant. This should be small enough to permit the detector output to follow the highest video frequencies yet long enough not to follow the i.f. carrier. On v.h.f. with a vision i.f. of 34·65Mc/s the duration of one cycle is approximately 0·03μS while the highest video frequency of 3Mc/s has a one cycle duration of approximately 0·3μS. Thus the time constant of the detector load must be between these two figures, and we can assume an average of 0·1μS.

With the customary series-diode detector circuit however there are really two time constants involved, one when the instantaneous value of the signal is rising and charging the load capacitance via the low forward resistance of the diode, and the other when this capacitor discharges through the much higher load resistor when the applied signal is decreasing. Other factors being equal therefore the leading edge of a sudden increase in carrier strength—towards peak white on v.h.f.—

Fig. 24 (right): Dual-standard vision detector circuit using separate diodes on v.h.f. (D1) and u.h.f. (D2), with a.c. coupling on both standards to the grid of the video output stage. This circuit is found in the Alba T990 series of receivers. The triode section of the PCL84 is diode-connected and used on u.h.f. as an overload diode to supplement the a.g.c. potential.



will be more clearly defined than a following equivalent reduction. However in practice this effect may well be masked by the receiver's overall frequency response so that the detector time constant is always taken to be the product of load resistance and shunting capacitance. Assuming an average load resistor of 5kΩ and total shunt capacitance, strays plus that of the reservoir, of 10pF, the time constant will be:

$$CR = 10 \times 10^{-12} \times 5 \times 10^{3} \times 10^{6}\mu S$$
$$= 0{\cdot}05\mu S.$$

In contrast, the time constant of the v.h.f. sound detector will be very much larger. Taking the Bush TV135R as a typical example, the load resistor is 100kΩ with a shunt capacitor of 47pF. Rounding off the latter value to 50pF to include strays, the combination's time constant will be:

$$CR = 50 \times 10^{-12} \times 500 \times 10^{3} \times 10^{6}\mu S$$
$$= 500\mu S.$$

Clearly the latter could never respond to video frequencies taking no more than 0·03μS for the complete cycle.

Practical Designs

So much then for a broad outline of the main factors involved in detector circuit design; now to see how designers cater for both the negatively and positively modulated transmissions in current dual-standard receivers. There are three possibilities open to the designer and all are used in practice. The first is to employ one vision diode but with circuit switching to take the output from the cathode (positive going) on v.h.f. and from the anode (negative going) on u.h.f. The second is to use two separate diodes with rather simpler switching than with the first approach for selection of the required output on system change. The third possibility is to use one diode with the output whether negative or positive going fed to a video amplifier phase-splitter stage. This latter system is used in recent Pye group transistorised models and also widely in colour receivers.

A typical example of the first approach, as employed in the Philips Style 70 series of models, is shown in Fig. 23. Note that d.c. coupling is maintained to the grid of the video pentode on v.h.f., a.c. coupling d.c. restored by a BA115 diode being used on u.h.f. This means that no change of bias to the valve on system change is required and as the anode is directly coupled to the c.r.t. cathode the d.c. level is virtually maintained throughout the circuit on both v.h.f. and u.h.f. The u.h.f. intercarrier sound signal is tapped from the detector stage instead of the more common technique of taking it from the video amplifier anode circuit. The coupling also feeds bias to the sound i.f. valve from a point in the grid circuit of the triode a.f. amplifier. The various chokes filter out the i.f. content while only two s.p.d.t. sections of the system switch are required.

A two-diode circuit, the second design approach, is shown in Fig. 24 and applies to the Alba T230 series. D1 provides the positive-going output on v.h.f. with D2 providing a negative-going output on u.h.f. The detector load is the 3·3kΩ resistor connected from the switch arm to chassis, but it should be noted that the u.h.f. diode is also loaded with a 6.8kΩ resistor so that on this system the effective load is the reciprocal addition of the two to correspondingly shorten the time constant on u.h.f. to cater for the higher maximum video frequency.

The triode section of the PCL84 is connected as a diode and acts in the same way as the more usual germanium overload diode to augment the a.g.c. voltage during predominantly dark scenes on u.h.f. when the potential developed at the sync separator grid will be low. Dark picture values on u.h.f. represent high carrier amplitudes and although this will result in a high detector output a generally dark scene will have little variation in amplitude and thus a video signal of small a.c. content will be fed to the sync separator to produce a small negative voltage at its grid. During such periods the overload diode conducts and applies the high mean d.c. value of the detector output to the a.g.c. rail. The 220kΩ resistor in series with the valve's cathode serves to isolate the valve's general capacitance from loading the u.h.f. detector circuit, but due to the negligible current flow through the valve has no real effect on the potential applied to the a.g.c. line.

Video Phase Splitter

Probably the most interesting technically and certainly the most recently introduced is the third

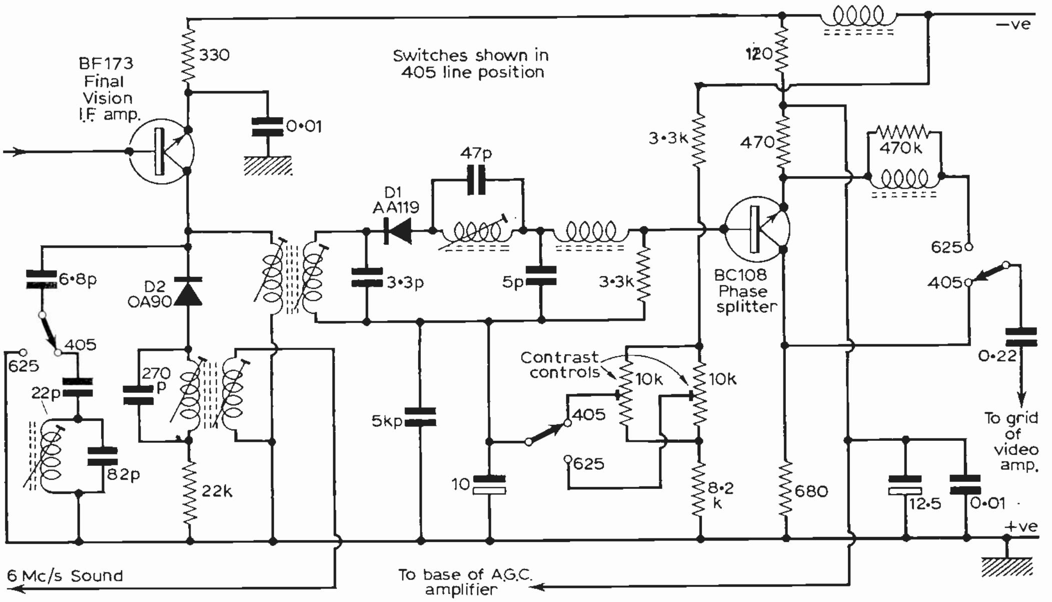


Fig. 25: Single diode (D1) u.h.f./v.h.f. vision detector as used in the Pye group 1967-68 hybrid chassis. A separate detector (D2) is used for the 6Mc/s sound signal on u.h.f. The video phase splitter stage Tr2 provides a positive-going output at its collector on v.h.f. and a negative-going output at its emitter on u.h.f.

approach which employs one vision diode on both systems to feed the base of a transistor phase-splitter. The example shown in Fig. 25 is taken from the Pye 1967 series of receivers. A negative-going output from the diode (D1) anode varies the instantaneous base-emitter potential of the phase-splitter whose standing bias is fixed by the separate v.h.f./u.h.f. preset contrast controls. Transistor output with phase unchanged is taken from the emitter on u.h.f. and with 180° phase change from the collector on v.h.f. via a s.p.d.t. switch and 0.22µF coupling capacitor to the grid of the PFL200 video amplifier.

Since the collector load resistor is 680Ω while the emitter load resistor is 470Ω the amplitude of the v.h.f. signal is relatively higher than that on u.h.f. The emitter of the phase-splitter is also directly connected to the base of an a.g.c. amplifying transistor, not shown in the illustration, so that the current through this and hence the level of a.g.c. control is determined both by the adjustment of the preset contrast controls and the rectified signal strength. The diode load on both systems is 3.3kΩ while a separate OA90 diode (D2) provides the intercarrier sound via an i.f. transformer tuned to 6Mc/s.

A phase-splitter arrangement very similar to the type described is used in several colour receivers but with an additional tuned circuit in the emitter lead both to extract the 4.43Mc/s subcarrier signal for amplification by the chrominance section and to provide negative feedback at this frequency to the luminance signal developed across a resistor in the collector lead. In some receivers this tuned circuit is taken out of circuit during monochrome reception to preserve the full black-and-white signal bandwidth.

Servicing

The detector stage gives little trouble in practice the most prevalent fault being reduction or even complete loss of signal output due to a faulty germanium diode. Although such diodes often went high resistance in older receivers the incidence of such failures is steadily falling so that they are now becoming quite rare. As previously mentioned they are generally mounted inside the last i.f. transformer can, but there is seldom need to remove this or even actually to get at the component to measure its forward/reverse resistance ratio since this can usually be measured by ohmmeter application across the video grid and chassis when the receiver is switched to v.h.f. where direct coupling is generally employed.

When checking in situ remember that while the lowest reading indicated mainly represents the forward resistance of the diode the high reading obtained on reversing the meter leads will be mainly that of the load resistor. It is essential to remove the video valve when making this test if the set has just been switched off, for a surprising degree of conduction can occur across the grid and cathode of a warm valve if ohmmeter polarity is the right way round.

Leads or components shorting to the i.f. transformer can sometimes cause intermittent operation while a dry jointed or open-circuit filter capacitor can cause background patterning. Should strong signals of mainly dark picture content cause loss of sync on u.h.f. the overload diode could be suspect although because of the high resistance of the a.g.c. circuit its forward resistance could materially increase without introducing visual evidence.

TO BE CONTINUED

DX-TV

A MONTHLY FEATURE FOR DX ENTHUSIASTS

by Charles Rafarel

WE should expect at this time the end of the SpE season for the year, but in fact it still seems to be holding on and there have been relatively better openings during late August than I would have been prepared to predict last month. The period under review this month is shorter than usual as we are going away on holiday to the Continent on September 6.

With the certain further if temporary decline of SpE reception until next year I feel that this would be a good moment for all of us to prepare optimistically for the late Autumn Trops by getting receivers, preamps, aerials, etc., overhauled and ready for possible end of the year openings. Really first-class gear with high overall gain will be required. Trop signals are seldom as the high-level bursts of SpE, so may I suggest that we all get well organised!

Here is the log for the shortened period 17/8/68 to 5/9/68:

17/8/68 USSR R1, Poland R1.
18/8/68 USSR R1 and R2, Poland R1 and R2, and Norway E2 and E3.
19/8/68 Poland R1.
21/8/68 USSR R1, Spain E3 and Italy 1A.
27/8/68 USSR R1.
29/8/68 USSR R1, and Italy 1A and 1B.
30/8/68 Sweden E2.
31/8/68 Norway E2 and E3, Sweden E2, Poland R1 and R2.
2/9/68 West Germany E2.

Since the F2 season should theoretically extend for some time yet into the winter and although it has not been as promising as the last one in 1957/58 it is the best that we shall get for some 10 years, so just in case we have in the past been giving lists of possible "exotics" since details of stations outside Europe are rather difficult to obtain. This month we have some information of this nature, thanks to E. Baker of Blyth. As far as I know this will be the first time that these details have been available in the West.

Republic of China TV. Bands I/II, 625 lines, negative modulation, 50 fields/sec.

Channel C1: Vision 49·75Mc/s, sound 56·25Mc/s. Harbin, Sian, Taijun and Nanking.
Channel C2: Vision 57·75Mc/s, sound 64·25Mc/s. Peking, Changchi, Canton and Hangchow.
Channel C3: Vision 77·25Mc/s, sound 83·75Mc/s. Peking and Tiensin.
Channel C4: Vision 93·25Mc/s, sound 99·75Mc/s. Shanghai, Shenyong and Wuhan.

In addition to these regular ones there are a number of experimental transmitters in other towns on the same channels. I am giving this list in spite of possible suggestions that they will never be received: that may be so but I know for a fact that a C1 station was received in Belgium in 1958.

Just in passing C1 = R1 Russian channel, and C3 and C4 = R3 and R5 Russian channels respectively.

We have just heard from F. Dombrowski in the States that SpE over there was in fact better than last year. You lucky people, it only goes to show that SpE is more fickle than ever! There seems no valid reason for the improved conditions across the Atlantic.

R. Bunney notes that the standard Swiss PTT card now carries a contrast wedge across the lower part of the circle.

We have reported before on the reception of Russian space stations located in Siberia. I now give the following list of frequencies for the six channels in use: they are 33·42, 36·50, 37·00, 38·25 and 43·75Mc/s, and are used for two-way voice communication space shots. This is a "forward-scatter" net.

An experience that I myself and other DXers have had, and which can be very misleading, applying in particular to the l.f. end of Band I, channels E2 and R1, is that a steady although rather weak 625 negative-going picture is seen on the screen, and from the type of signal I for one have thought in terms of a Trop signal on E2 from TVE Spain! Alas, further investigation showed that it was a BBC-2 programme. The domestic TV in another room was on this service and on switching it off the E2 signal disappeared, confirming that it was due to re-radiation probably breaking through at i.f. frequency. I hear from a friend in the trade that this has happened from BBC-2 preamplifiers as well, even with no set connected. So be careful: it can fool anyone, even more than once, as I know to my cost!

M. Dalby of Stroud has had the rare one, Bucharest R2. He continues with Swiss E2 and E3, which have been difficult this year, and Denmark E3, which is another missing one for most of us, was received on 18/7/68 and 13/8/68.

A newcomer, Mr. L. Hunter of Eastleigh, made a fine start with France, Belgium, Spain, Portugal, Norway, Sweden, Italy, Poland, Czechoslovakia, USSR, Austria, Hungary and E. Germany, and even Finland. This is nearly all countries in Europe already!

Well done J. Bentley of Huddersfield: Rumania via Bacau Ch. R1 is excellent reception.

A further new correspondent who has made a good beginning is H. Adams of Birmingham. He already has France, W. Germany, Spain, Portugal, Italy, Austria, Hungary, Norway and Switzerland, and his query about an E2 625 positive signal reveals that he has had Belgium as well, so he too has had nearly all Europe too in this poor season.

Servicing TELEVISION Receivers

No. 151 K-B RV20 SERIES
—continued

by L. Lawry-Johns

Field Timebase

V12 PCL82 is the field oscillator-output valve. The usual fault symptoms produced by this stage are: A white line denoting a complete collapse of field operation which should direct attention to the PCL82, continuity of the field output transformer, deflection coils and the thermistors CZ9A (RV10 only—short these out for test). Bottom compression again should direct attention to the PCL82, then to the C88 50μF 25V electrolytic. Check C89 if necessary and also R110. If the bottom of the picture is folded up check the PCL82 and the capacitors C92 and C95.

It has already been mentioned that there are two thermistors in the field output h.t. supply of Model RV10 only. In all other models there are two VA1008 thermistors in the boost line feed to the oscillator (height control) circuit. If there is any doubt about these, shunt them with a 150kΩ resistor, i.e., connect across R148 1MΩ.

Vision Faults

Perhaps the most common fault which occurs in the vision strip is a heater-cathode leak or short in the 6AL5 (EB91) V5. This causes loss of vision signal, a very bright but shaded raster. The brilliance control has little effect or appears to work in reverse, the e.h.t. being overloaded as it is advanced. The PCF80 V6 video amplifier (pentode section) is also inclined to give a little trouble, normally nothing more than loss of emission giving rise to loss of contrast, and in fact can lead one to believe that the tube is failing. The fact that the brilliance can be advanced to show a bright raster is however a pointer that the trouble is more likely to be in the video amplifier or detector diode D1. Sometimes however V6 can develop an internal short which means that a replacement PCF80 may not cure a loss of picture fault since the detector diode D1 is often damaged by the heavy current flow caused by the defective valve. The diode can be checked without taking it out of the L39-L40 coil can by connecting a meter switched to the ohms range on one side to chassis and the other to pin 2 of the PCF80, then reversing the leads. The reading one way should be about 6kΩ and the other practically zero. If a zero reading is obtained both ways the diode is shorted. If a reading of 6kΩ is obtained both ways the diode is open-circuit.

V4 6BW7 is the vision only i.f. amplifier. The valve itself rarely gives trouble but the pin 8 decoupling capacitor C47 may give trouble. This results in a "no signal" condition where the sound is normal but the screen is bright with no picture. Shunting C47 with a good 0.001μF capacitor (pin 8 to chassis) will prove whether this is in fact the cause of the trouble.

V3 (9D7) is the vision-and-sound i.f. amplifier. Not much trouble is to be expected in this stage but we would point out that the equivalent of a 9D7 is an EF85. If an EF80 or 6BW7 is used in this stage some degree of sound-on-vision may be experienced.

Sound Stages

V10 PCL82 is the audio output valve. This can give a little trouble depending upon the fault which develops. It can be responsible for no sound at all, intermittent sound, particularly when tapped, or distorted sound due to it running into grid current. This would result in a positive voltage being present at pin 3 and the pin 2 (cathode) voltage being higher than normal. A leak through C77 would give identical symptoms,

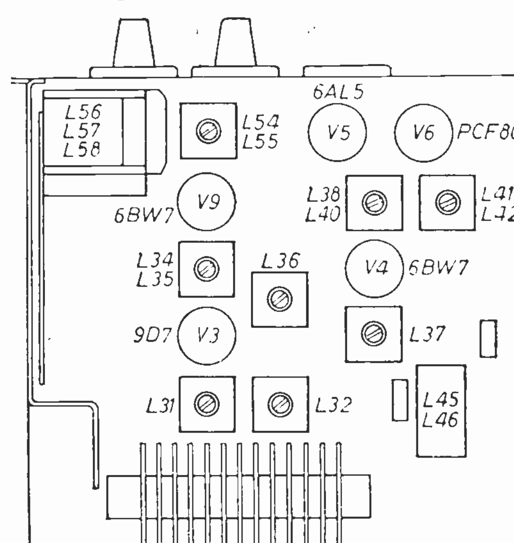


Fig. 2: Above chassis layout of the i.f. stages.

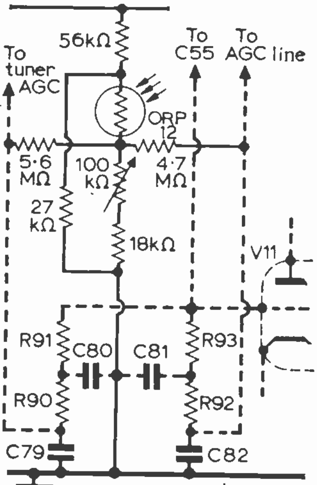


Fig. 3: Modifications to the a.g.c. circuit in Model RV80 which incorporates an ORP12 light-sensitive resistor to provide automatic contrast control.

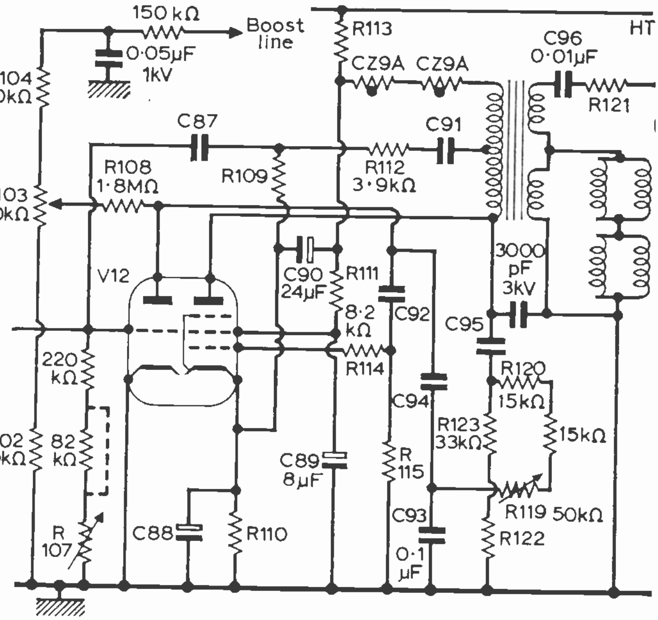


Fig. 4: Modified field timebase used in Model RV10.

however. In the event of weak sound check C75 and C78 as well as V10, also R86.

The noise limiter diode D3 is a GD9. The resistor R81 (10MΩ) can go high causing severe distortion particularly on strong signals. The sound only i.f. amplifier is V9 6BW7 which doesn't give trouble as a rule but which should not be neglected in the event of absent or weak sound when the audio stages are obviously healthy.

Tuner Units

Two types of tuner may be encountered as a rule but early versions may be found with a third. These may have the Plessey-Brayhead turret tuner which follows conventional lines and requires little comment. Oscillator adjustment is through the front and the coil biscuits clip in in one piece. The studs should be regularly cleaned. The main type which is fitted is the Fireball. Again this is so well known that comment is hardly required. To clean the studs on this, remove the cover, undo the 2BA nut and remove the coil disc. Oscillator adjustment is on the PCF80 side. No other adjustments should be made. It is possible to adjust the oscillator

—continued on page 71

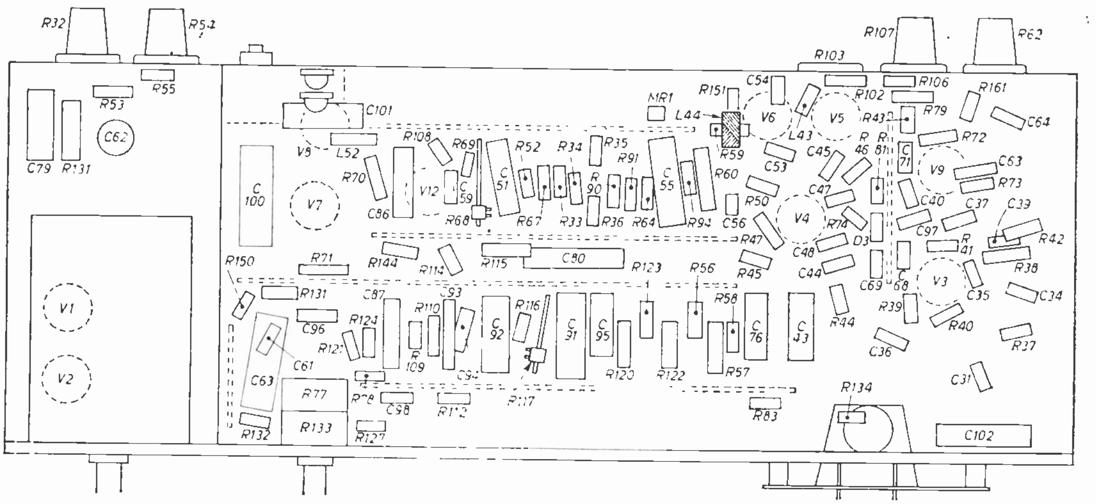


Fig. 5: Underchassis view.

BAND III LOFT AERIAL

R. L. GRAPER

DESIGNED FOR EASY INSTALLATION IN THE LOFT

THIS aerial was made for loft use only and will be found to give excellent signal pick-up due to the large diameter tubing used. The central tubing was $\frac{3}{4}$in. diameter Duralumin and the dipole constructed from $\frac{5}{8}$in. diameter copper tubing. The elements of the array were cut from brass curtain runner sections. It is more suitable of course for use with a receiver having a separate Band III aerial input socket, and is ideally suitable for use with any of the older types of receivers having a preamplifier or converter. The main purpose of this article, however, is to describe the novel form of construction used.

A conventional array of dipole, reflector and four directors is used, the dipole being fixed to the central tubing by a stout block of $\frac{1}{2}$in. plywood, see (1) in Fig. 1. The form of construction is a simple but very rigid one, and a novel feature of the design is the method of fitting the reflector and director elements. These can be folded almost parallel with the central tubing (3) allowing the aerial to be passed easily through the loft aperture after which the elements can be swivelled back to their correct positions at right angles to the central tube. The dipole (2) is fixed but even this could be quite easily dismantled and reassembled in the loft, a spanner being all that is necessary.

The design calls for the use of $\frac{3}{4}$in. Duralumin tubing for the central rod and at least $\frac{5}{8}$in. diameter tubing for the folded dipole to allow the bolt method of fixing. This, however, gives a larger surface area which helps considerably in obtaining greater signal strength, quite an asset in loft aerials. The block (1) is made from $\frac{1}{2}$in. thick plywood and is drilled with five bolt holes A, B, C, D and E. The author used 2BA brass studding, with its appropriate hexagon nuts, cut to fairly liberal lengths ($1\frac{1}{2}$in. long). However, 2BA brass nuts and bolts can be purchased if preferred and these are shown in the drawing.

Forming the dipole

Copper tubing $\frac{5}{8}$in. outside diameter was used for the dipole. It should be cut to a length over twice that of the actual length of the dipole to allow for the folding and the 2in. spacing. With care the bending can be done quite easily using a blowlamp, but the tubing should first be filled with silver sand and plugged at each end. This avoids tube flattening at the bends. Before bringing the two ends of the dipole in line a 3in. length of dowelling should be inserted in one end, the other end then aligned, and the dowelling slipped in, giving a $1\frac{1}{4}$in. insert in each tube. The two holes for connecting bolts, again 2BA, can then be drilled. The dowelling both aligns the tube ends and strengthens the bolt tightening. Bolts A and C pass through the dipole and block while D and E fix the block and central tubing together. The central bolt B electrically connects the centre tubing with the centre point of the folded dipole. The block could be slightly grooved to give a more rigid construction. After a trial assembly the block should be given a good coat of shellac varnish.

Director and reflector fixing

The other five elements of the array, one reflector and four directors, were cut from brass curtain runner section. However, this section can also be obtained in the lighter aluminium. Do not use the plastic variety of course. These five elements cut to the exact lengths are seated against the specially designed aluminium brackets. These are clearly seen in the drawing at (6) and (7) for the first director and reflector respectively. Cut similar brackets for the other three directors. One bolt G passes through element, bracket and centre tubing and is double-nutted to allow the element to swivel to a position almost parallel with the centre tubing. The bolt F is for finally fixing the element at right angles to the centre tubing.

Aerial support

The array shown has two wooden rest blocks, one at each end of the central tubing, fixed by bolts H. As the aerial was constructed for Channel 11 (Anglia) which is horizontally polarised the array must be supported with dipole and elements in a horizontal position. If a vertically polarised signal is to be received then the array must be mounted vertically. The resting blocks would then have to be fixed at right angles to the elements.

The length of the central tubing (3) is dependent upon the existing joists or rafters in the

Table 1: Element dimensions in inches

Channel	*A*	*B*	*C*	*D*	*a*	*b*
6	33	$31\frac{1}{2}$	$29\frac{1}{2}$	29	17	$8\frac{3}{4}$
7	$32\frac{1}{2}$	30	$28\frac{1}{2}$	28	$16\frac{1}{2}$	$8\frac{1}{2}$
8	32	$29\frac{1}{2}$	$27\frac{1}{2}$	27	$16\frac{1}{2}$	$8\frac{1}{4}$
9	$31\frac{1}{2}$	29	$26\frac{1}{2}$	26	16	8
10	$29\frac{1}{2}$	28	26	$25\frac{1}{2}$	$15\frac{1}{2}$	$7\frac{3}{4}$
11	29	$27\frac{1}{2}$	25	$24\frac{1}{2}$	15	$7\frac{1}{2}$
12	$28\frac{1}{2}$	27	$24\frac{1}{2}$	24	$14\frac{1}{2}$	$7\frac{1}{2}$
13	28	$26\frac{1}{2}$	24	$23\frac{1}{2}$	$14\frac{1}{4}$	$7\frac{1}{4}$

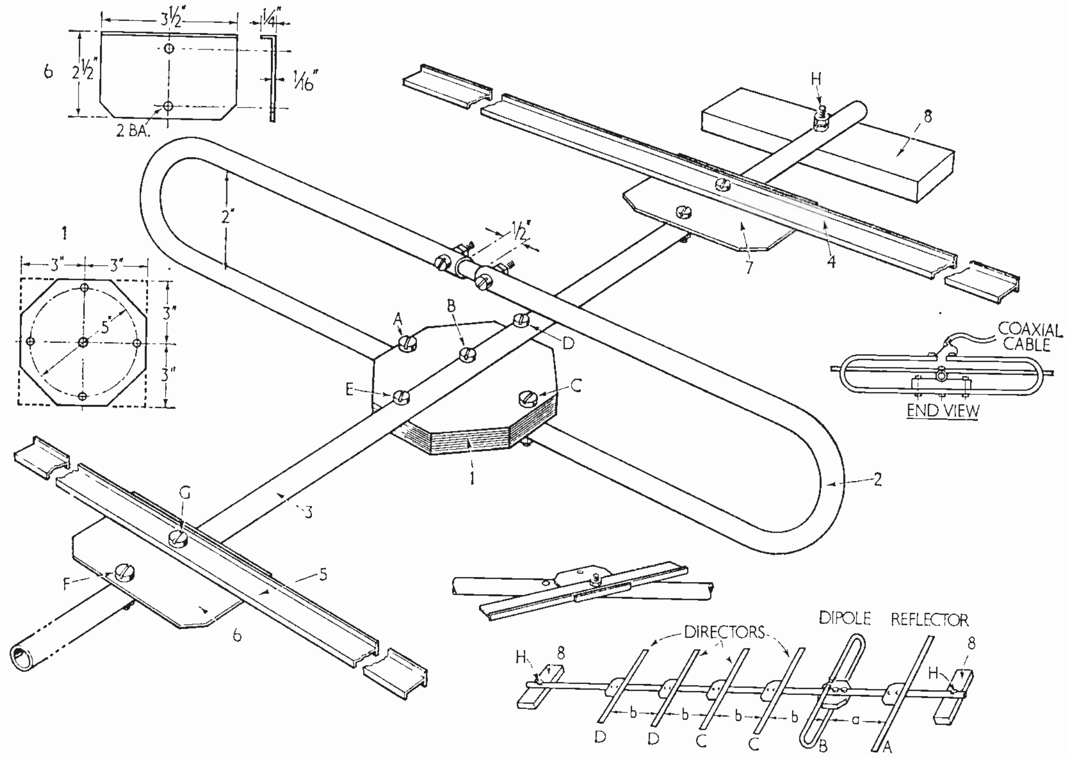


Fig. 1: Full constructional details of the Band III loft aerial.

roof area. Any supporting blocks, pedestals, or the like used to rest the array upon should of course be rested themselves upon joists or rafters and not on the lathes between them.

Whilst the aerial was made for separate connection to the aerial socket of the receiver there is no reason why it could not be incorporated with the BBC-1 aerial using a junction box or switching device. Many factors are involved and this is a matter for individual experiment. ■

SERVICING TV RECEIVERS

—continued from page 69

coil through the bottom of the cabinet grille with a fine trimming tool.

The RV80 has a push-button or pressmatic tuner which gives a selection of two Band I and two Band III channels. The on/off switch is interlocked so that the receiver is switched on when any one of the keys is depressed. The tuner contains four coils any one of which is lifted into contact when the appropriate button is selected. Spare coils for alternative channels should be found in a small bag on the rear chassis strut. Fine tuning is by separate adjustments for each key. Access is from the front when the panel above the keys is removed. Oscillator adjustment is through a hole in the selector when the key is down. Inability to tune in the required signal may be due to a faulty PCF86. No signals can be due to a faulty PCF86 or PCC89 whilst weak and noisy signals particularly on Band III are usually due to a failing PCC89.

Power Supplies

The 750mA delay fuse is in the h.t. supply line only, from R141 on the dropper to the metal rectifier. There is no fuse in the heater circuit.

No Valves Lighting

Check mains supply to dropper, trace along dropper sections R138, R136, then R153. If these points are alive check heater chain, particularly the PY83 and the 6AL5.

Some Valves Lighting Brightly

If some valves light up brighter than normal but others do not light at all check final valve in chain which is lighting for heater-cathode shorts.

Valves Lighting, No Other Supply

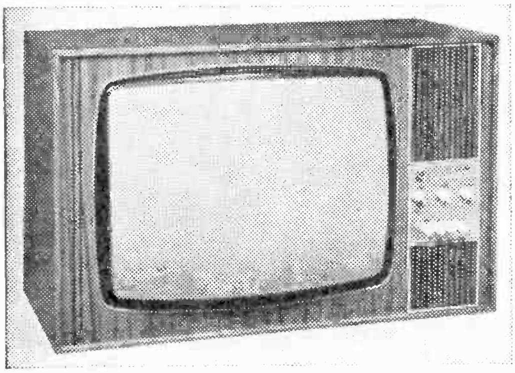
Check h.t. supply to rectifier and suspect fuse or R141. Check R139 and R140 if necessary.

NEXT MONTH: PHILIPS 9158A SERIES

TV AT THE

THIS year's trade shows were held at various London hotels during the period 25th to 29th August. The exhibitions were extremely well attended by dealers, some manufacturers selling all their next few months' production. Colour TV was an attraction, but there seemed less interest than there was last year, in spite of the increased availability of the colour service.

The trade-only shows provide all that the average retailer requires in the way of information on new products. However, it seems to us that the manufacturers have missed a valuable opportunity. 1968 is the year in which colour TV has really caught the imagination and interest of the public, and not to stage a public national exhibition to exploit the situation seems a short-sighted policy.



The first UK single-standard colour receiver was shown by Philips—their model 511 *above.*

A national exhibition would have provided first-class demonstrations of colour TV, thus offsetting the effect of the poor showing most dealers have given to colour. Very few of the public have seen a good demonstration of colour—all too often sets are demonstrated in shop windows with too great a level of ambient light and with too much colour in the picture, caused by too high setting of the saturation control.

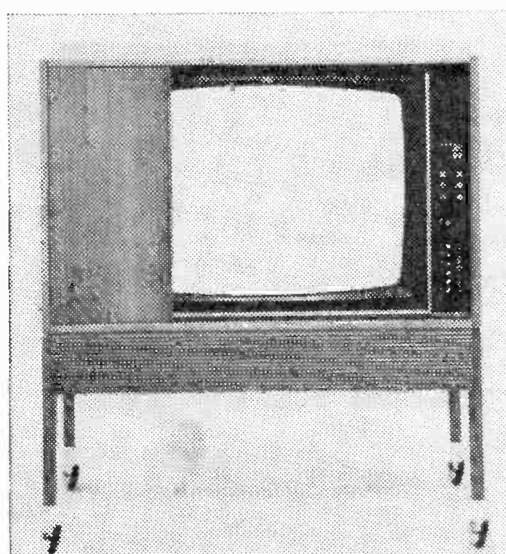
This contempt for the public—for that is what it amounts to—means that prejudice against colour TV is created. Add to this prejudice the high price of colour sets and one can understand why most of the sets being sold are acquired as status symbols. Perhaps when all the well-off have a colour set the makers and retailers will be forced into giving better demonstrations of colour TV.

Another factor must be the shortage of colour receivers—order books are full for some considerable time ahead. This seller's market means that makers and retailers can move sets very quickly without much effort. However, the current easy time will quite possibly be paid for later.

It is also rather unfortunate that right from the start BBC-2 got the reputation of being a highbrow service of interest to few people. There might have been a grain of truth in this supposition at the beginning, but it is certainly not true now, although many people still believe it. No attempt seems to have been made to enhance the image of BBC-2, and this state of affairs is another reason for sales resistance to colour sets. When ITV is available in colour, no doubt demand for sets will rapidly increase.

Colour Quality

The general public seem to think that the quality of colour reception is poor, having formed this impression from the demonstrations in retailers' windows. In case any reader has any doubt, let it be said here that with a correctly adjusted receiver viewed under optimum conditions the quality of colour TV is excellent. Of course, when films are transmitted the final results



A number of technical innovations are incorporated in the Bang and Olufsen Beovision 3000 *colour receiver.*

SHOWS

are determined by the quality of the film, and in many cases this is none too good. However, when live transmissions are seen, the quality and clarity of the pictures are amazing and make film colour seem primitive.

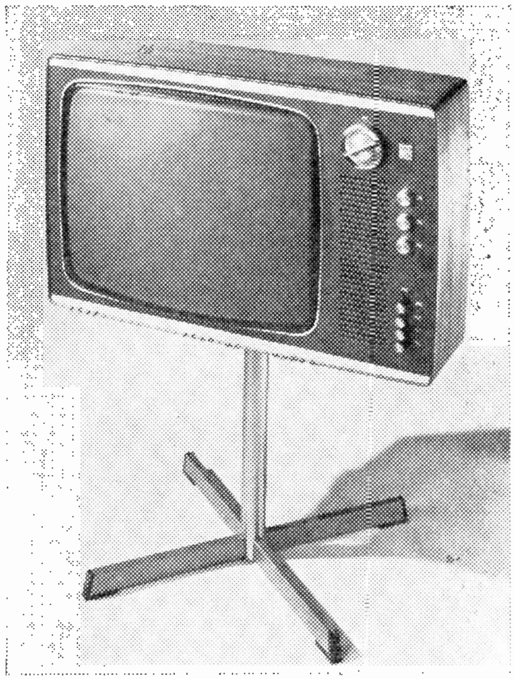
Current Trends

Colour TV sets started off with 25in. c.r.t.s, then went to 19in. and now seem to be heading for 22in. The new 22in. c.r.t. has an aspect ratio of 4 : 3 instead of the old 5 : 4, and has a squarer appearance giving a much more pleasing aspect to the sets. We had hoped to publish technical details of the new tubes but unfortunately the manufacturers refused to supply technical information even though sets using the new tube are in current production.

Black-and-white c.r.t.s of the new type are also being used in current receivers. These tubes are generally of the 20in. size.

The Norwegian firm of Radionette showed the Kurer Planar 11in. transistorised dual-standard monochrome portable (imported by Denham and Morley). This model, priced at 79 gns., may be powered from 220V-240V a.c. mains or a 12V battery (an adaptor enables the set to work from a 24V battery). The size of the set is 13½in. × 10in. × 11in.

H.M.V. introduced a 20in. black-and-white TV using the new type of c.r.t. The cabinet is veneered in walnut and has rounded corners. This model (2649) is to retail at £79.



The H.M.V. Model 2649, featuring the new square screen Mazda 20 in. picture tube.

In the Ultra range were two colour TV sets using the Thorn transistorised chassis. The 19in. model 6701 has a recommended price of £308 2s. and is finished in teak like the 25in. model 6702 which is priced at £362 18s.

The Bush CTV174D and Murphy CV2210D are 22in. colour receivers retailing at 299gns. Both of these models feature an integrated circuit used in the chrominance section to provide red, green, and blue drives to the c.r.t. which thus plays no part in the matrixing circuit (in most sets to date the luminance signal is fed to the cathodes of the tube and the colour-difference signals are fed to the grids, the c.r.t. thus providing the final matrixing to give red, green and blue at the screen of the tube).

Bush also showed a dual-standard 23in. consolette (TV178) receiver priced at 92gns.

Murphy had a number of brightly coloured black-and-white sets. They are produced in a variety of designs ranging from abstracts to pop art. The first receiver to be available in quantity has its cabinet painted in a leafy pattern in shades of red, brown, orange and yellow on a white background. Another set in the range has the names of television programmes painted in red and blue letters on the cabinet. These receivers have 23in. tubes and will retail at 100gns.

ITT KB showed two monochrome receivers with the new 20in. square tube. The KV027 priced at 76½gns. is veneered in teak and the RV227 at the same price is finished in sapele.

Also unveiled by ITT KB was their 19in. colour receiver, model CK400 (see this month's Teletopics). This has a number of interesting features including automatic tint correction so that monochrome pictures are given the blueness characteristic of black-and-white picture tubes while the picture is automatically restored to the correct white (illuminant C) when colour programmes are viewed. The decoder board in the receiver may be unplugged or removed and the receiver will still operate in monochrome. The convergence controls are accessible from the front (after removal of a panel) to facilitate their adjustment.

All receivers in the KB range, including the colour set, are hand-wired, a feature much publicised by KB.

A colour 25in. receiver is now available under the Masteradio brand name (G.E.C. group). This model is of the console type, finished in teak, and uses 34 transistors, 11 valves, and 42 diodes.

From G.E.C. came four new models, two 19in. and two 23in. The 2038 19in. set is finished in teak like the 2039 23in. receiver, and the 2032 19in. set is in walnut paldao, as is the 23in. 2033. Similar models from Sobell were the 1038, 1039, 1032 and 1033. As in all G.E.C. and Sobell TV sets, the chassis slides clear of the cabinet for easy servicing while remaining in circuit.

New colour TV sets from Decca were the CTV25/CE and the CTV22/C. The former set is a 25in. model available in teak finish at 342gns. and in walnut at 345gns. The CTV22/C uses the new 22in. square c.r.t. and is available in teak at 325 gns., in walnut at 329 gns. and in rosewood at 339gns.

Two new black-and-white sets from Decca were the 23in. DR23 finished in walnut and priced at 84gns., and the 20in. DR20 also in walnut at 79gns., the latter set using the 20in. square tube.

The Pye group showed the new Ferranti 19in. colour set model CT1167, priced at £299. Also introduced were two 20in. monochrome sets, the Pye 63 and the Ferranti 1176, both priced at £83. The Pye 64 23in. black-and-white set was also shown: this model is available in four cabinet colours—white, red, brown, or black. The price is £83.

In our report of last year's shows we forecast the introduction of single-standard colour receivers. This year Philips gave a preview of their 22in. single-standard colour set model 511 which is to be released next spring. Philips expect that prices for single-standard sets will be about 10% less than their dual-standard predecessors.

A new Philips dual-standard 22in. colour set will also be released next year (model 503).

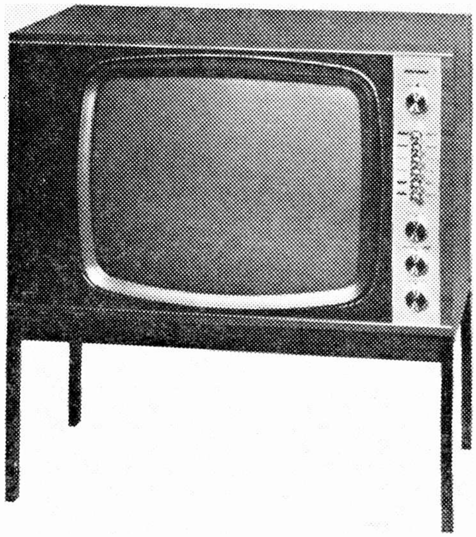
Philips also showed the black-and-white model 0230 with the new 20in. c.r.t. This set too will be available next year. New this autumn are models 9212 (19in.) and 3212 (23in.) which are electrically similar to their predecessors 9210 and 3210, differing only in appearance.

The Stella 20in. monochrome receiver for release next year is model ST2030.

A single-standard colour set was exhibited by Bang and Olufsen. This set, the Beovision 3000, covers Bands IV and V on the 625-line standard and is not suitable for 405-line programmes (although we understand that it covers Bands I and III on the Continental standard). The set has a 25in. c.r.t. and uses 14 valves, 52 transistors and 52 diodes. It retails at 398gns.

From Teleton Electro came a mains/battery 12in. portable. This dual-standard set, model SWP3000, has a power consumption of 30W at 240V a.c. and 13W at 12V d.c. It uses 33 transistors and 20 diodes and weighs 16½ lb. The retail price is £79 13s. 7d.

In the field of test equipment, Decca were showing the impressive Körting colour TV service generator model 82512. Priced at about £200, this unit provides eight video signals: an eight-step grey scale; six colour bars in the standard colours; B-Y component signal; R-Y component signal; vertical lines; horizontal lines; crosshatch; and dot pattern. The generator works on the PAL or NTSC system as required, and gives r.f. output signals which can be tuned over Bands IV and V.



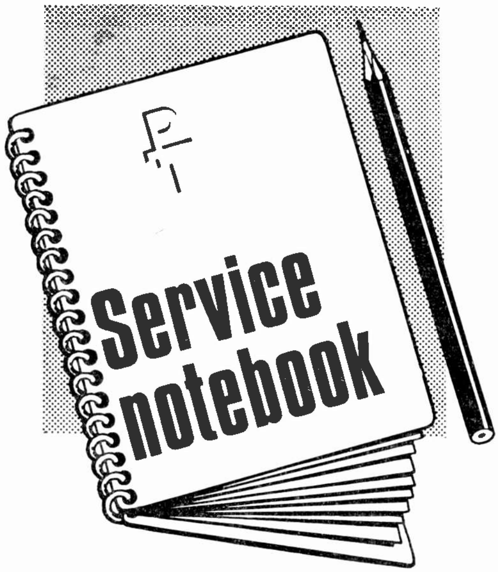
The 22 in. Murphy colour receiver model CV2210D features an integrated circuit for signal processing in the decoder, providing R, G, B drive outputs.

Antiference were showing their new u.h.f. aerials which combine their Trumatch feature and the Belling-Lee shaped dipole. This new range, entitled Trucolour, replaces all existing u.h.f. aerials from the two brands. Antiference are also making log-periodic Band III arrays—these have wide bandwidth and will be of particular benefit to those viewers receiving BBC-1 *and* ITV on Band III.

J Beam exhibited their comprehensive range of TV aerials including the Parabeam u.h.f. series which is claimed to give increased power gain over similarly sized standard arrays. Technical details of the thinking behind the aerials are contained in a leaflet available from J Beam Aerials.

Forecasts

In our report of last year's shows we included a few predictions. This is a more difficult undertaking this year but we have a suspicion that manufacturers will soon have to modify the circuitry of colour receivers in order to bring down prices. If this is carried out by the introduction of integrated circuits, picture quality and standards in general will probably improve even though prices fall. However it is possible that simplification and compromise will prove the only methods of reducing price and that the picture quality will deteriorate as a result. We hope that of the two alternatives the former occurs. ■



by G. R. WILDING

YOU can expect almost anything to be wrong when investigating faults in a set that has received previous but unsuccessful service attention. The owner of a Ferguson 21-in. model said her set had gone completely off but a friend had managed to restore sound only and thought that the line output transformer was faulty—could I attend to it?

On test although sound was present it was not at normal volume and the general tone and faintness of clicks when the tuner was rotated suggested that the h.t. might be low. Accordingly we immediately replaced the PY33 but only obtained marginal improvement. The main trouble, however, was lack of raster so we removed the e.h.t. protective can. There was no suggestion of a spark at the PL81 line output valve anode and no audible line whistle, but we found that the top cap of this valve was loose and not making electrical contact with the lead-out wire.

We fitted a replacement valve but there was still no line whistle. We then noticed that the ECC82 line generator was failing to warm up, obviously due to a short-circuit across the heater. A replacement restored line whistle and enabled us to draw a small spark from the PL81 anode and a rather larger but not normal size spark from the EY86 anode. As the latter spark was much greater than that obtainable at the PL81 anode it was fair to assume that the transformer was in order and that the insufficient spark size was due to reduced drive to the PL81 grid. However, this valve was running cooler than usual so that this idea could be discounted.

Inadequate screen voltage then seemed the most likely probability and on testing we found it to be rather less than 150V while the h.t. rail voltage was about 155V. As the PY33 had been replaced and was also running cooler than normal we thought it best to check the value of the new surge limiter which had apparently been fitted after the set had gone completely off. To our surprise we found it to be 1,000Ω and on replacing it with a 50Ω type normal h.t. voltage was restored with a full-size raster!

Faulty Tuner Valves

By and large we change many more r.f. amplifiers than frequency-changers. The ratio must be at least 3 : 1, for low contrast, grainy pictures are almost always due to a low-emission r.f. valve and although an ageing mixer will reduce the overall gain they rarely do so to the same extent as r.f. amplifiers and generally introduce little extra grain.

The most common indication of a defective mixer is that the sound and vision suddenly bursts into life after the raster has appeared, due to the failure of the oscillator section to operate till it has reached a good working temperature. Normally sound should be present and increase gradually well before the raster appears since the mixer reaches working temperature well before the boost rectifier which due to its high heater/cathode insulation takes about 50 seconds longer than all other valve types to fully warm up.

Recently we were servicing a dual-standard Ferguson receiver and found that on v.h.f. the raster always appeared before sound and vision broke through, and we were not unduly surprised when the owner said that between 5 and 6.30 p.m, the set often failed to work at all. Obviously the slight mains voltage reduction during this time was sufficient to prevent the mixer valve oscillating. The mixer in this model was quite a rare type, a PCF805 or 30C18, and on replacing it we found that sound always gradually developed to maximum before the raster while there was a slight increase in overall picture contrast.

The gain of a mixer, or its conversion conductance, does not directly increase with increased local oscillation amplitude but peaks at quite a low figure and is dependent on several factors. With any particular mixer valve designers aim at producing optimum oscillator amplitude over the tuner range by the degree of coil coupling, anode voltage and by choice of grid capacitor/grid leak values.

Flywheel Sync Discriminator Faults

Most modern receivers now have flywheel line sync circuits and although they generally prove very reliable in practice whenever the standard of locking becomes impaired always first check the dual discriminator diodes where fitted. In most instances it will be found that one or both has a high forward resistance, and on replacement results will become standard again.

Sometimes defective diodes merely cause the line lock position to be "edgy", or may require the line hold control to be constantly adjusted during the course of an evening, but occasionally, as in an H.M.V. 12 in. portable we had in for service recently, it can produce an unusual sideways oscillation in which the picture appears to move for a fraction of an inch each way at a slow frequency. In many Bush, Murphy and Alba models, however, a.f.c. diode failure can result in complete absence of or intermittent line oscillation. We came across one recently which commenced to operate normally for a few minutes then stopped oscillating to result in the PL36 line output pentode runing red hot due to lack of grid drive. After changing all valves in the line circuit we subsequently found on ohm-testing the twin diodes that they were virtually open-circuit, and replacement completely restored normal results.

Various types of diode are used as a.f.c. discriminators, although in emergency on outside work we usually find that almost any miniature diode will suffice for this purpose if exact replacements are not to hand. Sometimes the two diodes are encapsulated in one container while in other models they may be connected back-to-back as one unit with the commoned elements sharing a centre lead out wire. Again if the exact replacement is not to hand we use two similar type diodes connected together.

When fitting such diodes care must be taken to ensure that they are connected the right way round. When in doubt ohm-test the faulty diode on a high-resistance meter range in both directions and, having found the lower forward polarity, no matter how little less this is than the reverse polarity, connect the replacement in similar manner. Sometimes it may be virtually impossible to detect any difference in the forward and reverse resistance, and in such cases if the service manual is not available the best move is to lightly solder the replacements in and note effects. If put in the wrong way round line locking can be completely ineffective or the picture may lock but have the raster split vertically with a dark sync pulse band separating the two sections. This latter fault, as can be imagined, could lead to a great deal of work and thought if tackled in a prior attempt to rectify a line fault. The R.T.E.B. in their Servicing Examinations place component defects in normal commercial receivers. I only hope for the sake of the candidates that they never think of this one!

Unstable Tuner

A fairly modern H.M.V. receiver was brought into the workshop recently with the complaint that the tuner was making very poor contact. Cleaning tuner contacts is one of our most regular service jobs but this particular one was especially bad while we noticed that the picture intermittently seemed to "blurr away" in a similar manner to that produced by an intermittent heater/cathode short in a tube. So it appeared that we could have a defective c.r.t. or a video fault in addition to the badly contacting tuner.

The latter was so bad, however, that it made any sort of diagnosis difficult so we first removed the chassis to clean both moving and fixed contacts. On testing we then found that the picture intermittency depended on fine tuner setting. When it was peaked for optimum gain the picture was fair but when the fine tuner was at either extreme vision was intolerable.

We replaced both tuner valves but the fault persisted and it became obvious that a decoupling capacitor was open-circuit or dry-jointed. The most logical suspect was a 1,000pF capacitor decoupling the screen of the mixer pentode section, and on replacing it results became normal. It seemed in retrospect that vision was fair when the fine tuner was at maximum because then a.g.c. would be at maximum to reduce the valve's gain and thereby reduce the tendency towards instability.

Field Fault

We had a 19-in. Pye receiver for overhaul recently that had suddenly developed a raster which only covered the top three-quarters of the screen, and, after a brief period of running, the raster further contracted to cover little more than the top half. The PCL85 field timebase valve was running excessively hot but a replacement produced little improvement and also began to get unduly hot so that it was obvious that we had a component defect.

On removing the chassis for voltage tests we found that the voltage on the grid of the pentode section of the PCL85 equalled the voltage on the triode section anode, due to a dead short-circuit in the 0.03 μF coupling capacitor. We have sometimes found leaks in these capacitors but this was the first time we had found a complete short-circuit. As expected we found that due to the extremely heavy pentode anode current the cathode bias resistor was badly charred and much lower than its correct value. On replacing this resistor, the coupling capacitor and the PCL85 we again obtained a normal raster.

TO BE CONTINUED

CONVERGENCE ADJUSTMENTS

—continued from page 60

adjusted it correctly on, say, a 625-line pattern you may find that it is slightly out on 405 lines. Obviously if you readjust it on 405 you will merely be transferring the error to 625-line operation instead. Some receivers have extra potentiometer controls to overcome this problem but in most cases it will be necessary to settle on a compromise. In difficult cases the 625-line picture should have precedence because most viewers will be watching many more 625-line colour programmes than 405-line monochrome ones.

Here is a final convergence tip that may come in useful. On a small proportion of receivers the static convergence changes from time to time for no apparent reason. You adjust it carefully on one occasion and next time you switch on it is different. There is no point in readjusting it every time because you simply cannot win. The trouble is caused by an electrostatic charge which builds up on the inside of the neck of the c.r.t. and as this charge varies so does the convergence. The way to overcome the problem is to adjust the static convergence only when the receiver has been switched on for at least ten minutes. If you have to switch off for some reason, wait at least 3-5 minutes before making any static adjustments. It may also be possible to stabilise the charge on the tube neck by switching several times between 405- and 625-line operation. Fortunately this problem seems to disappear after the receiver has been in daily use for a week or two.

TO BE CONTINUED

Book Review

TV VIDEO AND SOUND CIRCUITS
By Thomas M. Adams. Published by W. Foulsham & Co. Ltd. 158 pages. 8½ x 5½in. Price 25s.
TV SYNC AND DEFLECTION CIRCUITS
By Thomas M. Adams. 160 pages. Other details as above.

IT is impossible to consider these two books separately; they are part of a series under the general heading of *Electronic Circuit Action Series*, which includes books on transistor circuits, detector and rectifier circuits, and, of course, radio circuits. But this pair knit together quite effectively. The technique of "action" circuit or "circuit action", call it what you will, is certainly different and with a little assiduity helps the student to follow those confusing current paths that occur in high frequency circuits in complicated equipment.

The author asserts that any circuit can be understood with the minimum background of mathematical terminology or even technical experience by studying the electron currents. That may be true of valve circuits, and probably accounts for the absolute neglect of transistor receiver circuits that sadly dates these two books. We feel Mr. Adams may have been on less secure ground had his multi-coloured diagrams been used to illustrate solid-state television sets. Older hands will know the frustration of having to "unlearn" valve technology and assimilate "holes" and impedance matching rather than pure current flow.

Although a further restriction on the usefulness of these books is their treatment of transatlantic designs, yet from the aspect of TV principles we may regard some of the common ground covered here as a form of easy introduction. It is no more and like transistors *colour television gets not even a mention in either book*. In the "receiver" volume after a chapter on the signal (American style) there follow four chapters on the principal sections, r.f. amplifiers, mixers and oscillators (curiously flat to re-read in these days of transistorised tuners!), i.f. amplifiers and video stages. Then comes Chapter 6 which deals with TV sound systems using gated-beam and locked-oscillator-quadrature-grid detectors. This chapter and the next, dealing with ratio detectors and discriminators, are both worthy of study.

Similarly the book on Deflection Circuits merits some attention if only for the detailed look at sync separation and noise limiting, automatic frequency control circuits and the operation of reactance valve (sorry *tube*) circuits. At what is for present days a fairly modest price one cannot wholly discount the value of Mr. Adams' easily digested lessons.

However despite a fresh approach, a good style, no slipshod errors and a modest price we must give this pair from Foulsham & Co. a thumbs down sign. There are so many good books on the subject, not least from our homegrown authors, that any import which ignores techniques by no means novel and contrives to make even the standard techniques seem old-fashioned has to fail by comparison.—H.W.H.

THE PRACTICAL TV VALVE TESTER

PART 3

MARTIN L. MICHAELIS, M.A.

IT REMAINS to draw attention to further points of detail. The h.t. voltage control potentiometers VR2 and VR5 are not connected between the output voltage and chassis as in the basic circuit but between these points via preset limiting resistance networks on either side. The preset potentiometers are aligned so that the manual controls just cover the range of stabilised output voltages for each circuit without encroaching into the high and low voltage regions in which stabilisation is lost. Figs. 6 and 7 show the ripple and voltage stabilisation characteristics for the two circuits and also state the alignment procedure for the limit presets.

Resistors R11, R19, R24, R26, R10 and R25 damp any chance v.h.f. resonant circuits which may be constituted by the wiring and stray capacitances. These could otherwise lead to parasitic oscillation. It is very important to wire these resistors close to the respective grid pins. The three zener diodes D11, D12, D13 restrict the source voltage for V1 to the maximum rating of 300V with respect to V1 cathode. This restricts the maximum stabilised output voltage to about 300V but improves the stabilisation factor since V1 is now operated from a prestabilised source voltage.

R38 provides a minimum load current through V3 when the output is open-circuit to maintain stabilisation even for very small output currents. The same function for V2 is fulfilled by V4 and R9. R5, R12 and R13 are safety discharge resistors to prevent retention of charge on the electrolytics when the unit is switched off. R29 and R30 ensure that the d.c. resistance between the heater and cathode of a valve on test is never more than 22kΩ. This is the normally permitted maximum value. Larger values or a floating heater would lead to uncontrollable capacitive or ionic potentials between heater and cathode which may destroy the insulation. R29 and R30 do not restrict the permissible connections of T2 secondaries for obtaining the various heater voltages because these connections can never do more than place R29 and R30 across certain parts of the windings: the additional current drain of a few mA is quite negligible.

If a 3Ω 10mA meter is unobtainable any other 10mA meter with a resistance not exceeding 50Ω is satisfactory. If a meter movement of higher sensitivity is to be used shunt it accordingly. In every case choose R37 so that the total resistance for 10mA f.s.d. sensitivity is exactly 50Ω. Select a ±1% resistor for R35 and obtain the correct value for R36 to within ±1% by selecting a 10Ω and a 6.8Ω resistor for connection in series.

If a 220V neon pilot is to be used for LP1 connect it straight across R3 and omit R4, R8. Make sure that the neon pilot contains a limiting resistor built into the cap: otherwise include a 1MΩ ½W resistor in series with the lamp. All power zener diodes should be rated for at least 750mW dissipation or any larger value. In other words the product of zener voltage and maximum permissible zener current in mA at 45°C ambient temperature should be at least 750mW. This product should be at least 75mW for the miniature zener diode D10.

NEGATIVE BIAS CIRCUIT

D3, D4 form a full-wave rectifier circuit producing a negative raw d.c. voltage across the reservoir capacitor C3. Zener diodes D15 and D16 prestabilise this supply to −150V. R31 and the zener diode D17 effect the final stabilisation to −100V. This two-stage stabilisation is necessary to make the final bias voltage quite independent of the mains and h.t. load fluctuations reflected back through the mains transformer and R9.

The preset potentiometer VR7 is aligned so that the voltage across the track of VR9 is exactly 50V with VR8 turned to zero resistance. Now connect a valve voltmeter (input impedance at least 10MΩ) to P4, turn VR9 slider to the end of the track connected to VR8, and then calibrate the linear potentiometer VR8 for zero to −4V

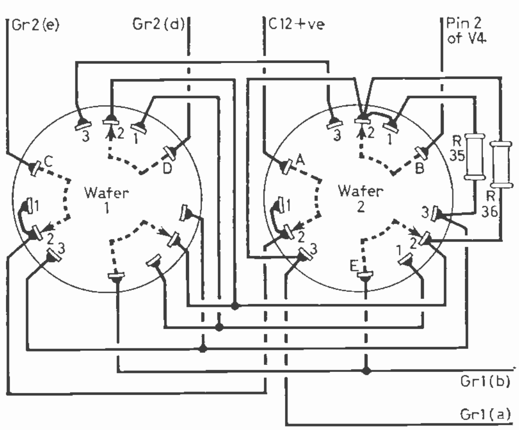


Fig. 5: Wiring of the meter switch S2. The contact wipers of the switch must be narrow so that make-before-break operation is ensured. A 3-way, 6-pole switch is used: connect the sixth pole in parallel with section E to reduce variable contact resistance in the meter shunting circuit.

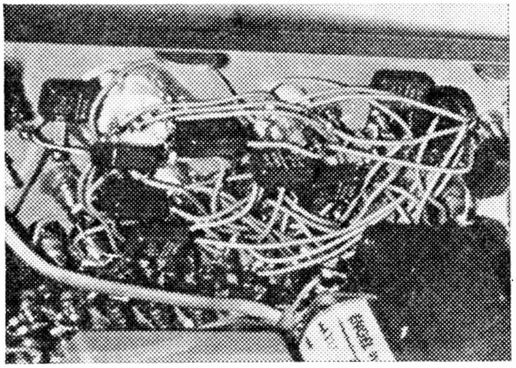
output readings on the valve voltmeter. This will cover almost the entire track of VR8. Ignore the rest. Now return VR8 to the zero resistance setting and calibrate the logarithmic potentiometer VR9 for zero to −5V output readings on the valve voltmeter. These should cover at least half the track of VR9. If they all lie in an unresolvable point at one end of the track the latter is connected the wrong way round. Reverse it and start again. Finally calibrate the rest of the track of VR9 against a separate scale arc reading −10V to −50V.

The two potentiometer settings are directly additive for all small bias voltages up to −9V. Variations for slope measurements can be made directly against the scales which possess sufficient resolution in this range.

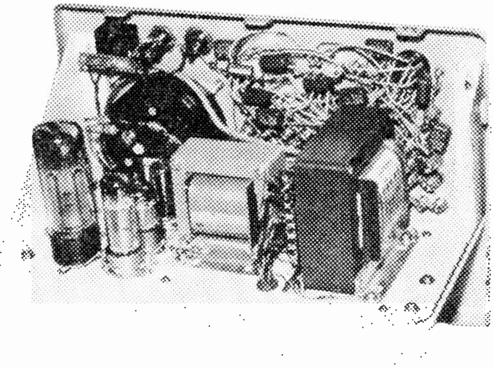
Bias voltages of −10V or greater should be set with the logarithmic control VR9 alone, with VR8 set to zero resistance. Slope readings are then taken by increasing the bias voltage through exactly 1V with VR8 and noting the resulting drop of anode current. The settings of the two potentiometers are no longer strictly additive here so that VR8 must be provided with a further inner scale arc as shown in Fig. 8. The range between 1V and 2V on the main outer scale is divided linearly from zero to 50. To increase the bias by exactly 1V for any setting of VR9 in the 10 to 50V arc turn up VR8 from zero on its outer scale (left-hand stop) to the corresponding point on the inner scale arc.

THE TEST PANEL

Any six or more valveholder types can be mounted on the front panel for the valves which the constructor may wish to test. Three rows of ten insulated wanderplug sockets each are mounted below these valveholders as shown in Figs. 3 and 8. Each row is numbered one to ten and the sockets in the top row are looped with the shortest possible lengths of connecting wire to the respective pins on all valveholders which carry the same number in the international valve base coding. Each socket in the top row is strapped to the corresponding one in the second row via a 100Ω ¼W resistor. The second row is similarly strapped to the third row via 24kΩ resistors (22kΩ



Detailed view of the wiring between the valve bases and the rows of valveholder sockets.



Rear view of the unit withdrawn from its cabinet.

or 27kΩ will also do). A 0·1μF 500V low-inductance capacitor is connected between each socket in the top row and a chassis loop between the two earth sockets.

The resistors and capacitors are provided to suppress parasitic oscillation in screen and grid connections of high-slope valves. Such parasitic oscillation is shown up by sudden discontinuities in the voltage/current characteristics, i.e., the anode current jumps abruptly to some higher or lower value as the bias or h.t. voltages are varied through certain points. If such instability is found with some high-slope valves in spite of the general suppression measures incorporated solder another 0·1μF 500V low-inductance capacitor between chassis and the pin on the valveholder which happens to be the grid for this valve. If this still does not cure the trouble add another such capacitor between the cathode pin and the same chassis point. Such additional capacitors behind the valveholders should rarely if ever be needed and as they will not interfere with testing of other valves with different base connections once fitted they may be left connected permanently. If plug-in Perspex panels are used carrying ready-wired connections between the voltage output sockets and the valve holder sockets additional capacitors to suppress any parasitics can be tried on these panels where necessary for specific valves, but they will generally be less effective there than directly at the valveholder pins.

MAKING CONNECTIONS FOR TESTS

The connections between the bottom row of voltage output sockets and the three rows of valveholder sockets must be established as follows irrespective of whether temporary connections are made with insulated wires fitted with wanderplugs or a plug-in panel is being wired for repetitive tests of a certain type of valve. The length of the wires used for temporary connections should be ten inches from tip to tip of the wanderplugs.

Four special cables are also required, one containing a 30V zener diode and another a 50V zener diode for voltage reduction when required as described in Part 1. The third special cable is for making connections from the bias socket to a

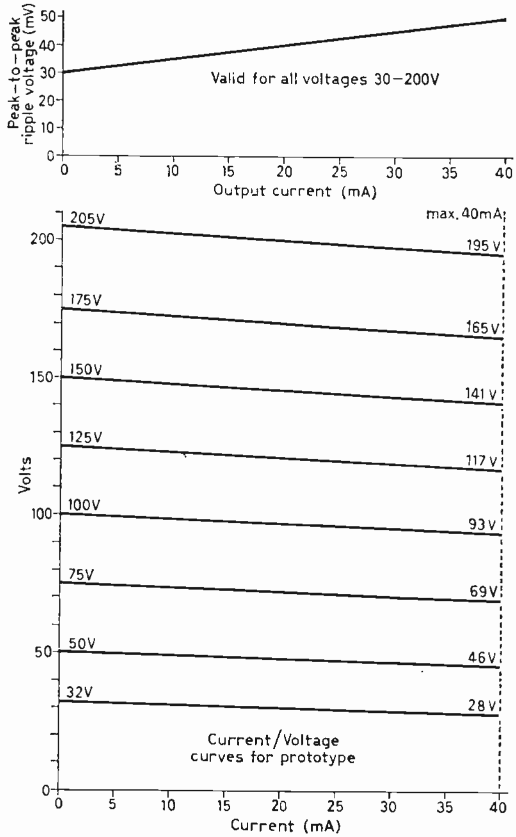


Fig. 6: Performance of the H.T.1 30–200V output. To preset the output from this circuit proceed as follows. With zero output current drain (open-circuit) alternately adjust VR1 for 32V output and VR3 for 205V output between P5 and P6, with VR2 at its left- and right-hand stops respectively. The final adjustment is of VR3 for 205V output with VR2 at its right-hand stop. Then calibrate the scale of VR2.

top cap grid. It is fitted with a wanderplug at one end and a universal top cap at the other with a 27kΩ 1W series resistor directly at the top cap. The fourth special cable carries a wanderplug at one end and a top cap at the other without any series resistor; it is intended for making connections to any other top cap electrode of a valve apart from the control grid.

Commence making connections by linking the two heater windings in the appropriate manner to obtain the correct heater voltage between two heater voltage sockets from which two cables are then plugged in to the heater sockets of the valve on the top row. Next link the zero (chassis) socket of the voltage output row to the cathode socket of the valve on the top row. If cathode bias is specified make this connection via a resistor of the specified value instead of direct. In this case the grid will be earthed by taking a link from the corresponding socket of the third row to one of the green earth sockets adjacent to the valveholders. Otherwise this same grid socket from the third row or the top cap is linked to the negative bias voltage socket. Then connect the h.t.+1 and h.t.+2 voltage sockets to the screen socket on the second row and the anode socket on the top row, with or without the zener cables as appropriate for the particular nominal test settings.

HEATER TESTS

The connections are now complete. Check them carefully. Then set the two h.t. voltage controls and the bias controls to the nominal test settings and again check carefully. Switch-on at the mains switch and wait about one minute for the internal valves and the test valve to warm up. If the heater of the test valve flashes brightly for a second or two immediately after switching on but dims again to a normal appearance soon afterwards do not worry. This is a common

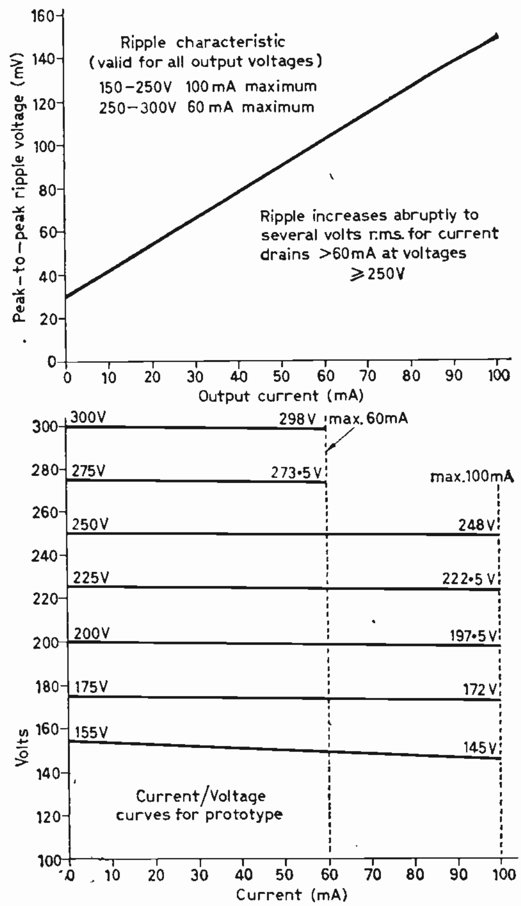


Fig. 7: Performance of the H.T.2 150-300V output. Procedure for presetting the output from this circuit is as follows. With zero output current drain (open-circuit) alternately adjust VR4 for 155V output and VR6 for 300V output between P5 and P7, with VR5 respectively at its left- and right-hand stops. Final adjustment is VR6 for 300V output with VR5 at its right-hand stop. Then calibrate scale of VR5 with respect to output voltage readings at intermediate settings.

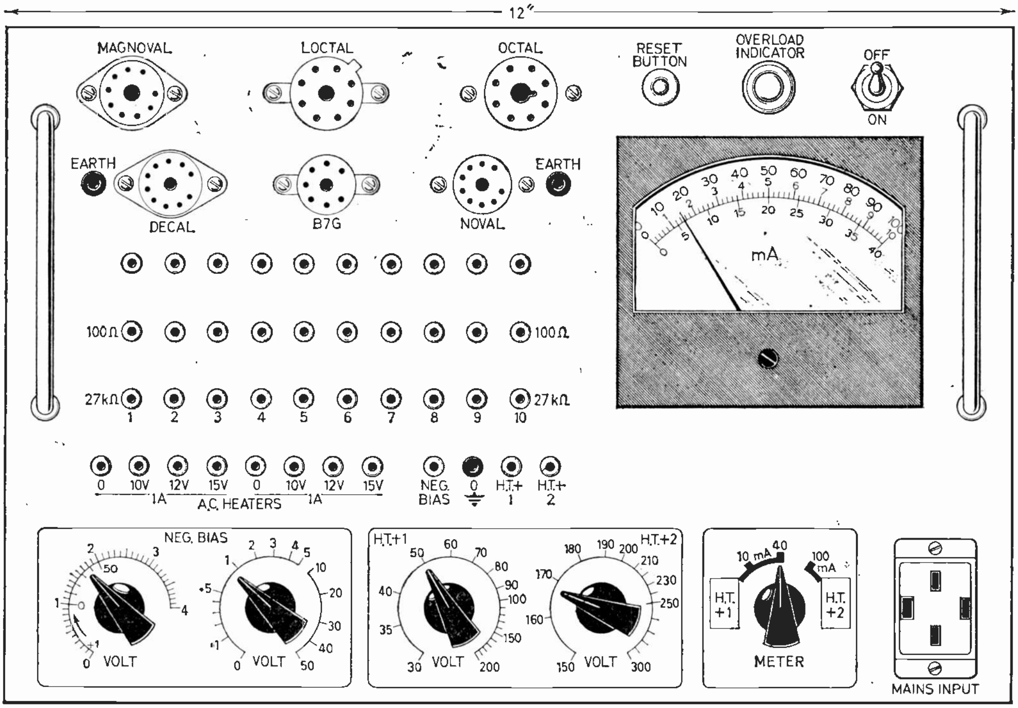


Fig. 8: Front panel layout. The front panel and chassis form an integrated drawer unit which pushes into the 6½in.-deep cabinet.

effect when some valves are run on a fixed voltage instead of in a heater chain and it is normally harmless. However, if the heaters persist in running abnormally bright or do not light up at all something is probably wrong. Switch off at once and make checks.

Withdraw the valve and test with a multimeter on the ohms range to determine whether the heater is open-circuited. If not switch the multimeter to a suitable a.c. voltage range and connect it in parallel between the supply sockets from which the heater sockets are being fed. Switch the valve tester on before reinserting the valve to verify that the heater voltage reads correct. Now insert the valve in its test holder. If the multimeter reading then shows a very large drop or vanishes altogether there is a heater short-circuit in the valve. Switch off at once.

GENERAL TESTS

Assuming that the heater operates correctly, watch the meter as the valves warm up. If the reading climbs to a value much greater than nominal or the overload trip operates and the neon pilot lamp lights there is a leakage fault or electrode short present in the valve. If the meter reading is more or less normal take readings of the anode and screen currents and determine the slope. Compare these readings with the nominal values to assess the condition of the cathode emission and vacuum of the valve as described in Part 1. Good valve data tables often specify the tolerable slope and current reductions beyond which the valve should be replaced. It may also be expedient to compile such data with respect to specific receiver models coming into the service shop. For example when a field output valve is encountered which just fails to give a picture filling the full height of the screen, test this valve and note its slope and current discrepancies with respect to a good specimen.

SHORTS AND LEAKAGES

Detailed investigations of electrode shorts and leakages may be made on a hot or cold valve by connecting a suitable h.t. voltage to one electrode and one of the earth sockets to the other, as well as the correct heater voltage to the heater if the tests are to be made with the valve hot. Note the meter reading or whether the overload trip operates. Do not use test voltages greater than those which a healthy valve is rated to withstand between the electrodes concerned.

HEATER-CATHODE INSULATION

To test the heater-cathode insulation connect an h.t. voltage (within the permitted voltage ratings) to the cathode and one side of the correct heater supply (cold tests) or both sides of the correct heater supply (hot tests). Positive voltage tests normally suffice but if a negative voltage test is necessary reverse the polarity of connections heating the valve from an external floating supply.

—*continued on page 86*

UNDERNEATH the dipole

TELEVISION production centres are at present being built in all parts of the Kingdom; complex structures of steel, bricks, mortar and rockwool sound-proofing. Rapidly and efficiently the BBC and the ITV companies have planned and are now constructing studio stages and ancillary premises second to none in the world. Competition, technically and artistically, has been a wonderful incentive to both the BBC and the ITV companies. Film studios in Britain are following the same trends, with purpose-built stages suitable for feature films for the cinemas as well as for TV plus live or taped television, black-and-white or colour. Such optimism is probably encouraging to other industries, though the television production side has been subject to more than the average amount of levies and taxation. Nevertheless they are all still building premises specifically planned for the job instead of being adapted from old warehouses, theatres, churches and factories as is still being done in many other countries.

The list of new construction projects includes the multistage complex in the centre (almost) of Leeds, of which two stages were ready (almost) for the opening of Yorkshire Television. This has turned out to be a magnificent concept, superbly planned, of which a detailed report will appear later in these columns. Southern is well ahead, building a brand-new three-stage colour TV complex to replace their original conversion from a cinema. ATV are now ready to go ahead with a magnificent multipurpose show business centre in Birmingham, which will also include three stages. Tyne Tees are about to expand with new colour TV stages and Thames Television, already possessing the very advanced Teddington Studios (adapted from film studios), is now in the planning phase of an elaborate studio layout off the Euston Road, London. Practically every other ITV company has allocated huge sums to carry out the lush promises made in their written applications to the Independent Television Authority for the television franchise for their areas.

The Franchise Trail

All these new buildings are growing up solidly in fulfilment of the contracts solemnly signed and sealed by the Independent Television Authority with each of the successful applicants. The manoeuvre of the contestant and the reactions of all the parties concerned were amusingly portrayed in "*The Franchise Trail*", a lengthy TV play about the ITA's reshuffle of TV area licences. Actors giving impressions of real-life appearances of Lord Hill, Lord Goodman, Sir Hugh Greene, David Frost, Lord Thomson, the P.M., Mr. Gulbenkian and others, thinly disguised under other names, must have induced many a laugh from people actually in the television industry—but with not much response from other viewers. What are known in theatrical circles as "pro jokes" don't often succeed with the general public unless fortified with dramatic or comedy situations such as occur in the daily life of Mr. Everyman. The Hollywood-made "theatrical-life" musicals have been successful because they have resisted the temptation to satirise or burlesque biographies of big film, stage or opera stars. After all, you can't really burlesque burlesque, a term which, fairly accurately, indicates the larger-than-life laughter and tears of stage, films and—yes—television.

Colour Separation

I watched part of the Morecambe and Wise Show with two television receivers side-by-side, one a very good colour set and the other an average black-and-white set with a.g.c. The colour set quality was superb, revealing the care applied by director, designer and lighting men in achieving satisfactory results for both "penny plain tuppence colour" objectives. For example the choice of plain blackgrounds of particular shades of blue backing with appropriate decor and wardrobe in the foreground added that abstract (yet definable) thing called "presence". Performers with magnetic personalities stand out well enough even on flattish black-and-white TV sets, but on a good colour set they seem to be in the room with you, a kind of stereo effect. Efforts to achieve good lighting modelling in black-and-white are continuously being made by both BBC and ITV, but however good the results are on their studio monitors (and as sent out from the transmitters), badly adjusted home TV receivers (without black-level clamping) spoil the picture.

Not all lighting specialists have learned the lesson of making the actors stand out clearly from the backgrounds. In a day and age when stage lighting equipment has never been so good the handling of it by many so-called specialists has never been so bad. The lighting of live musical shows, opera and ballet are often ruined by failure to use colour separation principles. Psychedelic-type colouring of costumes of players moving about in front of psychedelic-type scenery is hard to look at and merely dazzles. If the backgrounds are too busy, their lighting can be dimmed.

Colour—and Colour Blindness

The presentation of colour as a contribution to drama and comedy has been an important factor in entertainment from the earliest days of strolling players. Theatre and cinema have used colour for years and television is now doing the same. But every viewer doesn't necessarily see the same kind of colour and a surprising number are colour blind or possess vision which is partially colour deficient. One of the most go-ahead regional ITV companies made colour vision tests on 210 of the staff on their production and engineering departments. Of 183 men tested no less than 13 had unsatisfactory colour vision, 5 of them being totally colour-blind. Of 27 women tested only one was partially colour deficient and none of them were colour-blind.

Such results are "eye-openers" in more than one sense of the word as some persons have different reactions in peripheral vision, which is what you see in the corner of your eye. This is what musicians see of a conductor when they are also reading the music on their stands and is what railways have understood so thoroughly for over ninety years since they first started testing the eyes of engine drivers. Red has meant danger ever since block signalling was made compulsory on the railways and red displayed at all times except when the line ahead is safe and clear of traffic. Prior to that time white, amber or green was normally displayed, except when danger was definitely ahead. "Permissive" signalling of this type led to many accidents and defective colour vision played a part in these.

Turning to the less serious aspects of colour vision, the humour and entertainment that has been got out of colour by comedians and musicians on the stage will certainly be presented on colour television. Coloured handkerchief tricks will mystify colour viewers, but will not necessarily enthral owners of black-and-white sets. In America, viewing NTSC colour in poor reception areas would give totally different results, psychedelic in concept and permissive for those who reach for their sun glasses.

Educational TV

We all know that television whether on the air, on closed-circuit, for taping or on film has many uses other than for entertainment. In education it is becoming a useful instrument when used in the right way and not merely as a gimmick. There is no doubt that educationalists in Great Britain recognise that TV in any of its forms has its appeal and impact, but few of them have applied any of the "show business" knowhow. American educationalists appreciate this particular angle, though their equipment is no better than ours. It is its operation that counts.

The Inner London Educational Authority opened up their television operations in September in splendid form, using all types of television, film, live or taped, with local or closed-circuit facilities laid on over a big area. This is a big step forward long overdue. The Authority is to be congratulated on the importance at last being attached to the engineering side of education, with fit and proper technical policies being worked out by engineers.

Iconos

INSIDE tv TODAY

PART 13 M. D. BENEDICT

COLOUR BROADCASTING—2

NEW lighting equipment was introduced recently with colour in mind. In order to save time rigging the two different types of light—the soft light and the spot light—Mole Richardson developed a dual-purpose lamp which was introduced not long ago. One end is a spotlight, the other end a soft light, and the bulb can be directed towards either end. Tungsten-halogen lamps such as the quartz-iodine lamp are particularly good for colour as they are up to three times as efficient. Hence a new version of the dual light has been brought out for colour work. Dimming lights in the normal way is not possible in colour television work as when the bulb is dimmed it tends to change the colour of the light: in fact it gets more red as it dims.

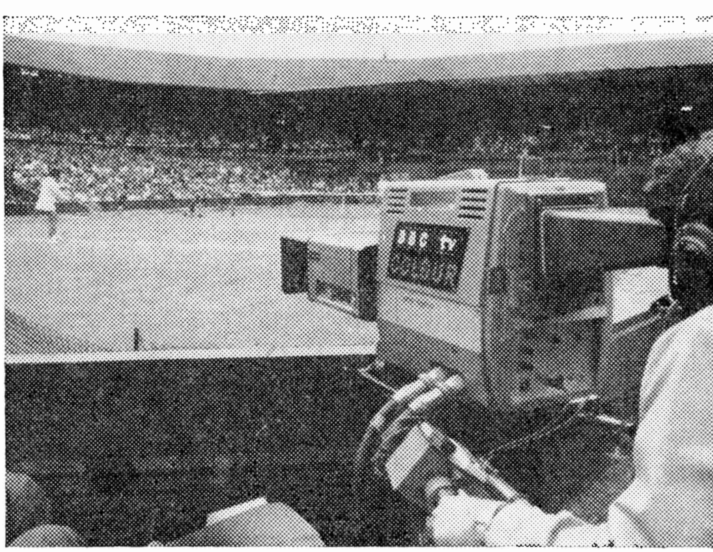
Colour film lights and stock are usually balanced for 3,200° Kelvin colour temperature, but for practical reasons 2,800°K is becoming more popular as a basic temperature. As long as all light on a given scene is within 200°K no variations are noticed and a good colour balance is achieved provided the cameras are lined up on this colour temperature. Meters are provided to measure colour temperature and guide the lighting supervisor. 200°K corresponds to variations of about $\frac{1}{3}$ in light output. A greater range is achieved by varying the spread of the beam from wide to narrow (flooding and spotting) but newer lights use a second bulb which is switched into circuit to double the light output of each lamp and further extend the range which can be covered without affecting the colour temperature of the lights.

Electronically the equipment is much as the monochrome television studio with a few additions. Each camera produces red, green and blue outputs which are combined in an encoder which adds the correct proportions of each signal in a matrix to give the correct luminance signal and by subtracting this from each colour signal obtains the correct chrominance signals (R-Y and B-Y). Most modern encoders will take an external luminance signal straight from a four-tube camera.

Each coder is fed with three further signals: the colour subcarrier, burst gate (a pulse used to gate out the colour burst from the subcarrier before it is added to the encoded signal) and PAL ident (or PAL flag—a half-line frequency square wave which is used to switch the phase of the R-Y component of the chrominance signal on alternative lines). All these are generated in the c.a.r. equipment associated with the pulse generator or the pulse generator itself. Several fully encoded outputs are available from each encoder and these feed monitors, vision mixer, etc. NTSC coders are also fitted and switched in for 525-line, 60c/s operation. To line up the equipment a special colour-bar signal is switched in. Colour bars representing white, yellow, cyan (green and blue), green, magenta, red, blue and black are easily generated and being "pure" colours enable the coders to be easily checked.

Most studios only use two colour monitors in the control room, one for transmission and one for preview. It is found that it is not possible to match two monitors accurately enough to balance a picture from different cameras so only one is used and the vision controller switches between the outputs of each camera, judging the results on the one monitor. Most professional quality monitors do not have decoding facilities so a decoder is provided separately and this feeds red, green and blue signals to the monitor.

Colour signals can be synthesized from a black-and-white caption by passing it through a device which switches one colour for the white part of the original picture and another colour for the black parts. Some colour synthesizers give a selection of colours, others an infinitely variable adjustment. Special effects such as wipe between



Peto Scott Plumbicon colour camera in action at Wimbledon.

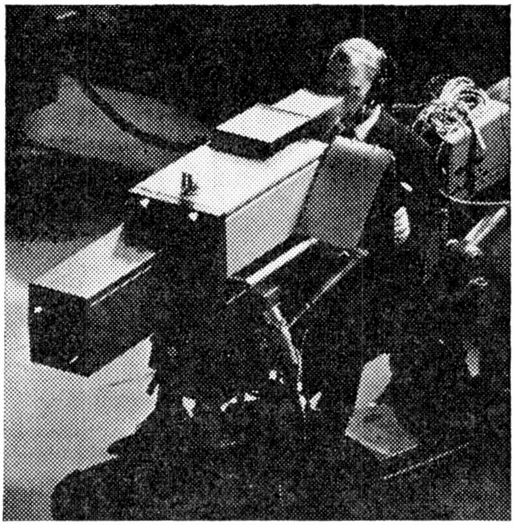
different colours are also possible using similar equipment.

A highly sophisticated and very effective overlay technique is possible with colour. Equivalent to the "Blue Matte" technique used on films it is called chroma key and uses a colour-difference signal, usually (B−Y), to provide an edge where switching takes place in the normal manner of monochrome overlay. Thus if an actor is placed against a pure blue background only on the background is any large (B−Y) output obtained and this drives a video switch so that the actor's image appears against any selected background, usually film. Such a technique is much more successful than normal overlay, which uses a black/white tonal separation to achieve the switch, due to the small amount of blue in most images.

Although all the cameras previously mentioned are designed to operate "hands off" not all are as successful and in several studios it has been found necessary to revert to the technique of using a "racks operator" for each pair of colour cameras unlike the black-and-white technique of one man controlling all cameras in the studio. Like early monochrome cameras each racks operator controls two cameras but has access to all c.c.u. controls, unlike the vision control operators who only control the lift, iris, gain and the "paint pot" (if fitted) controls. It has been found necessary to adjust many of the minor controls in order to compensate for drifting and to obtain the best quality.

Colour Telecine

Colour films form a large proportion of the colour programme so that colour telecine is most important. As with black-and-white there are two types of telecine, the flying-spot and the vidicon/Plumbicon channel. By using a white phosphor for the scanning tube of a flying-spot system and three photomultipliers, one for each colour, a direct colour analysis of the film is achieved. Problems of registering the images are eliminated entirely so that no luminance channel is needed. Modern monochrome telecine channels are designed so that by adding two photocells and corresponding amplifiers they convert to colour working. For many years the flying-spot technique has been used to generate colour test signals with a great deal of success. In America three vidicon-tube channels have been used as the flying-spot technique is not entirely suited to their standard. Vidicons or Plumbicons are used but their advantages over the flying-spot telecine are less than the corresponding advantages on black-and-white. Pye have produced a four-Plumbicon colour channel used by the BBC News Division although Philips channels will be used in the BBC News Headquarters, and Marconi produced a telecine version of the Mark VII camera using vidicons instead of Plumbicons. With telecine it is easy to provide sufficient light for good operation of the vidicon tube and unlike the Plumbicon the output of the tube is easily varied by altering the target bias, simplifying an a.g.c. system considerably. Both Rank-Citadel and EMI produced flying-spot telecines. On most telecines automatic control of lift and gain is available. This grades each shot accurately and quickly.



Marconi Mk. VII colour camera at the BBC Studio 6.

Errors in colour reproduction always occur with film owing to the dyes available and difficulties in masking one colour from another. Compromises are always needed when selecting chemicals to perform several functions in the photographic process but errors which do occur can be corrected to a considerable extent as they are consistent. It is possible to compute these errors and then correct them electronically. Each film has its own characteristic errors and a switchable unit can correct these. Other errors can be corrected in a unit called T.A.R.I.F. (Television Apparatus for Rectification of Indifferent Film) which has been developed by the BBC to correct these errors in processing or exposure. Basically it consists of an adjustable gain and gamma correction unit which can be switched to any primary colour or its complementary colour. Even so it is still not possible to correct entirely and errors between film and television camera reproduction may be observed particularly with bright colours so that colourful uniforms for example are avoided when they will appear both in a film sequence and in the studio immediately following the film when a direct comparison could be made.

Colour Video-tape Recording

Colour video-tape recording suffers from no such handicaps and can at its best reproduce perfectly a colour studio picture. Achieving this standard took a lot of development work over many years. Before Ampex introduced their quadruplex-head system colour v.t.r. on the linear recording principle had been tried. Soon after the successful quadruplex system came into being work started on a compatible colour v.t.r. system.

An early system used in the USA took the chrominance information off its subcarrier and remodulated it on to its own specially generated subcarrier. On replay a special demodulator was used feeding an ordinary NTSC modulator. The system was much more robust as regards stability and distortion but unfortunately it was necessary to drastically limit the luminance bandwidth to cope with the non-standard subcarrier. Sub-carrier visibility was much worse than with NTSC as a result of these techniques, as well as there being a general loss of quality. In spite of this the system functioned in a reasonably satisfactory manner but work proceeded on techniques of recording the standard NTSC signal. The problems were: moiré or r.f. patterning; frequency response—tied up with the first problem; differential phase and gain; and timing errors.

With a large amount of high-freqency signal in the form of chrominance information moiré patterning was much worse than monochrome working. Careful attention to setting up the frequency standards and filters reduced this but a better cure was effected by using the high-band standard where the carrier frequency is raised considerably. The frequency response of the video signal had to be maintained for the whole video bandwidth, particularly at subcarrier frequencies. Stabilising circuits compensate for changes and drifting of frequency standards.

Differential gain and phase distortion occurs when the subcarrier is reduced in amplitude or phase shifted by different amounts according to the level of modulation in the video signal. It may occur in an amplifier and is always found where bandwidth is restricted. However selection of modulation standards and careful design has overcome this, even for the NTSC system. PAL is much less susceptible than NTSC to these forms of distortion.

Timing errors in the signal coming off the tape are probably the main source of errors but with modern techniques of working synchronously it is possible to stabilise the signal off the tape during replay to within 30 nanoseconds. From this it is possible to reduce errors to within 6° of subcarrier by using a voltage-controlled variable delay line just like the Amtec or a.t.c. circuits in principle but with finer control. These Colortec or Color a.t.c. units vary the delay time through the line so as to bring the replayed signal into exact synchronisation with studio pulses and subcarrier.

The processing units have to handle the colour signal without distortion, causing some problems. For example, when does one switch from one head to the next? Normally this occurs during the back porch period but for colour television the burst occurs then. One solution adopted by RCA is to use two demodulators, one for the sync pulses, switching during the picture period, the other for the video and switching during the sync periods. After both are demodulated they are combined to give a switch-free signal.

Colour working demands a very high standard of alignment. For example even minute variation in tape thickness from one side of the tape to the other can cause a type of colour banding so that the machines are set up to each tape rather than to a standard tape as is monochrome practice.

Even helical-scan video-tape recorders can be given a low-quality colour capability by using the early remodulation of a special subcarrier technique, and some of the advanced helical-scan and other similar recorders give broadcast-quality pictures. All the normal facilities of a v.t.r. are available for colour working and operation is similar in principle though as with most colour apparatus technical line up must be more rigorous and careful than is necessary for monochrome working.

TO BE CONTINUED

PRACTICAL TV VALVE TESTER

—continued from page 81

H.T. rectifier valves are best tested by connecting the proper heater voltage and h.t.+ voltage to the anode with the cathode earthed. Start with a low h.t. voltage. A healthy rectifier should already draw its nominal current with a very low applied voltage. Such tests are relative and assessments can be made only by comparing the performance with that of a healthy specimen.

TESTING MULTISECTION VALVES

Multisection valves should be tested one section at a time. For example when testing a triode pentode first connect and test the pentode section leaving the triode pins disconnected, and then connect and test the triode section leaving the pentode section disconnected. The same applies for testing double triodes, twin rectifiers or any other compound valve.

SHORT-CIRCUIT CHECKS

The h.t.+1 output can be reduced to zero but a minimum of about +20V is necessary to make quite sure that the series neon V4 definitely strikes when the valve tester is switched on. The lowest value for which the overload trip operates on a short circuit was found to be +30V. Thus it is considered advisable for reasons of safety to choose this value for the lower limit of the control range of the h.t.+1 output. This has been specified in the alignment instructions accompanying Fig. 6.

NEON V4 RATING

The neon tube V4 (type 90C1) is rated at 40mA maximum continuous current or 100mA surge for 10 seconds. The surge current arising for a fraction of a second before the overload trip responds to a short-circuit on the h.t.+1 output when set to a voltage near the upper limit may amount to several hundred mA but this does not appear to damage the neon tube. Dozens of deliberate short-circuits were produced on the prototype under these circumstances followed by a re-plot of the characteristics of the neon tube. They had not changed to any perceptible extent. Nevertheless after making initial checks that the overload trip responds correctly to a short-circuit on either h.t.+ output at the lowest as well as at the highest voltage settings do not produce further short-circuits unnecessarily. The 90C1 is a particularly robust neon tube designed for rugged duty so it is inadvisable to use a substitute. ■

ILEA CLOSED CIRCUIT ETV system

JOHN CHAPMAN

NINETY THOUSAND children at three hundred schools and colleges in the London area now have their own educational television service, and during the next twelve months the network is to be extended to take in the remaining thousand State-run educational establishments in the Inner London area. This will give London the biggest closed-circuit educational television complex in the world and possibly make it the largest closed-circuit television network ever to be built.

A technical feasibility study for this massive project was put forward in May 1965 and in the following December the Inner London Education Authority was given the go-ahead. Contracts for the installation and commissioning of the distribution equipment were quickly negotiated by the Authority and in under three years the Post Office and private industry have linked three hundred schools and colleges by coaxial cable and installed eight hundred and seventy specially-designed 25in. receivers.

Schools and colleges in Islington, Hackney and Tower Hamlets are the first of the London schools to be linked-up by a coaxial network laid by the Post Office. The cable is at present capable of carrying up to seven channels simultaneously. Two of these will be used to relay BBC and ITV educational programmes—scheduled to begin in 1969—and another is reserved for use by the universities, the polytechnics, colleges of education and other higher educational bodies in the London area. The remainder are for transmitting programmes made at the Authority's Laycock ETV Centre in Highbury.

For the first year fourteen series involving nearly two hundred programmes are scheduled. These include a series for the fifteen-year-olds about leaving school, first year French for eight-year-olds and a series on London for younger children. For adults there is a series on art and another on educational technology in which thirty programmes deal with the use of audio-visual aids. Also there are programmes specially for the teaching staff—one deals with modern mathematics at GCE and CSE levels.

The programmes are being transmitted throughout the working week, from 10 a.m. to 7.30 p.m., and many of the programmes are being repeated three or four times to suit the varied timetables and also to enable teachers to preview the following week's work. Advance programme notes are provided.

All programmes are being relayed from a temporary centre in Islington, but the Authority plan to move into a permanent centre next September when nine hundred of the remaining schools and colleges are to be brought into the network. Work has just begun in converting a former school in Battersea into a permanent centre for the Authority's television activities. The cost of the conversion is estimated to be over £200,000 and the studios are scheduled to be completed early in 1970.

LAYCOCK TV CENTRE

All studio programmes are made in the Authority's Laycock TV Centre, where the formal inauguration of "ETV London" took place on 12th September. Here there is a production studio, another for training purposes, a control room fitted out with video-tape recorders and transmission switching equipment, another room for the modulators and transmission equipment, a maintenance workshop, and a two-camera mobile television unit. Back-up facilities include a photographic department, graphics and scenic department, rehearsal areas, a film viewing and editing area, and production and administrative offices.

The production studio is equipped with three image-orthicon EMI cameras. Each of these is fitted with two-, three-, five- and eight-inch lens turrets and the camera control units are equipped with "joysticks" for remote control. These are grouped for operation by a single vision engineer who also has 16mm. telecine under remote control.

The vision mixer used can cope with five inputs

The training studio and control room at the Inner London Education Authority's Laycock ETV Centre and has a preview bank. Seven 14in. picture monitors provide viewing of all inputs and give preview and transmission facilities. Comprehensive talkback facilities are also provided.

Although the studio is small by BBC and ITV standards, it is fitted with a curved cyclorama covering two walls. Air conditioning is provided and the ceiling and walls are acoustically treated for sound absorption. Extensive lighting equipment is provided, with s.c.r. lighting control on twenty of the outputs. A remote control panel for the lighting dimmers is readily accessible to the vision engineer.

A separate sound control room is provided for the production studio. This has a twelve input Elcom mixer which features preset level control, foldback and echo. The inputs can be routed via a "red" or "green" group, and group faders and a main fader permit comprehensive mixing. A jackfield covering all inputs and outputs provides facilities for the insertion of frequency correcting filters into any channel or group of channels.

The Inner London Education Authority also operate a training studio at the Laycock Centre. This is fitted with three Marconi vidicon cameras, a vision mixer similar to that used in the production studio, and a simplified sound mixer.

Here teachers seconded to the television service are taught all the production roles of scripting, directing and making educational TV programmes. So far forty-five teachers have received intensive training in a three-month course and are now contributing to the service. They are seconded to the television service for periods of up to two years.

The heart of the Laycock Centre is of course the master control room. This contains a 625-line broadcast type pulse generator and a number of distribution amplifiers to support the studio and technical areas with the necessary pulses. The master mixer is of the auto-preview type and can accommodate up to eight sources. It is normally operated in the "married" condition, but separate picture and sound switching can be employed if required for special projects.

There are two four-head broadcast type videotape recorders (Ampex 1200) and the machine normally used for recording is fitted with an electronic editor. The other is normally used for transmission and has an "Amtec" unit for correcting head timing errors. Both machines can be operated as synchronous sources and used for studio insert purposes.

Two vidicon cameras provide the "interval signal" which is transmitted between programmes and the "one minute" cue which is transmitted before each programme. There is also a test pattern generator.

The network has a maximum capacity of nine channels and is at present capable of the simultaneous transmission of seven channels carrying 625-line monochrome or PAL colour television signals. The channels are in the v.h.f. band (40 to 140Mc/s with a spacing of 10·5Mc/s) and the vision and sound signals are modulated in an identical manner to BBC 625-line broadcasts.

Terminal amplifiers are used in the usual way to distribute the signals throughout the educational establishments taking the service. They provide a signal level of between 1mV and 3mV at each reception point, with an isolation of at least 40dB between individual points.

RECEPTION

The 25in. receivers used in this huge project have been produced by Decca Radio and Television Ltd. to a tight specification laid down by the Authority. They are said to be of a much superior quality to the normal domestic receiver with improved picture linearity, higher brightness and a black-level clamp. The receivers are suitable for 625-line programmes only and incorporate a transistorised tuner specially designed to ensure good adjacent channel rejection. Over 3,400 of these receivers will be in use when the service becomes fully operational.

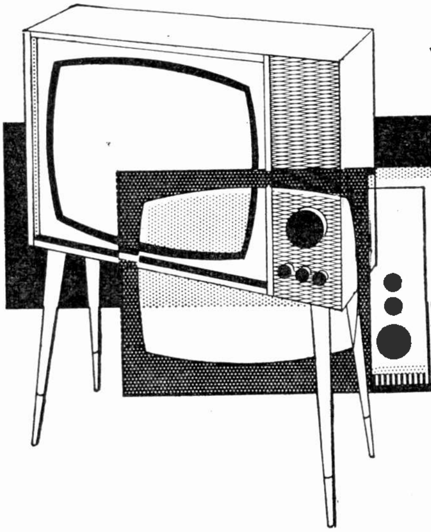
Continuity of service is extremely important to the Authority which has taken steps to ensure that programmes lost for any reason are quickly restored. A simple routine has been devised to enable the teacher to quickly decide whether a fault is due to the receiver or the network, and a supervisory system has been set-up to give immediate indication and location of network faults. The Authority has round-the-clock maintenance contracts with the Post Office and Decca to back-up its own staff.

OUTSIDE BROADCAST UNIT

The Authority has its own outside broadcast unit—a sixteen-seater bus which has been adapted to accommodate a four-man crew and equipment including two cameras, microphones, sound and vision mixing equipment, talkback equipment and video-tape recorders. Two of the crew operate the cameras while a director and technician select either of the two pictures offered and make the recording.

The presence of microphones, cameras and their operators is not much of a problem with younger children, but the unit has found that adolescents take longer to settle down. Teachers who have been televised with their classes say that they find the cameras less distracting than the presence of student teachers in the classroom.

The capital cost of this outside broadcast unit was £14,300 and the annual running costs, including depreciation, are about £11,000. A second unit is to be introduced to serve the University of London Institute of Education and other colleges of education in the London area not maintained by the Authority. The cost of this will be recovered from the users. ■



Your Problems Solved

Whilst we are always pleased to assist readers with their technical difficulties, we regret that we are unable to supply diagrams or provide instructions for modifying surplus equipment. We cannot supply alternative details for constructional articles which appear in these pages. WE CANNOT UNDERTAKE TO ANSWER QUERIES OVER THE TELEPHONE. The coupon from page 92 must be attached to all Queries, and a stamped and addressed envelope must be enclosed.

PILOT TV110F

I am having trouble with the field height. The picture creeps up and down, but if I turn the height control fully to its limit everything is OK except that the picture is too far down. I have replaced the PCL83.—G. Walker (Newcastle-on-Tyne).

This effect could be caused by a faulty field output valve. This is best checked by substitution. However, if the valve is proved to be in order, check the condition of the height control and the feed from the top of this to the h.t. line. A resistor here could change in value as it warms up.

HMV 1919

The picture on this receiver rolls over and over. I have had this seen to a few times. Firstly it is OK, then after about a week or so it starts again. —P. Cornwall (London, E.17).

If the picture tends to lock within range of the vertical hold control, the trouble lies in the circuit from the sync separator stage to the field generator. Checks should be made of the associated components here, including resistors, capacitors and diodes, as one or more may have failed or changed in value. If a lock tendency is when the control is hard against one stop, check the value of the resistors connected to the hold circuit.

FERGUSON 206T

There was lack of brilliance, width and focus before the set finally gave up. Now when it is switched on all the valves light up but there is no raster. The sound is OK. I connected a booster transformer to the tube but still no raster appeared. There is a tremendous amount of line whistle.—J. Silva (London, S.W.17).

We would advise you to replace the tube which is doubtless of low emission. Also check the h.t. rectifier, line output and efficiency diode valves if necessary.

BUSH TV66

The fault is lack of brightness. When the brightness control is turned up, the retrace lines appear. I have had a new tube fitted and checked the ion trap magnet, and the EY86, PL81 and PY82 valves.—H. Wilkinson (Yorkshire).

We advise you to check the left-side PCF80 video amplifier and associated resistors. Also check the 820pF capacitor from pin 2 of the c.r.t. base to pin 1 of the PCL83.

FERGUSON 317T

There is no picture but a raster is present. The sound is quite normal. I have changed all the diodes (X1, X2, X3 and X4) for new ones. I have also changed most of the capacitors and have fitted a brand new tube.—A. Lawson (Derby).

The trouble is probably an open-circuit choke in the video stage. These chokes (L20-L21) are on the reverse side between V6 and the deflection coils. Check V4 and nearby decoupling capacitors, also choke L22 near V15 (PCF80).

PHILIPS 23TG170A

The bottom of the picture starts flicking upwards, but this is not consistent. I have changed the ECC82 but this has not made any difference.

On BBC-2, the brightness keeps building up and needs attention till it reaches the correct level, turning the brightness down time after time. Also, the sound on BBC-2 is rough but very good on BBC-1 and ITV.—J. Boyne (Liverpool, 13).

Check the seating of the field timebase valves. If poor, clean the valve pins and the holder sockets. Use Electrolube No. 1. Otherwise, check for poor soldered connections in the circuit.

Change the video amplifier valve for the brightness fault and the bad sound on BBC-2 is caused either by misalignment of the intercarrier channel or unbalance in the f.m. detector circuit.

FERRANTI T1125

After the set had been on for about half an hour, the picture disappeared leaving a brilliant screen. The sound remained normal. I switched the set off and when it came on again the picture and sound came up quite normally.—J. McGuire (Cannock, Staffordshire).

When the fault occurs again, check the tube base voltages. If the cathode voltage falls to practically nothing, note the effect of shorting the video grid to chassis.

If this restores the c.r.t. cathode voltage, check the vision i.f. screen decoupling capacitor, 0·001μF (C24) pin 8 to chassis. If shorting the grid does not produce the required change, check the 0·1μF capacitor C65 which connects to the junction of R62-65 in the grid (pin 2) circuit of the c.r.t.

GEC BT303

Over the past few weeks, the picture on this set has been losing height (equal amounts top and bottom) until it was only about 2in. wide.

Only the most critical setting of the height control would restore the picture to normal, but this would only last for a short time.—S. Myall (Eastbourne, Sussex).

Check the height control and the resistor in series with this. This section of the circuit supplies power to the field oscillator from the boost h.t. line. It is possible that you have an open-circuit here somewhere. Check carefully round this part of the circuitry.

ALBA T988

The horizontal control needs constant adjustment. The top of the picture is elongated, whilst the bottom is compressed.

The vertical control is very critical and there is insufficient black content and telephone wires. —W. Higgins (Cheshire).

Most of these symptoms could be caused either by a weak aerial signal or by low sensitivity of the vision channel. The best plan would be to have the overall sensitivity of the set checked. If low, a valve could be low emission or the i.f. stages could be misaligned. The non-linearity in the field scanning could be due to maladjustment of the vertical linearity presets or a low emission field timebase valve.

EKCOVISION T267

This set has very little contrast. The picture is short both sides of the screen and also very wavy at the edges, tending to roll and not lock properly with the vertical hold control. I have replaced the U25 and the other two valves with the top anode connectors and the screwdriver test shows the e.h.t. to be in order.—G. Thornhill (Lancashire).

Check the h.t. rectifier valve and the surge limiter resistors on its anodes (to the a.c. supply). Also the main electrolytic smoothing and reservoir capacitors. It seems from your letter that the trouble is caused mainly by low h.t. voltage accompanied by mains ripple.

MURPHY V689X

The BBC-1 picture has gone all "grainy". The ITV picture remains 80% good. The sound is unaffected.—J. Houlihan (Lancashire).

You should suspect your BBC aerial and the 30L15 valve in the tuner. If you have to dismantle your receiver, why not obtain a set of Channel 12 coils for BBC Winter Hill which should ensure good reception of this station.

K-B KV005

There is a buzz on the 625 channel only. The picture quality is good but maximum sound on the fine tuner is not consistent with the best picture position. Adjustment of L35 resulted in some improvement. The nature of the sound fault can be reproduced on 405 by slight misalignment of L31 and is a rapid staccato buzz. —A. Smith (Birmingham, 29).

It seems from your letter that the dual-standard i.f. strip is misaligned. However, check the 6Mc/s tuning of the intercarrier sound channel first, and ensure that the f.m. sound detector on 625 lines is correctly balanced for the least intercarrier buzz, which is the effect you are getting.

If realignment is necessary, the instructions in the service sheet or manual *must* be followed closely.

FERGUSON 308T

When first switched on the picture is perfect but after about half an hour the picture goes off. The sound is still present but the screen is blank with not even a raster to be seen.

While the picture is present during the first half hour of viewing, there is a faint whistle which disappears with the picture. I have noticed that the EY86 valve goes out and that there is no power from T2 to the top of the valve. I have tried another valve but this made no difference.

When the set is switched off then on again a few minutes later, the picture comes back on. —D. Weldon (Sheffield).

This is the symptom of failure of the line timebase from whence the e.h.t. power is derived. Check the booster diode and the line output valve in the e.h.t. box first.

BUSH TV36

The picture is closed up vertically to about 6in., slightly curving in at the bottom corners with the height control low down. Attempts to obtain height increase results in two "curls" of bright light at top and bottom centre of the raster as if drawn into a bunch.

The scan coils have been changed and the line timebase transformer, the primary having gone "high". Picture width is normal.— R. Jackson (Halifax, Yorkshire).

The symptoms described suggest hum in the field timebase. Suspect a heater-cathode ECL80 field timebase valve, and also suspect smoothing capacitors C21, C40 and cathode bypass C12.

Another cause of your trouble could be a leaky feedback capacitor 0·02μF designated C10.

REGENTONE Ten17

The picture disappeared and there was a smell of burning. On removing the back I found that the bottom section of the mains dropper was red hot. The choke connected across the reservoir capacitor was also so hot that the wax was boiling out. Both these components seemed OK when tested on the meter. I have also tested the reservoir capacitor and the mains rectifier, both of which are OK.

The only other thing I could see was that R33 seemed to be too hot considering that the set had only been switched on for about 15 seconds.—J. Colquhoun (Lancashire).

There is certainly a short-circuit somewhere on the h.t. line or at the output of the h.t. rectifier. Since the smoothing choke overheats we feel that the main smoothing capacitor is shorted out; but, of course, there could well be a short in some other component, reflecting a short-circuit on to the h.t. line. You will have to check the h.t. supply circuits carefully with an ohmmeter. Sometimes high ripple current in the main smoothing develops due to the reservoir going open-circuit. This can also overheat the choke.

MARCONIPHONE VT157

The picture is very good but the line timebase only works when the tuner is correctly set. For example, if there is no signal, the screen is black. —A. Leave (Hampshire).

It is not unknown for the line timebase to become active only when the vision signal is present, but it is not a safe condition since lack of line drive can burn out the line output valve and line output transformer. We would suggest that you check the condition of the components in the line oscillator, for it seems that one of these may be faulty preventing the stage from being free-running. The oscillator valve could be low emission, incidentally.

QUERIES COUPON

This coupon is available until NOVEMBER 22, 1968, and must accompany all Queries sent in accordance with the notice on page 89

PRACTICAL TELEVISION, NOVEMBER 1968

TEST CASE -72

Each month we provide an interesting case of television servicing to exercise your ingenuity. These are not trick questions but are based on actual practical faults

? THE original fault on an Alba T655 was the lack of e.h.t. voltage and, of course, no raster. Tests showed that the line timebase generator was functioning—the line whistle could be discerned faintly as the line hold control was adjusted with the aerial disconnected—but that the line output valve was failing to absorb the drive signal. A replacement PL81 line output valve cured this trouble and restored the e.h.t. voltage and the raster, but after a short period of operation excessive corona and arcing from the line output transformer were observed.

Tests on the smaller line timebase components failed to reveal any fault that would be likely to cause this effect, and corona was still present after spraying the windings of the line output transformer with an anti-corona preparation. Finally, the line output transformer itself was replaced and while this minimised the actual corona effect severe arcing took place between the base of the EY86 e.h.t. rectifier valve and chassis.

What are likely causes of this symptom which were overlooked by the service technician? See next month's PRACTICAL TELEVISION *for the solution to this problem and for a further item in the Test Case series.*

SOLUTION TO TEST CASE 71

Page 45 (last month)

The red-hot video output valve gave the clue to this problem, and since this effect occurred only when the final vision i.f. amplifier valve was rocked in its holder it was assumed that the vision i.f. strip was going unstable. When this happens the strip effectively turns into an oscillator and an r.f. signal is applied to the vision detector diode. It is thus possible to detect such spurious signal by checking the d.c. voltage across the vision detector load resistor with a high-resistance voltmeter. Sure enough, when the valve was wriggled to start the red-hot valve symptom the voltage across the load jumped to a relatively high value—about 25V on a 20,000Ω/volt meter.

Checking carefully around the holder of the final vision i.f. valve brought to light an intermittent connection within the screen grid decoupling capacitor, and replacing this completely solved the problem.

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LIVERSEDGE, YORKS.
Telephone: Cleckheaton 2866

SPECIAL OFFER OF TV SETS
Just off Rental. 12 Channels.
R.G.D. Deep 17, **£5.0.0. Bush** TV 85, **£8.0.0. K.B.** New Queen, **£5.0.0.**
Sets tested with good tubes, cabinets fair, could do with cleaning out.
Carriage £1. Passenger train double rate.

NEW BOXED REBUILT TV TUBES
Type MW43/69. Top grade, not a second. 12 months guarantee. **47/-.** Carriage 12/-.
New TV Tubes with slight glass fault. All types 19in. and 17in., **50/-.** Carriage 12/-. 12 months guarantee.
Reclaimed TV Tubes with six months guarantee. 17in. type AW43/88, AW43/80, **40/-,** MW43/69, **30/-.** 14in. types **17/-.** All tubes 12/- carriage.
Speakers Removed from TV Sets. All PM and 3 ohms. 8in. round and 8x5in., **6/6.** Post and Packing 3/6. 6in. round **3/-.** P/p 3/-. 6 for **24/-,** post paid. 6x4in., **3/-.** Post and packing 3/-. 6 for **24/-,** post paid. 7x4in., **5/-,** P/p 3/-. 6 for **34/-,** post paid. 5in. round, **3/-,** P/p 3/-. 6 for **24/-,** post paid. Slot speakers 8x2½in., **5/-,** P/p 3/-. 6 for **30/-,** post paid.
Special Sale of ex-W.D. Gear. R.A.F. Tube Unit, Type 266, just like the 62A Unit. Fitted with VCR97 Tube. Mu-metal screen, full of EF50 valves, complete with outer case. Grade 1, **27/-,** Grade II, **22/-.** Both units 10/- carriage each.
Untested 12-Channel 14in. TV Sets, 20/-, carriage 15/-. Passenger train double rate.
Bush TV 53, 14in. 12-Channel tested, with good tube, cabinets fair, **£5.0.0,** carriage 15/-, passenger train double rate.
Untested Pye, K.B., R.D.G., Ekco 17in. TV Sets. **Bush** 17in. TV Sets **50/-** each, carriage 15/-. Passenger train double rate.
VCR97 Tube complete with mu-metal screen **10/-,** p. & p. 5/-.
Top Grade Mylar Tapes, 7in. Standard, **11/6,** 7in. Long Play, **14/-,** 7in. Double Play, **19/6,** 5in. Standard **7/9,** 5in. Long Play, **10/-,** plus post on any tape 1/6.

VALVE LIST
Ex. Equipment. 3 months' guarantee
Single Valves Post 7d., over 3 Valves p. & p. paid. 10F1, EF80, EB91, ECL80, EF50, PY82, PZ30, 20P3. All at **10/-** per dozen, post paid.

ARP12	1/6	PCL83	5/-	6K25	5/-
EB91	9d.	PL36	5/-	6U4	5/-
EF85	3/-	PL38	6/-	6V6	1/9
EBF80	3/-	PL81	4/-	6P28	5/-
ECC81	3/-	PY33	5/-	10C2	5/-
ECC82	3/-	PY81	1/6	10P13	2/6
ECC83	4/-	PY82	1/6	185BT	8/6
ECL80	1/6	PZ30	5/-	20D1	3/-
EF50	1/-	U25	5/-	20L1	5/-
EF80	1/6	U191	5/-	20P1	5/-
EF91	9d.	U281	5/-	20P3	2/6
EL36	5/-	U282	5/-	20P4	8/6
EY51	2/6	U301	5/-	30PL1	5/-
EY86	5/-	U329	5/-	30P4	5/-
KT36	5/-	U251	5/-	30P12	5/-
PCC84	2/-	U801	8/6	30F5	2/6
PCF80	2/-	6B8	1/8	30FL1	5/-
PCF89	4/-	6BW7	2/6	6/30L2	5/-
PCL82	4/-	6K7	1/9	50CD6	6/-