SLOT AERIALS FOR TELEVISION

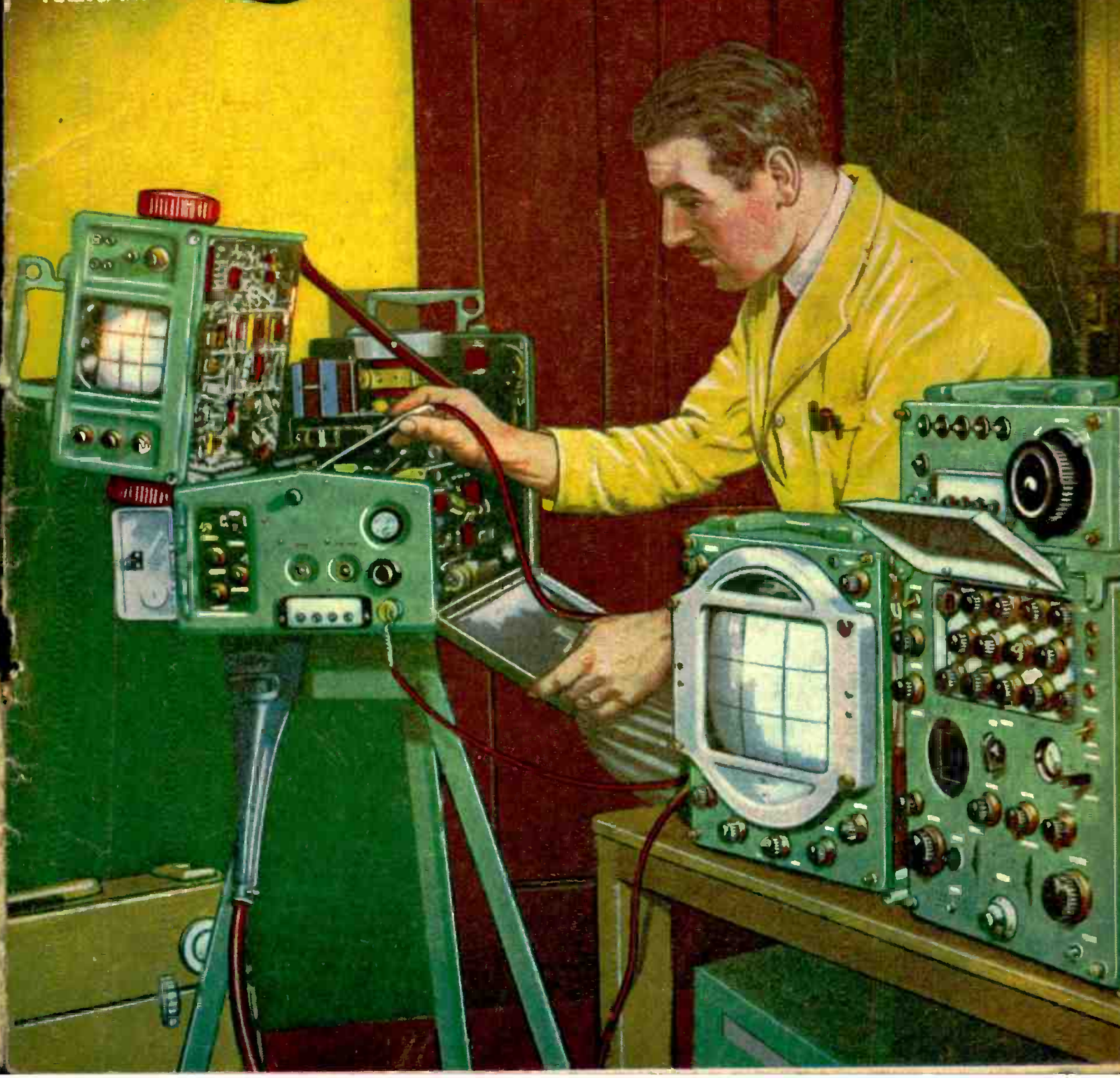
Practical Television

1/3

AND TELEVISION TIMES

FEBRUARY: 1957

EDITOR: F. J. CAMM



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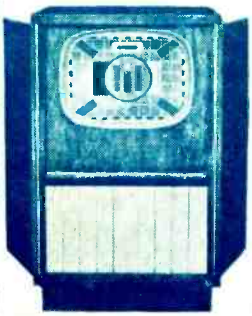

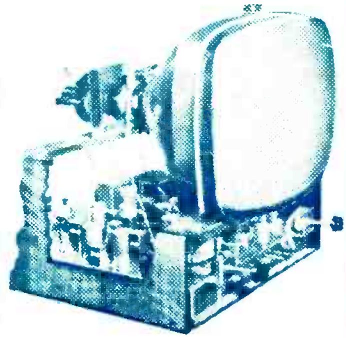

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Practical Television

& TELEVISION TIMES

Editor : F. J. CAMM

Editorial and Advertisement Offices : "Practical Television," George Newnes, Ltd., Tower House, Southampton Street, Strand, W.C.2. 'Phone : Temple Bar 4363. Telegrams : Newnes, Rand, London.

Registered at the G.P.O. for transmission by Canadian Magazine Post.

Vol. 7 No. 79 EVERY MONTH FEBRUARY, 1957

Televiews

TAPE-RECORDED TV

TAPE-RECORDED television pictures were successfully demonstrated in America on December 20th, 1956. During a closed circuit test, making use of a video tape recorder, a programme was radiated from Hollywood to the Columbia Broadcasting System Headquarters at Madison Avenue, New York. This programme had been recorded the previous day when the live show went on the air. It is reported that in most respects the picture had the clarity and sharpness of a live broadcast, although in a few instances the programme was spoilt by white lines, flashing intermittently across the screen. This, it was stated, was due to imperfections in the tape itself.

R.C.A. gave the first public demonstration of V.T.R. on December 1st, 1953, when colour as well as black and white pictures were shown. They used half-inch plastic tape with five tracks, three for primary colours, one for synchronising signals and one for sound. The speed of the tape remains one of the major problems, for a 17in. reel lasts only four minutes on this system.

Another American firm states that V.T.R. will be on sale to the public in 1957. This company states that in their system they break the video frequencies into 15 frequency bands on different tracks. The tape speed is very much lower, a 15in. reel giving 16 minutes of playing time.

Trouble experienced by all experimenters has been the poor ability of the tape to magnetise itself at a frequency of about 4 Mc/s, a frequency which is necessary if a picture of any detail is to be recorded.

TV BETWEEN 6 p.m. AND 7 p.m.

READERS will recall that in our November, 1956, issue in a paragraph headed "That Vacant TV Hour," we criticised the BBC, stating that their reason that the vacant hour enabled parents to put their children to bed was unrealistic, since children are not put to bed at such an early hour. This criticism had almost immediate effect, for the Postmaster General announced on December 12th that from February 16th, 1957, both the BBC and the I.T.A. would be free to broadcast during periods which they think best, although they must not exceed the present permitted maximum of 50 hours a week and eight hours on any one day. Both services will now be able to fill the present programmes gap between 6 p.m. and 7 p.m., except on Sundays, when, to avoid affecting church attendances, there will be an evening break from 6.15 to 7.25 p.m.

But neither the BBC nor I.T.A. have yet made use of the full 50 hours a week, so each will be able to fill the 6-7 p.m. gap without reducing other features. It is known that the I.T.A. has used pressure for a change and that the BBC were somewhat reluctant. We are glad that the TV authorities have taken note of our comments.

CLASSROOM LESSONS BY TV

WE are promised that this year emphasis will be laid on the educational possibilities of TV, for both the services are to commence transmissions to schools. It is possible that I.T.A. will devote more time to this programme than the BBC. In America the N.B.C. has offered facilities to the American 22 Educational Station.

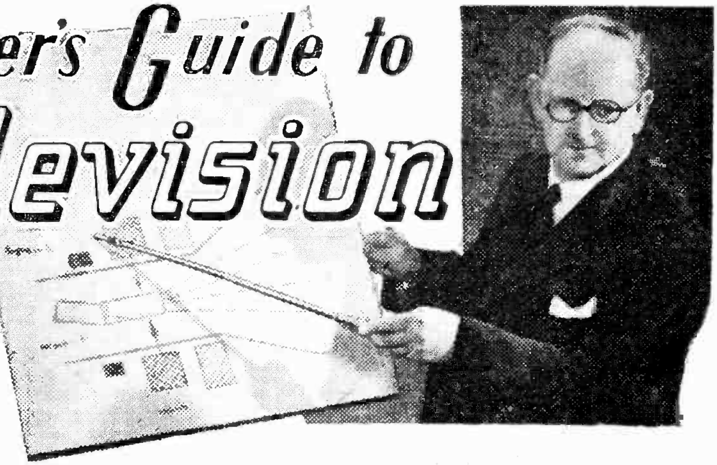
"AMPLIFIERS : DESIGN AND CONSTRUCTION"

WE have just published an important new work on amplifiers, covering all aspects of design and construction and giving constructional details of a wide range of amplifiers for tape recorders, gramophones, P.A. and radio purposes, both of high and low power. A chapter is included on D.C. amplifiers. All of the designs have been tested in the Practical Wireless Laboratory. It costs 17s. 6d., or 18s. 3d. by post.

This limited edition has been produced at the request of those who missed the series on the subject in our companion journal, *Practical Wireless*, in which most of the material originally appeared.—F. J. C.

Our next issue, dated March, will be on sale on Friday, February 22nd.

A Beginner's Guide to Television



11.—TELECINE—VIDEO TAPE RECORDING

By F. J. Camm

ONE of the difficulties which greatly adds to the cost of production of TV programmes is that of recording them for retransmission. Owing to the wide band of frequencies involved it has hitherto been impossible to record them on wax, wire or tape as with sound programmes. This means that in the majority of cases if a programme is repeated it must be "live" and all the expense of bringing the artistes together again and resetting the scenes in the studio are incurred again. One method, however, has been found of recording TV programmes and the BBC makes use of it frequently. It is known as telecine.

Telecine

Certain parts of even live programmes make use of film, where it would be impossible in the studio to produce the required scene, just as gramophone records are used for other effects and aural backgrounds.

Every TV station, therefore, has a telecine machine working on the continuous motion principle. The film moves steadily through the machine and not in jerks as in an ordinary cinema projector, and the blurring of the image which would obviously be produced by this motion is exactly compensated by an inverse movement of mirrors which are interposed in the path of the emergent optical beam. The machine, therefore, delivers a steady optical image from the moving film and this is projected straight into an ordinary TV camera. Operational control is brought up to the control gallery in the studio so that the producer has films on demand.

The transmission of films presents separate problems. Films such as newsreels, feature films, documentaries, etc., are televised from apparatus housed in the central telecine room. In the telecine machine the iconoscope type of pick-up tube is not used, but the film is scanned by means of a flying spot developed on the screen of a special cathode ray tube, and a photo cell behind the film interprets the varying light intensity which it receives as video frequency current.

Programmes originating in either the studio or the central telecine room are fed to the central control room, which acts as a monitoring and switching centre between programme contribution and programme distribution. Thus if the evening programme starts with an item from Studio A and continues with an item from Studio B then it is the central control room which effects the changeover of both vision and sound. The sound changeover is simple, but the vision changeover is more complex, since it is essential not to interrupt the flow of synchronising signals, otherwise receivers would go out of step during the change and untidy presentation would result.

The vision transmitter may be divided into four main parts—the modulator, the radio frequency amplifiers, power supplies and the auxiliaries. The radio-frequency amplifiers generate R.F. current which is modulated by the video frequency signals provided by the modulator. The power equipment follows fairly normal practice. The central control room also feeds a vision output into one Post Office-operated system of cables and beam radio station, by means of which the video signal is sent out.

Recording on Tape

Experiments have been continuing for some time with the recording of TV programmes on tape, and both monochrome and colour pictures have been successfully recorded. Although the system is not at present a commercial success results are so gratifying that it is certain to come into general use within the next few years. R.C.A. in America gave the first public demonstration of video tape recording in December, 1953, both colour and black and white pictures being shown. They used half-inch plastic tape with five tracks, three for primary colours, one for synchronising signals and one for sound. At present the speed of the tape is the greatest bugbear, for a 17in. reel only lasts four minutes. Another American firm, however, which is developing V.T.R. says that they will have the tape system on the market in 1957. In their system they break the video frequencies into 15 frequency bands on different tracks. In this system the playing speed is very much slower, a 15in. reel giving 16 minutes of playing time. Another difficulty with V.T.R. is the poor ability of the tape to magnify itself at a frequency of 4 Mc/s.

The Columbia Broadcasting System, on December 20th, 1956, demonstrated in a nation-wide broadcast their TV tape recording system. A critic said that in many respects it had the clarity and sharpness of a live broadcast and the *New York Times* commented favourably on it.

During a closed-circuit test that made use of an Ampex video tape recorder, a programme was fed from Hollywood to C.B.S. headquarters at 485, Madison Avenue. The programme, "Art Linkletter's House Party," had been recorded the day before when the live show went on the air at its usual time from Hollywood.

The quality of the recorded pictures was impressive. In some instances, however, it was marred by what engineers call "drop-outs." These are white lines that flash intermittently across the screen somewhat in the manner of a motion picture film that is scratched.

William B. Lodge, vice president in charge of engineering for C.B.S., said the "drop-outs" were caused by imperfections in the tape itself and not the recording machine. He suggested that "drop-outs" were only a minor problem and would be eliminated as manufacturers improve the production processes for video tape.

Mr. Lodge predicted that the average viewer would not be able to note any difference between the picture quality of a live show and a programme recorded on tape.

He also said that the quality of the Ampex recording process had been remarkably improved since the recorder first was demonstrated at a broadcasting convention in Chicago last April.

No Processing Needed

The recorder, developed and manufactured by the Ampex Corporation, of Redwood City, California, uses a 2in. wide magnetic tape that records sound and picture simultaneously. After a programme is recorded, the tape can be rewound and played back immediately, without any processing, through a regular TV transmission system.

C.B.S. now has two recorders installed in its Hollywood studios and has received its first at network headquarters. Nine others are on order.

The network confirmed that the Douglas Edwards news programme, which originates there, has been recorded on tape and played back at a later hour on the west coast for some weeks. Hitherto, the programme was recorded in Hollywood on film for later release. The film, of course, must be processed rapidly and is more costly.

C.B.S. also disclosed that "Arthur Godfrey's Talent Scouts," which also originates in New York, will be recorded on Ampex tape in Hollywood and released to west coast viewers at the usual hour. If the experiment is a success, C.B.S. said, Mr. Godfrey's programme would be recorded on tape each week for west coast release.

By coincidence, engineers and executives of the National Broadcasting Co. also witnessed a private demonstration of Ampex tape.

(To be continued).

Headphone TV for Hospital

"SILENT" television will shortly be introduced into the wards of a Birmingham hospital. Patients will see the programme on a normal screen but will pick up the sound only by using headphones and a new form of control unit at their bedsides. Thus patients who are sleeping, or who are too ill to join in general ward viewing, will not be disturbed.

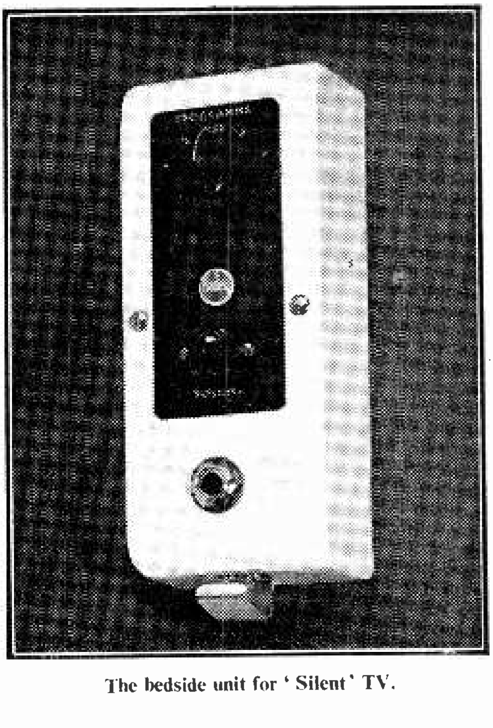
"Work on the development of a new control has only recently been completed, and the Royal Orthopaedic Hospital at The Woodlands, Northfield, will be the first in the country to have this 'headphone television' for nearly 200 beds" said Mr. Vernon Hadley, managing director of Hadley Telephone & Sound Systems, Ltd., of Smethwick. "Hospitals television, of course, is not new, but there has always been the difficulty that a general ward television show might be enjoyed by the majority but endured by a few. The new system of sound-by-headphones makes it possible for each patient to listen or not, as he or she may wish.

"The picture will be there on the screen, but with the set's sound turned off—just like the old silent films, and without sub-titles. Through a separate channel the sound is piped to the bedside headphone unit. In fact, there are four separate sound channels, with individual volume control, so that a patient may listen to the Home or Light programme or even hear ITV sound whilst watching a BBC picture!

"This unit completely solves the biggest problem of television in hospitals, and hospital authorities generally are already showing great interest in the system we have devised."

Mr. Hadley pointed out that the four-channel control unit need not necessarily be used for television programme sound, but could, in addition to Home and Light programmes, be used for internal broadcasts or special hospitals broadcasts from local outside events such as football matches.

Pillowphones or headphones may be used. A jack socket is provided for plugging in the headphones, which rest on a chromium plated steel hook beneath the control unit when not in use. The unit can also be used for controlling loudspeakers. Dimensions are only 6in. x 2½in. x 2in.



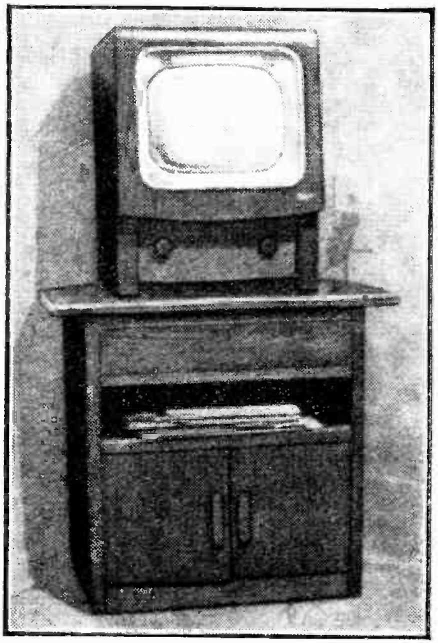
The bedside unit for 'Silent' TV.

A TV Table

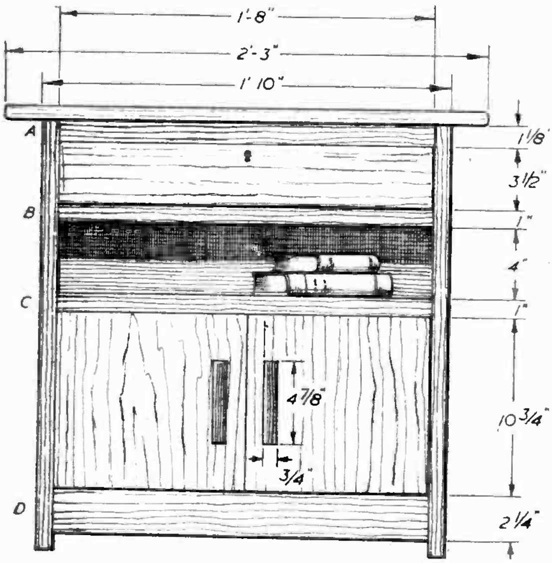
A MULTI-PURPOSE STAND WITH EXTENSION SPEAKER

By W. E. Amos

AT one time our table model receiver was placed on a normal occasional table, sufficiently strong to take the weight. It was found, however, that this did not lend itself easily to movement, and the one small shelf under it would not accommodate all of the books which usually found a place there. Most viewers will know that there are times—for instance, when an extra crowd of visitors arrives for some special programme—when the position of the set is best modified, and that is where the movement takes place. These receivers, although table models, are by no means light, and an occasional table has rather thin legs which do not lend themselves to being dragged round. I therefore set about thinking what better arrangements could be made to accommodate our receiver without going to the trouble of converting it into a console model. We like the extra height of a table model on a table, as compared with the console arrangement, and although the idea of just closing in the sides of the table with plywood or hardboard did occur, it was decided that this was by itself not neat enough, and various other ideas occurred once thought was given to the conversion. For instance, a much better and larger speaker could be housed in the lower portion and connected in addition or in place of the self-contained speaker to give improved reproduction. A record-player could be housed in the upper portion, with its speaker in the lower section. These and many other suggestions arose, but in the design finally adopted, and which is illustrated at the top of this page, an extension radio speaker was fitted to the rear wall of the lower section of a special cupboard which was constructed from second-hand timber.



A view of the finished table.

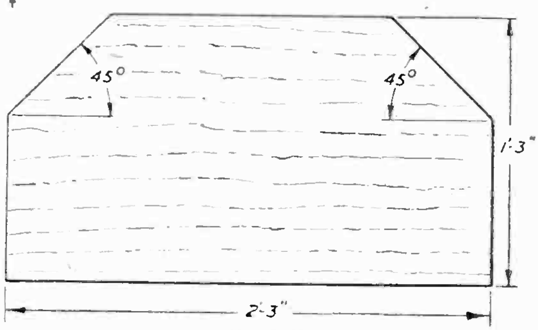


General measurements of the author's cabinet or table.

The Design

An old second-hand cupboard was purchased, made of oak, and this was pulled down and the oak scraped with a scraper to remove the surface varnish and leave the natural wood. The portions were then cut out as shown in the various sketches, leaving out the back, the portions of the drawer which are inside, and the bottom. From the scrap the two handles were cut, although these could be purchased ready-made in an alternative design if desired. The top was cut larger than the general section of the cupboard, and the rear corners taken off so that it could be placed well back in the corner of the room. The back and drawer portions may then be made from plywood or any other timber ; the edges of the top and sides are rounded off. I had some special volumes which I wished to keep and therefore the lower section was cut to accommodate these : but any alternative may, of

(*Concluded on page 344*)



Details of the top.

A Useful Calculator

RESISTANCES IN PARALLEL : CONDENSERS IN SERIES : AND INDUCTANCE VALUES EASILY READ FROM THIS HANDY DEVICE

By A. M. St. Clair

RESISTANCES in parallel: R1.R2/(R1 + R2). A familiar expression, but an awkward one, since it cannot even be directly performed on a slide-rule. And an expression of the same form holds, of course, for inductances in parallel and for condensers in series, and a very similar one for stage-gain. When we ask the question, "What resistance must I put in parallel with R1 to obtain R2?" the formula is, oddly enough, less well known. It is R1.R2/(R1 − R2), and if we work with a slide-rule, we must simultaneously perform a mental subtraction. It is a well-known fact in psychology that even the best of us make appreciably more errors in mental subtraction than in addition. And if you wish to find out which pairs of resistors in parallel will produce a given value—say, for instance, that you require a 75,000 ohm, and do not possess one—then,

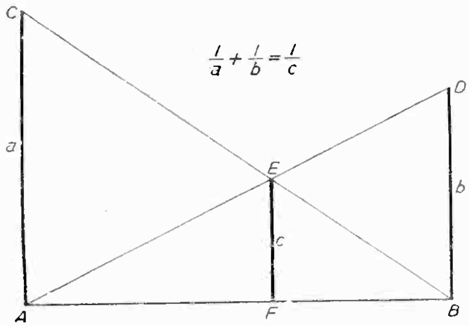


Fig. 1.—The basic principle of the calculator. See also Note 1 (page 309).

if you have no simple automatic method of calculation, you will have a lot of paperwork or a lot of trial and error.

The formula R = R1.R2/(R1 + R2) can be written as 1/R1 + 1/R2 = 1/R. This will be obvious to readers familiar with the use of conductance, but in any case it follows by the use of a little elementary algebra. Now there is a very simple geometrical construction which takes two given lengths a and b, and produces a third length c, such that 1/a + 1/b = 1/c. It is shown in Fig. 1. Draw any base AB. Erect perpendiculars AC and BD, so that AC = a, and BD = b. Join AD and BC. Let them meet at E. Draw EF perpendicular to AB. Then, calling the length of EF c, we have 1/a + 1/b = 1/c. We could, by picking suitable units make AC represent R1, BC represent R2. We could then solve the value of the pair in parallel by simply measuring EF. Equally well, by constructing the figure in a different order, we could solve any of the other problems connected with these formulae.

It is not necessary, however, to draw the figure afresh each time we need to make use of this principle. We can, with very little trouble, make ourselves a "figure" which is permanent, accurate, and adjustable. Look at Fig. 2. Here we have a base with two perpendiculars, each graduated from 1 to 10. This could be from 1 ohm to 10 ohms, or from 1,000 to 10,000, or from 1 megohm to 10 megohms, or any of many other possible ranges. Provided that the two resistors with which we were concerned fell within such a range, we could find their paralleled value by drawing a couple of lines. The lines in the diagram, intersecting at E, show that 8 ohms in parallel with 5 ohms produce very clearly 3.1 ohms; or that 80 megohms in parallel with 50 megohms produce very nearly 31 megohms; or that 800 pF in series with 500 pF produce a little under 310 pF. If we were to mount this figure on a board, and attach a couple of celluloid strips, suitably ruled, by means of pins at A and B, we should be well on the way to having our calculator. However, if one component were more than ten times the value of the other, we should be unable to obtain any answer, or at least, any answer of reasonable accuracy. It is necessary to extend the scales.

Before we do this, there are some points worth noting. Firstly, we almost never connect resistors or inductances in parallel, or condensers in series, when one is as much as a hundred times as large as the other. The reason is that the larger, then, has so little effect. We should, therefore, endeavour to extend our scales to read from 1 to 100. Secondly, it will be necessary to extend only one side of the scale; the larger value can always be set on this side. And finally, since the basic 1 to 10 scale must remain reasonably open and readable, it will be necessary to use some form of compression for the larger numbers. Indeed, this is in any case logical, since component values are rated in accuracy by means of a percentage

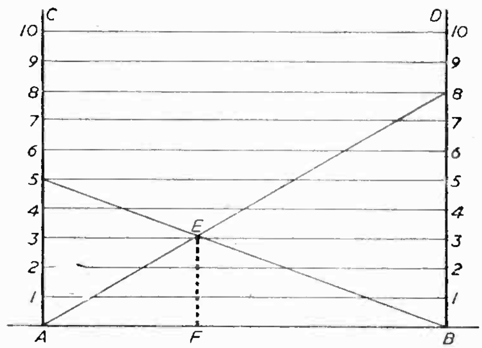


Fig. 2.—One graphical method of calculation.

of the total, and it is seldom that more than two significant figures are quoted.

The method of extension is shown in Fig. 3. A quadrant of a circle is added to the graduated lines, and points are marked on it to correspond with the numbers from 10 to 100. These points could be located with accuracy by the direct method indicated in Fig. 3, if sufficient drawing-board or table space were available. A length of over 50ins., and a straight-edge to match, would be required. If these are available it is the best method. If not, a more artificial approach is indicated, and is detailed below.

Laying Out the Scale

The most convenient lengths for the basic scale have been found, by trial and error, to be either 5in. or 10 centimetres. The latter gives a pocket-sized instrument, the former has greater accuracy. There is no reason why a model for bench use should not be constructed having an even larger scale and correspondingly greater accuracy; the construction would follow on exactly similar lines. We shall deal, therefore, with the laying out of a scale having a basic dimension of 5in. (see Fig. 4).

Lay off a base AB exactly 2½in. long. Erect perpendiculars AK and BH at least 7½in. long. Mark off each from AB upwards in units of 1/10in., and join the markings across for a distance of 5in. The last of these joins is CD, exactly 5in. from AB, and parallel to it. With centre D and radius 2½in., draw the quadrant CH. Join CH. Continue drawing lines through the 1/10in. markings parallel to AB, but terminate them on CH. There will thus be parallel graduations for a distance of 7½in. A number should be placed opposite every fifty graduation, the numbers proceeding from 0 at A and B, to 10 at C, and 15 at H.

Now mark L and M on AB and respectively ¼in. and ½in. from B. Through them draw lines parallel to BH. These lines are used to locate points on the quadrant CH. With the line MP, you must associate a multiplier of 5, and with LN one of 10. Thus, to locate the point on the quadrant corresponding to 20, draw a line through B and the intersection of MP with the graduation line marked "4" ($4 \times 5 = 20$) and produce it to meet the quadrant. The points from 11 to 70 will be found in this way; those from 11 to 15 may be checked by the fact that the lines used to position them should pass through the corresponding points on the line CK. In fact, if it is convenient, CK may be extended and all the points up to, say, 25 may be located directly as in Fig. 3.

For graduations between 70 and 100, it is necessary to use the line LN. Here a line should be drawn through B and the intersection of LN with that graduation having one-tenth of the required value, e.g., to find the "80" mark, join B with the intersection of LN and the "8" graduation ($8 \times 10 = 80$) and produce to meet the quadrant CH.

All the above work should be done as lightly as possible in pencil. When it is complete, the lines AB, AC, BH and CH, together with the quadrant CH, and all the graduation lines, should be inked in. The construction lines may now be removed by means of a soft eraser. It is recommended that the following points be located on the quadrant: 11-22 inclusive, 25, 27, 30, 33, 39, 40, 47, 50, 56, 60, 68, 70, 80, 82, 100. Any more would lead to confusion, any fewer to loss of accuracy; while all the "preferred values" are included.

The "preferred values" should be distinguished clearly in some way on the face of the instrument. Red ink is perhaps the best way. It will be noticed that, since each division on the main scale corresponds to 0.2 numerically, certain of these values will have to have half-way graduations marked for them. It is not desirable, in an instrument of this size, to make the

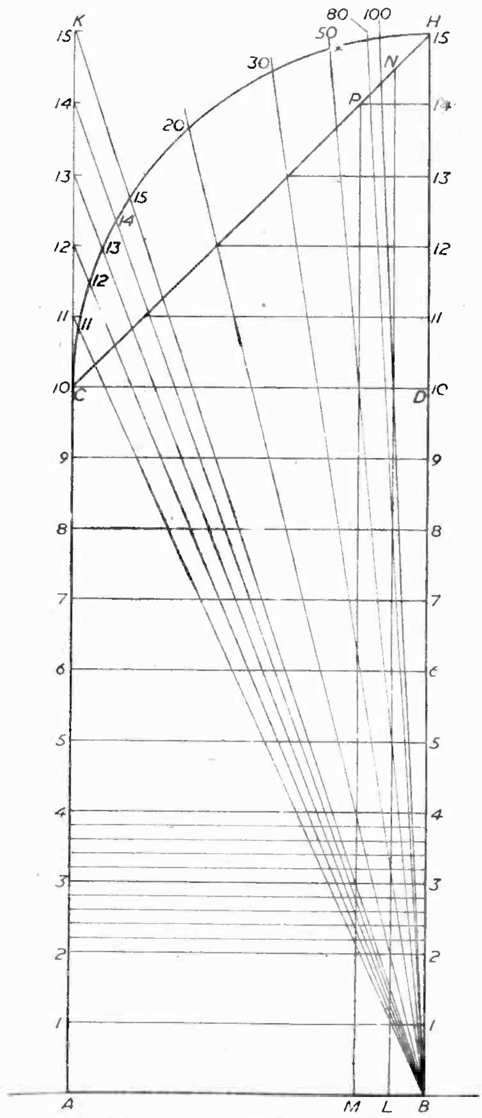


Fig. 4.—Laying out the basic scale.

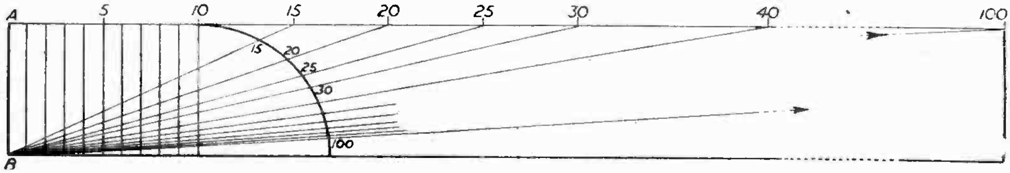


Fig. 3.—This type of scale requires a large area.

graduations any finer than we have done, or a confused appearance will result ; however, it is essential to mark 1.5, 2.7, and 4.7.

Mounting the Scale

The scale should, when thoroughly dry, be attached to a piece of celluloid. To do this, cut

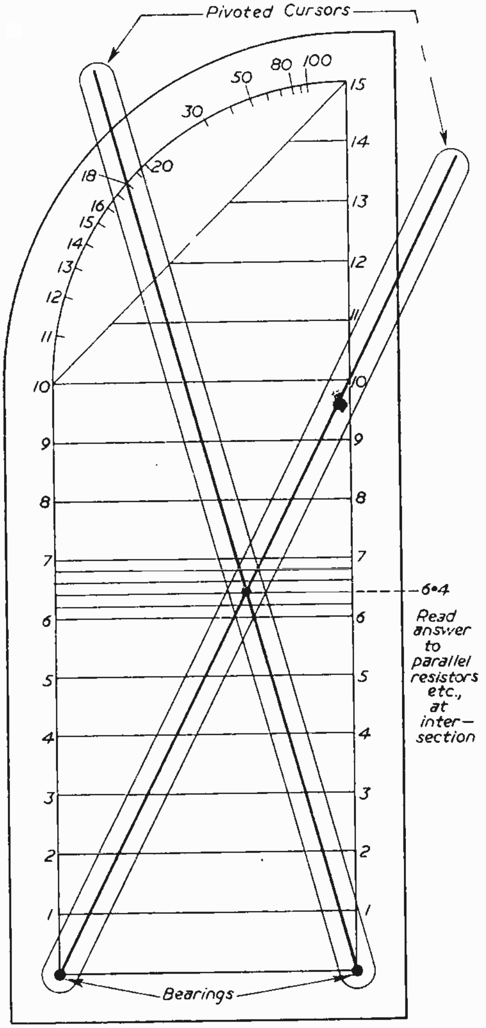


Fig. 5.—The finished calculator.

it out, leaving a suitable border all round, and place it, *face downwards*, on a flat piece of celluloid. Now take a piece of cotton wool well damped in acetone, and quickly and thoroughly moisten the paper all over, making sure that it does not wrinkle. In a matter of seconds it will be neatly and permanently attached to the celluloid, and safe from defacement. I know of no better means of rendering paper scales permanent ; it should be said, however, that it is suitable for use only where Indian, Chinese, or other good draughtsman's ink has been used, since many ordinary writing inks, and all ball-point inks, will " run " in acetone.

The resulting structure should be mounted for rigidity on bakelite, Perspex, plywood, hardboard, or other similar material. Two pointers, or cursors, should now be made. These consist of strips of celluloid or thin Perspex, 8½ × ½in., rounded at the ends, and with a straight line scribed deeply down the centre. Indian ink is rubbed well into the scribed side with s small pad of cotton wool, and allowed to dry. Upon cleaning the ink off with a damp swab, it will be found that the scribed line retains its ink, standing out as a fine black mark.

The cursors are now drilled and mounted on the scale. It must be ensured that the holes in the cursors are centred exactly on the scribed lines, and that the corresponding holes in the mounted scale are centred exactly on A and B. Any form of bearing which is convenient may be used—round nails, small screws, rivets—and naturally, the better made they are, the longer will the instrument retain its accuracy. Since the cursors are designed to cross over each other, it is necessary to place a small washer under one of them, in order to raise it a distance equal to its thickness. It is unnecessary to attempt to arrange the cursors so that they will meet those divisions between 0 and 1, since they will never be required to do this in practice.

To use the instrument, cross the cursors. Set the one projecting to the right on a figure corresponding to the lower of the two values concerned, and that which projects to the left, to the higher. Read off the answer at the intersection of the lines on the cursors. In Fig. 5, the cursors are set to 10 and 18. The cursor intersection is a little above 6.4. Thus 10 ohms in parallel with 18 gives 6.4 ohms. Or 10k in parallel with 18k gives 6,400 ohms. Or 0.001 μF in series with 0.0018 μF gives 0.00064 μF.

If we had wanted to know what resistance, in parallel with 10k, will give 6,400 ohms, we would have set the right-hand cursor to 10, and moved the left-hand one until the intersection was on the 6.4 line. The left-hand cursor would now have offered the answer, 18k.

To find what two resistances in parallel will give a required value, move the cursors together so that the intersection moves along the graduation line corresponding to the required value. Any pair of readings taken from the ends of the cursors will serve ; several settings will probably be found where both cursors are quite close to " preferred values ". One may be found where the values are in your spares box.

A little practice with this calculator, and you will find that resistances or inductances in parallel, and condensers in series, offer no more difficulty than the simple additions and subtractions of the converse cases.

Notes

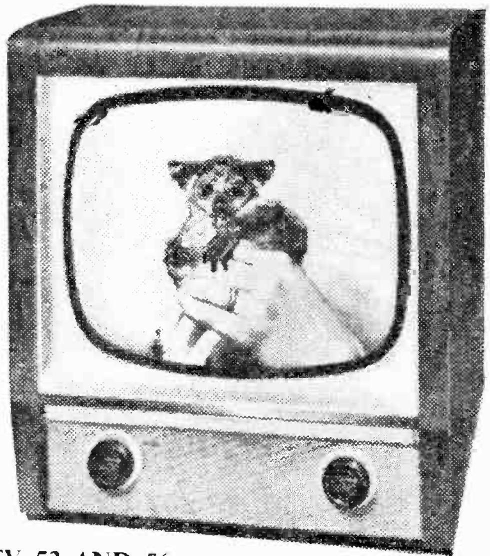
1. Referring to Fig. 1; proof of basic construction.
   $c/a = FB/AB$, by similar triangles FBE, ABC.
   $c/b = AF/AB$, by similar triangles FAE, BAD.
   $\therefore c/a + c/b = (FB + AF)/AB$.
   $= AB/AB$.
   $= 1$.
   $\therefore 1/a + 1/b = 1/c$, dividing both sides by c.
2. If $R = R1.R2/(R1 + R2)$,
   $1/R = (R1 + R2)/R1.R2$
   $= (R1/R1.R2) + (R2/R1.R2)$
   $= 1/R2 + 1/R1$.

THE P.T DATA SHEETS

No. 3.—BUSH TV 53 AND 56

THESE two models, alike in general appearance and employing 14in. tubes in the case of the 53 and a 17in. tube in the case of the 56, both follow the more or less standard A.C./D.C. technique. Console models are available with similar chassis under the references T.57, TUG. 58 and TUG. 59. Following the lines adopted in most modern commercial receivers, a built-in turret-tuner type of R.F. unit is employed with 13 channels, rotation of the channel selector control automatically changing all the R.F. coils.

The circuit employed is a superhet of the single side-band type covering from 41 to 68 Mc/s on Band I and from 174 to 216 Mc/s on Band III, the change-over from Band I to Band III being effected automatically by a cam on the channel selector switch assembly. Both timebases utilise cathode-coupled multivibrators and two metal rectifiers are used for the flywheel sync circuit. The overall bandwidth of the vision section is 2.5 Mc/s and adjacent channel is over 36 dB down.



Bush Model TV 53

SPECIFICATION OF THE TV 53 AND 56

Physical Dimensions

Model	Type	Height	Width	Depth
TV.53	14in. Table Model	19in.	16½in.	18¾in.
TV.56	17in. Table Model	21¾in.	19in.	18¾in.

Mains Supply

A.C. or D.C. 200-250 volts (50 cycles A.C.).

Consumption

140 watts approx.

Channels

The tuner is the Bush "Telepic" device, giving 13 channels from 41 to 68 Mc/s on Band I and 174 Mc/s to 216 Mc/s on Band III.

Intermediate Frequencies

Vision 34.65 Mc/s and Sound 38.15 Mc/s.

Valves

V1A/B	PCC84	Cascode R.F. stage.
V2A/B	PCF80	Oscillator/Mixer.
V3	EF80	Vision/Sound I.F.
V4	EF80	Vision I.F.
V5	EF80	Vision I.F.
V6A/B	EB91	Sound Det. and Interference Limiter.
V7A/B	PCF80	Video and C.F. Output.
V8	EF80	Sound I.F.
V9	EF80	Sound I.F.
V10A/B	EB91	Sound Det. and Interference Limiter.

Main Deck

V1A	PCL83	1st Audio Amplifier.
V1B		Audio Output.
V2A	ECC83	Sync Separator.
V2B		Frame Osc. (one half).
V3A	PCL83	Frame Osc. (one half).
V3B		Frame Amp.
V4A	ECC82	Line Oscillator.
V4B		
V5	PL81	Line Amplifier.
V6	EY51	E.H.T. Rectifier.
V7	PY81	Efficiency Diode.
V8	PY82	Power Supply Rectifier.
V9	PY82	

Picture Tube. Mullard

TV.53.
M.W. 36-24, 14in., rectangular tube.
TV.56, T57 and TUG.58.
M.W. 43-64, 17in., rectangular tube.

Loudspeaker

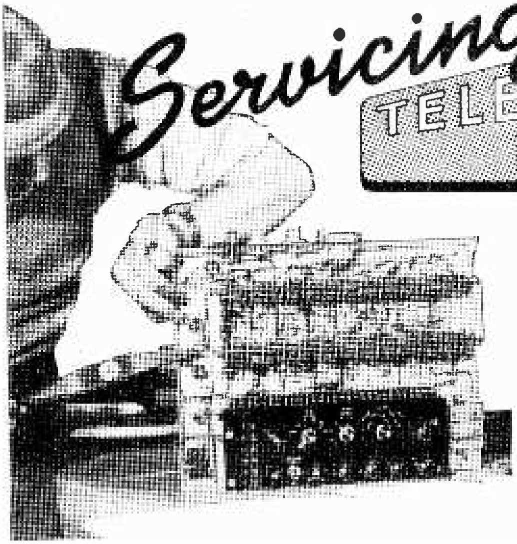
6in. elliptical in both TV.53 and TV.56.

Sensitivity

Band I—30 microvolts.
Band III—50 microvolts.

Aerial Input

80 ohms unbalanced.



Servicing TELEVISION RECEIVERS

No. 27.—AMBASSADOR TV4 AND TV5

By L. Lawry-Johns

THIS article will concern the later models in this range, but the notes at the end will detail the differences in the various circuits which apply to the early models and the intermediate production runs. The receivers are five-channel superhets, working on the lower sideband of the vision carrier. The I.F.'s are 15.75 Mc/s (mean vision) and 19.25 Mc/s (sound). It should be noted that in order to obtain the higher sound I.F. the oscillator is tuned to a frequency above that of the transmitted signal.

In practical terms, this means that a suitable converter or adaptor for the addition of Band III will have to employ a circuit with the oscillator "working high."

This, of course, only applies when an input at I.F. is desired. The usual "all-purpose" converter is not affected since it merely changes the Band III signal frequency to Band I.

Therefore, a simple conversion is nearly always successful without modification to the receiver, but where a tuner unit of the 12- or 13-Channel type is desired, such as the Valradio, for example, the order should clearly state "Oscillator high." For normal five-Channel BBC use, channel changing is by altering the composite dust-iron and brass cores of the oscillator. R.F. and aerial coils. The aerial input is designed for coaxial (80Ω) cable, the outer screening of which, and the aerial input coil, is isolated from the chassis by a .001 μF capacitor.

The contrast control is included in the cathode circuit of the first valve (V1 6F1).

V2 is another 6F1, working as a combined oscillator and mixer, the output of which is transformer coupled to the first (common sound and vision) I.F. amplifier (V3 6F1). The cathode of this valve is coupled to the cathode of V1, the contrast control, therefore, operates on both valves, affecting both the vision and the sound amplification.

From the anode of this valve (V3) vision signals are fed to the vision I.F. amplifier, which is followed by the vision detector. The vision I.F. amplifier is a further 6F1 (V4) and the detector is section A of a 6D2 (V5). This is followed by the video amplifier (V6) 6F1. Section B of the 6D2 operates as the interference limiter with its cathode wired to the anode of the video amplifier.

The anode of the diode is taken to the vision noise limiter control which varies the H.T. applied and thus the conducting point.

V6 has a single anode load resistor (6.8 K.) and the signal voltages developed across this are applied to the tube cathode and the sync separator (V11 6F1).

This circuit is shown in Fig. 1. It will be noted that the G3 suppressor grid of V11 is fed from a positive source rather than returned to the cathode as is more usual in this type of circuit.

The line sync pulses are taken from the anode of V11 and applied to the screen grid of the 20P1 line oscillator/amplifier.

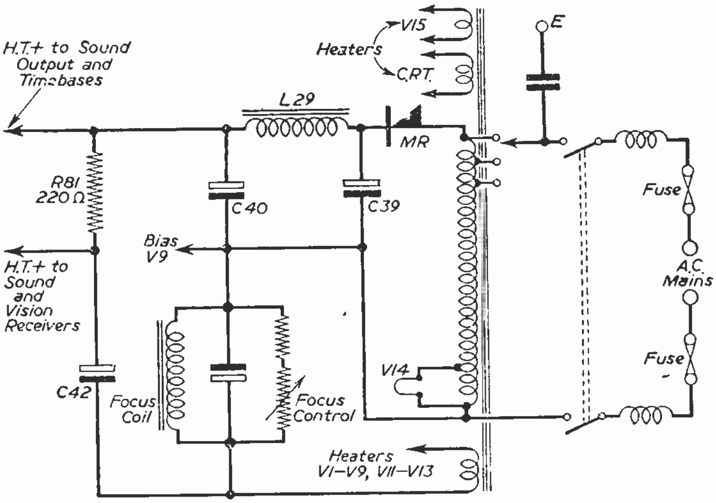


Fig. 4.—Mains Supply Circuit.

The frame pulses are taken from the screen of V11 and are applied to the 6K25 frame oscillator.

The Frame Timebase

This is fairly conventional. The vertical hold control is wired in the V12 (6K25) circuit, and the waveform at the anode is fed from the Vertical Form control to the 6P25 (V13) frame amplifier.

The height control is included in the cathode circuit of this valve, the output voltage of which is developed across R72 and L34, and is applied to the scanning coils, which are of the high impedance type, in series with a 32 μF to chassis.

The Line Timebase

As already mentioned, the 20P1 (V14) is used as a self-oscillating line amplifier, the control grid being coupled to a winding on the line output transformer. The frequency of the circuit is controlled by the horizontal hold control in series with this winding. An efficiency diode V15, usually a U281, is used and this provides boost voltage, not only for V14 but also for the anode of the frame oscillator V12.

An overwind on the transformer supplies the EY51 anode whilst a separate winding supplies the heater of this valve.

Mains Supply

A metal rectifier is used, fed from one end of the mains winding of the transformer. The output of the rectifier is smoothed by the choke L29 and the capacitors C39 and C40 (100 by 200 μF).

Separate windings supply the various valve heaters, as shown in the diagram. Note that the chassis is *live*, i.e., is connected to one side of the mains. It is important to see that the mains plug is correctly inserted or wired as the case may be.

The focus coil is connected between the chassis and the mains return, shunted by an electrolytic capacitor (25 μF) and the focus control resistors. Thus the total H.T. current of the receiver passes through the focus components.

Fault Symptoms

For poor focus in bands across the picture, pulling of verticals and intermittent loss of line hold, loss of definition, smudging horizontally, etc., suspect heater/cathode short in tube. If symptoms vary when the tube neck is tapped, an isolating transformer should be fitted. Several types are available, and regularly advertised. The 1-1 ratio type is suitable, and is merely inserted in series with the heater leads. Even simpler to fit is the Nuray unit, which again is

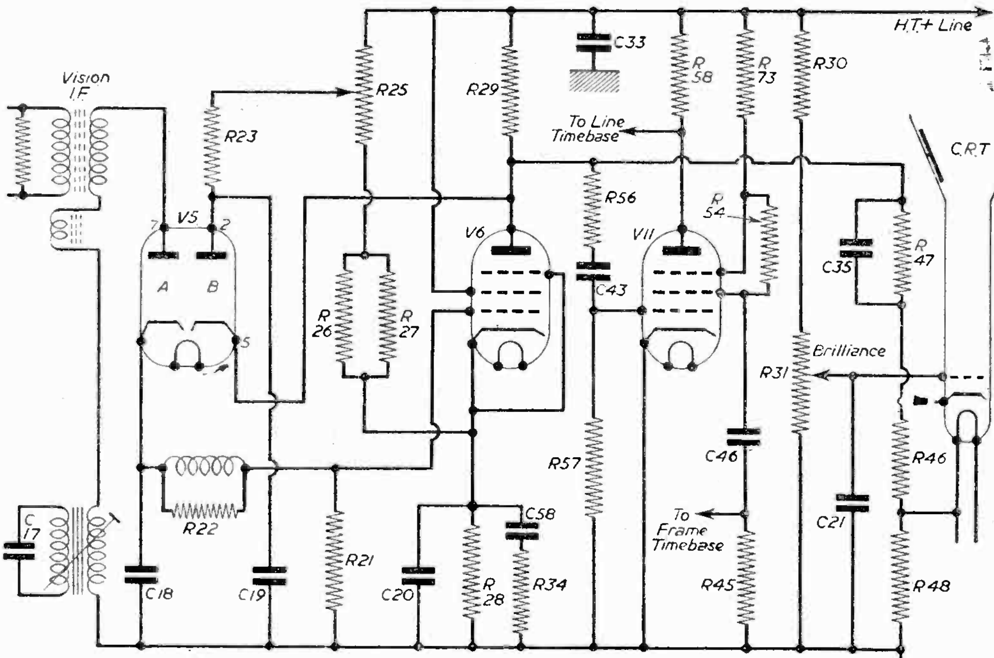


Fig. 1.—Video detector, limiter, video amplifier, sync separator and C.R.T. circuit.

C17—30 pF.	C43—.1 μF.	R23—2.2 M.	R34—100 Ω.	R73—150 K.
C18—6 pF.	C46—.05 μF.	R25—30 K.	R45—100 Ω.	R30—100 K.
C19—.1 μF.	C58—1,000 pF.	R26—33 K.	R54—220 Ω.	R31—100 K.
C20—200 pF.				
C21—.1 μF.		R27—33 K.	R56—10 K.	R46—100 K.
C33—2,200 pF.	R21—5.6 K.	R28—270 Ω.	R57—470 K.	R47—150 K.
C35—.25 μF.	R22—47 K.	R29—6.8 K.	R58—68 K.	R48—470 K.

regularly advertised and features plug and socket fitting and various boost positions. Uncontrollable brilliance on this receiver usually denotes a heater/cathode short in the limiter section of V5 (6D2). As the cathode is directly connected to the video amplifier anode and as one side of the heater is taken to chassis, it is not difficult to see that a short between the two caused the H.T. voltage to be dropped across R29 leaving the anode, and thus the C.R.T. cathode, at chassis potential.

This means that the control grid can only be made equal, but not negative, to the cathode, which, of course, it must be for normal working. The simplest check for this is to remove the 6D2 which should then restore the brilliance control provided that R29 (6.8 K.) has not been damaged by the heavy flow of current during the faulty condition.

It is always as well to check upon R29 when this particular fault develops since the definition of the picture is much affected by the value of this resistor.

Vertical Jitter

In nearly all cases where the picture is unsteady vertically the 6K25 valve (V12) will be found responsible.

A defective 6K25 can also cause white lines across the top of the picture, variation in frame hold, lack of height with the vertical hold control at one end of its travel and other troubles associated with the vertical scanning.

A picture which is compressed at the bottom, the height control extending to the top, usually indicates a failing 6P25 valve V13, whilst a fold over at the bottom often indicates poor insulation in the .5 µF coupling capacitor.

Faults in the Line Timebase

These are a little more difficult to diagnose due to the use of a single-valve oscillator and amplifier.

However, inability to secure line lock should direct attention first to the 20P1 (V14), if replacement does not help matters, check the 4 K. screen dropping resistor, and then the 2 µF capacitor associated with the grid circuit hold control. Lack of width or poor linearity will often be noticed at the same time as the loss of hold. The H.T. voltage should not be less than 250, if it is it can generally be assumed that the metal rectifier is failing. This will cause lack of width and will necessitate an increase in height.

The efficiency diode will cause various width and linearity troubles, but as a general rule this valve (V15) is fairly trouble free.

C44—.02 µF.	C52—1,000 pF.	R60—47 K.	R67—500 K.	R76—270 K.
C45—.01 µF.	C53—2 µF,	R61—47 K.	R68—1 MΩ.	R77—1 K.
C47—2×.1 µF.	C54—2 µF.	R62—220 K.	R69—47 K.	R78—680 Ω.
C48—.5 µF.	C55—.001 µF. 10 or 12.5 KV.	R63—560 K.	R70—180 Ω.	R79—5 K.
C49—.02 µF.	C61—1 pF.	R64—2.2 K.	R71—1 K.	R80—2.8 K.
C50—32 µF.		R65—2.5 K.	R72—10 K.	R82—2.2 K.
C51—300 pF.		R66—68 Ω.	R74—4 K.	R83—33 Ω.

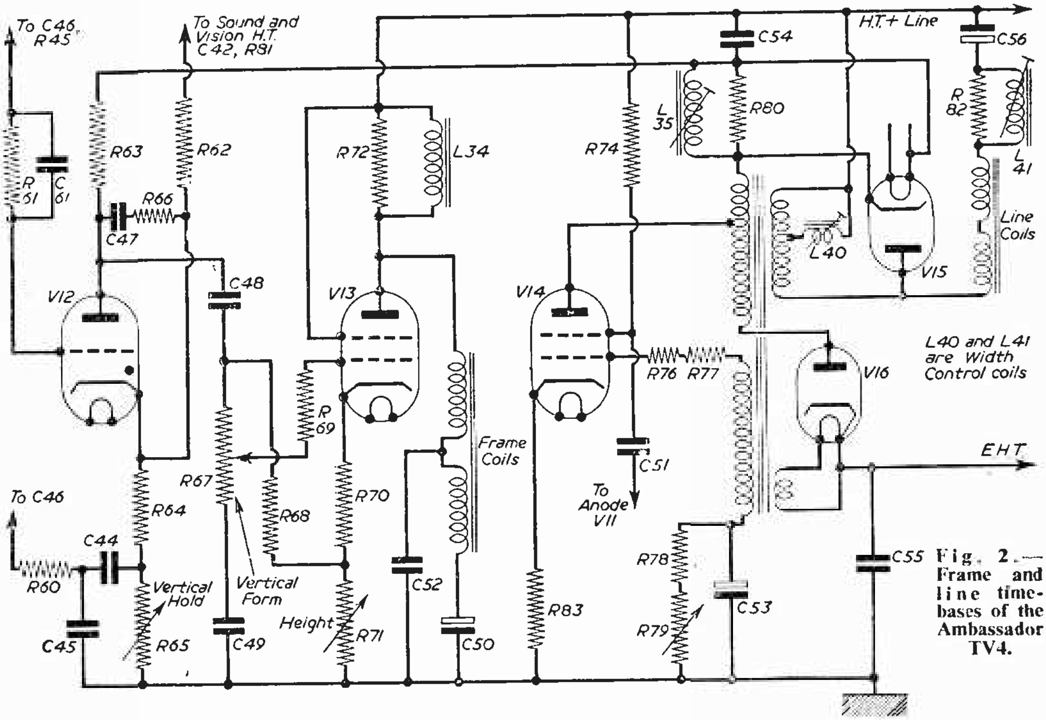


Fig. 2.—Frame and line timebases of the Ambassador TV4.

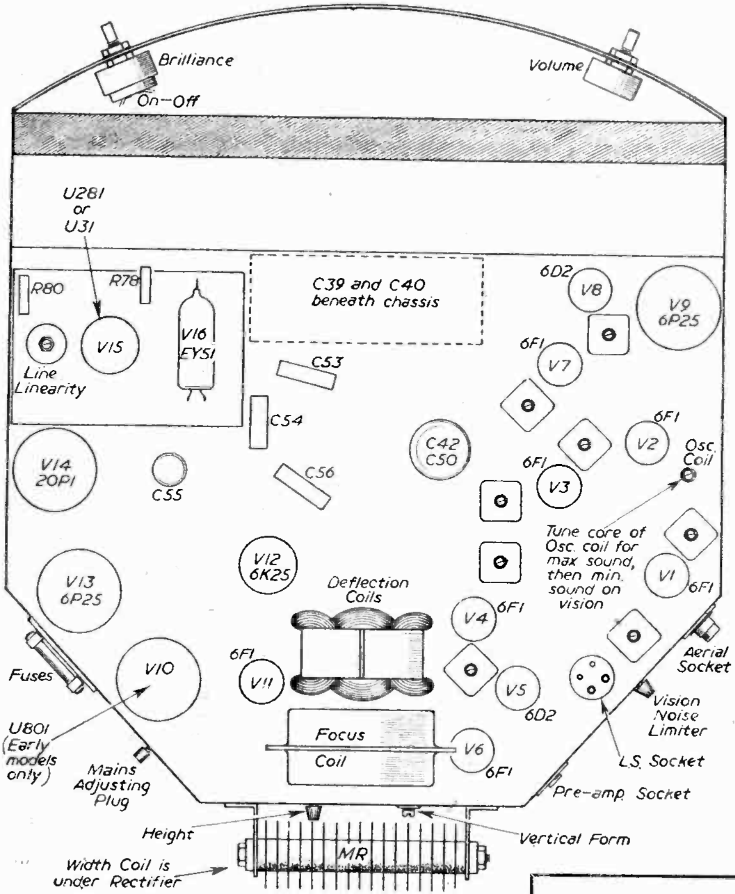


Fig. 3.—Top of chassis view.

Crushing on one side (right) should direct attention to the associated 2 μF capacitor and in some circumstances a failure in this capacitor can cause complete loss of picture, EHT, etc.

The EHT rectifier is an EY51 and the unmistakable symptoms of this valve failing are when the white picture content becomes defocused, this continuing to a point where as the brilliance is advanced the picture becomes larger and more defocused until it "blows up" and fails completely.

The defocusing of the white picture content should not be confused with that effect produced by a failing tube. In this case the image appears to separate, giving a blurred effect, and further advancement of the controls produces a negative picture. This is as the emission of the tube fails. Where boost voltage has been applied and the tube becomes soft, i.e., the vacuum becomes impaired, streaking of the picture results, and various other poor definition effects. A good symptom to watch for is the shape of the spot left on the screen when switching off. If the tube is soft this spot will "mushroom," i.e., expand into a patterned circle. This heralds the end of the tube's useful life and extra boosting will only aggravate the effect.

The Sound Circuit

Sound signals at I.F. are taken from the anode of V3 and are applied to the control grid of V7. The volume control is in the cathode circuit of this valve. From the anode, signals are transformer coupled to the detector/limiter V8 (6D2).

Signals at A.F. are fed from the limiter anode to the 6P25 (V9) sound output valve.

The bias of this valve is derived from the mains side of the focus coil, since this is negative with respect to chassis, and is applied to the control grid. The cathode is taken direct to chassis.

Distorted sound should direct attention first to the 3.9 MΩ resistor which is wired from H.T. to the anode of the noise limiter section of V8. This is coloured orange, white, green. If this resistor is not at fault, check the .05 μF coupling capacitor to the control grid of the 6P25 as the insulation of this capacitor must be of a high order.

Early models differed considerably in some respects, the earliest having a U801 H.T. rectifier. This is marked V20 in the top chassis layout. Later models employed two U31 rectifiers in place of the U801.

Slot Aerials for Television

SOME PRACTICAL AND THEORETICAL CONSIDERATIONS By B. L. Morley

(Continued from page 259, January issue)

DO not let bare copper wire come into direct contact with the chicken netting or corrosion will take place in a damp atmosphere, a small cell being set up between the two (copper and zinc). This is particularly important where the aerial is to be fitted out of doors.

The slot should be cut out with wire cutters, and it is advisable to strengthen the edge of the slot with stiff wire. This would also serve as a suitable mounting for the triangular-shaped pieces if balanced feeder is to be used.

The four corners of the netting can be fixed to the rafters by a piece of strong twine so that the netting is spread out neatly. Note that the aerial should face the transmitter, and note most carefully that if your local station is vertically polarised, then mount your slot aerial horizontally, while if it is horizontally polarised, then mount your aerial vertically.

If there is any doubt about the polarisation of the local transmitter simply observe local outdoor aerials and mount your slot aerial at 90 deg. to them.

Where the aerial is fitted in the roof it is possible to bring the feeder down between the walls when the house has cavity walls. A neat fitment can thereby be achieved.

Using a Reflector

The gain of a slot aerial can be materially increased by the addition of a reflector. This can take three forms: it can be a plain wire-mesh reflector, a slot reflector or a rod reflector.

For a plain wire-mesh reflector all that is necessary is to use a piece of wire netting of the same gauge as that of the slot aerial, with the dimensions given in Table III, behind the slot aerial, i.e., on the side remote from the transmitter.

The reflector should be fitted at 90 deg. to the slot

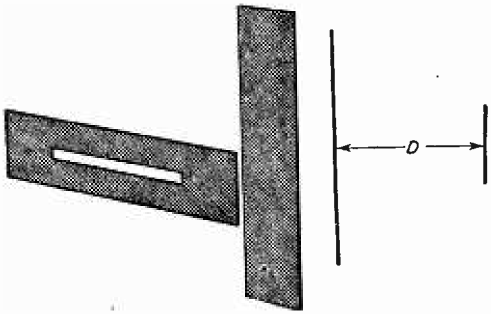


Fig. 12.—Fitting a reflector.

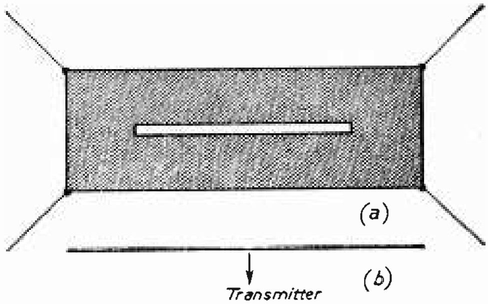


Fig. 11.—How the slot is fixed or orientated.

aerial as shown in Fig. 12 and should be a quarter-wavelength behind it; the distance " D " is given in Table IV.

The slot reflector is built on exactly the same lines as the slot aerial, a slot being cut in the centre of the netting. The dimensions of the netting in which the slot is to be cut should be those in Table III and the dimensions of the slot are given in Table V. The aerial and slot should be in the same plane, the slot being mounted on the side of the aerial remote from the transmitter.

Table IV gives the distance between the aerial and the slot.

The slot reflector should be mounted in a similar manner to the slot aerial and can be simply strung from the rafters in the loft.

A plain rod or tube can be used as reflector and should be of the same length as given in Table V. It should be mounted behind the slot aerial and should be at 90 deg. to it, i.e., that if the slot is horizontal the reflector must be vertical and vice versa.

The distance between the rod and the aerial must be that given in Table IV. This reflector is, in fact, very similar to the wire mesh aerial, except that the rod is used instead of wire mesh.

Note that in all cases no electrical connection is made between the reflector and the dipole.

Effects of Adding Reflectors

Adding a reflector to a slot aerial has several effects. The foremost of these is, of course, the increase in gain. and a reflector will improve the gain by about 3 db—roughly the same as that of the reflector added to a normal dipole as in the " H " aerial.

The second effect is that pick-up to the rear of the aerial is considerably reduced. This is particularly so in the case of the plain wire-mesh reflector. By using this property it is possible to obtain a high front-to-back ratio with the system and so to discriminate against interference of a man-made type.

A third effect is that the impedance of the aerial dipole is increased. With a simple reflector such as illustrated the resulting mismatch between aerial dipole and the feeder need not cause worry, as under

TABLE III

Channel		Length	Width
1	...	15′ 6″	5′ 6″
2	...	14′ 6″	5′ 0″
3	...	12′ 6″	5′ 0″
4	...	10′ 6″	4′ 6″
5	...	9′ 6″	4′ 6″

normal conditions the mismatch will be masked by the increased gain.

Boxing the Slot

A very high front-to-back ratio can be obtained from this aerial if it is boxed. (By front-to-back ratio we mean the signal voltage picked up in front of the aerial compared with the signal voltage picked up behind the aerial.) Where it can be arranged for an aerial to be sited between an interfering source and the transmitter, any method giving a high front-to-back ratio will be of real value in minimising the interference.

In Fig. 13 we show two methods of boxing the slot aerial.

The method shown in Fig. 13(a) is where a complete

TABLE IV

Channel		Distance
1	...	5′ 6″
2	...	5′ 0″
3	...	4′ 6″
4	...	4′ 1″
5	...	3′ 9″

TABLE V

Channel		Length
1	...	11′ 2″
2	...	9′ 8″
3	...	8′ 10″
4	...	8′ 0″
5	...	7′ 5″

TABLE VI

Channel		Length
8	...	2′ 3½″
9	...	2′ 2¾″
10	...	2′ 2″

wire-mesh box is built. The front section is made as given previously and then a complete box is made, the depth of the box " D " being a quarter-wavelength as given in Table IV.

It is permissible to build the box on a wooden framework so as to give mechanical strength.

The second method is to erect a hemisphere of wire mesh behind the slot as shown in Fig. 13(b). A stout

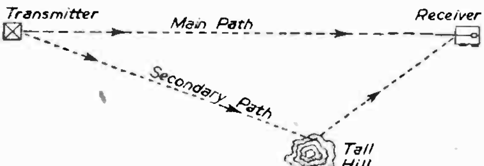


Fig. 14.—Reflected signals.

wire frame could be used, and the dimension " R " could be the same as that given in Table IV.

Boxing in the slot gives an extremely high front-to-back ratio and can give a great increase in performance.

One effect of boxing is that the impedance of the slot is increased rather and becomes in the region of 1,000 ohms. This becomes rather difficult to handle, but a fairly reasonable match can be made to 80-ohm cable with a quarter-wave matching section of 300-ohm cable.

Matching

We have talked about matching in various sections, but there may be some who are not really familiar with this term.

In all circuits the maximum power is transferred

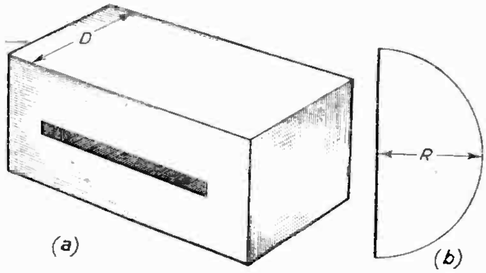


Fig. 13.—Method of boxing the slot.

from one point to another when these points have the same impedance.

Our objects are first of all to pick up as much power in our aerial system as we can and then to transfer as much as possible into the feeder and then from the feeder into the televisor.

If the impedance of the aerial is 80 ohms and the characteristic impedance of the cable is 80 ohms, and the input to the televisor designed to be 80 ohms, then we shall get the maximum transference of power from the aerial to the receiver.

Unfortunately this ideal state of affairs rarely exists, and to overcome the difficulty we have to resort to various devices. In the case stated above we say the aerial is matched to the feeder and the feeder is matched to the televisor. If a mismatch occurs, then we shall have losses.

A simple device for effecting matching is by means of a transformer and at the frequencies of television broadcasts it is a fairly easy matter to use a quarter-wave section of line to effect matching.

A full discussion of the details is rather beyond the scope of this article, but suffice it to say that if a quarter-wave section of cable is inserted between the feeder and the aerial, then correct matching conditions can be obtained.

When dealing with cables a factor called the velocity factor of the cable comes into consideration (Vo) and this must be accounted for when calculating quarter wavelength sections of cable.

Under average conditions the velocity factor can be taken to be 0.66 and this factor must be used as a multiplier against the calculated quarter wavelength figures.

Application of the Slot Aerial

The slot aerial can be used for both TV bands and one main advantage is that it can be easily mounted in the loft where space is restricted for reception of transmissions which are vertically polarised. (For horizontally polarised transmissions then no advantage is gained so far as space is concerned.)

The next advantage lies in the extremely high front-to-back ratios obtained when the slot is boxed in, and it is thus very suitable for use where a source of man-made interference lies behind the receiving point.

A third and very important advantage gained with the slot is its use for prevention of ghost reception, and it is probably the finest aerial for use in areas plagued with ghosts. Quite often it has been found that this aerial will succeed where others fail and the author would unhesitatingly recommend it for this purpose.

Ghost Reception

The reception of ghost images has been dealt with before in these pages, but it would not, perhaps, be out of course to give a brief explanation to the newcomer.

By ghost reception we mean the appearance on the screen of a second image displace to the right of the original image.

This second image is usually fainter than the main image and it is possible to receive yet a further displaced image. In fact under severe conditions multiple images can be received.

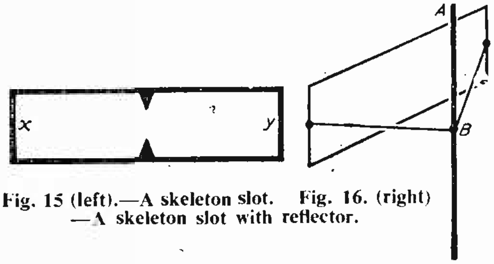


Fig. 15 (left).—A skeleton slot. Fig. 16. (right) —A skeleton slot with reflector.

In Fig. 14 we have a simple case of a reflected signal causing a ghost image. From the transmitter the receiving station receives the main signal by the direct path. It also receives a second signal which is reflected from the hill as shown in the diagram.

The second signal has farther to travel than the main image and therefore it will arrive slightly behind (in time) the main signal. It will therefore produce a second image on the screen displaced to the right of the main image.

Another point to note is that the second image has farther to travel than the main image and so it will be weaker. The second image is therefore usually weaker than the main one and has a ghost-like appearance—hence the term "ghost."

On Band III reflections are much more likely to occur than on Band I and can be really troublesome.

There is not only the annoyance of the second image on the screen, but also the synchronisation of the receiver can be upset by the reception of the ghost sync pulses.

In all cases where ghosts cause trouble the slot aerial should be tried. One point to note, however, is that it may not be possible to obtain enough gain in poor reception areas and if a reflector does not ease matters, then another aerial system can be tried.

It should be noted that it is possible to get ghost reception by reason of poor matching between aerial and feeder, or feeder and receiver, and here the cure is obvious. It does not often occur in normal feeders because of the restricted length, but can be troublesome in feeders which are longer than the normal. Even in normal length feeders it is possible to get this trouble, and in cases where reception has been previously good and is then marred by multiple images, the feeder connections should be inspected.

Slot Aerials on Band III

Slot aerials can be used quite effectively on Band III and the smaller dimensions make them easier to handle. Used exclusively without the aid of parasitic elements they are not, perhaps, quite so effective except in areas of high signal strength.

The same principles apply here as in Band I, the aerials functioning in a similar manner. It has been found that it is possible to increase their pick-up by the addition of reflectors and even directors.

Because of the smaller dimensions it is possible to erect these out of doors in Band III and thus full advantage can be taken of increased height. Further, it has been found that the aerial can be considerably simplified, the slot taking an elementary skeleton form. They are then termed "skeleton slots" and have been used both by amateurs and commercially.

The Skeleton Slot

It has been stated previously that for optimum results the dimensions of the surrounding media of the slot aerial should be such that one-fifth of the wavelength of the slot is covered. It is possible, at the higher frequencies, however, to dispense with a great deal of the media and it can be trimmed away so that only the slot remains as shown in Fig. 15.

It is remarkable that this skeleton still exhibits the characteristics of the original slot and has a very good pick-up. The centre impedance is of the same order as the original slot and it can be fed in similar ways. The polarity characteristics are similar, as the slot must be mounted vertically for horizontal polarisation and horizontally for vertical polarisation.

With the skeleton slot it should be noted that the centre of the two ends is the point of zero potential and, therefore, connection can be made to these two points for purposes of mounting the aerial. This feature has been taken advantage of in at least one commercial array.

One method of mounting a skeleton slot with a reflector is shown in Fig. 16. The central mast forms part of the reflector and the section from "A" to "B" should be one quarter of a wavelength of the channel it is desired to receive. This section can either be a continuation of the existing metal mast or a section of smaller diameter mounted on top of it.

The slot itself is supported by the two arms which are joined to the two points of zero potential in the slot (points "x" and "y" in the diagram of Fig. 15).

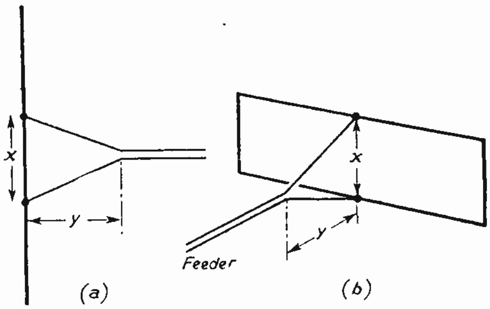


Fig. 17.—On the left a delta match, and on the right a delta applied to a slot.

The length of the slot should be the same length as applied to a normal B and III dipole appropriate to the channel it is desired to receive. The metal sections can be firmly bolted so that the whole array stands up to the normal weather conditions (Table VI).

Connecting the Feeder

It should be remembered that the slot aerial has a central impedance of about 500 ohms and, therefore, some form of matching must be employed to enable connection to be made to normal 80-ohm cable.

The connection can take the form of a quarter-wave matching transformer as explained in a previous section. Another method which has been adopted commercially is to use a delta section.

In Fig. 17(a) is shown the delta method of matching as applied to a normal dipole. The dipole itself is a straight rod not broken in the middle; the impedance of the rod varies through its length and tappings made at different points will have different impedance values.

The end of the feeder cable is opened out in roughly an exponential form which makes the delta shape. The width of the mouth "x" will depend largely upon the characteristics of the array to be matched and is best found by empirical methods. The length of the delta "y" is made about 15 per cent. longer than "x."

In Fig. 17(b) is shown the delta applied to a slot. The mouth of the delta is determined by the actual width of the slot and this can be in the region of 18in. ("x"). The "y" section is made longer as for a normal delta connection.

One ingenious method of using the slot principle with delta matching is in the J beam Band III aerial, designed for long distance working. The aerial comprises a double array consisting of three directors and a reflector in each arc.

Unlike the normal Yagi there is no separate dipole for each array, but a single slot aerial is fitted between the two, forming a coupling unit, matching device and mechanical support all in one.

In Fig. 18 is shown a skeleton diagram of the arrangement. It has quite a high efficiency coupled with good mechanical strength to combat the elements.

The feeder is taken to the slot by a matching delta section.

There are other methods used for connecting the feeder. In one system using coaxial cable the centre

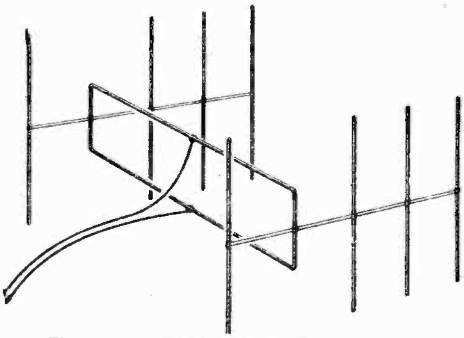


Fig. 18.—A Yagi array with slot aerial.

conductor is taken to a sliding bar which bridges across the two extreme ends of the slot.

The system is shown in Fig. 19. It will be seen that the outer of the coaxial cable is fastened along the bottom of the slot for half its length as described previously. The inner of the coaxal cable is taken to the rod "R," which can be moved up or down.

In practice the rod is adjusted under receiving conditions so as to obtain optimum working. Careful experimentation will produce good results.

Where the amateur is concerned it is convenient to have a method of varying a matching device so that he can obtain the maximum benefits from his array.

A slot used with a Yagi can be tilted in the same

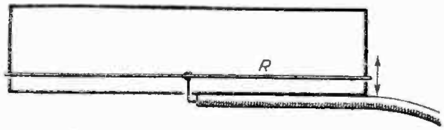


Fig. 19.—Another matching device.

manner that an ordinary Yagi is sometimes tilted so as to obtain the best results.

The reason for the tilting is so as to take advantage of any malformation of the incoming wave. The waves are to a certain extent refracted by the curvature of the earth because of atmospheric conditions. This is more noticeable in Band I than in Band III, but it does occur to some extent in the higher band. If the wave front is inclined a little from the strictly vertical position, it is sometimes beneficial to incline the aerial in a similar manner.

It is always best to do this under practical working conditions and the proximity of near-by objects will be found to have some effect. Generally in the open spaces little is to be gained by inclining or tilting the aerial except when a near-by hill comes between the transmitting station and the receiving point. In built-up areas it is often found that a greater amount of signal can be obtained by inclination.

Future Possibilities

The development of the slot aerial has not come to a halt; indeed, we seem to be at the beginning of the adventure and herein lies a field open to the amateur for experimentation.

Slots can be stacked where the skeleton type is used and this would appear to hold out possibilities for Band III. The increase in the total area of metal used to intercept the incoming signals is of material assistance.

The slot aerial can be completely boxed and a small exciter inserted into the box so that the whole arrangement behaves as a cavity resonator. This has fascinating possibilities for future experiments.

It would appear that the main difficulty is with the feeder because of the high impedance of the aerial. When this problem is overcome by matching arrangements, then the aerial can give better results than the dipole.

In the skeleton slot we have an interesting field particularly for Band III as this band is particularly liable to ghosting troubles, especially in built-up areas. Many slot aerials have been used under adverse ghosting conditions in Band III and have proved well worth while.

The author would be pleased to receive any factual reports on the performance of this class of aerial which would be likely to assist others.

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Making Your Own Aerial

FACTS AND FIGURES, AND HINTS ON AERIAL CONSTRUCTION FOR BAND I AND BAND III

By W. J. Delaney

WE are continually receiving requests for details of aerial construction, and this appears to be one of the most interesting of the amateur's activities in television. Unfortunately, the design of an aerial for a given station is not a simple or straightforward matter, although the actual construction is not really difficult. We have, of course, published constructional aerial articles on many occasions in the past, but as new stations come on the air new details are called for and it is therefore proposed to try and include in one article all of the details necessary to make up your own aerial.

Materials

The first and most important point is the material from which it will be made. The sound and vision are radiated on different frequencies and each has what is known as a bandwidth. That is to say, it is necessary for the aerial to tune flatly so as to take in both the sound and the vision, and also to cover some distance on each side. Up to a point the bandwidth over which the aerial will tune is governed by the size of the conductors, and it is necessary to remember that at the television frequencies the currents travel on the surface. Therefore a solid rod 1in. in diameter would afford no more advantage than a thin walled tube with the same overall diameter. Alternatively, a series of thin wires may be supported by a metal disc in skeleton tube formation, although apart from the weight point of view this will not possess any main advantages. Experience has shown that an improvement in bandwidth takes place as the diameter increases up to about ½in., but beyond this the gain increase falls off, so that for all practical purposes ½in. tubing is the most satisfactory and easily obtained, and as weight has to be considered aluminium is the most useful material to employ. Connections to such tubing will have to be made by means of screws as soldering is not practicable (see Fig. 2) and therefore if you do wish to adopt soldering copper tubing should be employed.

Reflectors and directors should be of the same material and diameter and therefore all the required material may be bought at once. Where a multiple system is being built up, the main cross-member should be of a suitable material and stout enough to support the total weight of the complete aerial assembly. In the case of Band I aerials this cross-member may be of stout timber or bamboo, whilst in the case of Band III arrays it may be of 1in. diameter metal tubing, with the various elements passed through holes drilled in it. From the above it will be seen that in the case of the Band I arrays the various elements are insulated from one another and from the aerial dipole itself, whilst in the Band III assemblies the entire array is usually all connected together (except for the open end of the dipole, whether this be simple or of the folded type). When made up all exposed parts should be painted or otherwise protected from the elements, say with one of the modern spray type lacquers, and the ends of tubes should be plugged. Ordinary dowel may be used for this purpose but the insides of the tubes may be filled with sawdust to prevent "drumming" in high winds. The last point will concern high exposed positions rather than the ordinary town viewer, but is a point worth remembering.

Sizes

We now come to the most important point, namely the size of the aerial. As most readers know the simple television aerial is known as a dipole and this means that it is one-half a wavelength long. This is, however, as will be explained later, only an approximate measurement. The all-important factor now is how does one measure the physical length of the rods? To simplify matters the table on page 322 has been prepared, but for those who wish to work out values for themselves, remember that wavelength in metres may be found by dividing 300,000 by the frequency. The TV stations and most of the V.H.F. or U.H.F. stations are always quoted in frequency rather than in wavelength. As a rough start, the Holme Moss BBC transmitter radiates sound on 48.25 and vision on 51.75 Mc/s. 50 Mc/s comes in between these two frequencies, and 300,000 divided by 50,000 kc/s (remember 1 Mc/s is 1,000 kc/s) is exactly 6. Therefore the centre wavelength of the Holme Moss transmitter is 6 metres. Now a metre is equal to 3.28084ft. and therefore the actual wavelength of the station in

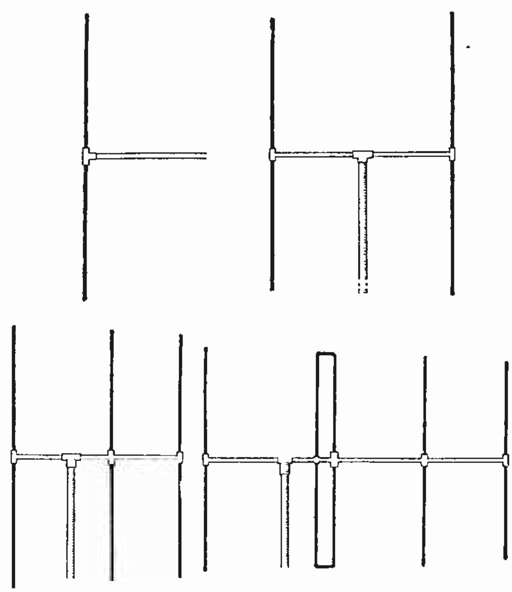


Fig. 1.—The four basic types of aerial, is the simple dipole, the 'H' and 'H' with one director, and a folded dipole with reflector and two directors.

English measurements is 19.68504ft. A dipole for this station would therefore theoretically be 9.84ft. approximately, and as the dipole normally has the feeder taken to its centre for various technical reasons, two pieces of tubing 4.22ft. long would be used. The gap at which the feeder is joined, however,

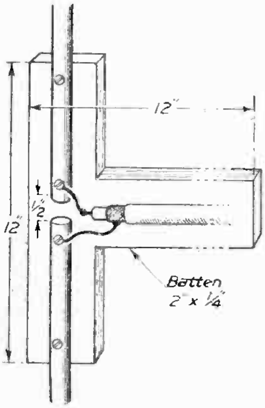


Fig. 2.—A simple and effective method of connecting the feeder to a dipole.

would be about 1in. to 2in., and this would mean that the lengths would theoretically be less than this. However, other factors come into the question such as the proximity of roofs, etc., and any such earthed body will affect the length required. Similarly, with an aerial having reflector and/or directors, further modification takes place. The actual size is therefore varied slightly in practice, usually being shorter than the theoretical length by about 5 per cent.

The additional elements mentioned, i.e., reflector and director are arranged on the supporting rod or tube at distances of a quarter or one-eighth wavelength. The reflector increases the forward gain and reduces reception from the back, and here is the first problem. Readers who have obtained commercial aerials may have measured them and found that different makes vary for a given station, whilst those who have seen various articles on aerial design will have found that designers give different sizes for the elements and different spacing. This is because the designer will follow his preferences for what is known as the " polar diagram " of the aerial, that is, a plotted curve showing the forward gain and the gain from other directions. One will work for maximum forward gain, whilst another may work for a wide angle of reception. One designer will cut the dipole to have its main resonance exactly midway between the sound and vision frequencies, another will cut for the centre of the vision band, whilst another may give preference to the sound frequency. Here the constructor must adopt a compromise or be prepared to experiment, taking the basic figures given in the table.

A folded dipole is simply a single length of tube bent as shown in the fourth illustration of Fig. 1. The two " sides " should be about 3in. apart and the overall length of the complete folded aerial is one half wavelength. The two ends of the rod are arranged to have the normal gap and the long continuous side can be attached to the supporting rod in the case of the Band III arrays, the gapped portion standing away from the support.

The aerial/director spacing given in the table is for the single or first director, any further directors which may be added being fixed at gradually reducing intervals of approximately 1in.

Feeders

A simple dipole has an impedance at its centre of 75 to 80 ohms and feeder of this type should be used. It may be coaxial or twin feeder, in the former case the internal single lead being joined to the top of the gap and the outer braided screening being joined to the bottom of the gap. It will not matter with twin feeder which wire is joined to the sides of the gap, although at the receiver end the plug should be wired so that the bottom half is at earth. If the aerial is folded, that is, a single rod or tube is bent with about 1-2in. separating the sections, and the ends brought down until they are about 1in. apart, then the impedance at that point will be in the region of 300 ohms and this type of coaxial or feeder should be used. If, however, reflectors and directors are added to such an aerial then the impedance will fall to the usual 75-80 ohms, and again this type of feeder is called for. It should be repeated that the additional elements, namely reflector and directors, should be in contact with the supporting bar or tube on Band III, and that a folded dipole will also be in contact on the side of it which is continuous, that is, the gap will stand off by the 3in. or so over which the aerial is bent. At the point where the feeders are joined some form of protective covering should be provided, either a small wooden box, sealed with some form of weatherproof adhesive and painted, or a commercial type of junction box which can be weatherproofed.

With regard to the type of aerial which should be used, we do not have reception details for every part of the country and therefore the best thing is to look round and see what type of aerial is fitted by local contractors who will be familiar with the reception conditions.

Channel Band I	Dipole		Reflector		Director		Spacing Aerial/Reflector		Aerial/Director	
	ft.	in.	ft.	in.	ft.	in.	ft.	in.	ft.	in.
1	10	10	11	2	10	0	3	0	2	2½
2	9	4	9	8	8	8	2	10	1	11
3	8	6	8	10	7	11	2	8	1	9
4	7	9	8	0	7	2½	2	5	1	7
5	7	3	7	5½	6	9	2	1½	1	5
Band III										
8	2	6	2	7	2	3½	1	3½		9½
9	2	5½	2	6½	2	2	1	2½		9
10	2	4½	2	5½	2	0	1	1½		8½

RECEIVING THE CONTINENTALS

COMMENTS AND MODIFICATION DATA FOR TELEVISION RECEPTION FROM EUROPE

By "Erg"

FROM time to time reports are received of the reception of television programmes from the Continent. These reports mainly originate from the south coast of England, but under favourable conditions signals have been received at much wider distances.

One of the most common reports is of the reception of transmissions from France. In France there are two systems running simultaneously, and one of those systems is very similar to the existing British system.

The transmissions originate in Paris and are broadcast on 46 Mc/s with the sound on 42 Mc/s. The vision signal is double sideband; positive modulation is employed. Signals are vertically polarised and therefore they can be received on a vertically mounted aerial system.

These signals compare very favourably with those on Channel 1 London which gives a positively modulated, vertically polarised signal on 45 Mc/s. Where a modern receiver is used which has vernier tuning arrangements, it is fairly easy to re-tune the receiver to the Paris transmissions.

It is only fair to say that the 441 line system of the French is now obsolescent and they are abandoning it in favour of their own 819 line scheme.

The frame frequency is the same as the British system and the line frequency is a little higher, as in the British system we have 405 lines while the French is 441 lines.

Quite often a receiver will lock to the French 441 lines without further ado, but in other cases a slight alteration of the line hold (or horizontal hold as it is sometimes labelled on commercial receivers) will do the trick and lock the signal.

One important point for South Coast viewers to remember, is that often the aerial system used is directed at London and either a separate aerial system directed at Paris should be used, or the aerial set in a position of compromise between the two transmitters.

Viewers who use the Isle of Wight transmitter at Rowbridge have their receivers tuned to Channel 3 and, in this case, if it is found possible to pick up Paris, then a Channel 1 aerial system using high gain (such as a Yagi array) may be well worth while. To tune in on Paris when signal conditions permit, all that is then necessary is to switch to Channel 1 and change the aerial.

Where Channel 3 signal conditions are good it is often possible to employ the Channel 1 aerial to receive the Channel 3 signals, but if the aerial has a narrow bandwidth then there will be some loss of quality in the picture. An aerial with a really narrow bandwidth will not be found to be suitable.

The 819 Line System

The second French system is one which is almost unique to that country and has not been adopted by any other country with the exception of Luxembourg. In Belgium partial use is made of the 819 line system but, in the main, the 625 line system is employed. Two transmitters at Brussels operate so that one uses 819 lines and the other 625 lines.

In North Africa the 819 line system is used by "French" transmitters.

It will be seen that the 819 line system is dominated by the French. In Luxembourg commercial programmes are transmitted and these are aimed at the French people and, therefore, the French 819 line system is the most obvious choice.

Again the Casablanca transmitter in North Africa caters mainly for those who understand the French language and, therefore, employs the French system.

In Belgium we again have the problem of catering for French audiences and those living near Belgium can enjoy transmissions from that country on their French built receivers.

We do not propose to discuss the merits and demerits of the system here but will offer some suggestions on reception when conditions are favourable.

Common Factors

Although the number of lines in the French system differs widely from that of the British system, there are some factors in the transmissions which are similar.

The sound is similar being amplitude modulated as in the British system and not frequency modulated as in the C.C.I.R. system which is in general use on the Continent. It should be possible, therefore, to receive the sound in a standard way.

Also the transmissions are vertically polarised and can be received on a standard vertical aerial. They operate in Band III and it is possible to receive them on standard high gain Band III aerials. Transmissions take place in the region of Channels 7 and 8.

The bandwidth of the system is more than double that of ours; here each channel covers 5 Mc/s (including the sound channel appropriate to the vision) while theirs covers a bandwidth of 13 Mc/s.

To give an example of what this means in tuning arrangements it can be stated that in the British system the sound carrier is spaced 3.5 Mc/s from the vision carrier, whereas in their system the carrier of the sound lies 11.15 Mc/s from the vision carrier.

In practical terms this indicates that if a British receiver is tuned to the carrier of the 819 line transmitter, then the vision signal from that transmitter will also be heard on the sound.

Up to a point the position can be modified by careful tuning (the French sound lies below the vision carrier as in our transmissions) but such tuning would result in a deterioration of the quality of the picture and possibly in a reduction in its strength.

Where a permanent receiving system is envisaged, being justified by the reception conditions (Channel Isles for example), it may pay to ignore the sound channel of the TV receiver and to employ a separate receiver for sound.

Line Frequency

The greatest difference lies in the line frequency and here we have the position where one is about double that of the other.

In very many cases the frequency coverage is within the range of the line oscillator, and a simple adjustment of the line hold (or horizontal hold) control will serve to resolve the picture.

Users of electrostatic timebases will often find that such a simple adjustment is all that is needed, but an electromagnetic timebase employed in most commercial televisors will not always perform adequately by reason of the fact that the EHT is derived from the line flyback.

Modern circuits are so designed that the circuitry

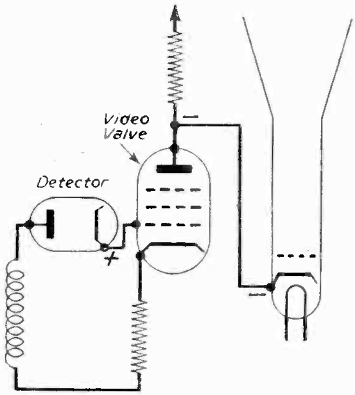


Fig. 4.—Phase relationship.

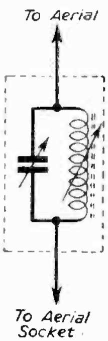


Fig. 5.—An I.F. filter.

around the line oscillator resonates strongly on the flyback so as to provide optimum conditions for the production of EHT.

When the line frequency is varied from this optimum condition, then there is loss of EHT and the picture is dimmed.

This point can be very easily checked with most commercial receivers and it can be noted that if the horizontal hold control is altered to any extent, then there is a loss of brightness on the screen (the picture will also be lost, of course, but this is incidental, as the modulation remains).

Under these conditions it is sometimes found that, although the French picture can be resolved, there is some loss of brilliance of peak whites, which is quite separate from the loss of contrast due to a weak signal.

Modifying the Timebase

The timebase can be fairly easily modified to cater for the higher line frequency, and in Fig. 1 we have a complete line circuit showing the typical modifications required to an electrostatic timebase.

The particular timebase chosen is of fairly standard type and could be used in a televisor designed especially for reception of the Continental stations. It can also be used to receive the C.C.I.R. system working on 625 lines.

It will be seen that the only difference between this and a standard circuit is the alteration of the circuitry around the charging condenser responsible for the forward stroke of the scan and also around the condenser responsible for the flyback.

The two 100 pF condensers are very common

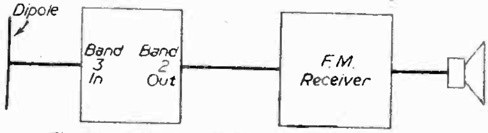


Fig. 2.—Diagrams showing the use of a converter.

values in use on the British system. They are supplemented by two other condensers of half their value (50 pF each) and switching is arranged between the two (see diagram below). The switches are coupled to the same spindle so that simultaneous operation takes place. Principles are similar to those used in oscilloscope circuits, the control often being labelled the "Coarse" frequency control.

The operation is quite simple. If it is found that the required frequency of the incoming transmission is beyond the range of the line hold control, then the switch is operated and the line hold readjusted.

It is a good idea to ensure the focusing is correct before switching to the higher frequency, as at 819 lines it is very difficult to distinguish between the lines. With most VCR97 tubes the lines merge.

Electromagnetic Circuits

With electromagnetic circuits conditions are a little more difficult. The same principle of switching to a lower-valued condenser can be used, but the constructor must be prepared for a drop in EHT. It does not appear worth while going to the length of switchable modifications in the remainder of the flyback circuit because of the possibilities of distortion of the scan.

Remember, we are speaking of the general case and we have handled receivers which can give good EHT at 819 lines.

Other Continentals

Although most other Continental transmitters use the 625 C.C.I.R. system, there are some exceptions.

The C.C.I.R. system differs from the British, not only in the number of lines employed but also in the fact that negative modulation is the rule and the sound is frequency modulated.

To receive the sound, then, the receiver must be designed for F.M., and here the possibility of employing the double superhet principle and feeding the signal to a standard F.M. receiver can be visualised.

In Fig. 2 will be

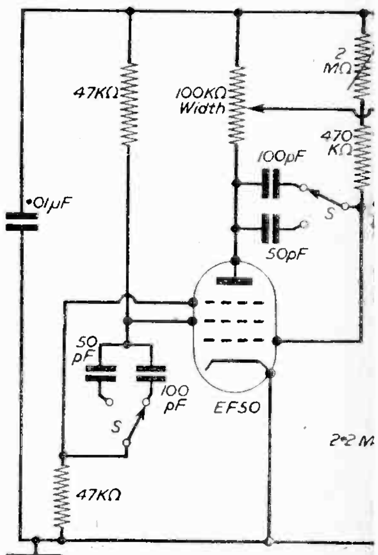


Fig. 1.—Basic

found the basic principle involved. A converter is used and this can be either coupled to the Band III aerial used for Continental reception directly or, better, can be fed from a loose coupling coil on the output of the first R.F. valve of the Band III receiver.

The signal is converted to Band II frequency and it is best to employ one that is removed from the local F.M. signal.

The converter could comprise a cascode R.F. stage with a mixer stage using one of the modern mixer

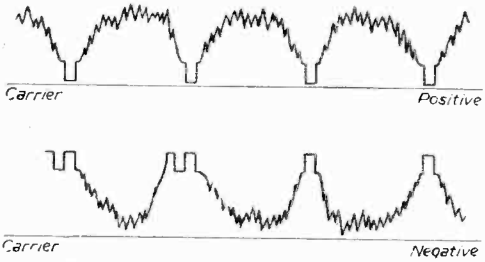


Fig. 3.—Positive and negative modulation.

valves specially designed for Band III operation. It should be possible to employ a standard Band III converter provided the oscillator frequency is altered and the output coil designed for 90 megacycle Band.

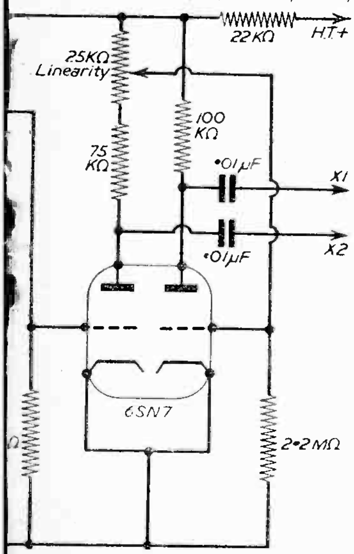
Negative Modulation

The C.C.I.R. system uses negative modulation as opposed to our positive system. In our system peak white is represented by maximum carrier amplitude, whereas with the negative system peak white is minimum carrier amplitude. The two systems are compared in Fig. 3.

Now, peak white at the C.R.T. must be when maximum beam current flows. If the tube is cathode modulated, then this point must be where the cathode is least positive with respect to the grid. In other words, the bias on the tube is reduced to minimum.

It must be ensured, then, that the signal reaching the cathode goes towards the negative direction (that is, less positive) when peak white is required, and this is accomplished at the detector stage, the output of the detector being so arranged that the output of the video valve is in the required direction.

In Fig. 4 we have the elements of such a condition where the cathode of the C.R.T. is fed directly from the anode of the output valve. Peak white must move the cathode in the negative direction and therefore the output at the anode of the video valve must be negative when peak white appears.



switched line circuit.

As a phase reversal takes place between grid and anode the grid must be fed with a signal in the positive direction, and therefore the cathode of the detector is attached to the grid of the video valve. This means that the video valve can be heavily biased and work much more easily than if it were fed with a negative signal.

Consider now if a negative signal is received then the cathode of the C.R.T. would be driven positive and the beam current would be cut off. To reverse the phase then, the simplest method is to reverse the polarity of the detector and this can be done quite easily.

Ensuring the phase is correct will prevent a reversal of black and white in the picture and reversal of the sync pulses. If the sync pulses are reversed the timebase will not trigger correctly.

When building a video receiver for the C.C.I.R. system it is necessary to cater for the reversal of signal conditions, and it would be possible to do this by arranging switching to change from one to the other.

Complete System

For the experimenter there is no better combination than the R1355 unit with RF26 and an electrostatic

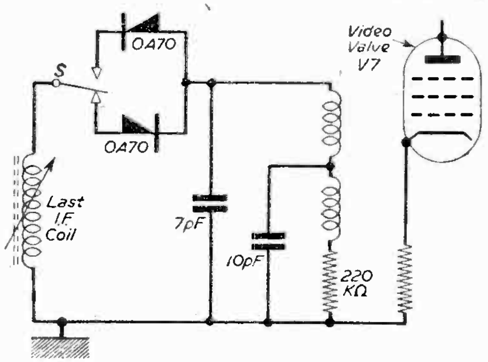


Fig. 6.—A switched detector stage.

timebase and VCR97 for cheapness, power and to save interfering with the family televisor.

In the case where the aim is to use the 441-line French system then a standard timebase and vision receiver can be used. If the R1355 is used with an RF26 then a very powerful combination is available. It is advisable to employ a single RF26 and R1355 for the vision alone, and the sound can be another R1355 with R.F. unit or a simpler form of receiver.

Modifying the RF26

The RF26 unit does not cover the Paris transmitter channel but it can be very simply modified by inserting iron dust cores into the coils. Three coils are concerned and they are the R.F. amplifier (this is the coil under the chassis adjacent to the air-spaced trimmer); the mixer (this coil is located in the second compartment from the front end); and the oscillator (this is the coil nearest the Jones plug at the far end of the chassis). There is a coil located in the third compartment but this is the I.F. output coil and should not be touched.

When tuning in the transmitter first set the cores level with the tops of the coil forms and when the station is tuned in on the dial adjust the oscillator trimmer for optimum performance. The oscillator trimmer is located next to the oscillator coil in the last compartment.

If no signal is picked up on the dial, then set the dial at its central position and then adjust the oscillator trimmer until a signal is heard.

A good method of checking is to trim the receiver for the London transmitter and then it will be found to tune in to Paris provided signal conditions are suitable.

Modifying the R1355

The only modifications required to the R1355 are the standard ones employed to convert it to a vision receiver.

For the sake of those who have not met this useful unit before, the modifications are as follows:

Set the switch marked "Z-X-Y-N" to the "N" position. The switch can actually be removed if desired, ensuring that all connections in the "N" position are made. (This will result in the recovery of a few condensers which are short-circuited out by the switch.)

The next step is to remove a small condenser of 0.005 μF, which is found in the back of the screen holding the diode detector. After being removed the two connections to which it was made should be bridged.

The last valve, V8, can be removed and the output taken direct from the anode of V7. Surplus components can be removed.

If it is intended to cathode drive the tube, then the anode and cathode connections of the diode should be reversed. If grid modulation is intended then connect a 150 ohm resistor across the cathode resistor of the output valve V8, and for maximum power decouple it with a 50μF 25 volt working condenser.

It is advisable to fit a sensitivity control. A 3 K potentiometer can be used and it should be connected between the cathode resistor of V1 (330 ohms) and the chassis.

This control can also serve the functions of a contrast control.

The Timebase

This calls for little comment as no modifications are required other than to ensure that the line hold control is easily accessible.

Modifications for the 819 Lines

These transmitters work on Band III and the simplest way of providing a powerful receiver is to use the above combination but with a Band III converter used as a front-end. Such a combination can form a very powerful receiver.

As positive modulation is employed the R1355 need be modified only as given in the preceding sections, no other requirements being necessary.

The bandwidth of the R1355 is grossly inadequate to provide good picture quality under these conditions but against this must be set the increased sensitivity. If the quality is found inadequate then the I.F. stages can be stagger tuned and a 4.7 K resistor fitted across each tuned coil. This will, however, considerably reduce the signal strength.

One point which must be guarded against is the possibility of I.F. breakthrough and if this should prove troublesome then filters at I.F. can be fitted in the aerial circuit. The filter can be easily made by duplicating one of the I.F. coils and tuning it with an 0-30 pF trimmer (Fig. 5).

The whole filter should be inserted in a screened can. It is still possible to buy I.F. coils for the 1355 complete with can and this is an ideal method of dealing with the problem.

In the timebase it will probably prove necessary to adopt the switching system given in Fig. 1. However, it is worth trying without at first so as to avoid complications. Timebases vary in their ability to cover the necessary frequency and much depends upon the C/R complements of the particular circuit concerned.

Modifying for 625 Lines

If it is desired to venture into the dizzy realms of 625 lines, then the modifications need not be complicated. Most line oscillators will cover the frequency range required, and the main modifications necessary are in the vision receiver.

Using the R1355/RF26 combination the details mentioned in previous paragraphs should be noted. As the transmissions are in Band III mostly, then a Band III converter could be used as a front-end to the RF26.

Other than the R1355 modifications mentioned it will be necessary to cater for negative modulated signals. If the intention is to use the gear solely for trying out the 625 line transmitters, then the cathode and anode of the detector can be permanently reversed. If, on the other hand, it is desired to cater for positive and negative modulation, then the reversal at the detector can be accomplished by means of switching.

For this purpose the "Z-X-Y-N" switch can be used, the existing wiring being removed from it, and the switch section nearest the detector being employed for switching.

Two diodes can be used such as the OA70 and they can be mounted across the switch. The detector valve should be taken right out and the feed from the coil can be taken down through the chassis to the switch via coaxial cable lengths. The sheath of the coaxial cable should, of course, be earthed.

Fig. 6 shows the scheme.

Except for the C.C.I.R. 625 line system the sound unit can follow normal practice, but if trying to receive this particular system then an F.M. receiver should be used. It is fairly easy to convert the R1355 to F.M. by removing the detector and subsequent stages and building in its place a standard F.M. demodulator system.

Power Supply

It is convenient to use a separate power supply for each section. The R1355 is very greedy on heater current and needs 6A at 6.3 v. The H.T. required is about 250 v. at 80 mA and suitable transformers giving these power requirements can be purchased. They usually include a winding for a 5U4G valve or similar of 5 v. at 2A.

The power unit existing in the R1355 is practically useless as it caters for an 80 v. input at 2,000 c.p.s. The best method is to remove it in its entirety and fit the new power supply in its place.

In the case of the sound receiver, it is possible to include the power output stage using a 6V6 or similar valve in the position previously occupied by V8.

V7 becomes the first audio stage and its performance in this respect can be improved by replacing its anode load resistor by one of 220 K.

Testmeter Design Problems

HIGH SENSITIVITY IS NOT NECESSARILY AN ASSET

WE are often asked by readers if we can supply a diagram or constructional details to enable them to make up an All-purpose type of test-meter, using as a basis one of the ex-government meters having a full-scale deflection of 500 μA or less. They are under the impression that by using extremely sensitive meters, such as may be obtained from ex-government dealers, they can make up a more accurate meter than one using the more usual 1 mA meter. We have before pointed out that this is not necessarily so, and that in any case it is not a simple matter to describe in a letter how such a meter can be made. However, the makers of the well-known

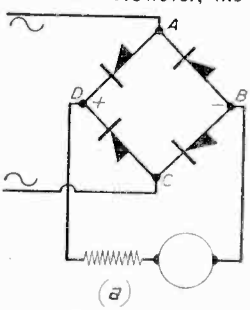


Fig. 1(a) The basic bridge rectifying circuit used in meters.

AvoMeter recently published some very interesting information on the subject of meters and it appears that they, too, are often asked why they do not supply a meter having a more sensitive movement. The following extract is taken, with permission, from the *Avo News*, and we are sure that they will interest our readers. Avo say that they are often asked why they do not manufacture high sensitivity rectifier type A.C. instruments having an A.C. sensitivity of 20,000 Ω/V or greater. They agree that such a performance looks most attractive when presented in a specification to a prospective buyer, but they regard such "sensitivity" as being most undesirable in an instrument which must withstand years of hard usage yet maintain its accuracy. The problem is entirely related to the rectifier and leakage currents, and the more currents and the more detailed explanation which follows will show that the accuracy of a rectifier type of instrument is partially dependent on the relationship between current which passes through the movement and that which leaks away through the individual elements of the bridge rectifier. If this relationship is extremely high, as is the case with a meter movement which requires 1 mA to bring it to full scale (e.g. Model 7 AvoMeter), then a few μA of leakage current is of no consequence, for the meter will continue to present a high degree of accuracy even should the rectifier leakage increase during service, as is often the case. On the other hand, if a 50 μA full scale movement is substituted for the 1 mA load, then a leakage of a few μA becomes quite disastrous, for whilst correction for this leakage can be made at full scale deflection when the meter is new compensation cannot be applied down the scale due to the non-linearity of the rectifier characteristic, whilst even slightly increased leakage current with age will soon cause the instrument to give widely erroneous readings.

Thus it will be appreciated that, whilst it is possible for the instrument designer to produce an A.C. rectifier type instrument which, when new, will meet the degree of accuracy planned for it at full scale deflection, there may possibly be errors down the scale and the accuracy of the instrument is almost certain to drift slightly, if not considerably, with age. In practice, however, every constructor is likely to subject a meter at some time or other to an inadvertent A.C. overload, and electrical stresses of this type, even in spite of the overload protection, will in time cause an instrument to read low when used for A.C. measurements.

The explanation which now follows will give the reader a more detailed description of the operation of instrument rectifiers and enable him to understand, more fully, the technical problems which face the instrument designer.

Instrument Rectifiers

There are many materials in the semi-conductor classification, such as copper oxide, germanium, selenium, etc., which can be used to convert alternating current to direct current, but the AvoMeters use copper oxide rectifiers, for these exhibit the most useful characteristics for the Avo form of rectifier moving coil instruments.

A few words relating to the operation of this component might prove useful.

Diagram (a) shows the bridge type of rectifier, four rectifier elements being arranged in the form of a bridge to provide the maximum conversion of alter-

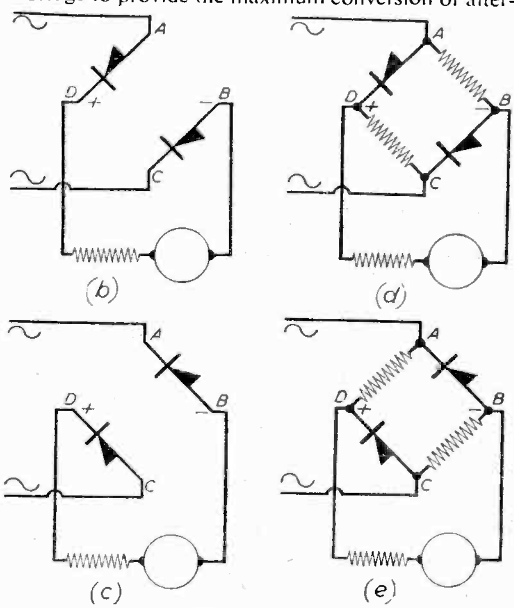


Fig 1 (b) to (e). How the bridge rectifier works.

nating current to direct current. To understand the operation of the complete rectifier, it is convenient to think of alternating current as a backwards and forwards flow of current (electrons within the wire do actually move in this manner) and to consider the action of the rectifier when current flows one way and then the other. As a first approximation, it is advisable to consider each element as being of low resistance for current passing in a forward direction but of such a high resistance for a reverse potential that only an insignificant current flows through the element.

The rectifier symbol on the diagram indicates the conventional flow of current, and diagram (b) illustrates the operation of the rectifier in one half cycle. In a similar manner, diagram (c) shows the operation on the second half cycle (when the current is flowing in the opposite direction). It will be seen, therefore, that current continuously flows in the same direction through the moving coil, although it has reversed in the external parts of the circuit.

This function of the rectifier is well known, but it must be remembered that no form of "semi-conductor" rectifier is perfect, for at its best it will show a low forward resistance and a high reverse or leakage resistance. It will be appreciated that the moving coil is at an apparent mid-potential between the alternating input. In diagram (d), which is a more exact representation of diagram (b), the elements D. C. and A. B. are not functioning in a forward direction for the particular half cycle shown, but act as high resistance "leaks."

Current entering at A. passes to B. mainly through the element A. D. and the moving coil, but a small amount by-passes the moving coil and arrives at B. by leakage through the element A. B. (which should ideally be a perfect insulator). Furthermore, all the current which passes through A. D., does not traverse the moving coil, since it can reach C. through the element D. C., thus by-passing the moving coil and the element B. C. The nett result is that the current which passes through the moving coil is reduced from the total available by the sum of the two leaks. In a corresponding manner, the reverse cycle is shown in Fig. 1(c), which is a more exact representation of Fig. 1(c).

The highest degree of efficiency is obtained when the forward resistance of each element is as low as possible, the reverse resistance as high as possible, and these conditions are carefully checked in the factory, due allowance being made in the original calibration of the instrument for the tiny leakage currents which always exist.

This rectification system works perfectly (practically without any degree of wear and tear for a long period), but if the instrument is overloaded, the voltage across the rectifier input may rise to a dangerous level. Although the voltage rise is not in exact proportion to the rise in current, a condition can ultimately arise where the voltage across the moving coil and one operative element is sufficiently great to puncture the element which is acting as a "leak" across them. It will be appreciated that the molecular structure of the copper/copper oxide barriers which form the rectifying elements is such that electrons can be pulled easily through them by means of a low voltage applied in one direction, whereas the same voltage applied in a reverse direction only manages to capture very few electrons. If, however, an increasing voltage is applied in the reverse direction, there comes a point at which the natural molecular bonds are broken, thus allowing electrons to flow in the reverse direction, usually resulting in the complete destruction of the rectifier element.

The higher the resistance of the load constituting the moving coil, the greater will be the rise in voltage across the rectifier elements acting as "leaks" on overload. It follows, therefore, that a breakdown of rectifier elements can occur on a lower percentage overload on a Model 8 AvoMeter than on a Model 7 AvoMeter, due to the higher resistance of the Model 8 moving coil. This is a most important point to remember, for in the past many engineers have become contemptuous when using Model 7 and Model 40 AvoMeters, subjecting them time and time again to A.C. overloads without causing any damage. For the reasons which we have already discussed, it can be seen quite clearly that the Model 8 AvoMeter must not be treated in this manner, for, otherwise, damage may result, causing the instrument to read low when measuring alternating current. This "short-coming" is in no way peculiar to the Model 8 AvoMeter, but equally applies to all makes of high-sensitivity instruments of the same type, which should also always be carefully treated when being used to measure alternating current.

Easily Damaged

It is not generally realised that rectifier instruments can be easily damaged, due to voltage transients (very steep-fronted current pulses caused on lines due to the opening and closing of switches, charging and discharging of condensers, etc.). Some transients commonly encountered only persist for a few milliseconds, and are quite unreadable on normal moving-coil instruments (in fact, complex apparatus has to be used for their detection), for their duration is still, nevertheless, long enough to puncture rectifier elements.

Accessibility

THE modern television camera is a much more complicated piece of apparatus than the television receiver, and has to have a much higher degree of reliability. However, valves and similar items cannot be guaranteed not to fail, and in the event of failure servicing has to be carried out, usually in the shortest possible time, as the camera may be in use in a particular transmission where its absence would affect the programme. Consequently, the facilities offered for speedy servicing involve hinged cabinets and completely removable sections, such as timebases, etc. Such a procedure could well be followed in the case of the home-built television receiver each section of the timebase, the vision receiver and the sound receiver being built on separate chassis and furnished with plugs and sockets so that they could be interchanged. Such an idea would also be useful for experimental purposes, enabling different timebase circuits to be tried out, whilst no doubt most constructors would welcome commercially-produced units of this type such as I.F. strips, etc., which they could use either in a domestic receiver or for experimental purposes. At the moment it does not appear that such units are available on the English market. Our cover illustration shows a service engineer overhauling part of the O.B. equipment used by the BBC in the West of England, and it will be seen how accessible the transmitting equipment is made.

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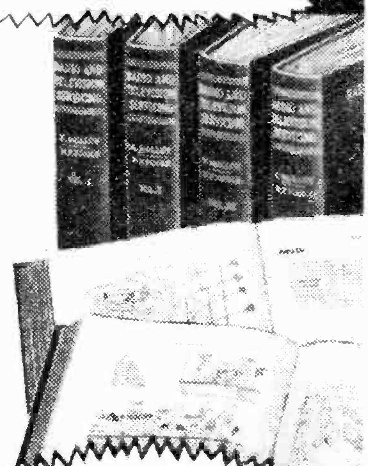

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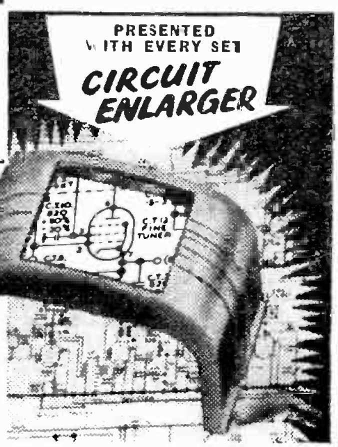

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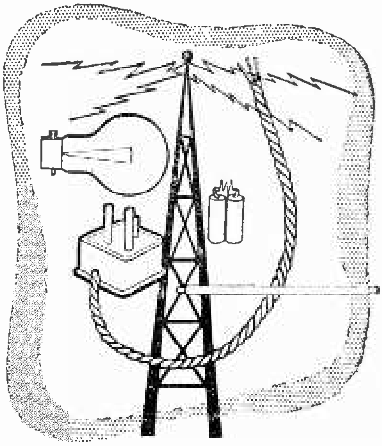

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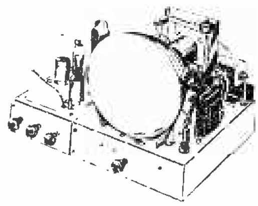

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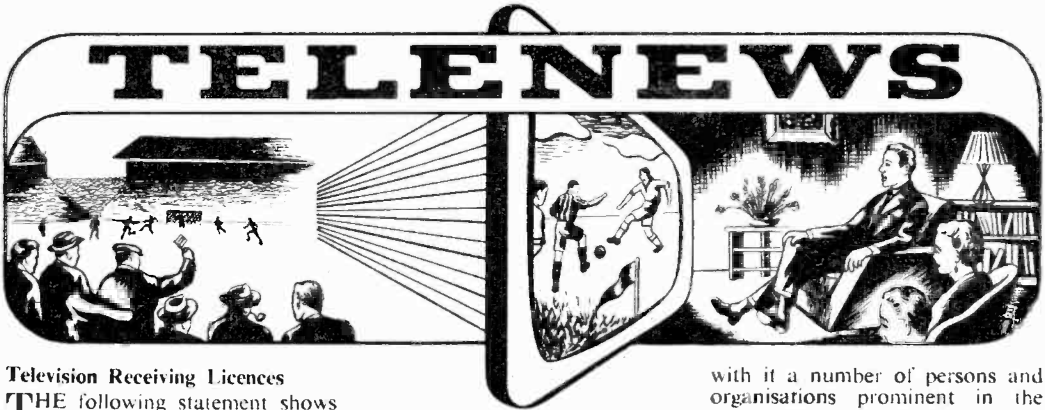


Television Receiving Licences

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

During November the number of television licences increased by 142,345.

Region	*Total*
London Postal	1,386,099
Home Counties	750,105
Midland	1,086,513
North Eastern	992,078
North Western	920,196
South Western	458,094
Wales and Border Counties ...	357,469
Total England and Wales ...	5,950,554
Scotland	429,230
Northern Ireland	53,633
Grand Total	6,433,417

Electrocuted by TV Aerial

A LONDON shoe-repairer, not satisfied with his picture, went on to the roof to make adjustments to his aerial. When he touched it, with his wife watching to see what improvements, if any, resulted in the picture, he received a shock which caused his death. An expert said afterwards, that the set had been wrongly wired, making the aerial "live" to the mains. Changes had been made to the receiver by the owner and someone who had installed the set, and not by the makers. Remember that any D.C. or A.C./D.C. type of receiver, must have an isolating condenser in the aerial and earth leads to avoid this risk.

Scottish Site

THE illustration on the right of the I.T.A. site at Blackhill shows the commencement of the main mast on the right, and in the centre the Belling-Lee "Skytower" acquired by the Authority and which will be used for the early test signals. This mast has now been completed and signals scheduled to commence early in March. On the left is Mr. A. P. Hale, Grad.I.E.E., and Mr. Boyd, both of Belling & Lee, whose riggers are seen at work. The sheet of water in the background is the Airdrie Coatbridge and District Reservoir.

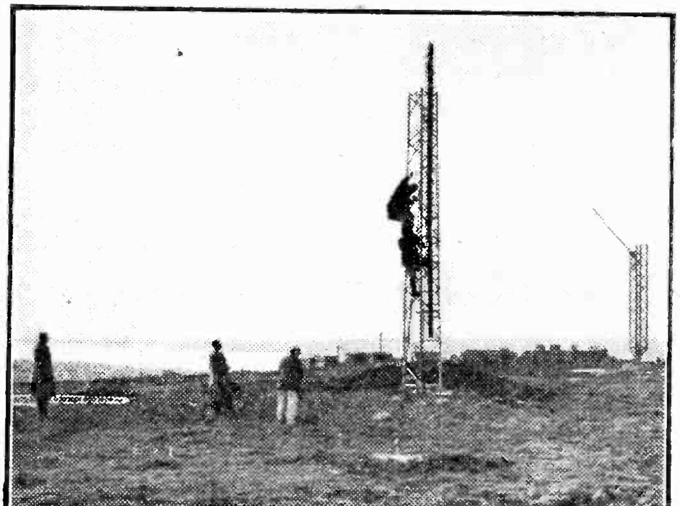
I.T.A. in S. Wales

THE Independent Television Authority announces that it has decided to accept, subject to contract, the application of a group under the chairmanship of Lord Derby to provide all the programmes from its station which will serve South Wales and the West of England. The programme company will be known as W.W.T. Ltd. (Wales and the West Television) and will have associated with it a number of persons and organisations prominent in the area.

The Authority hopes to start the construction of its new Wales and West of England transmitting station early in the New Year, and an application for planning permission has been submitted for a station to be located a few miles west of Wenvoe and to be known as St. Hilary. The Authority plans to bring this station into operation towards the end of the year. It will cover South Wales and areas to the east and south of the Bristol Channel, including the Bristol and Taunton areas, reaching a population of about 2,750,000.

Stockbroking by Television

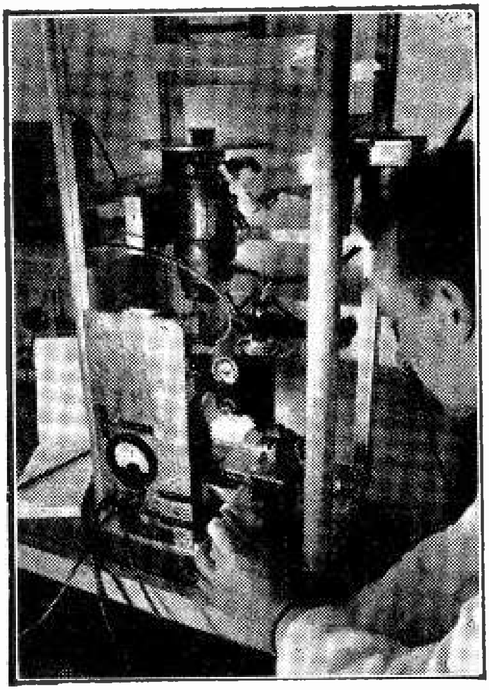
A BRITISH stockbroking firm are installing Pye industrial television to relay information between their "box" at the London Stock Exchange and their main offices about a quarter of a mile



The Scottish I.T.A. site.

away. It is believed that this will be the first use of television for stockbroking.

In the firm's "box" at the Exchange a Pye industrial TV camera will scan a board containing prices of stocks and shares in which clients are interested. The board, which is 5ft. by 5ins. in size, can hold prices of about 200 stocks and shares at 12 per column. A prism, driven by its own motor, will move continually in front of the camera lens, allowing the camera to scan from beginning to end of the board every three-quarters of a minute. As the board itself will not move, price changes can be filled in immediately they occur. The picture will be relayed over a private G.P.O. line to a number of 14in. TV receivers at the firm's main offices.



A member of the scientific staff of Sylvania-Thorn testing a germanium crystal with delicate electro-optical equipment at the new colour TV factory at Enfield.

British Export Success in Australia

THREE out of the four television Outside Broadcast vehicles which televised the opening of the Olympic Games in Australia, and also gave Australians their first view of a regular TV service, were manufactured by Pye Limited.

Behind this simple statement of fact there lies a remarkable story of British export effort and achievement.

A team of Pye's top line engineers worked without break, day and night, for weeks so that the vehicles could be rushed to Australia in time for the opening ceremonies. The normal production time for manufacturing an outside broadcast vehicle was ultimately reduced by more than a half.

Mr. Leslie Germany, one of Pye's senior research engineers has followed the O.B. units to Australia to advise the Australian Broadcasting Commission, who own two of the vehicles, and General Television Corporation, who own the other, on how to use them. Before leaving England for Australia he said, "This is a really great achievement considering the complexity of producing these highly intricate seven-ton mobile units, and when you realise that there are about 750 valves in the equipment to each vehicle you will see what I mean by that!"

Scottish TV Rates

THE advertising rates to be charged by Scottish Television Ltd., the Independent Television Authority's programme contractors in Scotland, will range from £7 for a five-second "flash" to £250 a minute at the peak period on Sunday evenings.

Announcing these rates Mr. Roy H. Thomson, chairman of S.T.V., disclosed that in the initial stages the company is expected to produce about 10 hours of Scottish programmes out of the maximum 50 hours permitted under the Act. The remainder of the programmes will be network productions, mainly from London.

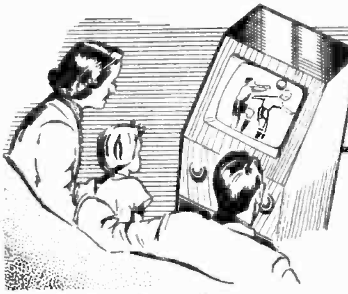
Scottish commercial television broadcasting is due to begin on August 31st next year, but test signals will be sent out from the Blackhill station, starting on or about March 1st and will continue until the opening date.

New Telecine Technique

A NEW telecine technique has recently been developed which enables programmes to continue with hardly a break in the event of camera failure. The BBC has already ordered nine sets of this equipment, developed by Pye, and some have already been delivered.

Basically, the system consists of two cameras instead of one, used in conjunction with a film projector. As the cameras employ specially developed "Staticon" tubes—which are of the photo-conductive type—projectors of standard design are used.

In the normal telecine unit, one camera is focused on the projector. Should this camera fail the programme cannot continue until either the camera has been repaired or the film has been transferred to another telecine unit. With the new technique, which has been described as "cross-fire" telecine, two cameras are used in conjunction with movable mirrors. One camera is focused on the projector, while the other is set up at right-angles to it. Should the first camera fail the engineer presses a button on the control console which swings a mirror into position in front of the projector, allowing the second camera to take over. This operation takes under two seconds.



UNDERNEATH THE DIPOLE

TELEVISION PICK-UPS AND REFLECTIONS

By Iconos

PALLADIUM REVERSE-SHOTS

THE idea of removing the camera from the conventional position of shooting straight at the stage seems to be catching. Reverse-angle shots, as they are called, were also used in a recent Palladium Show, giving a fresh treatment to the second part of *Rocking the Town*. This time one camera was sited somewhere up in the flies—that part of back-stage above the scenery—thus enabling a zoom lens to look down upon Winifred Atwell playing Grieg's Piano Concerto and also at the conductor and the orchestra. Shots from the side of the stage, across rows of dancers, also introduced a greater variety and interest to the presentation. Harry Secombe, top TV and variety comedian scored heavily with his clowning and his vocal numbers, and managed to survive a rather poor sketch in which he was assisted by Beryl Reid. The trouble with some of these Palladium sketches, like those in the Crazy Gang Show, is that the participants add so much new "business" to the act that the original idea and shape of the sketch is almost lost. This doesn't matter very much, perhaps, if the new material is really funny—as Harry's always is. But somehow or another the author's original "pay-off" or curtain gag, if there was one, frequently degenerates into the petering sparkle of a damp squib. Comic sketches should end with a quick decisive black-out, following a snappy twist or big comedy line: they shouldn't fade away.

IVOR NOVELLO

THE Ivor Novello TV biography made a very pleasant 90 minutes' viewing. Stars of several Novello musical shows took part, including Vanessa Lee, Olive Gilbert, Elizabeth Welch and Peter Graves. The programme was written by Spike Hughes and covered the period of Novello's life from when he composed *The Little Damozel* in his teens up to the spectacular shows which packed Drury Lane and other West End theatres: *Glamorous Night*, *Careless Rapture*, *The Dancing Years* and other successes. Some of the most interesting excerpts were from the middle period of revues and less spectacular musical plays, such as *A to Z*, *Theodore and Co.* and *Arlette*, for which Ivor Novello wrote all or part of the music. I particularly liked Peter Graves' rendering of "Her Mother Came Too," which I remembered Jack Buchanan made such a success with in Charlot's *A to Z* revue. The biographical part of the TV production was less good than the musical numbers. Laurence Payne looked very much like Ivor Novello, but failed to convey the almost overwhelming warmth and charm of Ivor, his passionate affection for the theatre, or the intense loyalty he inspired in all who worked with him. This is a tall order for any actor to reproduce. I happened to know Ivor Novello very well indeed; he was a unique character. Perhaps the producer Graeme Muir will give us another aspect of Ivor Novello: his work as a playwright and a film actor. This side of his work was touched on only slightly in this TV biography. As usual, full marks go to conductor Eric Robinson and arranger Arthur Wilkinson for the excellence of the musical score, and to the engineers who handled the sound side of the transmission.

A.R.-TV Drama

IT is hard to realise that A.R.-TV have produced over a hundred TV plays since they started transmissions on September 22nd last year. Eighteen of these were filmed at Shepperton Studios and stock-piled, and the remainder were sent

Belinda Lee looks at a TV set carrying a closed-circuit picture of Benny Hill in the film "Who Done It?" For this the film cameras had to be specially synchronised at 25 frames per second to maintain a steady picture.

out live from the Granville Theatre, Walham Green (now closed) and from Wembley Studios. No less than 29 plays have been of one and a half hours in duration and 52 lasted an hour. This is a splendid record which puts A.R.-TV ahead of the other ITV companies, so far as drama is concerned. Nevertheless, I think it will be generally conceded that the BBC maintains its lead in television drama, particularly as regards technical values. BBC producers have learned from experience that fussy backgrounds are a hindrance; BBC engineers are not entirely "sold" on three-inch image orthicon cameras, which so often make the actors—worse still, the actresses—look so careworn and old. These cameras can be so good, especially on closed-circuit and monitor systems. But it is extraordinary how bad they can be, due to compression at the white end of the monochrome scale, when viewed on an average commercial receiver.

THE IDEAL TELECINE

IT is now possible to assess the full requirements of the ideal telecine facilities for British television contractors :—

(a) 35mm. film telecine, capable of scanning the full silent frame, also the Movietone frame, and the CinemaScope frame.

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(c) Slide scanning, with automatic device for dissolving or changing slides.

Flying spots scanners have long been regarded as the most satisfactory telecine reproducers. But they have certain disadvantages—including their high cost—and are not so adaptable as the cheaper staticon type of machine, which is virtually a cinema projector (with intermittent film pull-down) shining its beam on to a TV camera. The staticon telecine equipments are now highly flexible and efficient and are gaining popularity with producers as well as engineers. Incidently, it is interesting to note the number of ex-engineers on the programme side of A-TV, headed by Bill Ward and Keith Rogers. They are just the men to take advantage of the go-ahead electronic ideas now being developed by A-TV engineers.

Telerecording is still under consideration by many of the contractors. It is a useful but expensive facility. The BBC and Rediffusion are equipped, but the other contractors are hesitating on installing this type of apparatus. Perhaps they are waiting to see the video-tape magnetic picture-recording system, recently developed in America. Sooner or later, however, I feel that actual photographic telerecording will be a "must," since at the present time only this system gives a negative capable of producing the many copies of television film prints which are now required for the growing world-market for such products.

CINEMASCOPE ON TV

FROM the engineering point of view A-TV is rapidly achieving the reputation of being the most go-ahead independent television company. Every few weeks they seem to produce some new gadget. The latest one enables a much better presentation to be made of cinema films which have been photographed with the CinemaScope system, which reproduces an elongated picture with an aspect ratio of 2.35 to 1 (2.55 to 1 when shown with magnetic sound). This looks fine when projected on a huge screen, but when reduced to the size of a TV picture, tends to resemble the aperture of a letter box, with top and bottom sections of the picture cropped off with black masking. This has been the normal method of transmitting CinemaScope pictures on TV.

Alternatively, the BBC and I.T.V. organisations have been enlarging the CinemaScope picture somewhat to fill the height of the television screen, with consequent cropping of the sides of the picture, which has often resulted in action and characters being cut off.

A-TV's new device enables the telecine operator to select an area with an aspect ratio of 1.65 to 1 in any part of the full CinemaScope picture. Furthermore, his controls enable him to panoram this selected section from left to right, following the principal actors about and keeping them in the centre of the television screen. A telecine scan which can be adjusted to cover the full width and height of the old silent film frame, which has a much larger area than the "Academy" Movietone-shaped frame that has been standard since talkies were introduced in 1928. Old silent films are invariably cropped when televised, particularly on the left-hand side, and are further distorted by being run at 25 frames per second instead of the 16 frames at which they were photographed. That is why people in them appear to walk about so fast and jerkily.

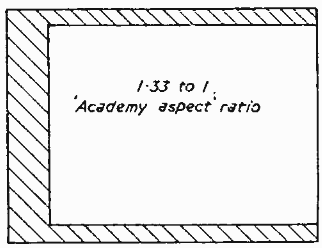


Fig. 1.—Shaded area indicates section of old silent film frame which is not reproduced on television. "Academy" area is fully reproduced.

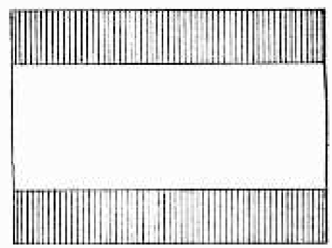


Fig. 2.—Shape of CinemaScope 2.35 to 1 picture on TV screen, reproducing full width, but masking top and bottom.

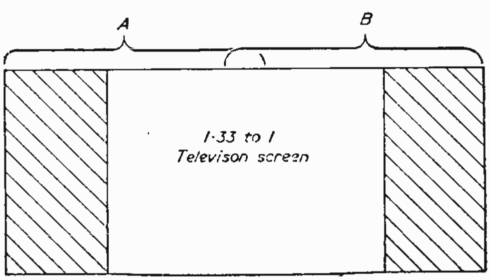


Fig. 3.—When reproduced to the full height of the TV screen, each side of CinemaScope picture is cropped (in section shaded above). This restricts the choice of CinemaScope film sequences for TV to those with main action in the centre. A.-TV's new scanning system permits a panoramic shift from "A" to "B" to follow the main action.

CORRESPONDENCE

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

STRANGE SIGNAL PICK-UP

SIR,—Re the November issue, page 186, J. K. Sims (Barnet): "The background is *not* radio or TV I *am* sure, as the conversation always appears to be between two people."

Is he so sure about the first part of his sentence? According to my experience recently, these "Sporadic E," as far as I know, started Friday evening, October 12; he is so right about the second half (again according to me). Twice I have noted what he calls peculiar signals on Channel 1. As he writes from Barnet, near London, I presume he refers to that channel.

First, on Saturday, October 13th, when I was really looking at picture quality on Channel 1 I suddenly noticed that the accent of the sound was either American or Canadian. A minute of listening (or, rather, trying to listen) soon gave me the impression of a scrambled 'phone conversation (scrambled later proved an erroneous impression) and I heard clearly "one-one-nine" and subsequently snatches of more figures on a frequency which was nearer the Channel 1 BBC vision than the sound.

The BBC picture was heavily interfered with although coming in well.

Now to the evening of Friday, October 19th.

The BBC Channel 1 was coming in, but not at anything like the strength on October 13th, and the same 'phone transmission was there, and I got several sentences (or parts of some) in a clear male American voice, examples as follows (and sound strength equal to BBC Channel 1):

"Mississippi," followed by six figures, which I did not jot down, "query car No. M. . . ."

"John Harper's father to go to the inspector."

"Lumber wagon travelling north—keep a look out for him," etc.

Immediately after the latter I heard a fainter transmission, not loud enough to distinguish what was being said, presumably a car (naturally on lower power than the main transmitter) replying.

So perhaps J. K. Sims has to look rather further than his neighbour's aerial or the 'phones of this country.

I must point out that the reason I could not get the transmission clear for longer periods was that it was interfered with on both occasions by a transmission which "seemed" to have a varying frequency causing a "het" whistle for a second or two, and then severe distortion. Really I presume it was a transmission on a close frequency "fading" in and out (as regards here).

Time was around sunset (Children's Hour BBC) on both occasions October 13th and October 19th:

October 13th: Practically peak of E layer activity. Channel 9 London coming in well.

October 19th; E layer activity practically ceased. Channel 9 only a faint sound, vision nil.—N. E. (Dartmoor).

SPECIAL NOTE

Will readers please note that we are unable to supply Service Sheets or Circuits of ex-government apparatus, or of proprietary makes of commercial receivers. We regret that we are also unable to publish letters from readers seeking a source of supply of such apparatus.

RECORDED PROGRAMMES

SIR,—Your correspondent in the October copy of PRACTICAL TELEVISION, Mr. G. Smith, overlooks one point regarding television on tape. The frequency response of the average tape recorder only extends to some 10 or 12 kc/s, which is useless for recording 3 Mc/s or so video. To cover the necessary frequency range the tape would have to travel at a tremendous rate.—P. FARROW (Ipswich).

AMATEUR TV TRANSMISSION

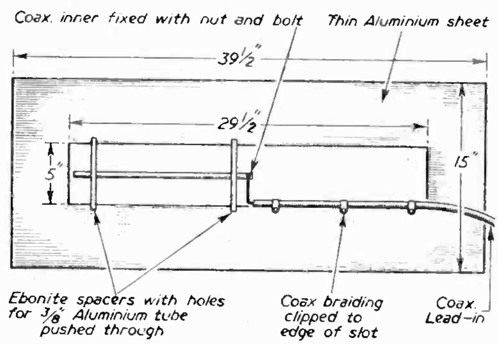
SIR,—You have through the pages of your magazine whetted my appetite (and others, I hope) with articles on closed circuit and amateur TV, but all have been superficial. I am sure among your readers there must be some who could give us some practical circuits, for those who would like to try.

I am possibly in the minority, but what do other readers think?—S. TYSON (York).

EXPERIMENTAL SLOT AERIAL

SIR,—The sketch shows an experimental Band III Channel 8 slot aerial which I have made up and has proved very satisfactory 35 miles from the station. This may be of interest to correspondent L. M. J., of Woking.

I do not claim any originality for you will see that it is merely a scaled-down version of the improved slot aerial in PRACTICAL TELEVISION issue December, 1953—but the most interesting point I would mention is the complete absence of pick-up of the BBC Channel 4 signal which is really strong where I am situated.



Mr. Lawton's slot aerial for Band III.

I have made several Band III indoor aerials, single dipole, folded dipoles with nine elements, etc., from various ideas in your magazine, all of which picked up the BBC so strongly that the rejectors in my home-made "E.F.50 Convertor" would not cut out the interference. With the slot aerial there is absolutely no interference and I have removed the rejectors from my convertor completely.—E. LAWTON (Stoke)

Your PROBLEMS Solved

Whilst we are always pleased to assist readers with their technical difficulties, we regret that we are unable to supply diagrams or provide instructions for modifying surplus equipment. We cannot supply alternative details for constructional articles which appear in these pages. WE CANNOT UNDERTAKE TO ANSWER QUERIES OVER THE TELEPHONE. The coupon from p. 347 must be attached to all Queries, and if a postal reply is required a stamped and addressed envelope must be enclosed.

EKCO TS88

Recently the picture has taken on an " out of focus " effect, then seemingly jumps into crispness by a very slight but quick movement to the right. This does not stay long when back it goes, so it seems, very slightly to the left and is again of " soft " appearance with general overall pulling of vertical definition to the right. This continues so long as the set is switched on, and replacement of valves in the line generator (SP61s) does not improve the situation. Can you help ?

Secondly, there is a slight tendency to the frame jumping up and down. I have replaced the 6K25 and SP61 in this circuit without improvement. Can you suggest another line of approach.—E. G. Dore (Winchester).

The tube has an intermittent heater-to-cathode short. You should fit an isolating transformer (2 volt type A) or Nuray unit as advertised.

If the vertical jitter remains when the picture is cleared, replace valve 6K25 beneath tube neck.

FERRANTI T.138

The Video peaking coils were burnt out, also the anode load resistor (R46). I changed the resistor and rewound the coils (L13, L12) in a hit and miss fashion as I had only a charred mass to go by.

The set then worked reasonably well apart from a slight amount of Sound on Vision. It operated for approximately 14 hours, then just as the transmission was closing down the picture started to roll, and the height got too great for the raster.

The raster is now made up of a series of evenly spaced lines with approximately 1/16-in. gap in between and fly back lines clearly visible.

All valves have been checked and found O.K. Vertical linearity control checked by substitution and all condensers and resistors on the EL42 frame output checked the same way. When the sound volume is turned right back there is a slight amount of mains hum.

As I have no C.R.O. I cannot check waveforms of timebases. Also, is the set originally aligned to the upper, double or lower sideband ?

I cannot resolve the picture sufficiently to see the effect of the various controls. The only one which does not appear normal is the frame amp. which produces a whistle similar to line output in some positions.—P. Davenport (Sanderstead).

In most cases of extended height, C65 or C68 will be found at fault. However, R93, R79 or R86 may be responsible. The sound on vision can be removed by slight adjustment to C17 and C42. The receiver was designed for double sideband working.

DEFIANT TR9/47/T

With contrast turned right down I receive the I.T.A. programme O.K., as I am near to the transmitter. On turning the converter off it is necessary to increase the contrast on set to receive BBC. This, of course, is as it always has been, but now I find that on turning up the contrast to the correct amount I get a bad picture with spots flying from right to left across the screen ; also the figures in the picture have a saw tooth appearance on their left. The picture also tends to come a little brighter and fade. If I reduce the contrast I can obtain a picture by increasing brightness too much until the lines are faintly showing, but this condition is not correct. I experience none of these troubles on the I.T.A. when I can operate with the contrast on the set turned right down, the trouble only occurring when I have to increase contrast. I would also mention that the converter is completely isolated when I am on BBC.—James Farrington (Lowton).

You should check the two D1 diodes (V12 and V13) and the .05 mfd which couples the anode of the video amplifier to the cathode of the first diode.

ULTRA MODEL V7116

I have an Ultra TV table model No. V7116 which has recently had an isolating transformer fitted to the C.R.T. heater.

The set functioned perfectly satisfactory for a period but has now developed the following fault.

The picture which is quite good and steady flicks off leaving a bright blank raster showing the flyback lines. Some nights this does not occur, but on other evenings for no apparent reason the picture will flick on and off all the evening, sometimes remaining off for a long period, but showing the bright raster as described above. The sound is unaffected.—G. J. Smith (Stockport).

The vision detector/limiter 6D2 has an intermittent heater/cathode short.

ETRONIC H.V.203B

I have just fitted a new line and EHT transformer owing to the other having a short in its heater winding. I can detect and see part of a good picture but cannot hold it from either running up or down ; when it's running down it also goes to the left bottom corner. I also notice a vertical black bar on the right of this erratic picture similar to the one you generally see before a programme starts being broadcast, which I cannot move off the screen. It is continually tearing in the middle to the left, also the frame hold control, when in the middle of its controlling of the up or down motion of the picture, closes the picture completely,

(*Continued on page* 343)

and in this position an intermittent flashing across the screen only can be seen. I have checked this control which is a 30 K potentiometer but find no fault in it. Can you advise me on this information I have given ? How I might control this erratic picture ? The sound is all right.—H. Ball (Sheffield).

The fault would appear to be centred either in the sync separator or video amplifier stage. A check upon these valves and their associated resistors should be made. In any case a general check on the 6AM6 valves would be advisable.

PETO SCOTT 1415

I bought a Peto Scott 1415 in June, 1955, prior to going abroad.

It was fitted with a Band III tuner but this was not connected to the set. On my return I plugged it in but I find that I can only receive the A.T.V. sound with no trace of the vision.

The sound is of good quality and of approximately the same strength as the BBC.

When the fine tuner is tuned slightly off the position where the sound is received a loud buzzing is heard in the speaker.

Is it possible that the slugs in the fine tuner are incorrectly assembled or else the oscillator components of the wrong value ?

The aerial is a doubled-up three-element array in the loft.—S. E. North (Wolverhampton).

It should only be necessary to retune the oscillator coil core in order to receive the vision signals. However, if this results in complete loss of sound, the receiver as a whole should be realigned.

INVICTA T112

Having had trouble with picture slipping I replaced ECL80; this cured it for about a month, when slipping started again even with control turned fully left.

Have now replaced EY51 and PY31 and cannot get single picture—only double or treble; control locks about half-way. Can you suggest next fault to look for or replacement needed.

Incidentally, sound has improved and picture would be excellent if single.—L. C. Rust (Ipswich).

You should replace the 470 KΩ resistor associated with the frame hold control centre slider.

BUSH TV36

My main worry is the power supply for a converter as there does not appear to be a spare power socket on the chassis.

Another point is that the receiver contrast control has to be advanced almost fully to receive a signal at all. This has been so since it was installed by the dealer—thus, if the transmitter goes on low power it is impossible to receive a picture. The aerial is in order as I have tried other receivers on it.

Will this have any effect on the efficiency of the converter, i.e., BBC breakthrough ?—A. Milington (Stancross).

The five-pin plug on the right side of the main chassis should be removed and plugged into the socket provided on the TC184 tuner unit ; the plug from this then plugs into the vacant socket on the main chassis.

You should check the receiver tuning and have the EF80 valves tested.

If all are in order, check the 50 μF capacitor associated with the contrast control.

ULTRA 814 A.C.

My set was new one year eight months ago. The trouble is I cannot get the picture to fill the mask half-inch top and bottom. Height and vertical hold both adjusted fully clockwise to get that. I have changed valves 20P3, 6K25, W801, but no response. Width O.K. Sound and picture contents good.—F. R. Moody (Hatfield).

You should replace the 470 KΩ load resistor of the 6K25 valve.

MURPHY TELEVISION V120C

Recently, whilst viewing on the above model and receiving a perfect picture, the screen went blank, the picture closed up horizontally from each side until the centre was reached and then became blank. Valves 11 and 13, T41, 12—PEN45, 14—PEN46, 16—U24, have all been renewed.

The heater on U24 (EHT rectifier) does not appear to light up.

I have measured the windings on the Line Output Transformer and they appear to be correct, as per service sheet, and I would esteem it a great favour if you could kindly suggest how I can restore EHT.

All H.T. voltages are correct.—R. Baker (Birkenhead).

This is the symptom of failure of the line timebase. Check the smaller components associated with this section, viz., T41 and PEN46 stages, and if these appear to be in order suspect a shorted turn in the line output transformer. This would not be revealed on a resistance check.

SOBELL T.V. MODEL T90

The 64 and 120μF electrolytic has gone down with the result that the H.T. choke overheated and short-circuited.

Can you please tell me the resistance/inductance of the replacement choke, also the variation allowed on the 64 and 120 μF electrolytic.

I have no service sheet and am having great difficulty in obtaining same, having written to all advertisers of service sheets in "Practical Television."—W. J. Goodwin (Bedford).

The choke should have a resistance of not exceeding 120 ohms and an inductance of 20 Henries at 250 mA. Elstone type SC250 would make a suitable replacement.

G.E.C. BT2147

I have recently had a television set given to me. I knew it had been mis-aligned and generally tampered with. However, as I had it given to me I decided to do something about it.

The tube had gone, so being a 9in. model I decided to convert it to a 12in. I obtained a cheap 12in. tube—namely Cossor 121K and took the H.T. for the additional electrode from the junction of L15, C35 and the line op. transformer. I got a good raster then and started tuning up.

The set is stamped Midland, so I made a Sutton Coldfield aerial and started tuning, using a pair of headphones and condenser on the op. from the video amp. to listen for the video signal.

I found that I could obtain the TV sound on both the video and sound outputs. I could tune it out from both channels but the adjustments of the sound channel components made a difference to the vision channel and vice versa.

I then thought it may be due to the set having been altered to Channel II (Holme Moss). So I put a Holme Moss aerial on it then found that I could obtain the vision signal on both channels. On putting the vision op. on to the set I could get a very clear and distinct picture but I did not see Test Card C, but presume that it would be about 2 Mc/s bandwidth at least.

I have obtained sound very faintly by removing two turns off L16, but it is not right by a long way.—A. Brookes (Betley).

From your remarks we can only conclude that incorrect modification of the tuned circuits is responsible for the lack of loud sound. If the tuned circuits in the sound channel appear to be peaking, then suspect the tuned circuits which are common to both sound and vision; you may find that these are peaking in favour of the vision signal and thereby attenuating the sound signal. If this appears to be the case you may have to remove a turn from each winding.

PAM PYE TELEVISION

My Model 954 is fully equipped with commercial aerial, but the reception is hopeless. The Lichfield station for our area is on full power and I cannot receive the Manchester station, either. I have to turn the vision sensivity control full on, also the volume control and brightness and contrast. The picture from Lichfield I.T.A. is very poor and weak, flyback lines all across the screen. Can you advise me, please ?—John Edgerton (Stoke).

We assume the channel switch is set to switch position 7. If reception is generally good in your immediate locality and your aerial is unscreened by nearby houses, etc., either the aerial is improperly aligned, improperly connected (at the aerial or at the diplexer) or the PCC84 valve in the tuner unit is at fault. There are many other possibilities, of course, but we consider these the most likely.

PHILIPS MODEL 1200U

On switching the television on the picture appears torn; an advancement of brightness or contrast makes it worse. The width and horizontal linearity controls are right at the end of their travel (clockwise). To keep the picture from tearing up I have to reduce the width control, which gives me blank sides. Any ideas you may have on this, could you please clarify, as I have no service sheet on my set ? I have replaced PZ30 and ECL80 on vision side.—Ronald Davis (S.E.17).

Make sure that all the ECL80 valves are up to standard and then check the PL81 and PY80 valves.

If these are in order check the resistors associated with the V15 (ECL80) pentode section, i.e., those associated with the line oscillator transformer, etc. V15 is mounted in the rear centre of the left side chassis.

PYE TV4

The control lever for focus has gradually been moved to the maximum position which is with the magnet nearest to the deflection coils.

A good picture is obtainable, but the moment the picture content is extra bright the picture goes hopelessly out of focus.

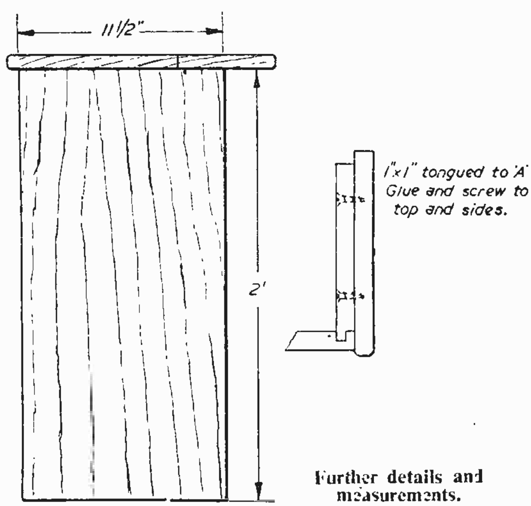
Am I right in thinking it may be the EHT rectifier ? Or is this a tube fault ?

If possible please give brief details of how to get to the part/parts concerned.—E. V. King (Sheerwater).

The EY51 EHT rectifier is at fault. Remove the left side screening cover, when the EY51 will be exposed on the top of the line output transformer. There is one soldered connection at one end and two at the other, both inside the anti-corona rings.

A TV TABLE — *(Concluded from page 306)*

course, be adopted, as the details given are merely those which I used and the reader may desire to adopt some slightly alternative scheme.



Further details and measurements.

Similarly between the drawer and the top of the cupboard portion I left a space into which magazines and periodicals could be placed and, again, this is an obvious personal choice.

Finishing Off

When all parts have been constructed they should be glued and screwed together and a suitable finish adopted. In my case, as the wood was of oak, matching the TV set, and I had the natural surface exposed, I had it french-polished in its natural colour. Some form of contemporary finish could, of course, be adopted if desired and this matter is left to the individual constructor. The result, for quite a small outlay, is a neat and attractive "cupboard-table" with the added advantages already mentioned; small castors let into the bottom enable it to be easily swung round when and as desired.

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MISCELLANEOUS

ENGRAVING.—Amateurs and trade surplus can be undertaken by getting in touch with A. G. ENGRAVING. now at 292. Earlsfield Road, London, S.W.18. (Tel.: BAT 9897.) (Engravers to well-known makers of Electronic Equipment used by the Aircraft industry. A.W.R.E., etc.)

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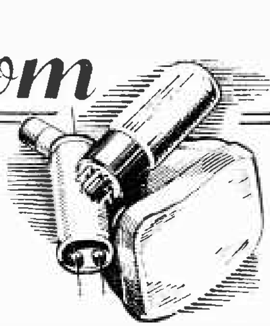
News From the Trade



K-B "New Queen"

A NEW table model TV set — the New Queen — has been added to the K-B range. With a 17in. screen and handsome wooden cabinet, the K-B "New Queen" is ideal for family viewing in the smaller home.

It is a high-quality set, built to an ideal rather than down to a price, and features a number of advanced technical developments in electronic engineering. It has full sensitivity, and incorporates 17 valves with flywheel synch. circuit, three germanium diodes, selenium diodes, and printed circuit section.

Specially made for A.C. mains, the New Queen also has parallel heaters for increased performance. The walnut veneer cabinet is inset with a decorative gold-colour metal strip.

The price of the New Queen is 75 guineas.—Kolster-Brandes Ltd., Footscray, Sidcup, Kent.

In Line Attenuators

AERIALITE LTD. announce that they have been able to reduce the retail price of their In Line Attenuator, Ref. No. 169, from 5s. 6d. to 4s. 6d.—Aerialite Ltd., Castle Works, Stalybridge, Cheshire.

Electrical Engineering Radio & Television Diary, 1957

THE latest copy of the diary has the following features:

Format: 3½in. by 5½in. approximately.

Binding and Price: Leather, 5s. 6d.; L/Cloth, 4s. 3d., including Purchase Tax. Postage 4d. extra.

Contents: 96 pages of technical information (pages 1/57 Electrical Engineering, pages 58/96 Radio and Television, with plates).

A section of 16 pages of coloured road maps.—H. O. Quinn Ltd., 151, Fleet Street, E.C.4.

New Marconiphone Television Receiver

TO complete their range of television receivers for the 1956-57 season, Marconiphone have now released the Model VC151—a 17in. console with full-length fold-back doors.

It incorporates the new Emiscope aluminised electrostatic-focus tube which gives sharp, crisp focus over the entire screen; freedom from spot distortion; exceptionally high brightness and outstanding picture quality.

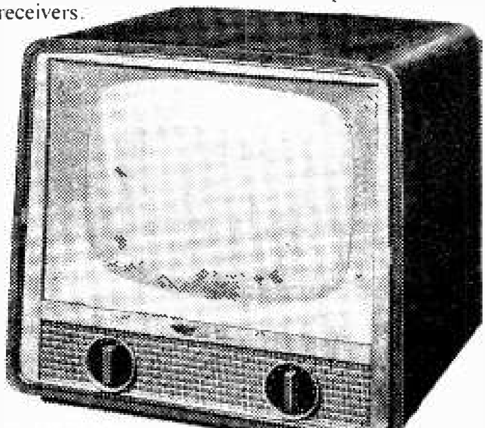
Notable circuit features include: 13-channel incremental inductance tuning unit with coils for *all* Bands I and III channels; selective band-pass circuits with high gain on Band III channels; "sync cancelled" vision A.G.C.; adjustable "black spot" picture interference limiter; tunable input filter for diathermy and similar interference; automatic interference suppression and A.G.C. on sound.

Special attention has been paid to the sound reproduction, and an advanced design of sound channel combined with a 10½in. high-flux elliptical speaker provide a generous output at very high quality.

The price of Model VC151 is 105 guineas inclusive.

E.M.I. Turret Tuning

NOW that Channel 10 has come into service with the opening of the new I.T.A. transmitter at Emley Moor in Yorkshire, it may be opportune to remind both the trade and prospective viewers of an important feature of "His Master's Voice" and Marconiphone television receivers.



The K-B "New Queen" (see column 1).

All multi-channel receivers of these makes—that is to say, all models which have a 13-point channel selector switch—use an incremental inductance tuning unit which is completely equipped with coils for tuning to any of the 13 channels. No additions or alterations to the tuning arrangements are or will be needed for any existing or projected BBC or I.T.A. television transmissions in Bands I and III.—E.M.I. Sales & Service Ltd., Hayes, Middx.

Philips Electro-acoustic Division

PHILIPS ELECTRICAL LTD. announce that their ELA (Electro-acoustic) Division has been merged with the Musical Equipment Department. The latter will in future be responsible, within the framework of the company's TV and Radio Division, for the marketing, etc., of all ELA products.

QUERIES COUPON

This coupon is available until FEBRUARY 21st, 1957, and must accompany all Queries sent in accord with the notice on page 339.

PRACTICAL TELEVISION, FEBRUARY, 1957.

Published on the 22nd of each month by GEORGE NEWNES, LIMITED, Tower House, Southampton Street, Strand, London, W.C.2, and printed in England by W. SPEAIGHT & SONS, Exmoor Street, London, W.10. Sole Agents for Australia and New Zealand GORDON & GOTCH (A/sia), LTD. South Africa: CENTRAL NEWS AGENCY, LTD. Subscription rate including postage for one year: Inland 17s. 6d., Abroad 16s. 6d. (Canada 16s.). Registered at the General Post Office for the Canadian Magazine Post.