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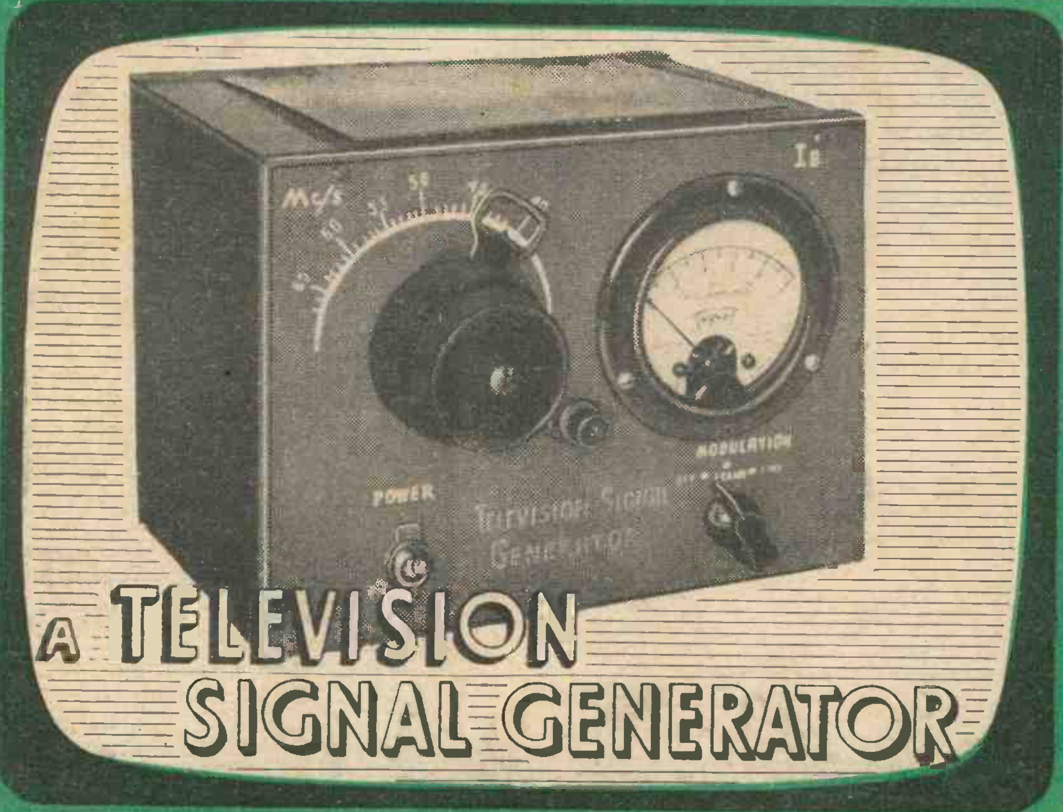
EDITOR F. J. CAMM

A NEWNES PUBLICATION

Vol. 6 No. 61 JUNE, 1955



FEATURED IN THIS ISSUE

Experimental Video and Sync Amplifier
T.R.F. Receivers
Making a Test Meter

Frame Flyback Suppression
Servicing The G.E.C. BT 7092 and 7094
The Miller Timebase

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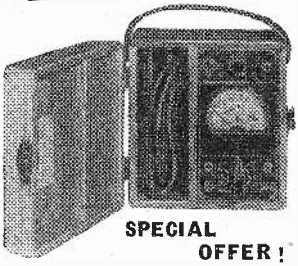

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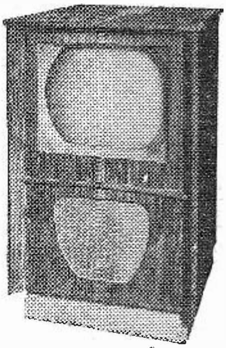

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Practical Television

& TELEVISION TIMES

Editor : F. J. CAMM

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Vol. 6 No. 61 EVERY MONTH JUNE, 1955

Televiews

MANUFACTURERS of TV receivers and equipment are now well advanced in their plans to enable the viewing public to receive the I.T.A. programmes, which are due to commence in September. The receivers not already designed for these programmes will need an adaptor or to be adapted, and it is clear that a special aerial will also be required. We shall, therefore, review in a later issue the arrangements made by the various manufacturers for the adaptation of their receivers. We shall also describe how to make an I.T.A. adaptor, the design for which is now complete and awaits test.

At this stage it is impossible to say whether the I.T.A. programmes will appeal to the public to the extent anticipated. It is obvious that the price of programme time—nearly a thousand pounds a minute—will place the new service in the hands of large advertisers only. Such advertisers are unlikely to continue to spend such large sums of money merely to provide an alternative service at no cost to the State or to the viewer. A manufacturer must recover his costs, and it is problematical whether results in the form of sales will be sufficient to warrant such a large outlay. It is possible that advertisers will find that older forms of advertising are still the best means of bringing home the bacon.

The amount of "plugging" to be permitted in these programmes is to be severely limited and such as will be permitted must be on a dignified scale. No doubt the whole of the I.T.A. programme arrangements and regulations will be reviewed after the first year. It seems a pity, however, that cost will preclude many small firms from taking advantage of this new method of expanding their businesses. It might to some indeed seem unfair that large concerns should be virtually granted a monopoly merely because their purses are larger.

TELEVISION TRADE TEST TRANSMISSIONS

WE are glad that the BBC has decided that the existing schedule of Trade Test transmissions are to continue until August 31, 1955. It will be recalled that it was announced at the end of 1954 that the additional hour introduced on September 1st, 1954, into the morning transmissions on week days would be continued until April 30th. But in order to assist the radio industry and trade to test and adjust television receivers the date has been extended as stated above, subject of course to any interruption that might be necessary for technical reasons.

"TELEVISION PRINCIPLES AND PRACTICE"—NEW EDITION

THE second edition of *Television Principles and Practice* is now available at 25s. from booksellers (or 25s. 6d. from the offices of this journal). It has been fully revised and includes a dictionary of television terms. The contents are : The Television System ; The Television Camera ; From Transmitter to Receiver ; Projection Receivers ; Stereoscopic and Colour Television ; Time Bases ; D.C. Receivers ; Aerials ; A London-Birmingham Converter ; Servicing ; Interference ; A Pattern Generator ; Choosing a Receiver ; The Beveridge Report.

We also publish *Practical Television Circuits* at 15s. or 15s. 6d. by post. It contains instructions for building a number of cheap receivers and a spot wobbler, a black spotter, E.H.T. generators, a pattern generator and pre-amplifiers.

INDEX FOR VOLUME 5

THIS issue commences Volume 6. Indexes for Volume 5 will be available shortly at 1s. 1d. by post from the offices of this journal. Readers who wish to have their copies bound will be glad to know that we have made arrangements with Hazell, Watson and Viney, Ltd., 52, Long Acre, W.C.2, to undertake the binding of your issues in complete volumes with the appropriate index. If you are desirous of having your parts bound, Messrs. Hazell, Watson and Viney will be pleased to let you have a quotation for the work on receipt of an inquiry. Those readers who prefer to have their copies bound by a local bookbinder can obtain not only the above-mentioned index but also an index for any previous volume from us direct for 1s. 1d. each.—F. J. C.

Experimental Video and Sync Amplifier

CIRCUITS FOR PROVIDING IMPROVED PICTURE QUALITY IN POOR RECEPTION AREAS

AMATEUR television constructors share in common with fishermen a distressing tendency towards exaggeration and tall stories.

The tale of "the picture we had last week" is getting as common as "the one that got away." These candid comments apply only to the "fringe area" man.

Seriously though, it is surprising how few home constructors care to view Test Card "C"—assuming, of course, the meagre showings by the BBC of this almost indispensable card are convenient for them to do so.

The most common picture defects met with in fringe areas, apart from fading signals, are "snow," line tearing and poor resolution—the latter usually being excused (or considered necessary) to minimise the former.

Line tearing is a fault which should only be met with in weak signal areas, as its primary cause is random "noise" pulses which erratically trigger the line timebase.

With a low signal this triggering can be caused by valve "noise" alone—as distinct from outside electrical disturbances—and in a poorly designed receiver can make an otherwise usable signal unwatchable.

Sheer gain—as the user of converted "surplus" equipment will be well aware—is not the answer to this problem. The remedy—assuming an efficient aerial array and low-noise preamplifier stages are already in use—lies in the careful design of the synchronising circuits themselves.

If one is just starting to build completely new equipment, some form of "fly-wheel" synchronisation would be the obvious choice, but there are many improvements which can be made to the ordinary triggered timebase—the more advanced circuits to be described—comparing very favourably with the best "fly-wheel" type.

Many keen amateur enthusiasts receiving pictures well outside the accepted range of the TV transmitter will protest that they do very well without the need for fancy circuits, but—in many cases—it is merely the *distance* that seems impressive; the measured signal strength may be well in excess of that met with in the poorer reception areas within 30 or so miles of the transmitter.

In undulating country—south-west England for example—as distinct from predominately flat areas, distance bears little relationship to the prevailing signal strength, and the terms "fringe area" and "long-distance reception" can be very misleading.

The increasing popularity of "fly-wheel" sync in commercial "fringe area" receivers and their inherent immunity from line tearing has "laid by the heels" the generally accepted belief that a

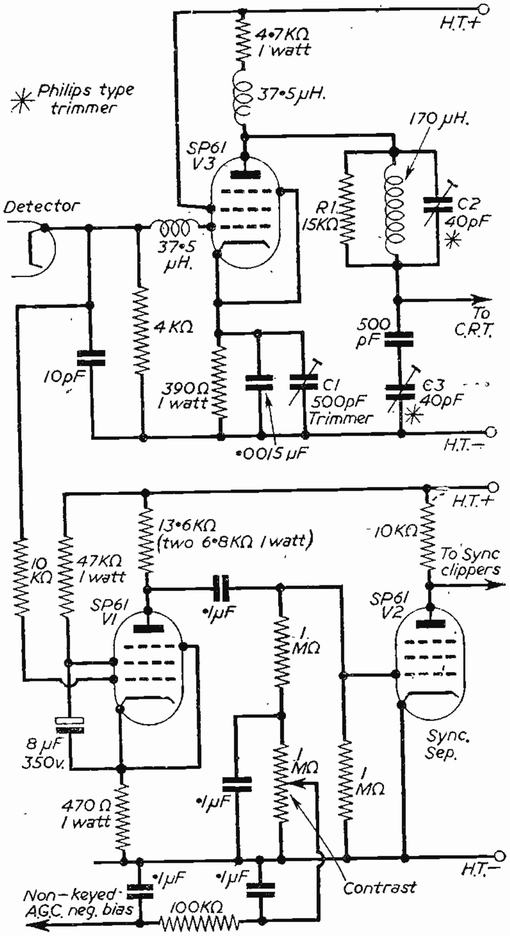


Fig. 1(b).—Theoretical circuits of the Fig. 1(a) scheme.

C1.—Adjust to reduce smearing with minimum overshoot.
C2.—Turn C3 to minimum capacity then adjust for maximum response on highest frequency grating visible, i.e., 3 or 2.5 megacycles.
R1.—Reduce value to 6.8 KΩ if excessive "ringing" experienced.
C3.—Increase to maximum value possible without visible response cutting—this trimmer is useful to eliminate any 3.5 megacycle patterning which may be present.

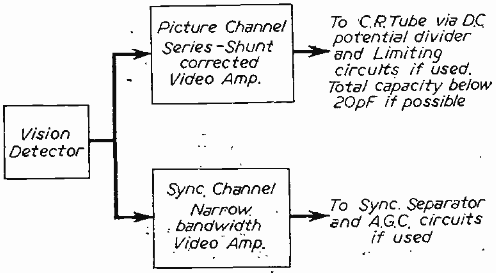


Fig. 1(a).—Block diagram of picture and sync channels.

restricted band-width in the vision channel was beneficial in reducing picture "noise" or "snow." Anyone who has seen the very much finer textures of the picture "snow" prevalent with a normal band-width, and how much less noticeable it is at the correct viewing distance, will be very dissatisfied with the "smeary" picture inevitable with a reduced response.

Of course, the reduced band-width fan (who may sometimes regard sound rejectors as an unnecessary encumbrance) will insist that response cutting is still essential to minimise line tearing; but the band-width can be narrowed in or to the sync circuits themselves, where it is unquestionably beneficial with the triggered type timebase.

For the effective sync separation—and to avoid that annoying fault "pulling on whites"—a response of 1½ megacycles is required, so a separate narrow band-width channel to the sync circuits is quite practicable.

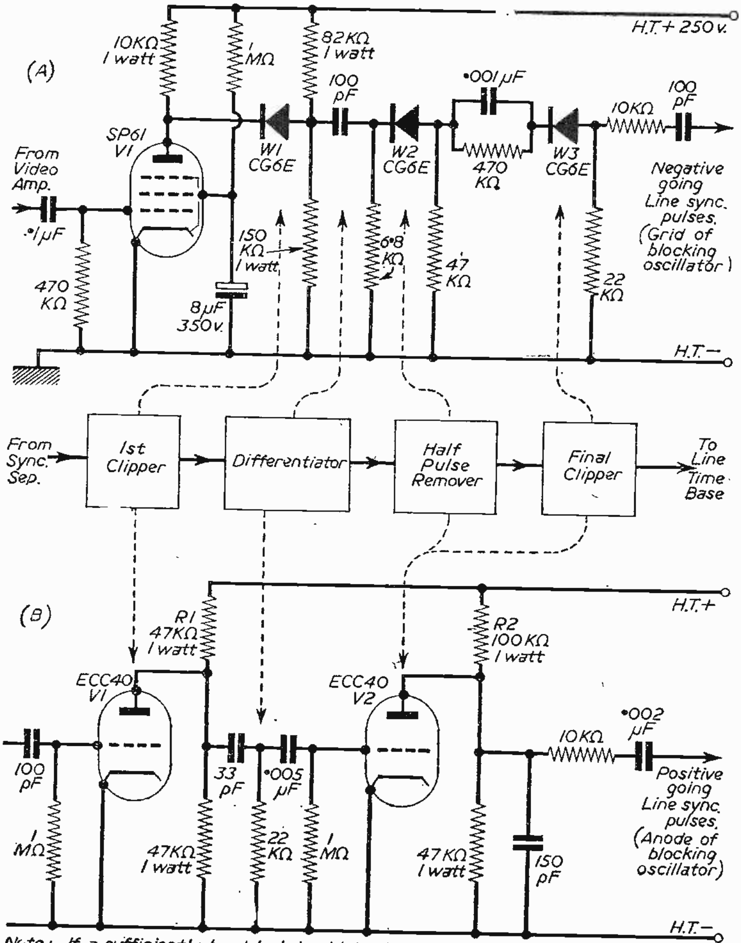
A Simple Scheme

One of the easiest methods of adapting an existing receiver chassis is simply to add an extra narrow response amplifier stage for the sync pulses, and utilise the existing video amplifier for picture signals only.

In this way both functions can be carried out separately and, consequently, with greater efficiency, with the additional advantage that there is now unlimited scope for experiment with the video amplifier (a much neglected field among amateurs) there being no longer the danger of interfering with picture synchronisation.

A practical circuit for experimental video and sync amplifiers is shown in Fig. 1, with several variable components which can be adjusted for optimum performance under the varying conditions that are met with in fringe areas.

The line sync pulse can also be much improved after the sync separator by adopting the technique shown in Fig. 2 (A) and (B). Basically both these circuits work on the principle that better results should be obained by removing from the sync pulse all that is not wanted, and improving what is left.



Note: If a sufficiently hard lock is obtained more efficient limiting is possible by doubling the values of R1 and R2

Fig. 2.—Two methods of line-pulse shaping.

With this in mind the first step is to clip the negative going line sync pulse as it appears at the anode of the sync separator. Then it is differentiated, and the positive-going half so produced, removed; finally the negative-going pulse remaining is again clipped and fed to the line timebase.

In the second circuit, Fig. 3, using triode valves, it is, of course, the negative-going trailing edge which is removed, the output pulse, being positive-going, should be fed to the anode if a blocking oscillator is used, the necessary negative pulse on the grid being obtained by reversal action in the transformer.

Having (we hope) reduced line tearing and made an improved video response possible, it may be necessary to widen the vision channel bandwidth to obtain full advantage of the modification. If no signal generator is available this is best accomplished by using Test Card "C," and, as the most favoured I.F. strips among amateurs seem to be "stagger tuned anode or grid circuits" broadening the response curve by "trial and error" requires only a little patience. Contrary to what many articles published on converting surplus I.F. strips would lead one to think, it is virtually impossible for the amateur to use a receiver with a three megacycle bandwidth without the aid of sound rejectors. This statement must, of course, be qualified by excluding Channel 1, where the use of the alternative side-band makes this practicable.

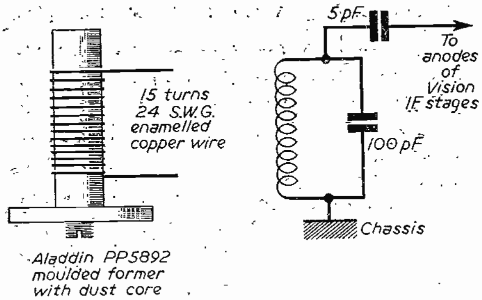


Fig. 3.—Suitable rejector for use with ex-Government I.F. strips.

Sound Rejectors

For the other channels—even by using band-pass coupling transformers throughout—it is exceedingly doubtful whether a response up to three megacycles could be obtained with the necessary drop of 35 decibels at three-and-a-half megacycles.

Sound rejectors should present no problem, however, and three—including a sound take-off point—are usually sufficient. Constructional details of a type suitable for use with most "surplus" I.F. strips (13 Mc/s) is given in Fig. 3.

The final results of all or some of these modifications should be some improvement in overall picture quality, but at least one has a very adaptable circuit which will give a range of control over video response which is impossible in the average receiver without affecting picture synchronisation.

New BBC Stations

Channel Islands

THE BBC announces that it has placed a contract for building work at the Television Station at Les Platons, Jersey, with Messrs. J. A. Parr, 62, Rouge Bouillion, Jersey.

The contract covers the construction of the transmitting station building, installation of water supply and drainage, and the provision of the access and service roads.

Work is starting almost at once and it is hoped that the installation of plant will be completed, and the station brought into service, before the end of this year.

Crystal Palace

The latest of a series of contracts signed between the BBC and Marconi's Wireless Telegraph Co., Ltd., for equipment for the Crystal Palace television station provides for the construction and erection of the transmitting aerial array.

This follows upon orders for the two vision transmitters, the two sound transmitters, Control and Monitoring equipment, two Vestigial Sideband Filters, two Combining Units and the main Transmission Lines, work upon all of which has been in progress for some time at Marconi's.

The Crystal Palace installation, which is to replace Alexandra Palace, will be the BBC's largest television station, and will incorporate the most modern transmission techniques. It is scheduled to go on the air early next year.

In the system planned for this station, the two 15 kW. vision transmitters and the two 4½ kW. sound transmitters will be fed into one aerial. This will be accomplished by feeding the respective outputs from one vision and one sound transmitter into a Combining Unit, whence it is conducted by a common main transmission line to half the aerial system. The remaining pair of transmitters will be connected in a similar manner to the other half of the aerial.

The two vision transmitters will thus be effectively working in parallel, as also will their sound counterparts. One big advantage of this procedure is that, in the event of one transmitter developing a fault, the station does not cease transmission, but merely operates at reduced power until the fault is rectified.

TV Advertising

TV ADVERTISING LTD. announces that Terry Bishop, well-known film director and writer, has been placed under exclusive contract to the company.

Terry Bishop is best known for his documentary film "Daybreak in Udi," a film which received world-wide theatrical and TV release and won both American and British TV awards.

He spent a number of years writing, producing and directing subjects covering the entire shorts, documentary, advertising and instructional range. He was for two years senior director with the Crown Film Unit and for three years under contract to Ealing Studios.

He joins a lively, creative group in TV Advertising, Ltd., which already includes Stanley Black as musical director and composer and script writers including Peter Myers, Alec Graham and David Climie, among whose theatrical and film successes is the current West End review "Intimacy at 8.30."

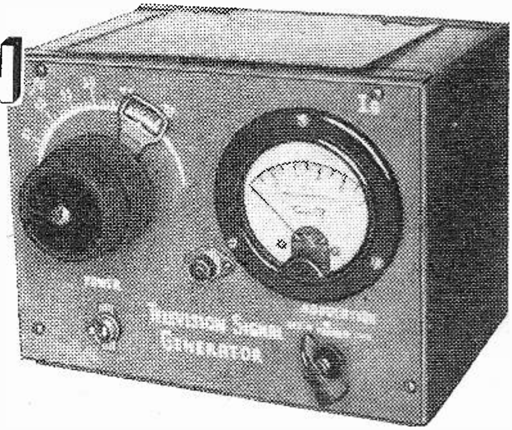
Terry Bishop will work mostly with Robert King, TV Advertising producer, and M. Danischewsky, who is in charge of the company's planning and production and whose colleague he was at Ealing Studios.

Production Manager

Another new appointment in the production department of TV Advertising Ltd., is that of Clive Freedman, who has joined the company as a production manager.

Clive Freedman has been production manager and writer for the Crown Film Unit, studio manager for the Film Producers' Guild, and his last feature film was "The End of the Affair," in which he acted as location manager.

A TELEVISION SIGNAL GENERATOR



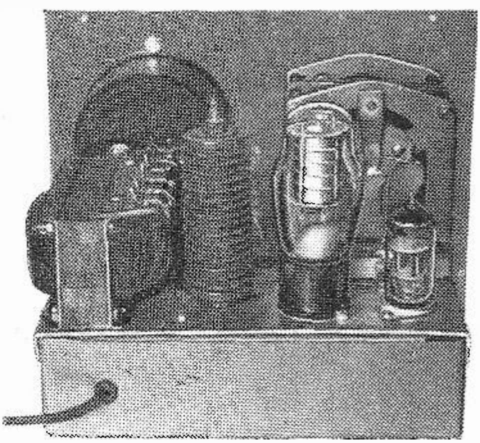
A USEFUL SERVICE INSTRUMENT FOR USE ON BAND I

By Denis C. Jefferies

WHETHER servicing or constructing television receivers, some form of signal generator will be found invaluable to the television engineer. The minimum requirements are that it should provide an unmodulated, and line or frame modulated, carrier for any channel in Band I. It should also be accurate and reliable and should, in the interest of safety, be isolated from the mains.

Such an instrument has recently been constructed by the author and the complete circuit diagram is shown in Fig. 1. It uses only one valve plus a voltage regulator and provides, in addition to the abovementioned features, grid-dip tuning facilities. The grid-dip tuning feature enables the engineer to ascertain the resonant frequency of a particular L/C combination, providing it occurs within the frequency range of the generator. The signal generator output loop is simply placed over the inductor and the frequency of resonance is indicated by a dip in the meter.

In order to ensure good frequency stability of the carrier oscillator it is essential that wide variations of temperature and voltage do not occur in the unit. The total power consumption of the generator is less than 10 watts and the components are therefore subjected to very little temperature change after switching on. Slight changes in the H.T. voltage busbar are taken care of by the voltage regulator. In practice the oscillator frequency reaches a steady value within one minute of switching on and the long-term frequency stability has been found to be very good.



A rear view of the completed signal generator.

The valve used is a 12AT7 high-slope double triode. This was designed primarily for use as a frequency changer operating at frequencies up to 300 Mc/s and no trouble will be experienced in getting it working at Band I frequencies.

The first half of the valve is used for the carrier oscillator. This uses a Colpitts circuit with an inductance of about .5 μH tuned by a 5—35 pF split-stator variable capacitor. The tuning capacitor used by the author was a surplus twin-gang shortwave tuning condenser with a capacity of about 100 pF per section. However, this gave a wider frequency range than was really required and a 35 pF maximum capacity would be more suitable. With the modulation switch in the "off" position the cathode is earthed and the grid current varies between 400 μA and 800 μA depending on the L/C ratio of the tuned circuit. This corresponds to an oscillator voltage of 4 to 8 volts across the 10 kΩ grid resistor.

The output from the oscillator coil L1 is inductively coupled to a single turn on the former and wired to the co-axial output socket. From the socket it feeds into about a yard of flexible co-axial cable terminated with a single ¾in. dia. loop of 16 s.w.g. copper wire. This probe coil holder was made from a polystrene coil former the base being drilled to make the co-axial cable a tight fit into it. As no buffer stage is provided in the unit the carrier frequency will be found to vary slightly if the co-axial output lead and probe are disconnected. It should not be normally necessary to do this, however, as the radiation from the probe coil is ample for normal work and it is usually quite sufficient to lay the probe coil near to the aerial input connection of the receiver to be lined up.

The calibration of the unit can be checked from time to time by beating the output from it against a known television sound channel frequency. Trimmer C2 is included in order that the unit may be very simply re-calibrated if the 12AT7 is changed at any time.

If frame and line linearity checks are to be made on receivers, two modulating frequencies are required in the signal generator. These frequencies must be multiples of the frame and line timebases if the cathode ray tube is to display a fixed pattern. The British television system uses 50 c/s frame and 10,125 c/s line repetition frequencies and therefore 300 c/s and 81 kc/s were chosen as the two respective modulating frequencies in the generator. These produce six white bars in the frame and eight white bars in the line position of the modulation switch. These give a bar

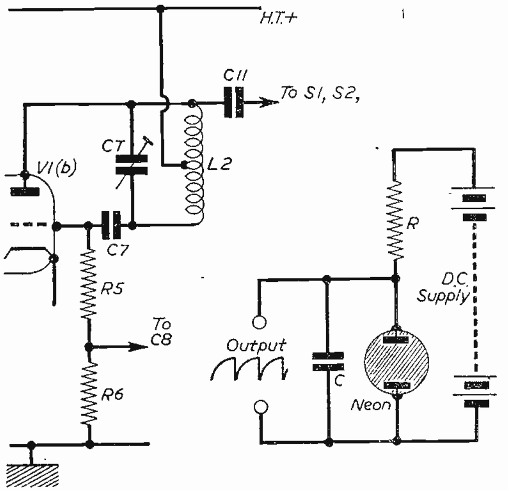


Fig. 2 (left).—Alternative 81 kc/s oscillator circuit if centre-tapped coil is available. CT=250 pF trimmer. R4, C5 and C6 are not required. Fig. 3 (right).—Basic circuit of a neon relaxation oscillator. The D.C. supply charges C through R until the potential of C is sufficient to cause the neon to strike. On striking, the neon discharges C and the cycle is repeated.

ratio of 3 : 4 which is the same as the picture aspect ratio and the bar widths, therefore, should be exactly the same on frame or line if the timebase amplitude controls of the receiver are correctly set. Lack of linearity in the receiver timebases shows up as differing bar widths down or across the screen.

The 81 kc/s oscillator producing the line modulation is another Colpitts circuit using the other half of the 12AT7. The coil used by the author was a 100 kc/s oscillator coil obtained from Government surplus radar gear. However, a bias oscillator coil as supplied for use in tape recorders would do very well. These are usually centre-tapped and a slightly modified oscillator circuit can be used as shown in Fig. 2.

Modulation of the television carrier is effected by means of the cathode resistor R2 which is common to both V1(a) and V1(b). This is short-circuited when C.W. is required as a greater amount of grid current is then obtained for accurate grid-dip tuning.

The frame modulation frequency generator is a simple neon relaxation oscillator working at 300 c/s. This feeds into the grid of V1(b) which acts as a cathode follower buffer stage modulating V1(a). A neon relaxation oscillator circuit is shown in Fig. 3. With a particular neon lamp and supply voltage the frequency of oscillation is determined by the product of the components R and C. In the prototype these worked out to 150 kΩ and .01 μF, but constructors will have to experiment with the values in order to get the frequency exactly right. R7 could conveniently be made up from a 50 kΩ fixed and a 200 kΩ variable resistor in series in order to save time in the initial setting up.

The 300 c/s frame modulation also provides a tone source for the alignment of the sound section of television receivers.

The striking voltage of neon lamps is affected by the amount of light falling on them. Any variations caused by this phenomena will not be enough normally to matter, however. The meticulous constructor will of course paint the neon bulb black !

The power supply is quite conventional and consists of a small instrument-type mains transformer supply-

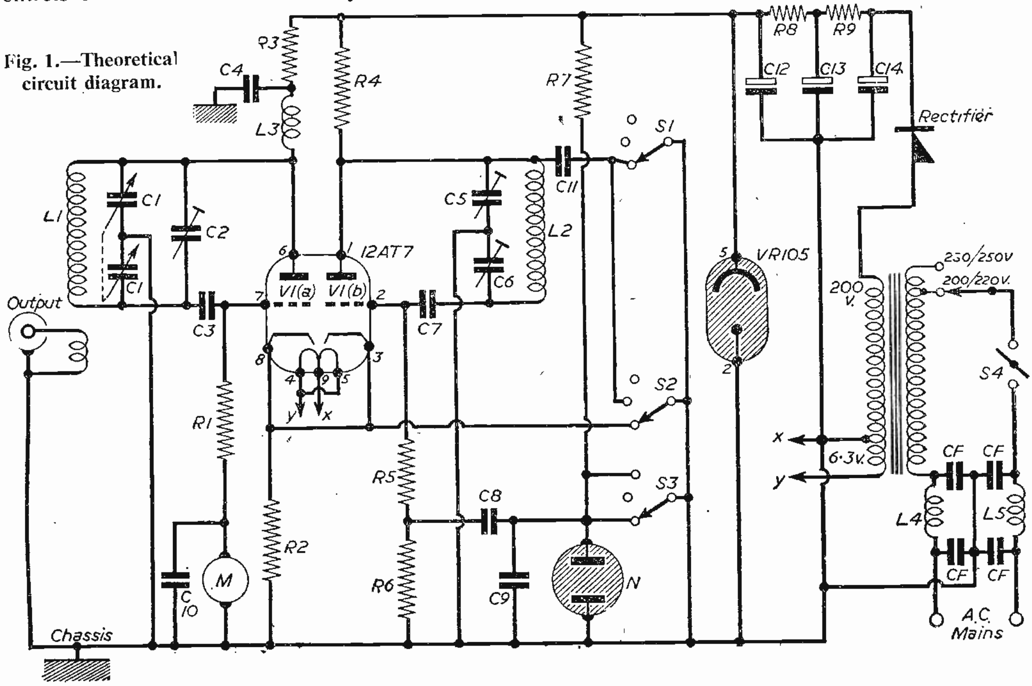


Fig. 1.—Theoretical circuit diagram.

ing 200 volts at 30 mA and 6.3 volts at 1.5 amps., followed by a metal rectifier feeding a resistance capacity smoothing network. Where test gear is concerned it is well worth paying a few shillings extra for a completely isolated mains transformer as there is a very real danger when using unisolated test equipment with A.C./D.C. television receivers. To reduce radiation from the unit via the mains lead an R.F. filter is fitted in the lead where it enters the generator. Putting the filter on the other side of the power switch would have meant that quite long lengths of mains lead in the generator would be unfiltered. The only disadvantage with the system used is that there is mains leakage through the four C.F. filter condensers. Their combined capacity is .001 μF and at 50 c/s they have a reactance of about 4 mΩ giving less than 100 μA drain across the mains supply. Good quality new capacitors are essential here if they are not to break down after a short period of use.

The half-wave metal rectifier feeds into an 8+16 μF electrolytic smoothing condenser followed by a 2 μF paper block condenser. A 2 μF electrolytic could, however, be used. Resistance capacity smoothing is quite sufficient and it avoids the expense of smoothing chokes as well as saving space. The H.T. supply to the 12AT7 and neon oscillator is regulated by means of the VR105 voltage regulator. This maintains the H.T. voltage to within a few per cent. of 105 volts, despite mains voltage fluctuations and changes in the current drain of the 12AT7 occurring in different positions of the modulation switch.

Construction

The unit was built in a ready-made steel instrument case size 8in. × 6in. × 5½in. This was supplied complete with an aluminium chassis, and the only metal work involved was the drilling of valve meter and component mounting holes. A 0-1 mA meter is used to indicate the grid current of V1(a). Its resistance is not important providing it is less than about 2 kΩ. The main variable capacitor C1 is controlled by a 100 : 1. Utility slow-motion drive and the calibration frequencies are painted directly

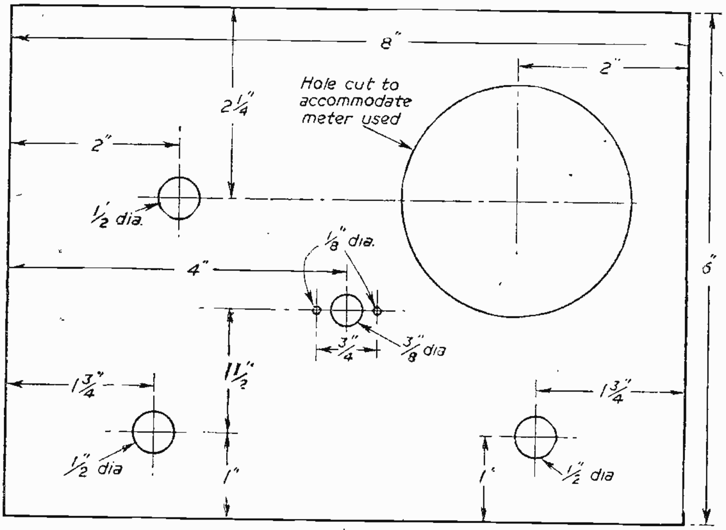


Fig. 4.—Front panel drilling.

on to the faceplate of the case. Figs. 4 and 5 show the layout of the front panel and chassis respectively.

Wiring the generator should present no difficulty providing the components are set out approximately as shown. The generous use of tag strips greatly simplifies the wiring and enables all small components to be rigidly mounted. The carrier-frequency oscillator wiring, carried out with bare 16 s.w.g. tinned copper wire, is prevented from shorting to the chassis by the use of rubber grommets placed in the feed-through holes. Heavy gauge wire is used for wiring this section to ensure rigidity and to reduce the losses in the resonant circuit. It is essential to use a trimmer capacitor with an insulated mounting for C2, as both plates are at H.T. potential.

When the wiring has been completed it is advisable to check it over thoroughly to ensure that no mistakes have been made. This is especially important in the meter circuit, as the meter can be permanently damaged if the wiring is in contact with the L.T. or H.T. supplies. If the polarity of the meter is known, the negative side should be connected to the grid resistor.

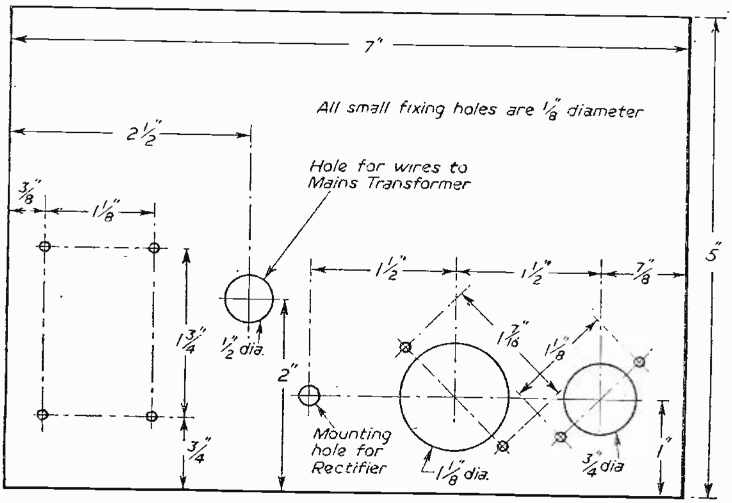


Fig. 5.—Plan of chassis.

Calibration

Calibration of the unit should be carried out when it is in its metal case. Another television signal generator covering Band I is not required for the calibration. The author, in fact, used a radio type signal generator over the range of 13 to 23 Mc/s. These generators usually have quite a usable third harmonic output and therefore the above frequencies will give check points in the range of 39 to 69 Mc/s.

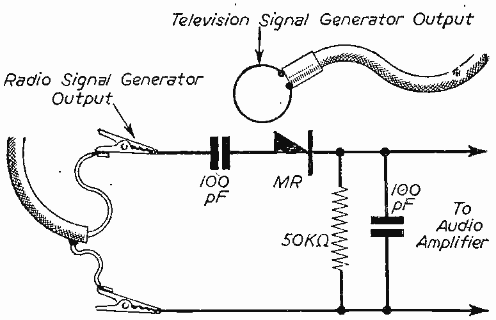


Fig. 6.—Circuit used for beating the outputs of two generators together.

The output from the radio signal generator is connected directly to the probe of a signal tracer and the output loop of the television signal generator is placed near to this connection. When the third harmonic is near the carrier of the TV signal generator a " squeal " will be heard in the signal tracer speaker. The two frequencies can then be adjusted until the beat note is zero. If a signal tracer is not available, an audio-amplifier can be made to work as such with the hook-up shown in Fig. 6. MR is a germanium diode. The " pick-up " facilities provided on a broadcast receiver can be used for audio amplification.

A correctly adjusted television receiver is required to set up the 300 c/s and 81 kc/s oscillators in the generator. The aerial of the television receiver is disconnected and the output loop from the generator is placed near to its aerial socket. With the modulation switch in the " frame " position the generator output should be adjusted to the sound frequency appropriate to the receiver. A tone will be heard in the receiver if the neon oscillator is working correctly. If the generator output is then shifted to the vision frequency of the receiver a horizontal bar pattern will be seen on the screen. Resistor R7 should then be adjusted as previously mentioned until six steady white bars are obtained. The modulation switch should then be turned to the " line " position and the 81 kc/s oscillator capacitors adjusted until eight vertical white bars are seen. The trimmers can then be set with quick-drying cement if it is thought necessary.

Receiver Alignment

It is essential that the television engineer be familiar with the nature of a vestigial sideband transmission if he is to obtain the best possible performance from the receiver he is working on. The transmitted waveform is shown in Fig. 7(a). V is the vision carrier frequency and S its associated sound carrier. It will be seen that the transmitted sidebands extend

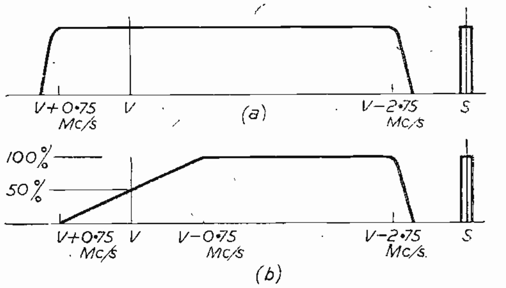


Fig. 7.—Showing (a) a vestigial-sideband transmission; and (b) the correct receiver alignment curve.

to V−2.75 Mc/s and V+0.75 Mc/s. After demodulation the outputs of the sideband frequencies each side of V are added, and it is necessary to make the receiver response curve the same as shown in Fig. 7(b) if the receiver is to perform correctly. It will be seen that the receiver response should drop steadily from maximum at V−0.75 Mc/s to zero output at V+0.75 Mc/s and will therefore be 50 per cent. down at V.

LIST OF COMPONENTS

- C1—0-35 pF split-stator variable condenser.
- C2—0-10 pF airspaced pre-set trimmer.
- C3—20 pF (250 v.).
- C4, C10 and CF condensers—.001 μF (500 v.).
- C5, C6—100 pF trimmers.
- C7—500 pF (250 v.).
- C8, C11—.1 μF (250 v.).
- C9—.01 μF (250 v.) (see text).
- C12—2 μF paper or electrolytic (300 v.).
- C13—16 μF electrolytic (300 v.).
- C14—8 μF electrolytic (300 v.).
- R1—10 K ½ watt.
- R2—1.2 K ½ watt.
- R3—5.6 K ½ watt.
- R4—12 K ½ watt.
- R5—50 K ½ watt.
- R6—470 K ½ watt.
- R7—150 K ½ watt (see text).
- R8—3.9 K 2 watt.
- R9—2.2 K 2 watt.
- All resistors are carbon.
- N—Small neon bulb striking at about 70 v. (without internal resistor).
- Metal instrument case 8in. x 6in. x 5½in. with aluminium chassis.
- 0-1 mA meter.
- 100-1 " Utility " slow-motion drive.
- Co-axial plug and socket.
- Four 5-way tag strips.
- S1-S2-S3—3 p., 3 w. switch
- S4—On/off toggle switch.
- Miniature mains transformer: Pri. 200/250 v. sec., 200 v. at 30 mA, 6.3 v. at 1.5 amp.
- Metal rectifier: 250 v. 40 mA (2 type RM1's suitable).
- L1—Main coil approx. 3 turns on ⅜in. diameter ceramic former.
- L2—81 kc/s oscillator coil (Osmor) (Type QT8 suitable).
- L3, L4, L5—40 turns 30 s.w.g. D.C.C. spaced in four sections on ¼in. diameter former.
- One B9A valve base and one International Octal valve base.
- One-valve type 12AT7 and one-valve type VR105.
- One yard of ¼in. diameter co-axial cable and three yards of mains lead.
- 4BA and 6BA nuts, bolts, washers, etc.

HOW TO FEED TWO OR MORE RECEIVERS FROM A SINGLE AERIAL ARRAY

By "Serviceman"

THE rapid advance of television has resulted in an alteration of the skyline of Great Britain; wherever one goes, chimney stacks are adorned with TV aerials of all sorts of shapes and sizes.

A few years ago there was very little difficulty with the erection of an aerial on the chimney. So much of the country consisted of fringe area that only the foolhardy or the brave attempted reception. One or two neighbours who shared a chimney stack decided to "have a go" and an aerial was duly erected.

Nowadays, things are different and it is very common to see two aerials perched on the same chimney stack, neither being of the slightest assistance to the other nor to the stack. When Band III gets really going, and both neighbours have dual aerial systems, we shall have the sight of four aerials on the one chimney stack.

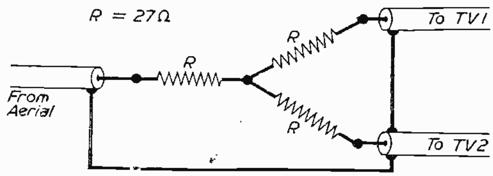


Fig. 1.—A simple method of providing two channels from one aerial.

Not only is the multiplicity of aerial systems unsightly, but when aerials are erected in such close proximity to each other, then they are not working really efficiently. Permanent and fleeting ghosts often result and the automatic gain controls are worked hard to retain a steady picture during high winds when the two arrays sway to and fro.

Fitting an Outside Aerial

The first thing to consider when confronted with the problem of an additional aerial on a dual chimney stack is whether the outside aerial is really necessary. *There are very many elaborate aerials erected on chimney stacks which are totally unnecessary.*

If one were to remark that the system is good for business it would, perhaps, be considered unfair, but the writer can conceive no other notion for the erection of high-gain aerials in many places within the service area.

Let us make no mistake about it; in a poor service area a good aerial system is a *must*, but in many cases within the service area a good dipole erected in the loft will provide all the picture signal which is necessary.

As an example of the unnecessary use of outside aerials I would like to quote the position in my own immediate locality. We are situated less than 30 miles from Wenvoe, yet from the window of the room where I am writing I can see 14 "X" aerials on chimneys, five "H" aerials on chimneys, two "H" aerials fitted on the facia board, three "X" aerials fitted on the facia board, two dipoles, one on the chimney and one on the facia board. In addition, I know that three of my immediate neighbours have dipoles in the lofts as I have myself, and reception with these is adequate.

The first thing to do then is to verify that an aerial on the chimney is really necessary. The home-constructor can quite easily make up a dipole and try it in the loft, and if he then finds the signal pick-up is inadequate, elaborations can be made.

If there is room in the loft, an "X" or an "H" aerial can be tried, but if reception or conditions do not allow this, then the possibility of two neighbours sharing one aerial should be considered.

Sharing an Aerial

The simplest arrangement possible is where the circuit from the aerial is divided into two channels. Fig. 1 shows the arrangement. The coaxial lead from the aerial is terminated in a small junction box (one of the round plastic type available from multiple stores can be used), and two feeds are taken out. All

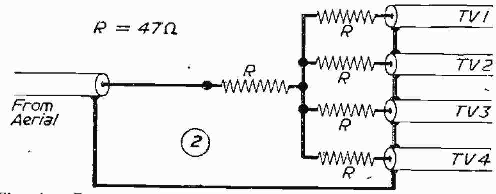


Fig. 2.—In this scheme four receivers may be fed from a single aerial.

outers of the coaxial cables are connected in parallel and the centres are connected via resistances of 27 ohms. Half-watt resistances can be used.

Although simple, the arrangement is perfectly workable, though some losses must be expected. If the area is one in which the signal strength is on the

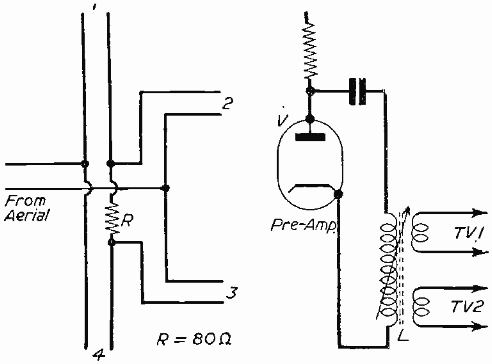


Fig. 3 (left).—Using a balanced twin feeder. Fig. 4 (right). —Splitting the output of a pre-amplifier.

low side, it would be beneficial to erect an aerial of a more elaborate type so as to counter losses. It is better for there to be a single high-gain aerial than for two aerials to be erected on the same chimney, both from the point of view of possible strain on the chimney stack, and from the electrical angle.

It is possible to operate more than two televisors from one aerial, and a scheme catering for a total of four receivers is given in Fig. 2. The system is very similar to the first case, but the total losses will, of course, be greater.

Another circuit which uses a balanced twin feeder is shown in Fig. 3. Four outputs are available, and for its successful working each branch should be terminated. Any branch which does not have a receiver at the end should have an 80-ohm non-inductive resistance fitted across the termination.

Pre-amp Output

In each case so far quoted the fitting of the extra circuit(s) involves a certain loss in the overall signal available. In the fringe areas this loss cannot be tolerated so an alternative must be found.

The simple answer is to use a pre-amplifier with a divided output.

In Fig. 4 will be found the simple case. V is the output valve of the pre-amplifier and L is the output coil. Normally, this coil has one secondary winding which feeds the television receiver. It is a very simple matter to add a further output coil on top of the existing primary.

The idea can be further extended and split feeds fed from the two separate outputs. By this method it is practicable to feed eight television receivers from a single aerial system.

When a single pre-amp feeds two houses, there may be difficulty in arranging its switching; it is wasteful to have the amplifier switched on permanently. A solution to the problem is shown in Fig. 5.

With this arrangement a relay is employed to switch on the mains supply to the pre-amp. The relay is shown as " A " in the diagram.

The scheme is for the relay to operate when either television receiver is switched on; for this reason it is operated from the H.T. supply of each receiver, a relay with dual coils being employed. There are a large number of relays of this description on the market from ex-Government apparatus. All that is necessary is for the relay to operate from either H.T. supply, the resistance " R " being used to limit the current.

When one of the television receivers is switched on the relay " A " operates, and the contacts A1 and A2 switch on the mains supply for the pre-amp. When both television receivers are switched off the pre-amp automatically switches off.

The location of the pre-amp will depend upon local arrangements, but it could quite conveniently be mounted in the loft of one of the houses and leads fed to each house.

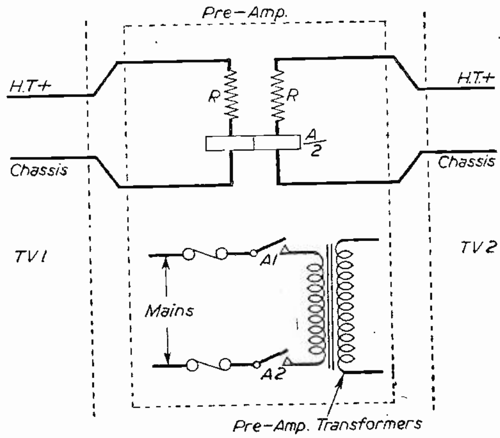


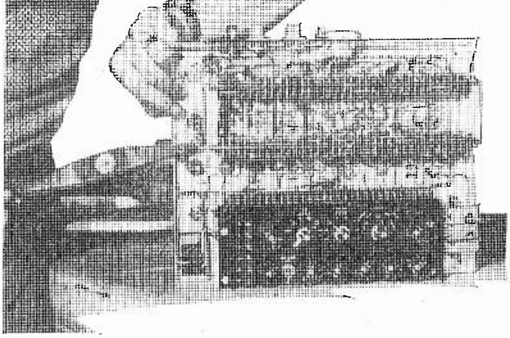
Fig. 5.—Using a mains-operated relay for switching on and off.

Conveyor Speeds Production

AT the Romford factory of Regentone Radio & Television, Ltd., a new " soak test " conveyor has been installed to speed up the testing of television chassis before final assembly and despatch.

For the satisfactory testing of newly assembled television chassis, several hours of continuous operation are necessary, since it is during this period that any faults in new sets are normally discovered by the purchaser. The ever-increasing rate of manufacture at the Regentone factory made the stationary testing of assembled chassis for this period a drag upon the production line and the " soak test " conveyor has been introduced to speed up this part of the process.

Supplying electricity to the individual chassis whilst in motion presented a problem which has been successfully overcome by the use of miniature current collection arms running along hard-drawn copper bars. Each bank of three television chassis is supplied via two of these miniature arms, which are completely swivelling and are particularly suitable for installations of this kind, having been specially developed by British Insulated Callender's Cables, Ltd., who co-operated with Regentone in the design and installation of the current collection equipment.



No. 10.—THE G.E.C. BT7092 AND BT7094

By L. Lawry-Johns

THIS receiver first came on the market in 1948 and large numbers are still in regular use. Later models incorporated several modifications, which will be detailed later. The 7092 was the table model with a side-mounted 6½in. P.M. speaker and the 7094 the console version with a 10in. speaker and separate chassis. Both models featured an all-wave radio, the tuning dial of which was mounted below the 9in. tube. Beneath the dial was fitted a push-button assembly for selection of S.W., M.W. and L.W., Gram, TV, Tele Sound, and Off. The total number of valves used is 24. One essential job on these receivers is that of cleaning the tube and the large piece of plate-glass which covers both the tube face and the radio dial. The speed with which this glass and tube face collects dust is amazing and regular cleaning is an absolute necessity.

To remove the chassis, this being necessary to gain access to the tube face and glass, the front knobs should be pulled off. When the two inner ones are removed the press-button indicator plate will be released. The next step varies with the table and console types. With the table model the retaining screws should be removed from beneath the cabinet, there being four screws set in rubber feet. Another four screws may be found, but these should have been removed when the set was installed as they are only meant as transport securing screws. When these have been removed the entire chassis of the table model may be withdrawn to the extent of the speaker leads. A small table is not advised on which to do this job ! If so desired the leads may be unsoldered from the *speaker* to enable the cabinet to be removed completely.

When cleaning the tube face it will be noticed that the tube is not rigidly mounted and can quite easily rotate a few degrees whilst being attended to. As the scan coils also rotate with the tube the raster may not be square in the mask when the set is tried out. If it is desired to test the receiver with the back cover removed the plug and fuseholder connections will have to be removed from the cover. This is a simple job, and the removal of the various screws and clips is all that is necessary permanently to leave the plugs in the chassis sockets when the cover is removed. Remember that the E.H.T. on this receiver is derived from the mains via the left-hand transformer and is therefore lethal. The utmost respect is required when handling the chassis.

Chassis Removal

The removal of the console chassis is a slightly different procedure. The front knobs should be pulled off as before, also the Contrast and Tone from beneath the overhang of the cabinet, where the preset controls are adjusted by means of a screwdriver. Also under this front projection are the front chassis-retaining screws, which should now be removed.

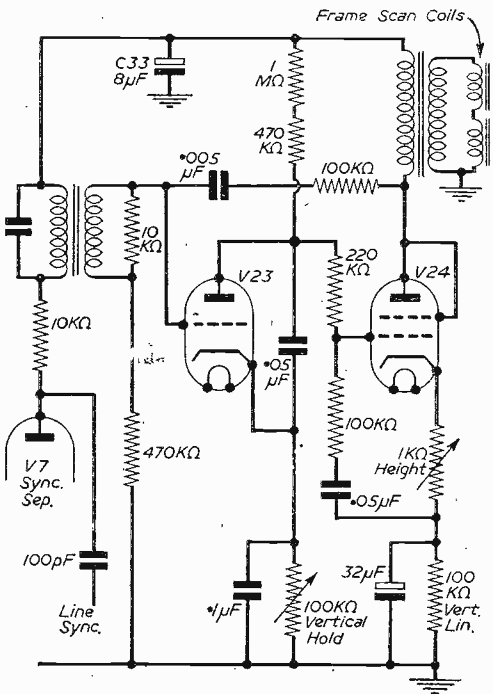


Fig. 1.—Frame timebase. Note 32μF vertical linearity bypass. This circuit is for early table models only as far as the method of feeding frame pulses from sync separation are concerned.

Remove the back cover, and the two screws which secure the wooden blocks on which the chassis is mounted may be unscrewed.

The chassis may now be removed to the extent only of the multiple connecting leads which join the receiver chassis to the power-pack chassis. The length of these cables is sufficient to enable the receiver chassis to be placed on the floor at the rear of the instrument. This allows the tube and glass to be cleaned and also routine servicing to be carried out. If more convenient access is required the power pack will also have to be removed to enable both units to be placed on a bench. The two chassis are of considerable weight and assistance is necessary as they are joined by a large number of soldered cables.

This difficulty does not arise on the table model as the power pack is divided each side to form "wings" on the main chassis. Although more convenient to remove completely the weight is considerable. The mains connecting plugs and fuses are fitted to the console model and the method of removal is the same, care being required when handling the rear of the receiver after this modification has been carried out as the rear of the mains plugs is exposed.

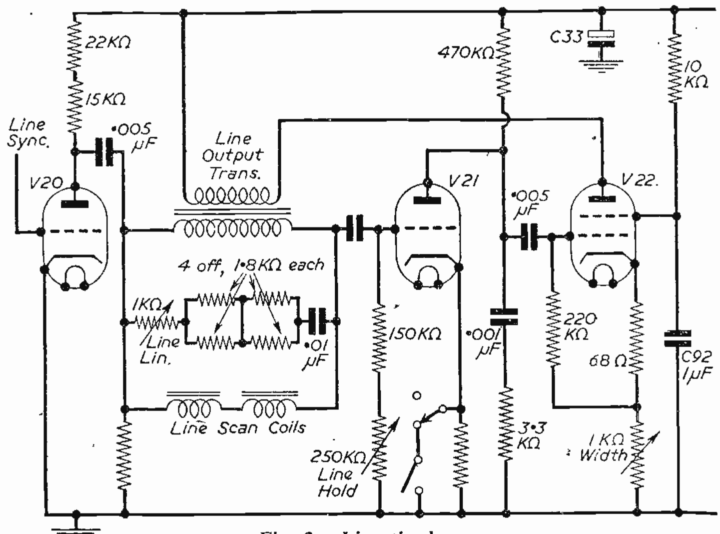


Fig. 2.—Line timebase.

Picture Faults

The frame timebase uses two valves—a KT81 output and part oscillator and an L63 triode which, together with the KT81, functions as the frame oscillator. The anode of the KT81 is connected back to the grid of the L63 via a resistor (100 K) and a condenser (.005 μF). The anode of the L63 is D.C. coupled via a 220 K resistor to the control grid of the KT81. Height is controlled by an unbypassed variable resistor of 1 K. In series with this to the chassis is the vertical form control, 100 K, which is bypassed by a 32 μF 150-volt electrolytic condenser. When this condenser goes open circuit, and this is a frequent fault, the raster compresses with bad linearity. As this condenser is mounted on the top of the chassis it is an easy matter to remove it and check its capacity. A healthy swing over and back to infinity or thereabouts on a good quality meter is all that is required. The position of this condenser on the chassis is indicated in the diagram of the "top chassis view," C97. The vertical hold control is a 100 K variable acting as the cathode bias resistor of the L63. In the diagram V23 and V24 indicate the L63 and KT81 respectively. The sync pulses to the frame timebase, L63 grid, are via a transformer in the anode circuit of the sync separator in earlier models. In later production models the transformer was omitted and the pulses were fed through a differentiating resistance capacitor network to the control grid of V24 (KT81). All BT7094 console models are wired

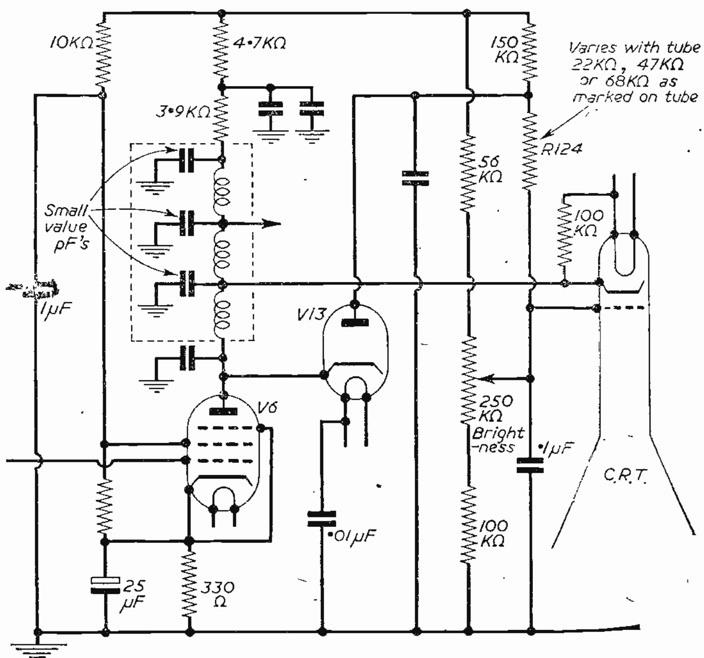


Fig. 3.—Video amplifier, noise limiter and CRT circuit. R124 is located beneath the chassis, adjacent to the radio aerial sockets.

thus, as well as the later BT7092 table models. The H.T. supply to both frame and line timebase is decoupled by an 8 μF 500-volt electrolytic condenser marked C33 in the top chassis diagram. If this condenser dries up erratic operation of timebases coupled with poor focus will result. The focus coil is in series with the H.T. supply to the timebases and is shunted by the focus control and its series resistors and is bypassed by a 50 μF 50-volt electrolytic. Note that the MU14 rectifier marked V9 is solely concerned with supplying the line and frame timebase. The H.T. voltage at the smoothed point of supply to the timebases, i.e., at C33, should be approximately 340 volts.

The Line Timebase

This consists of a two-valve unit preceded by a triode pulse inverter. The line output, KT45, marked as V22, acts as part oscillator as does the frame output. In this case, however, the coupling to the control grid of V21, L63, is from the secondary of the line output transformer via a 47 pF condenser. The anode of V21 is condenser coupled to the control grid of V22 (.005 μF).

The cathode of the KT45 is joined to chassis via a 68 ohm and a 1 K variable resistor, this latter functioning as the width control. Neither of these has a bypass condenser, and the control grid leak, 220 K, is taken to the junction, that is, the bottom of the 68 ohm and the top of the 1 K variable. Horizontal form is a 1 K variable which, in series with a resistor condenser network, comprises the linearity arrangement across the scan coils.

I have found that if the raster tends to compress at the left-hand side the linearity network is not generally at fault. The cause is more often to be found at the screen grid of the KT45 This is supplied from the H.T. supply by a 10 K resistor and is decoupled to chassis by a 1 μF paper condenser. This condenser appears to dry up or otherwise go open circuit and causes a decreased line scan with the left-hand side compressed as stated. The testing of this component is extremely simple, as it is mounted just behind the previously mentioned frame cathode condenser, and as it is much taller it is more obvious, and its " hot " end is at the top. Therefore, all that is required is for the lead to be removed and the condenser tested in the normal way with the reactive clip of the meter to chassis and the positive probe just touched on the tag at the top of the condenser. The swing of the meter will, of course, be very small compared with that of a higher capacity electrolytic, but assuming a meter of reasonable sensitivity is used sufficient indication will be given to prove the component up to capacity. If there is any doubt a suitable condenser of 1 μF or more may be shunted across to check any change in the raster. An electro-

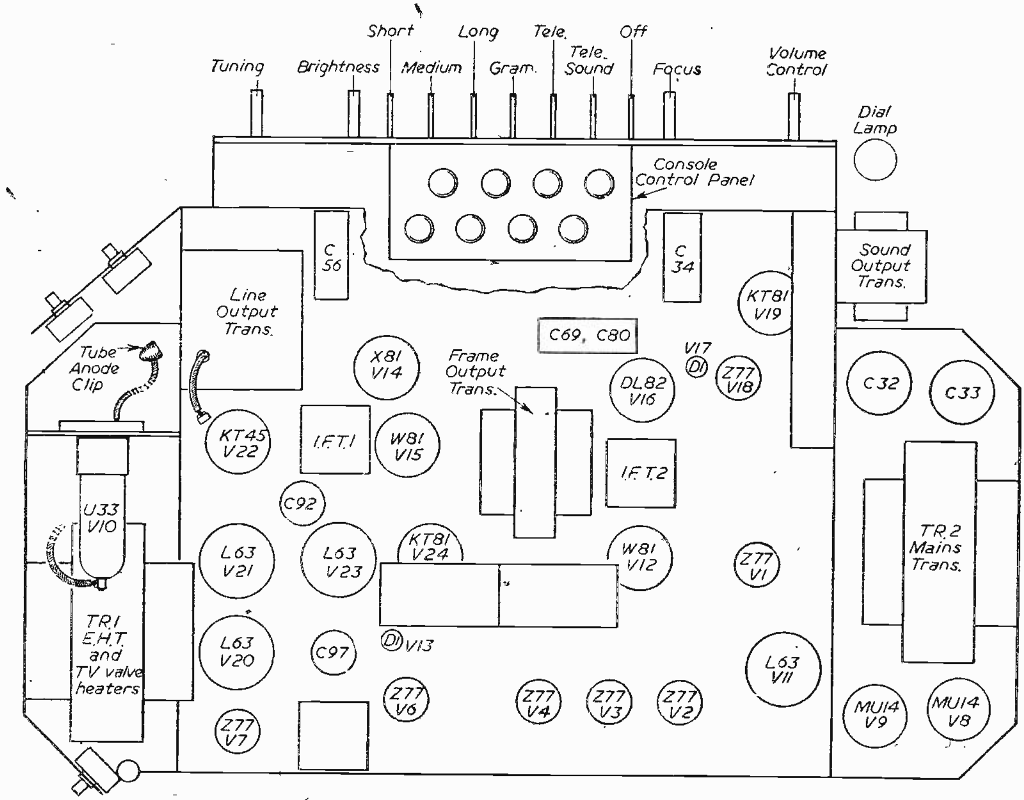


Fig. 4.—Top chassis view of table model. The side transformer " wings " are combined to form a power pack on the console version. The panel marked " Console control panel " is only mounted on the Console and is actually located under the P.B. selector unit. The positions of C92, C97 and C33 should be noted.

lytic may be used if a paper type is not available, attention being paid to polarity and working voltage, not less than 450 volt being used for this test. If no line scan is obtainable, a white line extending vertically down the screen centre, attention should be directed first to the valves V21 and V22.

If these prove good the voltage at the top of the previously mentioned condenser should be checked; 175 volts is approximately correct. If this voltage is absent remove the lead from the tag and check the voltage on the lead. If voltage is now present it will normally indicate a shorted condenser, and a meter check should reveal a short circuit from the tag to chassis. If, however, there is no voltage when the lead is free it will indicate one of two things—either the 10 K 2-watt dropping resistor is open circuit; quite possible if the condenser has shorted, or the KT45 has an internal short. This, of course, presupposes that the KT45 (V22) was not checked for emission or shorts previously. However, if a higher voltage than 175 is found at the condenser tag it could well indicate that the width control (1 K series cathode of KT45) is open circuit. It is as well to point out here that it is essential to check the cathode bias resistors of any valve if an internal short has occurred which could result in a heavy flow of current passing through these components.

Tube Defects

The effects of a heater-to-cathode leak or short are well known and should not need reiterating. However, a short in the tube of this receiver will not cause uncontrollable brilliance as the heater has an isolated winding on the mains transformer. The vision interference limiter V13, Mazda D1, also has its heater fed from a tapping on this winding, and this point should be borne in mind as one side of this diode's heater is decoupled by a .01 μF condenser. If there is any doubt as to the cause of a particular defect the diode should be removed altogether. Excessive brilliance will most often be caused by a defective condenser in the video amplifier anode circuit; a study of the diagram will show that there are several of these components which may cause a drop in cathode tube voltage should a defect occur. The voltage at the anode of the video amplifier should read approximately 240 volts.

If this voltage is at or near this figure the tube grid potential should be checked and a high reading here will indicate that the voltage divider network comprising three resistors is at fault. This network is made up of a 56 K ½ watt from H.T. to the top of the brilliance control, which is a 250 K variable,

(Concluded on page 36)

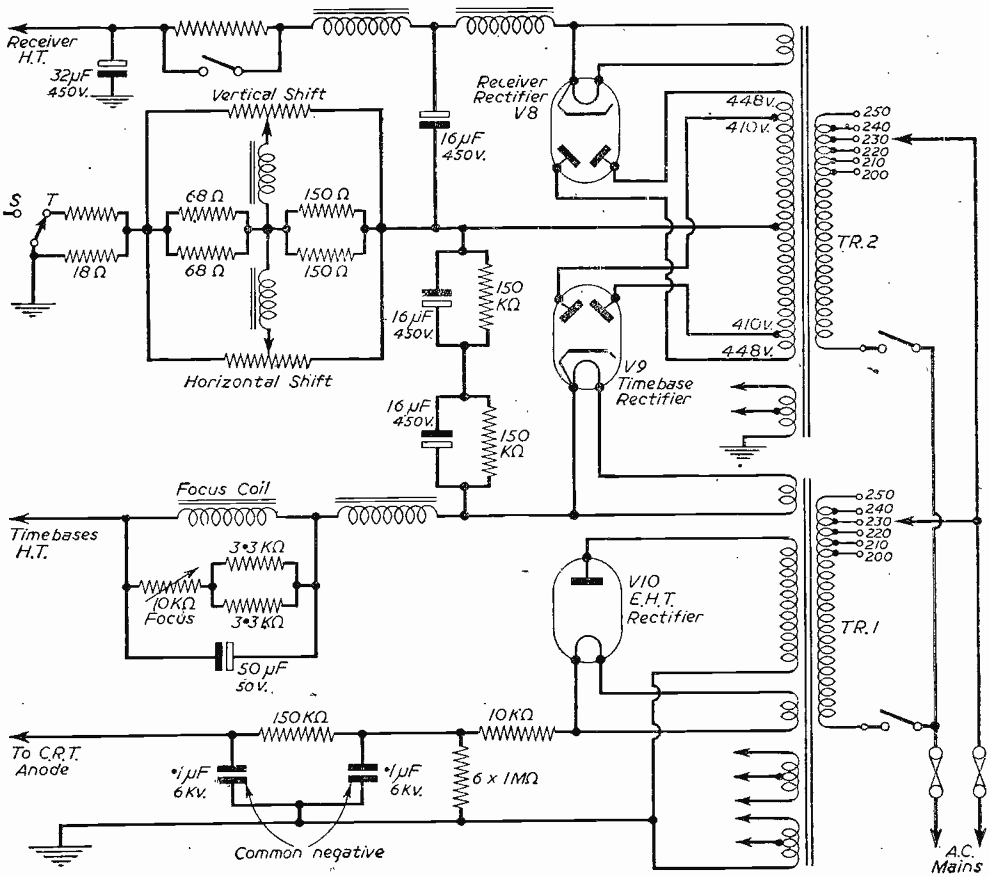
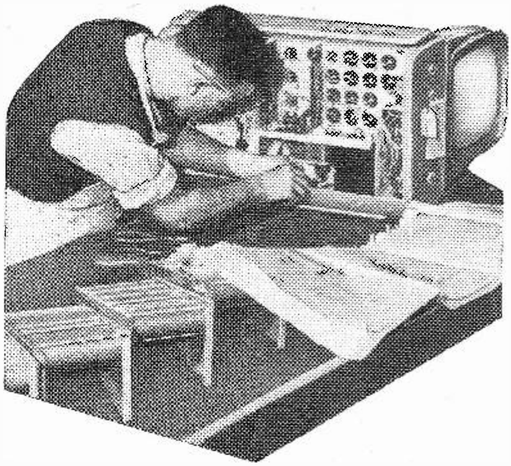


Fig. 5.—H.T. and heater supply. TR1 is disconnected on radio.

PAGES FROM A TELEVISION ENGINEER'S NOTEBOOK



A VALVE SELECTION CHART

THERE are many types of valves now available to the television constructor and experimenter, and no doubt the supply of ex-Government types is still far from exhaustion. The valves in mind are those suitable for R.F. and video voltage amplification, and so cover those characterised by high mutual conductance and low inter-electrode capacity.

These types are almost invariably pentodes or tetrodes, and it is often difficult to select a suitable valve for a particular purpose without wading through manufacturers' catalogues and characteristic data. For this reason the valve selection chart to be described has been drawn up ; with this it is possible to get the main points of suitability of a particular valve almost immediately, and it can be built up by the user as newer types are released so that its information is always up to date.

The important features of a pentode for television and other wide-band work are its mutual conductance gm and its input and output capacities, Cgc and Cac respectively. The anode impedance Ra is usually very large compared with the anode loading R, and so may be ignored.

As we have seen in previous articles in this series the gain of a pentode amplifier is given to a close approximation by the equation

$$\text{Gain} = gm.R$$

If the stage is uncompensated, this gain falls at the high frequency end of the range, and is actually 0.707 of the above amount when the reactance of the shunting capacity across R is equal to R. As the bulk of such capacity comes from the sum of the input and output capacities of the valves used, it is seen that these reactances are very important in consideration of wide-band design.

If the frequency $f = \frac{1}{2\pi CR}$ (where C is this total valve capacity) is called the bandwidth of the system, then

$$\text{Gain} \times \text{Bandwidth} = \frac{gm}{2\pi C}$$

which depends solely upon C and gm. For the maximum bandwidth, therefore, a large gm and a small capacity C is necessary. In valve design, of course, these two requirements conflict with one another, and a high gm leads to an increase in input capacity.

Complicated networks will increase the bandwidth of a particular amplifier, but the criterion is always dependent upon the ratio of gm to C.

The Selection Chart

Fig. 1 shows the basic idea of the chart under discussion, though this is by no means complete.

To draw the chart, gm is taken as the horizontal axis, with C, the sum of the valve input and output capacities, as the vertical axis. Logarithmic scales are used in both directions because this permits lines representing a constant gain-bandwidth product to be drawn in as 45 deg. diagonals, shown in the figure as broken lines. As the chart is built up, the best valves for the purpose of wideband requirements are those positioned towards the bottom right-hand corner.

For the constructor who wishes to make up his own chart for ready reference, get a large sheet of double log. graph paper and mark out the co-ordinate axes as shown in the figure. It is of little purpose taking gm beyond 20 mA per volt or the sum of the capacities beyond 30 pF. The positions of the various valves are then marked in by taking the figures of gm and the capacities from the manufacturer's list and plotting these in the usual way, the

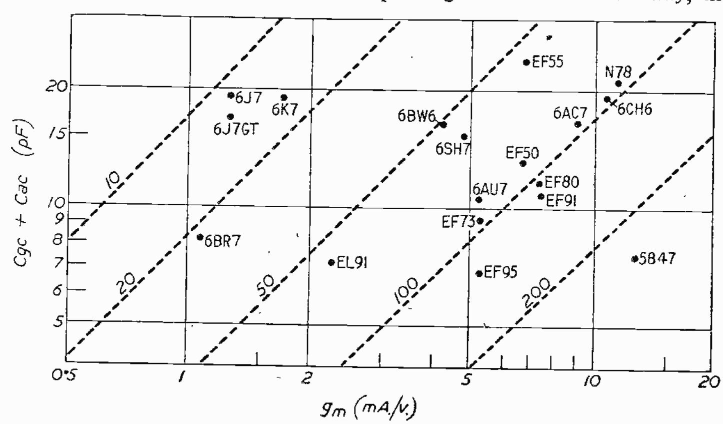


Fig. 1.—A basic idea of the valve selection chart discussed in this article.

name of the valve type being marked beside its own locating point. Equivalent types, such as the EF91, 6AM6, Z77, etc., are, of course, all represented by one point.

The diagonals are marked in to give the appropriate gain-bandwidth products ; they run parallel to each other as shown.

In addition to showing the best valves for wide-band working as mentioned above, the chart shows valves which are electrically similar, such as the EF91 and EF80. It also shows how a valve is improved by a higher mutual conductance (6AU7 compared with the EF91), or by a reduced capacity (6AU6 compared with the EF95).

Valves on the same diagonal line are revealed as having the same gain-bandwidth product, but different values of gm and C, such as the 6AC7 and the 6CH6.

With a large sheet of paper it is not difficult to list over a hundred valve types for easy reference without confusion.

"TeleVet" Tester

EVERY service engineer who is called upon to retrim a television receiver needs other apparatus besides a signal generator. Usually, for some particular types of receiver a wobbulator is essential for accurately lining up the I.F. circuits, and in addition to these an audio output for the sound section, plus a pattern generator, might also be needed at certain times of the day when there is no actual signal on the air. This means that usually a receiver cannot be serviced in the customer's home, but must be taken away where the full facilities of a service workshop may be obtained. The Airmec people have tackled this problem, and as a result have produced the neat instrument shown below, and known as the "TeleVet." Consisting basically of a signal generator, it incorporates a C.R. tube for indications, and by means of the various test leads and controls it is possible to obtain a video output at any frequency on Band I or Band III, with a wobbulated signal controlled at 5 Mc/s intervals by means of a self-contained crystal ; a pattern consisting of a horizontal bar and two vertical bars ; an audio oscillator ; an A.C. and a D.C. voltmeter measuring up to 20 kV, and an output meter.

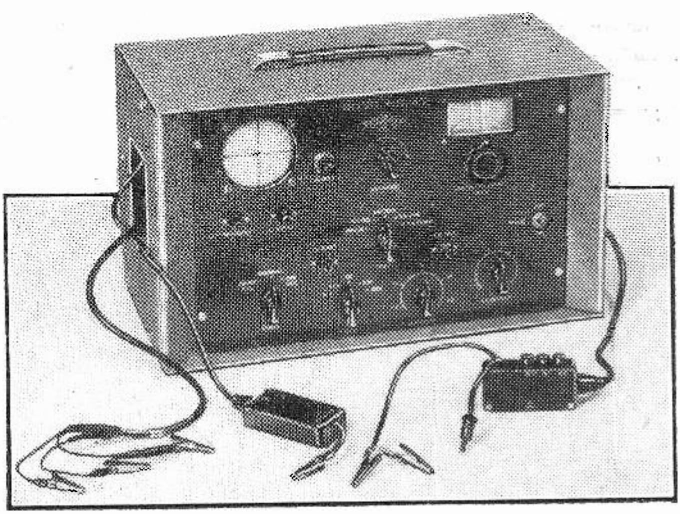
Fixed Leads

Unlike many multi-instruments, this instrument has all the various test leads permanently attached, and stowed, when not needed, in pockets on each side of the cabinet. Screened leads are used for the various R.F. outputs, and each lead or termination is identified by means of a letter. The very exhaustive manual supplied with the instrument makes it a simple matter to select the required lead when first using the instrument, and after a short period of use it becomes a simple matter automatically to choose the required lead. The unused leads may be left lying on the bench or stowed inside the pockets and do not affect the results on the used leads. A standard signal generator round which the instrument is assembled covers the ranges from 8 to 70 Mc/s and from 168 to 230 Mc/s, and a 5 Mc/s crystal incorporated with a special circuit enables the instrument to be set to any multiple of 5 Mc/s—an accuracy better than .02 per cent. A mechanical wobbulator varies the setting over a 12 Mc/s sweep, and an initial setting of the controls enables the waveform on the tube to be centred with three pips at 5 Mc/s spacing so that bandwidth may easily be read off or identified. The wobbulator can, of course, be switched off, and an unmodulated R.F. output obtained, or alternatively, the signal generator may be switched off and the tube used at a straightforward oscilloscope with built-in D.C. "Y" amplifier.

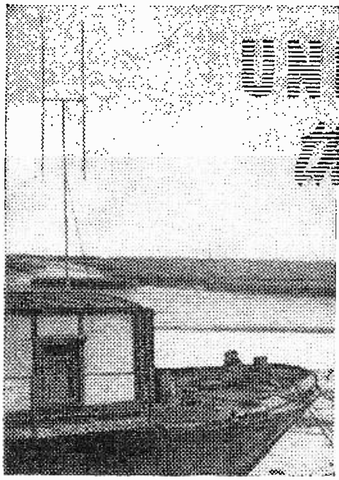
Dial Readings

The scale provided has a deep-set cursor with a vernier, and the built-in oscillator produces beats which may be ignored for rough tuning, but where a high degree of accuracy is required, a little skill and some calculation are called for in finding, by means of the audio output, two dial settings on the vernier and then calculating an intermediate setting, but although a little complicated when first using the instrument one soon gets accustomed to the procedure, and one or two short cuts become evident—dependent upon the type of receiver being serviced and the accuracy which is required. The chassis and earth line are isolated, and the tester may thus be employed in servicing A.C./D.C. apparatus, and all the facilities mentioned have been incorporated in a case measuring overall 15½in. long, 8½in. high and 9½in. deep, and weighing only 25lb. The case size is actually larger than the instrument itself, as this includes the two pockets on each side of the case. We have had one of these testers in use in our lab. for some time now and have found it to be one of the most useful pieces of equipment which we have come across.

The price of the instrument is 57 guineas, and the makers are Airmec, Ltd., High Wycombe, Bucks.



The Airmec "TeleVet" Tester.



UNDERNEATH the DIPOLE

TELEVISION PICK-UPS AND REFLECTIONS

By Iconos

LAUGHTER THE ATTRACTION

"IF it's laughter you're after . . ." was Tommy Trinder's publicity catch-phrase a few years ago. To-day, it seems to be an appropriate slogan for almost any kind of entertainment—theatre, radio, films or TV—which is destined to click with the audiences. The general public seems to laugh easily and eagerly at the moment and responds to any feature-title which shows promise of laughter, particularly when it is coupled with the name of a star comedian.

"ASKEY-ITIS"

BEFORE Your Very Eyes, with Arthur Askey, has now finished its run but has established the Big-Hearted Arthur as the finest TV comedian in England; his timing of gags, impromptu chit-chat to viewers, easy, relaxed style and excellent diction all add up to his complete mastery of the extremely difficult technique of being funny in front of the television camera. Sabrina, the dumb blonde of the show, was put into the series as a "gimmick" by Bill Ward, the producer, with the astonishing result that she is now in demand for personal appearances at sporting events, for films and for stage work. She will continue to puzzle us with her extraordinary Robey-ish eyebrows which, I am told, are the new fashionable style. This comedy series will have broken new ground by creating a new starlet, starting a new fashion and consolidating the reputation of Arthur Askey. We've all got Askey-itis now and his name soars to the top. Such is the impact of TV; it achieves in two or three shows the same progress as years of steady consolidation in other branches of show business. No wonder the national advertisers are getting all steamed up about sponsored TV in Britain.

MRS. SHUFFLEWICK

ANOTHER name which has shot to the top of the music hall bills as a result of a TV series is Mrs. Shufflewick, the "gimmick" of the Ralph Reader show, *It's a Great Life*. Mrs. Shufflewick is the name which has been adopted by Rex Jameson, a first-class comic dame in pantomime style. The Shufflewick interruptions of the Reader Show were amusing and I thought that Rex Jameson made the most of rather poor dialogue material. Comedy scripts are not easy to write but usually take the form of presenting old, well-tried chestnuts in a new shape. The introduction of catch-phrases, character stooges and gimmicks, if successful in the first episode of a comedy series, definitely builds up goodwill for subsequent instalments. Even the introductory music to a feature can create anticipatory laughter—for instance, the title music of early Laurel and Hardy films, seen occasionally (not often enough !) on television.

SUNDAY NIGHT GLOOM

SUNDAY night is a peak viewing time. The BBC's ace TV drama producers are given their heads, and the result seems to be either horrific or merely boring. Rudolph Cartier, whose skilled direction has been devoted to quite a few of the full-length Grand Guignol-type plays, changed his style to some extent in "Midsummer Fire," a play by Hermann Suderman, translated by Ashley Dukes. The TV version sets the piece in modern Mexico instead of in East Germany eighty years ago, as originally written. The modernising pep-up (which seems to be applied to most plays written more than twenty years ago) fails to sustain the piece, in spite of good performances by such experienced TV players as George Coulouris, Laurence Payne and Jeannette Sterke. It seems to me that when adapting old three- or four-act plays for television, the transposition should concentrate upon shortening the playing time from ninety minutes to sixty or less. The speeding-up process should be achieved by deletions rather than by speeding up the dialogue delivery. An American TV producer visiting England said of British actors: "They talk too fast and move too slowly." There is a great deal of truth in this criticism, though the effect of too-speedy a delivery is often achieved by poor diction, heavy dialect, or the ultra-natural throwing away of lines. In due course, recorded versions of our television plays will be exported to the U.S.A., Canada and elsewhere. It will then be necessary for the dialogue to be easily understood internationally. These remarks do not particularly apply to "Midsummer Fire," which played its full hour-and-a-half for those who stayed to its end, but to dramatic plays in general.

"FABIAN OF SCOTLAND YARD"

THE half-hour episodes of Fabian's adventures, made in England primarily for American Television, are models of the type of presentation suitable for the international market. Bruce Seton is a most convincing detective and each story is well-worked out and played, partly with commentary and also with directly-recorded scenes. "The Executioner" was a very good example of a taut half-hour's "who-done-it" entertainment. I understand that the producers turn out two "Fabian" films a week at the Twickenham Studios. This is fast going for this type of feature, which required specially built settings as well as exterior scenes. Compare any "Fabian" episode with some of the BBC 90-minute dramas which play in one or two sets. Each Fabian episode must have at least eight sets, though some of them are quite small and others, such as the Scotland Yard Offices, are used again and again. The ingenuity of the Art Director in arranging for "revamps" of sets in a few hours, changing drawing-rooms into kitchens and such-like, is a most important factor in this type of production, and can save hundreds of pounds in costs.

TELEVISION LIGHTING

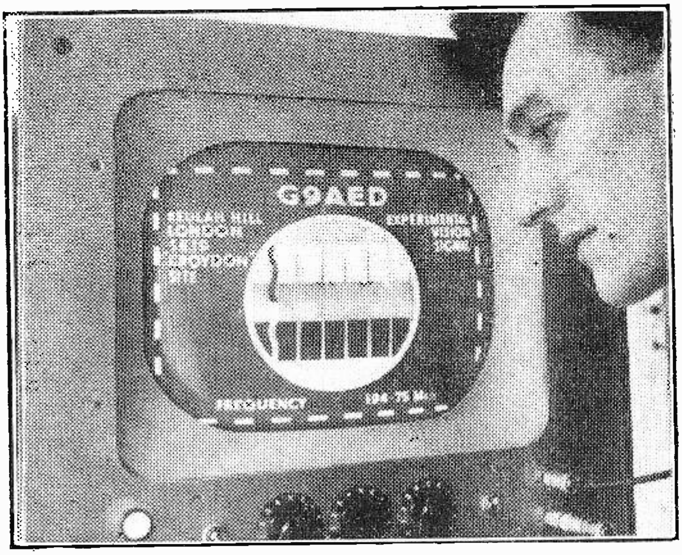
THE Video-Film camera is likely to be taken up by several of the American TV organisations. Nevertheless, it will be appreciated that a higher level of lighting is usually necessary for filming as compared with live television; and when a combination of both methods is used, sufficient light is required for film photography. This level is particularly high for colour photography, sometimes requiring intensities of up to 1,000ft. candles as compared with less than 100ft. candles for electronic cameras. In practice, rather more light than 100ft. candles is used in TV studios, and the difference is not so great with black-and-white film photography. There would, therefore, seem to be a definite place in this complicated business for the Video-Film type of camera, of which a great deal will be heard in the next few months.

THE VIDEO-FILM CAMERA

AMERICAN technical magazines carry advertising for dozens of equipment companies offering all kinds of gadgets as aids to television production, either live or on film. Camera dollies of all varieties, magnetic recorders, special types of lights, microphone booms and other impedimenta crowd the pages. One of the latest innovations is the Video-Film Camera, which is capable of transmitting a live image via TV and at the same time photographing on 35 mm. film the same picture. The scene is picked up by the normal camera lens, one of three of different focal lengths mounted in a turret, which transmits it to a normal film gate. Between the lens and the film, however, a beam-splitter is interposed which diverts a proportion of the rays to a vidicon tube contained in the camera. There is an electronic viewfinder inset in the back of the camera, enabling the operator to see the actual scene transmitted and filmed, and duplicate outlets feed monitor tubes for the producer or others. The camera is, therefore, two cameras in one—a film camera and a television camera. It is being used at present for filming the Burns and Allen weekly show and the popular *I Love Lucy* feature, the electronic side being used, for the time being, mainly to assist the producer in cutting-in and out the appropriate cameras when required. The image seen by the camera operator is exactly the same as that filmed, since it is picked up through the same lens, and is not subject to the parallax troubles experienced with the normal separate view-finder attached to the side of the camera. Producers also appreciate that they can spot any errors immediately, without having to wait for the film rushes to be processed and printed. They are able to instruct the operators and grips, via an intercommunication system, as to camera movements with the same accuracy as with live TV camera set-ups. Naturally, the camera is somewhat larger than either a TV or a film camera, and has to be fitted with a sound-proof blimp.

16 mm. OR 35 mm. ?

EVER since the commencement of BBC television the film side has been standardised on 35 mm. film for picture and variable area photographic recording for sound. In the course of time magnetic recording has been introduced in 35 mm. perforated form and also on magnetic tape which is used on exteriors when extreme mobility is required. Synchronisation of tape with picture has been maintained by recording a time-base signal from the picture camera motor on the tape at the side of the sound recording. This is used as a speed reference when the tape recording is re-recorded on to photographic film. Such use of twin-track tape recording is now in general use by film studios as well as the BBC on the Leevers Rich Synchropulse recorder. On the picture side the 35 mm. standard has been maintained because of the greater ease in scanning and telerecording. But now the problems of 16 mm. film scanning have been tackled and the considerable economies to be obtained are likely to bring about changes of technique both here and in the U.S.A. Colour television is now in commercial use in America and it has been found that the cost of film stock and processing of Kodachrome 16 mm. film is precisely one tenth that of 35 mm. Eastman Colour. Consequently, there has been a very rapid development in 16 mm. work. Some of the most popular weekly commercial features, such as the Hank McCune Show, are now filmed in 16 mm. colour, using a new combined sound-and-picture camera, the Auricon. Kodachrome is a reversal film stock, however, and if more than one copy is required, duplicate 16 mm. negatives have to be printed, during which process the sound track is likely to suffer degradation unless it is re-recorded electrically.

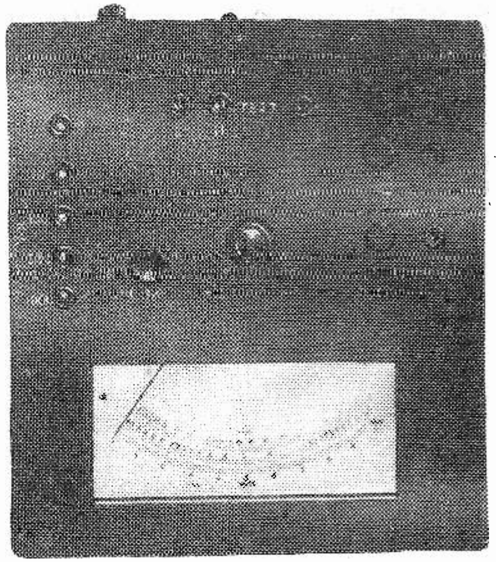


Engineer Mr. C. F. Whitbread, of Edmonton, London, examines the monitor screen in the experimental test station on the I.T.A. site at Croydon, during a broadcast of test signals.

MAKING A TEST METER

BUILDING A UNIVERSAL INSTRUMENT ROUND AN EX-GOVERNMENT VISUAL INDICATOR UNIT

By P. Green



Front view of the finished meter.

A RELIABLE test meter is an essential piece of equipment to any amateur who intends to build his own radio or television receiver. From surplus supply stores instruments containing good moving-coil movements may be obtained, and these may be modified and used to make a good test meter. Visual indicator type 3 (10Q4) is one, and may be obtained for a few shillings. The writer recently bought six of these for a shilling each, and all have been used to construct the meter described. There seems to be a good supply of them, and a practical description of how to adapt this fine movement of approximately 500 microamps F.S.D. to make a test meter may be of interest to others. The movement used is the vertical one. The other, a centre zero movement, is not suitable, although this may be used to make a light or exposure meter.

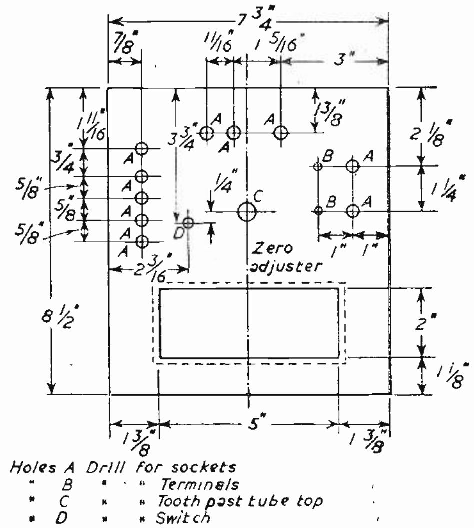


Fig. 1.—Details of the plywood top of instrument.

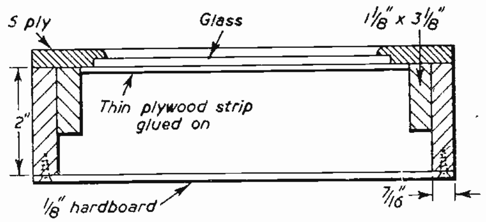


Fig. 2.—Section through case.

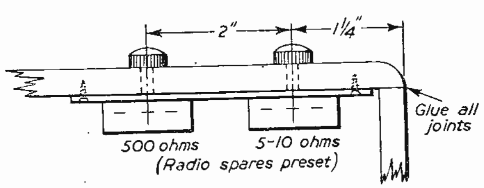


Fig. 4.—Corner of case showing potentiometers.

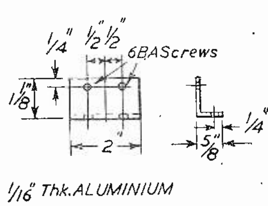


Fig. 5.—Movement support.

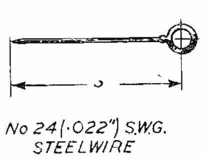


Fig. 6.—Tool for pointer.

Construction

Before removing the movement from its case it is advisable to construct the wooden case, movement support and scaleboard, as a rigid support is required while other work is being carried out. Using clean 5-ply wood and baywood for the box, the constructional details are shown in Figs. 1 to 5. Use "cold" glue on all joints, and tack with fine sprigs. For the window, a recess is made by removing two layers of plywood, as shown by the dotted line on Fig. 1. The glass is cut from an old negative plate, which is ideal for this purpose as it is thin and free from flaws. To fix the glass peel off from a spare piece of plywood the top layer, sufficient to make a strip ⅛in. wide. Glue down over the glass as shown in Fig. 2. A little Bostik cement round the edges of the glass will make a seal. It is important to keep the case dustproof, and to keep metallic particles away from the movement.

Dismantling

When all the parts are ready, remove the movement from its case, handle carefully, and mount on the angle bracket on the scale board with 6 B.A. screws. Now snip off the end of the pointer with a razor blade, using a piece of wood under the pointer as an anvil. This leaves the pointer 1¼in. long from the centre of the movement. Now to start experimenting in making an extension pointer. First, make a wire tool (Fig. 6) from a piece of steel wire 0.022, 24 s.w.g. The new pointer is made from thin aluminium foil removed from an old electrolytic condenser; the thickness of which will be anything from .0018in. to .0025in. thick. Cut strips 5/64in. wide (.002in. thick approximately). These strips are now bent round the wire to make a tube, and after a little practice you will be able to make quite good pointers. When you have been successful, draw ⅜in. of the tube off the wire; flatten out this end by scraping with a penknife; trim with scissors and cut down to a length of 2 7/16ins. Now carefully push this extension piece on to the movement pointer for approximately ¼in. The total length from centre of the movement to be 3 7/16ins. Fix with a little Durofix.

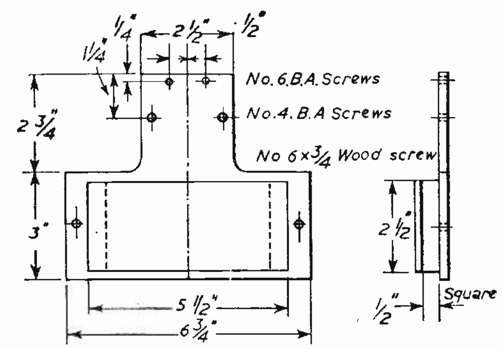
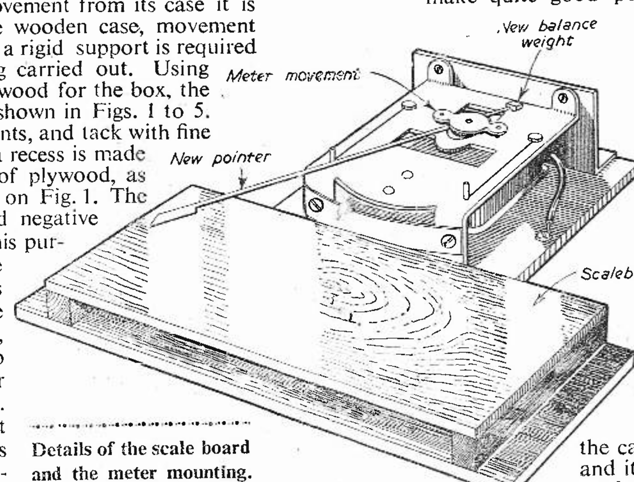


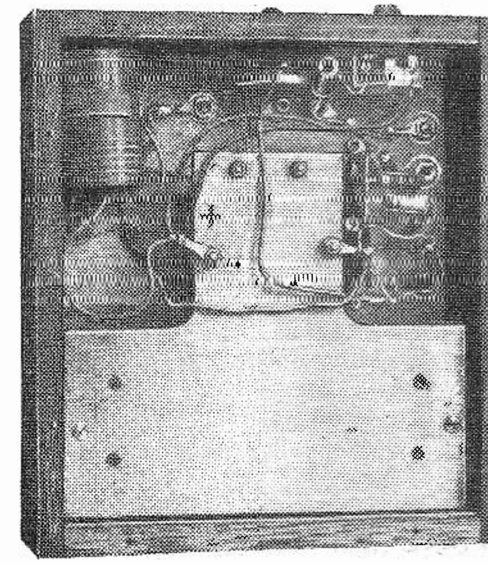
Fig. 3.—Details of the 5-ply support and scale board.



Details of the scale board and the meter mounting.

Balancing the Movement

The meter will now have to be re-balanced. The pointer of a perfectly balanced instrument will return to zero when the case is placed on any of its sides, and it is by this method you can proceed to balance your instrument. First wind on the wire tool about six turns of 36 s.w.g. copper wire. Place this on the stub end of the pointer. You will note there is already one on but do not attempt to remove this, as you may damage the movement. Having placed the additional weight, which will fit, loosely proceed to place the instrument on all its sides and note how the pointer behaves. You will be able to judge if the weight is too light or too heavy, and will have to make your adjustments to suit. When sure your instrument is well balanced fix the weight with a little Durofix.



Inside details of the meter.

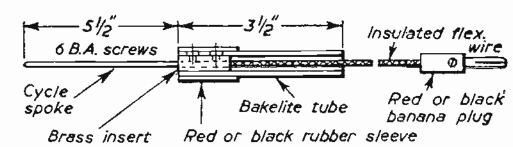


Fig. 7.—Details of the prods.

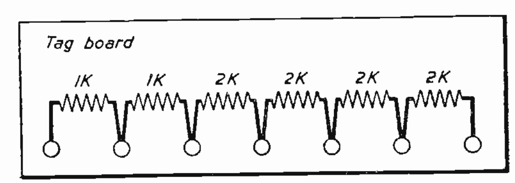


Fig. 8.—Check panel for high range.

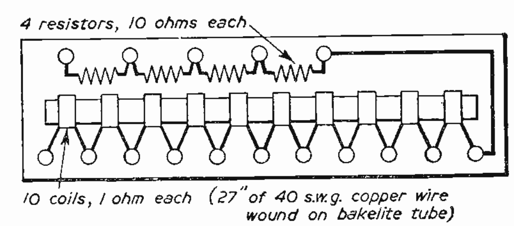


Fig. 9.—Check panel for low range.

The Scale

The scale can now be attached to the scale board, but do not stick down with glue or paste as this will warp the scale. Fix round edges with cellulose tape. Solder the instrument leads now to the heads of the 4 B.A. brass screws, and this part of the meter is now finished.

Proceed to fit the sockets and terminals in the meter case, using a solder tag at each one. Fix also the 500 ohm and 5 to 10 ohm potentiometers (Fig. 4) and the switch for changing over the resistance ranges.

Calibration

The voltage ranges can now be calibrated, and new batteries may be used to carry out the tests. As the movement gives a linear scale adjust the resistances to suit one voltage reading, say 6 volts on the 10 volts range. Similarly choose a suitable voltage for the other ranges. Sometimes a resistance is found that will give a correct reading, but a combination of two chosen resistors in series or parallel will give the reading required. For each range an approximate value is given in the diagram. All resistors are 10 per cent. tolerance. When calibrating it is an advantage to have a number of the same kind of resistors, and also a few very high ones, viz. ½, ¾ and 1 M Ω. Figs. 8 and 9 show two panels which may be used to check the resistance ranges. The 2,200 ohm resistor and the 500 ohm potentiometer for the high resistance scale are not critical, but the low resistance range is rather critical of adjustment, and a total resistance of approximately 50 ohms is required. The potentiometer Y in the diagram should be 5 to 10 ohms; the resistor X must be self-wound, and "trial and error" method must be used for the meter to read correctly on the low-resistance scale.

External shunts are used for current readings and connections are brought out from the meter movement to two large terminals, which are then connected to the sockets. The method of making the shunts is shown in Fig. 10, copper wire being used. Always keep the ends clean and screw down the terminals tight when taking readings or errors will occur. Testing prods may be made as shown in Fig. 7.

Socket and plug connections have been used which give "at a glance" safety positions, but if the constructor desires he may incorporate switches. No attempt has been made to provide a laboratory meter, but a useful and practical instrument which will meet any amateur constructor's requirements.

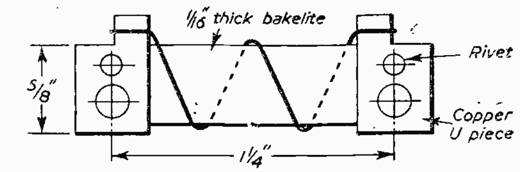
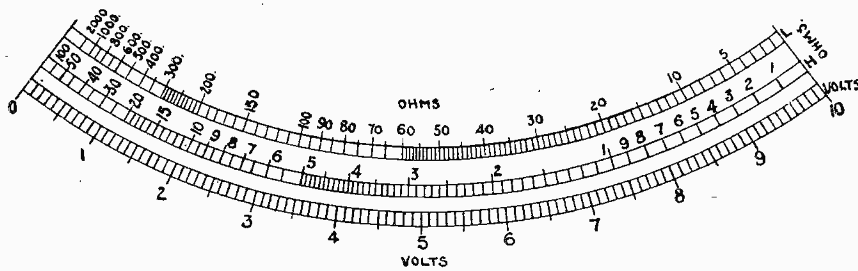


Fig. 10.—Details of the shunts.



This scale may be cut out and stuck to the scale board. It is accurately drawn for this instrument.

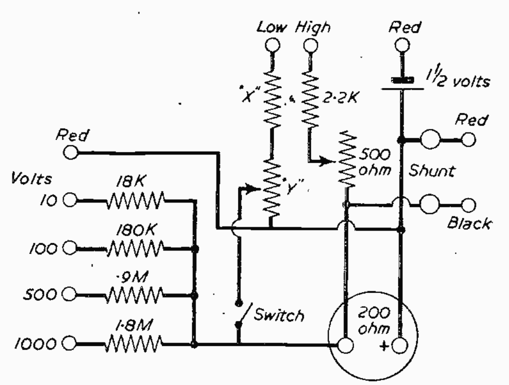


Fig. 11.—Circuit of the meter.

Viewer Research

LATEST Viewer Research figures issued by the BBC reveal the following interesting details:

Average level of evening viewing *among the whole adult population* of the United Kingdom (approx. 37,600,000 persons):

	% of the adult population
January-March, 1955	14.9
January-March, 1954	11.5

Average level of evening viewing *among the "television public"*:

	% of the "televison public"
January-March, 1955	43.8
January-March, 1954	45.0

The increase in the size of the audience for the average broadcast on television in the evening from 11.5% to 14.9% of the adult population closely parallels the increase in the number of TV sets in use.

In January-March, 1955, the average audience of evening television broadcasts included 43.8% of the (enlarged) TV public; the corresponding figure for January-March, 1954 (when the TV public was appreciably smaller) was 45.0%.

T.R.F. RECEIVERS

THERE IS NO NEED TO SCRAP OLD-PATTERN SETS AS EXPLAINED HERE

By W. J. Delaney

A QUERY which we are often receiving to-day is whether or not a T.R.F. receiver should be scrapped, or whether it is possible to modify it for the reception of the I.T.A. programmes. Most television receivers of this type were designed in the very first days of television, when the only station on the air was the London transmitter, and this, unlike the remainder of the BBC transmitters, uses double-sideband transmission. Further, at that time, the 9in. tube was in general use, and thus these receivers will not be very useful to-day unless they have been modified to take a larger tube. However, many viewers are quite content with this size of picture and it is quite conceivable that the majority of users of this type of receiver would prefer to retain it. The problem is, however, what can be done about the I.T.A. programmes when they commence. It will be appreciated that in a superhet the majority of the tuned circuits are pre-set to one frequency and, so long as the frequency changer is tuned to the required station and the oscillator coil is suitable, the set can be tuned to any station quite easily. In the T.R.F., however, it becomes necessary, if another station is required, to retune all the coils, and this is impracticable. Does this mean, then, that receivers of the T.R.F. pattern must be scrapped, or the user restricted to only one station? Fortunately, there are solutions to this problem, although they are not simple.

Conversion

First, of course, the entire circuit may be redesigned to use a superhet arrangement. This would, of course, be a major reconstruction, and in receivers of the type of the P.W. Receiver might also call for a modification in the layout, as the coils are all unscreened and instability might arise with the higher efficiency and gain of the superhet. One could, however, replace the coils in the final stages by screened components of modern design and rearrange the first two stages. The first stage would be left in its original form to act as an R.F. stage, with the second converted into a frequency changer. As the custom was sometimes to take the aerial to both sound and vision (no common stages), this would mean that there would be a need to change the input circuit to the sound section and feed this from the frequency changer in the usual way. The result of this might be to provide too much sound, and the possibility would then have to be explored of using the first sound stage as a separate oscillator to work in the frequency changer circuit. This might avoid the necessity of purchasing new valves, but much will depend upon those which are in use in the existing circuit. Alternatively, it might be found that the circuit which is now being used would, on conversion on the lines above mentioned, provide insufficient amplification at the I.F. for the vision, and perhaps, therefore, one of the sound stages could be rearranged to add to the vision I.F.

Sound Rejection

The T.R.F. circuit would, undoubtedly, have sound rejector circuits in it, and these, too, would have to be replaced by suitable rejectors at the sound I.F. It will be seen, therefore, that there would be a fair amount of work involved in modifying a T.R.F. set for modern two-station reception, but such a rearrangement of parts would be advisable in many cases. Of course, there is also the question of redesigning the timebases at the same time, to take advantage of the larger tubes which are now available, and if this is considered worth while, the entire receiver would practically have to be rebuilt, and in such a case it would no doubt be thought desirable to start by building a completely new design. A market for the old receiver would no doubt be difficult to find, but as a second transmitter becomes available the market will undoubtedly grow smaller, and therefore the user of this type of receiver has to consider seriously now, what may be done.

An Alternative

In addition to the modifications which have been outlined above, there is one very useful alternative which might eventually prove the most satisfactory way out. Converters for the new commercial stations will shortly be available and will be described in these pages, but in most cases they will consist of frequency changers designed to cover one Band I and one or two Band III stations, and the output from such converters will be at the now more or less standardised I.F., round about 34 Mc/s. This output if normally intended for connection to the I.F. stages of existing television receivers, and most commercial models which have been produced during the recent period have been provided with input arrangements to enable this to be done. The home-constructed models will, however, have no such provision, and therefore any such converter which is used will have to be designed for the I.F. which is employed in the receiver, and then the latter will have to be modified so that the input may be applied at a suitable point. The T.R.F. receiver which we have been discussing, however, will offer a more useful application in this connection, as it will only be necessary to retune the existing coils to the I.F. output of the added converter. If the coils permit, it might be possible to do this merely by changing the cores or, alternatively, the converter may be designed to provide an output at the same frequency as is used in the existing receiver and merely to use the latter as an I.F. amplifier. The big problem which will arise in many cases, however, will be the production of patterns on the screen due to the existing receiver picking up one of the transmissions on its wiring. The older type of receiver was not so comprehensively screened as modern models, and in areas which are close to one of the stations not only the coils but also the actual wiring may function as miniature aerials and pick up the unwanted signal, resulting in either a background pattern on the screen or cross-talk on the sound side. This trouble may, indeed, arise even in some modern commercial receivers, but this will depend upon the proximity of the transmitter, the reception conditions, and whether or not the aerial(s) and leading-in cable are suitably disposed.

Frame Flyback Suppression—3

SOME CIRCUITS FOR THE EXPERIMENTER

By "Erg"

(*Continued from page 567, May issue*)

ASSUME that the circuit is once again stabilised so that anode and cathode potentials are equal. Now if a negative pulse is applied to the cathode current will flow in the circuit for the duration of the pulse. The current will cause a voltage drop across the anode load R, and the

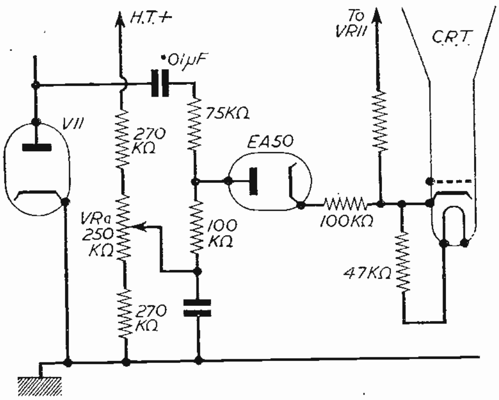


Fig. 12.—Details of the "Simplex" with diode gate.

voltage at the anode of the valve will be less than it was previously. In other words, the anode moves in a *negative* direction. The negative pulse at the cathode has produced a negative pulse at the anode and this can be passed on to a circuit via the outlet B.

Should a positive pulse be applied to the cathode, then no current will flow through the valve, and therefore no positive pulse will be felt at the anode and no pulse appears at outlet B.

The diode gate can be reversed quite easily so that it will pass a positive pulse and not a negative one.

In this case let us assume that the circuit is balanced and no current flows. Now apply a positive pulse to the anode; this will cause the valve to pass current which will be drawn from the cathode. The current will be drawn from the circuit attached to the point A and there will therefore be a positive pulse at point A.

Summarising, a diode gate used for negative pulses has the cathode as input and anode as output; a diode gate used for positive pulses has the anode as input and the cathode as output.

Practical Application

Now let us see how this useful feature can be applied to our suppression circuit.

Fig. 12 shows one method as applied to the Simplex electrostatic model. If this is compared with Fig. 9 it will be seen that the same basic principles are retained, but a diode is inserted between the frame oscillator and the cathode of the tube. VRa is adjusted so that the diode passes no current.

Now during the forward stroke, when the scan is negative going, the diode will not conduct due to the fact that the anode is driven in the negative direction. However, when the flyback pulse occurs the diode is driven positive at the anode, it conducts, and the positive pulse appears at the cathode of the tube.

One defect of the arrangement is that the potential applied to the cathode of the diode is dependent upon the setting of the brilliance control. A rather more elegant way of doing the job would be to feed the cathode from a separate potential divider. This need not be variable, but can be fixed, VRa being retained for adjusting the point at which the gate operates.

The refinement is shown in Fig. 13.

It is possible to apply the method to a cathode-modulated C.R.T. by reversing the diode action so that a negative pulse only is passed. A typical example is given in Fig. 14, which shows the system applied to the Lynx televisor.

In this case the frame scan is positive, the flyback being negative. The flyback is connected to the diode via C, which is the same as C in Fig. 7. VRa is adjusted in the first instance so that no current flows through the valve. During the forward stroke the cathode is made positive and the diode does not conduct. During the next part of the cycle the fly-back which is nega-

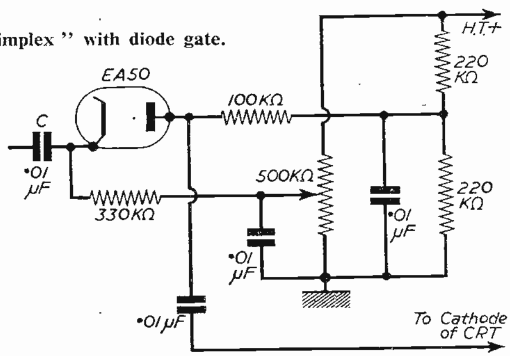
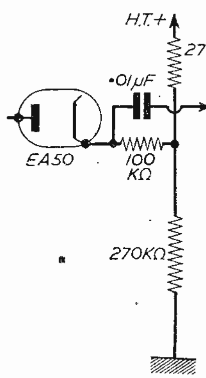


Fig. 15.—Diode with separate potential divider.



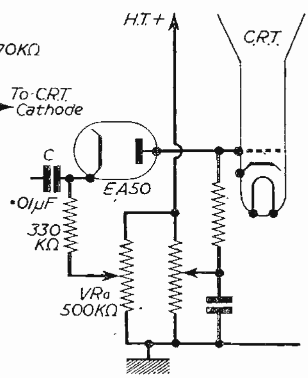


Fig. 13 (left).—Modification of Fig. 12. Fig. 14 (right).—Diode gate fitted to the Lynx.

tive is applied to the cathode of the diode; the anode therefore becomes more positive than the cathode, current will flow, and in the manner explained previously the pulse will appear on the grid of the C.R.T.

As in the previous case, the operation of the diode will depend upon the setting of the brilliance control and to make the circuit independent of the brilliance the diode anode can be fed from a separate potentiometer network.

A suitable circuit is shown in Fig. 15.

It is not always necessary to provide blocking condensers on both sides of the diode. In some cases the diode can be directly coupled to the frame circuit, and a single potentiometer used for balancing the valve.

This method is shown clearly in the circuit given in Fig. 16.

Conclusion

It will be appreciated that it has not been possible to test out the circuits given on every type of home-constructed televisor now on the market. The method has been tried out in a mixed sample of models and has proved very satisfactory.

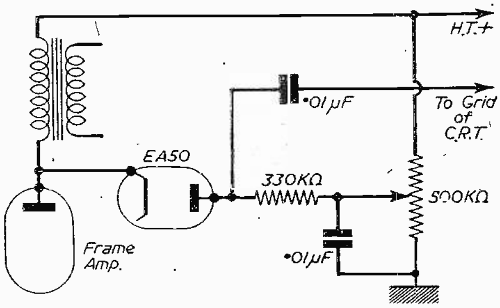


Fig. 16.—Directly-coupled gate.

It is hoped that the basic information given, coupled with the practical circuits and examples, will enable the constructor to adapt the principles to his own particular needs.

TV in the Isle of Man

THE following statement was agreed by His Excellency the Lieutenant-Governor of the Isle of Man, the Lt.-Governor's Advisory Committee on Broadcasting, and the BBC, as the result of a meeting held on Thursday, April 14.

After consultation with His Excellency the Lieutenant-Governor of the Broadcasting Committee of the Isle of Man, and with their full agreement, the BBC has now decided its plans for the future development of television and sound broadcasting for the island.

Divis Transmitter

The immediate situation is as follows: The temporary TV transmitter at Carnane, near Douglas, is giving a satisfactory service to about 60 per cent. of the island's population. In addition to this, a new permanent TV station has been erected at Divis, near Belfast. This station is expected to begin operating in July of this year, and it is hoped that it will give a satisfactory service to viewers living in the north of the Isle of Man, provided they are favourably situated and use good aerials. This transmission from Divis, together with the transmission from Carnane and also with the transmission already received in reasonable quality by viewers of Holme Moss direct, will mean that from summer this year the majority of the population of the island should receive satisfactory service.

Meanwhile the BBC has been searching for a suitable site on which to erect a permanent TV transmitter for coverage of the whole island.

New Station on Snaefell

After considering and testing a number of alternative proposals, it became obvious that the summit of Snaefell would give an entirely satisfactory service to the island as a whole. Approval, therefore, was sought to build the new station there. The Ministry of Transport and Civil Aviation, for reasons of safety of life, was not prepared to grant permission for such a station to be erected unless the BBC could demonstrate by tests that no interference would be caused to the Ministry's transmitting and receiving station which is already operating on Snaefell. Two difficulties arose. For reasons of geography and other commitments, these tests cannot take place until early summer, 1956. Secondly, the Ministry reserves the right to close down the transmitters temporarily should the safety of aircraft be in danger. In spite of this, and having regard to the long-term welfare of broadcasting in the island, the Broadcasting Committee and the BBC are convinced that the advantages of the Snaefell site are over-riding and that the proposal to use this site should be pursued. This means that the necessary tests will be carried out early in 1956. Thus, dependent upon their success, the BBC confidently hopes to begin the erection of the permanent television transmitter on the Snaefell site immediately after. At the same time, in order to improve the island's sound broadcasting reception, the BBC proposes, subject to Post Office approval, to incorporate in the Snaefell site, three VHF-FM transmitters, designed to carry respectively the Home, Light and Third Programmes, as this site is also the only one which will provide an entirely satisfactory service for sound broadcasting in the island.

The whole project at Snaefell will be completed as quickly as transport and weather conditions permit.

The Miller Timebase

BASIC THEORY AND PRACTICAL OPERATION

By "Engineer"

(Continued from page 556 May issue)

Foldover

BY foldover we mean a turning back of the scan on itself so that it appears like the fold of a curtain. Fig. 10 shows the fault (the actual lines have been omitted for the sake of clarity). In the illustration it is shown in the line circuit, but similar conditions can exist in the frame circuit, the foldover appearing at the top of the scan.

The fault is due to the flyback being unduly prolonged. What happens is that the blacked-out spot is travelling rapidly from right to left so as to begin the next line. If the flyback time of the oscillator is too long the picture intelligence will commence before the spot has reached its correct position on the extreme left of the screen. The picture information starts coming through while the spot is still travelling towards the left and hence the trace is brightened; the fold contains part of the picture.

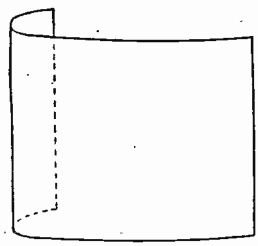


Fig. 10.—Illustration of line foldover.

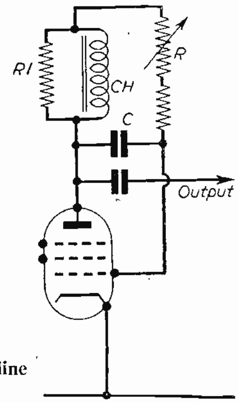


Fig. 11.—Choke coupled circuit.

Flyback time depends to a certain extent on the R, C and R1 combination (Fig. 11), but C and R are fixed at the correct time-constant, and R1 is set so as to obtain the optimum response from the circuit. In obstinate cases some variation of R1 can be attempted, but the main factor controlling the flyback is C1.

Where foldover is experienced the first action should be to try a reduction of C1. This condenser should be reduced in value to a point where foldover ceases.

It should be noted that here we are referring to trouble in the oscillator itself. Where an amplifier stage is included it is possible for the fault to be caused by the amplifier section or coupling circuit.

Small Amplitude

The amplitude of the scan obtained from the Miller Integrator depends upon correct choice of R1 to suit the valve, and correct choice of C1.

Generally, sufficient amplitude is available in the frame scan as the valve works more efficiently at this frequency, and also the frame output is usually fed to the Y plates which are positioned mechanically within the C.R.T. so as to exert a greater influence on the beam.

Line circuits are not so happy; first there is the loss of efficiency due to the frequency itself, and secondly the output is usually connected to the deflector plates with the lower sensitivity.

Provided that R1 is of the correct value then certain other steps can be taken to improve the width (or height) of the scan.

C1 can be increased in value, and the maximum value is that which causes foldover. At this point further increase of C1 only increases the foldover.

In line circuits a useful increase in scan can be gained by the insertion of a choke across R1. The choke should have a value of one to three Henries and R about 120 K. Too high a value choke will introduce distortion in the waveform.

This method is quite a good scheme to employ where a Miller Integrator circuit is being used in a magnetic circuit where much greater power is required in the horizontal scan.

Another method of increasing the amplitude is to increase the timebase H.T. rail voltage. When building a standard circuit, and lack of width and height are experienced, the first thing to suspect is too low a value at H.T.

Adding an Amplifier

It is not difficult to add an amplifier to the Miller Integrator. This class of circuit is usually used in electrostatic deflection, and one of the simplest and best methods of increasing the scan is to add a paraphase amplifier by the use of a second valve, which operates on the opposite deflector plate. By this method a kind of push-pull feed is obtained,

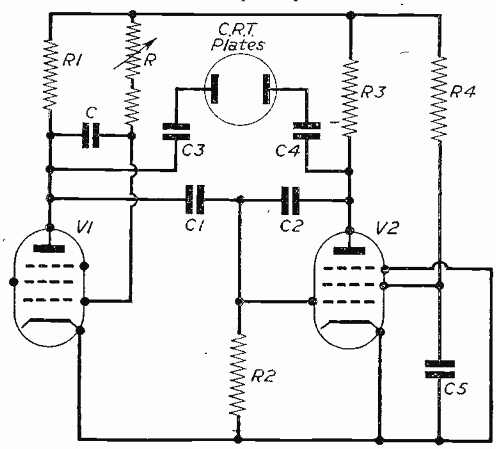


Fig. 12—Paraphase amplifier.

and the circuit is nicely balanced, trapezium distortion being avoided by suitable choice of components.

A basic working circuit is given in Fig. 12. A portion of the output of the oscillator valve V1 is fed to the grid of V2 via the coupling condenser C1. Note that the component values of C1 and R2 must be carefully chosen having regard to the time constants of the circuit as given in previous chapters.

V2 is a conventional R.C. amplifier, the same class of valve being used as for V1. A certain portion of the output of V2 is fed back by means of C2 and this tends to cancel the input signal. Actually, a state of equilibrium is reached by suitable choice of components so that there is just sufficient input to V2 for the production of an equal and opposite voltage at the second deflector plate.

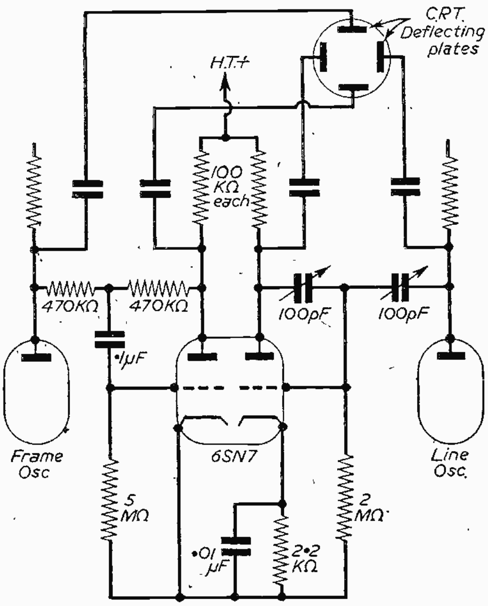


Fig. 13.—An economy circuit.

Typical values for the frame circuit are 0.001 μF for C1 and C2 and 5 MΩ for R2. R3 should be of the same magnitude as R1, and R4 should be chosen according to the characteristics of the valve. For an H.F. pentode about 220 KΩ with 0.1 μF for C5 should be found sufficient. C4 should be of the same value as C3.

For the line circuit typical values are 100 pF for C1 and C2 and 2 MΩ for R2. Other values can be as for the frame circuit.

Note that an increase in C1 will increase the scan but care must be taken to avoid distortion of the trace. Similarly, a reduction of C2 will also increase the scan.

In the line circuit optimum working can be obtained by making C1 and C2 variable, say about 200 pF for C1 and 100 pF for C2. By this method it should be possible to obtain maximum amplitude with minimum distortion.

Economy Circuit

Fig. 13 shows a circuit which uses a single valve for provision of amplification for line and frame circuits. It will be seen that conventional practice is maintained using paraphrase principles. A 6SN7 is employed, one half being used for the frame circuit and one half for the line.

The main disadvantage of the circuit is the possibility of interaction between the two sections, first from stray sync pulses and, secondly, by modulation of the line circuit from the frame resulting in curved edges to the raster.

Dual Amplifiers

In Fig. 14 is shown the circuit of a dual amplifier. In this amplifier the output from the oscillator is fed directly to the amplifier which comprises two valves, one being used to feed one deflector plate, and the other valve feeding the second deflector plate.

The output from the oscillator is taken from the anode load resistor which, in this case, is made variable. Its value should be the same as that of R1 in Fig. 11. The input to the amplifier is thereby made variable, and control over the total amplification is obtained. This particular circuit is to be used for a frame circuit and VR1 could therefore be labelled "Height Control."

The first triode acts as a normal R.C.-coupled amplifier, but its anode load is split, part of it being in the form of a potentiometer VR2, which controls the amount of input to V2. V1 feeds the first deflector plate, the second deflector being fed from V2; thus we have a balanced push-pull amplifier.

The second portion of the amplifier V2 has its input tapped down the grid resistor R5, R6. This is in order to reduce the possibilities of hum from V1 being amplified by V2.

It is quite practicable to make V1, V2 a single valve, such as the 6SN7, though single triodes, such as the 6J5, can be employed.

Typical values for the frame circuit are C1 0.1 μF, C2 0.1 μF, C3 0.05 μF; R1 5 MΩ, R2 22K., R3 100 K., R4 100 K., R5 2 MΩ, R6 8MΩ.

In Fig. 15 we have an amplifier for the line circuit. In the case of the line frequency we not only have to consider the different time constants of the circuit, but also the question of hum which can be quite a thorny problem. Any hum reaching the deflector plates will show as a wavy edge to the raster.

(*Continued on page 35*)

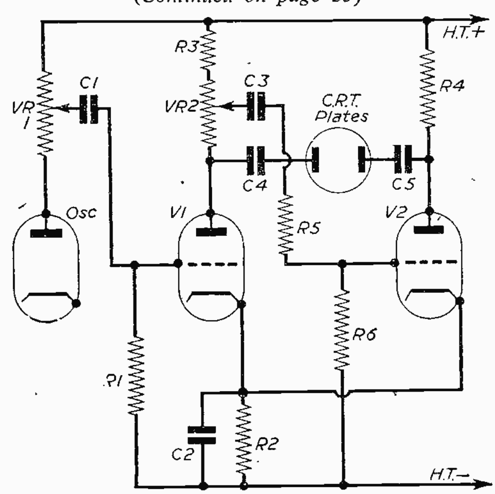


Fig. 14.—A dual amplifier (frame)

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Part of the TR1196, this 6-valve unit makes an ideal basis for a mains operated All-wave Superhet, full modification data being supplied. Complete with valves, 2 each EF36 and EF39, and 1 each EK32 and EBC33. AS NEW. ONLY **27/6**. (Postage, etc., 2/6.) Mod. data FREE.

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Unit contains VCR517 Cathode Ray 6in. tube, complete with Mu-metal screen, 3 EF50, 4 SP61, and 1 5U4G valves, 9 wire-wound volume controls and quantity of resistors and condensers. Suitable either for basis of television (full picture guaranteed) or Oscilloscope. Offered BRAND NEW (less relay), **67/6**. Plus 7/6 carr. "Radio-Constructor" 'scope circuit included.

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1T4	7/6	6SJ7GT	8/6	TZ40	35/-	SP2	8/6	ATP4	4/-
1R5	7/6	6SK7GT	8/6	0Z4	7/-	TDD2A	8/6	MS/PENB	7/6
3A4	7/6	6SN7GT	9/-	25Z5G	8/6	VP2B	8/6	MS/PEN	7/6
3Q5GT	10/-	6SL7GT	9/-	25Z6G	8/6	215SG	4/-	PX25	12/6
3S4	7/6	6SC7	10/-	35Z4GT	8/6	866A	15/-	6A6	10/-
3V4	7/6	6V6G	7/6	35Z5GT	8/6	354V	5/-	46	10/-
1LN5	8/-	6V6GT	7/6	35L6GT	8/6	4D1	4/-	AC/PEN	10/-
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6B8	7/6	12A6	7/6	EF54	6/-	TH233	10/-	U19	10/-
6K8G	9/-	12K7GT	8/6	EB34	3/6	41MP	7/6		
6K7G	6/6	12K8GT	8/6	EA50	2/-	SP61	4/-		
6J7G	6/6	12Q7GT	8/6	D1	2/-				

EY51	12/-	UL41	11/-	EF80	10/6	PL81	12/6	12AT6	8/-
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10 EF50 (Ex-Brand New Units) 5/- each ... ...45/- „
6K8G, 6K7G, 6Q7G, 5Z4G, 6V6G ...37/6 „
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12K8GT, 12K7GT, 12Q7GT, 35Z4GT, 35L6GT (or 50L6GT) ... ...37/6 „
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V1 circuit follows the conventional pattern, but the coupling circuit is made via a small variable condenser C4. At the line frequency the input capacitance of V2 has an appreciable effect, and this, together with C4, forms a capacitance bridge across the anode load resistor R7.

However, at the lower frequencies, such as 50 or 100 cycle hum conditions, the coupling becomes essentially that of C4 and R5, which thereby offers a high impedance path to the hum.

Typical circuit values are C1 0.005 μF, C2 0.1 μF, C3 0.1 μF, C4 0-10 pF, R1 470Ω, R2 1MΩ, R3

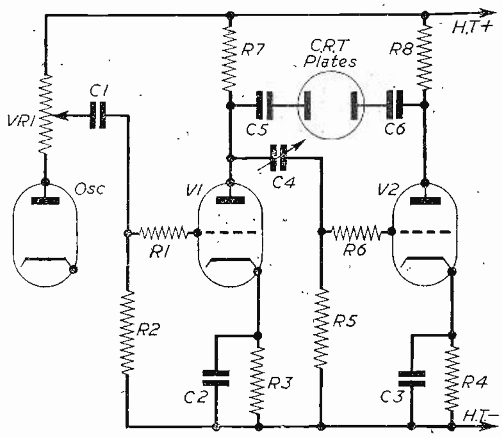

Fig. 15.—A dual amplifier (line).

4.7 K., R4 4.7 K., R5 1 MΩ, R6 470Ω, R7 100 K., R8 100 K.

V1 and V2 can be 6J5 valves, or for the sake of economy a single 6SN7 can be used.

Hum

Hum is usually more distressing on the line circuit rather than the frame. In the frame the usual result is a false-looking condition, and the cure is fairly obvious but in the line circuit the symptoms are not so obvious. There will be a wavy edge to the raster, but this can be caused by direct pick-up on the deflector plates themselves, by poor smoothing, by interaction from the frame circuit, or by over-amplification of residual hum due to faulty coupling components or incorrect choice of component values.

Direct pick-up can usually be avoided by careful positioning of mains equipment and the use of a mu-metal screen; poor smoothing can be corrected by simply increasing the smoothing arrangements; interaction from the frame circuit can best be avoided by adequate decoupling and careful layout of components and wiring; residual hum troubles have been dealt with in the previous paragraphs.

In the frame circuit, very severe hum will cause the frame to lock solidly at a position removed from that of the signal giving a picture which is often split into two halves. Moderate hum will cause the scan to be non-linear, generally by cramping at top and bottom or simply cramped in the middle. This must not be confused with normal non-linearity, which does not have this particular characteristic of dual appearance.

Hum which causes light and dark bars across the screen is not due to leakage in the timebase but more usually to leakage to the grid or cathode of the C.R.T.

Synchronising

It is not intended to deal extensively with synchronisation as this is a different subject, but a few pointers will be made which assumes that the sync pulses for both frame and line are being correctly produced.

One defect of the Miller circuit is that only a small sync pulse is required for its operation. This often makes synchronisation of the frame circuit a little tricky as spurious pulses from the line circuit can cause triggering. For this reason really accurate interlace is difficult to obtain.

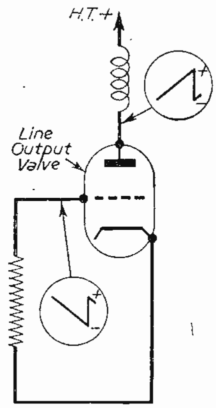

Fig. 16.—Waveform at grid and anode.

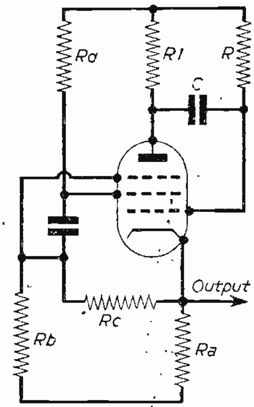

Fig. 17.—Producing a positive scan.

To achieve good interlace it is advisable to ensure adequate filtering of the sync, and a two-valve separator is often desirable. Frame and line circuits should be kept well clear of each other and adequately screened. Decoupling of both circuits should be very efficient.

When using the smaller screen the problem of interlace is not so acute but the larger screen may show defective interlace. Even so, a well-designed Miller circuit gives as good an interlace as many commercial receivers.

In the line circuit the amplitude of the sync pulse is of great importance. In some circuit layouts it is almost unnecessary to couple the sync directly to the oscillator, there being sufficient pick-up in the wiring.

The ideal arrangement is a firm lock without line

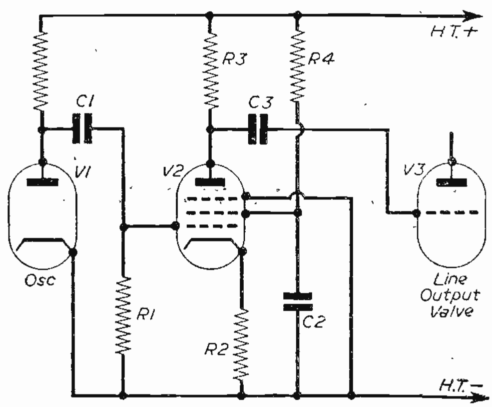

Fig. 18.—A reversal stage.

tearing, and the minimum value of sync pulse which will bring this about is a desirable feature. For this reason, the coupling condenser is often made variable, a small component of about 50 pF usually being quite sufficient.

Too heavy a sync pulse results in the picture appearing watery or produces a tearing of the lines, all sharp edges appearing jagged.

The simplest form of integrator will be found adequate for the line circuit. Frame pulses do not disturb it.

Where the top few lines of the picture are inclined to wander, then the fault generally lies in the sync circuit itself rather than the timebase proper.

Reversing the Output

The output from the Miller oscillator is the reverse of the general rule, the trace being negative-going on scan. This is because the forward stroke is brought about by the *discharge* of a condenser rather than the more usual *charge* method.

Where the output is to be fed to an electrostatic C.R.T. the polarity of the output is of no importance, but where it is desired to drive an electromagnetic tube, then the polarity of the line circuit must be in the positive direction. The main reason for this lies in the high voltages produced by the line flyback due to the inductances of the scanning coils and output circuits.

A negative-going scan produces a positive flyback. If this type of waveform is applied to the output valve then at the anode we shall have a positive-going waveform which is negative on the flyback. As the flyback voltage at the anode rises to over 2,000 volts a sudden transition on the anode from the positive position to a highly negative one may result in severe damage to the valve itself, which is not designed to withstand such conditions.

A further important point is that modern practice inclines to the use of the flyback pulse for the production of E.H.T., which obviously precludes the use of a negative pulse.

Yet another reason is the safe and efficient running of the output valve. If a negative-going scan is applied to the grid, the valve must be very lightly biased or it would be quickly driven to the cut-off point. A very light bias means that under static conditions the valve would draw a very heavy current. It is preferable to bias the valve back as far as is practical so as to reduce the standard running anode current and to use a positive-going waveform.

A simple circuit for producing a positive-going waveform directly from the oscillator is given in Fig. 17. The waveform is taken from the cathode by means of the voltage produced across the cathode resistor Ra, which should be of the same order as R1. Rb should be 1 MΩ and Rc and Rd are of standard values.

One disadvantage of the circuit is that the amplitude of the waveform produced is about half of that available from the anode.

Where maximum amplitude is required the best method is to use a phase reversal stage. This is simply another valve inserted between the oscillator and the output valve in order to reverse the phase.

Fig. 18 shows a basic reversal circuit. The output from the oscillator is fed to the reversing valve V2, via C. C and R1 should have a time constant which is adequate to cope with the frequencies involved.

V2 is a standard power output valve (a triode could be used or a pentode of the 6V6 class). The cathode resistor is un-bypassed, but if extra gain is required a condenser up to 25μF can be used for decoupling providing the linearity is not affected.

The anode load resistor R3 is comparatively low in value (around 5 K) and should be rated at about 10 watts.

Some typical values for the line circuit are C1 0.005μF, C2 0.1μF, C3 0.005μF, R1 2 MΩ, R2 235 Ω, R3 5 K, R4 2.2 K used with a 6V6 valve.

The frame circuit needs no reversal stage as the flyback does not produce such high voltages. The use of such a stage does, however, allow the output valve to work at a much easier rating and this may possibly be sufficient justification for its use.

SERVICING TELEVISION RECEIVERS

(*Concluded from page 16*)

the bottom end of which is taken to chassis by a 100 K ½ watt. Should this 100 K go high or open circuit the grid voltage would rise and cause a high brightness level. A grid-to-cathode leak in the tube itself will also give similar symptoms.

It is pointed out that the cathode bias resistor of the video amplifier is shunted by a 25 μF electrolytic condenser. If this component dries up, a large amount of negative feedback will be generated, resulting in a marked loss of video signal or contrast as it may be termed. This will also cause a loss of sync, especially the frame pulses, which, being of low frequency, will be most affected. This condenser is located under the chassis near video detector V5. The video amplifier is a Z77 and is marked V6 in the diagram. V5 is another D1, and is used as the video detector. These valves cannot be replaced by the Mullard EA50 as they have a 4-volt heater.

Vertical and horizontal shift controls are provided and they control the amount of D.C. passing through the respective shift coils. This circuit is in the negative return from chassis to the H.T. negative centre tap on the right-hand transformer, as viewed from the rear.

The left-hand transformer is concerned with supplying the E.H.T. (approx. 4 kV) and the heaters of the valves which are used on TV only.

The radio receiver is quite straightforward, V17 (Mazda D1) being rendered inoperative whilst the broadcast section is in use. The valve is the sound noise limiter, and is required on TV or TV sound only.

V14 is the X81M frequency changer, V15 the I.F. amplifier for both TV and broadcast sound (W81).

V16 is the DL82 double diode triode, V18 the Z77 A.F. amplifier, and V19 the KT81 sound output. The volume control is in the grid circuit of this last valve.

When replacing the tube on this receiver it is advisable to check that the value of R124 in Fig. 4 is the value marked on the tube. This has a marked effect upon the efficiency of the interference limiter.

Correction

In the April issue the receivers dealt with were the Philips 1101U and 1200U. In the May issue the reference EK10 should be deleted from the heading of the article, and from the cover.

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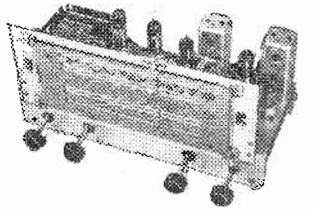

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16/450 v. B.E.C.	3/6	60/350 v. B.E.C.	6/6
16 + 16/450 v. T.C.C.	5/6	60 + 100/350 v.	11/6
32/350 v. B.E.C.	4/-	60+200/275 v.	12/6
32/500 v. Dub.	5/-	100 + 200/275 v. B.E.C	12/6
32+ 32/350 v. B.E.C.	5/6	1500/6 v. B.E.C.	4/6
32 + 32/500 v. Dub.	7/6	1000 +1000/6 v. B.E.C.	6/6
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ENGRAVED CONTROL KNOBS for ¼in. Spindle. 1⅜in. diam. Walnut or Ivory. Gold Filled. "Focus," "Contrast," "Brightness," "Brilliance," "On-Off," "Brilliance—On-Off," "Record-Play," "Vol.—On-Off," "Volume," "Tuning," "Tone," "Wavechange," "Treble," "Bass," "S.M.L. Gram," "Radio-Gram." **1/6** ea. Plain knobs to match above, 1⅜in., **10d.** ea., 1⅛in. dia., **8d.** ea. Superior Unmarked Knobs with Gold Ring. Walnut or Ivory. 1⅜in., **1/-**ea. ; 1in., **9d.** ea. Pointer Knobs, Black with White Line, **9d.**

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I.F. TRANSFORMERS. 465 K/cs.
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ALUMINIUM CHASSIS.—18 s.w.g. Plain, undrilled, folded 4 sides and riveted corners lattice fixing holes. Strong and soundly constructed with 2½in. sides. 7in. x 4in., 4/6 ; 9in. x 6in., 5/9 ; 11in. x 7in., 6/9 ; 13in. x 9in., 8/6 ; 14in. x 11in., 10/6 ; and 18in. x 16in. x 3in., 16/6.

CHARGER TRANS.—Prim. 200-250v., Sec. 0-9 v.-15 v. (for charging 6 v. and 12 v.) 1.5 a., **13/6**, 2a., **16/-** ; 3 a., **18/6** ; 4 a., **21/-** ; 6 a., **26/-.**

FULL WAVE BRIDGE SELENIUM RECTIFIERS.—6 or 12 v. 1½ amp., **8/9** ; 2 a., **11/3** ; 2½ a., **12/-** ; 4 a., **15/6** ; 6 a., **23/6.** 12 v. ¼ a., F.W. only, **4/3.**

CARBON MIKE INSERT.—Superior quality type 2¼in. x 1in. Brand new and boxed only **3/6** each.

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

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

SWITCH CLEANER Fluid, squirt spout, **3/9** tin.

TWIN GANG TUNING CONDENSERS.—375 pf. Midget, **6/6** ; ditto, with dust cover and trimmers, **8/6** ; .0005 mfd. Standard size with feet, **8/6** ; ditto, with trimmers, **9/6.**

RECORDING TAPE.—Scotch Boy 1,200 ft. reels, **30/-** each. Spare spool, 5in., **3/8** ; 7in., **4/3.**

LOUDSPEAKERS P.M., 3 OHM.
Richard Allen, 5in., **16/6** ; 6in. Goodmans, with trans., **21/6** ; 6½in. Goodmans, **17/6.** 7in. Elliptical, **18/6** ; 8in. Goodmans, **18/6** ; 8in. Elac., **20/-** ; 10in. Plessey, **25/-** ; 12in. Plessey, **37/6.**

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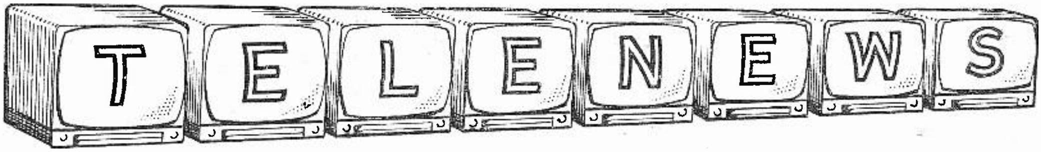


Television Liaison Officer

MR. JOHN ELLIOT, producer of the series of BBC television films, "War in the Air" has been appointed Television Liaison Officer to the film division of United Nations in New York and took up his appointment for a term of one year on March 14th.

Mr. Elliot hopes to return to BBC television in April, 1956.

May Lose Licence

MR. GAMMANS, Assistant Postmaster-General, said in the House of Commons recently that the owner of a television receiver that caused interference to sound radio reception is liable to have his licence withdrawn if the trouble is not rectified.

Television Licences

THE following statement shows the approximate number of television licences issued during the year ended March, 1955. The grand total of sound and television licences was 13,980,496.

Region	*Number*
London Postal	1,124,779
Home Counties	488,030
Midland	824,752
North Eastern	653,220
North Western	653,644
South Western	246,697
Wales and Border Counties ...	244,816
Total England and Wales ...	4,235,938
Scotland	244,020
Northern Ireland	23,808
Grand Total	4,503,766

School Extension

A NEW dormitory block is being added to the BBC's Engineering Training School at Wood Norton Hall, near Evesham.

This will mean accommodation for another 90 to 100 members of the BBC staff attending the residential engineering courses, bringing the total capacity of the school to about 200.

"Live" Sport Better

TELEFILMS of soccer matches show that in addition to the slightly hazy picture effect, the ball appears to move in rather jerky movements as compared with "live" transmissions of matches. Thus, telefilming major sporting events is only second best to an actual broadcast.

Channel Islands Station

WORK is progressing on the BBC television station at Les Platons, Jersey, which is to serve the Channel Islands. It will probably be ready for service by September, although at first the transmissions may not be up to the final standard because the link from the mainland may not be reliable until the permanent station at North Hessary Tor in Devon is completed at the end of the year.

Agreement for Artistes

THE Variety Artistes' Federation have agreed with the BBC that V.A.F. members may be engaged for broadcasts to be given simultaneously in sound and television, subject to the assurance which has been given by the BBC that the fee shall take into full consideration the demands likely to be made on the artiste by way of rehearsal, material, etc., by the TV medium.

Bob Hope for Commercial TV

THE Associated Broadcasting Company announce that they will be presenting two big Sunday night shows when commercial television begins in September.

One will be a 60-minute variety programme, "Sunday Night at the Palladium," for which Bob Hope, Norman Wisdom and Gracie Fields have been contracted; the other a series of 30-minute filmed playlets entitled "Theatre Royal." The artistes signed for these short plays include Sir Ralph Richardson, Eric Portman and Wendy Hiller.

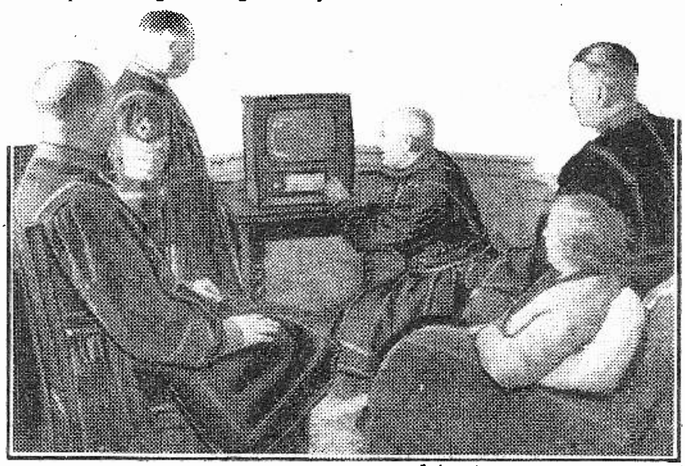
Charge for Aerial

TELEVISION viewers wishing to erect aerials on Bootle Corporation property are to be charged a premium of 1s. 6d. per annum.

BBC Buy Film Cameras

BRITISH ACOUSTIC FILMS LTD., have received an order from the BBC for the manufacture of 12 combined sound and picture film cameras.

The new cameras, for which the BBC is preparing its own specification, will produce either a 35 mm. picture film with a separate 35 mm. magnetic sound track or a 16 mm. picture film with a separate 16 mm. sound track. The picture section of each instrument will consist of a Cameflex 35/16 mm. camera.



Yeomen Warders off duty at the Tower of London spend some of their spare time "looking in." All *H* aerials have disappeared from the Tower and a new E.M.I. central aerial system has been installed.

New Aerialite Factory

WE learn from Aerialite, Limited, that they have bought a new factory specially for the manufacture of television aerial equipment, convertors and electronic components.

The factory is sited at West End, Congleton, Cheshire.

German Exhibition

THE German Radio, Television and Gramophone Industry Exhibition this year will be held for 10 days from August 26th to September 4th.

The show will be sited in the big Düsseldorf exhibition park on the bank of the Rhine.

Microwave Link

THE G.E.C., Ltd., has supplied the equipment for another microwave radio-television link in Switzerland. It connects Uetliberg (Zurich) with La Dole (Geneva) and on the way ties in with the trans-Alpine Chasseral - Monte Generoso link, which was supplied by the G.E.C. one year ago for the Eurovision exchange of programmes.

The new link forms part of a TV network to cover most of Switzerland.

Ship Communications

CLOSED circuit television is being installed in a ship of the Canadian Royal Navy by Pye (Canada), Ltd. The intention is to communicate visually to various key points in the ship tactical information that has hitherto been transmitted by telephone.

A camera in the Operations Room will be focused on the plotting chart upon which the movements of enemy aircraft, surface or undersea craft as well as those of friendly ships may be recorded.

Tests at Sea

TELEVISION reception tests at sea have been made recently by the *Loch Carron*, a Clyde cargo boat which carried an experimental receiver on its journey among the coastal islands on the west coast of Scotland.

Grand old character actor Bransby Williams, who returned to television during May under producer Kenneth Milne-Buckley.

Workmen operating a winch by one of the giant base plates, which goes 40ft. under the ground and will take one of the four legs of the aerial. (See a New BBC Mast.)

New BBC Mast

A 240ft. erecting crane was placed in position at the Crystal Palace in south-east London recently in readiness for the construction of a new BBC television mast.

The mast, the largest of its kind in this country, will be 640ft. high, 700ft. with the aerial extension, and will be situated over 1,000ft. above sea level.

Sales Drive in Europe

PYE, LIMITED, held a series of demonstrations of industrial and underwater television at the Kongresshaus in Zurich early in May. Prominent businessmen from all over Europe were invited to the demonstrations, which were designed to show how the technique of television can be applied to assist production in modern industry.

North Scotland Transmitter

THE BBC has acquired a site for the proposed north of Scotland television station, to be known as Rosemarkie. It is about $11\frac{1}{2}$ miles from Inverness and covers an area of six acres.

The new station is expected to be ready for service by the end of 1956.

Master Aerials

COMMUNAL television aerials may be erected by the Brighton Corporation on corporation flats.

Engineering Division Appointment

THE BBC has appointed Mr. T. P. Douglas, M.B.E., as Engineer in Charge, Sutton Coldfield television transmitting station.

Mr. Douglas joined the BBC in 1938 as a junior maintenance engineer at the Daventry transmitting station.

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).

STEREOPHONIC-STEREOSCOPIC TV

SIR,—I should like to inform other readers, through the medium of your correspondence columns, of a most startling effect that can be derived from television viewing and which is almost akin to a visit to the best West End cinemas so far as technical "gimmicks" are concerned.

A friend of mine told me that by looking at his TV set through the narrowed slits between his fingers, he had been amazed to find that it produced a three-dimensional effect and that sometimes he obtained the same results by merely screwing up his eyes and squinting at the picture. I told him I had heard vaguely of that "stunt" before but did not believe him. On arriving home, however, I was just in time for the Cambridge-Oxford Boat Race and decided to try out the theory. At first the picture seemed the same but after a little while I found that the 3-D effect was there and bridges and trees along the course stood out clearly.

That same evening I had an inspiration. I switched on "In Town Tonight" on my TV receiver and also on my sound radio set. I sat midway between the television and the radio and was thus able to enjoy the wonder of stereophonic-stereoscopic viewing. Too much at a time of course tires the eyes, but the sensation is really remarkable.—A. REES (Cardiff).

VIEWING TIP

SIR,—If any other reader is plagued with neighbours and relations practically every evening as I am, just to see television, he might be interested in a little hint on the accommodation of the "invaders" so that all are in a comfortable viewing position. Silence will then prevail and enable the owner of the set to look in himself without disturbance.

I have fixed a large sloping mirror to the wall opposite the TV screen so that those people who normally have to stand to see over the heads of the other "invaders" can sit on the floor with their backs to the set itself and view the programmes via the mirror. This system actually works very well and viewing conditions have been much quieter since I first introduced it. Now that commercial TV is in the offing I suppose my potential audience is likely to increase, in which case I may have to buy a larger mirror. Or, of course, I can always sell the set. —"CRUSHED VIEWER" (Birmingham).

BAND III RESULTS

SIR,—It may be of interest to your readers who have built their own T.R.F. Television Receivers that I have been able to pick up quite a strong signal from the new Beulah Hill I.T.A. Station, using a Band III TV Converter Type C1, manufactured by Channel Electronic Industries of Burnham-on-Sea, Somerset. The set I am using is an "Electronic Engineering."

I was rather surprised at receiving it without any adaptor on my Dublex aerial, and at the same time without any modification to the coils in the set. I am working on top contrast for Band I, and when switching over to Band III I received a steady picture showing clear outlines. I realise I am within 4.5 miles of the transmitter, but as you know this is on very low power.

The converter uses its own power pack and is easily fitted with coaxial plugs. and retails at 9 gns. —K. FIGG (Croydon).

CONTINUOUS SPORT

SIR,—For the first time this year I have been looking at an afternoon's tennis on television. Although I quite enjoyed it, I have great misgivings when I think that this is only the beginning of what we were given last year and the year before—that is, so much sport that not only are we tired of looking at two hours of the same game continuously but other programmes will probably be affected as well.

I remember last year when after two and a half hours of tennis Children's Hour was due to begin. Instead of giving the children the scheduled programme, the announcer said with a smile: "I am sure the children will all want to know how the tennis match finishes, so we will stay at Wimbledon for another fifteen minutes or so."

Let us have sporting programmes by all means, but let them be in digestible doses.—A. REES (Croydon).

AN UNUSUAL FAULT

SIR,—Recently, when watching my television set, I was struck by a fault which consisted of intermittent flashing across the screen. As it persisted I realised that the flashing occurred at regular intervals and, having no time-piece handy with a seconds hand, I counted my heart beats and found that the interference occurred at the end of a period of 35-36 heart beats (with a subsequent speed-up to 37-38, as the effect of having discovered something caused a slight increase in the heart rate).

Having established that the 30 second interval remained constant, I looked for the source of the trouble and found that a large public electric clock situated 120 yards away was the offender.

The dial of this clock is illuminated by a lamp having a screw base, the holder of which is fitted inside the hollow spindle carrying the hands. Owing to the lamp being loose in the holder the dial was not illuminated, but the lamp flashed each time the minute hand vibrated the holder as it jumped a half-minute space on the pulse from the master clock, thus causing interference over a very large area. — F. J. H. WOOD (Maidstone).

AMPLIFIER TYPE 178

SIR,—I should like to express my thanks for the aid which your paper has given me, and also in the pleasure which has resulted therefrom. I have had several pieces of ex-Government equipment hanging about for years now, and often wondered what to do with them. Amongst these was the amplifier type 178, and in your January issue you gave some very explicit details for the conversion of this. Although by no means a radio "expert," I found the details easy to follow and, barring one or two snags, did not find it over-difficult to carry out the modification. I fitted the vision section to a home-made set which I have had in use for a long time (I did not make it) and get a very much better picture than I have had before, and apart from the enjoyment of the programmes I found the work of conversion most interesting. Unlike the construction of a complete set, I think the converting of ex-Government apparatus has an interest far and away above anything else, as you start off with a piece of equipment designed for one purpose (and very well made at that) and proceed to turn it into something else. The final success of the effort I find most satisfying.—G. WATTS (N.W.9).

THE SUPERVISOR

SIR,—I have had one of these receivers in use now for a long time, with not a very satisfactory frame hold. It would appear to jump at the least provocation, and I have tried various suggestions to improve this. In your recent issue you gave some details concerning this fault, if I may call it so, and although I carried out these ideas it did not really effect an improvement. I then suddenly thought of changing over V15 and V20—I don't know why I had not thought of this before. The frame then locked perfectly, but the line was slightly erratic. I took the valve now in V20 to the shop for test, and it was below standard—not actually faulty, the dealer told me, but in such a condition that it was less use in the frame circuit than the line. It is still working in V20 socket and gives less trouble there. This only goes to show that one cannot be too careful in having parts tested—when a circuit fails to function as described—before blaming the design.—B. E. BETTERTON (Kingsbury).

BAND III SNAGS

SIR,—I have recently had the opportunity of picking up the experimental trade Band III transmissions, and have been most unlucky—or viewers are in for a bad time. First, I used a commercially made unit, and easily picked up the transmission. But it was in a terrible state, and with the converter connected, and the set switched to Band I, this also was in a sorry state. I had made a Band III aerial, but decided to buy a ready-made item. This I fitted to the chimney stack, in place of my home-made one, with no improvement. After a lot of experimental work I found the following troubles: reflections from one aerial on the other; interaction between down leads; direct pick-up on the wiring in the receiver from London when on Band III, and any amount of background noises on each of the signals. After much trouble, I lined the bottom of my cabinet with a sheet of very thin aluminium, and then on placing the set back (one which was home-made) the aluminium effectively closed in the bottom of the chassis and all the troubles ceased. I can now get a clean picture on either Band I or Band III, and although the latter is only a test card and on weak power it promises very well for the future. But in my case the closing in of the bottom of the chassis was a "must." —G. FRANCIES (N.W.5).

THE BRITISH SERVICEMAN

SIR,—Whilst reading an old copy of a journal (not PRACTICAL WIRELESS) I came upon an article written by an American radio engineer. I wonder how many of our British radiomen have read it? To quote the writer, "The British Service engineer is a dignified individual who wears a white coat." As a lone wolf enthusiast for twenty years, I think I would have said something stronger.

I have always been of the opinion that our service radio men and dealers are stuffed up, snooty individuals who have no time for a genuine enthusiast, *nor* can they tell the difference between a would-be "tuppenny-ha'penny" radio repairer and a genuine man.

Also, I find that dealers especially are determined year after year to keep prices (even of junk) sky high. They place a false value on everything connected with radio. They bought up all the ex-W.D. gear at ridiculous prices, but are charging fantastic prices from the public. The R1155's are a good example.

We all know that it cost a lot to build them, but that is no excuse for the dealer to charge high.

Lastly, I *have* had contacts with radio clubs, but as soon as I wanted help with some theoretical problems the clubmen were anything but helpful. I am still a keen enthusiast and I have *not* become a "tuppeny ha'penny" jobber, although I *could* be quite easily. Hoping to see a lot more American radio men come over here.—S. MALLOY (Dundee).

BRITISH STANDARDS

SIR,—We are shortly to have a new set-up in this country under the I.T.A., and I should like to make a plea for the Authority to make, at the same time, a change of standards more in agreement with Continental or American systems. We are restricted to low-definition here, compared with the 625 lines or other systems, and service engineers who I know have seen the American pictures claim that they are better—although the studio technique etc., is not so good and, therefore, the final result does not come up to ours. Furthermore, why do we adhere to the vertically polarised transmission, which gives greater troubles from car interference than the radiation difficulties of a horizontal system. Could not the new transmitter make a change—I know many receivers would apparently be rendered obsolete, but again, our technical experts could no doubt introduce some form of timebase adapter to be connected in circuit with the tuning converter, and I am sure the result when switching over to an alternative programme with better definition would "sell" the new arrangement.—H. J. KELVIN (Brighton).

BAD NEWS SERVICE

SIR,—The recent newspaper strike should have been the BBC's big chance to show the viewing public the true value and efficiency of "News and Newsreel." But they failed miserably.

Television means sound with pictures; we can get all the sound we want from radio but we look to TV to give us a pictorial record of topical events, instead of which most of the time in "News and Newsreel" is allotted to close-ups and stills of correspondents and scenes. The remainder of the time is filled in with very poor quality pictures and sound which have all the earmarks of having been hurriedly processed and scrambled together. Practically all the papers and magazines which I read have had letters from viewers complaining of the poor quality and I would have thought, with the imminent competition of the commercial rivals, the BBC would have taken heed of the all-round dissatisfaction and reverted to the original type of "Newsreel."—J. BAKER (Beckenham).

BRAND NEW R.F. Units, 26 or 27, **27/6**, 24 **12/-**, 25 (used) **10/-**; Tuner 161, 160/220 mcs, Valves: 1/CV66, 1/VR137, 2/VR136, **17/6**; (postage 2/4 above), Transformers, input 230/250v, outputs 6v, 3a (twice) tapped at 4 and 5v, **9/6**; 2,000v, 5ma and 2v, 2a, **17/6**; 350-0-350v, 150ma and 5v, 3a, **25/-** 6.3v, 10a and 5a, **17/6**; 250-0-250v, 6.3v, 3a and 5v, 2a, **16/6** (350v same price); (postage each 2/-). STC Met. Recs., 600v, 30ma, **6/-**, 450v, 80ma, **6/-**, 300v, 300ma, **15/-**; W'house, 250v, 200ma, **10/-**; all H.W. Bells, A.C., underdome, **5/-**; hand generators for these, **5/-**, Condensers, bakelite tub., 0.25 mfd, 1.5kVw, **1/6**; 500pf or .001 4kVw, **1/3**; .001, .01 and .1 mfd, 350/500vw, rubber sleeved, **5/-** doz; metal cased, .1 mfd, 500vw or .01, 1kVw, **9d.**; 4 met. recs., 15v, 8ma, with 2/500 ohm min. pots, w.w., **3/6**; wire-wound pots, from 500 ohms to 100k, each **2/6**. Lists and enquiries, 1½d.; s.a.e.; cash with order; postage extra. W. A. BENSON, 308, Rathbone Rd., Liverpool, 13.

JIM'S RADIO COMPONENTS, 23, Alexandra Rd., Sleaford, Lincs. Send s.a.e. for free price lists and order forms.

CONDENSERS, .1mf, 2,500v., d.c., wkg., **5/6**; .1mf, 1,500v, d.c., wkg., **2/6**; tubulars, 500v, d.c., wkg., .001, .002, .005, .01, .02, .05, .1mf, **5/-** doz., can be mixed; .0005, .002, .003, .005, .01, .03mf, 4,000v, d.c., wkg., moulded tubulars, **1/6** each; .003mf, 5,000v, d.c., w., **2/-**, Alum. alloy "H" Aerials, complete with chimney lashings and 5ft. pole, **45/-**; money back guarantee. GLADSTONE RADIO, Gladstone Place, Newton Abbot, Devon.

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STORAGE BATTERIES, 12v, 75AH heavy duty, 19 plates, separate cells in hardwood cases; finest possible specification, **£5/17/6**, 9/6 delivery; 12v, 22AH, almost similar specification, surprisingly powerful, **£2/14/-**, delivery 5/6. TEDDINGTON ENGINEERING CO., LTD., Dept. "C," High St., Teddington, Middx. (KINgston 1193-4.)

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

K.B. EV305

When the picture started to fade I sent it for repair. An RM4 rectifier was fitted. The picture is quite good, but after operating the set for about an hour I get what you describe recently as corona discharge, and quite a pronounced sparking on the neck of the tube. I returned the set for repair, and since having it back the trouble persisted until the sound and picture failed, and the 15-ohm 5-watt resistor and a .1 μF condenser were found to be burnt out. These have been replaced, but the noise, such as one gets from a sparking plug, persists together with the spark of light. I have inspected the base of the receiver after an hour or so of operating, and I find that the resistor mentioned runs very hot indeed, almost hot enough to melt the solder. There is much evidence of melting wax on surrounding condensers. Can you kindly advise which may be the offending component ? The set is about three years old and has given good service so far ; the tube is quite clean.—H. Moore (Bristol).

It is quite normal for the resistor mentioned to work very hot, and it is also quite normal for soft wax to be in evidence on various components, particularly small capacitors, after the receiver has been operational for three years.

We are not clear as to the actual point where the flashover is occurring ; if it is taking place inside the tube, we fear that the tube itself may be responsible. If, however, it is occurring in the vicinity of the scanning coils or focus unit, it may mean that the insulation of one or other of the windings is defective.

CATHOVISOR 9MW2 TUBE

I would be grateful if you could supply me with the following information on the above tube :

(a) Base connections.
(b) Anode voltage.
(c) Filament voltage and current.

—G. Smith (Thornton Heath, Surrey).

As the Cinema-Television C.R.T. type 9MW2 has been obsolete for quite a long period, we are having difficulty in tracing its details as requested ; the tube is not listed in the current issue of the tube Encyclopaedia, and, furthermore, Cinema Television, Ltd., themselves are unable to assist. We would mention, however, that we have noted your name and address, and if any details come to light in the future we will advise you accordingly.

EKCO TU142B

I cannot receive sufficient volume. I tune the volume in from under the chassis to the maximum, which is then just audible, then when I turn the volume-control it has no effect. I would be obliged for your advice.—H. Owen.

No one could possibly tell the cause of the trouble with your receiver from such limited detail. Is the vision affected ? How did the symptom occur ? Does the volume alter when the volume-control is adjusted ? We shall need to know much more than just "insufficient volume" before we can possibly assist you.

EKCO T.161

The picture has the appearance of being out of focus. After the set has been on for a time bands of the picture from ¼in. to 1in. or more wide move a fraction of an inch to the right and are then in perfect focus, but only remaining there for less than a second. The picture is very light, but when these bands appear there is an excellent contrast.

I have tested all resistances and condensers, coils, etc., but can find nothing amiss.—R. B. Wadman (Wokingham).

This is one of the symptoms of an intermittent heater to cathode short in the picture-tube. A separate heater winding is used for the tube in your particular model, and a heater to cathode short causes excessive attenuation of the higher modulation frequencies as the result of losses in the transformer. You may be able to continue employing the tube by making use of a separate low-loss transformer for energising its heater.

ULTRA VA722

It has been necessary to change a valve, and from a service chart which I was able to borrow, the valve is a UL46, but on examination of this new valve and the existing valve there seems to be some difference in its internal make-up. As this service chart is one taken from a trade journal, I feel that perhaps a mistake has been made in the identification of the valves.

I am sending you the old valve for your identification.

Since replacing this valve with a UL46 the set has not worked as well as previously. It is very slow opening out to the full picture height, and the picture quality is not as good as before.

I hope you will be able to give me the necessary assistance, and should be glad if you could give me the full valve line-up for my set, with alternatives.—E. Walker (Walkden).

Two UL46 valves are used in your type receiver ; one functions as the frame amplifier and the other as sound output. We would point out that there is a slight physical difference between the old style UL46 and the current issue.

Your model uses four 6F1's, a 6L1, a 6LD20, a D1, a 6F14, a 6F15, a 6D2, a 6P28, a 6K25, two UL46's, two PZ30's, and a U25.

It is recommended that only the above valve types be used as replacements.

"SIMPLEX"—FRAME FAULTS

When I advance the brilliance control the picture blurrs and flies off at the bottom of the tube, leaving it blank. The next fault a folded raster. The top is rolled back and the bottom is rolled up until they meet.

Now I can get a picture on the centre part of the tube, showing head and shoulders of a person, but if I release the mains plug I get waist downward.

If I operate the height control the picture opens up but breaks up into five or six bands with widely spaced lines between each band.—C. Lethbridge (Bamber Bridge).

A leaky C29, 30 or 31 would cause raster to fly off tube with operation of brilliance.

The double appearance of the raster is due to too fast a frame speed. Double the value of C24.

Check the whole of the frame circuit if the above modification does not clear the trouble.

PYE B.18.T

I notice this set has a tube type Mullard MW22/14. I would like to know if I could use any other tube in place of this one. Also could I put a 12in. tube on this set ?

As I have no circuit for this set I wondered if you could tell me if this is fitted with a pre-amplifier ; if not, would my reception be improved with one fitted ?—R. P. Byhan (Sudbury).

The current substitute for your tube is the Mullard MW22/18, but this necessitates a base change. From the electrical aspect, you should be able to use the 12in. type MW31/18 with slightly less brightness, but we have no data concerning any possible mechanical alterations.

A separate pre-amplifier is not incorporated in your set, though it should be sensitive enough to operate successfully in your district without one. If it does not, then we would advise you to ensure that your aerial is up to standard.

"SIMPLEX"—NO SOUND

I have recently built the "Simplex," complete with sound output stage, and have had considerable difficulty with it. At the present moment I have a picture (of sorts) but no sound is available.

The picture fault is a non-linear frame timebase, the lines on the top half of the picture being too well defined, then there appears to be a bend and on the lower part of the picture the frame timebase is cramped. This results in the artistes having large heads, very short bodies and no legs. As a matter of interest, when the timebase valves are taken out of their sockets there is no spot on the screen, but a long trace. This, I presume should not have any effect on the frame timebase.

The contrast control appears to make the line timebase to come off lock when retarded from the maximum gain position.—A. E. Harrison (Liverpool, 20).

It would appear that the frame is not operating at the correct speed. This is possibly due to tolerance values in the scan circuit and we suggest you try doubling the value of C24.

MURPHY V200A

I shall be glad if you can help me with my Murphy V200A.

The fault is cramping on the bottom half of the picture—I can't "pull it down."

I have the service sheet. V15 has been replaced with a big improvement, but the cramp is still there. I have thought of removing R37 but don't know whether this would be detrimental. Height control is all out and the linearity control nearly so. The latter only affects the top half of the picture.

Further, the left-hand bands on Test Card C are longer than those on the right band and they get progressively wider as they go up from black, i.e., the white is the widest.

Both frame and line seem, therefore, to be at fault and I shall be glad of your suggestions.—E. W. Warren (Bristol, 6).

Since both scans are affected, we feel that the trouble may be caused, or at least aggravated, by low H.T. voltage. This often happens if the RM4 metal H.T. rectifier reduces in efficiency. You should suspect this trouble, and replace the rectifier, if the H.T. voltage, relative to chassis, is less than 205—that is measured from the output of the smoothing choke, i.e., measured across C65.

ULTRA V470

On switching on a good picture is obtained. After a quarter of an hour a continuous hum on sound commences which drowns speech and music. This hum on sound varies in pitch as cameras switch from one scene to another. Then thin black and white curved vertical lines appear on the screen, generally moving downwards, but occasionally upwards. Also, the brilliance fluctuates and for a time one has to keep getting up to adjust the brilliance control. After a time the hum on sound ceases and speech and music come back. Also the curved lines disappear. The set will then be O.K. for some time. Suddenly a loud ripping sound is heard on sound with dark and light bars moving up and down on the screen. The noise is so bad that sound has to be turned right off. After a time this rights itself and sound can then be turned up again.—Reginald W. Plimsaul (Welling).

Your remarks indicate that the frequency of the local oscillator drifts as the inside of the receiver increases in temperature. Sometimes this trouble is caused by a defective oscillator valve, but if you are sure that the valves are up to standard, an alteration in the value of a capacitor associated with the oscillator circuit should be suspected.

QUERIES COUPON

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PRACTICAL TELEVISION, JUNE, 1955.

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.05 mfd., 500 v. ; .01 mfd., 1,000 v. ; .1 mfd., 350 v. ; .02 mfd., 750 v. All 9/- doz.

TCC VISCONOL CATHODRAY CONDENSERS

Type CP57XO, .002 mfd., 18 kV., 7/6 ea. Type CP55QO, .001 mfd. 6 kV., 5/- ea. Type CP55TO, 500 pF., 10 kV., 5/- ea.

BULGIN INDICATOR LIGHT. Single hole fixing (Red glass), 3/3 ea.

HUNTS CONDENSERS

Type W99 .001 mfd. 400 v., 7d. ea.
Type W99 .001 mfd. 350 v., 6d. ea.
Type A305 .05 mfd. 250 v., 7d. ea.
Type W99 330 pF. 600 v., 6d. ea.
Type W99 .005 mfd. 150 v., 6d. ea.
Type W99 200 pF. 350 v., 6d. ea.

TCC CONDENSERS

Metalmite CP35N .05 mfd. 350 v., 1/- ea.
Electrolytic CE37PE 100 mfd. 450 v.; 4/- ea.
Metalmite CP33N .02 mfd. 350 v., 9d. ea.

HEATER TRANSFORMERS

230 v. Input 2 volt .5 amp. 4/6
230 v. Input 2 volt 3.0 amp. 7/9
230 v. Input 4 volt 1.5 amp. 5/-
230 v. Input 4 volt 3.0 amp. 10/-
230 v. Input 5 volt 2.0 amp. 10/-
230 v. Input 6.3 volt .5 amp. 5/-
230 v. Input 6.3 volt 1.5 amp. 6/
230 v. Input 6.3 volt 3.0 amp. 9/-
230 v. Input 12 volt .75 amp. 5/-

PRE-SET CONTROLS (CARBON)

50 kΩ, ½ MegΩ, 1 MegΩ, 2 MegΩ, 1/9 ea.

RESISTORS 2 WATT

2.2 kΩ, 470 Ω, 7.5 kΩ, 22 Ω 150 Ω, 5.6 kΩ, 390 Ω, 150 kΩ ½ meg. Ω, 39 Ω, 1.5 meg., 56 kΩ. All 4d. ea.

★ ★ ★ ★ ★ ★

EX GOVERNMENT AND SURPLUS CONTROLS

This popular range is suitable for all Television constructors, etc. Keep your costs down when building the "Argus" or "Simplex" receivers. Available : 500 Ω, 600 Ω, 1,500 Ω double type, 2 kΩ, 5 kΩ, 10 kΩ, 20 kΩ, 25 kΩ, 50 kΩ, 200 kΩ, 100 KΩ, ¼ meg. Ω, ½ meg. Ω, 1 meg. Ω, 2 meg. Ω, 50 kΩ double type. All 1/2 each.

COLVERN PRE SET CONTROLS

Type CLR 1106/88, 1,000 Ω ... 1/9 ea.
Type CLR 1126/78 250 Ω ... 1/9 ea.

★ ★ ★ ★ ★ ★

RESISTORS

The following range of Resistors is available in ¼/½ watt and 1 watt. Prices ¼/½ watt 3d. ea. 1 watt 6d. ea.

10 Ω	120 Ω	1.5 kΩ	18 kΩ
12 Ω	150 Ω	1.8 kΩ	22 kΩ
15 Ω	180 Ω	2.2 kΩ	27 kΩ
18 Ω	220 Ω	2.7 kΩ	33 kΩ
22 Ω	270 Ω	3.3 kΩ	39 kΩ
27 Ω	330 Ω	3.9 kΩ	47 kΩ
33 Ω	390 Ω	4.7 kΩ	56 kΩ
39 Ω	470 Ω	5.6 kΩ	68 k
47 Ω	560 Ω	6.8 kΩ	82 kΩ
56 Ω	680 Ω	8.2 kΩ	100 kΩ
68 Ω	820 Ω	10 kΩ	120 kΩ
82 Ω	1 kΩ	12 kΩ	150 kΩ
100 Ω	1.2 kΩ	15 kΩ	180 kΩ

SOLDERING IRONS

Solon type 964 fitted oval bit .... 19/11 ea.
Solon type 968 fitted pencil bit .... 19/11 ea.
Both types are complete with approx. 6ft. of Henley 3 core cable and are suitable for 230/250 v.

SOLDERING PASTE

Large tin soldering paste by Tyne Chemical Co., approx. 1 lb. .... 1/9 per tin

VCR97 6½in. CATHODE RAY TUBES Picture tested, 20/- each, carriage 3/6.
BELLING LEE SAFETY MAINS CONNECTOR. Unit Type L707. Listed 8/9. Our Price, 4/6.
Valve Type CV271, complete in holder, 6/- ea.

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Full instructions with each one. Listed 50/-. Our price, 14/6, plus 1/6 packing and post.

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18	2/1	32	3/3
20	2/3	34	3/5
22	2/5	36	3/7
24	2/7	38	3/11
26	2/9	40	4/2
28	2/11		

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