SERVICING TV RECEIVERS

Practical Television

1/6

AND TELEVISION TIMES

APRIL 1960

CONTENTS

Transistor Set Parcel

Cabinet as illustrated—with handle and motifs—2 gang tuning condenser—printed circuit—tuning scale—full circuit diagram showing other necessary parts—separate value £3—will all be sent for **29/6**, plus 2/6 post and insurance.

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250/300 volt, 250 mA equivalent of R.M.5 will replace many expensive valve types and will last. Price **12/6**, plus 1/- post.

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P.V.C. covered in 100ft. coils—**2/9** a coil or four coils different colours, **10/-**, post free.

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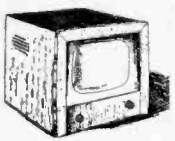

14in. TV cabinet of the latest styling—beautifully veneered and polished—limited quantity, sale price **9/6** each. Carriage and packing 3/6 extra. Masks **10/-** extra.

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Super Transistor Kit

Makes ideal bedroom radio, uses one transistor and one crystal diode.
Complete with case **19/6**
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Cossor—930, 930T, 931, 933/4/5, 937, 938, 938A, 938F, 939, 939A, 939F, 943T, 946.
Decca—D14, D17, D17C.
Defiant—TR1453T, TR1753.
Ferguson—306T, 308T.
H.M.V.—1824, 1824A, 1825, 1825A, 1826, 1826A, 1827, 1827A, 1829, 1829A, 1865, 1869.
Marconi—VT63DA, VT68DA, VT69DA.
R.G.D.—6014T, 6017T, 7017C, C54.
Regentone—14T, 17C, 17 Comb., 17T.
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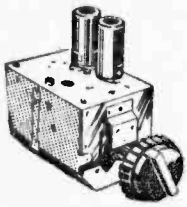
Most others available at short notice.
ALSO exact replacement line blocking, frame blocking and frame output transformer—for most makes and types. Post inquiries please, enclose S.A.E.

TURRET TUNERS



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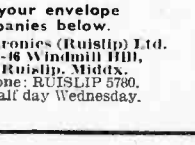

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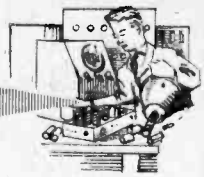
Practical Television



& TELEVISION TIMES

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CONTENTS:

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

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

Sound Improvements

MOST of the modern developments in the design of TV receivers seem to be concentrated on improvements to the reproduced picture; the quality of the sound, far from being improved with the advent of new models, seems to be deteriorating. The increasing use of cathode ray tubes with deflection angles of 110deg has caused the depth of cabinets to be reduced, and smaller loudspeakers to be used.

Early TV receivers were bulky units and the designer was forced to employ large cabinets to accommodate the chassis. Whilst these receivers are ugly by modern standards, the cabinets were large and made of thick wood. In console models particularly, there was sufficient space to use 8in. or even 12in. diameter loudspeakers and the quality of the reproduced sound was excellent. Now, fashion dictates that TV receivers be as small as possible and large diameter loudspeakers are rarely used. In order to reduce the frontal area of the cabinet many designs position the loudspeaker at the side of the receiver. Whilst this procedure may occasionally permit the use of an 8in. diameter loudspeaker, the improvement in sound quality thereby obtained is offset by the way in which the highly directional top notes are absorbed by the furnishings of the room.

To summarise, the loudspeaker employed in a TV receiver should have as large a diameter as practicable and should be positioned to face the viewer. As we have shown, these two requirements conflict and there are, we think, two solutions to the problem, one for existing receivers, and the other for new models. If the sound reproduction of an existing receiver is poor, it may be improved by using a separate loudspeaker and enclosure. However, if such a course is adopted and the receiver is of the live chassis variety care must be taken to ensure that no dangers are created by the additional wiring.

The solution proposed for incorporation in new TV receiver designs would give little difficulty in execution and would involve little alteration to either appearance or basic design. As we have pointed out, the high notes emitted by a loudspeaker are directional and are lost if it is not facing the viewer but the bass notes suffer little or no deterioration. Thus, provided the high notes are directed towards the viewer, reproduction will generally be satisfactory and certainly improved. This principle can be realised by using a large diameter speaker in the wall of the cabinet, where there is generally a large space available. A small diameter, high efficiency, "tweeter" can be placed at the front of the cabinet in a central position.

It has been said that "A picture is worth a thousand words" but it is surely wrong to neglect the sound section of the TV receiver and concentrate only on improving the vision section.

Our next issue, dated May, will be published on April 22nd

A Versatile "V" Aerial

A SIMPLE INDOOR AERIAL

By C. A. Oldroyd

OUR TV set was due for retirement; it had given us years of faithful service. The family wanted something new, with a bigger screen. In due course the latest 17in. set arrived, and was installed. Its performance was superb and apart from the TV programmes it also provided the VHF radio broadcasts. The serviceman suggested fitting two additional rods to the existing outside aerial, and a new downlead; but I was thinking of fixing-up a special indoor aerial for the VHF transmissions. We are a long way from the transmitter, and although the built-in aerial brought in a signal, an external aerial was obviously needed.

Polarisation

In addition to the outside TV aerial a loft aerial had been installed. It was a modest "V" aerial consisting of two copper tubes, as shown in Fig. 1. The rods of an aerial for F.M. should lie in a horizontal plane, and since the rods of a "V" aerial slope outwards, and are neither vertical nor horizontal, it was hoped that it would bring in the VHF transmissions. A trial showed that it did so surprisingly well; a special VHF aerial could not have done better. Now neither a new VHF aerial nor a new feeder line was required; and if anything went wrong with the outside aerial, the "V" loft aerial could be used for the reception of the TV programmes. With the new set, the loft aerial worked quite as well as with the outside aerial, despite the fact that we are about sixty miles from Holme Moss.

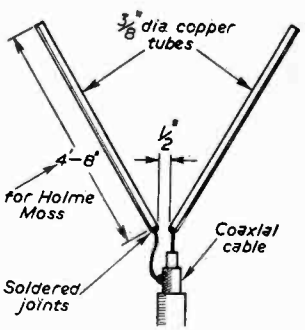
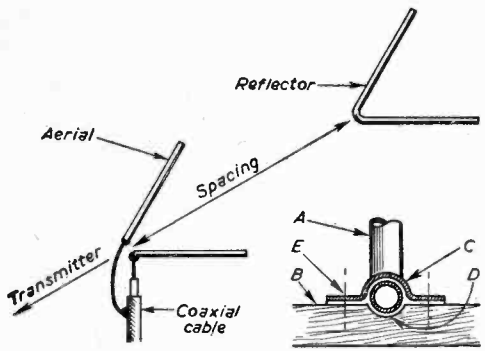


Fig. 1.—The construction.



Figs. 2 and 3.—Adding a reflector, and the method of fixing the elements.

Dimensions

It will be realised that for stations other than those operating on Channel 2, the length of the elements forming the dipole (see Fig. 1), will be different. An article on aerial design appeared in the January issue and in the table of dimensions on page 185, the figures in the column "a" may be divided by two and used as a basis for the length of the elements of the "V". The remaining dimensions given in Fig. 1 may still be used. The total length of the reflector (before bending) can be determined from column "b" in the table in the January issue.

Apart from the dipole which has no directional effect, the "V" aerial is, perhaps, the most compact and versatile aerial for TV and VHF reception. It is surprising that its design has not been developed beyond the original, simple type. Gain could be increased by fitting a reflector, as suggested in Fig. 2. Even then the double "V" does not take up much room, and is compact enough to be erected in small lofts.

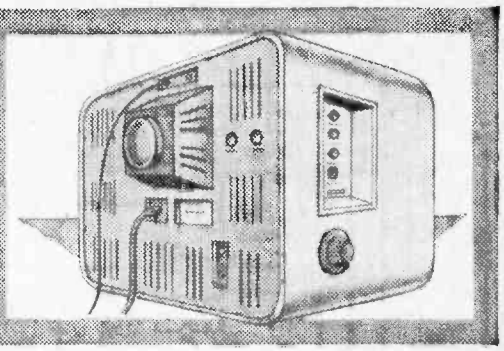
Construction

One point must be borne in mind when making up simple aerials: one cannot afford to lose any energy, and the joints between aerial rods and downleads should be soldered; for this reason the elements were cut from copper tubing. The reflector can be bent from one piece of tube and Fig. 3 shows a suggested method of fixing the reflector to the wooden base. A is the copper tube, and B the baseboard. The clip C clamps the tube to the base B. To provide a good seating for the bend, a groove D is cut into the face of B with a half-round wood chisel. Bolts E are countersunk 3/16in. Whit. There is no need to mount aerial and reflector on a long baseboard; the two elements can be fixed to two smaller bases. This allows the spacing to be altered without having to remount the reflector. For greater selectivity, and increased gain, a director element in front of the aerial may be well worthwhile.

DIMENSIONS OF THE ELEMENTS

Channel	Length of dipole elements ft.	in.	Length of reflector (before bending) ft.	in.
1	5	3	10	11
2	4	8	9	8
3	4	2	8	9
4	3	10	8	1
5	3	6	7	5
8	1	2½	2	7
9	1	2½	2	6½
10	1	2	2	5½
11	1	1½	2	5

Servicing Television Receivers



No. 54—THE PHILIPS 1115U. STELLA ST8314U, etc.

By L. Lawry-Johns

THERE is a very close resemblance between the above receivers and many others in the Phillips, Stella family. The basic design started with the Philips 1101U 12in. model (console version, the 1200U) and continued with the 1114U 14in. version, 1427U console, to the 1437U, 1726U (17in.). Stella 8314U. Fitted with turret tuners, the Philips 1446U, 1746U, Stella ST6414U and ST6417U followed.

All models use a double chassis system, the dual band versions having the tuner fitted in the centre. To avoid confusion, it is worth noting that the Philips 1748 and Stella ST8317U are completely different receivers using a much simplified circuit based on the earlier 12in. versions, the Philips 1100U—1236U—1238U—1229U and Stella 1500U.

Intermediate Frequencies

All these receivers use an 8.5Mc/s sound, 12Mc/s vision I.F. with a single 0.3A series heater chain, The Cyldon P10L, Brayhead 10s and similar tuners with PCC84 and PCF80 valves and a low I.F. output are suitable for conversion. The usual method of fitting is by removing V1, the EF80 R.F. amplifier, inserting the R.F. plug, removing the V2 EF80 mixer and inserting the mixer (I.F.) plug or adaptor. Various other methods suggest themselves, such as wiring all leads to the R.F. plug, altering the V1 and V2 bases so that V2 is retained and used as an extra I.F. amplifier, or wiring the leads to the valve bases instead of using the plugs.

Common Faults

Of the various "usual" complaints, the most common is undoubtedly weak line hold. This shows as persistent loss of hold where the picture repeatedly slips sideways necessitating frequent adjustment of the hold control. In fact, the "hold" circuit is rarely at fault and where it is, a replacement V15 (ECL80) or hold control (0.5M—500k) will most often put things right. In the majority of cases the line sync pulses are too weak to lock the oscillator owing to excessive clipping by the line sync clipper (triode section of V15). The

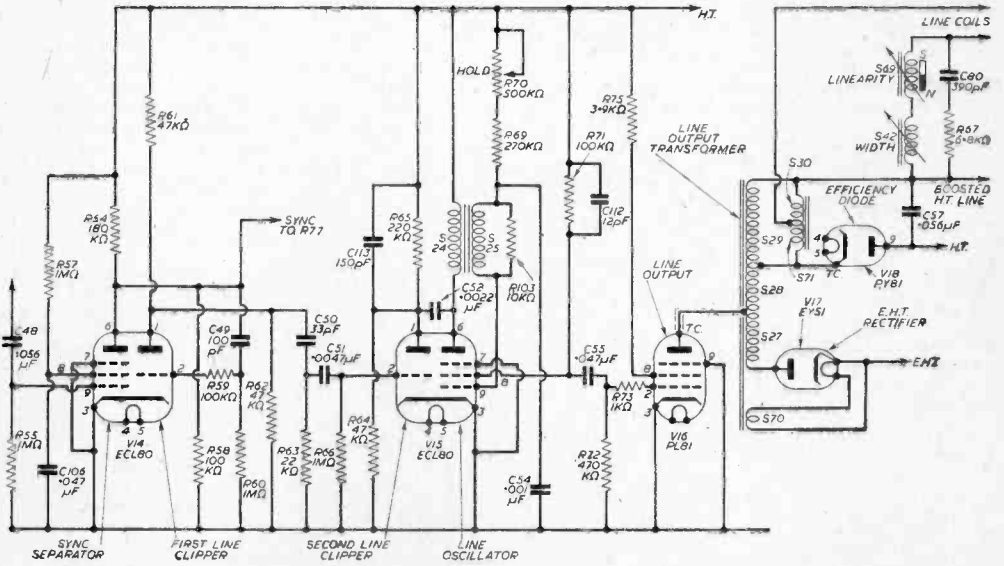


Fig. 1.—Sync separator and line timebase circuits.

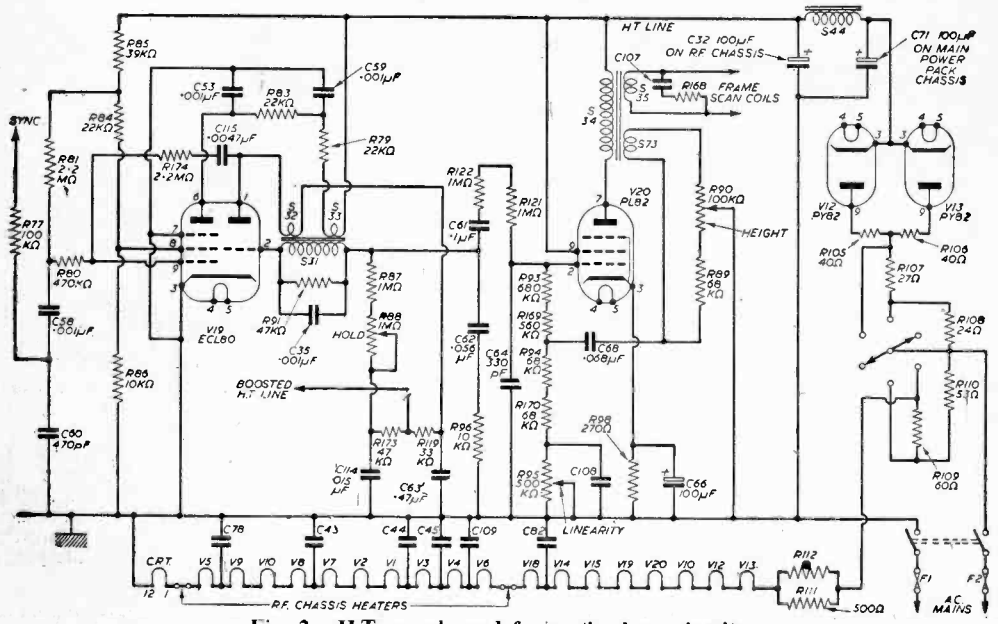


Fig. 2.—H.T. supply and frame timebase circuits.

anode load resistor is R65 (220k-red, red, yellow), this being the resistor wired to pin 1 of V15. This resistor often goes high in value and should be replaced. It will usually be found beneficial to reduce the value to 100k. This results in a much stronger locking pulse and the setting of the hold control becomes less critical. It is sometimes recommended that R64 (47k) be disconnected also but the writer has rarely found this necessary.

Horizontal White Line

Another very common fault is complete loss of height resulting in the appearance of a thin white line. When this fault appears, first check the PL82 (V20) and ECL80 (V19). If these are in order, check for H.T. at pin 1 of V19. If absent, check at the top tags of the frame blocking oscillator transformer (S32 tags). If H.T. is present at one of the upper front tags but not at the other the winding is open circuit. Sometimes the internal connections corrode resulting in a high resistance joint with varying height and intermittent collapse. In cases where doubt exists, sharply tapping the transformer will often confirm the diagnosis. This small transformer has six tags in all; two pairs at the top and one pair under the front. Tags S32—S31 form the oscillator windings and S33 is the frame sync coupling from the clipper stage which is the pentode section of V19.

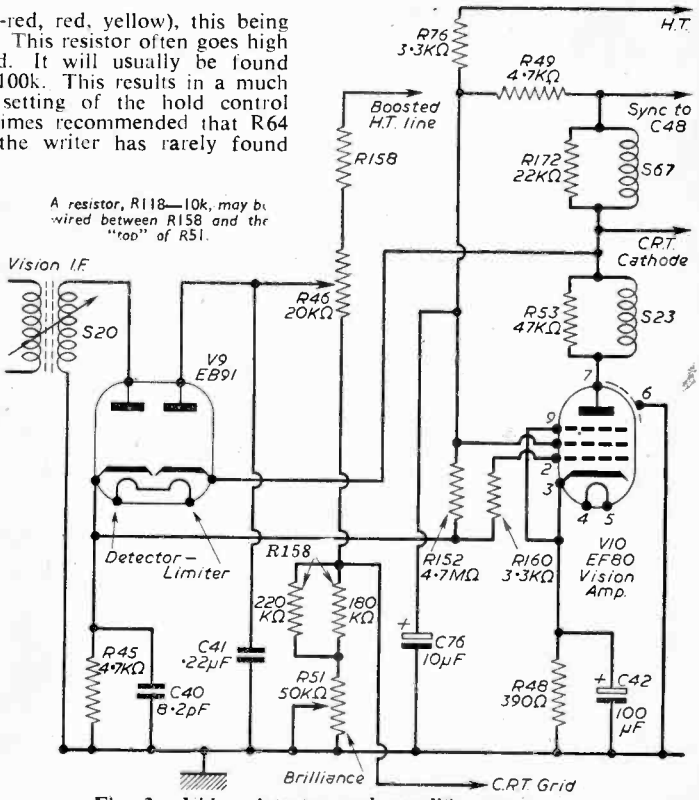


Fig. 3.—Video detector and amplifier stages.

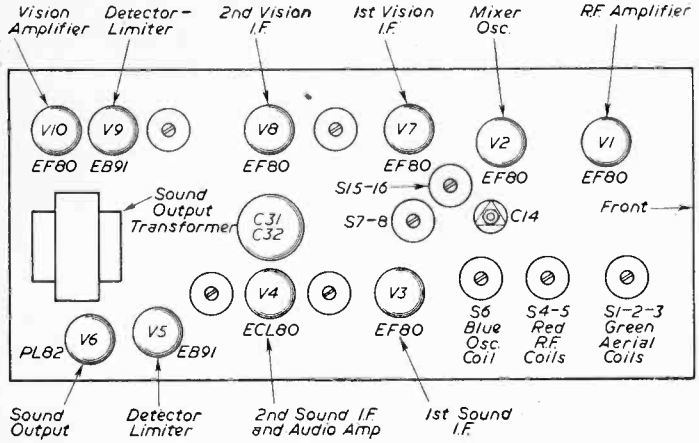


Fig. 4.—Chassis layout.

A Less Common Fault

On occasions, the height control (R90) becomes defective and this produces a rather startling effect, similar to that seen in "the hall of mirrors." The lower part of the screen is vastly elongated and the top compressed. These symptoms would normally lead one to suspect an open-circuited linearity capacitor but in most receivers in this range, a feedback winding is included in the frame output transformer and this feedback is divided and controlled to effect variations for height. When the circuit is working normally, quite a heavy feedback is applied. When a component, such as the height control becomes open-circuited, no feedback is applied and the above effects become obvious. When the bottom of the picture is compressed the PL82 may be fairly suspected but when the bottom is opened out the PL82 grid resistors R93 and R169 should be checked.

Sound on Vision and Vision on Sound

Sound on vision, showing as vibrations of the picture as the sound modulation varies, and vision on sound showing as a buzz on the sound on white picture content, could be due to misalignment of C14. However it is often the case that C14 is correctly set and the above symptoms continue. This is normally caused by an open-circuited electrolytic capacitor and the C31—C32 can should be checked. A wire ended 32μF 350VW capacitor is useful to check these sections quickly. The negative side of the capacitor is touched to chassis, the positive end to each tag in turn and the effect noted. A correct replacement should be used (65 + 100μF).

Weak Frame Hold

The grid leak R81 (2.2M) is returned to a point of H.T. potential. When this resistor (red, red, green) goes high in value, the setting of the frame hold becomes critical the picture rolling upward or downward frequently. Weak sync and impaired definition often results as C76 (10μF electrolytic in the H.T. supply to the video amplifier) becomes open-circuited.

White Screen

When the screen is brilliantly illuminated with the brilliance fully down, it can be assumed that the cathode potential of the tube has fallen to a very low level. This D.C. voltage is derived from the video amplifier anode circuit. If the voltage at

Note—Ferrite beads are used in certain parts of the circuit and have been indicated by dotted lines. For an example see the screen grid lead of V2, below.

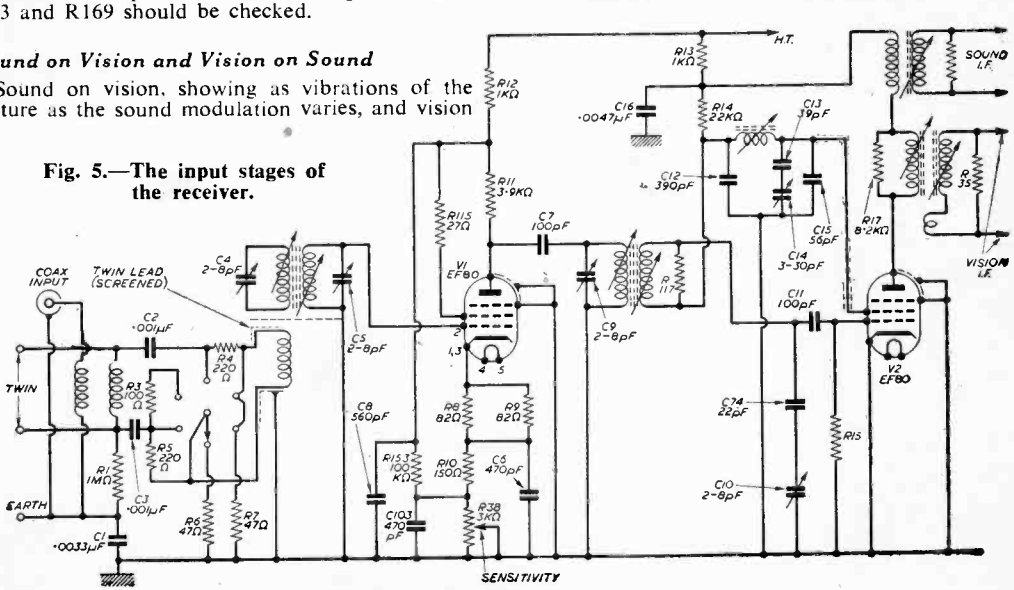


Fig. 5.—The input stages of the receiver.

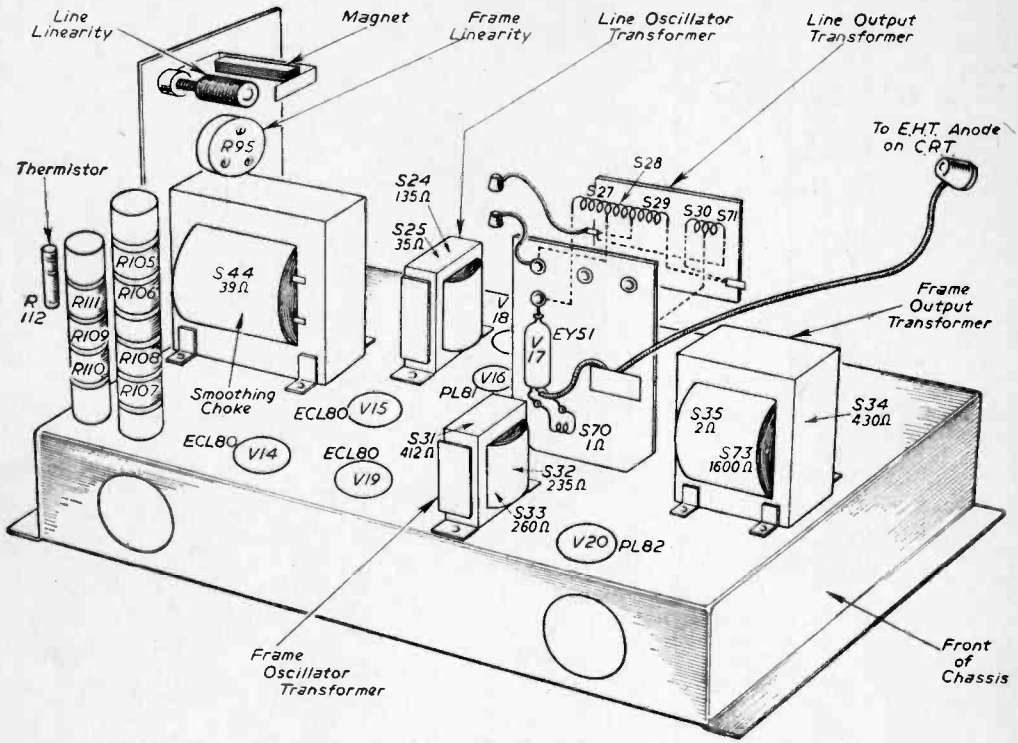


Fig. 6.—The chassis layout.

pin 11 of the CRT base is absent or very low, the most probable cause is a heater to cathode short in the tube itself. Pin 12 of the CRT base is connected to chassis and therefore a heater-to-cathode short results in the anode of the video amplifier being connected to chassis. This absence of cathode voltage on the tube results in a heavy flow of beam current with the brilliance at minimum. As the brilliance is advanced the beam current increases still further resulting in the EHT rectifier being overloaded and the screen darkens. Thus the brilliance control appears to work in reverse.

The cure is quite simple. A 6.3V isolating transformer (with mains primary) may be fitted under the tube neck. Pins 1 and 12 are the tube heater pins. The leads to these are removed, connected together and soldered to one of the primary tags of the transformer to form the chassis connection. The other primary tag is connected to the lower tag of the rear left side mains dropper to pick up the live side of the mains. The secondary tags are connected to pins 1 and 12 of the tube base.

Instability

The tube is not necessarily the cause of excessive brilliance however. Oscillation in the vision I.F. stages would result in the anode voltage at the video amplifier falling to a very low level. If this is suspected, short pin 2 of V10 to chassis.

If the brilliance returns to normal when advanced (there will be no picture, of course) and the anode voltage at pin 7 of the video amplifier (or pin 11 of the CRT) rises to say 150 to 180, the decoupling capacitors (4,700pF) associated with pin 8 of each vision I.F. stage (V7 and V8) should be shunted with a capacitor of similar value (say 0.003 to 0.005μF) which is known to be "good".

Other Shorts

Reference to the video circuit diagram will show that the cathode circuit of V9 presents another possible source of a short circuit path from the video anode circuit. Here the symptoms are a little different, however, since a heater-to-cathode short will modulate the cathode very slightly with a low A.C. ripple which will show on the bright raster (with the brilliance at minimum) as light and dark bars with the heaters of V5 and the tube glowing brighter than normal. A very bright raster will also result if C76 should develop a short. In this case, R76 will overheat severely.

No Picture

If the sound is in order but there is no brilliance on advancing the brilliance control, check for EHT as outlined in previous issues of this journal, testing for a spark at either end of EY51, with and without the CRT clip connected. Then check PL81, PY81, ECL80, etc. The symptoms of a low EY51 (picture expands and fades as brilliance is advanced) have also been described so many times that a full description is hardly necessary. This also applies to the symptoms of a failing tube and other common faults.

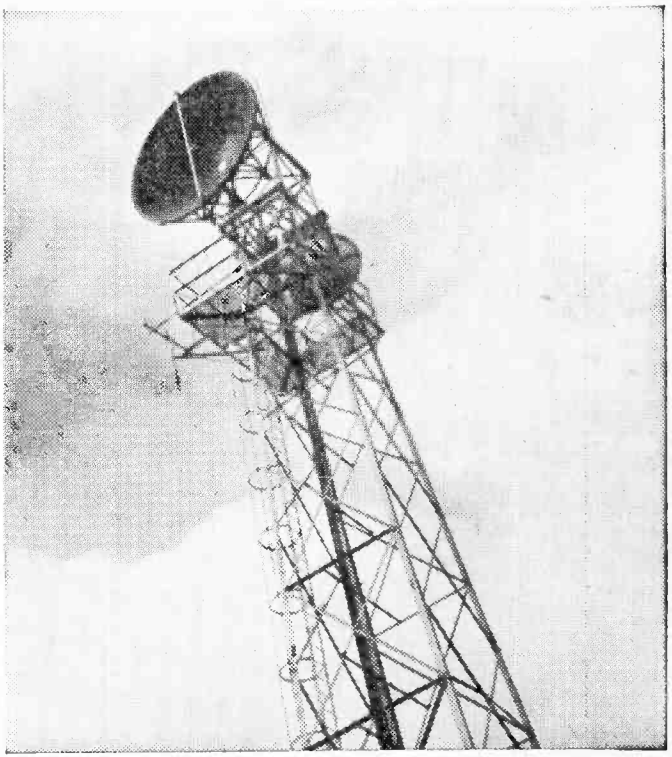
(To be continued)

London to Birmingham TV Link

A NEW TRUNK CIRCUIT

THE first long-distance trunk TV circuit in Britain to be built, installed and maintained by private enterprise was formally handed over to Associated Television in London recently. The circuit carries high quality vision and sound from the Alpha Studios at Aston Road, Birmingham, to the ATV London Headquarters at Marble Arch. It will enable ATV's London management to monitor programmes originating in Birmingham and to watch rehearsals and dry runs. It will also enable advertisers in London to see programmes radiated from Birmingham without having to travel to Birmingham as at present.

The new microwave scheme which has been manufactured and installed by Pye Telecommunications Limited has many entirely novel features. Apart from being the first long-distance trunk circuit of its kind to be operated by free enterprise, it is also the first 7,000Mc/s microwave permanent trunk circuit in Great Britain. It makes use of passive reflectors, which eliminate the expensive waveguides normally required by such systems to carry the transmitter power to the aerials. The microwave link carries high quality TV sound in addition to the picture. Radiotelephone circuits for



The microwave aerial system at Cold Ashby between Market Harborough and Rugby.

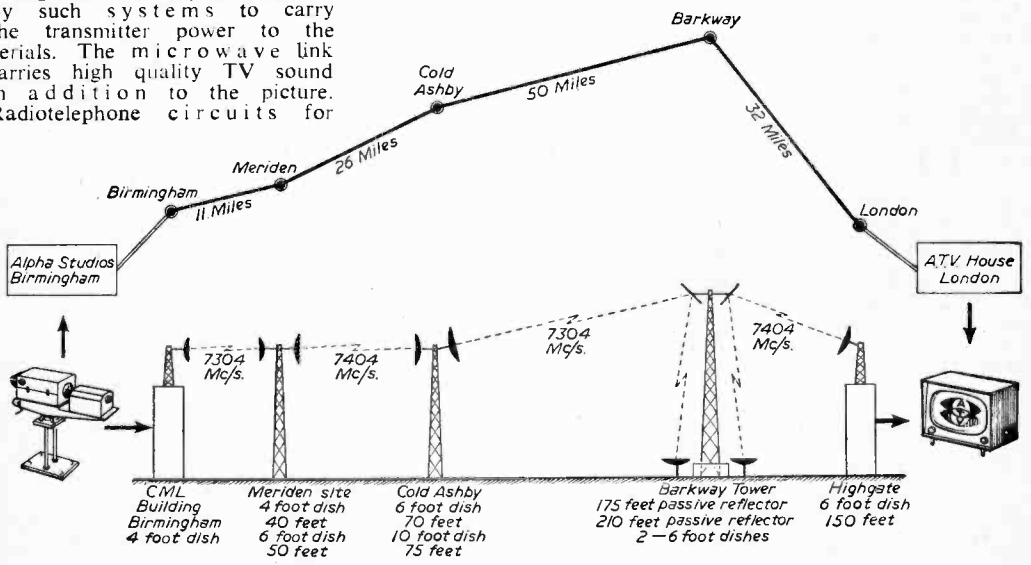
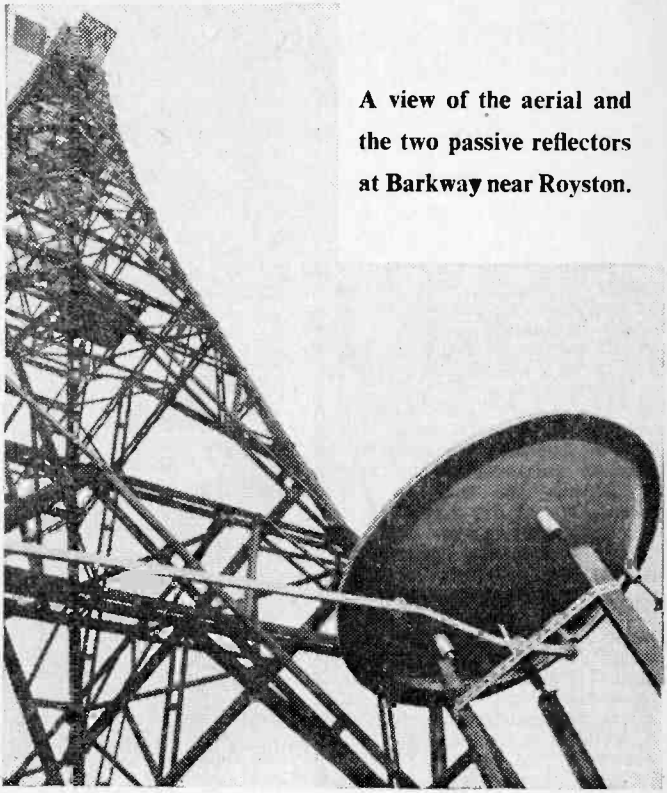


Fig. 1.—A diagram of the route taken by the new TV link.

engineering maintenance have been put on a separate 450Mc/s channel. One of its features has been very low cost—probably a fraction of links previously supplied for the purpose.

The passive reflectors are employed at the Barkway Tower and their method of operation is indicated in Fig. 1. At the frequencies used on the link, the radiation can be focused and beamed in much the same way as light waves. The signal is therefore led by waveguide to a dish aerial (as may be seen in the illustration on this page) and this aerial is directed towards a metal sheet at the top of the tower which acts as a mirror to reflect the signal beam in the required direction.



A view of the aerial and the two passive reflectors at Barkway near Royston.

Faults

The circuit, which is routed via automatic radio repeater stations at Meriden, Cold Ashby, Barkway and Highgate, is 135 miles long. The repeater stations are fully automatic and unattended. Apparatus faults occurring at any station are automatically indicated on the London control board by telemetry circuits operating over the 450Mc/s control link.

Authority to install and operate the system was granted by the General Post Office, who have recently made a band of microwave frequencies available for operations of this kind. The Birmingham to London Link is thought to be the first of many such applications.

FULL POWER AT THRUMSTER

THE Thrumster television and VHF sound broadcasting station of the BBC was brought into full service on 1st March 1960. A temporary television service at reduced power has been in operation at this station since 15th December 1958; on 1st March this was brought into full-power operation and in addition a three-programme VHF sound broadcasting service was opened.

Test transmissions were radiated each weekday from 15th February—on television at full power from 10 a.m. to 1 p.m. and on VHF from 9 a.m. to approximately 11 p.m., and as in the case of other new transmitters, these test transmissions are for engineering purposes and to assist the radio trade in the installation and adjustment of receivers and aerials.

Site

The new BBC station shares the site of the G.P.O. communications station at Thrumster some 3½ miles south-south-west of Wick. The aerials for both the television and VHF sound services are mounted on a Post Office mast which is 325ft. high. The site is 236ft. above sea level.

Thrumster receives its television and VHF sound programmes direct from the BBC transmitting station at Meldrum, Aberdeenshire and special aerials mounted on a separate 150ft. mast are provided for this purpose.

TV Service

Thrumster will radiate the BBC's television service on Channel 1 (vision 45Mc/s; sound 41·5Mc/s) using vertical polarisation. These conditions are the same as those which have been used for the temporary service. The transmitting aerial is directional giving an e.r.p. of 0·25 to 7kW according to direction. The new station will extend the BBC's television service to almost the whole of Caithness and in conjunction with the BBC's Orkney station the total population coverage will be some 43,000.

VHF Sound Service,

Thrumster transmits the Scottish Home Service on 94·5Mc/s, the Light Programme on 90·1Mc/s and the Third Programme with Network Three on 92.3Mc/s. Polarisation in this case is horizontal. The VHF aerial system, like that for the television service, is directional giving an e.r.p. of 0·1 to 10kW according to direction. The coverage will be almost identical with that of the television service.

Timebase Faults

CHECKING SYNC CIRCUITS

By G. J. King

SOMETIMES a leak develops from the element of a pre-set control associated with the frame timebase circuit to chassis. Such a leak does not always affect the performance of the generator generally. This point was revealed to the writer while investigating an early receiver for an unstable frame. The fault was finally established to be due to a leak between the frame linearity control and chassis—replacing the control cleared the symptom.

No Line Lock—Frame Hold Normal

It is general practice to supply the line generator with sync pulses derived from the anode of the sync separator valve via a series capacitor shunt resistor combination. Such a network is depicted by Fig. 1(a), and is often termed a differentiating circuit. Not only are the line sync pulses subjected to little attenuation by this form of coupling but the pulses also undergo a shaping process, essential for correct "firing" of the line generator. This is illustrated by the waveforms in Fig 1, which show at (b) a positive-going line sync pulse at the anode of the sync separator valve, and at (c) its modified shape developed across the resistor R.

The action of the circuit is such that the uncharged capacitor C offers little impedance to the leading edge of a pulse; the current in the resistor R and therefore the volts drop across it are at maximum. As time goes on, however, C charges exponentially and the potential across R falls. A virtual change of input in the negative direction is provoked by the trailing edge of the pulse, and the potential across R is thus changed instantly from a positive to a negative magnitude, which is again followed by an exponential return to zero. For optimum operation of this circuit the value of the time constant formed by RC must be appreciably smaller than the 10μs line pulse duration.

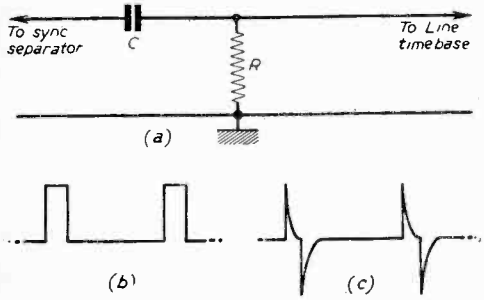


Fig. 1.—A basic differentiator circuit is shown at (a) and line sync pulses at (b), while (c) shows how the pulses are shaped due to the action of (a).

It is easy to see, therefore, that a change in value of any component associated with the line pulse coupling circuit might severely impair the efficiency of line lock. In receivers where a simple differentiating circuit is used, the symptom of no line lock can nearly always be traced to an open circuit differentiating capacitor.

In certain receivers the line generator demands the application of positive-going sync pulses for successful operation, and where a conventional pentode sync separator is employed, providing negative-going sync pulses at its anode, a form of phase reversing section must also be included in the line pulse feed circuit. A triode valve is often used to perform the phase reversing function. Fig. 2 shows the circuit details, and as will be seen the differentiating components, CR, go to make up the grid coupling circuit.

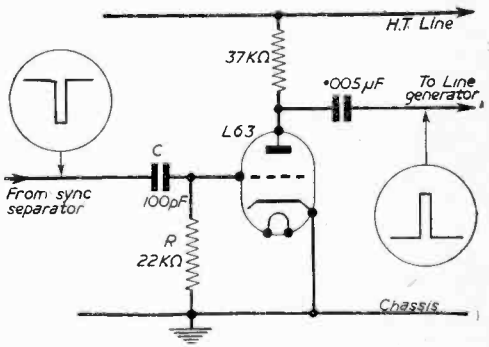


Fig. 2.—A typical line sync inverter circuit using a triode valve.

In a receiver of this type we have, therefore, another factor which could fail and cause a loss of line hold. The sudden occurrence of this symptom should immediately lead one to suspect the triode valve for low emission. On the other hand, an open-circuited anode load resistor would produce a similar effect by blocking the passage of line sync pulses.

Top of Picture Bent to the Right

The repetition frequency of a sawtooth generator in its "free-running" (unsynchronised) state is determined by the time constant in the circuit. For instance, the potential on the grid of the generator valve rises exponentially until it reaches a value which "fires" the valve (flyback). This effect we can illustrate as in Fig. 3 (a).

The repetition frequency of a synchronised generator is wholly controlled by correct injection of the appropriate sync pulses, the effect being that just before flyback would be initiated—should the generator be free-running—a sync pulse arrives and the valve is immediately "fired". We can clearly visualise from this, then, that the correct setting of hold control is such that in the free-running state the generator frequency should be very slightly lower than the sync pulse frequency. A line sync pulse exercising complete control on the repetition frequency of the generator during a normal line scan is shown by Fig. 3 (b).

During the framing pulse period, which generally comprises eight 40μs frame pulses radiated collectively, the line generator is held in synchronism by reason of the differentiated leading edge of every other frame pulse (see Fig. 4). A condition may arise, however, where the pulse—not necessary for line synchronising—which occurs in the middle of a line scan during the framing period fires the generator prematurely. How this undesirable condition may result is depicted at Fig. 3 (c).

Owing to such an occurrence the line generator is momentarily caused to operate at twice its normal frequency, and its output voltage is reduced to one-half of normal during this period. The line

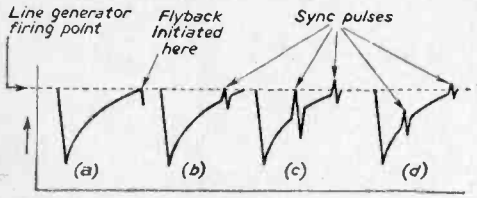


Fig. 3.—Firing points of line generator: (a) free-running, (b) normal synchronised line scan, (c) fired prematurely in the middle of a line scan during the framing period, (d) normal synchronised line scan during the framing period.

output valve drive, and thus its bias potential diminishes as a result, and the first few full amplitude lines at the top of the screen tend to be displaced to the right-hand side. The top section of the picture bends over to the right and is much more noticeable where excessive vertical picture content exists at the top of the screen. Sometimes the bending over is not stable, in which case the top of the picture appears to waver between the vertical and the bent positions.

It would follow, therefore, that since even the pulses which occur half-way through a line scan—remember these occur only during the framing period—possess sufficient amplitude to fire the generator prematurely, the overall amplitude of the line sync pulses generally must be far too large. This is the normal cause of this symptom, and it can be prevented without much trouble by taking steps to reduce the amplitude of the line sync pulses by the inclusion of a simple attenuator, generally in the form of a potential divider system. Fig. 3 (d) shows the normal relative amplitude of the sync pulses for correct "firing" of the line generator during the framing period.

Top of Picture Bent to the Left

Bending to the left is another common and troublesome fault in the line timebase and, as with the previous symptom, the top of the picture often wobbles in a most disconcerting manner. The bend in this case is caused by a change in the relative amplitude between the pure line sync pulses and those which are used for line synchronising during the framing period. This sometimes results in the line generator momentarily falling out of synchronism during the framing period and giving rise—during its unsynchronised state—to an increased output.

The difference in output voltage of the generator between its synchronised and unsynchronised states is easily realised by considering, for instance, waveforms (a) and (b) of Fig. 3. In (a), the free-running state, the horizontal scan continues until the potential across the time constant capacitor reaches a value sufficient to initiate flyback. In (b), during synchronisation, the line scan is cut short, however, since the line sync pulse initiates flyback slightly before it would otherwise have occurred.

We can see, then, that the line generator falling out of sync during the framing period—at the top of the screen—will provoke an increase in the bias of the line output valve, and this has the effect of displacing to the left the first few lines of picture following the framing period.

The change in amplitude of the sync pulses during the framing period is often caused by a slight variation in main D.C. level of the composite sync pulse chain when it is conveyed to the line generator through the differentiating network. Although the leading edge of every other frame pulse is differentiated for application to the line generator, the duration of a pure line pulse is considerably less than the duration of a frame pulse.

A sudden occurrence of this symptom should lead one to suspect first of all an alteration in the value of a resistor or capacitor associated with the differentiating, or line sync feed network. A defect in the sync separator stage proper may also cause the symptom. It is, therefore, advisable, particularly in obstinate cases, to check the sync separator

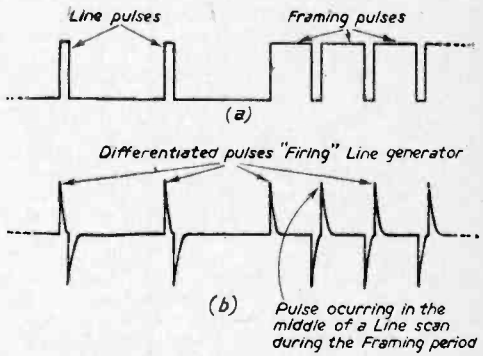


Fig. 4.—The differentiated pulses employed to hold the line generator in synchronisation during the framing period.

valve for emission and the associated components for value and it is important to pay special attention to the insulation property of the sync separator coupling capacitor.

Flywheel Synchronising

Flywheel synchronisation is now in common use in quite a number of the more sensitive—fringe area—receivers. In a large number of cases it represents—from the performance aspect anyway—a desirable inclusion, for as we have already discovered the trouble with most conventional sync separator stages is that the circuits are not able fully to differentiate between a line sync pulse and an interference pulse.

Such differentiation is rendered even more difficult in areas of poor signal strength owing to

the fact that insufficient signal is available at the input to the sync separator to produce a 100 per cent clipping action. Moreover, it often follows that in high interference and weak signal areas, the interference level might well exceed that of the signal, and this factor, coupled with valve and circuit noise, provokes premature line timebase triggering to give rise to the symptom we have already considered of "ragged verticals".

The relevant circuit details of a form of flywheel sync are depicted in Fig. 5, and though, perhaps, formidable in appearance its mode of operation is quite straightforward and easy to follow.

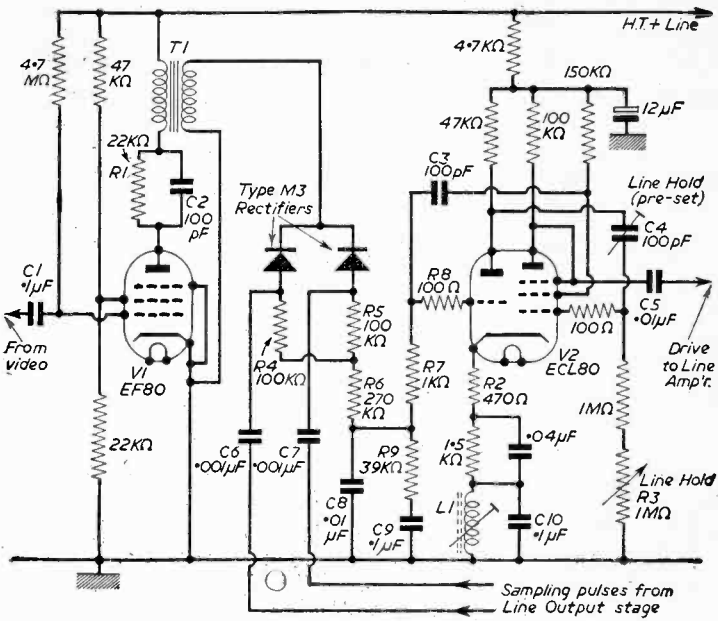


Fig. 5.—The "auto-sync" and associated circuits of a commercial television receiver.

Operation

Valve V1 constitutes the sync separator valve, to the control grid of which the composite video signal is applied through C1. This section follows conventional design inasmuch as the positive going sync pulses drive the valve into grid current and the resulting charge across C1 is sufficient to place the video portion of the wave-form below cut-off. The line sync pulses thus appearing in the anode circuit are differentiated by C2 and R1, and phase inverted by the transformer T1 for direct application to the small metal rectifiers.

Leaving this section for a minute, let us now divert our attention to the ECL80, V2. This valve is primarily employed as the line scan voltage generator, and is wired in the form of a multivibrator using the triode section, and the control grid and screen grid of the pentode section as a second triode with common cathode coupling by R2 and anode to grid cross coupling by C3 and C4. The frequency of operation can be controlled manually by altering the time-constant C4 and R3, where the resistor forms the main line hold control, and the capacitor, also being variable, enables the correct line generator frequency to be adjusted so that it falls in the centre of the range of R3.

The sawtooth voltage appearing across C3 is fed through C5 to the control grid of the line amplifier. Apart from supplying scanning energy to the line deflector coils, the line output transformer also provides a small sampling pulse voltage for application to the metal rectifiers through C6 and C7, and because the winding concerned is centre-tapped, the sampling pulses are in two opposite phases which are balanced about earth potential.

Discriminator

Thus, the two metal rectifiers (discriminating rectifiers) are in receipt of two signals; the sync signal from the sync separator, and the line generator signal from the line output transformer. The criterion for accurate line synchronising is, of course, to ensure that the two signal frequencies are matched, and this is where the discriminator takes over.

How this happens can be realised by assuming for the time being that only the sampling signal voltage is being applied to the rectifiers. Each rectifier is, therefore, receiving a voltage differing in phase by 180 degrees. Both rectifiers conduct equally and the currents in the load resistors R4 and R5 are of similar magnitudes. The resulting voltages are added in opposition, and resolve to provide zero potential at the junction R5, R6.

When both signal voltages are applied to the rectifiers the balance is maintained, but only so long as the phase of the two voltages corresponds. Should the generator frequency start wandering, for instance, the balance will be disturbed, and a control potential will exist at the junction R5, R6, the magnitude of this potential depending on the phase difference between the two frequencies. It is this potential which is utilised, by being fed through R6, R7 and R8, and filtered by C8, C9 and R9, to control the frequency of the multivibrator at the grid of the triode section.

Momentum

A momentum or flywheel effect is given to this system by the inclusion of a tuned circuit, L1 and C10, in the cathode of the generator valve. The tuned frequency is in the region of 8,500c/s, and its oscillatory effect tends to maintain line sync even for a brief period, should the sync pulses fail completely, or should they become distorted due to impulsive interference or other reasons.

TWO INTO ONE—2

(*Continued from page 242 of the February issue*)

IN the previous article, which appeared on page 239 of the February issue, details were given to enable the H.T. (or power pack), sound section, and R.F. stage to be checked. Before attempting to check the line and frame sections of the receiver the voltages at the base of the cathode ray tube should be measured. If these are normal, turn up the brilliance control and observe whether there is any scan on the face of the tube. If there is no scan, then the tube may be low in emission or there may be no EHT. In the case of the first fault, a microammeter can be wired in the cathode lead and will indicate this fault. The f.s.d. of the meter should be about 500μA and such meters can be obtained as government surplus quite cheaply. If the cathode current of the tube is approximately 30μA it may be assumed that the tube is serviceable.

F. E. Apps explains how two old, faulty TV sets can be serviced to provide one working receiver.

No EHT

In the case of flyback EHT, which has been in general use for many years now, this fault can be due to a defective EHT rectifier, lack of line oscillation, a faulty line output valve, or a defective line output transformer or component in the line circuit.

EHT Rectifier

These valves are generally of the wired-in type and are very often soldered on to the top of the line output transformer. The single wire end is the anode of the valve and goes directly to a point on the line output transformer where it taps off the high flyback voltage. Even if the EHT rectifier is faulty, a spark can be drawn from this point if a screwdriver *(with an insulated handle)* is brought near to it. If the line circuit is working and this spark can be obtained, observe if the filament of the rectifier is alight. If it is not, it may be open-circuited. If there is no scan and the valve is alight it may have very low emission. This point can often be checked by rotating the brilliance control from minimum to maximum, when a flash of brilliance may appear on the screen.

Line Oscillator

This section too can be responsible for lack of EHT. Line oscillator circuits vary considerably; a blocking oscillator driving a line output valve; a multivibrator consisting of sections of one or two valves; a blocking oscillator output valve, etc. For this part of the work the circuit diagram is required. If the line circuit is working correctly it should be possible to hear the characteristic 10k/s whistle. Absence of this is a clue. Have the valves tested on a valve tester at the local dealers. Check or replace the line blocking oscillator transformer as well as any doubtful components in the line oscillator circuit. Do not forget the various control components. These consist of line hold, width and line linearity controls. Test them not only for continuity from end to end but also for good contact between the moving arm and the track.

Line Output Transformer

Here again there are various types, check with the circuit diagram. A continuity check can be made although this will not give any indication of breakdown of insulation under the stress of high voltage. It may be necessary to replace the component with the one from the spare set, but it is very important that before you disconnect the replacement you make a careful diagram of the connections. Should it happen that both transformers prove to be faulty, new ones can usually be purchased through advertisers in this journal, provided the make and model number are stated when ordering.

When soldering joints in the EHT section (when replacing the EHT rectifier, or the line output transformer, for example) make sure that there are no sharp points on the blobs of solder; if care is not taken in this respect corona may be experienced.

Frame Circuit

Here again different methods are used by manufacturers. The two usual ones are a multivibrator oscillator feeding an output valve, or a blocking oscillator feeding an output valve. Lack of frame scan is generally due to a faulty oscillator, faulty components, low H.T. to frame circuit or faulty deflection coils. The latter may be either disconnected, open-circuited or short circuited.

Lack of Height

This can be caused by a low emission output valve, faulty height control or a resistance in series with this control going high in value. Meter checks can be made.

Poor Vertical Hold

This is often due to fault in the frame oscillator circuit. Check all components, but suspect the valve and hold control first.

Fold Over

This is where the frame does not extend over the whole of the screen and is shown by broad white line at the bottom of the screen. Here, check the output valve and especially the electrolytic condenser across the cathode bias resistor of the output valve. Components between the frame oscillator and the output valve should also be checked.

(*Continued on page 368*)

Safe Modifications

THE SAFETY FACTOR IN SERVICING

By L. E. Higgs

THE Coroner's Court is a formidable place and I hope and trust none of us ever find ourself there—dead or alive as a result of modifications or alterations to television equipment in either a professional or amateur capacity.

Whether or not changing the design of a receiver is correct depends on the circumstances of each case, and in particular, to whom the set belongs. Some may retort that they may do as they like with their own property, in order to learn by experiment, save money on spares, save time by using substitute parts lying around at hand rather than wait the arrival of the exact items from elsewhere, and in any case the results are often better than the original.

Chances

This is true; nobody minds, nobody cares, nobody knows—unless that one in a thousand chance crops up when a person is accidentally hurt, or worse, killed (one in a million). Then the coroner, police, borough safety officer, several insurance companies, the injured party's solicitors, TV manufacturer (and newspaper men) swarm up and turn the spotlight on our right to do as we like with our own equipment.

Fortunately such happenings are rare but the safety aspect of alterations must always be kept in mind. Another point with our own receivers is the possibility of it evolving into a "Bitzer"—bits of this and bits of that—with no clear integrated design of section matching into section, an irregular circuit maze that other service men refuse to touch should it break down when the originator is temporarily absent. Finally, remember the loss of value when resale or part-exchange is attempted.

Nevertheless, we all like to have a dabble—"research" the large companies call their dabblings, and it is best to confine it to an old receiver that we intend running to a standstill. (This avoids the wrath of the rest of the family too.)

Policy

The other person's TV that we are called upon to service is quite a different matter from our own. He is entitled to expect a proper workman-like job for his money, executed with the correct parts, and indistinguishable from the original condition of the set. By doing this we ensure safety, reliability, and, above all, our good name. If the set later goes into the hands of another man there can be no report of bad work (right or wrong) because there will be no way of telling the job from the rest of the set.

There come many occasions, though, when the ideal cannot be realised owing to obsolescence, delivery delay, or the customer's poverty. On such problems we can use our skill of improvisation—with the customer's consent—as we have to with conversions (Band III), tube boosts and requested attachments such as 'phones, tape sockets, and extension speakers.

Dangers

The discovery of an elderly lady, deaf, listening to TV sound with a pair of 'phones framed with bare metal, connected direct to chassis and output valve anode (Fig. 1), quite unaware as she watched her gangster films that she was wearing a similar rig to the condemned man in the electric chair,

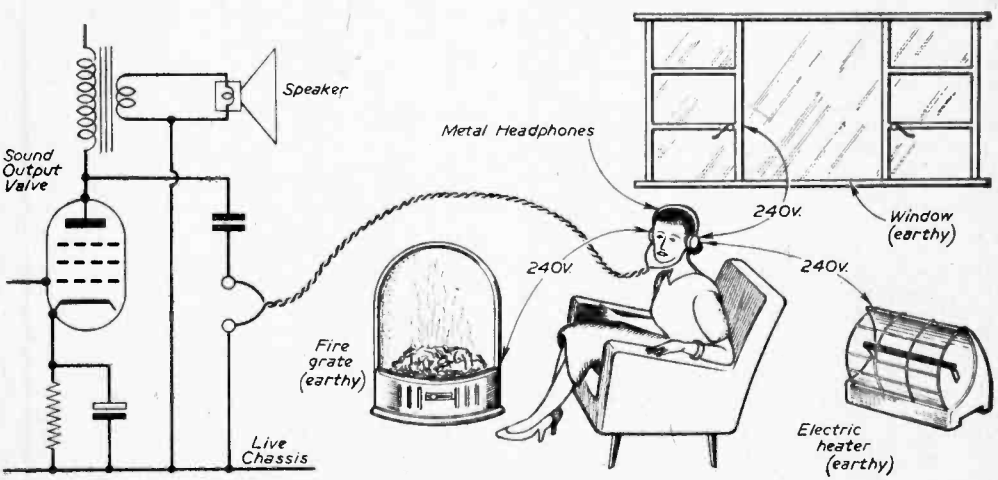


Fig. 1.—The dangers of connecting headphones direct to a live chassis.

first brought home to me the dangers of well meaning modifications by people unaware of the danger. It only needed a leak to 'phone frame by the frayed silk tinsel lead—not designed to withstand mains voltage—to place this lady's head 240V above earth when the mains plug is the

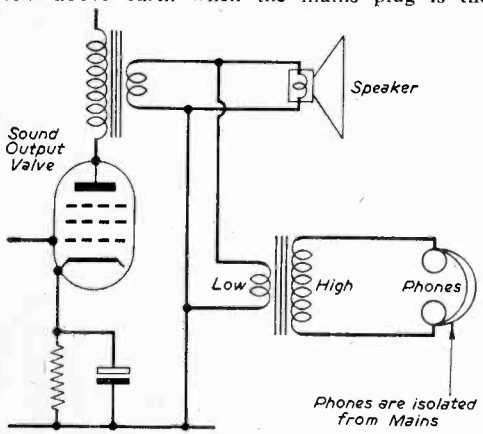


Fig. 2.—Headphones should be wired using an isolating transformer.

wrong way round. All well and good if she stays in her warm dry chair, feet on the carpet, but the moment she leans over to switch off the earthed metal electric heater, or opens the steel-framed windows, or just pokes the fire with the brass fire iron? "Killer TV Strikes Again" will probably be the headline.

All attachments from live-chassis equipment must be via a double wound transformer with insulation adequate to resist mains breakdown (Fig. 2). An extraordinary amount of damage can be produced when a tape recorder with an earthed chassis is fed from the speech coil of a speaker of a TV or radio with a live chassis, when, as often is the case, the coil is taken down to chassis. Recorder input, switch wafers, contacts, and speaker, manage to burn up before the fuses go. Its good policy to "megger" any attachments to the mains plug when finished, in particular the aerial socket on newly fitted ITV converters. Ensure that no bare metal parts can be reached by the customer's fingers. The authorities use a dummy finger (of a specified size) to test guards and shields to ensure protection, and insist on even the grub screws in control knobs being covered with wax.

Ventilation

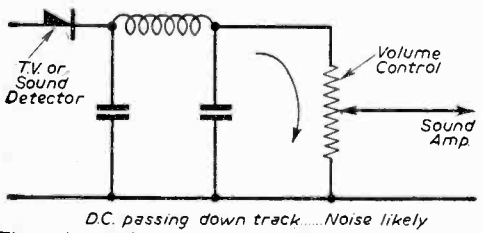


Fig. 3(a).—The usual method of wiring the volume control; D.C. passes through the control.

Another point of care when modifying is to see that any components that become hot are placed in well ventilated positions where no scorching, melting or blistering of cabinet or parts can take place. Wire-wound volts droppers and tube booster resistors are the main offenders. It is a problem to decide whether to replace a whole dropper or just to bridge the o/c section with a small wire-wound resistor. Rightly, replacement of the complete resistor is the best policy, and if more than one section has gone, the likelihood is that other original sections will follow. But where the first section goes and a long delay in obtaining a replacement is expected, it is tempting to wire in a 5W wire-wound and complete a quick, cheap, job. It is legitimate I think as long as the customer is informed.

Improvements

Modifications that result in improved performance are very gratifying, some being the result of using more up-to-date parts on obsolete sets. Contact-cooled rectifiers that prematurely cause reduced H.T. can with advantage be replaced with the earlier air-cooled types. Volume controls that become "noisy" owing to the to and fro on/off switching may be replaced by unswitched types, and a separate toggle switch for the mains provided in the side of the cabinet. This facility is appreciated by the older folk who dislike turning knobs, and like to control the set in one simple move. Persistently noisy controls are usually caused by D.C. passing through the track. Blocking off

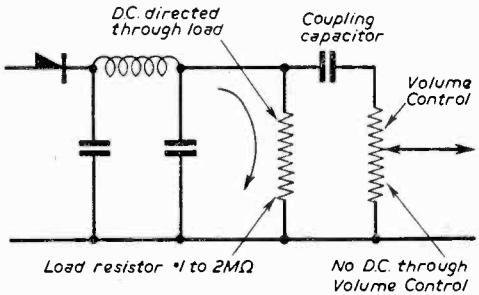


Fig. 3(b).—Fitting an isolating capacitor before the volume control.

the steady current with a capacitor and grid leak (Fig. 3) stops this recurring annoyance for good.

Some of the simpler alterations can be the most effective, especially to improve ease of service. My favourite with those sets which have solid bottoms, such as certain Pye models, is to cut out the slotted cabinet base with a padsaw, making a neat inspection cavity which can be covered with a perforated panel—safety again. The other cabinet improvement that saves much time where it can be applied is the conversion of the fixed viewing glass to a detachable one. Alternatively, after cleaning a tube which was difficult to replace, seal it off from the air with sponge rubber strip fixed with adhesive crêpe paper (as used in packing departments). The reason for this interest in time saving in my own case is that some of these instances are on rental contracts, and time saved on repeat calls is money saved. The fact that the

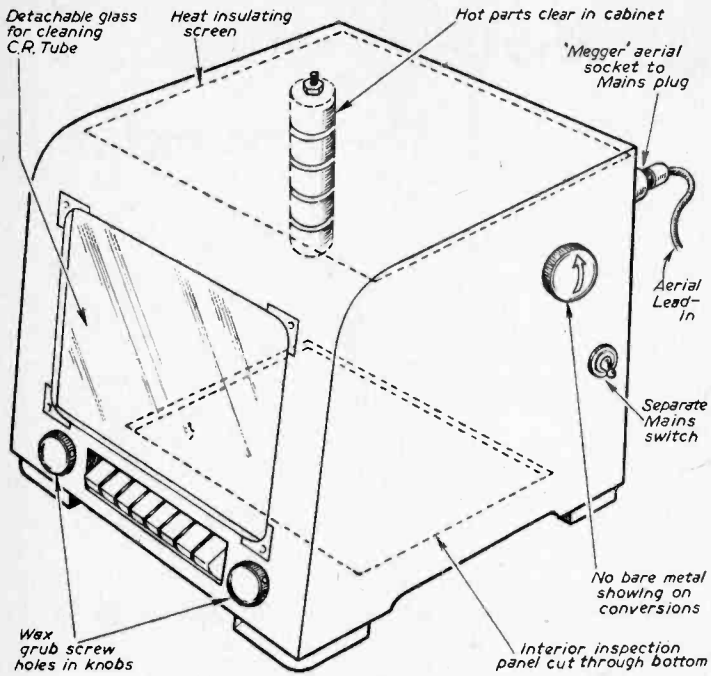


Fig. 4.—Various modifications to improve safety.

property does not belong to the client has allowed circuit modification for simpler and more reliable working. A receiver with flywheel sync, notorious for wobbly verticals and line slip with every slight change in circuit condition or ignition interference has been given steady line hold permanently just by cutting out the flywheel section and providing plain sync. How this is executed depends on model and circuit; Fig. 5 shows a typical example. The point of interest with this modification is that when the sync is applied in antiphase the line will still hold, but the top of the raster just will not lock at any position, wavering about as the incorrect pulses force the line to start at any point except the right one.

Tuning

Difficulty in reaching tuning points in certain tuners in spaces of restricted access can be overcome by punching or drilling a small hole in the screening cover opposite the oscillator slug path and counting the number of clicks or channels to bring it into coincidence, where it is turned back a fraction, tested by switching back, the difference observed, repositioning for tuning, etc., until the station is correctly set on its channel.

Common sensitivity controls are troublesome where Band I is strong and Band III weak, here if there can be found spare, unused, contacts on a switch wafer in the tuner, as there are in the Bush TV 43, the sensitivity control can be shorted out on the weak station, or a separate one switched in. Parts that experience and observation show are overloaded and prone to fail — solid carbon screen resistors in line timebases, decoupling resistors in H.T. lines—are worth changing for wire-wound types. To measure one of these over-run parts, hot and then cold, comparing it with the value it ought to be, is a revelation — three different readings.

Polish

Some modern cabinets are constructed of very thin single layer material with consequential cracking of the polish with the grain, flaking, and discoloration owing to the heat developed within the cabinet. The provision of a heat baffle by fitting a false roof of hard board or similar fibre, inclined up to the rear of the cabinet to deflect out heat, leaving a small air pocket between the two to act as a heat insulator, will prevent this if done in time (Fig. 4).

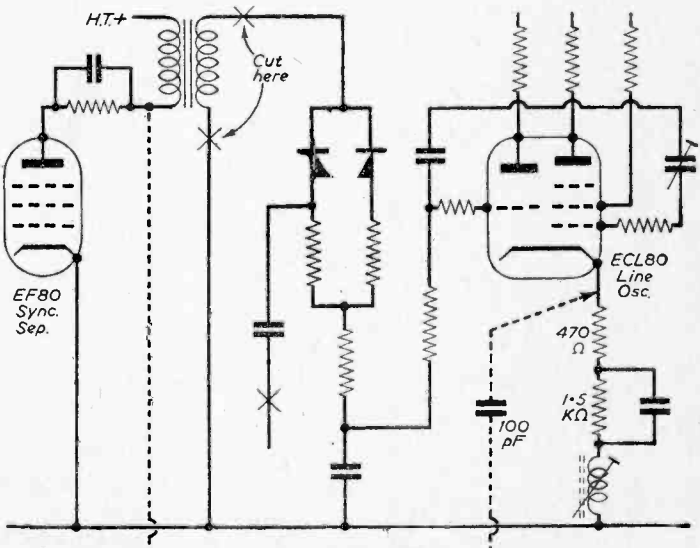


Fig. 5.—Conversion from "auto" to "plain" sync.

Vision Interference Limiters

SIMPLE "SPOTTER" CIRCUITS

EVEN with the widespread use of suppressors on all types of electrical equipment, interference is still a problem in many areas and any limiting circuit should be made as efficient as possible. This is particularly important when one is unfortunate enough to be situated near a main road as well as in an area of low signal strength.

In fact, the efficiency of the more advanced "Spotters"—to be described—is such that it is actually beneficial for the interference to be over a certain level with respect to the signal strength. This was borne out in practice, when careful siting of the aerial to reduce ignition interference from a main road resulted in an inferior picture, although the signal strength was—if anything—slightly greater.

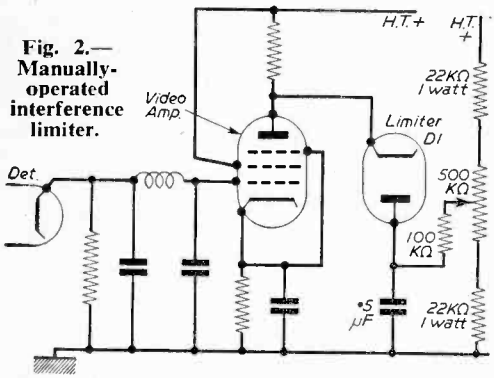


Fig. 2.—Manually-operated interference limiter.

By far the most common "spotter" circuit both in commercial and home constructed television receivers is the so-called automatic limiter (Fig. 1). It is, of course, only automatic in the sense that no manual adjustment is necessary—bias for the diode being obtained by setting the time-constant of C and R so that C charges to a mean level approximating to peak-white. Pulses of interference exceeding peak-white level in amplitude cause the diode to conduct—thus shorting the video load and reducing the output, designers who employ this circuit work on the assumption that "what you never see you never miss", for it is virtually impossible to obtain reasonable spot suppression without severely clipping the picture highlights.

Highlights

To avoid losing highlights it is only necessary to provide means whereby the bias potential may be adjusted manually to suit the contrast level (Fig. 2). However, this circuit suffers from the disadvantage that limiting is accomplished by shunting the diode and condenser across the video load and, although the condenser can be made large, the internal resistance of the diode—even is small—is not zero.

Instead of using the interference pulse as a switch to short-circuit the video load, it can be used

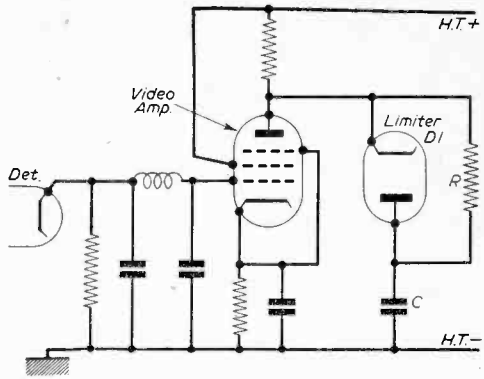


Fig. 1.—Simple automatic type of vision limiter.

(D1 is a diode with as low an internal resistance as possible; R1 may have a value of 1—10M according to the level of highlight clipping which can be tolerated and C may have a value of 0.1μF).

in the form of negative feedback to the video grid circuit, and in this form the internal resistance of the diode is not so critical (Fig. 3).

A similar method is to feed the pulse to the grid of the tube (assuming cathode modulation is in use), but the limiting efficiency of the circuits shown in Figs. 3 and 4 is only slightly better than the previous methods.

R.....1—10MΩ according to the amount of highlight clipping that can be tolerated

C.....·1μF

Black-spotters

In America, where negative modulation of the vision carrier is used, with zero modulation corresponding to the white level, interference pulses appear on the screen as black spots, and because of this visitors who have seen American television often think that they have conquered interference problems. This is not really true, of course, but it is a fact that black spots are far less noticeable—at normal viewing distances—than white ones. This is partly due to the light intensity being lower, but also because the average picture is predominantly in shades of grey. If we take the circuit shown in Fig. 4, but

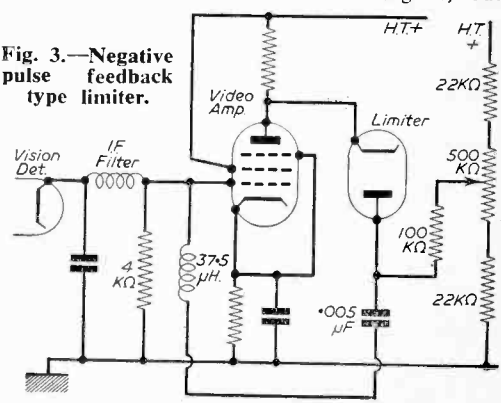


Fig. 3.—Negative pulse feedback type limiter.

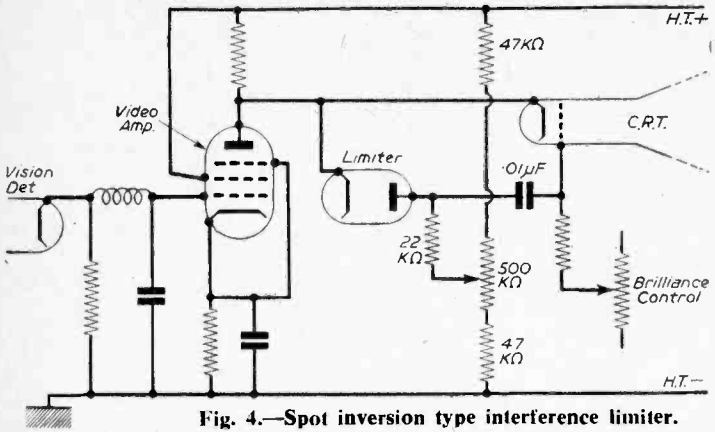


Fig. 4.—Spot inversion type interference limiter.

amplify the interference pulse before feeding it to the picture tube grid, its amplitude will be in excess of that on the cathode, and the effect will be to drive the tube to beam current cut-off and the visible effect on the screen will be a black spot instead of a white one (Fig. 5). Thus an interference pulse in excess of peak-white level is no longer limited to that (peak-white) light intensity, but can be reduced to zero (black level). Unfortunately interference pulses which do not exceed peak-white level do not operate the black-spotter circuit and this explains the statement in the opening paragraphs that there is an optimum interference-to-signal ratio.

The "black-spotter" circuit is of no advantage where the prevailing interference level is below peak-white at the video anode, but, under certain conditions, principally in fringe areas, the reduction in visible interference spots cannot be stressed strongly enough. It is not always convenient, or practical, to add an extra stage to an existing receiver, but the circuit shown in Fig. 6 can be fitted to any receiver which already has some form of diode limiter.

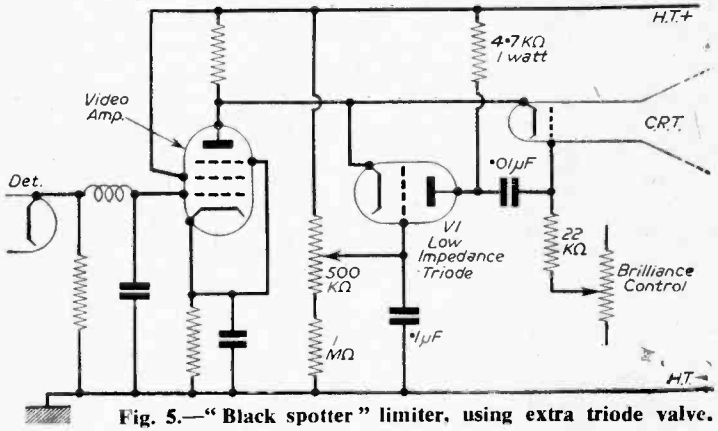


Fig. 5.—"Black spotter" limiter, using extra triode valve.

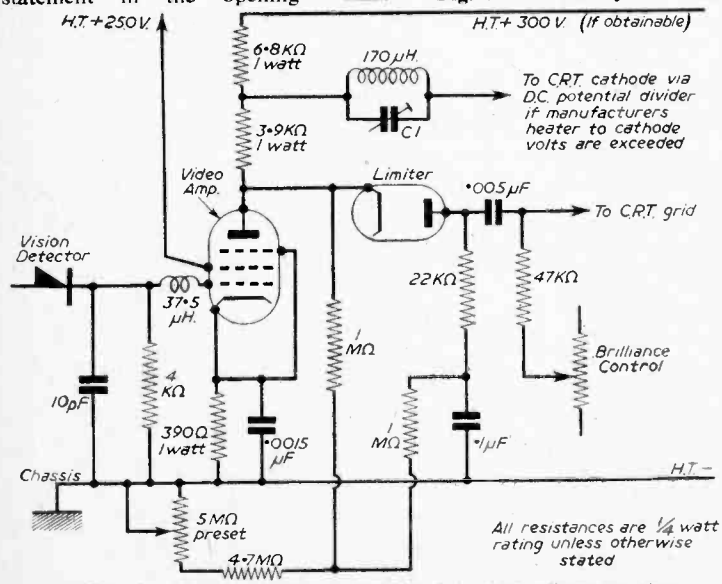


Fig. 6.—Circuit which can be added to any existing receiver.

The modifications are simple to carry out, and in an area where its inclusion is worthwhile, the slight falling off in response, caused by the higher video load, should not be apparent. If necessary a series correcting choke can be added and this will usually more than compensate for any high-frequency loss.

The extra amplification needed for the limiter circuit is obtained by using a tapped video load and it is an advantage to increase the H.T., if possible, to compensate for this additional resistance.

If the potential divider providing the bias for the diode is fed from the video anode, as shown, the circuit becomes semi-automatic in operation and small changes in contrast will not necessitate re-adjustment of the limiter-control.

A Cathode Follower Voltmet

A ONE VALVE CIRCUIT PERMITTING ACCURATE READINGS WITH METERS

WHEN using an ordinary voltmeter on television equipment, the readings are often very inaccurate owing to the comparatively large current drawn by the instrument. For example in Fig. 1, the presence of the meter will make the anode voltage about 16 per cent lower than normal. The cathode follower voltmeter will give a considerable improvement in this instance and in many others. This old dodge does not seem to be widely known nowadays among experimenters.

Basic Circuit

The basic circuit is shown in Fig. 2. The voltage under test is applied as an input to a cathode follower and the output of the cathode follower is

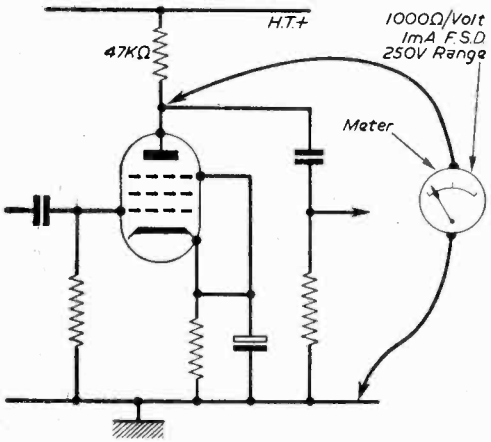


Fig. 1—Using a conventional meter to read an anode voltage; errors may be introduced if the meter takes a large current.

applied directly across the meter (using the same range as would be used directly). The input resistance of the cathode follower is of course very high and so the load on the circuit under test is negligible. There will however be an error because grid bias is required and so the cathode voltage will exceed the grid voltage by this amount. This error will be much less than that caused by loading in a circuit such as in Fig. 1. The heater and H.T. supplies are simply tapped off those of the apparatus under test.

The errors due to bias have been found from the makers curves for ½ 12AX7 assuming a meter having an f.s.d. of 1mA as this is probably the most usual meter in the amateur's den. These are plotted in Fig. 3 for two values of H.T. and, for comparison, two error curves for the meter connected directly as in Fig. 1 have been put on the same graph.

Advantages and Limitations

In the example taken, there is a decided gain in accuracy and this will hold for most measurements where the voltage is more than about 25. For lower ranges, where the circuit impedances will usually be lower (e.g. cathode voltages), the meter will often give most accurate results when connected directly.

Even in cases where the error of the cathode follower voltmeter is large compared with the voltage under test, it may still have advantages because of the small loading.

The error due to bias can be determined from curves or by a check using a low impedance supply. On the other hand, the change in voltage which occurs on connecting the meter directly may be difficult or even impossible to calculate.

While the basic circuit is adequate where a "hook up" is used for a few measurements, a leak from grid to earth is desirable if the circuit is made in permanent form to prevent possible meter overloading when the grid is left floating. This can be made very high so that the loading on the circuit under test is still very small (say 4.7M giving a load of 53μA at 250V).

A grid stopper (about 220k) is advisable to limit grid current if excessive voltage is applied.

Naturally the valve must not be worked with the grid positive with respect to the cathode for the loading would then be appreciable. The upper limit of voltage measurement is thus less than the H.T. supply by the drop across the valve at zero bias.

To cater for higher voltages the grid could be shifted to a tap at the mid-point of the grid leak by a ÷2 press button as shown in Fig 4.

The heater-cathode insulation might be inadequate but for many valves, this insulation will withstand up to 250V so this point will often not arise. Battery operation of the heater is quite feasible for the short periods for which the instrument will be used or a separate small heater transformer could be used.

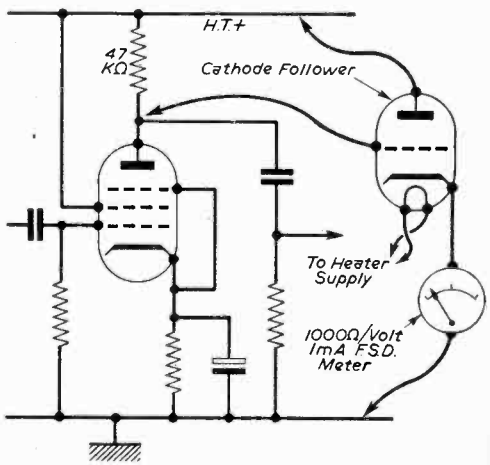


Fig. 2.—Using the cathode follower voltmeter for reading an anode voltage.

...er By J. COOPER

OF LOW SENSITIVITY

Circuits using valves of different heater ratings may require checking. Battery or separate transformer operation is again the answer.

Choice of Valve

If the valve curves are available, the performance of the circuit with any meter can be checked easily by the usual load line construction. If, however, only a fixed set of operating conditions are given, an approximation to the error curves can be drawn.

The formulae for this purpose are:—

Maximum Error = (V/μ) volts.

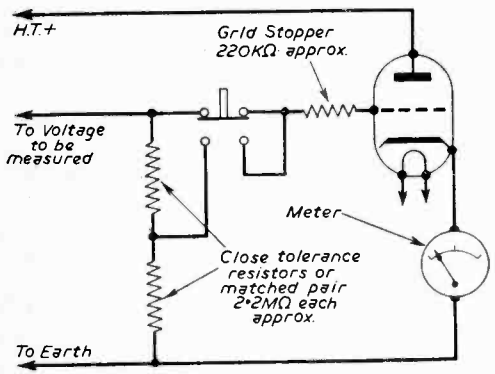


Fig. 4.—A suitable circuit for the cathode follower voltmeter.

$$\text{Maximum meter reading} = \left\{\frac{V}{(1 + ra/Rm)}\right\} \text{Volts.}$$

Where V = H.T. supply voltage.
μ = Amplification factor of valve
a = Anode resistors of valve in ohms
(Quoted in operating conditions)
Rm = Meter resistance in ohms.

To show the use of these formulae, it will be assumed that ½ 12AT7 is being considered for use with a meter of 200Ω/V (5mA f.s.d.) and an H.T. supply of 300V, the meter range being 250V. Firstly, two axes should be drawn on the graph paper as in Fig. 5. Now the maximum error should be worked out. In the case considered, a value of 55 is quoted for μ.

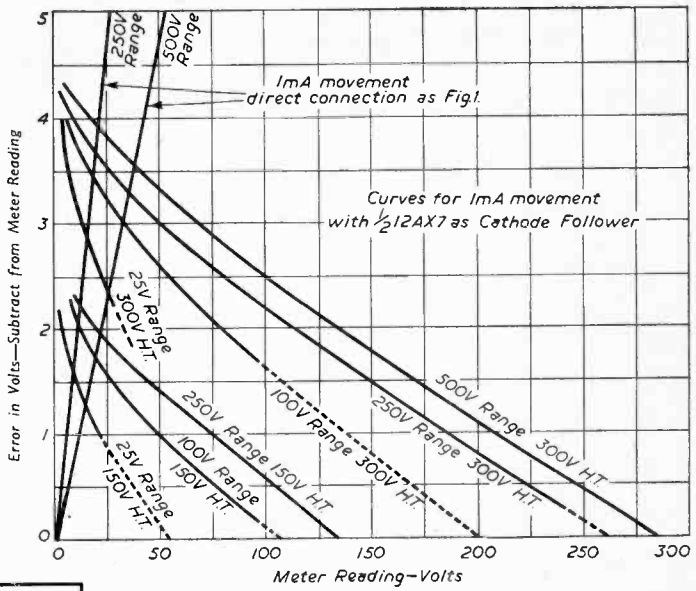


Fig. 3.—Error curves corresponding to the connections in Figs. 1 and 2.

∴ Max. Error = 300/55 = 5.5V.

This value of 5.5V should be marked on the error axis—point A in Fig. 5.

To find the maximum meter reading requires ra which is given as 10,000Ω and Rm.

Rm = 250V × 200Ω/V.
= 50,000Ω.

Thus, max. meter reading =

$$\frac{300}{1 + (10.000/50.000)} = \frac{300}{1.2} = 250\text{V}.$$

A point should then be marked at 250V on the meter reading axis (point 'B' in Fig. 5). Then join these points by a straight line.

(Continued on page 380)

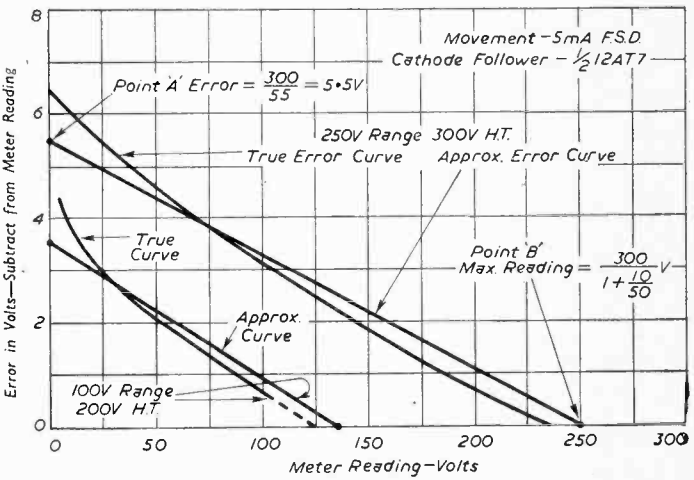
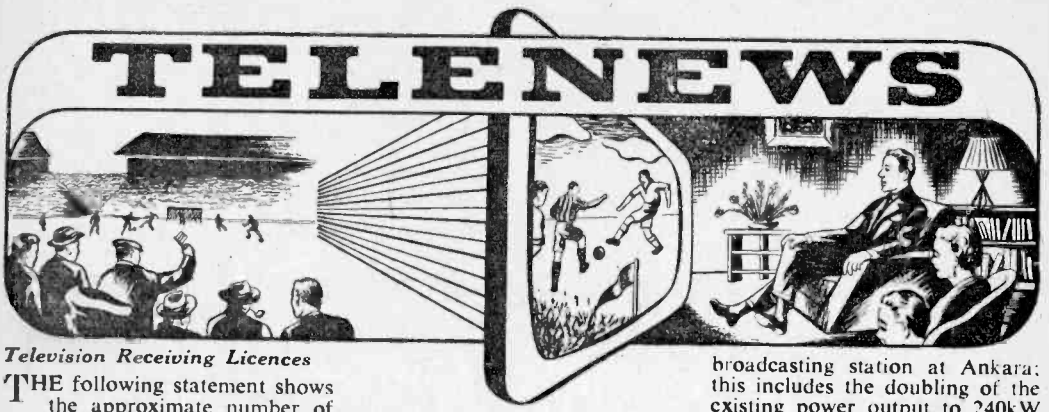


Fig. 5.—Comparison of approximate method and true error.



Television Receiving Licences

THE following statement shows the approximate number of Television Receiving Licences in force at the end of January 1960 in respect of television receiving stations situated within the various Postal Regions of England, Wales, Scotland and Northern Ireland.

Region	*Total*
London Postal	1,773,249
Home Counties	1,370,459
Midland	1,557,496
North Eastern	1,672,193
North Western	1,368,563
South Western	856,502
Wales and Border Counties ..	612,711
Total England and Wales ..	9,211,173
Scotland	872,089
Northern Ireland	136,605
Grand Total	10,219,867

International Festival

THE Swiss television network has now given its full support to the world's first International Festival of Television Arts and Sciences. Announcement of this official backing was made by Mr. Edward Haas, Director of the Swiss Television Authority. He said the network would sponsor the International Festival to be held at Montreux during the second half of May next year, and disclosed that governmental and independent networks from Africa, Asia, Britain, the Commonwealth countries, Europe, the Middle East, Russia, Latin America and the United States have been asked to participate. The first British network to express its interest is ABC Television. Other Networks from Australia, Argentine, France, Germany, Holland, Mexico, Russia, Britain and America are now also in touch with Montreux. The idea of the Festival was first proposed by the Montreux City Council some months ago and was originally scheduled for May this year. Because of the tremendous interest aroused, it has been postponed to permit maximum world participation.

Amateur TV Convention

THE fifth Amateur Television Convention, organised by the British Amateur Television Club, will be held on Saturday, 10th September 1960, in the Conway Hall, London, W.C.1.

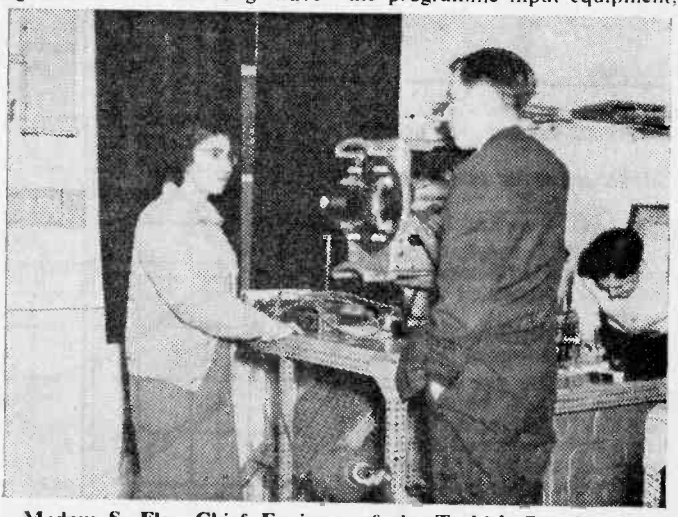
Contract

MADAME S. EKE, Chief Engineer of the Turkish Broadcasting Administration, recently paid a visit to the Marconi Company's Chelmsford Works. Marconi's are currently engaged in fulfilling a £1,000,000 contract for the complete re-organisation of the long wave broadcasting station at Ankara; this includes the doubling of the existing power output to 240kW and a considerable extension of the existing studio and control facilities.

ITA's Dover Station

THE Independent Television Authority's transmitting station at Dover, which came into full programme service on 31st January serves a population of approximately one million. The service area covers those parts of Kent and Sussex which are bounded by Folkestone, Dover, Margate, Chatham, Tunbridge Wells and Eastbourne.

Marconi's Wireless Telegraph Co. Ltd. have been responsible for the supply and installation of the transmitters, the combining units, the paralleling equipment, the programme input equipment,



Madam S. Eke, Chief Engineer of the Turkish Broadcasting Administration recently paid a visit to Marconi's Chelmsford Works. Here she is seen discussing the latest Marconi television camera, the Mark IV, with Mr. A. G. Husselbury of Broadcasting Division.

the control desk, the flying spot caption scanner and test equipment.

The two Band III vision transmitters are each of 4kW peak output power whilst the two sound transmitters each have an output of 1kW. Provision has been made at the Dover station for parallel operation should this ever be required, but it is the present intention of the Authority to use one vision and one sound transmitter only for the programme service, with the other two as 'stand by'.

The transmission is vertically polarised, with an effective radiated (vision) power of 100kW in the direction of maximum propagation. The station operates in Channel 10, the vision signals being radiated on a frequency of 199·7135Mc/s and sound on 196·1985Mc/s.

New British Standard

Fixed ceramic-dielectric capacitors Grade 1 for use in telecommunication and allied electronic equipment (B.S. 2133A: 1960) Grade 1 General requirements and tests.

THIS new publication specifies general requirements and tests for fixed ceramic-dielectric capacitors, Grade 1, for use in telecommunication and allied electronic equipment.

The capacitors are suitable for use in tuned circuits or in any other application where low loss and stability of capacitance are essential. They are for radio-frequency currents not exceeding 1A or a reactive power not exceeding 200VAr and having a nominal temperature co-efficient not exceeding 1500 parts per million. They are not intended for radio interference suppression nor for isolation purposes in telecommunication equipment. (Capacitors for these applications are dealt with in B.S. 613 and B.S. 415, respectively).

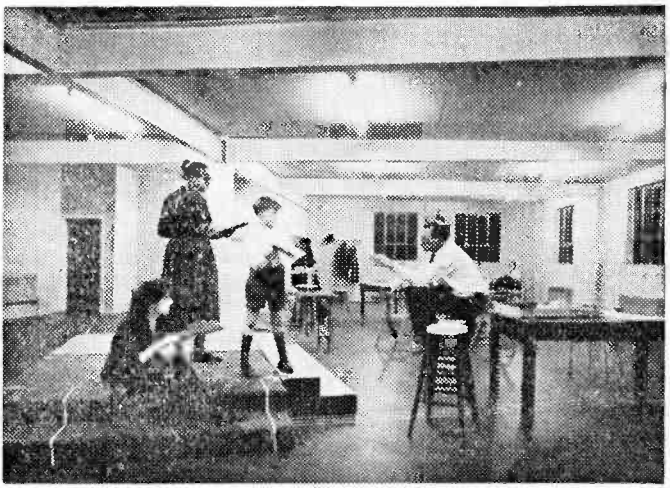
Part 1 includes a series of mechanical robustness and climatic and durability tests for the capacitors together with colour codes for indicating capacitance value, tolerance and temperature co-efficient.

Part 2 of B.S. 2133A, comprising a list of standard sizes, ratings, etc., for these capacitors, will be published in due course.

Copies of this Standard may be obtained from the British Standards Institution, Sales Branch, 2 Park Street, London W.1. Price 12s. 6d. (Postage will be charged extra to non-subscribers.)

Rehearsal Rooms

GRANADA TV's new rehearsal rooms at the Oval, London, are now in use for the first time. The illustration below shows leading members of the cast of "Member of the Wedding" —which was transmitted on Tuesday, 16 February—rehearsing a scene under the direction of Julian Amyes. They are (left to right) Frances Guka, Vinette Carroll and Dennis Waterman. Granada Group Ltd., has acquired the lease of a former factory building at the Oval. It has a total floor space of 2,000sq. ft. and is being converted and modernised at a cost of £25,000. The building is designed as a central depot for servicing more than fifty Granada theatres in London and the Home Counties. It will also provide additional facilities—including the rehearsal rooms for Granada's television operations.



Granada TV's new rehearsal rooms at the Oval, London. This illustration shows leading members of the cast of the play "Member of the Wedding", rehearsing a scene under the direction of Julian Amyes.

TV Unit for Hungary

AN order has been received from Elektroimpex, Budapest, on behalf of the Hungarian Broadcasting Authority by E.M.I. Electronics Ltd., for one of the Company's latest Outside Broadcast Units. The vehicle, which will be used for televising outdoor events from all over Hungary, will be equipped with four of the latest E.M.I. Image Orthicon Cameras and a zoom lens. The cameras can be fitted with either 3in. or 4½in. Image Orthicon pick-up tubes. In this case, they will use 4½in. tubes, which can easily be replaced through the lens turret, without opening the side panels of the camera. Four video outputs and four sound outputs from the vehicle are provided to make it possible to distribute signals independently to four monitors, when the vehicle is used as the control room for a Television Studio.

Another interesting feature is the provision of a special position in the Unit for a "Production Chief Engineer". Besides inspecting the picture quality of all four camera channels, he can check the output of a microwave link, the picture received by the off-air monitoring receiver and one external video source.

BBC Appointment

THE BBC has announced the appointment of Mr. W. L. Nicoll, A.M.I.E.E., as Engineer-in-Charge of the Kirk o' Shotts Television and VHF sound broadcasting station in succession to the late Mr. J. Cleland. Mr. Nicoll joined the Corporation in 1937 as a maintenance engineer at the Burghead transmitting station. He has held the post of Assistant Engineer-in-Charge of the Kirk o' Shotts station since it was opened in March 1952.

Make Your Own Abacs

SIMPLIFY RESISTOR CALCULATIONS

By T. Pickering

MOST amateur wireless enthusiasts use abacs at some time during their career, but how many of them are able to construct their own? Very few, probably, because abacs (or nomagram) theory is rather complicated and many amateurs have neither the time nor the inclination to master it. For this reason a simple, straight-forward method is given below for one commonly used type of abac.

Equations

The abac to be described will solve equations such as $y = k.x_1^a.x_2^b \ldots\ldots, x_n^i$, where x_1, x_2 etc., are variables and k, a, b, etc., are constants. This may look rather formidable at first sight, but a familiar example is the expression of Ohm's Law i.e. voltage = current x resistance or, $E = IR$. In this case, comparing the expression for Ohm's Law with the general equation given above, $y = E$, $x_1 = R$, $x_2 = I$ and k, a and b are all equal to one.

To illustrate the principle of construction, an abac will be made to solve Ohm's Law. This will be very handy when resistor values have to be calculated, as once constructed, it is there for good and tedious calculations are eliminated. The materials required in its construction are some tracing paper (or similar semi-transparent paper), a slide rule or semilog paper and a little patience.

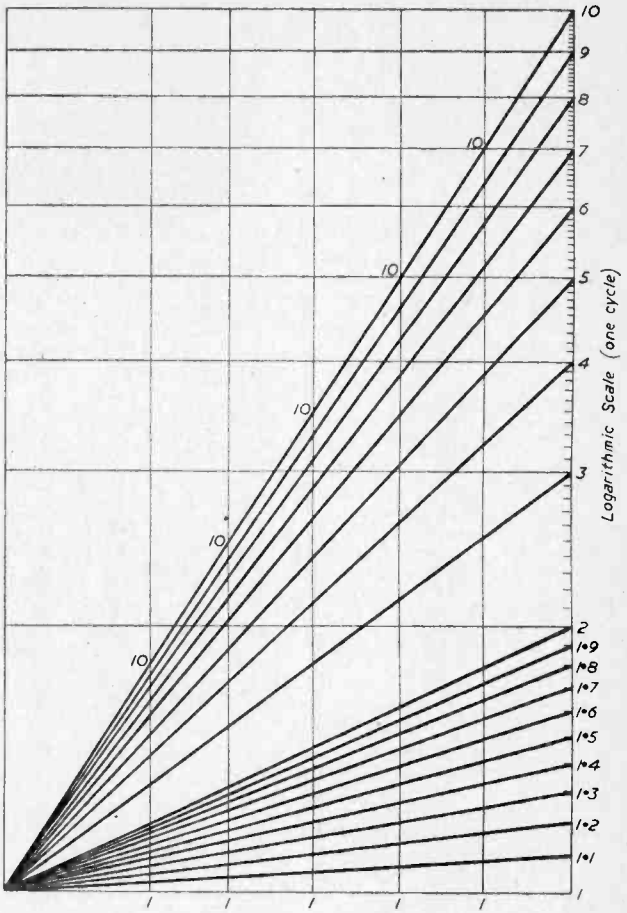


Fig. 1.—Drawing the modulus chart.

Procedure

The procedure is as follows; first draw up a modulus chart as shown in Fig. 1, using the semilog paper or the centre portion of a five inch or ten inch slide rule to mark off on tracing paper a one-cycle log scale. Draw two lines like this spaced about six inches apart. Number from one to ten then join the numbers with horizontal lines as shown. Then, starting at 1 in the bottom left-hand corner, draw a line connecting 10 in the top right-hand corner, then 1 to 9, 1 to 8 and so on down to 2. The space between 1 and 2 should then be marked off as shown or, preferably, the whole thing re-drawn up to the horizontal lines and then each whole number space subdivided as illustrated in the space between 1 and 2. When the modulus chart (or charts) is completed, the abac can be commenced.

On a sheet of tracing paper draw two vertical lines a few inches apart. Using the modulus chart of Fig. 1, mark off suitable set of values on the left-hand vertical line as shown in Fig. 2 on the lines marked "milliamps". On the scale in Fig. 2, one and a half cycles has been used. This was done by using one of the smaller scales on the modulus chart and half repeating it. On the right-hand vertical line mark off a set of values for voltage as in Fig. 2. (Note that this is also a small cycle repeated three times *but in the reverse direction.*) The reason for this is that the equation being solved is another equivalent of Ohm's Law, $R = E/I$ or $R = EI^{-1}$, where I has a negative exponent so that one of the lines (it is immaterial which one) has to be marked off in the reverse direction.

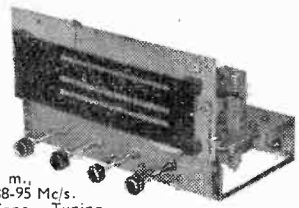
Second Scale

The second modulus chart or the portion of Fig. 1 which has been subdivided (between 1 and 2) may now be used to subdivide the larger spaces on the current and voltage lines. This is most easily carried out by placing the abac over the modulus chart and moving it so that the ten-line

7-VALVE AM/FM RADIOGRAM CHASSIS

TRS

Valve Line up: ECC85, ECH81, EF89, EABC80, EL84, EM81, EZ80.



3 waveband and switched gram positions. Med. 200 m.-500 m., Long 1,000 m.-2,000 m., VHF/FM 88-95 Mc/s.
4 Controls. Vol., On-off, Tone, Tuning. Wavechange. P.U., Ae. and E., and speaker sockets. Magic eye tuning. Philips continental tuning insert with permeability tuning on FM, and combined AM/FM IF transformers, 460 Kc/s and 10.7 Mc/s. Dust core tuning all coils. Latest circuitry, including AVC and Neg. Feedback. 3 watt output. Sensitivity and reproduction of a very high standard. Chassis size 13½in. x 6½in. Height 7½in. Edge illuminated glass dial 11½in. x 3½in. Vertical pointer, Horizontal station names, gold on brown background. A.C. 200/250 v. operation.

£13.10.0 *Carr. and Ins. 5/-. Complete with 4 knobs walnut or ivory to choice*

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14in.	£7	21in.	£10.10.0
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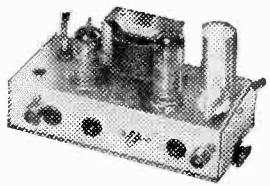

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(87-105 Mc/s)

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50 yards Thornton Heath Station. Buses: 130A, 133, 159, 166 and 190

subdivision just fills one space on the current line, then mark off the subdivisions where they cross the current line. Do the same with each space on current and voltage lines until the spaces become too small to subdivide into ten, then mark off as a half-space (i.e., divide into two instead of ten).

Resistance Scale

When current and voltage spaces are completed, the position of the resistance scale must be determined this must lie between and parallel to the current and voltage scales. In order to do this it is best to use one fixed resistance (say 1k) and remembering that 1A = 1000mA, then 100V/100mA = 1k. Take a ruler and lay it across the current and voltages scales at 100mA and 100V (line 1, Fig. 2) and join the two points. The resistance scale must lie somewhere on this line. Since 50V divided by 50mA also equals 1k, another line (line 2, Fig. 2) drawn from 50mA to 50V will intersect the first line at a point through which the resistance scale passes. To make certain, 10V divided by 10mA equals 1k, so draw a further line between 10mA and 10V and this, again should intersect the first two lines (line 3, Fig. 2). At the intersection of these three lines, draw another line which is vertical and therefore parallel to the current and voltage lines, and this is the line on which resistances are to be marked off.

Having fixed the scale at 1k, the 100Ω mark may be fixed by joining 100mA and 10V (line 4, Fig. 2), since 10V divided by 100mA = 100Ω. Further points may be fixed by lines 5, 6 and 7 (Fig. 2) as shown. It will be noticed that all these cycles are the same length, so all that is now necessary to complete the abac is to determine the points on *one* cycle, then trace them and mark off on the others. This may be done quite easily as 4V divided by 200mA = 20Ω, 6V divided by 200mA = 30Ω, and so on for a complete cycle.

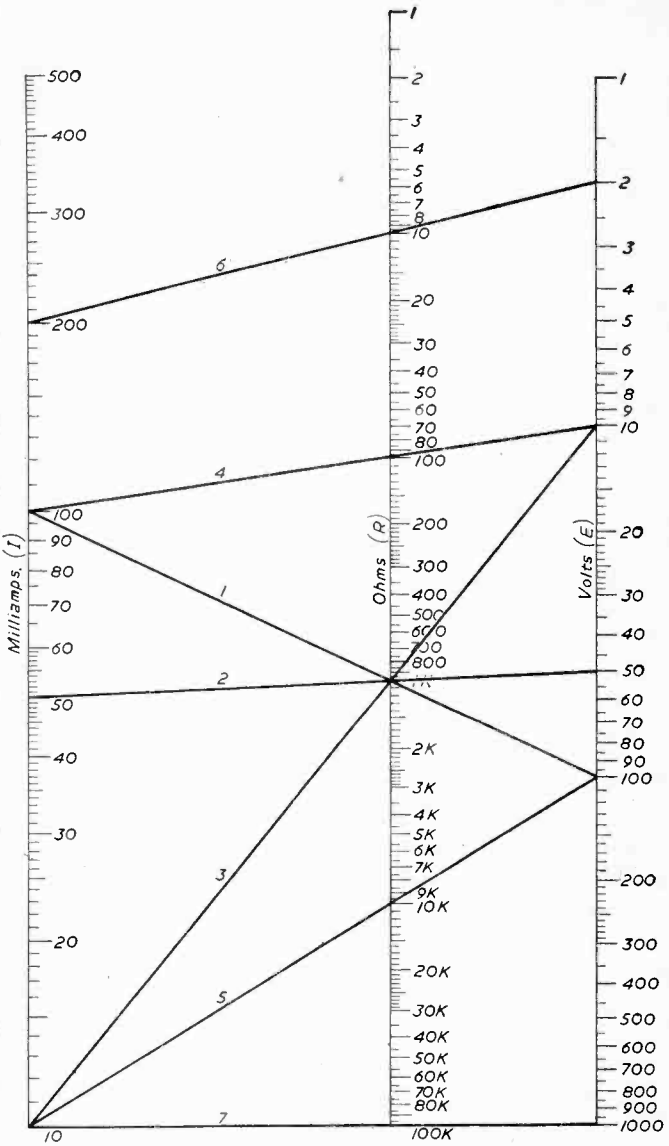


Fig. 2.—An abac for Ohm's Law.

Uses

The use of the abac, of course, should by now be fairly familiar, as it has been used to determine several points on the resistance scale. It may be used to calculate current, voltage or resistance, providing that any two of the three values are known, e.g., if the voltage drop across a resistance of 300Ω with a current of 90mA flowing is required, simply place a ruler or straight-edge on 90 on the milliamp scale and 300 on the resistance scale and read off the result on the voltage scale, i.e. 27V. Similarly, knowing that the P.D. across a 1½k resistor is 60V, the current passing may be obtained by placing a straight-edge at 60 on the voltage scale, 1.5 on the kilohm scale and reading the result (40mA) on the current scale.

It may be found convenient to mark off the current scale in milliamps on one side and amps on the other as can be seen in Fig. 3. This will save time and avoid errors in converting from one to the other. One further abac will be described employing exactly the same technique as before, since Watts = Volts × Amps, two of the scales have been used in the first abac and it is only necessary to trace them on to another sheet of paper. Notice, however, that this time neither scale is reversed.

Power Scale

To find the position of the power (i.e. Watts) scale, proceed as before by using a constant value of Watts, ten being convenient. Now 100V × 100mA = 10W, so draw a line (line 1, Fig. 3) from 100 on the voltage line to 100mA (0.10A) on the current scale and follow this with a line from 200mA to 50V, 250mA to 40V and the intersection of these lines (1, 2 and 3, Fig. 3) fixes the position of the wattage scale. Draw a vertical line through this and draw lines 4, 5 and 6 (Fig. 3) which intersect the scale at 1, 0.1 and 100W respectively. As in Fig. 2 it will been seen that the cycles are all of equal length, so that fixing the graduations of one automatically fixes them all. Thus 100mA × 90V = 9W, 100mA × 80V = 8W, 100mA × 70V = 7W, and so on. The lower (decimal) scale of watts may be marked off on the other side as its equivalents in milliwatts, which again will be found rather convenient.

The use of the abac is similar to the previous one: providing any two of the three variables are known, the unknown may be found. It may, for instance, be used for calculating resistor ratings, e.g., if a resistor has a P.D. of 80V across it and a current of 0.025A (25mA) is passing through it, what should the minimum rating of the resistor be? Lay a straight-edge across 80 on the voltage scale and 25 on the milliamp scale and read off the answer, 2W on the wattage scale.

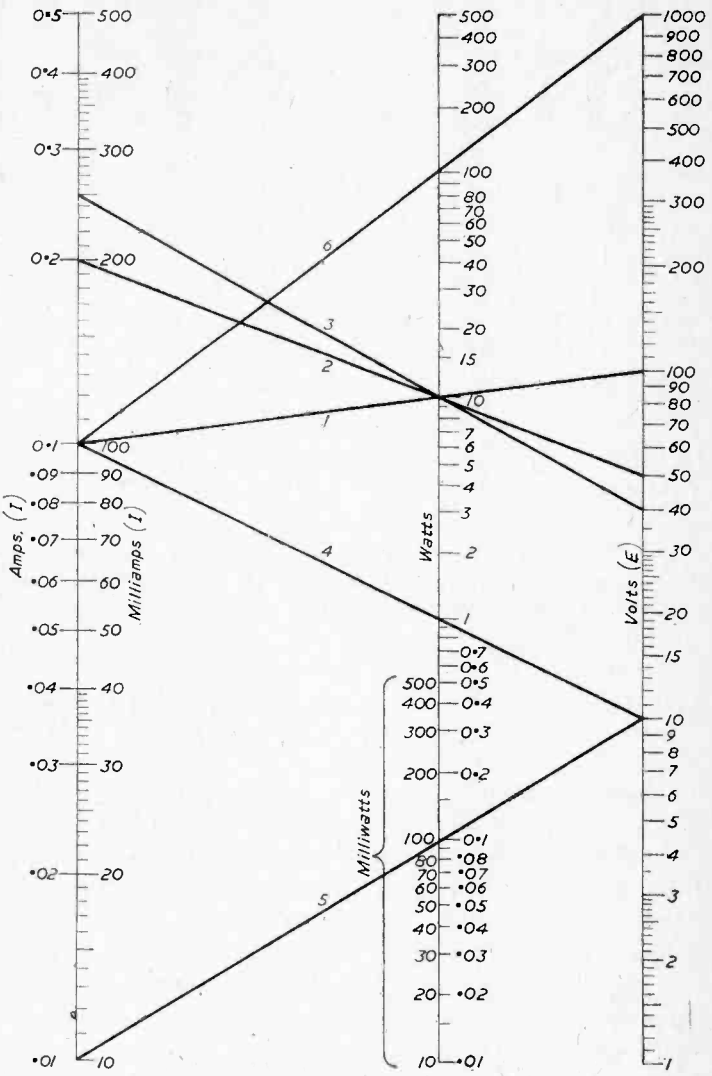


Fig. 3.—An abac for power dissipation.

TWO INTO ONE—2

(Continued from page 352)

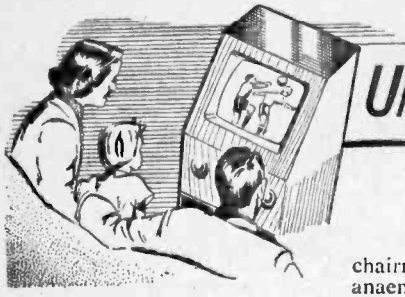
Further Procedure

It may happen that a fault not covered in the article may develop. All the faults that may occur could not possibly be covered and if you need advice, write in (observing the Query rules). May I advise, however, that it is much better for you to try and locate the fault yourself. By this means you will teach yourself more than many articles can tell you. In making application for assistance, please state as briefly as possible the stage you have reached, and the snag encountered. Do not forget to give the maker's name and the model number of the set.

Should you succeed in making one of these two sets work both on sound and vision, you can now teach yourself quite a lot as regards faults and their symptoms. Try altering valves of resistors and also capacitors. Make a note of the effect on either vision or sound. Do not expect though, that a certain symptom is always the result of one certain fault. You will find after a short experience, that two or even three different faults will cause apparently the same symptom.

A Final Warning

Please remember the warnings given in Part 1 of this article about the danger of high voltages on a television receiver. Remember that if these receivers are A.C./D.C. the chassis may be alive to the mains voltage. If using screwdrivers, use only those with well insulated handles.



UNDERNEATH THE DIPOLE

A MONTHLY COMMENTARY

By Iconos

"Down-beat" BBC TV?

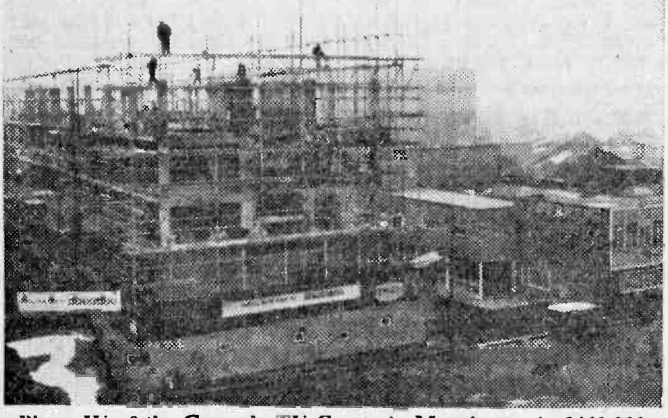
WHAT has been happening lately to the dignified BBC television service? Why have its standards of good taste been lowered in so many programmes, particularly those of the "interview" type? Who has changed the policy of competition with ITV from a defensive one into an offensive one—in more senses than one? Why have the pleasant slightly pompous and smiling announcers become aggressive, and why have new recruits to the ranks of their interviewers included ill-mannered angry young men who provoke their victims in front of the TV camera and embarrass the viewers sitting in front of their sets? These are queries which have puzzled many viewers lately and have formed a topic of conversation on the 8.20 a.m. train to town. Even Granada's "Under Fire", notorious for the truculence of chairman and audience, appears anaemic by comparison with the bad manners of the BBC's angry boys. Worse still is the growing "down-beat" flavour of some of the BBC documentary programmes, which seem to be always ready to give maximum prominence to the views and opinions of none-too-friendly nations. In fact, there have been occasions when I have felt that the great Corporation might well have added the prefix "Anti-" to its honoured title.

Sour Grapes

"Panorama" has always been considered to be a first-class piece of television journalism. It is still first-class, but it is no longer high-class. In an effort to become contemporary, provocative and lively, some of its items have become merely sour. Naturally, the lower journalistic standards may attract more viewers, even if it does not please them. There are various degrees of mud-slinging, third degrees and candid interviews, but none of them are very elevating or constructive.

Ulster and Anglia

I HAVE visited several of the ITA's regional stations, the most recent visits being to the Belfast studios of Ulster Television and the Norwich television centre of Anglia. Belfast studios are a compact and very well devised conversion of factory buildings, with a small stage and an excellently laid out technical area and master control. Cameras in the studio are of the vidicon type, requiring more light than image orthicon cameras, but giving particularly pleasing results on close-ups. By contrast, the network vision pictures looked harsh and contrasty to me, after their long journey up the lines and microwave links from London. Local programmes are still on a modest scale, yet the small stage is very fully utilised and it can't be long before a second stage will be needed. By comparison, Anglia's Norwich studio seemed lavish, with an immense Master Control Room, four flying spot telecines, a three-camera O.B. truck and an elaborate tape operated programme switching and indicating equipment, known as "TOPSIE". Here, like Ulster, the technical equipment has been most efficiently laid out, though everything is naturally on a bigger scale to cope with a much larger local programme schedule. The conversion of the old Agricultural Hall premises into a television centre has been done very well indeed, and no attempt has been made to patch any modern embellishments on to the exterior of this eighty years old building of the Alexandra Palace type of architecture. The interior decor has a dignified modern appearance which blends surprisingly well with the elaborate decorative patterns of the original ironwork supporting the roof. Full marks for all concerned with



Phase IV of the Granada TV Centre in Manchester (a £460,000 ten-storey office building) is now being built. The new building, which will be linked with the existing television studios, control rooms, technical departments and offices, is expected to take 20 months to complete.

the planning and design of both Ulster and Anglia stations!

Image Orthicons Galore

While in East Anglia, I took the opportunity of visiting the great Marconi works at Chelmsford and was privileged to see some of the latest types of studio cameras and ancillary equipment being tested. Dozens of the new lightweight Mark IV image orthicon TV cameras were coming off the assembly line for delivery in all parts of the world. The English Electric 4½in. image orthicon camera tube is used in these cameras, which have been found superior to the American 3in. camera tube, even by the Americans themselves! I was able to see the prototype of a most ingenious automatic slide changing apparatus, part of the latest Marconi vidicon telecine equipment. The sound side of television had not been neglected. There was a most elaborate 18 channel sound mixer with quadrant faders—an ultra-modern version of the BBC's original dramatic control panel. Very great improvements have been made in the sound equipment, including provision of compressor amplifiers, so necessary in these days of "naturalistic" dialogue, throw-away lines and end syllables dropped by the actors. It was disillusioning to think of the degradation sound will subsequently receive on so many modern television receivers, with tiny little loud speakers fitted in the side or the back.

Spot Wobble

THE better the picture at the transmitting end, as seen on high-class monitors, the more conscious one is of the degradation it receives at the receiving end, by maladjustment or by poor design. Unfortunately, it is true to say that probably the most important selling point of a television receiver is the styling of the cabinet. Two or three years ago, one mass-production set manufacturer turned out a fine console set which included spot-wobble, to reduce the visability of the lines on the picture. This device is no longer available on the same maker's current sets—and I haven't yet found the reason why. It is true that spot-wobble is not always successful in areas where aerials are grouped together on roofs, due to interference effects. In such circumstances, the resultant picture becomes broken up by a tweedy kind of interference pattern, which disappears when the spot-wobble device is switched off. But where there is no such interference, spot-wobble improves the quality of a picture very considerably. I hope some enterprising makers will revive the use of this worthwhile refinement.

The Church on TV

THERE have been many fine live outside television broadcasts from cathedrals and churches during the last few years, particularly from the BBC. Probably the best and most moving outside broadcast of this type from an ITA contractor was made by Anglia, quite recently, when this regional station taped the solemn ceremony in Norwich Cathedral of the enthronement of Rt. Rev. William Scott Fleming as the 68th Bishop of Norwich. The impressive dignity of the ancient ritual, the wonderful sounds of the choir and the R.A.F. trumpeters and also the interpolated shots of the huge congregation, were skilfully picked up by the Anglia cameras. I saw a replay of the Ampex tape on closed circuit during my recent Norwich visit and was particularly impressed with the quite thrilling and delicate handling by the Anglia producer, Geoff Rimmer. Anglia are particularly well equipped with Ampex, two fixed equipments being set up in the very large master control room. Ampex taping is no longer regarded as an expensive luxury—it has become a "must" for all stations. Japan has just produced its own video tape recorder, working on an entirely different system—not just the usual Japanese copy. But I have the feeling that the Ampex standards are now so firmly established that there is little likelihood of alternative methods being generally accepted.

Production Grammar

MANY years ago, in the days of the silent films, a primer on film production techniques was written by a film producer, L. C. McBean. Mr. McBean died some years ago. His films are forgotten. The silent film has become a talkie, with colour, cinemascope and all the gimmicks. But though techniques have progressed and changed, the McBean book is still a valuable reference work for all the elements of kinematography, especially of trick photographic work. The equivalent primer for television production has now appeared — "The Grammar of Television Production" by Desmond Davis, a front-rank television director who recently died. This work was sponsored by the Guild of Television Producers and Directors and is profusely illustrated with sketches and diagrams. Like McBean's primer, it is a reference book which should be studied by all producers, directors, lighting men and engineers connected with television. Certain parts of it should even be learnt off by heart, especially the fundamental principles of reaction shots and camera angles. Would-be script writers should keep it always at their bedside, for constant consultation.

Letters to the Editor

The Editor does not necessarily agree with the opinions expressed by his correspondents.

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

TRENDS IN TV DESIGN

SIR,—There is one point I should like to make about a recent article and a letter in reply published in the December issue. Whilst it is true that the controls may be dispensed with—a fact which would probably lead to better reception and fewer trips to the serviceman—certain items are essential for ideal reception. Granted that if these are provided the customer will try and find a better setting, but why not fit them underneath the chassis, say, mounted on brackets or a strip of insulating material. All such variables should, in my opinion, be so placed, and then the serviceman could find the best setting, by using a proper television servicing instrument, and the customer could not get at them without taking the chassis out of the case, and I think this would be a suitable deterrent.—H. R. MALIN (S.E.1).

625 LINE DEFINITION

SIR,—I am fully sympathetic with Mr. Jenkins in his problem set out in the January issue. I, too, want to experiment and try and find an arrangement which I can adopt when (and if) the new definition starts up. Unfortunately, there are no transmissions on which one can experiment. I believe Band IV and V transmissions have taken place, which gave some an opportunity of trying out tuners, but why cannot the BBC or ITV give us some high definition pictures on the vacant Saturday morning period? I think that if the BBC can spare the transmitter for stereo experiments, they must surely be able to spare it for high definition transmissions which I think are very much more important, as stereo may come eventually but will not use two transmitters.—F. L. KERRISON (Ramsgate).

SYNC SEPARATION

SIR,— I recently had a fault which caused much comment and hours of fault finding, but which eventually turned out to be a simple matter to cure. I would like to pass on the hint in case other readers may be similarly placed. The trouble was poor frame hold. Line seemed to lock perfectly, but the frame would periodically slip, sometimes locking with a bar across the centre of the picture. The power supply was provided with improved smoothing, and everything was checked, even to the extent of replacing the valves and components in the clipper and oscillator stages, but still the trouble persisted. One night, whilst adjusting the signal strength I noted that a reduction of signal caused the slip, but at the strongest position, the hold was best. This made me think that the sync separator might be at fault, and this was checked. To cut a long story short, it was finally found that the grid leak from the sync separator to earth was open-circuited. The wire end was detached *inside* the moulded component and could be pulled without coming adrift, but enabled the resistor to be rotated about the wire. Replacement of this cured the trouble.—R. MURRAY (Belfast).

CRITICAL LINE LOCK

SIR,—In "Your Problems Solved" in the February issue a reader described the fault of critical line hold with a shift to the right in a Cossor 946. Having cured this fault in a set recently I am in a position to give advice. If, after replacing the 12AU7, and the 6AB8, there is no cure I suggest the replacement of C47 which has a value of 0·002μF. This is a cathode bypass capacitor of the 12AU7 line multivibrator. In my particular set this capacitor varied with the temperature and caused lateral picture shift.—S. WITTON (Buckingham).

AN ACORN VALVE TV BOOSTER

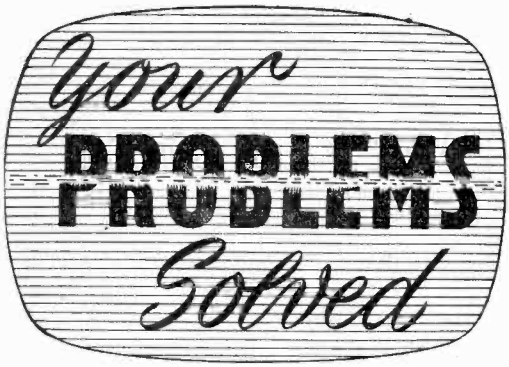
SIR,—In your January issue you gave a constructional article on the above and in the list of parts there is a small slip. There are three condensers used in this and they are all 0·01μF, but not 25VW as given. They should, of course, be 250VW.—F. TREEBY (Eastbourne).

LENGTHENING TUBE LIFE

SIR,—I was recently given, in all good faith, a "tip" which may eventually reach other viewers. I was told that by turning round my tube at monthly intervals, the scanning would come at a different place on the screen, and thereby give prolonged life to the tube. Surely, this is a fallacy. It might prevent a residual spot from appearing always in the same place and thus prevent a burn, but with modern tubes provided with an ion trap, I fail to see how rotation of the tube can have any effects whatsoever. It will, of course necessitate readjusting the scanning coil unit, and any magnets fitted to the tube.—K. L. PEARSON (Tiverton).

TV SCOPE

SIR,—I believe I have read somewhere that it is possible to use a television receiver as an oscilloscope. The idea is that the timebases are altered slightly and the modulation of the signal is removed, with the result that one can obtain a series of waveforms on the tube, not only of the signal with and without sync but also of the response curves of the tuned circuits. If this is practicable, I wonder if any reader can provide the necessary data.—E. W. GIRLING (Portsmouth).



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

FERGUSON 992

This set has been converted to ITA with the makers' own converter type "A". The BBC is perfect but I cannot get sound or vision on ITA. When a probe is placed on L2 of the converter heavy 'mush' results on sound and vision. There is no response whatever when tuning pedals are pressed. All valves have been checked by substitution. The gain control is in order but valve voltages are not stated on the service sheet. Is it possible that the oscillator is not working? When the switch on the converter is turned, usual loud clicks and flashes on the screen are evident. —F. Johnson (London S.W.6).

It would appear that the oscillator stage is not working although a defective aerial or aerial plug could give rise to similar symptoms. We mention this since the probe at L2 does promote "mush." The suspects are the 8.2k triode anode feed receiver, its 800pF decoupling capacitor and the grid components. Upon inspection it may be found that the 8.2k resistor is overheating owing to the capacitor having developed a short circuit.

PHILLIPS MODEL 1115U:15

I cannot receive either vision or sound. Could you please tell me where to look? The tube shows a raster.—E. Mitchell (Ripon).

The fault will be located on the front of the right side R.F. chassis. Check first the two EF80 valves on the front left side of this chassis and the components associated with them. See that the coil cans are properly fitted.

ENGLISH ELECTRIC TV63 3360M

I get a fairly good picture on this receiver, but only about three-quarter size. If I try to get it larger it goes out of focus. I have renewed the SU25 and the 185 BTA in the cage. I am unable to get a service sheet to help me to check H.T. voltages. If you can suggest the parts most likely at fault will you please state their positions in the set. Another thing that may have some bearing on the fault is I get a light flick on the screen about 6in. from the top every few seconds—something like car interference, but much too slow for that.—W. Ayre (Kettering).

You should replace the metal rectifier situated in the centre of the lower pack chassis. Check the 185BT frame output valve on the front left side.

MURPHY V216C

There are striations on the left hand side of the picture; line output valve (20P4) appears to be glowing blue and the cathode is glowing red. I would be grateful if you could tell me if the CRM153 tube has an equivalent or if it could be replaced by any other make. If so, what modifications would be necessary.—S. Bryant (Weybridge, Surrey).

Although the striations are often due to a faulty 20P4 they may also be caused by a faulty 4.7k resistor which is wired across one half of the width control and is located on the adjacent tagstrip. There is no direct equivalent for the CRM153.

ULTRA VT917

The trouble began with a short between chassis and voltage adjustment. It blew the fuses and I have not been able to obtain EHT since. I have replaced U25, and all valves light up except U25. Sound is OK. Could you tell me the damage and what extent has been caused, and how to put this right.—G. K. Southwick (Brierley Hill, Staffs).

There is no reason why a short from the voltage adjustment to chassis should cause a loss of EHT. You must assume that this is a separate fault. First check the H.T. from the U801. If low, check U801 and its surge resistors, 100 ohms each. If the H.T. is in order check 20P4 and U329 valves on right side and all associated components. Check voltages: 20P4—pin 4, 125V, pin 8 10V, boosted H.T. 450V.

DEFIANT TR1252:TA

The tube is soft, and I am going to replace it with a new one, but could you tell me if it will take a larger tube? Will it take a turret tuner, or will it need one that runs off the mains, for converting to ITA Channel 8 and BBC Channel 5?—R. E. Perrett (Peterlee).

Although the CRM152a 15in. is strictly speaking a wide-angle tube, the deflection angle is only 67 deg., and the existing scanning circuits should be able to fill it. A duodecal base is required. A turret tuner can be used and the Cyldon U1OL or Brayhead 10s (with "U" series valves) is recommended.

FERRANTI 14T3

The first problem is serious overheating of the line output valve PL81, which becomes almost red hot after a few minutes. When I remove anode cap of either PL81 or PY81 it cools immediately to normal. The EHT transformer had short to heater winding of EY51, but otherwise no faults, but I have ordered a new one.

Could you give me wiring details for transformer, also which one of two leads on the transformer tag board should go to PL81 and PY81? There is also a frame fault, causing fold-over at bottom and loss of height; height control is at limit.—G. Callin (Stirlingshire, Scotland).

Check 1.8kΩ resistor to pin 8 of the PL81. The heater winding of the EY51 could be hand wound with well-insulated wire, such as coaxial inner.

The L.O.T. should be numbered as follows: 6 to PL81 anode top cap; 5 to PY81 cathode top cap; 3 to scan coils, 0·5μF capacitor, 4·7MΩ resistor (to pin 10 of CRT), 15KΩ to 33kΩ (height circuit); 2 to resistors to horizontal holds; 1 to 22kΩ resistor to 4·7kΩ and P181 control grid.

K.B. CONSOLE KF40:F

I bought this TV with an o/c filament in C.R. tube. I had it rebuilt and fitted it myself but picture is very dim. I improved it by altering all the slugs in the coils and managed to get a fairly good picture, but if I turn up the brightness to get a good picture, it expands and the screen goes blank. Also when set for a good picture and a brighter scene is set on screen, the screen goes blank and I have to turn the brightness down again to get a picture. I have to keep on doing this during a programme, and also the focus is not very good.—E. Brookes (Castle Cary, Som).

You should replace the R12 (EHT rectifier) valve which is wired on the top of the line output transformer, which is situated inside the left side screened section.

The R12 (EY51) is soldered into position, and this soldering must be carefully done. No sharp ends or edges of solder must be left and the connecting wires must be kept short and direct.

H.M.V. 1807A

The fault is as follows, most of the time the picture is perfect, but suddenly the picture will go, leaving a blank screen but for a small amount of fluorescent light around the edge of the screen. This light is fluctuating as though it was rolling downwards. If I turn the brightness up, all signs of life leave the screen, and on turning brightness down as far as it will go, bright bands appear which roll downwards. They are quite bright.—J. Redmond (Blackheath, S.E.3).

The fault could be due to a heater-cathode short in the tube or perhaps in the video amplifier 277. It is always, however, good practice to replace the B36 valve, which often gives rise to misleading symptoms.

PHILLIPS PROJECTION TG 1800A:15

The picture has collapsed to a thin line across the screen. I cannot get height by adjusting the height or frame hold controls. What valve or component do you advise checking or replacing in the frame section? I have no service sheet for this receiver.—L. Blackburn (Oldham).

The first component we would advise you to check is the frame blocking oscillator transformer. This is a small black component with four tags, secured by two screws under the rear centre of the chassis. Check the continuity of each pair of tags: normally, one winding will be found open circuited. The thin line should not be observed on the screen unless the protection circuit is inoperative or the frame scanning coils are disconnected or defective. We presume, therefore, you have observed the line on the face of the actual tube.

MARCONIPHONE VT53DA

There are two distinct pictures with a black band down the middle.—F. Ellis (Criccieth, N. Wales).

You should change the B36 valve and check the 330k resistor situated on the small tag panel near the KT36 valve base. This resistor is connected to the horizontal hold control at one end, to the line blocking oscillator transformer at the other. Colours—orange, orange, yellow. You may find a 390k fitted (orange, white, yellow).

MURPHY 12 in. V118

The picture on the above set is good but when switching on with full volume the sound is very faint. After about 10 minutes it gradually becomes louder, it reaches maximum volume, which is quite loud, and then remains. One way to obtain full volume when switching on is to adjust what must be the oscillator screw, which stands proud through the frame on the right hand side of the set when viewed from the back. This unfortunately has the opposite effect because while getting full volume at the start it gradually gets fainter, until after about ten minutes again it is necessary to readjust the oscillator to obtain audible sound.—K. E. Frost (Walton-on-Thames).

Your fault is frequency drift in the local oscillator and we suggest you first try replacing the local oscillator valve, which is the 6F12 nearest to the oscillator tuner, and if not successful proceed to check by substitution the condensers and resistors in the associated circuit.

FERRANTI 17K3

When the picture is set, as I think, correctly there are about 12 vertical white bars through which the picture can be seen down the left-hand side. If I move the width control I can remove these, but then the picture is mis-shapen. Another fault is the top 3in. of the screen are elongated, giving an egg-like appearance to circular objects. I have replaced ECL80, PL81, PY81, but can see no visible improvement in either the height or width faults.—G. Metcalf (Mixenden, Halifax).

You should check the 6·8k resistor across the linearity coil and the 2·7k associated with the width coil. Check the setting of the vertical linearity control, the value of the 2·2M grid leak resistor of the ECL80, and the resistors associated with the linearity control.

PYE V4

For the last two years I have been feeding the heater of the tube, which was weak, or appeared so, with a 6V transformer. There is a fair picture but it is grey or blue, and if I advance the brilliance up too far the picture goes negative. Also if I increase the heater voltage to eight, after ten minutes the picture gradually shows only the whiteness till finally it disappears altogether, but on first giving it 8V it is a fairly good picture. I have to hand a Brimar tube type C14BM. Can I use this instead of the MW36-24? The only difference I can see myself is that the 36-24 is a tetrode and the C14BM a triode, in which case the screen pin would not be in use.—R. A. Demin (Ramsgate).

Two other difficulties that we can foresee are focussing and the ion trap. A triode tube needs a greater focusing field, but since the V4 magnet

is nearly always set at its minimum it should be able to cope. The ion trap will probably end up in the bakelite tube base, where its function will be that of coarse picture positioning.

KB MV100

This set is approximately 3½ years old and has just started to give me trouble. The picture broke up, giving poor linearity. The set now shows a ¼in. white line across the centre of the screen. I have replaced valves 6BW6 and 12AU7 with no effect, and checked PCCP4 and PFC82, which have been reported OK. The only exception being that the emission on PFC82 is down a bit. — G. Mason (Chesterfield).

You will have to check the 6BW6 valve base voltages, ensuring that H.T. is present at the anode and screen (if absent at anode only, suspect frame output transformer). Check the voltage at the cathode. The H.T. should be about 200V or more, cathode about 15V. Then check 6SN7GT as the blocking oscillator transformer may be o.c., resulting in no voltage being present at the triode anode.

FERGUSON 988T

The above set is for five channels, London, Holme Moss, Kirk O' Shotts, Wenvoe, and Sutton Coldfield. It is in perfect order and I am thinking of using it in the N.E. of England (Pontop Pike). Would I have any difficulty in tuning in the set to that station?—W. T. Elwell (Sutton Coldfield).

There are only three adjustments to make. First unscrew the rotary capacitor in the rear right side square can (only a little), using a plastic tool, until Channel 5 sound is heard. Then adjust the two brass threads on the rear edge for optimum vision and sound. Retrim the oscillator capacitor for optimum sound and freedom from sound and vision. Make no other adjustments.

STRAD 12in. TA1414

I would like some help regarding foldover on my TV set which has a cathode ray tube 14KP4A. The picture is about 2in. in depth with foldover at the top. There is a continuous plopping sound from inside the tube. The valves have been tested and found to be satisfactory. I have changed the height control. The line whistle is audible.—T. Porter (Southport, Lancs).

We would suggest that you check the 6AB8 (ECL80) frame output valve and the capacitors associated with it, including the 100μF 12V cathode decoupler. If the noise described from "inside the tube" could be more accurately described as coming from the scanning coils, the frame coils may well be at fault.

PORTADYNE T237

Can you please oblige me with details on how to set up the above set for service?—A. Moxoy (London E.3).

Setting up is quite simple and a rough outline is as follows: Switch on and allow 4-5 minutes to warm up. Advance brilliance with aerial plug removed to show a blank raster. Reduce brilliance just enough to fade this out. Replace aerial plug, set to desired channel and advance volume and set fine tuner for maximum sound. Advance contrast half-way. Advance sensitivity to show modulation on the screen. Lock with frame hold and line hold. Adjust height and width as required.

ULTRA Y84NF

When switching on the set all I get is a horizontal line across the tube face about ½in. wide. The sound is still very good. Please can you help me to locate the trouble.—W. Burrell (King's Lynn, Norfolk).

Check the 6K25 and UL46 on the front right side of the chassis. If these valves are in order, check the wire-wound anode resistor of the UL46. This has a resistance of 3K and no H.T. will reach the anode pin of the UL46 if it is open circuit.

DECCA DM14

After switching on the set a bright, defocused raster appears, unaffected by the brilliance control. After about 10 minutes a normal picture appears. Sometimes after switching on there is a very, very faint picture, but low brilliance. The picture will jump back to normal itself, or by switching the set off and on again. I have replaced the PL81 and H.T. smoothing condenser with no results. When fault is on H.T. is 180 volts, when picture is normal H.T. is 205 volts. The sound is OK all the time. Am I right in thinking C.R. tube is faulty?—R. G. Dunn (Sutton Coldfield).

You describe two distinct faults. One, a bright defocused raster indicates a tube fault, probably a heater-cathode short, which occurs intermittently. The faint picture could be due to a partially shorted heater in the tube, but the fact that the H.T. falls to 180V at the same time seems to point to a different cause, such as variation in the mains supply voltage. Both effects could be due to a defective on-off brilliance control and we would suggest you replace this item first (250KΩ with D.P. switch).

CATHODE FOLLOWER VOLTMETER

(Continued from page 361)

The same process has been carried out for another set of conditions and together with true error curves has been plotted in Fig. 5. The true and approximate curves agree within about ½V over the effective range on the meter.

These results show incidentally that, providing the H.T. can supply 5mA, this high consumption meter can be used for serious work in conjunction with a cathode follower whereas it would be almost useless when used directly.

When sufficient heater power is available, two in parallel will be advantageous as the effective value of ra is then halved (but μ is unchanged).

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LUXEMBOURG EXPANDING AERIALS. Compact and easy to fit. No technical knowledge required. Greatly improves reception. **3/11.** Post 6d.

ACOS MIKES. 40-1. **25/6.** Post 1/6.

NIFE ACCUMULATORS. Size 3 x 2¾ x ¾in. 7 amp 1.25 v. Weight 13ozs. **1/11.** Post and Packing 1/6 one only, add 9d. cell.

SPECIAL OFFER!
CAR RADIO KITS. Seven Transistors. Long and Medium Waves 2 watts output. R.F. stage and automatic gain control. Complete kit with cabinet **10½gns.** Speaker extra 17/11. Post and Packing 5/-. Please state voltage.

JACK PLUGS. Standard **1/11.** Post 6d.

2000mfd. CONDENSERS. 6 volt working **1/6.** Post 6d.

DIMMER SWITCHES. Ideal for train speed regulators. **1/11.** Post 9d.

GERMANIUM DIODES. 1/- each, **9/6** Dozen. Post 4d.

HEADPHONE CORDS. High Quality 6ft. lengths. **1/11** Pair. Post 6d.

SPEAKER GOLD GRILL. 6¼ x 4in. **1/-** each. Post 6d.

VIBRATORS. 12v. 4 pin. **4/11.** Post 1/-.

CO-AXIAL CABLE. Air spaced suitable for TV fringe area V.H.F. etc. **7½d.** per yard. Cut to any length. Post 1/3 Doz. yards.

ACOS CRYSTAL PICK-UPS. Turnover Head (2 sapphire styli). **29/11.** Post 2/6.

THROAT MIKES. 1/-. Post 6d. Could be used for electrifying musical instrument.

RECTIFIER/STABILISER for 1.4v. valves Midget. **3/-.** Post 6d.

10mfd. PAPER CONDENSERS. Block. Ideal for cross over networks. **3/11.** Post and Packing 1/-.

ALL ABOVE ARE NEW AND GUARANTEED

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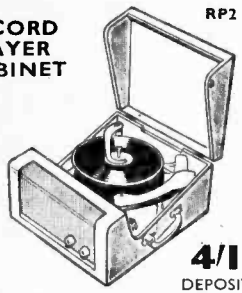
1A7GT	12/6	6K8G	6/6	B36	8/6
1C5GT	10/6	6Q7G	7/6	DAF96	8/3
1D5	9/6	6SA7M	6/-	DK96	8/6
1H5GT	9/9	6SG7M	5/-	DL96	8/3
1L4	3/9	6SN7GT	4/9	DM70	7/6
1N5GT	9/9	6V6G	5/9	EB41	7/-
1R5	6/6	6V6GT	6/6	ECC81	6/-
1S5	6/6	6X5GT	6/6	ECC82	7/-
1T4	4/9	10F9	7/6	ECC83	7/6
3Q5GT	8/9	12A6	5/6	ECC84	8/9
5U4G	5/9	12AT6	8/6	ECC85	8/6
5Z4G	9/-	EB91	4/-	ECF80	10/6
6AM6	4/-	20D1	9/6	ECF82	10/6
6B8G	2/11	25A6G	8/-	ECH42	8/9
6BA6	6/6	25L6GT	9/-	ECL80	9/6
6BE6	6/6	25Z4G	7/6	ECL82	10/6
6C4	3/6	35L6GT	9/6	EF41	8/6
EL84	8/3	35W4	6/9	EF42	7/6
6C6	4/3	35Z4G	7/6	EF50	1/9
6CH6	9/3	807(B)	3/9	EF80	6/6
6F1	6/6	954	1/6	EF85	7/-
6J5GT	3/6	955	3/11	EF86	11/-
6J5M	4/3	956	2/11	EF89	8/-
6K7G	2/3	AZ1	12/6	EL41	9/3

Any parcel insured against damage in transit for only **6d.** extra per order. All uninsured parcels at customers' risk. Postage and packing **6d.** per valve extra. Over **£3** Free C.O.D. or C.W.O. only. C.O.D. charge **3/-** extra.

S.A.E. with all enquiries.

RECORD PLAYER CABINET

RP2



4/1 DEPOSIT

Balance at 2/11 per week for 19 weeks. A beautifully styled cabinet. Made by a famous manufacturer. In polka dot cloth with clipped lid and carrying handle. Size 16 x 14½ x 8½in. deep. Will take a B.S.R. Monarch 4-speed Autochanger and 7 x 4in. elliptical speaker and most of the modern portable amplifiers. Carr. & Ins. 4/6. Cash price **59/6**

EXTENSION SPEAKERS

19/9

Polished oak cabinet of attractive appearance. Fitted with 8in. P.M. speaker W.B. or Goodmans of the highest quality. Standard matching to any receiver (2-5ohms). Switch and flex included. Ins. & Carr. 3/9. 8in. P.M. Speaker 8/9. Std.: 2-5 ohms. With O.P. Trans., 10/-, P. & P. 2/6. Elliptical Speaker 7 x 4in. 19/6. Elliptical Speaker 9½ x 4½in. 22/6.

STEREO RECORD PLAYER CABINET

with extension speaker cabinet

at the amazing offer of **99/6**

Portable 1960 show model in two tone colours. Extension speaker cabinet secured in lid. Size 18 x 14 x 18½in. high. This stereophonic player retails at 35gns. in the shops today. A must for teenagers, and an essential for the enthusiast. Carr. & Ins. 5/6 with order. OR 6/1 initial payment and balance at 4/11 for 19 weeks.

Many other types and sizes of beautifully designed cabinets in stock at prices from 29/6 to 79/6

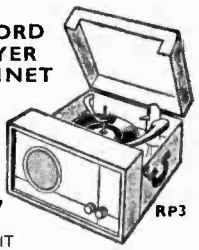
U.A.8. B.S.R MONARCH 4-SPEED AUTO-CHANGER
8/1 initial payment and 19 weekly payments of 6/11 (Cash Price £6.19.6.)

T.U.9 B.S.R. 4-SPEED SINGLE PLAYER 89/6 Carr. & Ins. 5/6

COLLARO CONQUEST 4-SPEED AUTOCHANGER
8/1 payment and 19 weekly payments of 6/11 (Cash Price £6.19.6)

PORTABLE AMPLIFIER MK DI 59/6 P & P 3/6

RECORD PLAYER CABINET



RP3

4/7 DEPOSIT

Balance at 3/5 per week for 19 weeks. A delightful looking cabinet. Size 14½ x 17½ x 8½in. in two-tone leatherette. Will take a B.S.R. Monarch 4-speed autochanger and 6in. round speaker. Carr. & Ins. 4/6. Cash price 69/9

MODERN 17" TV CHASSIS

Complete and working 22 gns.

A chassis including 17in. tube, permanent magnet speaker, 13 channel Turret Tuner (any two selected channels fitted). Other channels supplied on request at 7/6 each. 13 valves. Chassis and valves guaranteed for three months. CRT. 12 months' full guarantee. Sound I.F. 19.5 Mc/s Vision 16 Mc/s. A.C. only. Ready and working to fit into your own cabinet. Carr. & Ins. 25/-. As above with 14in. tube, complete and working £19.19.0.

NO DEPOSIT—INTEREST FREE—20 OR 36 WEEKS TO PAY

DUKE & CO.

(Dept. E.4), 621/3 Romford Road, Manor Park, E.12
Tel.: ILF 600/3 *Send for a FREE catalogue*

"AS-NU" Regunned TV Tubes

Supplied from stock, and despatched by British Railways same day.

COMPLETE NEW GUNS

fitted in every tube and fully guaranteed for TWELVE MONTHS.

	Mullard	Mazda
12 in	£4.15.0	£5.0.0
14 in.	£5.0.0	£5.10.0
15 in.	—	£6.5.0
16 in.	£6.10.0	—
17 in.	£6.0.0	£6.5.0
21 in.	£8.10.0	£8.10.0

Plus 10/- Carr. & Ins.

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J. P. WRIGHT

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Sole Distribution Agent
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BRAND NEW GUARANTEED VALVES

CHECK THESE PRICES AND SEE HOW WE CATER FOR THE CITIZEN'S POCKET

DAF96	8/-	EF86	11/-	PY82	6/9
DF96	8/-	EL41	9/-	PY83	7/9
DK92	8/3	EL84	8/-	UAF42	9/-
DK96	8/3	EY51	9/6	UBF89	9/-
DL94	7/3	EY86	8/9	UCC85	7/9
DL96	8/-	PCC84	7/6	UCH42	9/-
EBC41	8/3	PCC85	11/-	UCH81	8/9
ECC81	5/9	PCF80	7/3	UF41	8/6
ECC82	6/3	PCF82	9/-	UF89	7/3
ECC83	6/9	PCL82	9/-	UL41	8/6
ECC84	8/6	PL36	14/-	U25	11/3
ECC85	8/6	PL81	9/9	1R5	6/9
ECF80	10/10	PL82	8/-	1S5	6/-
ECL80	8/3	PL83	7/9	1T4	5/-
EF80	6/3	PY81	6/6	3S4	6/6

Postage 6d. valve extra.

May we quote for obsolete and transmitting types? (S.A.E. please.)

CITIZENS' VALVE SERVICE

(REGD.)

Office Address—No Callers :

103, GANTSHILL CRESCENT, ILFORD, ESSEX.

A SUPER SPECIAL TV TUBE OFFER

Why buy rebuilt or reconditioned tubes when we can supply you with **a brand new** 17in. tube to replace the MW 43-64, 43-69, 171K, 172K, 17 ASP4, 17 AXP4, C17-1, C17-A, CR17-22, C17-FM, MW 43-80. Made by world-famous manufacturers complete with 12 months' maker's guarantee. **Our Unbeatable Price £8.10.0.** Also available brand new 14in. to replace 36-24, 36-44, TR14-21, TR14-22. 14 KP4A, 14-LP4, 141K, C36-24 or for AW 36-20. 36-21 12in. brand new 31 MW 31-74, all at £7 each. Also Cossor 65K 15in. 4 volt filament equivalent to TA15 or 85K by fitting 6 volt filament transformer 10 gns. Cossor 108K 10in. equivalent to EMI 3/16 £6.10.0. Ferranti 9in. T9/5 4 volt filament 50/-. Post, packing & insurance 10/- extra.

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for London's Finest Bargains in electronic and radio equipment. Also Largest Selection of Tape Recorders in the U.K. Also in stock 500 shop soiled and H.P. repossessed TV sets in all sizes. All Guaranteed.

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TYPE A. OPTIONAL 25% and 50% BOOST. 2 V. *OR* 4 V. *OR* 6.3 V. *OR* 10.8 V. *OR* 13.3 V., 12/6. TAPPED MAINS INPUT.
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TYPE B. MAINS INPUT, MULTI OUTPUT 2, 4, 6.3, 7.3, 10 AND 13 VOLTS. BOOST 25% AND 50%. LOW CAPACITY. 21/-.

TRIMMERS, Ceramic. 30, 50 70 pF, 9d.; 100 pF, 150 pF, 1/3; 250 pF, 1/6; 500 pF, 750 pF, 1/9.
RESISTORS. Preferred values. 10 ohms to 10 meg., ½ w., 4d.; ¼ w., 4d.; 1 w., 6d.; 1½ w., 8d.; 2 w., 1/-.
HIGH STABILITY. ½ w., 1%, 2 -. Preferred values 100Ω to 10 meg. Ditto, 5%, 100Ω to 5 meg. Ω., 9d.
5 watt, 10 watt, 15 watt } WIRE-WOUND RESISTORS 25 ohms—10000 ohms { 1/3, 1/6, 2/-
15,000 ohms—50,000 ohms, 5 w., 1/9; 10 w., 2/3.

PLASTIC RECORDING TAPE

Long Play 7in. Plastic reel, 1,700ft.	35/-
Long Play 5½in. Plastic reel, 1,200ft.	28/-
Long Play 5in. Plastic reel, 850ft.	21/-
Long Play 3in. Plastic reel, 225ft.	7/6
Standard 7in. Plastic reel, 1,200ft.	24/-
Standard 5in. Plastic reel, 600ft.	15/-

"Instant" Bulk Tape Eraser and Head Defluxer, 200/250 v. A.C., 27/6. Leaflet, S.A.E.

O.P. TRANSFORMERS. Heavy Duty 50 mA, 4/6. Multiratio, push-pull, 7/6. Miniature, 384, etc., 4/6.
L.F. CHOKES 15/10 H. 60/65 mA, 5/-; 10 H. 85 mA, 10/6; 10 H., 150 mA, 14/-.

MAINS TRANSFORMERS 200/250 v. A.C.

STANDARD, 250-0-250, 80 mA, 6.3 v. 3.5 a. tapped 4 v. 4 a. Rectifier 6.3 v. 1 a. 5 v. 2 a. or 4 v. 2 a. ditto, 350-0-350	22/6
MINIATURE 200 v. 20 mA, 6.3 v. 1 a.	10/6
MIDGET. 220 v. 45 mA. 6.3 v. 2 a.	15/6
SMALL, 250-0-250, 100 mA, 6.3 v. 3.5 a.	19/6
STD., 250-0-250, 65 mA, 6.3 v. 3.5 a.	17/6
HEATER TRANS. 6.3 v. 1½ amp.	7/6
Ditto, tapped sec. 2, 4, 6.3 v., 1½ amp.	8/6
Ditto, sec. 6.3 v. 3 amp.	10/6

ALADDIN FORMERS and core, ½in., 8d.; ¾in., 10d. 0.3in. **FORMERS** 5937/8 and Cans TV1/2. ½in. sq. x 2½in. and ½in. sq. x 1¾in., 2/- ea., with cores.
TYANA.—Midget Soldering Iron, 230 v. 40 w., 16/9.
REMPLOY Instrument Iron, 230 v. 25 w., 17/6.
MAINS DROPPERS. 3in. x 1¼in. Adj. Sliders. 0.3 amp., 1,000 ohms, 4/3. 0.2 amp., 1,000 ohms, 4/3.
LINE CORD. 0.3 amp., 60 ohms per ft., 0.2 amp., 100 ohms per ft, 2-way, 8d. per ft, 3-way, 7d. per ft.
LOUDSPEAKER P.M. 3 OHM. 5in. Rola, 17/6. 8in. Plessey, 19/6. 6in. x 4in. Rola, 18/-. 6½in. Rola, 18/6. 10 x 6in., 27/6. 10in. Rola, 30/-. 4in. Hi-Fi Tweeter, 25/-. 12in. R.A., 30/-. 14 x 8in., 45/-. 12in. 15 ohm, 10 w. Plessey, 45/-.
STENTORIAN HF 1012 10 in. 3 to 15 ohm, 10 w., 95/-
12in. Baker 15 watt 3 ohms, or 15 ohms, 105/-.
CRYSTAL DIODE G.E.C., 2/-. **GEX34,** 4/-.
HIGH RESISTANCE PHONES. 4,000 ohms, 16/6 pr.
MIKE TRANSF. 50 : 1, 3/9 ea.; 100:1, Potted, 10/6.
SWITCH CLEANER. Fluid squirt spout. 4/3 tin.
TWIN GANG TUNING CONDENSERS. 365 pF miniature 1in. x 1¼in. x 1¾in., 10/-. 0.0005 Standard with trimmers, 9/-; less trimmers, 8/-; midget, 7/6.
SINGLE. 50 pF, 2/6; 75 pF, 100 pF, 150 pF, 160 pF, 7/-. Solid dielectric 100, 300, 500 pF, 3/6.
SPEAKER FRET. GOLD CLOTH. 17in. x 25in. 5/-. 25in. x 35in., 10/-. Tyran 4ft. 6in. wide, 10/- ft.; 2ft 3in. wide, 5/- ft. Samples S.A.E.

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1S5	7/6	6L6G	10/6	EB91	6/6
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3S4	7/6	6S4	6/-	EBF80	10/6
3V4	7/6	6SJ7M	6/-	ECC84	9/6
5U4	7/6	6SN7	6/6	ECF80	9/6
5Y3	7/6	6V6G	7/-	ECH42	10/6
5Z4	9/6	6X4	7/6	ECL82	10/6
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6B10	10/6	12AX7	8/-	EF80	7/6
6BW6	10/6	12BE6	10/6	EF91	5/-
6D6	6/-	12Q7	6/6	EF92	5/6
6F6G	7/6	12Q7	6/6	EL32	5/6
6H6	3/6	35L6	9/6	EL84	8/6
6J5	5/6	35Z4	7/6	EL84	8/6
6J6	5/6	80	10/6	EM81	9/6
6J7G	6/6	807	5/6	EZ40	7/6
6K6GT	6/6	954	1/6	EZ80	7/6
6K7G	5/6	EA50	1/6	E1148	1/6
				HABC80	8/6
				HVR2A	6/6
				MU14	9/-
				P61	3/6
				PCC84	9/6
				PCF80	9/6
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				PL82	10/6
				PY80	7/6
				PY81	9/6
				PY82	7/6
				SP61	3/6
				U BC41	10/6
				U CH42	10/6
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70/- ea. from stock.

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Argosy: T2, CTV517. **Decca:** DI7 & C. **Defiant:** TR1753. **RGD:** 6017T, 7017C, C54. **Regentone:** 17C, 17T, 17 Comb.

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Marconi: VT63DA.

Baird: 2014, 2017, 2114, 2117.

Cossor: 930 & T, 931, 933-4-5, 937, 938 & A. & F. 939 & A & F, 943T, 946.

H.M.V. 1824 & A, 1825 & A, 1826 & A, 1827 & A, 1829 & A, 1865, 1869.

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Other makes available (7 days). S.A.E. with enquiries.

LINE BLOCKING TRANSFORMERS, 10/- to 16/6.

FRAME BLOCKING TRANSFORMERS, 13/6 to 21/-

FRAME OUTPUT TRANSFORMERS, 27/6 to 39/-.
Most makes available (7 days). S.A.E. with all enquiries.

TV and RADIO SERVICE SHEETS. 1,500 models. Send **2/6,** your Model No. and S.A.E.

HIGH GAIN TV PRE-AMP KITS
BAND I BBC
Tunable channels 1 to 5. Gain 18dB. ECC84 valve. Kit price 29/6 or 49/6 with power pack. Details 6d. (PCC84 valves if preferred.)

BAND III ITA—Same prices.
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CRYSTAL MIKE INSERT by Acos, precision engineered. Size only ¾ in. x 3/16 in. 6/6.

ALUMINIUM CHASSIS. 18 s.w.g. undrilled. With 4 sides, riveted corners and lattice fixing holes, 2½in. sides, 7 x 4 in., 4/6; 9 x 7in., 5/9. 11 x 7in., 6/9; 13 x 9in., 8/6; 14 x 11in., 10/6. 15 x 14in., 12/6; 18 x 16 x 3in., 16/6.

TELETRON "TRANSIDYNE"
MIDGET SUPERHET PORTABLE 6" x 4" x 1¾" 6 transistors, printed circuit. Ferrite aerial. All parts and cabinet, £11.19.6.
We include Ediswan Transistors for maximum performance. Details 9d.

BBC TRANSISTOR RADIO. Med. and Long Wave. Complete kit, 32/6, phones 7/6 extra. Deaf Aid Earpiece with Special Lead 15/-. Details 6d.

GARRARD TA MK II SINGLE PLAYER
AUDIO PERFECTION
Designed to play 16, 33, 45, 78 r.p.m. Records 7in., 10in., 12in. Lightweight Xtal pick-up. GC8 plug-in head. Auto stop. Stereo-wired.
OUR PRICE **£8.10.0** each. Post Free
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Model 4HF TRANSCRIPTION QUALITY. With Plug-in Normal Heads, £18.0.0.
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Volume Controls Long spindles. Guaranteed 1 year. 5K ohms to 2 Meg. No Sw. 3/- D.P.Sw. 4/9 Linear or Log Tracks. Midget Post ld. per yard extra. Semi-air, spaced. ¼in. dia. Losses cut 50%. Fringe Quality. Air Spaced. **6d.** yd. **1/-** yd.

80 ohm CABLE COAX

COAX PLUGS	1/-	LEAD SOCKET	2/-
PANEL SOCKETS	1/-	OUTLET BOXES	4/6

BALANCED TWIN FEEDER yd. 6d. 80 or 300 ohms.
DITTO SCREENED per yd. 1/6. 80 ohms only.
WIRE-WOUND POTS. 3 WATT. Pre-set Min. TV Type. All value 25 ohms to 25 K., 3/- ea. 30 K., 50 K., 4/-. (Carbon 30 K., to 2 meg., 3/-.)
WIRE-WOUND 4 WATT. Pots Long Spindle Values, 100 ohms to 50 K., 6/6; 100 K., 7/6.
CONDENSERS. New Stock. 0.001 mfd. 7 kV. T.C.C., 5/6; Ditto, 20 kV., 9/6; 0.1 mfd., 7 kV., 9/6; Tubular 500 v. 0.001 to 0.05 mfd., 9d.; 0.1, 1/-; 0.25, 1/6; 0.5/500 v., 1/9; 0.1/350 v., 9d.; 0.01/2,000 v. 0.1/1,000 v., 1/9; 0.1 mfd., 2,000 volts, 3/6.
CERAMIC CONDS. 500 v., 0.3 pF to 0.01 mfd., 9d.
SILVER MICA CONDENSERS. 10% 5 pF to 500 pF, 1/-; 600 pF to 3,000 pF, 1/3. Close tolerance (±1 pF) 1.5 pF to 47 pF, 1/6. Ditto 1% 50 pF to 815 pF, 1/9; 1,000 pF to 5,000 pF, 2/-.

I.F. TRANSFORMERS 7/6 pair
465 Kc/s Slug Tuning Miniature Can. 2¼in. x 1in. x 1in. High Q and good bandwidth. By Pye Radio. Data sheet supplied.
Wearite **M800** I.F. 465 Kc/s, 12/6 per pair.
Wearite 550 I.F. 465 Kc/s. 12/6 per pair.

NEW ELECTROLYTICS. FAMOUS MAKES

TUBULAR		TUBULAR		CAN TYPES	
1/350v.	2/-	50/350v.	5/6	8/500v.	3/-
2/450v.	2/3	100/25v.	2/-	16,500v.	4/-
4/450v.	2/3	250/25v.	2/6	32/350v.	4/-
8/450v.	2/3	500/12v.	3/-	100/270.	5/6
8/500v.	2/9	8+8/450v.	4/6	2,500/3v.	4/-
16/450v.	3/6	8+8/500v.	5/-	5,000/6v.	5/-
16/500v.	4/-	8+16/450v.	5/-	32+32/350v.	4/6
32/450v.	5/6	8+16/500v.	5/6	50+50/350v.	7/-
25/25v.	1/9	16+16/450v.	5/6	64+120/275v.	7/6
50/25v.	2/-	16+16/500v.	6/-	64+120/350v.	11/6
50/50v.	2/-	32+32/350v.	4/6	100+200/275v.	12/6

LATEST EMI. 4-SPEED SINGLE RECORD PLAYER. Acos 73 hi-fi stereo and normal crystal pick-up. Silent motor, heavy turntable. Special Offer, £6.19.6. Post 3/6.

MAINS TYPE SELENIUM 300 v. 85 mA, 7/6.
CONTACT COOLED 250 v. 50 mA, 7/6; 60 mA, 8/6; 85 mA, 9/6; 200 mA, 21/-; 300 mA, 27/6.
COILS Wearite "P" type, 3/- each. Osmor Midget "Q" type adj. dust core from 4/-. All ranges.
TELETRON. L. & Med. T.R.F., with reaction, 3/6.
FERRITE ROD AERIALS. M.W., 8/9; M. & L., 12/6.
T.R.F. COILS A/HF, 7/- pair. H.F. CHOKES, 2/6.
FERRITE ROD, 7in. x ¾in., dia., 2/6.

JASON F.M. TUNER COIL SET, 26/-. H.F. coil, aerial coil. Oscillator coil, two I.F. trans. 10.7 Mc/s. Ratio Detector and heater choke. Circuit book using four 6AM6, 2/6.
COMPLETE JASON F.M. KIT WITH VALVES. £6.5.0 Model FMTI.

FULL WAVE BRIDGE SELENIUM RECTIFIER: 2.6 or 12 v. 1½ amp., 8/6; 2 a., 11/3; 4 a., 17/6.
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