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JANUARY 1965

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Practical Television

AND TELEVISION TIMES

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Contents

Pick of the Pops

ON April 20th, 1964, the first BBC-2 programmes were radiated from Crystal Palace. In welcoming this event in the April issue, we touched on the preoccupation with competition and audience rating figures and entered the plea: "*We hope that BBC-2 does not inherit the same outlook.*"

After nine months to shake down and with Birmingham now in the "club", BBC-2 is beginning to spread towards its ultimate national coverage. How is it shaping up?

Perhaps we were naive, but we had great hopes of BBC-2 and were encouraged by talk of a real alternative programme all good heady stuff, enough to "convert" even the cautious.

But since April we've had indecision at the BBC, dark mutterings in the trade, naughty words from Uncle BREMA. And, apparently, steadfast apathy from the general public.

After the initial shaky start, a New Deal was launched with magnificent fanfares and publicity, to be virtually scrapped again for yet another switch in programme policy.

The interesting thing is that BBC-2 was intended from the start to be a *real* alternative programme, to attract the more discriminating viewer rather than the Admass. But because the new channel was treated with cavalier indifference by the mass public, manufacturers and trade associations began screaming that they couldn't sell 625-line sets.

The BBC stuck out its chin, affirming stern resolution not to succumb to outside pressure. Splendid! And reasonable, for you cannot have minority programmes and get a mass audience, although set makers presumably did not subscribe to this logic. And, to judge from some of their policies, neither do the BBC.

For the brave promises of BBC-2 have sadly somewhat wafted away. More and more programmes of "popular appeal" have crept in, including pop music sessions, quizzes, and the like. Coincident with the latest bout of programme reshuffling, the BBC, for some extraordinary reason impossible to fathom, is obviously beside itself with delight because the magic audience figures have started to rise.

It has taken nine months to discover that pop programmes have a wider appeal than minority programmes!

We are therefore beginning to wonder what exactly BBC-2 is using for a target. Does it really want a "different" approach or is it ready and willing to sacrifice the original ideals on the altar of Audience Ratings?

There can be little doubt that BBC-2 is influenced by the actual weight of numbers and programmes are more and more being designed to draw the largest possible audience.

This is surely treading the path to total surrender. We already have deliberate clashing of similar programmes at similar times on BBC-1 and ITA channels. And also a certain similarity in the type and make-up of programmes.

Unless a proper formula can be devised for BBC-2, the day may yet dawn when long suffering viewers, instead of a choice of three alternatives will have only a Pick of the Pops!

Our next issue dated February, will be published on January 21st

TELETOPICS

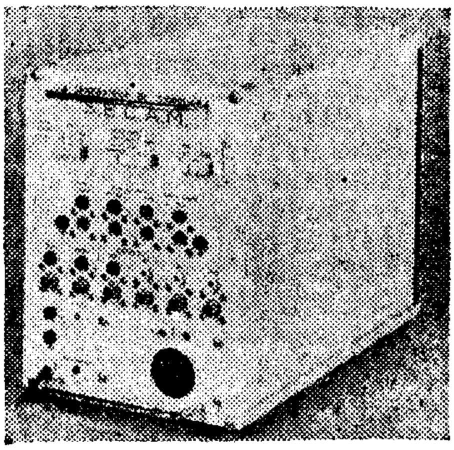
More Moves Toward Colour TV

AS the time of the March meeting of the C.C.I.R. approaches, when a decision on the colour television system to be adopted by the countries of west Europe is finally reached, activity throughout Europe's television industry makes certain the event will be preceded by a fitting amount of publicity.

Already further international discussion has taken place in London during October, when demonstrations by the BBC and the British Radio Equipment Manufacturers' Association were given to the European Broadcasting Union Colour Television Group. And now the Compagnie Francaise de Television has announced new servicing and test equipment for receivers operating on the S.E.C.A.M. system—one of the three systems from which the C.C.I.R. has to make its choice.

At the London meeting, representatives of the broadcasting organisations, the telecommunication administrations and the radio industries of France, Germany, Italy, the Netherlands, Switzerland and the U.K., gave further consideration to the three systems, N.T.S.C., S.E.C.A.M. and PAL, when transmitted over long international links, when recorded on video tape, and when transmitted direct to domestic receivers. The demonstrations served to illustrate important improvements in colour television apparatus that have been made since the previous series of demonstrations in London last February.

The number of S.E.C.A.M. colour TV receivers being manufactured and in use in France and



The GS.10 signal generator, specially produced by the Compagnie Francaise de Television for the alignment of S.E.C.A.M. colour receivers.

abroad, is already sufficient to demand new alignment and maintenance equipment even before a decision by Europe has been made either for or against the French system. As witness to the basic simplicity of S.E.C.A.M., the C.F.T. equipment consists of only two small, compact units; the GS-10 signal generator intended for use in factory alignment of S.E.C.A.M. colour receivers and "SERVOCHROM", for installation and maintenance use of receivers in the home.

'PRACTICAL TELEVISION' FILM SHOW: SEND FOR FREE TICKETS NOW

IN just over a month's time, the *Practical Wireless* and PRACTICAL TELEVISION Film Show will once again attract readers from all over the country to this annual event.

As in previous years, the show (to be held on February 5th) will be presented at Caxton Hall, Westminster, London.

The programme for this year's show, arranged in collaboration with Mullard Limited, has been designed to entertain as well as inform, with refreshments provided in the intermission. Films to be shown include "Electromagnetic Waves" and "The New Panorama Tubes". These will be accompanied by a lecture on current topics and trends and some Mullard equipment will also be shown.

Last year's show attracted a record audience of more than 400—sufficient to fill the Hall to capacity. This year as many, if not more readers are expected to apply for tickets—free from these offices—and so only immediate applications to PRACTICAL TELEVISION, enclosing a stamped addressed envelope can guarantee *your* seat.

LONGEST TELEPHONE CABLE IN EUROPE PROVIDES TV LINK

A NEW international telephone cable, which is capable of carrying radio and television signals between three east European countries, was recently inaugurated.

The three countries, East Germany, Russia and Czechoslovakia, are linked by a 2,880 kilometres cable—the longest in Europe—at Moscow, Kiev, Katowice, Brno, Prague and Berlin. Up to 1,920 telephone calls and two television transmissions can be handled simultaneously by this cable.

BBC-2 BEGINS IN THE BIRMINGHAM AREA

AFTER three weeks of test transmissions, BBC-2 in the Birmingham area began service on December 6th.

Programmes proper began that evening after Test Card and music transmissions from 2 p.m. in the afternoon.

From Monday, December 7th, with the service in full operation, trade test transmissions linked to those from the BBC-2 transmitter at Crystal Palace, London, have continued during the day before each evening's programmes between 9.30 a.m. and 1 p.m., and 2 p.m. and 6 p.m. Material for these test transmissions comprises a 30-minute sequence and consists of a Test Card with 440c/s tone between 9.30 a.m. and 9.34 a.m., a Test Card with no sound between 9.34 a.m. and 9.35 a.m. and a Test Card with recorded music between 9.35 a.m. and 10 a.m. The sequence is repeated until 1 p.m. and again from 2 p.m. to 6 p.m.

World-wide TV for Aircraft-carrier Crew

MEN of HMS Eagle—the Royal Navy's aircraft-carrier recently refitted—can now watch local television programmes in practically any port in the world.

Wherever the ship is suituated, provided 625-line transmissions exist, a television distribution system aboard the Eagle will relay the pictures to a total of five TV receivers in the officers' ward room, petty officers' mess and ratings' mess.

British Relay installed the system, which includes Pye HDT 13-channel sets capable of receiving all known channels in Bands I to III. Signals are received by two wide-band aerials—incorporating a special device for changing polarisation—and then relayed to the receivers by double screened low-loss, coaxial cable.

Colour Television Subject for Faraday Lecture

AT the time of going to press, the 1964/65 Faraday Lecture will already have been delivered at two stops—Swansea and Bristol—on its nation-wide tour of 14 towns and cities to be accomplished during the six months between November 24th and April 6th.

This year's Lecture, the 36th in the series arranged by the Institution of Electrical Engineers, is being given by Mr. F. C. McLean, the Director of Engineering of the British Broadcasting Corporation. His subject is "Colour Television".

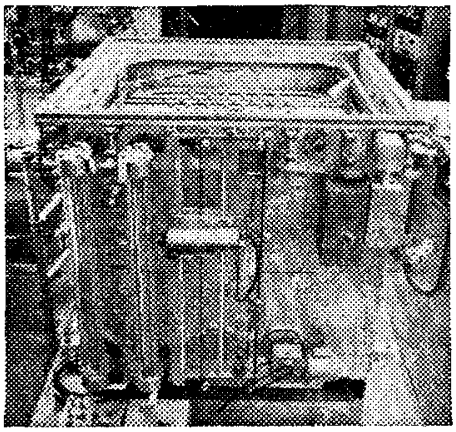
The I.E.E. introduced the Lectures in 1924 to pay tribute to the memory of Michael Faraday and with the object of informing the general public about recent advances in the applications of electricity. The Lectures are intended to appeal to the layman, although in many centres special performances for students are arranged.

Mr. McLean's lecture explains the basic principles of colorimetry —the science of colour and colour measurement—and, with the aid of a number of demonstrations, shows how these principles are applied to colour television systems. From this he goes on to explain and demonstrate how a scene viewed by a colour television camera is analysed into its three primary colour components and converted by the colour camera into equivalent electrical signals, which are transmitted and finally appear again at the receiver as a colour reproduction of the original scene.

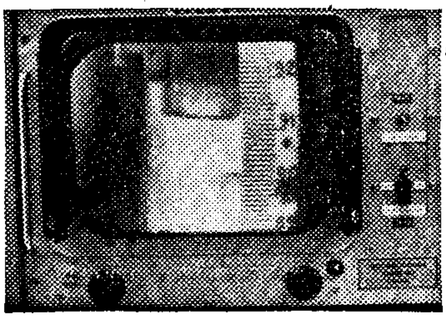
To illustrate how a colour receiver works, a large model of a shadow-mask tube is used. This demonstrates optically the manner in which the electrical signals are converted into the colour picture appearing on the face of the tube. The demonstrations also include colour television pictures obtained from "live" cameras in a studio and from films and slides, which are projected on to a large screen.

Admission of the public to the lecture is by ticket, which can be obtained free of charge.

C.C.TV KEEPS AN EYE ON NUCLEAR EXPERIMENTS



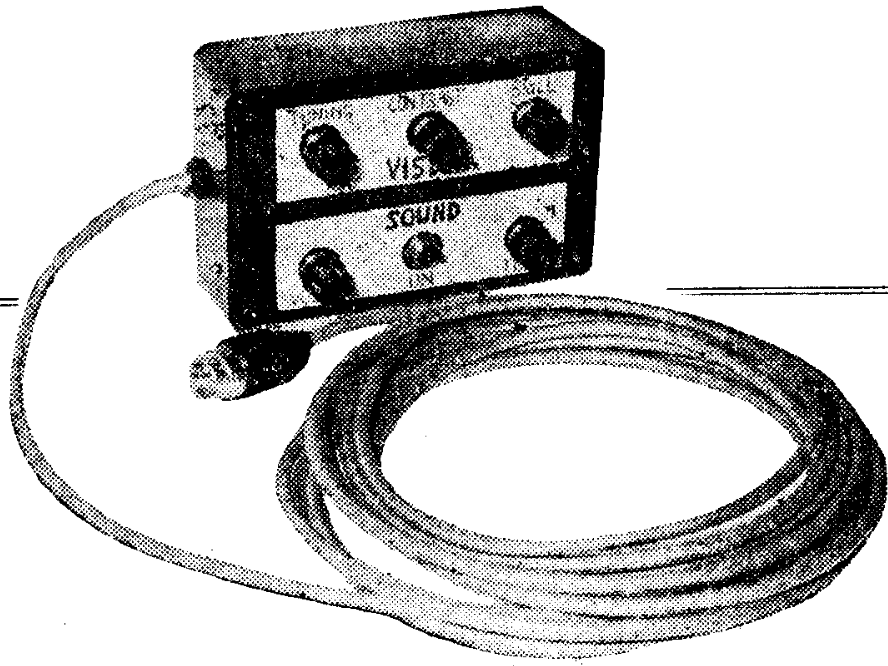
The EMI camera on the HELEN III nuclear assembly (above) transmits information on the liquid level in the apparatus to a monitor (below).



AT the Atomic Energy Establishment, Winfrith, Dorset, a closed-circuit television system supplied by EMI Electronics Ltd., is being used to transmit crucial information regarding the liquid level inside the HELEN III nuclear assembly to a monitor outside the reactor cave housing, within an accuracy of ±0·5mm.

HELEN III has been designed to study the physics of reactor cores of the type used in pressure vessel reactor designs, and as reliable information of the height of the liquid in the HELEN III tank is essential during experiments, the closed-circuit TV camera is used to magnify the variations in this height so that readings can more easily be taken from the television screen.

The EMI minicamera mounted at right-angles to the gauge (a transparent tube in which the liquid is contained) is driven by an electric motor so that it always follows the rise and fall of the liquid.



REMOTE CONTROL OF TV RECEIVERS

By
M. L. Michaelis

A NUMBER of modern domestic television receivers incorporate facilities for remote control. Indeed some designs are very elaborate in this respect, employing various arrangements such as servo-motors and stepping relays for remote channel switching, piezo-electric supersonic loudspeakers in the control unit or focused beams of light for communication between the control unit and the receiver. A special microphone in the receiver responds to the supersonic whistles or a photocell responds to the light beams. In each case the received commands are translated into electrical pulses or d.c. currents which actuate the main controls of the television receiver. Such advanced circuits, however, are not the subject of this article, since they frequently require some non-standard components which are not readily obtainable and their adjustment can lead to difficulties.

Our aim is to discuss a number of fundamental questions involved in simple remote control circuits of a "cable-connected" nature. Satisfactory and reliable performance can readily be obtained using standard components in straightforward d.c. control circuits. The control cable between the television receiver and the control unit may be of any length and is readily installed under the carpet, around the skirting board or in some other unobtrusive way. There are no impedance matching criteria to satisfy, so that a cable may be installed as a permanent fixture with several outlet sockets wired in parallel at the respective control points desired. The remote control unit may then be plugged in at any point from which control is desired.

Cable-connected remote control systems can readily be added to virtually any existing television receiver, even where the makers never specifically considered such features at the outset. It is our aim in this article also to go into some detail concerning modern television receiver circuitry by way of taking the author's receiver as an example in order to show how the local and remote controls blend into the circuit as a whole. Whilst all matters of principle are certainly of universal application, circuit details and component values may well have to differ from receiver to receiver. The circuits illustrated should thus not be copied blindly unless, of course, one is building a completely new receiver from scratch and wishes to incorporate these features. In general it is far more important to understand the principles and apply them logically in carrying out the appropriate modifications to a particular receiver in question.

A final point of such importance that it must be included in the introduction to this article is the question of insulation and safety. Most television receivers employ an a.c./d.c. type chassis in which one side of the mains supply is connected directly to the chassis. The seven-way screened cable between the TV receiver and the control unit *must* therefore have a substantial outer sheathing of plastic or other reliable insulation approved for domestic mains wiring, since the screening braid, being connected to chassis, could be *live*. For the same reasons the control unit itself should *not* be built in a metal tin or box but in a substantial bakelite or plastic case.

Why Remote Control?

The first question of importance in planning an efficient remote control system for a domestic television receiver is to define the borderline between necessity and luxury. The necessity for a remote control system is not primarily dictated by the question of the viewer's comfort in not having to leave his armchair for every adjustment required during a programme, although this comfort is a welcome by-product of the system. Far more important is the fact that optimum picture adjustment is very often not possible close to the receiver with its own controls because the optical impression there is greatly different from that obtained at the correct viewing distance. This point is largely overlooked by most viewers but is immediately evident once one has ever viewed with a remote control unit at one's fingertips.

Seen from this aspect remote control facilities for contrast and brilliance are of paramount importance, since these have the greatest influence on picture quality and vary most frequently during programmes. Remote control of sound volume is of virtually equal importance for several reasons. Firstly, broadcasting authorities unfortunately do not always keep the transmitted sound volume to a constant mean level and thus large fluctuations frequently arise between individual programmes and sometimes even within a single programme. Secondly, if a group of viewers are sitting together it can be useful to reduce the sound volume temporarily for conversational purposes, for which purpose it is useful to have a switch on the remote control unit in addition to the continuous volume control. This switch can be used to mute the sound channel if either the vision or sound carriers fail at the transmitter until normal transmission is restored. This point is of importance for the new CCIR 625-line programmes in particular, where frequent use is made of the d.f. (difference frequency) principle of sound i.f. extraction at the video detector. The vision and sound carriers beat at the video detector to produce their difference frequency as sound i.f. fed into the sound strip. If either carrier is absent no d.f. is produced and the f.m. sound circuits generate the characteristic extremely loud and unpleasant hiss characteristic of such arrangements in the absence of a signal sufficient to saturate the limiter. It would, in principle, be possible to fit a " squelch " of the type familiar in modern f.m. radio communications receivers and radio-telephone links. This consists of a relay muting the audio amplifier until it is energised via sufficient rectified carrier voltage from the ratio detector. However, such an arrangement is as yet hardly ever found in a television receiver.

Remote control of other functions of a television receiver is of lesser importance, though two further operations—fine tuning and sound tone control—can be quite useful for reasons discussed later in this article. Channel selection and on/off switching are more infrequent operations and there is generally no objection to performing these only at the receiver itself. However, the remote control unit design which will be presented in this article has a spare line in the control cable so that a switch through to the h.t. + line in the control unit may be added to operate a relay in the receiver for any of these functions if desired. Alteratively the spare line may be connected, *via an isolating transformer in the receiver*, to the low-impedance speaker output for connecting headphones at the control unit. This will enable a slightly deaf person to receive a greater sound intensity level without inconveniencing other viewers having normal hearing, or the internal loudspeaker can be switched off and a single viewer receive sound on headphones alone so as not to disturb other occupants of the room. A headphone volume control can be interposed within the control unit. As we shall see, all control lines carry only d.c. potentials and the entire multi-cable is screened. Thus there is no objection to such an incorporation of a single audio frequency line if desired, particularly as this is very insensitive to interference pick-up when run off the low-impedance loudspeaker output.

Mutual Interference

A problem specific to *wired* remote control systems is created by the possibilities of mutual interference between the individual controlled functions on account of cross-couplings in the multi-cable. Individual screening of all lines within the control cable would be highly undesirable because this would require either non-standard cable, difficult or impossible to obtain, or unsightly bunches of single screened cables. Furthermore, long runs of screened cable carrying audio or video signals would give high capacitive attenuation of high-frequency signal components unless complicated matching devices defeating the aims of simplicity are employed.

A more subtle principle is therefore involved in an elegant solution for a simple remote control arrangement for a number of functions via a standard multi-cable with common screening. No active a.c. signals are sent down the cable to the controls and back but only d.c. control voltages and currents which influence the signal circuits in the TV receiver without diverting the relevant signal paths. Capacitive and inductive cross-couplings or shunting effects are impossible in such a circuit when carried to its logical conclusion. Indeed quite large bypass capacitors may be inserted in the TV receiver where the d.c. control lines emerge so that a.f. video and r.f. signals are definitely kept off the control cable and out of the control unit. Virtually any desired length of control cable may therewith be used without the slightest difficulty. The d.c. control signals can interfere mutually only if leakage currents between the various lines should arise. But such leakage currents are very easy to avoid simply by paying proper attention to good insulation.

D.C. Control Methods

It is necessary to devise methods of d.c. control for all functions which are to be fitted with remote control facilities. This presents no problem for brilliance control, since this is a d.c. control operation anyway and can readily be extended through a cable line to the remote control unit. Contrast control can be affected via a variable-mu control voltage for the vision i.f. amplifier. Whilst there would be no fundamental objection to doing this directly with a suitable negative bias voltage this would in practice unnecessarily block one line of the control cable in first taking the bias source voltage out to the control unit. It would be better if the control function could be achieved with a positive voltage from the main h.t. line so that only one outgoing line carrying the h.t.+250V supply need be occupied as source voltage for all remote controls. As we shall shortly discuss in detail, a simple solution in a typical circuit for remote contrast control is to vary the screen grid voltage of the video output stage. In common gated a.g.c. circuits for the vision i.f. strip the operating point of the a.g.c. gating stage is set from the cathode potential of the video output stage so that variation of the screen voltage in turn varies the negative control voltage for the vision i.f. strip, developed from the gated line sync pulses, in the correct sense. The necessary circuitry is present anyway in conjunction with the gated a.g.c. requirements so that addition of this arrangement for remote contrast control is very simple and cheap indeed. Remote control of fine tuning for the channel selector is quite easy by fitting a variable capacitance diode in parallel with the oscillator coil (via two blocking capacitors) and feeding a variable positive cut-off voltage to this diode via a v.h.f. filter circuit derived from the h.t.+ line through a control potentiometer in the remote control unit.

As far as remote control of sound volume and tone by d.c. methods are concerned there are some problems posed by the fact that no simple method of controlling audio amplifiers in this manner quite free of distortion is available with conventional components. Variable-mu control methods, which are primarily meant in this statement, are applicable to audio amplifiers only at very low signal levels much smaller than those encountered anywhere in normal sound sections of TV receivers on the audio side. The reason for this limitation is to be found in the very nature of any variable-mu characteristic, which has to be curved instead of linear, leading to the production of harmonic components, i.e. more or less severe distortion. This is unimportant in r.f. and i.f. circuits because the tuned circuits immediately reject the harmonics produced, but an audio amplifier would pass them as severe distortion unless the signal level is kept very lwo. At the best a rather radical redesign of the existing audio section of the TV receiver would be necessary. Short of new components for d.c. control of audio amplifiers being devised, d.c. control of sound volume should preferably be applied to the sound i.f. section. In the case of a.m. sound accompanying BBC 405-line transmissions, conventional variable-mu control of the sound i.f. amplifier is quite satisfactory. The problem of achieving control with a positive voltage from the h.t. supply in the remote control unit to give negative variable-mu control bias voltages whilst avoiding the need for an extra negative line in the control unit can be solved in two simple ways. Firstly, control voltage can be applied through a variable high resistor from the h.t.+ line to the cathode resistors of the controlled i.f. amplifier stages, which amounts to negative grid bias voltages, and this method is to be recommended as being the simplest for receivers which are BBC 405-line *only*. The second method employs a simple d.c. bridge between equal positive and negative supply voltages obtained from a voltage doubler rectifier circuit driven from a suitable tap on the heater chain of the TV receiver. This establishes a negative control voltage to be applied to the bottom ends of the grid leaks or grid tuned circuits in the controlled i.f. stages in the normal arrangement of variable-mu gain control and is the method recommended for *dual-standard receivers* where switchover to a different method of sound volume control is required for the CCIR f.m. sound channel. The same remote volume control potentiometer then functions in the *same sense* as sound volume control on both a.m. and f.m. sound and a switch shorting the track thereof mutes the sound channel on either standard. Variable-mu gain control of the f.m. sound i.f. channel is of no avail, since it would be tantamount to amplitude modulation, which the limiter and ratio detector circuits counteract and annul. The method of d.c. control is here to vary the limiter stage, screen grid voltage between zero and the value used for normal gain. This varies the bottoming level of the limiter pentode, and therefore the limited output level, i.e. the audio volume, without the slightest distortion.

Sound tone control by d.c. methods is possible by employing the saturable reactor principle, using any readily saturable small intervalve transformer. D.C current passed through the primary varies the inductance of the secondary, which is situated in an L-R tone-control circuit. This principle is not usable for sound volume control because the range of inductance variation available without distortion due to nonlinearity of the magnetic characteristic of the transformer core is far too small to achieve a swing from high volume to zero volume. The range of tone control normally required is much less, so that the principle there is generally satisfactory. Various intervalve transformers and d.c. control currents should be experimented with in a given case.

New Control Components

Among the most interesting developments of new components just appearing on the market (as far as possible applications for d.c. remote control systems are concerned) are the so-called "Raysistors" made by Raytheon of USA, at present available in Europe from Messrs. Raytheon-Elsi AG, Zurich, Switzerland, Hohlstrasse 612. These devices consist of a special lamp and a special photoresistor combined in one component with high overall screening and screening between the two named sections. A large number of special types for various applications are already being offered by the makers. The lamp sections may be of the filament, or neon discharge type. Types are available in which the photoresistor section is free of significant photo-e.m.f. or rectifier effects, behaving almost exactly as a linear variable resistor controlled by the illumination incident from the lamp section. Types of this kind, in conjunction with a neon-discharge lamp section able to operate off the h.t.+ line via a potentiometer in the remote control unit and free of dangers of fatigue, drift or filament burnout, are of particular interest for our present purposes. The photoresistor sections can be used for both volume and tone control circuits in normal audio amplifiers. We are conducting some experiments with these devices, and hope to bring an article at some suitable future date dealing with specific uses of Raysistors.

Contrast and Brilliance Control

In a modern television receiver, the contrast and brilliance control circuits are often intricately tied-up in a network of subsidiary functions such as gated a.g.c., noise gating, sync extraction, etc. Fig. 3 shows a typical circuit as present in the author's receiver for 625-line operation, and a discussion thereof will clarify a number of fundamental points regarding the basic functions and methods of incorporating remote control facilities therein.

The video voltage developed by the video detector D1, largely across R19, the diode load resistor, is applied between the grid of the video output stage V1a and a tap on the cathode resistor combination of this stage (junction of R23/R24). The video signal output of this stage is largely developed across the anode load resistor R7, from which it is coupled to the cathode of the c.r.t. It will be seen that a d.c. path exists between the video detector D1 and the c.r.t. cathode, so that the black level is transmitted directly. R22, R23 and the contrast control VR6 at the receiver together constitute

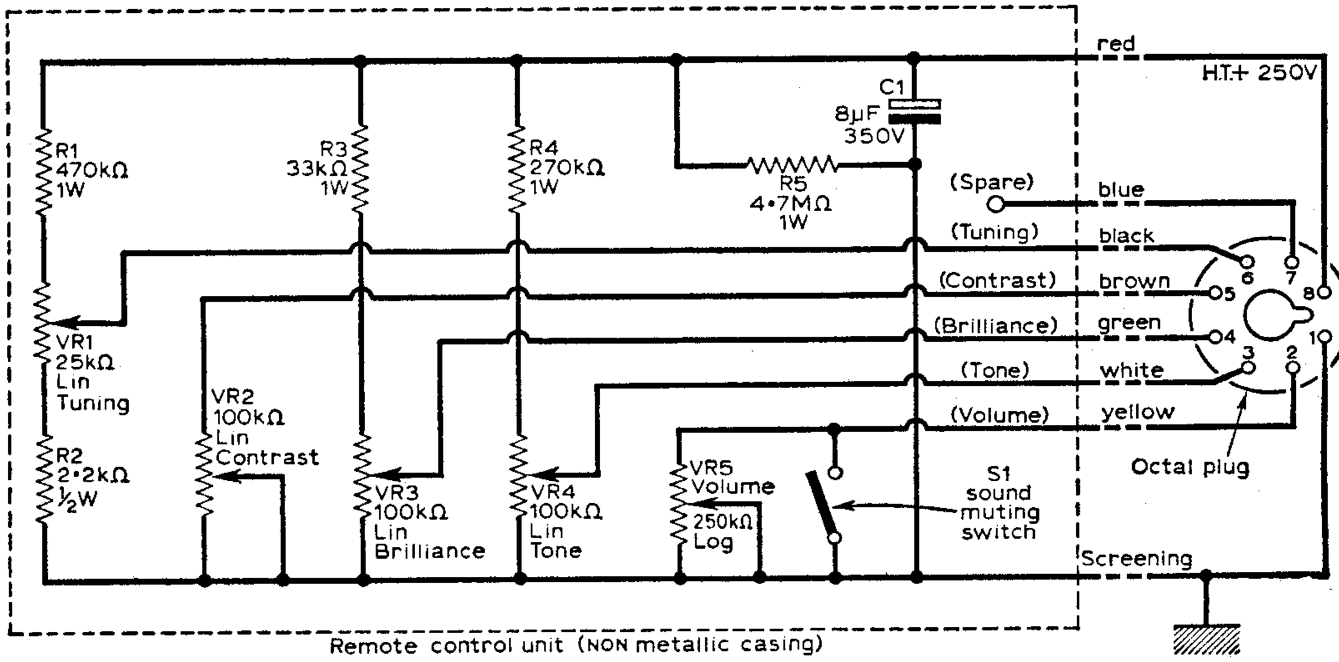


Fig. 1—Theoretical circuit of the remote control unit as used by the author.

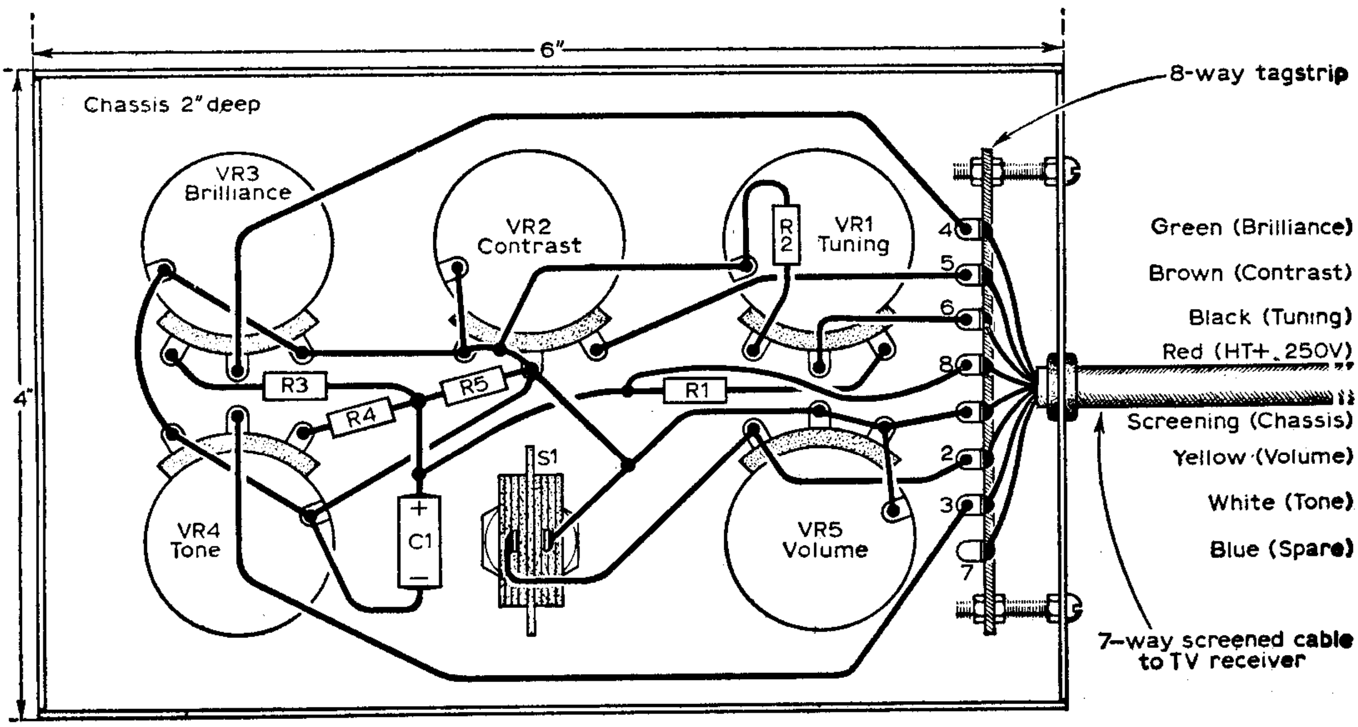
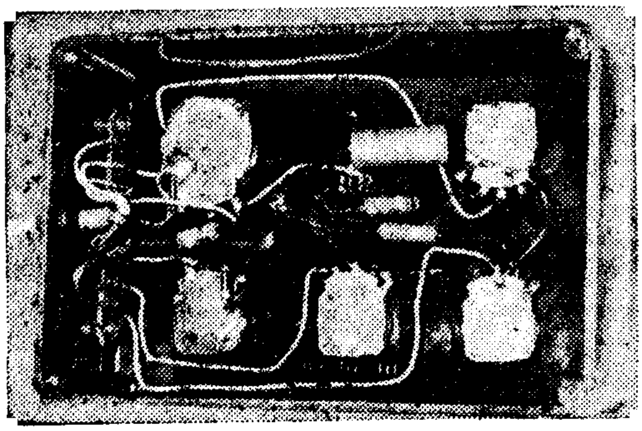


Fig. 2—The layout and wiring diagram of the unit assembled in its case.

negative feedback for the video output stage which is varied by VR6, which not only controls the video output voltage at the anode, but also the video output voltage across R24 in the cathode circuit. This resistor is shunted by C10 to suppress the video waveform at this point, and gives clean reproduction of line sync pulses, which are fed directly to the cathode of V1b, the a.g.c. gate stage. It is quite common to find a triode pentode used as combined video output stage and a.g.c. gate stage, since the two functions are generally closely interlinked.

The A.G.C. Gate Stage

One may consider the a.g.c. gate stage as a diode, since the grid is normally at chassis potential (due to grid current in V2a on account of R29 being returned to h.t.+), and the positive cathode potential thus determines the "effective anode resistance" of the "diode", i.e. the anode current drawn for a given anode pulse voltage. The anode is not connected to any standing h.t. voltage, but is fed with positive line flyback pulses from an auxiliary winding on the line output transformer. The method of coupling is the same as in a leaky grid detector, with C14 corresponding to the grid capacitor and R25 to the gridleak, in conjunction with R26. A negative voltage is consequently established across R25 and R26 due to the leak-away of electrons accumulated on C14 during line flyback pulses. C13 and C15 smooth this negative voltage, which is then applied to the bottom end of the grid circuits of the variable-mu controlled stages in the tuner and vision i.f. chain. Since V1b can conduct only during line flyback, during which time always the line sync pulse level is operative at the cathode in determining the resulting pulse current establishing the negative control voltage, the latter is a measure of the vision carrier amplitude during line sync pulses, i.e. a true measure of the received signal strength suitable for correct a.g.c.



An inside view of the author's unit complete and wired.

If the signal strength received increases, the rectified voltage at R19 is more negative during line sync pulses (D1 is a rectifier for CCIR negative modulation), so that the positive voltage across R24 and thus at V1b cathode is less than before. V1b can therefore draw heavier pulse currents on line flyback pulses, whereas the negative voltage developed in the anode circuit increases, and reduces the gain of the vision amplifiers appropriately to restore the signal level at the video detector to almost its previous level. In case of decreased signal strength, the reverse action takes place.

If the contrast control, VR6 is adjusted, so as to decrease its resistance, the negative feedback in the video output stage is also decreased, and the gain of this stage therefore increases, which amounts to increased contrast. Furthermore, the voltage developed across R24 also increases as a result of this change, so that V1b cathode is more positive than before, pulse current in V1b is reduced, developed a.g.c. voltage reduced, i.e. vision chain gain increased, which is the second form of increased contrast. In spite of the apparently weak control range of VR6, the action is in fact quite powerful, giving a wide range of contrast control. Although this manual control is in fact to a large extent via the a.g.c. gate stage, the a.g.c. action itself is not disturbed, holding each signal level chosen with VR6, constant.

Remote Contrast Control

The impedance level at VR6 is low, of the order of a few hundred ohms. Thus moderate lengths of screened cable would be tolerable. There is consequently no objection to positioning VR6 anywhere on the receiver cabinet. However, distant removal to a remote control unit via an arbitrary long length of screened cable would not be permissible, since capacitive shunting of the video signal at V1b cathode could then be excessive and lead to incorrect a.g.c. gating.

The remote contrast control is therefore undertaken at the screen grid of the video output stage, where there are no video frequency signals, on account of the large bypass capacitor C9. If the resistance of VR2 in the remote control unit (Fig. 1) is increased, the screen grid voltage of the video output stage V1a is thereby increased, so that the gain and contrasts are also in turn increased. Furthermore, since the anode current and screen current, i.e. total cathode current, of V1a is thereby increased, the voltage across R24 will also have increased. The cathode of the a.g.c. gate stage V1b is consequently more positive, so that less line flyback pulse current can flow, the a.g.c. voltage drops and the vision chain gain increases, giving further increase of contrast. The wide range of contrast control is thus once again indirectly via the a.g.c. gate, without however disturbing the a.g.c. action itself.

The Noise Gate

If interference pulses appear in the vision i.f. waveform, these are passed to the grid of V2b which operates as an anode bend detector giving negative rectified pulses at its anode sufficient to cut-off the noise gate V2a at its grid, via C17, on all interference pulses which exceed the line sync level (full carrier) by only a relatively small amount. When the noise gate V2a is cut-off in this manner by a rectified interference pulse reaching its first signal grid, neither the sync feed from the video output stage anode to the second signal grid of the noise gate can get through to the noise gate anode, nor can the a.g.c. gate V1b function, because it is also cut-off at its grid under these conditions.

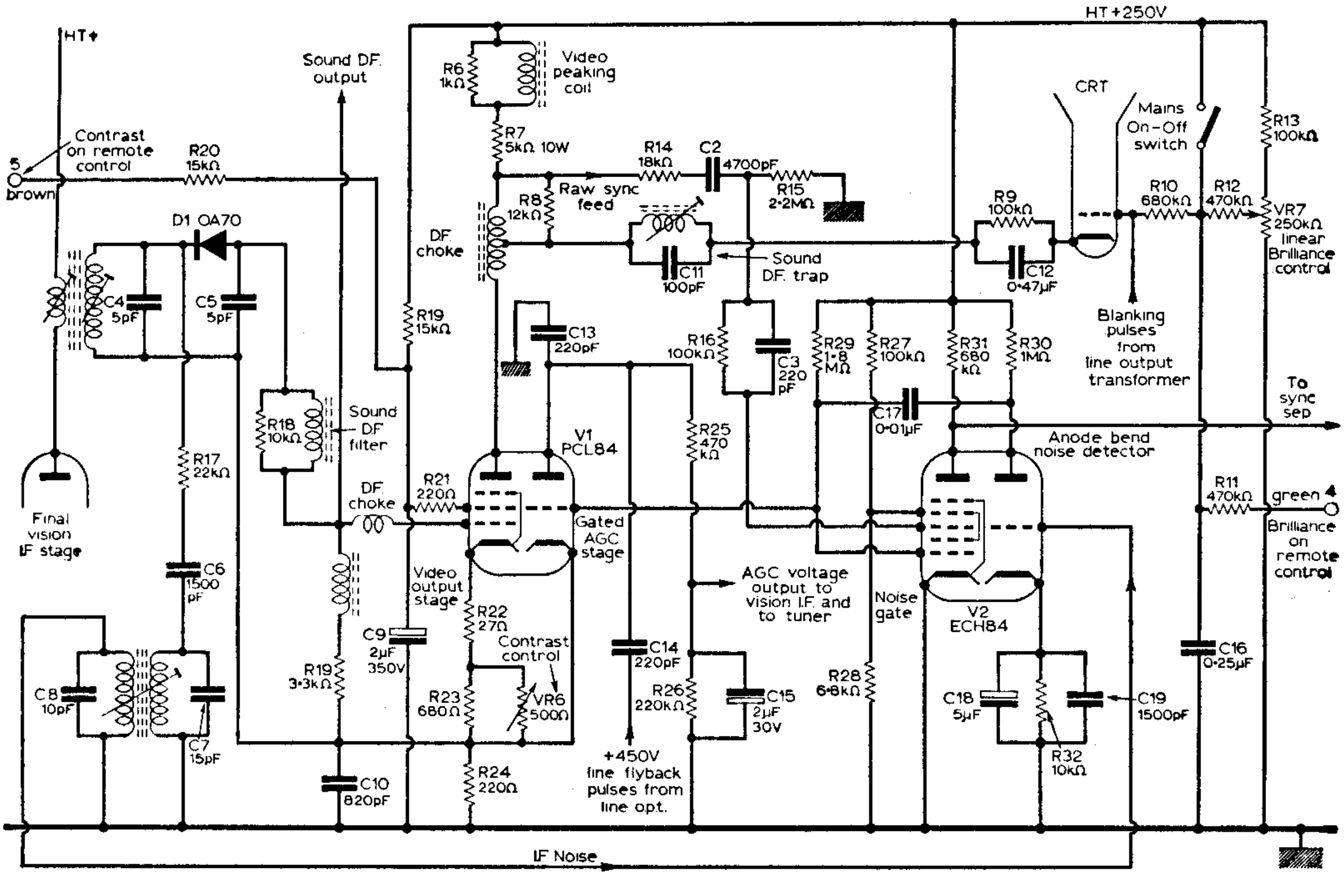


Fig. 3—Video circuitry of the author's television receiver, showing remote and local contrast and brilliance controls. The circuit as drawn is for 625-line operation.

Thus high noise levels cannot lead to falsified a.g.c. levels, and noise spikes are removed from the sync pulse train fed from V2a anode to the sync separator. In the design of the coupling network R14, C2, R15, R16, C3, the noise gate V2a is already made to function as a preliminary sync separator, i.e. to clip-off sync from picture content in a rough manner at its second signal grid, the subsequent true sync separator stage then merely having to complete the process under much less exacting conditions. The need for this two-stage cascade sync separation is due to the method of wide-range local and remote contrast control adopted, due to which the video signal amplitude at the point of sync feed extraction (video output anode load resistor R7) varies widely, making a single-stage sync separator critical and unreliable.

The noise gating on the sync separator chain is essential on account of the memory discriminator line sync circuit used in this type of receiver, in which the train of line sync pulses is compared in phase with the train of line flyback pulses from an auxiliary winding on the line output transformer in a discriminator developing an appropriate d.c. control voltage for a reactance valve circuit correcting the frequency of the line sinewave oscillator. The phase discriminator has an extremely high inverse impedance, so that the last standing control voltage is " remembered " for considerable periods, maintaining excellent line lock even if large numbers of line sync pulses are missing. Far more serious is the effect of noise pulses riding on line sync pulses, since these produce spurious phase error signals on the relatively low forward impedance of the discriminator and could thus easily upset line lock. With the noise gate properly adjusted and the discriminator set correctly, the performance of the circuit is in fact remarkable, with rigid line lock even on very weak signals with many missing line sync pulses. The receiver concerned has no manual line hold control, since this is quite superfluous in this type of circuit which is gaining popularity.

Brightness Control

The local brightness control, VR7 (Fig. 3), and the remote brightness control, VR3 (Fig. 1), are virtually in parallel and fulfil similar functions at the c.r.t. grid.

In the contrast and brilliance control circuit for local and remote operation described here, control is available at either position. The controls should always be set to maximum in one position, when full control is desired at the other position, otherwise only limited control is possible at both positions. Needless to say, the circuit design is such that correct control of contrast and brilliance is still possible at the receiver controls when the remote control unit is unplugged from the octal socket to be fitted at the rear of the receiver. This is true for all control functions involved in this design, being a basic essential of " compatibility " of the system.

This article will be completed next month. However for another angle on TV remote control, see page 166.

Servicing TELEVISION Receivers

No. 109: Radio Rentals 340 Series

by L. Lawry-Johns

CONTINUED FROM PAGE 127 OF THE DECEMBER ISSUE

IN later models a PCL82 replaces the sound a.f. and output valve V17 with a revised circuit and, of course, different valve base connections (Fig. 4).

Line Output

A 3·3kΩ resistor is wired between the contrast control and chassis with a 100kΩ resistor from the junction to h.t. X5 is added to the a.g.c. to prevent this becoming too positive (Fig. 5).

Mains Voltage Adjustment

A revised system enables the voltage adjustments to be carried out by plug and socket selection.

H.T. Rectifier

The LW12 originally fitted was changed to LW9 and then to LW7. The h.t. voltage output of this, 185V, should not be considered low as the normal, smoothed h.t. voltage is not much more than 165V.

This voltage should not be exceeded by any amount, and if a silicon diode is used as a replacement, a series wire-wound resistor should be wired in series to maintain the h.t. at about 170V.

A higher h.t. is not an advantage and would lead to rapid failure of valves and components which would otherwise have continued to function normally.

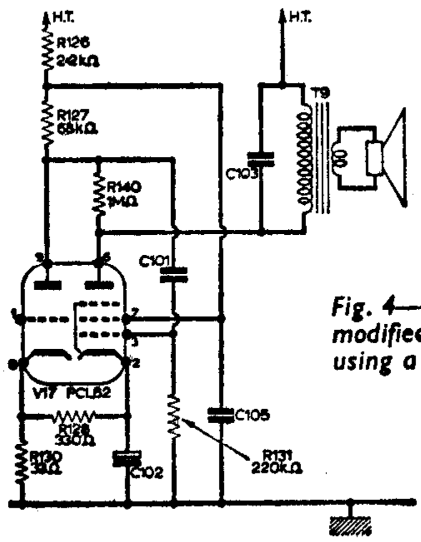


Fig. 4—In later versions this modified sound output stage using a PCL82 was incorporated.

FAULTS TO BE EXPECTED

No Sound

The chief suspect must be V17 (PCL83) or the PCL82 if this type is fitted. If the valve is not at fault check the voltages at pins 6 and 8 as indicated in Fig. 1b.

Absence of voltage at both points should direct attention to the condition of R126 (1kΩ). If this is burned out check C105 (16μF), and check the valve (V17) if this has not already been done. A short in the output valve often causes failure of this resistor.

If the voltage is present at pin 8 but absent at pin 6, check the continuity of T9 sound output transformer. Also check the condition of R128 (180Ω) and R130 (150Ω) bias resistors. These will be damaged if V17 passes heavy current.

If voltages are correct at pins 3, 7, 6 and 8, but there is little or no voltage at pin 1, check R127 (220kΩ). This occasionally goes high.

Before the sound fails almost completely due

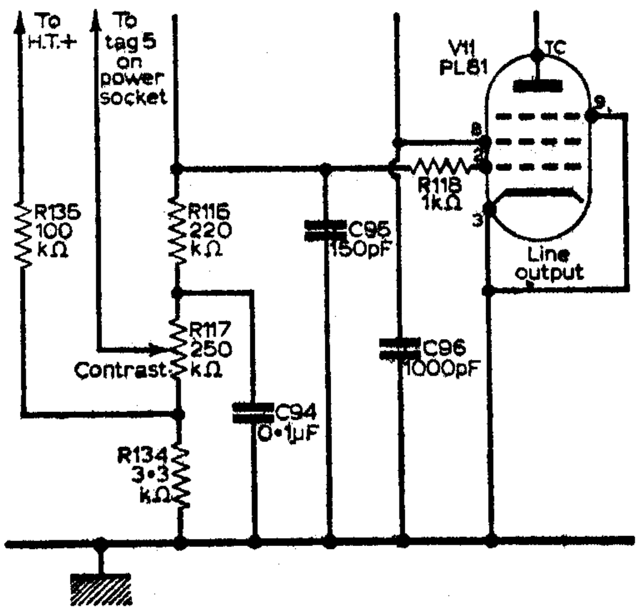


Fig. 5—Modified line output circuit.

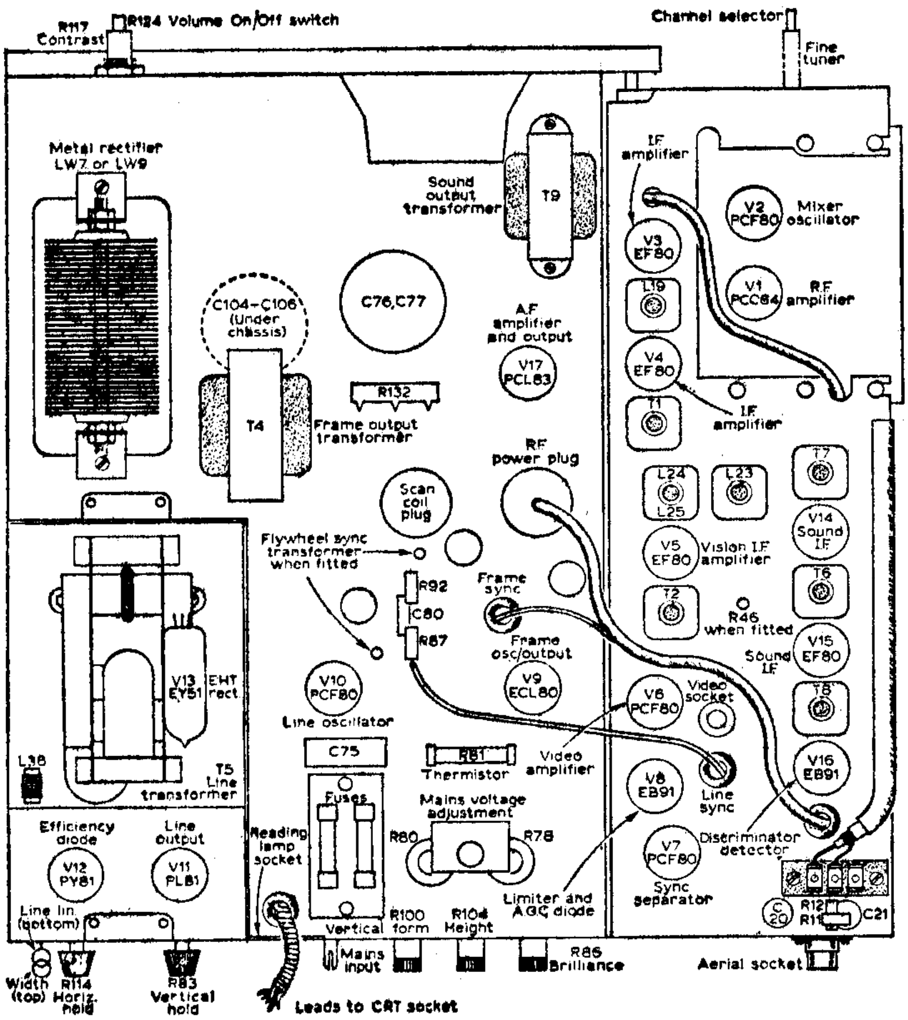


Fig. 6—An above-chassis view of a Radio Rentals 340 series receiver, showing the layout of the major components.

to R127 going high, severe distortion will be apparent.

If the output stage is obviously in order, as evidenced by background hum and some response as the volume control is advanced, the noise limiter and detector stages can usually be ignored and the search concentrated on the two i.f. stages V14 and V15.

Check pins 7 and 8 voltages to ensure h.t. is reaching the anodes and screens, and the cathode voltages at pins 1 and 3 to ensure the valves are passing current.

Raster—No Picture

If the sound is present and a good raster is displayed when the *rear* brilliance is advanced (the front control is contrast), it will be necessary to check the V5 and V6 stages. If the brilliance level is higher than normal, attention is directed to V6 PCF80 and it quite likely that this is at fault with no emission.

The reasoning is as follows: If V6 passes little or no current there will be little or no voltage drop across R35, which is the cathode resistor of V6 triode. This means that the cathode will be at (or near) chassis potential, and as the c.r.t. cathode is directly coupled to this point a drop of c.r.t. cathode voltage has precisely the same effect as increasing the brilliance setting.

From this, therefore, it can be seen that as the emission of V6 falls, due to ageing, the brilliance level will rise and the contrast will fall off producing a watery picture of poor sync.

It is sometimes found that the no-picture condition is due to a burn out of components in the V6 pentode stage affecting those components to pins 2, 3 and 7. This is often due to an internal short in V6.

However, when V6 is replaced and the faulty resistors renewed, the symptoms (no picture) remain. This is nearly always due to the OA70 (X4) having sustained damage during the time when the V6 control grid became heavily positive when the short occurred between the screen (G^2) and grid (G^1).

Replacmeent of X4 will normally restore working conditions if L27 is intact, which it usually is.

If none of these conditions obtain, the trouble will almost certainly be found in the V5 stage and the voltages, or lack of them, at pins 1 and 3 (bias) and 7 and 8 (h.t.) will quickly reveal the cause.

This assumes that V3 and V4 are used as vision and sound amplifiers as they are in all modified models.

Weak Sync

When there is plenty of contrast in the picture, but it is hard to hold both horizontally and vertically, the stage to receive attention is V7 PCF80 which is the sync separator.

The next suspect is R37 (1·8MΩ), which may go high, but leakage through C45 (0·1μF) can equally lower the pin 3 voltage.

No Raster—No Picture

Nothing on the screen when the brilliance is advanced, sound normal. This usually points to a line time base defect and the following procedure is a time saver.

Note whether the line whistle is audible and whether the EY51 heater is glowing. If there is little or no whistle the EY51 will not light, but if the EY51 heater shows a normal glow it is unlikely that the fault is in the line time base at all and attention should be directed to the tube base voltages and the ion trap magnet.

Assuming, however, that the EY51 is out, note the line whistle pitch and check for spark at the anode, single wire, end. If the whistle pitch is normal, and a good spark can be drawn off, it is

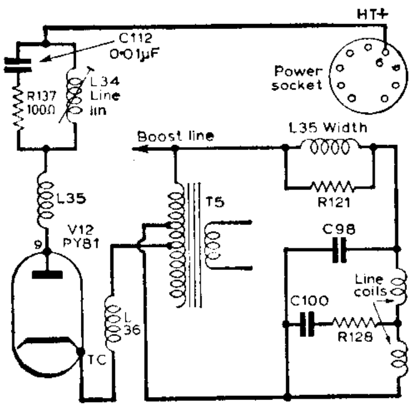


Fig. 7—The line linearity circuit of later versions.

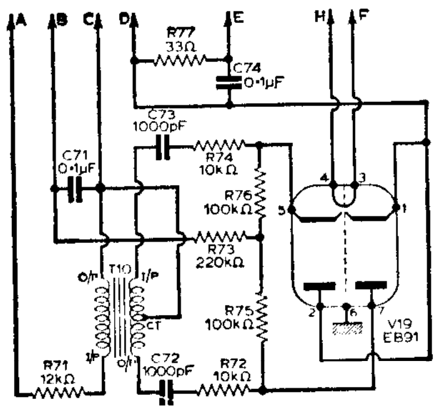


Fig. 8—The flywheel sync unit circuit. Some models may employ an alternative circuit using a 39K2 rectifier, when pins 4 and 5 of the r.f. plug (F and G; see also Fig. 1b last month) will be linked.

likely that the EY51 heater is o.c. and a new valve will restore normal conditions.

If the line whistle is subdued or ragged, note the effect of removing the e.h.t. clip from the side of the tube. If the whistle becomes normal and the arcing from the freed e.h.t. clip has a more violent or flame-like quality, it is almost certainly due to an internal short in the EY51 which must, of course, be replaced.

If removal of the e.h.t. clip brings no change in the conditions, check the PL81 and PY81 by replacement, and then suspect C97 (0·25µF). If the PY81 is red-hot, disconnect C97, which will probably be found shorted to chassis. If the PL81 is found to be overheating, check V10 PCF80 and associated components.

Lack of Width

If the h.t. voltage is much under 160V the metal rectifier may be suspected, but if the voltage is a lot lower than this, C76 (150µF) should be the chief suspect.

If the h.t. voltage is over 160V, attention should be confined to the line time base V10, V11 and V12 and associated components.

Lack of Height

If the height control is at maximum without filling the screen top and bottom, attention should be directed to the resistor R96 (1·5MΩ) wired from the boost line to i.s. of T3, and the decoupling capacitor C86 (0·01µF), which may be leaky.

Should, however, these items not be at fault, check the resistor R103 (390kΩ) which can, but doesn't often, go high.

Bottom Compression

Check V9, ECL80 and C87 (100µF), and if neither are at fault, the linearity components, C91, etc. If the bottom is folded, check C88 and C90.

Vertical Hold

If this is at the end of its travel, check V9 and R91 (2·2MΩ), C86 if necessary.

Valve Base Voltages

The voltages indicated on the diagrams were taken with a fairly low sensitivity meter and in a circuit containing fairly high resistance, higher readings will be obtained when a more sensitive meter is employed.

For example, using a 1,000Ω per volt meter, a reading of 67V would be recorded at pin 1 of V9, whereas if a 20,000Ω per volt meter is applied to the same point approximately double this voltage would be recorded.

This is due to the feed resistor having a high value (1·5MΩ), as at pin 6 about 150-160V would be obtained on both meters, i.e. the shunting action having little effect where the total impedance of resistance is low.

Tilt

A lever is attached to the deflection coils to enable them to be rotated slightly. Reduce height and adjust lever to straighten top edge.

Shift

The centring lever protrudes from the top of the focus assembly. Up and down movement produces a side to side shift of the picture. Sideways movement produces a vertical shift of the picture.

NEXT MONTH EMERSON E700 AND E701

PART I EARLIER SYSTEMS

VIDEO A.G.C. SYSTEMS

BY H. W. HELLYER

WHILE preparing Part 6 of the recent series on "Stock Faults" it became obvious to the writer that the subject of automatic gain control systems was too large to be covered in a single article. This is not to say that the number of faults appearing in these circuits exceeds the average—although they may seem at times to be much more elusive.

But there are many differing forms of circuit achieving the same end; the Editor has kindly allowed us the space to discuss them

First, what is the end these circuits set out to achieve? What, in short, is a.g.c.? Why is it necessary?

As with a radio receiver, the principle of automatic gain control is to smooth out fluctuations of signal level and present an unvarying strength of picture. There are likely to be wide differences between the signal strengths of the several stations to which the television receiver is tuned and a.g.c. obviates the need for constant manual control when switching programmes.

With a radio receiver this is comparatively simple to achieve: a sample of the signal is rectified and fed back as a bias voltage to the controlled stages. A delay is effected to allow the set to operate at full gain on weaker signals by backing off this bias voltage.

The time constants of the a.g.c. circuit tend to smooth out the variations and give an average level of signal, the bias being roughly proportional to the amplitude of the carrier.

FLUCTUATING MEAN VALUE

Things are not quite so simple when attempting to sample the modulated carrier of a television signal to obtain the control voltage. The carrier does not keep a constant average—or mean—value.

It fluctuates according to the brightness content of the picture. In short, if there is no video modulation there would then be no a.g.c. and the controlled stages would overload.

Adjustment of bias to eliminate this would result in peak whites being reproduced at "Brand X" quality, while black pictures would be grey.

Then why not use the sound channel signal as a source of control voltage as before? In fact many early receivers did just this, relying on separate sensitivity controls for coarse control and the a.g.c. from the sound channel to help control the finer variations.

Unfortunately the type of signal variation, fading, which it is most desirable to smooth out is frequency selective and the sound and vision channels may very well be out of phase as regards changes in signal strength.

So a further refinement was necessary: the signal had to be sampled at some video point and augmented by sound a.g.c.

A convenient point at which to sample the video signal is the input to the sync separator. This is the usual tapping-off point employed in circuits that incorporate a "mean level" a.g.c. system.

TWO MAIN SYSTEMS

There are two basic methods: the mean level, just mentioned and which we shall go on to discuss, and the "keyed" or "gated" system, rather more complicated, which we shall deal with later.

The former is most widely used, mainly because it requires much less circuitry and seems to be generally acceptable by viewers. Readers of *Practical Television* are, *ipso facto,* not to be included in the category of those who will put up with anything.

The following notes may therefore be regarded as of academic interest and attention will be paid to the various systems in use by manufacturers in the hope of sparking off some home-built modifications toward picture improvement. Any practical ideas will be considered, tested and reported upon.

To resume, the mean level system was discussed in Part 6 of "Stock Faults" and several commercial circuits given. Fig. 1, accompanying this article, is an idealised circuit which shows the rudiments of those circuits. Readers may be interested in turning back the pages to compare notes (pp. 33-37, October, 1964).

The pentode valve, V1, is a conventional sync separator. The video signal is applied to the grid via a d.c. blocking capacitor C1 and charge component. The action is that of a diode, the grid-cathode path forming the diode with R1 the load. Positive-going sync pulses cause a flow of grid current, C1 charges to the negative cut-off voltage and thus any variation of video signal level gives a change in voltage across R1.

The negative voltage is applied to the a.g.c. line via a high-value resistor R2, with C2 acting as a bypass for any residual video voltages. This filtering action is necessary as the control voltage is being fed back to r.f. and i.f. amplifier stages, which would tend to amplify the video signals if they were not bypassed, giving out-of-phase signals at the video amplifier which would display as distortion.

In practice separate filtering is provided at each application point. The high-value resistors have negligible effect on the d.c. bias as the amount of current flowing is very small indeed.

But the full negative bias is not required, especially when weak signals have to be amplified. Therefore a neutralising positive voltage is applied to the point A.

This is derived from a tapped or variable resistor across the h.t. line, which can now be used as a preset contrast control, determining the level at which the a.g.c. shall come into operation. This may be considered as the delay voltage and is applied via R3.

This last resistor has another function besides isolating the contrast control from the sync separator grid circuit. A clamp diode D1 is placed across the a.g.c. line with its cathode taken to chassis. Thus in the absence of a signal the positive voltage from the contrast control causes D1 to conduct and the a.g.c. line is effectively clamped to chassis.

There is a voltage drop across R3. But when signals cause the capacitor C1 to charge up, the negative voltage at point A increases, and when it equals (or very nearly equals) the positive voltage, D1 ceases to conduct.

The two voltages across R3 are then in opposition and any increase in signal is fed as a negative bias along the a.g.c. line.

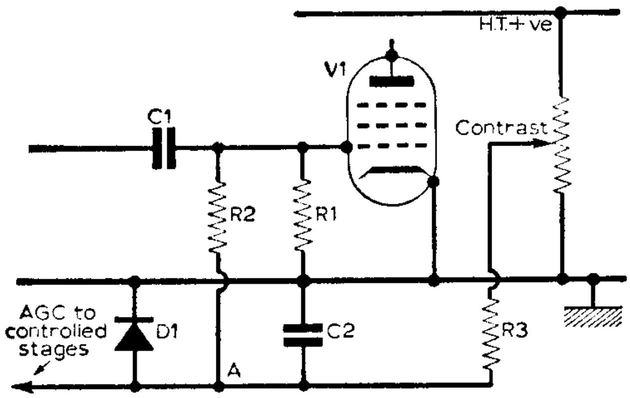


Fig. 1—Simple mean-level system. Pulses from the sync separator grid are rectified and passed as d.c. to the stages which are to be controlled. A backing-off voltage is applied via the contrast control to determine the level at which the a.g.c. comes into operation.

The effect of this type of simple system is to reduce the sensitivity of the receiver when a bright picture is coming in, and this is what reduces the overall contrast of the picture, increasing the gain of dark pictures and reducing the gain of bright ones. The d.c. component of the signal is removed.

Further, the time constant of the filter components may be about a half-second (R2=5kΩ and C2=0·1μF as a typical example). This gives a pretty average response to brightness variations due to normal fading and allows the set to recover when switching from a weak to a strong signal without too much delay but does not allow it to respond to rapid variations caused by aircraft flutter, for which more elaborate circuits have to be used.

VARIANTS

Variations on this theme include different methods of clamping, some of which employ parts of the sound channel and others the suppressor grid of a non-controlled i.f. stage.

An example of this is the Regentone Ten-17 circuit, illustrated in Fig. 2 of the previous article. When a suppressor grid of an amplifier is positive with respect to cathode, conduction occurs, the valve electrodes acting as a diode.

In the absence of a signal the positive voltage from the contrast control brings about this state of affairs and the a.g.c. line is held at approximately the voltage of the cathode of this "clamp" valve —about 3V positive to chassis.

This system gives a better range of a.g.c. control than by using a simple clamping diode which is only effective on weaker signals.

Other variations may be separate delays for r.f. and i.f. amplifiers, with individual clamping and individual filtering, which can become quite complicated. But the basic factors of the mean-level system are as shown above and no great difficulty should be experienced in translating the complications of different makes so long as the principle is understood.

GATED A.G.C.

The same can hardly be said of the gated system. There have been many variations with quite different circuitry and although modern methods have largely superseded this type of circuit it is only proper that we should raise our hats to Messrs. Pye, who brought out their a.p.c. (automatic picture control) system in a blaze of publicity in 1953 with the V4 circuit.

This employed the principle of the sampled pulse: keying a valve at the correct moment so that the conduction is actuated by the flyback but delayed slightly, driving the grid of a control valve positive, switching the video circuit to the a.g.c. line for a very short period during the "back-porch" period.

There should be little need to go into the details of the "back porch" except to state that the television signal waveform is at black level, a constant 30% of the video signal, for a few brief microseconds before and after the "blacker-than-black" excursion of the line sync pulse.

This black level is always of the same amplitude for any given strength of signal, regardless of picture content, and thus provides a useful reference level. In this method the a.g.c. bias is not affected by the video modulation.

Normally the control sample is taken from the video output and various circuits shape and apply it to the a.g.c. control valves.

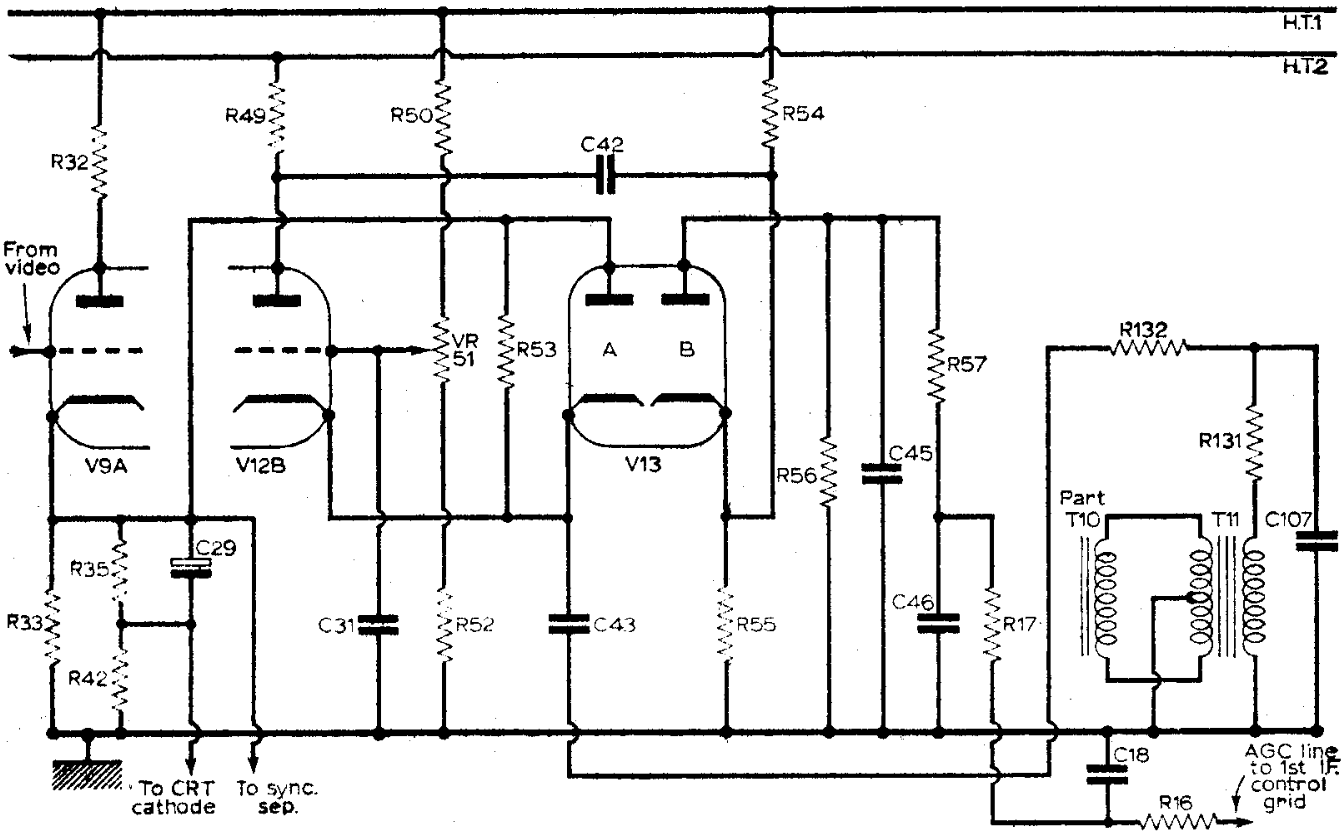


Fig. 2—The original Pye "automatic picture control" circuit, used in their V4 and V7 range. Details of operation are given in the text. Note the switching action of the pulsed diode, V13, and the delayed pulse derived from the line output transformer T10 via the special transformer T11.

PYE A.P.C. SYSTEM

In the Pye system, illustrated with the frills removed in Fig. 2, the video output is applied directly to a cathode follower stage, V9A. The complete video signal is thus available to the cathode of this valve.

This is taken to the anode of the signal diode V13A. To the cathode of this valve is fed a delayed pulse from a winding on the line output transformer. This cathode is also linked to the cathode of V12B when the diode conducts.

The circuit is arranged so that the pulses are delayed to occur during the "back-porch" period or the black level period that follows the sync pulse. At that moment the cathode of V9A has returned to black level and V12B is virtually joined to it by V13A conducting.

The cathode of V12B drops to the potential of V9A cathode and the resulting negative pulse at the anode is passed, via C42, to the cathode of V13B.

This diode is normally biased to cut-off by R54, R55, but it now conducts. The output pulse charges C45 and smoothing and filtering by R57, C46, R17, C18 and R16 leaves a voltage to be fed back to the controlled first i.f. stage.

V13A can thus be seen to act as a switch connecting the cathodes of V9A and V12B when the gating pulse arrives. A change in signal level results in a change in black level voltage at V9A cathode, which causes a change in V12B cathode voltage when V13A conducts. The gain of V12B is set by the contrast control VR51.

Safety circuits are incorporated to prevent overloading during the warming-up period. The a.p.c. pulses do not occur until the line output stages warm up—and the efficiency diode, a PY81, is a slow-warming type.

A crystal diode is connected between video amplifier control grid and line output cathode effectively short-circuiting the signal and protecting the video amplifier until the line output valve conducts and biases the diode off.

Despite the mutterings of service engineers when the incompletely understood V4 went wrong this system really worked, giving a reasonably constant picture for a signal variation up to 20dB, which is a ten-to-one change approximately.

By modern standards this is limited as systems to be discussed later, applied to several stages at varying control levels, give a range of automatic control up to 60dB. Moreover the system needed a special winding on the line output transformer, a separate pulse transformer, several valves and a number of additional components.

Different ways of doing the same job were quickly developed by other makers and one or two are illustrated and described in the following text.

COSSOR CIRCUIT

A single-valve system that came into use quite early was the Cossor a.g.c. circuit used in the 938 series of receivers. Fig. 3 shows the rudiments, the two sections of the 8A8 triode-pentode valve being independent but with a common cathode connection.

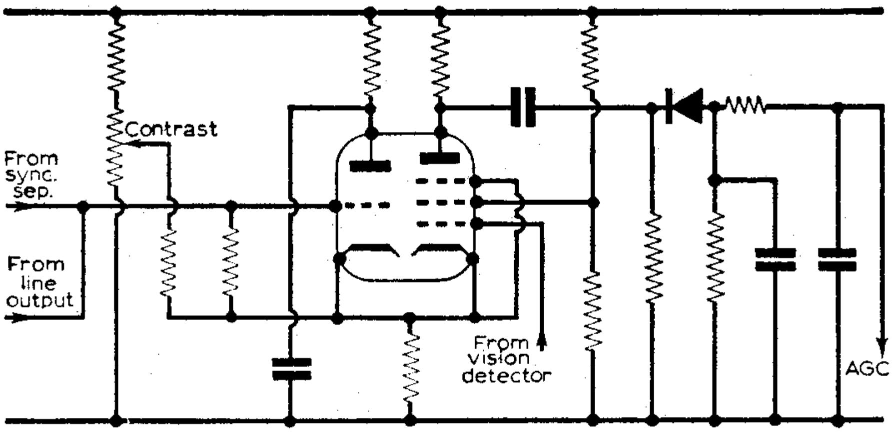


Fig. 3—A single-valve system, as used in the Cossor 938 and similar models. The valve is an 8A8, triode-pentode. The notable feature is the connection to the line output stage to provide keying pulses when no signals are coming in, and to prevent overloading of amplifier stages.

The triode grid returns to the cathode, whereas the pentode grid is taken to the vision detector. (Return path of this grid circuit is via the detector load resistance.)

Setting of the contrast control biases off the pentode but the triode passes anode current until sync pulses arrive at the grid.

These negative-going pulses drive the triode beyond cut-off, the cathode potential falls, the pentode conducts because the grid is driven positive, the sync pulse having been delayed to arrive during the "back-porch" period.

The amplified, negative-going pulse at the pentode anode is passed, via capacitor and diode, to the reservoir capacitor and filtered to be applied as a.g.c., controlling the r.f. valve and two of the i.f. amplifiers.

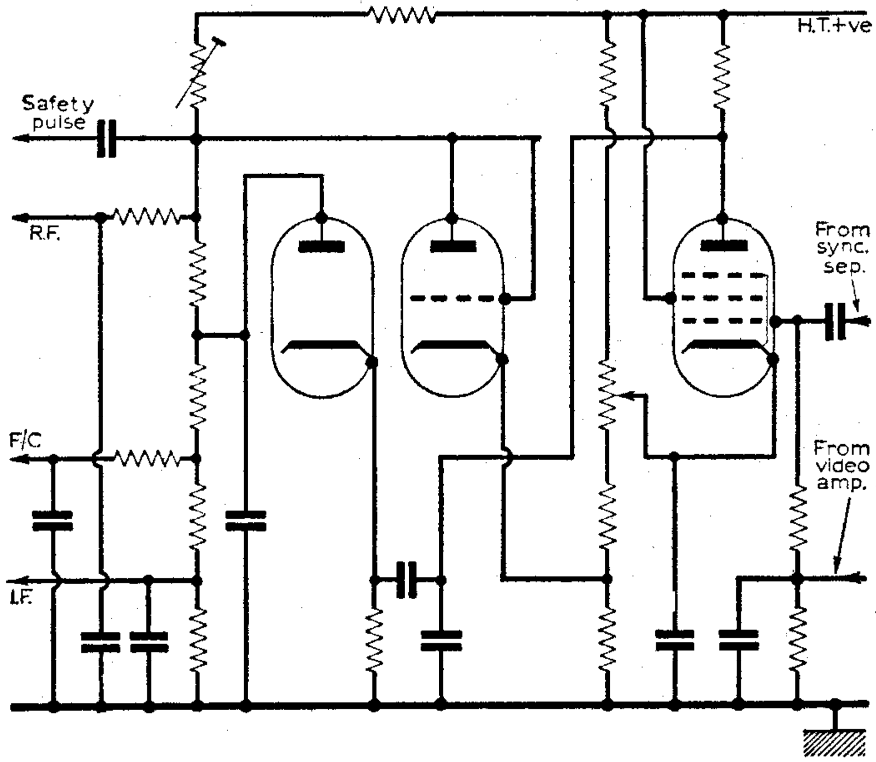


Fig. 4—A Ferguson circuit, with a.g.c. applied to the r.f., frequency-changer, and two i.f. stages. Point of special interest is the safety pulse applied to cut off the diode-connected triode, during surges.

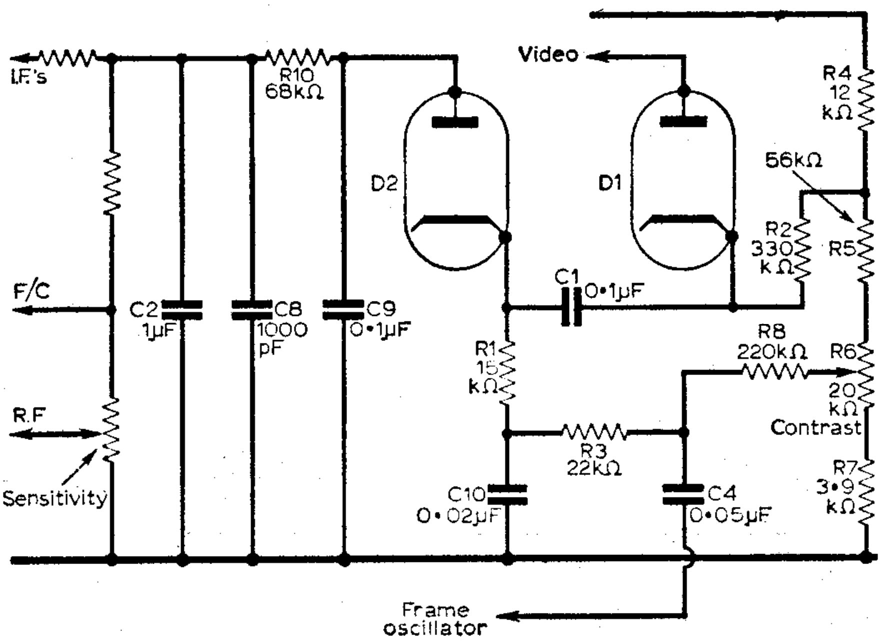
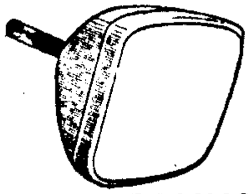


Fig. 5—An unusual frame-derived a.g.c. circuit, used by Ultra in the V15-60 range of receivers.

From the foregoing it can be seen that the setting of the contrast control determines the voltage at which the circuit kicks off, in turn dependent upon the pulses at the pentode, which are effectively the black level voltage at the instant of keying.

One necessary protection is the provision of artificial keying when no signal is coming in, so another signal is fed to the a.g.c. circuit from the control grid of the line output valve. This provides the a.g.c. line with a low voltage from the flyback pulses.



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FERGUSON A.G.C. SYSTEM

A different method was used by Ferguson to control several stages, as shown in Fig. 4. One special feature was the application of a.g.c. to the mixer and the first two vision i.f. stagse.

Other refinements were the delaying of a.g.c. to the r.f. amplifier, using a separate sensitivity control, and an unusual circuit whereby the uncontrolled i.f. amplifier became an anode-bend detector when a surge input reached it as during channel changing switching, applying negative drive to the triode anode, cutting it off.

The video signal is applied to the pentode grid and the setting of the contrast control in the cathode of this valve is such as to approach but not cause conduction. Sync pulses are also applied to the grid via a differentiator circuit.

The positive peaks cause the valve to conduct during the "back-porch" period, negative-going pulses at the anode are passed to the diode and thence via the filter circuits to the frequency changer and i.f. valves.

The triode, which has grid and anode strapped to operate as a diode, has its cathode potential fixed but its anode potential varied by the sensitivity control, giving a delay to the r.f. valve a.g.c. line. Strong pulses drive the diode to cut-off.

ULTRA METHOD

A very different principle is employed by Ultra in the V15-60 range. Here the frame sync period is used as the keying fundamental instead of the "back-porch" period. As this frame period is considerably longer in duration the circuit has some quite unusual component values and these are given for reference in Fig. 5.

It will be seen that D1 samples the incoming pulses from the video amplifier, being d.c. coupled to the video anode, and from the anode of the frame blocking oscillator via C4. These frame pulses are applied to the junction of R3 and R8 so that both cathodes receive the keying signal.

On negative excursions D2 conducts and C9 charges up. The same pulse drives D1 cathode negative and, as the video signal is negative-going, at the bottom of the sync pulses there will occur peak positive excursions.

So D1 passes current throughout the frame sync pulse period and as this is at black level during the half-line periods the stronger the signal the more negative the black level voltage will be and the greater the pulses passed to D2, rectified and applied as a.g.c.

The a.g.c. is applied to the r.f. valve, the frequency-changer and two of the three vision i.f. stages as with the Ferguson circuit of Fig. 4. It is quite unusual for the mixer to be controlled in this way but the procedure of applying a delayed or adjustable bias to the r.f. valve will be found in many sets and the variable control is used as a sensitivity control.

Many of the receivers with less ambitious a.g.c. systems also employ sensitivity controls varying the gain of the cascode r.f. amplifier. On some models, notably earlier Raymond and Beethoven and the first of the Alba "packaged" printed circuit sets, separate sensitivity controls were used for Band I and Band III channels.

Examples of these circuits were given in the previous series of articles and need not be repeated here.

The foregoing is a small sample of the types of a.g.c. circuit that may be met when handling the popular ranges of receiver. A notable exception is that of Philips, whose circuitry is, to say the least, quite individual.

It is hoped to remedy this omission in the second and final part of this article next month by describing some Philips circuits in detail and discussing a.g.c. servicing procedure. In addition the problems of dual-standard receivers and their a.g.c. circuits will be looked at.

It is perhaps worth noting, if only to encourage the fainthearts, that a.g.c. systems are by no means the complicated jungles that some early circuitry might have led us to expect. A reversion to mean-level systems is obvious in the latest models, but with certain differences, as we shall see.

PART 2 NEXT MONTH

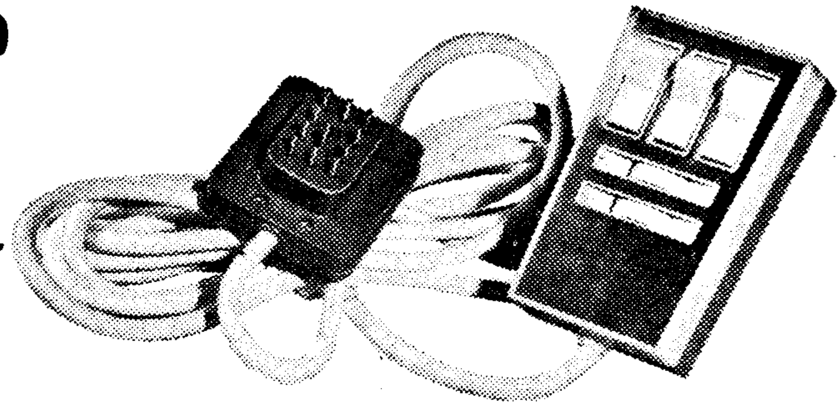
Christmas 1964

Seasonal Good Wishes
to All Readers
from The Editor, Staff
and Contributors of
"Practical Television"

Switch to REMOTE CONTROL

an inexpensive modification

by D. W. GRAHAM



IT is a desirable feature to add to a television receiver, remote control, for apart from the prestige value, it is nice to be able to relax in comfort and make adjustments to the volume and brightness of your set from the armchair. This of course has great appeal to anyone who is confined to bed and is lucky enough to have a TV in the bedroom.

It is not the author's idea to describe the construction of such a unit but to show the uses of a ready made remote control unit made by a leading manufacturer which is readily available at the incredibly low price of 7/6 complete with 12ft of cable etc.

The unit consists of a control unit which contains on/off mains switch, sound muting switch, channel switch, and volume and brightness controls, this is connected by 12ft of multi core cable to a plug, and inside the head of the plug are many more components, reference to Fig. 1 shows the physical layout and Fig. 2 the circuit of the unit.

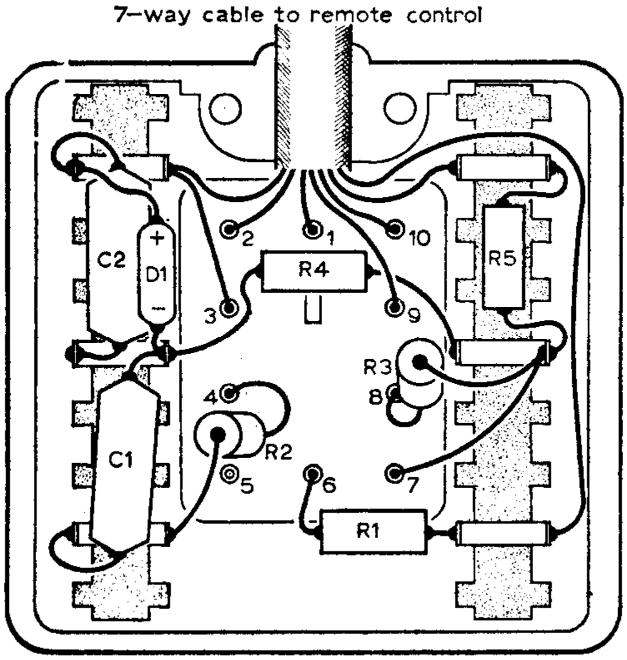
Circuit description

The mains on/off switch can be wired in series or parallel with the existing switching arrangement as will be described later on.

If you are fortunate enough to have a set with auto tuning by motor drive mechanism the channel switch can be wired in parallel with the existing switch, if you are not fortunate to have this function a use will be described later on for this control.

Brightness control is achieved by shunting the lower portion of the brightness network in your receiver with R1 and RV1.

The ingenious part of this unit is the method used to control the volume. Looking at the circuit you will notice that the volume control is only 5kΩ, this is where the procedure deviates from the normal practice and in fact if the volume were controlled by using the normal grid circuit volume control it would be very susceptible to hum pick-up. In this unit a portion of the line time base output derived from G2 of the line output valve is applied via R2, C1, to the OA81 crystal diode D1, which simply rectifies this signal and produces a negative d.c. output filtered by C2. This negative potential is varied by RV2 and applied to the sound a.g.c. line enabling the sound i.f. gain to be controlled. Operation of the muting switch S1 open circuits RV2 allowing this bias to rise sufficiently to cut off the i.f. valves.



COMPONENTS CONTAINED IN PLUG

Resistors:

R1	270kΩ	R4	3·3kΩ
R2	2·2kΩ	R5	560Ω
R3	1MΩ		
VR1	1MΩ potentiometer (brightness)		
VR2	5kΩ potentiometer (volume)		

Capacitors:

C1	0·01μF miniature paper
C2	0·0047μF miniature paper

Diode:

X1	OA81

Fig. 1—The layout of the components inside the plug.

This unit has been used by the author very successfully on the Ekco T231 series and Bush TV56 series. The connection of the unit to T231 series will be described and where possible in general terms, although no problem is envisaged with the connection of this unit to practically any set.

Connections

The connections will refer to the pin layout as in Fig. 2 looking at the ends of the pins (not the soldered ends).

If the on/off switch is the rotary type as in the T231 the remote control switch will have to be wired in series.

Connect pin 3 of the unit to receiver chassis. Remove the lead in the set connected from the chassis to one tag on the on/off switch, now connect to this tag a lead from pin 9 of the remote unit. Next determine the pair of switch contacts that switch the live side of the supply, remove the lead from one of these contacts (either one will do), mount this lead on a tag strip which can be fitted nearby and to it also connect a lead from pin 1 of the unit, now connect a lead from pin 2 of the unit to the tag on the switch from which the wire was removed. If the set has a push button on/off switch it is a simple matter to connect the remote switch in parallel with the existing one, making sure that pin 9 is connected across the earthy pair of contacts.

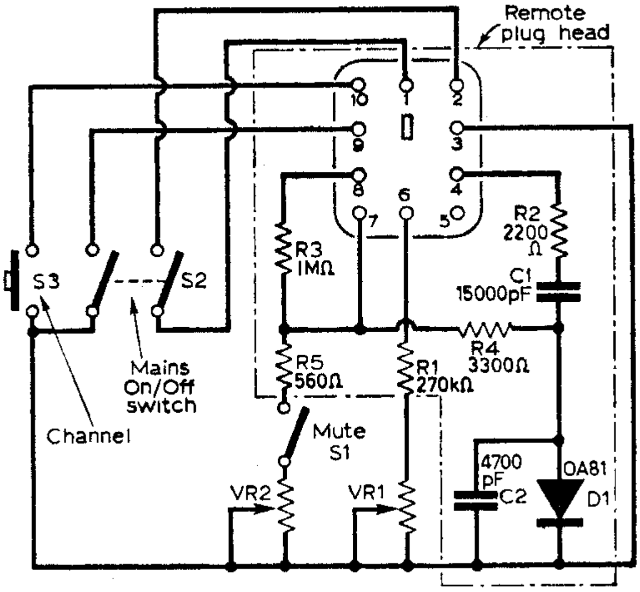


Fig. 2—The circuit of the complete unit. The plug is represented as seen from the pins side.

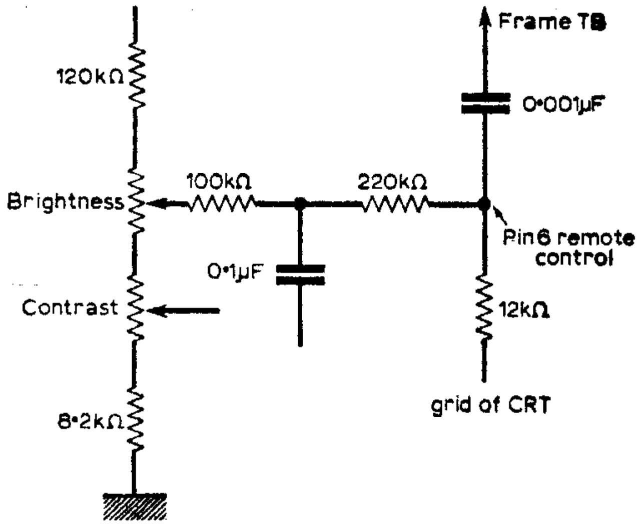


Fig. 3—Connection for brightness control between the unit and an Ekco T231 receiver.

Brightness control

This is a fairly simple matter to connect the remote brightness circuit to the centre connection of the set control, but unfortunately this is not so in the T231 series as this would also have some effect on the contrast network. The point chosen for the connection in the T231 is at the junction of the 12kΩ resistor going to the grid of the c.r.t., the 220kΩ going back to the brightness network and the 0·001μF capacitor connected to the frame time base. A lead is taken from pin 6 on the remote unit to this junction as in Fig. 3.

Volume control

First it is necessary to connect a lead from grid 2 of the line output valve (pin 4, 20P4) to pin 4 on the remote control unit. It is necessary now to ascertain the correct point to pick up the sound a.g.c. line, in the T231 pin 8 on the plug is connected to the earthy end of the sound i.f. coil going to the grid of the 1st sound i.f. valve (Fig. 4). This should not be too difficult a point to find in any receiver. Of course reference to your set circuit diagram is advised in making all the connections.

The only modification found necessary to the remote control unit was to fit a 1MΩ resistor across

—continued on page 179

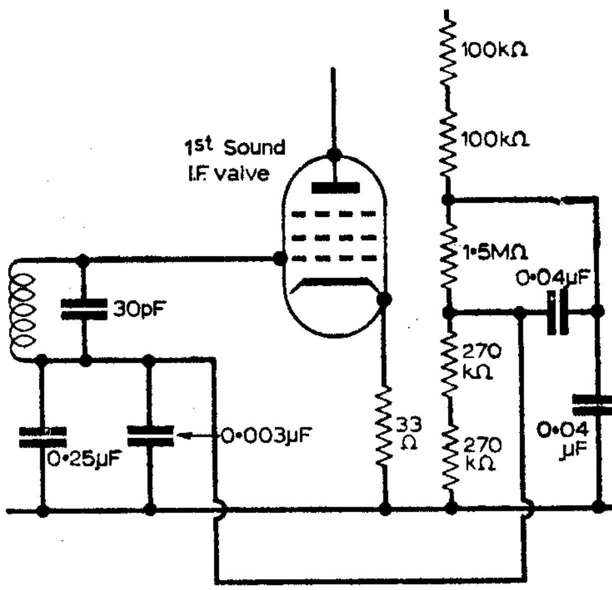
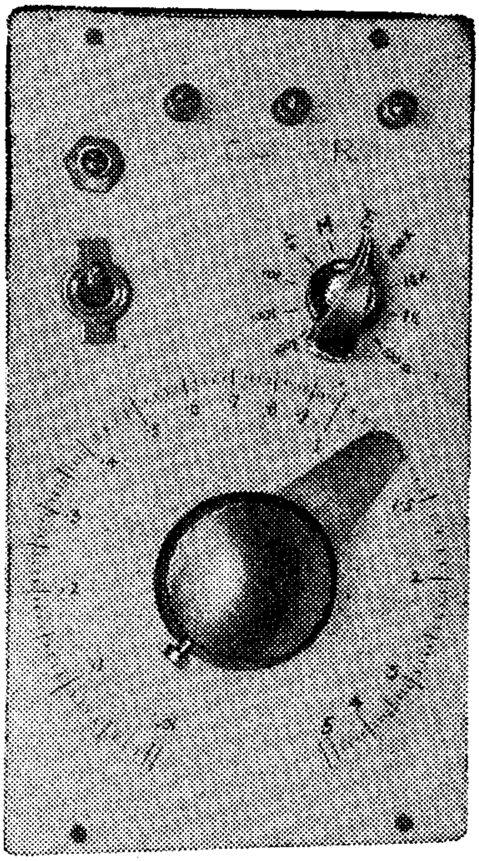


Fig. 4—Connection to the T231 sound a.g.c. line for volume control.

THE "RAVENOR" C



WHILE many amateurs have some sort of instrument for measuring resistance with varying accuracy, there seems to be a need for an instrument which can be used for determining resistance more accurately than can be done using the cramped scale of the usual multimeter.

The meter to be described can be built to measure resistance and capacity with an accuracy of 2% or better. It uses very few components, consequently the building cost is very reasonable.

Two versions of the meter will be described; the first being the usual arrangement with scale markings from 1/100 to 100 times the standard, the second a more accurate one with markings from 1/100 to 5 times the standard in use.

The Bridge Circuit

As the meter uses the principle of the Wheatstone Bridge, a brief explanation of this device for those unfamiliar with it may be acceptable. All meters measure a quantity against a standard which has been adjusted by the manufacturers. The resistance range of a multimeter measures an external resistance against an internal standard, and shows the value by a pointer moving across the face of a sensitive micro-ammeter, graduated in ohms and megohms. With a wheatstone bridge, an external resistance is measured by a potentiometer as a proportion of an internal standard. The scale can be made quite large, and is calibrated as a fraction, or directly in ohms.

Fig. 1 shows the bridge arrangement; the four resistors are arranged in the form of a square, with a sensitive meter connected across one diagonal, and a battery connected across the other. If the value of R4 is adjusted, a position of balance can be obtained, when the meter will show no deflection. In this condition the values of the resistors will be proportional, as shown by the equation

By G. R. Parish

$$\frac{R1}{R2} = \frac{R3}{R4}$$

If the values of three of the resistors are known, then that of the fourth can be calculated,

$$R1 = R2 \times \frac{R3}{R4}$$

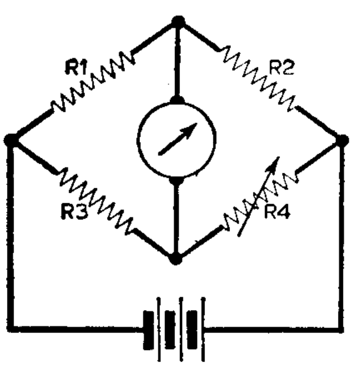


Fig. 1—The basic Wheatstone bridge arrangement.

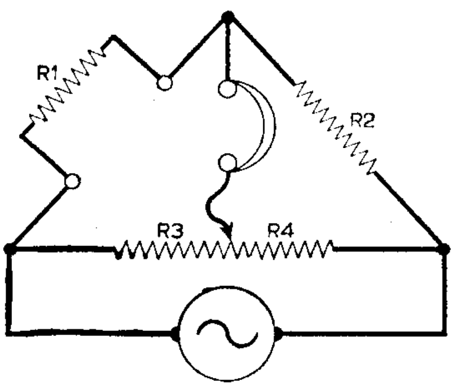


Fig. 2—A simple a.c. bridge.

It is more usual to make both R3 and R4 adjustable, using a potentiometer in place of both resistors. This makes the bridge much more flexible in use, and more convenient, since we can calibrate the scale of the potentiometer to show directly the value of

$$\frac{R3}{R4}$$

at any position of the pointer. Most of the calculations can, therefore, be avoided, and no more

and R BRIDGE

mathematics are involved in reading the bridge than are necessary with the usual multipliers on a meter.

Simple A.C. Bridge

Since we wish to measure capacity as well as resistance on the bridge, we cannot use d.c. current as a means of energy, as this will be blocked by the capacitors. A.C. must therefore be used, and, if a signal at audio frequency is injected, a pair of phones can be used to determine the zero signal condition. The new arrangement is shown in Fig. 2. R1 is the unknown resistor, and R2 is a high stability, accurately measured component. For measuring capacity, the positions of R1 and R2 will be occupied by the unknown and the standard capacitors.

If the potentiometer is calibrated in the ratio of the values of R3/R4, the same scale can be used for measuring capacitance and resistance, the only snag being that, while current diminishes with increasing resistance, the opposite is true of capacitance, so one scale should be a "mirror" of the other. However that difficulty can be easily overcome by reversing the positions of the standard and the unknown when switched to measure capacitance.

The Oscillator

Any audible source of a.c. could be used to energise the bridge. Anyone possessing an audio-signal generator could use this, for example, but it is obvious that convenience and accuracy can be affected by the frequency of the signal.

A signal at 50 c/s, for instance, could be easily obtained from the mains, but this would be too low to use with small capacitors, and the null point would be difficult to determine anyway. Even the 400 c/s signal used in some signal generators would be rather low for use here.

An inexpensive oscillator circuit based on a Mullard design has however been included in the circuit and gives excellent results. It uses only one transistor, a home made coil, and a few capacitors and resistors. The layout and construction are not at all critical, and the signal of about 5 kc/s is clearly audible with even the smallest capacitors. (The output can also be used as a signal injector in audio circuits.)

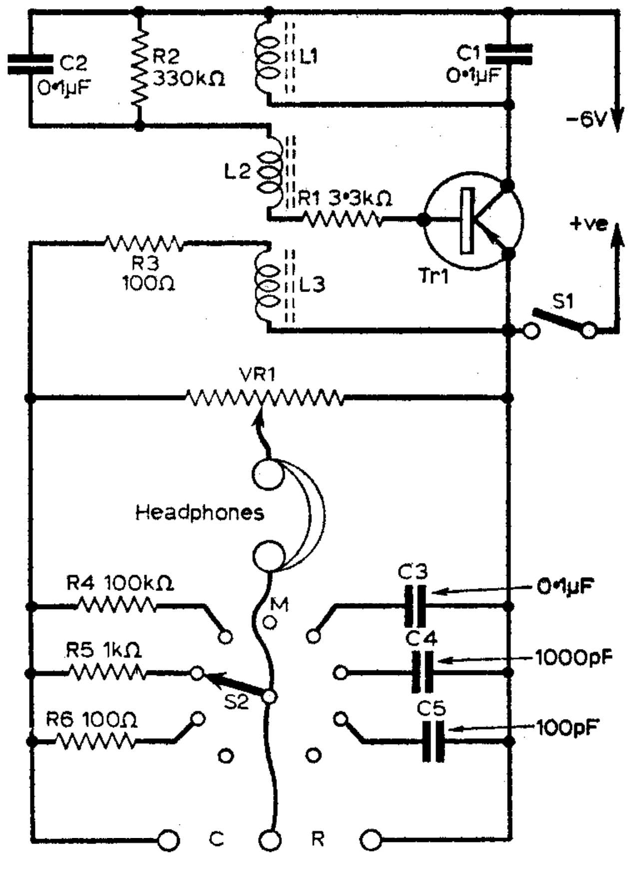


Fig. 3—The complete circuit of the instrument.

The Complete Circuit

The circuit for the instrument is shown in Fig. 3, and one or two points about the components should be noted. The most important item is, of course, the potentiometer VR1. It must be linear, wirewound, and the larger the diameter, the more accurate it will be. That used in the prototype is a surplus W.D. item, 3in. in diameter, value 3kΩ. Any value, however, from 1kΩ to 5kΩ may be used.

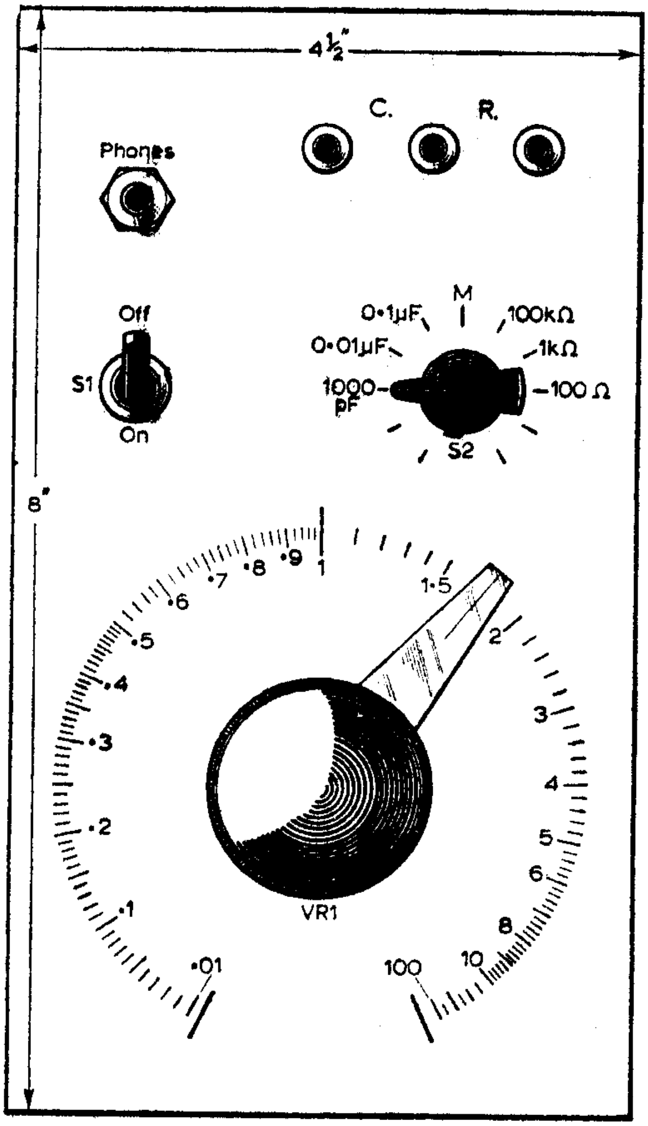


Fig. 4—The front panel layout of control and sockets adopted by the author.

The standard resistors should be of 1% tolerance, high stability, and need only be ¼W type. A minimum of two will be required, 1kΩ and 100kΩ. These will cover the range from 10Ω to over 1MΩ, but the accuracy at the lower end of the scale will be improved if a 100Ω standard is included. This will be an advantage when measuring low values for transistor circuits.

A 1,000pF silver mica 1% tolerance capacitor, and a 0·1µF paper capacitor, preferably non-inductive, and of close tolerance as possible, are required for standards. Again, the accuracy can be improved by the addition of a 100pF silver mica 1% for the small capacitors of a few "puffs," or a 0·01µF paper or mica for the middle of the range.

The range switch is a single-pole miniature rotary type, with from five to nine contacts, according to the number of standards it is intended to use. It will be noted that one contact is not used; the purpose of this will be explained later.

Construction

The bridge is built on an insulating panel; the prototype used a piece of white formica. This has the advantage of allowing the markings to be made directly on the surface and dispenses with white cardboard scales which fade or discolour all too soon. Fig. 4 shows a suggested layout; the components should be laid out on the panel before drilling in case differences in dimensions are not sufficiently allowed for. The oscillator is built on a separate sub-panel, which is mounted at right angles to the main panel to save space. All connections should be kept as short as possible, and the two output wires from the oscillator should be kept widely spaced to prevent capacity effects

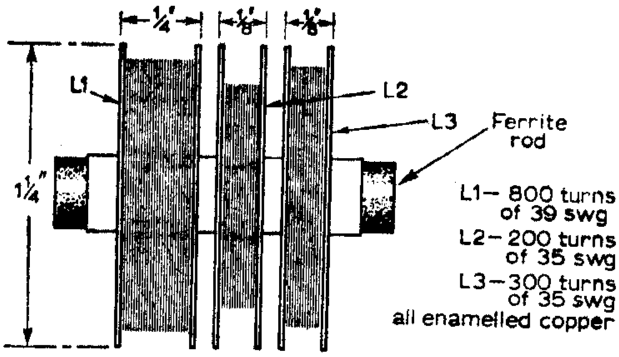


Fig. 5—The oscillator coil (L1, L2, L3) winding details.

COMPONENTS LIST

Resistors:

R1	3·3kΩ	R4	100kΩ 1% H.S.
R2	330kΩ	R5	1kΩ 1% H.S.
R3	100Ω	R6	100Ω 1% H.S.

All 10% ¼W carbon, unless otherwise stated.
VR1 1kΩ-5kΩ w.w. potentiometer

Capacitors:

C1 0·1µF paper
C2 0·1µF paper
C3 0·1µF paper, H.S.
C4 1,000pF silver mica
C5 100pF silver mica 1%

Miscellaneous:

S1 On/off toggle switch
S2 Single-pole, 9-way miniature rotary switch
Tr1 OC71

Pair of balanced armature headphones. Jack plug and socket (P.O. type). Formica panel. Terminals, etc.

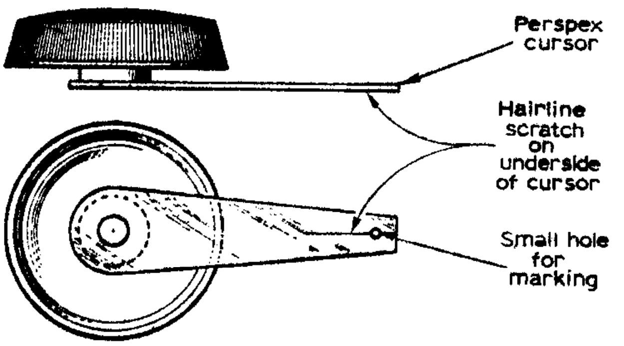


Fig. 6—Details of a suitable pointer knob for VR1.

between them. Connections to the transistor should be soldered as quickly as possible, and it is advisable to use a pair of pliers as a heat shunt on the transistor leads, to avoid excess heat being carried along them. A heat shunt should also be used when soldering the standard which are mounted directly on the switch contacts.

The Oscillator Coil

This is wound on a piece of ½in. dia. ferrite rod, 1½in. long. (If ½in. rod is not available, 7/16 or even 3/8in. may be used, but it may be necessary to increase the turns on the coil to ensure satisfactory operation.) The rod is covered with a layer of paper, and cardboard or plastic discs are cut and stuck on to make a former as shown in Fig. 5. The coils are wound when the adhesive is dry, and the component is then fixed to the sub-panel by strong thread round the ends of the ferrite rod. (If more readily available, 36 and 40 s.w.g. wire may be used in place of that specified.)

When all connections are made and checked, the battery is connected and switched on. If no whistle is heard on the phones, switch off and reverse the connections to coil L2.

Any 4·5 or 6V battery can be used. The consumption is very low, and the bridge will only be used infrequently, so a couple of 3V penlight batteries will suit very well.

Calibration

A long pointer is required for the scale, and this should be made by sticking a piece of perspex, shaped as shown, to a bakelite knob. The marker line, which is a needle scratch, is made more visible by filling in with a pencil, and then wiping clean. A very small hole is then drilled about ¼in. from the end of the pointer.

The knob is now fixed to the potentiometer so that the sweep is equal each side of the middle line, and the arc is marked with a needle through the marking hole.

If an accurate resistance box can be borrowed, then marking of the scale points can be done without difficulty. The phones are plugged in, and the box is connected across terminals R. The selector switch is turned to 1kΩ, and values from 10Ω to 100kΩ are selected in turn. The oscillator is switched on and the pointer rotated until the whistle either disappears or is at a minimum with a change in note. The point is then marked by a needle scratch through the hole, and labelled. Indian ink and a very fine pen are best for clear marking. When all marks are made, the scale can be protected by a thin piece of perspex, or by transparent "Fablon," which is self-adhesive.

Calibration Without a Standard Resistance

This is clearly more difficult, but this method was used on the prototype, and can provide interesting problems for the learner. The user must have access to 1% or 2% high stability resistors, or must buy a few surplus ones. If you have a multimeter, the resistors in it can be used.

Since each reader will have a different set of values at hand, it will not be possible to give detailed instructions for every scale gradation, but general principles will give the reader some idea of procedure.

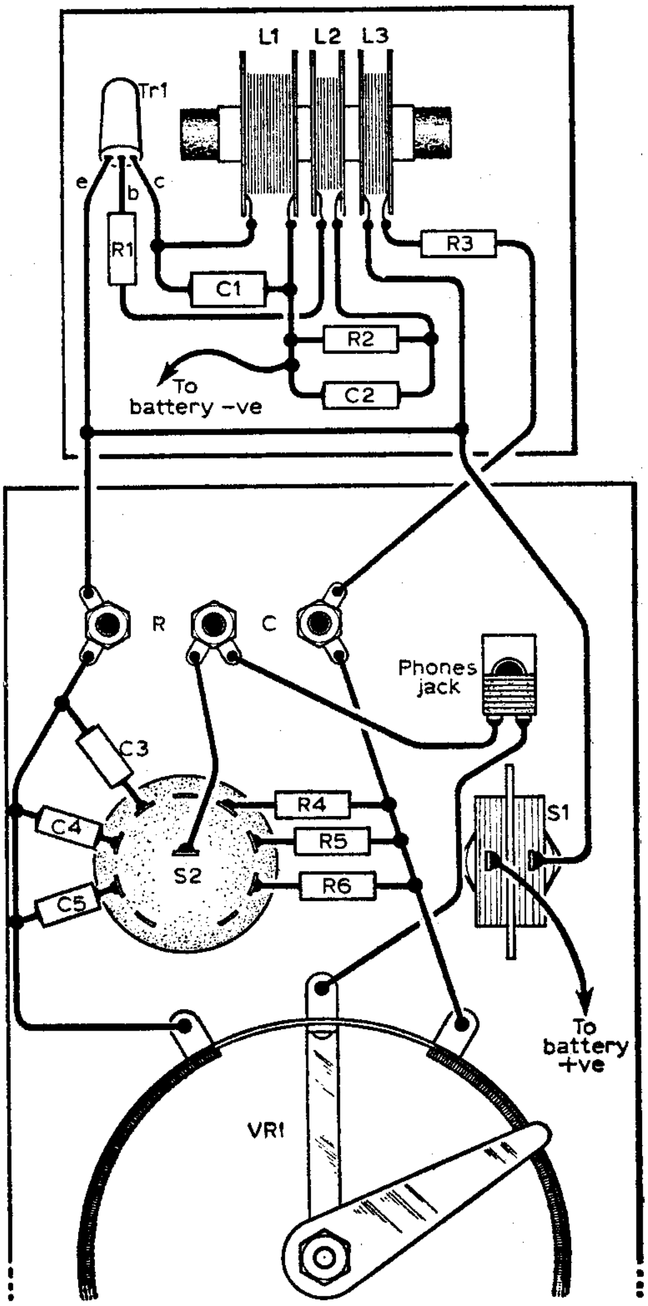


Fig. 7—The complete wiring diagram. The oscillato panel is shown separately for clarity.

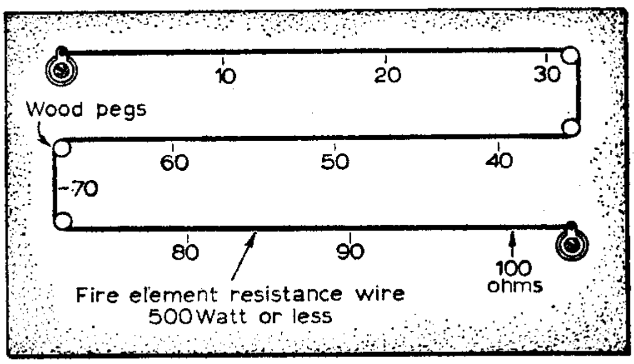


Fig. 8—A resistance wire graduated in units of 10Ω.

The first mark to fix is 1, the middle of the scale. Secure any two resistors of equal value, and connect one across **C** terminals, and one across **R** (the middle terminal is common to both). Switch to **M,** which is the point used for matching resistors or capacitors. Find the "null" point and mark position in pencil. Reverse the position of the resistors, and find null point again. If it is the same as before, mark it in as " 1 ". If the two points are not in the same place, but are very close, then the mark required is in between the two. If the marks are not close together, then the resistors are too unequal to give an accurate scale mark, and another pair must be tried.

The 100kΩ standard can be connected across terminals **R** and, with switch on 1kΩ range, the bridge balanced to provide the **100** mark (100kΩ/1kΩ). Similarly the 1kΩ standard can be detached from the switch, connected to **R** and, with range switched to 100kΩ, with the latter in circuit, the **·01** mark can be found (1kΩ/100kΩ).

A variable resistor, in series with a fixed one of about 80kΩ can be connected to **R**, and the value of the combination adjusted to 100kΩ. This, in parallel with the 100kΩ standard, will give 50kΩ which will provide the **50** mark on 1kΩ range.

If three values of, say, 30kΩ are available, they can be used to mark several points as follows:

Resistor	Range	Mark
30kΩ	1kΩ	30
30kΩ	100kΩ	0·3
30kΩ + 30kΩ (series)	1kΩ	60
ditto	100kΩ	0·6
30kΩ + 30kΩ + 30kΩ (series) ...	1kΩ	90
ditto ...	100kΩ	0·9
30kΩ and 30kΩ in parallel	1kΩ	15
ditto	100kΩ	0·15
Ditto, + 30kΩ in series	1kΩ	45
ditto	100kΩ	0·45
30kΩ, 30kΩ, and 30kΩ all in parallel	1kΩ	10
ditto	100kΩ	0·1

The value of any number of resistors in parallel is found by the formula

$$\frac{1}{R} = \frac{1}{R1} + \frac{1}{R2} + \frac{1}{R3} \text{ etc.}$$

Small resistors for intermediate markings on the scale can be made from a spiral replacement wire for an electric fire or toaster (500 watt). The wire is pulled out straight and a length found which will give a value of exactly 100Ω on the bridge. This length is then measured carefully and marked into 1/10, 2/10, 3/10, etc. These divisions will mark resistances of 10, 20, 30, etc, to 100Ω. Further sub-divisions can be made to give a comprehensive set of graduations against a 100Ω standard. Connecting wires must be as short and thick as possible; long thin connections will introduce unwanted additional resistance and prejudice the accuracy of the calibrations.

Modified Version

It will be realised that the end of the scale, where values are multiplied by 30, 50 or even 100, cannot give accurate results, as even a tiny error is multiplied. This part of the scale is, therefore, rarely used, and is so much wasted length. We can, very simply, cut out all measurements above five times, and stretch the scale to use the extra length. This is done by including a fixed resistor at one end of

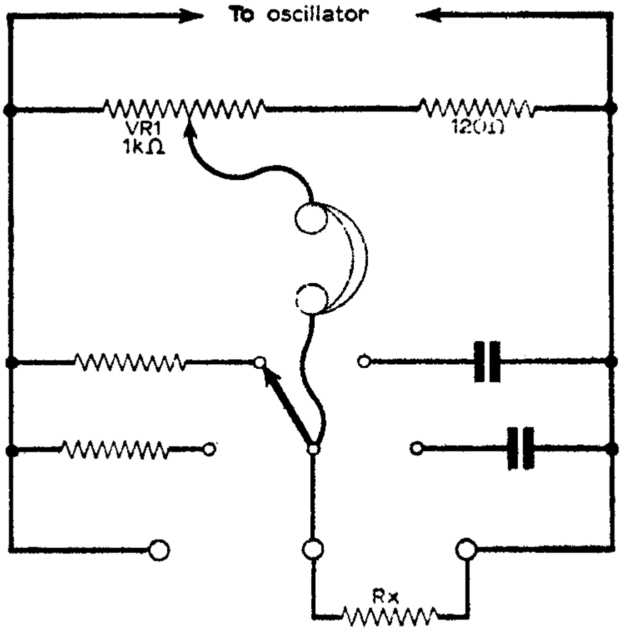


Fig. 9—A circuit modification to make use of otherwise wasted parts of the scale.

the potentiometer so that the slider does not traverse the whole length of the resistance in circuit.

Fig. 9 shows the principle. If a 1kΩ potentiometer is used then a fixed resistor, value 100Ω, is connected between the right hand end of the pot, and the oscillator. When the slider is turned fully to the right there will be 120Ω still in circuit (instead of almost zero as before). The maximum ratio of R3/R4 will be, therefore,

$$\frac{1{,}000\Omega}{120\Omega} = \text{approx. } 8$$

If a 20% tolerance resistor is used, the value of a nominal 120Ω could be as high as 144Ω, and

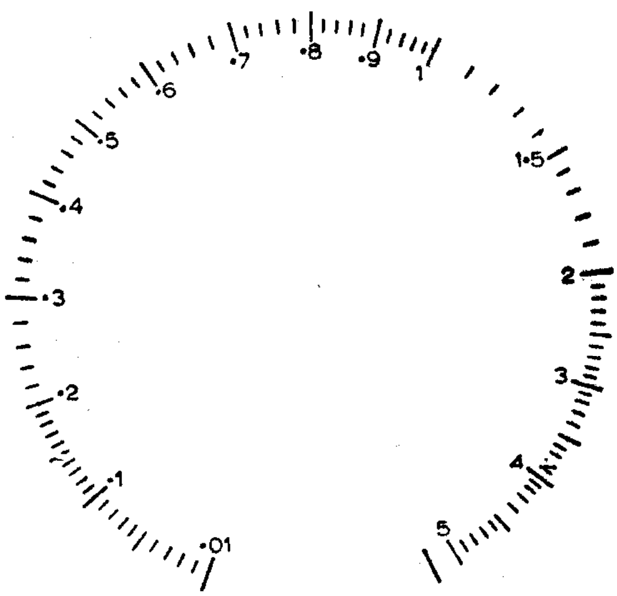


Fig. 10—The altered scale used when the circuit modification of Fig. 9 is incorporated.

the ratio of R3/R4 would then be

$$\frac{1{,}000}{144} = \text{nearly } 7$$

This assumes, of course, that the slider can be moved to the very end of the potentiometer, which will not be the case in practice. A value for the fixed resistor of

$$\frac{\text{Total resistance of variable pot}}{7}$$

should ensure that ratios of up to five times will be available.

It will be seen that, in the new arrangement, the scale will be stretched round to the right, and the 1 mark will no longer be in the centre of the scale. Referring to Fig. 9, the 1 mark, which was previously at 500Ω, will now be at

$$\frac{1\text{k}\Omega + 120\Omega}{2}$$

that is, at 560Ω.

The new appearance of the scale, which must be calibrated as before, will be as shown in Fig. 10. It will be seen that the markings are now all spaced out much better and consequently the possibility of accurate reading is very much improved, particularly at the ends of the scale.

The constructor will now require at least three standards accurately to cover the usual ranges, as shown below:

1kΩ standard to cover 10Ω to 5kΩ
10kΩ standard to cover 100Ω to 50kΩ
1MΩ standard to cover 10kΩ to 5MΩ

It is suggested that a 100Ω standard will be invaluable for measuring low values down to 1Ω. This will be particularly useful for measuring emitter resistors for transistor output circuits.

It may be found that the oscillator note changes when very low value resistors are measured on the 100Ω range. This is because the oscillations are damped by what is almost a short circuit across the coil, and the frequency will be much lower than normal. The balancing of the bridge will, however, be unaffected by this occurrence, and accuracy will not be impaired. This effect will not occur with capacitor measurement, when a note of relatively high frequency is essential.

Measurement of Small Capacitors

It is impossible completely to eliminate capacitance effects between components in the bridge circuit, and, consequently, the value of small capacitors below. say, 15pF cannot be determined with accuracy. In this case, another small capacitor should be connected first, and the null point determined. The unknown should then be connected in parallel, and the bridge balanced again. The difference between the two readings will give the value of the unknown.

Matching Resistors and Capacitors

In many applications such as push-pull output circuits, pairs of resistors have to be closely matched. In this case, the values are often stipulated as "within 5%" of a particular figure, when the requirement is really that they shall be as close to each other as possible, while being approximately the required value. Suppose, for example, two resistors are required for biasing the output transistors of a single-ended push-pull circuit. The parts list might well stipulate 100Ω 5% tolerance, and in this case one of 95Ω and another of 105Ω would meet the requirement, but would differ by about 10% from each other. Clearly, two resistors within the range 95 to 105Ω closely matched to each other (on the same side of the **100** mark, for example), will suit very much better. If the point marked **"M"** on the bridge is used, pairs can be matched very accurately. In this case, each is used as a standard for the other, the standards on the bridge being disconnected at the **"M"** position. The resistors are connected across the **R** and **C** terminals respectively, and the bridge is balanced in the usual way. If the pair are identical in value, the null point will be indicated at **1**; if they are within **5%** of each other, the pointer will be between **·95** and **1·05.**

Cabinet

Constructors with an interest in cabinet making who wish to make a more elaborate case will be able to design their own. Those who wish to mount the bridge in a metal case will find a suitable one can be obtained from many of the advertisers in this magazine as an aluminium chassis, size 7 x 4 x 2½in. In this case a few of the components must be rearranged, as there will be less room on the top panel, but more depth. □

DX-TV

A MONTHLY FEATURE FOR DX ENTHUSIASTS

by Charles Rafarel

TROPOSPHERIC reception in Bands I and III and also u.h.f. has continued to improve and the medium distance stations have been coming in well.

In this area there has been excellent reception from France via the Brest Roch Tredudon transmitter on Ch. F8. In fact, although under normal conditions this station can be relied on to give good regular reception, the past fortnight has produced really excellent pictures after dark.

After the Sporadic E "lull" of recent weeks we had a very good late opening in this area (Poole) on October 28th, 29th and 30th, during which the path to the south was wide open, and T.V.E. Spain gave excellent test card and programme pictures via Madrid Ch. E2, Alicante/Zaragossa Ch. E4 and Bilbao/Guadalcanal Ch. E4. These openings occurred near noon and were of some one to two hours' duration.

On the evening of November 2nd R.T.P. Coimbra, Portugal, was received for about half an hour with reasonably steady pictures. The duration of these late opening Sporadic E signals was well above average and I sincerely hope that other DX-ers managed to benefit from this return of good reception.

I feel, however, that we should not be too optimistic about further openings of this type until the new season begins next spring in April/May. So once more I suggest that we should concentrate on Tropospheric reception during the next few months but not, of course, exclusively as the possibility of further Sporadic E reception should not be overlooked.

Once again I must mention the possibilities of good Tropospheric reception during fog, and recent French results fully bear this out, and this applies particularly to Band III and u.h.f.

U.H.F. TUNERS AND CONVERTERS

There are also a number of u.h.f. tuners available on the surplus market and these can be used for u.h.f. reception on existing converted 405/625-line receivers. Some of our readers and in particular Mr. R. Roper, of Torpoint, have been thinking along these lines and of using the tuner as a "front-end" converter.

The i.f. output of these tuners is usually 38/40Mc/s and it has been suggested that the output of the tuner could be fed directly into the Band I aerial input of an existing converted receiver and the receiver tuned to the l.f. end of Band I, Ch. 1, which would approximately tune to 40Mc/s.

This arrangement will work but there is a serious "snag". The oscillator stage in the original Band I tuner will produce various harmonics and these will "clash" with certain channels in the u.h.f. bands. Granted we may retune the Band I tuner slightly to avoid this type of interference on any one specific u.h.f. channel but we will then find that the interference has been transferred to other channels, and the difficulties of u.h.f. calibration will be very greatly increased as any alteration to the i.f. frequency (i.e. the Band I input frequency) will necessitate retuning of the u.h.f. tuner for any particular channel.

A much better method is to feed the output of the u.h.f. tuner directly into the first i.f. stage of the existing receiver by means of a change-over switch permitting the use of either the original Band I—III tuner or the new u.h.f. tuner. An additional pair of contacts on this switch should be arranged so that the h.t. supply to the oscillator section of the Band I—III tuner can be interrupted when the u.h.f. tuner is in use.

If long periods of u.h.f. reception are envisaged I suggest that these h.t. contacts are bridged with a resistor, high enough in value, to reduce the voltage on the oscillator anode sufficiently to stop it oscillating, whilst still applying a little voltage, as valves may suffer damage if operated with no voltage on the anode.

Agreed that the "front-end" method will give us two additional i.f. stages by virtue of the two stages in the Band I tuner, the difficulties noted above outweigh this advantage and I feel that it is better to add an additional i.f. stage directly following the u.h.f. tuner before injecting the signal into the first i.f. stage of the existing set.

READERS' REPORTS

D. Richards, of Great Barr, Birmingham, has been doing well with his converted Bush TV53 receiver and reports the following: O.R.T.F. France on Ch. "7"; this would appear to be Lille-Bouvigny on Ch. F8a which propagates a good signal in a northerly direction.

On 625 lines negative he has received Moscow Ch. R1, Bydgoszcz (Poland) Ch. R1, Ostrava Ch. R1, Netherlands, Spain and Italy, and on u.h.f.

—continued on page 179

TV Receiver Reconditioning

BY G. R. WILDING

ONE of the most interesting and certainly the most rewarding aspect of practical television work is the complete reconditioning of old models to "as-new" standard, for with the advent of 625 lines, many suitable receivers can be obtained very cheaply.

But as they are usually offered "as is" and without the benefit of even a mains connection, the question arises "What rules determine the possibility of any set being a good buy?"

Clearly, any receiver that has been working on the 230V tapping from a 250V supply for some time is doubtful, and any set that has been in use on the 220V tapping or lower is completely unacceptable since it would certainly require a new tube and almost certainly new valves.

Then, although they are first-class receivers in every way, and give perfect results, from this point of view I would generally avoid the *older* KB, Ultra, Ekco and Murphy sets as they may incorporate the less prevalent type of valve which may be expensive and/or difficult to obtain.

As a general rule, too, I would avoid vertical chassis receivers, for all the small components being mounted on the underside and close to the tube are extremely difficult to test and replace.

Receivers with well thumbed line hold controls, particularly if incorporating flywheel sync, are best avoided, unless you want a lot of work, while signs of an often removed back usually indicates a set that has had more than a fair share of trouble.

A badly flaking mains dropper usually indicates prolonged use while, of course, shorted out sections not only over-run valves and the tube, but also indicate poor standards of maintenance which may well be evidenced in further ways once the chassis can be examined.

If it can be seen that a replacement tube has been fitted within recent times, and it is a maker's re-gun (i.e. "Lumenar"), the odds are that it will still give a brilliant picture. If, however, it is of the re-gunned but not re-screened type, the odds are against it giving a bright picture, and premature failing or inadequate brilliance may well have been the cause of the receiver's disposal. On the whole, re-gunned tubes are excellent, but occasionally they do fail to give really lengthy service.

With tubes of the older type fitted with a bakelite end-cap, it is sometimes possible to gauge how much use the tube has had by noting the discoloration caused by the heating effect of the cathode. This is only a very rough guide, but a strongly discoloured cap would certainly suggest a lot of continued use.

Finally, a well-cared-for cabinet is always a sure sign of a receiver that has given generally good service as well as being essential if some care and attention is going to be paid to the chassis.

As regards type of sets preferred, I would accept any make for complete reconditioning that fulfilled the above requirements, although from the point of accessibility and reliability tend to prefer the non-printed circuit. A very good example of such a chassis, made by the Plessey company and marketed in slight variations by the Regentone, RGD, Argosy, Co-op (Defiant), and Currys (Westminster), and manufactured just prior to the introduction of printed circuits, can be always recognised by the three front mounted pre-sets on the cabinet of line-hold, frame-hold and brilliance.

The Regentone model number was TR177, while the RGD version was known as the "Deep 17", but in common with all chassis types they were all virtually free of line output transformer troubles.

However, most of the older models of any make are well worth reconditioning with the possible exception of some of the earlier portables, which were particularly difficult of access and which often had small banks of resistors and capacitors connected together so that it became necessary to change the entire unit if any one component failed. Due to the compactness of the receiver the dropper resistor often charred the back and overheated nearby components.

When it comes to the actual reconditioning of the receiver it will be found worth while to change all electrolytics that are not absolutely 100% and all picofarad capacitors around the sync separator and video stage that show signs of deterioration. The screen feed resistor to the line output valve, if carbon, should always be checked for value, as should the cathode bias resistor of the video output valve.

Most instances of short life in PL81 and PL36 type valves can be directly attributed to excessive screen volts occasioned by a reduction in the ohmage of the feed resistor, while constant years of use often reduce the value of the video bias resistor, causing lack of gain, loss of picture gradation and some clipping of the sync pulses.

Preset controls will be found to be the biggest source of trouble in older receivers and whenever suspect should be changed. They give trouble not only by having poor or intermittent contact between slider and track but also by carbon dust, aided by too liberal applications of switch cleaner getting between the slider and the earthed metal case, thus effectively connecting a resistance of some kilohms between these two points.

On many Pye/Invicta receivers the four frontal presets invariably give imperfect contact after some years of service, resulting in constantly varying gain, poor frame lock, poor line hold and even intermittent collapse of the raster.

As these controls have a special long knob it is necessary to obtain exact replacements from a Pye

—continued on page 181

TV on channel 40

Mainly for Birmingham's new BBC2 viewers, this article will also be of interest to all present and potential receivers of the third TV programme.

By K. Royal

THE second u.h.f. station has recently opened up. This is the Birmingham station on channel 40. The London u.h.f. station on channel 33 has now been operational for some months, but now our readers in the Birmingham area will undoubtedly wish to try out the new transmissions on 625 lines and experiment with new aerials.

While this article gives statistics on channel 40 in terms of aerial elements and so forth, it will be of interest to readers within the range of the London u.h.f. station and, indeed, to all of those readers who will shortly be in range of such stations in other parts of the country.

Each area is allotted a group of four u.h.f. channels. Initially, only one channel of the group will carry a programme, and that is BBC2. Eventually, another of the three remaining channels will be occupied by ITV2 programmes. Ultimately, BBC1 and ITV1 will be put over to the u.h.f. channels, as also will colour programmes, but this will not be for some while yet.

While the v.h.f. channels of Bands I and III carry 405-line transmissions, all of the u.h.f. channels will carry only 625-line transmissions. Thus, BBC2, the coming ITV2 and the BBC1 and ITV1 transmissions will eventually be radiated on 625 lines. It is likely that BBC1 and ITV1 will be radiated simultaneously on both standards on v.h.f. and u.h.f. channels until eventually there is a complete change-over on the 625-line standard. But that is well into the future.

Channel 40 has a vision carrier frequency of 623.25Mc/s. This is the highest frequency so far used in Great Britain for television transmissions. Channel 33 was the highest frequency, this being 567·25Mc/s. The highest channel allotted so far is one of the West Sussex group namely channel 68. This has a vision frequency of 847·25Mc/s.

The channels allotted to the Birmingham area are 40, 43, 46 and 50 and to the London area 23, 26, 30 and 33. Although channels 40 and 33 respectively are only being used at first, u.h.f. viewers in these areas should ensure that their aerials are wideband so that they will respond to the other channels of the group when they are put into operation eventually.

If this is not taken care of, then when the new channels come on the air the aerial will have to be changed to ensure optimum results on the new channels as well as on the original one.

Aerial manufacturers, of course, are fully aware of this problem and they ensure that the aerials they distribute in the London and Birmingham areas will embrace all the channels in the local groups.

More Bandwidth

This means that u.h.f. aerials have a far wider bandwidth than their v.h.f. counterparts which usually respond only to a single channel. The spectrum corresponding to the Birmingham group of channels is 88Mc/s wide, while that corresponding to the London group is 80Mc/s wide.

The lattice nature of the channel allotments in the group areas over the country provides for an overall bandwidth in the majority of cases of 88Mc/s, though in some non-standard cases the bandwidth may be considerably greater or a little smaller.

At this stage it should be noted that the bandwidth of individual 625-line u.h.f. channels is 8Mc/s overall as distinct from 5Mc/s in the 405-line v.h.f. case. Moreover, while the sound carrier of a 405-line channel is spaced 3·5Mc/s *below* the vision carrier, that of a 625-line channel is spaced 6Mc/s *above* the vision carrier.

This means that the sound carrier in channel 40 falls at 629·25Mc/s. The channel limits of channel 40, incidentally, are from 622Mc/s to 630Mc/s.

To receive channel 40 (or, indeed, any u.h.f. 625-line transmission) a receiver different from that of the 405-line-only BBC1 and ITV1 model is required. So far in this country, there are no 625-line-only sets. So-called "dual-standard" models are now in current production. These permit reception of both the old 405-line programmes and the new 625-line BBC2 programme at the turn of a switch.

These sets incorporate two tuners, the ordinary v.h.f. tuner for BBC1 and ITV1 programmes and a rather special type of u.h.f. tuner which is continuously variable over all the u.h.f. channels for BBC2 and ITV2 later.

The i.f. channels are also switched so as to suit the characteristics of the signals applied to them from the selected tuner. Details of dual-standard receivers have been given in past issues of this magazine.

625-line Conversion ?

We often receive queries from readers asking whether it is possible to convert ordinary 405-line sets for 625-line reception. A brief reply to such a query is that while an advanced television experimenter or enthusiast may have sufficient technical skill to effectively rebuild a 405-line model for 625-line u.h.f. reception only, it is far outside the scope of even this type of keen enthusiast to adapt an old-style set for dual-standard working. This entails virtually a start from square one, using many new components and designs. Information on the con-

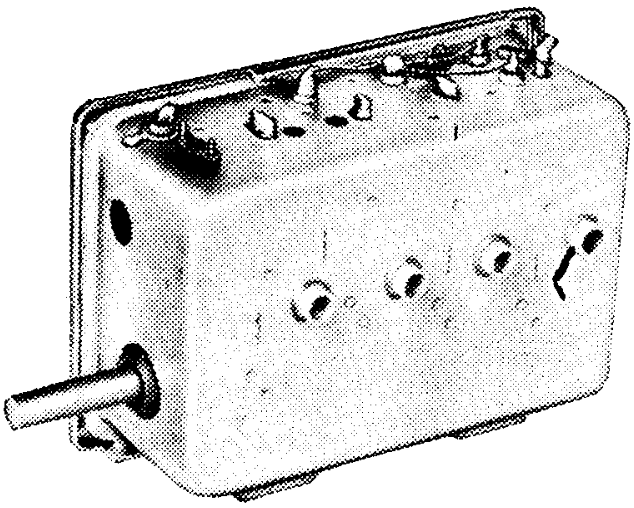


Fig. 1—Outside appearance of the latest transistor u.h.f. tuner. The overall size of this is little more than that of two matchboxes.

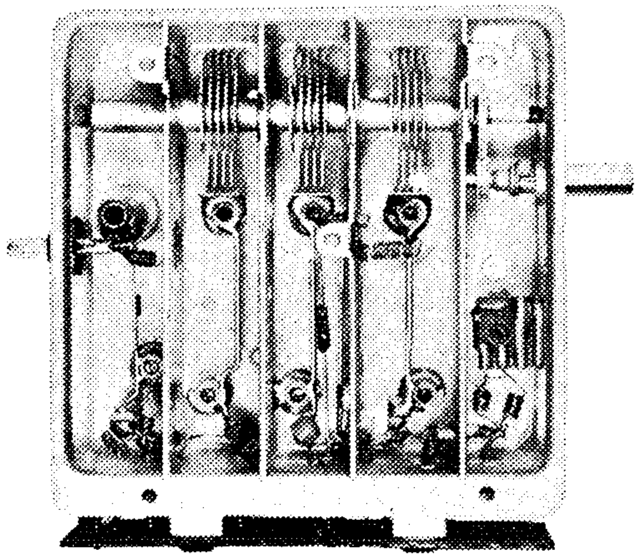


Fig. 2—Inside view of transistor tuner used in RGD sets. This employs quarter-wave resonant-line tuning by the ganged tuning capacitor.

version of 405-line-only models for 625-line u.h.f. operation has already been given in these pages[1].

Some readers in range of channel 40 will be in possession of dual-standard sets minus the u.h.f. tuner. To get such receivers working on the new station a u.h.f. tuner and aerial are required. The tuner itself costs about five guineas and a pound or so to have fitted while the aerial may cost up to seven or eight pounds installed, depending upon the receiving site signal conditions. The signals at u.h.f. are far more unpredictable than their v.h.f. counterparts, and it does not follow that good v.h.f. reception automatically means good u.h.f. reception.

In good u.h.f. reception areas one can probably get away with a relatively inexpensive aerial, costing a pound or so, but where the signal is weak a transistor aerial amplifier in addition to a good outside aerial may be necessary. We shall talk more about preamplifiers later.

1—" *Towards 625* ", PRACTICAL TELEVISION, *July, August, September and October, 1963.*

Super Low-Loss Coaxial Cable

In all cases, the aerial should be connected to the u.h.f. socket of the dual-standard set through super low-loss coaxial cable, having in mind that the signal weakening (attenuation) factor of a cable rises with increase in frequency.

Some experimenters may wish to experiment with aerials of their own make, and details about this exercise will be given towards the end of this article.

Some of the early so-called "convertible to dual-standard" receivers demand more than the mere fitting of a u.h.f. tuner to get them going on the u.h.f. channels. A number of this type of receiver was sold both in the London and Birmingham areas several years back.

The general design was geared either to the fitment of an extra 625-line i.f. channel complete with u.h.f. tuner or to the installation of an entirely new dual-standard i.f. section. There was a great diversity of method for conversion to dual-standard and it is absolutely impossible to provide any detail in this article.

Readers with this type of set should seek from their dealers information as to the current method of conversion provided by the makers. While some sets were designed with a specific type of conversion in mind at the time of their early release, more recent practical data have in some cases caused the manufacturers to change their minds and issue an entirely different conversion mode. Conversion details have been given in these pages.[2]

U.H.F. Tuners

Early u.h.f. tuners used valves, but more recent models adopt transistor tuners. These have a far better noise performance than the early valve models which means that u.h.f. pictures of a given noise content and picked up on a specific type of aerial will be received at a somewhat greater distance from a u.h.f. station on a set with a transistor tuner than on a similar type of set with a valve tuner.

Fig. 1 shows the outside appearance of a transistor u.h.f. tuner which is little larger than twice the size of a matchbox. These units employ quarter-wave resonant lines tuned by a ganged capacitor, as shown in Fig. 2

Aerials

We now come on to aerials. One just cannot say which type of aerial will provide the best picture in any given area. This is because the u.h.f. signals vary considerably in strength in built-up areas.

On the chimney stack of one house, for instance, a simple nine-element u.h.f. array may give very good pictures yet on the chimney stack of the house next door a thirteen-element array may be needed to get the same strength picture on the neighbouring set.

Some of this discrepancy is sometimes caused by the u.h.f. sensitivity difference between sets. Much of it, however, is caused by " standing wave " conditions around the roofs of houses, especially where the chimney stacks are called upon to support an abundance of v.h.f. aerial metalwork.

2—" *Converting the Convertibles* ", PRACTICAL TELEVISION, *February, 1964.*

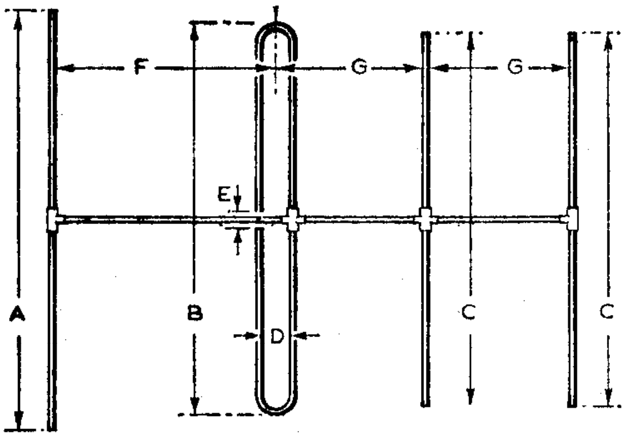


Fig. 3—Dimensions of a basic Yagi aerial for channel 40 (BBC2 Birmingham). Reflector "A"=9·45 in., the folded dipole "B"=9 in., the directors "C"=8·55 in., the reflector-dipole spacing "F"=4·75 in., the dipole-director spacing and director-director spacing "G"=3·75 in., the spacing between open ends of dipole (across insulator) "E"=1 in. approximately and the spacing between dipole fold "D"=1·25 in. approximately. Additional directors should be of the same size and spacing.

lead. Moreover, the existing coaxial cable usually has too great a loss on the u.h.f. channels.

However, in areas of high signal field where one could afford to lose about half the aerial signal (6dB) the existing feeder carrying the v.h.f. signals could be used also to carry the u.h.f. signals by the employment of a pair of v.h.f./u.h.f. filters, as shown in Fig. 4. These are available commercially.

There are very few places where the need for u.h.f. attenuation arises, and, funnily enough, attenuating u.h.f. signals is not all that easy! Ordinary v.h.f. attenuators are not much use owing to their relatively high capacitance which, at u.h.f., represents a very low reactance and allows almost free passage to the signals irrespective of the v.h.f. attenuation ratio of the device.

U.H.F. attenuators are, of course, available, but so far as the author is aware a simple type has not yet been manufactured for domestic applications.

Much more often the signals need to be boosted. There is not a lot of point in using valve boosters nowadays, particularly if the set itself employs a transistor u.h.f. tuner, for the valve in front of this would impair the tuner's noise performance! Clearly, then, the booster must be transistorised.

Standing Waves

Standing waves have the effect of causing the signal field to rise and fall over the wavelength of the signal. Because the wavelength of the u.h.f. signals is very small, the movement of an aerial along a wave of a foot or so (about half a wave-length) could change a poor picture into a good one. There could be a signal strength change in the aerial by as much as 6dB (twice). This effect is nowhere near as startling on the v.h.f. television channels.

Standing waves are encouraged in built up areas by the buildings themselves and by other adjacent metal items, such as BBC1 and ITV1 aerials. It is for this reason, therefore, that u.h.f. aerials should be mounted as far as possible away from their partnering v.h.f. aerials.

Details for the construction of BBC2 aerials have already been published[*] and readers requiring practical information in this respect should consult these articles. However, for channel 40 the various dimensions differ from those of a channel 33 aerial and the new dimensions are given in Fig. 3 for a simple four-element aerial.

In general, the u.h.f. aerial feeder will be a separate run, since to combine the u.h.f. signals with the v.h.f. ones in a common feeder results in extra losses at the combining filter at the aerial end of the lead and at the splitting filter at the set end of the

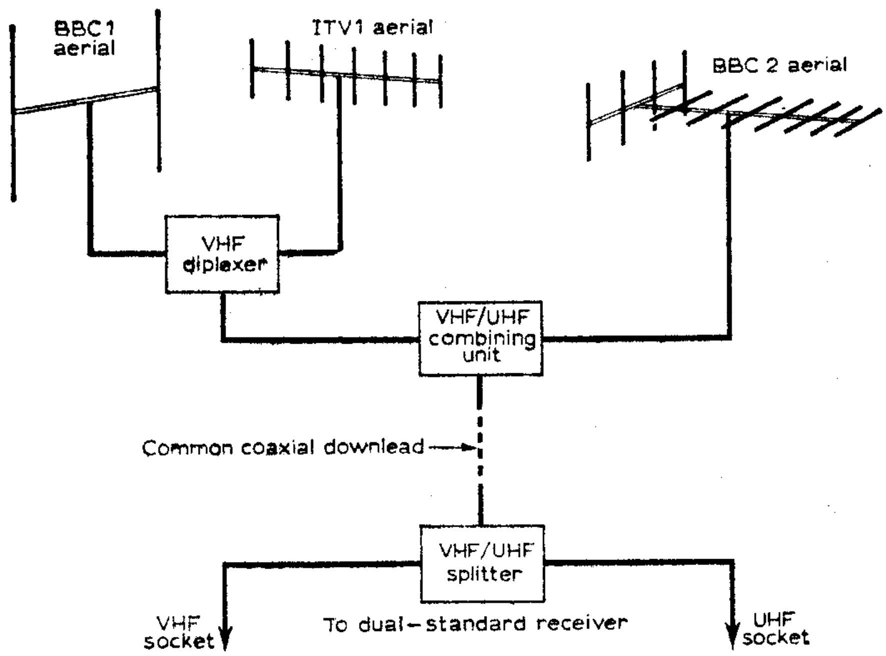


Fig. 4—An existing coaxial downlead can be used to feed the u.h.f. signals to the set along with the v.h.f. signals by using a v.h.f./u.h.f. combining unit at the aerials and a v.h.f./u.h.f. splitter at the set, as this drawing shows. The losses by this method are greater than by the use of a separate length of low-loss downlead for the u.h.f. aerial.

Boosting

A diversity of transistor boosters are now available, ranging from those which are self-powered at the set end to those which are masthead-mounted and powered from a small power unit located by the set, the power supply being fed to the amplifier up the coaxial cable.

The best position for any aerial amplifier, of course, is right at the aerial, but this is not always a practical proposition and the technical advantages

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—"Aerial Design for BBC-2"*, PRACTICAL TELEVISION, *March and April, 1964.*

of mounting in that position are often outweighed by the great simplicity of a set-mounted booster.

This does not need complicated power feeds up the cable and power units at the set. Instead this type of booster contains a small all-dry battery which makes the unit perfectly safe from the user's point of view.

The low current consumption of a single u.h.f. transistor stage (just over 1mA) means that the small battery will have a life of several months provided the booster is switched off when the set is switched off.

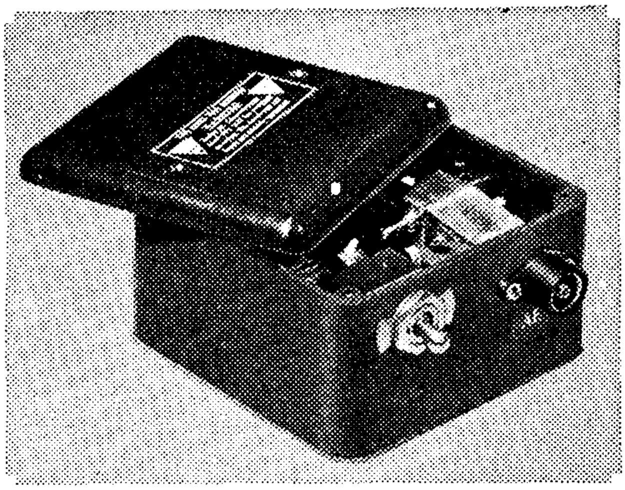


Fig. 5—The King u.h.f. Telebooster showing the front of the cavity and transistor mounting.

There are various commercial set-mounted versions, including a model by Perdio and one by Transistor Devices Limited, of Brixham, Devon. Masthead types are made by Belling and Lee, by Labgear, by Transistor Devices Limited and by other manufacturers. They all employ special low-noise u.h.f. transistors and in many cases their connection between the aerial and the set can make all the difference between a very grainy picture due to noise and a good, viewable picture.

Transients

Points to note with regard to this type of booster, however, are that transistors are easily damaged by transients and for this reason a set-top booster should be disconnected from the aerial when a thunderstorm is near.

Of course this is not possible with masthead units and during a thunderstorm one has to chance to luck that the transistor will survive the transient producing lightning flashes! Some aerial-mounted transistor equipment is protected from such effects by a fast-acting zener diode bypassing the transients from the transistor.

Fig. 5 shows the King *Telebooster* for set-top mounting. This needs no fixing apart from connecting between the aerial and the set u.h.f. socket. Its small internal 9V battery lasts about two months in normal operation and the unit differs from the majority in that it features a quarter-wave cavity resonator instead of the conventional coil of wire for tuning. The front end of this cavity and the transistor can just be seen in the picture. □

SWITCH TO REMOTE CONTROL

—*continued from page 167*

R3 to give greater control of the sound volume. The muting switch is taken care of in the unit and cuts off the sound completely. Pin 7 may be ignored, as this was only used as a test point to measure the negative potential.

Alternative use for Channel Switch S3

The channel switch is a biased switch (press to make) but this can be made into a normal on/off switch by removing the small spring between the body of the switch and the knob. It is now a simple matter to use this as a switched tone filter by connecting a resistor/capacitor filter from the grid or anode of the sound output valve to pin 10 of the unit. if connected from the anode the capacitor must of course have a suitable voltage rating and one in the order of 1000V working is to be recommended with values to suit the amount of correction required. It is an easy matter to fit the remote control plug in the cabinet of the TV simply by removing the plug cover and fitting the plug to the cabinet with a screw through the centre hole the wires can then be soldered to the ends of the pins.

These units are obtainable from:—A. Dear Ltd., Dept. RCU, 8-10 Devonshire Road, Forest Hill, S.E.23. (at 7/6d., postage and packing, 2/6d.) □

DX-TV

—*continued from page 174*

London Ch. 33, together with a number of unidentified Continental u.h.f. transmitters, including West Germany identified from D.B.P. test cards, and what must have been N.T.S. Lopik Holland on Ch. 27.

R. Gilchrist, of Clifton, Bristol, while at a friend's house in Godalming, Surrey, received excellent pictures from N.T.S. Lopik Holland on Ch. 27, and he notes that the aerial was directed towards London so the signal must indeed have been a very strong one. His report is dated 8-11-64, so November u.h.f. reception seems to have started well as I suggested might happen. He also received an unidentified sound channel which he suggests might well be Lille-Bouvigny Ch. 27 and I feel that his assumption is probably correct.

There has been a somewhat reduced number of readers' reports this month and this, of course, confirms the poor reception during recent weeks. I hope that the recent improvements in Tropospheric results will cause an increase in the mail in the very near future and I look forward with interest to reading your reception reports.

So in conclusion may I wish you all very good DX-TV in the coming period and I think that we will find that reception will be good for the medium distance stations received by Tropospheric propagation.

UNDERNEATH THE DIPOLE

"THE Music goes round and round—and comes out here!" was the title of a pop song of the thirties. It had a tuneful melody and its words described the tortuous journey made through tubes and valves before emerging from the trumpet of a bombardon, tuba or sousaphone. Notwithstanding the complexity of the piston-like valves of a sousaphone, its ompah-ompahs reverberate with a robust fruitiness that is almost impossible to reproduce on the diminutive loudspeakers in many television sets.

Really accurate reproduction of all musical instruments from piccolos to euphoniums, from triangles to tympani, is not easy to attain. Poor room acoustics and side-way sited loudspeakers make it all the more difficult.

It has always puzzled me how the sibilants manage to wriggle around the corners of some television sets and penetrate the blanketing effect of the curtains of a room. It makes matters worse when the original sound recording is woolly, with the microphone gagged on exterior scenes when the weather is windy, how ever slight, or when the actors mumble their lines, slam doors or tinkle cups over key words or when music is dubbed over dialogue at too high a level.

They Throw It At You

In ABC-TV's play "They Throw it at You" for instance, a great deal of dialogue was drowned by both music and effects. This was all the more surprising when I discovered that the music was credited to one of the finest composer-orchestrators in the business, Robert Sharples.

Here was a Sunday night Armchair Theatre production with a lively setting on the Golden Mile at Blackpool, with all the noise and excitement of the background breaking in on several well-written and excellently acted scenes, notably those in which Megs Jenkins and Bert Palmer played.

Some of the scenes were, it is said, videotaped at the actual Blackpool location and others in the studio in London. This probably accounts for the patchy mixture of real exteriors and phoney interior settings, side shows and sound effects.

These troubles seem to be less noticeable in the BBC's Rudyard Kipling series, which integrate filmed exterior sequences with videotaped interiors. The skirmish between British troops and Indians on the hill in an episode from "Love of Women" was very well filmed on location and well edited, too, a refinement which is restricted on tape sequences.

Thorndyke

Music played an important part in the BBC's Thorndyke series, of which "Percival Bland's Brother" was a good example. John Gorrie, the director, handled a complex collection of taped and filmed sequences which related a rather gruesome story in the smoothest possible manner and the insurance assessors tracked down the horrific frauds with the logic of Sherlock Holmes, Sergeant Jack Warner or Cluff.

Peter Copley's performance as Dr. Thorndyke was most impressive and puts him in the top rank of actors who have acquired the rather special techniques necessary in television drama. "Hamming" a part in a melodrama was all very well on the stage of the London Lyceum, when the broad gestures of the villians were essential for the huge audience of 2,000 or so to see (and hear) what was happening.

In this day and age of close-ups on television, heroes, villains, detectives and soldiers are endowed with dead-pan features and restraint. The eyes tell the story, if the lighting is good enough to eliminate the terrible shadows which result so often from overhead TV lighting.

One way to remove rings from under the eyes is to attach small lamps to the TV cameras, known as "bashers" in studio slang. This particular fault was not noticed in "Thorndyke", which had first-class technical qualities.

Woodwind

Music doesn't always go round and round, it sometimes goes straight through, its characteristic vibrations being varied according to the position of alternative escape holes! This was clearly illustrated in the BBC's School Broadcasting series about "The Orchestra", when it dealt with flutes and clarinets.

Very rarely am I able to view this programme, which takes place in the early afternoon, but it is well worth watching. Produced by John Hosier and introduced by Kenneth Alwyn, it is an admirable presentation of solo instrument playing aided by clear diagrams (filmed) of the manner in which the particular type of sound is created.

Explanations given by Kenneth Alwyn were concise, interpolated at just the right moments to retain the interest of grown-ups as well as children. In fact the subject matter was far more absorbing than many of the evening programmes on both BBC and ITV.

The Pygmalion Trend

When playright George Bernard Shaw wrote "Pygmalion" many years ago, he evolved a kind of Cinderella story-line with a "message" and a swear word not normally used on the theatrical stage at that time, in 1912. Alan Jay Lerner and Frederick Loewe had the brilliant idea of setting the play to music with a new title "My Fair Lady," which was produced in New York about ten years ago, long after Bernard Shaw's death.

The huge royalties that have accrued to the author's executors have flowed in over the years, supplemented by further royalties from the Warner Brothers' film version, now showing in London.

Success breeds success and the musical versions of theatrical and literary classics of Edwardian and pre-1914 days are hopefully blossoming, though not on television. "*The Barretts of Wimpole Street*" (musically "Robert and Elizabeth"); "*Kipps*", (Half a Sixpence"); "*Blithe Spirit*" ("High Spirits") are packing in the audiences which have so long retreated from the down-beat-kitchen-sink, hopeless stuff.

This gloom has outstayed its popularity in the London theatres, excepting in one or two "arty crafty" places. Unfortunately, gloomy subjects persist to some extent in the cinema and on television, particularly on BBC-TV, whose scriptwriters are obviously in favour of the use of bad language when possible.

Escapism

I don't know just how old "Kitty", a BBC Sunday film was, but it was certainly of good vintage, fruity, well matured and larger than life. It must have been made by Paramount in Hollywood about fifteen years ago. With a background of London in 1783 and with a story of the adventures of a pretty street urchin who became a duchess, well-groomed and well-spoken, it reminded me once more of "Pygmalion"—or yet another "Cinderella" story.

World Currency

Television has penetrated all parts of the world, we know. What we don't know is the exact number of TV transmitting stations, networks and studios. Estimates vary, but my guess is that there are at present well over 5,000 transmitters.

The largest number are said to be in USA, followed by Japan, with Great Britain in third place and Russia fourth. What an immense united appetite these stations have for programme material, with USA the largest producer of programmes of international appeal.

Westerns, of course, head the list of demands and American-made "horse-operas" are viewed everywhere from Singapore to San Francisco, Brussels to Buenos Aires. Japan now has 80 stations compared with 70 in Britain.

It is therefore quite understandable why 80% of American television programmes are on film, which is a readily exportable, cuttable and dubbable product; far more suitable for easy conversion and re-editing for customers in far off lands. Great Britain exports a fair number of programmes, but is at a disadvantage when videotaped.

History seems to be repeating itself. USA practically monopolised the world market for cinema films for years. It now looks like monopolising the making of TV programmes for international consumption unless a more practical medium is used in Britain—direct photography on to 16mm or 35mm film. Exports do matter.

Iconos

TV RECEIVER RECONDITIONING

—continued from page 175

dealer, but fortunately they are easily and effectively made as good as new.

Prise off the paxolin cover plate, remove the spire-type securing plate and the rotor arm can be removed complete. A thorough cleaning of track and moving contact with the rotor arm pushed well down on reassembly will be found to give the control a new lease of life. In retrospect I believe many a good receiver of this type has been discarded or traded in when its only real defects were preset controls in urgent need of cleaning.

Another point worthy of mention with Pye/Invicta receivers is that the tuner is of the incremental inductance type and if reception of BBC or ITA does not come fairly within the travel of the fine tuner no attempt should be made to bring it in with adjustment of the unit until a new frequency changer has been tried, for in most instances this defect is caused by a change in the valve's internal characteristics.

Sometimes in the older receiver it appears that the valve heaters are not quite "cherry red", as they should be, and appear to be under-run. Invariably this is due to the thermister not reducing to its normal low value after years of use and requiring replacement.

One fault, however, will be found common to all older receivers and that is dirty and poorly contacting valveholders, which must be put right if reception free of all crackles and streaking is to be obtained. The most effective treatment after cleaning the surface and if possible blowing out the sockets is to put a drop of switch cleaner down each pin socket and then scrape with a fine file the pins of an appropriate valve, thus slightly roughening them, and insert and withdraw it several times in the holder. Finish off by putting the slightest drop of Electrolube down each socket and the holder should be as good as new.

If, however, any of the sockets have become enlarged by bent-pin valves being forced in, *gently* lever the sides of the U-shaped contact together either with a small watchmaker's screwdriver or a medium sized needle.

In conclusion note that no improvement in gain (but rather the reverse) will be obtained by using more modern valves such as the PCC89 in place of the older PCC84, and when fitting BY100s in place of older pattern metal rectifiers ensure that the surge limiter is within the maker's figures. □

BOOKS REVIEWED

UNDERSTANDING TELEVISION
An Introduction to Broadcasting.
Edited by Robert L. Hilliard. Published by Communication Art Books, New York; London: Focal Press Ltd. 254 pp., Price 55s.

MANY books have been written specifically and individually about the theatre, films, acting, scripting, set and costume design, lighting, electronics, etc. One wonders how it would be possible to compress into the 254 pages of one volume all the information essential to attain a full understanding of the arts, crafts, engineering skills, administration and show-business which are this thing called television.

Of course, it just isn't possible to do this. Nevertheless Robert Hilliard, who is Associate Professor of Radio, Television and Motion Pictures at the University of North Carolina, has assembled the pens of several specialists to deal with Growth Organization and Impact; Studio and Control Equipment; Producing; Writing; Directing; Staging—together with supplementary material on performing and research.

This book necessarily condenses much of the basic information of the diverse fields covered under the above headings. The American backgrounds of the team of authors, their scholastic attainments and practical experiences have naturally coloured the opinions expressed. Unfortunately, from the British and Continental point of view, there are a number of inaccuracies which reveal some wide differences in techniques.

The chapter on "Growth, Organization and Impact," which covers historical aspects, omits to mention that the first public television service in the world was started in Britain by the BBC in 1936, after months of public experiments by EMI, Marconi and Baird. Big screen reproduction by Scophony, also in Britain, was not mentioned, nor many of the improvements in television equipment which has been developed in England for studio lighting, flying-spot telecine, 4½in. image orthicon cameras, pedestals and remote controls.

Facts and figures, both historical and economic, may differ in the U.S.A. compared with the development of television in Britain, but there are great similarities in details of operations, as are so clearly laid out in the chapters dealing with production techniques on the studio floors. Of particular value and clarity, for instance, are the pages dealing with the important functions of the floor manager, including his tic-tac signals which silently interpret the instruction (given on the intercom headphone) by the director in the adjacent control room. Every television studio seems to have its own slight variations, but here at last is a standard instruction which ought to be adopted everywhere. Scripting techniques, also, are clearly set out, including "artistic" methods of slotting in commercials.

"Understanding Television" is a book which should be read by all people who want to know what goes on in television, particularly if they take note of the American approach to this important development in mass communication. It is a book which can be read and enjoyed.—*B.H.*

BBC-2 RECEIVER TECHNIQUES
By E. A. W. SPREADBURY, M.I.E.R.E.; published by Iliffe Electrical Publications Ltd. 70 pages, 8¼ in. x 6 in., paper cover. Price 7s. 6d.

"REPEATED by popular demand" is a phrase beloved of the entertainment industry. Rarely is it applicable to the work of the technical writer. Mr. Spreadbury's booklet is a notable exception.

The material first appeared as a series of 27 articles in *Wireless and Electrical Trader*. Before the series was halfway through, dealers, manufacturers and educational authorities were asking for reprints in such numbers that it was obvious the only solution was a collated publication.

The work explains, in terms familiar to the technician and television enthusiast, the differences between the 405-line and 625-line British television systems and illustrates these differences with descriptions of circuits used by leading British manufacturers.

There are 61 diagrams. Despite Mr. Spreadbury's well-known gift of lucidity these diagrams are the one barrier to complete understanding, for component values are not given. It is necessary to refer to the manufacturer's data or *Trader* service sheets. Component designation is by maker's numbering in every case and the only values given are those required to explain points in the text.

Nevertheless, for readers who may have felt that articles which have appeared from time to time in these pages explaining the 625-line system were a little restricted by having to say much in a confined space this booklet will serve to make many mysteries clear. A service engineer, handling many different receivers in his daily work, and often too busy to delve deeply into the intricacies of design, will find this book of great value.

No words are wasted on history and theory of dual standards. Mr. Spreadbury plunges straight into his subject, explains briefly the earlier "convertible" and "adaptable" models in his first chapter, then goes on to take the receiver step by step.

The series of articles has been combined into seven chapters dealing with the i.f. stages, detector and video output, sound channel, the u.h.f. tuner and, finally, alignment. A point that is stressed in this final chapter is that no new instruments will be needed; the only "different" item, from the angle of frequency, etc., is the u.h.f. tuner.

Careful reading of this booklet, in which not a word is wasted yet not a practical point unexplained, confirms this reviewer's belief that for true concision no book is better than a collection of authoritative articles. At this modest price Mr. Spreadbury's booklet is a bargain to technician and amateur alike.—*H.W.H.*

a series for the intending professional serviceman

The business of SERVICE

PART 5

by John D. Benson

CONTINUED FROM PAGE 127 OF THE DECEMBER ISSUE

THE growth of a business is a slow process and servicing is no different in this respect to any other business. The confidence of the public must be won by the quality and reliability of the work which is executed for them.

From experience it has been found that it takes two to three years to develop a business from scratch and to ascertain whether or not the growth is in the right direction.

When it becomes necessary to increase staff, the choice of labour is important if the greatest efficiency is to be gained from it; an apprentice who has finished his time and obtained his City and Guilds Radio certificate, but who has not yet taken his television course, is the ideal choice.

The labour force can then be split up, and the television engineer relieved of radio and its allied equipment which is left in the hands of the radio engineer, helped out by the apprentice who, now in his second or third year, can relieve both the television and the radio engineer of many basic jobs.

It is good practice that an engineer having found the faulty component can leave its installation etc., to the apprentice who, in this way, increases his knowledge and usefulness.

A further saving of the television engineer's time can be effected by delegating collections and deliveries to the radio engineer and apprentice. It is always the best policy to have repaired receivers delivered by a technician and not just a van driver. It is a point greatly appreciated by the public and a sure prestige builder.

Following basic business principles it is usual, as a business increases, to plough back profits in the shape of labour saving equipment. The market is crowded with many types of test gear; purchase of extra test instruments is most useful in the all-important object of saving time.

First priority is given to the oscilloscope. These instruments vary in size and price enormously but for all-round usefulness the 3in. 'scope covers most needs. If possible one which includes expansion of the X timebase is most versatile in the examination of timebase and sync pulses. These instruments, by reputable makers, are quite reasonable in price and can be purchased either new or second hand by studying the advertisements in various trade journals.

Second preference should be given to a C and R bridge capable of measuring capacities from a few pF to several hundred μF with power factor and leakage indicators. The resistance section is already covered by the multi-test instruments but supplies a useful standby when these instruments are all in use.

Thirdly, a valve voltmeter is of great use, especially for dealing with faults in transistor receivers. The great benefit of this instrument is that voltage at r.f. can be measured, stage gain can be quickly assessed, eliminating a number of measurements.

In fringe areas where weak and fading signals, together with locally generated interference, a waveform generator is a great asset. A complete video signal with sync pulses can then be supplied to the receiver under examination and faults speedily located. These instruments generally include a pattern generator, which is of great value in setting up receivers so that they produce a linear picture.

If a Megger has not already been purchased then it most certainly should take its place amongst the workshop equipment, for this versatile little instrument is very useful where leakages between windings and cores are suspected. If capital is available a valve tester which gives individual readings for all electrodes, etc., is a most useful addition. A valve tester can show a fair return for outlay by charging a small fee for testing valves for customers who call in the shop. A transistor tester can perform a similar function now that they are so popular with home constructors.

Before leaving the subject of test instruments it should be mentioned that it is the practice in many establishments to include the building of test equipment by apprentices as part of their training. In this way the stock of instruments can be built up for further expansion. Certain kits now on the market provide a most economical method of building up the range of workshop equipment.

Equally important to the efficient functioning of a service department is the checking and keeping up to par the stock of components that are drawn from for repairs. Here a senior apprentice can be trained to carry out this operation weekly.

The careful filing of job cards for each completed job is essential so that instant reference can be made to them if a receiver is reported as unsatisfactory after repair. It also shows the exact date of expiry of the guaranteed period.

The clerical side of a repair service is equally important as the engineering aspect and experience has proved that for best results accounts should follow the return of service receivers with little or no delay. It is good business to allow a small discount for prompt settlement. ■

TRADE NEWS • TRADE NEWS • TRADE NEWS TRADE NEWS • TRADE NEWS • TRADE NEWS

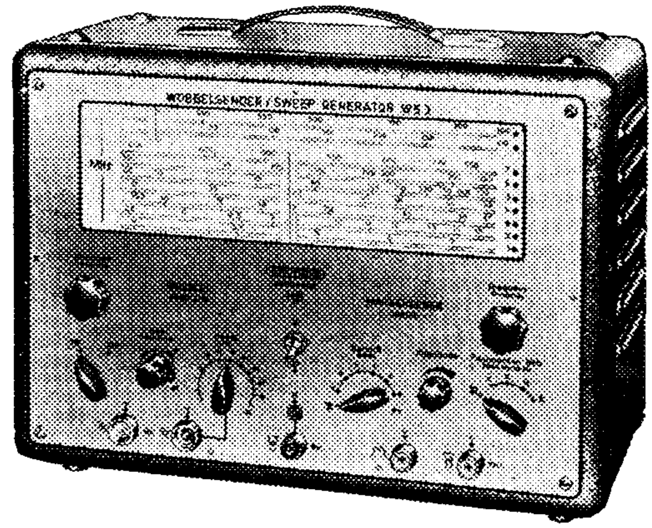
Further Aerial Price Reductions

SINCE publication in our October 1964 issue, of Belling & Lee aerial prices, there have been two further reductions. The U210/4A and U210/5A are now priced at 89s., and the U410/4A and U410/5A, at 187s. *Belling & Lee Limited, Great Cambridge Road, Enfield, Middlesex.*

Sweep Generator

VISUAL ENGINEERS LTD. announce their appointment as sole agents in the United Kingdom and Ireland for Grundig Measuring Instruments and the consultant and advisory facilities which Visual Engineers already offer will now become available to potential users of the Grundig instrument range of equipment.

The W.S.3 sweep generator is a typical product of Grundig Measuring Instruments now available from Visual Engineers Ltd. This particular unit provides a frequency range from 4 to 800Mc/s with a variable sweep from 0 to 30Mc/s, plus a marker oscillator with crystal controlled markers to cover the same range. The price is £165. *Visual Engineers Ltd., Stocklake, Aylesbury, Buckinghamshire.*



Right—This sweep generator is made by Grundig Measuring Instruments and is now available in this country from the sole agents, Visual Engineers Ltd.

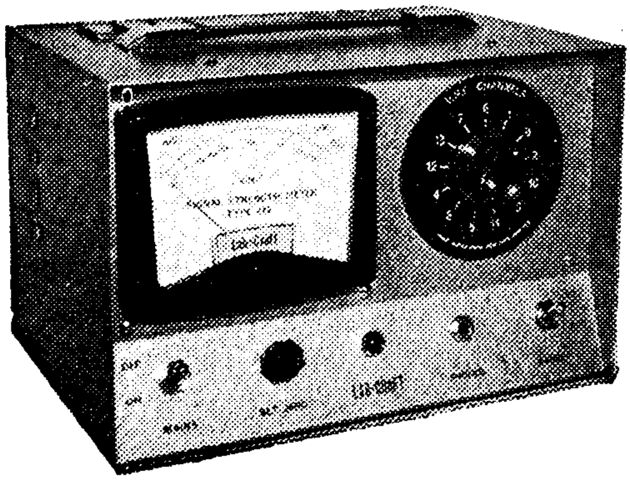
Jason move to Larger Premises

JASON ELECTRONIC DESIGNS LTD., manufacturers of the Jason range of equipment and home construction kits, have moved from their previous premises in Wardour Street, London, W.1., to a new and larger West End showroom.

Jason-made kits include the JTV2 tuner which provides reception of BBC f.m. programmes and BBC-1 and ITV sound. The television sound obtained from this tuner is superior to the reproduction obtained from almost all commercial TV receivers and because nearly all these receivers are a.c./d.c. operation the JTV2 provides a far safer method of feeding TV sound into a tape recorder or hi-fi system.

In the new premises at Tudor Place, London, W.1, the JTV2 and other Jason equipment will be on display for inspection by the public in a special demonstration room. *Jason Electronic Designs Ltd., Tudor Place, London, W.1.*

Below—Representing a new range of instruments, the Lab-Craft 215 series v.h.f. signal strength meter.



Signal Strength Meters

LAB-CRAFT LTD. announce a new range of v.h.f. signal strength meters, series 215, succeeding the 115 and 118 series which have been in their range since 1957.

The new series uses a presentation similar to Lab-Craft u.h.f. model 415 introduced this year and includes models 215/S for aerial erectors, retailers, etc., 215/R for relay wired distribution signals and 215/E for export CCIR standards. Dimensions of series 215 are 7in. x 7½in. x 10½in., weight is 7lb and power supply is 200—225V, 226—250V a.c. Input is 75Ω coaxial, sensitivity 10μV to 100μV in two ranges with calibration better than 2dB and power consumption 36W.

New features include stabilised h.t., "memomatic" fine tuning, adjacent channel selection, etc., and Lab-Craft claim accuracy within 2dB.

Priced at £37 10s. ex works, the standard models are fully loaded with channels 1—13. *Lab-Craft Ltd., Gainsborough Road, Woodford Bridge, Essex.*

LETTERS TO THE EDITOR

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.

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

LETTER OF THANKS

SIR,—As a regular reader of *Practical Television* may I say "Thank you" for all the advice and help you have given me, also for the help in your queries section?

I think and believe what has been more useful to the "Kitchen Table Brigade" is your "Valves and Their Habits" as contained in the February and March, 1961, issues and the servicing tear-out guide. My issues and, I suppose, those of many other amateurs, are all the worse for wear and my purpose in writing to you now is with a suggestion that you once again reprint these, perhaps enlarge upon them, include a few more valves and perhaps some data on silicone diode rectifiers.

I am trying to be a little constructive and in no way destructive and I am sure this tear-out or separate booklet would be a blessing to many.—H. WILDASH (Wythenshawe, Manchester 22).

[What do other readers have to say on this subject?—Ed.]

MR. EDISON'S METHODS

SIR,—I am surprised that the dreamt interview between Thomas Edison and Iconos (October issue) advanced as far as it did, as I imagine Iconos having to shout at the deaf Edison, which would surely have prompted someone to waken him from his apparently freakish nightmare.

I was also surprised that Mr. Edison conceded so much of the development of the vacuum tube diode to Preece, Fleming and Thomson and of the cinema to Paul and Lumiere—I suppose it would have been too much to expect him to acknowledge Friese-Greene as the inventor of cinematography as well, as this would have been *totally* out of character.

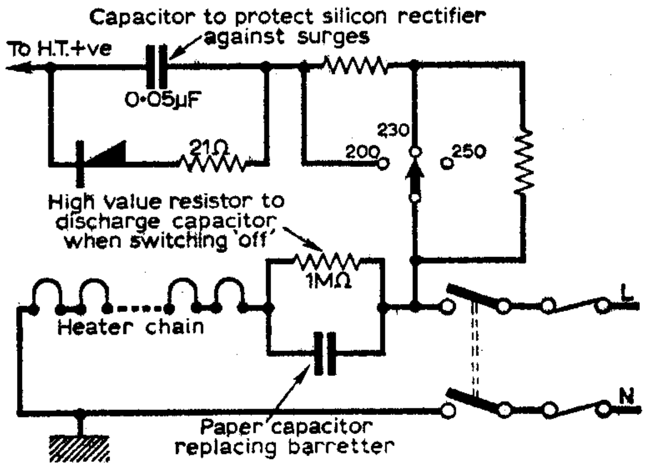
Regarding Iconos' waking thoughts, as far as I am aware, Edison did *not* even claim to invent the transistor and washing machine, which is perhaps just as well, as in those circumstances many firms would be paying unjustified royalties on Edison patents with every pocket portable and twin-tub sold, such were his methods. — P. R. ROGERS (Croydon, Surrey).

ABOLITION OF THE MAINS DROPPER

SIR,—Like K. Amor (Letters to the Editor, November, 1964, issue) I am a television engineer with an experimental turn of mind. We had a G.E.C. BT8245 receiver in the workshop for reconditioning with a new tube and silicon rectifier and I attempted to replace an unobtainable barretter with a capacitor, using its capacitative reactance to drop the voltage for the heater chain.

Several block capacitors of unknown value but near $4\mu F$ were tried until the voltage drop across the heater (this being a convenient measuring point) registered 6·3V.

This arrangement has been in use for over two years and is still going strong.—J. H. STACEY (South Molton, Devon).



The circuit arrangement evolved by Mr. Stacey to replace the barretter in a G.E.C. receiver.

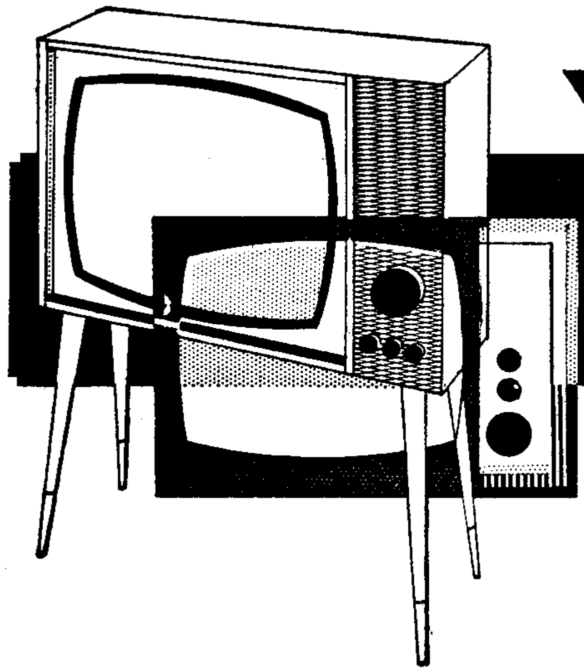
FREE SERVICING FOR OLD PEOPLE

SIR,—I wish to thank you for your kindness in publishing my letter in the September issue of PRACTICAL WIRELESS regarding the free servicing of radio and television receivers I undertake for old and disabled people here in Bristol. The publicity which this afforded my appeal for other engineers interested in this spare time activity to contact me with a view to forming a national association, brought an encouraging response.

Engineers from many parts of the country have written to me and as a result an association has been formed, with the sole aim of providing free TV and radio servicing for elderly and disabled people.

I would, of course, be pleased to hear from any PRACTICAL TELEVISION readers interested in joining the association (which has been named the National Electronic Association for Old and Disabled People) who are willing to give a little of their spare time to provide this service in their own towns.

Thanks once again to the publicity given by *Practical Wireless* and PRACTICAL TELEVISION to this movement, which I know from experience will bring happiness to many old people.—S. FREETH, (6 Buxton Walk, Horfield, Bristol, 7).



Your Problems Solved

Whilst we are always pleased to assist readers with their technical difficulties, we regret that we are unable to supply diagrams or provide instructions for modifying surplus equipment. We cannot supply alternative details for constructional articles which appear in these pages. WE CANNOT UNDERTAKE TO ANSWER QUERIES OVER THE TELEPHONE. The coupon from p. 188 must be attached to all Queries, and a stamped and addressed envelope must be enclosed.

PYE P131MBQ

When working on the mains this set has a perfect picture but there is a kind of "wobbling" on the sound. I have tried the set with the batteries and the sound is perfect.—B. Howard (Failsworth, Lancashire).

We suggest that you check the electrolytic smoothing capacitors, as one of these may be faulty.

DECCA DM 1

Please could you give me details of dismantling and replacing c.r.t. for the above set.—J. Eveleigh (Salisbury, Wiltshire).

Remove front knobs by pulling off. Remove rear and bottom covers. Remove four screws from under chassis and withdraw the complete unit; tube, loudspeaker, etc., are all attached to the chassis. Remove base socket, ion trap magnet and e.h.t. connection. Release front band and remove tube using the neck, through the deflection coils. The new tube—AW36-20, should be fitted reversing the above procedure. The ion trap magnet is carefully adjusted for maximum brilliance and should be initially placed in the same position as that which it occupied prior to removal.

SOBELL TPS173

This set operates for 10 minutes, then the frame begins to slip and no amount of adjusting will hold it. I have tested the PCF80 and PCL82 but these were both found to be all right. I have also checked the values of all the resistors in the multivibrator circuit. The 22kΩ resistor in the anode of the triode half of the PCL82 runs hot but maintains its value. The voltages on the valves are all near those given on the service sheet. The OA71 interlace diode has been tested.—P. Churcher (Watford, Hertfordshire).

Unfortunately, you do not describe the manner in which the frame hold is best, i.e. whether the control is at one end of its travel or whether it can be rotated both ways but not locked due to loss of sync. If the former is the case, replace C62 0·02μF, check R64 270kΩ by replacement.

If the sync is lost check C60 0·05μF and components associated with the OA71.

WESTMINSTER 21L40

The EY86 valve has been replaced twice in the last three months. Since another new valve has been placed in, it appears to be lighting up too brightly.—J. Meckley (Leeds, Yorkshire).

The trouble lies somewhere in the line timebase. If the line remains locked normally and there is no undue line non-linearity, check the components in the line output stage, for a value alteration may cause over-running. Check that the boost voltage is correct.

PETO SCOTT TV1729

The white parts of the picture seem to be "pulling" out to the left, so that the whole picture is slurred. I can almost rid the set of this fault by turning the contrast control fully clockwise.

The picture also slips at times so that the top half is at the bottom and vice-versa. I have had the valves tested and replaced any weak ones. The sound is good but does vary with adjustment of contrast control.—W. Bins (Diss, Norfolk).

This is the symptom of "pulling on whites." Since it is affected in your case by the setting of the contrast control, the trouble probably lies either in the sync separator or in the video amplifier. The sync separator valve is the pentode section of the PCF80 located just to the left of the tube neck. Check all components on its control grid (pin 2), screen grid (pin 3) and anode (pin 6).

The video amplifier is the 6BW7 in the near left corner of the chassis. Check the cathode, screen and anode components. In the near right corner of the chassis is a line sync adjusting plug. Try this in the other setting.

ALBA T766

The bottom of the picture gradually rises to about 2in. in the first hour of switching on, then remains steady, leaving the bottom half of the picture cramped.

I have replaced all the relevant valves but still the trouble persists.—M. S. Grosvenor (Cwmbran, Monmouthshire).

The field output valve is a PL84, V12. You should check this valve and its bias resistor of 270Ω, bias voltage of 13·5V. Check C67 100μF and C68 0·01μF if necessary.

PYE TV751

The sound is perfect, the raster is OK but there is no picture. All the valves have been changed and all the h.t. seems to be in order.—R. W. Hill (Hanham, Bristol).

We cannot trace a Pye 751, but the Pam 751 is similar to the Pye VT17. If this is your set, check the a.g.c. circuits, especially the 10MΩ resistor from h.t. to the M3 delay diode.

SOBELL TPS173

When first switched on, both the picture and the sound are perfect. However, after a minute or so, the picture begins to roll and the frame hold control seems to have no effect. I have changed the PCF80 frame oscillator.—L. Arnold (London, E.4).

The trouble is caused by drift in the frame oscillator. If you are sure that the valve is in order, check the components associated with the frame hold control, as drift in value of one of these could cause the trouble. It is also possible that the h.t. voltage falls when the set warms up. Check for this. If it does, change the h.t. rectifier.

G.E.C. BT5348

There are a number of black and white bands across the screen accompanied by heavy sound on vision. This fault seems to be much more pronounced on ITV and at times covers the whole screen. The line timebase valves have been changed, but no improvement has been noted. By adjusting the trimmers at the back end of the tuner, it is possible to get a stable picture on both channels, but the sound is lost and there is a very loud hum.

The line hold is at its fullest extent clockwise and a slight turn anticlockwise breaks up the picture completely.—F. Simms (Liverpool 24).

Your remarks indicate that the i.f. stages and sound rejectors are out of alignment. We would suggest that you have the set re-aligned on instruments. Co-channel interference causes similar symptoms, as does adjacent channel interference, but both of these faults could be aggravated by misalignment.

FERRANTI 17SK6

The frame hold rolls and judders. The ECL80 frame output valve has been replaced and this steadied the picture up slightly, but when camera changes are made the rolling picture starts again. —J. Rae (Bexleyheath, Kent).

This judder effect, if not caused by valve trouble, usually results from a fault in the frame blocking oscillator transformer. This set was particularly prone to this symptom.

MASTERADIO TG7T

Capacitor C76 was shorting and R57 was overheating. On renewing the l.o.t. and readjusting the ion trap, a rather pale picture appeared which blew up when the brightness was increased past half way. On removing the wires from T5 to 19 and 20 across frame coils, a very bright band about 1in. in width appeared. This widened as the brightness was increased, and a faint picture could be seen on the narrow bright band.—A. Price (Ebbw Vale, Monmouthshire).

The collapsed field scan would, of course, be normal on removing the wires mentioned. The blowing up effect signifies poor e.h.t. regulation. This is nearly always caused by a low emission e.h.t. rectifier and/or low emission of the line output valve and booster diode.

FERGUSON 3602

Whilst viewing, the picture lost all contrast and showed all the symptoms of a weak signal. The contrast control was still operating, although it did not make much difference to the brightness. The whole loft aerial system down to the set coaxial plug was checked. Both tuner valves were replaced and also valves 3, 4, and 5. Voltage checks were made on these three valves and it was found that the anodes and screens read some 10V higher, and the cathodes about 1V lower than the maker's figures. Resistance checks on the components determining these potentials read correctly to within the usual tolerances. Several other checks were made, but no faults could be found.—G. H. R. Doubtfire (Stanmore, Middlesex).

There is every possibility that the tuner is responsible for the troubles mentioned. If the valves are in good order, check the h.t. feed resistors and bypass capacitors. The latter decoupling an h.t. source have a habit of going leaky and increasing the value of the associated resistor or burning it out completely. Look for scorched resistors.

AERIAL FAULT

Is it practical to get rid of a ghost image? I came to this area of indifferent reception recently and erected a three element folded dipole aerial on the chimney stack. I have tested the aerial over an arc of some 90° but without noticeable difference. Picture and sound are otherwise good.

Sometimes (more at night) twin white lines appear at the very top of the picture area, and often the switch-off spot lingers on the screen.—E. Mercer (Weston Favell, Northamptonshire).

It is usually possible to reduce the ghost image of multipath interference by re-orientating the aerial. However, in your case, it would appear that the aerial system is not very directional or that the interference is arriving at an angle which cannot effectively be discriminated by the aerial. In this event, the use of a more directional aerial would be warranted.

The lingering spot effect could be caused by a low emission picture tube, trouble in the video amplifier stage or, in fact, by the basic design of the receiver. The white lines at the top of a picture are displays of pulses sent out by the authorities during the black periods between the frames. These are normally hidden but a slow field retrace can cause them to show.

REGENTONE 176T

The picture on BBC-1 is perfect, but on switching to ITV there is acute sound on vision.—R. Alexander (Epsom, Surrey).

This effect results from incorrect adjustment of the ITV local oscillator in the tuner. If the fine tuning control fails to effect a cure, the control should be set to range centre and the core in the ITV oscillator coil adjusted for maximum sound consistent with minimum sound on vision. The core is accessible through a small hole beneath the channel selector knob. Use a long, thin plastic knitting needle with the end shaped like a screwdriver for this adjustment.

MASTERADIO TJ7T

After the usual warming up period, the picture appears for about ten seconds, it then disappears leaving a thin vertical white line in the middle of the screen. The picture then reappears from ten to sixty minutes later.

When tuned to BBC channel 3, the sensitivity and contrast controls have to be turned back to minimum, the faces are white " globes " and on the point of turning negative.

When tuned to ITV channel 11, the contrast and sensitivity controls are turned to maximum, the picture definition then being fairly good. On both channels, the background always seems to be shimmering.—G. Morgan (Newmarket, Suffolk).

A fault in the boost diode in the line timebase/e.h.t. section could be responsible for the main trouble mentioned. This valve is best checked by substitution. The shimmering and overloading on the picture could signify a worn picture tube, but overloading due to a much stronger BBC signal than ITV signal is a probable cause. In this event it would be correct to retard the contrast on BBC.

QUERIES COUPON

This coupon is available until January 21st, 1965, and must accompany all Queries sent in accordance with the notice on page 186.

PRACTICAL TELEVISION, JANUARY, 1965

TEST CASE -26

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

? *The receiver—Ferguson model 548—suffered from a gradual reduction in picture width as the set warmed up and a consequent failure of the line timebase. For a few minutes after the set was first switched on the picture width was normal.*

It was noticed that the line timebase whistle ceased when the picture eventually failed. Line timebase and booster valves were checked by substitution but the fault persisted. An h.t. line check revealed a slight rise in voltage coinciding with the decrease in width and a corresponding fall in boost voltage on the line output transformer. Both the boost reservoir capacitor and the line output transformer were checked and found O.K.

What did the symptoms signify and what tests should be made to locate such a fault?

See next month's PRACTICAL TELEVISION for the solution and for another problem.

SOLUTION TO TEST CASE 25

(Page 140, last month)

Since the h.t. voltage was found to rise as the fault occurred, a reduction in the h.t. loading is signified. Moreover, as both sound and vision were affected the reduction in loading would be common to both sound and vision sections of the set.

About the only things common in this way to both sound and vision are the valve heaters. This was deduced by the engineer and during the fade-out he noticed that the heaters gradually went out. Further investigation revealed that the sparking was originating from a fractured thermistor in the heater chain.

This component was replaced and the set then worked normally.

Published on the 22nd of each month by GEORGE NEWNES LIMITED, Tower House, Southampton Street, London, W.C.2, and printed in England by WATMOUGHS LIMITED, Idle, Bradford; and London. Sole Agents for Australia and New Zealand: GORDON & GOTCH (A/sia) LTD. Subscription rate including postage for one year: To any part of the World, £1.9.0.

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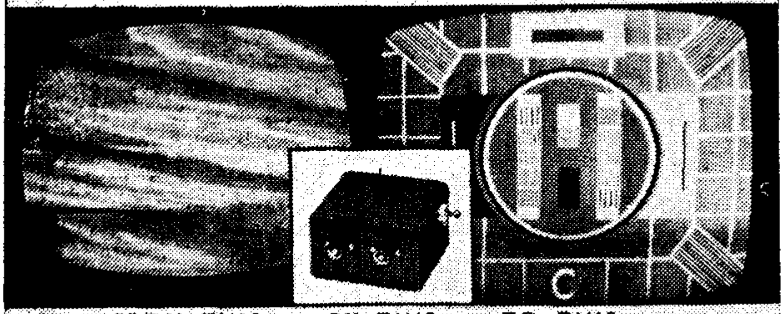

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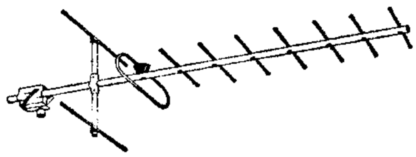

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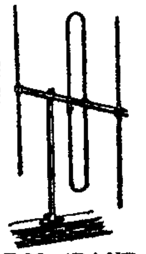

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