USING THE 62 UNIT

PRACTICAL TELEVISION

1/-

EDITOR F. J. CAMM

& "TELEVISION TIMES"

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IN THIS ISSUE

PRACTICAL TELEVISION
& "TELEVISION TIMES"

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Televiews

INTERFERENCE

THERE can be no doubt that one of the major sources of electrical interference with television reception emanates from the ignition system of motor-cars. One or two motor manufacturers have given the lead by announcing that all new models will have suppressors fitted. Recently a Post Office engineer expressed the "hope" that it will become compulsory to fit suppressors to cars. This has brought criticism from car owners, the gravamen of their argument being that they pay taxes on cars that conform with all the safety laws and they therefore consider their obligation is at an end with their consideration for other road users.

They further argue that TV owners pay the B.B.C. for a decent standard of viewing, and that therefore if suppressors are needed they should be supplied by the G.P.O. or the B.B.C.

This is a tangled problem. Receivers *can* be manufactured with built-in devices to eliminate interference, but it is costly. It is much cheaper for suppressors to be fitted to devices which give rise to interference.

As the Television Service grows the problem will grow with it, and so will the volume of complaints. It is undoubted that when there is a nation-wide complaint a law will be passed making interference an offence and the fitting of suppressors compulsory. There is no sign that manufacturers of receivers intend to tackle it from their end, as has been done in connection with sound receivers. There is, of course, a vital difference. With an ordinary broadcast receiver the volume can be adjusted so that the interference is reduced to a practically inaudible level. With a vision receiver this cannot be done without destroying picture brilliance.

Every piece of electrical interference becomes visible, and destroys the pleasure of viewing. The moment may not yet be ripe for compulsion, but it will come. As more and more motorists become viewers, and themselves experience this form of interference, they may adopt a more reasonable attitude. At present the motoring organisations oppose another law relating to motor-cars, reminding us that there are over 2,000 regulations already !

GOVERNMENT COMPETITION

THE Yorkshire Electricity Board is a branch of the nationalised electricity service. They have entered into competition with private traders by retailing radio and television sets. This grossly unfair competition with local ratepayers and traders has brought a vigorous protest from the Halifax Chamber of Commerce, supporting the protest also made by the Halifax Chamber of Trade.

Such trading is an infraction of civil liberty. Fortunately, there is an easy remedy, if the trade will only adopt it. Let every manufacturer refuse to supply radio and television apparatus to any local authority. Alternatively, let the traders themselves boycott any manufacturer who does supply apparatus to them.

The scandal is that some traders rent their premises from local corporations.

INCREASED SALES

THE greatly increased demand for television receivers experienced by traders in the reception areas during the past two months is undoubtedly due to the fear that the rearmament programme with its concomitant cut in the supply of raw materials to the so-called luxury trades will reduce their supplies. Manufacturers report, however, that there is no immediate likelihood of shortage.

Whether the drift of skilled workers back to armaments factories will affect the situation cannot at present be foretold. Firms report no diminution of personnel.

READERS' REPORTS

WE invite all our readers to report reception conditions to us from time to time so that we can, if necessary, take up the matter on their behalf with the B.B.C. Such reports will be particularly valuable from the fringe areas, for it is in such places that experiments must be conducted to develop the type of receiver which will eliminate the difficulty. We also welcome local news items from readers, the results of any experiments they may have conducted, articles of a general and technical nature dealing with Television, interesting photographs, and club news. Constructional articles are particularly welcome.—F. J. C.

Using the 62 Unit

An Experimental Television Set-up Built from the Surplus Indicator Unit

By B. L. MORLEY

THIS very useful unit can still be bought quite cheaply, and besides providing most of the components required for the time-base, it contains a VCR97 tube, fitted with a mu-metal screen.

When buying this unit it is advisable to check the tube, if possible under actual working conditions. Low emission and loose tube bases have been discovered. Most vendors will replace the tube if it is faulty and the majority actually test them before despatch. The condensers should also be given a thorough test as they may have deteriorated under storage conditions. A small leak can cause some bewildering faults in time-bases !

The chassis will accommodate the complete time-base, plus EHT power supply and the tube network ; although the one described here uses a separate power pack there is sufficient room to include this on the chassis provided care is taken with the screening.

The first operation is to strip down the unit. Remove the tube by first unscrewing the screw fitted at the base of the bracket which supports the holder ; the holder can then be drawn back, thus freeing the tube. The panel containing the potentiometers is hinged and can be swung back to allow the tube to be withdrawn from the chassis.

The valves should be removed next and the whole unit stripped down leaving only those items shown in Fig. 2. The focus and brilliance controls can remain where they are, though in the prototype they were removed to a position underneath the chassis to allow the unit to be fitted into a certain type of cabinet.

It is not necessary to disconnect the leads on the tube holder, D.C. restoring diode, EHT bleeder network, or focus and brilliance controls.

Underneath the chassis remove all components, including the double-sided paxolin strip. Remove all the potentiometers from their panel.

Circuits

The time-base circuit is given in Fig. 6, and the C.R. tube network in Fig. 5, though any time-base may be used. It will be noted that the C.R. tube works with the EHT positive earthed. The reason for this is to keep the peak inverse EHT voltage from the transformer and thus prolong its life. In the prototype a cheap transformer costing 37s. 6d. was obtained from an advertiser

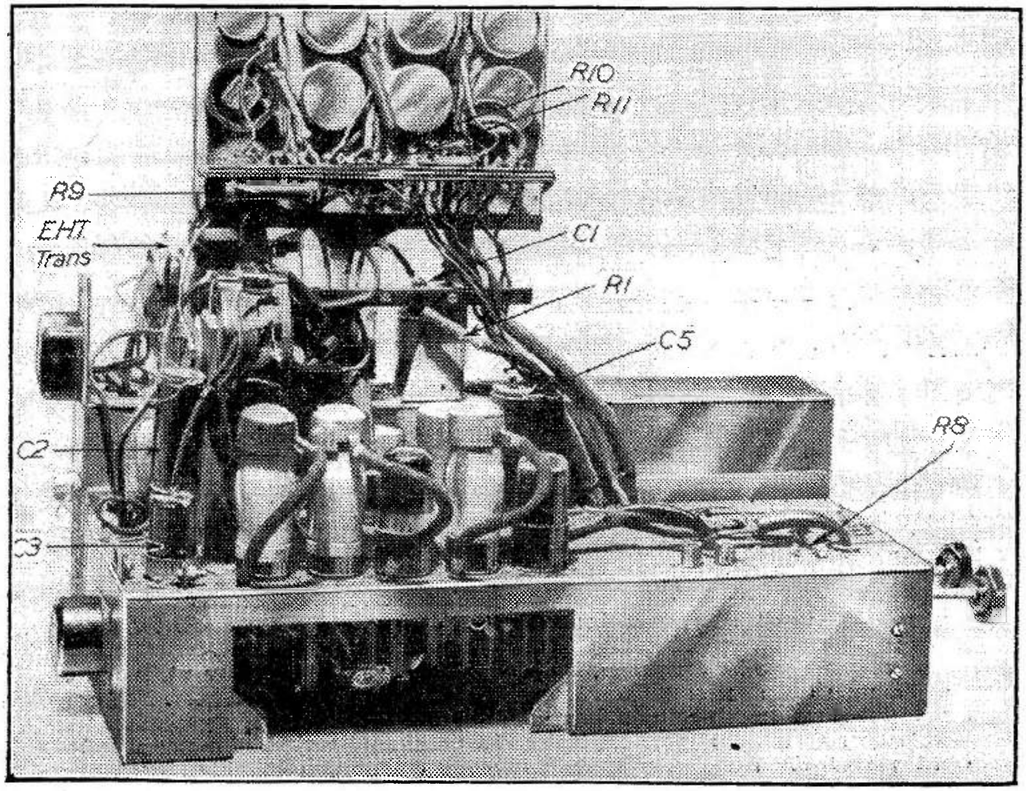


Fig 1.—General view of the modified Unit.

in this journal, is still working and has given nearly three years' satisfactory service. Another advantage gained by this method is that the condensers coupling the time-base to the deflecting plates need only be 450 volt working.

The metal front panel should be removed and the

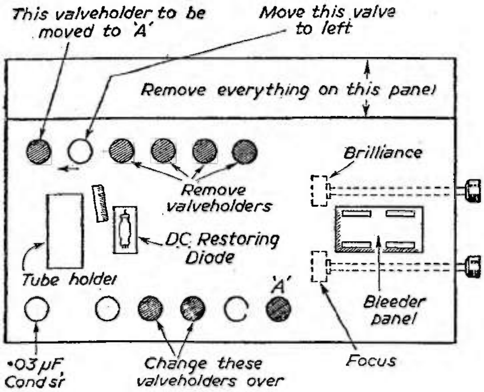


Fig. 2.—Layout indicating modifications.

tube holder can be moved forward a little so that the front end of the tube will project over the edge of the chassis. This will allow a rubber mask to be fitted to the tube.

The unit can now be rewired. Most of the components for the time-base can be mounted on the double-sided paxolin strip fitted underneath the chassis, but components requiring very short leads (such as the line time-base condensers) can be fitted direct on to the valve bases. The panel can be conveniently wired up before being placed in the unit, leaving about 4in. leads (either differently coloured or suitably labelled) where required to make connections between components on the strip and those on the chassis.

Height and width controls are mounted on the potentiometer panel on top of the chassis. This panel also holds the deflecting plate biasing resistors (VR3, 4, 5 and 6) as well as the line hold and frame hold controls.

The input to the time-base is via a "Pye" socket fitted at the rear of the chassis adjacent to C6 and R16.

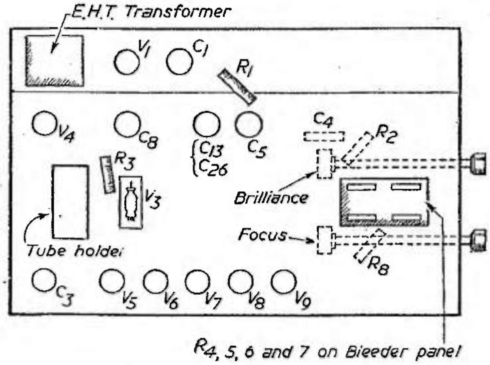


Fig. 3.—Further layout modifications.

Both the last two items are mounted on a separate paxolin panel.

If the focus and brilliance controls are moved to a position underneath the chassis great care must be taken with the insulation of the leads (which are at EHT potential), and with the positioning of C4 and R2.

Layout

The layout on the top of the chassis is shown in Fig. 2 and in the photograph. The following points should be noted.

The bleeder network is already wired except for the insertion of R8, which is placed as shown in the photo. The X and Y shift potentiometers are mounted on the

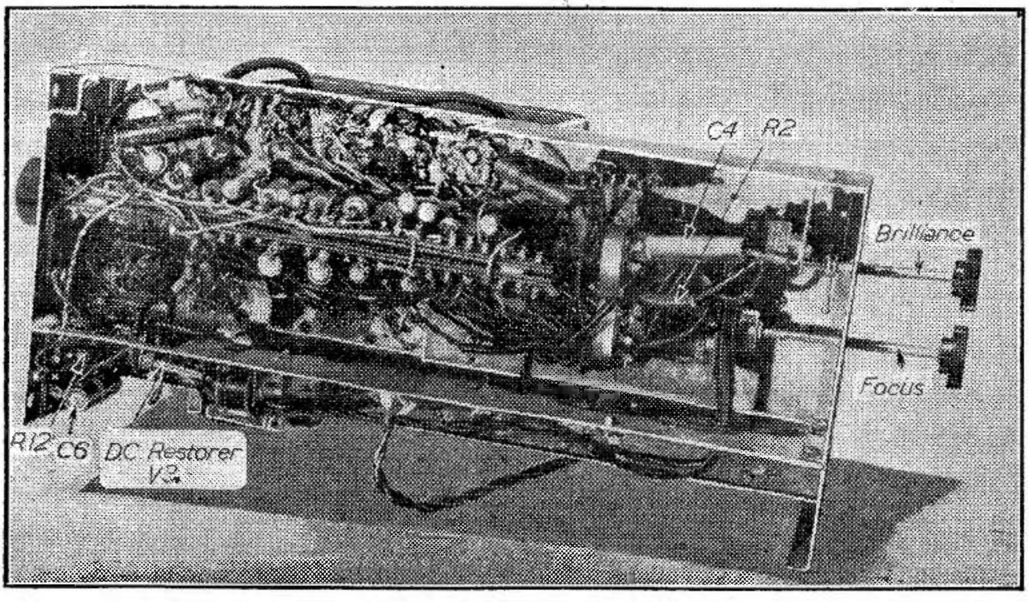


Fig. 4.—View of the underside of chassis.

hinged panel. To obtain accurate focusing over the whole of the raster four shift controls can be used, the connection from R12 being broken at "x" and the lead taken to another potentiometer, VR6 as shown by the dotted line (Fig. 6) and R13 disconnected at "y" and taken to VR7.

R9, 10 and 11 are mounted on the ebonite tag strip which forms part of the hinged potentiometer panel.

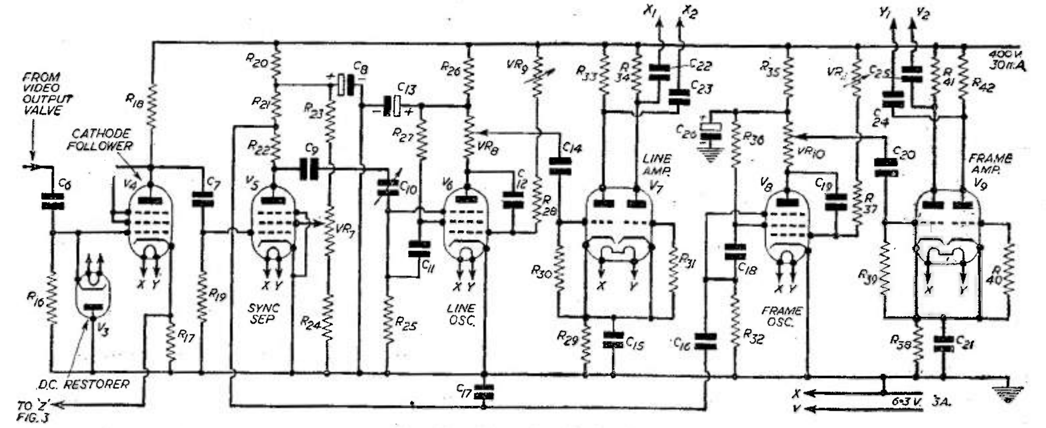


Fig. 5.—Time-base circuit.

LIST OF COMPONENTS

R16, 19, 30, 31, 39, 40 = 1 MΩ ½ w.
R17 = 3 KΩ.
R20, 23, 26 = 10 KΩ, 2 w.
R18 = 10 KΩ, 1 w.
R21 = 20 KΩ, 1 w.
R22 = 6 KΩ, 1 w.
R24 = 47 KΩ, 1 w.
R25, 27 = 47 KΩ, ½ w.
R28, 37 = 500 KΩ.
R29, 38 = 27 KΩ, 1 w.
R35 = 27 KΩ, 2 w.
R32 = 27 KΩ, ½ w.
R33, 34, 41, 42 = 100KΩ, 2 w.
R36 = 100 KΩ, ½ w.
VR7 = 25 KΩ.
VR8 = 50 KΩ (width control)
VR9 = 2 MΩ (line hold)
VR10 = 50 KΩ (height control)
VR11 = 2 MΩ (frame hold)
C6, 7, 15, 17, 20, 21, 22, 23, 24, 25 = 0.1 μF., 450 v.
C8, 13, 26 = 8 μF, 450 v.
C9 = 10 pF.
C10 = 0.30 pF.
C11, 12 = 100 pF
C14, 18 = 0.01 μF
C16, 19 = 0.05 μF.
V3 = EA50.
V4, 5, 6 and 8 = SP61.
V7, 9 = 6SN7.
Tolerances ± 10 per cent.

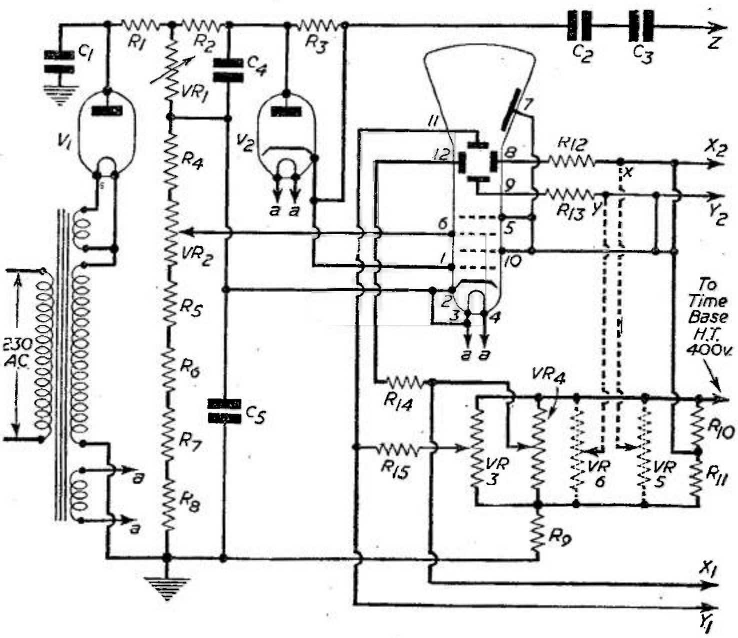


Fig. 6.—Tube and power unit details.

LIST OF COMPONENTS

R1 = 500 KΩ.
R2, 12, 13, 14, 15 = 2.2 MΩ.
R4 = 180 KΩ.
R5, 6, 7, 8 = 470 KΩ.
R3 = 1 MΩ.
R9 = 100 KΩ, 2 w.
R10, 11 = 100 KΩ, ½ w.
VR1, 3, 4 = 100 KΩ.
VR2 = 500 KΩ.
C1, 5 = 0.1μF, 2.5 Kv.
C2, 3 = 0.03 μF, 2.5 Kv.
C4 = 0.1 μF, 450 v.

C2 is fitted as an additional safety device. If C3 should break down full earth will be applied to the grid of the tube, and as positive is earthed this means that 2.5 kV would appear on the grid, thus ruining the tube. Of course a condenser with a higher rating could have been employed but C3 is already existing in the unit and another 2.5 kV. working condenser was available from the spares box. The two condensers share the voltage and the possibility of them both breaking down is extremely remote.

The existing wiring between the C.R. tube base and its D.C. restorer is left as it is but the anode and cathode of the diode must be reversed, i.e., the cathode of the EA50 must be connected to the grid of the tube. R3 is already *in situ* mounted on the diode valveholder. Any connection between the diode cathode and heater must be removed, and remember that this diode with its wiring is 2.5 kV. above chassis.

If desired the 6SN7s can be replaced with SP61s already in the unit using the well-known "see-saw" method of amplification. In this case some degree of

(*Concluded on page* 563)

World's First Televisor

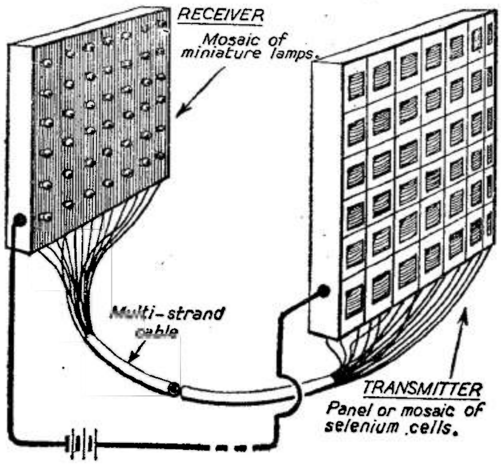
A Television Instrument of Queen Victoria's Day

IT is not easy, in these modern days of ours, to realise that the first basic notion of television science belongs not to the highly technical and scientific times in which we live, nor even to any period of technological development intermediate between the two world wars, or, for that matter, to any period of the present century. The germ of television is older than that. Surprisingly, it can even outdate the birth of wireless communication. Television, so far as its fundamental conception is concerned, is nearly as old as the telephone, or as the original phonograph which squeaked out its 2-minutes wax cylinder records to the astonishment of many of our more advanced grandsires. In very truth, the idea of television is, when all has been said and done, essentially a Victorian one, for it was when Britain was at the height of her prosperity that the first crude televisor was constructed, described and subjected to an experimental demonstration.

Possibly, the individual of literary taste and of an inquiring mind might, given a sufficiently large library in which to conduct his researches, be successful in unearthing some very early and long-forgotten reference to the possibility of seeing at a distance by electrical means just as it is possible to come across dusty scientific treatises containing unexpected and sometimes startlingly-true prognostications respecting the technique of photography, steam and oil power, aeroplanes, and a host of other scientific practices and inventions with which we are all now so well familiar. But, be that as it may. The fact remains that television has its deepest roots not in our own century but in the one preceding it.

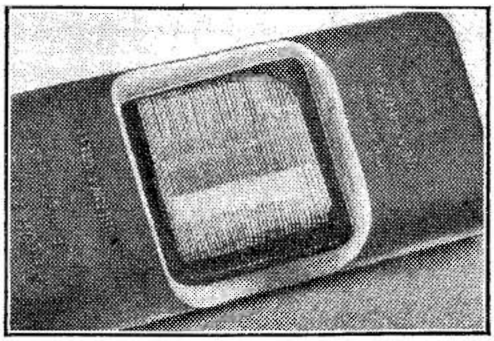
Selenium Started It

The root idea of television seems to have first arrived as a result of the discovery that the element selenium is capable of exhibiting a remarkable sensitivity to light. The history of selenium goes back as far as 1817, in which year it was first discovered and prepared in the bulk state by John Jakob Berzelius, Professor of Chemistry at Stockholm, and Secretary of the Swedish Academy of Sciences. But few people, even the scientific people of the day, took any notice of Berzelius' discovery. For more than 50 years selenium, the so called "moon element," a dark-coloured, glassy-looking, semi-metallic substance, allied to sulphur on the one hand, and to the metal tellurium on the other, remained nothing more than a mere chemical curiosity entirely devoid of practical use or interest.



The arrangement used by Carley in the 1870s.

Then, quite unexpectedly, in 1873, a certain Willoughby



A modern selenium cell of the wire-wound type.

Smith, Chief Electrical Engineer of the Telegraph Construction Company, a big concern of its day, working at the Transatlantic Cable Station on Valentia Island, off the south coast of Eire, happened to use some rods of selenium to push-up the resistance of some of his experimental electrical circuits. The results which he obtained were anything but accurate and constant ones. In fact, the circuits actually altered in resistance from day to day. Willoughby Smith gave closer investigation to the matter, ultimately finding that the puzzling changes in resistance were centred in the selenium rods which themselves varied in resistance (or, in other words, in electrical conductivity) according to the intensity of the light to which they were exposed. They showed maximum resistance (or minimum conductivity) in the dark, and exactly the opposite when they were exposed to full sunlight.

When Willoughby Smith's announcement of this curious and unexpected light-sensitivity of selenium was first published, it made a tremendous stir among physicists and electricians. World-wide scientific attention immediately became focused on the strange property of the "moon element." The "selenium cell,"—the first of the long line of photo-sensitive electric cells—came into being, and, for a decade at least, Patent Offices in various countries did good business with inventors who had been quick to devise novel and ingenious applications of selenium's inherent photo-sensitivity.

Selenium seems always to have, in some strange way, captured the imagination of scientists and scientifically-minded people, although, as a matter of actual fact, its original promise has never really fructified, and no really first-rate selenium application has been forthcoming.

" Seeing by Electricity "

Nevertheless, one definite result of selenium's rise to technical interest as a light-sensitive material were the first glimmerings of the notion of a possible system of television, or of " seeing by electricity," as our Victorian forbears termed it. An obscure individual named Carley became so engrossed and captivated with the idea that he actually set to work and contrived a crude, impossible sort of instrument based on selenium, an instrument, which despite its obviously and even hopelessly impracticable nature, must be of very great interest to us, since it may truthfully be described as the world's first televisor. No trace of this instrument now remains. Only its description has come down to us to testify to its originality, and to the fact that it attained the constructional stage and, with severe limitations, was apparently operated successfully.

Carley's television instrument in its fundamentals is brought back to life again in the diagram on page 535. It was really a surprisingly simple device, which probably worked as well as any crudely conceived instrument of its nature could possibly be expected to do. Needless to say, it did not transmit or receive actual television images. It could only deal with rough, black-and-white, shadowy silhouette-like designs, and its transmissions were, normally, of the cable or landline type, radio-transmission being unknown at that period.

It was in 1880, seven years before the nation celebrated Queen Victoria's first Jubilee, that a description of Carley's instrument was first given to the world. The Carley transmitter consisted of a blackboard surface, approximately square in its proportions and about the size of an engineer's drawing-board. Inset into its surface were regular rows of miniature selenium cells.

Selenium Cell Mosaic

The receiver comprised another board of similar dimensions, but, instead of selenium cells, it was inset with corresponding rows of small electric bulbs. Each selenium cell on the transmitter had its corresponding electric bulb on the receiver, every selenium cell being electrically connected by cable with its corresponding lamp on the receiver panel. Both the transmitter and the receiver were earthed, and a battery of appropriate capacity was placed at the receiving end of the arrangement to furnish current for the lamps.

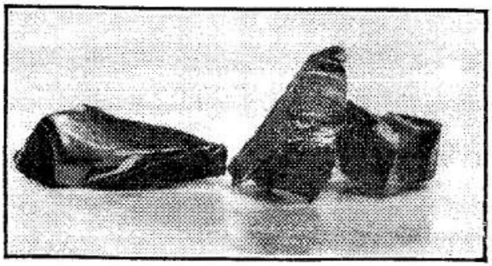
The main idea behind this extraordinary device will now be apparent. The transmitter comprised a coarse mosaic of selenium cells on to which a shadow-image was projected. Consequently, the selenium cells on the transmitter which received the highest light-intensity decreased to a maximum extent in resistance so that their corresponding lamps on the receiving panel glowed with a maximum brilliance, whereas the selenium cells on the transmitter panel which were the least illuminated caused their corresponding lamps at the receiving end of the system to glow with a minimum illumination. Intermediate light-intensities falling on the transmitter selenium cells set up corresponding glow lamp intensities on the receiver panel.

Hence, Carley's idea was to arrange matters so that each individual selenium cell formed a light-controlled resistance for its corresponding miniature glow lamp of the receiving instrument. Thus, in theory at any rate, half-tones of illuminations were transmittable in addition to the full and positive differences between maximum light and maximum shade. For all this, however, Carley's system of " seeing by electricity" was, despite its novelty, utterly impracticable. It failed, mainly because, at the best, it could only give a very coarse, highly granular reproduction of the transmitted image, an image which could best be described as a half-silhouetted shadow.

Using Carley's " Electric seeing " system, an enormous number of selenium cells and of corresponding receiver glow-lamps would have been required to produce any clearly-defined, recognisable image. It was calculated, some time afterwards, that Carley would have needed some 150,000 selenium cells and a similar number of miniature lamps to give only a very small picture having the " grain " of the coarsest-screen newsprint reproduction. And each of these cells and lamps would have required separate cable connection between them.

A Practical Impossibility

The enormous difficulty of making and accommodating such a vast number of cells and lamps can be realised. It was, indeed, quite beyond the technical resources of Carley's day. Furthermore, the complexity of the necessary multi-strand connecting cable needs no stressing. Its cost, even in those days of low prices, was quite prohibitive. It was, indeed, pointed out that a hundred miles of this cable would have been, so far as its manufacturing cost was concerned, in the region of a million and a quarter pounds sterling. Hence, Carley's invention, like the majority of over-optimistic inventions which have assailed Patent Offices the world over, quietly faded away, and little more was heard of it.



Specimens of selenium or the " moon element."

Crude !

The apparatus was crude and the possible cost of the system was enormous. No wonder, therefore, that the notion of " seeing by electricity " seemed quickly to die a natural death. It was ridiculous, thought the worthies of the day, to transmit vision by electrical means. It was as impossible as flying in a heavier-than-air machine ! Common consent dubbed the notion of Carley concerning electrical seeing as wholly fantastic and absurd. In face of such prejudice and opposition the invention was, at its very birth, marked out for rapid descent into the limbo of hopeless impracticalities.

Yet, possibly, throughout the whole gamut of scientific curiosities, there are few things of more peculiar interest than the Carley televising device. Carley, it was true, had been one of the very first individuals to get hold of the notion of televising images, but he was not born to develop the idea. A full forty years had to elapse before another original mind took up the same idea with practical intent, and before Baird's earliest dim, distorted images flickered faintly and tentatively across the receiver screen of the first of our modern televisors.

HOW IT WORKS

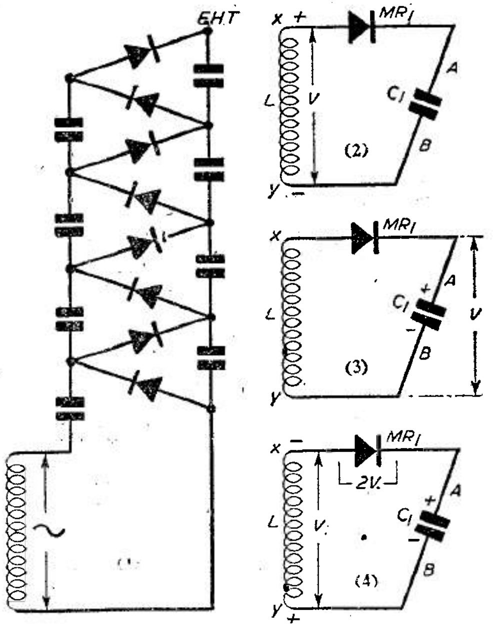
The Voltage Multiplier

A Simple Explanation of a Useful E.H.T. Device

By A. DUNN

THE following explanation will not meet with the approval of the purists. If, however, it assists even a few to a better understanding of what is beyond question a difficult and complicated subject, then the technical critics can be left to their righteous indignation.

It is of extreme importance that the reader and writer are on common ground—that the subject is seen from the same viewpoint. To accomplish this it will be advisable to agree to an interpretation of certain fundamental facts.



Figs. 1, 2, 3 and 4.—Conventional Cockroft Walton multiplier circuit and the component sections.

1. The potential of the earth is chosen as zero potential.
2. A point can be said to have positive potential if, when it is connected to earth, electrons flow from earth to the point. A positive point is, therefore, deficient in electrons.
3. A point can be said to have negative potential if, when it is connected to earth, electrons flow from the point to earth. A negative point has, therefore, a surplus of electrons.
4. Current flow is defined as a movement of electrons. The direction of flow, in any external circuit, being from the point of greater electron content to that of lower electron content, no matter what originally caused the surplus or shortage of electrons at the respective points.
5. It is to be particularly noted that " external circuit " means to the exclusion of any generator or generators feeding the circuit. This point will be enlarged on as the occasion arises.

To elaborate somewhat on the current definition as given above. While it is advantageous, in visualising the action, to consider an actual flow of electrons from one part of the circuit to another, this is, in fact, not taking place. It is more a " beg-o'-my-neighbour " affair. An exchange of so-called " free " electrons between adjacent atoms. The acquisition of an electron by any particular atom resulting in the expulsion from its orbit of, maybe, an entirely different electron.

Cockroft Walton Multiplier

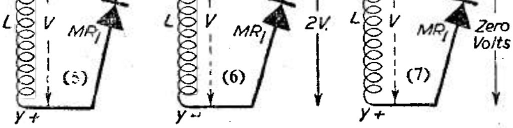
Using the above basic essentials it is possible to explore, with ease, the action of almost any circuit. To illustrate the procedure it is proposed to analyse the operation of the Cockroft Walton voltage multiplier—a device for obtaining E.H.T. from a comparatively low voltage supply such as that available from the H.T. winding of the normal radio transformer.

A six-stage Cockroft multiplier is shown in Fig. 1. This imposing edifice proves, on close inspection, to be but a series of similar sections, each containing a metal rectifier and capacitor. It would appear pertinent, therefore, to examine in detail the action of half-wave rectifier circuits.

A conventional circuit is depicted in Fig. 2. L is the source of A.C. supply, having a peak voltage equal to V. The rectifier MR1 permits passage of electrons in the direction A to X.

During the positive going half-cycle (x positive) electrons will flow anti-clockwise from Y to plate B of the capacitor C1 (which thus acquires a surplus and becomes negative) and from plate A (which loses electrons and becomes positive) through the rectifier to X. The capacitor becomes charged to the peak voltage V. At the conclusion of this half-cycle the position is as Fig. 3, and will remain so—assuming there is no leakage and the resistance offered by the rectifier to a clockwise movement is infinite. At the peak of the next half-cycle, negative going, the voltages due to C and L act in series in a clockwise direction to present a pressure of 2V across the rectifier (the peak inverse voltage). Due to MR1 no electron movement takes place. See Fig. 4.

This circuit is quite suitable as a source of H.T., the points A and B offering a fairly steady difference of potential roughly equal to the peak of the input. There



Figs. 5, 6 and 7.—Rectifier and capacitor are reversed in these circuits.

is, of course, a fluctuation since immediately current is drawn from the capacitor the voltage will drop and replenishment is only taking place every half-cycle. However, it is not intended to go into the question of regulation and smoothing in this article.

Polarity Reversed

Suppose the positions of rectifier and capacitor are changed, as shown in Fig. 5, and the action followed during the negative going half-cycle. Electron movement is clockwise towards A, which becomes negative and away from B, making it positive. The potential so gained by capacitor C1 acts in series with the following positive half-cycle to supply a pressure of 2V (Fig. 6) and in opposition to the subsequent negative half-cycle to produce zero volts (Fig. 7) across MR1. Points B and Y, therefore, present a potential difference, which is fluctuating between 2V and zero. If a capacitor and rectifier in series are connected between these points the fluctuation can be eliminated, for the capacitor will acquire a steady charge equal to 2V. Observe the action in Fig. 8 (Fig. 6, re-drawn with new section added). Electron movement anti-clockwise from D (which becomes positive) through MR2 to B and from Y to left-hand plate of C2. Resulting potential across C2 equals 2V. To be accurate this happy state of affairs is not reached during a single half-cycle. If electrons are moving towards B, then it is becoming less positive, and if A is losing electrons it is becoming less negative. This loss of charge is made up during subsequent negative going half-cycles and the final result is as stated.

Fig. 9 shows our progress so far. It is clear that the potential between B and D depends on the direction of the voltage produced by L, as shown below:

Negative going half-cycle.

Clockwise voltage due to C2 and L.. ..	3V
Anti-clockwise voltage due to C1	1V
Total voltage acting clockwise	**2V**

Positive going half-cycle.

Clockwise voltage due to C2..	2V
Anti-clockwise voltage due to C1 and L ..	2V
Total	0

Once again a fluctuating potential and no electron movement until another section (shown dotted) is added, when C3 charges up to 2V.

It is now perfectly obvious that each time a new section

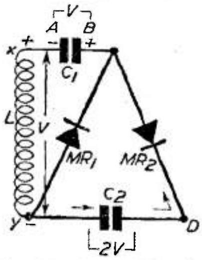


Fig. 8.—A modification of Fig. 6.

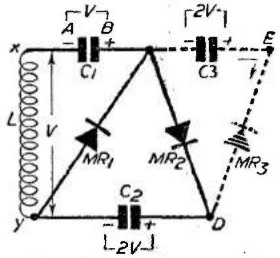
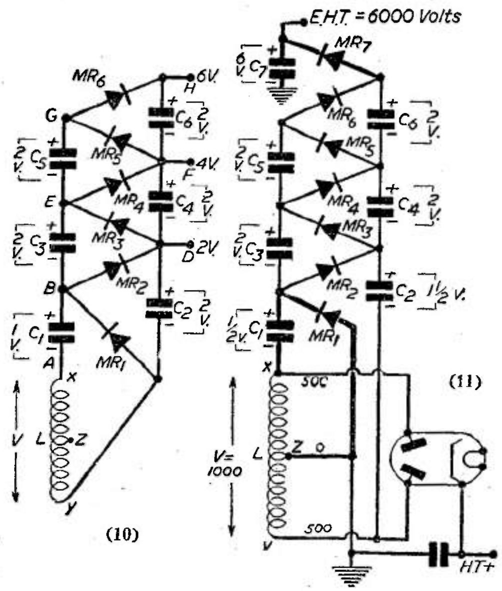


Fig. 9.—Development of Fig. 8.

is connected the added capacitor develops a potential equal to twice that of the input V. It follows that in Fig. 10 capacitors C2, C4 and C6 will act in series to make points D, F and H positive by 2V, 4V and 6V relative to Y. It is of interest to note that using Y as negative points B, E and G do not offer a steady output, but are varying by an amount equal to 2V since the alternating potential across L is being injected into the H.T. supply.

Applications

The multiplier just described can, with a slight modification, be connected directly to the transformer, which is already supplying H.T. through a normal rectifier to the receiver and time-base valves. In this way both H.T. and E.H.T. can be obtained from the same winding, and they will have a common negative point. This winding is usually of the order 350-0-350 R.M.S. The peak voltage across the whole winding is, therefore, about 1,000 volts (700 x $\sqrt{2}$). This would be increased to 6,000 volts by a six-stage multiplier. Now for the snag. If in Fig. 10 the supply is drawn from H and Z instead of H and Y, then the bottom half of the winding L will add an A.C. component to the E.H.T. To overcome this the circuit is altered to that of Fig. 11. A five-stage multiplier is used with the addition of two half-voltage rectifying circuits (shown in heavy outline). That some 500 volts ($\frac{1}{2}$V) will build up across C1 is immediately obvious. Should any difficulty be experienced in following the action of MR7 and C7 observe how simple it becomes when this part of the circuit is re-drawn as Fig. 12. During each negative going half-cycle 500 volts ($\frac{1}{2}$V) is added to that of the capacitors in series to give a total of 6,000 volts across C7.



Figs. 10 and 11.—Voltage distribution in the complete network.

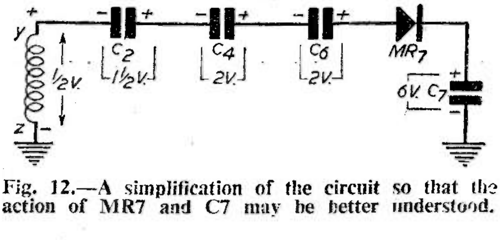


Fig. 12.—A simplification of the circuit so that the action of MR7 and C7 may be better understood.

Picture-tube Mountings

Some Suggestions for Home-constructed Apparatus

By W. J. DELANEY (G2FMY)

ONE of the drawbacks faced by the home constructor of a television receiver is the satisfactory housing of the finished article. A radio receiver can be used and left without a cabinet, although the construction of a suitable case is not difficult. A television receiver is, however, a much more delicate piece of apparatus, and the tube must be protected. Messrs. Tallon have come to the constructor's assistance with a " pack flat " cabinet which may easily be assembled with a screwdriver, and the finished article bears comparison with any commercial set. Many constructors are sufficiently handy with wood-working tools to be able to make a presentable cabinet, but whether using the Tallon or similar article, or a home-made one there is still the vital problem of mounting the tube. The keen experimenter will require this to be a separate and distinct part so that when trying out new time-bases, etc., it will not be necessary to handle a bulky chassis carrying a very expensive and easily-damaged tube. Even if the receiver is built as a complete unit, with tube on the chassis, there is the question of getting into the cabinet and fixing it so that dust cannot easily get on to the tube face, and so that it is easily removed periodically for dusting. The following are a few ideas which have been tried out and found simple and effective and at least one of these should be found satisfactory in your own particular case.

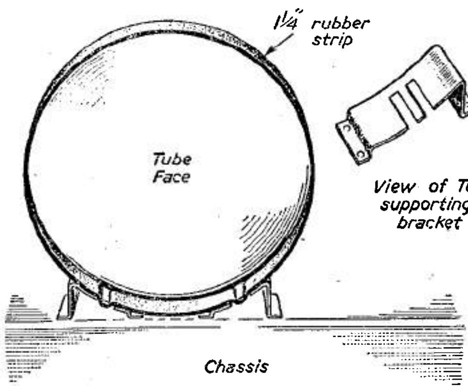


Fig. 1.—A rubber band may be held with a metal bracket on each side as indicated here.

Mask Fitting

Every tube must be used with a mask and most constructors will obtain one of the standard Long and Hambly rubber masks. These fit over the end of the tube sufficiently firmly to require no fitting to the tube itself. There is thus presented to the constructor two alternative methods of mounting—fitting the mask on the end of the tube first, or mounting the mask on the inside of the cabinet and offering up the tube to the mask. This latter is probably the most satisfactory way of keeping out dust, as the protecting glass and mask may be firmly fitted together with rubber solution, the glass held to the inside of the cabinet with wood fillets also dust-proofed by rubber solution round the joints, and the tube finally pushed right home into the mask. Provided that the shelf carrying the tube (whether this be mounted on a chassis or by itself on the lines of Fig. 3) is at a suitable height no fixing would be needed. Where, however, frequent removal may be required one good idea is that depicted in Fig. 1. Two brackets are made from aluminium as indicated and these are bolted to the front edge of the chassis at a distance apart to suit the tube in use. A 1¼in. strip of rubber either purchased as a rubber strip or cut from a bicycle or motor-car tyre is then cut to a length sufficient to allow 2in. overlap, and cemented with rubber solution to form an endless band. This is then slipped through the two slots in the brackets and when the tube is in position the band is stretched round

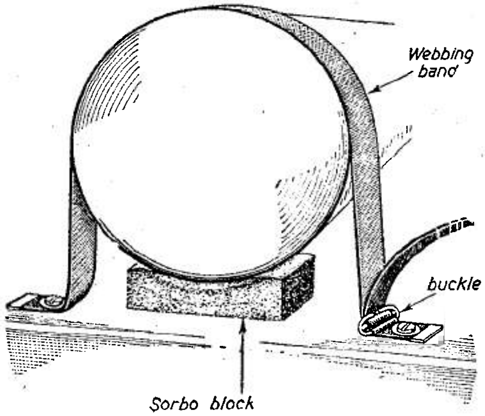


Fig. 2.—An alternative, using a block of Sorbo and a webbing strap. Undue pressure must not be used in this arrangement.

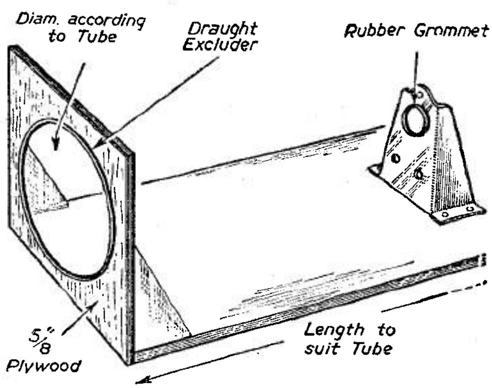


Fig. 3.—A mounting device for tube alone. This has many advantages but needs more room in the cabinet.

the outer edge allowing the tube to rest on the rubber band and providing a "floating" support. Obviously the critical factors here are the height of the brackets (to prevent the lower edge of the tube coming into contact with the chassis), and the overall length of the strip to provide a good clamping, but not so tight that force is needed to get it into position.

A simpler idea is shown in Fig. 2. Here a thick slab of sponge rubber is cemented at the front edge of the chassis and to one side the end of a piece of webbing strap is bolted. On the other side of the rubber a buckle with short length of strap is also bolted, the overall spacing being about 1in. less than the overall diameter of the tube. The webbing can be that used for carrying books, or surplus strapping from soldier's equipment which is now obtainable at a number of ex-government stores. The tube is simply rested on the rubber support and the webbing passed round the tube face and clipped in the buckle with sufficient tension to give good support. Both of these methods make it difficult to obtain a good fit in the rubber mask but may be used with plastic or home-made masks if a dust-proof joint is not required.

Tube Only

For mounting the tube only the arrangement in Fig. 3 cannot be beaten. A wooden baseboard and wooden front are assembled with side fillets and screws to form a rigid assembly. A hole in the centre of the front is cut to suit the tube in use, and should be of such a diameter that when the tube is in position the anode cap is at the back of the board (nearest the rear support). Surrounding the hole a length of rubber draught excluder is tacked, and it is not essential that it should go all the way round. Four short lengths attached at equal distances will afford sufficient support, and the rear metal support which carries the focusing magnet is provided with a grommet to hold the rear of the tube firmly. The tube must be held from the front in this type of mounting as

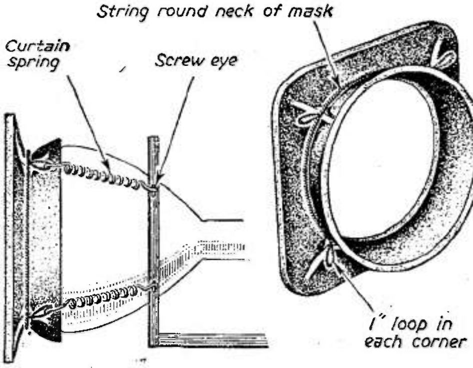


Fig. 4.—A simple arrangement making use of the rubber mask to hold the tube in position in the arrangement shown in Fig. 3. The "springs" are short lengths of flexible curtain rod.

otherwise it slides forward due to the sloping sides of the tube, and the simplest way of doing this is used in the PRACTICAL TELEVISION Receiver. Here the mask is fitted over the tube, the plate glass or thick plastic sheet fitted in front of the mask, and a shelf with a lip at the bottom holds the lower edge of the glass whilst two metal clips may be slipped over the upper edge. A more robust fitting, still using the wooden support, is shown in Fig. 4. Here, the mask is fitted over the tube and a length of string passed round the shallow portion of the mask. At each corner a 1in. or 1½in. loop is tied, and two screw eyes are screwed into each side of the wooden upright. A short length of the popular expanding curtain rod is then cut into four short lengths and screw hooks attached at each end. When the tube is pushed home in the opening, the hooks are hooked into the string loops and then drawn back and into the eyes in the upright as shown. The exact lengths of the spring must be found by experiment, and undue tension should not be

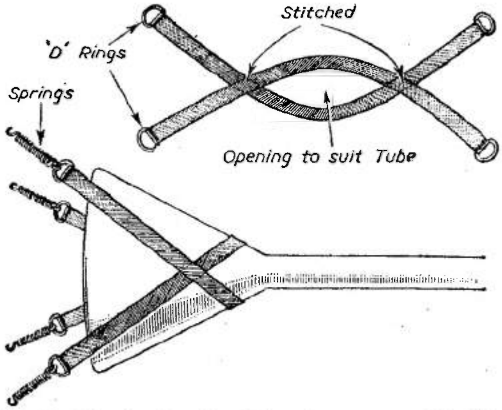


Fig. 5.—Two lengths of webbing strap are used in this arrangement which is the most satisfactory from the point of view of dust-proofing the tube face.

placed on the tube, although the front is the strongest part and it is the neck which has to be guarded. With this arrangement the protecting glass must be attached to the inside of the cabinet. The final arrangement illustrated also utilises webbing bands, two of which are stitched together as shown in Fig. 5, and "D" rings are stitched to the ends. Again four springs are used, and in this case the screw eyes are attached to the inside of the cabinet front, just outside the glass protecting plate. If this is firmly attached to the cabinet and dustproofed the springs may be chosen of sufficient strength to hold the tube and mask firmly against the glass and keep out the dust. The actual shape to which the straps are formed may easily be gauged by wrapping them round the tube and where they cross pencil marks may be made to indicate the correct angle of crossing.

It may be worth while pointing out here that if you are making your own cabinet it is preferable to provide for a removable or hinged top to the cabinet. This not only facilitates dusting but with the top off or raised you can gain easy access to the deflection coils for straightening the picture, adjust P.M. focussing, etc., all from the front where it is possible to see the actual screen and observe the effects of the various adjustments.

A Stabilised Power Supply

An Experimental Circuit for Use with Television Receivers, Time-bases, etc.

By A. DAY

FOR many experiments it is highly desirable that the power supply on the H.T. side should be reliable and constant. In a video stage, for instance, a stabilised supply to the screen will improve the video response, and in some circuits it is imperative to use a stabilised supply to ensure that the sync pulses are taken off without distortion. Although a neon stabiliser may be used direct on to a point where the stable supply is required, this will restrict the voltage to 150 and the current available is also restricted. It is, therefore, very desirable that some source of stable power supply is available—especially for experimental purposes—where voltages up to 200 or more may be obtained and this at either low or high current loads.

The power pack described in this article is capable of delivering a stabilised output of 250 volts at any load between 15 mA and 150 mA ; within these current limits the output voltage will be found to remain constant within approximately 2 volts. Variation of mains input voltage over quite wide limits will also produce no appreciable variation of output voltage. The actual value of output voltage may be varied at well over a range of approximately ±25 volts, but when set to any value it will remain constant irrespective of input mains fluctuations and D.C. load current changes.

Operation of the Unit

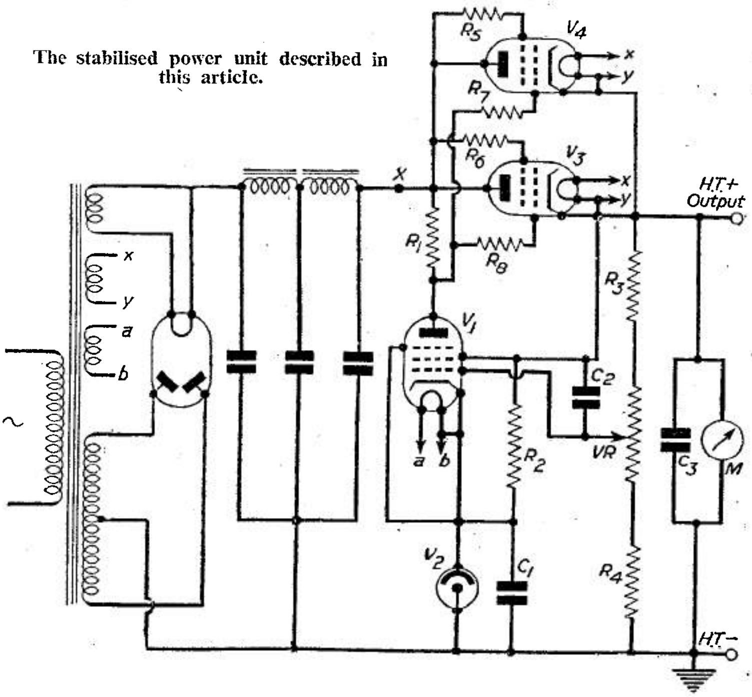
If the circuit is analysed it will be seen that the valves V3 and V4 are, in effect, parallel cathode followers with the power pack output load as the cathode load of the valves. The output impedance of a cathode follower is, of course, extremely low, hence the excellent regulation of this circuit. It will be seen that the neon stabiliser V2 is connected in the cathode circuit of the amplifier valve V1, thus the cathode potential of V1 is always maintained at a constant potential irrespective of the current flowing through it or through V2 (within wide limits). It will be remembered that the property of a neon stabiliser is that the voltage drop across the electrodes remains constant whatever the current flowing through it. The bleed resistor, R2, is included in order to maintain sufficient current through the neon tube for it to remain struck at all times.

The grid of V1 is connected directly to the slider of the potentiometer VR which is connected across the output H.T. line, and the values of R3, VR and R4 are chosen so that V1 operates on its normal grid base even though the cathode is held at about 120 volts above earth by the neon tube. The position of VR thus controls the grid bias of V1 and hence also its anode current and potential. The anode of V1 is D.C. connected to the control grids of the series stabilising valves V3 and V4. Variation of bias on V3 and V4 varies their effective resistance, of course, and so controls the output voltage of the stabiliser. It will be seen, therefore, that variation of the position of VR alters the output voltage of the

LIST OF COMPONENTS

- **R1, 270 kΩ 1 watt 20 per cent. carbon.**
- **R2, 6.8 kΩ 5 watt wire wound.**
- **R3, 68 kΩ 1 watt 10 per cent. carbon.**
- **R4, 68 kΩ 1 watt 10 per cent. carbon.**
- **R5, 100Ω 20 per cent. ¼ watt carbon.**
- **R6, 100Ω 20 per cent. ¼ watt carbon.**
- **R7, 100Ω 20 per cent. ¼ watt carbon.**
- **R8, 100Ω 20 per cent. ¼ watt carbon.**
- **C1, 4 μF 250 v. working.**
- **C2, 0.1 μF 350 v. working.**
- **C3, 8 μF 350 v. working.**
- **V4, 25 kΩ wire wound potentiometer.**
- **V1, EF50.**
- **V2, S130.**
- **V3 and V4, 6L6G.**
- **M, 0-300 voltmeter (optional).**

Note : For greatest possible long term stability R3 and R4 should be wire wound resistors.



The stabilised power unit described in this article.

circuit and thus acts as the voltage adjustment of the unit.

Consider now the effect of variation of load currents on the unit. If the load is increased, the output voltage will tend to decrease, the voltage at the slider of VR (i.e., grid of V1) will also decrease, and this will reduce the anode current of V1. Its anode potential will rise, so raising also the grid potential of V3 and V4. The internal resistance of these valves is thereby reduced and the output voltage rises. In this way the tendency for a reduced output voltage due to increased load is immediately counterbalanced by an increase in voltage due to the action of the series valves.

The condenser C2 by-passes the resistances R3 and VR so that any A.C. ripple remaining on the output of the stabiliser is fed to the grid of V1 at full amplitude. V1, V3 and V4 operate at ripple frequencies exactly as they do for changes of D.C. operating conditions so that the ripple on the final output is reduced to an exceedingly low level. Variation of A.C. mains input is also stabilised; since any increase in supply voltage will tend to increase the output voltage, V1, V3 and V4 will react as before and thus maintain a constant output voltage.

Practical Details

In order for the stabiliser to operate correctly, it is necessary for at least 130 volts to be dropped across the valves V3 and V4, thus, if the final output voltage is required to be 250 volts, at least 380 volts D.C. (and preferably more) must be available at the point X in the circuit and the transformer, chokes and rectifier drawn to the left of X must have suitable ratings to ensure this. The double section smoothing filter shown is not by any means essential, but it was designed by the writer for use in a power unit with the very best possible performance. The transformer delivered 485-0-485 volts, the smoothing condensers were 4, 8 and 8 μF, respectively, the chokes were 12 henries each and their ohmic resistance was 500 ohms the pair. The valve used was a 5U4G and the D.C. voltage measured at the point X was approximately 400 volts with the full current drain of 150 mA. on the unit. The component values specified are suitable for a stabilised output of approximately 250 volts with a plus and minus 25 volts variation available by adjustment of VR,

It will be noted that the cathodes of the series valves V3 and V4 are operated at about 250 volts positive to earth, and since the heater/cathode insulation is only rated for 100 volts it is necessary for the heaters to be fed from a separate winding on the transformer, one side of the winding being connected to the valve cathodes as shown in the circuit diagram. The EF50, V1, has about 120 volts on its cathode and it should, strictly, have its filament fed from a separate L.T. winding connected to the cathode to prevent excessive heater/cathode voltage. In fact, the rated heater/cathode voltage is so little exceeded that, unless a separate winding is readily available, the filament of V1 could be run from a normal earthy heater supply without much risk of valve failure.

The resistors R5, R6, R7 and R8 are for the purpose of preventing the possibility of parasitic oscillation, they are quarter watt carbon types and should be mounted very close to their respective valveholders, in fact the screen resistors should be slung directly from screen to anode pins, and the grid stoppers should be slung from the grid pins to the spare pins on the valveholders, the latter being used merely as stand-off insulators.

Apart from the points mentioned the general layout of the components is of little consequence and no special precautions have to be taken with the wiring.

Although the component values given will be found correct for the voltages and valves specified, any number of variations of input and output voltages or valve types is permissible. If changes are made it is merely necessary to adjust R2 so that the neon takes its specified current and to ensure that V1 operates on its characteristic by suitable choice of values for R3, VR and R4.

It will be found that a power pack of this type is a very valuable possession and amply repays the trouble in constructing it. Many of the components will be available from the usual surplus equipment sources.

Component Exports

AT the 18th annual meeting of the Radio and Electronic Component Manufacturers Federation, in London, on March 15th, it was stated that exports of loose components were now running at the rate of £6,000,000 a year. "Great Britain is now the world's premier exporter of loose components," Mr. W. T. Ash, the Secretary, said.

Exports of components in 1950 were valued at £5,300,000, as compared with £4,000,000 in 1949. The value of the exports to South America was nearly double the 1949 figure (Brazil alone taking over £500,000), and to North America (mainly U.S.A.) the value increased nearly twelvefold. The British Commonwealth absorbed 40 per cent. of the total value as compared with 49 per cent. in 1949. Other percentages, with 1949 figures in brackets, were: Europe, 31 (33.5); South America, 18 (11); North America, 6 (0.5); Asia, 3 (3.5); and Africa, 2 (2.5).

Television Growth

Major L. H. Peter, chairman, said that the increase of television receiver production in 1950 to 150 per cent. of the 1949 figure represented a load of the same magnitude on the component industry, and the output of components for television was now about equal to the output for broadcast receivers. The remarkable fact that the increase in television had not harmed the market for sound receivers had kept the whole industry in full production.

The future, Major Peter continued, was clouded by two things—the rearmament programme and the shortage of raw and semi-manufactured materials. Any failure to meet material requirements or any disorganisation of production for civilian needs before the floating of Government contracts would lead to the loss of the skilled labour which would be essential to meet the rearmament programme. It would also leave factories disorganised and unbalanced at a time when executives would need to devote all their time and energies to the problems of producing the new equipment.

"The industry," Major Peter concluded, "can well meet the Defence Programme if allowed to do so in its own manner. It is essential to get the Government to float contracts quickly with complete information and definite specifications to enable manufacture to proceed. The other requirement is that if the Government want the equipment, they must find the raw materials."

Mr. W. F. Taylor (Telegraph Condenser Co., Ltd.) was elected chairman of the Federation for the ensuing year, and Mr. P. D. Canning (Plessey, Ltd.) vice-chairman.

A SOUND CONVERTER

A Two-stage Unit for Use with any Standard Broadcast Receiver

MANY experimenters have found difficulty in obtaining good quality sound without a vision background, or find that the particular receiver they have constructed cannot be satisfactorily adjusted to cut out sound from the picture without seriously reducing the band width of the vision receiver. If you possess a really good broadcast receiver there is no reason why you should not use this for sound reception, confining the television equipment to a vision receiver and associated tube circuit. This does remove quite a lot of difficulties, but makes the final equipment perhaps more complicated. However, for those who wish to experiment with this idea, all that is necessary is a simple converter which may be supplied with any type of aerial, as the question of band-width does not affect the sound side so much.

A single valve will give satisfactory conversion with either a T.R.F. or superhet. circuit at short ranges, but for reliable results under all conditions, a two-stage unit should be built.

The Circuit

The circuit of Fig. 1 has been designed to give satisfactory results whether used in the "swamp area," or at the edge of the service area. It employs one R.F. amplifying stage followed by a frequency changer. The R.F. valve is one of the very popular EF50s which, as most enthusiasts are aware, have the Service No. VR91. With regard to the frequency changer, this may be Marconi X65, Mullard ECH35 or Brimar 6K8G. Each of these valves is interchangeable without alterations to circuit values or wiring.

Both R.F. and F.C. stages follow normal practice with one or two small exceptions. Coils are permeability tuned and are home wound on Aladdin coil-formers. The latter are to be used with the appropriate dust-iron core. Tuning is accomplished by screwing the core in or out of former as required, using a screwdriver made from some kind of insulating material—whalebone shirt-collar stiffeners are excellent. Coils L2, L4 and L5 are all wound centrally on their respective formers and for the London transmitter each has 7 turns space-wound, L1 has 2 turns wound above L2 and spaced from it by 1/32in., whilst L3 has 6 turns and is similarly spaced from L4. All coils are wound with 34-gauge D.S.C. copper wire, and windings should be held in position with a suitable glue. For the Sutton Coldfield transmitter coils L2, L4 and L5 are wound with 2 turns less. L1 should be 1½ turns and L3 4 turns. The heater R.F. chokes may be made by winding 20 turns of 14-gauge enamelled copper wire on a lead pencil and then slipping them off; they may then be stretched slightly so that there is adequate inter-turn spacing. It is intended that they shall be self-supporting, and their inclusion is to prevent unwanted coupling between circuits via the heater wiring, coupling which would most probably induce uncontrollable instability. Variable resistor VR1 in the cathode circuit of V1 should not be regarded as a volume control but rather as a pre-set anti-swamp control for the use of those residing close to the transmitter. The frequency changer circuits are completely orthodox, and the only item that requires comment is the choice of intermediate frequency. This is fairly flexible as regards exact frequency but should be somewhere in the region of 600 kc/s (500 metres). A Wearite coil type PA7 tuned with a small 500 pF. mica variable condenser enables the I.F. to be adjusted to the required frequency, and the

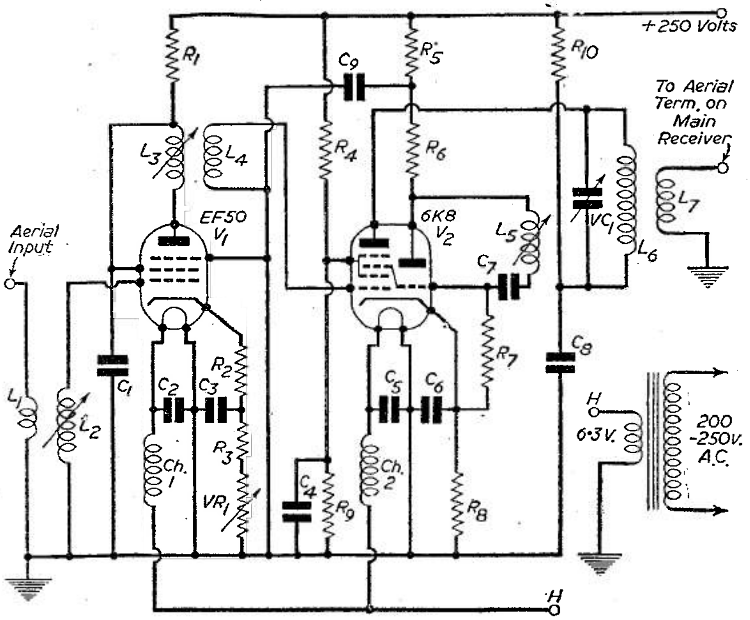


Fig. 1.—Theoretical circuit of the converter.

LIST OF COMPONENTS

- L1, 2, 3, 4, 5—See Text.
- L6 plus L7—Wearite PA.7.
- C1, 2, 3, 4, 5, 6—.002 μF mica.
- C7—.0001 μF mica.
- C8, C9—.002 μF mica.
- R1, 5, 10—5 kΩ.
- R2—32Ω.
- R3—220Ω.
- R4—40 kΩ.
- R6—25 kΩ.
- R7—50 kΩ.
- R8—230Ω.
- R9—30 kΩ.
- VR1—10 kΩ potentiometer.
- VC1—.0005 μF. Midget mica.
- Chassis, 12in. x 3in. x 2½in.
- Two Screens as text, plus one plain one.
- Other components—See text.

normal primary (now the secondary) winding serves as output coupling coil.

Energising the Unit

As the total H.T. current required by the converter is only about 15 milliamps, it is hardly necessary to build a separate power-pack, for most broadcast receivers will have sufficient reserve for this. In view of this a filament transformer only is included in the unit ; H.T. may then be picked up from the main receiver via a single plug and socket. Of course, those who possess power-packs of the general purpose type may use these instead, in which case former will not be needed.

Chassis

Two views of the chassis with position of main components are shown below in Fig. 2. A good metal from which to make the chassis is tin-plate. It is fairly easy to work and solders very easily. The drawings show the chassis as being open at the bottom with a small angle bracket at each corner. These brackets are made from the same metal as the chassis and are soldered to it. If a 13in. x 4in. baseplate is now cut it may be affixed to these brackets either by nuts and bolts or solder, thus giving total enclosure of the sub-chassis components. An alternative arrangement is to have a ½in. flange on each edge of the chassis lengthwise ; then, if it is drilled about ¼in. from each corner, bolting to the baseplate is simple.

Details of the sub-chassis screens are shown in Fig. 3.

Connections and Adjustment

The process of connecting a converter of this type to the main receiver is, of course, a simple matter for the more experienced constructor, but may be rather confusing for those not so advanced ; therefore, for the benefit of the latter here are the main details. Firstly, disconnect the aerial from the aerial terminal on the main receiver. A second lead connects the chassis of the converter to the earth terminal on the main receiver to which the earth proper may be left connected. The final connection between the unit and the receiver is the H.T. positive plug already mentioned ; incidentally, a good place to obtain 250 volts positive is at the "hot" side of the output transformer.

Aerials

If a proper television aerial is not available, the converter will work quite well off a normal one provided this is not too long.

It only remains now to plug in the mains lead to the converter, switch on the broadcast receiver and all is ready for alignment. To carry out this part of the work, first tune the broadcast receiver to about 500 metres and turn up the gain control ; set VC1 three-quarters of the way in, adjust all coil cores via the holes in the chassis so that they are approximately flush with the top of the chassis, and set VR1 to have minimum resistance in circuit. Some kind of signal should now be heard. If there are no results, then either L5 or VC1, or both, require adjustment. Having "resolved" a signal, final adjustments may be carried out to the aerial and H.F. coils, and to VC1.

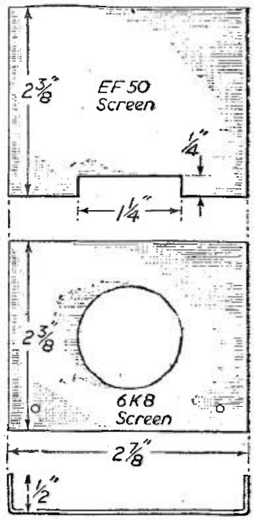


Fig. 3.—Details of the screen which is fitted across the EF50 valveholder.

Signal Generator

Of course, as with any type of superhet, or multi-circuit receiver, the simplest way of making preliminary adjustments is with the aid of a signal generator. It should be remembered that the combination of this unit and the broadcast receiver is a superhet, the broadcast receiver being the I.F. portion, and therefore the process of lining up and using is identical with any straightforward superhet with the difference that the I.F. stages (the tuning of the normal broadcast receiver) may be adjusted when the combination is not used, and when required again will have to be set to the correct tuning point, or, in other words, set to the correct I.F. It is therefore desirable to take some very clear dial-indicating point or station-marking which may easily be duplicated as the receiver is required for use, and then tuning will not be needed, the converter unit being merely connected up and switched on. If this point is not attended to the two sections will have to be tuned each time they are required together for the sound programmes.

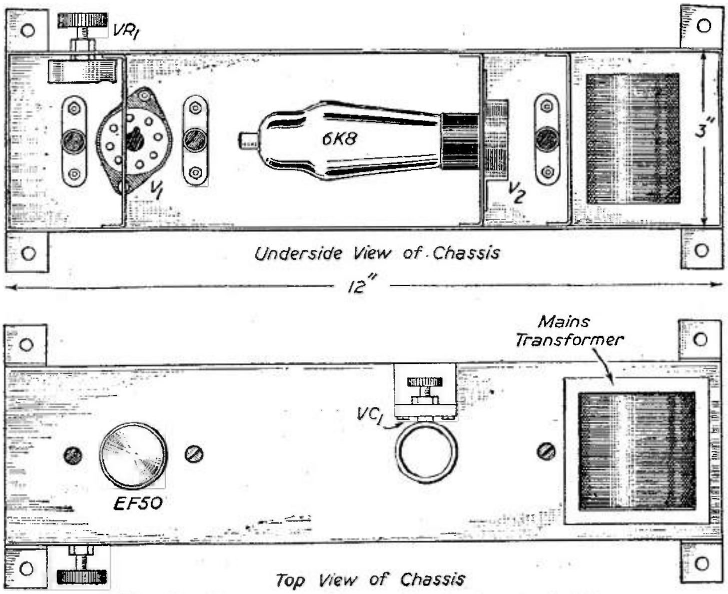


Fig. 2.—Upper and lower chassis layout details.

Newsreels

PHILIP DORTE, head of the television film section of the B.B.C., is investigating the newsreel position in U.S.A. It is stated that he wants more American newsreels for our screens, and at the moment the B.B.C. are sending five times as much newsreel material to the U.S.A. as they send to us, and he is endeavouring to step-up the contribution from America.

Interference

GROWING use of electrical equipment is giving rise to more complaints from viewers of interference. It is stated that these now run into more than 200 a week, and it is taking as long as three months for some of them to be dealt with by the G.P.O.

No Low-power Stations Yet

DUE to the defence programme, it has now been officially confirmed that work on the five low-power stations illustrated on the map in our March issue has been postponed indefinitely. The three high-power stations will go ahead, but some delays may be expected here and there.

Broadcast Receiving Licences

STATEMENT showing the approximate numbers issued during the year ended February 28th, 1951.

Region	Number
London Postal	2,353,000
Home Counties	1,646,000
Midland	1,745,000
North Eastern	1,900,000
North Western ..	1,618,000
South Western	1,063,000
Welsh & Border Counties	729,000
Total England & Wales ..	11,054,000
Scotland	1,116,000
Northern Ireland ..	207,000
Grand Total	12,377,000

The above total includes 703,000 television licences.

When installing their television sets, viewers should not wait until their 20/- sound licences have expired, but should purchase without delay a £2 television licence, which also includes sound reception. A rebate on the unexpired portion of the sound licence should be claimed from the Post Office.

American Enterprise

PANTHER VALLEY, in Pennsylvania, was screened from all three Philadelphia transmitters by Summit Hill of the Blue Mountains ridge. Forty-five thousand people in the valley were thus deprived of any television signals, but five local dealers got together and fitted a master control and amplifier on the top of Summit Hill, with three feeders down the hillside and a distributor in the valley, and as a result a community distribution system has been set up to bring television to the residents. Many problems had to be overcome, of course, in this ambitious project.

Midlands' Viewers Grow

IT is claimed that well over half a million people in the Midlands are now regular viewers and that the number is swelling at the rate of nearly 20,000 a month. Birmingham heads the list with 38,786 licences; Nottingham comes next with 14,252, and Leicester next with 13,158. Stoke-on-Trent follows with 9,997, then Coventry with 9,647.

Gloucester Relay

GLOUCESTER relay service was the first to come into operation, when Gloucestershire cricketer, Tom Goddard, tapped into the service at his Gloucester home on March 16th. At a cost of 7s. 6d. a week, subscribers obtain a good picture in an area where previously reception was very difficult. The service is operated by Pye-Murphy Joint Subsidiary Link Sound and Vision Services, Ltd.

Television "Export"

IT is stated that a proposal has been made that B.B.C. television programmes should be filmed and the films exported to various countries for televising.

French Advances

MR. LESLIE KNOPP, Ph.D., M.Sc., F.I.E.S., in the annual report of the C.E.A. Technical Department, states that French television equipment is more modern than that of the B.B.C., but the French service lags behind that given in this country.

No Colour at Festival

SO far, details of the exhibits at the Festival South Bank Exhibition make no mention of colour television. The Telecinema will provide displays of other forms of TV, including "candid" camera interviews, demonstrations of 625-line equipment, and big-screen shows.

Northern Transmitter

WORK at Holmfirth is being speeded up. Sections of the standby 150ft. mast to be used for the preliminary transmissions due to begin in July are now on site. Work on the main mast, interrupted by bad weather when it had reached 620ft., should be resumed any day now, and provided there are no more hitches, full-power transmissions will be on the air in late September.

Radar Interference

TELEVISION viewers in Southern England have been caused great anxiety recently through radar interference.

Ronald G. Finnigan, general secretary of The Televiewers Association, made repeated requests to the Under Secretary of State, Air Ministry, to look into the matter.

This has now been done and all radar stations dotted along the coast have changed their frequency to eliminate distortion of the TV screen.

Cause of Decline

UNDUE concentration of power at the centre is the cause of the decline in virility and spontaneity in the radio and television programmes. This statement was made by Mr. John Coatman, former North Regional Controller for 12 years. He adds that "civil service mentality" is creeping in the administration of the B.B.C.

Cut-price Receivers

IN an endeavour to sell their large stock of receivers a firm in New York recently advertised that on receipt of a 'phone call they would supply by return a 17in. square screen receiver in mahogany veneer cabinet for 5s. 5d. weekly. This is a result of their over-stocking in anticipation of a sales rush resulting from the defence plan which it was thought would lead to shortage of materials.

6-Lens Camera

AT the Festival of Britain visitors will see what is claimed to be the only 6-eye television camera in the world. The majority of modern cameras have three or four lenses of different focal lengths mounted on a turret, but this special Emitron camera, designed for 625 line working, has six special lenses and a built-in 6½in. viewing screen of the electronic type for the operator.

Local Rediffusion

NOW that Gloucester has started up, concern is being expressed in various districts which had turned down rediffusion systems for TV. Residents in various quarters are complaining that reception is very bad on individual receivers and that satisfactory results can only be obtained in their district through the medium of a redistribution system. In nearly all cases the Council have made the decision and the public have not been approached for their views in the matter.

Publicity Aid

THE Federation of British Industries exhibitions committee has agreed that television provides a good opportunity for publicising British industry generally, and increasing British prestige abroad. The recent demonstrations at Copenhagen and Berlin resulted in considerable interest and brought to the attention of visitors the other British goods on show.

Local Interference

IN Littlehampton a local interference problem is causing concern. At 8.30 almost every night a 3in. wide band, accompanied by a loud humming on the sound side, spoils reception over a very wide area. A protest to the P.M.G. is being considered.

Wired TV

IT is stated that a system whereby ordinary television programmes may be sent over ordinary telephone wires and thereby give reception in many homes, without aerial complications, is being stifled by the Post Office. Action is being taken through the Society of Post Office Engineers to have the facts brought to light.

TV in Scotland

PLANS for the rapid development in TV in Scotland are well advanced, manufacturers having completed their plans. A recent estimate states that there is an immediate demand in Scotland for 20,000 TV receivers when the Scottish Service starts. It is optimistic to suggest that this may be in November.

Production Figures

IN the 18th Annual Report of the R.E.C.M.F. it is stated that production in 1950 exceeded that of 1949 by 50 per cent., exports being 42 per cent. higher. The report states that prospects for the current year are not so bright. The sale of television sets has not adversely affected the sale of broadcast sound receivers and radio gramophones. The number of television sets manufactured is 1,700,000.

No Relay for Eastbourne

BY a three-vote margin, Eastbourne Town Council has decided not to approve the installation of a radio and television rediffusion service in the town. The main opposition has come from local radio traders, whose appeals against the service were rejected by the Highway Committee.

Queen Mary and Princess to Visit Show

THE Radio and Television Show, to be held from August 28th to September 8th, will be patronised by Queen Mary and Princess Elizabeth. Details of the exhibition were given last month in our leader.

The Boat Race

THE repeat performance of the Boat Race on television was seriously marred by transmission difficulties. Like the Oxford crew, the B.B.C. also foundered!

H or I Aerials?

WHEN TV comes to Southampton and Plymouth areas aerials, says the *Daily Graphic*, will be horizontal instead of vertical, as in London and the Midlands. Flat aerials will be needed because of the transmission system. Stations in the new areas will transmit on low power on a wavelength corresponding to that used by high power stations. Horizontal aerials are, of course, in general use in the U.S.A. It is claimed that they pick up less electrical interference.

Relay Stations Deferred

FIFTEEN million people are affected by the announcement by Mr. C. R. Hobson, Assistant Postmaster-General in the Commons recently, that the construction of the five low power relay stations previously planned had been postponed indefinitely because of the Defence programme. The Newcastle-on-Tyne and Southampton stations were to have been started next year, the Aberdeen and Belfast in 1953 and Plymouth in 1954. These would have served 5,000,000 people, and stations linked to the main transmitters and operated by private enterprise were expected to relay TV to the 10,000,000 not directly served. Electronic equipment needed for TV is required in vast quantities for radar and other defence systems.

Holme Moss

MR. HOBSON announced that Holme Moss Station, near Huddersfield, will certainly open this year. He did not state when that at Wenvoe in the Bristol Channel area will be ready. It is scheduled for mid-1952.

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SOUND	,,	,,	£3. 1.0	,,	,,	,,	2/6
TIME BASES	,,	,,	£8. 5.6	,,	,,	,,	5/-
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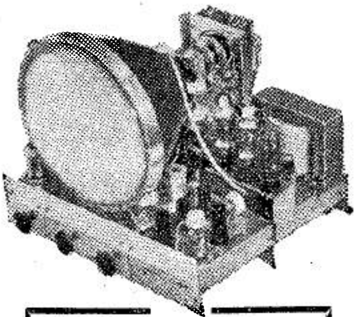

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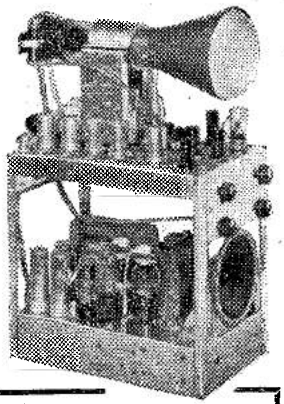

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£17.17.0 inc. Tube (carriage and packing, 15/-).

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TUBE ASSEMBLY, carriage and packing 2/6	£2.18.6

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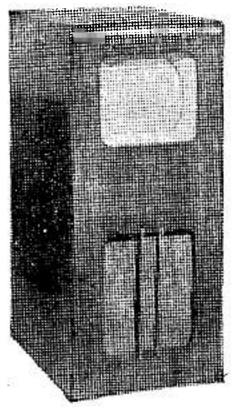

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The Miller Timebase

An Improved Arrangement for Use with Electrostatic Tubes

MANY experimenters are using the ex-Government radar tubes for television reception and have found that one of the simplest and most satisfactory types of timebase for this particular kind of electrostatic tube is the well-known Miller arrangement. The standard circuit, however, has certain defects which prevent optimum results being obtained. The three main drawbacks are the "pip" at the commencement of the scanning stroke, as shown in Fig. 2 (a), loss of linearity at the lowest frequencies, and considerable differences in sweep amplitude in any normal arrangement of the timebase for oscilloscope work, where various capacitors are switched between the grid and anode of the timebase valve by the coarse frequency control switch. The timebase also suffers from a rather long flyback time at the highest frequencies.

The "pip" at the positive commencement of the scanning stroke would appear to be eliminated, at least in part, by careful design and choice of capacitance values, and the flyback time can be reduced to a minimum in the same manner; these two points have been dealt with in the design shown in Fig. 1, and neither the "pip" nor the flyback time are obtrusive. The two major defects, loss of linearity and variation of amplitude, remain, however, in the single-valve timebase circuit built up round V1, and it is highly desirable that no matter for what type of operation the timebase is to be employed these two faults should be eliminated.

In an oscilloscope the most important point is the variation of amplitude between the ranges as the main control switch S1 is rotated through its positions. Neglecting V2 of Fig.1 for the time being, and assuming the sweep output to come direct from the anode of V1, it would be found that were the sweep voltage fed to the X plates of a tube the scan would be short with S1 in position 1 for the low frequencies, long with S1 in positions 2 and 3, and again short with S1 in position 4. This is annoying even for the most unexacting oscilloscope work, but where careful measurements or close observations are important these differences in scan length make the work difficult and tiring and can lead to the recording of inaccurate results.

For television work, on the other hand, amplitude variation is of no account since the timebase is operated at a fixed frequency. For line scanning a single-valve Miller timebase can give really excellent results, but in the majority of cases the loss of linearity makes itself felt when this circuit is used for the frame timebase, the top eight or ten lines of the picture opening out seriously. In the circuit of Fig. 1 both amplitude variation and loss of linearity are dealt with, and it is felt that the final timebase gives most satisfactory operation in an oscilloscope. The writer has as yet had no opportunity to test the circuit for television purposes, but there can be little doubt that it will provide a very marked improvement over the ordinary single-valve Miller frame timebase used by many constructors; a plain raster drawn on a VCR 97 screen had a very pleasing appearance.

Amplitude Equalisation

In Fig. 1, the EF37, V1, works as a conventional Miller timebase with switched capacitances in both the anode-grid and screen-suppressor circuits. The timebase will operate with a single unswitched capacitor of .01 μF value between the suppressor and screening grids, but some adjustment of capacitance over the ranges is desirable to reduce the flyback time and the "pip." The range of the timebase extends approximately

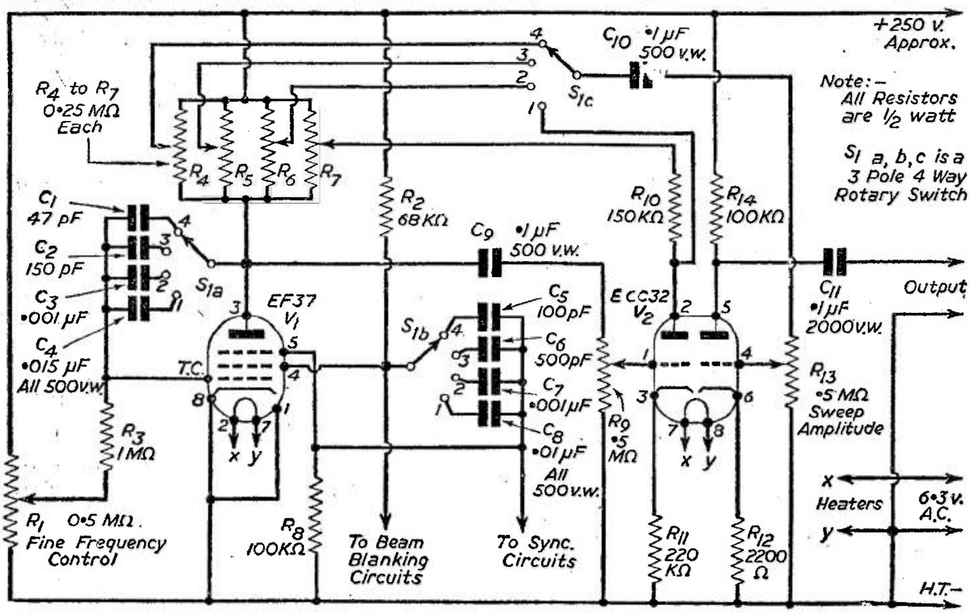


Fig. 1.—Circuit of the Improved Miller Timebase.

from 15 to 20,000 sweeps per second, in four overlapping bands.

It is usual practice to make the anode load resistor of the Miller timebase circuit a potentiometer, taking the output from the sliding arm of this component so that sweep amplitude control is thus obtained. An extension of this idea provides for the amplitude equalisation of the present circuit, for the output resistance of V1 is made up of four potentiometers in parallel, the full saw-tooth voltage output therefore being set up across each potentiometer simultaneously. The sliding arms of these potentiometers are switched in such a manner that the range 1 output (low frequency) is drawn from R7, the range 2 output is drawn from R6, the range 3 output is drawn from R5 and the range 4 output is drawn from R4. These outputs can therefore be adjusted to be equal simply by setting the appropriate potentiometer to the correct position, and the four equal outputs are fed selectively (after linearisation has been applied to range 1) through C10 and the sweep amplitude potentiometer R13, R4, R5, R6 and R7, whence once set, do not require to be touched again, and so may be preset potentiometers mounted on the timebase chassis or on a small sub-panel tucked out of the way.

Since each of the four possible inputs, when presented to R13, are equal in amplitude, this control acts as a general sweep amplitude control and does not require resetting when the timebase is switched from one range to another, unless it is desired to expand or contract the trace.

The signal from R13 is applied to the second section of an ECC32 double triode, V2, for amplification before being passed to the tube deflection plates. Some amplification is desirable, since the low-frequency range, already low in amplitude when compared with the other three ranges, is further decreased by the linearisation process. As a triode is in any case necessary for the lineariser, a double triode can be employed to combine the functions of these two circuits at very little extra expense.

Low-frequency Linearisation

It will be noted that whilst the outputs of ranges 2, 3 and 4 are presented to R13 direct through S1c, the output from range 1 (the low-frequency range) is passed through R10, the anode resistor of the first section of V1. The anode current to this triode is also drawn through R10 and must be supplied from R7, the low-frequency output potentiometer. The anode of this triode is, therefore, swinging in potential at the saw-tooth frequency to which the timebase is set.

The type of non-linearity which affects the saw-tooth curve at low frequencies is shown in Fig. 2b, where the "pip" or top of the saw-tooth is positive, and if this curve is compared with the ideal saw-tooth of the Miller timebase in Fig. 2a, it can be described by saying that the curve is becoming negative too rapidly. If this potential curve is applied to the anode of a triode the anode will fall in potential too rapidly to pass a "linear saw-tooth current" through the triode, assuming the grid to be held steadily at a suitable bias voltage, and with R9 of Fig. 1 set to its minimum position—i.e., with the slider to the chassis end of the potentiometer—the output on range 1 from the whole circuit will exhibit this non-linearity.

Under these conditions, where the grid of the triode is returned directly to earth, the anode current through the valve is extremely small, since the cathode bias resistance is unusually high and the valve is biased back to the cut-off point; the saw-tooth voltage is therefore taken off after R10 with practically no attenuation due to this resistor. The amplitude of the range 1 output to C10 and R13 is, of course, controlled by the setting of R7 just as the other range amplitudes are controlled by their respective potentiometers.

With R7 set to a suitable position, consider now the effect of advancing R9, which may be termed the linearising control. Since R9 is connected via C9 to the anode of the timebase valve V1, the full saw-tooth voltage is set up across this potentiometer, and as the slider of R9 is advanced from the earthed end of the control, a fraction of this saw-tooth voltage is applied to the grid of the first section of V2. Moreover, this saw-tooth voltage is in-phase with that already applied to the anode of the triode via R7, and the triode grid thus becomes most positive as the anode also becomes most positive.

As R9 is advanced the grid of the triode will become sufficiently positive at the top of the scan stroke to overcome the high bias set up across R11, and when this condition is reached the valve will pass current at the

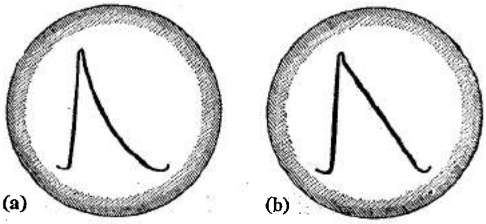


Fig. 2—(a). The ideal Miller Timebase voltage sweep and (b) (right) non-linearity at low frequencies.

positive peak of each saw-tooth. This current must flow through R10 across which, accordingly, is set up a voltage drop tending to drive the triode anode less positive, and this occurs at the instant when the anode is driven most positive by the saw-tooth voltage. The net result, therefore, is that the final saw-tooth voltage on the triode anode is compressed at the positive point, the non-linear top of the tooth being "bent down," and by careful setting of R7 and R9 the degree of "bending" can be adjusted to nullify the reverse curve of the saw-tooth, the final output being slightly less in amplitude and very substantially linear.

Construction and Adjustment

The circuit of Fig. 1 is offered to the experimenter for his own tests and adaptations; the oscilloscope constructor may require extra frequency ranges, and the television receiver constructor can eliminate the switching and build the timebase up in a simpler form. For this reason no components list is included and all component values are shown in the diagram.

No effort should be made to provide linearisation on frequency ranges other than the lowest sweep speeds, for the Miller timebase gives excellent linearity on medium and high speeds where a linearising stage will succeed only in introducing distortion.

No provision for switching the lineariser out of action on ranges 2, 3 and 4 is shown, since on trial this appeared unnecessary.

Valves other than the EF37 and ECC32 can probably be employed with equivalent results, although some changes in resistance values and particularly that of R11 may be required.

The circuit is non-critical and may be built up in any form so long as the timebase capacitor switching is arranged to have neat and short wiring, especially so far as range 4 is concerned.

Beam blanking and automatic synchronisation can be applied to the timebase, the two connecting points being indicated in Fig. 1.

It should be noted that although there are seven potentiometers in the circuit of Fig. 1, only R1, the fine frequency control, and R13, the sweep amplitude control, are panel controls. R4, R5, R6, R7 and R9 are all pre-set components which, once adjusted, require no alteration. They can therefore be built into the chassis of the timebase.

To adjust the circuit a separate oscilloscope is really desirable, although the linearisation and amplitude controls can be set by drawing a sine wave on the timebase scan. When a separate oscilloscope can be employed, feed the output from the timebase direct to the Y plate and set the 'scope to draw out two or three complete saw-teeth with S1 switched to range 1 and R1 at about the centre of its travel.

If the timebase is being supplied from the oscilloscope power pack remember to decouple the H.T. line through about 20,000 ohms and an 8 mfds. capacitor.

Rotate R7 to the H.T. end of the component and set R9 so that the slider is earthed, then turn back R7 so that the saw-tooth wave is drawn on the screen. R13 should be set centrally or in a position to give satisfactory amplitude, depending on the size of the oscilloscope screen.

As R7 is adjusted and the wave appears, the lack of linearity will be clearly visible. Now slowly advance R9 ; as the correct setting is approached, the saw-teeth will be seen to decrease in amplitude and the curve of the scanning stroke will flatten out. If R9 is rotated too far the curve will reverse, distort and then the saw-teeth will reverse in phase by "juggling" with the settings of R7 and R9 a number of interesting—though not very useful—waveforms can be obtained.

If the saw-tooth, when linearised, is not of sufficient amplitude, make a further advance of R7 and then re-linearise with R9. Observe the amplitude control obtained through R13 and especially the fact that a change of amplitude has no effect on the timebase speed, a further improvement over many timebase circuits.

With the low-frequency range satisfactorily linearised, set R13 to a suitable position and leave it, then switch S1 to range 2, after marking the height of the saw-teeth provided by range 1. This height can be observed on the graticule, should this be fitted over the screen, or by marking the tube screen direct with a crayon pencil.

Set the oscilloscope timebase to give two or three saw-teeth on the screen, and adjust the height of these saw-teeth to correspond with the amplitude of the trace obtained from range 1, adjusting R6 till the same amplitude is obtained. Repeat the process on ranges 3 and 4, employing R5 and R4 respectively.

The timebase is then correctly adjusted.

If no separate oscilloscope is available and the timebase is being built into an oscilloscope, feed suitable 50 cycles sine wave to the tube Y plates, either direct or through an amplifier. Switch the timebase to range 1, set R13 to a suitable position depending on screen size, and with R9 set to the earthed end of its travel draw out a trace by advancing R7 from the H.T. end of the potentiometer. Correct the timebase speed by adjusting R1 so that 5 or 6 complete cycles of the sine wave are drawn steadily on the screen. Observe the trace ; it will be found that at one end the waveform is compressed and at the other that it is expanded. Now slowly rotate R9. The expanded end of the waveform will slowly compress—it may be necessary to make a slight alteration to the frequency control as the adjustment is made —and R9 should be rotated until the end of the trace suddenly compresses further and commences to turn in on itself, or fold back. Turn R9 back a little to counter this effect, and the scanning stroke will then be linearised correctly.

Make further adjustments to R7 and R9, should these be required to extend the scanning amplitude, and then mark the ends of the timebase sweep. Switch to range 2 and adjust R6 to give the same sweep amplitude, and similarly adjust ranges 3 and 4 for amplitude using R5 and R4. The timebase is then set up for correct operation, further amplitude adjustments being made through R13.

If it is desired to employ this type of timebase in the D.C. oscilloscope, V2 must be chosen to have an .2 Amp. heater to suit the heater chain. In place of the double triode it would therefore be necessary to use a pair of valves such as EF37s triode-connected.

Festival Exhibition

FESTIVAL week is being celebrated at West Bromwich by, amongst other events, a Radio and Television Exhibition. This will be held as part of the Evening Institute Week Exhibition of spare time educational classes, at Four Dwellings School on Tuesday, Thursday and Friday of the week May 28th to June 2nd. Admission to this and several other parts of the exhibition will be free, but to other parts, i.e., concerts, dancing and other entertainments, will be by guide book.

The exhibits in the Radio and Television section, which will be held in the school laboratory, will consist of:

A.—Apparatus made by the class consisting of:

Two types of stabilised power units.

One heterodyne wavemeter with 10 and 100 standards.

A 100 Kc/s. standard oscillator accurate to better than 1 c/s.

A multi-range meter. A square wave generator.

Two valve voltmeters.

Two 'scopes 6in. and 3½in. with linear, 50 cycle and ext. time bases.

An adapter for the Avo-Minor to read inductance, capacitance, and insulation.

A 12in. television receiver made from a kit of parts.

B.—Commercial equipment consisting of:

Various types of meters, including multi-range and thermocouple.

A sphere signal generator with D.A.

A Taylor valve tester on which visitors to the exhibition can have their own valves tested free of charge.

An old 1930 Ekco receiver that has been renovated by the class.

COLOURED SOLDER

SUPERSPEED solder with a coloured rosin core was shown for the first time at the annual R.E.C.M.F. Exhibition by H. J. Enthoven and Sons Ltd. The coloured rosin is in red, blue, green or yellow.

The addition of the colouring matter does not impair the normal efficient function of the flux at any soldering temperature, nor has the addition to the rosin proved in any way adverse to the electrical behaviour of the residue, nor to the insulation resistance of the component parts to which it has been applied.

A Compact

A Complete 6in. TV Receiv

By E. N. BRA

DESPITE the present state of the surplus market and the current low costs of conversion receivers such as the 1355, correspondence recently received by the writer has made it clear that there is still a widespread demand for a reasonably compact and cheap 6in. televisor, particularly of the type where the vision and sound channels, together with the power supply, are all contained on one chassis. It is to meet this demand that the compact televisor, Fig. 1, has been designed.

It was decided at the outset that although costs should be cut as far as possible, the reception range and the quality should not suffer as a result. The final receiver, tested in London on the Alexandra Park frequencies, is not perhaps outstanding in any particular, but it does give a clear and steady picture with as good resolution as the VCR97 tube can handle, and has some interesting design points incorporated in it. Not the least of these is the real ease of construction—there are, for example, no under-chassis screens at all, whilst the single mains transformer is seated directly below the base of the tube. Direct video feed is employed and especially simple sync. separating circuits are provided.

The form in which the receiver is built is made possible by the screened coil formers marketed by Messrs. Haynes Radio, Ltd., Queensway, Enfield, Middx. These components appear so far to have been neglected by the amateur TV constructor despite their low price. The row of R.F. coil cans (clearly seen in the photograph of the final chassis) not only house the coils but also contain the anode chokes which feed V1-V4, the coupling capacitors C3, C8, C13 and C18, and the shunting resistors R1, R6, R12, R17 and R(X). (The value of R(X) is discussed later in the text.) All the feedback-sensitive sections of the circuit, therefore, are totally screened, as are the tuned circuits of the sound channel, and the receiver is completely stable despite its quite high sensitivity and total lack of screening compartments. At the same time, it is possible to employ valves with the highest slope currently obtainable, the 6AC7 which has a gm value of 9 mA/V., and to place them close together to give a very neat and compact R.F. amplifier.

As this issue of PRACTICAL TELEVISION goes to press it is learnt that the Haynes screening cans have temporarily gone out of production due to the metal shortage. It will therefore be necessary for intending constructors either to await the resumption of supplies or to experiment by making their own screened coils. If the coil-winding data is to remain correct the formers should be 5/16in. outside diameter, in 13/16in. square cans. We understand that there is no shortage of the formers, spills, etc., but merely of the screening cans, and deliveries have been promised as soon as possible. Supplies should be available by the time the remainder of this article appears on the bookstalls.

The change in winding data could easily be determined by trial and error, or data for similar sized coils in other circuits published in PRACTICAL TELEVISION could be employed.

It is understandable that in these days the first interest on the part of the intending constructor is the cost of the final televisor, and therefore a summary of costs is included below to serve as a guide. These costs are intended to show average prices obtainable by careful shopping—all the valves employed, for example, can be purchased on the surplus market at cut prices, and these are the prices shown, not the full market prices of the valves. The same holds good for the other components. Readers should find it fairly simple to match these prices, if they study advertisements, and buy from reputable dealers. The component specifications in the components list shows the makers' name of the component employed in the prototype, but these specifications need not rigidly be adhered to providing that equally good parts are used. Good mica and electrolytic capacitors must be chosen, and old tubular capacitors should not be employed unless they can be tested for leakage and power factor.

PRICE SUMMARY

	£	s.	d.
Valves, 12 at 5s., 1 at 1s. 6d.	3	1	6
C.R.T.	1	15	0
Loudspeaker and transformer		12	6
Coil formers, set of 9 (see text)		12	6
Mains transformer	1	2	0
L.F. choke, say..		7	6
Valveholders, say		5	0

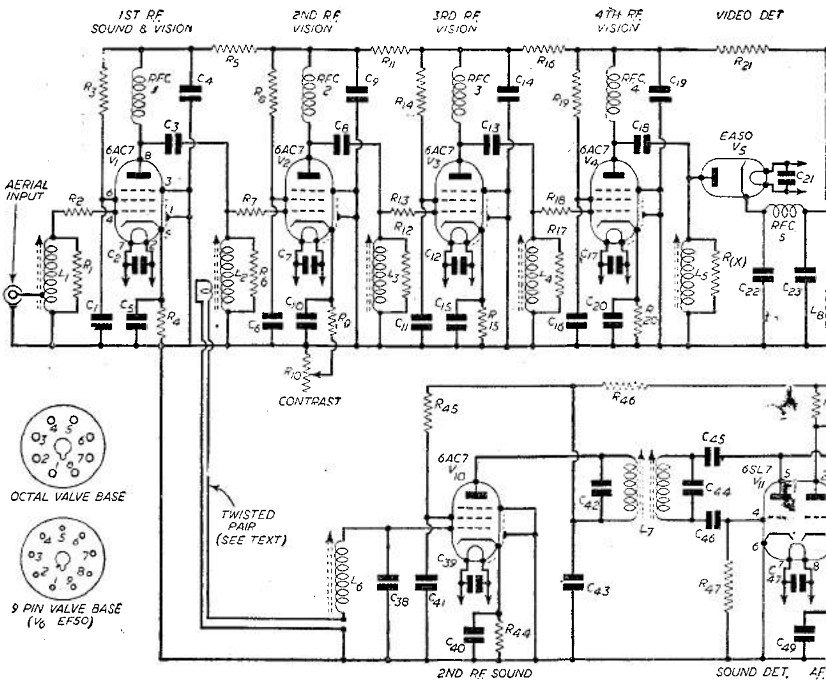


Fig. 1.—Theoretical circuit of the

Televisor

...er on a Single Chassis

...ADLEY

	£	s.	d.
12 potentiometers, less switch, say	1	5	0
1 „ with switch		4	0
6 electrolytic capacitors, say		15	0
56 mica and tubular capacitors, say ..	1	10	0
Chassis, say		10	0
Hardware (plugs, wire, etc., etc.), say ..		10	0
Rectifiers, 3 of RM3		19	6
E.H.T. rectifiers, 2 of 1,000v. 1 mA... ..		12	0
61 resistors, say	1	2	6
	£15	4	0

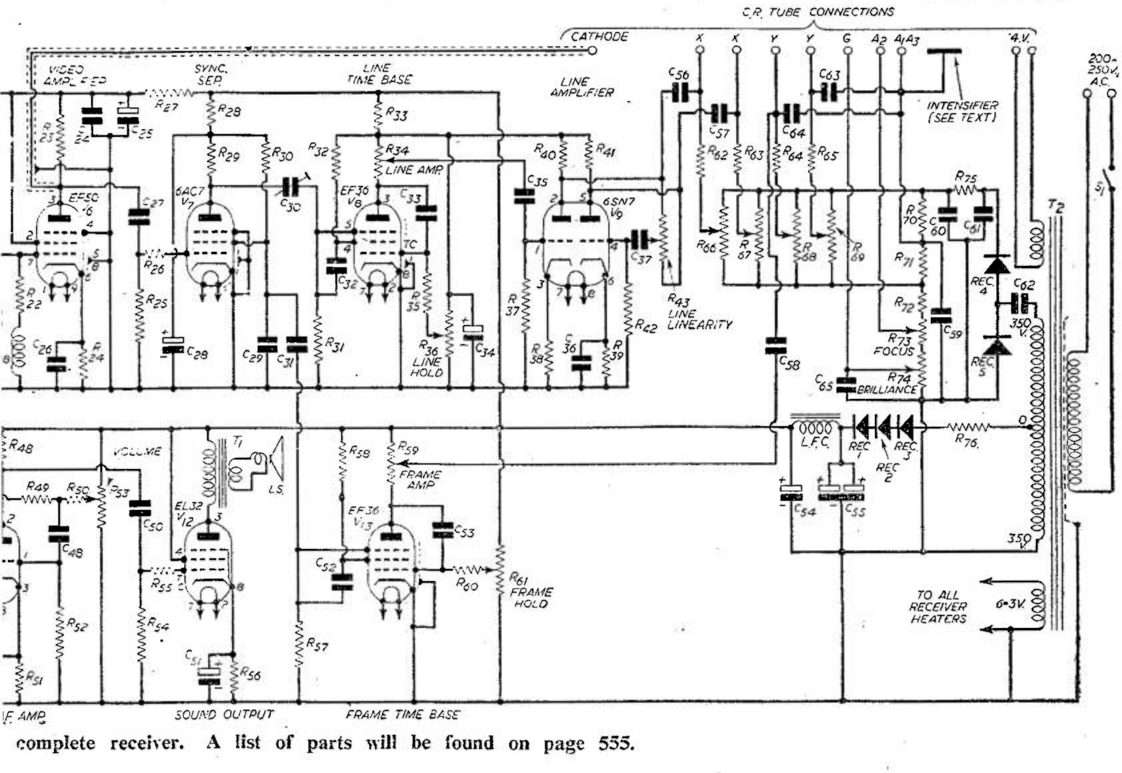
It will be understood, of course, that most of these are no more than estimates subject to fluctuation, as are the currently fixed prices; the transformer and rectifiers may well rise in price in the interim between writing and publishing. We cannot enter into correspondence on prices, sources of supply, etc.

Circuit Features

To make the televisor simple both to construct and to align, a T.R.F. circuit was decided upon, utilising four R.F. stages on vision, with the first stage common to both the vision and sound sections. Despite considerable argument and pessimism, it has proved possible to obtain good results on the Sutton Coldfield frequency, in Channel 4, with a T.R.F. circuit, and therefore this receiver with suitable coil variations should prove perfectly satisfactory for Alexandra Palace and Belfast on Channel 1, Holme Moss and South Devon on Channel 2, Kirk O'Shotts and South Hants on Channel 3, and Sutton Coldfield and Aberdeen on Channel 4. The writer expects to find a superhet necessary on the Wenvoe (Cardiff) and Pontop Pike frequencies, because in this channel the percentage difference in frequency between the vision and sound signals is quite small, whilst to maintain gain it is probable that transformer coupling will be needed. This is more easily provided in a superhet where only one or two R.F. stages are needed, the major gain being given by an I.F. strip.

The receiver has quite high sensitivity as high slope valves are employed, whilst the anode voltage is well maintained by the use of chokes, rather than resistors, as anode loads. The valves are decoupled "in cascade" —the decoupling is cumulative along the amplifier as is a certain voltage drop, so that the input stage is working at a lower anode and screen voltage than the final amplifier. This has been found to assist the excellent stability obtained. The amplifiers can quite well be aligned on signals, although a signal generator in the early stages of lining-up is useful.

Readers may already have noticed that no conventional contrast control is fitted to the R.F. amplifier; instead, the second R.F. stage has a pre-set sensitivity control. The writer has never found a great deal of use for a contrast control and generally sets this to the required sensitivity position, thereafter leaving the control alone. It was decided, therefore, to break with common practice in this receiver and incorporate a simple sensitivity control which could be preset and left, and in order that this control should have no effect on the sound section of the televisor it is fitted to V2. V1, as a result, operates



...complete receiver. A list of parts will be found on page 555.

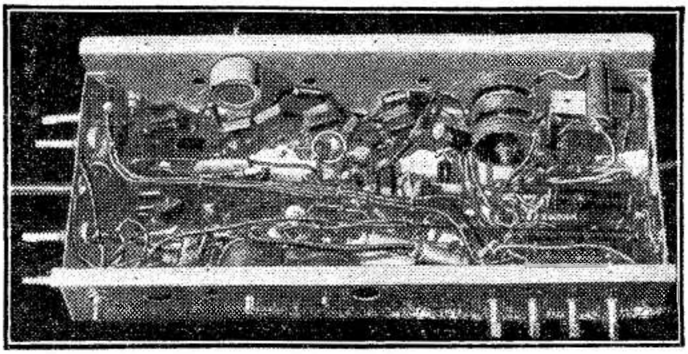
at full gain. There is, presumably, some detuning in the V2 stage due to the simple form of the control, but if this is so, it appears to have no deleterious effect on the final picture.

A constructor requiring a continuously variable contrast control could bring out R10 to the front panel. It would be as well, in that case, to employ a screened cable for the lead between R9 and the slider.

At the detector stage a further departure from normal home-construction design will be noted. The diode is connected to give a positive output and is directly coupled, in the normal manner, to the video amplifier, V6. The video amplifier, therefore, gives a negative output—readers will know already that by a negative output is meant a waveform such that the modulation peaks on white are negative-going whilst the sync. pulses may be regarded as positive-going, taking the 30 per cent. modulation level as a reference line. The output from the video amplifier is thus suitable for direct application to the cathode of the C.R. tube. No D.C. restoration is needed as direct coupling is employed from the detector to the tube, and at the same time the phase splitter, very commonly employed to feed the tube and the sync. separator, becomes unnecessary. Two valves are thus saved at no expense to the signal. The usual frequency-correcting inductance appears in the grid circuit of the video amplifier as L8, and a single resistor is employed as the anode load of V6.

A further advantage of this method of tube feed is that the video amplifier can be biased normally by a 330 ohms resistor—where a negative signal is applied to the video amplifier grid the bias resistor is commonly of the order of 50 ohms. The valve works at a far easier rating, therefore, and a longer life can be expected.

A good deal more correction could be employed in the video amplifier. Inspection of commercial circuits employing direct negative tube feed from the video amplifier anode will show in almost all cases that multiple correcting chokes or a correcting network such as the very interesting Pye circuit are commonly used, but it was felt that a tube such as the VCR97 did not warrant the extra complication. A test was accordingly made on the circuit as it stands, a variable frequency being fed directly



Below chassis view of the receiver.

into the grid of the video amplifier to give a set of vertical lines on the screen. The frequency was set to 101.25 kc/s. to give 10 locked bars or lines, and then increased smoothly to 3 Mc/s. At this latter frequency the bars, now about 300 in number, were still clearly defined, a satisfactory performance, especially in view of the fact that the input was of sine wave character. During later reception tests on an actual vision signal the promise of the earlier trial was established as fact.

Some precautions are, of course, necessary when employing direct coupling to the tube. In the first place the coupling itself must be as short and direct as possible, and in the prototype a length of 80 ohms co-ax. feeder

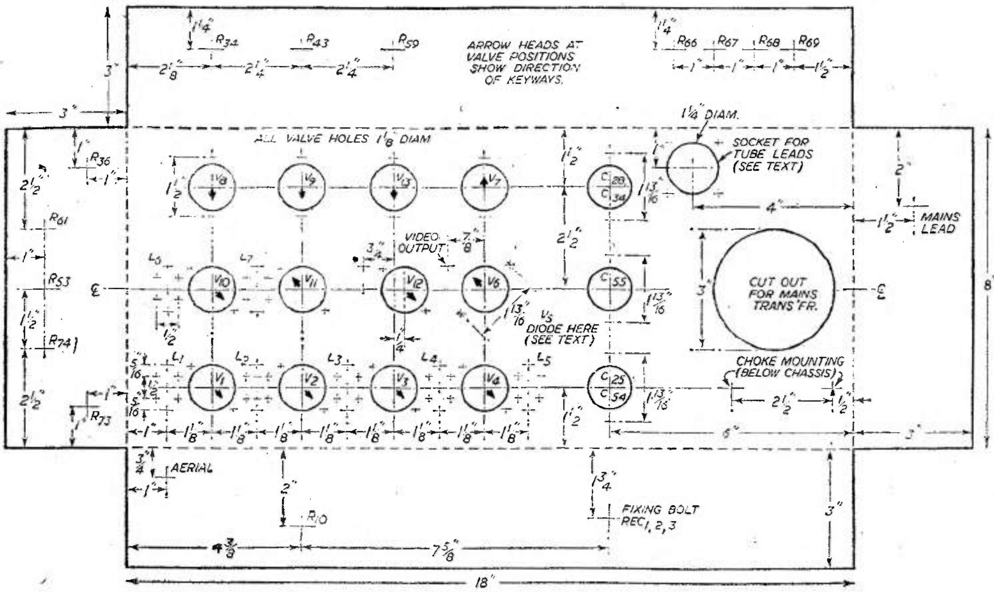


Fig. 2.—Details of chassis layout and drilling.

was used, the inner core carrying the video output with the outer screen earthed. This introduces some small capacitance but losses appear to be negligible, whilst the screening so afforded is practically essential to prevent feedback into the first R.F. stage via the aerial feeder. It may be stated at this point that a co-ax. aerial feeder is desirable; if a balanced twin feeder is used it is probable that special care will be needed to prevent feedback.

A further important point to remember is that the C.R. tube cathode is tied to the video amplifier anode and is thus about 200 volts positive to earth. The common practice of connecting the cathode to one side of the heater should not be employed in this circuit, but the heater should be left "floating"—connecting the two will add a very considerable capacitance to earth to the cathode via the heater winding and the other windings and the core of the mains transformer. This method of tube feed also means that the tube grid must be made positive to earth (although still negative with respect to the cathode) before a trace can be seen; remember that the C.R. tube grid should never be allowed to become positive with respect to the cathode. If the mean cathode potential is 200 volts to earth the grid potential must, therefore, be about 195 volts positive, and this positive potential is obtained by running the C.R. tube grid up the tube bleeder network by means of R74.

LIST OF COMPONENTS

RESISTORS

R(X) : 3,300 Ω, ½ watt for good reception areas; 5,100 Ω, ½ watt for fair reception areas; 8,200 Ω, ½ watt for poor reception areas.
R1 : 3,300 Ω.
R2, R7, R13, R18 : 10 Ω.
R3, R8, R14, R19, R45, R47 : 47,000 Ω.
R4, R9, R15, R20, R44 : 200 Ω.
R5, R11, R16, R39, R46 : 1,000 Ω.
R6, R12, R17, R22, R38 : 4,700 Ω.
R10 : 5,000 Ω potentiometer. Sensitivity control.
R21 : 1,000 Ω, 2 watts.
R23 : 6,800 Ω, 2 watts.
R24 : 330 Ω.
R25, R72 : 2.2 MΩ.
R26, R29, R49 : 33,000 Ω.
R27 : 270 Ω, 2 watts.
R28, R31, R32, R57, R58 : 22,000 Ω.
R30 : 150,000 Ω.
R33, R55 : 10,000 Ω.
R34 : 100,000 Ω potentiometer. Line amplitude.
R35, R50, R60, R70, R71 : 470,000 Ω.
R36 : 0.5 MΩ potentiometer. Line hold.
R37, R42, R52 : 220,000 Ω.
R40, R41, R48, R75 : 100,000 Ω.
R43 : 1 MΩ potentiometer. Line linearity.
R51 : 2,200 Ω.
R53 : 0.25 MΩ potentiometer. Volume control.
R54 : 330,000 Ω.
R56 : 470 Ω.
R59 : 100,000 Ω potentiometer. Frame amplitude.
R61 : 0.5 MΩ potentiometer. Frame hold.
R62, R63, R64, R65 : 1 MΩ.
R66, R67, R68, R69 : 1 MΩ potentiometer. Shift controls.
R73 : 0.5 MΩ potentiometer. Focus control.
R74 : 0.5 MΩ potentiometer. Brilliance control. (With S1.)
R76 : 27 Ω, 3 watts. (With SI.)

All resistors ½ watt except where otherwise stated.

CAPACITORS

C1, C2, C4, C5, C6, C7, C9, C10, C11, C12, C14, C15, C16, C17, C19, C20, C21, C26, C32, C39, C40, C41, C47 : 0.001 μF 500 v.w. mica, Micamold.
C3, C8, C13, C18, C33, C46 : 100 pF 350 v.w. mica, T.C.C. CM20N.
C22, C23 : 10 pF 500 v.w. ceramic, T.C.C. Rod/pearl.
C24, C35, C37, C48, C50, C52, C53 : 0.01 μF 500 v.w.
Tubular, T.C.C. 543.
C25, C54 : 16 plus 16 μF 450 v.w. Electrolytic, T.C.C. CE37PA.
C27, C29, C36, C43, C49 : 0.1 μF 500 v.w. Tubular, T.C.C. 543.
C28, C34 : 8 plus 8 μF 450 v.w. Electrolytic, T.C.C. CE27P.
C30 : 3-30 pF. concentric air trimmer.
C31, C65 : 0.25 μF 500 v.w. Tubular, T.C.C. 543.
C38 : 50 pF 350 v.w. mica, T.C.C. M.W.N.
C42, C44, C45 : 25 pF, 350 vw. mica, T.C.C. SMWN 10 per cent.
C51 : 25 μF 25 v.w. Electrolytic, T.C.C. CE32C.
C55 : 8 plus 8μF 450 v.w. Electrolytic, T.C.C. CE27P.
C56, C57 : 0.1 μF 1,000 v.w., Sprague.
C58, C62 : 0.1 μF 1,000 v.w. Tubular, T.C.C. 1545.
C59, C60, C61 : 0.1 μF 2,000 v.w. Tubular, T.C.C. 2045.
C63 : 0.005 μF 350 v.w. mica, T.C.C. M3N.
C64 : 0.001 μF 350 v.w. mica, T.C.C. CM20N.

VALVES

V1, V2, V3, V4, V7, V10 : 6AC7 (CV846).
V5 : EA50, Mullard (CV1092).
V6 : EF50, Mullard (CV1091).
V8, V13 : EF36 or EF37, Mullard (CV1056).
V9 : 6SN7, GT.
V11 : 6SL7, GT. (6SN7 may be tried in this position).
V12 : EL32, Mullard (CV1052).
11 Octal chassis mounting valveholders.
1 B9G chassis mounting valveholders.
1 Diode holder. See text.
COILFORMERS.—1 set of formers, cans, wires, cores, etc. Messrs. Haynes Radio Ltd., Queensway, Enfield, Middx. Type G1.
SPEAKER AND TRANSFORMER.—5in., 6in. or 8in. to suit cabinet. Transformer to match to anode load of 8,000 ohms.
MAINS TRANSFORMER.—Messrs. Coulphone Type 351, drop-through. 350-0-350 volts, 100 mAs., 6v. 4A., 4v. 2A.
L.F. CHOKE.—10 or 20 Henrys, 350 Ω approx., 100 mAs.
RECTIFIERS.—Recs. 1, 2, 3 : SenTerCel RM3; three in series. Recs. 4, 5 : SenTerCel 1,000 volts 1 mA. Surplus type K3/40. Stock type, H3/100.
MAINS SWITCH.—S1 ganged with R74, single pole on-off. Output socket and plug. Belling Lee 10-way, L332, and L1244.
Aerial and vision output sockets and plugs, Belling Lee, L1267 and L1249.
Chassis : Stout aluminium, 18in. x 8in. x 3in.
Five knobs.
Length of 80 Ω feeder, vision output cable.
Length of screened cable, grid lead to V12.
Soldering tags, nuts, bolts, wire, sleeving, etc., etc.
C.R. Tube.—VCR97, with base.

Ideally the value of R74 should be chosen so that the grid could not possibly become positive with respect to the cathode, but in practice this was found very difficult to accomplish. Different tubes will take slightly different currents, whilst the cost of precision resistors in the bleeder network would not be justified unless precision potentiometers could also be obtained. R74 is, therefore, chosen to give a satisfactory voltage drop with any tube and within the limits of resistor value variation, and it is left to the common sense of the constructor to advance the slider of the brilliance control no farther than is necessary. In actual fact, the risks are very small, so long as the brilliance control is turned right off when the set is switched off, and to ensure that this is done the brilliance control also serves as the mains on-off switch. During the wiring-up it is ascertained that the slider is earthed (i.e., is at the negative end of the control) when the switch is in the " off " position and thereafter it is only necessary, when switching on, to remember not to advance the control too far until the valves are warm and the receiver operating. In any case the experienced constructor will never run his tube at too great a brilliance, whilst newcomers to this type of construction will find it difficult to obtain good overall focus on the majority of VCR97s with too low a grid bias. This effect comes into play before the grid becomes positive to the cathode.

The establishment of the grid voltage could be made a simple matter were it possible to supply the grid potential from a network between the ordinary or receiver H.T. line and earth, but unfortunately this cannot be done. Under those conditions a variation of brilliance affects the focusing, and it is found necessary to draw both the brilliance and focusing potentials from the same network.

Sync. Separation

Like the C.R. tube grid, the sync. separator is also supplied from the video amplifier anode, though in this case a capacitive coupling is used. The sync. separator thus receives a negative signal and provides its own D.C. restoration. D.C. restoration on the signal supplied to the sync. separator is essential in order that all the sync. pulses may appear to have equal values despite the picture content. The signal waveform after the capacitive coupling provided by C27 would centre itself about a mean value dependent upon the potentials attained by the sync. pulses and the picture content were it not for the fact that the cathode and grid of V7 act as a diode. During the positive-going sync. pulses grid current flows through R25 so setting up a potential and charging up C27, and this potential biases off the valve for the picture content of the following line. The action is repeated at the next sync. pulse, and the bias set up depends on the apparent value of the sync. pulse which, in turn, depends on the picture content of each line. In this way, therefore, the D.C. restoration is automatic.

The valve chosen for the sync. separator is another 6AC7, since a short grid-base type is required in this position. The cathode current is low for the major part of each line as the valve is biased back and also because a high value screen-grid feed resistor is employed, but during the sync. pulse both the screen and the anode conduct so that there is a negative-going pulse produced at each. The anode pulses are applied to the line timebase to give line synchronisation, and the screen pulses are applied to the frame timebase. As with any other type of sync. separator it is very important to ensure that no line sync. pulses are applied to the frame timebase, and that no stray couplings are provided between the two timebases. For this purpose the whole sync. separator circuit is decoupled from the H.T. line by R28 and C28, and the line sync. pulses are applied to the line timebase by a very small capacitance, C30, a trimmer set to the correct value by trial. The screen and its associated circuits are decoupled to earth by a 0.1 μF capacitor C29, which acts as a practical short circuit to the line sync. pulses but charges on the frame sync. pulses, the rising charge being conveyed to the frame timebase by C31.

The Timebases

As might be expected in a compact televisor, the ubiquitous Miller timebase is employed in both the line and frame positions, all the component values being chosen for linear operation. Normal circuits are employed and the chief point of interest is in the circuit of the paraphase line amplifier. A great deal of amplification is not actually necessary—it would be possible to draw a full scan with V8 alone—but the amplifier is included in the circuit to permit the timebase to run at a comfortable level and also to provide double plate deflection so that no trapezium distortion occurs.

The first section of V9 draws its input from the anode potentiometer of the line timebase, V8, and delivers a normal output to one side of the X plates. This section of the valve has a fairly high cathode bias resistor. The second section of the valve draws its input from a potentiometer connected to the first anode, but since the potentiometer, at its other end, is connected to the anode of the second section, there is heavy negative feedback over the control. At the same time the feedback is varied by the setting of the slider, for this determines the input to the grid of the second section, and the final result is a balanced amplifier, by no means critical in setting, which in some respects is not unlike a long-tailed pair in its operation. The linearity of the scan, as shown by a test signal, is definitely pleasing and the controls are easily set up on a signal.

Actual picture trials showed that whilst the present values of R38 and R39 suit the majority of 6SN7 valves, one or two valves require a slight change in these values, the exact change being determined by trial. The change is needed if the picture is slightly cut off on one side (presuming, of course, that the cut-off is not integral in the C.R. tube). Of several 6SN7s tested one required the two cathode circuits to be reversed for best results, but this would appear to be an extreme case—probably the majority of cases of cut-off, which in any event should be rare, can be cured by by-passing R38 with a 0.1 μF capacitor.

In the early stages of the design it was decided to employ a frame amplifier as well as the line amplifier, but various tests soon showed that the extra double-valve was by no means necessary. The single deflecting plate system shown in Fig. 1 gave adequate amplitude without trapezium distortion and the amplifier was therefore omitted. The squareness and steadiness of the picture is assisted very considerably by the fact that each deflecting plate is returned to a bias potentiometer in the network R66-R69, the Y plates being by-passed to the tube anode. Many circuits show only two shift or bias controls, but the extra two potentiometers, even though they are only preset controls and do not require more than one adjustment, pay real dividends in picture stability. No matter what the change in picture brilliance there is no sway or creep—common occurrences with a two-shift network.

(To be continued)

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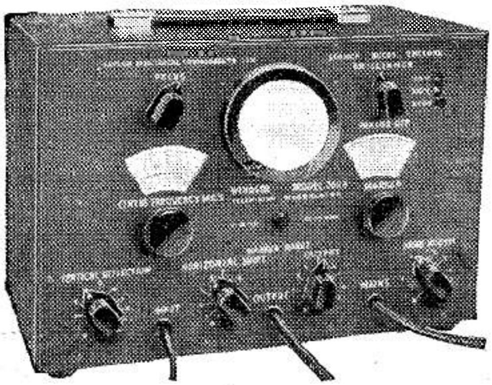

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Correspondence

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

HOME-MADE TRANSFORMERS

SIR,—I would like to comment on two articles appearing in PRACTICAL TELEVISION for January and dealing with transformer construction.

In the first an article on voltage multipliers gives the design for a suitable transformer but is rather vague regarding insulation. Oiled cotton is specified, but no thickness is given. This is of some importance, since it is used to insulate the high working voltage heaters. The h.v. winding is not specified as having any interleaving which it should have, as the volts per layer will be of the order of 100 volts.

I would suggest, therefore, that this transformer should be on a larger core, thus allowing more room for insulation and the heater windings might well be of flexible P.V.C. or Polythene-covered wire. This would also improve the insulation at the lead-out point—always a danger point if lead-outs are not well insulated.

Turning to the article by Mr. Scarisbrick, who treats the matter in much better detail, here again no thickness is given for insulating paper or other insulation.

If it is desired that home-made transformers should be as reliable as possible, care should be taken to see that insulation, particularly paper, is suitable for electrical purposes—it may be mentioned that if it is not desired to impregnate coils in any way, greaseproof paper is quite useful; it has an average breakdown voltage of some 300 volts per inch, although, of course, it should only be worked at a fraction of this voltage.

In conclusion I would like to warn constructors against expecting too much of home-made transformers for voltages above 1,000 as unimpregnated and undipped transformers for these voltages will not be likely to last long and for this type of transformer it pays (as always) in the long run to buy a commercial article from a reputable manufacturer. I have no desire to discourage constructors from winding transformers but I do feel that a warning is needed that there is rather more in designing and winding the higher voltage types than is sometimes appreciated. I would also like to give a warning regarding purchasing enamel-covered wire. Here again it pays to buy new material as a lot of surplus on the market is of poor quality since during part of the war there was a lot of very inferior enamel about and much has been in stock for a long time.—T. P. LYNOTT (Abingdon).

DEFINITION LIMITS

SIR,—It is refreshing to read Mr. N. A. Hough's letter (March issue) in which he frankly concedes the difficulty experienced in securing good reproduction of the 3 Mc/s. bars. As he states, it is not such a simple matter to secure a correct rendering of these as is often claimed. Very often they appear to be reproduced insofar as separate bars appear in the 3 Mc/s position, but it will be found desirable to compare the received picture with a copy of the original test card and actually to count the number of bars reproduced. I have frequently observed pictures where the characteristic of the receiver has resulted in the artificial production of bars due to "ringing" phase shift, etc. Even when the bars can be discerned it does not follow that everything is in order for they should be reproduced at an intensity in keeping with the rest of the picture. It is possible to check that this is so by referring their brightness to the transmitted black level condition. It should be borne in mind that the 3 Mc/s components transmitted are sinusoidal in form and are not pulses. The second harmonic component of these pulses is absent, assuming the bars to be equally spaced, so that transmission and reception of 9 Mc/s components would be required to provide a first variation of this sinusoidal form. May I suggest to Mr. Hough that he should check carefully the overall response of his receiver? A reasonably effective way of doing this is to employ two signal generators. One of these can be a simple fixed frequency oscillator and is set to carrier frequency. The other is varied in frequency plus or minus, say, 3.5 Mc/s of this frequency. Both outputs are applied to the aerial input of the receiver being tested and their signal voltages carefully adjusted to provide a suitably modulated picture. It will be apparent that as the variable frequency generator is adjusted a modulated carrier will be provided and resulting horizontal and vertical bars will be produced on the screen. When the variable frequency generator differs by 3 Mc/s from the fixed frequency one the modulation is, of course, 3 Mc/s, and though I do not suppose Mr. Hough will want to count the close vertical bars, if he can see them at all he will be progressing.

I would also add that he may find it necessary to erect a different aerial. As a first relatively simple change, I suggest that he increases substantially the diameter of tube used for this item.—S. WEST (Gt. Yarmouth).

STRONG FIELDS

SIR,—I read with interest of the experience of Mr. A. G. Bloomfield, of Chingford, in the March issue of PRACTICAL TELEVISION. As it seems very similar to a fault I had on my own home-made televisor, and incidentally one built to a standard design, perhaps my experience may be of value to Mr. Bloomfield.

I had similar distortion of the ring around the clock on the tuning signal, though the normal pictures were satisfactory. This puzzled me until I had an opportunity of seeing the B.B.C. Test Card "C," when I noticed the black-and-white margin around the card. All lines on my picture which commenced on a black portion of this margin were slightly displaced towards the right (viewer's right, that is). It then became apparent to me that there was something wrong with the "black level" and that the black parts of the margin were in effect lengthening the line sync. pulses. I also found that the distortion was removed when I turned up the contrast control, but this, of course, made the blacks almost disappear.

As the fault must lay in (1) the video output, or (2) the D.C. restorer, or (3) the sync. separator, I examined these circuits carefully, when I found I had put a 0.1 μF condenser to the phase invertor valve input and a 0.05 μF condenser on the output to the sync. separator. When these condensers were transposed to their correct positions the trouble ceased.

It occurs to me that the margin on Test Card "C" must be designed to check for such faults, yet I have never seen it mentioned in connection with television servicing. It is a fault which must have occurred on many televisors and could happen on a commercial set if some component changed in value or became faulty.

Trusting this may be of some service to Mr. Bloomfield and any other constructors.—COLIN H. COWELL (Birkenhead).

THE "CASCODE" PRE-AMPLIFIER

SIR,—In his recent letter concerning the "Cascode" circuit, Mr. Thomasson takes the matter much further than I at this stage am prepared to debate in detail. My primary aim was to give an amended and more suitable version of the circuit, as applied to television reception, than was given by Mr. Thomasson in his original article. In this sense it is observed that Mr. Thomasson is not keeping strictly to the point. I have already agreed that developments are likely, but at present the version of the circuit I gave is the favoured form for it. To make vague suggestions indicating what lines of development to follow, whilst being useful in a broad sense is generally, of course, a very easy and tempting thing to do. In this particular controversy it only serves to confuse matters. I propose, however, to deal with Mr. Thomasson's remarks in the same order as he writes in case my own previous comments are judged, as it were, by default.

If Mr. Thomasson prefers his own circuit arrangement to that of others it is entirely his concern and I shall not feel hurt. He should, however, have read my original letter as a condemnation of his circuit insofar as it did not represent the present developed form of this circuit. I do not know quite what to say to Mr. Thomasson concerning his disclosure of the method of neutralising described in the M.I.T. Radiation Laboratory series. As he says it is a time-honoured method and is very well known, but what puzzles me a little is the fact that this method was also described in the "Electronics" reference he has already given and which he assumed I had also read. I had, of course, but I cannot help now concluding that he had not done so very thoroughly. The figure of 5 per cent. for the neutralising coil which he mentions as being quoted is vague; 5 per cent. of what? In any event, I have not said the neutralising adjustment is critical. I said it was difficult, and, of course, it is. Certain equipment is required, and these things are not normally available to the home constructor. I also indicated that a careful choice of component values was desirable by which remark I embrace all of the components in the feedback network which was my intention. Alignment of the grid coil also complicates the matter and the performance of the circuit when all adjustments are correctly effected is, I suppose, not unexpectedly, markedly superior to the same arrangement adjusted experimentally without equipment. I am afraid that I cannot make any really good suggestions for the home constructor to enable him to align the various coils, etc. I do not think he will be enabled to neutralise by employing the received signal for when the neutralising is correct almost no signal at all is passed on to the succeeding stages. All in all, I think if no signal generator is available one should be begged, borrowed, etc., or a simple one made up. If at the same time this can be arranged for use as an absorption type meter adjustment of the grid tuning coil associated with the neutralising coil will be facilitated.

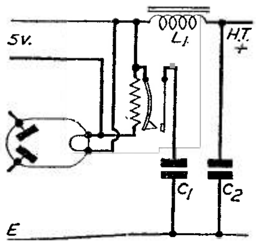
If Mr. Thomasson really considers his adjustment of the anode/grid and anode/cathode capacities or provision of grid impedance networks simpler than my suggested cathode coil, then he will use such arrangements. For myself I will stick to my little coil, which is very simply adjusted. Concerning an impedance in the grid lead of the grounded grid stage, I have much difficulty here. The term grounded grid stage should not be employed by Mr. Thomasson if what he says is correct. It would require a lot of space to put Mr. Thomasson right on this point, and as I have already mentioned, it is not really to the point. Moreover, as Mr. Thomasson is not very receptive it would perhaps be a waste of time. I would point out, however, that I originally criticised his suggestion of including a resistance in the grid circuit. I am aware that any electrode of a valve is lawful prey on which to hang a few networks, and every now and again I tend to confuse myself with extravagant circuits, but, in general, I try to keep a circuit "clean." It is much more likely to perform in a consistent manner. Mr. Thomasson refers to his analysis of the effect of an impedance in the grid circuit. Well, what did he find out and were these calculations verified with subsequent measurements? In my experience it is essential to carry out such a check when high frequencies are involved. I will add, however, that if I was unduly dogmatic concerning this item I accept Mr. Thomasson's rebuke, though I must say that reading once more my original remarks and observing that they related to a specific case I do not consider the rebuke justified. I am not very impressed with Mr. Thomasson's argument against the parallel feed arrangement for the circuit. Moreover, difficulties of providing a D.C. network for the second valve's grid and of cathode/heater insulation are removed. With the parallel arrangement, Mr. Thomasson endeavours to make an issue of the suggested R.F. choke across the cathode circuit. It depends what sort of choke it is, of course, but I made it clear that the tuned arrangement was to be preferred. Finally, the reasoning given by Mr. Thomasson for his assumption that I had described the best circuit is, to my mind, most extraordinary. I had only to describe a better one than his own to justify my use of words. I think this has already been conceded at least on one point, and to interpret my remarks in any other way is surely to stretch the meaning of words overmuch.—S. WEST (G. Yarmouth).

USING THE VCR97

SIR,—The following errors exist in the article on the above in the March issue:

R81 and R84—470 *ohm*, not 470 *kilo*-ohm.

Vision channel detector coupling transformer—55 turns. 38 S.W.G. primary and sec. — overwound - paper interleave wire is *lumex* or enamel covered, not *linen*. Relay connection is as shown, avoiding surges and heavy current through relay contacts.



Corrected relay connections.

In areas other than extreme fringe separate control (pre-set) of bias of V16 will enable maximum signal with minimum "graininess" due to valve noise to be obtained.—R. SHATWELL (Oldham).

SET DATA WANTED

SIR,—I wonder if any of your readers could help me to identify a rather ancient television set which I have recently acquired?

The tube, which is clear, is a Baird "Cathovisor" type 12 MW2. A unit, which I believe to be the time bases, uses Mullard TSE4 valves. These are housed in copper boxes.

The set is a table model, with the power pack and sound unit on the floor, and the vision, tube and time bases on the deck.

I am told that the make might be a "Brynaston," but I have never heard of this name before.—L. E. MILLER (E. Grinstead).

(Continued on page 563)

(*Continued from page* 560)

POOR SYNC.

SIR,—With reference to the trouble experienced by your correspondent, G. T. A. Ling (Norwich).

I would suggest that the poor sync. is probably due to the downlead running in close proximity to electric mains, and/or inferior downlead.—A. LAW (Ferring).

"ARE WE WATCHING ANOTHER WORLD?"

SIR,—Having read, I might say with amazement, this unsigned article in the April issue, I felt compelled to reply to one or two points raised.

Your reader infers that we want pictures as large as life and tells us that the "Shop" (the TV manufacturers and the B.B.C.) can prove that if Sylvia Peters was made (on a screen) as large as life one would have to open the lounge doors and sit in the hall to view her in comfort.

He then goes on to ask: "If she were actually in the room would you find normal proximity intolerable?"

Being an admirer of Sylvia Peters I should say definitely No! But, has the above-mentioned reader considered the possibility of, say, Mr. Pastry disporting himself all over the lounge (with the door shut) complete with custard pie or water butt?

And where, I wonder, would he put Eric Robinson and his boys, not to mention the competitors, when he was viewing his life-size Michael Miles show?

If one had a life-size edition of "Mr. Morgenthwacker's Loblies," one would never be quite sure that one of those cute little Loblies hadn't been left behind on the carpet, or on poor Aunt Jemima's aspidistra, or something, could one?

Your correspondent says, "Alas, I only know some very elementary facts about people looking." From the rest of his article I should say that he only knows very elementary facts about anything to do with TV broadcasting.

Admittedly the B.B.C. can transmit a greater number of lines but how many lines would he imagine would be required for his life-size picture?

His screen size, taking an average person's height to be 5-6ft., would be at least 8ft. by 6ft. using a 4/3 aspect ratio, and supposing the present line size at normal viewing distance to be optimum then he would need, basing calculation on a picture of 10in. height, 3,847 or say in round figures 4,000 lines, which would give us approximately 36 million picture elements to transmit, taking one picture element to be a square with sides equal to the width of one line.

And as the 503 elements of the present 405 line transmission require a 3 megacycles bandwidth for reasonable definition, the mind rather boggles at the bandwidth required for these life-size pictures.

On top of which we are to insist upon colour as well. The revolving disc will be out of the question in a picture of this size and that leaves us with either the 3-tube method (?) or spot sequential scanning which also I am led to believe requires a much greater bandwidth. Mind you, I wouldn't know about that, I'm just a poor struggling TV service engineer working from 9 a.m. till 10.30 p.m. nightly except Wednesdays servicing normal-sized TV sets. I take for granted the statements of the keeper of the "Shop" when he tells me that such and such an improvement though possible would require too great a bandwidth to be practicable.

I wonder on which wall of what room our "Reader" is going to install his screen, and where will he put his set or TV projector or whatever it will be called, and most important what does he expect to pay for it?

And, incidentally, who is going to cook his food and do his housework for him whilst his family sits down all day to see the wonderful 7 a.m. to midnight (?) mighty panorama of "our own world" unfolded before their wondering eyes?

From Ghoulies and Ghosties and Long-leggety beasties and life-sized Technicolored stereoscopic pictures, good Lord deliver us.—GERALD N. PENROSE (Streatham).

VIDEO STAGES

SIR,—I have been interested in the correspondence in the February and March issues of PRACTICAL TELEVISION relating to the merits of the American 6AG7 radio valve when used as a video amplifier. The Mullard EF55 with 4 kΩ anode load, 10 kΩ screen, with a 300 volt supply, and with the screen decoupled by 50 μF gives better results than the 6AG7. I am using 100 Ω in the cathode by-passed with a .001 μF condenser. Video detector is an EB41 with D1, D2, etc., connected in parallel. There is an increase in anode current when using the EF55, but the improved definition with this valve is quite noticeable.—R. YOUNG (Walsall).

LOW NOISE PRE-AMP.

SIR,—As a keen experimenter I eagerly scan your most excellent journal, PRACTICAL TELEVISION, every month in search of novel circuits to "dabble" with. I was particularly intrigued with the article in April's issue under the heading "Low Noise Factor Pre-amp."; in this circuit Mr. Rodwell follows V1 with a grounded-grid stage whose input resistance is approx. 200 ohms (1/gm), and, since this resistance is in parallel effectively with the anode circuit of V1, the gain grid V1—cathode V2 is gmV1 (.005) multiplied by the anode load of V1 (200 ohms), i.e., one (1). Since this appeared to me to be a waste of a valve, I tried feeding my aerial direct on to the cathode of V2 (cutting out V1), using a 100 ohm resistor as bias for V2 and terminating load for the aerial. Results were identical to the previous circuit—no measurable difference being obtained. I would, therefore, suggest this "mod" to all fringe-area enthusiasts like myself, who wish to economise.—W. LAMBERT (G3GEO), (Rawdon, Leeds).

USING THE 62 UNIT

(*Continued from page* 534)

control over height and width can be obtained by inserting a variable wire-wound resistor of 50 kΩ in the H.T. supply to these valves and decoupling it with an 8μF condenser.

VR7 adjusts the potential on the auxiliary grid of the sync. separator and allows good sync. separation to be obtained.

C10 is made variable so as to obtain maximum line sync. pulse without distortion. Where a good signal is obtained it will be found that when C10 is at its max. position, the picture will tend to look streaky; this condenser must then be reduced so as to clear the picture, and yet prevent the top of the picture from wobbling.

If the unit is used in conjunction with the R1355, the EHT rectifier valve together with its holder and C2 will be found spare in the receiver unit.

A final word of caution. In circuits where EHT positive is earthed it must be remembered that the heaters of the C.R. tube and its D.C. restorer, together with their cathodes and grid of the tube are 2.5 kV. "live" with respect to the chassis. Great care must be taken not to touch them when the unit is working.

Modified 6046/6050 Unit—2

A Pre-amplifier for London or Midlands Areas

By "ELECTRON"

THE input tapping is made one turn up from the bottom end of the complete winding. Then the coil can be re-bolted to the chassis. Wiring up is straightforward; the lower end is taken to the grid pin of the valve (pin 7), the top end to the junction of R1 and C2 (mounted on a three-way tag trip) and the tapping to the input coupling capacitor C1—which is also mounted at the tag strip.

L2 is then removed and five turns of 24 S.W.G. wire *double spaced* in the grooves already existing are wound on, looping the top end through one of the holes provided in the ribs and leaving sufficient wire to reach over to the other former in the compartment. The lower end is reconnected to the anode (pin 3) of V1.

The former containing the windings L3 and L4 is then unbolted from the chassis and both windings removed. L4 is rewound with five turns (as for L2), commencing the winding approximately an eighth of an inch from the bottom of the former. With the ends of the new L4 winding anchored through the nearest rib holes, commence the new L3 winding—this consisting of two turns *close spaced* commencing an eighth of an inch above the termination of the L4 winding.

Connecting up the re-wired L3/L4 coils, take the lower end of the L4 coil to the grid (pin 7) of V2 and the top end to the junction of R7 and C8 (mounted to the tag strip). The coupling winding L3 is wired as follows: The lower end is taken to the junction of R4 and C7 (mounted on a two-way mounting strip) and the upper end is taken through to a rib hole at the top of the former. This is then joined with the lead from L2, previously mentioned.

Final Alteration

The final alteration concerns the former containing L5 and L6. First remove both windings and proceed as for L3/L4, except that the coupling winding L6 has *three* turns, the procedure and details are exactly similar. Connecting up, take the lower L5 lead to the anode of V2 (pin 3) and the upper lead to the junction of R13/R11/C12 (on a two-way tag strip). The coupling winding L6 is wired to the output connector (lower end) and chassis (upper end).

Installation

The unit, whether modified for London or Midlands channels, is now ready for connecting up. The power supplies are derived from the existing equipment and three leads are required—H.T. positive, earth and L.T. "live" leads. The H.T. positive is taken to the tag marked "+330 V," common earth to "Earth" and the live L.T. supply to the tag marked "6.3 V." The current drain is not excessive and it is unlikely that the small amount taken by the two VR91's will upset the performance of the main receiver—or overrun the transformer—since the power supply will be, normally, running at less than maximum ratings. The actual H.T. voltage is not unduly critical and something between 320-280 volts will be suitable.

The existing input arrangements are for coaxial (unbalanced) line and the feeder is connected to the input connector in the normal manner. The output of the pre-amplifier unit is taken to the main receiver input via suitable coaxial cable; the receiver input circuit should, of course, be for unbalanced input. In the case where separate sound and vision receivers are used the two receiver inputs must be paralleled at the output connector of the pre-amplifier.

Final Adjustments

Alignment is achieved by the adjustment of the four dust cores, L1 by means of the protruding bolt from the top of the chassis and the remainder by direct adjustment of the slotted cores through the underside compartment holes provided for the purpose. On most units purchased it will be found that the cores are locked by an application of pitch and it is necessary to remove sufficient of this pitch to enable the cores to be removed.

The pitch can be scraped off with a sharp, finely-bladed knife, and this is sometimes sufficient to allow removal of the cores. If not, the pitch should be *slowly* and gently warmed so that when it begins to soften the cores can be unscrewed (in an anti-clockwise direction). Care must be taken not to force the cores since they are very brittle and may fracture, wedge in the former, or the slot become enlarged so that adjustment is impossible. Also take care not to overheat the formers since they may lose shape and the internal threads distort.

With the cores removed, they (and the formers) should be cleaned completely of pitch deposits and then replaced. The unit is then connected up to the aerial and main receiver(s) and the cores adjusted in the normal manner, starting at the aerial input circuit (L1).

Bandwidth

The pre-amplifier has an excellent bandwidth so that no difficulty will be experienced in peaking both sound and vision channels. Mutual adjustment of the cores by trial and error will enable perfectly satisfactory results to be obtained, but, naturally, if a signal generator is available the stages can be stagger-tuned accurately. The degree of staggering will, of course, depend on the gain required from the amplifier as a unit.

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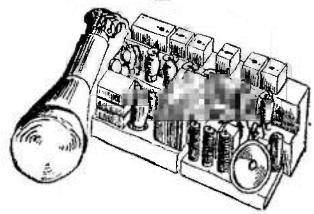

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Lime Grove Wonderland

Some Details of the New Studios and Arrangements

By LORD DONEGALL

PERHAPS my somewhat childish delight at finding the clock in the hall of Lime Grove Studios of the B.B.C. to be four minutes slow gives a theme to this article. In was my first visit to the Studios, and I came to the conclusion, after doing what they call the "grand tour," that the whole of this vast building really centres round the Children's Television programmes.

Of course, they do other programmes, such as Café Continental. In fact, when they opened the second Studio—Studio G—on December 23rd last year, the opening programme was Variety Gala, in which Dolores Gray, Peter Brough and Archie Andrews, Jimmy James and several other stars, took part.

To see what goes on in the preparation of the now daily Children's programmes you have to go right up to the top of the building. There you will find people walking down the corridors armed with paintings, posters, model theatres and every other kind of device that the children have sent in for the competitions. As the employee concerned shows you some masterpiece—or horror—sent in by a budding genius of four to eighteen, you really get the impression that the whole of that top floor is enjoying itself hugely in the production of these programmes.

I think that this is obviously reflected in the programmes themselves. Many grown-ups agree with me that they are one of the best things that the whole of the B.B.C. produces. Increasing interest has been aroused by these programmes in the last few months and they could not possibly have the genuineness if they reflected the opinion of the legendary bishop who, having finished a broadcast for children, failed to notice that the light was still on and said: "I hope that will keep the little so-and-so's quiet at least 24 hours."

But before we start having fun with the Children's programmes, I must take you on the "grand tour."

Starting with the clock four minutes slow in the Entrance Hall of Lime Grove Studios, we meet Mr. W. D. Hatcher, Assistant Engineer-in-Charge of Lime Grove. Statistics being extremely painful to me and possibly, I hope, to some of you, let us get them over as quickly as possible.

Five Studios

There are five studios at Lime Grove, two of which, taken together, have a floor space of more than twice the combined area of the two existing studios at Alexandra Palace. The largest, that is to say, F, which is not yet in operation, is by itself twice the area of the Alexandra Palace studios.

At present, Studios D and G are in operation. Studio D is where the Children's programmes are done and Studio G is for the other shows. Studio H, which is small comparatively, is used chiefly for rehearsal, and this is the first time that rehearsals have been able to be carried out the day before in front of the camera, owing to lack of space at Alexandra Palace. Anyway, the whole area is some 29,000 square feet, and a mathematically inclined reader may be able to work out exactly what area of Trafalgar Square that would occupy.

Mr. Hatcher takes us to Studio G and explains the system of air-conditioning. He says that with 300 kW. of lighting the temperature has never exceeded 67 deg. Fahrenheit, with a studio audience of 200 and two shows in the same studio.

The maximum studio audience at Alexandra Palace is 25.

Incidentally, we are shown the conductor's movable "dolly," for big band stuff. He has a pre-view screen on it, so that he can see what every member of his orchestra looks like to the camera. If the Triangle is having a quiet smoke in a 300-bar break, he won't get away with it.

For the first time there is a separate control room for sound.

In Studio G they have four cameras and two microphone booms, one spare camera and one spare channel.

Then we move up above to Studio D, where the Children's programme is usually produced. In the Producer's gallery we find Mrs. Dorothea Brooking

A general view of Studio "D" during the rehearsal of a variety programme. Left are two "hikers," in the centre the Western Brothers, and Jack and Daphne Barker, Ernest Butcher sitting on the fence in the rural setting, and Evelyn Dove on the right. Note how close the individual sets are placed so as to limit camera movements.

rehearsing. She is producing the "Railway Children."

On this evening the set consists of a printer's works with "lino," "mono" and all the rest.

Somebody says to us: "We had 50 of our legislators round here this morning." One of them said: "Oh, I didn't realise you printed the *Radio Times* here!" It does not surprise me. You see, they were all from the House of Commons.

B.H. Links

Now to the roof—a vast area on which I would like to land a helicopter. From Lime Grove they have one co-axial cable link to Broadcasting House and one radio link. Broadcasting House has two cable circuits to Alexandra Palace.

What interested me was the parabolic radio "aerial" to Broadcasting House. When they first put it up on what they thought was the most advantageous spot it hardly worked at all. They moved it thirty yards to what they thought was a hopeless position. It worked perfectly! "There are more things . . ., Horatio. . . ." The bee-line from Lime Grove to Broadcasting House does not visually exist, even with the best telescope and the unlikely fine day.

So confused was I with all the reshuffle that has taken place in television personnel that it might be worth while—as Anona Winn would say—to "recap."

Alexandra Palace still remains H.Q. George Barnes is the fourth in the line of Television Directors. Cecil McGivern is the Controller, with a seat on the Board of Management of the B.B.C. Cecil Madden's successor as Programme Manager is Alex Sutherland. (Corresponds to Feature Editor on a newspaper.) Philip Dorte is head of Films and Mary Adams is Talks and Features.

As far as Lime Grove is concerned, Val Gielgud is head of Drama. Ronnie Waldman is acting head of Light Entertainment and Joly de Lotbinière is still head of Outside Broadcasts, with his offices in the Marylebone Road.

Our old friend, Cecil Madden, who was Programme Manager, is now acting head of Television Children's programmes.

So, gratefully emerging from the high wind on the roof, we walk straight into his office.

Children's Programmes

Madden is very proud of the fact that the Children's programme only took a few months to work up from Sundays only to daily. What he is trying to do—and undoubtedly rightly—is to give the children a planned programme, just as the grown-ups know in advance what is going to happen at their theatre, cinema, social centre or club in advance. Thus, the over-fourteen-year-olds do not have to waste their time looking at what they might consider "kid" stuff and *vice versa*. Personally, I think that the "kid" stuff is the most fascinating of all (obviously second childhood!).

For instance, the children know that on Sunday they will get a play, on Monday an adventure film, Tuesday a serial, Wednesday a mixed programme, Thursday a documentary, Friday nature and sport and Saturday two magazines.

Broadly speaking, there is a staff of seven which organises all this. And I think it is certainly a credit to them that, up to the fifth performance of "Telescope," they had had 16,000 letters and entries to the competitions from children.

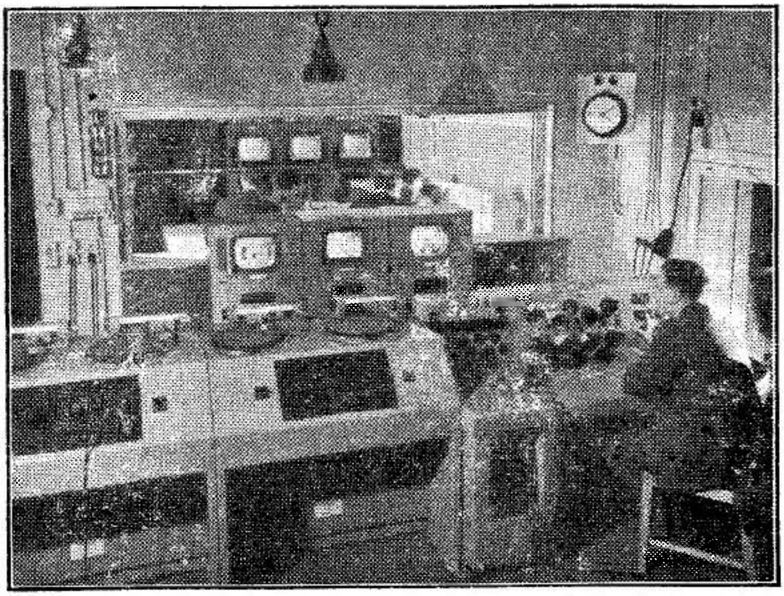
Madden intends to take sport in rotation and on this particular day two boys are rehearsing a boxing demonstration under expert guidance. They are coming to athletics, swimming and skating—with more to come. Cliff Michelmore, who used to be on the Forces Hamburg Station until he married Jean Metcalfe, supervises this programme.

Bruce Gordon, "the Man in Armour," has been a tremendous discovery. He came from Repertory and it has been suggested that he is a potential Sid Field or Danny Kaye.

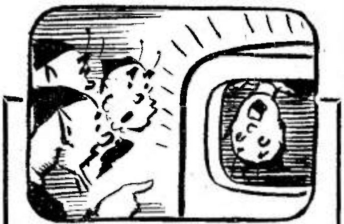
There are many others, such as Pamela Brown, who studied at the Royal Academy of Dramatic Art and played "Alice" in 1949. She has also written a book of short stories for children and produced the highly successful "Little Women."

Cecil M. tells me that if you ask children to make or draw anything you are immediately overwhelmed. The entries sent in for the Festival of Britain poster were, in my opinion, staggeringly good. On the other hand, if you try to get young people to write anything, you get a much

(*Continued on page* 572.)



Studio "G" Control Room. In the foreground are gramophone reproducers for sound effects and sound mixer desk at which the engineer controls and blends the outputs of the mikes in the studio. Facing the engineer are three monitors, one showing picture on transmission, the other two a pre-view of the pictures from any of the other cameras. On the other side of the glass screen are the producer and his assistant, senior engineer and the vision mixer. They can see into the studio through the window on their right.



TELEVISION PICK-UPS AND REFLECTIONS

UNDERNEATH THE DIPOLE

By Iconos

I OFTEN wonder what the TV face of Great Britain would be like if it had been built up on a competitive basis. Considering that we were the first in the field in the world with a public television service, we should have progressed a great deal further than we have. Comparing our present five permanent TV studio stages in London with the forty-four now in operation in New York, let us take a flight of fancy and try to imagine what things would be like if we had progressed as fast as the Americans have. The next four paragraphs are completely imaginary and any reference to places, personalities or publicly-owned institutions are purely coincidental !

FLIGHTS OF FANCY !

THE TV year 1951 in London started off with a six-way battle for viewers. As the New Year approached, British National TV Network made a bid for supremacy by staging an all-star "Crazy Night" show at the Gaiety Theatre, recently reconstructed as a television studio for live audiences. A new "high" was registered by presenting Bud Flanagan, Naughton and Gold, Nervo and Knox, Ted Ray and Gracie Fields in a glittering "*Oblongtine Health Food*" programme. But the rival TV networks were not asleep. The Blue Ribbon System made a hit with "*Jack's Back*," which had a special appeal on a New Year's eve —Jack Hylton presenting his original band, reassembled once more after its triumph at the Royal Command Variety Show. Here was streamlined entertainment de luxe, lavishly produced at the Blue Ribbon TV centre, Leicester Square. The principal items in "*Jack's Back*" were performed on a revolving stage, thus permitting spectacular effects reminiscent of the great shows at Drury Lane. Blue Ribbon allow small audiences in their studios for musical shows, most of which are sponsored by the Galbern Pneumatic Pen Company.

THE RIVALS

COMPARED with these giant efforts, the B.B.C.'s "*Around the World in Eighty Seconds*" and the National Television Corporation's "*Mass Hypnotism Demonstration*" fell a little flat. The Eighty Second World Tour, comprising part direct TV relay and part film reproduction of events photographed the same day, was very well done and deserved a larger viewing audience. But the Mass Hypnotism Test raised a storm of protest in each of the fifteen areas covered by the National Company's low-powered TV transmitters.

THE URGE OF COMPETITION

LET us consider TV progress made during 1950 so far as London is concerned. There are now forty-eight permanent TV studios in London, including five West-end theatres, two concert halls and four ex-cinemas. The three largest TV companies have headquarters within easy reach of the West-end, and each have seven fully equipped permanent stages, apart from outside theatres converted to TV use, with runways for camera tracks over stalls and special lighting. The smaller TV companies have retained popularity, though their public is "specialised" in one way or another.

The Atheneum TV System, for instance, has a special appeal for viewers who prefer something more serious than the musical shows of its rivals. Serious plays are put on with a technique and style far ahead of the others, and the mixture of direct TV and film sequences is so well carried out as to be undetectable, even by experts. Atheneum's network of twelve medium-powered transmitters has a steady viewing public and is eligible for a subsidy from the TV licence fund in respect of approved non-sponsored programmes. The Philharmonic TV Syndicate concentrates on the finest musical transmissions and uses frequency modulation for its sound side. This syndicate, too, receives a share of the licence fee in respect of certain non-sponsored concerts from the Albert Hall and elsewhere.

VIEWERS' POINTS OF VIEW

AND what of the viewers and their sets ? Aerials are more elaborate than ever, with motorised poles enabling the arrays to be orientated towards the transmitter it is desired to pick up. An extra knob on the receiving set controls a Selsyn motor which does this job. The large number of sets in use—roughly three and a half million—have resulted in the building up of a huge radio industry, and large-scale mass-production has brought about the reduction in price of sets. Advertisers are conscious of the value of the barest mention of their names before and after a programme. "This programme is transmitted by the courtesy of '*Oblongtine*'" is allowed and nothing more. Nevertheless, sponsors find that the name and visual trade mark gives an adequate return for the quite considerable outlay, especially when planned as part of a national advertising campaign in the Press and with posters. The British public will not tolerate indiscriminate publicity superimposed on their radio or television, but they have become conditioned to advertisers' brief announcements, just as they accept and even like the advertisements in newspapers and magazines.

DOWN TO EARTH

AFTER this excursion into the realms of fantasy, I return to earth with a bump ! I have been writing, not in the Wellsian time-machine vein or in the Shape of Things to Come—but of what *might* have been ! There still was an opportunity of a TV breakaway from the B.B.C. when the charter came up for review. Now, alas, the Beveridge Committee has set the course for the future and there will be no competition.

ROOM FOR BOTH ?

THE B.B.C. have done a fine job of work, particularly on the engineering side of their TV transmissions, and I believe that they still lead the world in television play technique. Nevertheless, it would benefit both B.B.C. and viewers if some kind of competitive service was possible. Maybe, in the course of time, a way will be found which will give this new and valuable industry the impetus it requires to keep ahead —where it was in 1937.

SPONSORED PROGRAMMES

THERE has been a lot of nonsense written about the fatuities of sponsored programmes, but this has resulted from observations of British listeners and viewers who make a brief visit to the U.S.A. The visitor who stays there three or four months gradually becomes conditioned to the vastly different approach, not only from the advertising angle, but from the showmanship employed in putting over news items, talks and commentaries. After six or seven months, if he returns to England, he usually finds the B.B.C. style stodgy, slow and lacking in any kind of sparkle. The entirely impersonal style of news-reading infuriates him—until, once more, he becomes "reconditioned" to the home methods, the understatements, the underplaying and the matter-of-fact attitude which is always associated with a public institution like the B.B.C. There are many points in favour of this outlook, but it is not entirely a national characteristic. The large circulation British newspapers prove that the majority of the public like their papers to have punch as well as a factual presentation of the news of the day.

Lime Grove Wonderland

(*Continued from page 568.*)

smaller response, as in the case of "Whirligig," where the children are asked to write the next episode of the serial story themselves.

However, Humphrey Lestocq is not discouraged, because the quantity may be small but the standard of writing is very high.

Dorothea Brooking, whom we mentioned before as a producer, was trained at the Old Vic and won a scholarship. It was in 1943 that she joined the B.B.C. as a Studio Manager in the wartime European Service and she was appointed a Television Children's Hour producer in April last year. Some of you may know her better under her writing and stage name of Darrell Wylde. She also paints portraits and has a son of thirteen.

The "Staff"

Now I think we should have a word about the children who take part in these shows. The "Resident" announcer is, of course, Jennifer Gay, aged 15. Then there is Janet Scott, whom we talk to on our "grand tour." She is 12 and, so she tells me, has done one film for every year of her life. She is in Marlene Dietrich's "No Highway" and "The Galloping Major."

Elizabeth Cruft, aged 12½, shows dogs. Just to see that the young public knows what it is talking about, we should note that she was only brought on as a regular because the children insisted on it in their letters. One wonders if they knew that she is the grand-daughter of the founder of Cruft's Dog Show.

Jeremy Spencer, of "Puck" and the "Powder Monkey," causes no worry at all to Alan Bromley, his producer.

Just as we are going down in the lift we run into Michael Westmore, the producer of "Whirligig." As a contrast from his tanks in the Middle East and Italy, he now likes models, puppets and model theatres. He also paints landscapes in water-colour and does crayon portraits.

Way down in the depths there is a miniature power-station, part of which is devoted to making the direct current used for the cameras and production lighting. In another section of this power-house, we see the newly-installed air-conditioning plant.

Just before we leave we must mention the wardrobe and make-up ladies. They are in seventh heaven compared with the restricted space at Alexandra Palace. Not unnaturally, the existing wardrobe and make-up rooms of the old Rank Studios have been preserved as such—and very nice too.

So, as we come out of Television's new Wonderland, the clock is still four minutes slow. "I thought it would be!"—Alice seemed to whisper in my ear.

Forces' Lifelines

FEW things are more important to the fighting Services to-day than good communications. Modern military strategy demands a bewildering variety of signals equipment, from tiny one-man radio sets with a range of two or three miles to great transmitting stations which flash messages around the earth. And this equipment, so far as human effort and ingenuity can ensure, must be completely reliable, able to stand up to the strains and stresses of Service life in all the varied climates and conditions of modern war.

Consequently, elaborate arrangements are made by the Ministry of Supply to ensure that signals equipment for the Services is up to standard. The Ministry's Inspectorate of Electrical and Mechanical Equipment near London has at its disposal a wide range of the latest scientific testing apparatus.

Battery Problems

Probably one of the most exacting tasks of all the Inspectorate's varied work, however, is concerned with what seems the simplest equipment of all. Compared with the complicated mechanism of, say, a radar transmitter, the ordinary dry battery appears childishly easy. But, in reality, it presents the staff with one of their biggest problems.

Dry batteries are more liable than anything else to cause breakdowns in electrical equipment. Their weakness is that they are practically self-destroying—a radio receiver may be in store for years without deterioration but, after eighteen months at most, the best battery is useless.

Consequently, of every consignment of any of the 150 types of batteries produced for the Services, one-half per cent. is brought to the establishment for testing. It adds up to some 10,000 batteries a year passing through the hands of the Battery section at the Inspectorate.

Painstaking statistical work is the basis of the methods. Testing a battery takes a full year to complete, for periodical checks have to be taken of the battery's strength through months of storage. In each year the section takes no less than 4,000,000 separate observations, all of which have to be checked and collated into graphs and comparison-charts. And, in addition, of course, there are the purely physical tests to be carried out on the strength of the battery case, its resistance to various climatic conditions and so on.

Hot and Cold

Most of the Inspectorate's physical tests are carried out in a building which resembles nothing so much as the Insect House at the Zoo.

There are no insects in the glass-fronted boxes along its walls, however. Instead, they contain radio sets and components undergoing stringent tests for proof against heat, cold and many other hazards.

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Television and the Child

An Analysis of the Effects of TV Programmes on the Younger Generation

By D. CHARLES OTTLEY

MUCH has been written about the service that television will render to the teacher in the class-room of to-morrow, considerably less of the likely benefits to be derived by the child.

Foremost of these is the all-important question of *approach*. As was the case when cinema first entered the class-room, the sense of novelty was found to be of the greatest possible value in engaging and retaining the youthful imagination.

The same emotions were functioning (though for a longer period) as function when a new teacher makes his or her début. The " smart " boy or girl will unconsciously psycho-analyse the subject and in a surprisingly short space exhaust it. Before a week has passed, that vital, inquisitive urge, that sense of curiosity (and with it the exploratory desire) will have vanished.

The physiognomy has registered, the mannerisms have been noted, the limitations and the possibilities determined. A single sentence, often a single word, will suffice to award the final " grading " which, unfortunately, *sticks* . . . " smashing " . . . " lousy." I mention the extremist designations. Somewhere between the two the " moderates " find accommodation for *their* verdict, saner perhaps, certainly kinder, " not so dusty."

The most successful teacher is the one possessed of a sphinx-like quality that protects the emotions without dulling them, who can draw without being drawn and win without being won. Unlike Wilde's sphinx, a " secret " is desirable . . . a heart essential. In practice the secret is a constant stimulation to the child, the heart a subconscious yet active mediator for the teacher.

The picture-tube, sphinx-like in appearance, guards a secret neither easily nor quickly wrested by impetuous youth. It intrigues because it baffles, it stimulates because it sees and speaks of an infinity beyond four walls and the teacher's glasses.

If for reasons of economy school television resorts to film transmissions, the step should be justifiable only as a temporary and purely experimental measure. Syllabus courses apart (and by syllabus courses I mean predetermined transmissions the subject-matter of which the teacher has in advance) all transmissions should be " live."

Youth resents nothing more keenly than " fake," particularly when the fake is deliberate, and the opportunity at last offered by television to deviate from a medium with so definite a psychological limitation should be exploited to the full.

Possibilities

So much for the approach. What of the possibilities?

Under proper guidance the " live " transmission can be made to incorporate those essential (mental) vitamins productive of the maximum imaginative response. The same element of adventurous uncertainty that makes a journey to Switzerland as exciting socially as scenically can be re-created in the class-room with the child an active participant in the joys of travelling and of living. If the ever-watchful " eye " of the electron-camera is at times allowed to become the *wayward* " eye," so much the better.

It is the unexpected that stimulates not only the juvenile but the adult mentality, no less than it is repetition and the colourless monotony of everyday existence that destroys the mind as surely, if not as quickly, as the active bacteria in a tubercular-infected lung destroys the body.

With all deference to communist theory, the advent of social equality will never (man being what he is) achieve a similar standardisation of the mind. *Every teacher, if he be honest, must admit this.*

The class-room of to-day (and I am fully conscious of revolutionary changes that have been introduced into all departments of education) is still, as ever, a place of varying though limited altitudes. Even when the brilliant are segregated from the not-so-brilliant and the dull accorded the benefits of specialist teaching, we none the less get the lesser altitudes, though at a greater price.

With television, all altitudes are absorbed and none need be limited, since its field of coverage, educational, social, domestic and individual, is limitless. Indeed, at the present rate of electronic development it may shortly be as practicable to transport the class to the moon for an introductory survey of conditions thereon as to follow in the wake of the contesting crews in that historic race from Putney to Mortlake.

With the possible exception of the ability to *repeat* the screening of a film, none of the educational services rendered by cinema need be lost when television enters the class-room. Since few schools possess a library of films it is doubtful whether much use is made of repetition projection in any event.

And the advantages over cinema are manifold.

Radio has taught many things and television will teach many more. Nor is the class-room the only place where these lessons have been and are being learned. The " open sesame " to music (and by music I mean the classics as well as " swing ") has been, for many, via the loudspeaker, and what this has done for the ear the cathode-tube will do, and indeed is doing, for the eye.

Imperfect though the loudspeaker may be, it has thrice shown (in the case of Charles Dickens alone) the beauty, vitality and power that lie hidden behind the sentiment of innumerable pages of cold print. " Our Mutual Friend," its essential narrative resurrected from the verbiage-heaps of Boffin's Bower, reveals the " Golden Dustman " as his creator never could, and if to the vivid mental picture is added the visual materialisation made possible by the cathode-tube, this major scientific achievement may well become the miracle of the century.

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. If a postal reply is required a stamped and addressed envelope must be enclosed.

FREQUENCY RESPONSE

"I made up a sponsored television receiver some time ago and found it very successful. It was, in fact, so good that a neighbour bought it from me, and I made quite a nice profit. I decided to build another for myself and with the extra money I bought tolerance components and ready-made coils. I also got what I thought was a better valve for the video stage, and finally got the set working. Now here is the point of my query. After it was going for a week or so I was experimenting and short-circuited the correction choke in the anode circuit of the video stage. To my surprise the picture seemed better, so I went over the set and cut out the other choke and also changed the bias resistor in the video stage. The picture quality is now definitely better. Can you say why it is so good with the chokes out?"—G. Hounsom (Oxford).

This is an example of why it is undesirable for unskilled experimenters to make changes in published designs. Sometimes quite simple changes may have far-reaching effects, and a design when published may be relied upon to have been worked out to give maximum performance with the valves and components used. Your changed video valve no doubt had different characteristics, and it is, of course, quite possible to use a valve and load resistance of such a type that no correction is needed. You probably used a lower impedance valve with a lower load resistor, and the commercial coils and more accurate resistors undoubtedly led to a more straight-line response with wider band-width, and thus the correction chokes would have over-accentuated the H.F. and spoilt picture quality rather than improved it.

TEMPERATURE COMPENSATION

"My —— receiver has only been installed a few weeks and whilst it is satisfactory in a general sense there is one thing which I am not satisfied with. My dealer tells me it is common to many receivers and I should like to know whether this is a fact. When first switched on everything is nice, but as the evening wears on the picture gradually contracts in a vertical direction and at the end of an evening there is a narrow border at the top and bottom and the faces, etc., are elongated. The width does not seem to be affected. Can this be cured and is it particular to my make of set?"—B. Burton (Guildford).

The fault is common to many makes of receiver and is caused by the rise in temperature either of the frame coils or some part of the frame circuit. The only satisfactory way of avoiding adjustment of the frame controls (which, of course, will overcome the difficulty during each evening) is to fit some temperature compensating device in the frame circuits. Messrs. Mullard make a special resistor of this type and it may be possible to include it in your circuit. Your dealer will advise you in this connection.

LINEARITY COMPONENTS

"In my home-made receiver there are a few bright and wide bands of light on the left of the picture. When there is only a raster you cannot see them, but when pictures come on the details are masked in the light parts and with some scenes you can count about five or six such lines down the picture with a slight waviness in the horizontals. Is this due to the coils I am using or some external magnetic influence?"—J. E. Walker (Westcliff-on-Sea).

We think you will find that there is a condenser and resistor in series across your line coils or some similar linearity device which includes a condenser. If this is leaky it will give a distortion to the waveform and produce this type of defect, but it can also be caused by some other form of waveform distortion. Much depends upon the time-base circuit you are using, but check the linearity circuit first, and then any components which control the fly-back.

BRILLIANCE CONTROL

"I have been experimenting with a home-made receiver and have come across a slight difficulty in controlling the brilliance of the tube. I am grid modulating this and have tried various series resistors in conjunction with the brilliance control but cannot get it just right. Is there any simple rule which I can follow to find correct values?" —Y. E. Tangey (Birmingham).

A potentiometer of 50 kΩ should give adequate variation, provided that the correct voltage is developed across it. The usual arrangement is to connect a resistor at each side and join the chain across the H.T. supply.

The article in the last issue of this paper may assist you here. However, what we think is your trouble is that you are using an aluminised tube and that the bias required is such that your H.T. supply for the receiver is not sufficiently high. If this is the case, you will have to connect your brilliance potentiometer chain, suitably modified as to value except for the 50 kΩ potentiometer across the boosted H.T. supply.

CHECKING E.H.T.

"I do not think my picture is bright enough. I have a RF EHT unit as specified by you in your receiver and it is supposed to give 6 to 8 kV. Can I check this without buying an electrostatic voltmeter, and what precautions should I take?"—G. C. Bernt (Maidstone).

The most satisfactory way of checking if you only have a normal type of meter is to measure the current output. You need a meter reading, say, 100 μA. full scale, and must include a chain of resistors across the EHT positive and negative totalling about 100 megohms. If you cannot obtain the specially designed H.V. type of resistor make up the chain with as many resistors as possible (do not use higher resistors than 10 megohms of the standard type) and mount them on a strip of good insulating material in zigzag fashion to provide a long leakage path. Connect the meter between the earth line and the last resistor, and if you make the chain total 100 megohms, then each microamp will represent 100 volts. If you find the total indicated current is 60 μA, for instance, then the voltage is 6,000 kV. Connect the meter before switching on, and do not touch it until a minute or so after switching off. Although this type of unit is unlikely to give a fatal shock it will give a nasty burn and it is safer to avoid risks.

BENT UPRIGHTS

"I have a VCR97 and surplus radar television receiver with magnifier, but although the picture is good for details, the sides of buildings in newsreels, etc., are bent. They go out towards the side and then come in again at the top and I have proved definitely that it is not the magnifier as it is the same when it is off. Is this due to the make of tube, or can I do anything to straighten them up?"—G. Loftus (Edgware).

There are two or three possible causes of this trouble. The most likely is insufficiently smoothed H.T., either on the time-bases or on the tube. An external magnetic field can produce a similar defect, as also can interaction between line and frame time-bases. Attention to each of these points in the order given should enable you to locate and cure the trouble.

SUPERHET OR STRAIGHT

"Can you say which is the better circuit to adopt in a home-made television receiver, superhet or straight. Can you tabulate the advantages of each kind as I am undecided which to use and a study of commercial circuits seems to indicate that the choice is about 50-50?"—R. C. Urwin (Watford).

The final result will be the same with either circuit. The superhet is harder to set up without instruments, but does enable the intervalve couplings to be designed to give a better band-pass effect, and it can more easily be modified for different stations. On the other hand the straight set can be easily lined up without instruments and more scope is provided for adjusting bandwidth by suitable shunts, etc. There may be less noise, but separate coils must be made for each stage if the receiver is wanted for use for different stations.

COIL ADJUSTMENTS

"I have built up a receiver using an ex-Service radar unit, with concentric trimmers, but find that the trimmers have to be wide open and I can then only just reach the London transmitter. I do not want to replace the tuning coils as they are fitted in nicely and I believe there is a way in which I could adjust the end turns to get the coils to bring in the station. Could you assist me in this?"—H. Arthurs (W.5).

If the trimming capacities have to be a minimum then the inductance is too large for the frequency required. Opening out the end turns will aid, but a better idea would be to use a copper or brass plug inserted in the coil. No doubt the formers will accommodate 0 B.A. brass rod, and a piece of rubber or string will assist in making a thread. Adjust the trimming capacities to slightly below half-way and then screw in the rod until the station is received. The L/C. ratio will be found critical and although stray capacities assist a great deal in tuning you will probably find that you will obtain best results with the parallel trimmers set as suggested.

VCR139A

"Can you tell me whether the VCR139A is suitable for television, and give me details of base connections and working voltages?"—L. Hughes (Timperley, Cheshire).

We have no details of the tube or reports of the tube having been successfully used for television.

MODIFYING AN AERIAL

"Can you advise me how to modify my 'H' aerial from Midland to Holme Moss frequency, and could you give me any idea when test signals will be starting?—G. Ogden (Manchester).

Modification of a single dipole is not a difficult matter, especially where it is modified from a low frequency to a higher frequency. All that is necessary is to cut the required length off each end. Extending it to cover a lower frequency is not so simple, however, and in the case of an "H" aerial there is the additional matter of the spacing which has to be a functional part of the frequency. As your aerial is designed for 61 Mc/s and you wish to use it for 51 Mc/s you would need extra lengths on each end of reflector and dipole, and would undoubtedly have to open up the spacing also. On the whole, therefore, we think the matter is impracticable and suggest you try and dispose of your aerial and purchase a new one designed for the new frequency. We have no date yet for the commencement of test signals.

GHOST IMAGES

"I have a —— receiver and an 'H' type aerial. I am about 50 miles from the station and my trouble is that I get a double image that my friends tell me is a ghost. Also, when the clock is on the shaded colours on the right of the picture are about ¼in. shorter than those on the other side of the clock. The ghost is on at all times. The set has been tested and is supposed to be perfect (I've tried others with the same result). The people where I bought the set try to pass me off and say it is a condition in the area. But this is the point, nobody else around here, except three of my friends who have the same make of aerial, get this trouble."—H. T. Haynes (Northampton).

It would appear almost certain that the trouble is caused by reflection of the signal from some nearby building or metallic structure, or even a hill. The signal can be "bounced off" in this manner and the reflected wave arrives out of step with the direct wave, thus giving the double image or ghost. Obviously, unless you are in a direct line with the reflected wave, you will not experience any difficulty, and your friends and yourself should try and plot your positions on a local map, sketch in the direct ray from the transmitter and we think you will be able to find the direction of the reflected wave so that it only comes in line with your aerials—eliminating those of neighbours who do not experience the trouble. This may then assist you to identify the reflecting body. A mis-matched aerial can cause a similar trouble, but as you tried other makes of receiver we think you could ignore this in your case. The width of the tone gradations on the right can be adjusted by the line linearity control in conjunction with the line amplitude control.

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