A PERSONAL TELEVISOR

PRACTICAL TELEVISION

AND TELEVISION TIMES

1/-

EDITOR
F. J. CAMM

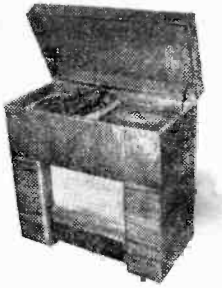
A NEWNES PUBLICATION

Vol. 3 No. 31 DECEMBER, 1952

FEATURED IN THIS ISSUE

New Television Coils
Rejuvenating Picture Tubes
Portable E.H.T. Unit
The Pre-detector Stages
Constructor Aids
Two Pre-amplifiers

INTRODUCING the £25 RADIOGRAM



Console Type Cabinet. With full grained walnut finish, will take standard type auto change gram unit. Price £11.10.0. H.P. Terms. £4.4.0 deposit and 12 monthly payments of 16/-, plus 15/- carriage. **Radio Chassis to Suit.** £8.19.6. H.P. Terms. £3.7.0 deposit and 12 monthly payments of 13/-, carriage and insurance 7/6. **Collaro Gram Unit.** For standard 10in. to 12in. records with hi-fi pick-up. £4.19.6, carriage and insurance, 3/6. **Special Offer.** Cabinet, Radio Chassis and Collaro Unit, £25 or £9.4.0 deposit and 12 monthly payments of £1.15.6. Non-callers add £1 carriage and insurance. Data-photographs-wiring diagrams, etc., 2/6, refunded if returned.

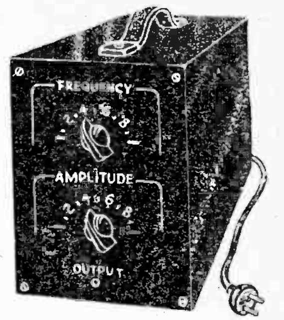
BUILD THIS FINE INSTRUMENT FOR 29/6

T.V. SIGNAL AND PATTERN GENERATOR

This generator has been carefully designed and although it can be built and used by any beginner it is at the same time a most useful instrument for the more advanced worker.

It can be tuned to the Vision channel and will produce a pattern on the face of the C.R. tube. Alternatively, if tuned to the sound channel it will produce an audible signal in the loudspeaker.

Thus its owner will become independent of B.B.C. transmissions and can fault find or test at any time. It operates entirely from A.C. mains and is quite suitable for use with superhet or straight receivers.



A complete kit of parts (in fact everything except the cabinet), with full constructional and operational data will be supplied for 29/6, plus 2/6 post and insurance ; alternatively data is available separately, price 2/6 (credited if you buy the kit later).

NOTE.—Cabinets as per the illustrated prototype will be available shortly.

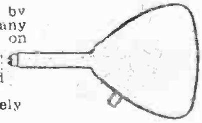
THE P.T. "ARGUS" TELEVISION RECEIVER

Although this televisor costs only about £20, it does not involve the conversion of ex-Government units, and had been designed for construction by the novice. The circuits have been kept straightforward and devoid of "frills" though nothing has been sacrificed which would assist in its efficient and stable operation.

We can supply the 21 valves, C.R. Tube and all the parts for £20. 10. 0. H.P. terms are available, deposit being £6.17.0, balance 12 monthly payments of £1.6.6 each. Carriage and packing 10/- extra.

A reprint of the data, by permission of the Editor of "Practical Television," together with some additional diagrams and notes produced by our Television engineers are available as a constructor's envelope. Price 5/-, post free.

THIS MONTH'S SNIP



15in. Magnetic Television Tube by very famous maker, as used in many Popular Television Receivers (list on request). New, with written guarantee, offered at approximately half price **£12-10** each, plus 10/- carriage and insurance.

Limited quantity so order immediately

(SMALL DEPOSIT SECURES.)

ELECTRONIC PRECISION EQUIPMENT DEPT. 5
42-46 WINDMILL HILL, RUISLIP, MIDDLESEX ● 152-3 FLEET ST. LONDON E.C.4.

---

faithful reproduction

from 50 c/s to 10 Kc/s at 7½ in/sec using

High-quality recorder reproducers demand high-quality tape to produce results that will satisfy the discriminating listener.

"SCOTCH BOY" MAGNETIC TAPE HAS:

- High, uniform sensitivity
- High fidelity at low speeds
- High signal/noise ratio
- Medium coercivity, easy erasure
- Low distortion and transfer
- Special cellulose acetate base giving strength and durability.

in 1200', 600', 300' reels and other sizes.

If you want advice on any tape-recording problem, our entire technical knowledge is at your disposal.

MINNESOTA MINING & MANUFACTURING Co. Ltd
167 Strand, London, W.C.2. *Telephone: TEMple Bar 6363*

VIEWMASTER

LONDON - MIDLAND - HOLME MOSS
KIRK O'SHOTTS & WENVOE

A superb quality receiver you can build in 7 easy stages from standard parts.

★ **Brilliant, high definition picture.**
★ **Uses 9" or 12" C.R. Tube.**
★ **Table or Console versions.**

A complete constructional envelope is available with 34-page, fully illustrated "How to make it" Manual, eight full-size working drawings, alignment and operating details, etc. Model "A" London, "B and E" Midlands and Wenvoe, "C and D" Holme Moss and Kirk O'Shotts. 7/6 post paid. Revised price list of Viewmaster components giving details of the 7 easy stages, 2½d. post free.

"VIEWMASTER" KITS IN STAGES.—Holme Moss, Kirk O'Shotts : (1) £3 2s. 3d., (2) £2 2s. 9d., (3) £5 1s. 10d., (4) 8s. 11½d., (5) £10 8s. 3d., (6) £7 5s. 3d., (7) £2 13s. 11d. Sutton Coldfield : (1) £3 3s. 0d., (2) £2 2s. 9d., (3) £5 1s. 4d., (4) 8s. 11½d., stages 5-7 as Holme Moss. Wenvoe : (1) £3 3s. 0d., (2) £1 19s. 0d., (3) £5 1s. 4d., (4) 8s. 11½d., stages 5-7 as Holme Moss. London : (1) £3 3s. 6d., (2) £2 1s. 10d., (3) £4 8s. 3d., (4) 8s. 7½d., stages 5-7 as Holme Moss. Kit of coloured sleeving and screened sleeving, 5s. Kit of unspecified bolts and nuts, 5/-.

Postage should be included on all orders under £2.

CATALOGUE No. 8.—54 pages, illustrated on fine art paper containing over 2,000 radio and television lines, 9d. post free.

SOUTHERN RADIO & ELECTRICAL SUPPLIES
85 FISHERTON STREET, SALISBURY, WILTS.
Telephone : Salisbury 2108.

PRACTICAL TELEVISION

& "TELEVISION TIMES"

Editor : F. J. CAMM

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

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

Vol. 3 No. 31 EVERY MONTH DECEMBER, 1952

Televiews

Adapting TV Circuits—A Warning

A FAIR percentage of the queries received by this and our companion journal *Practical Wireless* come from readers who, wishing to construct a piece of apparatus described therein, ask us to vary the design to suit the components they have on hand and which differ from those specified. In the case of radio receivers, providing the modifications are not too extensive, we are sometimes able to do this, although we are not, of course, able to guarantee that the results will be comparable to those obtained when the correct parts are used. It has always been part of our policy to insist upon the specified parts being used, and we have guaranteed our receivers to give the results we claim only on that understanding. Such a system also enables us rapidly to locate the cause of any trouble experienced by the reader. When other parts are used, diagnosis is more difficult. With ordinary radio, however, insistence on the use of the specified parts has not the same importance as with television receivers.

On many occasions we have warned our readers against trying to "mix" television circuits sponsored by different designers. When a television receiver is designed the component values are carefully balanced in relation to requirements of the circuit. By endeavouring to amalgamate a part of one circuit with a part of another, not only may the results be disappointing but there is also danger. In many cases it is extremely difficult to incorporate, say, the timebases from one design into another. It may be that such adaptation will merely result in the set not functioning and the only disadvantage is a waste of time. The reader who sets out in this way to create a television receiver from a patchwork circuit usually writes a letter to us asking for our assistance in putting the matter right. We can only suggest that he reverts to the original specification.

But, in other cases, there is a possibility of creating a very dangerous arrangement, and our attention was recently drawn to the attempt by a constructor to adapt the circuit given in our October issue for the use of wide angle components with a "View Master." *We wish very strongly to emphasise that the line output auto-transformer used in this circuit is a highly efficient component which will deliver up to 25 kV and, therefore, the utmost care is necessary to ensure that the H.T. rail voltage is not exceeded, that the circuit is used exactly as we presented it, that it is not modified for use with other published circuits employing the wide angle principle, and that the same timebases are used.*

In other words, our instructions are intended to apply to modifications of the "View Master" only and they must not be taken as applicable to any other receiver. You have been warned.

TV CONSTRUCTION INCREASING

IT is possible that to-day over 300,000 home constructed television receivers are being operated in homes which otherwise would be denied the benefits of this modern form of home entertainment. We are able to arrive at this figure by a careful analysis of the sale of components in relation to published designs. We have sponsored the "P.T. Receiver" for which we publish a booklet at 3s. 6d. and also the "Argus," both of which have been built in enormous numbers. We have also published a number of other designs by individual contributors and from queries we receive, of which a careful record is kept, we are able also to estimate the number of receivers which have been built. There are many other published designs which, although they may not be built in such large numbers as our own, add to the total.—F. J. C.

A "PERSONAL" TELEVISOR

BUILDING A PORTABLE RECEIVER WITH 3IN. TUBE FOR TESTING OR PERSONAL USE

By E. N. Bradley

(Continued from page 267, November issue)

THE omission of the V7 by-pass cathode resistor increases the already high output impedance of the stage, but an ordinary output transformer may be employed for satisfactory matching. C22 is optional for high note control, and will depend both on the requirements of the constructor and the transformer and speaker incorporated in the receiver. A suitable range of values is from 0.002 to 0.01 μF, chosen by trial if desired.

In the receiver's final form the mounting of the speaker must be in a position where its stray field will not influence the tube or distort the raster. It is generally satisfactory to mount the speaker in the side of the carrying case, towards the rear—the excellent shielding provided by the 3BP1 tube holder assists greatly in this respect.

The Power Supplies

For the sake of simplicity it was decided to employ half-wave rectification for the receiver and tube H.T. supplies, with direct connection to the mains, the valve and C.R. tube heaters being supplied from separate small heater transformers. It is necessary to isolate the tube heater supply source from the receiver valve supply source, since the tube cathode is made very negative with respect to the chassis. A transformer with two well-insulated secondaries could be used.

It will be seen that there are two mains switches, S1 and S2, Fig. 1. S1 controls the heaters of both receiver and C.R. tube, and should be switched on first. After 30 seconds or so S2 may be closed to apply H.T. to the circuits. This double switching is employed because selenium rectifiers are used—if a single switch controlled the whole circuit the H.T. supplies could build up to a high voltage before the valves and tube became conducting.

Several different methods of feeding the C.R. tube are possible the circuit shown in Fig. 1 being chosen since it was found desirable to feed the final anode of the tube from the decoupled H.T. supply to the frame timebase. This meant that for an adequate E.H.T. a negative supply must be provided, the Cockroft multiplier circuit made up of C40, Recs. 2 and 3, and C39 giving a negative supply of approximately 500 volts on load. The total potential across the C.R. tube is thus of the order of 650 volts, sufficient to give good brilliance although not, of course, permitting daylight viewing. Since the 3BP1 tube is well screened in its shielding hood this, however, is not important.

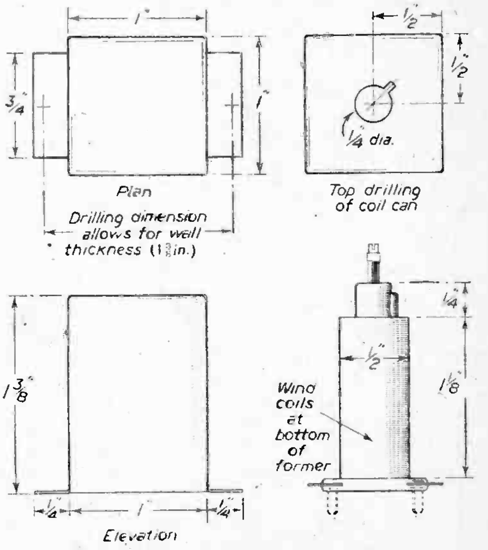
To obviate hum effects on the tube it is not sufficient to smooth the negative supply to earth—the smoothing must be returned to the positive receiver supply line, preferably by a high capacitance. Accordingly two 8 mfds capacitors are employed in series connection, C37 and C38, both components being shunted by a fairly high resistance to equalise their working potentials and minimise the risk of a breakdown. In conjunction with the negative smoothing resistor, R52, these capacitors give an E.H.T. circuit with an unusually long time constant and as a result picture drifting and similar effects often noticed with simple E.H.T. and supply circuits are entirely missing in this model. Shift voltages, always desirable when electrostatic tubes are employed, are also easily provided. Since the tube anode is returned to a point lower in potential than the receiver H.T. line it is sufficient to connect the two shift controls between the H.T. line and earth. Single shifts, rather than balanced shift voltages, are perfectly satisfactory since changes in the tube beam current produce negligible electrode voltage variations.

Vision signals are fed to the grid of the C.R. tube from the video amplifier via C11, which must have a suitable working voltage, and developed across the load of R44. D.C. restoration is necessary since the coupling is capacitive, and this is provided by a germanium rectifier, Rec. 4. It is probable that a suitable Westector or SenTerCel rectifier would serve as well.

In some areas it is possible that omitting D.C. restoration would improve the final picture. These areas would correspond with "fringe" areas in the case of a more comprehensive circuit, and would be those where due to a slightly low signal strength the picture is subject to some fading.

The majority of coupling components between the receiver and the C.R. tube are mounted at the tube base. C30, C31, C32 and C33, with R42 and R43, can all be so mounted. The tube heater transformer is also mounted apart from the chassis, requiring very little space in the cabinet or case in which the receiver is finally mounted.

C30 and C33 are by-pass capacitors which remove any line frequency potentials induced on the frame deflectors by crosstalk within the tube itself. Out of several 3BP1 tubes tested it was found that two operated better with the



Figs. 5 and 6.—Details of coil shield cans and coil former type.

slider of R45 also by-passed to the tube anode by 0.01 μF. 350 v.w. The inclusion of such a capacitor is, therefore, a matter for trial; when necessary it removes a trace of curvature from the line scan, best seen on test bars from a bar generator or signal generator test signal.

When employing other tubes than the 3BP1, with this circuit the scanning amplitudes provided from the time-bases may produce short, very wide pictures, or narrow, very high pictures. In such a case it is necessary only to turn the tube through 90 degrees, and to apply the line scan to the frame plates and vice versa.

In the case of the 3BP1 tube the frame scan is applied to electrodes Nos. 10 and 11, and the line scan to electrodes Nos. 7 and 8.

Constructing the Receiver

The chassis drilling dimensions for the "Personal" televisor are shown in Fig. 4, and this diagram, together with Fig. 8, showing the under-chassis wiring, bring out the majority of construction points. Considerable use is made of tagboards in the timebase circuits and power supplies.

So far as the vision R.F. strip is concerned it was found necessary to screen the coils, and the chosen method of doing this is illustrated in Figs. 5 and 6. Aladdin formers of the type shown in Fig. 6 were used for the coils, and it was found that these fitted well into 1in. square cans if the connecting tags were bent downwards as indicated by the dotted lines. Several 1in. square cans were to hand, taken from Weymouth coils of the K type, the cans being cut down from their original length to a height of 1⅝in. so that the coil connecting lugs protruded from the bottom of the can and through the 1in. circular holes shown in Fig. 4 into the under-chassis wiring space. Two opposite sides of each can must be left longer than the height of 1⅝in. by ¼in. to give two flanges for bending out and affixing to the chassis by a 6 B.A. bolt through each flange.

The coil former is secured within the can, and totally supported, by passing its neck through a ¼in. diameter hole drilled centrally in the top of the can (a small nick being filed to take the locating pip on the coil), a Spire nut then being pressed well down the coil former neck to grip both the coil and the top of the can.

Reference to Fig. 8 will show the coil former lugs to which the ends of each winding should be connected for greatest convenience.

To obtain a sharp rejection notch in the cathode sound trap this circuit, when fitted, must have a high Q and, at the same time, a fairly high capacitance and reasonably small coil to prevent instability and interaction. The trap in the original was therefore made of a 70 pF trimmer and a self-supporting air-wound coil of polystyrene-covered wire, the coil being connected directly across the trimmer. The combination is then supported rigidly below L2 by the cathode resistor and capacitor, R5, C6, on one side, and by a short stout lead to the lug of L2 on the other side. During preliminary tuning the trap should be shorted-out by a lead sweated directly across the contacts of C5.

A degree of shielding round the detector is generally useful in vision receivers, and can easily be provided in the present case by a bent strip of aluminium clamped below the cradle diode holder. Details of the strip are shown in Fig. 7. In the event of instability in a built-up receiver to this design (no feedback troubles were experienced in the prototype), it may be found beneficial to extend the shielding round the detector by cutting the metal strip longer and curving it to hood the EA50 almost completely.

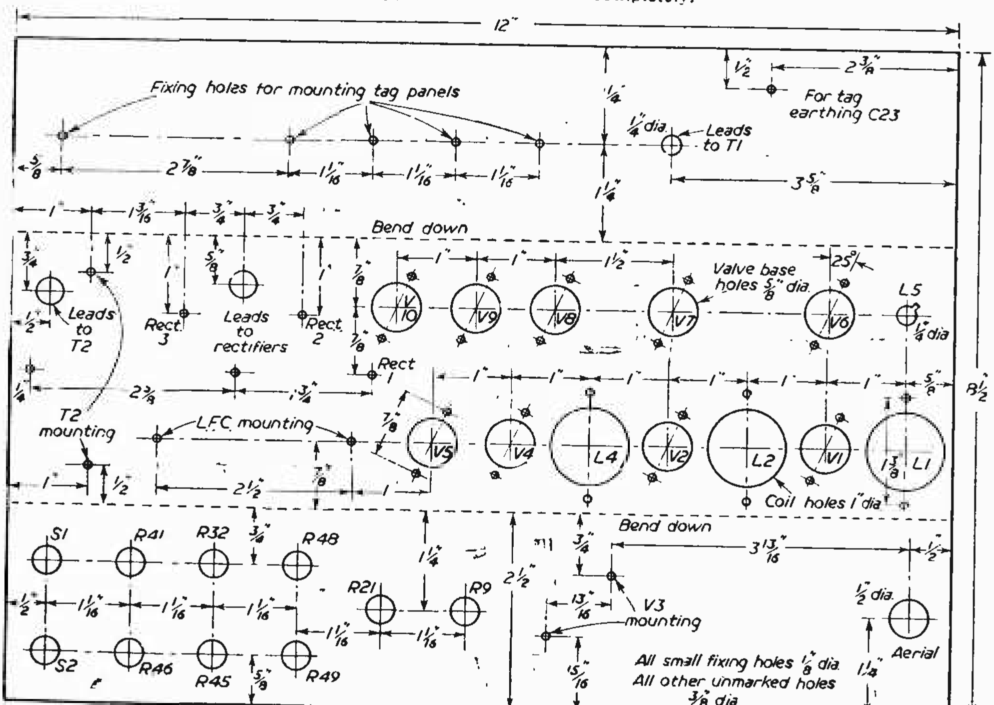


Fig. 4.—Chassis drilling diagram.

Mounting and Wiring

Construction commences by cutting, drilling and punching the chassis blank as shown in Fig. 4, the sides then being bent down to make front and back walls. Aluminium is the easiest metal to work, and a fairly stout gauge gives complete rigidity. 20 gauge and below is suitable. All components should then be mounted as shown in Fig. 8, including the wound coils in their screening cans, before wiring is commenced. It will generally be found best to mount the blank tagboards also, wiring these up with their components as the work proceeds; an iron with a fairly small bit is desirable and a rapidly-heating solder gun is by far the best implement.

The positioning of the valveholder pins can be seen from the wiring diagram in Fig. 8. Note that the valveholders without top screens are for the V8, V9 and V10 positions, screened components being used for the V1-V7 valves. Remember to insulate the aerial socket from the chassis by paxolin or polystyrene washers.

Besides the components mounted round the C.R. tube base, it will be found that one or two other capacitors are missing from the chassis view of Fig. 8 apart from the transformer, rectifiers and choke, which are obviously mounted on the chassis top deck. The missing components are C35 and C39, the two reservoir capacitors. It was found possible to mount these between the connecting lugs of their respective rectifiers and an earthed lug on the heater transformer, T2, so leaving extra room below the chassis for the other electrolytic rectifiers.

The rectifiers are all mounted on end, standing upright from the chassis. From the cooling point of view this is, unfortunately, the wrong method of mounting, but in actual fact the rectifiers run under easy conditions and there is no serious warming-up and but little heat for dissipation. The upright mounting, therefore, does no harm and has been tested for runs of several hours of the original receiver without any sign of stress. To assist the dissipation of valve heat it is worth while to paint the inside of each valve screen with matt black paint, leaving the exterior of the screen bright metal.

The five tagboards along the rear chassis wall are all five-way types, the central lug of each being the earthed mounting lug. C34 is supported between single-way and three-way tagboards, the three-way group also serving as the anchor for the mains lead. The single-way tagboard is of the tall variety, the end of the capacitor thus being well spaced from the underside of the chassis and convenient for the distribution of H.T. leads.

With all the main components mounted, the chassis may be supported at its ends, upside down, and the wiring carried out. Connecting up is best done in the usual sequence—first insert the complete heater wiring, pressing this well down on the under surface of the chassis, and follow on with all the earthed leads from each appropriate valveholder tag to the nearest earthing point. After this, complely wire each stage sequentially, commencing with stage 1, the first R.F. amplifier.

The power supply wiring may be treated as the final stage.

In Fig. 8 the output leads to the C.R. tube are shown as branching directly from the chassis for the sake of

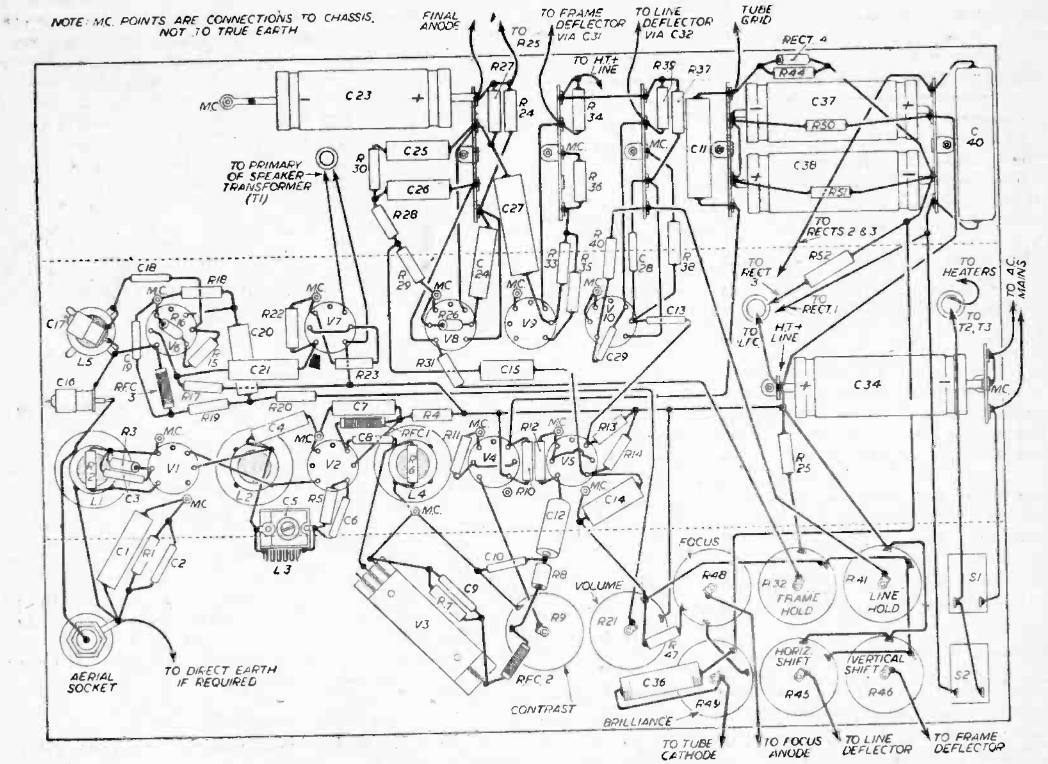


Fig. 8.—Under-chassis wiring.

clarity. Actually these leads should be gathered together rather in the form of a cable " harness " and brought along the underside of the chassis—plenty of room will be found along the chassis' central axis. Rubber-covered flex leads, preferably of different colours for ready identification, are ideal for these chassis-tube connections. The group of leads can be secured to the chassis by small clamps cut from scrap sheet metal, emerging at the rear of the chassis between the three-way tagboard and S1. These leads should be cut to length

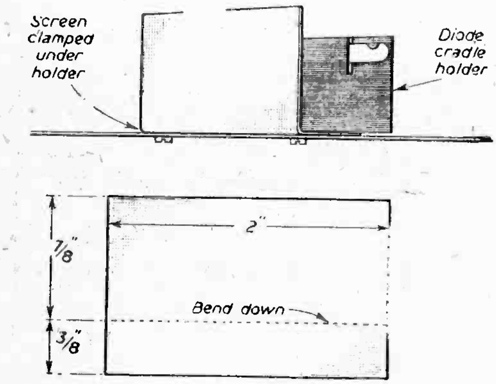


Fig. 7.—The detector screen.

only when the chassis and tube positions are finally established in the chosen case or cabinet of the televisor.

The dimensions and shape of the case can safely be left to individual requirements. For a portable receiver a narrow and tall case, with the tube mounted above the receiver chassis, is unquestionably the best arrangement, but for a small stand-by televisor in the home it is more pleasing to mount the tube alongside the chassis, thus giving a more squat cabinet shape. In each case it is both safe and satisfactory to mount the small speaker in the side of the case towards the rear to minimise as far as possible any likelihood of stray field interfering with the raster on the screen.

Testing and Aligning the Receiver

The original receiver had its tuned circuits prealigned against the grid-dip meter recently described in PRACTICAL TELEVISION, so that it was very near to correct tune when first switched on. If the constructor does not have such an instrument, it is a simple matter to align the receiver against an ordinary signal generator (covering the required frequencies directly or on harmonics) or on direct TV signals.

Before switching on, check the wiring throughout the receiver, then insert the valves. Ensure that the loudspeaker and C.R. tube are correctly coupled in.

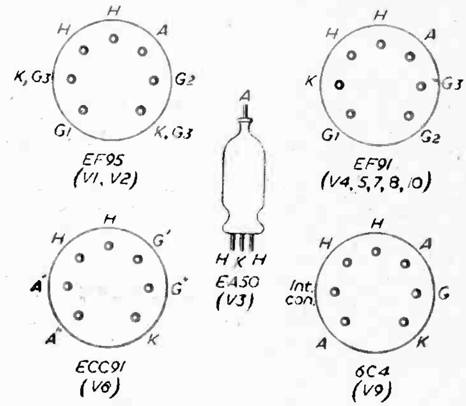


Fig. 9.—Valve-base data.

After switching on and allowing for the warming-up period, first adjust the sound receiver (the aerial, of course, should be plugged in whether the tuning is to be by TV or generator signals, generators being fed into a short length of wire to give sufficient pick-up. Under these circumstances the alignment should be carried out when the television programmes are off the air, so that there is no chance of interference with a neighbouring receiver). As a start employ the full capacitance of C16, set C17 about half in, and turn up R21 until the detector is on the verge of oscillation. Adjust the core of L5 until the signal is correctly tuned, backing off R21 for best results. If the signal is not heard, leave the core of L5 set halfway in the winding, and adjust C17 with a suitable trimming tool. Fine adjustments can then be carried out by further movement of the coil core.

(To be continued.)

Coil Data

All coils except L3 are wound on ¼in. diameter formers with iron-dust cores, using 30 S.W.G. D.S.C. copper wire. Slight variations in wire gauge are permissible and enamel-covered wire could be used—a variation of half a turn or so, on the figures quoted, might be found necessary with different wire sizes and insulation. All windings are closewound except that of L5, and are at the bottom of the former.

Coils for London and Holme Moss Channels

L1, 6 turns with 2 turns coupling loop spaced ⅛in. from main winding.

L2, L4, 6 turns.

Coils for Kirk o' Shotts and Sutton Coldfield Channels

L1, 5 turns with 1½ turns coupling loop spaced ⅛in. from main winding.

L2, L4, 5 turns.

Coils for Wenvoe Channel

L1, 4 turns with 1½ turns coupling loop spaced ⅛in from main winding.

L2, L4, 4½ turns.

When wound the coils may be waxed if desired with melted paraffin wax to secure the turns.

Sound Trap for all Channels

L3, 5 turns polystyrene-covered wire approx. 24 S.W.G. or below for rigidity. Coil wound on ⅜in. rod, expanding to diameter of ½in. when released and self-supporting. Turns closewound. No wax or cement to be used, and high Q necessary. Enamelled wire could be used, with turns very slightly separated.

Sound Tuner for all Channels

L5, 4 turns spaced own diameter, using 30 S.W.G. D.S.C. wire.

TELEVISED MAGIC

THE I.B.M. TACKLES THE PROBLEM OF PERFORMANCES BEFORE THE TELEVISION CAMERA

MAGICIANS from many countries in the world tackled national and international problems when they met in England at Hastings recently. The occasion was the Convention of the International Brotherhood of Magicians (British Ring) and they called in Marconi's Wireless Telegraph Co., Ltd., the pioneers of wireless, to help them with a new problem which has recently been added to their list of difficulties.

It has become a matter of great concern to the masters of prestidigitation that magicians' secrets are sometimes given away through the eye of a television camera. At this convention they were able to see for themselves the extraordinary amount of detail the cameras pick up, and it is hoped they will now be able to evolve special television techniques, particularly for close-up work.

The world of magicians is comparatively self-supporting. Delegates to this convention included bakers, butchers, fruiterers, cooks, doctors, dentists, hypnotists and even psychiatrists. Among the ranks of the amateur magicians can be found clergymen, politicians, house-furnishers, veterinary surgeons, farmers, printers, estate agents, chemists, publicans, tailors, grocers, jugglers and even fire-eaters.

Exposures

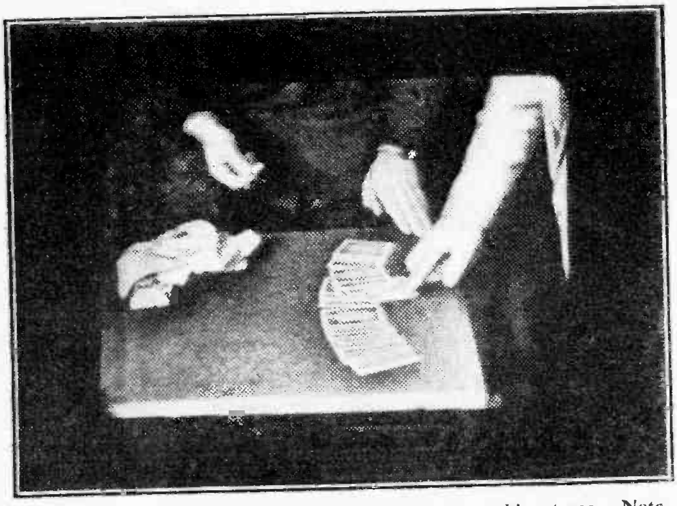
Despite the apparent self-support they are extremely worried about the many exposures which have recently been seen on television. For the first time in England they arranged this demonstration of magic mainly for study and the planning of what might be called an anti-television-exposure technique.

Marconi Image Orthicon cameras were used to show close-up magic to a much larger audience than could ever be accommodated around a small table, and it was expected that with this closed-circuit television chain—with an audience consisting entirely of magicians—faults could be seen, taken up and corrected.

Tricks, technique and other points of magic would then be discussed with a view to obviating exposure in the future.

The problems concerned rather the presentation of magic from a close-up point of view than the relay of a stage show in which larger illustrations may occur, although here, too, there are problems. Older viewers will remember that classic example of the "vanishing lady" who was seen to make her exit across the stage due to the producer allowing a camera to remain on too long. This is really a production or camera fault, and does not call for any change in normal magic technique. The stationary camera, on the other hand, not being distracted as is the eye by the magician's moves may easily note the palming of a card or some other point which, by misdirection, the magician is normally able to cover, and it is problems such as these which the magicians are hoping to overcome as a result of this convention. It is also hoped that as a result of the experiments some new principle may be evolved.

One of the performers as seen on the television screen.



The camera may reveal secrets which the eye would not see. Note, for instance, the unnatural position of the performer's left hand.

Civic Welcome

The Mayor and Mayoress of Hastings gave the magicians a civic welcome and the public were invited to join in watching many of the events both inside and in the open air.

One of the most colourful personalities attending was Maurice Fogel, who has baffled millions of people all over the world with his mind-reading. He has left the Press, public, and broadcasting circuits everywhere completely astounded by his feats.

New Type Television Coils

DETAILS OF THE BIFILAR METHOD AND ITS APPLICATION

By H. B. Schofield

WHETHER the new television receiver you are going to build is of the T.R.F. or superhet. variety, one thing is certain, coils of some type, irrespective of the general circuit layout, must be used.

From the early days of electro-magnetic wave propagation, right down to the present day of specialised developments, coils of all shapes and sizes have been progressively designed and used.

The ultimate in circuit and component design is perfection within the limits imposed by the standard of advancement reached in electronic research, and much of this has been the direct result of the time, patience and experiments of the radio amateur constructor well over two decades who, it can rightly be said, laid the foundations of the present vast industry.

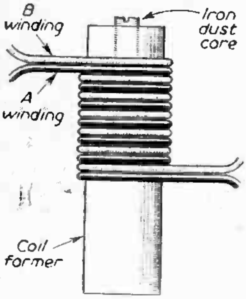


Fig. 3.—Details of a coil wound on the Bifilar principle.

The Bifilar method of coil winding, the subject of the present article, is by no means new, having been used for many years in certain types of laboratory apparatus, but it has not been employed in the lower frequency type of radio receiver, for the reason that no advantages over the ordinary standard methods would occur.

Having numerous advantages over other methods, the Bifilar-wound transformer is most excellently suited to the R.F. or I.F. stages of a television receiver, giving almost perfect 1/1 coupling. Transformers so wound act as a single conductor, having the same resonant characteristics as a single winding. Only one adjustment, by the usual method of varying the iron-dust core in the process of alignment, is necessary to resonate the primary and secondary circuits of the transformer.

Another advantage of great importance is the fact that no coupling capacitor is needed, the grid time constant being so extremely short that strong noise bursts cannot charge any coupling capacitor. The signal has a completely clear path, and there is no lowering of gain in the R.F. or I.F. stages due to blocking by noise for any interval after each burst.

Principles

In Fig. 1 the basic circuit of a conventional single tuned stagger type I.F. amplifier is shown, and it will be seen that each grid circuit is coupled by a capacitor and grid return resistor which results in an appreciable time constant.

Noise pulses of sufficient amplitude will cause grid current to flow in this type of circuit, developing a charge on the coupling capacitor which will maintain bias on the valve until it can leak off through the grid resistor. Bias so developed immediately lowers the stage gain until bias returns to normal after each noise pulse.

Severe noise will be sufficient to drive the valve to cut off, and will be accumulative in a three or four-stage amplifier, the last I.F. stage being extremely susceptible on account of the greatly increased amplitude of the noise pulses.

The effect as seen on the picture tube, when the video carrier frequency is being modulated by noise bursts towards the black level, is to produce white streaking across the picture which can build up to very objectionable proportions.

The employment of the Bifilar transformer eliminates all this, due, as previously explained, to virtually a zero time constant and the extremely low impedance in the amplifier grid circuits. At the same time, apart from the great advantages described, the 1/1 Bifilar coil has the same selectivity curve as the equivalent single tuned circuit, the same gain and bandwidth factors, and can be treated as such in the design of stagger tuned amplifiers.

Circuits

Fig. 2 shows a basic I.F. circuit using Bifilar wound transformers, the number of stages being left to the

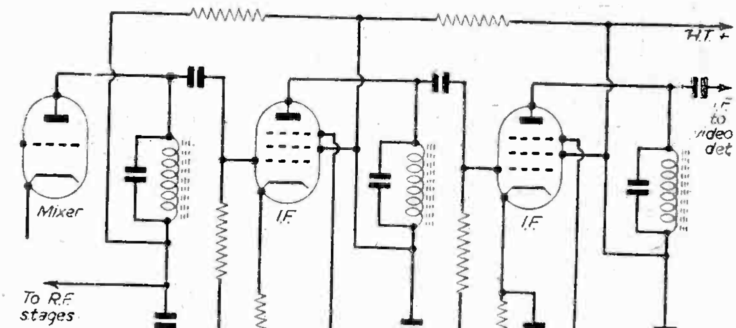


Fig. 1.—Basic single tuned stagger type amplifier.

requirements of the reader who will have his own ideas as to what type of valves to use, decoupling arrangements, etc., and general circuit.

The constructional details are really simple; the

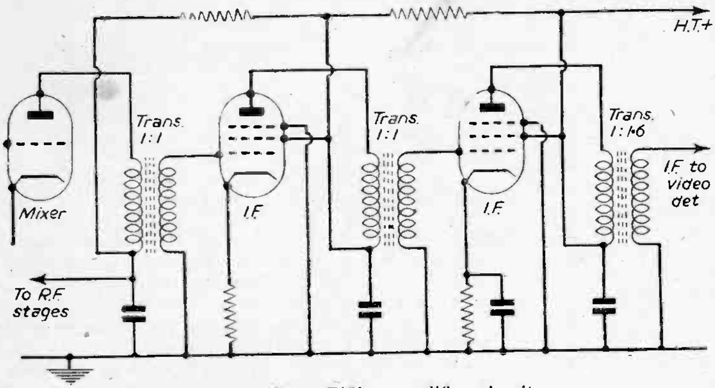


Fig. 2.—Basic Bifilar amplifier circuit.

first requirement to be observed by the constructor is the employment of wire with first-class insulation—nothing less will do. Wire with a first-class enamel coating, plus single silk covering is suitable, and it must be stressed that these requirements are kept in mind. The two windings are formed simultaneously, so that any turn on winding A (see Fig. 3) is adjacent to two turns on winding B, thus giving a very high degree of coupling between coils. When wound, the appearance of a Bifilar coil is exactly like a single layer wound coil, due to alternate turns of each separate winding lying next to each other in a single layer along the length of the coil former. The reader will now appreciate why it is necessary to have first-class insulation. As previously explained, the ideal Bifilar coil is one of 1/1 turn ratio, and any departure in the way of increase of turns ratio causes serious difficulty in approaching 100 per cent. coupling, apart from increased difficulty of winding, with one or two exceptions.

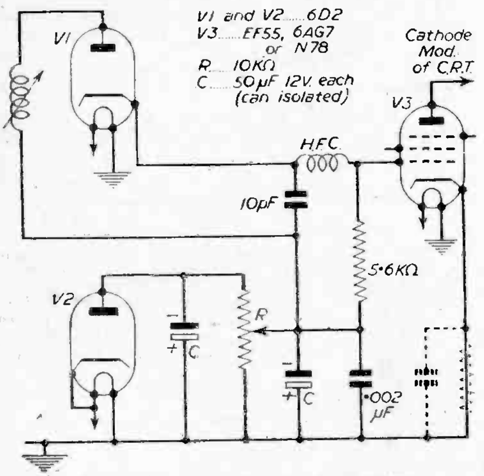
It would be an advantage in winding the Bifilar transformer feeding into the video diode to increase the turns ratio to 1/1.6, but, in winding the additional turns, care must be exercised so that there are no loose turns, and, what is important, the total number of turns should be divided so that they are equally dispersed and continue out from each end of the primary winding along the former. This arrangement, of course, is impedance matching and extra gain up to 35 per cent. may be obtained. The anode loading of a triode mixer is another position where the Bifilar coil of proper turns ratio can be employed to step up the anode impedance, and a fixed loading resistor used for circuit stability.

The writer understands that complete kits are shortly appearing on the market, comprising R.F. and I.F. stages, the I.F. stages being staggered from 17.5 Mc/s to 21.0 Mc/s, these values having been selected for stability, gain, channel interference, etc. In conclusion it is hoped that the experimenter and constructor may have a new avenue of interest in the application of the Bifilar principle of winding to their design problems.

Video Biasing

THIS subject has caused much thought amongst designers and various methods have been suggested so far, namely:

Biasing by a cathode resistor with small bypass condenser which emphasises higher frequencies and is too small to introduce phase distortion. This method



The circuit referred to in these notes.

sometimes includes a choke in the cathode circuit, also to emphasise the higher frequencies. The disadvantage with this method is that the omission of a normal sized bypass condenser introduces negative feedback.

Another method is to split the high-tension negative return and arrange to have tapped off a few volts which are applied negative to the grid. This has the disadvantage that the "various earths" are a few volts apart and considerable smoothing with enormous condensers is required to provide this voltage, and variations occur with the high-tension consumption.

Thirdly, there is the obvious method of using a grid-bias battery with or without potentiometer, but this is inherently disliked in a mains receiver.

Recently the writer came across a new and very simple method of obtaining this biasing. One-half of a double diode is used to rectify the 6-volt heater supply, and by means of the appropriate smoothing delivers a voltage suitable for biasing. This seems to have all the advantages in its favour, namely—common earth everywhere, bias voltage independent of H.T., full gain on the valve and no attempt at frequency correction in the cathode circuit. Alternatively, it would be possible to arrange a measure of frequency correction in the cathode circuit by putting a low value resistor and proportionate bypass condenser, as dotted in the diagram. In this design two resistors are used to give the potentiometer effect and thus a fixed voltage is delivered but, in the diagram this is substituted by a variable potentiometer which enables one to select the voltage to suit the size of the input signal, such that the synchronising signal is maintained satisfactorily. (G. T. Layton).

Two Low-noise Pre-amplifiers

CONSTRUCTIONAL DETAILS OF TWO UNITS USING TRIODE VALVES

By B. L. Morley

IT is generally accepted that pre-amps. using triode valves, and those designed on the grounded-grid mode generate less noise at V.H.F. than the standard type using R.F. pentodes, though their gain may not be as great.

The merits and drawbacks of this type of pre-amp. have been adequately discussed in previous issues of PRACTICAL TELEVISION ; here we offer some practical circuits for the experimenter so that he can decide for himself which type gives him the best results.

Grounded-grid Pre-amp.

Fig. 1 shows the circuit (coil details are given in the table). The valve used is a duo-triode and in the prototype a 6J6 was employed. The first half of the 6J6 acts

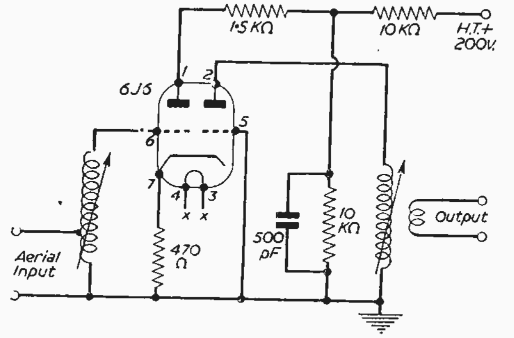


Fig. 1.—A simple grounded-grid amplifier circuit.

as a cathode follower, the output being developed across the cathode load resistor R4. The grid of the second half is earthed so that this section acts as a grounded-grid amplifier.

The circuit is quite simple and wiring is straightforward, the usual precautions adopted in V.H.F. circuits being employed, i.e., wiring as short as possible and grid and anode leads to be kept clear of each other.

Power supplies can be obtained from the same source as that of the normal televisor, the additional load being about 0.45 amps. at 6.3 volts for the heater and 17 mA at 250 volts for the H.T. supply. Alternatively, a separate power supply can be used employing a transformer of the type specially designed for pre-amps. and using a selenium rectifier. A suitable circuit is shown in Fig. 2.

It will probably be found that this circuit is unstable without the aerial connected, but it should settle down when properly loaded with an aerial and L1 adjusted for maximum stability. L2 is then adjusted for maximum signal and L1 finally adjusted for stability and to prevent regeneration.

If difficulty is experienced in stabilising the amplifier, then a reactive network can be included in the L1 circuit as shown in Fig. 3. C1 and C2 are 0-30pF. trimmers. L2 is adjusted for maximum signal and L1 is adjusted in conjunction with C1, C2 so as to obtain the best results. If the amplifier oscillates, increase C1 (or reduce C2) and retune L1. Unless care is taken the amplifier will become regenerative which, although it will increase the amplification, will decrease the bandwidth and spoil the quality of the picture.

It was not found necessary to neutralise though the experimenter can try this out if he desires.

Neutralised Triodes

When using triodes as R.F. amplifiers difficulty is experienced with instability due to the feedback path provided through the anode to grid capacity of the valve. It was this difficulty which resulted in the production of the screened grid valve.

As the demand for quieter valves increased designers have turned back to triodes and some of the old circuits used in the pre-screened-grid valve days have been employed. One of the methods in general use today is to neutralise the triode by feeding back externally to the grid a small voltage which is opposite in phase to that fed back internally in the valve due to the anode-grid capacitance. A small condenser can be used for this purpose and this method is used in the amplifier about to be described.

Triodes in push-pull are easier to neutralise than those in straight circuits due to the balanced arrangement of the circuit.

This circuit is shown in Fig. 4 and it will be seen that neutralising is effected by a variable condenser between each anode and grid. It is possible to obtain postage-stamp trimmers of approximately the value given in the ex-Govt. market, but failing this two short lengths of twisted wire can be used, undoing the twists to decrease the capacitance or increasing them to increase the capacitance.

Some patience is needed to set up the circuit but it should not prove too difficult ; the main thing to avoid is regeneration which, although it will materially increase the gain of the amplifier will narrow the bandwidth and spoil the quality of the picture.

When set up each neutralising condenser is adjusted so that the amplifier is stable, while L1 and L2 are adjusted for maximum gain.

Comparing Noise Levels

It is not necessary to have a table of complicated mathematical formulæ aided by a "guessing stick" (slide rule) to compare the noise level of different pre-amplifiers. From the practical point of view all that we are interested in is the result on the picture.

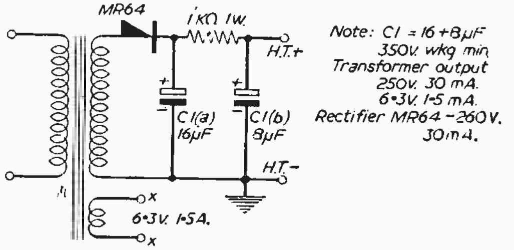


Fig. 2.—Power supply for an additional stage.

So far as the picture is concerned valve noise will show itself as specks of white on the screen covering the whole of the raster area. In bad cases it appears as though the scene being viewed was taking place in a violent snow storm, hence the popular term for the effect—snow !

The amount of snow will vary with the strength of the signal. The snow is actually the vision equivalent

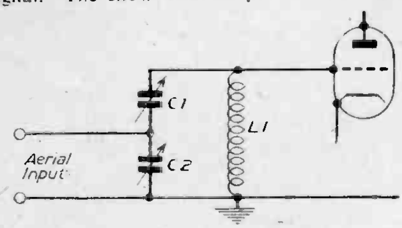


Fig. 3.—**Stabilising arrangement for the grid circuit.**

of the hissing sound heard on broadcast receivers, and as the overall gain is reduced due to an increase in signal strength, the level of the noise will fall below the level of the signal and no snow will be apparent.

It is the first R.F. stage in the receiver which is responsible for most of the noise and the object is to produce as high an amplification as possible with as low a valve noise, from this particular stage.

Generally speaking, the normal R.F. pentode provides a greater signal gain, but although the noise generated by the valve is greater than that generated by the grounded-grid circuit, the contrast control has to be set to a lower figure resulting in a moderate amount of noise.

On the other hand, if a grounded-grid pre-amp. with lower noise and lower gain is used, the contrast control will have to be increased and up will come the noise. It is possible, therefore, that a poorly-designed grounded-grid pre-amp. will produce as much snow on the screen as a well-designed R.F. pentode pre-amp.

The real secret of producing the best results is by accurate adjustment of the pre-amp., and when using neutralised triodes these adjustments are somewhat tricky, requiring patience to obtain the very best results.

When checking the performance of one pre-amp. against another with regard to the amount of snow produced, then the following method can be adopted.

It will be assumed that it is desired to check the performance of a triode pre-amp. against that of an R.F. pentode.

After the televisor and pre-amps. have thoroughly warmed up, reduce the contrast control to zero, turn up the brilliance control until the raster appears and then reduce it to the threshold position, i.e., to the point where the raster just disappears. It is assumed that both pre-amps. have been adjusted for maximum performance.

The pentode pre-amp. should now be connected to the televisor and the aerial plugged in. The contrast control should be adjusted until a picture of the normal shades of black and white are produced. This is best done on Test Card C or the tuning-in signal so that a standard is available for judging the effect on the screen. It is possible at this stage slightly to adjust the brilliance control so as to obtain the best tone gradations, but it should not be touched again.

In areas where fading is experienced it is possible for this feature to upset the comparison tests. A method of keeping a check on this is to insert a voltmeter across the cathode of the video valve, and to use Test Card C for the tests. When the aerial is connected directly to the televisor, the contrast control is adjusted until a usable reading is obtained on the voltmeter. This is the reference reading at that particular setting of the contrast control ; the position of the control is noted so that it can be readjusted to that setting.

Having obtained the best picture with the R.F. pentode the position of the contrast control is noted. A piece of paper marked off in degrees can be mounted temporarily at the back of the control and a temporary pointer fitted to the control so that its position can be accurately determined.

The next step is to disconnect the aerial and note the

TABLE

	Coil Turns			
	L1 Primary (or coil tap)	Secondary	L2	L3
London	2	7½	7	2½
Holme Moss ...	2	6½	6	2½
Kirk o' Shotts ...	1½	6	5½	1
Sutton Coldfield	1½	5½	5	1
Wenvoe	1	5	4½	1

Coil forms ⅜in. diameter, tuned iron-dust cores. Turns spacing 2mm. (approx.). 22 S.W.G. wire. L1 primary and L3 wound on top of L1 secondary and L2 respectively using insulated wire.

amount of snow on the screen. The contrast control should now be reduced until the snow just disappears and the amount of movement of the control required to attain this should be noted.

Now connect the triode pre-amp. to the televisor and connect the aerial to the pre-amp. The contrast control is now adjusted to produce a picture of the normal tones of black and white : the position of the control is noted and the aerial is disconnected and the amount of snow observed on the screen. The contrast control is once again reduced until the snow just disappears and the new position noted.

The results may be judged by comparing the movements of the control in both cases, for example, supposing in the first case the control had to be turned back 1in.

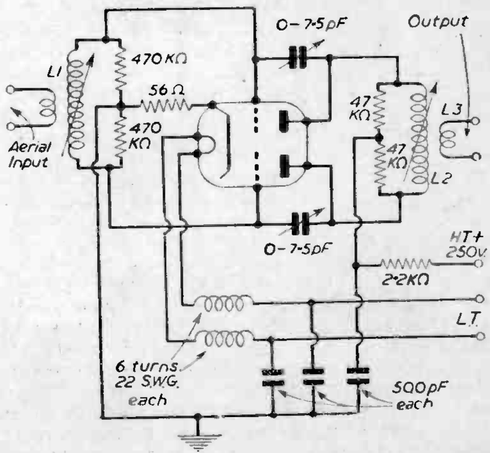


Fig. 4.—**A push-pull stage.**

and in the second case ½in., then the noise level of the first pre-amp. is twice as high as that of the second for the same amount of gain.

If the tests are being made in an area where fading is experienced then the reference level of the signal, when the aerial is connected directly to the televisor, should be taken in each case to ensure that the same amplitude of signal is being received for each test.

Should it so happen that the signal at the time of making the tests was so good that no snow was apparent on the screen when the aerial was removed, then the process can be worked in reverse and the contrast control, instead of being reduced to a point where the snow disappears, should be advanced to a point where the snow appears. If this is done in each case then a comparison between the two amplifiers can be made.

AMERICAN COMMENTARY

Public Benefits of Television

A REPORT BY THE HEAD OF R.C.A. LABORATORIES AT A RECENT ENGINEERING CENTENNIAL

VAST electronic knowledge accumulated in building television already has begun to vitalise many other fields of science for public benefit, Dr. E. W. Engstrom, vice-president in charge of R.C.A. Laboratories Division, declared recently at the Communications Symposium of the Centennial of Engineering.

"The techniques of television, although fairly well confined so far to television itself," Dr. Engstrom said, "have spilled over into radar design, into pictorial communications, into electron microscopy and have created new ideas in tubes and circuits. This process will surely gather further momentum."

Dr. Engstrom declared that just as television can nourish electronics and science as a whole, so will it become more and more a force to be considered in the social, cultural and political spheres.

Politics

"We can already see some of the future shapes that television broadcasting will take to enhance its services to the individual and the community," he continued. "At the moment, we are in the midst of pre-election fanfare which should not obscure the important fact that the American voter is getting a broad and close-at-hand picture and understanding of candidates, platforms and principles. He will more than ever before have a basis for his political convictions. He will know with more certainty just who will receive his approval and vote.

"Political contenders can now be screened by the voter to a degree never before possible. Not just the election process, but the whole workings of our form of government are going before the camera 'eye' of television for the scrutiny of the men and women of our country. Television should enable a revival of personalised democracy which, in simpler times, was attained through the town meeting or through public debate between candidates."

Dr. Engstrom expressed the belief that wider usage of television soon will be seen also in religious and educational activities.

The Church

"The church, which historically has employed such tools as the printing press and the visual and musical arts, will find great value in combining these proved media with television in order to spread its spiritual teachings," he said. "The natural conservatism of religious groups, particularly when confronted with a medium which, in its early stages, seems to bear the stamp of secular entertainment, is already being overcome. The church is finding a powerful and dignified instrumentality for sending religious services and discussion into the home.

Education

"And in education, we have only started. With the new channel allocations for educational television, this prospect should have a full chance to materialise. We may soon see evolve a pattern of adult education that surmounts evening classes and correspondence courses in convenience and effectiveness. Television courses can bring the blackboard, the laboratory, the art gallery, the library into the home with great efficiency, keeping much of the personalised treatment of the classroom."

Dr. Engstrom pointed out that with television becoming a part of virtually every American home, concern over the calibre of programmes is a healthy indication that large numbers of people want improvement in what they see.

"Whatever television broadcasting may lack in perfection to-day," he added, "is the responsibility of everyone involved, the broadcasters, the sponsors and the public. In the last analysis, the control of programming is in the hands of the American public. Theirs is the final say on the calibre and character of television broadcasting.

"I think we can see signs that all groups are aware of their responsibilities. The networks, for example, are striving to raise the standards of all kinds of presentations, by gradually increasing television's intellectual contribution through the content and techniques of their offerings. This applies to news coverage, to comedy shows, to drama, to any type of television presentation one can think of.

"We can expect, I think, a flow of new techniques in television broadcasting as the full versatility of the medium is understood and put to work. Signs of this are apparent, for example, in recent presentations of opera especially tailored for television or in dramatic programmes written and produced specifically for television. In television news roundups full advantage is taken of combined sight and sound to give a rounded and prompt picture of world events. Television news coverage, with its capability for immediacy and ubiquity makes each man his own reporter and provides a new dimension in modern journalism."

Looking ahead to international television, he said: "Modern transportation as applied to modern warfare has brought nations uncomfortably close together—it might be called a proximity that threatens destruction. With television, we have what I believe is a means to help counter this threat. It will enable a proximity that breeds understanding and friendliness between individuals. It will provide an interchange, heretofore unobtainable, of ideas and culture that may well hasten the day of a free and peaceful world."

CONSTRUCTOR AIDS

HINTS AND TIPS AND MAKESHIFT COMPONENTS FOR THE CONSTRUCTOR

By W. J. Delaney (G2FMY)

THE amateur who is continually building experimental receivers finds from time to time that he needs some piece of equipment or tool which is not available, and as a result has to make some kind of makeshift or improvised item. As a result he accumulates a large store of ideas which stand him in good stead, and, what is more, very often save him a large sum of money over the years. Ideas of this kind are often passed on to friends, but seldom find their way into print, and as a result the amateur who is making a single receiver, or is just entering the constructor field, finds things a little more difficult, and is often at a loss as to what to do next when he meets a problem. Some idea of what is indicated may be gained by the following hint which is now quite commonplace amongst service engineers, and, in fact, is often adopted in areas close to a transmitter by a dealer when installing a receiver on "appro." In such a case it is obviously unnecessary to erect a proper aerial, as the customer may decide he will not purchase a set after seeing two or three programmes. Alternatively, when called in to service a receiver which has gone wrong the service engineer may suspect a broken feeder or damaged aerial, and if it is night time it is not a simple matter to inspect the aerial. In these cases a temporary or makeshift aerial is called for, and nothing is simpler than to use a length of ordinary twin flex. At one end the two strands are separated for approximately half the length of a dipole for the station to be received, and opened out and fixed to the wall vertically with drawing-pins near the receiver. Alternatively, the top may be held against a picture rail by a picture hanger, the picture itself being used to provide the necessary weight to maintain the wire in position. The untwisted portion of flex is then taken away from the hanging wire at right angles to the aerial sockets on the receiver, connecting the two ends to the two sockets of a twin-feeder input, and one to chassis and one to the inner socket in the case of a coaxial plug. The two ends should be reversed to find the most suitable way round. On one occasion I required a temporary aerial and had no available flex, but a floor standard lamp was brought over to the set, the mains plug removed from the end and the two ends connected to the set, the vertical wire up the lamp standard providing a most satisfactory dipole in the particular locality, and very definitely confirmed a diagnosis of a broken aerial feeder.

E.H.T. Measurements

Another hint which has been well known to servicemen for a long time is one used to check E.H.T. in a faulty receiver. Theoretically, an electrostatic meter must be used, and until the recent advent of the Kilovolter these were expensive instruments. The latter instrument operates almost in the same manner as that which many servicemen still use, namely, the drawing of an arc by placing a metal object on the picture-tube anode and withdrawing the object slowly. A word of warning must be uttered here. The E.H.T. may be at small current rating, and may be generated in such a manner that it will cease if touched with the hand, etc., but it can give a very nasty jolt, and, therefore, this test should only be carried out with a screwdriver of the type having a long blade and a well-insulated handle, which should be held at the very end remote from the blade, whilst the other hand is kept in the trousers pocket! With experience, the serviceman can judge to a very narrow margin the approximate value of the E.H.T., and with experience of different receivers may quickly ascertain whether or not that part of the circuit is faulty.

Coil Former

In experimental equipment a coil may be required for a test and it may be found that there is no coil former handy. A dodge which has been found very handy here calls for the use of the wide brown paper gummed-strip. If none of this is handy a flap may be cut from a large envelope. A piece of newspaper is wrapped once round a fountain-pen or similar size rod, and round this is placed a length of the gummed strip, gum outwards. It is well moistened and the required number of turns wound on, not too tightly. Left to dry, which only takes a short while, the coil may be slipped off the pen, the inner piece of paper permitting this, and the coil will be found self-supporting and quite firm enough to enable it to be placed in a receiver for temporary use. The wire should, of course, be of the cotton- or silk-covered type to enable the gum to hold the turns securely. There are lots of other uses for this strip which may be rolled into tubes to carry leads as well as to anchor other components for temporary positioning, etc.

Condensers

There are very few other components which lend themselves to improvisation, except perhaps the very small capacitors used in modern television receivers. For instance, it is quite a common practice to feed the sound section of a straight receiver from one of the R.F. stages through a very small condenser, say 2 to 5 pF. It is unlikely that such a condenser would break down, but it may be necessary to try taking the sound input from some other part of the receiver, and instead of removing the condenser and transferring it, a suitable makeshift may be provided by means of two very short lengths of wire covered with insulated sleeving. The wires are twisted together, the degree of twist and the tightness of it regulating the capacity. It will serve to show whether the proposed modification is worth while or not. The two wires must, of course, not be permitted to come into electrical contact with each other. Such an improvised condenser may be joined across a coil to alter its tuning range, or used as a bypass if it is thought that some R.F. is present where it is not wanted.

Whilst on the subject of tuning, it is also worth while remembering that if it is found that a particular circuit is open to doubt, and an experimental coil is being used with an iron core, its range may be shifted in the opposite direction by replacing the iron core by one of brass. It is not necessary to have one with the correct thread; simply remove the iron core and place into the coil former any length of brass rod—a long bolt or screw, etc., will serve to show whether any improvement is effected and thus indicate whether the coil needs modification. Perhaps other experimenters have similar ideas which they would like to pass on to readers.

PICTURE TUBE REJUVENATION

OBTAINING A NEW LEASE OF LIFE FROM DEFECTIVE C.R. TUBES

By Edwin N. Bradley

PROBABLY the most mournful and distasteful task in the servicing of one's own televisor is the discarding of a picture tube for loss of brilliance after a hard life. The present price of tubes makes it necessary to retain these components just as long as possible and, providing that there are no structural or electrical failures, it is generally a rather dim screen that receives its quietus from the thrust of a crowbar.

In many cases this state of affairs can be alleviated and the life of the picture tube prolonged by what is known as "rejuvenation"—treatment by means of which the cathode of the tube is persuaded to increase its emission, where loss of brilliance of the picture is due to a reduction in emission. It will be clear that such treatment can do nothing to improve tubes which have gone soft, tubes in which the screen has deteriorated, or tubes in which defects such as enlarged gun apertures due to poorly aligned ion traps have arisen, but even so, cathode rejuvenation will give a very distinct improvement in the picture, and extend the life of a tube for a considerable time, in between 50 per cent. and 85 per cent. of old tubes so treated.

Rejuvenation is nothing new, for patents dealing with rejuvenation principles were being granted in 1926. Two basic methods are available, one a true rejuvenation process and the other a "brightening" process. Both are popular in the United States, where "Briteners" (sic) in particular are enjoying a steady sale.

Cathodes are commonly formed of nickel alloy cylinders coated with an electron emitting chemical —barium and strontium oxide coatings are best. The coating is made in the form of barium carbonate or strontium carbonate, the carbonate coating then being activated by the process of heating the coating to about 1,500 deg. absolute whilst the cathode has about 150 volts applied through a protecting resistor. Under these conditions the carbonates are thermally reduced to oxides and the oxide coating is bombarded by high energy ions; as a result the coating and cathode become highly emissive and normal operation can proceed at cathode temperatures of the order of 1,000 deg. absolute. Different manufacturers' processes naturally contain various refinements and additions.

Throughout its life the cathode deteriorates. It may be over-worked or incorrectly energised (by too high or too low a heater voltage) or the oxide coating may be contaminated by occluded gases in the tube—under normal working conditions the outer oxide coating of the cathode evaporates and is replaced by oxide from deeper layers; contamination can occur when evaporation is more rapid than replacement. Electrons are then emitted less freely, the beam current falls and the picture on the face of the tube becomes progressively dimmer.

The Simplest Method

The simplest method of obtaining at least a further measure of life from the tube is to increase the cathode temperature so that electrons can escape more readily; this is obviously achieved by supplying the tube heater with more than its rated voltage, an increase of 25 per cent. or so being usual. It might seem that this would lead merely to rapid burning-out of the heater but in practice this rarely happens, heaters being conservatively rated since they are employed in the first instance to raise the cathode temperature for the original activation of the carbonate coating. "Briteners" as sold in the United States usually consist of a small transformer supported in leads or in a plug-in base. The connecting socket of the televisor is removed from the base of the picture tube (which need not be disturbed or taken from the receiver) and the transformer assembly is plugged into this socket instead. A socket connected to the transformer assembly is slipped on to the tube pins, and in a surprising number of cases a dim, practically worthless tube is able to give months of extra service. The beauty of any rejuvenation system is that whatever the result may be, nothing is lost (if the rejuvenator is built up from the spares box). If the tube responds to treatment it may give a further three, six or even nine months service—if it fails to respond or if the heater does burn out (very rarely) a new tube will be required in any case.

A brightener may be either an auto-wound transformer, accepting heater power from the receiver from the original tube heater circuit and transforming this up to the higher voltage, or a two-winding transformer may be employed, the primary being fed from the mains and the secondary supplying the new heater voltage. In this case it is sometimes possible to overcome the effects of a cathode-heater insulation breakdown since the use of a two-winding transformer means that the heater and cathode can be strapped.

Rejuvenation

One deciding factor on the system to be used is whether the televisor is an A.C. only or an A.C./D.C. model—in the latter case an auto-transformer may not be used and a two-winding transformer can be employed only

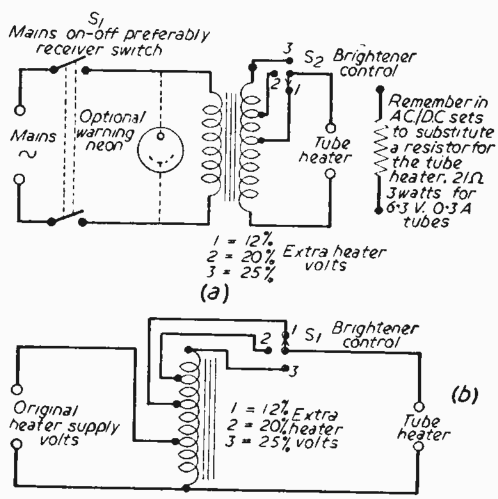


Fig. 1.—A two-winding brightener at (a), and an auto-transformer brightener at (b).

when the receiver is supplied from A.C. mains. If the set is fed with D.C. it is impracticable to build a brightener, and a rejuvenation process proper must be tried. When the picture tube forms part of the heater chain in an A.C./D.C. receiver an equivalent resistance must be wired in as a substitute for the tube heater, and some form of switching for two-winding transformers must be devised. In the majority of cases it will be possible to wire the transformer primary to the mains switch in the receiver ; if this is not possible, or not desirable, a warning neon or a similar device should be connected across the transformer primary as a reminder that this must be switched off as well as the main receiver switch. The ideal solution is, unfortunately, rather difficult for the home constructor to arrange. This consists of a heater operating a thermal switch, the heater being of the correct resistance to substitute in the A.C./D.C. heater chain for the picture tube heater. The heater thus comes up to temperature when the televisor is switched on, and then operates the thermal switch which connects the primary of the new heater transformer to the mains.

Circuits

The circuits of transformer type brighteners are shown in Fig. 1, and it will be seen that in each case three heater taps are made available. This is in order that brightening may be progressive—when the tube first loses brilliance to a marked degree the brightener is put into circuit and the heater supplied from the first tap, which

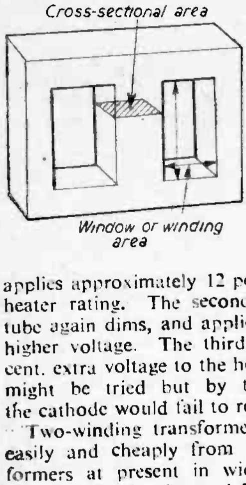


Fig. 2.—Transformer core showing the cross-sectional area and window.

applies approximately 12 per cent. extra voltage over the heater rating. The second tap can be used when the tube again dims, and applies 20 per cent. approximately higher voltage. The third tap supplies the full 25 per cent. extra voltage to the heater—still higher percentages might be tried but by that time it is probable that the cathode would fail to respond to further brightening.

Two-winding transformers may be constructed most easily and cheaply from the small-sized heater transformers at present in wide supply, rated to give an output of 6.3 volts at 1.5 amps. For the majority of tubes the basic heater rating is 6.3 volts at 0.3 or 0.6 amp., so that the existing secondary winding on a small heater transformer can be stripped off and a winding of thinner wire put on. (Choose for this purpose a heater transformer with the secondary winding on top of the primary, and ensure that there is perfect insulation between the windings when the secondary is re-made.) Count the turns taken off the secondary and to find the number of turns per volt divide by 6.3 or, if this fails, to give a round number or at least a simple fraction, divide by 6.5. (The majority of small transformers have an extra turn or two to allow for a voltage drop on load.) If any doubt exists a test winding can be put on, loaded by about 10 ohms, and the voltage across the winding measured by an A.C. voltmeter.

Using thinner wire than that removed, carefully wind on the new winding to give the three suggested heater voltages (basic rating plus 12 per cent., 20 per cent. and 25 per cent.). For 6.3 volt tubes the final voltages should be 7.0, 7.5 and 8.0 volts. Suitable wire is chosen by reference to wire tables—for 0.3 amp. tubes 24 s.w.g. wire, and for 0.6 amp. tubes 22 s.w.g. wire will serve at current density ratings of 1,000 amps. per square inch. If the winding space appears too small for these gauges it may be presumed that the transformer was designed to operate at current density ratings of 2,000 amps. per square inch when gauges of 28 s.w.g. and 24 s.w.g. may be used for 0.3 and 0.6 amp. heaters respectively.

Enamelled wire should be employed and tappings must be made with care. Good rubber-covered flex of thin diameter should be chosen for the tapping leads and the soldered joints where the taps contact the windings must be made neat and smooth, with no more enamel removed than is necessary. The joints must be perfectly insulated.

Winding Data

If it is desired to employ the auto-transformer type of brightener this may be wound up on any small core such as the stampings from an output transformer, since only between 2 and 5 watts approximately have to be handled. A former may be constructed from card or fibre, if one is not to hand with the transformer core, and the windings may be calculated from the simplified formula

$$N = \frac{5.6}{A}$$

where N is the number of turns per volt and A is the cross-section area of the centre leg of the transformer core (i.e. the leg round which the windings are to be placed). Thus if a core with a cross-section area of 1 sq. in. is used it will require 5.6 turns per volt (A is measured in square inches), and cores of lesser dimension will require more turns per volt.

For 6.3 volt tubes the previously mentioned voltages of 7, 7.5 and 8 volts will be required, so that the whole winding will give 8 volts, the lower voltages being taken from taps. Remember that there must also be a 6.3 volts tap into which the original heater supply of the tube is fed.

For the best possible efficiency and regulation the winding space of the transformer core should be full of wire—this will also mean that the thickest possible wire is used. The wire gauge should therefore be chosen from wire tables with reference to the size of the "window" (Fig. 2) and the number of turns of wire

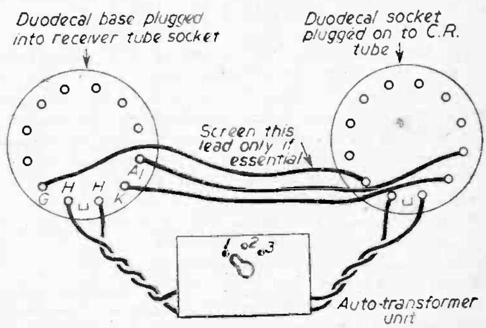


Fig. 3.—Typical arrangement of brightener unit.

per square inch. Allowance must be made for the dimensions of the former.

Before the writer is the core of a miniature output transformer, and it may be of help to the constructor to run through the calculations which show how this might be used for a brightener auto-transformer for 6.3 volts tubes. The cross-sectional area of the core is

$$\frac{3}{8} \times \frac{7}{16} = \frac{42}{256} \text{ sq. in.}$$

Therefore the turns per volt may be taken as

$$N = \frac{5.6}{\frac{42}{256}}$$

which simplifies to

$$N = \frac{5.6 \times 256}{42} = 35 \text{ turns per volt.}$$

The area of the window is $\frac{3}{8} \times \frac{5}{8}$ in., and allowing for a thin walled former this must be reduced to

$$\frac{5}{16} \times \frac{9}{16} = \frac{45}{256} \text{ sq. in.}$$

Thus the full winding, which is 35 × 8 turns, or 280 turns must be contained within this area and the wire chosen must be of a size such that in 1 sq. in.

$$280 \times \frac{1}{\frac{45}{256}} \text{ turns are contained.}$$

This simplifies to

$$280 \times \frac{256}{45} \text{ turns per sq. in.}$$

$$= 1{,}593, \text{ say } 1{,}600 \text{ turns per sq. in.}$$

Reference to wire tables shows that 24 s.w.g. enamelled wire can be wound with 1,794 turns per inch. This gives some small margin for bad winding, the affixing of tapping leads, etc., and with very careful winding this wire gauge could be employed—using 25 or 26 s.w.g. enamelled wire would enable the 280 turns to be wound on with little difficulty. No allowance has been made for copper and iron losses, however, so that this transformer could handle only small currents—it should serve for an 0.3 amp. tube. Larger cores would be preferable—with an increase in window space and a reduction in the number of turns per volt it would be possible to employ rubber-covered flex for the winding.

An ordinary output transformer has all the E and all the I laminations grouped together to give the effect of a gapped core. For use as an auto-transformer core the E's and I's should be interleaved, preferably one by one and at least in several groups.

If a small auto-transformer is made it may be suspended in the wiring or assembled as a very small unit—two winding or other, larger transformers should be supported inside the receiver cabinet. It is important to keep the video signal lead as short as possible, and to achieve this it is worth while to unsolder the heater leads from the picture tube socket, leaving the rest of the leads untouched, should it not be possible to support the transformer in the leads. If a supported unit is employed it should be fitted and wired as shown in Fig. 3, using an old tube base as a plug which fits into the present receiver tube socket. The socket fitted to the brightener unit then plugs on to the tube. As already explained, commence the brightening process by employing the lowest of the three output voltages.

When the picture tube is finally replaced remove the brightener unit and store it until such time as it is again required. Do not touch the tube socket, base, or other circuits, until the televisor is switched off and the mains plug removed from the wall socket.

In connection with the use of new tubes it is noteworthy that there is as much as a 50 per cent. drop in brilliance in the first 100 hours of operation. To counter

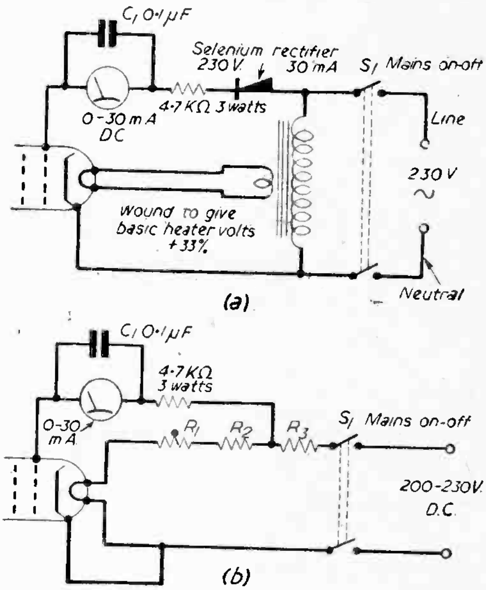


Fig. 4 (a).—**Rejuvenator for A.C. supplies. (b) for D.C. supplies. Here, for 0.3A tubes R1 = CZ6 Brimistor, and R2, 3 are 260 Ω 50 W each. For 0.6 A tubes R1 = CZ4 Brimistor and R2, 3 are 130Ω90 W each.**

this some American brighteners have a low voltage tap, giving a reduction of 10 per cent. or so to the normal heater voltage, this tap being used for some time until brilliance requires boosting. It is only correct to state that such practice is contrary to manufacturer's recommendations. Increasing the tube heater voltage at the end of the tube's life is one thing; running a new tube outside its ratings cannot be approved and such a device can only be advised for use in an area where mains voltages are high and cannot be reduced sufficiently to being the normal heater voltage to the correct level.

In rejuvenation proper, as distinct from brightening, the generally accepted method would appear to be the application of one and one-half times the normal heater voltage to the heater for one minute or so, with low voltages applied to the tube electrodes, the tube then being aged for two or three hours at normal heater voltage with no electrode voltages applied. Probably more satisfactory from the constructor's point of view is a method whereby the heater voltage is increased by 33 per cent. and the tube "cooked" for a time with approximately 100 volts applied between the cathode and the control grid. The cathode temperature is thus raised both by the increased heater voltage and current and also by a relatively heavy current between it and the grid, the net result being the boiling off of the old oxide surface and the exposure of a new surface (or the bringing of fresh oxides up to the surface). Visual control by meter is obtained.

The circuit for this type of rejuvenation is shown in Fig. 4, for both A.C. and D.C. supplies. In Fig. 4a, for A.C. operation, a heater transformer is rewound to give 33 per cent. extra heater voltage—in the case of 6.3 volt tubes the transformer must give 8.5 volts at 0.4 or 0.8 amp. for 0.3 and 0.6 amp. heaters, respectively. The ordinary heater transformer already mentioned can easily be rewound for this purpose, a slightly thinner secondary wire being wound on so that the extra turns can be accommodated. Count the number of turns removed from the 6.3 volts secondary and multiply by 1.35 to obtain the number of turns required in the new winding.

Half-wave rectification direct from the mains side of the heater transformer is employed so that the circuit must be handled with care. It must not be directly earthed, or wired so that it can be touched accidently. The use of a rectifier with no reservoir capacitor drops the D.C. output to roughly half the A.C. input, and no elaborate smoothing is required. C1 is necessary to prevent meter flicker and the value of 0.5 μF. may need some variation with different meters—it will be sufficient with moving iron instruments which are quite satisfactory for this application, but it may have to be increased where moving-coil instruments are employed.

In Fig. 4b is the circuit adapted for D.C. mains operation, the tube heater being fed via a dropping resistor with Brimistor protection. (This must be regarded as essential ; if the appropriate Brimistor is not fitted the heater may be burnt out.) The positive feed to the tube control grid is tapped up the dropper chain, and only a small meter by-pass will be required unless there is considerable hum on the D.C.

Chief Disadvantage

The chief disadvantage in the D.C. circuit is the necessarily high wattage ratings of the dropping resistors, which must supply 0.4 amp. to an 0.3 amp. tube and 0.8 amp. to an 0.6 amp. tube. These resistors, together with the Brimistor (which must be mounted by its leads, these being left at their full length and not trimmed) should be well ventilated, and not boxed in.

For greatest convenience either type of rejuvenator may have its output leads taken to a suitable picture tube socket so that tubes may be treated without being removed from the receiver cabinet. Switch off the televisor and remove the mains plug from the wall socket, then remove the wired socket from the base of the tube and plug on the rejuvenator socket instead. Connect the rejuvenator to the appropriate mains supply and switch on, watching the meter as the tube comes up to operating temperature. If the instrument pointer rises up the scale to a fair reading —10 mAs. or more—within a minute or so of switching on then the tube condition is one which rejuvenation cannot help—the screen has deteriorated, or the tube is, perhaps, gassy. If the meter reading is low, or if the pointer stays at zero, leave the rejuvenator switched on and keep a watch on the meter. A gradual rise in the current indicated shows that the cathode is responding to treatment, and rejuvenation should continue until the indicated current has risen to a final level and held at that reading for a short space of time. With some tubes the treatment may be completed within a space of minutes, with other tubes it may be worthwhile to continue the rejuvenation for an hour or so. The tube could then be run for an hour with normal heater voltage applied and with no voltages on the cathode, grid and anode, but usually the tube is put straight back into service. This type of rejuvenation is not always successful, or, if successful, the extra tube life gained may not be great before a further treatment is required, but every extra hour's run is pure gain and so worth having.

Throughout the examples, chief mention has been made of 6.3 volt 0.3 and 0.6 amp. cathode ray tubes with duodecal bases. Naturally this does not mean that other types of tube, such as the 2, 4, 7.3, 10.5, 11.5 and 13.3 volt heater types cannot be treated. It only remains with all these various heater ratings to increase the voltages by the percentages stated (an approximation to the nearest half volt is sufficient) for brightening or rejuvenation—in the case of a D.C. mains rejuvenator increase the rated current by 33 per cent. rather than the voltage when calculating the dropper resistances.

Pictures by Wireless

WHEN Her Majesty the Queen visited mid-Wales recently, to open the new Birmingham Corporation dam at Claerwen, Press photographs were sent from Llanrhayader over the normal telephone lines. When the Royal party arrived at the dam, however, they were in the heart of the mountains and some 14 miles away from the nearest G.P.O. line. To lay a special line over the rugged terrain for only one day would have been most uneconomical, so engineers of Marconi's Wireless Telegraph Co., Ltd., installed and worked a very high frequency wireless link over which pictures were sent to Llandrindod Wells and hooked up to the normal telephone line for transmission to the "Birmingham Mail" and then simultaneously by wire to the "Liverpool Daily Post."

At an early stage in the arrangements to cover this big event, it was realised that once Her Majesty left Llandrindod Wells and started the ascent to the dam it would not be possible to continue sending pictures back to Birmingham and Liverpool. It looked impossible at first to keep up a constant picture service until, through their Birmingham agents, Marconi's were asked to link the dam and the nearest telephone line by wireless.

A Marconi survey and demonstration team—such teams travel all over the world testing areas and advising on installations—went to Llandrindod and considered the problem. Fully conversant with the difficulties of setting up communication networks in difficult terrain, they then had to prepare to send pictures by means of a wireless link using their normal V.H.F. equipment.

The country separating Claerwen and Llandrindod Wells is mountainous, rugged, rising to 1,500ft. at the summit of Craig Fawr, overlooking the dam. It seemed, at first, that the team would be able to make a direct link between the dam and Llandrindod, but tests showed interference from the mass of Craig Fawr. The alternative scheme was then tried out, using the top of Craig Fawr as the site for a repeater station. Tests were made with walkie-talkies and others in and around Llandrindod. It was found that the ideal site for reception was on the golf course 500ft. above the town, directly in line-of-sight with Craig Fawr.

The team called on the assistance of a local farmer, Mr. T. C. Edwards, of Cerrigcwplan, Claerwen Valley, who carried up the collapsible masts and equipment in his tractor.

At the receiving end of the link on the Llandrindod golf course the picture was received and sent over a small land line to the near-by Cairn Tea Rooms who had kindly offered to let the "Birmingham Mail" use their normal telephone line to the town about 2 to 2½ miles away where it was connected to the G.P.O. telephone line and thence to Birmingham.

The Film in Television

By Philip H. Dorté, O.B.E., A.M.I.E.E.

A paper read by the Head of BBC Television Films to the Kinematograph Group of the Royal Photographic Society of Great Britain

IT was almost exactly four years ago that I last had the honour of reading a paper to this distinguished Society. The occasion was the Western Conference at Bristol in February, 1948, the title of the paper was "Television Production" (*V. Phot. J.*, 88A, 184) and my own title at that time was "Head of Television Outside Broadcasts and Films." The billing for tonight's lecture correctly describes me merely as "Head of Television Films" and this provides, I suggest, fair comment on the growth of Television in the last four years. For, as little as eighteen months after that Bristol meeting, it became clear that both Television Outside Broadcasts and Television Films were expanding at such a rate that it would be difficult for one man to continue satisfactorily to control both, and I was faced with making the decision as to which I would hand over to somebody else's care.

It was not an easy decision to make. From the time of the very first Outside Broadcast (that of the Coronation of King George VI in May, 1937), Outside Broadcasts were obviously destined to be the life blood of any and every serious television broadcasting system —to be the means whereby the world outside the artificialities of the television studios could be brought into the home in picture and in sound, so that events public and private, great and small, could be seen *as they were happening* by as many people as could crowd round the few thousand television receivers of 1937, the 1½ million receivers of Britain today and the many million receivers of tomorrow.

The BBC's Television Outside Broadcasts Department has covered almost every accepted sport (including the Olympic Games) and every type of event in the ceremonial calendar. In 1950 it relayed a programme across the Straits of Dover from Calais, and it plans to stage a series of Outside Broadcasts from Paris during the French National week in July, 1952. There is more than a strong rumour that American television intends next year to equip half-a-dozen multi-engined air liners with television relay equipment and, by orbiting them each some 500 miles from the other high above the Atlantic, to televise direct to the United States the Coronation of Queen Elizabeth II in London. But the fact remains that the majority of broadcasts such as these must, for a very long time to come, be classified as exceptional, even if not as stunts, and it follows therefore that for many years at least, television reporting of international events (and, to a considerable extent, the interchanging of television programmes between nations that are not adjacent) will, *faute de mieux*, have in the main to be by film.

The belief that it will not necessarily remain the sort of film which is largely used today and that there is thus a great deal of development work to be done in this field of "Film for Television," doubtless influenced my final decision to hand over Outside Broadcasts and to retain the charge of Films. It is also probably the justification for your having so kindly asked me to read this paper here tonight. But before talking about the future, I would like to review how film is being used in television today and, to illustrate what I have to say, I shall project quite a few more pieces of film, some of which you may well have seen already on the air. I apologise if this should prove to be the case, but you will, I think, be sympathetic if I suggest that to shoot special film, even for an occasion like this, could be construed as an unwarranted additional burden on a Film Unit whose monthly output of 35mm film already exceeds 50,000ft.

I refer, of course, to the BBC Television Film Unit and this figure of 50,000ft. of film per month provides, I submit, an admirable starting point for the main body of this lecture, in which I propose to consider three separate questions even though they (and thus the answers) are closely interwoven. They are :—

Of what is this footage composed?

Is it likely to increase in the foreseeable future?

Is there a big call for additional film from outside sources?

I shall also discuss, very briefly, the film requirements of other television broadcasting systems, and I shall presume to give my views on the probable future trend in respect of the technique of tomorrow in making films for television.

Monthly Footage

First of all then: of what is this monthly footage composed? Let me make the point immediately that the belief (in the BBC Television Service at least) is that in the medium of television broadcasting, preference should always be given to "live" transmissions and that recourse should be made to film only when it is impractical to effect a live broadcast of the subject in question. News comes clearly under this heading, in that news events occur, in the main, beyond the range of outside broadcast cameras—and, anyway, at times during the working day when television could command but a very small audience, even if the transmitters happened to be on the air. A Television newsreel must, therefore, clearly be basically on film and, with our present output of three 15-minute editions each week and a Sunday night review, this programme alone accounts for the better part of 25,000ft. of edited, recorded film each month. Here is the first few minutes of a typical edition, and what should be noted is the deliberately slow tempo compared with that of the *cinema* newsreels, and, indeed, of American *television* newsreels. [*The first part of television newsreel of* The Flying Enterprise *was then shown.*]

At this stage of the television art, a live outside broadcast from the Atlantic would, of course, have been impossible anyway. But, you might well ask, what of a news event that occurs *within* the range of outside broadcast cameras, which is actually made the subject of an outside broadcast but which it is felt should be shown again at a peak evening viewing time? Is it necessary to send film cameras as well as an outside broadcast unit to the site? The answer is that this would normally be wasteful as the outside broadcast can now be recorded with some faithfulness on film at base, and the resultant recording can later be transmitted in its entirety or in a shortened, edited form. This type of recording we in the BBC refer to as a "telefilm"—the Americans as a "kinescope." Here then is a short length of a telefilm of an outside broadcast—that of the Royal

Proclamation on 8 February, 1952—but I would ask you to remember that, in viewing it on a screen the size of the one in this theatre, you are, in fact, looking at one of several forms of cinema television, and that the resultant loss in quality is considerably greater than it would be if you were viewing it on the small television screen for which it is intended. [*The film was then projected.*]

Telefilm is not, of course, confined to the recording of news—or even of outside broadcasts, and I will be dealing fairly fully with this subject of telefilm later on. At this stage I would merely mention that the monthly telefilm footage is not included in the 50,000ft. of film to which I have already referred, and that it may, some months, reach nearly half that amount again, in its own right. But there are several types of film made by the Television Film Unit that *are* included in that total.

Almost above everything in importance is what we know as "the Film Sequence." In its simplest form, it is the establishing shot of, say, a riverside cottage transmitted as the lead-in to a play based on the happenings *inside* a riverside cottage—the cottage interior being built, of course, in a television studio and the drama (or comedy or farce—whichever it may be) being played wholly within its confines before "live" television cameras. In a more elaborate form it may be used for all the *exterior* scenes called for in a documentary programme, the majority of the *interior* scenes being enacted live in the studio. Here is an example—the filmed opening scenes of a recent television documentary programme in the series *The Rising Twenties.* The character whom you will see walking along the street appears again, of course, "live" in the studio sequences which follow. [*The opening sequence was then shown.*]

One *could* argue that film sequences like that one are not *essential* to the television production, and one could argue equally that the whole programme would have been more polished had it *all* been on film. But there is no argument that certain productions just could not be televised at all unless parts of them *were* filmed. This is because, given no filming facilities, a television production would be confined, essentially, to the type of script from which exteriors have been eliminated, a script which calls for an interval as the only device which can make it possible for the cast to change their clothes or alter their make-up. Here then is another film sequence: one from the television production *Men of Darkness* and one which just had to be filmed because, apart from the need to fire live ammunition, a trick effect which could not be accomplished by television cameras was essential—that of two men being shot dead, their ghosts appearing out of their bodies and the ghosts then solidifying. [*This sequence was then screened.*]

There is just one last type of film sequence to which I would like to call your attention. It is the sort of production which could, without question, *all* be filmed but which we do, in fact, stage "part film" and "part live" because we believe that the fact that the central personality is actually in the studio, talking directly to the viewer at the very moment that the viewer is seeing and hearing him, gives an additional and even vital attraction to a programme which would otherwise be "just another film." In such cases, it does not matter whether film constitutes 10, 25, 50, 75 or even 90 per cent. of the whole, but it *does* usually constitute about a third to a half. Here is a typical example—a film sequence from the first of a new series of programmes, *About Britain,* which, like its running mate, *London Town,* has as its central figure Richard Dimbleby. [*Film projected.*]

When, to these film sequences, one adds the sundry complete films of varying lengths made each month by the Television Film Units' "Film Sequence Section" (the Interlude Film which we saw at the beginning of this lecture is not necessarily "untypical" because it is just one continuous ten-minute "take") and one adds, too, the output of the Section which makes film sequences *and* a special weekly newsreel for Children's Television, one finds that at least a further 25,000ft. of film has been produced, that (forgetting telefilm) a grand total of over 50,000ft. has been achieved, and that my first question has been answered.

My second question—"Is the monthly output of the BBC Television Film Unit likely to increase in the foreseeable future?"—can be answered quite briefly and with some certainty, even if one assumes that we will continue to make films for home-television consumption only, that the overall transmission hours of the BBC Television Service will remain substantially as at present for some time, and that we shall not be setting out to follow the precedent of American television, which is on the air non-stop from seven o'clock in the morning until midnight or even later. . . .

Because of contractual difficulties which have not yet been overcome, we are not at present permitted to make, with a view to re-transmission here at home, a telefilm of a television broadcast in which professional artists are taking part—artists, that is, who are members of Actors' Equity, the Variety Artistes' Federation, or the Musicians' Union. We are hopeful that, in due course, a solution will be found and, indeed, Actors' Equity has lately agreed that we may telefilm a series of short drama productions with a view to their being televised in the United States—and, in the process, earning dollars. But the fact *does* remain that, at the present time, we can telefilm (in the main) only outside broadcasts, and such studio broadcasts as this: it is a discussion programme called *In the News* and we are going to see politicians, both of the right and of the left, discussing the desirability or otherwise of abolishing the House of Lords. [*Excerpt shown.*]

But we *are* permitted by the artists' unions even now to use our telefilming facilities as a "pre-recording" system when an artist will not be free to appear "live" on the requisite date, and when (for any one of several considerations) we wish to get his performance "in the can" by this, rather than by normal, filming methods. We did this not very long ago with Peter Ustinov in our series *Speaking Personally*, and I think that you will agree that, although no one could mistake it for a film made by ordinary methods, not much has been lost because the typical television single-camera technique has been employed in the production. The particular piece which I am now going to show you is where Ustinov is talking about his love of frontiers. [*Film projected.*]

Summarising, I think that there is little doubt that, however we use it and whatever we use it for, our telefilming equipment will be in greater and greater demand as the months and years go by.

Quantity

The third question that I set myself to answer was in respect of the amount of film required by the Television Service, over and above that made by Television's own Film Unit. In some ways this is the most difficult question to answer, because in order to be really truthful, I must reply that the extent to which we use films made by other organisations is governed largely by the availability of such films, and by their suitability for inclusion in our programme schedules. We must, of course, *always* have readily available for immediate transmission a small number of films of *all* lengths. This is to provide screen-time during those emergencies which occur only too often in television : when rain stops play at a sporting event that is being or is about to be televised, when the leading artist goes down with influenza immediately before a drama production is due on the air, and so on. These situations can be met and dealt with satisfactorily with comparative ease ; and so, although not so satisfactorily, can the state of affairs in which the need for more studio rehearsal for live productions calls for the transmission of film as the only means (apart from outside broadcasts) of relieving pressure on the studios. Now that we have more television studios in operation, the need for film to be used for this purpose is less today than it was a few years back, but we should still like to be able to televise a film occasionally *just because it is a really good film* and is thus as worthy of televising as is a first-class example of any of the other arts. The reluctance of the Film Industry to make such films available to us is well understandable, but it is to be hoped that we shall, in due course, be permitted to televise *after* their general release some of the films which have deservedly earned the title of "classic."

Meanwhile, we are beginning to be offered what some people might refer to as films, and others as "canned television." I refer to films made especially for that avaricious monster, American Television, which can consume—and pay handsomely for—hundreds and hundreds of films each year, if they are made to the correct prescription and (after the filmed advertisements have been stuck on each end and even sandwiched in the middle) are of exactly the right length to fit into the very strict 15-, 30-, 45-, and 60-minute periods into which American sound and television broadcasting is divided. All that I can prudently say about these films is that we have tried them once—some of you may remember the *Holiday in Paris* series, starring Dolores Gray which we televised some two years ago. We have looked at many others—and we are still looking—and I am hopeful that, in the course of time, the production of film for *world* television will be such as to enable us to have our pick of really good material. I say "*world* television" as opposed to British television or American television, because both television broadcasting networks and individual television broadcasting stations are now beginning to spring up all over the world—very often in places where live talent is non-existent in quantity and where, therefore, screen-time can only be filled by means of telefilms of programmes staged by more fortunate television stations located in a cultural centre with a thriving theatre, such as London or New York—or by means of films. And with a world-wide television market with, so to speak, its tongue hanging out for film, it will be profitable to make film especially for it. This is, of course, already realised in the United States, and I am told that when Hollywood closes its books on December 31st next, it will be found that in 1952 it has made more than five times as much film for television as it has for the cinema.

Technique

And that brings me to my last main point tonight—the technique of tomorrow in making film for television.

In the film industry, a film is made with a target of repeated projection in thousands of cinemas, and if it falls down in any way (including technically) the critics will hammer it and it may well show a financial loss instead of producing a sizeable fortune. Hence this striving for perfection : the months spent on preparation, the months on the floor, the months in the cutting rooms, the vast salaries to ensure the best technicians, the astronomical payments to the currently-popular stars. Hence the slogan, "Film is cheap." Hence the take after take and the retake after retake. Hence, too, the fabulous overall cost.

In the television world the situation is different. No television film will normally be transmitted more than twice by any individual network or station—and often only once. And, however well it is transmitted, reception will more often than not be comparatively poor—poor because the receiver is really too far away from the transmitter, poor because the receiver is old or badly adjusted, poor because local interference causes the vision to appear to be fighting a snowstorm, and the sound to be in competition with a platoon of machine-guns ! I do not mean that because of these snags it is permissible deliberately to relax story, acting, or technical standards in making films for television, but I do mean that on account of the first one (the limited number of screenings which any given television film will receive) even the television of tomorrow will not be able to provide the financial returns of the cinema box-office of today. The producer must, therefore, cut his cloth according to his means if he is going to make even a modest profit.

This producer can remember that, on account of the small size of the television screen, he can wear next to his heart the motto "establish in long-shot, then go into close-up AND STAY THERE"—and that he can economise in set design accordingly. He can take on the floor a really complete shooting script and a cast that, by virtue of pre-rehearsal, is already word and action perfect ; and he can break each sequence down into a few long scenes instead of a number of short ones. He can remember that the reverse angle is virtually non-existent in live television, that he can therefore eliminate it in a film for television—and that he can thus dispense with the fourth walls of his sets. He can limit his crew to one take of each scene and he can—although I do not necessarily recommend it—shoot on 16mm film instead of 35mm. He can go even further : by using electronic cameras (in other words, by making what we would call a closed-circuit telefilm) he can attain a shooting ratio of 1 to 1 and, by effecting all his editing at the time, he can reduce his post-production editing to the cutting-off of the recording-camera run-ups and run-downs at the beginning and end of each reel.

There is one more important point which I must make in connection with this subject : when making a closed circuit telefilm on equipment which is intended for television broadcasting, one is necessarily confined to the technical standards for which the broadcasting station is designed, which in the case of the BBC is 405 lines, 25 pictures per second interlaced to give 50 frames per second, and in the United States 525 lines, 30 pictures per second interlaced to give 60 frames per second. The reason for these comparatively few lines is that, talking rather loosely, the greater the number of lines, the greater is the bandwidth required to transmit them. This, in its turn, results in technical complications which do not come within the scope of this lecture, but I would ask you to believe me when I say that if electronic camera-channels are not to be used for actual television broadcasting, bandwidth becomes of no importance, and a system can be devised to operate on standards which make possible a much higher quality recording, and an obvious target would be 1,000 lines with sequential as opposed to interlaced scanning.

(*To be continued.*)

A Portable E.H

A STAND-BY UNIT DELIVERING

By J. Wood

THIS generator was constructed for the purpose of providing a stand-by E.H.T. supply and also to provide a semi-portable piece of test apparatus.

The circuit is shown in Fig. 1. It will be seen that a tuned-plate, tuned-grid oscillator is used, provided by L1 and L2. The output circuit L3 is inductively coupled to L2, and the frequency of the oscillator L2, L1, is adjusted by the trimmer in L2 until it resonates with the natural frequency of L3. At this frequency L3 resonates with its self capacity to form an extremely efficient parallel circuit whose impedance at resonance is then Q times the reactance, and since these are both high, the impedance is extremely high.

Design

The design considerations are fairly simple. The object was to provide a high voltage D.C. capable of supplying current up to fractions of a milliamp at reasonably good regulation. Twenty watts was considered to be a reasonable figure of input, and a 6 v 6 was chosen—though any similar type of valve could be used. An efficiency of 60 per cent. was assumed; this is a relatively easy figure to obtain in a class C oscillation, and the R.F. power output would then be—

$$\frac{20 \text{ watts} \times 60}{100} = 12 \text{ watts.}$$

A D.C. voltage of 5 kV was required at the output from the EY51 rectifier. Since the average D.C. from a rectifier is 0.9 of the r.m.s. input, the r.m.s. R.F. volts require to be approximately 6 kV—or 8 kV peak. For a voltage of 6 kV to be developed across L3 its effective impedance requires to be as follows:—

$$\frac{(\text{r.m.s.})\ E^2}{\text{watts}} = \frac{6000^2}{12} = 3 \text{ megohms.}$$

The plate load for the 6V6 requires to be about 4,000 ohms and at first it may be thought that a turns ratio of $\sqrt{3 \text{ megohms}/4{,}000}$ or 27 is required between L2 and L3. Turns ratio $= \sqrt{\frac{Z.1}{Z.2}} = \sqrt{\frac{3 \times 10^6}{4 \times 10^3}} = \sqrt{750} = 27.$

Coil Modifications

However, it is not possible to wind an inductance with an inductive reactance (and hence impedance) of 3 megohms, because the coil would have to be so large relative to its frequency that it would possess sufficient self capacity such that its capacitive reactance would be much smaller than its inductive reactance. However, by arranging the self capacity to resonate with the inductance a parallel resonant circuit is formed whose impedance is then Q times the reactance.

In this case the stray capacity of 20 pF resonated at 300 kc/s with the 12 mH inductance and the total impedance then becomes ωL.Q. (ωL. = inductive reactance) or 25k × 150 = approximately 3.5 megohms. The voltage developed across L3 is now equal to that developed across the inductive reactance (25kΩ) multiplied by the square root of the Q of 150 or about 8.5 kV peak. (It may be noted that this figure of 8.5 kV peak volts is achieved by a turns ratio of only 12 between L2 and L3.)

In this case the coils were wave-wound (Fig. 4) so as to reduce self capacity and improve the Q, but it is possible to achieve good results by ordinary methods of winding.

The curve shows the regulation curve of the D.C. output. Although the generator was only intended to supply a fraction of a milliamp current the oscillator remained perfectly stable up to a current drain of 2 mA, as can be seen from the curves (see Fig. 3). It will be noted that the output is about 4 watts of D.C.

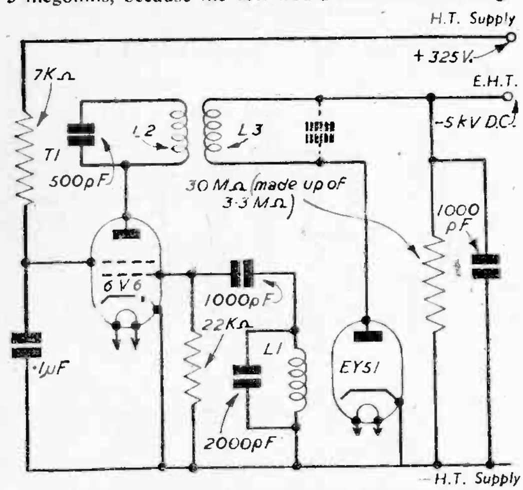


Fig. 1.—Theoretical circuit of the unit.

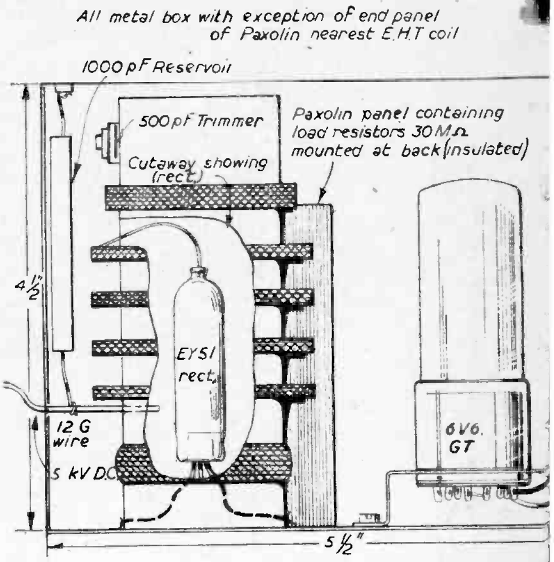


Fig. 4.—Details of the main components and layout. On the right (Fig. 5) is an alternative layout suggestion.

Input

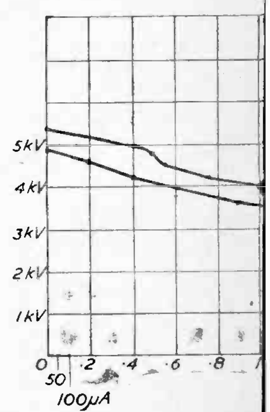


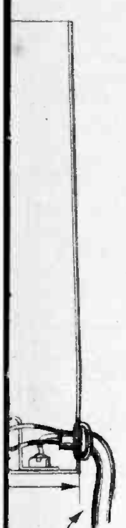
Fig. 3.—Graph

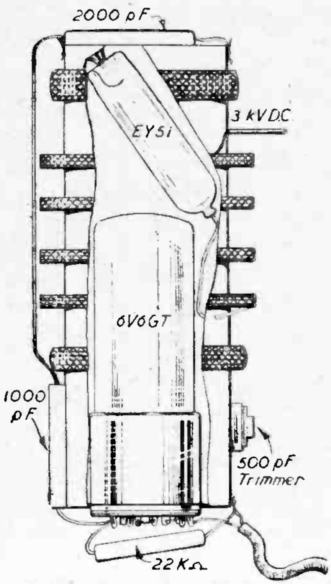
H.T. Generator

5 kV AND CURRENT TO 2 mA

(G3VG)

(4 kV at 1 mA), although the R.F. is 12 watts. This is because the power efficiency of a half-wave rectifier is only .450, on account of the half cycles not being utilised.



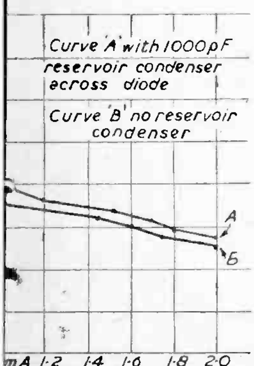


Flex (3-core)

E.H.T. Coil with 6V6 GT and EY51 inside coil (other components mounted outside)

The two curves are for the plotted outputs with and without the 1,000 pF reservoir condenser.

The D.C. output is negative, positive being grounded, but it could be arranged to give positive output by reversing the diode EY51, and in this case the diode heater would require a few turns wrapped around the coil former to provide R.F. heating for the cathode.



showing output.

Construction

The whole unit may be built in a small space since the components are few in number and physically small, with the exception of the coil itself.

In this model the unit was contained in a metal box measuring approximately 5⅛in. × 4½in. × 3⅛in. A fitting lid opens to disclose the interior as shown (Fig. 2). The end of the box was removed to fit a paxolin panel nearest the coil so as to lessen the damping effect and also to provide an insulated panel to bring out the 12 g. wire which is the high voltage output. A ¼in. hole was drilled also, to allow entry for a trimming screwdriver.

The high-voltage rectifier EY51 is mounted inside the E.H.T. coil, so as to allow a short lead to the top pip anode.

The 500 pF trimmer for the anode coil is fixed to the E.H.T. coil (top). The few remaining components may be mounted near the valve base, which is fixed to a bracket made of 18 g. aluminium. The reservoir condenser is mounted between the E.H.T. D.C. output and chassis, and the diode load of 30 megohms made up of a number of 3.3 megohms (or nearest) is mounted upon a paxolin component panel fixed to and insulated from the back of the box.

Interference

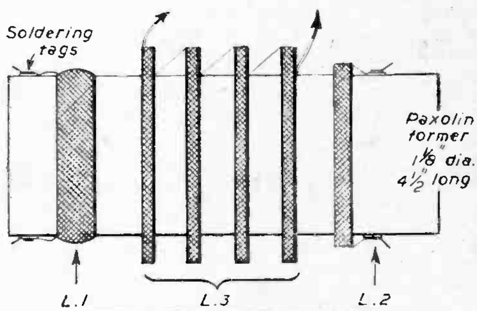
In an experimental model made up the valves 6V6GT and EY51 were both enclosed in the E.H.T. coil, and the remaining odd components fixed to the outside of the E.H.T. coil. By doing so the size can be reduced to that of the E.H.T. coil itself (see Fig. 2). However, this inevitably will reduce the Q of the E.H.T. coil and hence the maximum D.C. E.H.T. will be lowered. With such an arrangement it was possible to obtain over 3 kV D.C. Fig. 2 shows the principal components and gives an idea of the size relative to the 6V6GT.

It should be remembered that the unit will radiate, and unless totally screened will affect picture quality as well as probably causing interference on neighbouring radio receivers. If for any reason it is desired to mount the unit as an integral part of a complete receiver the parts may be placed on the chassis and then a cover of perforated zinc or similar metal placed over, thus providing adequate screening and at the same time affording good ventilation. For the reasons mentioned above, however, no attempt should be made to modify the construction or layout in such a manner that the Q of the coil is affected.

If for any reason the E.H.T. lead is required to run near other components and adequate insulation is needed, ordinary television coaxial lead may be used, stripping away the outer metallic braiding.

Miniaturisation

By using a smaller coil and a valve of the miniature B7G or B9A type in place of the octal-based 6V6, it is possible to construct a unit of half the dimensions given in Fig. 4.



L.1	50 Turns	30	D.S.C.
L.2	60 "	"	"
L.3	4 180 "	"	"

Fig. 2.—Coil details.

PRE-DETECTOR STAGES—2

BASIC FEATURES AND PRACTICAL DESIGN CONSIDERATIONS FOR THE EXPERIMENTER

WHEN the tuned circuit comprising L1 and C is at resonance their inductive and capacitive reactances cancel out, and the circuit retains maximum impedance, or dynamic resistance (Rd) determined by the value L1/Cr, where (r) notates the R.F. resistance of the circuit. But since we have R1 in parallel with (r), the former being very much the smaller, we can neglect (r) and redraw the circuit to the form of Fig. 5.

Now, the gain of a resistively coupled amplifier—and at resonance our circuit may be so considered—can be found from the well-known equation for gain, or gain equals $\mu R/(ra+R)$, but since the value R must be fairly low to produce the desired bandwidth, and also at television frequencies a valve which possesses a very high (ra) must be employed, it follows, therefore, that

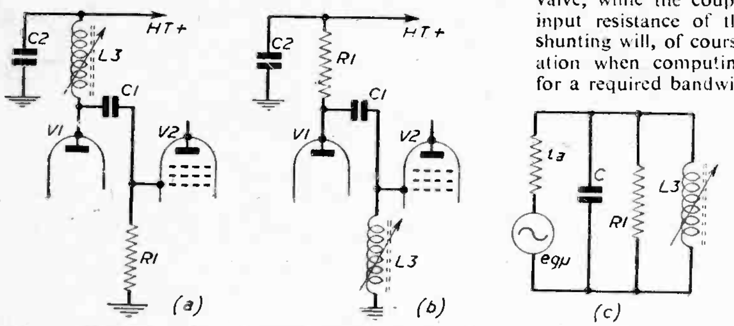


Fig. 4.—Showing at (a) a tuned anode circuit, at (b) a tuned grid circuit, and provided C1 has negligible impedance at the operating frequency, both circuits are equivalent as shown in simplified form at (c).

the portion $R/(ra+R)$ of the above equation is bound to be very small, resulting in very little gain in any case. So with diminutive error we can rewrite the gain equation thus: $\mu R/ra$, but since μ/ra is equal to gm (the slope of the valve):

The stage gain when R is small compared with ra equals R.gm ....(5)

By combining this with the bandwidth equation (1), we get:

Stage gain equals 159 gm—(r^2-1)/n.C..................(6)

This is a most useful equation for it indicates at a glance that for a given value of bandwidth the stage gain is inversely proportional to the total capacitance across the circuit and directly proportional to the slope (gm) of the valve. Clearly, then, a valve of the low (gm) class is next to useless for the amplification of high radio frequencies carrying picture intelligence. For this reason special high gm low-capacity valves have been developed. An 8D3 is a typical example; this valve has a gm of 7.5 mA/V and capacitances in the region of 10 pF. Using this valve and giving due attention to component layout (to minimise stray capacitances) it is possible to obtain a stage gain of between 10 to 15 times, although this figure, of course, is not very high compared with the gain that can be obtained at low broadcast frequencies, it is better than that obtained with, say, a 6K7, a typical broadcast valve, working at the same frequency and under similar conditions—indeed, such a valve tends to attenuate more than amplify a television signal!

Interstage Coupling

We have so far considered only the first stages; in the case of a superhet this will, of course, represent the signal frequency amplifier supplying the mixer, or there might be two such stages—one comprising a unit pre-amplifier. In the case of a T.R.F. receiver, however, it is usual practice to employ four or five signal frequency stages to provide sufficient signal voltage to actuate the detector. One of our chief concerns when working at signal frequency, as we have already seen, is that of input resistance and capacitance. From our tuned coupling aspect this means that the coupled stage will be subjected to the output capacitance of the previous valve, while the coupling itself will be damped by the input resistance of the coupled valve. This resistive shunting will, of course, need to be taken into consideration when computing the shunt resistance necessary for a required bandwidth. For instance, let us suppose that for a given bandwidth a resistance of value (R) is required; knowing the valve input resistance Rv, we can easily find the correct value damping resistor R1, or R1 equals R.Rv/Rv—R, this differs from the shunting necessary for the first tuned circuit inasmuch as no aerial feeder resistance is imposed across the following tuned circuits.

Now, if each stage of a multi-stage signal frequency amplifier were peaked to the centre frequency of a desired pass-band the tuned circuits would need progressively more damping to provide a constant overall pass-band. This is because the overall response curve is made up of individual response curves, and it follows, therefore, that as more stages are employed their individual gains reduce, since more shunt resistance is necessary to maintain overall bandwidth.

Stagger Tuning

Owing to this effect it is common practice to employ an artifice known as stagger tuning, and by this means

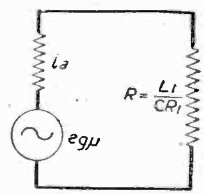


Fig. 5.—When at resonance Fig. 4 (c) can be simplified to this form.

the resonant frequencies of individual coupling are spread over a desired pass-band. This style of coupling means that the tuned amplifier circuits are divided into frequency sections and each section contributes to only a portion of the pass-band, resulting in a wide band response as shown by Fig. 6. By using this method of interstage coupling it is possible to achieve a greater overall gain for a given bandwidth since less damping will be required resulting in considerable increase in amplification per stage.

Stagger-tuned circuits hold several advantages for the home constructor. In the first place, one need use only single iron-dust cored (tuned) coils, and secondly, there is less possibility of instability since the first and final circuit will not be tuned to identical frequencies; and finally, interstage shielding does not present so much of a problem—unfortunately alignment is a little more difficult unless a signal generator is available.

Band-pass Coupling

Various types of band-pass couplings have been adopted for interstage coupling, a universal method is that of a coupled pair (see Fig. 7). With good design it is often possible even to obtain greater gain per stage than with the use of single stagger-tuned circuits. Each coil is tuned by its self-capacitance and that of the associated valve. Final tuning is, of course, performed by an iron-dust core rendering adjustable the coil inductance, the same as the other methods.

Coil coupling is invariably adjusted for a flat response,

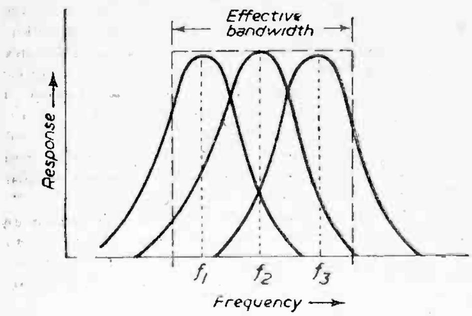


Fig. 6.—Illustrating how any desired pass-band may be obtained by the use of stagger-tuning.

usually just before the point of critical coupling. Increasing the coupling beyond this point will, of course, tend to provoke a double hump response curve analogous to that obtained with stagger-tuned circuits (see Fig. 8).

From the constructor's point of view it is advantageous to use a coupled pair only when a large difference of capacity exists between the primary and secondary circuits, a typical example being the coupling from the final signal frequency circuit of the detector valve. Stray capacitances are important with this type of coupling for they tend seriously to distort the response characteristic; they should, therefore, be kept to a minimum by extra-careful component layout.

Sometimes two separate tuned circuits are coupled together by a small winding in series with the anode coil, as shown in Fig. 9. Here, again, both coils are independently tuned by iron-dust cores, and it is usual in couplings of this nature to provide only a single damping resistor across the primary (anode) winding, as shown.

General Design

In order to appreciate the overall stage gain required from the pre-detector stages of a T.R.F. receiver, one need only consider the ratio of first grid signal voltage to necessary detector signal volts. A typical example might be: available signal on first grid 1mV, necessary detector input signal 5 volts, or a voltage ratio of $5 \times 10^4 : 1$. Overall gains of this magnitude—or even greater for fringe area working—demand adequate decoupling, and efficient interstage screening and component layout to prevent the instability bug from taking control. Special attention should be given to all earth returns, which should be grounded to a common tag for each stage.

Good-quality paper, or preferably mica capacitors, should be used for decoupling—a value of between 100 and 1,000 pF is usually sufficient for signal frequency stages. It is important to ensure that the suppressor grid is taken to the earth line, and not connected to the cathode as sometimes done in broadcast practice.

Instability is often caused by the heater line creating a coupling, in which case it is desirable to decouple

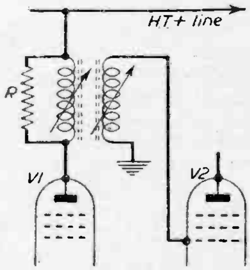


Fig. 7.—A band-pass coupling.

each unearthed heater tag to the earth line, via a 1,000 pF capacitor. In addition to this, the added precaution of small R.F. chokes in series with the heater leads may be found necessary.

The valves should receive their stipulated electrode potentials, for as we have seen, the overall response curve is governed to a large extent on how the valves are used and, needless to say, that when replacing a valve in a signal frequency stage ensure that it has characteristics identical to the original.

The essential difference between the signal-frequency and intermediate-frequency amplifier is that of operating frequency. The methods of obtaining the requisite bandwidth and of controlling gain are the same in both cases and have already been explained earlier in this series.

The effect of converting the signal frequency to a lower frequency (I.F.) eases the instability problem by a marked degree. This is because the midband frequency of the I.F. channel is considerably lower than the signal frequency, and the substantial frequency

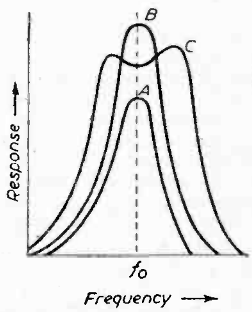


Fig. 8.—Curve (A) showing the response when two tuned circuits are under-coupled, (B) critically coupled, and (C) over-coupled.

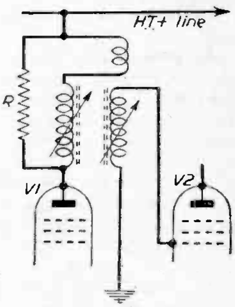


Fig. 9.—A method of coupling two tuned circuits by a small winding in series with the anode coil.

difference between aerial input and final I.F. renders the system less susceptible to the effects of feed-back, compared with a T.R.F. channel working at the carrier frequency.

Our bandwidth considerations will follow our previous reasoning, although it should be remembered that since a separate I.F. channel is provided for sound and vision, the bandwidth need be made no wider than that necessary to embrace the vision modulation frequencies only—this may not be true for the first I.F. stage, which sometimes amplifies both the sound and vision signals, but more will be said about this later. As with the signal-frequency stages, damping resistors are usually employed to maintain an overall bandwidth, but since the input resistance of a valve at I.F. is considerably higher than at signal frequency a lower value damping resistor is usually necessary.

Choice of Intermediate Frequency

Because we are dealing with a range of modulation frequencies which extend from zero to about 2.7 Mc/s it is clear that the choice of I.F. must be well above 2.7 Mc/s. Theoretically, the lowest useable frequency is in the region of 4 Mc/s, but even at this frequency the I.F. is only a little higher than the highest modulation frequency. Such a condition gives rise to the extremely difficult problem of filtering the I.F. component of the video signal to earth after demodulation, and means the employment of a circuit capable of discriminating between 2.7 and 4 Mc/s. And unless this process is carried out efficiently the picture definition is bound to suffer owing to attenuation of the upper modulation frequencies (see "The Vision Detector," PRACTICAL TELEVISION, February, 1952). Nevertheless, from the stability and stage gain aspects a low I.F. has many advantages.

Now, on the other hand, a high I.F.—little removed from the signal frequency—seems rather pointless, for it might well prove advantageous to use a T.R.F. circuit, and in view of the circumstances obtain superior valve-to-valve performance. This is because the inclusion of a frequency-changer stage gives rise to more noise than an ordinary amplifier, gives less gain, and in general, a superhet is considered far more temperamental than a straight receiver to align and get working satisfactory.

From the practical aspect, therefore, the vision I.F. is chosen somewhere in the spectrum between 10 to 20 Mc/s, and thus serves as a compromise between the two conflicting factors. Before we can decide on the precise frequency, however, another important factor emerges; that of I.F. harmonics. The output of any I.F. amplifier always contains harmonics of the fundamental frequency which may under certain conditions be fed back in sufficient strength to the signal frequency stage to generate beat notes (pattern interference). It is for this reason that post-detector filtering should be done as efficiently as practicable, making sure that the filter attenuates not only the I.F. component, but the second and third harmonic of the I.F.

Even though considerable precautions are taken in the form of filtering and decoupling, an appreciable signal usually finds its way back to the first stages. Should this signal represent a harmonic of the I.F., and happen to exist within the frequency spectrum of the input pass-band, it will be greatly magnified by the time it reaches the detector, and beat with the actual vision I.F. The resulting beat-note will be accepted by the video amplifier, and manifest itself on the picture-tube screen in the form of dark parallel bands, arranged in patterns depending on the beat frequency.

About the only effective cure for disturbances of this nature—apart from heavy screening, plus very efficient filtering—is to arrange the I.F. so that its harmonics are as far as possible outside the response of the input channel. Not only the vision, but also the sound I.F. must be considered, for harmonic feed-back is just as likely to occur via the sound I.F. and cause an audio whistle on the sound, as to cause a pattern on the picture.

As an illustration, let us suppose that we wish to arrange a receiver for the reception of channel 1 transmission (Alexandra Palace), and as we know, this channel embraces a vision band between 42.25 and 47.75 Mc/s. Now, by making our I.F., say 22.5 Mc/s, the second harmonic will fall spot on the vision carrier (45.0 Mc/s), thereby rendering our system responsive to interference originating from the second harmonic of the I.F. A similar situation would occur should we wish to receive channel 5 (Wenvoe) using an I.F. of 22 Mc/s, but here it would be the third harmonic of the I.F. which would cause the trouble. Generally speaking, at the higher intermediate frequencies it is easier to select a setting which is comparatively free from the above effects. The following table gives two intermediate frequencies for each of the five existing stations, the harmonics of which will not interfere with reception since they fall outside the frequency spectrum needed by the vision signal.

	Channel/Station	I.F. (1)	I.F. (2)
(1)	Alex. Palace ...	13 Mc/s.	18.5 Mc/s.
(2)	Holme Moss ...	11.25 Mc/s.	14.5 Mc/s.
(3)	Kirk o' Shotts ...	12.25 Mc/s.	16.0 Mc/s.
(4)	Sutton Coldfield ...	13.25 Mc/s.	17.0 Mc/s.
(5)	Wenvoe	14.5 Mc/s.	18.75 Mc/s.

Table indicating two interference-free intermediate frequencies for each TV channel.

It is usual practice with designers of commercial equipment to choose the lower value I.F., for the frequency is high enough to obtain efficient detector filtering with ease, and yet it is not so high that the advantages of employing the superhet mode are lost by electron transit effects of the I.F. valves and other causes inherent to high-frequency amplification. As observable from the table, an alteration of channel will necessitate a modification of I.F. to ensure complete freedom from I.F. harmonic interference. This is an impracticable proposition where the receiver is of the five channel (tuneable) variety, for obviously such a receiver could hardly be termed as five channel, if channel changing involved not only retuning the signal frequency and oscillator stages, but also realigning the whole of the I.F. channel!

Manufacturers of five channel receivers generally adopt an I.F. in the vicinity of 16 to 18.5 Mc/s, this frequency allows three channels to be received which are fairly clear of I.F. harmonic interference, the remaining two channels might respond to the third and fourth harmonic of the I.F., but by the use of careful screening and adequate filtering, the situation appears to cause very little trouble.

Sound Pick-up

Sometimes the sound signal is developed across a second tuned load in the anode circuit of the mixer valve. The tuned circuit of this load will, of course, depend on the frequency selected for the vision I.F. channel.

(To be continued.)

Come to CLASSIC for "THE VIEWMASTER"

Not just "The Television Specialists" but the "VIEWMASTER SPECIALISTS"

We are the boys, we have the goods, and we supply all Television Areas daily.

SEND FOR OUR LISTS TODAY ! !

VIEWMASTER Components for Cash — **£32**

Can also be bought Stage by Stage, or on available Hire Purchase Terms.

VIEWMASTER COMPONENTS

WB/200 S V Chassis ...	18 6
WB/101 Chassis Supports	6 0
WB 102 T/B and P Chassis	18 6
WB/103 Mains Transformer	£2 2 0
WB 103A Auto Transformer	£2 12 6
WB/104 Smoothing Choke	15 6
WB 105 Loudspeaker	£2 7 6
WB/300 Pre-Amplifier chassis	17 6
WB/106 Frame Transformer	£1 5 6
WB/107 Line Transformer	£1 12 6
WB 108 Scanning Coils	£1 13 6
WB 109/1 Focus Magnet	£1 2 6
WB 110 Width Control	10 0
WB/111 Boost Choke...	5 9
WB/112 Tube Support 12in.	£1 1 6
WB Conversion kit ...	£1 15 0
Wearite Coils, H M, K'SHTS, W V ...	£1 8 0
TCC Condensers ...	£7 7 0
Morganite Resistors	£1 16 3
Morganite Variable Resistances	9 0
Colvern Pts (Set 6) ...	£1 2 0
Westinghouse Rectifiers 36/EHT 100 ...	£1 9 5
Westinghouse Rectifiers 14/A/86	£1 0 4
Westinghouse Rectifiers 14/D/36	11 6
Westinghouse Rectifiers WX.3	3 9
Westinghouse Rectifiers WX.6	3 9
Westinghouse Rectifiers 36/EHT/45 ...	£1 2 6
Westinghouse Rectifiers 36/EHT/50 ...	£1 4 6
TCC Condenser Type CP55QO	4 6
TCC Condenser Type CP55VO	7 6
TCC Condenser Metal pack CP47N	3 6
Wearite R.F. Choke ...	2 0
Bulgin Parts (complete set)	15 3
Belling Lee Conn. Unit and Fuses ...	10 6

So "*Take it from here*" by *return of. Post.*

THE CLASSIC ELECTRICAL CO. LTD.

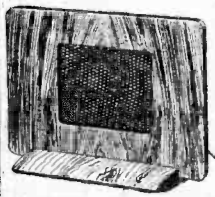
"THE HI-FI TELEVISION SPECIALISTS"

352/384 Lower Addiscombe Road, Croydon, Surrey. *Phone : Addiscombe* 6061/2

TELEVISION COLOUR FILTERS. For 10in. screens, 6/6. For 12in. screens, 8 3. For 15in. screens, 10/9.

TELEVISION LENSES. Magnifies the picture 1½ times. Best quality manufacture. For 8in. and 9in. screens, 55 - ea. For 10in. and 12in. screens, 75/-. Tinted a pale blue for Daylight and Anti-glare viewing 5/- extra. Post and pack., 2 6.

SALVAGE RADIO-GRAM CHASSIS. Price £7 17 6. 5 Valve S'Het. 1952 Models. Made to sell at three times this price. Latest pin-type Midget Valves (B8A series). Can be built into your own cabinet in combination with one of our salvage auto-change units to make a first-class radio-gram and save pounds. All units guaranteed and tested before despatch. Auto-change units, single speed, £5/19/6, and 3-speed, £8/19/6. P. & P. 3/6.



SALVAGE MAINS TRANSFORMERS. Price 12/6 each. 260-0-250, 6.3 V., 3 A. All tested and guaranteed for 3 mths. Postage 2/-.

O.P. Transformers for TRF and Personal sets. Will match all normal O.P. valves to 3 ohm speech coil. Price 2 9 each. Postage 1/-.

EXTENSION SPEAKERS. Price 19 9 Tax Paid. Latest baffle type with gold-sprayed metal fret. 5in. P.M. Speaker. Postage 1/9.

VALVES.—EY51, SU61, ECL80, GT1C, 807, 11/9 ; 5U4, 6V6, 5Y3, PM3, X66, 10 9 ; 1A3, 1R5, 1T4, 1S5, 3A4, 3S4, 3D6, 6F15, 10F1, EF39, EF50, EF91, EL91, 6F12, ECH42, 8/9 ; KT8, KT32, SP41, 6/9 ; 6J5, UF41, UY41, TT11, 5 9 ; AR6, 4D1, 6C5, C2C, VP133, 3 9 ; EA50, 1 9.

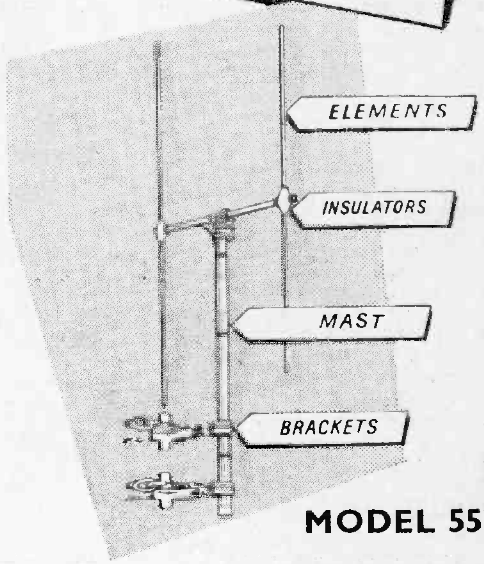
CONDENSERS. Below-cost offer of .0005 mfd. 2-gang variable tuning condensers. Standard and half size. Reduced to 2/9 each.

WIRE. Nickel chrome, 25 yard spools (.032in.) and 50 yard spools (.014in.). 4/6 per spool. Stainless Steel (same sizes), 1/- per reel. 5 for 4/-.

STAMP FOR 1952 LIST.

C.W.O. or C.O.D. **DUKE'S** 621, Romford Road, London, E.12. (*Grangewood* 6677) Money Back Guarantee.

The specification of A GOOD AERIAL



MODEL 55

ELEMENTS—constructed in light high Tensile duralumin fully heat treated and tempered. These elements are filled to prevent humming and processed to prevent corrosion ; of large diameter to ensure strength and the electrical characteristic of broad bandwidth.

INSULATORS—of robust construction and streamlined shape to reduce windage. The insulator is fully waterproofed at the element and boom entry points. Fixing of elements and boom is quick and positive and connections of the coaxial or twin feeder can be visually inspected by removal of the cap.

MAST—of high tensile duralumin combining great strength with lightness. Specially treated to prevent corrosion and of 2in. o.d. and adequate gauge. Tested to withstand winds of 100 m.p.h.

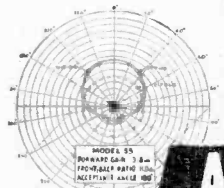
BRACKETS—of light aluminium alloy of special design to provide a strong fitting which will distribute stresses over a wide area of brickwork. The mast is rubber mounted in the brackets to eliminate any tendency of humming and to absorb vibrations.

ELECTRICAL PERFORMANCE

High Gain—the model 55 (illustrated) is a widespread H aerial with a forward gain of 3.8 dB.

Broad Bandwidth—large diameter tubes ensure a broad bandwidth and provide a picture with better definition.

Front/Back Ratio—the ratio is 11.0 dB giving the aerial valuable directional characteristics which enables interference to be minimised, or eliminated completely.

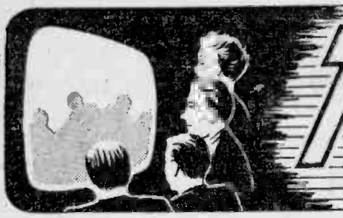


Acceptance Angle—of 180° which allows a useful degree rotation of the aerial before the signal is reduced.

Range—dependent on the location and can exceed 70 miles from the transmitter.

Aerialite AERIALS

AERIALITE LTD., STALYBRIDGE, CHESHIRE



TELENEWS

Ekco Conference

WHILE the Assistant Postmaster-General was making his statement in Parliament about the decision to proceed with the Belfast transmitter, Ekco dealers in Northern Ireland were in conference discussing plans for marketing Ekcovision in their territory. The conference was addressed by Sales Director G. W. Godfrey, and Publicity Director W. M. York. The meeting was interrupted to give Mr. Gammans's statement from a newsflash received by arrangement with the "Belfast Telegraph."

Television Licences

THE following statement shows the approximate number of television licences issued during the year ended September, 1952. The grand total of sound and television licences was 12,843,595.

Region	Number
London Postal	617,546
Home Counties	202,233
Midland	387,644
North Eastern	155,805
North Western	192,685
South Western	32,780
Welsh and Border ...	39,839
Total England & Wales...	1,628,532
Scotland	26,788
Northern Ireland ...	126
Grand Total	1,655,446

Export to Italy

AS Italian firms are unable to produce enough television receivers to meet the country's demand, 40,000 sets are to be imported from Britain.

"This is Show Business"

THE last of the Vic Oliver series, "This is Show Business," will be televised on November 22nd, and is to be a "bumper number," with many of the items in the two previous series.

Vic Oliver begins rehearsing for pantomime soon and will be appearing on the London stage throughout the whole of next year, so there is little likelihood of his regular return to television until 1954.

Signals Via the Moon

AMERICAN radio experts consider that television signals can be transmitted to Europe on a special wavelength which would be aimed to hit the moon and be reflected back at an angle and received in Europe.

One of the many disadvantages of the scheme, however, is the rough, indented surface of the moon which might not be suitable to reflect the signal accurately enough.

German Transmissions

REGULAR television transmissions from East Berlin have begun, covering the whole of Eastern Germany.

Telephone-TV

AT a recent National Guild of Telephonists meeting in Nottingham, members were told that it would not be very long before telephone callers could pick up their instruments and see the person speaking at the other end.

The speaker was Mr. E. J. Lansbury, National President of the Guild.

More Engineers Required

AN urgent need is reported for more television and radio maintenance engineers "to raise the scope of radio and television servicing."

The Radio Trades Examination Board, who examine engineering candidates, state that, out of 1,836

How a television-telephone would appear when in use.

men interviewed, just over one sixth sat for television examinations.

Temporary Low-power Stations

THE Government has decided to allow temporary transmitters to be installed at Pontop Pike in N.E. England and near Belfast in time for the Coronation.

The transmitter at Pontop Pike is expected to serve about one million people within a radius of 20 miles, which includes Tyneside. The transmitter in Northern Ireland will serve about half a million people in Belfast and its surroundings.

Post Office Advice

THE Post Office has found that in attempting to trace sources of interference to viewers' receivers, the trouble in many instances is caused by faulty sets themselves or an inefficient aerial and earth system.

Because of this, the Post Office is issuing a pamphlet to all set owners who complain of interference. It tells them how to apply simple tests to discover whether the receiver itself is at fault.

Television actress Elizabeth Allan, whose place in the "What's My Line?" team was taken by film star Joan Greenwood.

Film Programmes

HIGHBURY STUDIOS are to re-open soon when High Definition Films, of which Mr. Norman Collins is chairman, begin production of films to be transmitted as television programmes.

The studio, which was used by the J. Arthur Rank Organisation in 1947 and 1948, is claimed to be the first all-electronic film studio in the world.

Car TV

MR. ARTHUR PARKES, of Wolverhampton Street, Dudley, has installed a 9in. receiver in his car and runs it off a 12-volt battery.

He employs his own secret method of doing this and says that any commercial receiver can be adapted in the same way.

BBC Film Laboratory

THE BBC is planning to build its own photographic processing laboratory to speed up its showing of news items. At present, telefilms are sent out to film companies for processing and much valuable time can be lost in doing so.

Approximate cost of the plan would be £250,000.

Mr. Basil E. Nicholls

IT is probable that Mr. Basil E. Nicholls, who retires on December 1st, will act as part-time adviser to Sir Ian Jacob, BBC Director-General, during the Coronation period.

Mr. Nicholls has been with the BBC since 1924 and was temporary successor to Sir William Haley, previous Director-General, now editor of "The Times."

Ship-to-shore Experiment

IN collaboration with the southern region of British Railways, the BBC recently carried out experiments to explore the possibilities of obtaining television pictures from a cross-channel steamer on the Dover-Boulogne service.

One of the mobile transmitters of the outside broadcast fleet went to sea in the southern region's motor-car ferry *Lord Warden*, and transmitted special signals to a receiver mounted on the R.A.F. radar tower at Swingate, near Dover.

Storm Accident

A TELEVISION receiver was blown apart when lightning struck the East Keswick home of Mr. George Hardisty during a recent thunderstorm.

Mr. Hardisty's daughter had just unplugged the set when the lightning struck, causing a flash and dense sulphurous smoke. Part of the ceiling was ruined and the lighting system badly damaged.

Operations by Colour

THE Columbia Broadcasting System of America has announced its plans for televising surgical operations in colour by means of a closed circuit. The pictures would be studied by 18,000 physicians every week.

Crystal Palace Site

MR. I. J. HAYWARD, leader of the London County Council, has stated that although the public and Press may have gained the impression that almost the whole of the Crystal Palace grounds are to be used as a site for the new 750ft. television mast, only two of the 181 acres will be taken over.

Visual Discoveries

CARROLL LEVIS and his Discoveries, normally heard on the Home Service on Wednesdays, will present his programme of potential "stars of to-morrow" for the first time on television on January 24th.

The show will last an hour instead of the normal 30 minutes.

Sirdani's Commitments

BECAUSE of his radio and television commitments in this country, Sirdani, the "Don't be fright" magician, was unable to sign a three-month's contract to appear in variety on the Continent.

No Diffusion Service

BATH Surveying Committee has decided that a television diffusion service for the city would have an injurious effect on employment in its radio trade and has turned down the project.

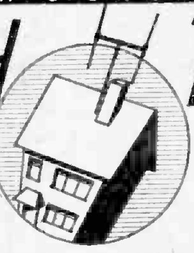
Another objection was the network of wires which would be erected all over the city for such a scheme.

TV Advisory Committee

ONE of the first moves of the newly-formed Advisory Committee is expected to be the application for enough wavelengths to operate another television service.

TELEVISION PICK-UPS AND REFLECTIONS

UNDERNEATH THE DIPOLE



By Iconos

NEW TECHNIQUE

ALL technically-minded viewers must have realised instantly that "Holiday in Berlin" was cutting new ground in TV play technique. The great variety of settings, interior and exterior, and the bold use of cine film for several lengthy exterior sequences, reached a new high level. Hitherto, departures from the straightforward stage play-TV technique have been made, but only half-heartedly. In "Holiday In Berlin," producer Dennis Vance and Art Director Barry Learoyd blazed new trails by making use of some of the exciting new gadgets now available at Lime Grove. Back projection of slides was utilised in a big way, with the artistes performing in front of linen screens on which were projected photographs of all kinds of settings, interior and exterior.

BACK PROJECTION

THE technique is not entirely new, but no producers have, up to now, relied so completely upon this means of providing backgrounds. A slide projector, with a 150-amp high-intensity arc and a special cooling arrangement to prevent the slides from cracking, was given its first real trial. A ten-foot mirror was used to divert the projected beam on to the appropriate screen, in front of which were placed the foreground "props," furniture—and actors. Technique triumphed completely, even if the play itself failed. Reginald Tate and a fine cast enacted the somewhat rambling story of an ex-German scientist who was being blackmailed into giving away British secrets to save his family, still on the other side of the Iron Curtain. And, if they missed the sustaining atmosphere of conventional 3-ply set backgrounds, they did not show it. The play itself, however, was uneven, with some bad patches of dialogue here and there, and an ending which was more suitable for a problem play than a straightforward melodrama.

Nevertheless, the producers are to be complimented for their courage in pioneering a broader canvas for TV plays.

TV TRICKERY

FIRST usage of trick processes in radio, films or TV always seems to be subject to a self-conscious emphasis on the particular illusion that is being performed. In the first days of radio plays at Savoy Hill, everything was produced in one studio, with one microphone, dialogue, music, effects and chorus. The technical boys of BBC Research evolved the dramatic control panel, which provided a multi-microphone technique, the use of several studios, the isolation of music and effects and the availability of artificial echo. For twelve months, the equipment was hardly touched by the radio play producers, until Cecil A. Lewis took possession of the new magic and assailed our ears with a dynamic mosaic of words, music and effects. At first the sound montage technique seemed to overawe both producer and listeners, Today, it is commonplace—the normal technique of radio drama. Perhaps in years to come, viewers will likewise recall the early efforts of Dennis Vance and Barry Learoyd.

SPONSORED TV PROGRESS

LAST month I referred to the Gilbertian possibility that more studio stage space in England might be devoted to films for sponsored TV than are now occupied by the BBC Television or by the cinema film people. Little did I think that this situation is already practically here, in spite of the fact that the sponsored TV films are all for export and not, at present, for transmission in England. In addition to the old British National Studios at Elstree, where Douglas Fairbanks, Ltd., are making a series of thirty-five films for American TV, the following studios or theatres are actively engaged (or will shortly commence) in the production of TV films; Wembley Studio (one large stage); Highbury Studio (one large, one small stage); Prince's Theatre, Shaftesbury Avenue; Penge Empire; Shepperton Studios.

The Shepperton Studios is said to be erecting two (possibly three) small stages, especially designed for TV films, additional to the six very large stages used for films. At the Penge Empire, Television Varieties Inc., an American concern, have improvised a studio on the stage and are already turning out first-class variety programmes at a great speed. Multiple motion picture cameras are used and the stage lighting has been considerably supplemented. Top-flight music-hall stars, including top liners from the Palladium, have been busy there—mostly working their musical numbers to pre-recorded playback. Television Varieties moved to Penge from the Prince's Theatre, which has since been occupied by other companies making TV films. The most interesting of these was the pictorial recording in colour of a musical play, "Gotham Valley," by the Moral Rearmament Group. It is intended to televise the resultant film in the U.S.A. in black and white and at the same time have colour copies available for the odd experimental colour TV transmitters. The technical set-up at the Prince's Theatre has been highly elaborated, since the level of lighting has to be much higher for colour photography. A large number of tungsten bulb spots and high intensity arc lights were strategically placed in circle and stalls, in addition to greatly reinforced footlights and floats. Three main cameras, each on run tracks, picked up the action from the stalls, while a fourth camera was available in the circle. Gevacolor is the colour system used, which has an integral tri-pack emulsion on a single negative, compared with the three separate negatives (yellow, cyan, magenta) required for Technicolor. I was able to watch a complete scene of the musical play filmed in one take lasting about ten minutes. The artistes worked to playback, provided by an orchestral accompaniment that had been recorded in New York! This was played back from magnetic tape at a low level, while a multitude of microphones in footlights and elsewhere picked up dialogue and vocals, no recording on a second tape machine.

Cameras were started and stopped during the course of the action, in accordance with a pre-arranged plan, and controlled by a technician at a portable switchboard in one of the theatre boxes. This is to avoid the excessive consumption of the highly expensive colour negative film stock. Either black-and-white or colour prints can be made, of course, and the producers of this TV film are looking ahead to the more general use of colour television in the U.S.A. I was very impressed with the technical set-up at the Prince's Theatre and the business-like way the TV film unit were setting about their jobs. The theatre auditorium seemed reasonably free of excessive reverberation, which is the usual snag encountered when recordings are made in empty theatres. Furthermore, there is little interference from outside noises, a plentiful supply of electricity and the location of the theatre is central and highly convenient for artistes. Dressing-room accommodation and the usual production offices, stores and property rooms, are exactly what is required for a TV film unit.

THEATRES FOR TV

AFTER all, this is the kind of thing that has happened to several theatres in New York, and I always wondered why the BBC did not do the same thing with the large theatre at the Alexandra Palace. Originally built for elaborate operatic spectacles and pantomime, this theatre was fitted with every mechanical contrivance and stage trap-door equipment of the late Victorian era, on the lines of Drury Lane Theatre. But it did not succeed in this field, and blood-tub melodramas followed, with occasional pantomimes. In the early 1900s the gallery was closed as being structurally unsafe—but the theatre was reopened in about 1909 for "Cinematograph Exhibitions," using the ground floor only. Later, the circle was reopened for a time. For many years now, the Alexandra Palace Theatre has been closed or used only as a store. There is no doubt, however, that the ready-made facilities of a theatre building lend themselves both to direct television and to television films. If and when sponsored television really gets going here in England, for British viewers as well as the Americans, then I expect quite a few of the old, disused theatres will take on a new lease of life instead of becoming mere furniture stores.

THE CLOCK

THE chimney clock at the end of the programmes was a valuable daily check on set adjustment, instantly revealing whether the circular dial has become egg shaped. The model of Big Ben is not quite so useful in this respect, though this opens the possibility of including the belfry lamp which is alight when the House of Commons is sitting. I don't know whether this information is of general interest, but it would add a little piquancy to the news announcements concerning debates concurrently in progress at the House.

TV FILM LABORATORY

I AM not at all surprised at the high figure of £250,000 being quoted in the daily press as a possible cost of a film laboratory for processing television films for the BBC. But I shall be very surprised if anything much larger than a small "pilot" or emergency plant is erected. At present, the BBC's films, telefilms or otherwise, are developed and printed by several film laboratories who process for the cinema trade. This is a highly competitive field, and prices are almost on a cut-throat basis, an odd farthing a foot making the difference to large contracts for the printing of 50 or 60 copies of a film for British release. Developing and printing machines carry out the work at high speed, and highly skilled technicians are employed. I would be very surprised if the BBC could undertake their own developing and printing at the same low prices, dealing, as they do, with the very limited number of prints required for their own use. On the other hand, a small automatic developing machine for negative work only, without the additional optical and printing equipment necessary for a complete laboratory service, might be reasonably inexpensive and worth while. For urgent newsreel work, negative can be edited and projected, reversed electronically into positive as it is transmitted. Such a plant would give the BBC a greater measure of independence and they would not have to send negatives abroad for processing—in the event of unofficial strikes at the laboratories, as has happened in the past.

New Miniature Valves

BOTH Brimar and Osram announce new miniatures which should find application in television equipment. The Brimar 6BW7 is a high-slope R.F. pentode designed for use in the R.F., frequency changer, I.F. and video stages of television receivers and similar apparatus.

It will operate from a 180 or 250 volt H.T. rail, making it suitable for use in A.C./D.C. or A.C. operated equipment, and is fully screened, thus eliminating the necessity for external screening. Its mutual conductance and figure of merit are higher than contemporary types with no increase in the filament rating which remains at 6.3 volts, 0.3 amp.

Two pin connections are provided for the cathode, enabling a high input impedance to be obtained when used in the recommended circuit. As an R.F. amplifier, it will provide efficient operation up to frequencies of 120 Mc/s.

These factors make this valve one of the most advanced types for use in television and V.H.F. applications.

ONE of the new Osram pentodes is type N.309 and is also a high-slope pentode, on Noval B9A base, suitable for the video stage of television receivers. Details are as follows:

Heater current, 0.3 amps.
Heater voltage, 15 volts.
Anode voltage, 200 volts.
Screen voltage, 200 volts.
Mutual conductance, 10 mA/volt.
List price, 17s. 6d. Purchase Tax, 7s. 7d. Total, 25s. 1d.

The other new valve, the Osram B309, is a double triode amplifier with indirectly-heated separate cathodes. Its characteristics are similar to the American 12 AT7 and the B9A base is used. The heaters are separate and can therefore be connected in series or parallel. Details are as follows:

Heater current, 0.3 amps (parallel), 0.15 amps (series).

Heater voltage, 6.3 volts (parallel), 12.6 volts (series).

Anode voltage, 300 volts (max.).
Mutual conductance, 5.5 mA/volt.
Anode dissipation, 2.5 watts per anode.

List price, 17s. 6d. Purchase Tax, 7s. 7d. Total, 25s. 1d.

ORYX SOLDERING IRON

IN our November issue we reviewed a new novel soldering iron for low-voltage operation. Unfortunately the price quoted by us for this iron was incorrect and we are asked to point out that the actual selling price is 25s.

ALPHA RADIO SUPPLY CO.

MAINS DROPPERS
Welwyn 702Ω with 3 taps ... 2/6 ea.
" 75Ω with tap at 40Ω ... 1/9 ea.
Eric 717Ω with tap at 600Ω ... 1/3 ea.
Zenith 358Ω with 5 taps ... 2/3 ea.

METAL RECTIFIERS
12 v. ¼ amp., 1/6 ; 250 v. 45 mA., 6/9.
2 v. to 6 v. 1 amp., 3/-. 250 v. 75 mA., 7/6.
12 v. 1 amp. 5/-. 12 v. 5 amp., 18/6.

CHOKES
Cast Iron Case, pitch dipped, 5 H, 250 mA. ... ... 8/9 ea.
Midget type, 10 h, 250Ω, 10 mA. 1/9 ea.

BIAS CONDENSERS
T.C.C. 25 mfd. 25 v. D./C. ... 1/3 ea.
Daly 50 mfd. 50 v. D./C. ... 2/6 ea.
Dubilier 50 mfd. 12 v. D./C. ... 1/9 ea.
Hunts 25 mfd. 50 v. D. C. ... 1/9 ea.
T.C.C. 12 mfd. 50 v. D./C. ... 1/- ea.
T.C.C. 50 mfd. 12 v. D./C. chassis mounting ... ... 9d. ea.
T.C.C. 50 mfd. 12 v. D./C. Micro-pac ... ... 1/9 ea.

THIS MONTH'S OUTSTANDING BARGAINS
T.C.C. 8 mfd. 350 v. ... 1/3 ea.
B.E.C. 32 mfd. 350 v. ... 1/6 ea.
Metal Rectifiers 12 v. ¼ amp. 1/6 ea.
T.C.C. 25 mfd. 25 v. D./C. 1/3 ea.
Octal Grid Caps ... ... 6d. doz.
Jack Sockets ... ... 6d. ea.
100 KΩ ¼ Meg.Ω S.P.S. ... 2/9 ea.
Morganite ¼ Meg. less switch ... ... 1/6 ea.
Wire Wound Controls, 200Ω, 5Ω, 10 KΩ, 25 KΩ, 50 KΩ 2/- ea.

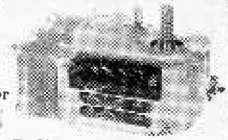
EX. GOV. VOLUME CONTROLS
200 Ω, 500Ω, 600Ω, 5 KΩ, 10 KΩ, 20 KΩ, 25 KΩ, 50 KΩ, 100 KΩ, 150 KΩ, 200 KΩ, ¼ Meg.Ω, ½ Meg.Ω, 1 Meg.Ω, 2 Meg.Ω. All 1/- ea.

VALVES

GUARANTEED NEW AND BOXED
SOME GOVERNMENT SURPLUS

X76M	10/-	5Y3G	9/6	80	9/6
PEN383	10/-	6AC7	7/3	807	10/6
7D5	10/-	5Z4G	9/6	954	2/9
UU9	9/-	6B4	8/6	12A6	7/9
TH30C	10/-	6C6	7/6	12C8	9/-
EBC3	10/-	6F6G	9/-	12K8	9/6
TSP4	9/-	6H6	4/6	25A6G	9/6
EL35	10/6	6J7M	8/6	35L6GT	10/-
12Z3	9/-	6K7G	6/6	35Z4GT	9/6
6SS7	9/-	6K8G	12/6	ECL80	12/6
L63	5/6	6L7	8/-	E1148	2/-
MS4B	12/6	6N7	7/6	HL23DD	8/6
12AT7	10/-	6Q7G	10/6	KT61	10/6
12J5	8/-	6SA7GT	9/6	KT66	11/6
9002	6/6	6SG7	7/9	KTZ41	6/9
3Q5GT	8/6	6SH7	7/-	MH4	8/-
VR150 30	9/-	6SJ7	9/6	MSPen	5/-
OZ4	8/-	6SK7	7/-	Pen25	8/6
1R5	8/9	6SL7	9/6	TP25	8/6
1S4	8/9	6SN7GT	11/6	UL41	11/6
1S5	8/9	6SQ7	9/6	UY41	10/6
1T4	8/9	6V6G	9/-	EF39	7/6
2A3	7/9	6V6GT	9/-	EBC33	8/-
215SG	4/-	6X5GT	7/9	EF36	7/6
2X2	5/6	6AM6	10/6	SP61	4/-
3Q4	9/6	6AL5	8/9	SP41	4/-
3S4	10/6	7B7	9/-	EF50	6/6
3V4	9/6	7C5	9/-	EA50	2/6
42	9/6	7C6	9/-	EF8	7/6
5U4G	9/-	7Y4	9/-	VU39	9/-

COLLARO AC37 VARIABLE SPEED MOTOR.
4 pole shaded pole. 100 125v. 200 250v. ¼" shaft suitable for recording. 32/6 each.



STANDARD VOL. CONTROLS
Centralab ¼ Meg.Ω, ½ Meg.Ω, 1 Meg.Ω, S.P.S ... ... 3/9 ea.
Centralabs 1 Meg. D.P.S ... ... 5/- ea.
25 KΩ less switch ... ... 1/6 ea.
Morganite ½ Meg.Ω, 1 Meg.Ω 2 Meg.Ω, S.P.S. ... ... 3/9 ea.
Morganite 1 Meg.Ω. less switch 2/6 ea.

STANDARD CAN ELECTROLYTIC
T.C.C. 16 mfd. 450 v., 3/3 ea.; Hunts 16 mfd. 450 v., 3/3 ea.; T.M.C., 16 mfd. 450 v., 3/- ea.; T.M.C., 8 x 8 mfd. 450 v., 3/6 ea.; B.E.C. 8 x 16 mfd. 350 v., 3/6 ea.; B.I. 16 mfd. 500 v., 3/9 ea.; B.E.C. 16 mfd. 450 v., 3/3 ea.; B.E.C. 8 x 8 mfd. 450 v., 3/6 ea.; B.E.C. 16 x 16 mfd. 450 v., 4/9 ea.; Dubilier 32 x 16 mfd. 350 v., 5/9 ea.; Dubilier. 24 x 16 mfd. 350 v., 5/9 ea.; Dubilier 32 x 8 mfd. 350 v., 4/3 ea.; T.C.C. 16 x 24 mfd. 350 v., 5/9 ea.; B.E.C. 32 x 32 mfd. 150 v., 7/- ea.

COIL FORMERS
Aladdin with iron core slugs, ⅜in. and ¼in. ... ... 9/- doz.
Paxolin 3in. x ¼in. ... ... 4d. ea.
Ceramic Coil Formers ... ... 5d. ea.

SPEAKERS
3½in. Elac, 13/6; 5in. Goodmans, 13/9; 5in. Plessey, 12/9; 6½in. Plessey, 12/-; 10in. Plessey, 22/6; 10in. Rola, 32/6; 12in. TruVox, 57/6. TruVox 12in. Heavy Duty Speaker, 15Ω. £6/10/0. carriage 3/-.

THROAT MICROPHONES
2 Units in box ... ... 2/- ea.

TERMS: Cash with order or C.O.D. **MAIL ORDER ONLY.** Full List available: send 3d. stamp.
Postage, 6d. to 10/-; 1/- to 20/-; 1/6 to £2; 2/- to £5. Minimum C.O.D. and postage charge 2/3.

5/6 VINCES CHAMBERS, VICTORIA SQUARE, LEEDS, 1

ARTHURS HAVE IT!

LARGE VALVE STOCKS
TEST METERS IN STOCK
AVO VALVE CHARACTERISTIC METER IN STOCK.
"AVO," "TAYLOR" TEST METERS AND SIGNAL GENERATORS. MEGGERS
AVO. No. 8 IN STOCK

Leak Point One Amplifiers		£28	7	0
Leak Pre-amplifiers		9	9	0
Leak Vari-slope Pre-amp. for Leak Point One		12	12	0
Leak Tuning Unit		38	5	0
Chapman Tuning Units		17	6	8
Connoisseur Two-Speed Motor		22	18	6
Decca Replacement Heads and Pick-ups				
Wright & Weaire Tape Deck		35	0	0
Cossor Double Beam Oscilloscope	1035 ...	93	10	0
	1049 ...	132	0	0
Partridge Output Transformers for Williamson Amplifier		7	5	3

LATEST VALVE MANUALS
MULLARD, OSRAM, & BRIMAR No. 4, 5/- each. MAZDA 2/- each. Postage 6d. extra.
TELEVISION SETS, WIRE AND TAPE RECORDERS ALWAYS IN STOCK
Goods offered subject to price alterations and being unsold.

Arthurs first Est. 1919

PROPS: ARTHUR GRAY, LTD.
OUR ONLY ADDRESS : **Gray House, 150-152 Charing Cross Road, London, W.C.2**
TEMple Bar 5833/4 and 4765
TELEGRAMS—"TELEGRAY, WESTCENT, LONDON."
CABLES—"TELEGRAY, LONDON."

TALLON CABINETS

for the

VIEW MASTER
ELECTRONIC ENGINEERING & PRACTICAL TELEVISION SETS
MINI-FOUR ● ARGUS P.W. 3-SPEED AUTOGRAM ● CRYSTAL DIODE ● P.M. TAPE RECORDER
"TELE-KING" WITH DOORS

in pack-flat kits or assembled cabinets, Radiogram, Radio and Television or combination cabinets made to suit customer's requirements, in quantities or singly. Tape Recorder Cabinets. Prices and literature on application

Mini-four Cabinet, Blue Leathercloth, complete with grille and plastic handle ... 14/- incl. postage

JAMES TALLON & SONS LTD.
(Dept. P.T.I)
MANOR WORKS . MANOR ROAD RUGBY . *Telephone : RUGBY 2070*

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).

LOW-NOISE PRE-AMPLIFIERS

SIR,—May I point to two slips in the article entitled " Low-noise Pre-amplifiers," by Mr. A. Thomson, in the November issue. On page 249, col. 1, it is stated that a 6AK5 can be used for V1 in Fig. 2. This valve is, however, not suitable for triode connection since the suppressor grid is connected internally to the cathode. To connect anode, suppressor and screen together as shown would therefore result in R2, L2 and R1 being placed directly across the H.T. supply. The valve required here is an EF91 or its equivalent (6AM6, 6F12, Z77, etc.).

It is also stated that the equivalent of the 6AK5 is a Mullard EF95. It would appear that EF91 is intended, and that the type shown is a misprint.—W. E. THOMPSON (St. Leonards-on-Sea).

AN E.H.T. HINT

SIR,—I recently had to change from a voltage-doubled E.H.T. system to a straight-output type. In the former two J-50 rectifiers were fed with 1,000 volts in a normal doubler circuit, using two 0.5 μF condensers feeding through a 100 k Ω resistance and smoothed by a 0.5 μF condenser to earth. (The negative side of the E.H.T. is earthed in this arrangement.) When I changed to the straight transformer with 2.5 kV output, I found that the spot was elongated to about ½in., and even further capacity up to 1 μF would not reduce it to a spot. When a further 100 K Ω resistor had been added in series with the first and a 0.5 μF connected from this junction to earth, perfect results were obtained.

The fact that extra smoothing is required when changing from doubler circuits to straight feed is a point worth watching.—F. H. WALKER (St. Margarets).

SMEARING

SIR,—May I be permitted to add a helpful word to B. S. Dengate, of Tonbridge " Your Problems Solved," October issue, and possibly any others with similar troubles ?

The cause of his defect may well be due to poor L.F. response in the video amplifier. This could be caused by either an o/c R24, change in value of R23 or leaky C19, each of which will alter the time-constant of the circuit, thus causing a trailing off of V5 I_A and resultant " streaking " instead of a sharply defined outline.—H. S. RONDEAN (Hornchurch).

AERIAL PRE-AMPLIFIER

SIR,—The position concerning aerial pre-amps is much simpler than Mr. Fleck appreciates (" Correspondence," September issue).

The real virtue of installing the unit as near the aerial as possible is to overcome noise generated in the feeder as well as the interference that is picked up by the outer sheathing.

Suppose the aerial picks up 10 volts and the noise from the feeder totals 5 volts. We then have a ratio of 2 : 1 signal/noise at the set (neglecting feeder losses) which cannot give a clear picture.

If we install an amplifier at the aerial with a gain of, say, 10, we have a signal of 100 volts, which arrives at the set with added noise-voltage of 5 volts as 105 volts, a s/n ratio of 100/5 or 20/1, which is much better and will give a good picture.

The actual position on the site is not quite as simple as this.

From much practical experience I can say that it is quite needless to go to all the trouble of mounting the amplifier at the masthead. Providing that the highest quality low-loss airspaced down lead is used, the loss in the run down the mast is negligible and the pre-amp can then be mounted inside the roof.

This is where it will be protected and accessible, and will still perform its function of improving the s/n ratio, as most of the interference is picked up inside the house.

Aerial-mounted pre-amps were developed for radar use where the requirements and conditions are quite different from TV use.—STEWART L. HUDSON (Paignton).

CAGE AERIAL

SIR,—I was horrified to see the " Cage Dipole " rearing its ugly head in the article " Aerials for Wenvoe," in your October number. Surely, it is high time that the popular fallacy that an increase in the effective diameter of the dipole gives improved definition was exploded once and for all ?

It is, of course, quite true that such an increase does result in increased bandwidth, but since the loaded bandwidth of even a fine-wire dipole (34 s.w.g.) is far in excess of present requirements, it is difficult to understand what advantage can possibly result from a dipole with an effective diameter of 4in. to 6in. !

Should anyone refuse to take the word of an amateur like myself for this, I would refer him to a paper read to the I.E.E. by F. R. W. Stafford, M.I.E.E. Herein it is shown that the theoretical loaded bandwidth of a 34 s.w.g. dipole on channel 4 is 9.4 Mc/s, while that of a ⅜in. tube is 10.8 Mc/s. Practical measurements show an increase of 15-20 per cent. on these figures.

It may be that the popular misconception has resulted from a consideration of the *intrinsic* bandwidth, which is just half that of the *loaded* bandwidth of a dipole correctly terminated with a matching feeder and resistive load.

A further point is that any increase in the effective diameter of the dipole (on TV frequencies) above 1in. materially alters the impedance at the centre, so that the cage dipole, with an effective diameter of 4in. to 6in., would be mismatched to the feeder if connected as shown in the diagram, with the probable result of an actual loss of efficiency.—H. B. GREGORY (Birmingham).

The Author replies :

I am certainly not in whole agreement with Mr. Gregory's comments. The question of the bandwidth of television receiving aerials bristles with difficulties as so many unknown factors enter into the problem, and while I do not doubt the statements made regarding the 34 s.w.g. dipole it should be noted that the bandwidth expressed was the theoretical bandwidth.

Not having read the paper mentioned by Mr. Gregory I cannot enter into a discussion on it ; however, there are a few points which must be considered when estimating the bandwidth of an aerial. They are :

The bandwidth depends upon (a) The intrinsic bandwidth of the aerial. This is taken with the active dipole short-circuited at the centre and is to some extent dependent upon the height of the aerial above the ground. The distance and nature of nearby objects may also have an effect.

(b) The length of the transmission line, and its particular

characteristics, which connects the aerial to the televisor.

(c) The nature of the input impedance of the receiver with its magnitude and phase.

From the practical point of view all that is required is that the aerial should be capable of enabling the 3 Mc/s lines to be resolved on Test Card C (this presupposes, of course, that the receiver itself will resolve these lines). The cage dipole, which has caused Mr. Gregory so much pain, was merely offered to the experimenter for his consideration; there is no doubt that if a televisor will not resolve the 3 Mc/s lines when used with a correctly constructed and linked cage dipole it will not resolve them at all.

I must thank Mr. Gregory for his remarks as it has drawn my attention to an error in Fig. 3 showing the construction of the cage dipole. The lower half of the dipole should be connected to the sheathing of the coaxial cable and not as shown in the diagram. The centre wire of the coax is connected to the wires in the top half of the dipole. I'm afraid I overlooked this in the proof stage.

It is not thought that the article requires any further defence. Suggestions were offered as to the type of aerial most likely to suit different localities served by Wenvoe and individual measurements of the different arrays was not given as they have been dealt with quite adequately in previous issues of PRACTICAL TELEVISION*—even those of quite recent date.—ERG.*

SIR,—I would like to bring to the attention of Mr. R. B. Miles, a point which he appears to have missed when he states that there would be no difference in the reception if the preamplifier were placed at the aerial or the receiver end of the feeder. This statement is incorrect. He correctly states the main source of noise is from the amplifier itself and cannot be got rid of by any means, but the important factor in determining the reception value is the signal to noise ratio. Now the noise generated by the amplifier is obviously the same wherever it is placed; therefore if we can put it where the signal is strongest, namely at the aerial itself, we will be better off. For example, if the total loss in the feeder plus losses due to pluggery mismatching, etc., is 6 db—quite a reasonable figure—this is 2/1 voltage ratio. Assuming a 50 μV signal at the aerial and 10 μV of noise from the preamp., then with a preamp. gain of 4/1, the signal to noise ratio would be at the receiver terminals $\frac{4 \times 50}{10} = 20/1$, but with the amplifier at the receiver end the ratio would be $\frac{4 \times 25}{10} = 10/1$. Therefore, the reception would be improved by 2/1 in the first case compared with the second.—M. R. HARKNETT (Portsmouth).

INTERLACING

SIR,—With reference to your query re "Interlacing," in PRACTICAL TELEVISION, October, 1952. The check I always perform is as follows:

1. Set focus of picture to give best definition of *lines*.
2. Very slowly scan the picture from bottom to top until the eye manages to fix on one line. This line will now appear to move vertically till it disappears off the top.
3. Repeat the operation but starting from the top; scan the eye downwards.
4. Check for the half line at top of picture; this should be quite clear and should not jitter horizontally.

If interlacing is not taking place at all the scan lines will appear to be stationary and the half line will not be seen as it will be superimposed on its neighbouring line. Also, if the half line tends to jitter horizontally this is usually a sign that some interference or other cause is upsetting the time-base synchronising.

In conclusion, I may say that bad adjustment of frame hold control will affect the interlace and the effect of stray line pulses from flyback will upset it also. —LESLIE LEWIS (Sheffield).

SCANNING COILS WRONGLY MARKED

SIR,—I have noticed that several readers have requested your advice regarding incorrect picture width and height in the Viewmaster Televisor, and I think that the following may be helpful to them.

On completing my set (also a V/M), I found that the frame scan was about an inch too great, and the line scan too short by a similar amount. After wasting a lot of time in testing or replacing most of the small components in the scanning circuits, I began to suspect the scanning coils of being faulty and, after ascertaining that no harm could result, I removed the two wires from L1 and L2 and joined them on to F1 and F2, and those from F1 and F2 on to L1 and L2.

This had the desired result, as the raster now took on the right proportions, with the controls set at about half-way. Obviously, the coil terminals had been incorrectly marked.

I think that any constructor who is faced with a similar difficulty may well be advised to try this, before doing anything more difficult or expensive.—W. ROLFE (Gravesend).

FROM VCR97 TO ACR2X

SIR,—It is apparent from the article and from his letter in the April, 1952, issue that Mr. J. Muir Smith has actually tried this conversion and one can only assume that his statements regarding the relative deflection sensitivities and the necessary modifications are correct. They do not, however, agree with the figures quoted, as these show that at a given final anode voltage the ACR2X has a Y plate sensitivity of the same order as the VCR97 but an X plate sensitivity of only about half that of the VCR97.

I note that the figures quoted for deflection sensitivity agree with those given in a recently published table.

I would be interested to know if other readers can confirm that these figures are in fact incorrect, as others besides myself may have been deterred from purchasing an ACR2X tube by the apparently low X plate sensitivity relative to the VCR97.—R. A. HARVEY, B.Sc. (Stockbridge).

SIR,—Your correspondent, J. Muir Smith, writing on page 268 of the November issue, compares the VCR97 and ACR2X cathode ray tubes, and states that the latter has double the Y plate sensitivity of the former. His quoted figures do not bear this out; we have, for Y plate deflections at a constant E_A of 2,000 v:

$$\text{VCR97} \quad \frac{600}{2{,}000} = 0.30 \text{ mm/v.}$$

$$\text{ACR2X} \quad \frac{675}{2{,}000} = 0.34 \text{ mm/v.}$$

whilst in the use of the X plates the figures are:

$$\text{VCR97} \quad \frac{1{,}140}{2{,}000} = 0.57 \text{ mm/v.}$$

$$\text{ACR2X} \quad \frac{600}{2{,}000} = 0.30 \text{ mm/v.}$$

indicating that the ACR2X has, in fact, a much lower deflection sensitivity. This is in line with my own practical experience wherein an ACR2X was considerably underscanned by a VCR97 circuit. — J. G. SLOAN (West Kilbride).

YOUR Problems SOLVED

Whilst we are always pleased to assist readers with their technical difficulties, we regret that we are unable to supply diagrams or provide instructions for modifying surplus equipment. We cannot supply alternative details for constructional articles which appear in these pages. WE CANNOT UNDERTAKE TO ANSWER QUERIES OVER THE TELEPHONE. The coupon from p. 332 must be attached to all Queries, and if a postal reply is required a stamped and addressed envelope must be enclosed.

"ARGUS"—NO SOUND

I recently purchased from you the blueprint and details of the P.T. Argus Televisor.

I have so far received no sound signal. The vision unit is not yet completed, but by substituting a wirewound resistance in place of a carbon one (R21 sound unit) I can receive mush, and I can receive the Somersetshire police car net very strongly.

I would appreciate any hints you can give me on this matter.—E. J. H. Edwards (Pontypool).

There are two points to note; the first is that an aerial of the correct type must be used, and that is one of the type normally used in your locality. The second point is that the first stage of the vision receiver serves the sound as well so the amplification of this stage is missed when the sound unit is used without the vision unit.

You are receiving the police network on a harmonic, and if the correct type of aerial is used at the correct height then no further trouble should be experienced.

WENVOE RECEPTION

Since my letter to you with reference to the View Master coils for Wenvoe, I have received a letter from the advisory dept., admitting that these coils are not altogether suitable for Wenvoe. In order to save future constructors some trouble I feel that this should be given as much publicity as possible.

I see no reason why these coils should not have been designed correctly in the first place without the transmitter, as this trouble is quite apparent with a signal generator. I can only think, therefore, that it is a genuine mistake.

I would be pleased to know whether you have any data re the number of turns on each coil ?—P. G. Kerrick (Cardiff).

The previous letter from the View Master advisory department was based on information received from several constructors, including yourself; since that date tests have been carried out in the Wenvoe area and it can now be definitely confirmed that so long as the wiring of the receiver is correct, and alignment has been carried out correctly, then it is possible to obtain an excellent picture, giving full definition and freedom from sound interference. It has, however, also been confirmed that on some receivers some little difficulty may be experienced due to four of the iron dust cores coming a little on the high side: this is readily overcome by removing one turn only from each of the following coils: L405, L408, L414, and L415.

UNSUITABLE SCANNING COILS

I should be grateful for your advice on the following:

My View Master frame timebase is non-linear, cramped across centre of picture, the top and bottom being about right. The adjustments as stated in the V.M. booklet have been tried without success. I have used an EL33 in place of 6P25 or KT61 as specified for V12, as I understood that it was an equivalent value. Would this be the trouble ?—Henry H. Wright (Staffordshire).

The non-linearity you describe is in our opinion due to either a faulty frame transformer or scanning coil or to the use of an unspecified type which is unsuitable with the View Master circuit. We suggest this be changed.

TUBE FAULTY ?

Several faults have arisen in a set built some 18 months ago.

The faults are as follows:

Occasional flaring of the C.R.T. in which all picture detail is lost. Reduction of the brilliance control increases the brilliance. The fault clears if the set is switched off for a few minutes. The start of the flaring is always accompanied by a loud crack.

The line width control has to be kept at minimum and a *slight* increase of this control causes the picture to defocus, go dim and increase in height.

The picture turns to the left at the top edge, and when the line hold is adjusted it effects a cure but these false line locks become frequent.

When a bright, white picture, such as open sky is transmitted the frame hold becomes critical and the picture "rolls." Reduction of the contrast control remedies the fault, but the result is a dim picture.

These faults have appeared during the last two to three months, and prior to that time no trouble other than an occasional false line lock was experienced.—R. G. Read (Enfield).

The trouble may possibly be in the tube itself, the most likely cause being heater-cathode shorting, or possibly cathode-grid shorting. However, check on the feed from the video amplifier to the tube, and ensure that the steady D.C. voltages on the grid and cathode of the tube do not alter when the fault appears. If the brightness control makes the tube brighter when it is reduced, the impression gained is that either the grid or cathode has "floated" or that an internal short has occurred. Try running the tube from a separate heater supply for a time. The change in raster size and brightness with changes in width show poor E.H.T. regulation, and the fault must be looked for in the E.H.T. circuit.

FAULT IN BUSH TV22 MODEL

After the set has been switched off, two illuminated spots appear on the tube and seem to move gradually towards the centre and linger for about 15 to 20 minutes. Would this cause an ion burn in time and lessen the useful life of the tube ? It is also accompanied by flashes at intervals.—G. W. Markham (Harringay).

A period of 20 minutes for a residual spot to stay on the screen of the tube after the set has been switched off is most unusual, but it does not indicate a faulty tube. You can overcome the trouble by wiring a bleeder of at least 25 MΩ (put 5 of 5 MΩ resistances in series) across the anode-chassis points of the tube.

The spots may, of course, be due to local fluorescence without the presence of a residual charge on the E.H.T. line, in which case the above remedy will have little effect. The effect will not damage the tube in any case.

SHORT-CIRCUITED ELECTROLYTIC

Can you please advise me ? I built a "View Master" set a year ago whilst living at Loughton, Essex, and I

received a reasonable picture, with an Aerialite aerial, but I always had to have the contrast control full on.

I have moved into Poplar, E.14, and cannot align the set to get a picture without the frame flyback lines being visible. I may add that they are very brilliant, being right across the picture, also I cannot get any more contrast on the set.

I have tested all resistors, also valves, and have done some voltage tests according to the book, but cannot see any fault. I am puzzled by the fact that I get a "short" from can of condenser 51 to chassis, which I have according to instructions isolated, but although condensers 53/4/5 are the same kind I do not get any "short."

Do you think that the aerial (a loft type) is suitable? Am I getting a good signal? If you do not think so, would you please advise me as to what aerial would be suitable for a "View Master" at my present address.—G. Foley (Poplar).

The fault would appear to be due to the "short" which exists between the can of C51 and the chassis. The negative terminal of this condenser is joined internally to the can in many instances, and so the can *must* be mounted in an insulating clip and *not* bolted directly to the chassis. If the can is earthed, resistor R64 will be shorted out and the frame timebase will not operate properly. Check that R64 is properly wired also. A loft aerial should be suitable at Poplar and should provide sufficient signal strength.

ANTI-GHOST AERIAL

Could you supply me with dimensioned details for constructing a double "H" anti-ghost aerial for Wenvoe?

Owing to my peculiar position, surrounded by hills, like being on one side of a basin, I find it impossible to cut out ghosts with any normal type of aerial, and having a supply of material on hand would like to construct my own.—W. Baker (Bath).

There is no easy answer to the problem of ghosts, and some experimenting will be required to obtain a clear picture. If, as sometimes happens, the ghost appears from the same position as the direction of the transmitter, the problem is very difficult indeed.

Two types of aerial have been found effective when ghosts occur, and they are the double "H" type and the slotted aerial.

The double "H" consists of two "H" aerials mounted 3ft. 7in. apart, the spacing between the reflector and director in each case being 3ft. 7in. The two aerials should be joined to the televisor with *exactly equal* lengths of coaxial cable. It is very important that the coaxial cable lengths are identical, but for the purpose of economy it is possible to join them at the aerial end rather than have two separate feeders. To do this the cables should extend, one from each dipole, to the centre of the boom holding the two arrays. Generally this will be where the supporting mast is connected to the boom. At this point the two feeders are connected in parallel and the cable leading down to the televisor also connected, i.e., all inners are connected together and all the sheaths. The joint should be a good one and insulated from the weather. It is important that the lengths of the cables from this joint to each dipole are of identical lengths.

Details of a slot aerial were given in the February, 1952, edition of PRACTICAL TELEVISION. The length of the slot should be 7ft. 2½in. and the length of the reflector 7ft. 5in. It is better for the reflector to be mounted vertically. Distance between reflector and slot should be 3ft. 7in.

VISION ON SOUND

I have recently completed construction of a "View Master" console, but the performance is marred by a background buzz on sound. This is either coming from the vision signal or from the frame timebase. I have increased the values of R33 and C32 with some slight improvement, but it does not cure the trouble.

The interference varies with the content of the vision-signal.—Alastair Stewart (Fife).

The fault you describe is due to vision interference on the sound channel, and can only be overcome by more accurate alignment of the sound receiver tuned circuits, each of which must be made to peak sharply. Only if these tune sharply will the selectivity be improved and the interference level reduced. Some slight improvement may also be obtained by increasing the spacing between L314 and L315.

INTERFERENCE

I have built a View Master and have been using it for the last 18 months, but I have always had trouble with interference over the sound.

I have tried removing the 10 pF condenser (C20) as you suggested in one of your numbers, but found that it did not make any difference.

I am using two pre-amps., also a multi-rod aerial, which is situated about 20yds. from the main road. —K. Lockstone (Cheltenham).

We presume that the interference to which you refer is ignition interference, and general high background noise due to the use of two pre-amplifiers since you are apparently some long way from the transmitter, presumably Sutton Coldfield. We would suggest, however, that as Wenvoe is now in operation the signal strength in your area will be appreciably greater, and you will probably be able to dispense with at least one and possibly both amplifiers, with the result that interference will be reduced. To change to the Wenvoe frequency it is only necessary to change coils.

However, to reduce the effect of ignition interference even further, we suggest checking R36, C33 and MR1, and if these are considered satisfactory then we suggest making the following changes:

Delete C25. Reduce the value of R32 to 47KΩ. Reduce the value of R30 to 47KΩ and use only low capacity screen sleeving for the volume control leads.

Finally, check that there is no instability in the sound receiver and connect a 47KΩ resistor across L12.

LINE WHISTLE

I have recently built a set with a Mullard 12in. C.R.T. The results achieved are completely satisfactory except for a high-pitched whistle, which does not come from the loudspeaker. Can you please advise me? —L. Derbyshire (Loughton).

The high-pitched whistle which you complain of is caused by the line transformer, which operates at a frequency of around 10 Kc/s. If the whistle is excessive, then the transformer can be returned to the manufacturer for replacement, or alternatively it may be mounted in a metal box lined with sponge rubber so that it is floating, though care must be take in bringing out the leads to ensure freedom from breakdown.

QUERIES COUPON

This Coupon is available until December 21st, 1952, and must accompany all Queries.

PRACTICAL TELEVISION, December, 1952.

LOOK ! R1355, new, 47/6; good used, 35/-; chassis only, 15/- (carr. 6/-); RF24, 3 valves, 22/6; Indicators with 8 valves and CRT, new, 75/- (carr. 6/-); I.F. Amp., 16.5 mcs, with 8 valves, 32/-; CRT, 3BP1 with base and screen, 25/-; small chassis, cased, with 2/CV181 (6SN7 type), 1/VR91, 1/VR92, 25/-; Chassis, new, with 1/6V6G, 1/5U4G, 1/VU120, 2/.02 mfd 8kV conds., etc., 25/- (carr. 5/-); Strobe Units, with 8/VR91, 1/EF55, 1/5Z4G, and a wealth of components, 60/- (carr. 6/-). Valves, 1S4, 1T4, 210VPT, 5Z4M, 1C5, VR150/30, 6G6G, 15D2, at 9/-; VU39, 5U4G, 6SN7, 6F6G, 35L6GT, ECL80, ECH42, 6V6, 12AT7, at 10/-; J6, 6AK5, 0Z4, at 11/6; VR65A, D1, 7193, EB34, VR66, VR21, at 2/6; 956, 12SK7, VR65, 9004, 9006, VR135, VU120A, VU111, 6H6, CV54, VS70, VS110A, 12H6, 954, RK34, MS/Pen, KTZ41, at 4/-; 6C4, 6J5G, EF39, 41MHL, 41MPT, 41MTL, 42SPT, MS/Pen. T, 4TSP, 4TPB, DDL4, 41MP, 4SHA, NT62A, NT20, NT37, P2, HL23, 8D2, 4D1, EF36, 6SH7, 9001, ARP12, ATP4, 12SH7, 955, 6AC7, 9D2, KTW63, KTW61, at 5/6; EF50, EF54, EC52, CV66, 12SR7, AC6Pen, 717A, 721A, 6K7G, NGT1, 12SJ7, 12A6, at 6/-. Auto-transformers 0-104-230v. 3A, 50c, 18/-. Chokes, 3H, 200ma, 5/-. Metal Rectifiers, 270v, 80ma, HW, 6/-. Bargain list 1½d., s.a.e., and enquiries. Terms: C.W.O.; immediate delivery. W. A. BENSON, 308, Rathbone Rd., Liverpool, 13.

WINWOOD for value. Viewmaster Coils, all areas, 17/- set, incl. choke. Viewmaster Valves, £6/4/6 per set, post free. Spkrs., 5in., P.M., 12/6. Condensers, fresh stk., 450vw, 4 mfd 1/6, 8 2/3, 16 3/-, 8 x 16 4/-, 16 x 16 4/9, 32 x 32 5/6; 500vw, 8 mfd 2/6, 16 3/6, 8 x 8 4/-. The new "Tyana" Soldering Iron, 16/9. Valves, EF91, 8/-, EB91, 6/6; 6V6G, 8/3; AZ31, 8/9; CL33, 9/6; ECH35, 6K8, Red EF50, EY51, ECL80, EF80, 11/6 each; 25Z4, 80, 5U4, 9/-. Semi-midget cntrls., 500k, 1/sp., non-sw., 3/-, 4 for 10/-. Miniature 3-wave Coilpacks, 32/6. I.F. Trans., 465 kcs, 9/6 pr. WINWOOD, 12, Carnarvon Road, London, E.10. (Mail only.)

TELEVISION and Radio Components, Short-wave Kits, Valves, Viewmaster Envelopes; new catalogue free. THE RADIO EQUIPMENT COMPANY (Dept. P.T.), Castor Rd., Brixham, Devon.

PT/TV/S'HET. ⅜in. canned tagged cored formers, 2/3 ea.; ⅜in. Poly., 1/-; trade supplied. BEL, Marlborough Yard, Archway, London, N.19.

TAYLOR MODEL 30 scope, as new, £18. Test Set 74, £6; good base for scope. WALKER, 20, William St., Staincliffe, Dewsbury.

BY RETURN OF POST: 12in. Cream Masks, 21/6; Line Output Trans, WB/107/Allen/Plessey, 32/6; Scanning Coils by Scanco, Hi Imp. frame, 24/6; Mains Trans. WB103, 42/-, 36 eht100, 28/-; P.M. Focus Magnets, R/17, 22/6; 8in. M.E. Spkrs. with Trans., 28/6; 6½in. P.M. enc. mag., 19/6; Rubber Grommets, 1/6 dz.; Self Tap Screws, 2.4.6 B.A., assd. lngth, 9d. dz.; 6 Tag Grp. Boards, 1/-. Orders under £2 add 1/6 p.p. Terms c.w.o. THE TELETRON CO., 266, Nightingale Rd., London, N.9. (How. 2527.)

SALE, EMI Vision Receiver, complt., 8 valves; 25kV Projection Unit and CRT; Garrard RC70B, Collaro 3RC511, 2 heads, Decca Heads, Valves, Cathode Ray Tubes. All new, unused, gtd. S.A.E. Box No. 140, c/o PRACTICAL TELEVISION.

VCR97 T.V., 21 valve, offers, N. London. Box No. 137, c/o PRACTICAL TELEVISION.

PREMIER RADIO Williamson Amplifier, newly built. Offers. Box No. 138, c/o PRACTICAL TELEVISION.

RATES: 4/- per line or part thereof, average five words to line, minimum 2 lines. Box No. 1/- extra. Advertisements must be prepaid and addressed to Advertisement Manager, "Practical Television," Tower House, Southampton St., Strand, London, W.C.2.

HANNEY OF BATH offers: Wide Angle Viewmaster Components. Allen Components, Frame Trans. FO.305 21/-; Scan Coils DC.300 42/-; Width Control GL.18 10/-; Linearity Control GL.16 10/-; Line Trans LO.308 50/-; Focus Coil FC.302 35/-. Elac Focus Rings, W22/MK11 for English Electric and GEC Tubes 52/6; W25/MK11 for Brimar C14BM and C17BM Tubes, 57/6. Condensers T.C.C. .002 CP30S 1/9; .01 CP33S 1/10; .25 CP48N 2/8; 1 mfd. type 345 3/6; .015 CP33N 1/9; 250 mfd. CE10DA 10/-; 47 pfd. SCT1 1/9; .005 CP32S 1/10; .05 CP37S 2/1; .003 M3N 2/3; .001 CP56WO 12/6; 102 CP34S 1/10; 32 mfd. type CE19LE 6/-. Resistors and Potentiometers, Morganite type T 6d.; Type R 8d.; 100K Linear Pots 5/-; .25 meg. and 1 meg. Linear Pots 6/3; Colvern type CLR 901 10K and 2.5K Pots. 3/3 each; Colvern 500 ohm 4 watt 6/9. Valves, inc. tax, Mazda 6P25 18/8; 6K25 15/1; Brimar 6CD6G 31/6; 6U4GT 21/6; R16 28/8. Rectifiers, Westinghouse 36EHT100 29/5; S.T. and C. K3-100 (8 kV), 14/8. All Standard Viewmaster Components are available ex-stock as previously advertised. Send 6d. stamp now for our complete lists which contain details on Viewmaster, Teleking, W.W. TV S'Het. P.W., 3-Speed Autogram, P.W. Tape-recorder, P.W. Electronic Organ, P.W. Modern One-Valver, etc., etc. Details of the Soundmaster Tape Recorder available shortly. Please add 9d. postage on all orders under £2 value. Above this amount post free. L. F. HANNEY, 77, Lower Bristol Road, Bath. (Tel.: 3811.)

ARGUS.—All components as shown in last month's issue. 5% discount on all orders over £3 during November-December. Booklet, "Fundamentals of Television Servicing for Beginners," 6d., post extra. R. E. HOPE, 6, Grange Rd., Thornton Heath, Surrey.

SIGNAL GENERATOR, 100kc-70m/c, crystal check incorporated; bargain Box 141, c/o PRACTICAL TELEVISION.

SCANCO and all Components. Flyback Line Trans. S.T.114 7-10 k.V. Width and Linearity Controls, Circuit available. Line Output Trans. S.T.11. Focus Coils S.T.8, S.T.28, S.T.18. Deflector Assembly S.T.9.R., S.T.19, S.T.29. S.A.E. for lists. A & J. B., 32, Cedars Rd., Beddington, Croydon, Surrey.

NEW BOXED VALVES AND GUAR.

1R5	9/-	3S4	9/6	5V4	9/6	12K7	10/6
1T4	9/-	6U5	8/-	6SL7	9/-	EF91	10/6
1S5	9/-	6J7	8/-	35Z4	10/6	EY51	12/6
1S4	9/-	SP61	8/6	VR92	2/-	EB91	8/6

EF50 7/6, ex. new equip., 5/6. *Lists 3d.*

1R5, 1T4, 1S5, 3S4 .... 32/6 } Special Price
Ten EF91 for Pract. T/V Set ... 85/- } Per Set

COAX CABLE.—Standard ¼in. diam., 80 ohm, Polythene Ins. Not Ex-Govt., 10d. yd.
VOL. CONTROLS.—Midget Ediswan type. All Values. Long spindle. Guar. 1 yr. Less Sw. 3/-; S.P. sw., 4/-; D.P. Sw., 4/9.
ELECTROLYTICS.—New, best makes.

8/450 v. B.E.C.	2/6	8+8/450 v., B.E.C.	4/-
16/450 v. T.C.C.	3/6	8+16/450v. B.E.C.	5/-
16—16/450v. B.E.C.	5/6	25/25 v. B.E.C.	1/9
60mfd. 350v. T.C.C.	6/6	250mfd. 350v. B.E.C.	8/6

RESISTORS.—¼ w., 4d., ½ w., 6d., 1 w., 8d., 2 w., 1/-, 5 w., 1/9, 10 w., 2/6, 15 w., 2/9.
W/W POTS. Min. T/V type. 5 w. 200 ohms to 25,000 ohms, 3/-. **SOLDER,** 60/40, 4d. per yd.

T. R. S. 71, MEADVALE ROAD, EAST CROYDON.
Callers: 307, WHITEHORSE RD., WEST CROYDON. *P. & P. 6d. Over £1 free.* *THO* 1665

"VIEWMASTER" Valves, exact to specification, guaranteed new and boxed, comprising 5 EF50, 1 6P25, 1 KT61, 1 EBC33, 1 EB91, 2 6K25, 1 6P28, set of 12 £6/2/6, including tax (post and insurance 2/-). "Tele-King" 16in. Receiver, complete set of 17 valves exact to specification, £9/9/-, including tax. 6AM6, EF91, 6F12, Z77, DH77, 6AT6, 7/6; EB91, 6AL5, D77, 6/6; 6V6G, 5Z4G, EBC33, MU14, 1S5, 1R5, 1T4, 3V4, 1S4, 8/6; 3S4, 9/-; PZ30, PL38, 17/6; 6P25, 13/6; EY51, PL83, CCH35, ECH35, U22, 6F15, 6C9, 12/-; 6K8GT, CL33, PL33, 10F9, 10LD11, 10C1, 10P13, PL82, 11/-; PY80, UCH42, UL41, UF41, UBC41, X78, N78, 10/6; 25Z6GT, CY31, UY41, U281, U404, AZ31, ECH42, DL35, 10/-; ECL80, EF80, KT61, 6SN7GT, 6Q7G, 12K8GT, 9/6; U50, 5Y3G, 80, 35L6GT, 50L6GT, 35Z4GT, 6V6GT, 9/-; EF39, EF8, EF50, 7Y4, 7C5, 7C6, 7B7, 7H7, 7S7, 7/6; HVR2A, 6K7G, 6/3; all new and boxed. Postage 4d. per valve extra. READERS RADIO, 24, Colberg Place, Stamford Hill, London, N.16.

PREMIER RADIO T/V, London. New and complete except for C.R.T.97 and speaker. Separate E.H.T. Vision, sound and time bases already built. Offers. Box No. 139, c/o PRACTICAL TELEVISION.

COMPLETE KIT, PRACTICAL TELEVISION, including Tube; perfect, as specified, £30; bargain. 6, Grasmere Rd., Ulverston.

50 SECONDHAND Televisions always for sale; famous makes. TOMLINS, 127, Brockley Rise, Forest Hill, S.E.23. (For. 5497.)

IF YOU REPAIR T/V SETS, send 4d. stamps for our Spares Manual. DIRECT T/V REPLACEMENTS, Dept. P.W., 134-136, Lewisham Way, New Cross, S.E.14. (TIDeway 3696.)

"VIEWMASTER" Valves, complete set of 12 as listed, £6/2/6; EF91, 8/-; EB91, 6/6; K.T.61, 9/6; 6K8, ECH35, 12/6; 6V6, 5Z4, U50, 8/9; 6K7, 6J7, 6K6, 6X5, EL32, EF50, 6C5, 6/9 each. 13,000 other Valves in stock at equally attractive prices. Stnd. 465 kcs I.F. Trans., 10/6 pr. Viewmaster Coils as spec., Lndn. 15/6, all other areas 18/6, 8in. non-mag. Speakers, 15/6. V/cntrls., all values, 3/-, SP/sw., 4/3. Amplion semi-midget, all values, 4/-, SP 5/9, DP 6/6. Fil. Trans., 6.3v, 1.5A, 6/9. Co-ax. Cable, ¼in., 70/80 ohms, 10d. yd., 9/- doz. Stamp lists. RADIO UNLIMITED, Elm Road, London, E.17. (Phone: KEY. 4813.)

EDUCATIONAL

FREE ! Brochure giving details of Home Study Training in Radio, Television, and all branches of Electronics. Courses for the hobby enthusiast or for those aiming at the A.M.Brit.I.R.E., City and Guilds Telecommunications, R.T.E.B., and other Professional examinations. Train with the College operated by Britain's largest Electronic organisation. Moderate fees. Write to E.M.I. INSTITUTES, Postal Division, Dept PT28, 43, Grove Park Rd., London, W.4. (Associated with H.M.V.)

MERCHANT NAVY and Air Radio. Day, Evening and "Radiocerts" Postal Instruction. Apply THE RADIO OFFICER. The Wireless School, 21, Manor Gardens, Holloway, N.7. (ARC 3694.)

I.P.R.E. Data for constructing TV Aerial-strength Meter, 7/6; 5,500 Alignment Peaks for superhets, 5/9; sample copy "Practical Radio Engineer," 2/-. Membership-examination particulars, 1/-. Syllabus of seven postal courses free and post free. SECRETARY, I.P.R.E., 20, Fairfield Rd., London, N.8.

News from the Trade

The "Scalamp" Electrostatic Voltmeter

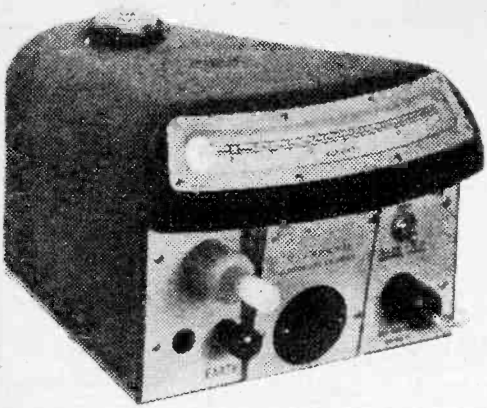
THE "Scalamp" electrostatic voltmeter was developed by Pye research engineers primarily for use in testing E.H.T. for picture tubes used in television receivers and cameras. Its compactness, portability, ease of operation and accuracy make it suitable for a very wide range of applications.

A specially designed vane is held in the proximity of a well-insulated electrode by a taut-suspension of the galvanometer type. The movement is critically damped under all circumstances by a magnet damping device.

The lamphouse is integral with the front panel. The inside face of the lamphouse carries the optical system. The external face comprises a removable panel upon which the 4-volt bulb is mounted. The bulb can be changed easily and quickly without disturbing any other components of the instrument; moreover, when the bulb is changed the "Scalamp" interior remains sealed off from the outside by the lamphouse.

The standard "Scalamp" electrostatic voltmeter is fitted with a transformer for use on A.C. mains, 200-250 volts. Connection is made via a 2-pin safety plug recessed into the front panel. For portable use or where no mains supply is available, removal of a shorting bar allows the instrument to be operated from a 4-volt battery. A switch, which is operative on both the mains and battery connection, allows the lamp to be switched on and off as required. The instrument can be supplied without transformer at reduced price if specially requested.

The components of the "Scalamp" electrostatic voltmeter are enclosed in a robust plastic case. All joints in the case are sealed with rubber strip to prevent the ingress of dust, and the only orifice in the case, through which the "Set Zero" knob protrudes is protected by a thick sorbo rubber ring. The scale is placed at a convenient reading angle.



The "Scalamp" voltmeter

Range of three "Scalamp" electrostatic voltmeters:

Cat. No. 11308.—1-5 kV on D.C. or A.C.

Cat. No. 11309.—3-10 kV on D.C. or A.C.

Cat. No. 11310.—5-18 kV on D.C. and 5-12 kV R.M.S. on A.C.

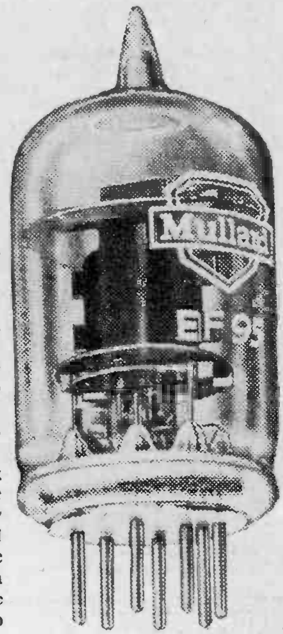
Accuracy 1 per cent. on all ranges D.C. and A.C. (up to 12 kV R.M.S.) up to 100 Mc/s. Period, 3 seconds.

W. G. Pye and Co., Ltd., "Granta" Works, Cambridge.

A New Miniature R.F. Pentode

A NEW R.F. pentode, the EF95, recently made commercially available by the Communications and Industrial Valve Department, Mullard, Ltd., will help designers of communications equipment to improve substantially the signal-to-noise ratio of receivers—even those operating at frequencies up to 200 Mc/s.

The EF95, which is constructed on the B7G base and has characteristics similar to those of the well-known American valve 6AK5, goes a long way in meeting these requirements by providing the best possible performance so far obtainable from a conventional all-glass pentode.



The new Mullard R.F. pentode.

Particularly interesting features of this valve are its extremely low input and anode to grid capacitances. These features together with a slope of 5.1 mA/V, give a very useful slope to capacitance ratio. Another advantage of the EF95 is that its optimum performance is obtained at the very low H.T. of 180 volts. Good results can even be obtained with H.T.s down to 120 volts and below.

In a number of modern highly complex circuits it is necessary to use several R.F. and I.F. pentodes. In such cases advantages can be gained by using EF95 valves throughout, not only will concentration on one-valve type facilitate maintenance of the equipment, but will also result in an appreciable saving in current consumption.

The principal characteristics of the EF95 are as follows:

Heater voltage	6.3 volts.
Heater current	0.175 amps.
Anode voltage	180 volts. 120 volts.
Mutual conductance	5.1 mA/V 5.0 mA/V.
Equivalent resistance	2 KΩ.
Input damping (at 50 Mc/s) ...	25 KΩ.
Optimum noise factor (at 100 Mc/s)	3.5.

Full technical details are available on request from the:

Communications and Industrial Valve Department, Mullard, Ltd. Century House, Shaftesbury Avenue, W.C.2.

Published on the 22nd of each month by GEORGE NEWNES, LIMITED, Tower House, Southampton Street, Strand, London, W.C.2, and printed in England by W. SPEAIGHT & SONS, LTD., Exmoor Street, London, W.10. Sole Agents for Australia and New Zealand: GORDON & GOTCH (A/sia), LTD. South Africa: CENTRAL NEWS AGENCY, LTD. Subscription rate including postage, for one year: Inland and Abroad 13s. 6d. (Canada 13s.). Registered at the General Post Office for the Canadian Magazine Post.

WENVOE CONVERSION

Type AC/4 Convertor unit for use with Sutton Coldfield receivers. Optimum picture detail and Sound reception without retuning or alterations. Incorporates power supply unit, R.F. stage and highly successful double mixer stage ensuring freedom from noise and correct reception of the new single side-band transmitters. Also available for Holme Moss on London type receivers. Price, complete with 5 valves, etc., **15 gns.** C.O.D. if desired, or by arrangement with your own Dealer.

The AC/3 neutralized triode PRE-AMPLIFIER. A well designed and proved unit giving the best possible results for 'Fringe' and long distance viewers. Our confidence in the unit is revealed by our 7 days' approval offer. Price complete, **10 gns.** C.O.D. if desired, or by arrangement through your Dealer. Illustrated leaflets and details, etc., available on request.

SPENCER WEST

Quay Works, Gt. Yarmouth

Telephone : Gt. Yarmouth 3009.

The "Fluxite Quins" at Work

" There'll be the dickens to pay.
Nice time to sweep chimneys, I'll say.
We're in a fine plight,
And we're out of FLUXITE,
Undoubtedly our blackest day."

See that **FLUXITE** is always by you—in the house—garage—workshop—wherever speedy soldering is needed. Used for over 40 years in Government works and by leading engineers and manufacturers. Of all ironmongers—in tins, from 1/- upwards.

FLUXITE

SIMPLIFIES *ALL* SOLDERING

Write for Book on the Art of "SOFT" Soldering and for leaflets on CASE-HARDENING STEEL and TEMPERING TOOLS with **FLUXITE.** *Price 1½d. each.*

FLUXITE Ltd.,
Bermondsey Street, London, S.E.1.

FIRST-CLASS TELEVISION and RADIO COURSES . .

GET A CERTIFICATE!

After brief, intensely interesting study—undertaken at home in your spare time—**YOU** can secure your professional qualification or learn Servicing and Theory. Let us show you how !

FREE GUIDE

The New Free Guide contains 132 pages of information of the greatest importance to those seeking such success compelling qualifications as **A.M.Brit.I.R.E., City and Guilds Final Radio, P.M.G. Radio Amateurs' Exams., Gen. Cert. of Educ., London B.Sc. (Eng.), A.M.I.P.E., A.M.I.Mech.E., Draughtsmanship (all branches),** etc., together with particulars of our remarkable Guarantee of

SUCCESS OR NO FEE

Write now for your copy of this invaluable publication. It may well prove to be the turning point in your career.

FOUNDED 1885—OVER 150,000 SUCCESSES.

NATIONAL INSTITUTE OF ENGINEERING
(Dept. 462), 148, HOLBORN, LONDON, E.C.1.

ALUMINIUM, LIGHT ALLOYS, BRASS, COPPER, BRONZE,

IN ROD, BAR, SHEET, TUBE, STRIP, WIRE, ANGLE, CHANNEL, TEE

3000 STANDARD STOCK SIZES

H. ROLLET & CO., LTD.
6, CHESHAM PLACE, LONDON, S.W.1.
SLOane 3463

Works :
36, ROSEBERY AVE., LONDON, E.C.1.
Branches at Liverpool, Manchester, Birmingham.
"No Quantity too Small"

RADIO G200 ANNOUNCES

VALVES.—At 1/9 : RK34/2C34. At 2/3 : EA50, D1, VR78, VR92, 954, 956, 2X2A. At 4/6 : 6H6, 12H6, 6H6gt, 6SH7. At 5/6 : 12SH7, 4D1, 6AC7, 6J7g, 6K7g, 6SS7, 6SG7. At 6/9 : 6K7gt, 6SK7gt, 12SC7, 6U5g, EC52, 12SK7, U78, 12SL7. At 7/9 : 7B7, 7C5, 7C6, 7C7, 7H7, 7R7, 7S7, 7W7, 7Y4. At 8/6 : 1S4, 1T4, 3A4, 6X5gt, 25L6gt, 35L6gt, SDL6gt, W77. At 9/6 : 1R5, 1S5, 3S4, 3Q4/N18, 3V4, 1D5, 6V6g, 6F6g, 6C6, 6D6, DF92/1L4, 6CH6, 6BG6, 25Z4gt, D77, DH77, X78, 35Z4gt, 6N7gt, 12AT7, 12AU7, 12AX7, KT81, 6SA7, 2A3, 6B4g. At 10/6 : 12K8gt, 12K8g, 6K8gt, X61, X76, 6U4g, 6CD6g, 5U4G, CV2. At 12/6 : 884, 12Z3, 45Z5gt, 5R4gy.

ARTHUR HOILE
55, UNION STREET, MAIDSTONE, KENT. 'Phone : 2812

TELEVISION COMPONENTS

FOR THE
Practical Television Receiver
THE VIEWMASTER AND E. E. TELEVISORS
IN STOCK
Price lists available on request
Prompt Postal Service

J. T. FILMER
MAYPOLE ESTATE, BEXLEY, KENT
TEL. Bexleyheath 7267

TELEVISION CABINETS

FOR ALL HOME BUILT RECEIVERS. ANY SIZE SCREEN UP TO 17". FITTED WITH FULL LENGTH DOORS AND BEAUTIFULLY DESIGNED. ALSO RADIOGRAM & L.S. CABINETS.

WRITE OR PHONE FOR LEAFLET

H. ASHDOWN, 98, Hertford Rd., Edmonton, N.9.
Tel : TOT 2621

COMPLETE VIEW MASTER SERVICE

ALL MODELS **ALL AREAS**

PRICES. We can save you up to £7 on your View Master. Our very detailed list gives full particulars. Send for your copy now.

SPECIAL OFFERS. Resistor Kit. Every resistor labelled with value and position in set. Please note that no knowledge of the colour code is required with our kit. London, **26/-.** Midland, **24/9.**

PAYMENT. Cash or C.O.D. H.P. Terms now available.

DELIVERY. All orders are despatched on day of receipt.

INSTRUCTION BOOKS. Any model 7/6 post free.

WATTS RADIO (Weybridge) LTD.
8 BAKER STREET, WEYBRIDGE, SURREY
Telephone : Weybridge 2542.

VALVES

All Guaranteed. 24 hours' Service.

41MP	5/-	MSPEN (7-pin)	4/6
4TSP	4/-	VR66	1/6
DDL4	4/6	SP41	2/6
MH4	4/6	2X2	4/6
MH4 (Metal)	6/-	EF50 (VR91)	5/-
42SPT	4/6	EF50 (RED SYL)	7/6
VR53 (EF39)	7/6	6Q7	10/-
CV9	4/6	6K7	6/6
8D2	4/6	6V6	9/6
9D2	4/6	6SH7	5/-
15D2	5/-	APV4 (4v.-Rec)	10/-
LP2	3/6	5Z4	9/6
KT44	4/6	VU111	4/6
KTZ41 (VP4B)	4/6	1R5	9/6
AR6 (2v.-Triode)	4/9	FW4/500	9/6
KT24 (2v.-Pen)	4/9	EA50	2/6
EF80	11/-	954	2/6
EF91	10/6	1S5	9/-
807	9/-	1T4	9/-
6J7 (Z62)	4/6	ECL80	10/-
6J5	5/6	6H6	4/-
6SN7	10/6	5U4G	9/-

TELEVISION.—Mark 17 Set. 2-valve Battery Transmitter and Receiver. Will receive TV. sound without modification. Instruction Book and Circuit—Free. 29/6.

TELEVISION TUBE.—ACR2X (Mu Metal Screen). 4-v. heater. Max. H.T. 4,000 kV. Work on 2.5. 28/6.

COLVERN W.W. POTS.—Boxed 1 k Ω. 2 k Ω. 2/9.

PANELS.—Complete with 18 Cond., 22 ½-watt Resistors, 3 Westectors. 4/9.

DOUBLE FUSE HOLDERS.—2/3.

PAPER BLOCK COND.—8 mfd., 500 v.w. 4/-.

BULGIN RED LAMP HOLDERS. 2/3.

T.R.F. COILS, A and HF Transformers, 6/6.

1½-v. **DRY CELL**—8d. **JONES 8-WAY PLUG.**—1/-. **ADHESIVE TAPE.**—½in., 50 yds., 1/6.

Mail Order Only. Postage Over £2 FREE.

REX RADIO

37, LOUIS ST., CHAPELTOWN RD., LEEDS, 7

R.F. E.H.T. GENERATORS FOR ALL SIZES OF C.R.T.

TYPE BG 6900

Output 6-9 Kv. Input 250/350v. 20/30mA. Regulation as good as 3 per cent. Size 4½in. x 3½in. x 5½in. high. **£6.6.0**

TYPE B 150

Output 10-13 Kv. or 13-16 Kv. Input 300/350v. 30/40mA. Regulation as good as 5 per cent. Size 4½in. x 5½in. x 8½in. high. **£9.9.0**

Coils and sub-assembly available separately.

A complete range of R.F. E.H.T. Generators up to 100 Kv. Prices on application.

BRANDENBERG DESIGNS LIMITED

196, DAWES ROAD, FULHAM, S.W.6

Tel. : FULham 1534

CITY & RURAL

Immediate delivery from stock.

"VIEWMASTER"

SPECIFIED COMPONENTS

SEND FOR STAGE I NOW—

price £3.2.3 post free.

Complete Kits, Stage-by-Stage and Single Components Supplied. "VIEWMASTER" ENVELOPES, 7/6.

COMPLETE SET OF GUARANTEED VALVES FOR "VIEWMASTER"
£6.15.0

Television Explained, by W. E. Miller, 5/-.
6in. CRT Magnifier Lens, 22/6.
Belling 72-ohm Twin Feeder, 7½d. yard.
Electrolytics, Tubular, 8 mfd. 450v., 2/3 : 32-32 mfd. 275v., 3/6.
Multi-Ratio O.P. Transformers, 5/11.
Speakers P.M., 3in., 13/6; 5in., 14/6; 6in., 16/6; 8in., 19/6.
6V6GT, 10/6, VR91, 8/6, 5Z4G, 10/6.
Heater Transformers, 6.3v. 1.5A., 7/6.
2.5 Kv. Transformer, 45/-.
Smoothing Chokes, 10H 100 mA., 8/3; 15H 60 mA., 5/11.

Extensive Stocks New & Surplus Components & Valves

For Attention—Advice—Service write

CITY & RURAL RADIO

101, HIGH STREET, SWANSEA, GLAM.

Telephone : Swansea 4677

NUTS, BOLTS, SCREWS AND WASHERS

ALL CADMIUM PLATED

SET 305 (Size 2BA). Assorted screws and bolts from 5/16in. to 1½in. long, with plain hex. nuts, Pinnacle nuts, double anchor nuts, lock washers and plain washers. All rust proof. **Average Contents, 450 Pieces 7/6,** plus 6d. post.

SET 306 (Size 4BA). Assorted screws and bolts from ⅜in. to 1½in. long, with plain hex. nuts, Simmonds nuts, and plain washers. All rust proof. **Average Contents, 600 Pieces, 7/6**, plus 6d. post.

SET 307 (Size 6BA). Assorted screws from ⅜in. to 1½in. long, with plain hex. nuts, Simmonds nuts, shake proof washers and plain washers. All rust proof. **Average Contents, 750 Pieces, 7/6,** plus 6d. post.

By post air-freight or ship, anywhere in the world. Overseas post extra

All sets well packed in compartmented boxes.

BERNARD F. WADE LTD.

ILKLEY, YORKS, ENGLAND

Tel : Ilkley 1767

VIEWMASTER

Exact specified parts at Shopping List prices by return post. H.M., Wenvoe and Scottish. Also valves and tubes.

H.G. RADIO ELECTRICAL CO.

1350, Stratford Rd., Birmingham, 28

'Phone : Springfield 2369. *Estb. 25 years*

S.E. LONDON CONSTRUCTORS

We hold good stocks of new and guaranteed

COMPONENTS AND VALVES

Rewinds, loudspeaker repairs, communication and TV. receiver alignment, etc.

GLYNDON RADIO SERVICE, 68, Wellington St., Woolwich.

WOO 2749.

THE MODERN BOOK CO.

Mandl's Television Servicing. 42s. 0d., postage 9d.

Time Bases, by O. S. Puckle. 32s. 0d., postage 9d.

TV Fault Finding, compiled by "Radio Constructor." 5s. 0d., postage 3d.

Television Receiving Equipment, by W. T. Cocking. 18s. 0d., postage 9d.

Television Faults, by N. Stevens. 5s. 0d., postage 3d.

Television Explained, by W. E. Miller. 5s. 0d., postage 6d.

Thermionic Valve Circuits, by E. Williams. 21s. 0d., postage 9d.

Amplifiers, by G. Briggs and H. Garner. 15s. 6d., postage 6d.

Practical Wireless Service Manual, by F. J. Camm. 8s. 6d., postage 6d.

The Radio Amateur's Handbook, by A. R. R. L. 30s. 0d., postage 1s. 0d.

Sound Recording and Reproduction, by J. W. Godfrey and S. W. Amos. 30s. 0d., postage 9d.

Magnetic Recording, by M. L. Quartermaine. 4s. 6d., postage 3d.

The Principles of Television Reception, by A. W. Keen. 30s. 0d., postage 9d.

The Williamson Amplifier. 3s. 6d., postage 3d.

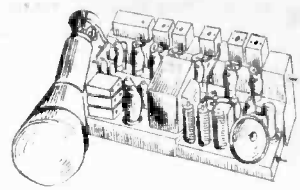
Radio Valve Data, compiled by "Wireless World." 3s. 6d., postage 3d.

We have the finest selection of British and American publications in the Country. Complete list on application.

19-23, PRAED STREET (Dept. P.12) LONDON, W.2

Tel. : PADdington 4185.

COMPACT T.V.



The now famous "New 1355 Conversion" enables you to construct a remarkably compact, self-contained televisor : Sound, Vision, Time bases, Speaker and power pack on one 1355 chassis—without the use of any expensive RF units.

Data, for all five channels, 3/-.

We can supply 1355 receivers, in original makers' cases, complete with 11 valves, 45/-.

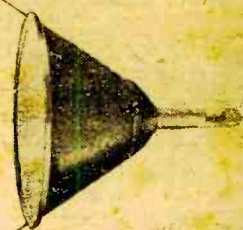
INDICATOR UNIT 182A containing VCR517 (6 in. C.R.T.), 4 SP61's, 3 EF50's, 5U4G, dozens of resistors, condensers, etc., 9 WW pots, these contain many of the additional components required for our conversion, or for 'Scope construction. 79/6 in original cases. We can supply a few less EF50's and 5U4—otherwise perfect. 50/-.

RADIO EXCHANGE CO.

9 CAULDWELL STREET, BEDFORD

(Phone : 5568)

The wide viewing angle is one of many reasons why 'English Electric' metal C.R. tubes are chosen for the 'View-Master' home constructor circuit today



The 'View-Master' (subject of an article in the October issue of this magazine), the 'Tele-king', 'Magnaview' and other circuits for home construction have all been designed to take advantage of the 'English Electric' T901 Metal C.R.T.—the tube to fit if you want "professional" results.

★ *Magnetic focus and deflection (70° angle)*
★ *Almost flat face plate.*
★ *Wide viewing angle and picture-focussing over the whole screen area.*
★ *Fitted with Ion trap.*
★ *Robust yet lightweight construction.*
★ *Overall length 17 1/16".*

For full information on the T901, including scanning, write to:
The English Electric Co. Ltd., Television Department, Queens House, Kingsway, London, W.C.2

'ENGLISH ELECTRIC'

Metal C.R. Tube