TELEVISION IN YOUR OWN HOME

Television and SHORT-WAVE WORLD

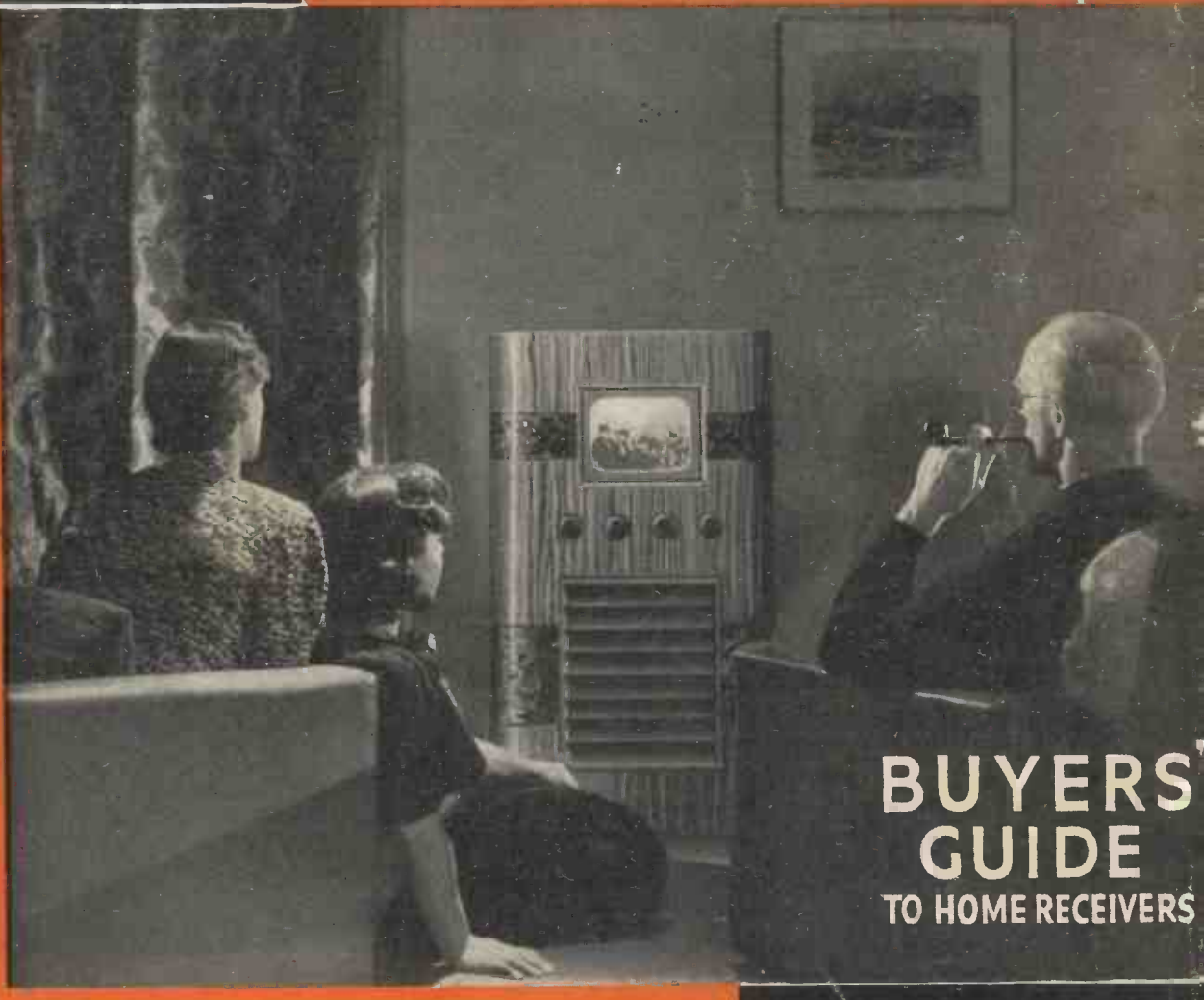
MARCH 1939
No. 133. Vol. XII.
1/-

PRACTICAL GUIDE TO RECEIVER SERVICING

MECHANICAL OPTICAL TELEVISION

SHORT WAVES

3-BAND C.W. TRANSMITTER



BUYERS GUIDE TO HOME RECEIVERS

MAKING MOST OF DUMMY ANTENNA

CRYSTAL CONTROL ON 5 METRES

6L6 FREQUENCY MULTIPLIER

BERNARD JONES PUBLICATIONS LTD.
CHANSITOR HOUSE. CHANCERY LANE
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THE FIRST TELEVISION JOURNAL IN THE WORLD

No. 133 VOL XII MARCH, 1939

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Special Features

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COMMENT OF THE MONTH

Making History

TWO events of great importance to the future progress of television have occurred during the past month. One was the decision of the B.B.C. to allow the Boon-Danahar fight at Harringay Arena on February 23, to be publicly televised and the other is the permission given by Sir Oswald Stoll to enable a monthly transmission to be made from the Coliseum. In the former case the B.B.C. are careful to point out that the permission to reproduce the transmission in certain places of public entertainment must not be regarded as a precedent, and that it must not be taken that any general exension of permission for the re-diffusion of B.B.C. television programmes in places of public entertainment is contemplated.

There is more in this apparent change of front on the part of the B.B.C. than is obvious for it is very probable that had it not been for the cinema relay, the B.B.C. would not have been given permission to transmit the fight at all.

It seems to us that this event provides an opportunity for making a good start in ending the opposition which exists between cinema interests and the B.B.C., and laying the foundations of a vast new industry. Quite obviously large-screen cinema television has got to come and advantage should be taken of this occasion for negotiations to place the whole scheme on a basis which will allow of the rapid development of cinema television. Up to the present progress has been entirely due to private enterprise with no immediate prospect of reward and the Baird Company are to be congratulated upon the foresight and research work which have made this public transmission possible.

The Dealers' Point of View

Resolutions put to the meeting of the Wireless Retailers' Association which found unanimous support were:—

1. Minimum picture size should be 6 in. by 5 in., and the 10-in. by 8-in. picture should be regarded as the normal standard.
2. Every chassis with a particular size of tube should be available as a sight-and-sound set only, and also combined with a normal broadcast set.
3. A standard guarantee covering a twelve months' period is desirable.

There is one of these resolutions with which we are not in agreement and this is the minimum picture size. As we have so frequently pointed out the only method of reducing the cost of a receiver is by the use of a small screen and it appears to us that with the minimum size of screen stated a large number of people will, for some considerable time at all events, be precluded from owning a television receiver. In cases where the number of viewers does not ordinarily exceed three the small screen receiver is quite capable of providing excellent entertainment.

BUYING A RECEIVER—

SOME USEFUL POINTERS

IT is fairly safe to say that the first considerations a prospective buyer of a television receiver will have are price and picture size. As a matter of fact these two factors are bound up one with the other for, broadly speaking, the larger the picture, the higher is the price; there are, however, several other matters which have a bearing and merely to base the selection of a receiver on a price-picture-size basis would be wrong.

Picture Size

For some considerable time after the present television service was introduced, the general complaint was that the pictures were too small. This was at the time when there were very few private viewers and the public had, therefore, judged by public demonstrations and in most cases had been a considerable distance away from the receiver. For public viewing the ordinary size of screen is certainly too small, but complaint of picture size is rarely, or never, heard from those who have receivers installed in their own homes. It is to be admitted that for viewing in large rooms large pictures have certain advantages as the receiver can be placed at a considerable distance away and viewed in comfort.

Picture size is closely concerned with definition; a very large picture cannot be viewed at close range without the scanning lines being visible, so where space is limited a moderate sized picture is definitely an advantage for the viewer. At a distance of approximately 6 ft., the picture detail is good and imperfections are reduced to such an extent that they are practically invisible.

Reference to the specifications on other pages in this issue will show that, excluding special projection receivers which are in a class by themselves, the average screen width is approximately $8\frac{3}{4}$ in., but that the most popular size of screen is 10 in. by 8 in., a size which enables a reasonably compact receiver to be produced at an economic price.

Now what of the really small screen receivers? Usually these give excellent pictures with remarkably good detail and considerable brightness. For what may be termed "intimate" use, they leave little to be desired, but they will be found wanting in cases where the audience exceeds five persons. They certainly bear out the previous statement that price is closely related to picture size, for they cost no more than a good radiogram.

Price Reduction?

Many people are delaying buying a television receiver because of a belief that, as was the case in the early days of broadcasting, there will shortly be a considerable reduction of price. This argument needs but little refutation. In the first place the modern television receiver as regards construction, components and valves, is the equivalent of three really high-class broadcast receivers, so a little calculation will show that upon this comparison the television receiver is better value for money. Secondly, all the components used in a television receiver are wireless types. Price reduction in the case of broadcast receivers was made possible by mass production and improved methods of component manufacture, and experience of this has obviously been available for television purposes from the outset. It can be stated definitely, therefore, that little or no reduction of price is at all likely unless some revolutionary new system were to be developed and of this there is not the slightest indication. It may, therefore, be regarded as certain that there will be no appreciable price reduction in the near future, in fact, as many receivers are being produced at uneconomic prices the reverse is just as likely.

Direct or Indirect

A comparison of the types of ordinary receivers on the market will show that the larger proportion give pictures that are directly viewed as opposed to those in which the picture is viewed in a mirror placed at an angle of 45 degrees in the lid of the cabinet. From these proportions it might be assumed that the former, being the more popular, is the better. Actually, however, it is a matter for individual preference as there is little material difference so far as the picture is concerned. The chief reason for using a mirror is that a saving of space (particularly back-to-front dimensions of the cabinet) is possible by allowing the tube to be placed vertically; but latterly there has been a tendency to produce cathode-ray tubes of shorter length and the advantage of placing the tube vertically has, therefore, been nullified to some extent, at all events in the case of receivers with moderate sized screens. As stated, the choice of one type or the other is really a matter of personal preference having regard to cabinet dimensions for pictures of equal sizes.

Range

The official range of the Alexandra Palace transmitter is 25 miles and it may be taken for granted that any receiver will be capable of giving good results up to this distance. This range, however, is conservative, and as a rule reception is possible at distances in excess of this. No manufacturer will sell you a receiver which will not operate in your particular district, and if you reside in an area outside the accepted range the makers will be prepared to advise and probably carry out tests. Fifty miles is, however, about the limit for consistent reception without special equipment. Some makers have available two models of the same type of instrument—one for use within the ordinary range and the other for distances, within limits, in excess of this. A greater number of valves are employed in the latter and the cost is naturally a little more. In addition there are pre-amplifiers available which will increase the range of any receiver, again within certain limits.

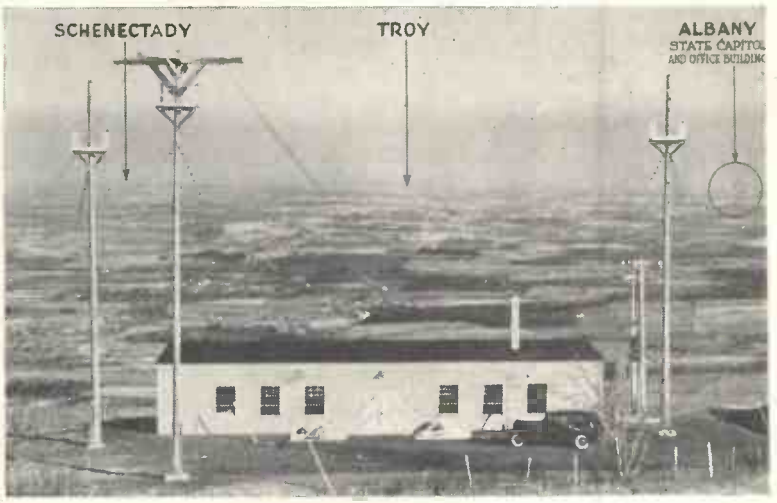
Control

Whatever make or type of receiver is selected it may be taken as a fact that the control is simple and quite within the ability of any ordinary person. Although in some cases a number of controls are provided, whereas in others there are, say, only two, operation in either case is really equally simple, for in ordinary conditions of use, it is only necessary to touch one or two.

There are a number of television

(*Continued at foot of next page*)

GENERAL ELECTRIC (U.S.A.) TELEVISION



The New General Electric television transmitting station will cover an area comprising Schenectady, Albany, Troy, Amsterdam and Saratoga, known as the Capital District, with a combined population of more than 500,000. The tower to the left supports the receiving antenna, picking up studio signals radioed from Schenectady ; the next is to broadcast the pictures, and the one to the right is the sound aerial. The small pole to the right is part of the power line, bringing electricity up the mountainside to the station.

AS announced in last month's issue, the General Electric Company of New York are now erecting a television station at Indian Ladder in the Helderberg Hills, 12 miles from Schenectady, N.Y.

The site is the top of a 1,500-ft. hill with the aerial on 100-ft. towers and it is stated that it will be at least 250 ft. higher than any other television transmitter in New York. The equipment will incorporate many new features developed by General Electric engineers.

From an ultra short-wave transmitter on the studio building, the signals will be relayed over the 12-mile gap on a 1.4 metre band to the main transmitter in the Helderbergs, where they will be broadcast for public reception on a wavelength in the 66-72 megacycle band or approximately 4½ metres. The sound signals accompanying the picture will also be broadcast on the same band, on a frequency close to that of the vision signals.

General Electric's television camera. The small, circular holes contain red lights which glow, signalling the actors when the camera is in operation.

The General Electric Company has been conducting television research for the last 10 or 12 years, and much of the pioneer work was done in the company's laboratories by Dr. E. F. W. Alexanderson; his first transmission was made in the autumn of 1928, and a year or two later a demonstration was given in a local theatre on a 7-ft. screen, with vaudeville actors in the laboratory studio at a distance of about one mile. The sound accompanying the picture on this occasion was broadcast by WGY on its regular wave band.

More than 250 valves are included in the complete television transmission equipment, many of which are of new design. The antenna used is a novel type resembling a cube of wires strung from the three 100-ft. poles.

Last year General Electric engineers visited Europe to investigate and study television in England, Germany, and Holland.

" Because of its ideal location and the fact that it will utilise at least 30 per cent. more power than any existing television station in this country, this station should have greater range than the one on top of the Empire State Building," explained C. A. Priest, the engineer in charge for General Electric. " We shall not use coaxial cable between our studio and the station but an ultra high-frequency sharp directional transmitter, because in our opinion this will produce better results."

The building and the towers at Indian Ladder have been erected, a roadway constructed, a well sunk to supply the necessary water for cooling the tubes, and a start has been made with the installation of the equipment.

"Buying a Receiver"

(*Continued from preceding page*)

receivers on the market which have erroneously been termed add-on units and adaptors intended for use in conjunction with existing broadcast receivers, and it appears that a certain amount of misconception exists in regard to these. Actually, they comprise a complete vision receiver, but use is made of the broadcast set by means of a convertor included in the same cabinet as the vision receiver for the provision of the sound accompanying the vision signals. Actually, therefore, the broadcast set has nothing whatever to do with the reception of the picture or its reproduction. By utilising the broadcast set for sound a considerable economy in price can be effected and the instrument made more compact.

The Aerial

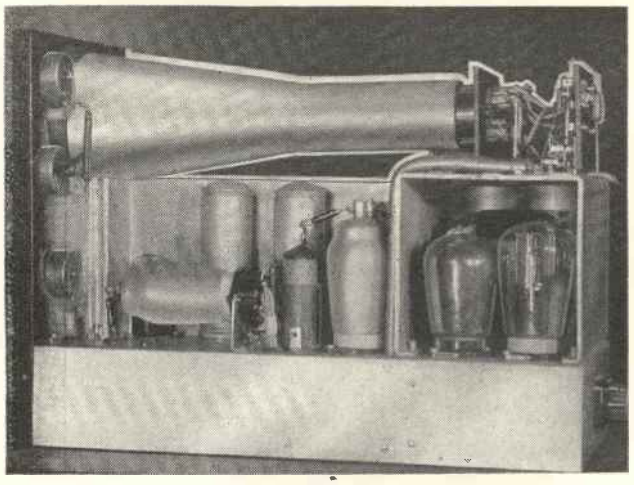
Then there is the matter of the aerial which must be a special type termed a di-pole. One aerial, which is a vertical type and quite compact will serve for both sound and vision signals and usually its erection is a simple matter. Some makers include the aerial and its installation in the price of the receiver, whereas others make a separate charge. Though the charge is only a few pounds it is a matter which should be taken into account of any price comparison.

All makers give twelve months' guarantee and free service within that period, and it should be remembered that if desired any receiver may be purchased on hire-purchase terms for, in some cases, a matter of a few shillings a week.

A PRACTICAL GUIDE TO TELEVISION RECEIVER SERVICING

By W. A. L. Plews

The first of two articles on receiver repair



For efficient servicing an oscilloscope is essential. This photograph shows the interior of the popular Mullard Model 3153.

THE maintenance of any complex apparatus such as a television receiver is best attempted by the process of splitting the receiver into sections, and then instead of regarding the set as a complex whole we would see it instead as a collection of units each performing an individual function.

With an understanding of each function the symptoms of any trouble which may occur can be localised in the unit from which it originates, thus greatly decreasing the testing time.

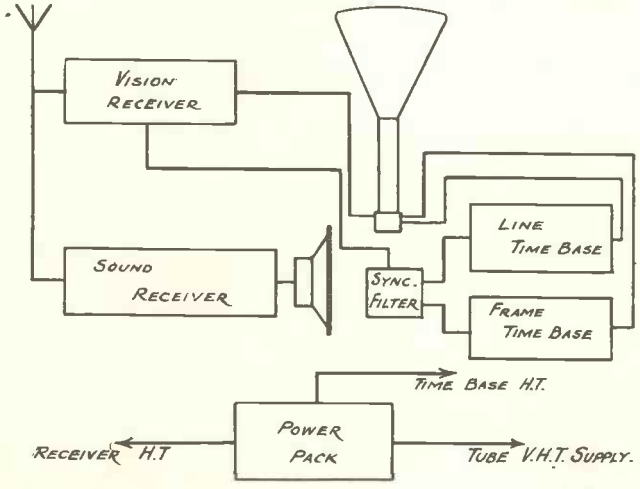
Fortunately, a television receiver lends itself readily to this mode of attack and the main units are shown below. Of course, each unit can be subjected to further division once the fault has been traced to it.

The units shown comprise:—

1. Vision receiver.
2. Sound receiver.
3. Synchronising filter circuits.
4. Time bases.
5. Power pack.
6. Cathode-ray tube.

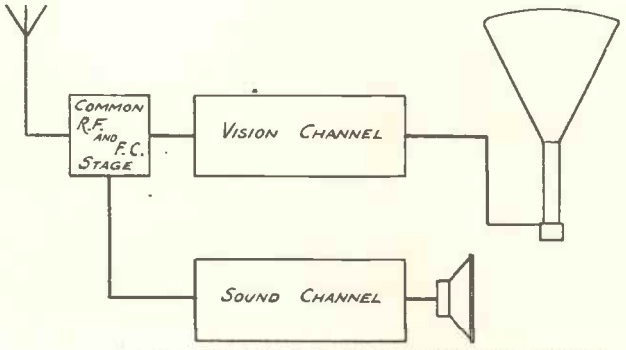
When testing a faulty receiver the symptoms should be carefully studied in relation to the circuit diagram and the behaviour of the relevant controls. By carefully noting the effects produced it is frequently possible to suspect the section of the receiver giving rise to the trouble.

It is not within the scope of a limited article such as this to attempt any but general guidance rules and for this reason specific circuits have been avoided. Since once a faulty section has been located, in most cases the procedure will then follow standard radio servicing methods, it was thought most useful to classify faults under general headings and these are summarised below together with the method of localisation.



Left: Straight R.F. Amplifier Receiver.

Below: Superhet Type with common R.F. and F.C. Section for sound and vision. Other units as above.



1. *Faults Affecting both Sound and Vision*

Symptoms: No sound or vision.
Weak sound and vision.

The first suspects should be the aerial and then the power pack. In superhet receivers where a common H.F. and frequency changer stage is employed for both the sound and vision frequencies this stage should also be investigated if the aerial and power supplies are in order. If the tube is D.C. connected to a video amplifier stage, failure of H.T. to the sound and vision receivers will give rise to an additional symptom

No sound or vision will in these cases be accompanied by a brilliant raster, since part of the tube bias normally developed across the anode load of the video valve will no longer be present.

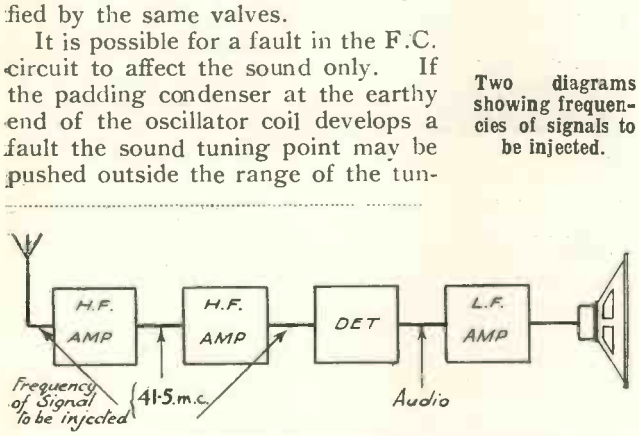
2. *Faults Affecting Sound Only*

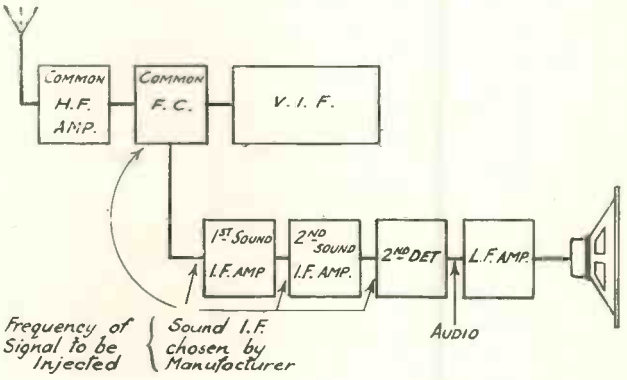
Sound receiver. Where any portion of the circuit is common to sound and vision checking of such section will not be required. After normal voltage measurements have been taken the remaining portion of the sound receiver should be sectionalised by using the service oscillator. This operation should be commenced at

the output end of the receiver and each stage checked by injecting signals of appropriate frequency, working back towards the H.F. end.

In a few receivers an examination of the circuit diagram will show that the sound and vision I.F.'s are amplified by the same valves.

It is possible for a fault in the F.C. circuit to affect the sound only. If the padding condenser at the earthy end of the oscillator coil develops a fault the sound tuning point may be pushed outside the range of the tuning control, but owing to the greater bandwidth of the vision I.F. chain, the picture can still be obtained.





Two diagrams showing frequencies of signals to be injected.

3. *Faults Affecting Vision Only*

No vision. Weak vision.

No vision. The first action should be to adjust the grid control of the tube and check whether a raster can be observed on the tube. If no raster becomes visible the power supplies to the tube should be investigated, and if in order the tube is faulty. Assuming a raster shows on the end of the screen the fault will lie in the vision receiver section. If no vision is accompanied by a brilliant raster where the tube is connected direct to the video output, the output valve of the vision receiver is the cause. A short circuit in this valve may also render the bias control inoperative, i.e., no raster will became visible in the first test mentioned in this paragraph. This is due to the heavy current through the load resistances in the valve anode causing excessive bias volts to be developed, and cutting off the tube beam current.

Weak modulation or a dim picture. A test should first be made by operating the frequency controls to determine whether or not the weak modulation is accompanied by poor synchronising. If the sync. is weaker than normal for the receiver, the symptoms are due to a fault in the vision receiver causing low gain. If sync. is normal the vision receiver may be taken as operating correctly, the symptoms now pointing to incorrect operating voltages on the tube, faulty tube, or in cases where a D.C. restoration circuit is used, a low emission diode.

Where the receiver is at fault the symptoms of weak modulation on the tube should be further examined in relation to the behaviour of the contrast or more properly speaking the gain control. If the control can be used in its normal position and no increase in brightness accompanies an increase of gain by turning up this control the detector, generally a diode, may be suspected.

Where the contrast control gives weak modulation in the normal position, and an increase only results in the screen going evenly white, in all probability the output valve in the video stage has lost emission, and can no longer accommodate the required voltage swing.

4. *Faults Affecting the Synchronising of the Picture*

Symptoms: Picture slips both vertically and horizontally. No line sync. No frame sync.

The fault lies either in the feed from the receiver to the synchronising filter or in a component in the filter circuits which is common to both the line and frame sync. circuit. In the cases of failure to sync. in one direction only the common feed is obviously not at fault and the failure is due to components in the line or frame filter circuits only, whichever is indicated.

Where the sync. is weak care should be taken to observe the picture and make sure that the slipping is not accompanied by a weak picture, as in this case the sync. signal is not of sufficient amplitude to lock the time bases properly.

5. *Faults Affecting the Size of the Picture*

Symptom: Insufficient or lack of horizontal amplitude. suspect line time base.

Symptom: Insufficient or lack of vertical amplitude. Suspect frame time base.

Where either amplitude is insufficient the cause may lie outside the time base concerned, and be found in the power pack. However, where this is the case, unless a separate supply to each time base is provided, the usual symptom will be insufficient picture size in both directions due to inadequate H.T. volts. The trouble will, however, generally show up first in the line scan since the horizontal traverse required is larger than the vertical traverse of the spot.

In time bases for electrostatic C.R. tubes if trapezium distortion is present with insufficient scan in either direction the second valve in the paraphase amplifier of the time base concerned should be tested.

Trapezium distortion on the raster of a magnetically deflected beam is usually due to shorted turns on one of the deflector coils. A variation of this fault occurs when one end of the coil is earthed and a portion of the winding short circuits to the core. Depending on the position on winding of the short to core the symptoms will vary from almost no scan in severe cases to trapezium distortion of an almost full-sized raster where only a few turns are shorted out.

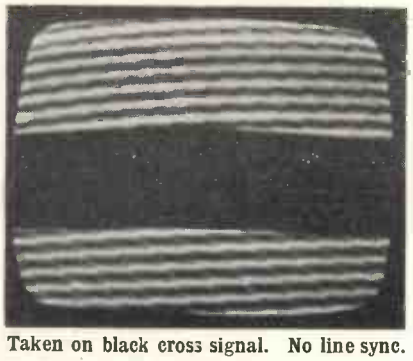
If the formation of the picture is not a true rectangle but rather a parallelogram the deflector coils are not at right angle to each other.

The presence of mains ripple due to failure of smoothing produces unmistakable results on the picture. If in the line time base, vertical objects and the edges of the picture assume a wave shape, the extent of the departure from a true vertical line, depending on the amplitude of the ripple. In the frame time base the effect is to cause either one or two patches on the

raster, according to whether the frequency of the ripple is 50 cps., or 100 cps., where the horizontal lines are more closely bunched than the remainder of the raster. In severe cases the vertical synchronising may be upset.

6. *Faults Affecting the General Performance*

The Power Pack. Since the power pack is connected to every section of



Taken on black cross signal. No line sync.

the receiver, failure in a portion of this section may obviously give rise to symptoms which could coincide with faults developed in any other section. Fortunately, failure of the power supply is one of the easiest faults to check, and it is not proposed to deal with the normal type of failures since all service engineers are fully conversant with this type of trouble from their experience with sound broadcast receivers.

In general there are three main H.T. supplies to be considered. A low voltage H.T. supply—250 v., to the sound and vision receiver. A higher voltage supply to the time bases—300/400 v., where magnetic deflection is employed—1,000/1,500 v., for electrostatic tubes. In the former

Taken on tuning signal. Weak line hold.

case one main source of H.T. is generally used, the receiver supply being lowered to the required voltage by passing it through the speaker field. For the 1,000 v. supply a separate rectifier system must be used.

Lastly, a V.H.T. (3,000/6,000 v.) supply for the tube anode is necessary. Both mercury vapour and hard valve rectifiers are used in this position, and since the current drain is extremely small, high resistances can be satisfactorily employed for smoothing in conjunction with condensers having capacities in the order of .1 to .25 mfd.

Where more than one anode supply for the tube is needed the voltage is broken down by a high resistance potentiometer across the V.H.T. supply.

Failure of voltage on any one anode will cause stoppage of the electron beam, and in consequence no raster or picture will appear. A gradual falling of the mains voltage gives rise to a corresponding drop in the brightness of the picture together with an increase in the overall size. The reason for this is that since the acceleration force acting on the electron beam has diminished, the deflectional sensitivity of the tube will have increased.

The focusing of the electron beam is often bound up closely with the power supply. In electrostatic tubes it is accomplished by adjusting the potential difference between the first and second anodes, by making variable a portion of the potentiometer across the V.H.T. supply. In magnetically focused tubes either a coil through which D.C. is passed (usually the H.T. supply to one section of the receiver) is placed around the neck of the tube, or a circular permanent magnet can fulfil the same function. Where a coil is employed, adjustment of focus is obtained both by altering the position of the coil on the tube neck and by shunting it with a variable resistance so that the current passing through it may be controlled. By tilting the coil or permanent magnet slightly the picture may be shifted bodily in any desired direction.

The smoothing across these focusing coils is very important, and they are frequently shunted with large low voltage condensers 50-100 mfd. An open circuited condenser in this position produces a narrow band of focus which can be moved vertically up and down the screen. A short circuit will simply make the focus control inoperative. In neither case is the H.T. supply to whichever portion of the set is taking its feed through the coil affected.

Should the smoothing on the tube anode become faulty, the picture will be confined to one bright band.

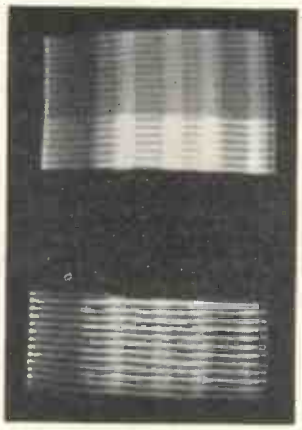
In the time bases a reduction of the necessary H.T. voltage will bring about a smaller picture and in the worst case a spot on the screen. If sharply focused this spot must never be allowed to remain stationery on the screen, since a very few seconds

Taken on black cross signal. Line time base inoperative.

in one spot will suffice to produce a brown spot in the florescent material of the screen.

It should be remembered that the mains voltage is more important in the case of television than a sound receiver. A large drop in the mains voltage or an attempt to run the receiver with the mains adjustment tap in too high a position will often affect the picture size, since both the H.T. and valve heater volts will be low.

Apart from failure of the H.T. to the vision receiver, with obvious results, the smoothing of this supply may become defective. In this way a certain amount of ripple may be conveyed to the grid of the C.R. tube. The effect on the picture is dark bands



Insufficient line amplitude. Photograph shows failure of second valve in the line time base paraphase amplifer designed for an electrostatic.

across the screen, often called hum bands.

(*To be concluded next month*)

KOLORAMA TELEVISION

AN AMERICAN MECHANICAL-OPTICAL SYSTEM

Details of a mechanical-optical television system designed to operate at comparatively low frequencies.

ALTHOUGH most American television companies of late have solely concerned themselves with the development of electronic methods, the mechanical-optical side has not been neglected in the U.S.A. A company that has devoted a great deal of attention to the latter is the Kalorama Laboratories of Irvington, N.J., and very successful results have been obtained.

Adequate coverage in a country the size of America is a difficult problem, but the Kolorama Laboratories have developed a plan which they claim is sound, both technically and economically, and which would permit a nation-wide television service in the shortest possible time.

American Standards

They claim that this is not possible with the standards set by the R.M.A., which are 441 lines, 60 fields, interlaced, and 3 by 4 aspect ratio. They suggest the use of two standards: first, the present R.M.A. standard of 441 lines 60 fields for coverage of local areas as at present planned and as limited by the ultra high radio frequencies required—and second, a standard using 225 lines, 24 fields, or in any event, a standard which permits the use of a signal frequency of not more than approximately 300,000 cycles; this second standard they state will utilise lower radio carrier frequencies, capable of covering large areas so that all of the public of America can have television without any considerable delay.

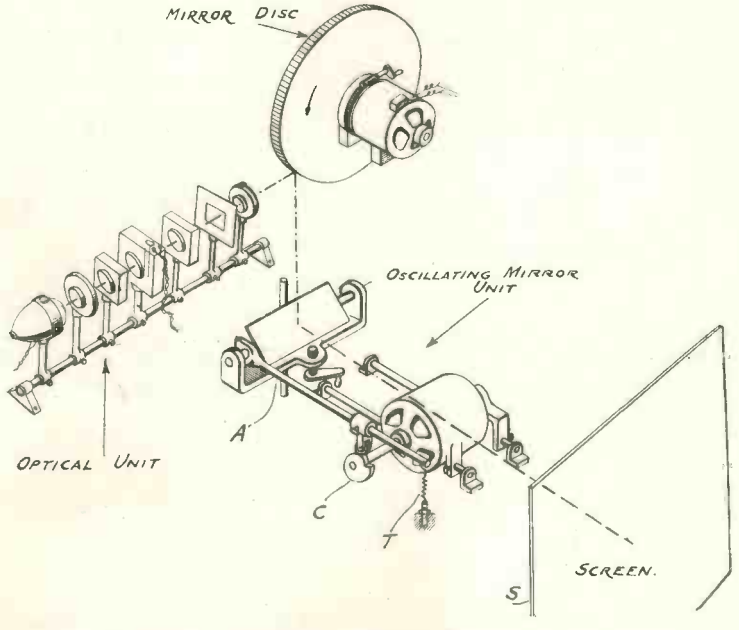
A photograph of a 5-ft. by 4-ft. picture produced by the Kolorama mechanical-optical system.

Kolorama pictures are scanned with 225 lines, interlaced. The field frequency is 24 and the frame frequency is 12 per second. The highest frequency requirement is only 250,000 cycles.

Mechanical-Optical System

The Kolorama system is entirely mechanical-optical and the broad principles of the receiver are shown schematically by the drawing. As will be seen, a pencil or beam of modulated light from an optical light-modulating system is projected on the periphery of a rotatable disc which is provided with a series of mirror surfaces each of which is identical with every other and normal to the radius of the disc. The beam of light is reflected from the surfaces upon an oscillating mirror the axis of which is at right angles to the axis of the disc. An arm A is secured to the mirror and is in contact with the cam C. As the cam rotates the mirror pivots about its axis in one direction and then by reason of the shape of the cam C and the action of tension spring T is made to quickly return to the starting position.

The light beam is thus reflected from two moving mirrors and covers every portion of the screen S. The mirror disc, the oscillating mirror and the light-modulating unit are positioned with respect to one another so that a beam of light



Schematic diagram of Kolorama mechanical-optical receiving system.

emanating from the latter is reflected from the mirrored surfaces on to the oscillating mirror. The rotary movement of the disc causes the beam to be swept successively along the oscillating mirror longitudinally at a frequency depending upon the number of mirrors upon the disc and upon the speed at which the disc rotates. The oscillating mirror is, of course, sufficiently long to contain the beam reflected by the respective mirrors as each moves through the arc which it subtends.

The arctuate motion produced by means of the cam C and the contactor is a saw-tooth motion, or one which comprises a uniform slow angular motion in one direction during which scanning takes place and a quick return motion in the opposite direction to return the mirror to its initial position. The vertical scanning is thus always performed in the same direction and sense, as for instance from bottom to top.

The cam rotates at a speed equal to the number of pictures or images desired per second. If twenty-four pictures per second are desired, the motor rotates the cam C at a speed of 1,440 r.p.m. The motors, of course, are synchronised by the signals from the transmitting station.

Demonstrations of this apparatus have been given and the accompanying photograph shows the results obtained. On this occasion the picture was projected on a screen measuring 5 ft. by 4 ft.

The Milhaly-Traub System

RECENT PROGRESS

FROM time to time we have reported the progress made in the development of the Mihaly-Traub system. This, as most of our readers are aware, is a mechanical system employing a stationary arc of mirrors with a centrally placed revolving polygonal mirror, the advantage gained by this arrangement being the comparatively low speed of the polygon, actually about 13,000 revs. per minute.

Originally designed for low-definition television, there has been progressive development and the problems which the introduction of high-definition television provided have all been overcome, in fact, the results which the Mihaly-Traub receiver now give on the B.B.C. transmissions are the equal of any other type of receiver, either cathode-ray or mechanical-optical. Synchronising was a great problem and until the rest of the apparatus was perfected mains synchronising was employed, but now the receiver is entirely radio synchronised and the picture remains perfectly steady both on the studio and outside broadcast transmissions.

Two scanners are employed, one for line and the other for frame, and both are actually driven by the synchronising signal after amplification. Each motor requires approximately 6 watts so the demands are not excessive, and as the motors are driven by the signals synchronism is absolutely correct unless there is some fault in the transmission.

The present picture size is 24 in. by 20 in., but it is considered that in the case of home receivers, this size could with advantage be reduced as this would allow of a more compact instrument and consequently, the use of a smaller cabinet. The picture is a sepia colour and is really very bright, so bright, in fact, that it can be viewed comfortably in but slightly subdued artificial lighting.

The light source employed at present is a self-feeding arc and this is the only remaining feature with which the designers are not satisfied, because although the illumination remains perfectly even over very long periods, it is appreciated that the attention it will require, such as changing carbons, etc., precludes its use by the average person. Naturally, the high-pressure mercury lamp has been tried, but not with entire satisfaction as regards life and reliability and therefore, research is still proceeding with this final problem.

It is a point of interest with this apparatus that though the results now compare with those obtained by any other method, the fundamental system remains unaltered from the time when it was first adapted for the reception of the high-definition transmissions; the final results are almost entirely due to a painstaking elimination of trivial faults and a general "cleaning up."

Excluding switching on, the receiver is virtually one knob control and is very easy to operate. The only unit that it appears will require renewal is the light source; motor wear will be negligible and the motor should be good for many thousands of hours' use.

No arrangements have as yet been made for marketing this receiver and the price at which it will be sold has not been decided upon, but it is expected that including all-wave radio it will be a figure less than £100.

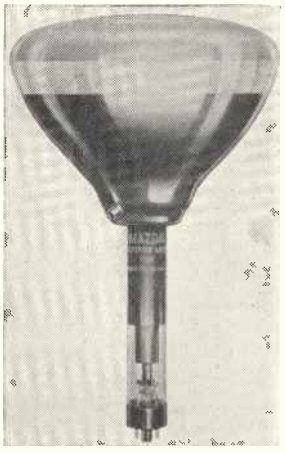
Ediswan Tubes

THE magnetically-focused tubes supplied by the Edison Swan Electric Co., Ltd., are made in three types with 7 in., 9 in., and 12 in. screens. These are known as: CRM.71, CRM.91 and CRM.121 respectively.

The largest size operates with an anode voltage of 5,500 and has a working grid bias of 30-60 volts.

The tubes are indirectly heated from a 2-volt supply and are notable for their extremely short overall length. The figures quoted by the manufacturers are:—

CRM.71	CRM.91	CRM.121
37 cms.	36 cms.	46 cms.



The Ediswan short Cathode-ray tube.

This compact dimension contributes materially to the neatness of the television receivers in which these tubes are fitted.

Among the television receiver manufacturers using Ediswan tubes are: Messrs. Burndept, E. K. Cole, Kolster Brandes, Murphy, R.G.D. and Ultra.

The focusing coils require approximately 450 ampere turns at working voltage.

The manufacturers state that at present their whole output is absorbed by the requirements of set manufacturers, but that these tubes will be available for amateur use as soon as adequate stocks are built up.

ADJUSTING THE MECHANICAL-OPTICAL TELEVISION RECEIVER

By J. H. Jeffree

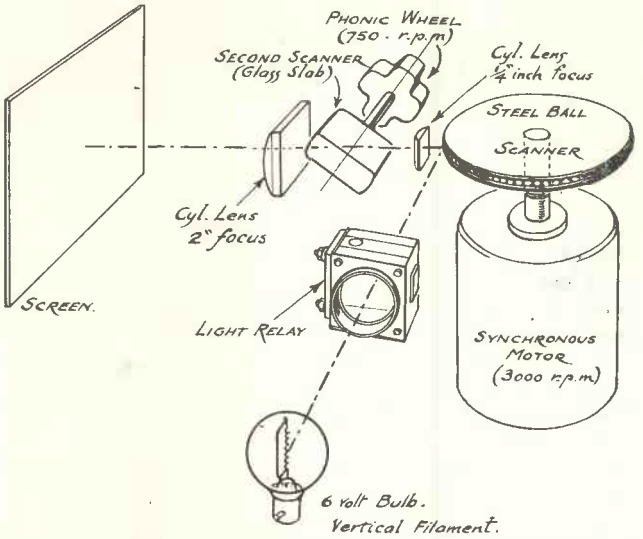
Constructional details of this mechanical-optical Receiver were given in the two preceding issues.

THE first adjustment is to set the ball scanner on to its spindle at the correct height, so that the balls are level with the middle of the small cylindrical lens. This can be done by eye.

The second adjustment is the focus of the small cylindrical lens, with or without its spherical lens attachment for the bigger picture; if everything is correctly put together it is very simple to focus this lens. The plate glass second scanner is set at right angles to the beam, and the lamp moved till its light is focused, by the light relay, on the steel balls at a point from which they can reflect it through the lenses on to the screen. This is done by adjusting the lamp for height, first, and then sideways, by the screw adjustment provided, till its image on the balls is directly behind the small lens. A match is stood against the light relay, somewhere near the middle, and its vague image should be seen across the patch of light on the screen. It facilitates this adjustment to move the *second* cylindrical lens as far *out of* focus as possible, so that a wide band of light, and not a sharp horizontal line, is produced. If the match shadow is not visible, try moving it from one end to the other of the light relay. When it is found, it should be focused to as sharp a dark vertical line as possible, and the mounting screw of the small cylindrical lens tightened up.

If it should be found that the range of focusing movement is not sufficient, it indicates incorrect placing, probably, of the ball scanner. Owing to the fact that the mains driven motor hangs from the downward turned web of the frame arm B, which can become bent, this is not impossible, and if it is found that the lens cannot be focused, the motor should be dismounted from its special plate, and the web bent, by gripping with a spanner and holding the rest of the arm B with the other hand near its point of attachment to arm A. The motor spindle ought to be in the position specified last month, 1.40 in. behind the intersection of the A and B optical axes.

The larger cylinder can now be focused to give as sharp a line as possible over the middle five-sixths, or so, of the picture height. The lens obtainable is $\frac{7}{8}$ in. diameter, which is a trifle too big for critical definition of the lines over the whole frame scan, and if the constructor wishes he can fix a stop, about $\frac{1}{2}$ in. wide (i.e., a horizontal slit) behind it. The best position for this is $\frac{1}{2}$ in. from the curved surface of the lens, towards the screen. The writer, however, prefers the



Schematic drawing of mechanical-optical television receiver.

extra light with slight loss of line definition, because it is a fact that the effect of such aberrations on the actual picture is far less than would be expected from examination of the stationary line image. The best focus will show, in the middle of the vertical scan, a sharp line with a certain amount of flare above and below, and at top and bottom a blurred line of width comparable to the flare, but a little in from top and bottom the definition will be quite sharp. As previously noted, the arrangements for the larger picture help to reduce this aberration.

The Light Source

The lamp must now be "focused" so that its image is in focus just behind the small cylindrical lens. Since the correct focus here depends on other settings it is best to proceed in the way here given. First note that the light relay is fairly closely at right angles to the axis of arm B, and tighten its fixing screw. Then rotate the ball scanner, and observe whether the line traced on the screen falls off in illumination on one or the other side. Adjust the sideways screw movement of the lamp mount until the illumination is symmetrical and as nearly uniform as possible across the screen, and then remove the ball scanner from its spindle and mount a slip of card, with plasticine or the like (but firmly enough not to move) just behind the small cylinder, adjusting its position until the light from the lamp is reflected from it through the cylinder on to the screen, making a vertical strip of faint illumination in the middle easily visible in a somewhat darkened room. This slip of card should stand at right angles to the B axis, approximately.

When the card is correctly placed, the distance of the lamp from the light relay can be altered by slackening the main lamp fixing screw in the vertical side of arm B and sliding the whole mount. The thinnest focus of the filament image on the card should be sought, with a preference rather for the woolly-edged image formed when the lamp is a shade too far away, than for the sharp edged, but wider, image formed if it is too close. Having got it the main fixing screw should be tightened and a mark made the actual distance of the lamp *filament* from the light relay along arm B, so that if subsequently another bulb of different

LIGHT-RELAY OPERATION

form is used the distance can be adjusted to the mark without the trouble of refocusing. It will suffice if the distance is correctly marked within about a sixteenth of an inch.

The scanner can now be replaced, and if, on rotating it, the illumination across the screen is not still quite symmetrical, the sideways adjusting screw of the lamp mount is there to correct it. This is a correction that will have to be made occasionally, as the lamp filament tends to warp with use. The small cylindrical lens may also be checked for focus again and if necessary refocused a little; a sideways movement of this lens across the direction of strip A would upset the adjustment just made, and is not permissible; hence the recommendation that home constructors of this mounting should make it a good fit against the edge of strip A. The scanner must, of course, be replaced, after making the above adjustment, substantially in the place it was removed from; large amounts of refocusing of the small cylinder after this adjustment are not in order.

There remains the setting of the light relay for black, which can only be done with a 10 mc/s oscillator; either the form which will be described in due course for this set, or any other simple form, e.g., that given in this journal in September, 1938. The cell is filled with common paraffin lamp oil, and the oscillator output then connected across the crystal terminals, as described in the above cited article. With the cell as nearly at right angles to the path of the light as may be, the tuning of the oscillator is varied till some spreading effect is seen in the filament image on the ball scanner. If desired, this adjustment can be made with a card in place of the scanner, as was the preceding one, and this facilitates it; moreover no very exact placing of the card is now necessary.

When an effect is found, the light relay is turned slightly till the setting is found giving the most symmetrical and maximum effect, and its fixing screw is tightened up securely. The adjustment is most easily completed with satisfaction if, after getting it about right, the oscillator is detuned until the central image of the fringe pattern is only reduced to brown, and about two or three fringes only are produced on either side; if too strong an excitation is used it is sometimes difficult to identify the true central image.

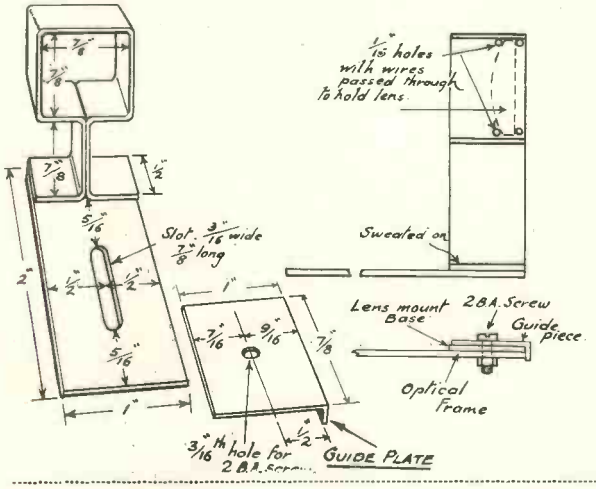
It should be noted that the above adjustment should be made after the other adjustments of the lamp are correct, otherwise it will not be precisely correct either. This completes the purely optical adjustments of the set.

There remain those for framing the picture, which can only be carried out on actual reception. That for vertical framing consists simply of turning the second scanner mount by the handle provided. Horizontally, it is not possible with mains synchronisation, to frame the picture in the proper sense, as the drift amounts to a good many frames; this can be controlled, with practice, by finger pressure to give a crude framing. There is, however, also a kind of framing operation that has to be done on the ball scanner, and this consists of rotating it to various positions on the motor spindle which carries it, and trying the effect, to find the setting at which the odd half element of the $67\frac{1}{2}$ comes *either* within the dark border of the picture at top and bottom, *or else* exactly midway between them in the centre of the picture. It can be recognised on the picture, as a faint dark line, above and below which are portions of picture half a frame displaced from each other horizontally; if it falls exactly midway between the top and bottom, the motor can be slipped half a cycle, by momentarily switching off and on again, to bring it into the dark border.

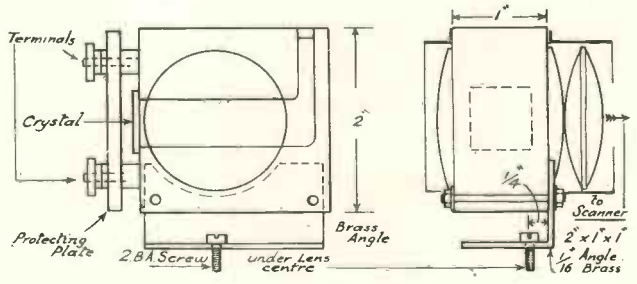
It is regretted that owing to haste in completing last month's instalment, some omissions occurred in the details of the lens mounts, etc. The drawing of the light relay mount is therefore repeated here, showing the exact positioning of the fixing hole relative to the lenses. The hole is $\frac{1}{4}$ in. from the wall of the cell nearest to the scanner, and under the lens centres, not, as would have been gathered from last month's sketch, under the centre of the container.

The best cement for sticking crystals to the cell, in the writer's opinion, is a mixture of about five parts of glue to one of treacle. In the case of leaks occurring, it should be emphasised that this cement is the one to use.

The pictures of the second lens mount omitted to show the fixing piece that goes above its base, making it possible to fix it with one screw only, in a way convenient for focusing. This is, therefore, also shown again.



Amplified drawings of lens, mount and light relay with associated lenses.



RECENT TELEVISION DEVELOPMENTS

A RECORD OF PATENTS AND PROGRESS

Specially Compiled for this Journal

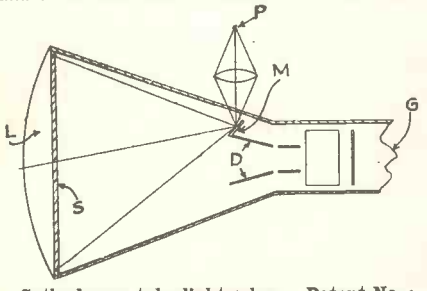
Fernseh Akt :: *Marconi's Wireless Telegraph Co., Ltd., and L. M. Myers* :: *H. Miller* :: *Zeiss Ikon Akt* :: *The British Thomson-Houston Co., Ltd.* :: *E. P. Rudkin*

Projection Systems

(Patent No. 494,967.)

THE electron stream of a cathode-ray tube is used to alter the transparency of a special screen S, which takes the place of the ordinary fluorescent screen, and is " capped " by a projector lens L. As a result of the scanning process, the transparency of the screen is controlled in accordance with the light-and-shade values of the received picture. It can therefore be used to project an image of that picture on to a large viewing-screen mounted outside the tube.

As shown in the drawing, the light



Cathode-ray tube light relay. Patent No. 494,967.

from an external lamp P is projected on to a small mirror M, which is fixed to one of the deflecting plates D and reflects the light on to the side of the screen S which is being scanned by the electrons from the gun G of the tube. A second lens, mounted some distance away from the objective lens L, then collects the light passing through and focuses it on to an external viewing-screen.

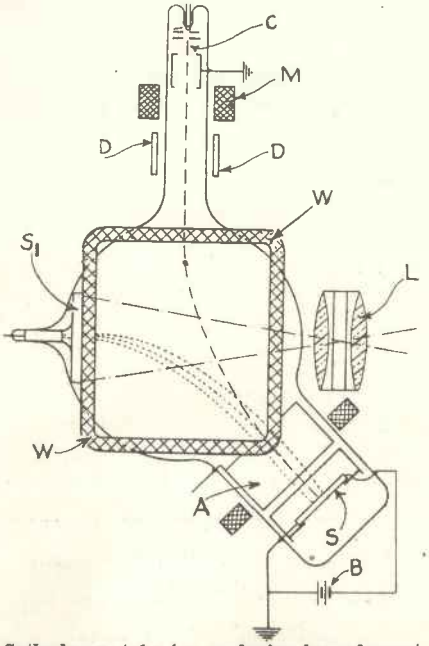
The special screen S consists of a thin hollow casing containing smoke, or other fine particles, which are deposited on the glass according to the varying intensity of the scanning stream from the gun, so as to produce the required differences of transparency.—*Fernseh Akt.*

Producing Incandescent Pictures

(Patent No. 495,646.)

The figure shows a cathode-ray tube in which the received picture is reproduced by incandescent instead of fluorescent light. In order to increase the heating effect of the electron stream, the latter is first made to impact upon a " relay " screen, which is coated with a highly-emissive substance so as to produce a copious supply of secondary electrons. These are then focused on to the final or incandescent screen.

The electron stream from the cathode C is controlled by the incoming signals, and by a focusing coil M and deflecting plates D, in the usual way. As it enters the bulb of the tube, the stream is deflected by an external magnetic coil W, and is made to strike against a screen S, which is coated with a film of caesium and heated by a battery B to a temperature at which it is particularly sensitive. The impact of the stream causes secondary electrons to be emitted at an intensity which varies from point-to-point with the details of the original picture. In other words an " emission image " is produced on the screen S.



Cathode-ray tube for producing incandescent pictures. Patent No. 495,646.

The liberated electrons are drawn off by a positively-charged anode A and are focused by the winding W on to an incandescent screen S1, which is thinly coated with lamp-black and finely-powdered tungsten. Here the impact of the stream raises the temperature of the screen S1, so that points which correspond to "bright " picture details become white-hot. The carbon-and-tungsten coating of the screen prevents the heat from spreading and so keeps the details clear-cut. The incandescent picture is viewed through an external lens L.—*Marconi's Wireless Telegraph Co., Ltd.*, and *L. M. Myers.*

Electron Multipliers

(Patent No. 496,564.)

The primary stream of electrons produced by directing a ray of light against a photo-electric cathode is made to pass through a series of grid-like electrodes each carrying a more-positive biasing voltage than the last. Secondary emission takes place at each stage, until the stream reaches the collector or output stage which carries the highest voltage of all.

Lying just beyond the output electrode is another perforated electrode, which carries a lower positive voltage and therefore acts to retard any electrons that pass through the collecting electrode. Last of all comes a solid electrode carrying a voltage which, although less than the preceding one, is still sufficient to attract the oncoming electrons and cause them to produce further secondary electrons. These are drawn back towards the output electrode, where they are finally collected.

The arrangement allows the overall amplification of the device to be controlled according to the critical voltage applied to the last or solid electrode.—*Fernseh Akt.*

Projecting " Close-Ups "

(Patent No. 496,751.)

When televising a studio scene, or an out-of-doors event, it is occa-

sionally desirable to be able to change-over from a long-shot picture to a "close-up." This usually requires two separate transmitting cameras, or else the use of a special turret containing separate lenses for the normal and large-sized projections.

According to the invention, the required change in picture size is secured by an electron-optical control of the electron stream flowing inside the cathode-ray tube of the transmitter. In the tube the picture is first projected on to a photo-electric cathode, the resulting stream of electrons being passed through the field of a magnetic winding. The latter focuses the stream on to a second screen, where it is scanned in the ordinary way. But instead of keeping the magnetic field at constant strength, the field current is varied by means of a control rheostat, which can be calibrated to produce any desired degree of magnification before the electron stream reaches the scanning screen.—*H. Miller.*

Television Systems

(Patent No. 496,756.)

The picture to be televised is first focused on to the front face of a translucent screen, which is coated at the back with a light-sensitive layer. The electrons set free from the rear face of the screen pass through a series of fine-wire "grids," where they liberate an increased supply of secondary electrons, so as to produce a strengthened "charge image" on a mosaic screen of small caesium-oxide cells.

The emission stream from the mosaic cells is then traversed across a scanning aperture, in the usual manner of the image-dissector type of transmitting tube, and produces intensified picture-signal currents.—*Zeiss Ikon Akt.*

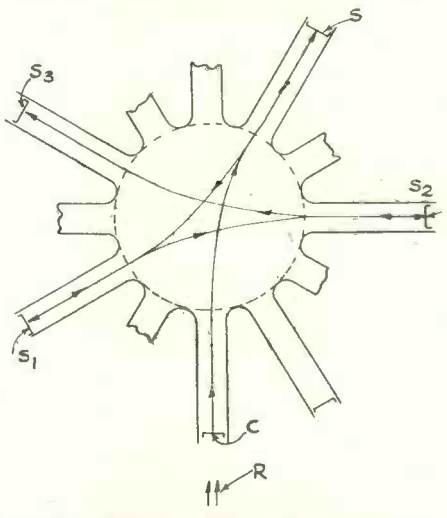
"Multiple" C.R. Tubes

(Patent No. 497,160.)

A "multiple" cathode-ray tube is designed to intensify the primary stream of electrons by causing the latter to strike in succession against a series of "target" electrodes, each of which adds its quota of secondary electrons. The main stream of electrons is forced to take the proper path, from target to target, by the magnetic field from a single winding surrounding the bulb of the tube.

The figure shows a section through the centre of the tube, and through the centre of the magnetic field (which is at right-angles to the plane of the paper).

Light rays R from the picture to be televised are projected on to a photo-sensitive cathode C, and the primary stream of electrons, as soon as it enters the magnetic "control" field) is deflected on to the first target electrode S. The resulting stream of primary and secondary electrons is attracted outwards by the anode voltage, and is then deflected on to the second target S1.



Multiple cathode-ray tube employing secondary emission. Patent No. 497,160.

The next impact is against the targets S2, S3, as shown by the arrows, and the process can be continued with other targets if required.—*The British Thomson-Houston Co., Ltd.*

Time-Base Circuits

(Patent No. 497,371.)

In a television system of the kind in which the synchronising impulses are transmitted as interruptions of the carrier-wave frequency, the line and frame impulses are separated from the picture signals in the time-base circuit by a double-diode rectifier. One of the diodes is biased by a delay voltage, whilst the other is not. The "delayed" diode serves to pass the picture signals alone, to an appropriate pair of terminals.

Both the synchronising impulses and the picture signals are, however, passed by the undelayed diode. Therefore by combining the outputs from both diodes in phase-opposition, the picture signals (which are common to both) will cancel out, leaving the synchronising impulses to appear alone at a second pair of terminals.—*E. P. Rudkin.*

Summary of Other Television Patents

(Patent No. 494,520.)

Safety arrangement for preventing the scanning spot from burning the fluorescent screen of a cathode-ray receiver.—*Ferranti, Ltd.*, and *M. K. Taylor.*

(Patent No. 494,620.)

Arrangement of the collecting anode in a discharge tube of the "image-dissecting" type.—*Farnsworth Television Inc.*

(Patent No. 495,822.)

Distributing or relay system for television programmes, controlled by a single set of time-base oscillators.—*Baird Television, Ltd.*, and *L. R. Merdler.*

(Patent No. 496,018.)

Iconoscope tube in which the mosaic-cell electrode is provided with a "braking" layer of low emissivity.—*N. V. Philips Gloeilampenfabrieken.*

(Patent No. 496,119.)

"Master" timing system and control for synchronising signals.—*E. L. C. White.*

(Patent No. 496,213.)

Rectifying circuit for television signals in which the highest molulation frequencies approach the lower side-band frequencies.—*Radio-Akt. D. S. Loewe.*

(Patent No. 496,756.)

Discharge tube in which the photo-electric image to be transmitted is strengthened by secondary emission.

(Patent No. 496,964.)

Television receiver in which the scanning system comprises a light-cell with supersonic waves, and cylindrical focusing lenses.—*Scophony, Ltd.*, and *J. H. Jeffree.*

(Patent No. 497,069.)

Light cell through which waves of supersonic frequency travel with repeated reflections.—*Scophony, Ltd.*, and *G. W. Walton.*

Scannings and Reflections

TRANSMISSION FROM THE COLISEUM

THE fact that the London Coliseum is now being wired for television and that regular monthly shows are to be given, is good news for viewers. The programmes will consist of the first half of the regular show in the second house, starting at 9 o'clock and lasting for an hour. The cameras have been arranged so that they do not interfere with the normal show as in the case of "Twelfth Night," in which a considerable part of the theatre was taken up with the television apparatus. It is transmissions of this kind which will do so much to further the sales of television receivers.

TELEVISION IN THE U.S.A.

Now that television has really got going in the U.S.A. it is expected that it will advance very quickly. American engineers feel quite sure that they will rapidly overtake television developments in this country, and that before long they will have a really large number of sets in commission. While we have the only regular television service in the world with a range of about 50 miles, it is expected that this range may be exceeded in America. It is also claimed that a coast-to-coast hook-up with television in the same way as with ordinary radio will not be very long in following the inauguration of the first public television service.

SHORT WAVES IN FINLAND

British commercial short-wave equipment is being supplied to most countries of the world, and the latest to install British gear is Finland, which country has just purchased a 50-kilowatt station from the Marconi Wireless Telegraph Co., Ltd., to be installed at Pori. The station is to be completed in time for the Olympic Games which are being held in Finland in 1940.

AN IMPORTANT TELEVISION EVENT

When the French President arrives at Victoria on March 21 he will be televised when he steps from the train to be greeted by the King. The television cameras are being mounted on a high platform inside the station while other cameras will pick up the arrival of the King, and later the departure of the procession. It is hoped that this transmission will be more successful than the previous one when King Carol of Rumania was televised as this was rather spoilt by fog.

THE BOAT RACE

Viewers this year will be able to see both the start and finish of the Oxford and Cambridge Boat Race. It will be remembered that last year only one mobile unit was in operation to televise the finish. This year, cameras on a balcony on the Surrey side of Putney will show the crews paddling to the starting point just before 10.30 a.m. It is hoped by means of tele-photo lenses to follow the crews until they round the bend at Craven Steps. From thence until the boats reach Barnes Bridge, John Snagge's running commentary on the National wavelength will keep viewers in touch, after which the cameras will show the final three or four minutes until the boats pass Mortlake Brewery on which the cameras are mounted.

USING THE TELEVISION CABLE

It is interesting to note that the transmissions from the London Coliseum will be conveyed by cable to Alexandra Palace for radiation. This shows that the cable is satisfactory as regards transference of the wide television band required even though it has still not been used for very long distances. The transmissions from the Coliseum should be technically very good for the cameras are being placed at the side of the dress circle to give comprehensive long shots and also close-ups of any portion of the stage. The transmissions from the Coliseum are scheduled for March 14, April 18, May 23, June 20, and a date in July to be announced later.

TELEVISION IN CINEMAS

The general public in London will soon become television minded should the Gaumont British Picture Corporation be successful in their negotiations with the British Broadcasting Corporation for permission to publicly show televised events. Both the Tatler Theatre and the Marble Arch Pavilion are wired for television with screens measuring 15 feet by 12 feet. It is not expected that this public television will counteract sales of home receivers or cause any loss of attendance when events such as boxing matches, are being televised.

AMERICAN AND BRITISH TELEVISION SALES

A friendly wager has been made between the British and American television manufacturers to see which can sell the biggest number of receivers during 1939. The wager is for a dinner, in either London or New York, to the Television Development Committees of the Radio Manufacturers' Associations of the two countries, the dinner to be paid for by the losers. Television sets are not as yet on sale in large numbers in America, so that there will have to be a very big increase to win. The weekly rate of sale, however, is increasing very rapidly.

TELEVISION ADVISORY COMMITTEE

The Postmaster-General recently announced that Lord Cadman has accepted the chairmanship of the Television Advisory Committee which became vacant through the death of Lord Selsdon. This Committee includes representatives of the Departments of Industrial and Scientific Research, the British Broadcasting Corporation and the Post Office. Its function is to advise the P.M.G. on the development of the television service. Lord Cadman was formerly the chairman of the committee of enquiry into civil aviation.

"THE UNQUIET SPIRIT"

Catherine Lacey has been booked to appear in Jean Jacques Bernard's brilliantly original play "The Unquiet Spirit," which is to be televised

MORE SCANNINGS

in the evening programme on March 3. The English translation is by J. Leslie Frith.

This is a play with an interesting idea subtly communicated to the audience less by what the characters say than what they withhold. With compelling suggestion, the author builds upon the theme that every one has one, and only one, completely sympathetic "mate"; that proximity to this twin soul, whether there be recognition or not, leads to profound emotional disturbance and, possibly, disaster.

Marceline, played by Catherine Lacey, is the supposedly happy wife who becomes the tragic figure in this play of unusual imagination.

"HARLEM IN MAYFAIR"

Harlem will come to Alexandra Palace via Mayfair on March 6 when the all-coloured cabaret from the Old Florida Club will give a half-hour television programme. Topping the bill is Adelaide Hall, the coloured vocalist who has won a great reputation on both sides of the Atlantic. With her in this lively programme will be Marko Hlubi and his Tom-Toms; Esther and Louise; Eddie Lewis; and Felix Sowande with his Negro Choir and Orchestra.

"ROPE"

Ernest Milton takes his original part of Rupert Cadell in "Rope," the thriller by Patrick Hamilton, which is to be televised in the evening programme on March 8 and repeated in the afternoon of March 13.

The story of this powerful play, which has several times been broadcast, is based on a murder of some years ago, when two undergraduates murdered a boy of fifteen. Legally, the crime was without motive, but it provides a fascinating psychological study not only of the murderers but of the man who unmasked them.

N.B.C. TELEVISION NETWORK

Danton Walker, New York columnist, has stated that a £12,000,000 network is being formed for the broadcasting of television and radio programmes. When it was first announced, it seemed rather unlikely or at any rate very premature. However, this statement has received more backing from Edward Sullivan, the Hollywood columnist, who definitely states that the National Broadcasting Company will announce that "trans-continental television is an assured engineering accomplishment" by the beginning of March.

AMERICAN RECEIVER SALES

The interest in television in New York is apparently booming for the Allan B. DuMont Company claims to have sold over 100 receivers in that area. These receivers are similar to those sold in this country. They have 21 valves and a 14-in. tube providing a 10 by 8 in. picture. The approximate cost is £80.

The General Electric Company of America plans to produce console and table model receivers and to provide demonstrations at the New York World's Fair. There is apparently already a sale for television sets in America despite the absence of regular programmes; it is claimed that dealers are using the apparatus as "crowd catchers."

ITALY AND INTERFERENCE

It is interesting to learn that the Italian authorities have issued a decree that users of apparatus that can cause interference to radio or television are liable to heavy penalties. A large number of viewers in this country wish that this law could apply here.

SPONSORED PROGRAMMES

American newspapers are rather inclined to deprecate the value of television as an advertising medium and devote little space in their columns to the advances that are being made. The reason for the lack of enthusiasm is that newspapers look upon television as a bigger competitor for advertising revenue than radio. Advertisers claim that one picture is worth 10,000 words and although broadcast words can describe, television can and will show the goods.

TELEVISION KITS

American manufacturers are now providing small television kit receivers for home constructors. They are publicising these with full page advertisements in well-known radio constructor journals, and it is felt that a new home constructor market will be made. The prices are low and, generally speaking, the receivers are fitted with 3-in. or 5-in. tubes. A fair amount of the construction is already done for the home builder, and the nature of the work is chiefly assembly.

TELEVISION QUESTIONNAIRE

The B.B.C. want to know how viewers like the programmes, which they prefer most, and all sorts of little things about length of programmes, timing and also whether they would prefer male announcers. The B.B.C. are having a big check up to make quite sure their service is a satisfactory one to all concerned. Who knows that before long the radio side of the British Broadcasting Corporation may also take an interest in how their programmes are received.

WHAT VIEWERS SEE

B.B.C. records show that during 1938 there were no less than 957 hours of entertainment excluding 300 hours of film transmission for trade demonstration purposes. About 25 per cent. of this time was devoted to drama with 18 per cent. to films, including news reels and cartoons. The balance was taken up by light entertainment, topical programmes and a little over 6 per cent. consisted of talks.

CHEAP TELEVISION

Now that television receivers of the "add-on" type are available for a little over £20, before very long listeners will begin to realise that a television set with 15 or 16 valves and an expensive tube is very good value for money and, in fact, is cheaper than many multi-valve radios. Alternatively, they may begin to wonder why radios are not even cheaper than they are.

A LONDON EXHIBITION

A mammoth television exhibition is being held at Selfridges where over £20,000 worth of modern equipment is being displayed. A Marconi E.M.I. television transmitter has been installed, complete with a glass-fronted sound-proof studio equipped with scenery, lighting and television camera. Visitors will be able to see practically every make of television receiver on the market working simultaneously, and it will be possible to compare each receiver under identical conditions. Also viewers will be able to see some of the artists being televised and also watch them on the screen at the same time.

There are also several historical items on show such as Baird's original gear which has been loaned by the Science Museum, South Ken-

BAIRD RECEIVERS SET A PERFORMANCE STANDARD BY WHICH OTHERS ARE JUDGED

Model T.18 is a complete Television Receiver combined with a very selective and high quality All-wave Radio, yet the compact cabinet housing the complete equipment is little larger than the usual Table Radio. The most recent developments in Television design are included, yet the price is below that of many modern Radio-gramophones. The set is easy to operate—and without any technical knowledge you can be confident of good results.

TELEVISION CONTROLS : These have been reduced to one which operates the Picture Contrast, and this will only need very occasional adjustment.

TELEVISION SOUND AND RADIO : The sound receiver is a super-heterodyne covering the Television sound waveband, and three bands for Radio programmes (Short : 16.5—51 metres ; Medium : 198—550 metres ; and Long : 850—2,000 metres). It is possible to receive the sound on the Television waveband either with or without the Picture by means of a switch integral with the Picture Contrast control. For Radio, stations are calibrated by name, and each waveband is individually illuminated. The reproduction is exceptionally fine since the set is capable of delivering an 8 watt quality output.

PICTURE SIZE : 10 in. wide by 8 in. high. Viewed direct.

POWER CONSUMPTION : 150 watts.

CABINET : The cabinet measures approximately 25 in. high, 18 in. wide and 16 in. from back to front. It is attractively designed as illustrated and is standard in walnut.

PRICE 44 GNS.

DEMONSTRATIONS ARRANGED

PRICE 35 GNS.

Model T.20 proves that Television for home installation need be neither a complicated nor a costly business, for here is a complete receiver no larger than a Radio set, yet capable of giving an excellent picture with all that wealth of detail for which Baird receivers are known, together with quality sound reproduction. Controls have been reduced to a minimum and no skilled technical knowledge is needed to operate the set and get the best out of it.

The very attractive price should make this model the means of bringing Television into many homes where the interest of this most modern source of entertainment has as yet not been enjoyed.

CONTROLS : The T.20 has two main controls on the front of the cabinet. Picture Contrast and Sound Volume.

POWER CONSUMPTION : 150 watts.

SOUND : A superhet radio receiver is fitted and this is pre-set to receive Television sound.

PICTURE SIZE : 7¾ in. wide by 6¼ in. high. Viewed direct.

CABINET : The Walnut Cabinet measures approximately 22 in. high, 18 in. wide and 13 in. from back to front. It is beautifully made and well finished.

Send for full descriptive literature. Post Free.

NAME AND ADDRESS OF YOUR NEAREST DEALER FURNISHED ON REQUEST.

BAIRD TELEVISION LTD.

Lower Sydenham, London, S.E.26

Telephone: HITHER GREEN 4600. *Telegrams:* TELEVISOR, FOREST, LONDON.

sington. It will be remembered that J. L. Baird gave his first public demonstration at Selfridges in 1935.

THE SCHENECTADY STATIONS

Effective Sunday, February 12, 1939, W2XAD operating on 2,500 kilocycles or 13.95 metres will broadcast daily from 8 a.m. to 10.15 a.m. E.S.T. W2XAD operating on 15,330 kilocycles or 19.56 metres will be on the air from 10.30 a.m. to 6 p.m. E.S.T. W2XAD operating on 9,550 kilocycles or 3.41 metres will be on from 6.15 p.m. to 9 p.m. E.S.T. The schedule for W2XAF operating on 9,530 kilocycles or 31.48 metres remains the same as at present, which is from 4 p.m. to 12 midnight, E.S.T.

TRANSATLANTIC AIR SERVICE SHORT-WAVE BROADCAST

Installation of a short-wave relay broadcasting transmitter and associated equipment on the Pan American Airways "Yankee Clipper," No. 17, for use during its initial flight to Europe has been completed. The equipment was built specially for this flight and will be used to keep the Clipper in contact with the C.B.S. network during the test flight from Seattle to Washington as well as during the maiden trip across the Atlantic.

The transmitter has been assigned the call letters WCBN, has an input of 100 watts, and a frequency range of 1,600 kilocycles to 23 megacycles. In addition to the transmitter, short-wave receivers have been installed to make possible two-way conversations between air and ground even from the middle of the Atlantic.

SHORT WAVES FROM AUSTRALIA

Regular transmissions from the Australian stations, Sydney, Melbourne and Perth are being received in this country and in March the transmission times are as follows:—

VK2ME, Sydney. Wavelength 31.28 metres equal to 9,590 kc.

Sydney Time.	G.M.T.
Sundays, 4 p.m. to 6 p.m.	06.00-08.00.
8 p.m. to midnight.	10.00-14.00.
Mondays,	
12.30 to 2.30 a.m.	14.30-16.30.

VK3ME, Melbourne. Wavelength 31.5 metres equal to 9,510 kc.

Nightly, Monday to Saturday (inclusive),

Melbourne Time.	G.M.T.
7 p.m. to 10 p.m.	09.00-12.00.

VK6ME, Perth. Wavelength 31.28 metres equal to 9,590 kc.

Nightly Monday to Saturday (inclusive),

Perth Time.	G.M.T.
7 p.m. to 9 p.m.	11.00-13.00.

The B.B.C.'s Local "At Home"

AS already announced in TELEVISION, the B.B.C., conjointly with the Radio Manufacturers' Association, are arranging a series of "At Homes" in towns situated on the outer edge of greater London. We (and it is not the editorial "we"—just the personal "we" invited by the B.B.C. in our capacity as residents of the area in which the "At Home" was to be held) attended.

Mr. Wolfe Murray gave an interesting talk of about thirty-five minutes on television including a sketchy account of how electronic television is achieved and emphasising the many advantages offered by the British television service. The audience asked many questions showing a real interest on the part of the public and betraying a certain nervousness as to whether it is wise to invest in a television receiver at the moment. The point was definitely answered by the speaker who assured the audience that the B.B.C. had no intention of altering its system of transmission for a long time to come, and that the Radio Manufacturers' Association for their part had reached the limit of price reduction. He said that if the public were waiting for something different and something cheaper they would have to wait for years and in the meantime be missing the advantages of a successful and remarkable service.

At 8.57 p.m. the lights of the hall went down and ten receivers, each of different make, were turned on and made ready for the transmission. The receivers were Baird, Cossor, Ekco, G.E.C., H.M.V., Invicta, Marconiphone, Murphy, Pye and Ultra, and most of them gave quite a good show in spite of the fact that a fault had developed in some of the line connections since the test carried through in the afternoon.

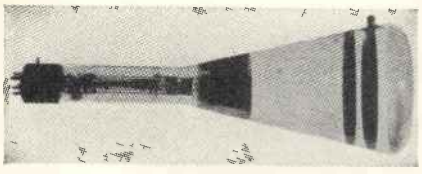
Our individual concern was the amount of interest taken in the pictures and we were glad to see that the audience (largely consisting of young people) thoroughly enjoyed the programme and were intent not to miss a moment of it. Each receiver had in attendance a representative of its manufacturers, and they were kept busy answering questions.

We congratulate the B.B.C. and the R.M.A. on this departure from conservative tradition, and feel sure that propaganda of this kind deserves and will certainly achieve success.

Intensifier Cathode-ray Tube

PRIMARILY for larger and brighter television images, but also suitable for other applications, the DuMont intensifier element is a fundamental improvement affecting sensitivity of cathode-ray tubes. It is claimed that this development will be reflected in a reduction in cost of television sets.

The intensifier electrode takes the form of one or two metallic deposit



The Du Mont Intensifier Cathode-ray tube.

rings near the screen end of the cathode-ray tube, and serves to accelerate the electrons *after* deflection. A tube so constructed is capable of increased brilliance without corresponding loss in deflection sensitivity. Previously, attempts at increasing deflection sensitivity while operating at given anode voltage, have been along lines of increasing deflection plate size and decreasing the space between. However, there is a definite practical limit as to how far it is possible to go in this direction without seriously affecting the focus characteristics of the tube.

In use, the electron gun is operated at the same potentials and in the same manner as other tubes of corresponding screen diameter. The intensifier electrode may be connected to the final anode and the tube operated in the conventional manner. If, however, an additional voltage, equal approximately to the accelerating electrode potential, be applied between intensifier and second anode, the effect of the former is increased brightness equivalent to doubling the accelerating voltage, yet without causing such sensitivity decrease as would normally result, and the design of deflection amplifiers is simplified considerably.

The positive potential required between second anode and intensifier electrode may be taken from existing cathode-ray tube power supply by the addition of a single half-wave rectifier operating from the same transformer winding and connected in reverse polarity. Filter requirements may be satisfied by the use of a filter condenser and a high resistance bleeder.

TELEVISION PICTURE FAULTS AND THEIR REMEDIES—IV

By S. West

The fourth article of a short series dealing with faults in television receivers, the effect of which on the pictures is illustrated by actual photographs.

LAST month we considered the requirements of synchronism for the horizontal circuits. In the case of synchronism for the vertical scanning circuits the effects are somewhat different, though the causes are the same. With pulses of insufficient amplitude, the frame hold is insecure, the picture will then travel upwards across the screen or may even assume

Fig. 1.—In this photograph the displacement of the top part of the picture is clearly rendered. This is due to incorrect line synchronising pulse application networks.

the form shown in the photograph reproduced in the January article (Fig. 4). If the frame pulse has too great an amplitude or if this pulse is poorly filtered the picture will tend to blink, or even assume permanently the form of the photograph also reproduced in the above article (Fig. 5).

Fig. 2.—Here the effect of poor line synchronism during the framing period is revealed. Note the instability present at the top of the picture.

If there is a substantial hum content in the sync. pulse output and if there is an appreciable phase difference between the mains supply of the receiving station and that of the transmitter, as is highly probable in districts remote from the transmitter, the picture will tend to lock at some intermediate position on the screen, thereby providing two equivalent fractions of the picture. It is of cardinal importance that there be no A.C. ripple present in the sync. filter output. Attainment of correct interlace under such conditions is impossible, but this will be more fully dealt with when considering the subject of interlacing.

It is now necessary to deal with a fault peculiar to the line time base only.

Reference was made earlier to the half-line pulses maintained during the vertical synchronising. It is to these we can attribute a very common trouble in television receivers. Namely, the tendency for the top part of the picture to be horizontally displaced, the subject matter therein appearing to lean sideways (see Fig. 1). In some cases this horizontal displacement will not be maintained stably, the top edge of the picture fluttering in an irritating manner.

This effect is a little difficult adequately to convey with photographs but careful study of Figs. 2 and 3 will give some idea of the effect. Note in Fig. 2 the "B.B.C." is fuzzy, showing that this portion of the picture has moved during the exposure. The "Television Service" suffers in like manner though here the effect is not so marked. The lower half of the picture has remained perfectly steady. Comparison with the same parts in Fig. 3 shows the latter to have remained steady throughout the exposure.

To appreciate the reason for this it should be remem-

Fig. 3. In this photograph the line synchronism is well maintained during the framing period as is revealed by the steadiness of the upper portion of the caption. The slight-off vertical inclination of the lettering is due to bulb curvature.

LINE SYNCHRONISM

bered that, during the framing period, the character of the synchronising pulses is altered, this change being necessitated by the requirements for vertical synchronising. It is, of course, essential to maintain accurate line synchronism during the framing period for, otherwise, the line time base operates freely and must be

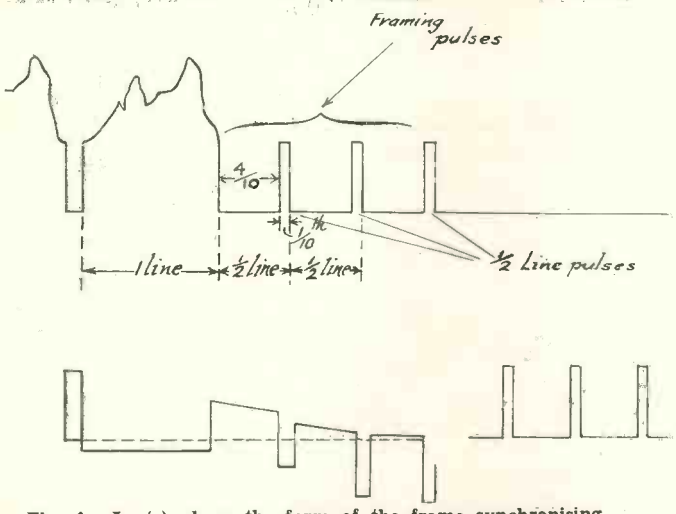


Fig. 4. In (a) above the form of the frame synchronising pulses is shown. These, when applied through a low time constant network, assume the form in (b). With a high constant the level is substantially maintained, the shape being similar to the pulses shown on the right above (b).

brought into step during the vertical sweep, thus causing some top part of the picture to be poorly synchronised.

This requirement is provided for in the transmitted signal. (See Fig. 4). It is seen that the framing impulses are divided into half line intervals; this incidentally is necessitated by the changed conditions prevailing during the odd and even frames in an interlaced system.

The steep front of these rectangular framing pulses is responsible for maintenance of line synchronism during the framing period and is applied through a high pass R.C. network to the blocking oscillator. This is only one of the many ways in which this function may be carried out, but it is the most popular. To deal with all the various arrangements possible is beyond the scope of the present series.

It will be obvious that, due to the presence of series capacity in the network, the D.C. level of the pulses will change. (See Fig. 4b). A corresponding change in amplitude of the pulses will occur and line synchronism will be poor during the framing period. This is the explanation for this displacement of the top edge of the picture. Whether the displacement is irregular, i.e., flutters, will depend on the design of the time base and the manner in which synchronism is applied.

Presence of this fault indicates a too low time constant and the value of the sync. application condenser should be reduced. A capacity of a few micromicrofarads will ensure that no D.C. change takes place, and will at the same time ensure adequate transfer of these steep fronted pulses. A capacity of 5-20 micromicrofarads will be very satisfactory. A reduction in value for the grid leak also is helpful, for this reduces the time constant.

Care is necessary, however, in order that the valve maker's recommendations for the resistance in the grid circuit be adhered to. In this connection it is inadvisable to maintain this resistance with a high value series leak, a slight elaboration of the conventional application network being more satisfactory. (See Fig. 5). This arrangement, it is seen, retains a reasonable value of resistance in the grid circuit and at the same time permits a high time constant for the network.

This completes the description of faults likely to be encountered in the scanning circuits, and attention may now be directed to the picture receiving circuits.

Receiving Circuit Faults

Two main considerations apply here, namely, the overall frequency response of the various circuits and the rather stringent requirements from the point of view of phase shift at the upper and lower extreme frequencies. In addition, there are picture distortions that can be attributed to "ringing" in the I.F. circuits or, where corrected vision frequency stages are employed, to ringing in these circuits. The term "ringing" embraces those conditions applying when a transient is not accurately reproduced, a damped oscillation occurring and distorting the applied transient voltage. This gives rise to effects that are illustrated and described later.

There are also faults due to the production of spurious beats which give rise to varying degrees of superimposed patterns in the picture. In general these patterns can be attributed to an incorrect choice of intermediate frequency, harmonics of this I.F. frequency then occurring in the region of the signal frequency circuit's pass band. Care in the design of

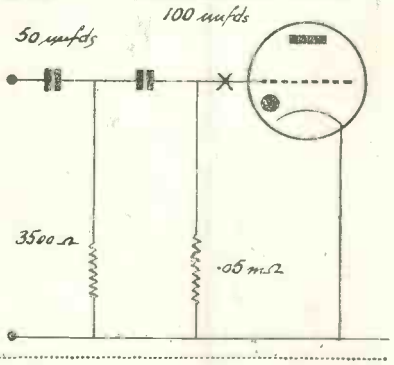


Fig. 5. A suitable application network for the line pulses is shown above. A resistance (5,000 ohms) may be necessary at X to avoid feed back of impulses due to grid current.

the detector filter will largely mitigate these effects, but in any case it is almost essential to choose an I.F. frequency that is inherently immune from such troubles.

In certain cases where a separate sound receiver is employed having its own oscillatory circuits interference may be experienced from this source. This can result from a number of causes, but it is necessary only to switch off the sound receiver to ascertain if this is the case. In this event it will be found necessary to re-choose the I.F. frequency for the sound receiver

VISION RECEIVER FAULTS

having particular regard to the oscillator frequency, harmonics of which usually extend liberally and can thus well occur around 45 mcs. For instance taking a flagrant example. If a sound I.F. of 3.5 mcs. is chosen and the sum frequency is employed for the oscillator, i.e., 41.5 plus 3.5 mcs., this will be 45 mcs. and severe

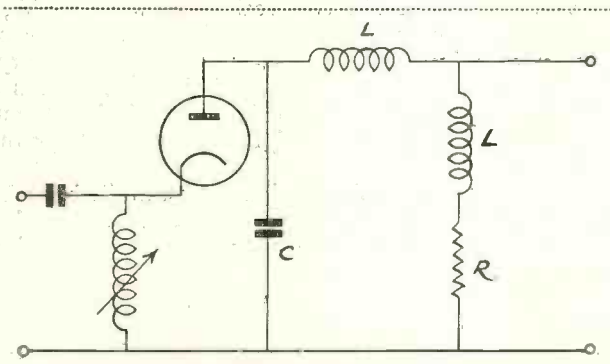


Fig. 6. A generally applicable filter is depicted. Data for the constants appear in the accompanying text.

interference with the vision circuits will almost certainly be experienced. The only likely remaining external source of these forms of interference will be that due to second channel interference from any stations that may be operating at suitable frequencies. In this event care in the choice of the oscillator frequency is desirable unless the selectivity of the signal frequency circuits is adequate. For example assuming the very suitable, and for this reason widely employed, I.F. frequency of 13 mcs. has been chosen, then it is preferable, indeed one can say it is essential, to employ the sum oscillator frequency, that is (45 plus 13 mcs.) second channel interference then is only possible from a band approximately 4 mcs. wide centred upon 58 plus 13 that is 71 mcs. Presumably there are no stations operating in this band.

On the other hand, if the difference frequency had

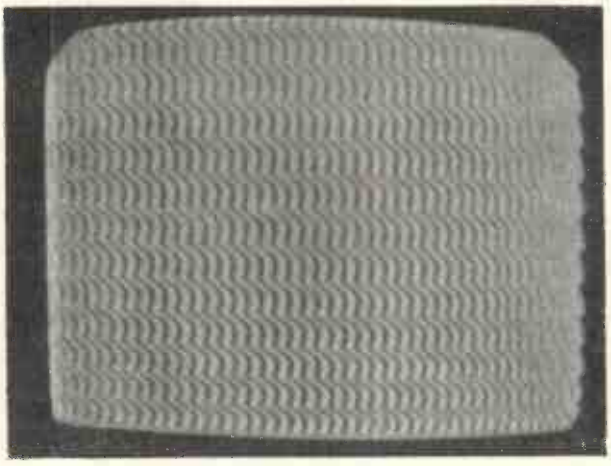


Fig. 7. This photograph shows the types of pattern resulting from an incorrect choice of I.F. frequency or to similar effects that are described in the text.

been chosen, that is 32 mcs. (45 − 13 = 32 mcs.) second channel interference occurs over a band centred upon 19 mcs. (32 − 13 = 19 mcs.). It is well known there are a great number of stations located in this band, consequently interference is almost bound to occur.

Concerning the choice of the vision I.F. frequency, an excellent chart rendering it a simple matter to determine this was prepared by the Cossor staff and published in the *Cossor Courier* some time ago. Subsequently this was reproduced in the *Journal of the Television Society* (March, 1937). From this chart suitable

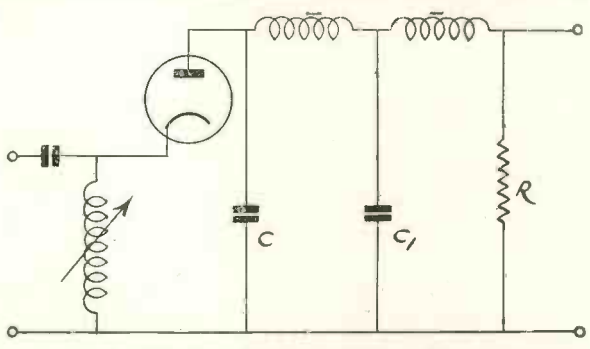


Fig. 8. An alternative form of detector filter is depicted. A series inductance is included to sustain the response at the upper modulation frequencies.

interference-free I.F. frequencies are readily chosen. For example, it is seen from this chart that suitable frequencies appear centred on 8.25 mcs., 10 mcs., 13 mcs., 18.5 mcs., and so on.

For various reasons 13 mcs., as has already been mentioned, is an excellent compromise. It must not be expected that all troubles are avoided by the simple expedient of correctly choosing the I.F. frequency. In addition adequate shielding of the I.F. and signal frequency circuits is required, incidentally this shielding of the I.F. circuits must also be adequate to prevent direct I.F. pick up of stations operating in the I.F. pass band.

A considerable improvement is also effected with the inclusion of a detector filter which also will have a marked effect in improving the overall stability of the receiver. Quite a simple type will in most cases suffice and this can be arranged as shown in Fig. 6. The inductances L are each comprised of 138 turns of 38 D.S.C. instrument wire close wound on $\frac{5}{8}$ in. formers. C is 10 mmfds. and C1 20 mmfds. The resistance R can have a value of 3,500-5,000 ohms. The inductances are mounted at right angles to each other and it is convenient to assemble these items in a common screening can. An alternative filter arrangement can be employed. In this compensation for losses due to the circuit and inter-electrode capacity are made by including a series peaking inductance in the load. In addition a filter inductance is included, the complete arrangement then attenuating rapidly above the highest desired modulation frequency. Fig. 8 shows one arrangement on these lines, the constants, however, depend largely upon the associated circuit conditions and a full treatment is outside the scope of the present series.

Actually the above remarks, strictly speaking, are true for any filter arrangement. That is to say the various constants ordinarily are assessed in accordance with conventional filter theory but, the arrangement of Fig. 6 is applicable in most cases and serves its purpose satisfactorily.

It is somewhat difficult to describe categorically or to provide photographs which will adequately convey the

INTERFERENCE TROUBLES

various forms of these interferences. If, however, interference which can manifest itself as wavy patterns, as diagonal lines or as small striations or spots in the picture is experienced then it is safe to assume the effect is attributable to one of the above causes. The effects are generally variations in lesser degree of that depicted

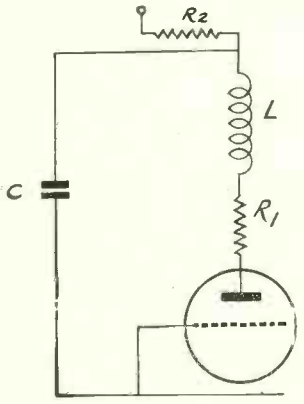


Fig. 9. An easily incorporated form of bass boosting circuit. This arrangement will also increase the circuit smoothing.

in Fig. 7. One point requires mention. Interference due to diathermy apparatus results in somewhat similar effects, but it is not difficult, because of the intermittent nature of this form of interference, to determine whether this actually is so.

With the question of the production of avoidable interference cleared up attention can be directed to the requirements of frequency response for the complete vision unit. In general two main sections of the unit are involved, namely, the I.F. amplifying stages and the vision frequency stage or stages. It is the horizontal definition in the picture with which we have to concern ourselves, for definition in the vertical direction is governed only by the line frequency (10,125 c.p.s.). With a picture ratio of 5:4 it is easily seen that for equal horizontal definition, frequencies of the

Fig. 10. Above is depicted the uneven picture illumination resulting from inadequate L.F. response.

order of $10^6 \times 2 \times 1.25$ mcs., i.e., 2.5 mcs. are involved. Actually somewhat less, as some portion of the picture necessarily is taken up for synchronising purposes.

At the extreme low frequencies good response down to 50 c.p.s. (i.e., the frame frequency) is adequate, especially as the response to D.C. level changes can be artificially invoked. It is apparent, therefore, that the requirement for first-class picture definition is a substantially linear response for the vision channel over a band extending from 50 c.p.s. to 2.5 mcs.p.s. The phase shift throughout this band must also be substantially constant although some degree of lag at the very high frequencies is permissible and is indeed not easily avoided. In general, the question of phase shift is a matter of adequate frequency response.

Dealing first with the low frequency requirements. The effect in the picture with inadequate response in this region is an apparent variation of brightness in the vertical direction. A D.C. correction or a D.C. restoring device will not necessarily remove this fault, though this will depend upon the time constant of the restoring device. The correct procedure is to improve the L.F. response. Where a coupling condenser and leak are employed between the V.F. stages or to the grid of the C.R. tube an increase in their time constant will improve matters, that is to say, the value of the condenser or of the leak is to be increased.

An alternative and preferable plan is to employ some form of low frequency correction which may well be an arrangement on the lines of that shown by Fig. 9. Here an additional load resistance R2 and its associated by-pass condenser C increase the response at the lower frequencies. It is obvious that with C possessing a fairly high reactance at low frequencies the additional load resistance R2 increases the anode load at these frequencies thereby increasing the gain; whereas, at progressively higher frequencies the reactance of C decreases, reducing the effect of R2. The circuit constants (i.e., the true load resistance R and the series peaking inductance L) are chosen without regard to these additional components (R2 and C) for these are only operative at the low frequencies, moreover the

Fig. 11. Here, the presence of hum in the receiver output results in the production of a dark horizontal band across the picture. The position of this band will depend upon the relationship existing between the supply mains.

overall stage gain is not affected for there is a boost at low frequencies, the levelling effect not being obtained with attenuation at high frequencies. Suitable

values for R2 and C are 3,000 ohms and 10-16 mfds. respectively.

It is desirable to interpolate a caution regarding the diagnosing of this fault. Similar shading effects occur due to (a) non-linearity of scan in the vertical deflecting circuits. This point has already received attention in this series and (b) presence of hum in the modulation output. This latter effect is usually manifest as a dark horizontal band across the picture. It is usually possible to ascertain whether this is the case by operating the equipment with no signal applied at the aerial terminals when this dark band will be observed passing vertically across the screen.

The photograph, Fig. 10, shows the shading effect described above. It is seen that the lower half of the picture is rendered at a greater illumination intensity than is that of the upper portion.

Fig. 11 depicts the effect obtaining when hum is present. In this photograph the hum band appears at the centre of the picture but this is not necessarily always so. Its actual position is determined by the relationship existing between the phase of the receiver and of the transmitter main's supply.

In the concluding article of this series the upper frequency response requirements and phase distortion in the I.F. and the V.F. circuits will be dealt with.

(To be continued.)

Long-Range Reception

SPENCER-WEST, of Worlingham, Beccles, has specialised in producing television apparatus for reception outside the normal service area. This includes a range of pre-amplifiers for employment in conjunction with commercial receivers. Each has its own power supply arrangements and they are entirely main's operated. Very real advantages result from the use of these under adverse conditions, the range being substantially increased and usually the signal to noise ratio is appreciably improved. The standard model in this range of amplifiers sells for 6 guineas, complete with all valves, and is suitable for attachment to any commercial receiver.

Left: The West vision chassis for long range.

Right: A pre-amplifier that can be added to any receiver to increase range.

A high-gain unit is also available, which is suitable for use with most receivers, and the makers will provide advice relating to this unit. Where unusual reception conditions exist, design of special models can be undertaken. For example, a unit is available which will restore the drop in signal voltage due to attenuation in feeders of exact length where reception is only possible by placing the aerial at a considerable distance from the receiver because of intereference. A typical example of specialised work is the vision unit and time base unit illustrated in the accompanying photographs. The vision unit is a super heterodyne having two R.F. stages, 3 intermediate frequency stages and a specially designed vision frequency amplifier. The overall response is only -2.5d. at 2.5 mcs. and the efficient signal frequency circuits result in a very low inherent noise level.

Book Review

Electron Optics. L. M. Myers. (Chapman & Hall, 42s.) 584 pp. 24 pp. bibliography. 379 Figs.

Apart from articles in the technical journals the science of electron optics has not been dealt with thoroughly in this country, although a book by Brüche and Scherzer appeared several years ago.

Mr. Myers is the first to assemble the known data on the subject and to deal with it in a thoroughly comprehensive manner. Indeed, it is not too much to say that this book will be the standard textbook in English on Electron Optics for many years to come.

Commencing with a review of the analogies between light and electrons, the author deals with the electron trajectory in various fields, together with methods for plotting the distribution of potential and the electron paths. The whole theory of electron lenses is then given with several original illustrations of lens systems and the aberrations due to them.

The remainder of the book is occupied with a detailed description of the various applications of electron optics: Electron multipliers, the electron microscope, electron telescope, and various special types of cathode-ray tube.

The book is accompanied by a complete bibliography of articles on the science, and it is here that the first criticism might be made. References listed under the name of the author are seldom of as much value as those classified under subject matter, and the arrangement in the book is not designed to enable the reader to verify a reference quickly in relation to others on the same point.

The author in his preface hints that the book will have only a limited circulation. We feel sure that the circulation will only be limited by the number of students interested in this important branch of the science of electronics, as it is indispensible for the true understanding of its theory and practice.

Indexes and binding cases for 1938 are now available.

Lenses for Picture Magnification

Readers who own television receivers employing small tubes of sizes up to 4 inches will be interested to know that H. G. Sanders & Co., of 4 Gray's Inn Road, London, have available a series of miniscus lenses of various sizes which can be used to increase the image size. Tests have shown that these are effective for small magnification, as for instance by employing a 5-in. diameter lens with a 3-in. tube. If too great a magnification is attempted distortion is inevitable and the viewing angle is restricted.

Telegossip

A Causerie of Fact, Comment and Criticism

By L. Marsland Gander

I SHOULD find the reports of successful results in the "television drive" more convincing if the organisers substantiated them with sales figures. Concealment is serving no purpose save to foster in the public mind the false impression that sales are so negligible as to be not worth mentioning.

As a fact the sales continue to be encouraging but there is nothing like a boom. Mr. H. G. Selfridge, junior, who is helping to crack the whip in this drive with his enterprising exhibition in Oxford Street, told me the other day that just over ten per cent. of his firm's radio sales in the London area were television purchases. Incidentally, I tackled him about a report that he had offered a large sum of money to sponsor a series of television programmes.

This story, it seems, is entirely without foundation. It probably arose because he is both a television "fan" himself and a believer in sponsored programmes. But Mr. Selfridge is of opinion that there is no possibility of programmes financed by advertising here. Even financial difficulties will not drive the Government and the B.B.C. into it. Yet the decision to allow reproduction of the Boon-Danahar fight on Baird big screens to paying cinema audiences is most significant as a move towards commercialisation of a kind.

Public Cinema Television

There have been long negotiations and discussions behind the scenes over this question. The B.B.C. is making no payment for the privilege of televising the fight, but the promotor was authorised to make his own terms with the Gaumont British Picture Corporation which wanted to show the contest on the same night at two of its West End cinemas. There has been a long struggle behind the scenes of the B.B.C. over this question.

A powerful faction wanted to keep television exclusively as a home entertainment and argued that the big screen was at present an indifferent advertisement for television. Others pointed out, however, that boxing promotors had already set their faces against televising except on prohibitive terms and that the big screen, with its possibilities for commercialisation, offered a solution of the difficulty. Eventually the Television Advisory Committee debated the matter and the "progressives" won—for the time being.

But even then the B.B.C. had some misgivings. When the National Sporting Club was talking of raising £35,000 by means of cinema television in order to persuade Joe Louis to fight over here, the B.B.C. issued a special announcement pointing out that the arrangement for the "Boon-Danahar fight" must not be regarded as a precedent.

But one thing is certain, that it would be wanton obstructionism to stop the forward march of the big screen on which so much ingenuity, time and money have been expended. On the face of it the arrangement made by the B.B.C. in this case seems an excellent way out of an impasse. Personally I do not see any reason to fear that this is the thin end of the wedge towards a sponsored system alien to the normal practice of the B.B.C. The principle involved is entirely new, without any precedents in sponsored broadcasting.

The Questionnaire

Postcards and letters at the rate of about 1,000 a day have been pouring into Alexandra Palace in response to the B.B.C. invitation to viewers to take a hand in constructive criticism of the programmes. At the time of writing the grand total of names for entry into this television "Doomsday Book" is about 4,000. This response is decidedly more encouraging than that when the B.B.C. made a similar request a few months after the service started. At that time they had about seventy replies!

What a pampered person the televiewer is by comparison with his brother restricted to sound programmes! The B.B.C. does everything to encourage and court him, short of presenting him with a pound of tea. Every viewer has had about £150 worth of entertainment in exchange for ten shillings, a pretty fair profit!

"Do you prefer men or women announcers?" is one of the questions in this "quiz." The majority have answered that they are more concerned with personality than sex. There is a big demand for a Children's Hour, and Mr. Gerald Cock hopes to provide one shortly on Saturday afternoons.

Other televiewers, myself among them, would like an earlier start in the evening.

Test Transmissions

There is a revolt among dealers and manufacturers just now against the morning film which gives snippets from ancient programmes transmitted at the start of the service. Protests have been made to Alexandra Palace, but so far without result. It is futile for the B.B.C. to contend that this film is simply intended to help the trade with installations.

Whatever the purpose the fact is that demonstrations are being given daily, and on it the public will form an entirely wrong impression of the programmes of 1939. I myself saw crowds round the sets at the Selfridge's exhibition, watching with that "so this is television," expression. There must be innumerable old films which the B.B.C. could use without recourse to this worn-out relic. A different film every day ought to place no great strain on the A.P. film library.

A great hunt is now in progress for the ideal "outside commentator" for television. Applicants have been on parade at Alexandra Palace like the girls in a "Miss California" competition, except that they were not obliged to wear bathing costumes. Finally Robin Duff, one of the Empire announcers, was chosen to broadcast the auto-gyro demonstration at Hanworth. He has the round face and well proportioned features, to say nothing of the Adonis profile, which the B.B.C. considers the best masculine televising material.

The mobile units now have six super-Emitrons at their disposal, but lately camera improvement has been offset by an unfortunate crop of technical hitches. I give full marks to producer Dorté for his Sunday programme ideas and wish him better luck with his transmissions.

I hear that pressure of rearmament work on some of the firms concerned is tending to hold up B.B.C. plans for converting the old Theatre.

Television in Your Home

THE RECEIVERS YOU CAN BUY —A COMPLETE GUIDE

In presenting this Buyer's Guide to our readers, we believe that it is complete and represents the latest information regarding all television receivers that are on the market. Upon request, we shall be pleased to amplify or provide special information in cases where prospective buyers desire more detailed particulars than it has been possible to give in this review.

PICTURE SIZE:—18 INCHES TO 24 INCHES WIDE

Maker.	*Type.*	*Cabinet.*	*Price.*	*System.*
Philips.	Television sound, all-wave radio.	Console.	£126 0 0	Cathode-ray projection.
Scophony.	Sound and vision.	Console.	£231 0 0	Mechanical.

TELEVISION receivers that produce pictures of sizes larger than approximately 14 in. by 11 in., are of necessity special types. This is because it is a difficult matter to make cathode-ray tubes in large sizes owing to the enormous atmospheric pressure, which on the screen end alone may amount to more than half-a-ton. There are two solutions to the problem of the large picture—one is by the use of a special cathode-ray tube upon the screen of which an intensely bright, though small, picture is produced which is then projected on to an external screen by means of a special lens system and the other is by mechanical-optical methods in which a beam of ordinary light is caused to traverse the screen, its intensity being varied in accordance with the received vision signals. The results obtained with either system may be said to be equal and both have certain advantages.

The design of the cathode-ray projection receiver follows ordinary cathode-ray receiver practice except that in order to obtain a picture sufficiently bright for projection, comparatively high voltages are used. In the mechanical-optical receiver quite low voltages are employed, but there are mechanical moving parts. Both systems are entirely satisfactory, though there is necessarily a little more elaboration than there is in the case of the ordinary type of cathode-ray receiver such as is used in receivers providing pictures of sizes less than those mentioned above.

Philips Projection

The projection screen of the Philips receiver automatically rises into its correct position when the lid of the cabinet is lifted. A slow motion device prevents damage to the glass screen and mirror by too rapid closing of the lid. The picture size is 18 in. by 14½ in., and the brilliance and definition are such that it can be viewed in comfort and under normal conditions. A Mullard 4-in. diameter projection type cathode-ray tube is employed and operates from a 25,000-volt supply.

Focusing and deflection are entirely magnetic. The tube is mounted with the projection lens in a metal case provided with gimbals to facilitate optical centring of the picture on the projection screen. The 25,000-volt supply for the operation of the cathode-ray tube is obtained from a voltage doubling rectifier unit using two Mullard 1878 H.T. rectifiers. The whole extra high tension equipment is contained in an earthed steel case with interlocked switches and an earthing device on the door. Opening the door breaks the supply to the rectifier and automatically earths the extra high tension terminals, thus making the equipment completely shock proof.

The television and broadcast equipment consists of five units:—

1. Vision and sound receiver with synchronising separator.

The Philips projection receiver giving a picture size 18 ins. by 14½ ins.

Scophony mechanical-optical receiver. The screen measures 24 ins. by 20 ins.

2. Frame and line time bases and H.T. supply.
3. E.H.T. equipment.
4. Projection assembly containing the cathode-ray tube.
5. Broadcast chassis type 753A.

In addition to reception of the television programmes, normal broadcast reception is afforded by a high-fidelity all-wave receiving unit.

Scophony Mechanical-optical

The Scophony mechanical-optical receiver gives a picture 24 in. by 20 in. The colour is bluish-black and white on a flat screen. Operating voltages are low, in fact not much in excess of those in an ordinary broadcast receiver. The light source is a super-pressure mercury lamp. The receiver incorporates (1) the Scophony supersonic light relay which makes it possible to employ, in this type of receiver, nearly 200 elements of the picture simultaneously, and (2) the special optical invention of focusing in two distinct focal planes (split focus) which makes it possible to reduce the size of moving parts whilst retaining the fullest amount of light.

The total number of valves used is 39 including all rectifiers, and the mercury-lamp power supply. The total consumption of the receiver when working is 1,000 watts.

The controls are quite simple. Starting is by means of a delayed push-button switch. This switches on all filaments, power supplies and mercury lamp. There is one control for sound volume and one control for vision gain; this knob controls the contrast. Another control is provided for picture brightness.

On the scanners there is one speed control with synchronising locking switch and one for frame adjustment. A focus control knob is also provided, but this has to be seldom used.

PICTURE SIZE—12 INCHES TO 14 INCHES WIDE

Maker.	*Type.*	*Cabinet.*	*Price.*	*System.*
Baird.	Television sound, all-wave radio.	Auto-radiogram.	£126 0 0	Cathode-ray indirectly viewed.
Baird.	Television sound.	Console.	£63 0 0	Cathode-ray directly viewed.
Cossor.	Television sound, all-wave radio.	Console.	£50 8 0	Cathode-ray directly viewed.

Baird

The Baird Console model T23 has been designed primarily for installation in hotels and clubs, for the size of the picture (13½ in. by 10¾ in.) enables a large number of people to view simultaneously. The T23, of course, is suitable for installation in the home where a large picture is desired. There are three main controls only, mounted on the front of the cabinet: picture contrast, brightness and sound volume. The power consumption is 200 watts.

A high-fidelity sound receiver is fitted and this is preset to receive television sound. The walnut cabinet measures approximately 43½ in. high (with lid closed), 25 in. wide, and 20 in. from back to front.

The "Cathovisor" cathode-ray tube is 15 in. in diameter and is mounted vertically and protected with a window of safety glass. The vision, sound and time-base generator chassis are mounted on a removable shelf above the H.T. and power units which are fitted at the base of the cabinet.

One power pack supplies current to the vision, sound and time-base generator. The other power pack feeds the anode voltage to the "Cathovisor" cathode-ray tube and five special resistor tappings supply variable bias for controlling picture brightness.

Baird Radiogram T14. An elaborate instrument designed to receive the television and also the radio broadcast programmes, and to act when required as a luxurious radiogramophone. This receiver provides a picture 13½ in. by 11 in., which is viewed in a hinged, part-mirrored lid. The gramophone is fitted with an auto-record changer which plays records of any size in any order. The superhet radio receiver covers the television waveband, and on the operation of a single switch three broadcast bands, as follows: short, 16.5 to 51 metres; medium 198 to 550 metres; long 850 to 2,000 metres.

The power consumption is 250 watts and the cabinet measures 58 in. wide; 42 in. high and 20 in. back to front.

Cossor

This instrument, Model 1210, incorporates the latest type of Cossor giant tube (glass protected) giving a direct-vision black and white picture 12 in. by 9½ in. approximately. It is simple to use, there being only three television controls. Also included in the cabinet (which is 48½ in. high, 20½ in. wide and 24½ in. deep) is a high-fidelity superhet radio receiver covering three wavebands, viz., 16-52 metres, 195-560 metres and 810-2,085 metres. This model has 21 valves and gives television reproduction up to approximately 20 miles from Alexandra Palace. The price is 48 gns.

Another model, 1210A, of the same type but with 24 valves, to give the extra power necessary for ranges over 20 miles and for exceptional conditions, is available for 51 gns.

Below: The Baird combined television receiver, radiogram and broadcast receiver. Picture size is 13½ ins. by 11 ins.
Right: The Cossor large picture (12½ ins. by 9½ ins.) console combined television and broadcast receiver.

10¼ INCHES BY 8¼ INCHES

Maker.	*Type.*	*Cabinet.*	*Price.*	*System.*
Ultra	Sound, and vision.	Console.	**£39 18 0**	Cathode-ray directly viewed

Ultra

The Ultra model T24 is a console instrument for sound and vision only and considering the picture size, is a remarkably compact instrument. The picture is directly viewed. A patented circuit reduces the number of valves required. Eight valves in a superheterodyne circuit receive both sound and vision signals. Double couplings give freedom from distortion and " cross modulation " troubles. The couplings in the sound amplifier are designed to give a total band width of some 40 kilocycles, resulting in high standard of fidelity.

The power unit comprises two Mazda full-wave rectifiers, transformers, chokes and smoothing condensers. High tension for the cathode-ray tube is derived from a special transformer feeding a Mazda U21 slow-heating mercury rectifier, an arrangement which prevents surges and reduces breakdown possibilities. The cabinet is of particularly neat design.

10 INCHES BY 8 INCHES

Maker.	*Type.*	*Cabinet.*	*Price.*	*System.*
Baird.	Television sound, all-wave radio.	Radiogram.	**£75 12 0**	Cathode-ray indirectly viewed.
Baird.	Television sound, all-wave radio.	Console.	**£49 7 0**	Cathode-ray directly viewed.
Baird.	Television sound, all-wave radio.	Table.	**£46 4 0**	Cathode-ray directly viewed.
Burndept.	Sound and vision.	Console.	**£47 5 0**	Cathode-ray directly viewed.
Cossor.	Television sound, medium and long.	Auto-radiogram.	**£94 10 0**	Cathode-ray directly viewed.
Cossor.	Television sound, medium and long.	Console.	**£73 10 0**	Cathode-ray directly viewed.
Dynatron.	Television sound, all-wave radio.	Auto-radiogram.	**£173 5 0**	Cathode-ray directly viewed.
Ekco.	Sound and vision.	Console.	**£51 9 0**	Cathode-ray directly viewed.
Ferranti.	Television sound, all-wave radio.	Console.	**£63 0 0**	Cathode-ray directly viewed.
Ferranti.	Sound and vision.	Console.	**£52 10 0**	Cathode-ray directly viewed.
G.E.C.	Sound and vision.	Console.	**£38 17 0**	Cathode-ray directly viewed.
H.M.V.	Television sound, all-wave radio.	Auto-radiogram.	**£126 0 0**	Cathode-ray directly viewed.
H.M.V.	Television sound, all-wave radio.	Console.	**£84 0 0**	Cathode-ray indirectly viewed.
H.M.V.	Television sound, all-wave radio.	Console.	**£63 0 0**	Cathode-ray indirectly viewed.
Marconiphone.	Television sound, all-wave radio.	Console.	**£84 0 0**	Cathode-ray indirectly viewed.
Pilot.	Television sound, medium and long.	Radiogram.	**£68 5 0**	T.65.
R.G.D.	Television sound, all-wave radio.	Auto-radiogram.	**£136 10 0**	Cathode-ray indirectly viewed.
R.G.D.	Television sound, all-wave radio.	Console.	**£94 10 0**	Cathode-ray indirectly viewed.
R.G.D.	Sound and vision.	Console.	**£78 15 0**	Cathode-ray indirectly viewed.
Tannoy.	Sound and vision.	Auto-radiogram.	**£89 5 0**	Cathode-ray directly viewed.
Vidor.	Sound and vision.	Console.	**£42 0 0**	Cathode-ray directly viewed.

Baird

The Baird Radiogram T21 has, in addition to television and all-wave radio, the added attraction of a high-fidelity radiogramophone. A four waveband superhet receiver is fitted, covering the ultra-short television waveband and three additional bands for radio programmes: short, 16.5 to 51 metres; medium, 198 to 550 metres and long, 850 to 2,000 metres. The television sound may be received either with or without the picture by operating a switch incorporated with the picture contrast control. The picture (size 10 in. by 8 in.) is viewed in a hinged portion of the mirrored lid. The power consumption is 200 watts and the approximate dimensions of the cabinet are 33 in. high, 39 in. wide and 20 in. back to front.

Baird Table Model T18. This is a complete table television receiver combined with a very selective and high quality all-wave radio, yet the compact cabinet housing the complete equipment is little larger than the usual table radio. The sound receiver is a superheterodyne covering the television sound waveband and three bands for radio programmes (short: 16.5 to 51 metres; medium, 198 to 550 metres and long, 850 to 2,000 metres). It is possible to receive the sound on the television waveband either with or without the picture by means of a switch integral with the picture contrast control. The picture size is 10 in. by 8 in., viewed direct, and the power consumption 150 watts.

The cabinet measures approximately 25 in. high by 18 in. wide by 16 in. from back to front. It is attractively designed as illustrated, and is standard in walnut. The receiver is heavier than a radio set, and it may be found convenient to have a suitable stool to support and raise it to a comfortable height for viewing. For this purpose a special stool can be supplied at an additional cost.

Baird Console Model. The general specification of this console is similar to that of table model T18, described above. The cabinet is strongly made and attractively designed in walnut. It is made available

Left : The Baird table model T20 giving a picture 10 ins. by 8 ins.

Below : The Burndept console television receiver. Picture size 10 ins. by 8 ins.

in this form for those who prefer to have one complete cabinet rather than a smaller cabinet with or without a stool to support it. The size of the console cabinet as illustrated is approximately 44 in. high, 20 in. wide and 16 in. from back to front.

Burndept

Burndept Limited have concentrated on one model of the console type providing vision and the accompanying sound. The brilliant black and white picture, size 10 in. by 8 in. is viewed directly. There are four controls in all, three for television and one for volume control of sound. A high fidelity speaker is incorporated, with undistorted output of 5 watts. It is housed in a handsome walnut cabinet of the console type, size 40 in. high, 26 in. wide, 22 in. deep.

Twenty-two valves are employed in the complete receiver. D.C. restoration is incorporated, ensuring that the general picture illumination follows faithfully that transmitted. A 12-in. cathode-ray tube with all-magnetic focusing and scanning is used, giving excellent definition. The vision receiver is of the superheterodyne type embodying H.F., mixer, and oscillator stages, which are common to both sound and vision. Two vision I.F. stages are used, diode detector and video amplifier which are connected to the cathode-ray tube. On the sound side there is an I.F. amplifier (100 Kc. band width) followed by a double diode triode with pentode output to the speaker (5 watts output).

Cossor

The Cossor model 137T is a combined television and high-fidelity radio receiver with a 13½ in. diameter cathode-ray tube. The radio is for use on two wavebands: 200 to 550 metres and 800 to 1,980 metres. The viewing screen—which gives a picture 10 in. by 8 in.—and controls are protected by doors when not in use. The cabinet is 44½ in. long, 20½ in. high and 24 in. wide. Twenty-one valves are used.

Another model is the 237T, as described above, but with an additional upper section incorporating an electric gramophone of the latest type with record changer. The size of the cabinet is 51 in. high, 20½ in. wide and 24 in. deep. The price is 90 gns.

Ferranti

Two Ferranti receivers providing a picture 10 in. by 8 in. are available. One, the model T3, is designed for television and accompanying sound, and the other incorporates a sound broadcast receiver for all-wave reception in addition to the usual television circuit. This is known as Model T4. The prices of these receivers are 50 gns. and 60 gns. respectively. Use has been made of the new secondary emission type R.F. pentode for vision amplification. Scanning and synchronising has been achieved its simplest form, one valve being used for each deflection circuit and one valve only for synchronising.

The all-wave radio section in the T4 model is a sensitive superheterodyne receiver employing the same I.F. valve as the television sound receiver. This is effected by having 465 kC. I.F. coils for radio and 7 Mc. I.F. coils for television sound in series in each coil section.

The sound receiver audio-frequency amplification has negative feedback for high fidelity. The frequency response is almost constant from 40 to 10,000 cycles.

The picture characteristics, television sound and vision circuits in both models T3 and T4 are identical. The brilliant black and white picture is viewed directly on a 12-in. Emiscope tube which employs magnetic scanning and electrostatic focusing.

There are six controls, of which four require only very occasional adjustment, making the operation of the set very simple. An extra control is provided on the all-wave model T4. The cabinet in walnut finish is built so as to permit viewers to see the picture in comfort and from a wide angle.

G.E.C.

For the present and pending the development of a new range of models the General Electric Co., Ltd., are concentrating on what may be described as a real utility instrument for television and the accompanying sound. This receiver, a console, gives a 10-in. by 8-in. picture at the remarkably low price of 37 gns.

The G.E.C. console television receiver. A fine instrument giving a 10 ins. by 8 ins. picture.

The Ferranti 10 in. by 8 in. console television receiver.

It is a direct-viewing model providing a true black and white picture with perfect focus and a remarkable degree of brightness, with every gradation of half-tone. Only three normal operating controls are required and the instrument is contained in a hand-polished figured walnut cabinet. The dimensions are, height 38 in., width, 20 in., depth 21 in., and the consumption is 200 watts.

H.M.V.

An H.M.V. model 901, giving a picture 10 in. by 8 in., is a console television receiver suitable for those who already possess a modern radio or radiogram and require a television sight and sound receiver only.

The picture is reflected from the end of the tube on to a mirror set at an angle of 45 degrees in the lid. Simplicity of operation is an outstanding feature of this model. The price is 60 gns.

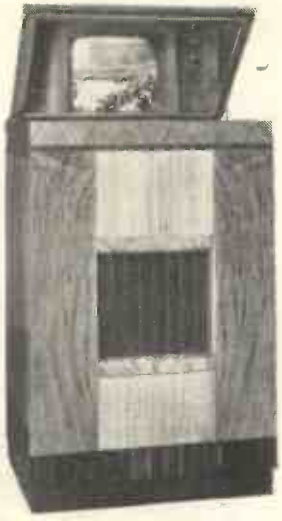
Marconiphone

Model 902 is a complete home entertainer. Contained in a single cabinet of figured walnut is a tele-

vision sight and sound receiver, an all-world radio receiver and an automatic record-changing electrical gramophone.

The black and white picture is viewed through an optically corrected lens and 45-degree mirror. The 6-valve superhet radio receiver has four wavebands (16.7 to 53 metres, 46 to 141 metres, 185 to 560 metres and 750 to 2,250 metres) with an extra waveband for television sound reception. The electrically-reproducing gramophone will play through eight records automatically without attention. The price is 120 gns.

Left : H.M.V. model 901 indirect 10 ins. by 8 ins. television receiver. Below : The R.G.D. television receiver, model 382.



Model 900 is a combined television and all-world radio receiver. It has a 6-valve superhet sound circuit with four wavebands (16.7 to 53 metres, 46 to 141 metres, 185 to 560 metres, 750 to 2,250 metres) and an energised moving-coil speaker. A separate waveband provides for television sound reception. The black and white picture, 10 in. by 8 in., is reflected into a special mirror in the lid, thus enabling a number of viewers at wide angles from the instrument to watch the programme comfortably and without distortion. Simple control for television and radio, sharply defined pictures, true-to-life tone, and a beautifully-figured walnut cabinet are features.

Marconiphone Model 705. This instrument consists of a television receiver with the sound accompaniment and a four-waveband radio receiver covering the following wavelength ranges: 16.7 to 53 metres, 46 to 140 metres, 185 to 560 metres and 750 to 2,200 metres. The vision equipment comprises the Emiscope tube unit which converts the electrical signal into a picture on the face of the tube. The vision receiver unit consists of a 6-valve T.R.F. receiver fixed-tuned to 45 megacycles (6.67 metres). A mirror supported in the cabinet lid, which, for television is held open at 45 degrees, reflects the picture. To facilitate tuning the lid may be raised into the higher position of 70 degrees.

The television controls are grouped to the left of the top board which masks the end of the Emiscope cathde-ray tube. The picture size is 10 in. by 8 in., and the mains consumption is 260 watts. The sound receiver unit is a normal broadcast chassis adapted to deal with the television sound broadcasting on 41.5 megacycles (7.23 metres) as well as the normal long-wave, medium-wave and two short-wave bands.

R.G.D.

Three entirely different models producing a 10 in. by 8 in. picture are made by Radio Gramophone Development Co., Ltd. These comprise a television receiver (with sound) only, Model 382, a television receiver all-wave radio receiver and auto-radiogramophone, Model 382 R.G., and a combined television and all-wave radio receiver, Model 382 R. The television features of these instruments are as follows: A 14-valve superhet circuit with H.F. stage, triode hexode frequency changer, two-channel I.F. amplifier, one having a band width of 4.5 megacycles for vision, the other having a band width of 20 K/c. for high fidelity reproduction of sound. Pre-set tuning of sound and vision. Triode portion of double diode triode valve as first audio stage, feeding output valve having an undistorted output of $3\frac{1}{2}$ watts.

An Ediswan type 12H cathode-ray tube, having a diameter of 12 in., and giving a clear picture 10 in. by 8 in. with electrostatic scanning of both frame and line is employed.

Forty valves are used in the autoradiogram and press-button tuning is incorporated for the radio receiver.

9 INCHES BY 7 INCHES

Maker.	*Type.*	*Cabinet.*	*Price.*	*System.*
McMichael.	Sound and vision.	Console.	**£63 0 0**	Cathode-ray indirectly viewed.
Murphy.	Sound and vision.	Console.	**£65 0 0**	Cathode-ray indirectly viewed.

Murphy

Among the three Murphy models is the A42V for television programmes only, which has certain refinements which it is not possible to include in a cheaper model. The picture is indirectly viewed. The top of the cabinet inside the lid is covered with dull leather to prevent any stray reflections which might interfere with the picture on the screen. The picture size is larger than on the other Murphy models, being 9 in. by 7 in., giving a wider angle of vision, which enables more people to view the programme comfortably. Opening and closing of the lid automatically switches the set on and off. The dimensions are $34\frac{1}{2}$ in. high by $31\frac{1}{2}$ in. wide by 18 in. deep.

$8\frac{1}{4}$ INCHES BY $6\frac{1}{2}$ INCHES

Maker.	*Type.*	*Cabinet.*	*Price.*	*System.*
Cossor.	Sound and vision.	Table.	**£47 5 0**	Cathode-ray directly viewed.

Cossor

Cossor Table Model 437T. This is another table instrument which has been produced for those who already have a satisfactory receiver for broadcast radio reception. It is designed for receiving television and its accompanying sound only. The picture ($8\frac{1}{4}$ in. by $6\frac{1}{2}$ in.) is of ample size for home entertainment. The walnut-finished cabinet is $22\frac{1}{2}$ in. high, $14\frac{1}{2}$ in. wide and 25 in. deep. 20 valves in all are used and the price is 45 gns.

7½ INCHES BY 6¼ INCHES

Maker.	*Type.*	*Cabinet.*	*Price.*	*System.*
Baird.	Sound and vision.	Console.	**£39 18 0**	Cathode-ray directly viewed.
Baird.	Sound and vision.	Table.	**£36 15 0**	Cathode-ray directly viewed.
Ultra.	Sound and vision.	Table.	**£29 8 0**	Cathode-ray directly viewed.
Beethoven.	Television sound, all-wave radio.	Console.	**£50 8 0**	Cathode-ray directly viewed.

Baird

The table and console models T20, have the same general specification and each consist of two main units: (1) the 9-in. diameter " Cathovisor " cathode-ray tube, time base generator and vision unit; (2) power pack and sound unit. The first unit forms a single compact chassis assembly which is easily accessible and is fitted in the top section of the cabinet. As in the case of the radio receiver, the vision is pre-set and requires no further adjustment. Current supplies for both main units, including the high tension voltage to the " Cathovisor " cathode-ray tube, are fed from the power supply unit. The cabinet of the table model measures approximately 22 in. high, 18 in. wide and 13 in. from back to front. The size of the console cabinet is approximately 48 in. high, 18 in. wide and 13 in. from back to front.

Left : Baird T20 console model television receiver. A fine example of a simple and low-priced instrument.

Below : R.G.D. television receiver and auto-radio-gramophone. Model 382.

Ultra

The Ultra model T22 is a table receiver for sound and vision only. The black and white picture, which is directly viewed, measures 7¾ in. by 6¼ in. The price is £29 8s.

Beethoven

The Beethoven receiver is a combined television sight and sound plus an all-wave radio receiver. The cabinet size is 38 in. high by 22¼ in. wide by 16 in. deep. The picture is provided on a slight incline for ease of viewing. There are only three controls for the television, which includes the on/off switch and these need only a very occasional adjustment.

The latest type Ediswan magnetic short cathode-ray tube is used and a total of 16 valves is employed in the television section. Positive synchronising is employed controlling both line and frame time bases. Each time base comprises a gas discharge relay followed by a single stage of amplification. The All-World Radio receiver incorporated is a Beethoven type A.C. 740 with certain switch modifications to meet the television requirements.

There are three wave ranges; short 16-50 metres, medium 200-500 metres and long 900-2,000 metres. The model TR20 is suitable for A.C. mains, 200-250 volts (adjustable) and the consumption is 250 watts.

7½ INCHES BY 6 INCHES

Maker.	*Type.*	*Cabinet.*	*Price.*	*System.*
H.M.V.	Television sound, all-wave radio.	Console.	**£47 5 0**	Cathode-ray directly viewed.
Marconiphone.	Television sound, all-wave radio.	Console.	**£47 5 0**	Cathode-ray directly viewed.
Murphy.	Television sound, all-wave radio.	Console.	**£45 0 0**	Cathode-ray directly viewed.
Murphy.	Sound and vision.	Console.	**£30 0 0**	Cathode-ray directly viewed.

H.M.V.

Model 907 is a combined television receiver and all-world radio receiver. Operation for both television and radio reception is extremely simple. A special super-het circuit is employed for the reception of television and sound, and a separate high-sensitivity chassis is incorporated for the reception of sound broadcasts between 13.5 to 50, 195 to 580 and 950 to 2,000 metres. The black and white picture size is 7½ in. by 6 in., and is viewed directly. The price is 45 gns.

The H.M.V. 903 is a console model for television sight and sound only housed in a figured walnut cabinet. The picture size is 7½ in. by 6 in., clearly defined in black and white and viewed directly on the end of the cathode-ray tube. The controls are grouped together on the front of the cabinet; the price of this model is £47 5s.

Marconiphone

Model 709 is a combined television and all-wave broadcast receiver. It incorporates an all-wave world broadcast receiver of the most up-to-date design and the picture is visible over a wide angle. The cabinet is attractively finished in light-coloured Australian walnut and is fitted with concealed easy-running castors. The picture size is 7½ in. by 6 in.

Murphy

The Murphy A56V for television programmes only is a very neat and compact receiver. The cabinet is of walnut with a sloping control panel of opaque plate glass to avoid reflections. The slope of the panel is designed to give comfortable viewing from a chair or when standing, and a wide angle of vision. The four controls grouped on this panel are volume control for

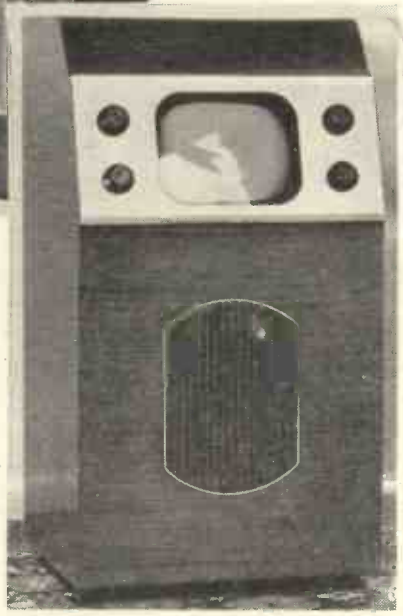
The H.M.V. Model 907 in the Home.

Baird Console Model T20.

Ferranti Console Model T3.

SOME REPRE TELEVISION

Three examples of directly viewed receivers by different makers. The Baird shown on the right also includes a normal broadcast receiver.

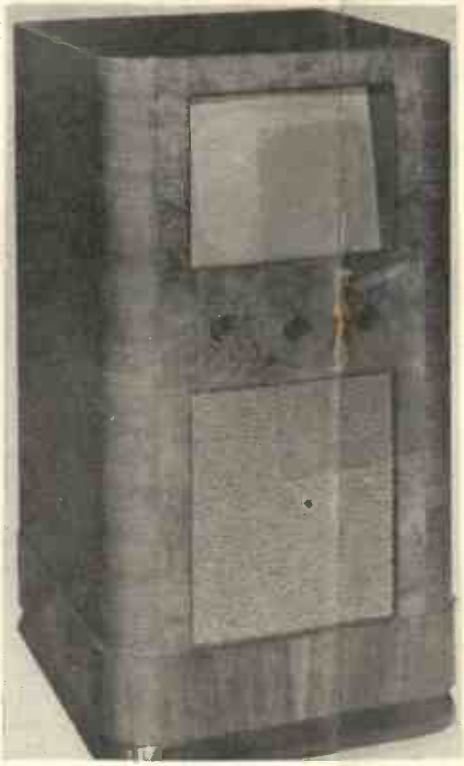


(Above) Baird Table Model T20.

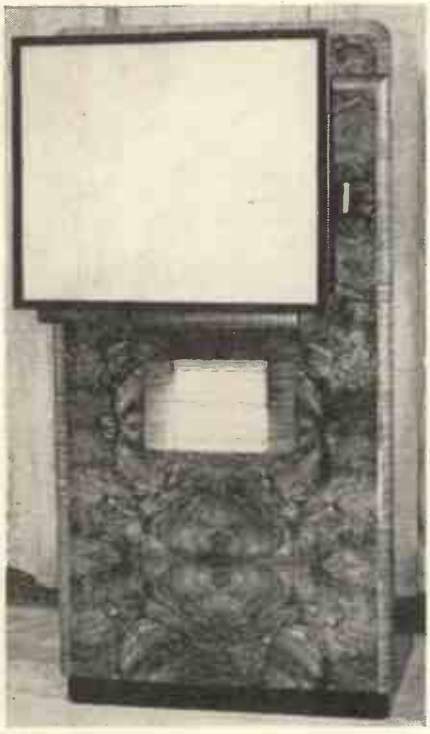
One of the largest receivers as regards picture size and at the same time one of the most compact is this table model Baird.

Murphy Console Model A56V.

Baird Table Model T18.



G.E.C. Console Model BT9121.



Scophony Mechanical-optical.

H.M.V. Table Model 905.

Table type receivers are made by several manufacturers. Small stands are generally supplied at an extra charge in order to convert the receivers to the console types.

Marconiphone Console Model 709

SENTATIVE RECEIVERS

Two interesting examples of modern console type television receivers which also include a radio set for normal broadcast reception.

Philips C.R. Projection.

Baird Console Model T18.

Ferranti Console T4.

sound, combined with on-off switch, and focus, brightness and contrast for the picture.

The picture is a clear black and white, size 7½ in. by 6 in. Sound output is ample for all ordinary purposes. The compactness of the instrument is largely due to the use of a new short type of cathode-ray tube. Fifteen valves are used for the sound and vision, and synchronising with three rectifiers to deliver the high voltages necessary. By an ingenious design, the chassis can be lowered in its cabinet and is, therefore, accessible for service.

The cabinet dimensions are 34½ in. high, 18 in. wide, and 17½ in. deep.

Another Murphy model, the A58V, contains the same television equipment and gives the same size picture, but also included is an all-wave radio receiver, and the cabinet is wider. The price of this is £45.

Below : Murphy combined all-wave radio and televison receiver. Right : The Ultra T24 console television receiver.

7½ INCHES BY 5¾ INCHES

Maker.	*Type.*	*Cabinet.*	*Price.*	*System.*
Invicta.	Sound and vision.	Table.	£32 11 0	Cathode-ray directly viewed.
Pye.	Television sound, all-wave radio.	Auto-radiogram.	£68 5 0	Cathode-ray directly viewed.
Pye.	Sound and vision.	Table.	£31 10 0	Cathode-ray directly viewed.
Pye.	Television, sound, all-wave radio.	Console.	£52 10 0	Directly-viewed.
Pye.	Television and sound.	Console.	£45 3 0	Directly-viewed.

Invicta

A particularly compact table model giving a directly-viewed picture 7⅛ in. by 5¾ in. is the Invicta TL5, the cabinet size being only 19 in. high by 17 in. wide by 14 in. deep and the consumption 150 watts.

One combined chassis carries both sound and vision circuits, resulting in increased compactness and electrical efficiency. It can be tuned with perfect results by any member of the family, because there are only two principal controls—one for vision brightness and the other for volume and on/off switch.

Marconiphone console, picture size 7¼ ins. by 6 ins.

Pye combined all-wave and television receiver.

Pye

Four receivers giving a picture 7¼ by 5¾ in. are manufactured by Pye, Limited, and these comprise a combined television receiver broadcast set and auto-radiogram in one cabinet, model 838, a table model 815, and two consoles, models 4046 and 843, the latter including all-wave radio with push-button tuning. The cabinet size of model 838 is 36½ in. high by 39½ in. wide by 19¾ in. deep, and the consumption 200 watts.

In the table model (815), which measures 19 in. high by 17 in. wide by 14 in. deep, only thirteen valves are used in a combined circuit. Only two controls are required.

The television pictures of the console models are the same, but the cabinet of the one incorporating all-wave radio is larger. It is interesting to note that a special model of either of these is available for use outside the ordinary accepted service area.

Pye all-wave radio and television table type receiver.

Invicta table television receiver.

6¼ INCHES BY 5 INCHES

Maker.	*Type.*	*Cabinet.*	*Price.*	*System.*
Ekco	Sound and vision.	Table	£27 6 0	
Ekco	Add-on vision Unit	Table	£23 2 0	
H.M.V.	Television sound, all-wave radio.	Table.	£36 15 0	Cathode-ray directly viewed.
Marconiphone.	Television sound, all-wave radio.	Table.	£36 15 0	Cathode-ray directly viewed.

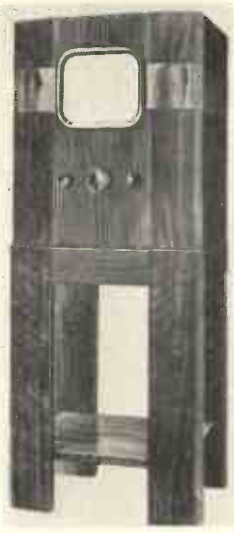
Ekco

Ekco receivers comprise two models at present, but two more are in course of development and will be ready shortly. Model TS701 is for sound and vision,

with the following specification. Power pack (3 rectifiers), 7-metre sound and vision receiver (12 valves), timebase (3 valves, with flat-ended, all-magnetic tube. Picture size is 6¼ in. by 5 in., the walnut cabinet 21½ in. by 17 in. by 16 in., and the sound output, 3 watts. The price is 26 guineas.

Model TA201 is an add-on unit for use in connection with A.C. radio sets fitted with pick-up sockets. This model, of course, does not include a sound output circuit and loudspeaker. The picture is 6¼ in. by 5 in., and the cabinet measures 19½ by 17 in. by 16 in. Eighteen valves are used, and the price is 22 guineas.

The models in the course of development are a sound and vision console model with a 9-in. tube and a radio and television table model giving a 6¼ in. by 5 in. picture.



Left: Ekco add-on vision unit. Below: Cossor table model 54 giving a 5 in. by 4 in. picture.

H.M.V.

H.M.V. model 905, a combined television and all-world radio receiver, and is generally similar in appearance to model 904, described later. This instrument shows a black and white picture 6¼ in. by 5 in. It also incorporates a 6-valve superhet sound receiver. The 3 waveband radio receiver brings in stations between 16.5 to 50, 200 to 570 and 725 to 2,000 metres. The The price is 35 guineas.

Marconiphone

Marconiphone model 707 provides a picture 6¼ in. by 5 in. It is a combined television and all-wave radio and the controls are no more complicated than those normally employed on many ordinary broadcast receivers. The equipment consists of a single chassis carrying (a) the vision receiver with associated equipment; (b) the Emiscope receiving tube; (c) the all-wave broadcast receiver; and (d) the power supply units for both sections.

5 INCHES BY 4 INCHES

Maker.	*Type.*	*Cabinet.*	*Price.*	*System.*
Cossor.	Sound and vision.	Table.	**£27 6 0**	Cathode-ray directly viewed.
Cossor.	Sound and vision.	Table.	**£24 3 0**	Cathode-ray directly viewed.
H.M.V.	Television sound, all-wave radio.	Table.	**£30 9 0**	Cathode-ray directly viewed.
Marconiphone.	Television sound, all-wave.	Table.	**£30 9 0**	Cathode-ray directly viewed.

Cossor

A picture size 5 in. by 4 in. is provided by the Cossor table models 54 and 54a. Simplicity of operation is a great feature, there being only two vision and two sound controls to operate. The cabinet, walnut finished, is 17½ in. high, 13 in. wide, and 20½ in. deep.

Model 54a is the same as model 54, but with extra amplifier (16 valves in all) for ranges over 20 miles and for exceptional conditions.

H.M.V.

H.M.V. model 904 is a combined television and all-world radio receiver for 29 guineas. The black and white picture, 4¾ in. by 4 in., is seen directly on the end of the cathode ray tube and gives clear vision over a wide range. All main controls are grouped together on the front of the cabinet. The 6-valve radio receiver has the wavelength scale clearly marked with many station names and a vernier scale simplifies tuning. The wave-range cover 16.5 to 50, 200 to 570 and 725 to 2,000 metres.

Marconiphone

Marconiphone Model 706 combines an efficient television receiver giving a picture 4¾ by 4 in., with an all-wave radio receiver of the very latest design. In picture brilliance and detail it compares favourably with the more expensive instruments. The Emiscope receiving tube has a diameter of 5 in., and the picture colour is black and white.

4 INCHES BY 3⅜ INCHES

Maker.	*Type.*	*Cabinet.*	*Price.*	*System.*
Invicta.	Vision only.	Table.	**£22 11 6**	Cathode-ray directly viewed.
Pye.	Television sound, medium and long.	Table.	**£30 9 0**	Cathode-ray directly viewed.
Pye.	Vision only.	Table	**£22 1 0**	Cathode-ray directly viewed.

Invicta

The Invicta table model TL4 is one of the smallest television receivers made, and the price is very low. It is a vision set with an adaptor, and specially designed for use in conjunction with any existing radio set having pick-up terminals and operating from A.C. mains to provide the sound. The picture, which measures 4 in. by 3⅜ in., and the cabinet size is 16 in. by 13 in. by 12 in. Consumption is 110 watts.

Pye

The two Pye table models differ only in that one incorporates an all-wave push-button broadcast set, and the cabinet is necessarily larger. The small model (817) is intended for use in conjunction with an ordinary broadcast set for the provision of the television sound. The large model (819) is, of course, entirely self-contained. Current consumption is 150 and 110 watts respectively. Only one vision control is required in either case.

Long Skip

G5KA would like reports from any amateur logging new DX Stations.

ONCE more the season of DX contests is upon us, and we hope you are all hearing and working lots of nice DX without getting too many headaches! The Senior B.E.R.U. is now a pleasant memory, the Junior contest is being run as we endeavour to put these notes into a readable form, and the high-spot of the year, the A.R.R.L. DX contest, will soon be upon us. The dates are March 4 to 12 for the brass-pounders, and March 18 to 26 for the 'phone men. As these two periods always bring lots of rare stations on the air, SWL's are well advised to put the bands under a microscope if they want to get hold of some nice unusual DX QSL's. We are wasting our time, we know, but we thought we would just give you all a gentle reminder that the 1.75 and 3.5mc. bands are not included in the contest this year.

The B.E.R.U.

We shall be greatly surprised if the winner in the B.E.R.U. Senior is not ZC6EC. At 2305 on the closing night of the ordeal, his number when in QSO with G6QX was 193. Bob worked him on both 14 and 7 mc. and tells us that ZC6EC must have finished up well over the 200 mark. As far as "G's" were concerned, conditions were fairly poor, and only the crack stations got over the 50 mark.

There was quite a rush one week-end for VU7BR who suddenly sprung up from the Bahrein Islands. G3BS and G6QX both worked him, and they list his frequency as around 14365kc. Other new ones from 3BS are CT3AB, an XZ, and VK9XX (14260 kc.) in New Guinea. Hector is now up to 81 countries, a fine record for a station only being licensed for 15 months. He is lucky in having his XYL (a licensed operator) to run the station while he is otherwise engaged. Louis, of G5RV, is now up to 121 countries worked, his latest being CT3AB. This station runs E.C.O. and has been heard anywhere between 14050 and 14260kcs.

VK7GJ

Tasmania supplied G6QX with another new one. The call was VP7GJ, and the frequency 14390. Bob noticed unusual conditions prevailing on the evening of January 30 when he got RST589 from W6GHU at 2230. On 7mc. he spent a lot of time calling VP2AT (7050kc.) without luck. The VP was working other G's, but was complaining of heavy QRM from the U.S.A. This band is certainly worth studying after 2300 if you can bear the strain of European QRM!

G6AY reports having worked a new one in India. The call is VU2FU, the frequency 14,220, and the QRA N. A. Printer, "Fairfield," 204 Cadell Road, Bombay 16. SWL Mallett reports poor conditions and puts this down to the effects of the Northern Lights which were visible from his QRA on February 6. Between 1300 and 1400 G.M.T. he has been hearing some respectable fone DX, and during this period on February 8 he logged W6, ZS, G6 and ZE.

More DX

PK6XX, the station of the Archbold Expedition in New Guinea, was heard on 'phone by Dennis Tyler. They were up the LF end, but on c.w. they should be looked for around 14007. Others on LF end ('phone) from Dennis are FT4AK, VQ2RE, XZ2BJ, ZK1AA, VK9WF and HC2EA. On the HF end there is HR1UG (Honduras), VS8AA (Bahrain Island), PK3TV and VP4TL.

BSWL 387 corrects us re the QRA of KA3KK which we gave last month. This should be Box 212, Baguis, Phillipine Islands, not Box 22. Bob sends along a nice list of frequencies for use by the 28mc. boys. There is K7EYM (28650), K7GCP (28550), KA1ER (28200), XZ2EX (28352), W6OZ, Nevada (29000-29500) and W6DTB, Utah (28510). Then there is VU2EU on 28760, who appears daily at 1830 G.M.T. with a 15 minutes' test on automatic at 8-10 w.p.m. Other c.w. stations listed by BSWL 387 are VQ5ELD and VQ5EJT. Look for them on 14046 and 14140 kcs. Both may be QSL'd at c/o Entebbe Post Office, Uganda, and will QSL reports when IRC coupons are sent.

You must have all heard of G6BW in Somerset. He is primarily a 'phone station and has raised 31 zones and 71 countries on voice. Ben Wallich was the first European station to obtain that much coveted diploma, "W.A.S." on 'phone. He sends along the following frequencies: VS7GJ, Ceylon (14050, 14110 and 28236 kcs.), W6FUO (Nevada), 14224 kcs., W6HCE (Nevada), 28900 kcs. and K5AN, 28748 kcs. If you want some of those rare States in the 7th U.S.A. district there is W7EAI, W7FL and W9GBI in Montana; W7BJS, W7GGG, W7GDE, in Wyoming; W7ACD, W7FEP, W7GGH, in Idaho; W7GPY and W7GLX in Oregon. If you are still not satisfied, there is CO7VP on 28168 and HC1FG on 28000 kcs. G6BW is W.A.C. on 14 and 28mc. 'phone, W.B.E. on 14 and 28mc. 'phone. We wonder if 6BW ever suffers from a sore throat?

Now 80 Metres

The report from GI6TK simply oozes with DX! He has worked 40 countries on 80 meters to date and is only awaiting a South American for W.A.C. on this band. Frank has a pretty versatile TX which covers all bands from 10 to 80 meters. He recently contacted W9MUX on the four bands over a period of 8 hours! As further proof that there is DX on 7mc if you look for it, 6TK has worked all districts of "W" over the last few weeks. Among those worked on c.w. are VQ2PL (19380), VP4TO (14300) and CR5PC (14300). He asks us to broadcast the fact that the Belfast Y.M.C.A. Radio Club are now active on 7, 14 and 28 mc, and would welcome reports. They have 12 operators and the station is on all day. Frequencies: 7141, 14282 and 28364 kcs.

G4AJ, who has only been on the air a few weeks, has already worked 4 continents on 7mc. He hopes to get the two missing continents, South America and Oceana, when his 8JK beam is erected. These new stations are certainly showing the old timers how to work DX!

Inexpensive Television Transformers

HIGH-VOLTAGE mains transformers for use in television receivers, are available from Galpins Electrical Stores, 75 Lee High Road, Lewisham, S.E.15. A typical example of these transformers is one with a 5,000 volt secondary at 3 mA. for 7s. 6d. with an additional 1s. for postage. 10,000 10 mA. transformers are prices at 15s. each with 1s. 3d. additional for postage and others giving 5,000 volts and 7,000 volts at 3 to 5 mA. are priced 10s. 6d. plus 1s. for postage.

There is a considerable amount of interest in frequency measurements and amateurs should bear in mind that Galpins have ex-Navy type heterodyne wave meters for 7s. 6d. each, which cover 200 to 24,000 meters. They can be adapted for other wavelengths if required.

Meters are always an expensive item for the transmitting amateurs, so that Galpins new stock of Western and Turner mA. meters should be inspected if at all possible. Instruments reading 0-5 mA. are priced at 12s. 6d. There is also another type reading 0-50 mA. at the same price and both are with 2-inch dials.

Enamelled wire of 16 gauge is being sold by Galpins in 7-lb. reels for 8s. 6d. This is ideal for coils and certain types of aerial and it is an undoubted bargain at this price. Send an additional 1s. for postage. Galpins have a new list showing hundreds of items suitable for the amateur and we suggest that readers should get in touch with them at the address given above.

This self-contained transmitter is designed for those who need simple equipment and reasonably low power. It is ready to go on the air with the addition of a key and aerial connection. At a later date, it can be used as a medium powered exciter for a high-powered output stage. The designer is G5ZJ.

This front view gives a good idea of the controls and layout. The transmitter is designed for C.W. operation and cathode keying.

A 3-band C.W. Transmitter

IN the issue dated October, 1938, was published a single valve exciter using a 6L6G in a tri-tet circuit. This transmitter was intended for use as an exciter to drive either a doubler or a final amplifier. However, many readers have been using it as a low-power transmitter, but have now found that although it gives ample R.F. output far more satisfactory results could be obtained if there were two stages so covering more wavebands with greater stability.

In any case, it is not recommended that the beginner use a tri-tet circuit, for this is a little tricky for those who have no knowledge of transmitting procedure. So for those who have asked for a very simple transmitter, I have modified this exciter to use two valves in such a way that three wavebands can be covered without coil changes. The fact that provision has been made for twelve crystals need not deter the beginner, for no modifications to the circuit need be made merely to use one crystal in the conventional way.

40-metre QRM

However, I do advise the exciter to be constructed in the manner shown, and allowances made for more than one crystal, for on 40 metres it is almost essential that rapid frequency changing be possible. In any case, if the switch is wired, crystals can be included as they are obtained.

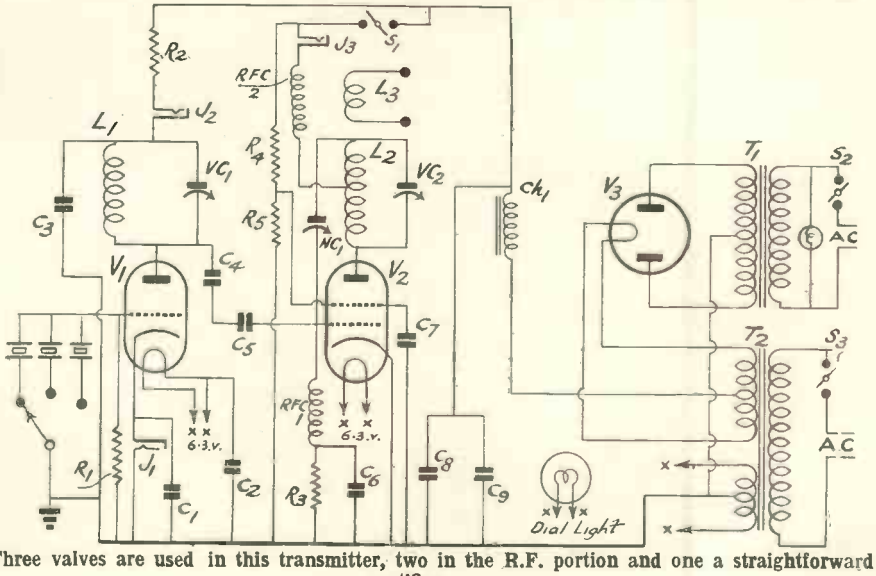
In order to keep cost as low as possible, and to make the transmitter a simple one, the coil and condenser values have been carefully worked out so that 40, 20 and 10 metres can be covered with one condenser and coil. It is agreed that on 40 metres the efficiency will not be as high as if the correct capacity were used, but as the output tends to drop on the higher-frequency bands, the capacity used becomes more or less correct so counteracting any tendency for a drop in output.

Also, the second valve has been deliberately over-biased by means of R_3 in order to make sure that the valve is an efficient doubler and quadrupler. For this reason, the output on 20 metres, is rather higher than it is on 40 metres, while on 10 metres it is still only slightly less than 40 metres. This unit, when demonstrated at a recent meeting of the International Short-wave Club, provided so much R.F. output on the three bands, that 8 volt flashlamp bulbs could not be used for indicating purposes. Tests should be made with a 15-watt 250-volt bulb coupled to the tank circuit by a single-turn link.

This bulb can be lit to full brilliancy on 20 metres, to about 12 watts on 40 metres, and nearly 4 watts on 10 metres. On all three bands, the R.F. output from the crystal-oscillator is in excess of the requirements of the 6L6G, for it will be found that should the grid current rise above 1½ mA. there is no further increase in R.F. output. Consequently, the crystal-oscillator does not have to be critically adjusted and if crystals are included covering the extremes of the 40-metre band, there is no need to re-tune when switching from one end of the band to the other.

Consider the circuit of the transmitter. The crystal-oscillator is a new valve recently produced by Tungsram, a 6J5G triode. This is very smooth and docile in operation and is one of the best crystal oscillators I have tried. With approximately 200 volts H.T. the anode current, under operating conditions, is only 40 mA. while crystal current is negligible.

At this point it is also interesting to note that the 6J5G is one of the few valves that oscillates satisfactorily with a 10-metre crystal. The values in the C.O. stage are not particularly critical, but in order to obtain the maximum R.F. output without stress the recommended values should be strictly adhered to. Across the crystal is a resistor,

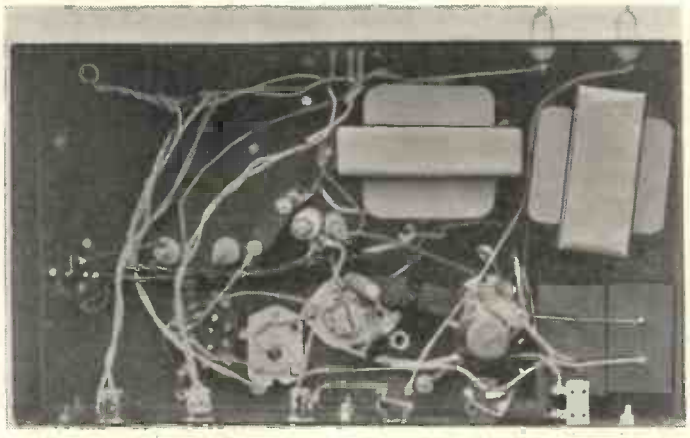


Three valves are used in this transmitter, two in the R.F. portion and one a straightforward rectifier.

40-20 and 10 Metres

R1, which has a value of 50,000 ohms and with this value the cathode—of the crystal oscillator—can be keyed without their being any tendency for the stage to go out of oscillation when not accurately tuned.

Across the key is a condenser of .001 mfd. and it appears to prevent clicks without causing any noticeable "chirp." However, as a separate H.T. transformer is used, primary keying can be used for those who prefer this method by merely connecting the key in series with, or in place of, switch S2. VC1, tuning the oscillator anode, has the high capacity of 100 mmfd. and if L1 is of the correct inductance, the 40-metre band is tuned to resonance with about 50 mmfd.



Most of the components are mounted underneath the chassis, including the filament transformer and smoothing choke.

No Meters

No radio-frequency choke has been included for it was found quite unnecessary providing the top end of L1 is by-passed to earth by a capacity of .002 mfd. In order to limit the total cost of the transmitter no meters have been included, so, for this reason, closed circuit jacks have been connected in series with the anode of both the oscillator and the buffer-doubler. Resistance R2, having a value of 7,500 ohms, is used merely to limit the total H.T. voltage which at the source is 500.

Again, in order to reduce the R.F. output to prevent over driving the 6L6G, condensers C4 and C5 have been included, which connected in series in this way have an effective capacity of 50 mmfd. This also has another beneficial effect in that it almost completely isolates the buffer from the C.O. and prevents any possibility of "pull" between stages. Consequently, when NC1 is accurately adjusted, the circuit is very easy to handle. The question of neutralising on 20 and 10 metres does not arise, for the valve then acts as a frequency multiplier not requiring neutralisation.

However, the fact that NC1 is left in circuit does not affect the valve in any way. Before completing the crystal oscillator stage, do not in any circumstances omit C2, a condenser of .01 mfd., which by-passes one side of the heater.

R.F. Output

The 6L6G has been arranged so as to give maximum output on 20 and 10 metres rather at the expense of the 40-metre output, but for guidance, as it stands, the output is sufficient fully to drive a T20 or ESW20 valve to full output, while it will also drive a T40 to about 30 mA. grid current.

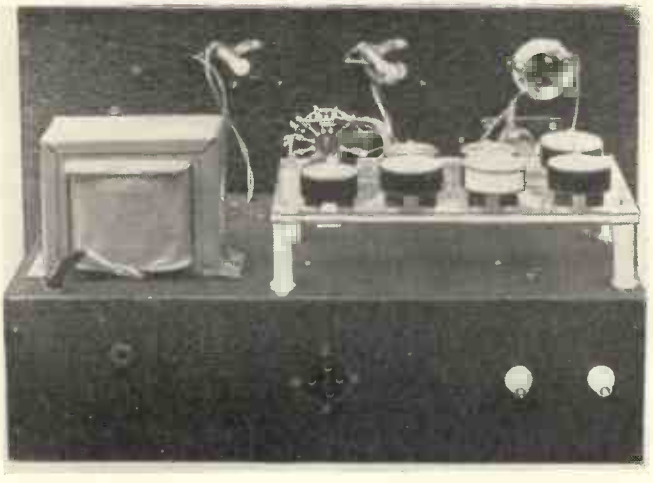
However, if the unit is going to be used more on 40 than on 20 metres, then resistance, R3, should be reduced from its present value of 100,000 ohms down to 30,000 ohms. There is, of course, no reason why R3 should not be made up of two resistors, one of 70,000 ohms and the other of 30,000 ohms, with a switch cutting out the higher value resistor on 40 metres.

So that the screen voltage to the 6L6G remains practically constant, a fixed potential divider is used to maintain this voltage. This also has the advantage that it keeps the D.C. supply to a reasonably steady voltage, particularly as choke input is used. R4 and R5 are actually one resistor of 20,000 ohms with a tapping clip which, when the valve has been tuned to resonance and loaded to the aerial, has to be adjusted so that the voltage on the screen is actually 275. During initial tests, this tap clip should be slightly lower than mid-way.

By-pass the screen by means of a .005 mfd. condenser and take the earth return via a short lead to cathode. The anode coil L2, is mounted on a 7-pin former with the link winding to L3. A mid tap should be made and H.T. voltage fed to the valve at this point through the choke RFC2. The switch in the anode circuit of this valve is merely to cut H.T. voltage for neutralising purposes.

Power Unit

Next comes the power unit, made up of two separate transformers, T1 giving 500 volts at 250 mA., and T2 purely for filaments giving 6.3 volts and 5 volts. The mid tap of the 5-volt winding is the H.T. positive connection and this is taken to one side of a heavy duty smoothing choke. C8 and C9 are condensers having a capacity of 2 mfd. each. It was found that a certain

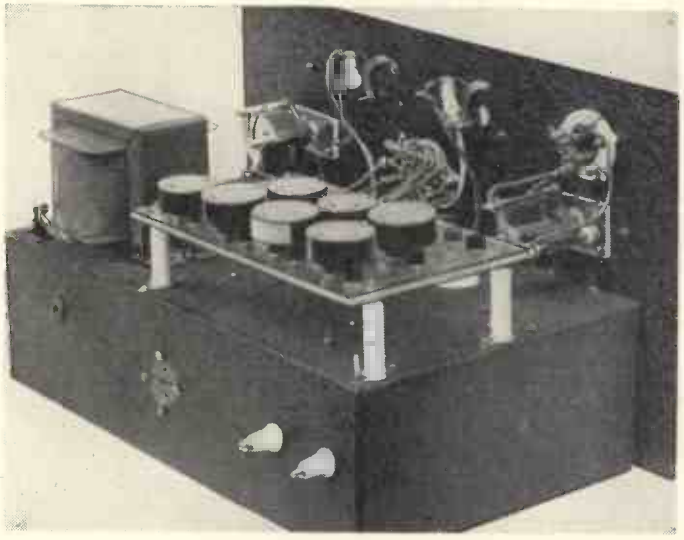


Provision has been made for 12 crystals, and it is suggested that room be left for a number of crystals even if they are not at present available.

Current and Voltage

amount of space could be gained by using two 2 mfd. units rather than a single 4 mfd. unit.

Across the 6.3-volt winding is a dial light to indicate when the heaters are alight, while across the primary of T1 is a 250-volt 15-watt bulb obtained from Messrs. A. F. Bulgin, which only lights when the mains have been connected to the H.T. transformer. Incidentally, this bulb is the one used for checking R.F. output.



It can be seen that the oscillator coil is mounted directly above VC1, so keeping the leads short. V1 is a 6J5 triode.

A 5Z3 rectifying valve is recommended, and, although this is suitable for 250 mA. output when operating normally, V1 and V2 plus R4 and R5, do not consume anything near this current, but when off-tuned, V2 very often takes up to 120 mA. This load is, of course, only momentary, but the choke and rectifying valve have to be particularly large to withstand it.

In order that the transmitter be built in the simplest possible way, the components have to be fitted in the correct manner and order. First of all consider the panel, for the components on this are those which have to be fitted first.

On the left-hand side is the oscillator tuning control with the tank condenser on the right-hand side. The jack underneath the oscillator condenser is in the cathode of V1 and as can be seen, is used for keying purposes. Next come two insulated jacks, the first in the anode of V1 and the second in the anode of V2.

Of the switches, the first is S1, the second S2, and the third S2. In the centre is the switch which is hand-drawn on thick cardboard and calibrated with the crystals available. Next look at the plan view. About half of the chassis is taken up with a strip of trolitol, complete with 24 sockets for the crystals. Alongside the strip is the 500-volt H.T. transformer, the connections from which go through the metal chassis via two small feed-through insulators. The mid tap of the H.T. winding is connected directly to chassis.

Along the front edge can be seen on the left-hand side L1, and underneath it, VC1. The first valve is a 6J5G, the second a 6L6G, then L2 and L3 on the same former, VC2 and finally the 5Z3.

Most of the small components are mounted underneath the chassis. This also includes the filament transformer, smoothing choke, smoothing condensers, special neutralising condenser, all resistors and by-pass condensers.

As L1 is mounted on the panel directly above VC1 the connecting leads are short. This coil consists of ten complete turns of 18-gauge wire spaced according to the threading on the former. The connections are terminated to the normal anode and grid pins on the coil form.

Coil L2 is made up of eight turns of 16-gauge wire centre tapped and a single turn of 2 mm. rubber-covered wire around the centre for L3, the link winding. The output from the link winding is fed into a short length of 80-ohm cable which is, in turn, terminated in another single turn link for coupling into a buffer or doubler grid coil if required or into an aerial coil.

Before switching on the supply mains to the transmitter, check between H.T. positive and earth for leakage for this should not exceed 30,000 ohms. Keep S1 open, switch on S3 and allow one minute before switching on S2. With a meter in J2, the anode current will be around 60 mA. and VC1 should be tuned quickly until this current drops to under 20 mA.

This shows that the circuit is tuned to resonance, after which S1 should be made and the meter transferred into J2.

(*Continued on page* 192)

Components for A THREE-BAND C.W. TRANSMITTER

CABINET.
1—Type 1034 steel with panel (Eddystone).

CHASSIS.
1—Aluminium finished black 16 in. by 9 in. by 3 in. (Peto-Scott).

COIL FORMS.
1—4-pin type CT4 (Raymart).
1—6-pin type CT6 (Raymart).

CONDENSERS, FIXED.
1—.001 mfd. type 690W (C1) (Dubilier).
1—.01 mfd. type 691W (C2) (Dubilier).
1—.002 mfd. type 620 (C3) (Dubilier).
1—.0001 mfd. type 690W (C4) (Dubilier).
1—.0001 mfd. type 690W (C5) (Dubilier).
1—.002 mfd. type 690W (C6) (Dubilier).
1—.005 mfd. type 620 (C7) (Dubilier).
1—2 mfd. type LEG (C8) (Dubilier).
1—2 mfd. type LEG (C9) (Dubilier).

CONDENSERS, VARIABLE.
1—100 mmfd. type 1130 (VC1) (Eddystone).
1—160 mmfd. type 1131 (VC2) (Eddystone).
1—Type UTC (NC1) (B.T.S.).

CHOKES, HIGH-FREQUENCY.
1—Type SW69 (RFC1) (Bulgin).
1—Type 1022 (RFC2) (Eddystone).

CHOKE, L.F.
1—150 mA. 40H. (CH1) (Premier Supply Stores).

DIALS.
2—Small type Johnson Handles (Webbs Radio).

HOLDERS, COIL AND VALVE.
2—8-pin ceramic octal (Clix).
1—4-pin ceramic type 949 (Eddystone).
1—7-pin chassis type less terminals (Clix).
1—4-pin chassis type less terminals (Clix).
1—American 4-pin chassis type less terminals (Clix).

JACKS.
3—Insulated closed circuit (Premier Supply Stores)

PLUGS.
1—P15 (Bulgin).

RESISTANCES, FIXED.
1—50,000 ohm type WE7 (R1) (Bulgin).
1—7,500 ohm type 8 watt (R2) (Premier Supply Stores).
1—100,000-ohm type 4 watt (R3) (Premier Supply Stores).
1—30,000 ohm type PR39 (R4 and R5) (Bulgin).

SUNDRIES.
1—Dial light type D7 (Bulgin).
1—Dial light type D35 (Bulgin).
4—Feed-through insulators type ST (Raymart).
4—Stand-off insulators type 1029 (Eddystone.)
1—Sheet trolitol 7 in. by 4 in. (Premier Supply Stores).

SWITCHES.
3—Toggle type S80T (Bulgin).
1—12-point rotary (Peto-Scott).

TRANSFORMERS.
1—High-voltage type SP500 (T1) (Premier Supply Stores).
1—Filament giving 6.3 volts 2 amperes.
5 volts 3 amperes (T2)
(Premier Supply Stores).

ACCESSORIES

MORSE KEY.
1—McElroy standard (Webbs Radio).

VALVES.
1—6J5G (V1) (Tungsram).
1—6L6G (V2) (Tungsram).
1—5Z3 (V3) (Premier Supply Stores).

Making the Most of a Dummy Antenna

It is difficult accurately to tell the efficiency of a transmitter without special equipment. The Ohmite dummy antenna is very useful for such checks as explained in this article.

A TRUE dummy antenna is useful, of course, in substitution for the regular antenna to check the transmitter before going on the air. The utility of such a device by no means ends here. While its use solely for this purpose was unanimously recommended as early as the spring of 1935 by the Board of Directors of the A.R.R.L. as a means of more effective employment of amateur frequencies, its adaptability as a tool in better transmitter adjustment far over-shadows its limited substitution of the regular antenna.

Technically, a true dummy antenna is a compact high wattage resistor of low inductance. It follows, therefore, that such a device has long been one of the chief instruments missing from the long lists of units available to the amateur, experimenter and manufacturer for use in radio frequency power on transmitters, efficiency of receiving antennas, diathermy equipment and like R.F. generating equipment.

The writer, in making a check among fellow amateurs some of whom had rigs as modern as the state of the art permitted, found in almost every instance that the overall efficiency of the final amplifier as well as the associated radiating equipment was an unknown quantity. Each reckoned that in view of the fact that the " plates of the tubes did not melt the efficiency must be pretty good—probably between 60 and 80 per cent." They further thought that since they worked fair DX and had a reasonable percentage of answers to calls, most of the power must be getting into the antenna. All admitted, however, that the difference between 60 per cent. and 80 per cent. efficiency represented about one-third more useful power which they might or might not be getting. If they were not, it was costing them something on the electric bill on each and every QSO.

The improvement in efficiency of all stages of the transmitter would represent a definite saving on the amateur's pocket-book. More concrete and tangible evidence is likely to be noticed through saving in equipment. How many of us have purchased a PDQ 150 for the final which the manufacturers assure us can be driven to the moon and back by a single PDW15! However, after hours of fussing and nursing the driver stage, because we have not had an accurate means of checking the performance of PDQ15 stage while making the various adjustments, we finally make an unnecessary investment in a higher voltage plate transformer, associated rectifier and filter equipment along with a PDQ50 to get the necessary drive.

Another angle on the possibility of direct saving can probably best be illustrated by a hypothetical case. Suppose a 200-watt transmitter had a final efficiency of 60 per cent. (the broadcast station figure). The useful output would be 200 × .60 = 120 watts. Improvement in efficiency to 75 per cent. would result in a useful output of 200 × .75 = 150 watts. How much would additional equipment cost (power supplies, larger tubes, larger tuning condensers, insulators, etc., to say nothing of the steady increased drain on the light bill for each hour of operation) for a larger transmitter at the 60 per cent. figure to obtain this 50-watt output? Simple calculation (150 × .6 = 250 watts) shows that enough equipment to make over the transmitter from a 200-watt job to a 250-watt job would be necessary.

This would undoubtedly include additional driving equipment and associated power supply equipment. There is little doubt that by brute force and cramming every watt of the allowable 1000-watt input into the final, we can get enough out even under extremely poor efficiencies to work all the DX we want to. There is less doubt that the cost of equipment and power under such conditions is far out of proportion to the results obtained.

A simple and direct means of measuring radio-frequency power, therefore, means to the amateur a simple solution of heretofore tedious adjustments of often unknown value in tuning up the various stages of a transmitter, as well as linking the transmitter itself to the antenna.

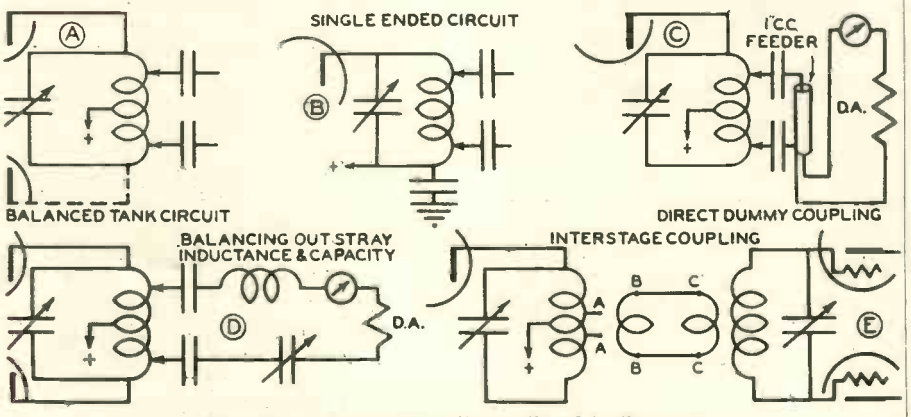
In connection with an R.F. ammeter the vacuum type dummy antenna becomes this unit and will be found as indispensable and important an instrument in the ham shack as the voltmeter, the milliammeter, the monitor and oscilloscope have proved to be.

The dummy antenna becomes an R.F. watt indicator when used in series with an R.F. ammeter, and the following determinations serve as a starting point to better transmitter operation. We have to find out how good or how bad our transmitter really is.

(a) Determination of efficiency and output of the crystal or oscillator stage.
(b) Determination of efficiency and output of intermediate and buffer stages.
(c) Determination of efficiency and output of the final amplifier.

A, B and C are in reality the same problem. They are solved by using the dummy load in series with an R.F. ammeter (or R.F. milliammeter in the case of small watts as in the crystal stage) and a short length of twisted pair or concentric line with a loop used to couple the device to the plate tank of the stage being measured.

If the quality of the twisted pair and link is in doubt, the combination can be coupled directly to the plate tank remembering, of course, that high voltage D.C. is present and should be treated accordingly. (The technique of



Some of the coupling circuits mentioned in the text.

We are indebted to W9CG the author of this article, who is on the staff of the Ohmite Manufacturing Co., and to the American publication " Radio News " in which it first appeared.

Examples of Use

the operator is a factor and a short coupling means may prove to give less trouble in adjustment. One foot of concentric feeder has been found less critical in adjustment than direct coupling probably because the R.F. ammeter and dummy are more removed from the R.F. field of the tank coil).

Where the impedance match for the maximum transfer of energy occurs is dependent upon the design of the tank circuit. Since the resistance of the dummy is 73 ohms (if it were a different value, the theory remains the same) it is necessary to find that point on the tank where the impedance is likewise 73 ohms, or whatever resistance value the dummy might have. A true experimenter will start with the proposition that his antenna match point on the tank *might* be wrong, and seek the proper match to the dummy experimentally.

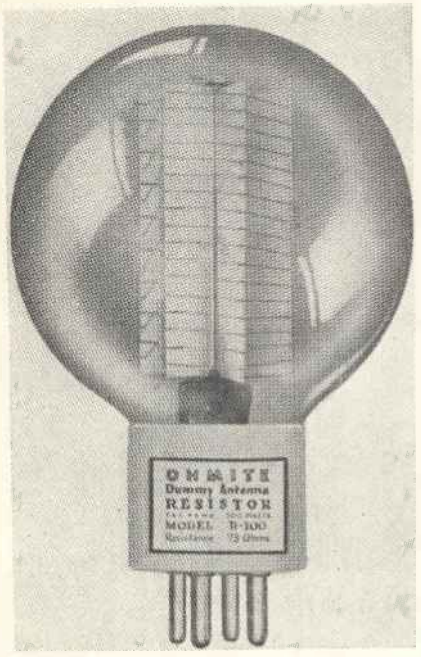
The optimum coupling for the maximum transfer of energy is determined experimentally by clipping across additional tank turns progressively until the R.F. meter reads the greatest amount of current flowing at tank resonance. For 600 ohm dummies this may amount to several turns.

In the case of a dummy of 73 ohms, optimum coupling for the best transfer of energy will be found very close (generally a turn or less) from centre of the coil for each clip in the case of a balanced tank circuit and a turn or less from the R.F. ground end in the case of a single ended circuit.

It should be mentioned here, that the clips, the connecting wires, etc., can add stray capacity and some inductance into the dummy system. With reasonable care in setting up the test circuit correction for this should not be necessary for the practical determination of efficiency, the stray capacity and inductance of the leads can be balanced out by inserting a small exterior inductance and variable condenser in series with the dummy antenna and R.F. ammeter. The values of the inductance and condenser should be such that resonance can be obtained as is noted by a *dip in the grid circuit* meter (high voltage of plate being off) when turned to such resonance. In this state all stray capacities and inductances are balanced out, and the dummy is the only resistance effective in the circuit.

The stage can now be fired up and tuned to resonance. CAUTION: The input should be reduced until it is definitely established that leads have not become shorted either in the series circuit or to ground. The R.F. current in a shorted turn can be unbelievably high even in a low power stage and thermocouples can be burned out. After assurance that all is well, the normal input can be applied.

By multiplying the current reading of the R.F. ammeter obtained in amperes by itself and then by the impedance of the device ($I^2 \times$ Ohms = Watts), the watts being transformed into heat is the result. This represents the output of the stage being measured. The efficiency of the stage is represented by the ratio of the output figure



A view of the dummy antenna.

just determined to the D.C. watts input to the plate circuit.

For example, suppose an amplifier is drawing 1/10 ampere at 1,000 volts. Input = (.1) × (1,000) = 100 watts. Suppose the dummy is 73 ohms, and the R.F. ammeter reads 1.02 amps. Output = (4.02) (1.02 (73) = 73 watts. Efficieny = $\frac{76}{100} \times 100$ per cent. = 76 per cent.

After finding out exactly what output can be obtained from each stage, all the regular adjustments should be made in bias, etc., to obtain the maximum output as measured by the R.F. ammeter, *always referring back to the input* and *calculating the efficiency after* each adjustment. After all, if the plate input goes up faster than the output nothing has been gained in efficiency. If the tube is operating in accordance with manufacturers' recommendations, as to bias, drive, plate volts, filament volts, etc., and the efficiency is still low, the next step would be to look for circuit components which are robbing the dummy of the power it should take. Remember that the tube can be operating at maximum efficiency, as evidenced by normal temperatures and cool plate, and actually be delivering to the output or tank circuit most of the power than is in turn being delivered to it.

Leaky insulation, high circulating current losses, and so on, may mean that the *load* may not get even an appreciable percentage of this power. Unless warm or hot inductances, by-pass condensers, etc., make this undeniably apparent, the engineer may overlook these possible sources of inefficiencies unless they practically jump right out at him. The writer remembers only too well a metal clad plate blocking condenser mounted on a metal chassis without benefit of stand-off insulators. Without a means of measuring the output, the writer rested snug in the satisfaction of a job well done because the tube apparently was doing its stuff, until a pool of compound dripping to the stage below indicated that about half the tube output was melting compound instead of going up the feeders.

Visible proof of losses may not always be so apparent. There is no doubt that the difference in the plate current reading between the loaded and unloaded conditions gives a fair indication of the presence of losses, however, several factors (tube characteristics, bias behaviour) involved make it practically impossible to estimate the probable efficiency. It is not intended in this article to more than border on the many possible sources of inefficiencies in R.F. circuits. Practically all amateurs have handbooks and other sources of information on the subject treated with far more thoroughness than could be employed in an article of this type.

I have endeavoured to show, however, that a simple means of measurement of power will enable the amateur to see some tangible proof of his efforts to improve his transmitter antenna and stages. As a matter of fact, even if the final amplifier had proved to be 80 per cent. efficient in the first place, there is a great deal of personal satisfaction in knowing what the actual figure is. Then, too, 90 per cent. efficiency is still worth trying for and not at all unattainable.

Because the dummy load can be used as an accurate indicator of R.F. power, additional uses other than the determination of efficiency, alone become apparent, for example:

(d) Determination of the optimum setting of all coupling devices for maximum transfer at the nominal impedance (impedance matching) between stages.

This is solved as follows: Regardless of what the efficiency of the stage being measured is, there will be one setting of the coupling device (link or otherwise) which will give the maximum reading of the R.F. ammeter representing the best impedance match between the stage and the load. Any other load

Simple Apparatus

having the same impedance as the dummy will also be matched perfectly with this setting. (The chances are that the grid and plate circuits of the stages being coupled may have widely different impedances both between themselves and made to the actual link circuit itself which is generally used and which has short lengths of 6 in. or so).

Generally the output of the driver can be measured at point BB, although the coupling coil itself can be measured at point AA as described in previous paragraph and at point BB after the optimum setting for maximum energy transfer is made. A decrease in indicated power at point BB with the same plate input would mean losses in the coupling system itself. *The plate input would, of course, be referred to again as it may have been reduced through wrong adjustment of the coupling coil and less power at point BB may be due to this reduced plate input rather than losses. The comparison between plate input and power output must always be made before any conclusions can be made as to losses occurring.* Repeating the power measurement at point CC will allow calculation of losses occurring in the line from point BB to point CC, again *referring to the plate input* before definite conclusions are made.

The simple equipment used by the author.

The same procedure can be followed for further information in

(e) Determination of the efficiency of the transmission line between the final amplifier and antenna.

After the final stage is adjusted for maximum output (say, e.g., on a 73 ohm dummy load) suppose we substitute a 73 ohm concentric line and place the dummy at the far end which would normally attach to the antenna. Without readjustment of the transmitter the R.F. current at the transmitter should be approximately the same as with the dummy. Likewise, the plate current and plate voltage. On a poorly regulated plate supply, in the event of a plate current change, plate voltage will also be changed.

If there are any appreciable line losses the current will be progressively less out to the end of the line where the dummy is attached. The current measured at this point is the current in the dummy and the power is calculated as before. The difference between this figure and the previous figure determined at the transmitter would be the approximate line losses, providing mismatches have not occurred which may alter the efficiency of the amplifier itself due to several reasons. This loss figure then may not be strictly true since the line losses are in part due to insulation resistance.

If the plate current or voltage changes appreciably, this is due to mismatches and/or appreciable distributed capacity entering into the system. Any change in plate current or voltage means that the efficiency of the final amplifier will alter and the figure for line losses may also include a change in amplifier efficiency as well. As a matter of fact, if the match was poor in the determination of the amplifier efficiency and should happen to be improved upon when the line was brought in to the system, an increase in overall efficiency might be the result. The above possibilities would also apply to previous measurements made on the link coupled stages described in the previous paragraph under (d).

These aerials are obtainable from G5NI (Birmingham), Ltd.

56 Megacycle Tests From Sheffield

DURING the past two years G8KD and the portable station G8KF have been active on 56 megacycles covering only a limited area. For these tests electron-coupled oscillators were used with an average input of 25 watts. The equipment has now been changed to crystal control with an input varying between 25 and 50 watts. Telephony is always used unless there should happen to be special requests for C.W. or I.C.W.

Reports are being received from the South of England and in view of this it has been decided to maintain regular schedules and to ask for the co-operation of amateurs in all parts of the country.

Every Tuesday and Sunday 5-metre transmissions will be sent out from G8KD using the crystal-controlled transmitter and both vertical and horizontal polarised waves. The following schedule will be strictly adhered to, but as there is a possibility of occasional lapses on Sundays, due notice will be given during the previous Tuesday's transmission.

The transmissions shown for Tuesdays and Sundays will be repeated each week until further notice, and actually started on February 14.

TUESDAYS.

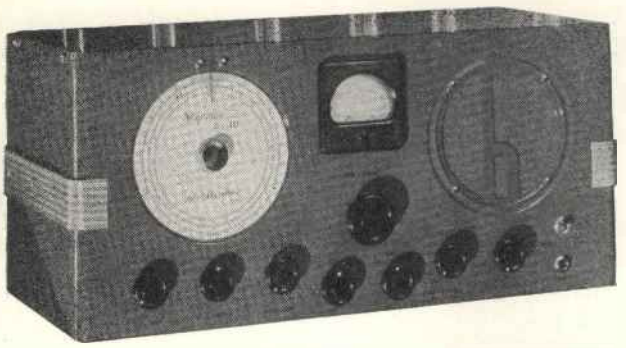
The first transmission is at 8 p.m. until 8.5 p.m. with 50 watts input and a long-wire horizontal aerial. The frequency used is 58.068 Mc. Between 8.5 and 8.10 p.m. is a listening period followed by a further transmitting period between 8.10 and 8.15 p.m. with 35 watts input at a frequency of 57.232 Mc. and a vertical di-pole aerial. The second listening period is between 8.15 and 8.20 p.m., and the sequence will be repeated throughout the following 20 minutes with tests concluding at 8.40 p.m.

SUNDAYS.

The first transmitting period is at 11.30 a.m. and the schedule will follow the same form as on Tuesdays, but concluding at 8 p.m. During the tests, information will be given as to the plane of polarisation and other items of interest. The long-wire aerial is 80 ft. high, 8 wavelengths long and is approximately east and west. This aerial is used for contacting eastern and western parts of England on either side of Sheffield.

The 5-metre vertical di-pole uses an unfed reflector with the whole system rotatable. During the test transmissions, the aerial and reflector will be directed on to the south of England.

Reports should be sent to G. W. Bagshaw, "Newfield House," Newfield Lane, Dore Moor, Sheffield.



The Hallicrafter model S-21 better known as the 8-valve 5-10.

A New Hallicrafter U.H.F. Receiver

This 8-valve U.H.F. receiver is a new release. Tests indicate that it is in the front rank of communication receivers of its type.

WE have been making a series of tests under all kinds of conditions with a new model S-21 receiver recently introduced by Hallicrafters, of Chicago. This set is designed for serious communication purposes on frequencies of between 27 and 68 megacycles, which is covered in two bands. On band one, the minimum frequency is 27 megacycles, with a maximum of 42 megacycles, and on band two 40 megacycles, to 68 megacycles. The main tuning drive is very accurately calibrated in keeping with this and appears to hold this accuracy to the extreme ends of the scale.

The circuit consists of an 1852 low-noise pentode R.F. amplifier followed by a 6L7 mixer, 6J5G high-frequency oscillator, 6K7 first I.F. amplifier with iron cored transformers, 6P7G second I.F. amplifier and beat-frequency oscillator, 6Q7G double-diode triode and 6F6G output pentode.

Noise Limiter

There are also two more valves, one being an 80 rectifier and the other a 6H6 which is used in a Dickert noise limiter circuit. The gain of the receiver can be adjusted both in the R.F. and audio sections, while there is also a switch to give two positions of selectivity.

In the broad position, selectivity is such that frequency modulated signals can be read quite comfortably, while crystal control transmissions are receivable in the sharp position.

The Dickert noise limiting circuit is extremely satisfactory and when local conditions are such that motor car ignition noise completely drowns all signals, the silencer is switched into circuit and the noise level is reduced from R9 to R2 leaving the signal in the clear.

In order to obtain maximum results with this receiver it is essential that the aerial be cut to approximately the correct frequency and to be suitable for connection to the receiver which has an input impedance of approximately 400 ohms.

During our tests a vertical di-pole with spaced line was used and this proved quite satisfactory. Low-loss 80 ohm cable was also tried without any apparent decrease in signal length. For C.W. reception the beat-frequency oscillator can be switched into circuit and as this is done the automatic volume control arrangements are rendered inoperative. The point of interest is that B.F.O. does not cause any rise in noise level. There is also a pitch control which can be varied to give the required note. Provision has been made for headphone reception and when phones are in use the loudspeaker is automatically disconnected.

During our tests a large number of stations on 28 megacycles were received with a signal level in excess of 70 db. The American police control stations and also actual police cars were also receivable at certain times of the day. In fact the frequencies above 28 megacycles were extremely interesting as there were so many unusual stations that could be heard.

The blind landing equipment at Croydon, which has a very limited range, could be picked up quite strongly on 32 megacycles, while the television mobile van, operating from Twickenham slightly above 60 megacycles provided a signal which completely overloaded the R meter. Incidentally, at this point, it is well worth mentioning that the R meter is an accessory which can be plugged into the receiver, but is not fitted as standard.

On 5 metres, a whole host of London amateur stations were logged, many of which had not been heard previously. By means of the band spread dial it was possible accurately to log the tuning positions of 5-metre stations without any difficulty which is of particular importance to those who are interested in DX work on this band.

The sensitivity level is reasonably constant over all frequencies with perhaps the best performance around 5 metres. The tuning controls are easy to handle, there being no trace of back lash, while frequency shift was absolutely unnoticeable even around 60 megacycles.

No trouble with selectivity was noticed even when the 10-metre band was extremely alive and full of DX stations. We were interested to find that owing to the high sensitivity a considerable number of British amateur stations up to 60 or 70 miles could be received, which gives some indication as to the sensitivity of the instrument.

With maximum sensitivity there is no trace of microphony despite the fact that the loudspeaker is built in. No traces of instability could be found and generally speaking the receiver is as docile to handle as an ordinary communication set on 7 megacycles.

Owing to the excellent tuning arrangements and the band spreading system, the operator does not obtain any idea of high-frequency reception as the tuning on 56 megacycle amateur band appears to be broad.

The receiver as standard is for A.C. operation, but on the rear of the chassis is a plug which can be removed so that the receiver can be operated from a vibrator unit and an accumulator.

This type of instrument has a big advantage over the superregenerative ultra-high frequency receiver insomuch as it is infinitely more selective and very quiet in operation. It should be remembered that in a broad tuning position the band width is sufficiently wide to receive transmissions which are not stable or crystal-controlled so that the advantages of the super regenerative receiver are not lost by users of a superhet such as this 5-10.

The price complete and ready for operation with all valves is £20, and it can be seen and demonstrated by Messrs. Webb's Radio, 14 Soho Street, or any of the other Hallicrafter agents, details of whom can be found in the advertisement pages of this issue.

The Tungsram OS-12/500

This new Tungsram valve is a high efficiency indirectly heated screened pentode designed in the first instance as an R.F. power amplifier for short-wave operation. It is fitted with a ceramic base and has a suppressor grid brought out to a separate pin for modulation purposes.

The heater voltage is 12.6 with a current of .27 amperes and it is designed to operate with 500 volts on the anode, 200 volts on the screen and a dissipation of 12 watts.

A similar valve is the OS-12/501 having a 6.3 volt 1.4 amp. heater. The price of these valves is 22s. 6d.

The New Garrard Record Changer

NOW that so many modern radio receivers include a really worthwhile output stage with a large moving coil loudspeaker, more and more gramophone pick-ups are being sold, for it is practically impossible to obtain good reproduction from a record unless a good amplifier and pick-up are used.

We have found that automatic record changers now that they have been reduced in price are a very good investment, for, in addition to being quite foolproof, enable records to be played for almost three-quarters of an hour without attention. This once and for all removes the great difficulty of record changing, for so few people can be bothered to change records every three minutes or so.

This illustration shows the type RC4 Garrard auto-changer which is of the bent spindle type. Either magnetic or crystal pick-ups can be fitted

An auto-changer of unusual efficiency is the new type RC4 manufactured by The Garrard Engineering & Manufacturing Co., Ltd., Swindon, Wilts. This changer uses an induction motor suitable for 200 to 240 volts 50/60 cycles, which consumes 19.5 watts. A similar motor is the RC5 model which will work on either A.C. or D.C. mains from 100 volts upwards. The records are placed on a stepped record spindle which leans at an angle towards the record platform. This ensures that the records rest on the platform on which are two studs the same thickness as an average record. When it is required to drop the record, the platform moves inward towards the centre spindle and the studs catching on the edge of the record push it off the step on the centre spindle. The record dropping down the angle on the record spindle pulls away the record platform and falls flat on to the turntable.

When the last record has been played, the changer automatically stops. This is controlled by the weight of a record on the centre spindle which interrupts the mechanical switch movement.

When there are no records on the record spindle, it lifts slightly, being spring loaded, so removing the switch interrupting lever from the switch allowing it to cut off the mains supply.

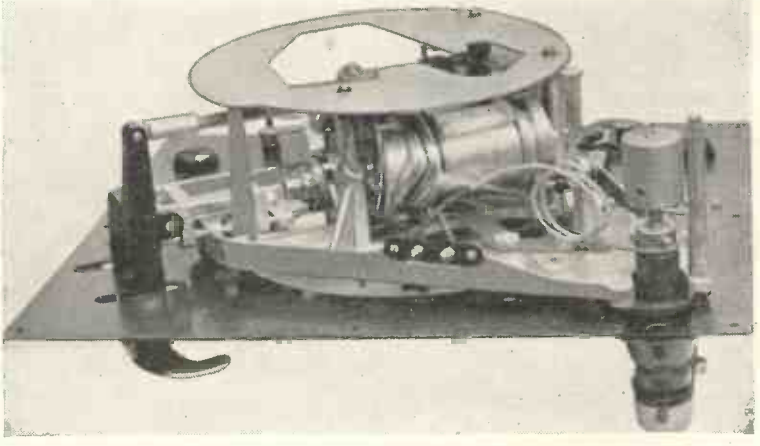
General Mechanism.—The changing mechanism is controlled from a cam driven through a clutch from the motor. The cam carries out the full changing cycle in one revolution at the completion of which the clutch disengages.

The clutch is engaged by the action of the auto strip mechanism which operates on the spiral running at the end of the record. The motor on the A.C. model is the induction squirrel cage type and is governor controlled. The universal A.C./D.C. motor is a series wound commutator type fitted with a tapped mains resistance. This motor is governor controlled and it fitted with a suppressor condenser to eliminate any chance of electrical interference from the brushes reaching the amplifier.

These changers are particularly well finished and can be fitted with either magnetic or crystal type pick-ups. We have noticed with some designs that when a changer is mounted in a cabinet with an amplifier providing a high-audio output and the speaker mounted on the front of the cabinet, that there is a tendency for mechanical feed-back to be set up. With this Garrard instrument the changer can be supplied for mounting springs to eliminate any such tendency.

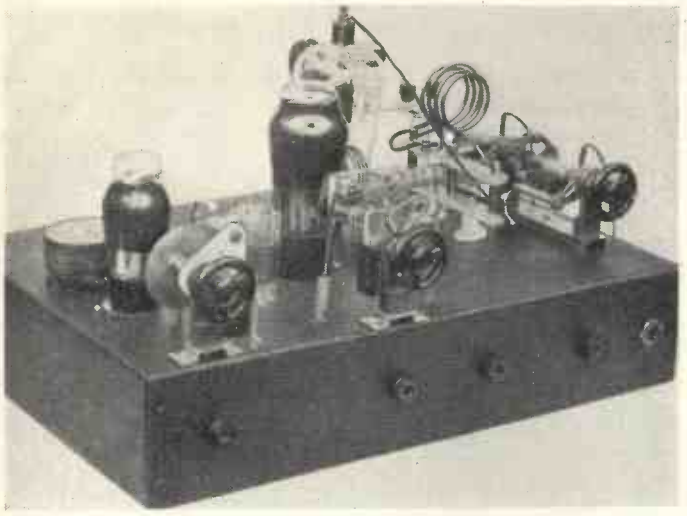
The operation of an automatic changer of this kind is extremely simple. To play 10-in. records, a knob has merely to be turned to the required direction after which, once the motor has been set in motion eight records will play one after the other automatically. This gives almost a thirty-minute playing time.

The consumption of the motor is low and on a 220-volt A.C. mains will run for 70 hours for the price of one unit.



An extremely robust motor is included in this auto-changer and there is no trace of slowing up even on records with predominant base. This applies when a maximum of eight records are in use.

We are at present designing a quality amplifier with a built-in loudspeaker and record changer which will be published in a forthcoming issue, and we are embodying the Garrard type RC4 unit. We strongly advise readers who are interested in automatic record changers to get in touch with the Garrard Engineering and Manufacturing Co., Ltd., regarding this unit, which is priced at £7 10s.



Crystal Control on 5-metres

Amateur interest during the next few months will be centred on ultra-high frequency working. This transmitter which gives up to 15 watts R.F. output on 5 metres and can also be used on 20 and 10 metres, has been designed by **Kenneth Jowers**

On the left-hand corner can be seen the compact C.O. stage with a 20-metre crystal and 20-metre anode coil.

IT is anticipated that during the next few months and particularly during the summer there will be a big rise in interest on the ultra-high frequency bands. It has been proved in other parts of the world that quite long distances can be covered on 5 metres and there still remains one important contact to be made and that is two-way communication across the Atlantic on 5 metres.

There have been numerous reports from both sides of the Atlantic claiming reception, but so far no proof of a two-way contact. In order to work long distances on 5 metres, a fairly good location has to be chosen, but amateurs should bear in mind that at the present time in this country experimenters such as G6DH, G6VA, G6FO, G5BY, G5RD and many others are doing good work from quite ordinary locations.

During the past few months, laboratory tests have shown that although satisfactory 5-metre output can be obtained from a 10-metre crystal, this arrangement is not ideal for such crystals are still a little difficult to handle. Many amateurs use 40-metre crystals with a tetrode valve taking 10 metres and in some cases 5 metres straight out of the anode circuit. This again is satisfactory and does not necessarily cause a high crystal current, but it is not every amateur who will be able to obtain satisfactory results with ample R.F. output and freedom from drift with this arrangement.

There is another angle, to use a Brookes fundamental 20-metre crystal which gives an output practically equal to that obtained from a good 40-metre crystal. By using a 6J5G with this crystal, and with a comparatively low voltage, ample output can be obtained at fundamental frequency to drive a 6L6G as a frequency multiplier with 20 metres in and 5 metres out. This in turn fully loads an ESW-20 as a final neutralised amplifier on 5 metres. The output with this arrangement is a comfortable 12 to 15 watts with 25 to 30 watts input.

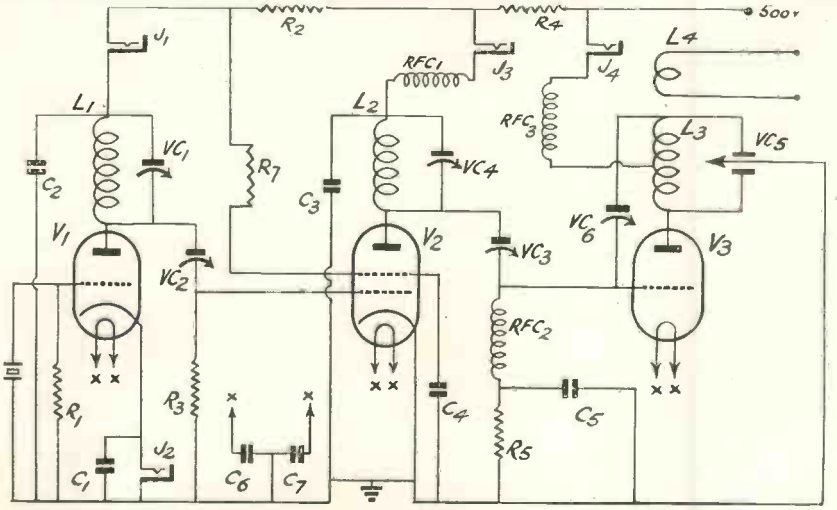
The circuit of the transmitter is shown on this page, from which it can be seen that the arrangement is comparatively simple and should not cause the constructor any difficulties when building. Also as cost is generally of primary importance, the transmitter is not limited to operation merely on the 5-metre band. The coils are of the plug-in type so that it can work on 10 metres without any modification and even on 20 metres by taking the drive from the crystal oscillator straight into the grid of the ESW-20 and omitting the buffer. An alternative scheme is to use the intermediate stage as a neutralised sub-amplifier. However, the 6L6G is not easy to neutralise owing to the very low capacity required.

It will be appreciated that losses in a transmitter of this kind have to be kept to an absolute minimum for even with a circuit oscillating satisfactory it is difficult to obtain a high R.F. output. The normal easy methods of construction such as can be tolerated on the lower-frequency bands, are impossible on 5 metres. For this reason we have had made up specially for the transmitter a set of coils built by Denco, of Clacton. Connected with this company is G6OH, the well known 5-metre expert whose ideas have been embodied in the design of these coils.

First of all, the 20-metre anode coil. This is wound on trolitol former and mounted directly across the 15 mmfd. tuning condenser. In this way, there are virtually no connecting leads between coil and condenser. If the crystal is also very close to the grid of the 6J5, so that the C.O. stage as a whole is closely wired, the R.F. output on 20 metres is unusually high.

The doubler coil is also mounted on the tuning condenser, but arranged so that it can be of the interchangeable type. From the illustration of the doubler coil, which consists of 4 turns only, it can be seen that a trolitol mounting strip is bolted directly across the stator plates of the condenser. On this strip are fixed two sockets into which plugs the 5-metre coil. Losses are again negligible and there is a high degree of efficiency in this stage, particularly as the correct L/C ratio has been obtained, the condenser originally having a capacity of 15 mmfd. has been double spaced and now provides a capacity of between 2 mmfd., and 7 mmfd.

Not quite the same method of mounting can be adopted in the P.A.



There are three stages in this transmitter in which the second and third stages are both tuned to 5 metres. See the special note in the text regarding inter-stage coupling condensers.

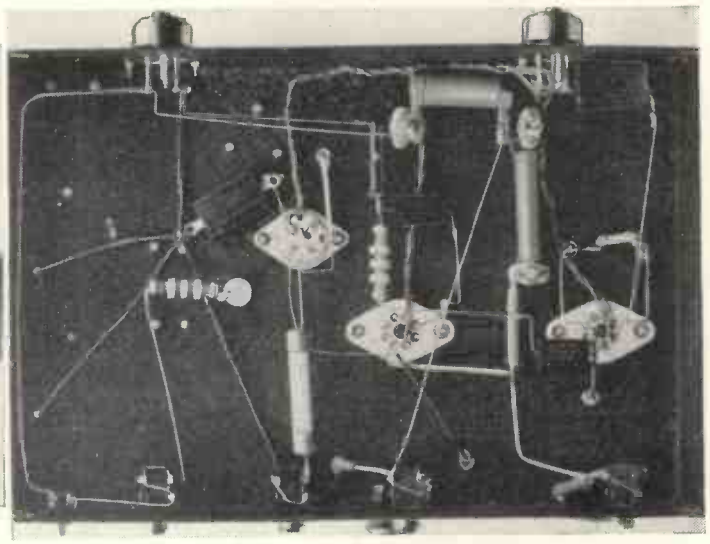
A 20-metre Crystal

stage for the coil necessarily has to be more robustly built. The problem of condenser is also an awkward one, for the majority of split-stator condensers

fixed with a capacity of 50 mmfd. This condenser is of the Dubilier ceramic type. However, if the experimenter wishes to use this transmitter on

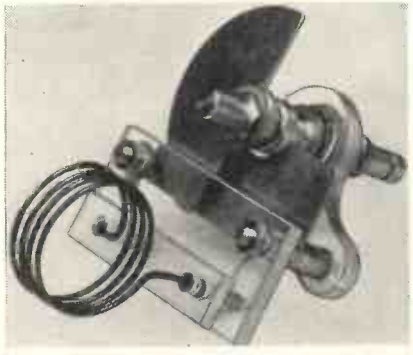
connected to the low voltage side of R2, via R7, having a value of 2,000 ohms. This keeps the voltage on the screen of the 6L6G to about 200 volts.

Two wide-gap midget condensers are used as a split stator in the final stage.



Make a particular point of taking all the earthy turns in the final stage to a common point.

are either too small or too large. However, one of the Eddystone cradles has been modified and used with a pair of their new wide-gap midget condensers which form an excellent split-stator condenser. The coil as can be seen from the illustration is wound with



This is the plug-in 5-metre coil in the 6L6G anode circuit.

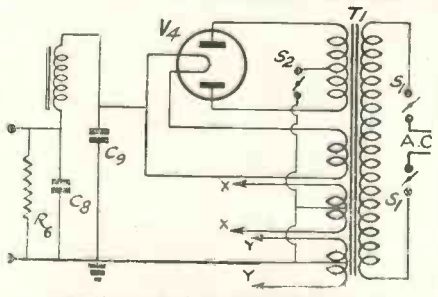
heavy gauge wire and mounted on another strip of trolitol. There is also a single turn link for feeding the R.F. into a remote aerial coil. The trolitol sub-base fits into a trolitol base which has been arranged so that the connecting wires come practically parallel with the end of the two condensers.

Refer again to the theoretical circuit of the R.F. unit. Between stages are two coupling condensers which are rather a variable quantity. If the transmitter is to be used on 5 metres only, then VC can actually be a fixed condenser of the mica type having a capacity of 100 mmfd. VC3 can also be

bands other than 5 metres, then it is a good plan to be able to vary the amount of drive and in such circumstances, VC2 and VC3 should both be of the pre-set type having a maximum capacity of 56 mmfd. Then on 10 metres for example, VC2 can be reduced in capacity so as to prevent over-drive of the following stage. The 6L6G requires so little drive and only 1½ mA. of grid current that it is very easily over driven by the 6J5 in this circuit.

The crystal-oscillator is extremely simple, no R.F. chokes in either grid or anode and no cathode bias resistor. Merely a resistor of 30,000 ohms across the crystal and a by-pass condenser of .0005 mfd. from the top end of the anode coil to earth.

The jack J1, is merely for checking anode current when making initial tests for it is quite unnecessary to include a meter. The 500-volt power pack is too large for the 6J5 on this frequency, so that R2, having a value of 5,000 ohms, is necessary. Also, the screen of the frequency multiplier is



An output of approximately 500 volts D.C. is obtained from this power unit.

The cathode of the 6J5 can be keyed if required, and a capacity of .001 mfd. should be connected across the key.

Although the 6L6G's are rated for 500 volts they run extremely hot as a frequency multiplier on 5 metres with

The 20-metre anode coil is fixed directly to the tuning condenser.

this voltage. This is only to be expected so R4 has been included, which has a resistance of 4,000 ohms, so reducing the voltage to about 300. The valve still runs warm at this voltage, but not sufficiently so to affect its working life.

In the grid of the 6L6G is a resistor having a value of 75,000 ohms. This provides quite a high bias which is required when frequency multiplying, and consequently, the output on 5 metres is extremely high. Should at any time it be necessary to use the 6L6G as a sub-amplifier, then R3

10 and 20-metre Use

should be reduced in value about 15,000 ohms.

No R.F. choke is required in the grid of the 6L6G, but a choke and by-pass condenser are essential in the anode circuit. The by-pass condenser should have a value of .0005 mfd., while the choke is a special Denco product made specially for this particular circuit.

So far the circuit is straight forward and easy to build and the only complication in the final stage as far as an inexperienced amateur is concerned is the fact that the ESW-20 has to be neutralised. This, however, should not cause any difficulty if the valve is neutralised as explained later in the text.

The grid of the ESW-20 is tied down to earth via an R.F. choke and R5, a resistor of 10,000 ohms. This resistor has a 15-watt rating and provides adequate bias to the ESW-20. The junction between the choke and the resistor is by-passed to earth by C5.

The tank coil, L3 is made up of four complete turns as can be seen from the illustrations and if mounted in the manner suggested, allows for reasonably short leads with the exception to the anode of the ESW-20 which does not apparently have any detrimental effect.

In order to prevent losses in the final stage, L4, a link winding has been included so that the transmitter can be coupled to a remote aerial coil close to the feeder by means of low impedance cable. It is considered that this scheme is better than having the feeder line coming straight to the tank coil which cannot always be placed in the best position.

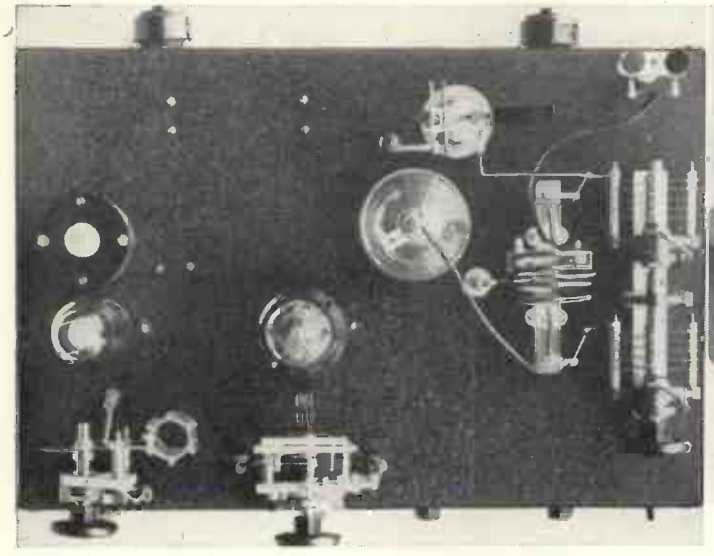
A glance at the plan view of the transmitter shows just how the components have been deliberately bunched together so as to keep the connections to each stage as short as possible. If any variation in layout is made, this point should be remembered. The underside view of the chassis shows the quite simple wiring. Make a particular point of taking all the earth returns in the final stage to one point as can quite clearly be seen.

Along the front edge of the chassis are four insulated jacks. Three for reading anode current and one for a key in the cathode of V1. On the rear lip are two valve holders, to which are connected a 6.3 volt winding and a 7.5 volt winding and the second 500 volts D.C. The circuit of the power unit is also given, but despite the fact that it is quite straight forward. The output is approximately 500 volts D.C. and to keep the voltage comparatively stable a bleeder of 25,000 ohms is connected across the total supply.

The switch, S2, is merely for stand-by operation with switch, S1, in the mains supply leads. If the transmitter is constructed strictly to specification, the loaded anode current of V1 is 40 mA.; on V2, 45 to 50 mA. and V3, 55 to 60 mA. This corresponds in the final stage to almost 30-watts input and constructors, who are limited to considerably lower power are advised to use a voltage not exceeding 300, when there will be a corresponding decrease in input in all three stages.

This transmitter will be on view at Webb's Radio, Ltd., 14 Soho Street, London, W., from March 1.

(*To be continued in next month's issue*)



Above is a view of the transmitter showing particularly the tank coil and link winding while on the left is a plan view showing the layout of the components.

Components for CRYSTAL CONTROL ON 5 METRES

CHASSIS.
1—Aluminium 16 gauge 15 in. by 10 in. by 3 ins. finished black (Peto-Scott).
1—Aluminium 16 gauge 10 in. by 6 in. by 2 ins. finished black (Peto-Scott).

COILS.
1—20-metre oscillator (L1) (Denco).
1—5-metre doubler (L2) (Denco).
1—Combined 5-metre tank and aerial coupler (L3 and L4) (Denco).

CONDENSERS, FIXED.
1—.001 mfd. type 690W (C1) (Dubilier).
1—.0005 mfd. type 690W (C2) (Dubilier).
1—.00055 mfd. type 690W (C3) (Dubilier).
1—.01 mfd. type 691W (C4) (Dubilier).
1—.001 mfd. type 690W (C5) (Dubilier).
1—.002 mfd. type 690W (C6) (Dubilier).
1—.002 mfd. type 690W (C7) (Dubilier).
1—4 mfd. type LEG (C8) (Dubilier).
1—4 mfd. type LEG (C9) (Dubilier).

CONDENSERS, VARIABLE.
1—TRO15 (Premier) 175.
1—56 mmfd. type SW57 (VC2) (Bulgin).
1—56 mmfd. type SW57 (VC3) (Bulgin).
1—VC15X modified (see text) (VC4) (Raymart).
2—Type 1094 with type 1114 cradle (VC5) (Eddystone).
1—8 mmfd. type 1088 (VC6) (Eddystone).

CHOKES, R.F.
3—Ultra-shortwave (Denco).

CHOKE, L.F.
1—Type 250 mA. 40H. (Premier Supply Stores).

HOLDERS, VALVE.
2—8-pin ceramic octal (Eddystone).
1—4-pin ceramic type Amphrenol (Webbs Radio).
1—American 4-pin (Premier Supply Stores).

JACKS.
1—Closed circuit jack type J6 (Bulgin).
3—Insulated closed circuit jacks (Premier).

RESISTANCES, FIXED.
1—30,000-ohm 1-watt (R1) (Bulgin).
1—5,000-ohm 8-watt (R2) (Premier).
1—75,000-ohm 3-watt (R3) (Dubilier).
1—4,000-ohm type 15-watt (R4) (Premier).
1—10,000-ohm 15-watt (R5) (Premier).
1—25,000-ohm 75-watt (R6) (Webbs Radio).
1—2,000-ohm 4-watt type (R7) (Premier)

SWITCHES.
1—Type S138 (S1) (Bulgin).
1—Type S80T (S2) (Bulgin).

SUNDRIES.
2—Insulated adjustable brackets type 1007 (Eddystone).
3—Instrument knobs type 1086 (Eddystone).
1—4-way terminal block (Bryce).
1—Terminal saddle type 1046 (Eddystone).

VALVES.
1—6J5G (V1) (Tungsram).
1—6L6G (V2) (Tungsram).
1—ESW 20 (V3) (Ediswan).
1—5Z3 (V4) (Premier Supply Stores).

The Short-wave Radio World

A Review of the Most Important Features of the World's Short-wave Developments

A WIDE BAND CRYSTAL FILTER

IN the January number of the American magazine, *Radio Digest*, is a brief summary of the new 455 kc. quartz crystal filter designed by D. K. Oram, of the Hammarlund Manufacturing Co. This filter has the very big advantage that it can be used for telephony, for it is variable between the normal band-width of the I.F. stages and the crystal maximum. The circuit is shown in Fig. 1, from which it can be seen that the arrangement can be embodied in almost any superhet receiver of conventional design, and as the switches are ganged, there is virtually one-knob control for continuously variable selectivity.

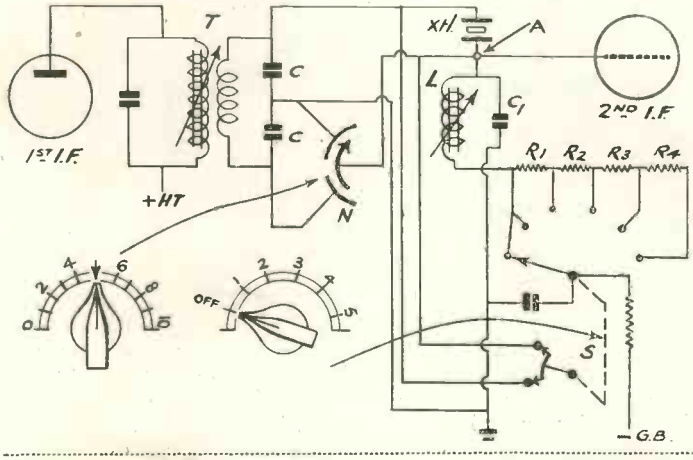


Fig. 1. Amateurs interested in the reception of telephony will find this wide band crystal filter of particular interest.

Transformer T is a permeability tuned step-down transformer with a high impedance primary providing correct loading in the first I.F. anode circuit. The secondary is of low impedance so that a reasonably constant voltage is delivered to the quartz crystal.

The secondary is mid-tapped by means of the two fixed capacity, C, so providing a neutralising voltage which is 180 degrees out of phase with the voltage fed to the crystal. Particular interest is displayed to the neutralising condenser N which is of the opposed stator type with which the capacity of rotor to each stator varies in the normal manner as the rotor is turned while the capacity between rotor and both stators in parallel remains constant no matter the position of the rotor plate.

The designer also points out that the crystal holder H is of unusual design in order to reduce capacity to a minimum the crystal itself is also of special cut having a high Q and a complete absence of harmonics, plus and minus 40 kc., of the fundamental frequency.

In the output circuit of the crystal is a permeability tuned coil L and its associated fixed condenser C1. Circuit values are as follows: Condenser C 100 mmfd., condenser C1 85 mmfd. silvered mica, L iron-cored I.F. coil with an inductance of 1.14 mh., R1 25 ohms, R2 50 ohms, R3 100 ohms, R4 2,000 ohms, and the switch a 6-point with extra contact for crystal shorting.

We are of the opinion that this type of circuit will be of distinct value to amateurs interested in the reception of telephony particularly on the higher frequency bands. The attenuation even at the maximum selectivity position is reasonably low while with the crystal in circuit, in the broad position, reasonably good quality can be obtained on music transmissions.

In the third edition of the *Radio Manuel* is the circuit and description of a direct reading double rectifier modulation meter, which uses straightforward components and meters.

The circuit is shown in Fig. 2 from which it can be seen that there are two diodes, two 50-volt meters and a microampere meter having a full scale of 50 microamps. The potentiometer, P, is fixed to the voltage equal to the rectified carried voltage. The voltage across the terminals A-C is alternated with the positive half cycles representing the positive modulation peaks and negative half cycles representing the negative peaks.

A diode valve uses either series (depending on the position of the reversing switch) of half cycles to discharge the condenser C. The resulting D.C. voltage is made up by means of a meter, in this case 50 microamperes, in series with the resistance, R. The condenser can charge up quite rapidly, the only resistance to charging being the internal resistance of the two diodes and a portion of the potentiometer.

On the other hand, the condenser can only discharge through the resistance, R. With a capacity of .25 mfds. and a resistance of one megohm, it takes roughly .25 of a second for the condenser to discharge. Before this time can elapse, excessive modulation peaks will renew the charge so that the condenser voltage will always stay close to the peak value of the rectifiers. The variation is very small, so that a meter shows a fairly steady reading rising rapidly when a new peak is reached, and then falling back slowly, which is an ideal characteristic for modulation monitoring.

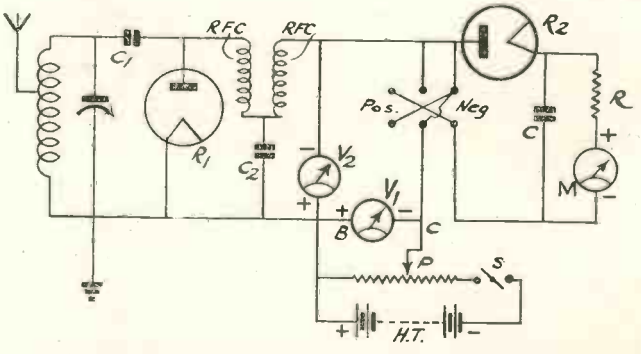


Fig. 2. Although straightforward meters are included, this modulation meter gives a direct per cent. reading without additional calculations.

A DIRECT READING MODULATION METER

American regulations are that amateurs should have some relidable means of accuratuely measuring the percentage of modulation. There are numerous circuits available for meters of this kind which give a good indication of percentage, but generally, calculations have to be made which rather upsets the value.

With the suggested resistance value of 1 megohm and a carrier pickup of 50 volts, the microammeter should read full scale for 100 per cent. modulation. The rectified carrier voltage is read across A-B in the usual way by means of a D.C. voltmeter which should be at least 1,000 ohms per volt.

A 30 Mc Tx

PORTABLE 30 Mc. EQUIPMENT

In Fig. 3 is shown the circuit of a portable crystal-controlled transmitter of a type that is favoured by American commercial broadcasting stations for remote pickups. The full data is described in the American publication *Communications,* in the January issue.

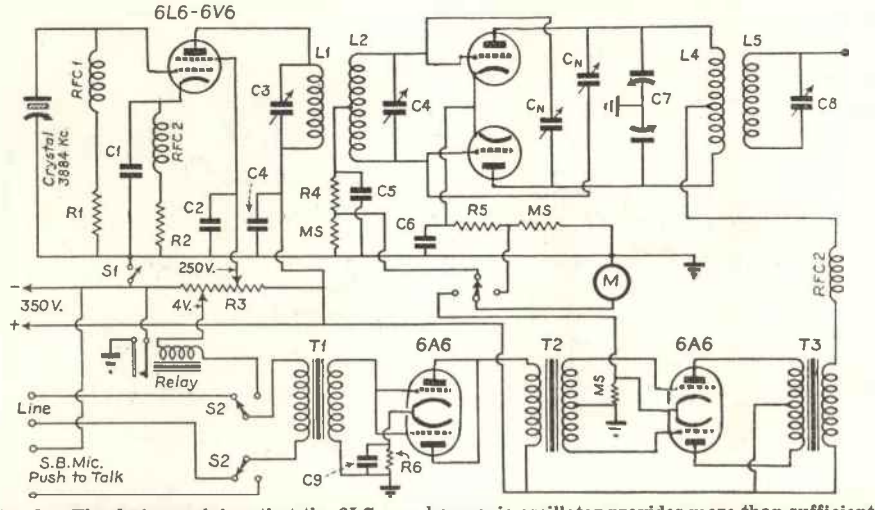


Fig. 3. The designer claims that the 6LG as a harmonic oscillator provides more than sufficient power to drive the final stage on 31 megacycles from a 3.8 megacycle crystal. It is also claimed that the oscillator will function down to 124 mc.

The transmitter uses a crystal-controlled oscillator which is capable of high power harmonic outuput feeding a final modulated stage. The oscillator uses a comparatively low frequency crystal with regeneration which enables an output of 10 metres to be obtained from an 80-metre crystal.

The crystal actually in this circuit was cut for 3,884 kc. with the oscillator tuned to a frequency of 31,100 kc. This in itself is quite an achievement but our own tests have shown that a regenerative oscillator using a tetrode valve is quite satisfactory in this way.

In addition, the crystal is mounted in a variable gap holder, which allows of a 50 kc. variation around 31.1 mc. The 6L6 in the first stage with an applied voltage of 350 with 250 volts on the screen, no crystal heating is evident, but an R.F. milliammeter in series with the crystal gave a reading of 30 mA. This is well within the capabilities of 80-metre crystals, but the designer states this reading is probably on the high side due to the use of long external leads to the meter.

Although the circuit of the oscillator is reasonably straightforward more importance than usual has to be devoted in shielding between crystal and final stage. It is also explained that contrary to general belief an oscillator having sufficient regeneration to obtain high power on remote harmonics has nothing "touchy" about it both in operation and adjustment. It is also suggested that the oscillator be of the metal type with the shell connected to the cathode. All R.F. chokes are of the small pi-wound 2.5 millihenry type with the exception of RFC2, which has one pi removed so as to provide an inductance of about 2 millihenries. This value, however, is not at all critical, in fact constructors can build this choke of 50 turns of 30 gauge wire bank wound to a diameter of 1½ ins.

Heater terminals on both oscillator and amplifier should be by-passed to earth by means of condensers having a capacity of at least .002 mfd. It was also noticed that although L2 is tuned providing this circuit is made resonant, C4 can be omitted, for the oscillator is capable of supplying far more power than the 6A6 requires.

For those who need telephony two twin triodes are used in the amplifier, the first with the electrodes connected in parallel and the second in straightforward zero bias class-B. It has also been arranged for a high-gain single button microphone to be used with a switch on the handle to connect it into circuit.

The tank coil should be space wound with a diameter of 1 in. and be self-supporting and constructed of number 10 gauge soft drawn enamelled wire. All insulation should be ceramic, otherwise losses are introduced. Power for portable use is obtained from a small generator energised by a 6-volt accumulator.

The designer claims that so satisfactory is this crystal oscillator that it will deliver power on all harmonics up to approximately 124 mc. from an 80-metre crystal.

A PORTABLE AERIAL FOR BROADCAST RECEIVERS

As the average broadcast receiver on medium and long waves has one R.F. stage plus a good performance between at least 20 and 50 metres on short waves, a simple aerial is all that is generally necessary. In the French publication *Haut Parleur,* is the design of a small tea trolley around which has been fastened in a decorative manner, sufficient wire to allow a pickup of most of the more powerful stations.

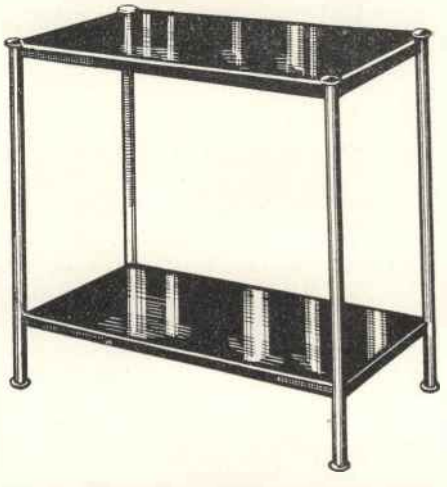


Fig. 4. This table is fitted with wires along the edges of the trays so making a compact portable aerial for the average broadcast receiver.

The wire is fitted to the edge of the top and lower deck so that the receiver can be mounted on the lower deck and close to the termination of the aerial wire. Although it is not suggested that this type of aerial be generally used, owing to the possibility of noise increasing on all but local stations, the idea has possibilities and it is shown in Fig. 4.

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Radio Society Activities

Will Hon. Secretaries of Radio Societies who wish for news to appear in this column please send the information before the 15th of the month.

The Maidstone Amateur Radio Society

Hon. Secretary, P. M. S. Hedgeland, Hillview, 8 Hale Road, Maidstone, Kent.

An 8-valve superhet communication receiver designed by GXB is being built for the use of members. The programme for March is as follows :—

March 7.—A demonstration of the Voigt loudspeaker by Mr. H. B. Lowther.

March 14.—A second of two lectures by Mr. W. H. Allen, G2UJ, on 56 megacycle operation.

March 21.—Film Night—the R.S.G.B. films and others.

March 28.—Practical evening.

Morse practice will be available to members before every evening providing those taking part have their own headphones. On March 29 at 7 p.m., Mr. J. Clarricoates, secretary of the R.S.G.B., will speak on the "Amateur Movement To-day and To-morrow." Admission to this meeting is by ticket only which can be obtained from the secretary before March 14.

The Sussex Short-wave and Television Club

Joint Hon. Secretaries, E. C. Cosh, Mill Road, Angmering, and C. J. Rockall, Aubretia, Seafields Road, Rustington.

Recent activities of this society have included a lecture by Standard Telephones and Cables, Limited, on modern short-wave valves and a visit to the Electrical and Radio Laboratory of the Portsmouth Technical College. Morse classes are to be held on March 9 and 23, April 6 and 20, May 4 and 18 and June 1. Lectures and demonstrations on the Cathode-Ray Tube are to be given by Mr. R. F. Hansford, on March 28 and April 11. Particulars of this society can be obtained from the Hon. Secretary.

The Medway Amateur Transmitter Society

Secretary, S. A. C. Howell, G5FN, Veronique, Broadway, Gillingham, Kent.

Meetings of this society are held every Tuesday, at 8.15 p.m., and an interesting programme has been arranged for several months ahead, details of which can be obtained from the hon. secretary. Morse code instruction is being carried on by G6NU, president of the society, while every effort is made to help non-licensed amateurs to obtain a radiating permit.

Eastbourne and District Radio Society

Hon. Secretary, T. G. R. Dowsett, 48 Grove Road, Eastbourne, Sussex.

During 1938 this society held 16 meetings with an average attendance of 14 per meeting. A full programme for 1939 has been arranged, while the total membership is now 27, including four fully licensed transmitters. Every endeavour is being made to increase the interest in amateur radio in the Eastbourne and surrounding districts and readers in that area are asked to get in touch with the hon. secretary at the above address.

Edgware Short-wave Society

Hon. Secretary, F. Bell, The Edgware Constitutional Club.

Although this society is now only one year old, considerable progress has been made, until now the number of members is no less than 42. The president of the society is G2AI, Leslie Gregory, who has offered two challenge cups, the second in view of the fact that he won

(*Continued on page* 189.)

A Directory of British Radio Clubs

(Continued from February issue and compiled from Charles Letts Wireless Diary)

Morpeth Amateur Radio Society. Hon. Sec.: C. L. Towers, 2, Edward Street, Morpeth.

Newbury and District Short-Wave Club. Hon. Sec.: L. Harden, 11, Highfield Avenue, Newbury, Berks.

Newcastle Radio Society. Hon. Sec., G. C. Castle, 28, Sandringham Road South, Gosforth, Newcastle, 3.

New Eltham Ratepayers' Ass. (Radio Secn.). Hon. Sec.: E. A. Gillborn, 87, Montbelle Road, New Eltham, S.E.9.

Newtownards Amateur Radio Club (N. Ireland). Hon. Sec.: T. L. Kirk, Chapel View, Newtownards, Ulster.

North Manchester Radio Society. Hon. Sec.: R. Lawton, 10, Dalton Avenue, Thatch Leach Lane, Whitefield.

North Middlesex Radio Society. Sec.: H. A. Crouch, 27, Middleton Park, Whetstone.

North Shields Radio Society. Hon. Sec.: G. A. Lee, 9a, Saville Street.

N.W. Ireland Amateur Radio Society. Hon. Sec.: S. Foster, 2, Florence Street, Park Street, Derry.

Northampton Radio Society. Hon. Sec.: D. W. Harries, 99, Ardington Road.

Northern Ireland Radio Society. Hon. Sec.: F. A. Robb, 46, Victoria Avenue, Sydenham, Belfast.

Oxford Short-Wave Radio Club. Hon. Sec.: E. G. Arthurs (2BHP), 13, Walton Well Road, Oxford.

Peckham Radio Society. L. J. Orange, 11, Granard Road, Peckham, S.E.15.

Perth Radio Society (Proposed). R. Adams, 120, Canal Street, Perth.

Peterborough and District Short-Wave Club. Jt. Hon. Sec.: W. S. Cornwell (2ACP), 80, Elmfield Road, Peterborough.

Portsmouth and District Wireless and Television Society. Hon. Sec.: F. L. Moore, 78, Laburnum Grove, Portsmouth.

Port Talbot Radio Club (Proposed). W. Ryan, 47, Margam Terrace, Port Talbot.

Prestatyn Short-Wave Club. Hon. Sec.: R. J. Stellig, "Romir," Victoria Road.

Radio Physical and Television Society. Hon. Sec.: V. R. Walker, 49, Fitzjames Avenue, London, W.14.

Radio Society of Great Britain (Bristol Area). Sec.: A. J. Webb, 12, Mervyn Road, Bishopston, Bristol, 7.

Radio Transmitters' Union. C/o. W. H. Martin, Knockinagh, Cloughfern, Whiteabbey, N.1.

Redhill and District Radio Society (Proposed) Hon. Sec.: H. Cartwright, Radio House, Victoria Road, Horley, Surrey.

Redhill and District Short-Wave Club. Sec.: D. Hessenaver, 139, Frenches Road, Redhill, Surrey.

Robert Blair Radio Society. Hon. Sec.: A. R. Richardson, 24, Mercers Road.

Sale and District Short-Wave Radio Club. Hon. Sec.: M. Postles (2CXH), "Norward," 56, Firs Road, Sale, Cheshire.

Salisbury and District Short-Wave Club. Hon. Sec.: C. A. Harley, 85, Fisherton Street, Salisbury, Wilts.

Sheffield Short-Wave Club. Sec.: D. H. Tomlin, 32, Moorsyde Avenue, Sheffield, 10

Sheppey Amateur Radio Club. Hon. Sec.: F. G. Maynard, 161, Invicta Road.

Short-Wave Radio and Television Society (Thornton Heath). Hon. Sec.: J. T. Webber, 368, Brigstock Road, Thornton Heath.

Slade Radio Society. Hon. Sec.: G. Game, 40, West Drive, Heathfield Park, Handsworth, Birmingham.

Slough and District Short-Wave Club. J. H. White, 20, Chalvey Road East, Slough.

Smethwick Wireless Society. Hon. Sec.: E. Fisher, 33, Freeth Street, Oldbury, Nr. Birmingham.

Southall Radio Society. Hon. Sec.: H. F. Reeve, 26, Green Drive, Southall.

South Hants Radio Transmitting Society. Sec.: E. J. Williams, B.Sc., "Rochdale," London Road, Purbrook, Portsmouth.

Southend and District Radio and Scientific Society. Hon. Sec.: J. M. S. Watson, 23, Eastwood Boulevard, Westcliff.

South London and District Transmitters' Society. Sec.: H. Cullen, 164, West Hill, Wandsworth, S.W.

Southport Amateur Radio Society. Birch Villa, Lulworth Road, Southport.

S.T.C. Radio Experimental Society. The Chief Instructor, Training Battalion, R. Signals, Catterick Camp, Yorks.

Stoke-on-Trent Radio Society (Proposed). H. Churton, 26, Victoria Street, Smallthorne, Stoke-on-Trent.

Surrey Radio Contact Club. Hon. Sec.: E. C. Taylor, 35, Grant Road, Croydon.

Sutton-in-Ashfield Society. Hon. Sec.: A. W. Fowler, 78, Kirkby Road, Sutton-in-Ashfield.

Swansea Radio Club. Hon. Sec.: R. J. Davies (Messrs. Watson & Davies), Mansel Lane, Swansea.

Swindon and District Short-Wave Society. Hon. Sec.: W. G. Barnes (2BWR), 7, Surrey Road, Swindon.

Thames Estuary Radio Society. F. S. A. Jenkins, R.N., W.A.R., "Cranleigh," Spencer Close, Rochford, Essex.

Torrington and District Short-Wave Club. Hon. Sec.: A. E. Cornish, 1, Halsdon Road, Torrington, N. Devon.

Thames Valley Amateur Radio and Television Society. Sec.: J. N. Roe, 19a, The Barons, St. Margarets, Middlesex.

Tottenham Wireless Society. Hon. Sec.: F. E. R. Neale, 17, Whitely Road, Tottenham, N.17.

Tottenham Short-Wave Club. Hon. Sec.: E. Jones, 60, Walmer Terrace, Firs Lane, Palmers' Green, N.13.

Tunbridge Wells and District Amateur Transmitting Society. Sec.: W. H. Allen, 32, Earls Road, Tunbridge Wells.

Wallasey Junior Radio Club. A. M. Wilding, 2, Wallacre Road, Wallasey.

West London Radio Society. Hon. Sec.: D. Reid, 15, Tring Avenue, Ealing Common, S.5.

West Sussex S.W. and Television Club. Hon. Sec. L. Frost, "Mikado," Station Road, Bognor Regis, Sussex.

Weymouth S.W. Club (Proposed). W. E. G. Bartlett, 59a, Franchise Street, Weymouth, Dorset.

Willesden Short-Wave Club (Proposed). S. A. Reeve, 115, Willesden Lane, Kilburn, N.W.6.

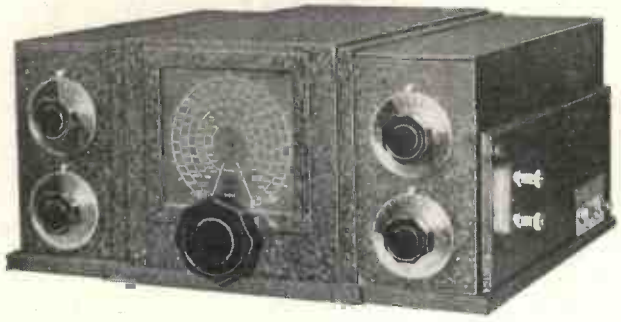
Wirral Amateur Transmitting and Short-Wave Club. Hon. Sec.: J. R. Williamson, 49, Neville Road, Bromborough, Birkenhead.

Worthing and District S.W. Club. Hon. Sec.: G. A. Lambourne, 16, Angola Road, Worthing.

Trade News of the Month

A most interesting selection of new components and receivers have been introduced during the past few weeks. Full information on these can be obtained from the advertisers in this issue.

VERY little attention appears to have been paid to battery-operated communication receivers of the multi-valve type. Very consistently for the past year new A.C. and A.C./D.C. sets of every type have been produced, so for this reason we are sure readers



The new Eddystone communication receiver type LPC is one of the few battery sets of its type available in this country.

will appreciate the importance of the new Eddystone battery-operated communication receiver type LPC. This set employs 8 valves and is comparable in performance to the best multi-valve mains operated sets of a similar type. The circuit is made up of a radio-frequency stage on all wavelengths, a mixer valve, separate electron coupled oscillator, two intermediate-frequency stages at 465 Kc., a double-diode triode, beam power tetrode in the final stage and electron coupled beat-frequency oscillator.

Two aspects have been given careful consideration—noise level and frequency drift. The manufacturers claim that noise level is exceptionally low with negligible frequency drift.

The chassis and cabinet are of a special type of aluminium die-casting with very complete screening between stages. Coils are in interchangeable die-cast screened boxes, each block being made up of three tuned circuits. The frequency coverage is 22,000 Kcs. to 530 Kcs. covered by five blocks of coils but these frequencies can be increased at both ends if required.

Despite the number of valves, the total high-tension current is only 16 mA. at 135 volts with a filament current of .9 amp at 2 volts.

Sensitivity figures claim better than 7 microvolts for an output of 50 milliwatts. Controls include radio-frequency and audio-frequency gain, beat-frequency, pitch and oscillator vernier, A.V.C. and beat-frequency oscillator control switch. The price of this receiver is £45 and full information can be obtained from Stratton and Co., Bromsgrove Street, Birmingham, 5.

The TV03-10 is a twin triode produced by Mullards having characteristics similar to those of the RK34.

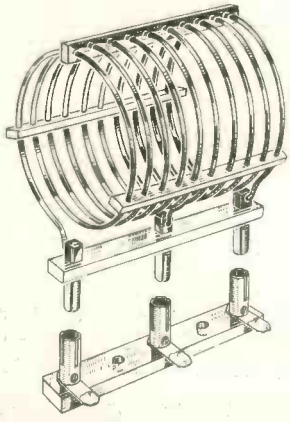
Components specially made for serious experimenters interested in ultra-high frequency working are being designed and manufactured by Denco, of 234 Burrs Road, Clacton, Essex. Associated with this company is D. W. Heightman, G6DH, the well known U.H.F. research worker who does know from practical experience just what amateurs need.

Denco are making four-pin coils of the plug-in type wound on trolitol formers to cover wavelengths from 2.5 up to 80 metres. These coils are priced at 3s. each, while the formers unwound are available to home constructors for 1s. 3d. each. Another interesting component we have tried is a short-wave choke wound on a hollow tube former which is free from resonance between 4 and 100 metres. It is priced at 2s.

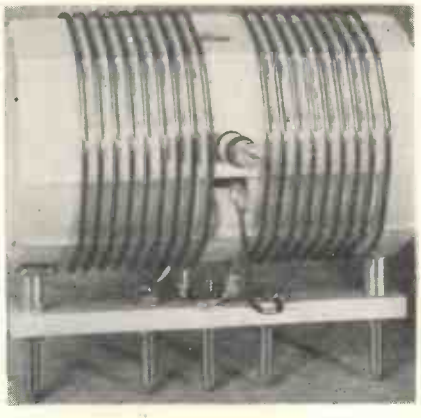
In addition to these ultra-short wave components, Denco plug-in transmitting coils are particularly suitable for amateur use and cover 7, 14, 28 or 56 Mc. with a power input of up to 150 watts. There is a minimum of trolitol insulation, but the coils are perfectly robust and rigid. These coils can be made to individual requirements if condenser capacities are stated. Denco issue a considerable amount of information on their new short-wave equipment which is well worth obtaining from the address given above.

At the present rate of progress amateurs will be able to obtain every conceivable type of transmitting valve, formerly obtained from America, in this country made by British manufacturers. The latest addition to the Mullard range is the Tv03-10, a twin-triode valve having useful characteristics and suitable for service down to 240 Mc. It is fitted with a standard British 5-pin

(*Continued on page* 190)



Components for the exacting amateur are now being built by Denco This is one of their low-loss transmitting coils.



This new Johnson coil will shortly be available in this country. It is for use in tank circuits and has a variable link winding built in.

"Radio Society Activities."

(*Continued from page* 184.)

the first cup. In addition, an electric clock is to be given to the member introducing the largest number of new members. An electric clock was also awarded to Mr. F. Harris, G3LT, the first member to obtain a full licence. An extensive programme of lectures has been arranged for 1939, and we strongly advise readers who are in the Edgware area, or who can attend these lectures, to obtain full information from the Hon. Secretary.

The Surrey Radio Contact Club

Hon. Secretary, A. B. Wilsher, 14 Lytton Gardens, Wallington, Surrey.

At the last meeting, the oldest member gave a talk on his experiences as a marine operator before and after the war. He displayed several Marconi instruments of pre-war vintage such as the magnetic detector. This society is made up of a large number of active transmitters and their forthcoming series of lectures is a particularly interesting one. A full list of these can be obtained from the hon. secretary together with full details of the society's rules and regulations.

Brentwood and District Radio Society

Hon. Secretary, B. A. Pettit, G3VD, "The Laurels," Warrin Road, Shenfield, Essex.

At the annual general meeting of this society, the following officers were elected, most of whom are well known to our readers :—

President : J. E. Nickless, A.M.I.E.E., G2KT.
Chairman : E. D. Hellyer.
Vice-chairman : W. G. Goult, G2WG.
Hon. Secretary : B. A. Pettit, G3VD.
Hon. Treasurer ; C. F. Turner, G4AG.
Hon. Publicity Secretary, J. R. Deane-Sainsbury, 2CYW.

The society's transmitter, with the call sign G8HV, is operative on 160 metres phone with a frequency of 1806 Kc. On these transmissions, reports are very welcome and should be sent to the Hon. Secretary. The society produces its own journal and holds meetings on the first and third Thursdays of each month, at the QRA of G8KM.

The Thorne Amateur Radio Society

Hon. Secretary, Gerald Beaumont, 15 Marshland Road, Moor Ends, Doncaster, Yorkshire.

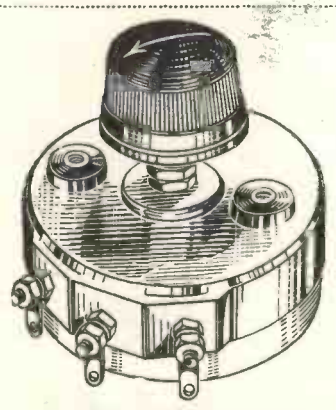
This society was first formed in January of this year and holds meetings every Sunday at 2 p.m., at 51 King Street, Thorne. A charge of sixpence is made for each person attending these meetings.

New Tx. Coils :: A Low C. Neut. Condenser

(*Continued from page* 188)

base having both anode connections brought out through the top cap.

Characteristics are almost identical with those of the RK34 insomuch as the heater voltage is 6.3 with a current of



This type of potentiometer is rated up to 20 watts and is one of the new range marketed by Reliance.

.8 of an amp. Each anode is rated for a dissipation of 5 watts down to operation at less than two metres. The valve has numerous applications, such as push-pull crystal oscillator, push-push doubler, C.O., frequency doubler or sub-amplifier and even as a two-stage low-power transmitter.

The input capacity is 4.2 mmfd. and the rated anode voltage 300. A total D.C. grid current of 25 mA. is permissible, while our tests show that 20 to 25 watts input can be obtained. The Mullard Wireless Service Co., now have these valves available for distribution and full data is available from them at 225 Tottenham Court Road, W.1.

Shortly available in this country through many suppliers will be two new Johnson coils which are of particular use to the experimenting amateur. The first of these coils is of the horizontal plug-in type for tank circuits in which is included a rotatable coupling coil. This coupling coil can be adjusted to provide the exact degree of loading required, while it is designed to feed into transmission lines of 75 ohms impedance. Complete coils are available for all bands from 10 to 160 metres and are suitable in two types for 250 watts or 750 watts input as required. Another coil in this range is of the plug-in type wound on high grade porcelain and designed to fit a five-pin socket. These coils are fitted with a coupling winding which can either be in the centre or at the end of the former as required.

Supplies of the Radio Handbook are available without waiting from G5KA who also has a complete stock of interesting short-wave manuals and text books.

Premier Supply Stores are now issuing a completely revised catalogue of amateur and other equipment. The high light of this catalogue is some information on their new 5-v-5 communication receiver which was produced under the supervision of G5MG.

It is a five-valve receiver covering from 12 to 560 metres without gap and 850 to 2,000 metres. Individual coils are included for each band which are of the Litz wound high-Q type. Refinements include beat-frequency oscillator, A.V.C. and send-receive switch, phone jack and a separate band-spread condenser. The loudspeaker is separate in its own steel case and the price complete 8 gns. on which special hire purchase terms are available.

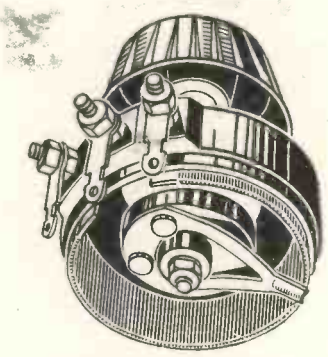
A whole series of high-gain amplifiers has also been designed which include a 6-watt A.C. type for £6, an 8-10 watt A.C./D.C. amplifier for 5 gns., 15-watt high quality A.C. amplifier for £7, and a special unit for modulation purposes which is available in two outputs of 30 and 60 watts. At 30 watts the cost is 12 gns., and 60 watts, in which are used 9 valves, 15 gns. The last three amplifiers are particularly suitable for amateur work as they are capable of modulating up to 30, 60 and 120 watts respectively. All are fitted with a special multi-ratio output transformer.

Reliance Manufacturing Co., of Sutherland Road, Higham Hill, E.17, manufacture a very complete range of potentiometers and variable resistors of all kinds. The new PIW is available in ranges of .5 ohms to 500,000 ohms with a tolerance of 5 per cent. The shaft is insulated to withstand a D.C. voltage of 1,000.

The more usual type of potentiometer type T.T. is also wire-wound, and has a maximum rating of 5 watts and a range of .5 ohms to 100,000 ohms. An interesting feature of this type is that the ends of the windings are metalised in order to obtain an extremely low "zero." Up to 90 ohms, the price of these potentiometers is 5s. 6d. complete with knob and from 100 ohms upwards, 4s. 6d. also with knob.

The 1939 copy of "Radio Handbook" is available from stock from F. L. Postlethwaite, G5KA, of 41 Kinfauns Road, Goodemayes, Ilford. This manual is one of the best of its kind and is suitable both for the raw amateur and the experienced experimenter. G5KA carries a most comprehensive range of radio journals and text books and it is well worth amateurs getting in touch with him for his new lists.

A special neutralising condenser of the plunger type with trolitol insulation is being marketed by Messrs.



A standard Reliance wire-wound potentiometer of this type is rated at 5 watts.

A. C. S. Radio, of 16 Grays Inn Road. This neutralising condenser sold under the trade name of Rex is priced at 4s. 6d. It has a minimum capacity of 1.5 mmfd. and a maximum capacity of approximately 20 mmfd. It is useful for inclusion in U.H.F. circuits, while the approximate capacity in use can quite easily be determined as each revolution of the plunger is equal to approximately 1.5 mmfd.

A.C.S. Radio have just introduced this low-capacity neutralising condenser. It has a minimum of 1.5 mmfd.

New Amateur Equipment at Webb's Radio

READERS who visit Webb's Radio, at 14 Soho Street, W.1, will find quite an interesting range of new items which came to hand just as we were going to press.

Amongst these are a number of Triplex thermo meters having a range of 0-1, 0-1½ and 0-2½ amperes with a separate thermo couple which can be replaced if required. These are priced at 45s. each. There is also an 0-1 D.C. mA. meter for 27s. 6d. which is very useful for inclusion in universal test sets. These instruments all have a diameter of 2 in.

The Taylor valve manual for 1939 is now available for 6d. post free and includes all the recent Taylor releases such as the T21 and TZ40 with full operating data. In the constructional section are details of an all-band transmitter and a transmitter for quick band change over with an input of 125 watts.

A New British Communication Receiver

Messrs. Stratton & Co., of Birmingham, the well-known manufacturers of Eddystone short-wave components and receivers have produced a multi-valve communication receiver for amateur use. This set, which includes all refinements such as crystal filter, beat-frequency oscillator, band spreading, etc., is extremely well finished in the typically British manner and in this respect is better than the majority of American communication receivers. We feel that this should be of particular interest to keen amateurs and also short-wave listeners who need world-wide coverage. A wealth of interesting information regarding this set is available from the manufacturers and elsewhere in this issue will be found an advertisement giving the address from whom data can be obtained. If readers use the coupon in the advertisement mentioning this journal, the information regarding the E.C.R. receiver will be sent free of charge.

The Candler Book of Facts

Owing to the unusual amount of interest taken in the Candler system of morse code training, the Candler Book of Facts which is sent to all interested is at present out of print. A new edition, however, is at the moment at Press and any applications made before supplies are available will be recorded and despatched in rotation.

The Candler system enables morse code operators to reach high speeds very quickly, and it is recommended by American services and also by T. R. McElroy, the Candler trained world's champion telegraphist. Obtain your copy of the Candler Book of Facts from H. Freeman, 121 Kingsway, London, W.C.2 Room 55b.

A 3-band C.W.Tx.

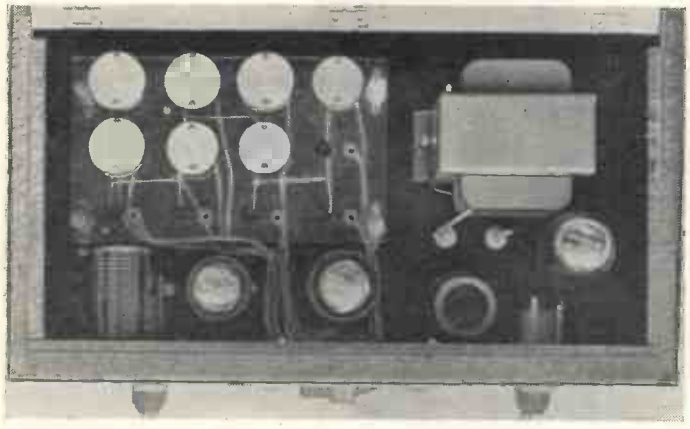
(*Continued from page* 167)

On 40 metres, that is with VC2 at almost maximum capacity, resonant current should be around 25 mA. On 20 metres, with a little under half capacity, the current is 25 mA. and on 10 metres with minimum capacity, 30 mA. It must be remembered that these are the resonant currents, not to be confused with the off-tuned current which is in excess of 100 mA.

When the two circuits are in tune, it may be found that by taking out the crystal, an R.F. output can still be obtained from L3. This will occur only on 40 metres, as it is due to the fact that the 6L6G is not properly neutralised.

Neutralising, however, is quite simple. A special condenser, type UTC, is mounted on the chassis. This condenser has been modified and all the plates except one variable and one fixed are removed. This is set at minimum capacity and the H.T. to V2 switched off. A looped lamp should be kept close to L2, as it will be found that this lamp lights up even though S1 is open. NC1 must then be very carefully adjusted until the looped lamp fails to light. This should be checked by rotating VC2 10 or 15 degrees to either side of the resonant point and if no trace of light can be found, it can be assumed that the final stage is reasonably well neutralised.

It is advisable to use a .3-amp bulb for the initial tests for neutralising, changing over to a 60 mA. bulb, when it is assumed that the setting of NC1 is correct.



The layout of the components can be seen from this plan view, also the coils and their correct positions.

Coil Data for the 50 Watt TX

The following coil data will be required by those constructing the 50-watt transmitter described in the February issue :—

20-metre Operation.

		diameter.		gauge.
L1	7 turns	1¼ in.	Close spaced	14
L2	8 turns	1½ in.	Double spaced	18
L3	12 turns	1½ in.	Double spaced	18
L4	11 turns	1½ in.	Double spaced	18
L5	6 turns	2½ in.	Triple spaced	12

10-metre Operation.

		diameter.		gauge.
L1	7 turns	1½ in.	Close spaced	14
L2	8 turns	1½ in.	Double spaced	18
L3	6 turns	1½ in.	Double spaced	16
L4	5 turns	1½ in.	Double spaced	18
L5	11 turns	2½ in.	Triple spaced	12

With the T20 valve operating as a doubler, the setting the neutralising condenser need not be touched even though the valve does not need neutralising when working these conditions. The grid bias supply, however, must be doubled. It is also recommended that a spark gap be connected across the secondary of the modulation transformer.

OPPORTUNITIES SECTION

BUSINESS :: EQUIPMENT :: EMPLOYMENT :: MISCELLANEOUS

The charge for miscellaneous advertisements on this page is 12 words or less 2/-, and 2d. for every additional word. Single-column inch rate displayed, 12/6. All advertisements must be accompanied by remittance. Cheques and Postal Orders should be made payable to Bernard Jones Publications Ltd., and crossed, and should reach this office not later than the 15th of the month previous to date of issue.

INDEX TO ADVERTISERS

MISCELLANEOUS

ALL TYPES of Rotary Converters, electric motors, battery chargers, petrol electric generator sets, etc., in stock, new and second-hand.

A.C.-D.C. Conversion Units for Operating D.C. Receivers from A.C. Mains, 100 watts output, £2. 10; 150 watts output, £3. 10.

WARD, 46, Farringdon St., London, E.C.4. Tel. Holborn 9703.

ANY CLASS of television receiver design and construction undertaken to special order.
Finest materials and workmanship at reasonable prices. May we have the pleasure of quoting ?
SPENCER-WEST, Worlingham, Nr. Beccles, SUFFOLK. Telephone: Beccles 3159. See also page 184.

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