REMARKABLE BAIRD DEVELOPMENT

TELEVISION

THE FIRST TELEVISION JOURNAL IN THE WORLD

and SHORT-WAVE WORLD

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TELEVISION

Interlaced Scanning Explained

Building Cathode-ray Scanning Circuit

The Principles of the Electron Microscope

Receiving B.B.C. Television in Iceland

ABC of the Cathode-ray Tube

SHORT WAVES

Electron-coupled Frequency Meter

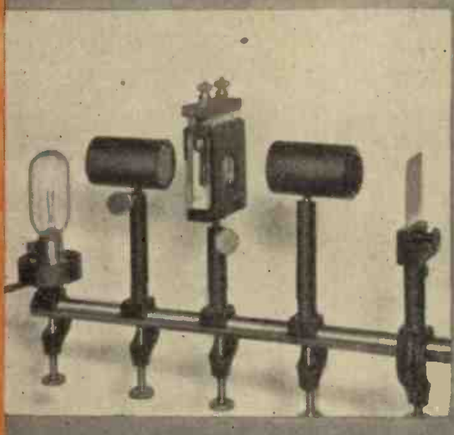
Five-metre Aerial Systems

A Three-valve Super-regenerative Receiver

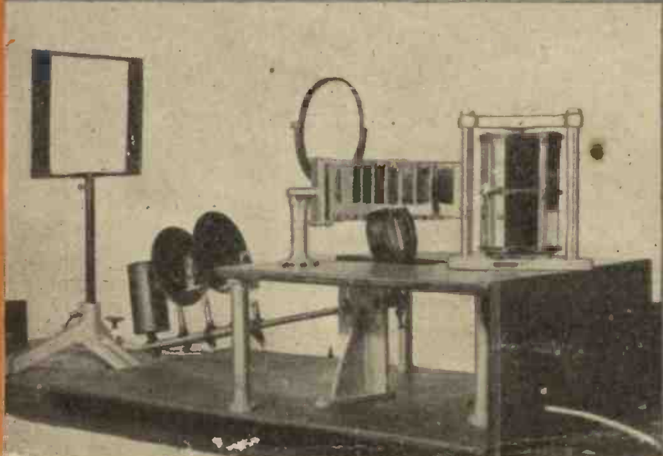
Pocket Five-metre One-valver

Battery Five-metre Transceiver

a New DEVELOPMENT



FIRST DETAILS of MIHALY-TRAUB RECEIVER



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TELEVISION and SHORT-WAVE WORLD

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AND
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COMMENT OF THE MONTH

A Cathode-ray Bias.

THE first public statement made by the Advisory Committee provides the information that two different scanning systems are to be used, one of 240 lines sequential, and the other 405 lines, 25 pictures per second, interlaced to give 50 frames per second, each of 202½ lines. Qualifying this statement the announcement proceeds: "The Committee have satisfied themselves that receivers can be constructed capable of receiving both sets of transmissions without unduly complicated or expensive adjustment." We do not dispute this last statement, but we do say that this decision will complicate receivers at a period of development when it is least desirable to do so. Such complication may not be of much consequence in very costly receivers, but it is a step which will impose a further limitation on the man whose pocket is not too deep.

However, there is another and more important criticism which we have to make in regard to this decision. The Committee appears to take it for granted that the only type of receiver which will be used will be the cathode-ray; this policy of employing two types of scanning reduces the possible utility of mechanical receivers by half unless some form of duplicate scanning equipment be employed, which would be so costly as to place mechanical receivers at a very serious disadvantage. For the moment the cathode-ray receiver finds most favour, but some of the leading experts of this country and Germany still subscribe to the opinion that mechanical methods will provide the final solution. However this may be, it appears to be an unfortunate step to penalise a system which, as two important concerns in this country have shown, has very great possibilities. The need for standardisation and a settled programme or policy has been one of the greatest retarding influences in the past and here at the very outset a departure is made which appears to be in opposition to the best interests of development.

Our Special Article This Month.

WITH the object of showing the reader the present position of television arising from the publication early this year of the Television Committee's Report, with its recommendation of the erection and operation of a television broadcasting station in London, we publish in this issue a special article from the pen of the Editor-in-Chief. The article reasonably covers the ground and is as free from bias as it well can be. The honest truth is that the story of television as unfolded by the last four or five months is more of delays and dallyings than of live and enthusiastic progress. Possibly it all some real progress has been made, and by the time these words are the secret history is one of opposition in influential places, but in spite of in print, or at any rate very soon after, we hope that the establishment of broadcast television some time during this coming autumn will be definitely assured.

THE MIHALY-

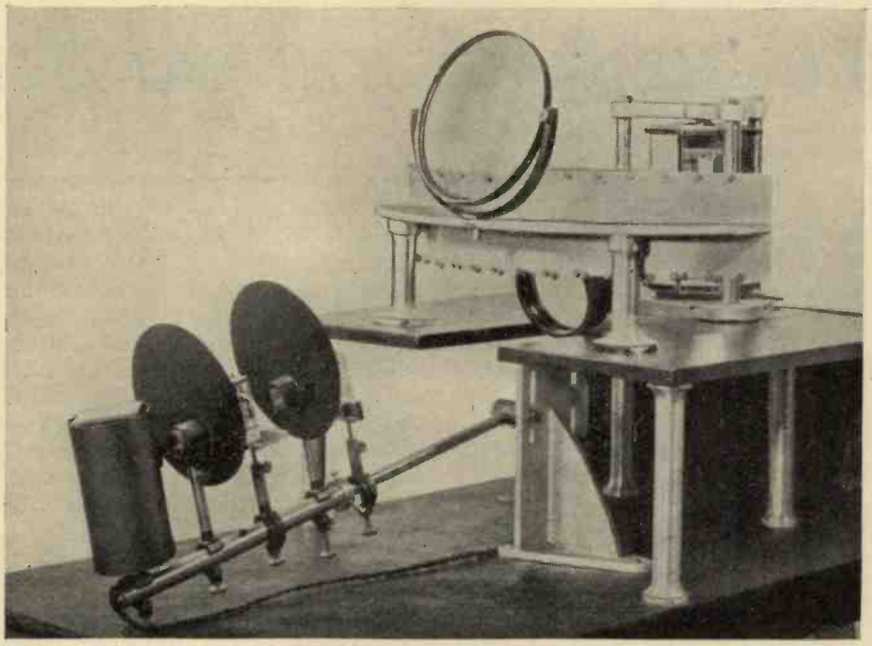
First details of a new high-defin

"Television" is privileged to be the first Journal

THE Editor has seen several demonstrations of high-definition pictures with this system and the results were very impressive. Brilliant pictures of a size of 8 ins. by 10 ins. were projected on to a screen, all this using only a small 32-watt exciter lamp.

Other features of outstanding merit of this system are its great compactness, its extreme simplicity and small number of component parts as well as its easy synchronism due to the small size of the rotating body.

The Mihaly-Traub system, as the name implies, is a development of the original Mihaly stationary mirror-drum, the improvements being due to a series of inventions by Mr. E. H. Traub. It is interesting to see how this invention was arrived at:



This three-quarters front view shows the extremely simple construction of the Mihaly-Traub receiver. (By courtesy of the International Television Corp.)

The Original Mihaly Receiver

As will be remembered from the description of the Mihaly system which appeared in TELEVISION some eighteen months ago, the Mihaly system consists of a complete ring of inwardly facing mirrors, the light being swept around them by a small rotating mirror. Now this mirror is double sided and silvered on both sides. Due to this fact *one-half* revolution of the rotating mirror about its axis scans one complete picture. Thus the mirror rotates at half the framing speed, i.e., only 12½ times a second for a picture repetition of 25 times per second.

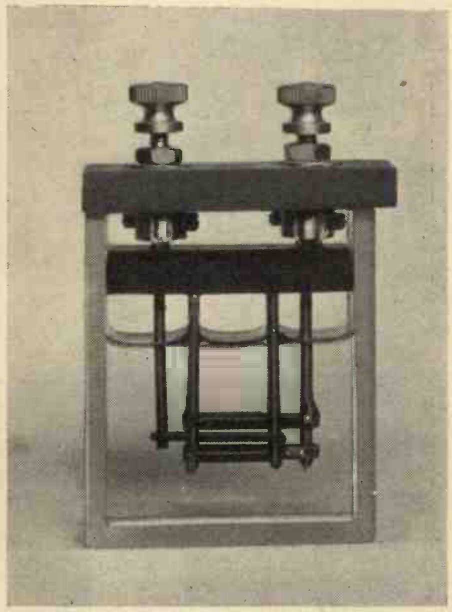
The inventor hit upon the idea of utilising this feature in such a way that the two sides of the mirror would not scan the same picture twice over, but by speeding up the rotation of the mirror to the true picture repetition speed and tilting the two sides relatively to each other would produce two sets of lines, one below the other, in one complete revolution of the mirror.

Thus it will be seen that by this simple change a Mihaly receiver for any number of lines can immediately be doubled in definition, still, however, using a complete circle of mirrors. This is the basic idea underlying the principle of the Mihaly-Traub system.

The Traub Modifications

It was found that by increasing the number of rotating mirrors above two, certain further advantages could be gained. For instance, the size of the moving part is not increased beyound permissable dimensions, if, for instance, six rotating mirrors are used. In this case it is no longer necessary to use a complete rim of stationary mirrors, but only a third of an arc, thus a great saving in price is effected, inasmuch that one complete mirror ring for a certain number of lines can be cut up into three pieces and utilised for three different Mihaly-Traub receivers of double the definition.

In practice, it has been found that the optimum number of central mirrors lies between six and ten. Naturally one does not want to increase the number of central mirrors beyond what is necessary in order not to make the moving part too big in diameter. An eight-sided polygon has been found the best compromise in practise, making use of a quarter of an arc of stationary mirrors surrounding the polygon.



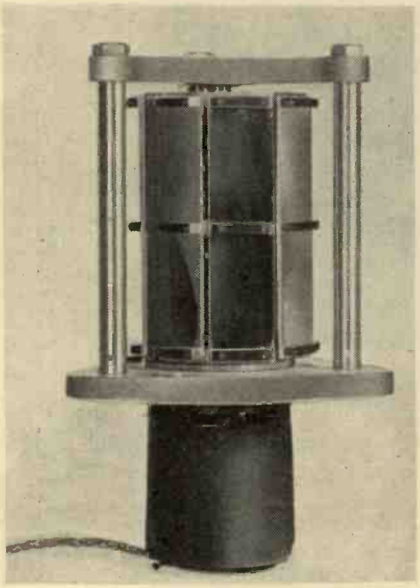
The low-capacity Kerr cell developed by the International Television Corporation, Ltd., for use in conjunction with the Mihaly-Traub system. (By courtesy of the International Television Corp.)

TRAUB SYSTEM

ion optical-mechanical system

ıblish technical details of the Mihaly-Traub system.

The system is, in a sense, a multiplying one as the number of lines produced on the screen is the product of the number of stationary mirrors and the number of faces of the polygon. This brings about an enormous saving in cost as the number of actual mirrors rotating or stationary need only be twice the square root of the number of lines.



The rotating polygon used in the Mihaly-Traub receiver. (By courtesy of the International Television Corp.)

Four-fold Increase of Light

The system should, however, not be confused with the simple multiplying systems of the conventional kind none of which give satisfactory results. The inherent feature which makes the Mihaly-Traub system a technically successful one is the fact that the light from the stationary mirrors is reflected back on to the top of the rotating polygon before being thrown on to the screen. This feature not only enables successful multiplication to be achieved, but incidentally gives an automatic four-fold increase in light as the screen angle is doubled.

It might be thought that this was also the case in the old Mihaly system, as double reflection on the central mirror is also employed there. Illumination is, however, not only a function of the number of reflections on the rotating part, but also a function of the speed of the rotating part relative to the number of pictures per second. In other words, a scanner rotating at double the picture speed will produce four times the light on the screen compared to one running at the true picture speed, and inversely, in the Mihaly system where the mirror runs at *half* the true picture speed, the light is reduced to quarter.

Thus, in the Mihaly system, the gain of double reflection is lost by the fact that the mirror revolves at only half the true picture speed. Therefore, in principle, the Mihaly system is just as efficient as the rotating mirror-drum with the exception that, of course much bigger drum diameters and mirror areas are possible. Even bigger mirror areas are possible on the Mihaly-Traub system. In fact, the system is extremely efficient optically.

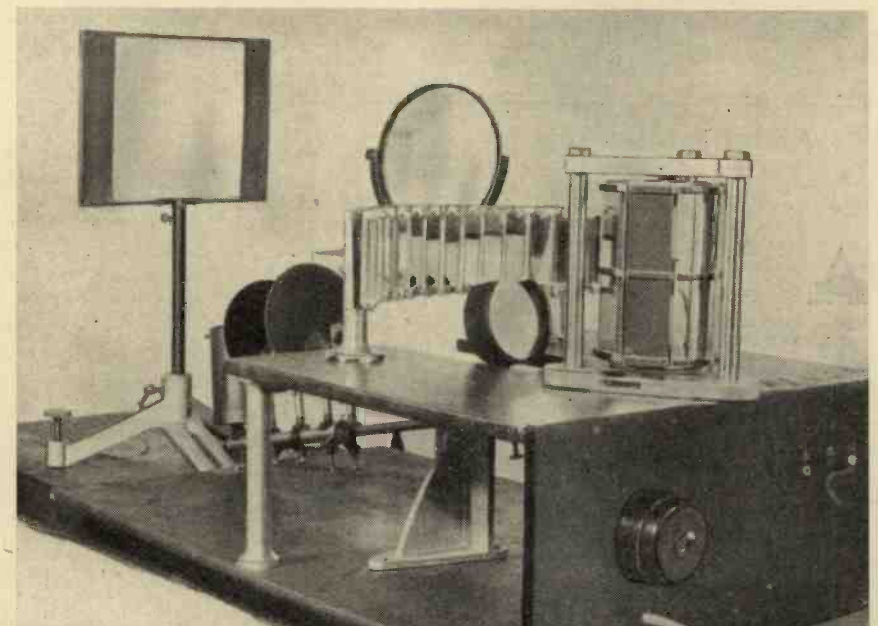
The accompanying illustrations show an early experimental 120-line model which uses the exciter lamp as light source, and a specially developed double-image Kerr cell as light valve.

Large 240-line Pictures

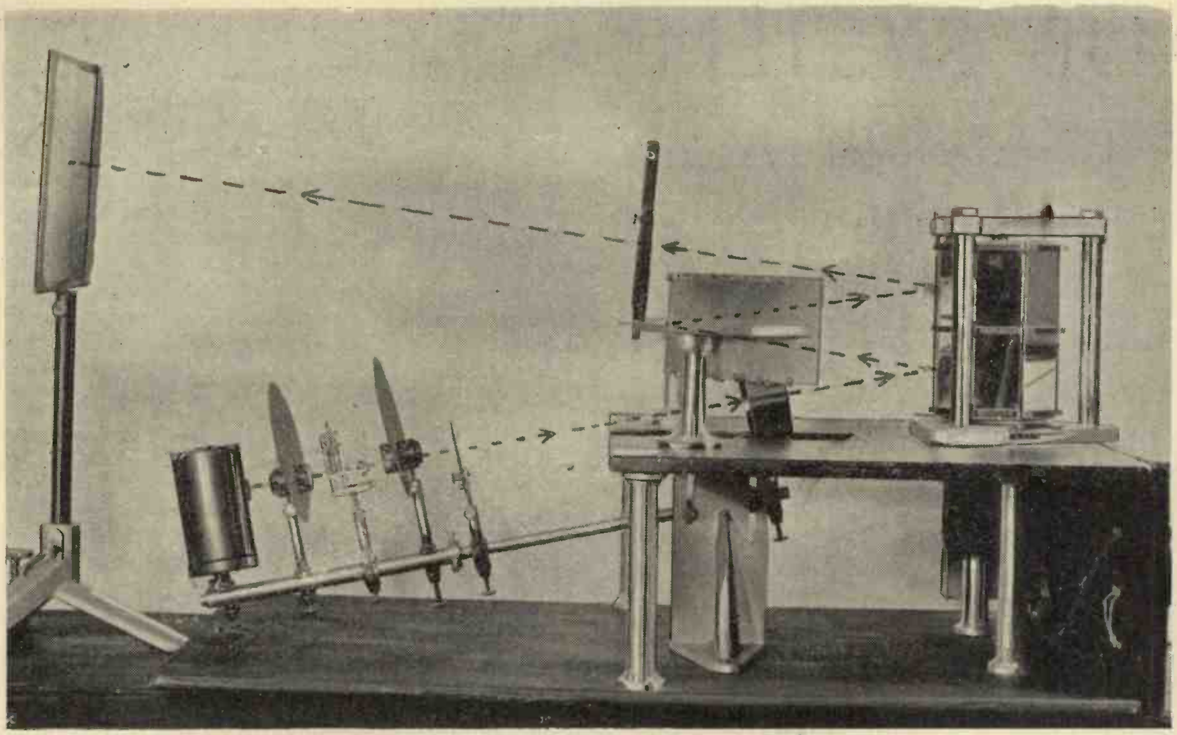
At the time of writing, 180-line models are in a very advanced stage, and designs are complete for an extremely small 240-line receiver giving a brilliant picture at least 12 ins. by 16 ins.

A word of warning to amateurs. The above description is merely a general one and a receiver constructed on these lines will tend to give certain optical abberations in the picture. The International Television Corporation, Ltd., have developed certain very simple methods for the correction of these abberations which can, however, not be disclosed at the moment. Without these correcting methods successful results are not possible. Amateurs should, therefore, refrain from attempting to build such receivers at this stage.

The system is, of course, applicable to all types of scanning, sequential or interlaced, and is indeed capable of much higher definition than 240 lines. As the system is one of the only two in existence to-day which are capable of producing high definition *projected* pic-



An experimental 120-line model of the Mihaly-Traub system. (By courtesy of the International Television Corp.)



A side view of the Mihaly-Traub receiver. The dotted line indicates the path of the light beam.

tures, big screen television is, of course, a logical development. For big screen work, certain minor modifications are introduced into the system, modifications which are permissable where cost is no object. In fact designs have been completed for a 240-line big screen projector giving a picture 8 ft. by 10 ft.

As a Transmitter

The system can, of course, equally well be applied to transmitters, especially those of the spot-light and daylight type. In conjunction with such modern photo-electric developments as the Farnsworth electron multiplier a portable 240-line daylight transmitter is possible, the size of the unit being no bigger than a standard news reel camera.

In short the Mihaly-Traub system is one of the most ingenious that has yet come to our notice and is capable of excellent results on high-definition. It should be stressed that even as a home receiver it is possible to give pictures which are considerably bigger than those obtainable with cathode-ray receivers and probably at a lower cost.

Activity on 28 M C.

By G. C. Allen, B.R.S. 250.

A MINIATURE boom on 28 m.c., caused by the re-appearance of European and North African signals, has attracted many new stations to this band, but, so far, the number of old pioneers heard has been small.

G6NF and G6WN are already back and hard at work, and they will be joined by G6LL, G6DH, G6QB, G6VP, G5ML, G2CX, G2OD and G2KF—to mention but a few—in due course, when DX conditions have become really interesting.

During the afternoon of May 19, conditions were extremely good, and OE1FH, OK1AW, SM5YQ, D4BAR, D4BDF, D4BHF, D4BNN and D4CNF were all excellent signals at one period, and several QSO's were effected with them by G stations.

The next good spell occurred on May 25 when between 14.00 and 17.30 B.S.T. FM8BG, FM8CR and FM8GT were good signals; the former being by far the best as his signals peaked at QSA5, R3/7. Several QSO's were effected with G stations.

FM8CR was heard calling "CQ Ten" at the unusually early hour of 08.05 B.S.T., on June 4, and later on the same morning OK1AW was logged at QSA4 R1/6. In the case of FM8CR, it is unusual to hear an extra-European at such an early hour.

June 5 provided some interesting material. During the morning commercial harmonics of SPW and HAS2 were audible, showing the band to be "open." Incidentally, the fact that the SPW is so often heard would seem to indicate that "SP" QSO's could be effected.

In the evening of June 5 conditions were excellent and between 19.20 and 19.50 B.S.T., OK1AW, OK3VA, OE1ER, OE1FH, OE3WB, FM8CR, HB9B and F3AR were heard; F3AR, whose QRA is Arles, Southern France, was a good signal at QSA5, R6.

It is significant that FM8CR was heard calling VE2IC, although no QSO was effected. Both OE1ER and OE1FH were heard to call G5OJ.

On June 6 the only DX heard was FM8BG, whose signals were QSA5, R5/7. This station was heard to QSO D4AAR and FF8MQ (Spanish Morocco) in quick succession, both of whom were inaudible here.

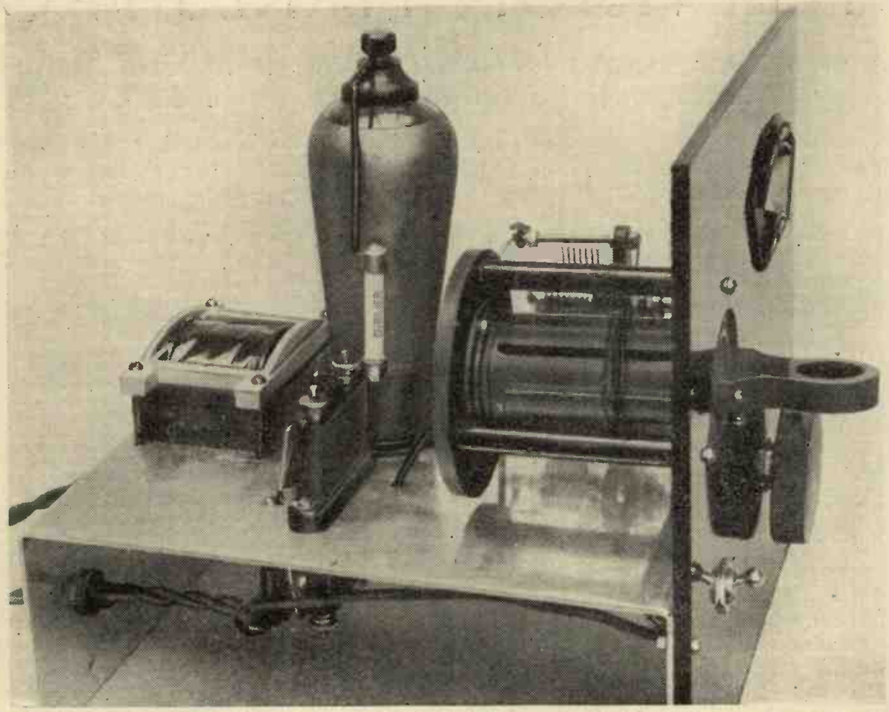
There was plenty of activity between 10.00 and 11.00 B.S.T. on June 8, and the following were heard: OE3WB, OK1AW, HB9B and HB9J, the two latter being particularly good. G6NF put excellent phone over to OK1AW on this date.

On the following morning conditions were poor. FM8CR was noticed using a new prefix—FA. Presumably this is to separate the Algerians from the rest of the "FM" stations in Morocco.

FM8CBO was heard calling G6RH at 11.45 B.S.T., and later, at 13.30, FA8BG was in contact with EI5F, whose first QSO it was on 10 meters.

It is learned from ZB1I, of Malta, that he is active on "Ten," and eagerly awaits his first QSO. On June 10, ZB1I heard EI5F and G6XS, of Bangor.

A frequency meter should be regarded as an essential part of every station. Too little attention is paid to the frequency measurement of amateur stations, at present due probably to the lack of suitable gear. This simple meter should solve the problem.



Mount the components carefully, for any movement may upset the calibration.

An Electron-coupled Frequency Meter

10—100 Metres

By E. N. Adcock (G2DV) and G. Brown (G5BJ)

A VERY useful and in fact almost essential piece of apparatus in the equipment of the serious short-wave listener's station is the frequency meter. Such a meter provides a means by which the receiver may be tuned to any predetermined wavelength, or by which the frequency of an unknown station that has been logged obtained—an important clue in discovering the identity of the station.

The cost of the construction of the apparatus is quite low, as it merely consists of an unmodulated oscillator having good frequency stability. However, not all oscillator circuits are suitable, some being extremely susceptible to slight changes in electrode potentials, exterior coupling, etc. The circuit decided upon as most suitable for the purpose is that of the deservedly popular electron-coupled oscillator, which has an extremely high degree of electrical stability. The circuit arrangement is depicted in Fig. 1.

In addition to electrical stability it is most important that the apparatus should possess good mechanical stability to preclude any possibility of the slightest movement of components and wiring, which would upset the calibration, and for this reason the design leans to a somewhat more rigid and stouter assembly than that usual in receiver construction.

The Layout

A glance at the photograph will give a good idea of the general layout. The front panel consists of a piece of $\frac{1}{4}$ in. ebonite measuring 8 ins. by 8 ins., while the chassis is a piece of $\frac{1}{8}$ in. aluminium 13 ins. by 8 ins. bent up to form a sub-chassis space of $2\frac{1}{2}$ ins. depth. It will be found convenient to mark out and drill the chassis for the mains transformer, valve-holder and disc drive before bending up. The disc drive control knob is located on the right-hand side of the front panel $2\frac{1}{4}$ ins. from the side and 2 ins. from the bottom edge, the remaining details for fixing being obtained from the instructions supplied with the disc drive. The 100-mmfd. microdenser is mounted directly on the drive, requiring no other form of support.

The unusual arrangement for coil mounting is so arranged to allow change from front of panel without exploring the internals of the apparatus. A five-pin chassis-type valve-holder is mounted on a $2\frac{3}{4}$ in. diameter ebonite disc, which is supported from the front panel by three $2\frac{3}{4}$ in. Eddystone eronoid pillars, the coil being inserted through a $1\frac{5}{8}$ in. diameter hole, concentric with the assembly, in the left-hand side of the front panel. An ebonite or metal handle is mounted on the top of the coil former for ease of handling. Another $2\frac{3}{4}$ in. eronoid pillar of $\frac{1}{4}$ in. diameter is mounted with a 6 B.A. bolt on the centre socket of the coil base, enabling the coil-holders to be slid down this and the pins guided to their sockets with the minimum of trouble. The only other front panel control is the on-off switch.

The other items mounted above the chassis are the valve, mains transformer, grid leak and condenser. Wiring between coil socket, condenser, and valve cathode must be as short as possible—any deviation from this will affect the coil ranges. Wiring is carried out with 16 s.w.g. wire to fix the

(*Continued on page* 432.)

BAIRD TELEVISION MAKES PROGRESS

Substance of a speech by Sir Harry Greer, at the Sixth Annual General Meeting of Baird Television Ltd., on June 20th, 1935.

At the Sixth Annual General Meeting of Baird Television Limited, Sir Harry Greer, the Chairman of the Company, gave an outline of the progress made during the past twelve months, and we take from it those portions dealing with technical development which are of particular interest to our readers.

AFTER dealing with the accounts of the company, the Chairman said: " I regret that it was not possible to fix on one single standard for the service. We can, if required, use 240, 400, or a greater number of lines, but we believe the public will not receive any better picture by using a larger number of lines, while the difficulties and expense of transmitting, manufacturing and receiving will be enormously increased, and delay caused.

Scanning Systems

" In dealing with standards, there is also the difference in the methods of scanning which have been adopted, that is, sequential (the orthodox scanning) and interlaced (the alternate-line system). This latter system was originally investigated and used by Mr. Baird in 1923, and has been used by him since. It is our considered view that while this method has some advantages, the present objections to it are greater, and we have adopted the sequential method as the best for practical purposes at the present time.

" We feel that we can speak of this matter from very great experience inasmuch as we have not only carried on research on television itself—that is, obtaining the picture, but on the means for transmitting this picture to the receiver, i.e., the radio transmitter, and on types of aerial, lines, and all necessary links in the chain.

" It was over a year ago when we showed a demonstration of high definition television—since when we have been in a position to supply a full service, but even now again we have to wait for the equipment of the Alexandra Palace, and this means still further delay. We do know what can be done from the Crystal Palace, and that the service from that tower can be received all over Greater London, covering a population of 10 millions, practically a quarter of the population of the United Kingdom, but exactly how the Alexandra Palace will compare, no one yet knows.

" Our laboratories at the Crystal Palace occupy a space of 60,000 sq. ft. and have the use of the towers which are ideal for transmitting television owing to their height of 700 ft. above sea level. This station comprises complete studios, the latest sound and lighting equipment, camera rooms, control rooms, high power ultra-short-wave radio transmitters for transmission of all types of scenes, with their accompanying sound, from close-ups to dramatic scenes, outdoor subjects, and also talking films.

" Since last February we have given no less than forty demonstrations of complete programmes, all of which have been successful, and these have been seen on Baird " Televisors " in various parts of London by over two thousand people. The Baird Company use many methods of scanning, that is, the picking up of scenes for transmission, and these are constantly being investigated by us in our laboratory. We have obtained most successful results with our spotlight scanners for transmission of close-ups of one or two persons. Our intermediate-film method not only enables us to transmit any scene that a cinematograph camera can take, whether indoor or outdoor, but it enables us to store up if required the film for further use.

The Electron Camera

" We also use an electron camera operating without any moving parts, and due to its great portability it should prove most useful for the transmission of news items and outdoor scenes. Film transmitters of new types have been developed which reproduce talking films with the utmost detail.

" We have pursued the development of the production of large screen pictures of high-definition television for cinemas. The results so far achieved are regarded by those who are expert in this form of entertainment as having good entertainment value, particularly in the presentation of news events.

" Important work is being carried on to extend the scope of television transmissions: firstly, by providing a practical method of supplying the central transmitter with scenes within its range, and, secondly, by means of *relay apparatus, increasing the range of the central transmitter* and supplying other broadcasting stations with the same programme.

" Twelve months ago we were attracted by certain of the developments announced by the Farnsworth Television Company of America, which, like Baird's, is a pioneer company, and in our opinion the foremost and leading exponent of television in the United States.

" After thorough investigation of their work, both in America and in this country, we entered into an agreement with them for the exploitation of their patents and technique in this country, and this agreement also covers the interchange of research, technique and manufacturing methods. This company had developed and was carrying out research upon the electron camera, which we considered to be much superior to the many other types of electric eye which have recently been described, and, in addition, amongst many interesting subjects they had developed an electron multiplier, a device similar to a wireless valve, but with greater performance and life. This has very great possibilities.

" These multipliers we are making and developing in our own laboratories, in conjunction with the Farnsworth Company. As an example of the importance of this, I may mention that one type of electron multiplier on which we have been working gives *an amplification of a million times,* a figure unheard of in connection with present-day valves, and we believe that it is possible that the electron multiplier in the future may take the place of the present-day valve and thus revolutionise the whole wireless, talking picture and television industry.

German Co-operation

" In Germany we still work in the closest co-operation with the Fernseh Company under an agreement whereby there is the fullest exchange of patents, research and technique. We believe that our association with this company in Germany and with the Farnsworth Company in America gives us immense possibilities and should assist us in maintaining a paramount position in the industry all over the world.

" We are now submitting tenders for a complete installation at the new B.B.C. station. These transmitters are being constructed completely by us in our own workshops.

" We are negotiating with the Radio Manufacturers' Association and others for *licences under which they will manufacture receiving sets under our patents and technique.*

" We have developed two types of television receiver, which will be marketed under our trade-mark, Baird " Televisors," and these are in a form ready for quantity production.

" We have carried out research and development work on cathode-ray tubes and believe we are making the best and *the largest cathode-ray tubes in the world.*

THE AMATEUR TELEVISION EXPERIMENTER

This article is another of the practical experimenter series which will cover all phases of experimental television. The information is based upon the actual experience of two well-known research workers.

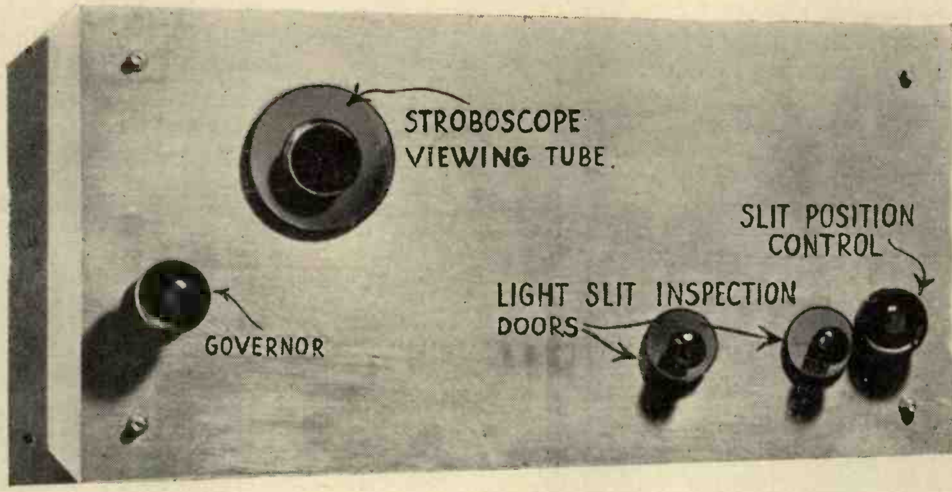


Fig. 1.—General view of 1 to 100 tone source. It is made for rack mounting.

PRODUCING 1 TO 100 CYCLES

IN this series in the April issue a tone source was described for producing from fifty cycles to a million and over. Now we will consider the generation of the lower frequencies which go to make up a television signal. For the benefit of new readers we will repeat that a strong low-frequency signal is generated by nearly all subjects being televised and that it is necessary for amplifiers to pass frequencies with little or no attenuation as low as 12½ cycles for present broadcast low-definition television, that is to say, repetition picture-speed, and if possible considerably lower. This is also true with regard to high-definition.

For the frequencies from about 50 cycles upwards the beat oscillator is very satisfactory, but, as already shown in the April issue, if such a circuit is to be used for producing the higher components of television signals it will not do for the lower, so the writers set about constructing apparatus completely different from the previous tone source.

At various times this journal has shown how different patterns or designs, if passed across a narrow illuminated area of light, the light reflected will vary in intensity as the pattern traverses the lighted area. Such, of course, is the system used in talkies for the reproduction of sound, while we are constantly reading of new apparatus for producing quite new types of musical sounds, where the patterns or wave forms are produced by the painter's hand. Such a device will now be described for the reproduction of 1 to 100 cycle sine-wave pulses.

Fig. 1 shows the completed apparatus, while Figs. 2 and 3, with cover removed, show the actual works. M is the driving motor, which in this case is of a 6-volt shunt wound type of about 24 watts, much more powerful than is really required. On one end of the spindle can be seen the conventional three-weight governor, G, as used in gramophone motors. This governor is mounted on an extension to the motor spindle.

It will be seen that the spindle passes through a rather loose fitting box arrangement with something like two funnels projecting from it. This housing encloses a wooden drum on which is attached a pattern for indicating the speed stroboscopically and is illuminated by a small neon lamp in the smaller of the two funnels, the larger being used for observing the pattern through. On the other end of the motor we see two more wooden drums D and D1, of which one rotates at the speed of the motor spindle, while the speed of the second and wider drum is reduced by a 4 to 1 gearing.

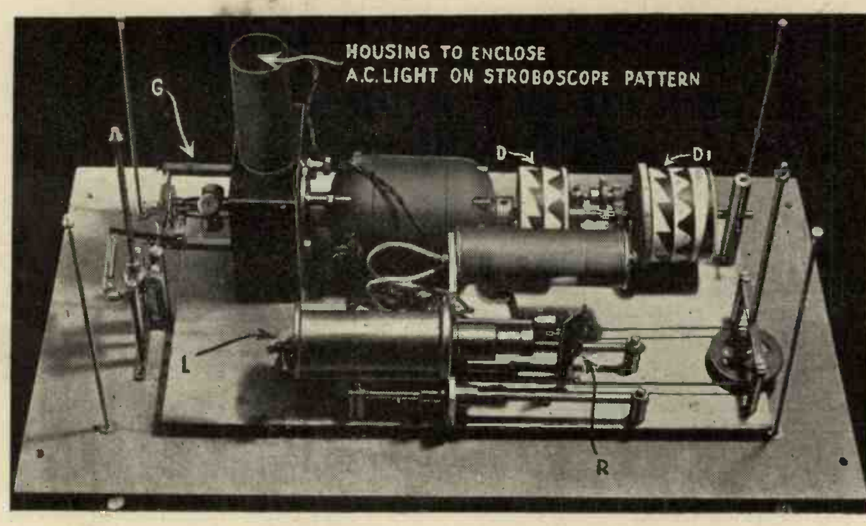
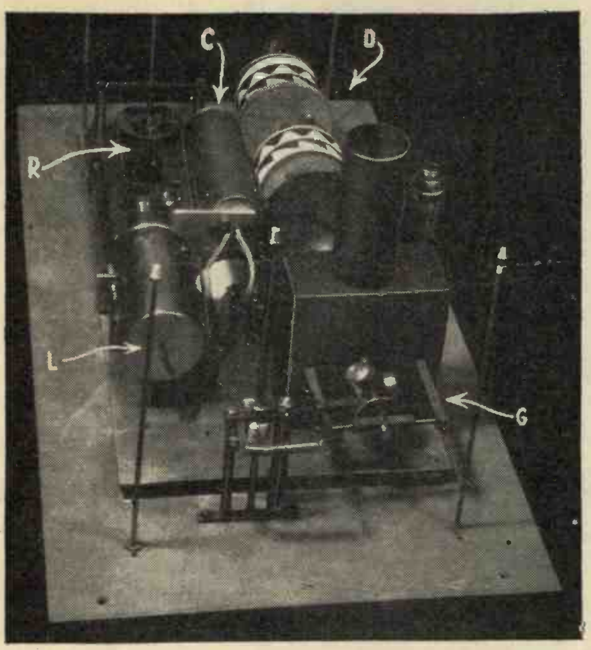


Fig. 2.—General view showing layout.

On the drums are patterns. Two are shown in Fig. 4. These patterns are of 10 and 1 sine-wave respectively. A third pattern was put on for a special purpose and will be mentioned later. L is a lantern which projects via the mirror R, a slit of light. Fig. 4A shows a close-up of the light falling across the pattern. The lantern is adjusted on runners so that the light slit may be adjusted to fall on each pattern as required. There is also another mirror, which can only just be seen in the pictures, which reflects, something like a periscope, the slit of light falling on the pattern so that its position (the slit of light) can be seen through the inspection doors, shown in Fig. 1. This mirror, of course, slides with the lantern.



Attached to the lantern is the container C, in which is enclosed a photo-cell, which is brought as near as possible to the illuminated area and, of course, travels along with the lantern. Such, in brief, is the apparatus.

Now let us examine certain sections more carefully. A battery-driven motor was chosen for constancy of speed, more especially as it was shunt wound and therefore easier to regulate the speed. A motor with extra long spindles is useful as it is always rather difficult to get extended bearings to run true. The construction of the fast and slow drums are best seen in Figs. 5 and 6, which show close-ups of the gearing system. These gears*, which are a 10-toothed driving a 40, which is locked to a 25 which drives another 25, the last two, of course, being necessary to bring the drums in line.

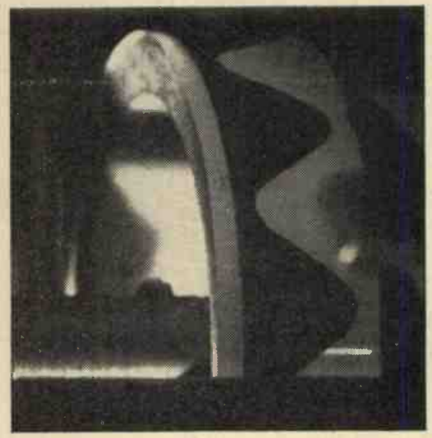


Fig. 3.—(Left) End view of tone source.

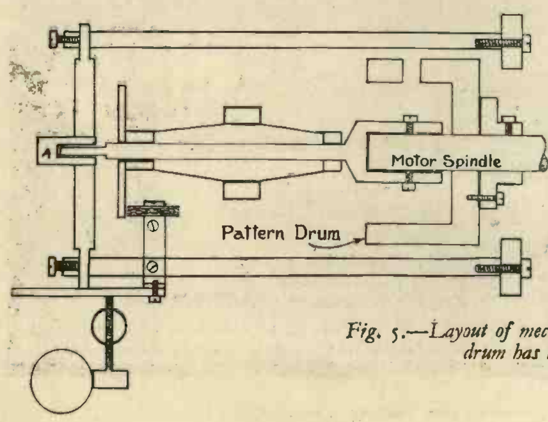
Fig. 4a.—(Right) In this photograph the slit of light can be clearly seen.

Fig. 4.—(Above) Pattern for drum.

The drums themselves were turned out of a hard wood, having first been mounted on their spindles, care being taken to make them the same diameter. At the other end of the motor spindle is the stroboscope pattern drum and the governor. It is hardly likely that one could obtain a motor with sufficient spindle-length to carry the governor and the spindle, therefore, will have to be lengthened. In Fig. 5 the principle employed in the apparatus is shown. It may be mentioned that this brass extension piece was first attached to the motor shaft, the whole then runs between centres, the brass part being turned to the necessary size. The arrangements of the brake on the governor are self-explanatory from the pictures.†

Next we come to the lantern shown sectionally in Fig. 7. The projection lens (Fig. 7) is achromatic of .7 in. focus. The slit measures .15 in. long by .01 in. wide. It was made by taking a strip of shim-

* Bought from Bond's of Euston Road, London.
† The worm and pinion were obtained from Meccano, Ltd.



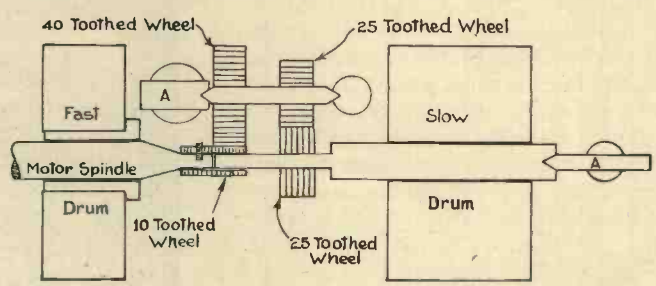


Fig. 5.—Layout of mechanical part. It should be noted that the spindle of the slow-speed drum has the 10-tooth wheel. Bearings AAA are adjustable.

stock AA brass .15 in. wide and .01 in. thick, which was placed in the centre of a brass washer WWW. The strip AA was held in position by two more pieces of shimstock, represented by dotted line, these, after

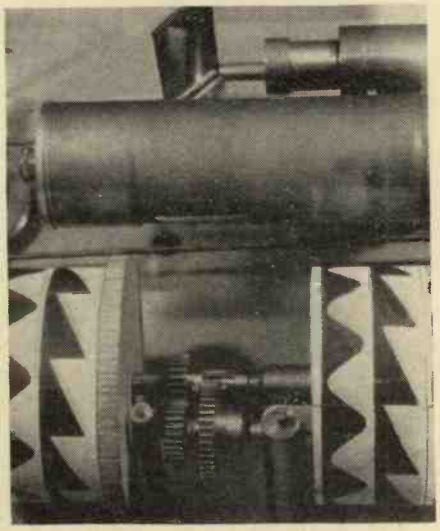


Fig.6.—Close up of gears and drums. This picture also shows the photo-cell housing and mirrors.

as a saw-toothed wave develops considerable harmonics.

Considering the patterns themselves, these are drawn on strips of paper, which are just a shade more than the circumference of the wooden drums. On these strips are painted two series of sine waves numbering ten and one for the slow drum, and one series only of ten for the fast moving one, the amplitude being so chosen as to be about 90 per cent. of the light slits length. The light slit in the writers' apparatus is 1.1 cm. long, the amplitude of pattern 1 cm. The drawing of these patterns calls for some careful work and though the ones on the drums were drawn into a space of 1 cm. by 14.3 cm., one cannot help feeling that drawn much larger and then reduced by photography, would be the best method. The saw-toothed pattern was put on for certain experiments for producing a slow-time base signal for cathode-ray work.

Next is our speed check, this is done as before stated, stroboscopically. The patterns are required to rotate from once to ten times per second to produce 1 to 100 cycles, such a range of speed being more than the motor will do running properly, so that the gearing was introduced, reducing the motor range to 4 to 12 r.p.s. To give all the speeds stroboscopically would,

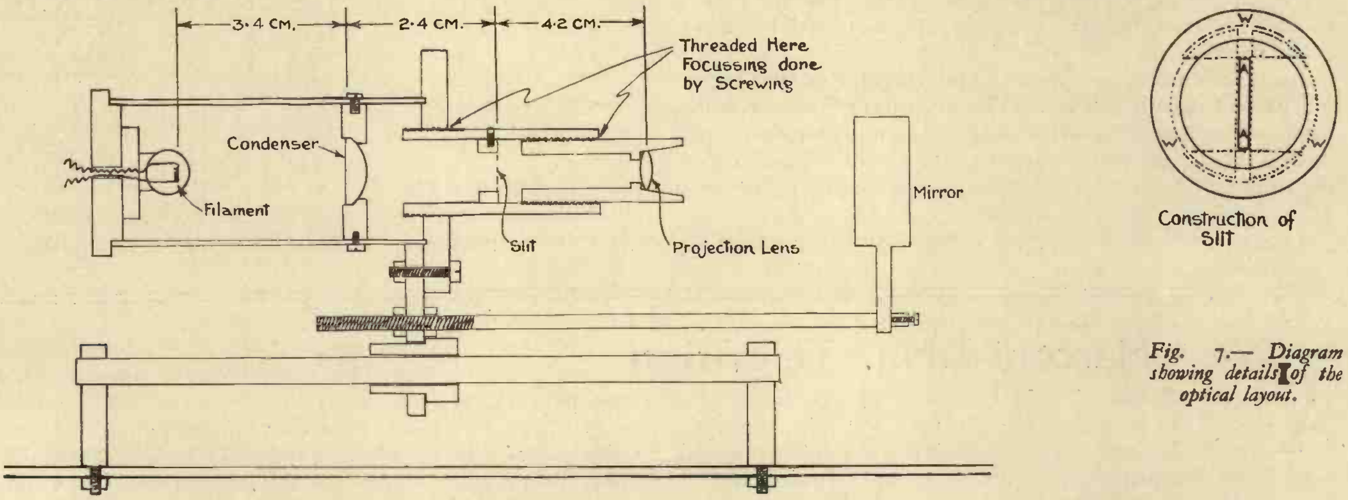


Fig. 7.— Diagram showing details of the optical layout.

being first clamped, were soldered into position, the process being repeated with two more pieces drawn as dash an dot, the AA piece then being removed.

It will be realised that the construction enables the slit to be moved relative to both the condenser and projector lenses, thus enabling focusing of the slit and adjustment of the slit to the best position with regard to the condenser. Also the slit can be revolved without altering the focus. The lantern runners and sliding arrangements are self-evident. Here it may be mentioned that experience has shown that a chain drive would be better than the belt as in the picture and the present belt and pulley has been changed to chain and sprocket wheels.

The photo-cell container is shown in Fig. 8. The photo-cell is one of the gas-filled Oxford type No. X.11, which is run only about 3 volts below its flash point, which in this case is permissible as the highest frequency is only a hundred. When the saw-tooth patterns are being used, however, it is advisable to reduce the cell voltage to about 10 volts below the flash volts

with one flashing light source, be almost impossible and the pattern shown through the pattern viewing tube in Fig. 9 is only capable of giving nine different speeds, which are given in the table along with the pulses developed. These patterns consist of so many equal black and white areas the number of which depends on

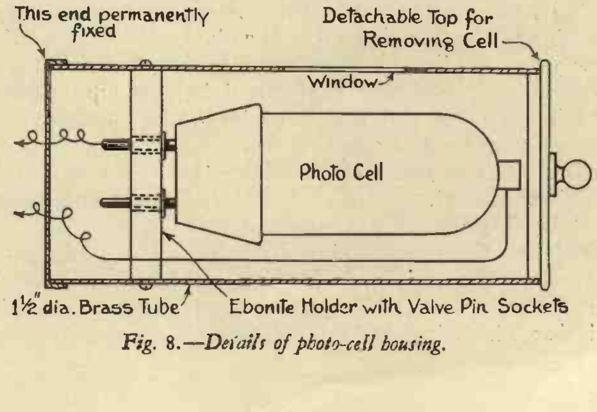


Fig. 8.—Details of photo-cell housing.

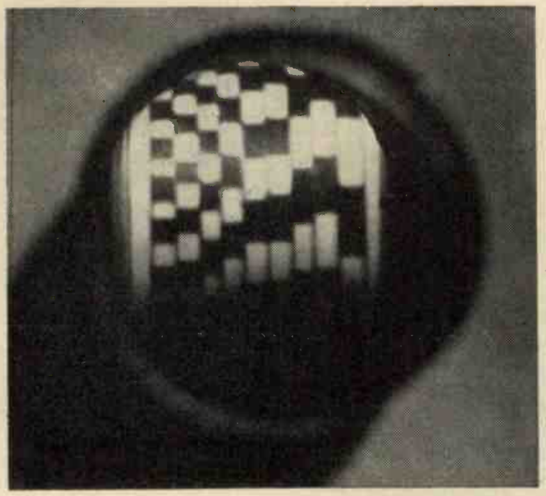


Fig. 9.—Photograph of stroboscopic pattern seen through tube when motor is not running.

the speed to be indicated and the flashing light source.

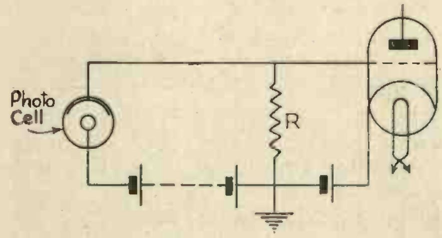
The speed of the motor is controlled by both the mechanical governor and two rheostats, one in the armature and the other in the field winding, and all three can be used with advantage. Designed for rack mounting, the rheostat controls are mounted on another panel.

No details are given as to amplifying the output signal, which is of low level. The keen experimenter will have considerable source of profitable experience in designing an amplifier to give, say, 1 volt output over the frequency range. The suggested coupling to the grid of the first valve is shown in Fig. 10.

To give any output signal valve is difficult as cells vary so, especially when run near flashpoint. The writers' apparatus develops about 10 milli-volts across 4 megohms for R8, Fig. 10.

This apparatus was primarily designed for producing

Fig. 10.—Circuit for coupling photo-cell to grid of first valve R, 1 to 10 megohms.



low-frequency sine-wave pulses for studying the phase distortion produced in television amplifiers and in conjunction with the other tone source described in this series will be referred to in a future issue.

TABLE OF SPEEDS AND FREQUENCIES PRODUCED.

Number of Strobo pattern.	Speed of motor.	Frequencies generated.		
		Fast drum. 10 wave pattern.	Slow Drum. 10 wave pattern.	Slow Drum. 1 wave pattern.
8	12.5	125	31.25	3.125
10	10.0	100	25.0	2.5
11	9.08	90.8	22.7	2.27
13	7.77	77.7	19.4	1.94
14	7.13	71.3	17.85	1.785
17	5.89	58.9	14.73	1.473
20	5.0	50.0	12.5	1.25
23	4.35	43.5	10.9	1.09
26	3.84	38.4	9.59	0.959

All above are in seconds. Stroboscope light from 50 A.C. mains.

Marconi-E.M.I. Television

A HIGH official of E.M.I. interviewed in connection with the announcement of the Television Advisory Committee made the following statement with regard to the Marconi-E.M.I. system:

"The principal objects in recent television development have been:—

1. To produce a picture of the highest definition possible.
2. To avoid flicker, which as everyone remembers was a very serious defect in cinematography years ago.

"In the system which the B.B.C. has been broadcasting for the last few years, 30-line pictures at 12½ per second were the best that could be obtained. This was only a preliminary step, and with the advent of high-definition television this service will be discontinued.

"In Germany a system has been inaugurated transmitting 180-line pictures at 25 pictures per second, but the report by the Television Commission wisely insisted on a minimum of 240 lines 25 pictures per second for this country.

"The research engineers of the Marconi-E.M.I. Television Company, Ltd., have for some months past been sending experimental broadcasts from Hayes to receiving stations in London using 405 lines, and have eliminated flicker by their method of "interlaced" scanning. The result of this development is:—

1. That with 405 lines the definition is adequate for all types of picture, either as seen at a cinema, or picked up from real life, and
2. Due to the method of interlaced scanning, the transmission is equivalent to 50 pictures per second, and therefore flicker, which is so fatiguing to the eye, is entirely absent.

"The receiver which will be required for these 405 lines interlaced pictures will not in any way be more costly or more complex than a receiver for the minimum number of lines and pictures recommended by the Commission.

"The cathode-ray scanner, or as we call it the "electric eye," which is a further development of the E.M.I. research laboratories at Hayes, is an instrument which enables the scenes and events to be picked up direct as they occur, in contradistinction to other systems in which it is necessary to photograph the subject before it can be televised. Owing to the absence of moving parts and its small size, the "electric eye" can easily be carried about for use out of doors for televising a football or cricket match, tennis at Wimbledon, the Boat Race, or the Derby, street processions, etc., etc.

"It can be used with equal facility in a studio or theatre, in fact, it can be employed for the broadcast of all current daily subjects which may be of interest to the public. Furthermore, the use of the electric eye is not restricted solely to the transmission of outside scenes and studio performances, as it can be used with equal efficiency for the transmission of cinematograph films."

THE A.B.C. OF THE CATHODE-RAY TUBE—IV

DEFLECTING THE CATHODE BEAM

By G. Parr.

THE use of a magnet for deflecting the beam in the cathode-ray tube, as mentioned last month, is not very practical, but is of use when we need to shift the beam about a little on the screen. For example, the beam might not travel up the tube and hit the centre of the screen right away. Various small imperfections in the mounting or position of the electrodes may combine to give it a position of rest at one side of the screen. In this case a tiny magnet could be fixed near the tube to give the beam a bias in one direction or the other and to restore it to the centre of the screen.

Moving the Beam Electrically

Like most correction devices, however, the magnet can be overdone. A strong magnet put very near the tube will bend the beam to such an extent that it will distort its travel altogether and spoil any subsequent movement, so this correction must be applied carefully—coaxing rather than coercion.

For a television image we shall have to move the beam all over the screen at a definite rate and according to a definite plan, and for this purpose it is best to use an electric field, or, more scientifically, an *electrostatic field*. You will see at once how an electric field can be made to produce a deflection of the beam, since we have been doing nothing else but guide the electrons with electrostatic fields since they left the cathode! So the last two items in the make-up of the complete electron tube are two flat plates which are mounted just above the second accelerating electrode, so that the beam passes between them on its way up the tube. " Last two items " in the sentence before should really be " last four items " because there are two pairs of these plates, but we can consider one pair first, They are seen in the photograph of Fig. 1 and are marked A_1, A_2, B_1 and B_2.

If we connect an H.T. battery between the plates A_1 and A_2, as in the sketch of Fig. 2, one plate will be positively charged with respect to the electron stream as it passes through the pair. It will therefore attract the electrons and they will deviate from their path over to the plate. The amount of deviation will of course depend on the " pull " of the plate, which will depend on the potential applied.

As the potential is increased the beam will move further and further over, in direct proportion to the value of the H.T. voltage. In fact the tube will be acting as a voltmeter, the beam of electrons acting as a pointer, and the fluorescent spot as the indicator.

The screen could be marked off in volts with a blue pencil, and the tube would always give the same reading provided that no alteration took place in the operating conditions. It does not make a very efficient voltmeter, however, as the sensitivity is not high. This is an important point, so we can spend a little time considering it. The *sensitivity* of the tube is the amount of movement of the beam in response to one volt of potential applied to the deflector plates. As a general rule this is about 0.5-1.0 mm., which is not a very big movement. It means that to move the beam across a screen 10 cms. diameter we should have to apply over 100 volts to the plate.

Sensitivity

We could, of course, increase the sensitivity of the tube by moving the deflecting plates nearer the beam, but the result would be that the beam would hit the edge of the plate when it swung right across the screen (Fig. 2b).

A better plan would be to make the beam itself longer, since it would obviously move farther over the screen if it were situated a greater distance away. But there are practical snags in this, not the least important being the unwieldy size of tube

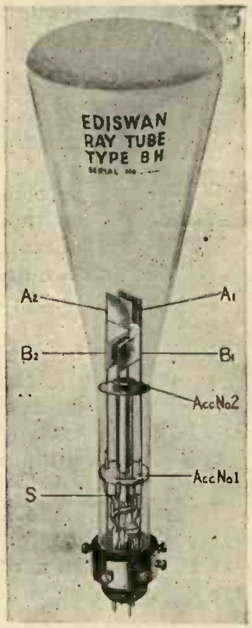


Fig. 1.—View of cathode-ray tube showing the plates for deflecting the beam. These are mounted above the accelerator A_2 shown.

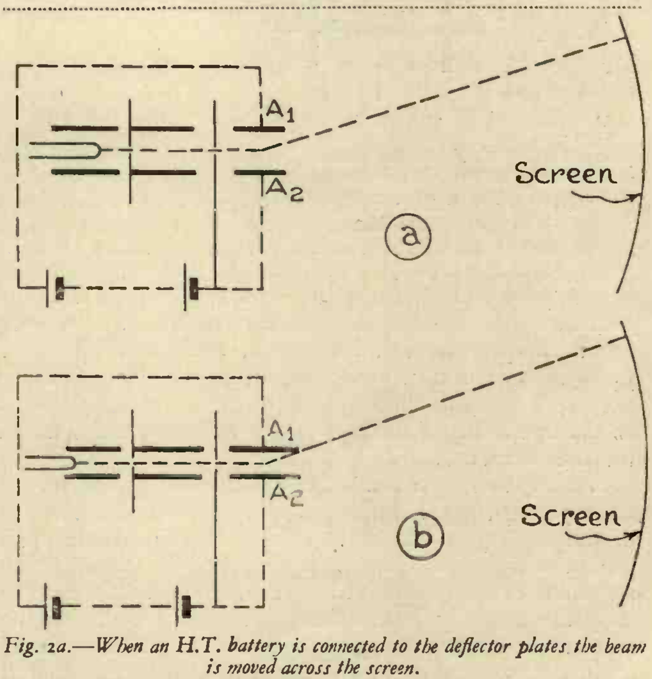


Fig. 2a.—When an H.T. battery is connected to the deflector plates the beam is moved across the screen.
Fig. 2b.—The movement of the beam could be made greater by putting the plates nearer to each other but then the beam would hit the edge.

which would be required. In practice the tube manufacturers compromise and arrange the size of tube and distance of electrodes to give a reasonable sensitivity of beam consistent with good intensity of spot on the screen. A last point is this—the sensitivity is affected principally by the accelerating potential used.

The higher the acceleration given to the electrons the less sensitive they are to deflecting impulses. The beam, as it were, becomes less supple as it travels faster, and requires a stronger force to move it out

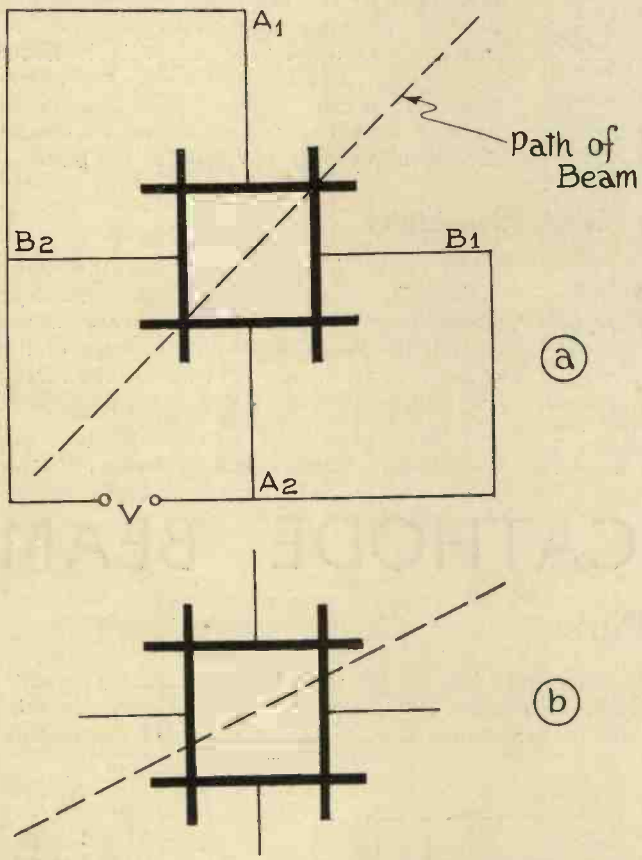


Fig. 3a.—This shows the end of the tube with the four plates as they would be seen through the fluorescent screen. A voltage V applied to the plates simultaneously will deflect the beam at an angle similar to the dotted line

Fig. 3b.—If one potential is smaller than the other the angle of movement of the beam will be less.

of its path. And since the intensity of the spot is greatest with a high accelerating voltage we have to again compromise in adjusting the tube conditions for good illumination, which shall leave the beam reasonably sensitive to deflection. However, all that belongs to the operating of the tube and that is not our concern for the moment.

Having deflected the beam to one side of the screen by applying the H.T. battery, if we reverse the polarity of the battery to make the other deflecting plate positive, the beam will move in the opposite direction to an equal extent. And if we reverse the battery regularly the beam will be swinging to and fro across the screen like a pendulum. If the reversals become more rapid the path taken by the beam will no longer appear to be made up of discontinuous dots but will appear as a thin fluorescent line, owing to the persistence of vision effect which was mentioned last month.

Reversal of Travel

There is an easy way of providing rapid reversals of polarity, and that is to connect the plates, not to a battery and switch, but to alternating current mains. These will give an automatic reversal every 1/100th second, and as a result the beam will swing to and fro so rapidly that we shall see a sharp line which does not appear to be made up of any movement at all. We need have no fear that the reversals will occur too fast for the beam to follow—if a moving-coil meter is connected to A.C. mains the pointer does not move because its weight is such that it cannot swing across the scale 50 times a second. But our pointer, being an electron beam, is to all intents and purposes weightless. This is one of the great advantages of the cathode-ray tube in radio research—the movement of the beam can be made to follow the most rapid variations in potential which would be quite outside the range of ordinary vibrating mechanisms. And there is another important point—it requires no power to move it in the accepted sense.

To move the pointer of an indicating instrument we have to expend energy—so many milliamperes at so many volts. For deflecting the electron beam the application of potential is sufficient. If the potential applied to the plates is too high no damage will be done, since the beam will simply swing right off the screen, or hit the plates—another useful advantage of the tube: it can't be overloaded like a meter!

But don't think because of this that the tube is indestructible or everlasting! Unfortunately for the user it isn't, but it has a reasonable life and if it is used carefully you will have forgotten the day it was bought when it comes to the end of its emission. Tubes can either die of old age or come to a violent end, and the latter is almost always caused by a wrong connection in the circuit or by mishandling. Don't forget that there are 2,000 of the best volts on one part of the tube and if they get to the wrong part it spells the finish of the emitting portion. However, we were talking about deflector plates.

Producing the Scanning Lines

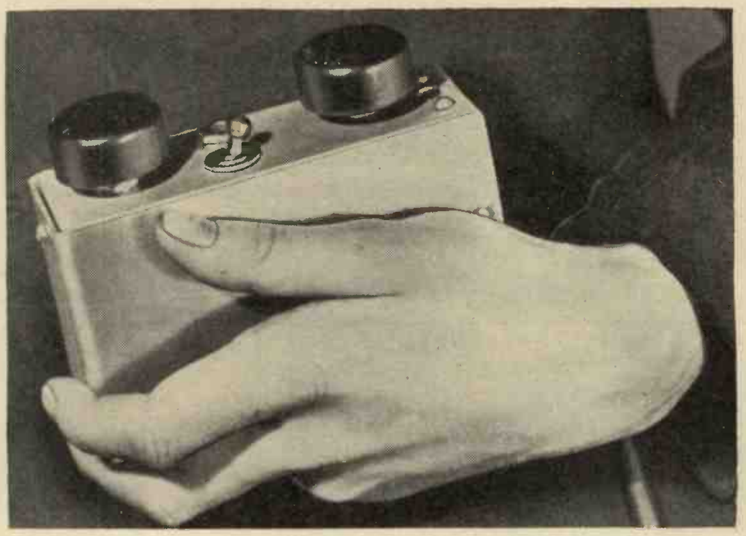
We have got a line on the end of the screen, and this is the first step towards television reception. We have drawn a luminous line which is exactly the same in appearance as the line of light obtained when a holed disc is moved slowly past a ground glass screen. And to complete the similarity we have to draw a whole series of luminous lines across the screen, each one spaced a little way apart from the next, until we have drawn the requisite number (30 for low definition and 240 or even 405 for high definition). This is where the second pair of plates comes in. You will remember that they are mounted a little higher up the tube than the first pair (Fig. 1 again) and note that they are *at right angles* to the original pair.

This means that if the first pair deflect the beam in the horizontal plane the second pair will act on it in a plane at right angles to this and will move it vertically.

(*Continued on page* 432)

A MINIATURE SHORT-WAVE RECEIVER

We believe this to be the smallest midget receiver for ultra short wave working yet published in this country.



This photograph by comparison with the hand will give an idea of the extremely small size of the receiver,

It has been designed by a well-known amateur transmitter and we can assure readers that it will give excellent results.

A Pocket 5-metre One-valver

By L. Pugh (2 BNR)

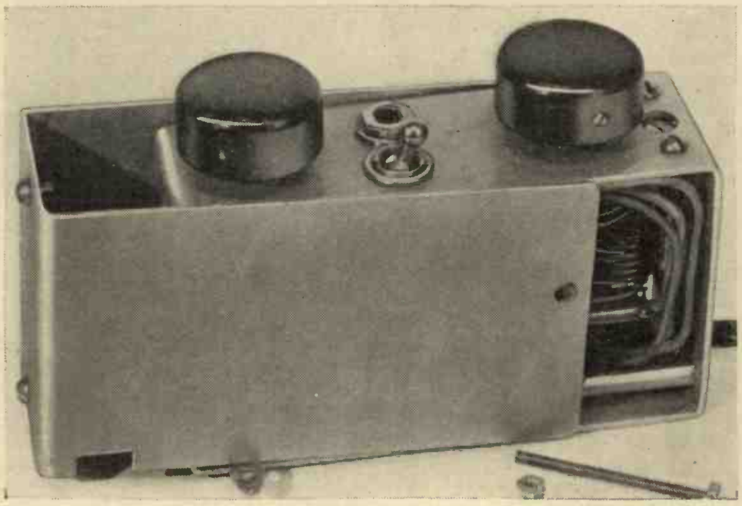
CONSTRUCTING a five-metre receiver does for some reason or other convey the impression of great skill to the average short-wave listener. The apparent lack of programmes is another reason for these receivers not being as popular as they should. We are doing our best to eliminate both of these false impressions for we realise that during the summer months the five-metre band can be particularly interesting.

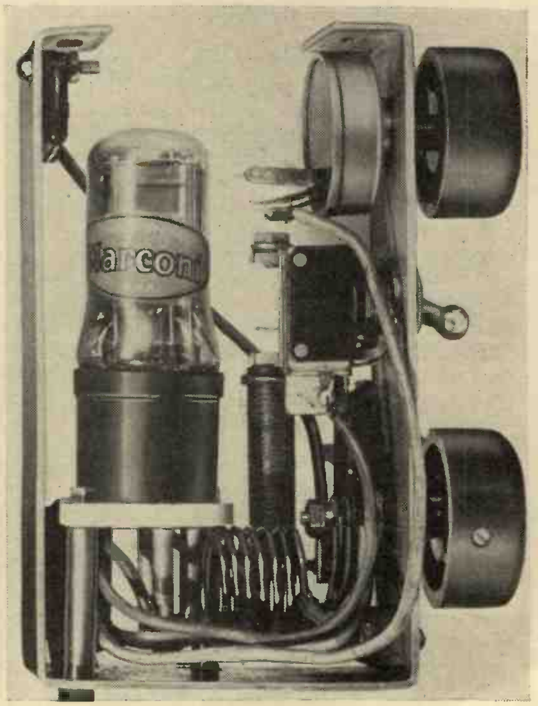
Several well-known amateurs have discarded practically all active work on the higher wavebands in favour of tests on five metres, so at the moment listening stations have an unprecedented number of transmissions on which to report. It is the general impression that five-metre transmissions are restricted to a nominal range of 30/40 miles, but we hear well-founded rumours that official bodies are sending out regular transmissions over distances up to 200 miles, while we should not be in the least surprised to hear of an experimental transmission getting across the Atlantic if conditions are at all favourable.

The receiver we are going to describe is one that will interest all grades of ultra-short-wave fans, and the beginner in particular. It is very cheap to build and owing to the simplicity of the circuit we cannot see any reason for readers not to obtain 100 per cent. results from the very beginning.

Most of the components are of a stan-

The photograph below shows clearly how the aluminium case is assembled, whilst that on the right shows the complete receiver with the sides of the case removed; note that one part of the case forms the chassis.





COMPONENTS REQUIRED

CHASSIS
1—Aluminium to specification (Peto-Scott).

CONDENSERS, FIXED
1—.00004 type M (T.C.C.).
1—.00025 type tubular (T.C.C.)
1—.006 type tubular (T.C.C.).

CONDENSERS, VARIABLE.
1—15-mfd. home constructed.

COIL
1—5-metre home constructed.

HOLDERS, VALVE
1—type SW41 (Bulgin).

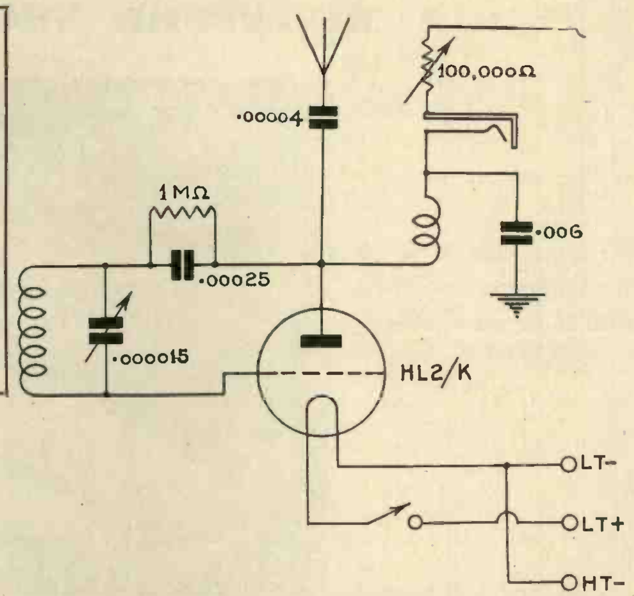
PLUGS, TERMINALS.
1—4-way cable complete with 2 terminals marked H.T. pos., H.T. neg. (Bulgin).
2—spade terminals marked L.T. pos., L.T. neg. (Bulgin).

RESISTANCE, FIXED
1—1-megohm ½-watt type (Erie).

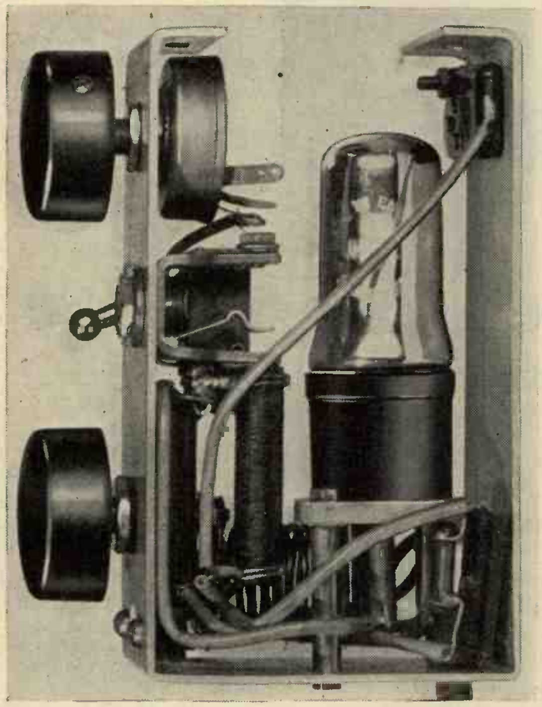
SUNDRIES
1 length of 2 B.A. screw brass rod 2½ inches long (Peto-Scott).
Quantity 4 B.A. nuts and bolts (Peto-Scott).

SWITCHES
1—S81 T (Bulgin).
1—type J3 Jack (Bulgin).

VALVE
1—HL2/K (Marconi).



No quench coils are used in this receiver consequently the background noise level is low.



It is essential that a Catkin valve be used, the reason can be seen from this illustration of the component layout.

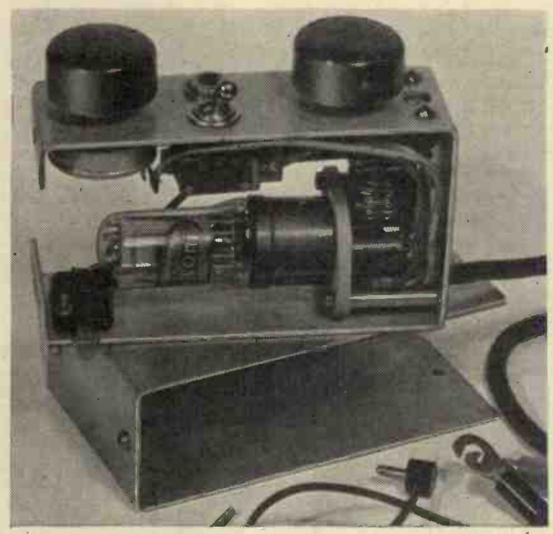
dard type while some of them can be home-built if need be. The circuit is a very unusual one, being a single valve super-regenerative, regeneration being obtained by the combination of coupling condenser and resistance which is connected virtually in series between grid and anode. This method, while perhaps not being as efficient as the normal quench coil arrangements, gives very satisfactory results with the minimum of bockground noise.

The chassis on which the receiver is mounted is 4½ inches high and 2¾ inches wide. Actually it is made out of a piece of aluminium 12¾ inches long and approximately 14 gauge. This is then built up into the shape shown in the illustration. The valve holder, of Seramic construction, is quite small, and is mounted on two brass pillars one inch high. In the centre of one side of the chasis are mounted a simple toggle on-off switch and the phone jack. Above these two components is a 100,000-ohm variable resistance and below a 15 m.mfd. condenser. For an H.F. choke use the midget Eddystone, or if you prefer to make it wind 30 turns of 30 gauge wire on a ⅜ in. ebonite former and construct it so that the turns cover 1½ inches. For the tuning coil, notice there is only one, so reducing any possible complications, wind on 7 turns half-inch diameter of 20 gauge enamel-covered wire. These 7 turns take up the winding space of ¾ inch.

It is essential to use the proper valve. The Marconi HL2K has been used with great success and in addition to being entirely efficient and completely free from microphony, it is very compact, being only a little over 2½ inches in height.

It can be seen from the illustrations that the case slides over the receiver, but make sure to cut out a little slot in one side so as to allow the tag end of a .00004 condenser to stick out about half an inch. On to this tag is connected the aerial.

The whole receiver can be run from a 36-volt dry battery of midget construction, while a single ear-piece is usually sufficient. It is possible to walk around with the battery supply in one pocket and the receiver in the other, simply using an aerial 4 ft. 3 ins. long trailing out behind. While we do not advise readers to construct this receiver for permanent use, it is ideal for field days, testing transmitters and for general portable work where there are a number of five-metre stations on the air. Although it is a midget it is by no means a toy and we feel confident that many readers other than beginners will construct it.



The 100,000 ohm variable resistance must have an isolated spindle.

RECENT TELEVISION DEVELOPMENTS

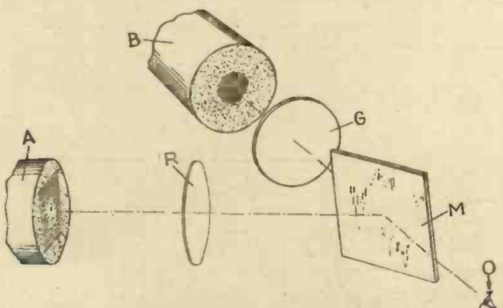
A RECORD OF PATENTS AND PROGRESS
Specially Compiled for this Journal

PATENTEES :—*The British Thomson-Houston Co., Ltd., ; Marconi's Wireless Telegraph Co., Ltd. ; Electrical and Musical Industries, Ltd., and W. F. Tedham ; Fernseh Co. ; A. G. West and Baird Television, Ltd. ; Radio Akt. D. S. Loewe and K. Schlesinger.*

Television in Colours
(Patent No. 424,743.)

Coloured effects are reproduced by superposing two independent pictures, one from a cathode-ray tube A which receives the result of a scanning made through a "red" filter at the transmitting end, and the other from a cathode-ray tube B which gives the result of an interleaved scanning made through a " green " filter. If now the two reproductions are viewed simultaneously through the red and green filters marked R G, the picture will appear in its natural hues.

The pictures are merged by using a partially-silvered mirror M, which allows the rays of light from both to pass through to the eyes of an observer at O. Instead of using the colour-filters R, G, the viewing screens of the two tubes may be made of materials which naturally produce a red and a green fluorescence.

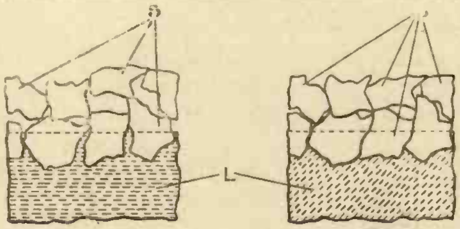


Method of producing television picture in colours. Patent No. 424,743.

The bias on the scanning electrodes of the tubes A, B, is so adjusted that both pictures are produced by interleaved scanning from the same saw-toothed voltage, one picture being controlled by the upper half of the wave, and the other by the lower half.—(*The British Thomson-Houston Co., Ltd.*)

Fluorescent Screens
(Patent No. 424,893.)

The backing plate of a fluorescent screen suitable for a cathode-ray tube consists of beryllium glass having a melting point in the neighbourhood of 900° C. Powdered crystals of zinc sulphide are carefully sifted over the hot surface of the glass, so as to form a uniform layer, say, two or three grains deep, as shown in Fig. A, where L is the backing plate and S the zinc-sulphide crystals, shown greatly enlarged.



Method of making fluorescent screens. Patent No. 424,893.

The lowermost crystals, it will be seen, have sunk to some extent in the semi-molten glass. The whole is then allowed to cool, so that a certain amount of contraction occurs. This results in the lower crystals closing-in upon the upper layer and holding them firmly in position. The final or cooled condition is indicated in Fig. B, and illustrates how the crystals are jammed together and held firmly in position.—(*Marconi's Wireless Telegraph Co., Ltd.*)

Cathode-ray Tubes
(Patent No. 425,234.)

One of the difficulties in the manufacture of cathode-ray tubes is the correct alignment of the cathodes inside the neck of the bulb. According to the invention this problem is solved by first mounting the electrodes, as a sliding fit, inside a special glass cylinder, which is then inserted and sealed in position in the neck of the tube. Accurate alignment of the various parts is ensured by their firm contact with the straight walls of the glass cylinder.—(*Electric and Musical Industries, Ltd.*, and *W. F. Tedham.*)

Cathode-ray Scanning
(Patent No. 425,267.)

In the ordinary way the electron stream is subjected to intensity modulation (to vary the brightness of its impact on the fluorescent screen) before it passes between the deflecting or scanning electrodes. This method has, however, certain disadvantages, and it is now proposed to modulate the stream at a point close to the fluorescent screen, i.e., after it has passed through the scanning electrodes. This is done by controlling not the velocity of the stream as a whole, but the number of the electrons which are allowed to impinge on any given spot on the fluorescent screen.

The screen is specially constructed so that, instead of being completely fluorescent, alternate strips are made of a non-luminescent material. The cathode-ray stream is first so concentrated that it occupies only half the normal width of a scanning-line. The incoming signals are then used to deflect more or less of the stream on to a fluorescent strip so as to vary the picture brightness. Meanwhile the remaining part of the stream falls on to a " dead " strip, where it produces no response. Incidentally the method allows lower control voltages to be used.—(*Fernseh Co.*)

Scanning Discs
(Patent No. 425,615.)

A known way of forming the apertures in high-definition scanning-discs is first to punch-out holes of comparatively large size, and then to cover them with small diaphragms of much thinner material in which very small apertures have been carefully prepared with specially clear-cut edges.

This method is now replaced by a photographic process, in which a disc of translucent material is coated with a sensitised emulsion composed of grains which are smaller in size than the area of the required apertures. An optical image of an illuminated aperture is then cast upon the disc by

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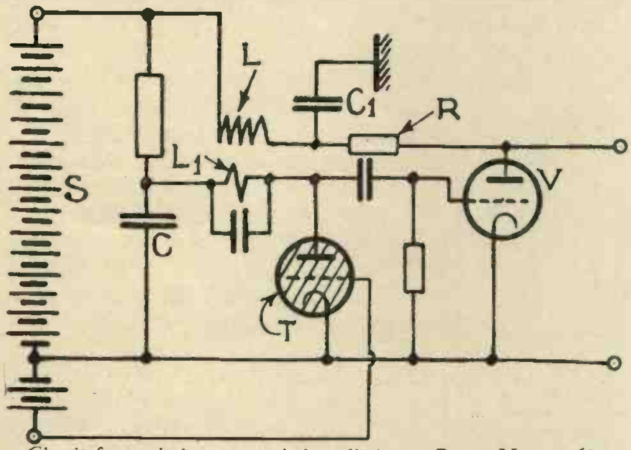
intermittent light, the source being shifted automatically so as to produce the required spiral series. Or a reduced image of a large-scale drawing of the apertures may be used for projection.

If the time of exposure is made short, the areas affected on the disc will be sufficiently well defined to allow the aperture " images " to be developed in clear-cut form.—(*A. G. D. West* and *Baird Television, Ltd.*)



Circuit for producing saw-toothed oscillations. Patent No. 425,685.

Saw-Toothed Oscillators

(Patent No. 425,685.)

When using a gas-filled discharge tube to produce saw-toothed voltages for scanning, the first part of the " flyback " or quick return stroke is usually so rapid that it is not seen on the viewing screen. During the latter part of its stroke, however, the spot moves more slowly, and may become visible and so tend to blurr the picture.

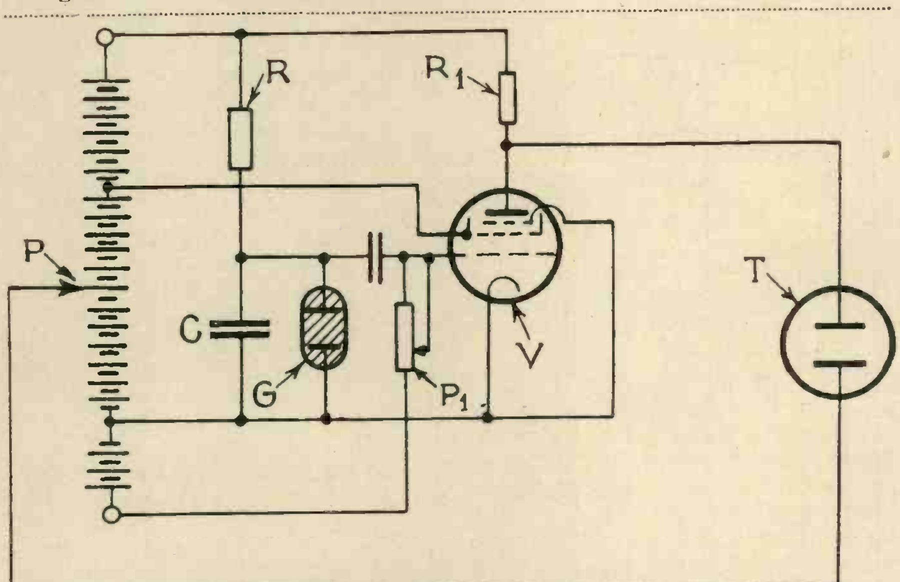
In order to prevent this, a counter potential is applied to the discharge tube, which is at least as great as the voltage on the condensers at the critical moment. As shown in the figure, the discharge tube T is shunted by the usual condenser C, and is charged from a source S to produce the required oscillations. The anode circuit of an auxiliary amplifier V is connected across the source S and includes the primary coil L of a step-down transformer, the secondary L1 of which is inserted in series with the anode of the discharge tube. A retarding network R, C1 produces a delay which corresponds to the high-speed part of the return stroke. At the expiry of this period, the coil L induces in the coil L1 a potential which is sufficient to quench the tube T immediately, and so throw the spot off the picture.—(*Radio Akt. D. S. Loewe* and *K. Schlesinger.*)

Regulating Scanning-voltages

(Patent No. 425,686.)

The saw-toothed voltages used for scanning should be strictly linear, a deviation of 5 per cent. from the straight being the maximum permissible to ensure good reproduction. For instance, the ordinary method of charging-up a condenser from a battery through a resistance gives an exponential voltage curve, which usually fails to comply with this standard.

According to the invention the charging-curve is " corrected " to a strictly linear form by means of a pentode valve having a characteristic of opposite curvature. Referring to the figure, as the voltage applied to the condenser C increases, the grid-bias on the pentode V also rises, and the resulting change in the anode current, flowing through the resistance R1, ensures that the effective scanning potential applied to the electrodes of the cathode-ray tube T follows a straight-line law.



Circuit for regulating scanning voltages. Patent No. 425,686.

A further advantage of the arrangement is that the gas-filled discharge tube G is operated under a comparatively small load, and therefore has a longer life. The tapping P regulates the position, and the tapping P1 the size of the picture on the fluorescent screen.—(*Radio Akt. D. S. Loewe* and *K. Schlesinger.*)

Summary of Other Television Patents

(Patent No. 424,763.)

Scanning system involving the use of two synchronous and transversely-moving bands.—(*H. Knudsen.*)

(Patent No. 424,895.)

Improvements in gas-filled lamps suitable for television.—(*P. Freedman.*)

(Patent No. 425,035.)

Saw-toothed generator consisting of a thermionic valve with a cathode and at least three other electrodes, two of which are back-coupled to produce oscillations.—(*Electric and Musical Industries, Ltd.*, and *E. Condliffe.*)

(Patent No. 425,177.)

Method of maintaining the correct level of absolute brightness throughout the period of transmission.—(*Electric and Musical Industries, Ltd., C. O. Browne* and *J. Hardwick.*)

(Patent No. 425,205.)

Synchronous motor with a laminated magnetic circuit for a television receiver.—(*H. A. Richardson.*)

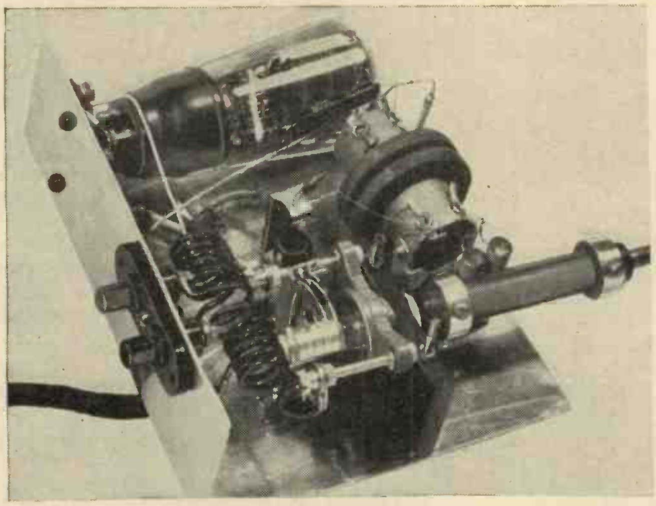
(Patent No. 425,660.)

Television transmitter using a moving-spot scanner and radiations, which may lie outside the visible spectrum.—(*H. A. Richardson.*)

A Standard One-valve 5-metre Receiver

For the benefit of those who are not partial to midget short-wave receivers, here are some brief details of a simple receiver used by G5UK. The designer of this receiver is well known as the C.R. for Essex and is a well-known high-frequency experimenter.

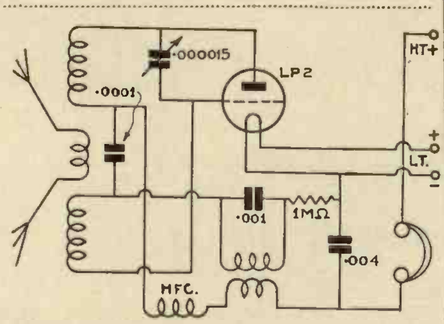
PROBABLY as a number of readers are not blessed with endless patience and in any case do not like the idea of midget receivers—there is still a distinct prejudice against compact sets—we are publishing these details of a one-valve super-regenerative receiver for five metres in addition to the midget one-valver described elsewhere in the issue. This receiver is a conventional super regenerative but uses one valve only to combine the functions of detection and super-regeneration.



The circuit is conventional, but an LP2 valve must be used. Notice how the aerial coil is mounted between the two other coils.

Commercially-wound quench coils are used, overcoming rather a nasty job without putting up the expense to any appreciable extent. In fact all of the components with the exception of the tuning coils are of commercial design. This will probably appeal to a number of readers. By reference to the circuit it can be seen that the anode of the valve feeds into one side of a five-metre coil, the other side of which goes directly to H.T. through a small H.F. choke and the primary of the quench coil. The second coil is connected to L.T. negative through the secondary of the quench coil and also to the anode coil through a .0001 condenser. These two coils have their extreme ends connected across a 15 mmfd. Eddystone type 900 tuning condenser. This keeps both coils anchored, but the gap between the inners should be ¾ in. into which space should be connected a three-turn aerial coupling coil.

Notice from the illustration how a double socket is mounted through the side of the chassis in such a way that the connections from the coupling coil are kept very short. The three coils in the receiver are wound with 18 gauge enamel wire in the following way. Anode coil five turns half inch diameter wound to cover ¾ inch. The grid coil is also five turns wound to cover half an inch. The aerial coupling coil is two turns with ¼-inch gap between turns. The five-metre choke is a standard Eddystone component, but a satisfactory substitute can be constructed from a small ebonite former 10 mm. in diameter and 30 mm. long wound with



None of the components is cramped for space even though the receiver is compact.

30 turns of 26 gauge wire. Space the turns to fill the former.

One component that will have to be made is the mounting bracket for the variable condenser. This consists of a strip of ebonite 2½ inches wide by 1½ inches high, bolted to the base plate.

During our tests we noticed that a suitable valve was the Osram LP2, so we advise readers to use this valve in preference to all others. It appears to be highly satisfactory in this particular circuit. Notice that high-tension is applied to the phone jack, and as the aluminium chassis is at earth potential the jack must be completely insulated. A pair of Bulgin spacing washers are ideal for this purpose.

Finally, the whole receiver is completely encased with an aluminium cover so that it is only 2¼ inches in depth, approximately 5¼ inches in height and 6 inches in width. We have left off the cover so that readers can see quite clearly the method of construction. We feel that, being as it is of more open construction than the midget, it will have a wider appeal, particularly as it can be carried very easily.

Components Required

CHASSIS
1—Peto-Scott to specification.

CHOKE H.F.
1—5-metre (Eddystone or home-constructed).

COILS
1—set five-metre (Eddystone or home-constructed).
1—Quench coil (Eddystone).

CONDENSERS, FIXED
1—.004-type tubular (T.C.C.).
1—.001 ,, ,, ,,
1—.0001 ,, ,, ,,

CONDENSERS, VARIABLE
1—.000015 type 900 (Eddystone).

DIAL
—straight three-inch (J.B.).

HOLDER, VALVE
1—four-pin baseboard type (W.B.).

PLUGS, TERMINALS, ETC.
2 wander plugs marked H.T. pos., H.T. neg. (Clix).
2—spade terminals marked L.T. pos , L.T. neg. (Clix).
1—J 3 Jack (Bulgin).

RESISTANCE, FIXED
1—1-megohm type 1-watt (Erie)

SUNDRIES
1—Ebonite strip to specification.
1—Packet spacing washers (Bulgin).
1—3-inch extension rod (Eddystone).
Quantity 4 B.A. nuts and bolts.
Connecting wire and sleeving.
1—three-way connecting cable (Bulgin).

VALVE
1—LP2 (Osram).
Complete kit of parts can be obtained from Peto-Scott, Ltd.

Directional Aerials for Transmission

By L. Wildman, A.M.I.R.E.—G2W1.

ALTHOUGH directional transmission is extensively used commercially, it has rather been neglected by the amateur, due, probably, to space limitation and a general desire for omni-directional radiation. With the growing interest in ultra-short wave work, the use of a directional aerial system opens up a new field for experiment, and as the general principles of design hold good for all bands a review of the action of a short-wave aerial and its application to directional effect may prove interesting and helpful to the amateur.

Generally, the intensity of radiation from a transmitting aerial may be better appreciated by the use of polar diagrams. For the sake of explanation, first consider the intensity of radiation curve for an aerial excited at its fundamental frequency, a $\frac{1}{2}$-wave Hertz aerial, suspended in space. Theoretically, the polar diagram of such an aerial appears as in Fig. 1(a). The intensity of radiation in line with the aerial AB is zero, growing to maximum at right angles. It must be understood that this is a purely theoretical representation of the intensity of radiation at any vertical angle of a $\frac{1}{2}$-wave aerial, suspended so that it is entirely unaffected by outside sources. In actual practice, however, the shape of the curve depends upon such factors as the proximity of the aerial to earth, conductivity of the earth, reflection and distortion of the waves due to aerial masts, guys, buildings, and so on. Leaving the latter consideration out of the question and assuming the conductivity of the earth to be perfect or at least uniform over the path of travel, it will be seen from Fig. 2 that the effect of increasing the height of the aerial above the surface of the earth splits up the radiation into beams at various and definite angles, the number of beams increasing and becoming narrower as the height is increased until, theoretically speaking, we arrive at the polar curve shown in Fig. 1(a).

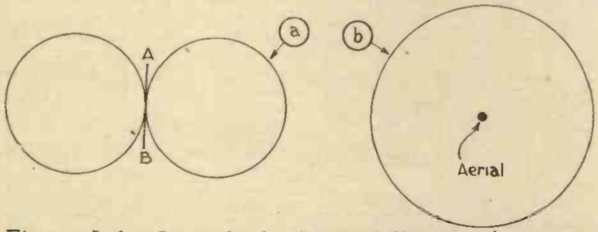


Fig. 1.—Left. Vertical polar diagram half wavelength aerial in space. Right. Horizontal Polar diagram half wavelength aerial.

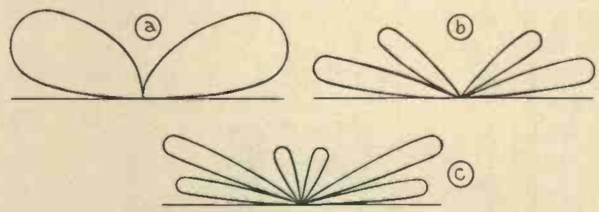


Fig. 2.—Left. Vertical half-wave aerial at ground level. Centre. Vertical half-wavelength aerial, centre full wavelength above ground level. Right. Vertical half wavelength aerial, with centre half wavelength above ground.

Reverting back to Fig. 1, it will be understood that if we look down on to the vertical aerial wire AB we should find a horizontal radiation curve in the form of a circle with the aerial as its centre, Fig. 1(b). The aerial is thus omni-directional along the horizontal plane. In order to effect directional transmission, some means of distorting this horizontal radiation curve from a circle into some definite direction must be found. This is accomplished by utilising a second aerial, similar to the first, and separated from it at a distance of $\frac{1}{2}$ wavelength, both aerials being excited at their fundamental frequency with their respective current distribution in phase. Here we have the simplest form of spaced aerial directive array, and as more ambitious arrays are an elaboration of this method it is desirable to thoroughly understand its operation.

In Fig. 3(a), assume that points A and B are vertical $\frac{1}{2}$-wave aerials at a distance of $\frac{1}{2}$ wavelength from each other, both excited at their fundamental and in phase. At point C the effect produced by radiation will be the sum of the effects produced by each aerial separately, due to the fact that the currents in the aerials are in phase at any point equidistant from each aerial.

The aerials being exactly $\frac{1}{2}$ wavelength apart, waves from each arriving at any point along the line ABE will be out of phase and cancel each other at any moment of time. Briefly, waves from aerials A and B combine at point C and oppose and cancel each other at point E. At point D the intensity of radiation will be the resultant of these two conditions. In view of the above, the horizontal diagram for this simple array would appear as in Fig. 3(b). If both aerials are excited so their respective current distribution is out of phase, the diagram would then be modified to that shown in Fig. 3(c).

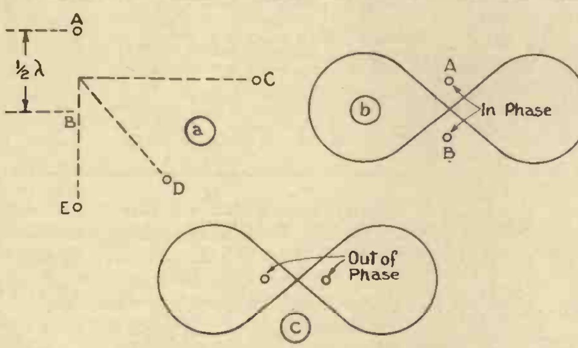


Fig. 3.—Horizontal curve showing simple directional array.

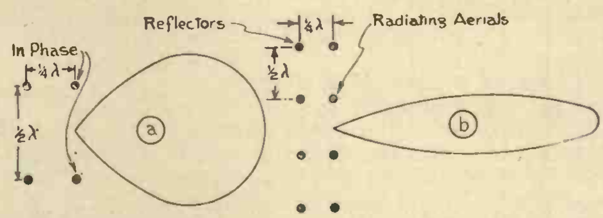


Fig. 4.—Horizontal polar curve of simple directional array is on left. On right is simple radiating aerial and in centre reflectors.

If we still utilise the two $\frac{1}{2}$-wave aerials A and B, operated in phase, but add two reflector wires, each about $\frac{1}{2}$ wavelength long, and place them directly behind the radiating aerials at a distance of ¼ wavelength, true directional transmission is produced. A wave travelling from the radiator to the reflector and back—a total distance of ½ wavelength—occupies sufficient time to allow it to combine with the succeeding wave, producing an additive effect in a direction opposite to the reflector, Fig. 4(a).

A simple array such as this, although giving true directive effect, produces rather a wide beam, so for commercial purposes, when more concentration of the field is economically desirable, arrays consisting of from 4 to 8 radiators, each with its reflector, are used.

Through consideration of simple phase relationship of aerials operated together we have produced directional effect along the horizontal plane, and for the quasi-optical frequencies this is all we require. On the lower frequencies it is well known without going into the matter here that long-distance communication depends on the sky or indirect wave. The angle which this wave comes into contact with the Heaviside layer is of importance, for low-angle radiation gives the greatest skip effect with the least attenuation during reflection back to earth.

An aerial operated at its fundamental frequency at ground level gives a fairly good low angle of radiation, for raising such an aerial above the surface of the earth (Fig 2) splits up the radiation into beams at definite angles. Dependent upon the time of the day, the frequency in use and the distance the waves have to travel, it may be desirable to utilise a beam which is preponderant in a ½ wave aerial raised too far from earth level to be practicable.

If we use an aerial several ½-wavelengths long, but a harmonic aerial that is at ground level, we have a radiator very productive of beams, but at too high an angle to be useful or desirable. Before considering how this state of affairs is altered, it would be better fully to appreciate the fact that in any radiating system the final radiation curve depends upon the sum total of the effects produced by each element of the system. Their current/voltage phase relationship and amplitude affects the field produced as a whole. It follows then that it is possible to alter the resultant radiation curve by judicious suppression or alteration of one or more of these elements. Take, for example, the polar diagram of an aerial, a full wavelength long, operated on its second harmonic. The current in each half would be out of phase with a resultant high angle of radiation, Fig. 5(a). If, however, we arranged for the currents in both halves to be in phase, our curve would be modified to a lower angle of radiation, Fig. 5(b).

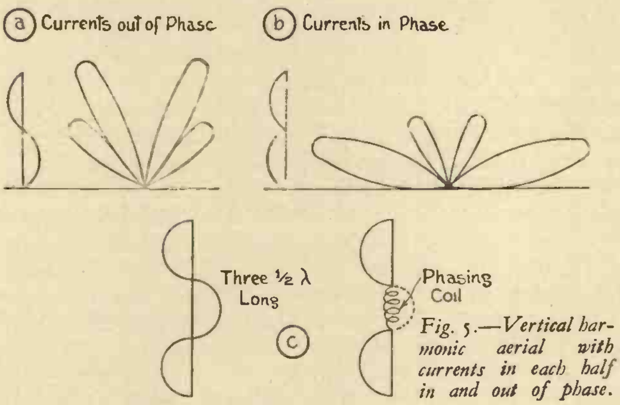


Fig. 5.—Vertical harmonic aerial with currents in each half in and out of phase.

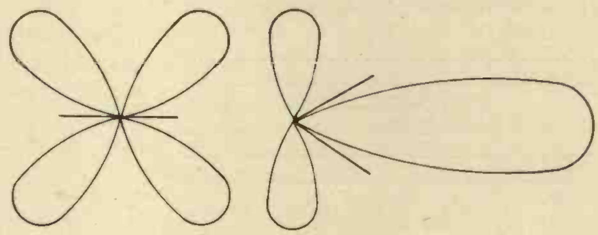


Fig. 6.—Horizontal radiation curves for horizontal aerials.

Altering Relationship

This desirable result may be accomplished by interposing in the centre of the aerial, or at every ½ wavelength, if the aerial be greater than full wavelength long, what are known as phasing coils. These consist of bunched inductances adjusted to resonate at ½ wavelength of aerial or to the frequency in use that is. By interposing a phasing coil in the centre of a full-wave aerial we really produce an aerial consisting of three ½ wavelengths long, with the field normally produced by the centre ½ wavelength, suppressed and non-radiating. So we have, for all intents and purposes, a full-wave radiating aerial with the current distribution in each ½ wavelength in phase with the resultant low-angle radiation. Fig. 5(c) will be explanatory.

Instead of using phasing coils and so wholly suppressing the field normally produced by the centre ½ wavelength of aerial, it is now commercial practice to alter the phase relationship of the aerial as a whole by folding the middle portion of the aerial in such a manner not only to obtain correct phasing, but at the same time to allow what field is produced by the centre half wavelength to be additive to the total effect.

So far reference has only been made to vertical aerials. The vertical polar diagrams for vertical aerials hold good for the horizontal type. A horizontal radiation curve, however, instead of being in the form of a circle and so omni-directional along the horizontal plane is somewhat distorted, and experience has shown that this type of aerial has definite directional properties at 45 degrees, Fig. 6. Again, if we use a horizontal aerial in V-form the angle formed may be so adjusted that the majority of energy is radiated in a direction opposite to the apex of the triangle formed.

For the amateur fortunate enough to possess sufficient space it should be possible to erect a simple vertical aerial directional array, say, for 14 mcs. In setting up any array for directive long-distance communication, the possession of a globe and a magnetic compass are all that is necessary to ascertain to what angle the array must point. A piece of thread between the points of land in question gives the true great circle route, whilst the angle formed by this route and the nearest line of longitude gives the true bearing to which the aerial array must be set. In marking out this true bearing by magnetic compass it must be remembered to apply the compass variation. Converting true bearing to compass bearing, a westerly variation is additive, whilst an easterly variation must be subtracted. The variation, of course, alters for different parts of the earth and also varies slightly annually. At the present time the variation along the west coast of England is about 14½ degrees westerly, whilst for the south-east it drops to about 11½ degrees westerly. For an example: from my location in Lancashire the true bearing of a great circle route to Sydney, Australia, is N53E or, in three-figure notation, 053 degrees. Compass variation 14½ degrees westerly. The compass bearing, therefore, would be N67½E, and this is the direction to which a directive array must be set for maximum results.

Our Policy
"The Development of Television."

"INTERLACED" SCANNING

—A MEANS OF REDUCING FLICKER

By J. McPherson

In view of the fact that the Marconi-E.M.I. Co. has announced its intention of employing interlaced scanning this explanation of the system is of particular interest.

IT can fairly be stated that the biggest problem in television is the handling of the high modulation frequencies. It can be argued furthere that this is entirely because "flicker" has to be got rid of. If we had not to be concerned with flicker there would be no necessity for making the finer image detail correspond to such extremely high modulation frequencies, which we do by scanning the subject at great speed.

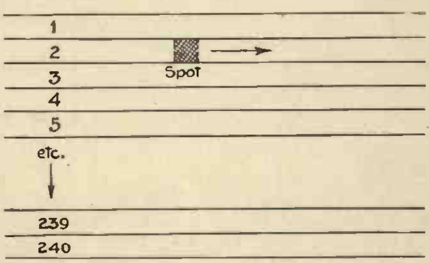


Fig. 1. Sequence of lines with ordinary scanning.

In picture-telegraphy there is no question of flicker, since the received image is permanently recorded; it is thus possible to scan very much more slowly, with proportionately lower frequencies to be dealt with. Being obliged as we are in television work to scan with sufficient rapidity to reduce, or preferably eliminate, flicker, it will be clear that any "dodge" which can be devised for eliminating a noticeable flicker without increasing the scanning speed will be much welcomed. For example, if we scan an image 25 times a second, the minimum speed recommended in the Report of the Television Committee, there will be a perceptible flicker, though not nearly so bad as that from the present 12½-per-second repetitions of the B.B.C. 30-line transmissions.

Reducing Flicker

How useful would it be to achieve the effect of 50 picture repetitions, but with no higher maximum modulation frequency than with 25 (i.e., about one million cycles per second). This is what in effect is done by the method of "Interlaced Scanning," referred to in the Committee's Report, which it is understood will be employed in the E.M.I. system for the forthcoming B.B.C. high-definition tests. We will try here to explain exactly what are the underlying principles of this interesting scanning arrangement.

Let us first consider a horizontal (top to bottom) scanning system of, say, 240 lines, though the actual number is immaterial. The argument is equally applicable to vertical scanning, but horizontal scanning is coming into vogue with the advent of high definition. In the ordinary course of events the lines are scanned progressively from top to bottom, the second line being contiguous to the first, the third to the second and so on, as indicated in the sketch, showing the first and last few lines, in Fig. 1. In this way the subject is scanned line by line from top to bottom, after which the operation begins all over again, taking one-twenty-fifth of a second each time. With this repetition frequency the eye is aware of a slight flicker; any part of the picture the eye may be regarding is covered by the scanning spot once every twenty-fifth of a second, but this is not fast enough for the image on the retina to be entirely permanent.

Sequence of Interlace Scanning

Imagine now that instead of scanning in the ordinary way described we adopt a different sequence. Let the first half of the total number of lines be used for scanning those parts of the picture covered by the *odd* lines of the ordinary system, and the second half cover the *even* lines. That is to say, starting from the top, the scanning lines will be distributed in the following order: 1, 121, 2, 122, 3, 123, etc., etc., the final two being 120, 240 (see Fig. 2).

We have still covered the subject with the 240 lines, but in a different order. In other words they are "interlaced." Instead of one complete sweep across the picture every twenty-fifth of a second with the whole of the 240 lines, we have two sweeps, each with 120 lines. The important point is that the eye regards this as a repetition frequency of double the previous case, or 50. It is not aware that each successive sweep does not really cover the same part of the subject, and that each is displaced from the other by the small distance of one line. The effect is thus just as if the scanning speed had been doubled.

Considering any pair of scanning lines with a normal scanning system, although each line is repeated only once in one-twenty-fifth of a second, the adjacent lines are separated by only a fraction of this—in fact, the time of traverse of one line, which in the 240-line system is 1/6,000 of a second. With interlaced scanning, however, since the odd and even lines are contained in separate scanning sweeps, they are separated by the time of the repetition frequency, i.e., 48 a second. Thus we have virtually two flickers—the general picture-to-picture frequency, 48 a second, and the interline flicker, also 48.

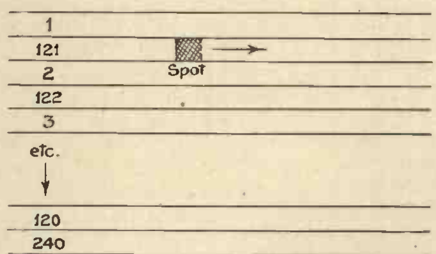


Fig. 2. Sequence of lines with interlaced scanning.

It has been found that the latter gives a rather peculiar and noticeable effect if the image at the receiving end is viewed at a distance nearer than the optimum viewing distance,* when the separate line structure can be seen. Since, however, no image should be nearer than the optimum distance, where the lines merge, this objection disappears; at such a dis-

* See "Definition and Viewing Distance," by J. M. Bartlett, B.A., TELEVISION AND SHORT-WAVE WORLD, May, 1935.

(Continued at foot of page 392.)

THE CHRONOLOGY OF TELEVISION

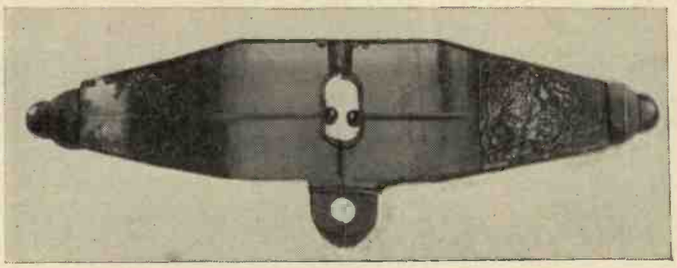
The natural laws, scientific theories and practical apparatus which, by combination, have produced the complete installation, bring to mind the pioneers whose labours are represented in its various phases. Experts in electricity, telegraphy, telephony, radiography and photography have given thought and time to the subject, many of them unaware of the importance of their discoveries or of their ultimate utility. Names and dates are often forgotten after a simple idea has developed into a complex yet commonplace piece of mechanism. In the following lines the progress of the various phases of television and of its sister picture system—photo-telegraphy—are recorded.

1814—Morichini demonstrated the magnetic effects of violet-rays of light.
(Elster and Geitel also carried out experiments in connection with the effect of ultra-violet rays. Bichat, Hoor and Blondiot studied the effect of daylight and sun on metals.)

1817—Berzelius discovered selenium.

1845, June.—Faraday found that a ray of light polarised in a certain plane can be diverted by the action of a magnet.

1850—F. C. Bakewell introduced a telegraph in which the picture was produced on chemically-prepared paper by discolouration caused by making and breaking a current at the sending end where the design was drawn in shellac ink on a metal cylinder traversed spirally by a metallic point.



One of the first liquid cells made by Dr. Kerr. It was constructed from a solid block of glass.

1862—Caselli introduced a telegraph similar to Bakewell's which was used on the Paris-Amiens line.

1863—Abbé Caselli devised a method of photo-telegraphy.

1873—Light-sensitive properties of selenium discovered by telegraph operator named May, at Valentia.
Willoughby Smith confirmed that selenium changes its electrical resistance when under the influence of light.
W. G. Adams found that the change of resistance varies directly as the square root of the illumination.

1877, Dec.—Kerr showed that a ray of polarised light is rotated by reflection at the end or side of a magnet.

1878—D'Arlincourt devised, in France, a system of photo-telegraphy, which was afterwards tried at the Central Telegraph Office, London.

1888, Sept.—Photo-electric cells constructed.

1889, Jan.—Wiedemann experimented at Wolfenbuttel in the photo-electric power of sunlight and diffused daylight.

1898—Hummell introduced in U.S.A. a system of photo-telegraphy.

1907, Nov.—Photograph transmitted over the London-Paris telephone circuits by means of Korn's system.

1908—Knudsen experimented in radio photo-telegraphy.

1912, Aug.—Thorne Baker "Telectograph" for transmitting photographs submitted to the Post Office.

1919—Tuning-fork used in relation to photo-telegraphy to obtain precise synchronisation.

1923, Oct.—John L. Baird commenced experiments in television at Hastings.

1925, April.—Outlines of simple objects transmitted by Baird's television apparatus.

1926, Jan. 27.—Baird demonstrated television before the Royal Institution.

1926, April.—Experiments in radio-picture transmission carried out between Berlin and Rio de Janeiro on wavelengths of 25 and 40 metres.

1926, June.—Thorne Baker's apparatus for cable and radio transmission of photographs placed on the market.

1926, Oct.—Alexanderson devised an apparatus called a "Telephote" for the transmission of views, etc.

1926, Nov.—Licences for radio working issued to "Television, Limited," owners of the "Televisor," invented by Baird.

1926, Dec.—A. Korn, of Munich, and H. Petersen, of Denmark, improved their method of transmitting photographs electrically.
Edouard Belin, addressing the French Photographic Society, explained the principles and the essential parts of his apparatus for seeing things from a distance by means of radio.
Belin, Bell and Siemens-Karolus photo-telegraph systems introduced in France, America and Germany respectively.
Baird experimental television broadcast took place through the British Broadcasting Co.'s transmitter 2LO.
Baird introduced "Noctovision," in which objects at a distance were seen by the use of infra-red rays.

1927, April.—Baird Television Development Company registered.
Bell system of television demonstrated between New York and Washington—250 miles.

1927, May.—"Televisor" tried successfully on London-Glasgow lines.

1927, Aug.—Denes von Mihaly, of Hungary, invented a method of transmitting scenes by radio.

1927, Sept 1.—"Noctovision" demonstrated over a London-Leeds telephone circuit.

1927, Sept. 7.—British Television Society formed, President, Lord Haldane of Cloan.

1927, Nov. 18.—Fingerprints of a man, arrested in London,

THE FIRST PUBLIC TELEVISION TRANSMISSIONS

transmitted to Chicago by radio and identified.

1927, Dec.—Karolus system of photo-telegraphy instituted between Berlin and Vienna.

Fulton demonstrated at Geneva an apparatus for radio broadcasting of pictures, drawings, etc.

Handwritten greetings accepted by the Marconi Wireless Telegraph Company for transmission by their photo-radiogram service.

1928, Feb. 9.—Successful demonstration of radio television by

The premises in Frith Street, Soho, where Mr. Baird had his first laboratory

Baird and O. G. Hutchinson between London and New York.

1928, April.—Some Baird television patents bought by N. Feldstern and H. Z. Pokress on behalf of an American group.

Cinema pictures transmitted by wire between New York and Chicago.

Telephoto system inaugurated between London and Manchester.

1928, June.—Service for transmission of pictures by radio from London to New York extended to large cities as far west as San Francisco.

1928, July.—Experimental two-way radio photo-telegraphic service opened between Germany and Argentine.

Daylight scene transmitted by television for first time.

1928, Aug. 2.—Karolus, of Leipzig, exhibited a photo-telegraphic apparatus capable of transmitting at least eight pictures a second, each composed of eight thousand light points.

1928, Sept. 4.—German Government purchased German rights of Mihaly's television apparatus.

1928, Sept. 5.—Postal Telegraph Company of America inaugurated a public photo-telegraphic service between eight of the largest cities.

1928, Sept. 11.—General Electric Company, of New York, transmitted a drama by radio television and telephone over a distance of three miles.

1928, Sept. 24.—Post Office engineers tested the Baird system of television.

Baird demonstrated television in colours before the British Association at Glasgow.

Stereoscopic effect used in conjunction with television.

1928, Oct. 30.—Experimental radio transmission of still pictures carried out by British Broadcasting Corporation.

1928, Dec. 13.—Radio news pictures received for the first time by a ship in mid-Atlantic.

1928, Dec. 16.—New York television broadcast received in Johannesburg.

J. de Wet, of South Africa, introduced a television camera and projector which transmitted a photographed object by means of rotation of the image and radial (instead of line) scanning.

1929, Jan.—London-Berlin photo-telegraphic service extended to Frankfurt-am-Main.

1929, Mar.—Baird system of television demonstrated to the Postmaster-General.

1929, May 17.—Pictures transmitted by radio from San Francisco to London.

1929, June 4.—Vladimir Zworykin demonstrated a system of photo-telegraphy in New York.

1929, June 18.—Experimental radio transmission of weather maps via Daventry by the Fultograph process began.

Pictures of the Derby transmitted by television from the racecourse to the London-Scotland express train passing through Yorkshire.

1929, Sept. 9.—Photo-telegraphic service opened between Sydney and Melbourne.

1929, Sept. 30.—Baird Television Co. again broadcast through B.B.C. transmitter, 2LO.

1929, Nov. 7.—Tablet in honour of Baird unveiled at Hastings to commemorate beginning of experiments in television in 1923.

1929, Dec.—Radio photo-telegraphy used in connection with detection of crime. Portrait telegraphed from New York to London resulted in arrest of a bank clerk.

1930, Feb. 20.—Anglo-Danish photo-telegraphic service opened.

1930, Mar.—Transmissions of television (vision and sound) established in London.

1930, April 14.—J. B. Kramer and two members of Birmingham University Electrical Engineering staff claimed important successes in television at a distance of 100 miles.

1930, May 28.—John Hays Hammond, of U.S.A., introduced a television "eye" by means of which an aeroplane pilot could ascertain his correct location and also obtain views for transmission.

Television variety performance given in a theatre in Schenectady under the direction of E. F. W. Alexanderson. The actors actually performed in the General Electric laboratories one mile distant.

(*Continued on next page.*)

"Interlaced Scanning"

(*Continued from page 390.*)

tance and beyond, the interline effect is quite concealed.

It will be readily understood that since the actual scanning speed has not been increased, although the apparent flicker frequency has been doubled, we have gained a very real advantage. With the old scanning methods this reduction in flicker could only have been achieved at the cost of doubling the maximum modulation frequency.

1930, May 29.—Anglo-Austrian photo-telegraphic service opened.

1930, June.—Bruno Lange, of Berlin, devised a form of photo-electric cell.

1930, July 23.—Pictures of American yacht race cabled from America to England by the Bart-Lane photo-telegraph system.

1930, July 28.—First public demonstration of Baird television took place at the Coliseum, London.

1930, Sept. 4.—Anglo-Swedish photo-telegraphic service opened.

1930, Nov. 16.—Radio photo-telegraphic service opened between Germany and U.S.A. via London.

1930, Dec.—P. T. Farnsworth, of California, produced a valve for use in television.

1931, Feb. 1.—Radio photo-telegraphic service opened between U.S.A. and Austria via London.

1931, Mar. 25.—Telegraph apparatus for high-speed black and white photo-telegraphic transmission demonstrated at Hendon. A speed of three thousand words per minute was claimed.

1931, April 15.—Television Society's third annual exhibition held in London.

1931, May 8.—First open-air televisor demonstrated in London. Robert Mehl, Charles S. Barrect and Giibert E. Doan, of U.S.A. Navy, introduced a "gamma" electric-ray apparatus which enabled a photograph to be taken through ten inches of hard steel.

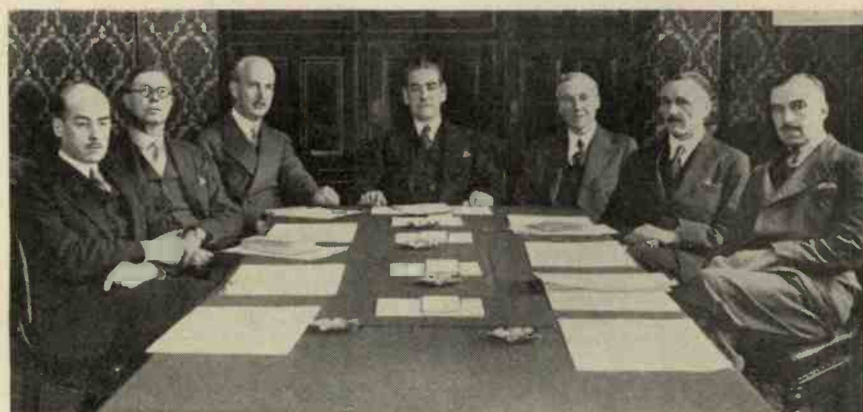
1931, May 16.—Photographs taken through a four-inch steel plate by means of a twelve-foot 900,000-volt X-ray tube at Schenectady, New York.

1931, June 1.—Radio- - photographic service opened between Amsterdam and East Indies.

1931, June 3.—Experimental transmission of the Derby horse-race by means of Baird system of television.
Wedding ceremony transmitted by television for first time in New York.

(To be completed next month)

The Advisory Committee makes its First Statement



The Members of the Television Advisory Committee under the chairmanship of Lord Seldon.

THE Postmaster-General announces that he has received a communication from the Television Advisory Committee regarding the choice of a site for the projected London television station, and other matters relative to the proposed experimental television service.

After having carefully considered a number of possible sites, the Committee have recommended the adoption of the Alexandra Palace for the station. This recommendation has been approved by the Postmaster-General; and the British Broadcasting Corporation have made arrangements with the Alexandra Palace Trustees for the use of a portion of the Palace buildings for the station.

The ground at the Alexandra Palace is 306 feet above sea level; and it is proposed to erect a 300 foot mast on the site, thus providing an aerial height of 606 feet above sea level which, it is considered, should enable a high-definition television service to be provided for the London area.

As recommended in the Television Committee's Report, the Baird Television Company and the Marconi—E.M.I. Television Company are being invited to tender for the supply of the necessary apparatus for the operation of their respective systems at the London station.

The Baird Company propose for their system the adoption of a standard of picture definition of 240 lines sequential scanning, 25 picture traversals per second, 25 complete frames per second; and the Marconi-E.M.I. Company propose for their system a standard of 405 lines, 25 pictures per second, interlaced to give 50 frames per second, each of 202½ lines. Subject to satisfactory tenders being received, the Advisory Committee recommend the adoption of these standards for a public service during the trial period. Whilst it is contemplated that each system will be operated mainly on the standard proposed for it by the relative company, the alternative standard may be employed by permission of the Advisory Committee with either system. In such event due public notice would be given of the change.

The Committee have satisfied themselves that receivers can be constructed capable of receiving both sets of transmissions without unduly complicated or expensive adjustment.

The Committee propose that the vision signals should be radiated on a wavelength of about 6.6 metres, and the associated sound signals on a wavelength of about 7.2 metres.

If the tenders submitted by the two companies are accepted, such technical information regarding the characteristics of the television signals radiated by the two systems as will facilitate the designing of television receivers capable of picking up those signals will be made available to manufacturers by the companies.

Scannings and Reflections

By THE LOOKER

6-metre Transmissions

MAJOR ARMSTRONG—famous in America as the inventor of " reaction " and the superhet circuit—has for some time been sending out mysterious 6-metre signals from the television station on the roof of the Empire State Buildings in New York. Short-wave enthusiasts in the locality, though aware of curious goings-on in this region of the ether, could make nothing intelligible of them.

The cat it seems is now out of the bag. Major Armstrong announces the discovery of a new method of handling short-wave signals—below the 10-metre mark—so as to render them free from static and other interference. If true, this development is bound to affect the future both of high-definition television and of short-wave broadcasting.

The inventor explains that he sends out his signals by modulating the carrier wave " in a different way " from that in which " interference " modulates it. This allows him to bring into play a new method of distinguishing between the desired signal and the undesired interference, and he arranges his receiving circuits to accept one and reject the other. Incidentally it is now clear why American listeners could make nothing much of the test transmissions. To receive such signals intelligibly it is necessary to use a special type of receiver.

It appears that instead of causing the signals to vary the amplitude of the carrier wave, as usual, they are made to vary its frequency. Now, although frequency modulation is not, in itself, a new idea, Major Armstrong carries it a good deal further than has previously been suggested. Knowing that he is working in a part of the ether where there is plenty of elbow-room—i.e., below 10 metres—he deliberately increases the side-bands produced by the signal until they cover at least ten times the usual 10 k.c. spread produced by ordinary amplitude-modulated signals.

A New Way of Reducing Interference

Since static—and what is even more important, the type of interference called " tube noise "—are both caused by amplitude variations, they are thus reduced to only one-tenth the signal volume. In other words, the receiving circuits are handling ten times more signal energy than interference, and it is possible to use intensive H.F. amplification without creating a background of noise, such as swamps out the ordinary listener when he attempts to tune-in to a station rather beyond the normal reach of his set.

To make assurance doubly sure, the second-detector stage of the Armstrong superhet receiver consists of two valves, which work in parallel on the signal and in push-pull on the interference, so that even the relatively small amount of interference is effectively balanced out so far as the loudspeaker is concerned. It is, of course, too soon as yet to say how far the new system will affect existing practice, but it comes from a promising quarter and has already aroused much interest in American wireless circles.

Persistence of Vision

There was a time when the laziness of the eye in responding to quick changes of scene was called the persistence-of-vision " defect," and, in a sense, the word was rightly used to describe what is in the nature of a slight imperfection. However, since then, both the cinema—and television—have proved the " defect " to be really a blessing in disguise, so that we now refer to it more respectfully as an " effect "—and a very useful one at that.

The Alexandra Palace

One of the deciding factors in the choice by the Advisory Committee of the Alexandra Palace for the first television transmitting station was its comparative nearness to town. As the studio must for the present be quite near to the transmitter it was necessary that the journey from the West End should not entail too great a loss of time for artists. This is a condition that may not persist for any considerable time for cables are being developed which it is anticipated will carry the high frequencies necessary for television.

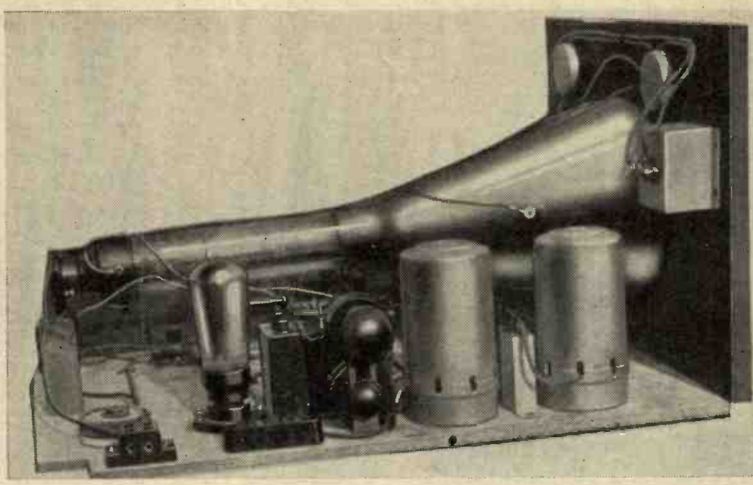
America getting Television Minded

Television activities in Germany and this country have received a great amount of attention in the States and the Americans are beginning to feel that they are being left behind in the television race. The problem of providing a service for almost the entire country seemed hopeless on account of cost, and no doubt this had a retarding effect. Now it appears to be appreciated that the first step should be to establish an experimental station in a suitable centre of population and manufacture a limited number of receivers. Technically, America claims to be ahead of both this country and Germany. Certainly a great deal of research work has been carried out there and it was in America that two of the most important recent developments first saw the light, I refer, of course, to the Iconoscope and the Farnswort electron multiplier.

That Term

My memory does not serve me sufficiently well to recollect whether when broadcasting started there was any difficulty in finding a term to designate the listener. Certainly the term seems natural enough nowadays, far more natural, in fact, than any which has been suggested so far for one who looks at television pictures. The B.B.C. favours " televiewer," but " looker " seems to be more on a parallel with listener. However, here is a new one descriptive of home television—"Lookies" —how about it?

THE DE LUXE CATHODE-RAY TELEVISION VIEWER



The tube and associated components are mounted so that they can be withdrawn from the cabinet.

THE SCANNING CIRCUIT

THE scanning circuit of the cathode-ray viewer which is shown below is on lines which are familiar to readers of this journal, and has been simplified from that used in the previous successful design. The charging condensers are connected to the H.T. through resistances which have been selected experimentally to give a 30-line scan with the minimum of adjustment. The exciter circuit for the tube is also of the standard pattern, with adjustments for focusing and for control of beam intensity.

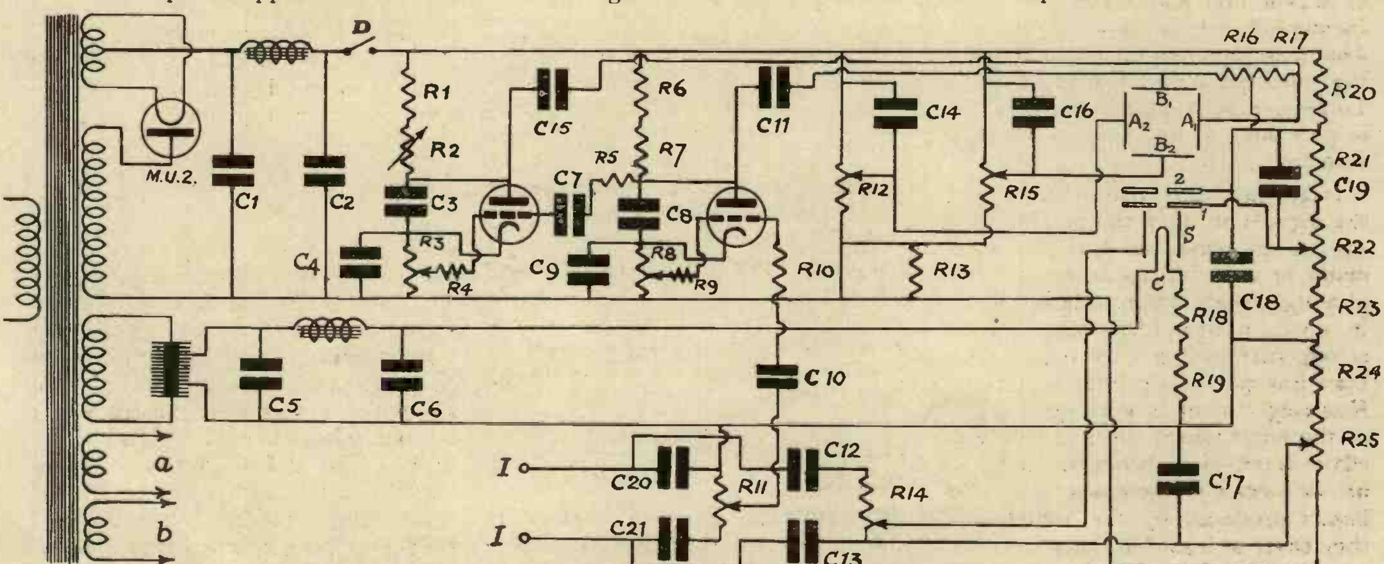
The heaters of the relays in the scanning circuit and the tube cathode are directly connected to the exciter unit and the H.T. is applied after a delay of 30 secs. by means of the Ediswan D.L.S.1 switch. This ensures that the relays will strike as soon as the condenser is charged and there is no possibility of damaging the circuit by applying a high voltage at the start, before the cathodes are hot. The radio input is applied to the terminals marked I, I in the diagram, and is isolated from the circuit by the condensers shown.

> *Preliminary details of this cathode-ray receiver which is adaptable to high-definition scanning were given in the two preceding issues.*

The transformer windings distinguished by the letters a and b are 4-volt windings for the heaters of the relays and the delay switch (D in the diagram). The switch is fitted with an ordinary 4-pin base, the heater being connected to the filament pins and the contacts across the anode and grid pins.

The wiring should present no difficulty if the main components are spaced according to the sketch on page 396, and a fair latitude is allowable, provided that the leads are very carefully spaced.

Before the components are screwed down to the baseboard a little preliminary work has to be done in fitting the board in the cabinet and making sure that the controls fit the holes to be drilled in the front panel of the cabinet. While theoretically it is possible to mark and drill the holes and to find that the resistance spindles fit them straight away, it is just as simple and more sure to "approach" the baseboard into position and mark the actual point at which the spindles touch the inner side of the front panel.

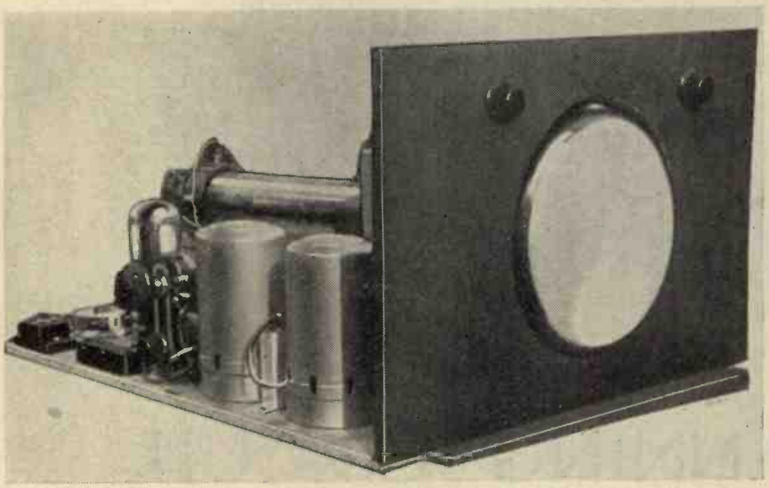


The scanning circuit of the De Luxe Cathode-ray Television Viewer.

Fitting the Controls

As mentioned last month, looking from the front of the cabinet the controls are arranged as follows:—

Focus. Synch. Speed.
Mod.
Shield.



This photograph shows the front of the tube and mounting.

The synchronising and modulating controls are obtained from an ingenious special potentiometer with concentric independent spindles. Commence by marking the position of the three mounting brackets, which are 4 ins. high. Since the potentiometers are a full 2 ins. diameter this barely allows room for mounting the two centre ones on the same bracket, and it will be necessary to lengthen the slot in the bracket by drawing it with a file.

The brackets screwed down, the potentiometers can be fastened on, the upper row being 3½ ins. above the baseboard level. The exact height is not important, provided that they are in a line and that room is left for the lower potentiometer on the centre bracket. Now lower the baseboard into position and mark the location of the spindles on the inside of the front panel of the cabinet, subsequently drilling ½ in. holes through to clear them well. For convenience in wiring, turn the soldering tags as follows, viewed from the front: focus potentiometer tags upwards; double potentiometer tags up; shield potentiometer tags to the right; speed potentiometer tags to the right. Now withdraw the board and mark the position of the tube in pencil so that none of the components are mounted too near it.

The side board with the tube hole in it can be temporarily screwed into place as shown in the diagram, and the tube socket on its wood base can be fitted to the end of the tube and marked round for fastening down. The position of the socket will vary slightly depending on the tube, but as a guide the front dome of the tube should be about ¼ in. behind the edge of the baseboard.

Having outlined the tube, take off the side board and screw down the components. The position of the various large condensers is marked on the diagram. The terminal blocks are a 6-way and a 2-way large from W. A. Bryce, the large one being for the leads to the cathode. The second accelerator of the tube is taken from a small terminal block (B.T.S.). At the back edge of the baseboard are mounted the two length controls R3 and R8, on a common bracket. Care should be taken in mounting this to make sure that the knobs do not project beyond the edge of the baseboard. The soldering tags should be turned to the right-hand side for ease in wiring.

The sockets for the relays are mounted inside Colvern coil screening cans 2¼ in. dia., which are just sufficient to clear the valve. A useful tip is to drill a peep-hole in the side or top of the can to allow of inspection of the relay when running. When screwing down the valve holders turn them so that the anode socket faces the right-hand side of the board, looking from the back.

Wiring Up

The theoretical diagram shows the circuit employed for 30-line scanning.

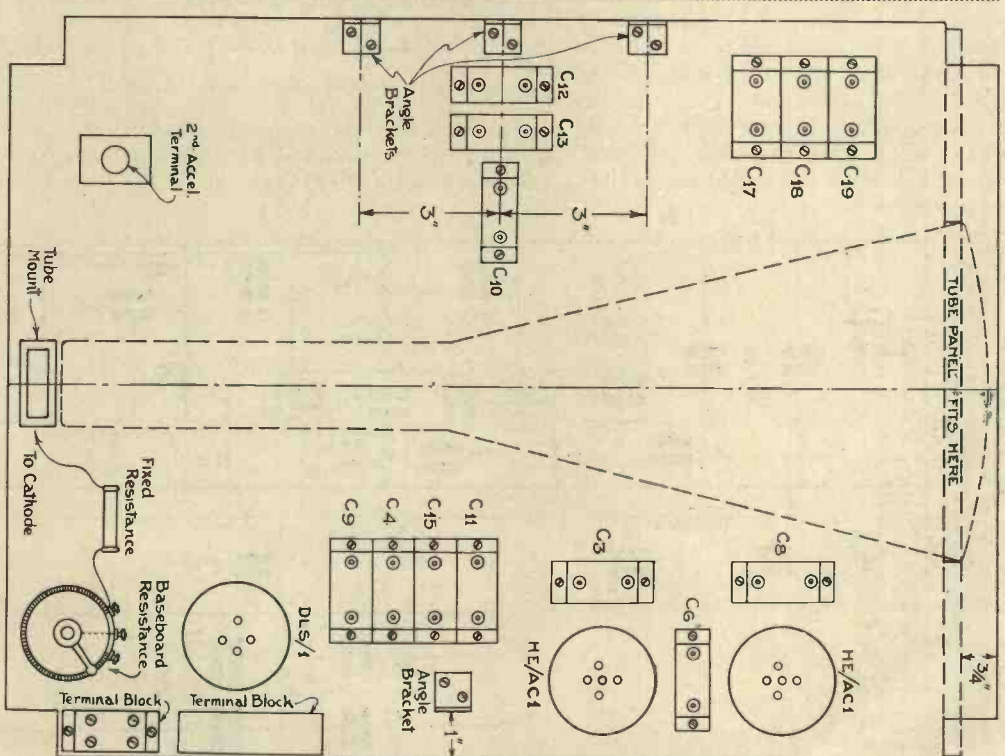


Diagram showing layout of scanning circuit components.

The bias for the relays is provided by the "self-bias" resistances R3 and R8. These are not true self-bias in the accepted sense, since the current for the potential drop is not derived from the cathode current of the relay, but is the charging current of the condenser. A shunt condenser is connected across each resistance. The two charging condensers C3 and C8 are mounted in front of their respective relays.

Before wiring up, cut a number of strips of thin fibre or stout paper $\frac{1}{8}$ in. by $\frac{1}{2}$ in. These can be used to fasten the wires in place on the baseboard by means of small pins, and will add to the neatness and safety of the wiring. Do not allow any two leads to run close together unless you are satisfied that they are at low potential. The wiring for the heaters of the relays must be done in screened flex, the ends being taken to contacts 2 and 3 on the terminal block; 4 and 5 are for the heater of the thermal delay switch, and 1 and 6 for the 2,000 volt H.T. leads. These are thus as far apart as possible on the board.

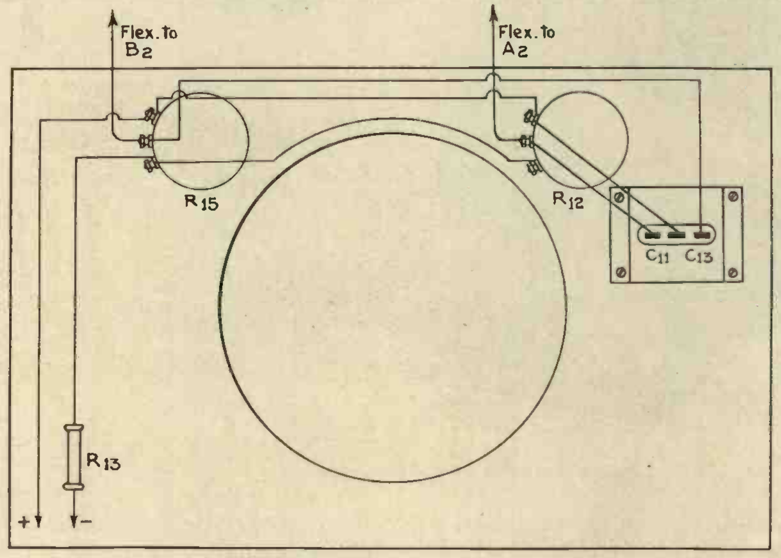
The valve holder for the delay switch is mounted so that the + H.T. lead joins directly to the anode terminal as it leaves the terminal block. From the grid terminal, which is the other contact of the switch, a wire is led straight across the board to the second accelerator terminal block, a 50,000-ohm resistance being interposed between it and the terminal itself.

From the H.T. end of this resistance a lead is taken through R1 fixed resistance to R2, the left-hand variable resistance on the front panel. From here a lead goes on to the "shift" potentiometers on the side board, but this wiring can be left until later.

The resistances comprising the potentiometer system for the tube supply (R21-R25) are all in series across the H.T. and the fixed resistances R21, 23 and 24 can be suspended in the wiring. The isolating condensers C12 and C13 are in front of the centre potentiometers, while C20 and C21 are tubular condensers which can join straight from the terminals of C12 and C13 to the tags on the synchronising potentiometer.

It will be noted that the deflector plates are joined to the anodes of the relays through isolating condensers C11 and C15, the plates themselves being earthed through two 5-meg. resistances with their junction taken to the second accelerator.

The leads to the plates and to the second accelerator on the tube should be sufficiently long to enable the tube to be twisted round in its holder. A flexible lead is also required from the graphite coating on the inside of the Ediswan tube to the second accelerator. Sometimes the focus of the tube is improved by connecting this coating to the A1 plate, and this should be tried when the tube is tested out.



8 *Arrangement of tube mount showing connections of controls.*

Wiring Up the Side Panel

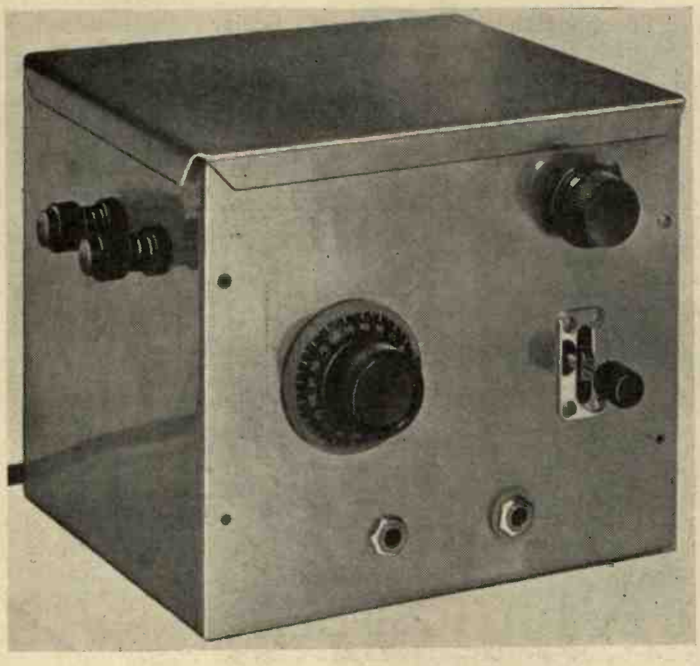
The side panel presents a little difficulty since it is not integral with the baseboard and is inserted in the cabinet after the latter is in place. To hold the tube rigidly, holes are drilled in the side board and screws run through it holding it to the main uprights of the cabinet. This will be made clear in the final assembly photographs, but for testing-out purposes it is sufficient to hold the side board temporarily.

The wiring of the side panel is shown in the diagram, and is relatively simple. Referring to the theoretical diagram, the shift potentiometers R12 and R15 are joined in parallel, one end being taken to the H.T. + lead, and the other end through a 2-meg. 2-watt resistance to the –ve. Flexible leads are taken from the centre tags to the deflector plates A2 and B2. The condensers C14 and C16 are combined in a special case, with a common terminal which goes to the H.T. +.

The values of components, of which a complete list is given, were selected to suit the particular tube used, and may be found to require slight modification if another type or even another of the same batch is fitted. The resistances which may require modification are R1 and R6 in the charging circuit, as slight variations in capacity make a difference to the scanning speed; R19 in the cathode circuit, since the regulation of the transformer may be slightly different; and R10 to increase the amount of the synchronising impulse.

CONDENSERS
C1—4 mfds. 2,000 v. Already in the exciter unit.
C2— do. do. do.
C3—0.25 mfds. 2,000 v. T.C.C. Type 131.
C4—2.0 mfds. 250 v. wkg. W.A. Bryce Type A3.
C5—2,000 mfds. Already in the exciter unit.
C6—2,000 mfds. do. do.
C7—0.1 mfds. 650 v. wkg. W. A. Bryce Type C6.
C8—0.01 mfds. 2,000 v. wkg. T.C.C. Type 13.
C9—2.0 mfds. 250 v. wkg. W. A. Bryce Type A3.
C10—0.1 mfd. W. A. Bryce Type C6.
C.11—0.1 mfd. W. A. Bryce Type C6.
C12—0.1 mfd. 2,000 v. T.C.C. Type 131.
C13—0.1 mfd. 2,000 v. T.C.C. Type 131.
C14—0.1 mfd. combined with C16.
C15—0.1 mfd. W. A. Bryce Type C6.
C16—0.1 mfd. W. A. Bryce Type 1,000.
C17—2.0 mfd. W. A. Bryce Type C6.
C18—1.0 mfd. 2,000 v. wkg. T.C.C. Type 131.
C19—1.0 mfd. 2,000 v. wkg. T.C.C. Type 131.
C20—0.1 mfd. 1,000 v. T.C.C. tubular.
C.21—0.1 mfd. 1,000 v. T.C.C. tubular.

RESISTANCES
R1—2.0 meg. 1 watt Erie or Dubilier.
R2—2.0 meg. potentiometer—Reliance Mfg. Co.
R3—50,000 ohm potentiometer—Reliance Mfg. Co.
R4—5,000 ohm 1 watt Erie or Dubilier.
R5—1.0 meg. 1 watt ,, ,,
R6—0.3 meg. 1 watt ,, ,,
R7—1.0 meg. 2 watt ,, ,,
R8—10,000 ohm potentiometer—Reliance Mfg. Co.
R9—5,000 ohm 1 watt Erie or Dubilier
R10—30,000 ohm 1 watt ,, ,,
R11—Combined with R14.
R12—2 meg. potentiometer—Reliance Mfg. Co.
R13—2 meg. 2 watt Erie or Dubilier.
R14—30,000 ganged potentiometer—Reliance Mfg. Co.
R15—2 meg. potentiometer—Reliance Mfg. Co.
R16—5 meg. 1 watt Erie or Dubilier.
R17—5 meg. do. do.
R18—6 ohm pre-set resistance (Bulgin).
R19—1 ohm fixed resistance—Reliance Mfg. Co.
R20—50,000 1 watt Erie or Dubilier.
R21—1 meg. 2 watt ,, ,,
R22—½ meg. potentiometer—Reliance Mfg. Co.
R23—½ meg. 1 watt Erie or Dubilier.
R24—10,000 ohm 1 watt Erie or Dubilier.
R25—½ meg potentiometer—Reliance Mfg. Co.



It is essential to use a B21 valve in this transceiver.

A Five-metre Transceiver

Amateurs will find considerably more interest in high-frequency work if some simple means of transmission is used. This transceiver has a nominal range of 20 miles and is excellent for experimental and portable use.

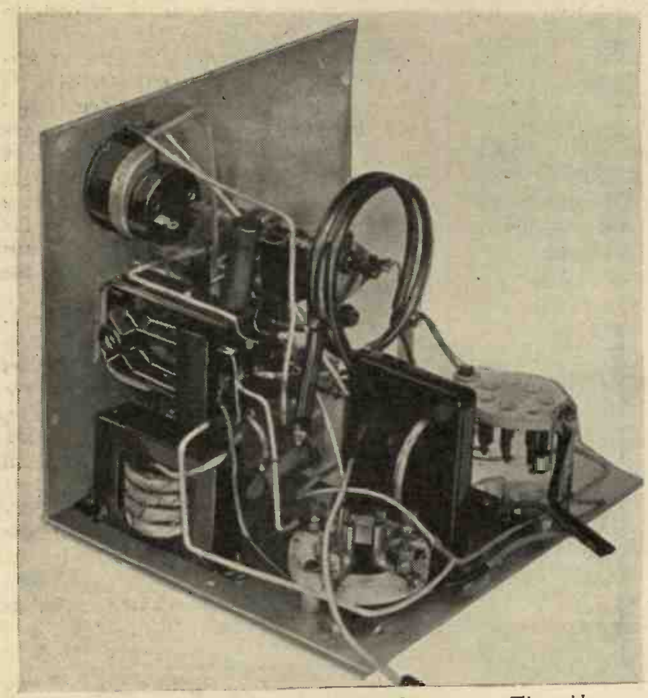
THE following are constructional details of a simple battery-operated transmitter-receiver. It was designed as a result of a considerable amount of experimental work by 2BNR and G5UK. It has been used with great success during the past few weeks, and over the Whitsun holidays was used by G5ZJ in conjunction with the three-valve super-regenerative receiver described elsewhere in this issue.

Fundamentally this transceiver consists of a class-B valve working as a self-excited oscillator, modulated by an LP2 low-frequency amplifier. That is for a transmission. A simple turn of a switch and the apparatus is ready for reception, when the class-B valve previously used as an oscillator is converted into a detector-quencher, while the LP2 functions as a normal amplifier.

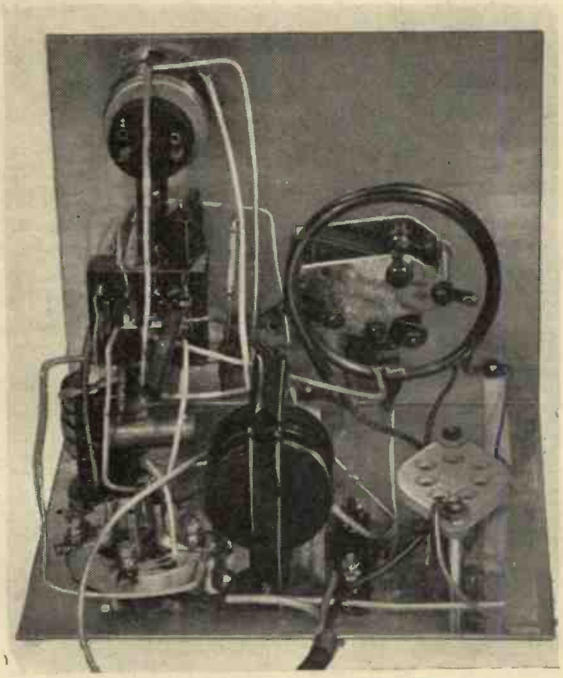
Even though only two valves are used, an equivalent of three valves is obtained for both transmission and reception. A class-B valve of the B-21 type is used throughout and this valve is essential for maximum results. Readers will probably know that the class-B valve consists of two complete sets of triode electrodes, which can be used separately. For example, when used for transmission, each half is used as an oscillator in the self-excited push-pull circuit.

One of the biggest difficulties with a five-metre transmitter is to obtain a steady signal and complete frequency stabilisation. In this instance the trouble has been overcome in quite a simple way. The anode coil is constructed of copper tube, of approximately 1¼ turns, 3-in. diameter. The grid coil is wound inside the anode coil and of course has a similar number of turns, but is wound with 1 mm. flexible wire.

It is essential that the anode coil be mounted so it cannot move and to this



The anode coil is mounted on insulated supports. The grid coil is inside this anode coil.



The layout can clearly be seen from this illustration.

end two Bulgin Seramic insulators are used to support the coil. Notice that the tuning condenser is above earth potential so it must be carefully isolated from the chassis. Insulating washers have been specified for this purpose and they can also be used to isolate the variable resistance in series with the primary of the L.F. transformer and high tension, the aerial and earth terminals and the phone jack.

Components for Battery Transceiver

CHASSIS
1—Aluminium (Peto-Scott).
CONDENSERS FIXED
1—.006-mfd. type tubular (Amplion).
1—.01-mfd. „ „ „
1—.0001-mfd. „ „ „
COILS
Home constructed or Eddystone.
CONDENSERS VARIABLE
1—.000075 double spaced midget (Cyldon)
CHOKES L.F.
Home built to specification.
DIAL
Straight three inch (J.B.)
FUSE
1—Micro-fuse 100 milliamps.
HOLDERS VALVE
1—7-pin chassis type (Bulgin)
1—4-pin steatite (Eddystone).
PLUGS, TERMINALS, ETC.
2—two-way terminal mounts (Belling & Lee).
2—J3 jacks (Bulgin)
4—Wander plugs marked G.B. pos., G.B. neg., H.T. pos., and H.T. neg. (Clix).
2—spade terminals marked L.T. pos., L.T. neg. (Clix).
RESISTANCES FIXED
1—25,000 ohm 1-watt type (Erie).
1—1-megohm 1-watt type (Erie).
RESISTANCES VARIABLE
1—10,000-ohms (Bulgin).
SWITCH
1—on-off four-pole change-over (Wearite).
TRANSFORMER L.F.
To specification.
VALVES
1—P2 (Osram)
3—LP2 (Osram)
SUNDRIES
2—valve supports (Bulgin).
Condenser spacing washers (Bulgin).
2—standard insulators 4B A. (Bulgin).
Wire and sleeving (Goltone)
Pair G.B. battery clips (Bulgin)
ACCESSORIES
1—H.T. battery 36v. (Ever Ready).
1—2v. accumulator type 698 (Ever Ready).

At least one of the components must be home-built, and that is the special L.F. transformer. Actually it has two primaries and a common secondary and has been constructed from a conventional low-frequency transformer. Any transformer wound on three bobbins will be satisfactory. A spare transformer with a similar number of turns on each bobbin was available, and it was a simple matter to remove half the turns from two bobbins and use these as primaries. Generally speaking, however, the secondary will require approximately 6,000 turns, while the primaries will want 2,000/2,500 turns on each half. These figures bear out with the normal size of iron.

The L.F. modulation choke is also home-constructed, and consists of 6,000 turns of 36-gauge enamel-covered wire wound on to an old L.F. transformer, from which the wire had been stripped. Alternatively any small 20-mA 30-henry choke of commercial construction will be suitable, the only qualification being size.

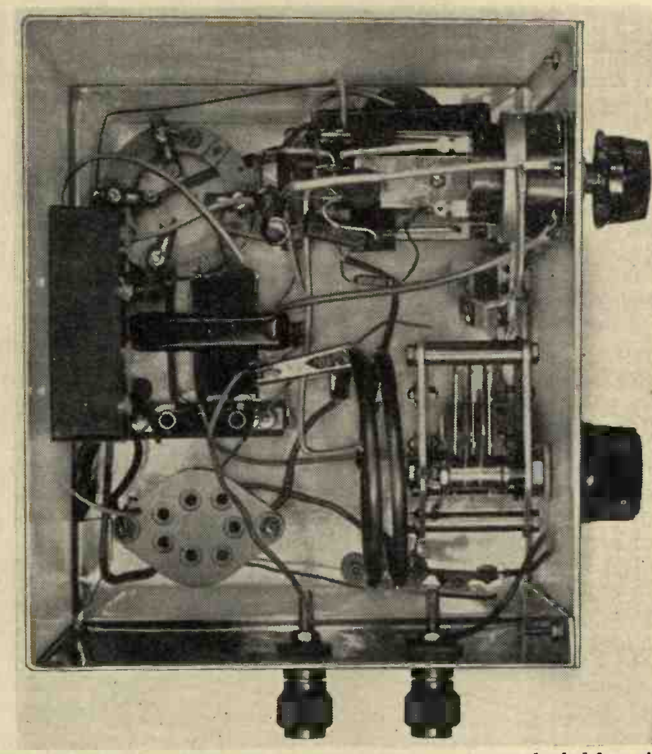
In the original receiver no provision was made for switching off the L.T. other than with the master switch used for converting from transmission to reception. Readers who would like a separate L.T. switch can use a volume control in which a make-and-break switch is an integral part. The tuning condenser is a Cyldon Bebe type of .0001-mfd. capacity, but most condensers can be double-spaced and will do equally as well. Do not forget that the rotor of the condenser must be isolated from the panel.

Construction should not present any difficulties, but remember carefully to isolate all of the components previously mentioned. The .00025-mfd. fixed condenser from the switch to chassis can be of the pre-set type with advantage, for valve variation sometimes causes a grunt when the apparatus is used for reception. A certain cure for this grunt is varying the capacity of the condenser.

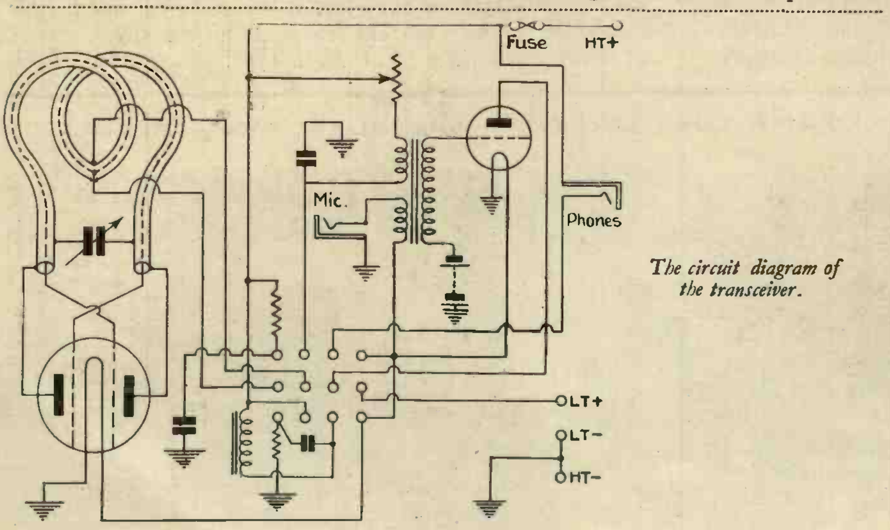
Energising voltage for the microphone is obtained from the L.T. battery, which is ample in the majority of cases. As a general rule the microphone used will be of the P.O. type, which only requires a small potential.

As regards power supply, a small high-tension battery, capable of giving 10 mA, will be required. The accumulator should be as large as conveniently possible, but it will only have to discharge .3 ampere at 2 volts.

The transceiver should be coupled to a horizontal di-pole with half-wave radiators and quarter-wave feeders. Where it is desired to use a high aerial, then series-tuned feeders will be essential.



Several components which are usually at earth potential in this transceiver are bushed from the metal chassis.



The circuit diagram of the transceiver.

THE PRESENT POSITION OF

SUMMED UP AND EXPLAINED BY THE

WHAT is the present position of television? What the position ought to be, we know quite well: by this time a transmitting station, complete with alternative systems should have been completed, or nearly completed; we might have had the advantage of test programmes by now, and the manufacturing trade should be hard at work in readiness to meet the public's demand for television sets. Instead of which we have had delay, inexplicable secrecy, and disappointment. Considerable technical progress has been made by various interests, but these activities are not, so far as we are aware, being co-ordinated, and at a moment when a very clear lead should have been given by those in whose hands the future of broadcast television has, for the moment, been placed, everybody is left wondering as to what is happening.

Television's Charter

On the publication of the Television Committee's Report on January 31st, we said "The Report can be regarded as television's charter. Television has made progress slowly, perhaps painfully, but certainly surely, but it will soon get into its stride and we are confident that it will progress at such a speed as rapidly to make history." We had every right to view the position with such confidence. The Committee, with Lord Selsdon at its head, and including among its members the B.B.C.'s Chief Engineer; a well-known official of the Department of Scientific and Industrial Research; and the Assistant Secretary of the General Post Office, had published its Report stating that high-definition television had reached such a standard of development as to justify the first steps being taken towards the early establishment of a public television service. The Report recommended that the B.B.C. be entrusted with the broadcasting of television, that a comprehensive television patent pool should eventually be formed, that a start should be made by the establishment of a station in London with two television systems operating alternately from one transmitting station, and that the Baird and Marconi-E.M.I. companies should be given an opportunity of supplying the necessary apparatus for the operation of their respective systems at the London station.

The Advisory Committee

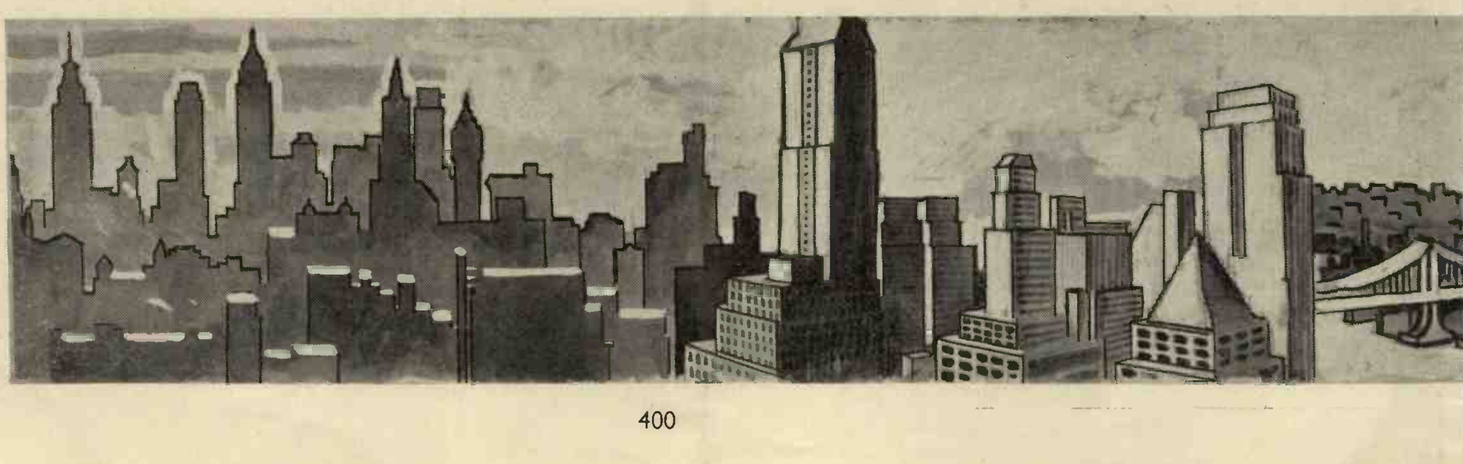
Immediately following the publication of the Report (printed in a special supplement to TELEVISION *of last February) the formation of the Advisory Committee was officially announced, its members to include the B.B.C.'s Controller and its Chief Engineer; the Assistant Secretary of the Post Office; the Assistant Engineer-in-Chief of the Post Office; the Secretary of the Department of Scientific and Industrial Research; with Lord Selsdon, the Chairman of the Television Committee, again as the Chairman of the Advisory Committee. Such promptness in announcing the Advisory Committee was generally applauded and taken as an earnest of the energy and seriousness which would be applied to the putting into practice of the Television Committee's recommendations. Four or five months have passed and only just recently have we learnt of any definite move.*

The Vicious Circle

The result has been most unfortunate. There have been manufacturers in the country extremely anxious to get down to the task of producing television receivers for home use, but what could they do in the absence of a lead from the Advisory Committee? Indications have come from Baird and from Marconi-E.M.I. as to what they could do, but until the Advisory Committee could tell the public what arrangements had been made for transmission, when transmission would probably start, what the scanning frequency would be, and when test transmissions would be available, what could the manufacturer or anybody else attempt?

Look at the little diagram opposite. It shows a circuit, but not an electrical one—just a psychological one. It is a complete circuit—our old friend the vicious circle. At A we have transmitter; at B, the manufacturer; at C,

THE PANORAMA OF "SKYLINE"—One of the most ambitious programmes

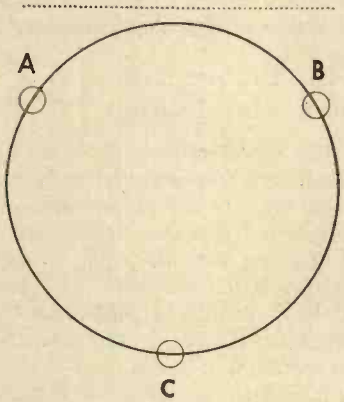


TELEVISION

EDITOR-IN-CHIEF

The first high-definition television transmitter is to be installed at the Alexandra Palace, which is situated in North London.

the public demand. In the old days, before the Television Committee had made its report, A was not prepared to do much because B hardly mattered and C was a very small quantity. C could do nothing; he had neither the service nor the sets, and either was useless without the other. Now, after the publication of the Report, A finds itself under orders to provide a television service, but until he does so, C cannot increase inasmuch as it is simply waiting for A, the oracle, to speak, whereas B, the manufacturer, having neither transmissions on the one hand nor a public demand on the other, is just simply stuck! And this is five months or so after the appointment of the Advisory Committee.



Of course, as every reader knows, we have for some long time been having the B.B.C.'s 30-line transmission, but in view of the recommendations of the Television Committee and the task entrusted to the Advisory Committee we can only regard the 30-line transmissions as a temporary service to be abruptly terminated when something better is available.

The First Public Transmitter

After a series of rumours, denied and then repeated, the public has learnt officially that the first public television transmitter will be at the Alexandra Palace, North London.

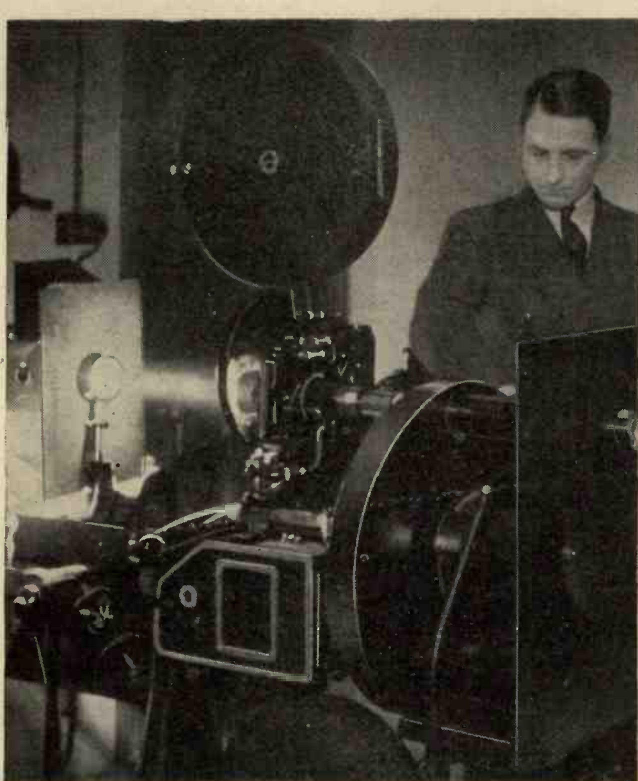
The Alexandra Palace—built approximately fifty years ago and a competitor as a place of entertainment with the much more famous Crystal Palace, south of London—stands on a site 306 feet above sea level. A mast 300 feet high will be erected, so the point of transmission will be somewhere about 600 feet above sea level, thus enabling a high-definition television service on a wavelength of about 6.6 metres, covering, it is hoped, the whole of the London area. The sound transmission will go out on a wavelength of about 7.2 metres, it is expected. As far as we know at the moment the Baird and the Marconi-E.M.I. companies will respectively provide transmission plants which will be used alternately. No date for completion has been officially announced and all we know at the moment is that the work of erecting the plant will start in the autumn. It is stated that the Baird transmission will be at 240 lines, 25 complete pictures per second, whereas Marconi-E.M.I. will be working at 405 lines.

Baird's Crystal Palace Station

Apart from this official announcement, the Baird company are probably in a position to give a service of some kind immediately. They have been carrying out experiments at the Crystal Palace over a long period and have there a fine equipment, including studios with up-to-date scanning

yet broadcast. This strip was transmitted via the caption machine.

THE BAIRD AND MARCONI-E.M.I. SYSTEMS



The Baird high-definition Telecine transmitter.

devices and all the necessary plant for broadcasting. The Baird Company chose the Crystal Palace because, as we have already explained in TELEVISION, *the site gave them the highest point in London and modern high-definition television transmission necessitates the use of ultra-short-wave transmitters, whose range is restricted but increases with the height of the transmission point. The top of the south tower of the Crystal Palace is 680 feet above sea level, and the aerials on top of that tower are believed to give the maximum possible range of anv site in the Greater London area.*

However, the Alexandra Palace has been selected as the first public transmission site, and it must be borne in mind that this building stands on high ground and a still more elevated transmission point could very easily be arranged for.

In a recent interview with the Press, Captain West, who is Baird's Research Director, stated that their television developments had surpassed the present technique of radio transmission, and that while they had obtained some remarkable pictures of a scanning frequency of between 600 and 700 lines it would be a long time before they had the means of transmitting pictures on such a basis. As announced, they will work with 240 lines.

Marconi-E.M.I.

Marconi's Wireless Telegraph Company have officially stated that they are in a position to offer complete stations for television transmission and to grant licences for the use of their patents to the manufacturers of receiving sets ; they have combined on a fifty-fifty basis with Electric & Musical Industries, Limited, to form the Marconi-E.M.I. Television Company for the production and sale of television transmitters. They state that " their experts have watched every company in television in Europe and in America " and there is no reason to believe that any other country in the world has made sufficient progress to introduce an efficient public service earlier than Great Britain. Marconi-E.M.I. will supply a transmitter for the Alexandra Palace site, and the statement is made that this company intends to use a standard of 405 lines, 25 pictures per second, interlaced to give 50 frames per second, each of 202½ lines.

Higher Definition

Both Marconi-E.M.I. and Baird announce their ability to transmit a public service using a far higher definition than that recommended in the Television Committee's Report. In that Report preference is given to 240 lines and 25 pictures per second, but both the companies mentioned, if we read between the lines, seem to prefer a still higher definition and we have ourselves seen experimental pictures of great beauty transmitted on a scanning frequency considerably higher than 240 lines.

We are perfectly satisfied, however, that a scanning frequency of 240 lines can provide a quality comparable with that of the home cinematograph picture.

Two Frequencies from One Station

The reader will see that when we do at last get the London station at work, one of its transmitters will be on one scanning frequency and one on another. We were in hopes that the Advisory Committee would see the very urgent necessity of insisting that all public transmission be at one scanning frequency and one alone, so that every television receiver in the hands of the public can receive every picture that is put upon the air in this country. Any other course will exasperate the public and involve great waste of money, as ultimately the principle of standardisation must triumph. It would be simply ridiculous if half the receivers in use in the country could receive only half the transmissions.

However, from official sources comes the statement that, " the committee is satisfied that receivers can be constructed capable of receiving both sets of transmissions without unduly complicated or expensive adjustment ! "

Systems of Transmission

We may briefly refer to the system of transmission favoured by Baird at the moment.

The Baird Company has developed three types of scanner. The simplest uses the original Baird method of a flying spot of light obtained by projecting the light from an arc lamp through the holes of a rapidly rotating scanning disc, the disc running in a vacuum. Very successful results have been obtained with an intermediate film scanner of the type which has found considerable favour in Germany but with the difference that the film is only used once and not re-sensitised as is the German practice. The time interval for producing a picture on the film is only thirty seconds, after which the film is scanned in the ordinary way.

A more modern development is the use of the electron scanner which is an all-electric device. Briefly, an electron image of the view to be transmitted is produced and this is

TELEVISION PROGRESS IN GERMANY

caused to move as a whole by magnetic means over a small aperture in proper scanning sequence.

Marconi-E.M.I. very religiously guard all details of their system, but it is understood that the system is purely electrical in its conception and that the analysis of the original scene or picture is brought about by the use of a cathode-ray scanner.

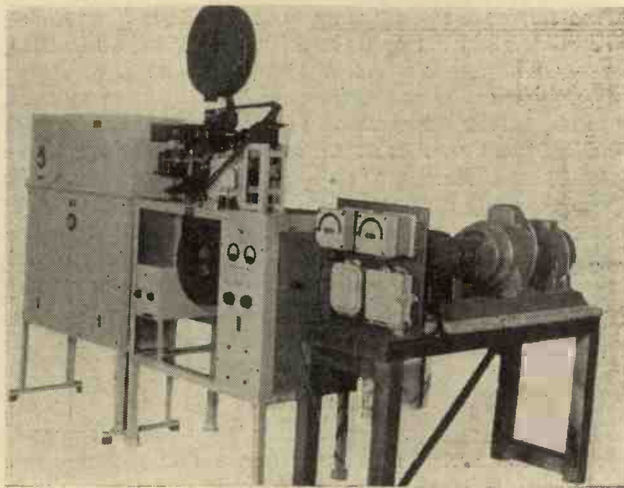
Whereas the Baird Company has developed all known types of successful scanning methods the Marconi-E.M.I. Company has concentrated entirely upon electrical methods and their system employs the more recent modifications of the Iconoscope which was developed by Zworykin in America. In this the image is thrown on to a special screen composed of a very large number of units and currents are produced according to the value of the light which any unit is receiving at any particular time. On another page of this issue details are given of the scanning frequencies to be used by this company.

There are, of course, other systems. For example, the Scophony system referred to in the Television Committee's Report is one of the most distinctive of the television systems under development in this country and is now controlled by a new company, the directors of which include Sir Maurice Bonham Carter, Mr. S. Sagall, Mr. G. W. Walton, the inventor of the system, and representatives of Messrs. E. K. Cole & Co., Ltd., the well-known radio manufacturers, who own an important interest in the company. Scophony is a radical departure from what we may call the orthodox systems of television which are originally based on the Nipkow invention of nearly 50 years ago. Scophony breaks away from all the preconceived ideas and employs a new method of optical representation equally applicable in cinematography and picture-telegraphy. The company, which, as we have said, now has the advantage of the co-operation of representatives of a highly experienced and successful radio manufacturing house, states that truly projected television pictures of the size of the home cinema are already available and that the system holds out the prospect of large screen television for cinemas. Details are given on other pages in this issue of the highly successful Mihaly-Traub mechanical-optical system.

Home Receivers

There would by now be on the market a number of receivers capable of dealing with Baird or Marconi-E.M.I. transmissions had the Advisory Committee encouraged the publication of any technical data. However, we can in this place refer to the enterprise of the Edison Bell Company who have designed two models—one a complete television and sound receiver and the other a television receiver only. The cathode-ray tube provides a rectangular picture 12 in. by 9 in. So far, the Marconi-E.M.I. have not given the public a receiver.

The Baird Company has demonstrated a couple of models which, however, were working on 180 lines but giving a very satisfactory and charming picture. The smaller model gives a picture 8 in. by 6 in., and the larger a picture 12 in. by 9 in. The model is so made that an increase in the frequency of scanning is provided for. In operation, the lid of the cabinet is raised and the picture is actually a reflection in a mirror of the end of the cathode-ray tube.



A photograph of the Scophony transmitter.

Progress in Germany

Considerable information is available as to the development of public service television in Germany and the British public may be forgiven if it draws the conclusion that more has been done in other countries than in this. British television workers are very emphatic that the opposite is the case, but it is mortifying to see already the establishment in Germany of a high-definition television service. Experimentally, Great Britain had the lead. In practice has it gone to Germany?

The German experiment may be regarded as a serious forerunner of a real service. Three times weekly, from 8.30 to 10 o'clock in the evening, there is an ultra-short-wave television transmission (6.7 metres) from the top of the Berlin broadcasting tower, 430 feet above ground level. In addition, there are regular test transmissions in the mornings and afternoons and on alternate evenings. Then there are " televiewing posts," one in Berlin and one outside that city, 13 miles from the transmitter, brought into existence by the German Post Office. The hour-and-a-half demonstrations are witnessed by about 3,000 people. Apparently, film pictures and original scenes are transmitted.

German Receivers

The service given by the German Post Office is sufficient encouragement to five manufacturers to produce television sets. The Fernseh A.G. set gives a 9.4 in. by 11.8 in. picture; the Loewe gives a small picture about 4 in. by 6 in.; the Ardenne a picture 6 in. by 6¾ in.; and the Telefunken is obtainable in two models, the larger giving a 9 in. by 10 in. picture and the smaller a 6 in. by 6¾ in. All the above are cathode-ray tube receivers. But in addition, there is the Tekade mechanical-type receiver using a mirror-screw which reflects the light of a neon lamp upon the back of a glass plate measuring about 4¾ in. by 6 in. Actually the German Government has been working hand in hand with the radio industry to sell broadcast receivers on the instalment plan, and this same plan is now being extended to television receivers.

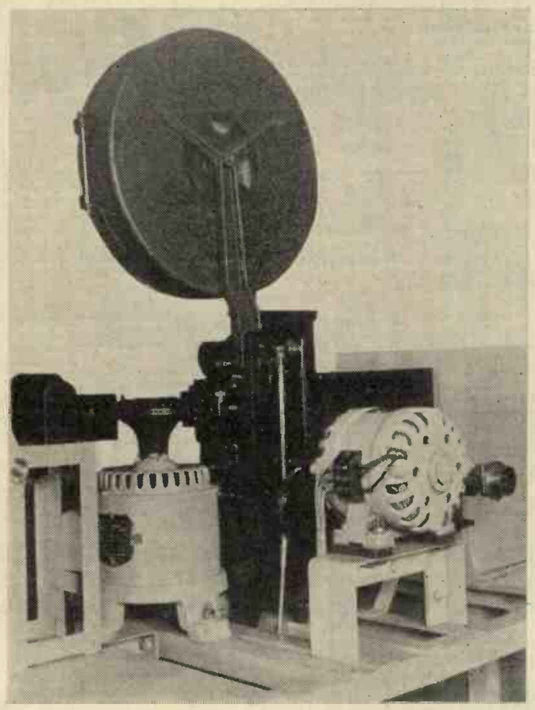
THE OPPOSITION TO TELEVISION

Apart from Germany, there is very little, if anything, to report. Every European country is immensely interested, but so far no public service has been announced.

Germany and Great Britain lead in television matters, and if the statements of our own companies are to be believed—and personally we see no reason why they should not be—we, in Great Britain, are in a better position to offer a public service than any other country in the world. We have the systems, apparently we have the apparatus, we have undoubtedly a number of men who know a great deal about the subject, we have the public demand—we have everything except—at the moment of writing—the service itself.

Meeting Opposition

The reader will wonder whether television has special opposition to meet. There are certainly a number of people and interests who view it with suspicion, and possibly with fear. The recent attitude of the British radio manufacturers has been rather disconcerting. On the publication of the Television Committee's Report, the popular newspapers of the country rather lost their heads and, speaking in complete ignorance, at once assured the public that "television was here" and that in a month or two's time every receiver worthy of being called up-to-date would be adapted for both sound and vision. The radio manufacturers believe that this unbalanced publicity very seriously interfered with the sale of the ordinary broadcast receiver in the early months following the publication of the report. We believe that other causes should share the blame for the drop in the sale of receivers and that it is incorrect to assume that all the trouble, or even a large proportion of it, could be attributed to the ill-placed enthusiasm of the general press, but the radio manufacturers got it strongly into their minds that television was the culprit and there is strong suspicion that they have, since February, systematically thrown doubt upon the ability of present systems of television to afford a satisfactory service within the next few months.



The Scophony transmitter light source container and film drive motor.

The radio manufacturers have banned from the forthcoming Radio Exhibitions in London, Manchester and Glasgow, any exhibits of television receiving or transmitting sets or kits of parts, and also catalogues, leaflets, brochures, or other literature, advertising or recommending or descriptive of such apparatus. (We extract this information from the printed rules of the Exhibitions.) We do not know the reasons that inspire or prompt such action. They may be good or bad, but the effect is to convey the impression, perhaps entirely unintended, that the Radio Manufacturers' Association is afraid of television. As year succeeds year, the radio exhibitions tend necessarily to become more and more exhibits of beautiful cabinets *and less and less of obvious* apparatus *and we should have thought, from the point of view of interest to the general public that television apparatus would have been welcomed as exhibits. In any case, we feel that the Radio Manufacturers' Association has made a mistake.*

Entertainment Value of Television

A television service to-day can definitely provide the public with interesting pictures. If I remember rightly, the very first television I saw some eleven years or so ago in J. L. Baird's back-room in Soho was the letter "H." For many years, as television very slowly and with great difficulty developed, the question everybody asked was, "Where is the entertainment value?" To-day the entertainment value of television can be taken for granted. At recent demonstrations I have seen cinematograph films televised with great success; I have seen horses jumping; I have seen theatrical scenes; I have seen demonstrations of drawing; I have seen, and, of course, heard, musicians playing various instruments; I have seen most fascinating and telling demonstrations of ladies' fashion. Yes, the entertainment value is there all right to-day, and with such special brains as a public television service would soon attract, there can be no doubt that it would be maintained.

Television and Films

The cinematograph film alone, which offers itself very readily for television, suggests immense possibilities. A public television service to-day could give us, in our homes, and, perhaps one of these days on the extended public screen, news pictures and stories of never-ending variety. It must not be forgotten that the Baird Company is itself within the financial sphere of influence of a great film producing company whose name is on everybody's lips, and they would have no trouble in obtaining a supply of films. Surely, too, Marconi-E.M.I. is big enough to make all arrangements necessary for the production and televising of a regular film programme, and it has been suggested that the B.B.C. may, in course of time, become its own film producer in connection with its television requirements.

The ease with which film pictures can be televised has suggested one of the most satisfactory systems at present in use for the televising of outdoor and indoor scenes: the scenes themselves are photographed by a cinematograph

THE FUTURE OF TELEVISION

camera, the film images there and then developed and fixed, and the pictures televised with a time lag of only 30 seconds or so, the film itself being either wasted or, as in the German system, scraped, re-coated with emulsion, and used over and over again in the form of an endless band. The result is excellent, but the coming of the electron scanner, already in use in the Baird and Marconi-E.M.I. studios may render this method unnecessary. Whichever way is adopted, whether or not photography enters into the scheme of television, we are assured that scenes of considerable area can now be satisfactorily televised.

I remember with what pride Mr. Baird showed me, some six years or so ago, how he could televise a scene in which two people—a couple of boxers—took part ; it is possible to-day to televise a scene comparable with that of any ordinary stage spectacle.

What about the Provinces ?

Is there to be no television in the Provinces ? Will the new station, when we get it, simply provide London with television and leave the Provinces in the cold (perhaps the proper metaphor is " in the darkness ") ? The London station is itself just an experiment, and in the light of the experience so obtained the Advisory Committee is empowered to proceed with the planning of additional stations until a network is gradually built up.

The question as to what area will be covered by one station has yet to be answered, for there is evidence to suggest that in practice the range covered by high-definition short-wave transmission may be much greater than theory would suggest.

Paying for Television

Finance is a stumbling block. The Report stated that the cost of providing and maintaining the London station up to the end of 1936 would be £180,000, but recommended that there should not be any separate licence for television reception at the start of the service ; that revenue should not be raised by any increase in the ordinary licence fee or by the sale of transmitter time for direct advertisements ; but that the permission in the B.B.C.'s existing licence to accept certain types of sponsored programmes should be applied to the television service. So the B.B.C. finds itself entrusted by the Committee with the broadcasting of television, but does not find itself with any special funds for the purpose. We are left with the assumption that the B.B.C. has been asked to shoulder the whole of the extra expense for an introductory period. In the B.B.C.'s new charter there will doubtless be special provision for the financing of television.

Sponsored Television Programmes

The B.B.C. has never favoured the financing of broadcasts by means of sponsored programmes. Commercially, such programmes are a success only when large numbers of the public can receive the programmes and when they do so willingly ; in the case of the ordinary broadcast sound programme, the sponsored programme is a failure unless it succeeds in selling goods in which the sponsors of the programmes are interested. At the start of television there would be very few people with viewers or receivers and the early sponsors would not be likely to get their money back. The difficulty would, of course, be only temporary, and if the sponsored programme as a means of financing television were kept as a permanent device, it would provide a remarkable demonstration of the selling powers of vision as compared with those of sound. It needs very little imagination to see what tremendous pulling power an advertiser would have if he could show us beautiful pictures of, for example, the houses he would like to build for us ; of charming ladies wearing the confections which he would like to sell ; of foods and drinks of an appetising character, and so forth. The general press, which largely depends for its income on the advertiser, might well shudder at the prospect.

The trouble will be, as we have explained, at the start when there will be but comparatively few sets to receive televised pictures and when the sponsors will be putting out their programmes with very little hope of return.

What of the Future ?

Is Television, as the public understands the term, coming soon ? Undoubtedly, yes. It is coming this Autumn—in spite of all the delays and all the peculiar difficulties it has had to meet and conquer. Technically, television can give a service and a very attractive one. Commercially, the way is none too clear at the moment, but we are convinced that television, which we have been told a hundred times " is here," is now only a few months off. The Alexandra Palace station will be working, we trust, before the end of the year and the months following the inauguration will teach us all a great deal.

There are many who have consistently failed to believe in it. There are those who have hindered its coming and there are still others who are jealous of it, but there is every reason for confidence that all of them will join the band of enthusiasts before many months are over. The Winter of 1935-36 should make history.

When to Listen for Short-wave Stations during JULY

By 2BWP, C. J. Greenaway,

B.S.T.	3.5 mc.	7 mc.	14 mc.
0100		W1, 2	W1, 2, 3, 4, 8
0200			W1, 2
0500	W1	W1, 2	
0600	W1, 2	W1, 2, 3, 4, 8; ZL	
0700		W1, 2, 3, 4, 8, 9 ; ZL	W6
0800		W1, 2, 3, 4, 5	W6
0900		W1, 5	
1400			FM4
1500			FM4, 8 ; SU
1600			FM8
1700			FM4, 8
1800			FM8 ; FF
1900			FM8
2000			FM8 ; SU
2100			SU
2200			FM4, 8 ; LU ; PY ; SU ; W1, 2, 4
2300			LU ; W1, 4
2400		VE2	W1, 2, 3, 4, 8, 9 ; LU

Design of a 5-metre Super-het

Many amateurs now feel the need for a simple ultra short-wave super-het. **Kenneth Jowers** *has been experimenting on the 5-metre waveband and from an arrangement suggested by the Marconiphone Company has evolved an efficient super-het suitable for the 5- and 10-metre amateur bands.*

ALTHOUGH I have generally used a super-regenerative receiver on five metres, I have always been of the impression that in suitable circumstances a super-het would be more efficient. Several super-het receivers have been made up during the past year and, although the B.B.C. and Baird transmissions were generally heard at good strength, amateur stations were not at all well received.

Bad Transmissions

Apparently the trouble has been that amateurs, content with obtaining a small amount of radiation and at the same time putting out bad-quality and low-modulation percentage, make their signals difficult to receive. In addition, few of the early amateur stations on five metres can claim even reasonable frequency stability. Consequently the super-het, no matter how efficient, was of little use. Frequently I have been able to pick up five-metre carriers which wobbled all over the place.

This is the X41 triode hexode with a 4-volt heater. It is also available in the universal range and is designated the X31. Although primarily intended for normal short-wave working it proves excellent down to four metres provided the circuit on this page is used. Make sure to screen the grid from the oscillator so that the only coupling is via the electron screen.

The super-regenerative receiver is inclined to smooth over these effects and until just recently has been one of the easiest circuits to get going. Consequently it is popular amongst the amateur fraternity.

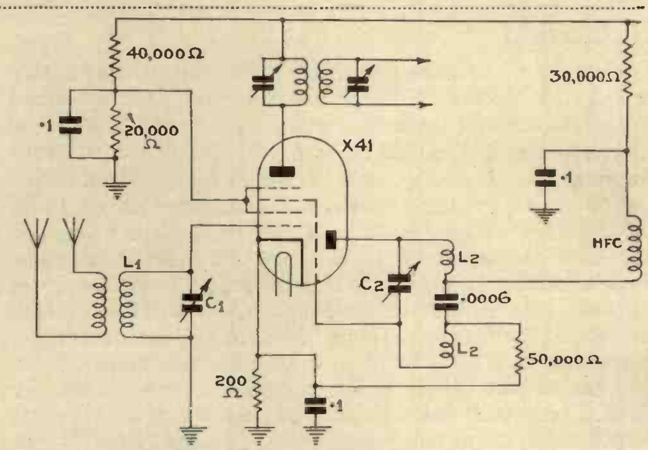
I was fortunate enough to obtain from the Marconiphone Co., under a promise of secrecy, some specialised details about the triode-hexode on five metres. Several circuits were already available, while I have also tried every circuit published by our contemporaries. Some of them were satisfactory and some were not, but even the best of them would operate with one valve and not with another.

The Circuit

The arrangement finally used is shown by the diagram and operated satisfactorily with four specimen valves obtained. First of all, for those who are not familiar with the triode-hexode, here are some details of its construction. Actually it consists of an indirectly-heated cathode common to two sets of electrodes, the hexode and triode. The hexode has four grids and an anode surrounding the cathode. These are control grid, screen grid, mixer grid and screen grid again.

Both screen grids are connected internally and shield the mixer grid from the control grid and anode. The triode grid is also connected internally to the mixer grid, so that the oscillation generated by the triode modulates the hexode cathode electron stream.

I do not consider it necessary to give the complete super-het circuit, for this is entirely conventional after the anode of the triode hexode. The only point to bear in mind is that the detector-oscillator circuit is designed to feed into the intermediate-frequency circuit of 465 kc. These coils are readily available.



Provided that the I.F. coils are of the correct frequency any conventional super-het circuit can be used with the X41. A.V.C. can also be added without difficulty.

The signal input is fed into the control grid of the hexode through a conventional coil and condenser circuit. Actually, C1, the grid-tuning condenser, should have a capacity of 25 micro-mfds. and be of the Eddystone type 900.

Coil Construction

L1, the grid-tuning coil, should be wound with 12-gauge enamel-covered wire and consist of five turns half-inch diameter and self-supporting. L1 should be connected directly across the grid pin of the valve holder and earth, while connections to C1 should be very short, less than an inch and a half.

C2, tuning L2, has a capacity of .00005 and should be of the same construction as C1. As both electrodes are above earth it is essential that this condenser be mounted on an insulated bracket and fitted with a reasonably long extension spindle. L2 is made in two sections and linked together with a fixed condenser of .0001, but both sections of L2 should not exceed five turns and be constructed in the same way as L1.

A cathode bias resistance of 200 ohms is also required, while the leak in the grid circuit of the triode should have a value varying between 10,000 and 50,000 ohms. The high-frequency choke in the anode of the triode section is of the standard five-metre type, but for the purpose of experiment 50 turns of 26-gauge enamel-covered wire, space-wound on a ½-in. former will give satisfactory results.

Alternatively, approximately 20 turns on a small test tube will be equally satisfactory. The voltage applied to the screen is rather critical, but my final circuit used a fixed potentiometer with 40,000 ohms on the high-potential side and 20,000 ohms on the low-potential side. However, as valves may vary in characteristics, perhaps it would be advisable to use, at any rate temporarily, a variable potentiometer to obtain screen voltage.

Again, with the voltage applied to the triode anode, although 50,000 ohms was satisfactory for the particular valve I had in use I do feel that a 100,000-ohm variable resistance would be an

(*Continued in 3rd column, p. 408.*)

REVIEWS OF THE PROGRAMMES AND RECEPTION REPORTS

JOAN ORMONDE, a distinct "find," televised for the first time under difficulties. Between her engagement to take part in a programme and her actual appearance in the studio she was offered and accepted a music hall booking at Dover.

Choosing not to disappoint either audience she secured a racing car which, dashing between the studio in Portland Place and the hall at Dover, allowed her to fulfil both engagements.

I liked this singer, who dances happily and takes so much trouble, and expect to see and hear her again.

Since considerable structural alteration will be necessary at the Palace it is impossible to forecast when the first high-definition programmes will begin.

Apart from the adaptation of a large section of the building for studios, offices and transmitter rooms, a mast has to be erected, and it is difficult to see how the work can be finished before the end of the year, even if a start is made immediately.

A survey was completed before the site was selected and plans are being prepared for the best use of the accommodation.

From the entry of the Eight Good Lookers downs the gang plank to the fade out after a Southern number there was no dull moment. It was a neat effect when the girls turned their black boxes to the scanner to reveal seven white initials which made SKYLINE.

The Irish cook and the Yiddish page were well drawn character. Real eggs and flour were used by Sara Allgood in the sketch; Broadway Lullaby was sung as only a coloured artist can; and when Billy Milton was seen at the piano I felt that I was one of his audience in "El Morocco."

* * *

Now that the crystal microphone is fitted into the portable "wand," a new use has been found for the wooden boom which was erected across a corner of the studio to carry the microphone.

The boom, hinged to the studio wall, at a height of about 8 ft., has been draped with curtains which, by means of the hinge, can be swung into position at right angles to the scanner and about four feet away. The curtains part to reveal an artist in close-up, or close to mark the end of an act. When not required the boom is swung out of the picture and the curtain hangs out of the way against the studio wall.

Storage of "props" is a problem at Portland Place and the producer would be a good deal happier if all the stage furniture could be handled as easily as this. "Props" must be accessible and yet out of sight. Tables, chairs, boxes, doorways, and a staircase are piled round the corner in the angle of the studio, which the scanner can never reach. Other pieces are kept downstairs in a passage and articles not in general use are housed in a garage at the back of the house. Engineers, designing accommodation at Alexandra Palace, will provide ample storage space.

However much the definition on our screens may be improved when we view pictures of 240 and 405 lines, the entertainment that Eustace Robb has provided during the past four weeks will be pretty hard to beat.

The Skyline programme would have made a good short film, and watching both performances I was impressed by the refinements of the second showing; it is extraordinary what a difference the addition of a few props such as a table and chair can make to a sketch.

An aerial view of New York was an ambitious project, but as we progressed up town from the Battery through the German quarter to the hotels and night clubs around Times Square and on to the negro haunts of Harlem, I longed to re-visit that amazing city. Eliot Hodgkin's drawings left a vivid impression of its architecture, and a black and white cast drawn from several nationalities gave a performance that was representative of its inhabitants.

Have you noticed the white wood piano with black edges now in use in the studio? It rests on blocks which raise the keyboard into focus. Sydney

Miss Cleo Nordi who recently gave a display of dancing. She is one of the most accomplished dancers who has appeared before the scanner and her interpretation of the music of Delibes was a pleasure to watch.

Jerome played the instrument in semi-close-up and I got several detailed pictures of hands and keys from a side view. It is a pity that this scanner cannot be " dipped " to give the kind of shot that makes dance band films more entertaining.

In the same programme Gus Chevalier acted as compere and his habit of blinking came through clearly on my screen. The cells seem to emphasise any idiosyncrasy as the microphone does in aural broadcasting.

Comedians think in terms of visual effect, it is an important part of their business, and Gus Chevalier devised his own " curtain," a spectacular leap and double somersault from the back screen to close-up with the company lined up on either side.

* * *

For his debut in the television studio, Leonard Henry produced costumes and material that he had used in concert parties before broadcasting claimed so much of his time. His toreador material would lose half its point if he could not be seen. This and other ideas which made me laugh had been discarded when he became a radio star. Perhaps he has others up his sleeve. Encouraged by Eustace Robb, who explains what makes a good picture, artists often produce good visual tricks.

The Ted Shawn male ballet gave a striking exhibition. At one point men danced non-stop for four and a half minutes, and what's more apparently enjoyed it. By a skilful fade from a drawing of a dancer in the caption machine to a dancer in exactly the right position in the studio it was impossible for some seconds to detect whether one was looking at cardboard or reality. There is another ballet night on July 3, when Algeranoff and Diana Gardner will appear in " Carnival."

* * *

The Victorian programme can best be described as illustrated history, and the experiment seemed to me to show the way to more palatable education in the future.

A fascimile of the first Queen Victoria penny postage stamp seen in the caption machine was followed by a group of songs of the early nineteenth century sung by artists dressed in the authentic costume of 1830-1840. The " Lady with the Lamp " was seen in silhouette; soldiers returned from the Crimea—it was 1856 —to the rousing melody of " The British Grenadiers."

1870 and a picture of the Albert Memorial indicated that the Prince Consort was dead. Later we observed the passing of the crinoline and the entry of the bustle, with a song of the times called "The Grecian Bend."

I could have taken more interest in history at school if only lessons had been taught this way.

The Ted Shawn troupe of male dancers who gave a remarkable performance before the scanner during June.

Design of a 5-metre Super-het

(*Continued from page* 406)

advantage until the correct value has been determined.

Aerial Coupling

It is most important that the aerial be very carefully coupled to the grid coil. Although the lead-in wire can be left looped around the grid coil, this does not give maximum signal strength and it is advisable to erect a doublet aerial cut to length similar to the one manufactured by B.T.S.

Even though the receiver is very efficient, simple to tune, and docile, results will not be satisfactory unless the receiving aerial is reasonably free from screening. Eight to ten feet will be ample, but in poor localities it is a good idea to try the effect of using a standard broadcast aerial coupled by means of a very small fixed capacity.

Background noise-level is low, a distinct change from the super-regenerative, so that weak stations really can be heard without much trouble. From the first preliminary experiments it seems that this type of valve with a suitable circuit will solve the problem of DX reception on five metres, while it is an easy matter to remake the tuning coils so as to cover the ten-metre band.

B.T.S. Ultra-short-wave Receiving Aerial

TO obtain maximum signal strength with an ultra-short-wave receiver, a correctly tuned aerial must be used. It has been recognised that the most efficient short-wave aerial is the half-wave doublet with tuned feeders.

B.T.S. have evolved an aerial of this kind and arranged for it to be supplied in kit form. It consists of two half-wave radiators, two correctly cut feeders, complete with insulators, spreaders, two series tuning condensers and a mounting bracket. In addition, a strong spring is also available so that the aerial can be kept taught.

The insulators are made of Megacite, well known to short-wave amateurs as being most efficient on high frequencies. This aerial can be used with any type of short-wave receiver and invariably will give a noticeable increase in signal strength. The price has been fixed at 21s. Supplies can be obtained from B.T.S., Ltd., Bush House, Aldwych.

RECEIVING B.B.C. TELEVISION IN ICELAND

By F. Livingstone Hogg

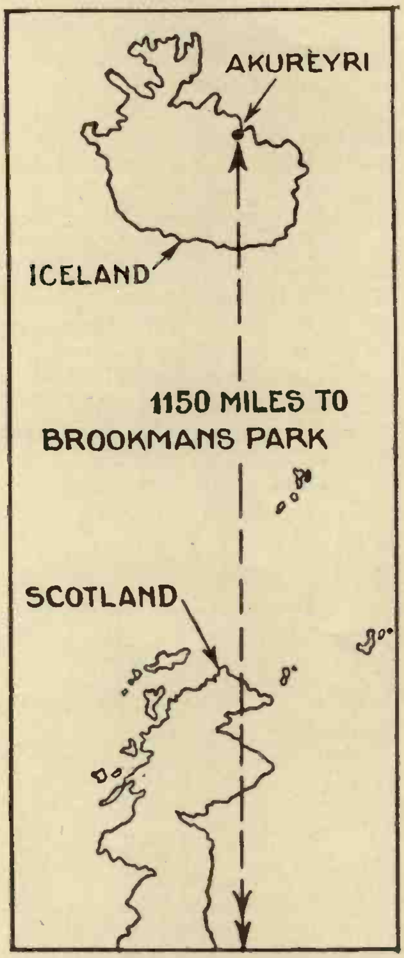
It is generally supposed that even low-definition television can only be received satisfactorily over comparatively short distances. This is not the case, and the writer describes results obtained over a distance of about 1,000 miles.

THE transmissions received were those sent by the Baird process from London National. The receiver was in Akureyri, Iceland. It is a very mountainous country, and not altogether a good place for radio reception. Signal strength varies greatly from place to place, and in the towns, local interference from electricity supplies is considerable. This is because nearly all distribution is by overhead lines.

In general, medium-wave stations are only received in the evening, at dusk or after dark, when their strength is often remarkable. In the summer months, there is no darkness at all, and then one cannot depend on any reception from such stations. London National gives a very fine signal, and can be depended on between August and March, except on occasional "bad nights." Although often receivable outside those months, it is hardly worth while then, as the local interference does not permit of the use of sufficient amplification.

Midland Regional is not heard at all well and, peculiarly enough, it appears to become weaker late in the evenings. Fairly satisfactory reception can often be obtained on a set using only one high-frequency stage, but for consistent results two or even three stages are desirable. Small superhets with no signal-frequency H.F. stages are not so satisfactory as straight sets. These remarks only apply *in toto* to the north of the island. In the south and east, conditions are not nearly so unfavourable.

Although I was familiar with the transmission and reception of television in the laboratory, my practical experience was obtained over four years ago. Fortunately I had a fairly large stock of components to draw on, but they were all three or four years old, and no new stuff was available. Much of the gear was out of date, and many unsatisfactory parts or methods had to be used as nothing else was available. Circumstances were therefore not particularly favourable, and the results were not obtained by using the best of everything regardless of expense. The televisor used was one of the original Baird disc machines.



This map shows the position of the receiver and the approximate distance from the London National transmitter.

Aerial Arrangements

The receiver was installed in what appeared to be a very good spot, but was not. The aerial was a single wire, slung from a short pole on the house top to a 100-ft. mast on a hill behind the house about 100 ft. high, rising with a gradient of about 1 in 1. The strange thing is that in places a mile or two off, signals are nearly as good, or sometimes better, on average aerials. The large aerial

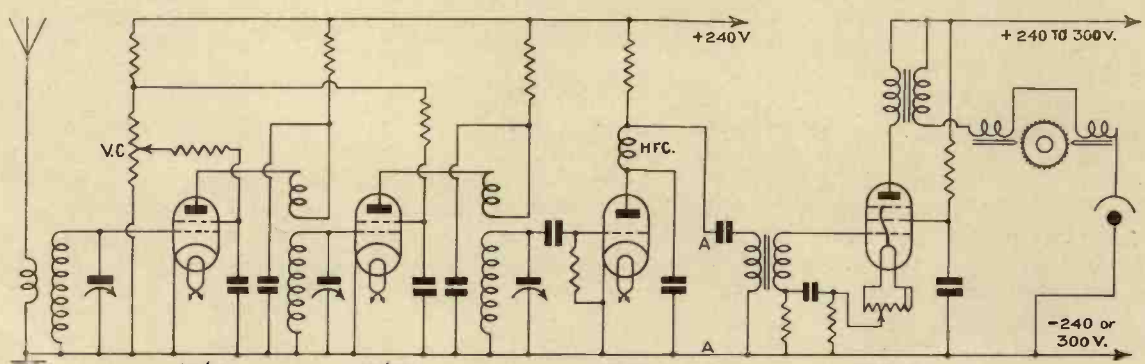


Fig. 1.—The circuit of the vision receiver used by the writer to receive the 30-line transmissions in Iceland. Modifications were made later, as described in the text.

SYNCHRONISING AT 1,000 MILES

is badly affected by interference from the electric supply lines, which are only a few yards away. It must be remembered that the tolerable amount of interference is very much less when a powerful receiver has to be used. Probably the actual field strength of the interference is not so very high, comparatively speaking.

Owing to pressure of work, there was no opportunity to try the televisor until November, 1933, but one evening I thought something ought to be done about it; I therefore began to take stock of what was available. There was an old half-finished receiver dating from 1929. It had two transformer-coupled H.F. stages using AC/SG valves, coupled to a 354V power grid detector, feeding a PM24A through a 7 to 1 transformer, with a final output transformer. The set was intended to be mains driven, but had never been finished; there were no grid bias or feed potentiometers. There were a 240-volt, 10 ampere-hour accumulator, and two large 4-volt accumulators, so these were connected to filaments and H.T. as necessary. The volume was varied by means of a potentiometer controlling the screen-grid voltage on the first S.G. valve. The set was tuned by edgewise dials on three separate condensers. The components were built up both sides of a metal base, coils on top and valves underneath, a large steel cover with partitions separating the top of the chassis into four compartments.

Some trouble was found with the biasing of the S.G. valves as modulation hum was picked up in the aerial circuit. Later a number of experiments was tried and it was found that using a separate bias cell, or any other means of biasing, was no better than returning the coils direct to cathode. Neither cross-modulation nor selectivity seemed to be effected at all, but one day on trying a modern high-slope valve, I could not at first imagine why the associated tuning condenser had apparently no effect at all. As the AC/SG valves were used for all the tests, no bias was used, but this should not be regarded as a precedent. Many other objections could be raised to this outfit, but there was no option, and the resulting amplification was very considerable. The worst trouble with it was cross modulation.

Later, the set was rebuilt using modern variable-mu valves. The difference in performance was very striking, much more than had been imagined. The televisor was connected up to the output transformer, so that the final circuit was as shown in Fig. 1. As an accumulator H.T. supply was used, it was not necessary to take much trouble about decoupling. The televisor motor was fed from the A.C. mains.

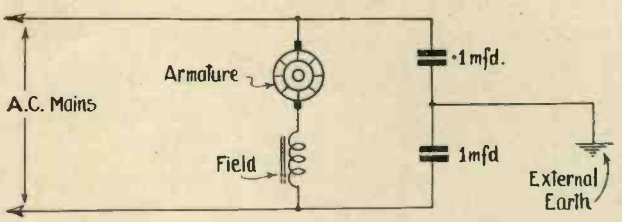


Fig. 2.—The means adopted to reduce interference.

As soon as the television transmission started, about a couple of hours after beginning to erect the apparatus, a picture was obtained. This appeared to be a negative, so the transformer secondary was reversed, but that did not seem to be much better—from which it may be gathered that the image was not particularly good. However, after tuning in a bit more carefully, and rectifying one or two small points, a recognisable picture was obtained, which caused the onlookers considerable amusement. They seemed to think it was a performance by a bearded lady of a circus, who was followed by the bearded gentleman. Still more laughter was caused when it was seen that the beards were more or less detachable, and did not move altogether in agreement with the performer.

It was obvious where the trouble lay: in the inter-valve and output transformers. There was also not sufficient output to give a good picture before overloading set in. Synchronising did not seem to be very noticeable either.

The next evening an eliminator was rigged up to supply 300 volts for the pentode. This improved things somewhat, and would almost hold in synchronism, but the beards were as bad as ever. It was found that the mains voltage variations were so greaat that the panel adjustment of resistance was not sufficient to cope with it. The motor was thereafter driven from the H.T. accumulator. Still there was not quite enough power to synchronise properly, so in a few moments another PM24A was paralleled with the first one, except that one fed the neon and the other the synchronising coils. This was worse than ever. A moment's thought showed that the impedance of the coils was not nearly high enough to work direct in the output circuit of a pentode, but no step-down transformer of suitable type was available.

Interference Troubles

At first, some trouble was experienced with the motor, as it interfered with the picture considerably, because the receiver was so powerful. Various suppressing arrangements were tried, and it was found that the best results, on the A.C. mains, were obtained from the circuit of Fig. 2. On changing over to D.C. from the accumulators, it was found that this scheme was worse than nothing, but by earthing to the frame of the motor instead of an external earth, the interference was eliminated.

All this was merely temporising—it was obviously necessary to eliminate the transformers. The members of the household who looked, and ought to have been duly impressed with the marvels, merely laughed, quite unappreciative of the difficulties. The next step was rather a big one—no valve was available between the PM24A and a DET1A, one of the earliest low-impedance valves, dissipating about 30 to 40 watts. It is rated at about 500/600 volts on the anode and 6 volts, 4 amps. on the filament. Someone once unkindly remarked that it was a valve remarkable for the curvature of the straight portion of its characteristic, but in its day it was unique. It requires about

GETTING GOOD PICTURES AT LONG DISTANCES

100 volts grid bias, but for television it is desirable to overbias it, when feeding the neon direct in the anode circuit, so that the feed current is not much over 30 mA on no signal.

This sounds like a very powerful and expensive arrangement, and so it was in the days when it was designed. Nowadays, one can get at least as much *undistorted* output from a PX4 on 250 volts, and probably a good deal more. Even if one does not demand undistorted output, the limit of the DET1A is about 4 watts. Modern valves would have enabled much better results to have been obtained with lower voltages and a much bigger factor of safety.

If all iron was to be eliminated, one stage was needed between the detector and the DET1A for a positive image.

The detector, with a 9 mA steady current, and a 10,000-ohm anode resistance demanded a valve with at least 13 volts bias to accept peaks of 100 per cent. modulation, which should always be allowed for, and preferably a little more for safety's sake.

But the only valve available which could give the necessary hundred odd volts for the DET1A was our good old friend the LS5B. This, resistance coupled, will take a bias of nearly 9 volts, and deliver something like 100 volts to the next valve. There was, therefore, no factor of safety; in fact, it would be better called a divisor than a factor, but there was nothing else available. A pentode was tried, but results were not as good.

Fortunately in television, one does not get the sudden changes in depth of modulation found on telephony; in fact, the average depth of modulation on television is probably very much greater than on telephony, as allowance does not have to be made for such big changes. This helped to minimise the disadvantages of the arrangement. The voltages for the DET1A and LS5B came from eliminators, except that a battery was used for the LS5B bias. H.T. came from a 3-phase outfit using RH1 half-wave rectifiers, delivering 500/550 volts of D.C. This voltage was not sufficient for the efficient operation of the LS5B and DET1A, quite 650 volts could have been usefully employed had they been available. Grid bias for the DET1A came from the eliminator previously used for the pentode H.T., via a potentiometer, so that it could be adjusted to the best value. The grid leak of the LS5B was a 50,000-ohm potentiometer, fed directly from the anode of the 354V through an H.F. filter and a 1-mfd. condenser. The synchronising coils and neon lamp were in series with the anode of the DET1A. The final circuit, from the detector output onwards, is shown in Fig. 3. The H.F. and detector portions were still as shown in Fig. 1.

Excellent Results

Rigging this outfit up did not take long—an evening sufficed—and all was ready just as the transmission started. Results immediately exceeded all expectations. The old chess-board floor came out clearly and distinctly, and all the beards had vanished. Synchronising was excellent, provided the motor had been running for a quarter of an hour or so. Once having been synchronised carefully, after settling down, it would not go out of synchronism unless there were bad fading or sudden change of scene. When one scene was faded into another, no trouble arose. After the first couple of evenings, hardly an alteration was made to the apparatus, which improved the image, and it was considered that as good results as possible had been obtained with the apparatus available. The deficiencies were obviously in the H.F. amplifier and unsuitable valves.

The pictures received were, apart from fading and such effects, quite free from shadows and hangover, but a deficiency in high frequencies was noticeable in the lack of detail in the eyes, as the pupils could not usually be seen. It is difficult to describe the quality of an image, particularly when it often changes due to fading, but, apart from this, results appeared to be well up to those obtainable in this country, and were better than expected considering the known deficiencies of the apparatus.

Effects of Fading

The only things which spoil the continuous appreciation of a programme are the fading and associated effects. There is the usual general fading in which the received signal strength varies between wide limits (which nearly always accompanies the reception of long-distance stations) but this can be rendered negligible, except when very bad, by means of A.V.C. Much more annoying, however, are the distortion effects, which cannot so readily be rectified. I have rarely seen double images, except on the " Good-Night," and triple images are rarer still. I put down the double images seen on the " Good-Night " to amplifier kick back, but the effect was rarely noticeable on other images. Just occasionally there would be a very marked case of multiple images, but it usually lasted only for a few seconds. In these rare cases the images were often more or less all of the same intensity.

The two most common effects were, probably, due mostly to selective fading of high and low frequencies. The first-named gives a peculiar " out of

(*Continued at foot of page* 414).

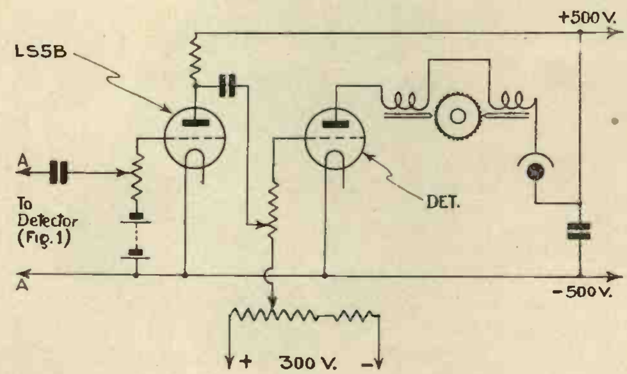
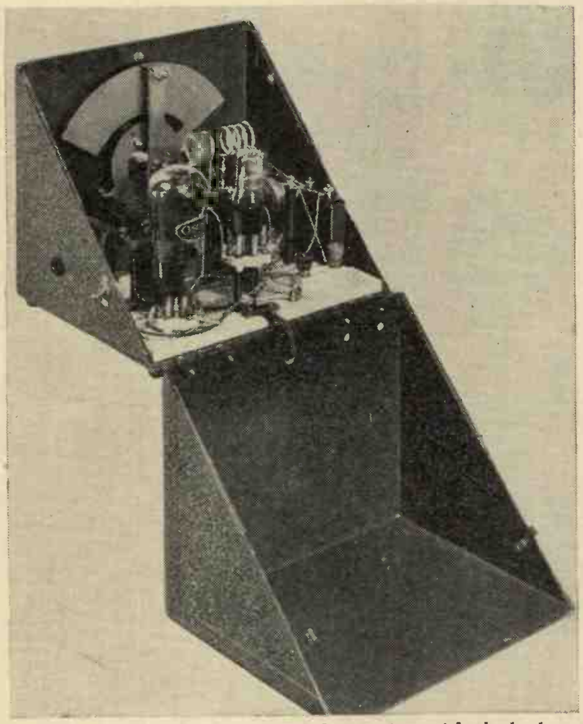


Fig. 3.—It was found necessary to modify the original circuit and this is the one from the detector onwards which was finally adopted.

A Three-valve 5-10 Metres Super-regenerative Receiver

Of all the receivers that might be adapted for ultra-short-wave working, none are quite so popular as the simple super-regenerative.

ALTHOUGH several types of super-regenerative receiver are available, they are all fundamentally similar. Portable midgets usually consist of one valve which combines the functions of detector and oscillator. Another variation is to have a separate oscillator or quencher and detector valve. The advantage of this arrangement is that the circuit is much more stable and the quench noise is considerably reduced.



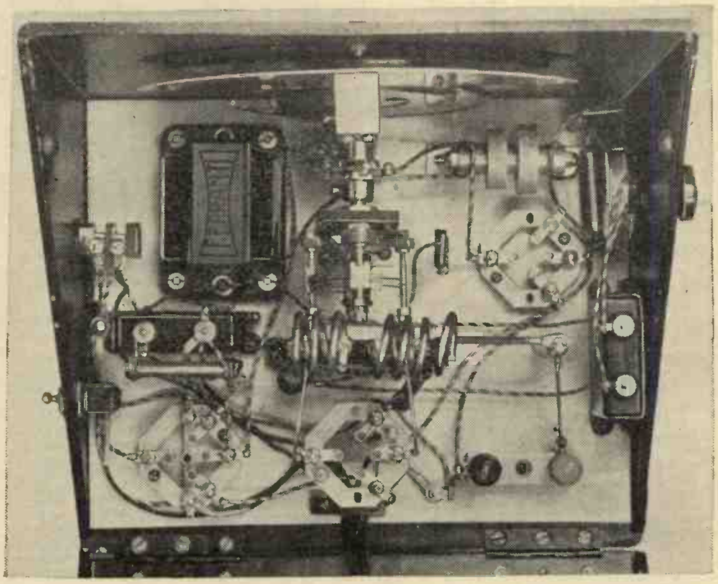
This photograph shows the complete receiver with the back of the case open.

When the receiver is to be used with a fixed station and can be coupled up to batteries and accumulators in the normal way, the doubtful advantage of compactness, economy in running costs and minimum weight are not really important. A fixed receiver is generally used reliably to bring in weak signals and to be used in conjunction with a transmitter with a view to obtaining duplex working. In such circumstances, we feel that this circuit we have used is the most satisfactory. The point is more or less proved by the fact that although several other receivers are available, G5ZJ has been for some time using this actual receiver for his 58-mc. tests.

Consequently any little deficiencies which might only have appeared after continual use have become apparent and removed, so now the receiver is as good as one can get it. Incidentally, if the receiver is good enough to be used continuously for reception of other stations as is the case with G5ZJ, we feel sure that our readers will be confident they will be capable of picking up all the signals within a reasonable range.

Circuit Arrangement

The final circuit arrangement is a triode detector with separate triode quench or oscillator valve, and one stage of audio amplification to boost up weak signals. A common H.T. tap to which should be applied anything over 75 volts supplies H.T. to the three-valve anodes. The voltage applied to the detector is variable by means of a 100,000 ohm resistance mounted on the side of the case. This enables the strength and fierceness of the oscillation to be controlled and in a measure governs the background noise level. Other than the main tuner, this variable resistance is the only control, and that need not be adjusted more than once or twice.



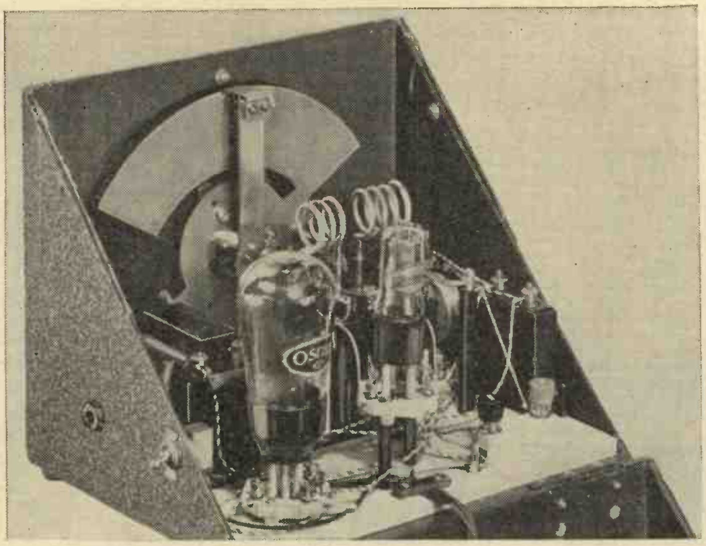
A plan view of the receiver chassis showing the layout of the components

The tuning scale is calibrated in degrees from zero to 100 and in practice the receiver covers from about 4 to 7 metres. With the coils used 58 mc. comes in at approximately 60 degrees.

Readers who have not had any experience with ultra-short-wave working will appreciate our choice for a super-regen. receiver, for in addition to its high degree of selectivity, we will not say extreme, for a super-het would probably be better, it is comparatively flatly tuned so that stations are easy to receive and slight frequency wobble is almost immaterial.

Although it has no bearing on the receiver and will probably not interest a number of potential constructors we do feel that a few words would be advisable on the super-regenerative circuit. It is well-known that the sensitivity of a regenerative receiver increases very rapidly as it approaches oscillation, but the oscillating point, or rather just below, gives the maximum amplification. With the super-regenerative system the application of an additional super-audible frequency voltage on the grid or even plate of the regenerative valve allows a high degree of regeneration to be obtained without giving the almost paralysing oscillation one normally would experience.

In a simple receiver, the regenerative valve is plate modulated by the long-wave oscillator so that the detector anode voltage swings backwards and



A close-up of the receiver in its metal case.

forwards at the frequency of the oscillator. On positive peaks the voltage is so high that it would normally make a conventional detector oscillate very violently. Such oscillation, however, has no time to develop for the plate voltage swings down on the following half cycle of the secondary oscillator. Theoretically oscillation may develop during positive half cycles, but the amplitude of such oscillation will be of such a low order as to make it of little consequence. Operated under such conditions a regenerative detector will give an amplification factor several million times greater than that of a leaky-grid detector worked inside its oscillation point.

Components for the Super-regenerative Three-valver

BASEBOARD
1—5-ply 9½ × 7½ (Peto Scott).

COILS
1—set 5-metre type 976 (Eddystone).
1—Quench coil type S46 (Bulgin).

CONDENSERS FIXED
2—1-mfd. type 50 (T.C.C.)
1—.0001 type M (T.C.C.)
1—.0005 ,, ,, ,,
2— .002 ,, ,, ,,
1— .005 ,, ,, ,,

CONDENSERS VARIABLE
1—.000015 type 900 (Eddystone).

CHOKE H.F.
1—type 947 (Eddystone).

DIALS SLOW MOTION
1—type 970W (Eddystone).

HOLDERS VALVE
3—type SW21 (Bulgin)

PLUGS, TERMINALS, ETC.
1—type S47 terminal block (Bulgin)
1—phone jack type J3 (Bulgin).
1—plug type P38 (Bulgin).
2—wander plugs marked H.T. plus, H.T.— (Clix).

PLUGS TERMINALS, ETC.
2—spade terminals marked L.T. positive, L.T. minus (Clix).

RESISTANCES FIXED
1—1-megohm 1-watt type (Erie).
1—50,000-ohms 1-watt type (Erie).
1—500-ohm 1-watt type (Erie).

RESISTANCES VARIABLE
1—100,000-ohm (Erie)

SUNDRIES
1—type 971 bracket (Eddystone).
1—Insulating coupling (Jackson).
1—Packet bushing washers (Bulgin)
6 inches 4 B.A. Brass rod.
Wire and sleeving (Goltone).

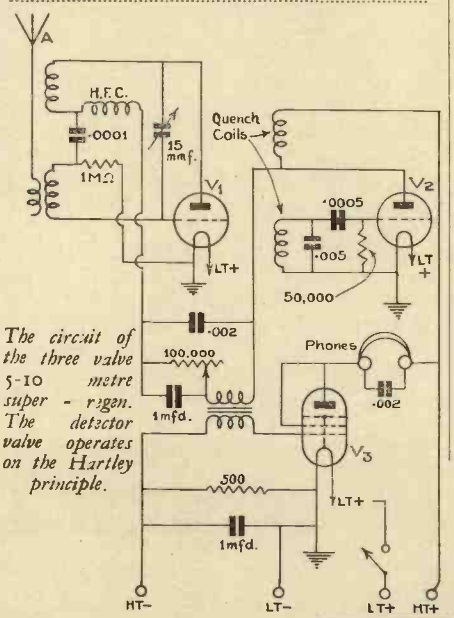
SWITCH
1—type S80 (Bulgin)

TRANSFORMER L.F.
1—AF8 (Ferranti).

ACCESSORIES

CABINET
1—metal type 974 (Eddystone)

VALVES
1—HL2K (Marconi).
1—PT2 (Marconi)
A complete kit of parts can be obtained from Peto-Scott, Ltd.



The circuit of the three valve 5-10 metre super-regen. The detector valve operates on the Hartley principle.

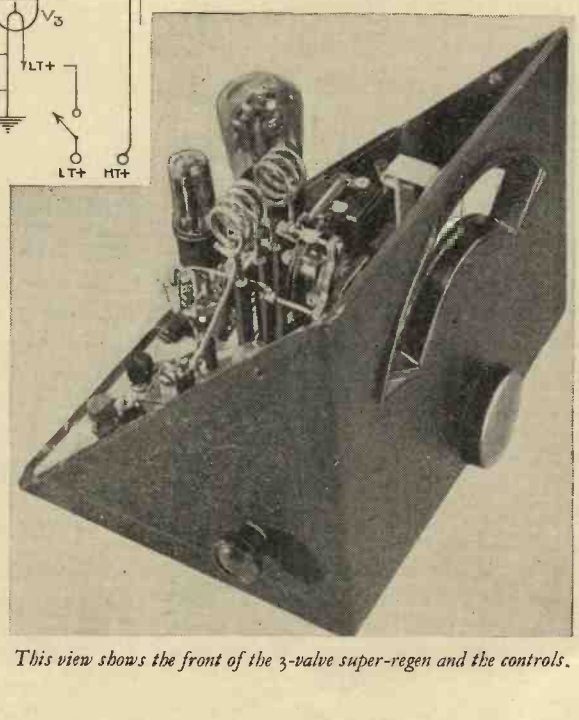
Variations on this arrangement have been evolved and in some cases one valve is made to combine the functions of detector and oscillator. This arrangement is only to be advised when the receiver is to be of portable construction for the noise level increases fairly considerably while the maximum sensitivity is decreased. If, however, the receiver is for local work so maximum gain will not be required, then it is immaterial whether or not a separate quenching valve is used.

A Stable Circuit

Anyway as we have mentioned we required the most stable circuit with sufficient amplification fully to load a small loud-speaker. The detector valve operates on the Hartley principle so that only one tuning condenser is required. This condenser is an Eddystone type 900 with a capacity of 15 micro-microfarads. Quench coils can be home-constructed, but we feel that in view of the low cost of this Bulgin component it is hardly worth while winding on about 2,000 turns on a pair of quench coils. Speech output from the detector is fed into a simple low-frequency stage in which we have used the popular-sized Ferranti transformer type AF8.

To simplify battery connections we have embodied automatic grid bias. Although the value of bias resistance chosen does not strictly conform to the manufacturer's specification, a small pentode valve such as the PT2 used, we find that 500 ohms is approximately the correct value. Across the moving arm of the 100,000-ohm potentiometer is connected a 1-mfd. fixed condenser. This condenser is rather important for it prevents noise from the moving arm.

We do not anticipate that readers will have any difficulty in the construction providing one or two little points are mentally noted. First of all the metal case is supplied with the main escutcheon hole already drilled, while the hole for the volume control, jack, and on-off switch can be cut very simply for the metal is quite soft.



This view shows the front of the 3-valve super-regen and the controls.

Construction

When constructing connect up the quench coil and its associated resistance and capacity network before the quench coil is screwed to the baseboard. Similarly with the L.F. transformer it is advisable to connect four lengths of wire to the four terminals before this component is firmly fixed. Other than that construction should not present any difficulties. The valve holders are all of the five-pin type, but to prevent any confustion we have removed the fifth contact from the detector and quench valve holders. The fifth contact on the pentode is, of course, the screen connection.

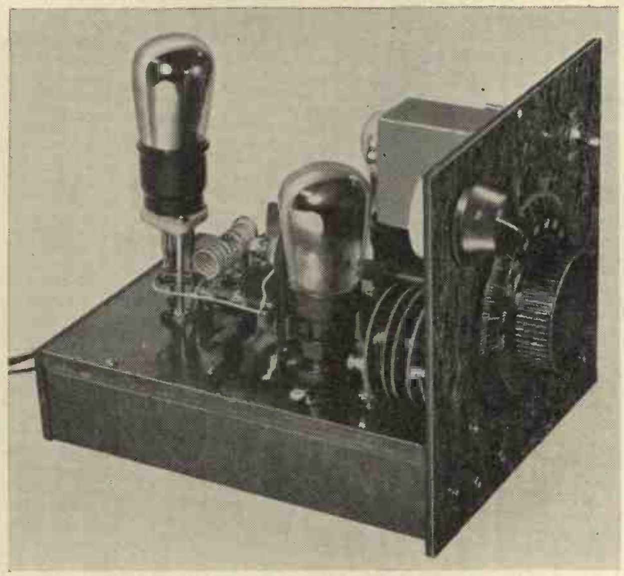
So as to keep losses to a low level the aerial and earth terminals are mounted on Steatite. This is another Bulgin short-wave component and the first Steatite block we have so far used.

Notice that in addition to the receiver being housed in a metal case the tuning drive does not make direct contact with the spindle of the condenser. A J.B. insulated spring coupler is used to link these two components together so that the possibility of hand capacity is extremely remote. In practice it is possible actually to walk around with the receiver having batteries and accumulators resting on top of the case without experiencing any variations in tuning.

For normal use up to two or three miles no aerial is required at all, while rarely is it necessary to use more than 8 ft. 6 ins., total length. If hand capacity is to be kept down to negligible proportions an earth connection is essential unless a doublet or Zepp type of aerial is used for reception as well as for transmission.

5-metre Coils

With regard to the coils these are most important and it is advisable, if you have not had any previous experience with these high frequencies, to buy the Eddystone set so as to make quite sure that you are actually in the required band. However, for those who are interested, the coils consist of three turns of twelve-gauge wire, spaced 5 mm. and covering 25 mm. The gap between the two three-turn coils is 18 mm. while the gap between the grid coil and the single turn coupling coil is 6 mm.



The original model of the three-valve super-regenerative upon which the design of the receiver described is based.

We can thoroughly recommend the Marconi midget valves. In addition to taking up considerably less space than the normal battery type they appear to give greater efficiency and they are certainly quite free from microphonicity.

Refer to the plan view of the receiver and you will notice that beside the earth terminal is a 4 B.A. bolt. This bolt serves two purposes. It actually earths the metal case and at the same time holds the baseboard into position.

As we previously mentioned, bias is obtained automatically and high-tension should be anything over 75 volts. The regeneration control should be adjusted so that the quench noise is down to a reasonable level, but remember that immediately a signal or even a carrier is received the quench noise is reduced according to the strength of the signal. With an R7/8 carrier the noise level is very low indeed and no worse than an average short-wave receiver.

Tuning is very simple. There is no need to listen particularly for speech for immediately a carrier is received down goes the quench noise, so the best thing to do is to adjust the tuner until a dip in the noise level is heard.

For the next few months interest on five metres will be at its maximum. During the evening several transmissions can be heard, while on Sundays all stations that are equipped usually transmit almost the entire day.

The photograph above shows the original experimental model of this super-regenerative receiver and we have published it for the benefit of those who wish to construct a simple lash up without going to much expense. It certainly works very effectively, but make quite sure to use an extension spindle to prevent hand capacity.

"Receiving B.B.C. Television in Iceland"

(*Continued from page* 411.)

focus " appearance to the image. This changes quite often, giving a rather peculiar effect, but it is rarely enough to spoil the image altogether. The second gave a more unpleasant appearance, but was rarer. In this case the whites brightened and widened, and the greys disappeared, the blacks becoming more intense, so that the result looked like a skeleton. It seems reasonable to suppose that phase distortion was combined with the selective fading, as it seems unlikely that mere frequency distortion would account for all effects seen; but on the other hand no effects were noticed which were attributed to phase distortion unaccompanied by frequency distortion.

Unusual Distortion Effects

It is remarkable that these distortion effects are to all intents and purposes unnoticed when listening to a programme from London National on the television receiver with a really good loud speaker. For this reason I feel inclined to think that phase distortion must play a considerable part, even though one remembers that the ear is so remarkably accommodating, whereas the eye is not. Lack of time and facilities prevented any experimental work on this, which would seem a very good field for some useful work.

I hope that this will suffice to show that television reception is not impracticable over long distances, any more than is broadcast reception, and that there is plenty of interest and field for experiment. Reception technique is somewhat different, perhaps, from the usual, but there are no outstanding difficulties. The necessary apparatus is not as expensive as might be imagined.

THE PRINCIPLES OF ELECTRON MICROSCOPY

By Robert I. Rosenfelder.

There is a most interesting parallel between the light beam and the electron beam. This article describes the electron microscope which operates on the same principle as the ordinary optical microscope but makes use of the electron beam and electronic lenses.

THE term "electron microscope" is given to projection systems using electron beams, by means of which enlarged images of illuminated objects or hot cathodes can be obtained. The simplest projection system is the simple electron lens, which has already been described in earlier issues. The magnification obtainable with such lenses is limited by the dimensions of the length of tube in which they are employed and of the lens itself.

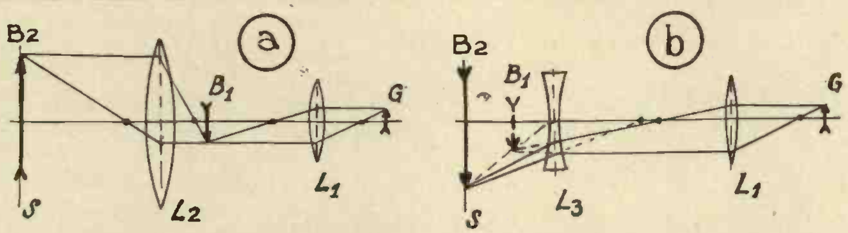


Fig. 1.—Microscopic projecting systems. (a) *Two-step magnifying system.* (b) *Magnifier according to Bruche.*

Optical Parallels

A knowledge of geometrical optics tells us that higher degrees of magnification would be obtained with systems using two lenses such as the combination shown in Fig. 1a. The object G is situated a short distance from the focal length of the convex lens L_1, giving an enlarged image at B_1. This image will be projected either by means of a second convex lens L_2 or a concave lens L_3, as in Fig. 1b, and can be viewed as a magnified image on the viewing screen S.

The same results can be obtained in electron optics on analogous principles, since it is possible to obtain different combinations of various types of magnetic and electron lenses. The systems employing electron lenses are, however, simpler than those using a magnetic field, since the latter have no true analogy in geometric optics. It is proposed, therefor, to confine ourselves to the study of that form of electron microscope using electrostatic fields for focusing or " electron lenses " as they are termed.

The Brüche Electron Microscope

The first microscope of this nature was built in 1932 by E. Brüche*. He employed two diaphragms connected to two potentials which gave an increasing degree of acceleration to the electrons emitted from the plane cathode K. In Fig. 2 the potential field of this projection system and the form of the electron beam are shown. The electron beam in the field undergoes a strong converging field, due to the influence of the first diaphragm lens G, and then the second diaphragm lens A.

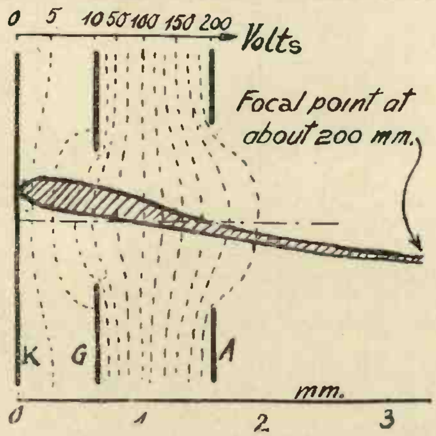


Fig. 2.—Concentrating an electron-beam by means of an immersion-lens.

This arrangement is similar to the microscope shown in Fig. 1b, the so-called " Brüche Magnifier." It should be noted that it produces an inverted image. With final electron velocities of 200-800 volts a total magnification of 100 can easily be obtained. This lens system can be described as an " immersion-objective " system, since the electrons emerge from a field having one value of electro-optic refractive index into a field having an index of another value.

To obtain the best possible image it is essential that the mounting and assembly of the cathode and electrode system be done with the utmost precision. A displacement of a fraction of a millimetre in the diaphragms in any direction results in a considerable reduction in quality of image. In order to screen the cathode from interference and stray charges, the anode diaphragm A is made in the form of a large disc or drum, and the

* (Natur wissenschaften—Vol. 90, p.49.)

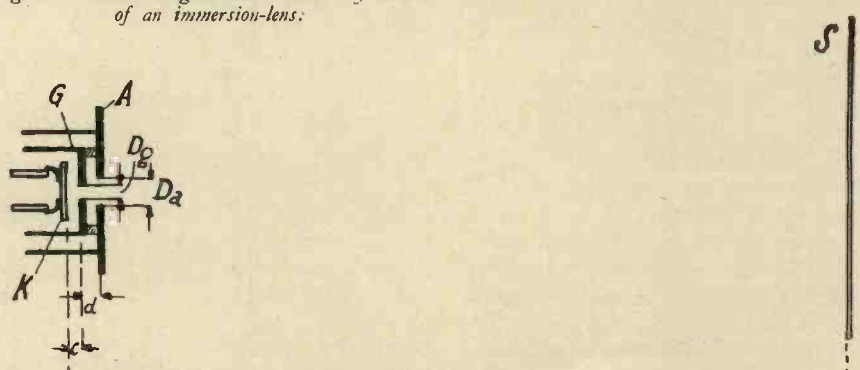


Fig. 3.—Scheme of the electron-microscope with immersion-objective.

OPTICAL AND ELECTRONIC PARALLELS

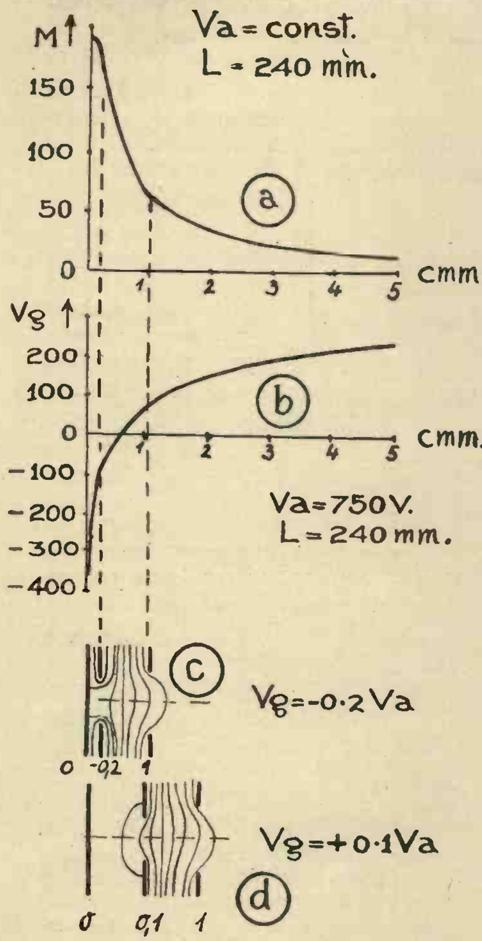


Fig. 4.—Characteristics of the immersion-objective

grid diaphragm G as a concentric cylinder, as shown in Fig. 3. The inner edge of the diaphragm aperture is made of thin molybdenum sheet which will withstand the very high temperatures in the neighbourhood of the cathode. The dimensions of the system of Fig. 3 which has proved to be satisfactory, are as follows:—

D_g — 1.2 m/m.
D_a — 1.0 m/m.
d — .95 m/m.
L — 240 m/m.

The adjustment of the image on the screen may be made by varying the distance C or by varying the grid diaphragm potential V_g. Any change in the anode diaphragm potentials V_g, which affects the acceleration of the beam, will result in variations of the luminosity on the screen. Images of the cathode surface are obtained at values shown in the characteristic of Fig. 4.

An interesting point about the curve of Fig. 4b is that for small values of c (below 0.5 mm.) the potential V_g may be increased to a very high negative value without the electron flow being cut off. This is due to the fact that for negative values of V_g the potential surfaces lie close to the grid diaphragm and the line of zero potential becomes perpendicular to the cathode surface, as seen in Fig. 4c.

It is thus possible to obtain a limited image of the cathode surface with negative grid potentials since the line of zero potential defines an area on the cathode surface which can be projected on to the screen.

The curve of magnification obtainable with this system (Fig. 4a) becomes approximately hyperbolic, as in the case of the optical lens. The magnification thus increases with a decreasing value of c, the refracting surfaces approaching the cathode becoming more sharply bent, thus giving a higher refracting power.

It should be noted that the magnification is independent of the anode potential V_a and that the quotient V_g/V_a remains constant. The curve M = f(c) can therefore be redrawn as in Fig. 5a, becoming a calibration curve. This enables the magnification to be calculated for any ratio of V_g/V_a.

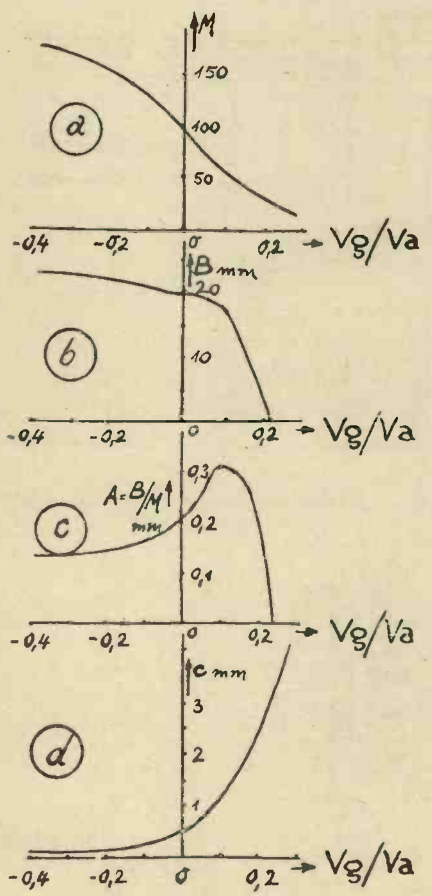


Fig. 5.—Calibration curves of the immersion-objective microscope.

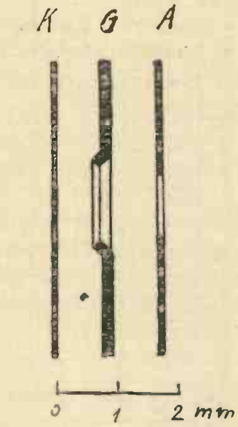


Fig. 6. — Improved grid diaphragm for the immersion objective.

Distortion

Owing to distortion the images on the screen can only be taken to be accurate over a limited central area. The curve of Fig. 5b is plotted from photographic observations and shows that the projected zone B at V_g/V_a = 0.1 abruptly decreases in size.

The curve of Fig. 5c is plotted from values given in Fig. 4a, and shows the diameter of the cathode which can be projected on the screen. By replacing the simple grid diaphragm with a specially shaped one (Fig. 6) it is possible to enlarge the surface zone of the cathode up to 70 per cent. —about 3 times.

Electron microscopes usually work at a magnification of 60 and are of the greatest use in examining the surface of cathodes for emissive properties and for uniformity of activation.

The first electron microscope has already yielded interesting results on the activation and reactivation of cathode surfaces, establishing, for example, that the surface of an oxide cathode should be rough to enable it to withstand overload.*

Higher degrees of magnification can be obtained by further decreasing the value of c, in lengthening the path of the beam and in decreasing the aperture of the diaphragms. It

* Annalen der Physik, Vol. 15, p. 145, 1932.

is also possible to introduce an "eye-piece lens" to give a still greater magnification.

The principle is not only confined to the study of hot cathodes, but is applicable to cold cathodes in which the emission is due to positive ion impact or the action of ultra-violet rays. Another development which is yielding successful results is the electron microscopy of objects through which the beam can be made to pass.

The advantage of the electron microscope over the optical type is in its greatly increased resolving power. The limit of resolving power of the optical microscope depends essentially on the wavelength of the light used, but under the most favourable conditions does not exceed 2,000 Å. In practice a good microscope will separate particles at a distance apart equal to half the wavelength of the illumination used. According to de Broglie's formula $\lambda = \frac{h}{mv} = \frac{12.3}{\sqrt{V}}$ Å an electron being accelerated with a velocity of 150 volts has a wavelength of 1.0 Å. Electrons of 15 kV or even 1,500 kV result in wavelengths of 0.1 and 0.01 respectively, the latter wavelength being 10^{-3} to 10^{-5} that of the visible spectrum. Unfortunately, owing to difficulties of a physical nature these figures cannot always be attained in practice, or we should be enabled to see the diameter of the molecule. (The diameter of the argon atom is 3 Å.)

The formula of the magnification of the immersion objective of Fig. 3 is approximately $M = \frac{k.L}{c + \frac{1}{2}d}$, k being a constant of 0.37†. The highest practical magnification obtained by the two-stage system has been 1½ or 15,000 Å‡. which is 8 times that of the optical microscope as regards resolving power, and resolving powers of 0.4 have been obtained§.

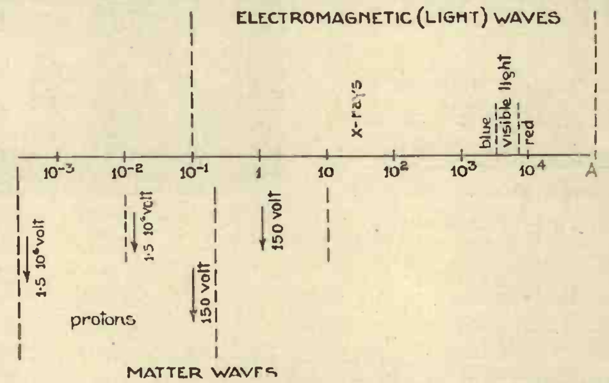


Fig. 7.—Plan showing the relation between light waves matter waves.

† Zeitschrift für Physik, Vol. 90, p. 748, 1934.
‡ Ibid., Vol. 92, p. 462, 1934.
§ Ibid., Vol. 87, p. 580, 1934.

Frequency Measuring on 5 Metres

By G5ZJ.

ONE of the biggest problems confronting the amateur interested in 5-metres is how to determine in some easy way the actual frequecy to which the receiver or transmitter is tuned.

With an oscillating receiver, it is quite easy to use an absorption wavemeter, of course, always providing the meter can be calibrated up against a standard, which is not always available.

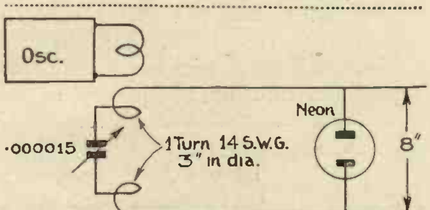


Fig. 1.—A Lecher wire aerial is erected in this way. The length of each side need not be very accurate.

One way of obtaining a standard is to use two 43-in. copper rods, mounted parallel on a piece of wood approximately 1 in. apart and joined together at one end with a single turn coil of ½-in. diameter. When the looped end is held close to the coil in a receiver oscillation will stop, indicating resonance. That seems to be about the only way of frequency measurement for the listening station. If a transmitter is available then, of course, frequency measurement is greatly simplified.

In my original experiments I erected a simple aerial half-wavelength long and fitted in the centre of it an ordinary flashlight bulb. When the transmitter was correctly tuned to the centre of the 5-metre band the bulb lit up to full brilliancy.

This arrangement was checked up against the standard Lecher wire system and was found to be comparatively accurate. Anyway, for those who do not wish to go to too much trouble with their experiments this idea has much in its favour. To obtain a high degree of accuracy there is no alternative to the Lecher wire system.

Actually the idea is to work on harmonics of the 5-metre transmitter. Erect two wires, as shown in Fig. 1, these wires are 21 feet long and separated by about 8 ins. Connect up by a coupling coil as indicated, and connect a neon lamp across the extreme ends of these two wires. The transmitter should be adjusted until the neon gives maximum light. When this point is reached it shows that the transmitter is resonating at the same frequency as the Lecher wire system, but, of course, no actual frequency is known. To determine the frequency of the transmitter slide the neon lamp along the two wires towards the transmitter with a piece of wood or some other insulator to make quite sure that the capacity of the body does not upset the tuning.

The tube will slowly lose brilliancy until it fails to strike, but still keep on pushing along the Lecher wire until a second point is reached where the bulb again strikes to full brilliancy. If the measurement is to be accurate be very careful to find the exact spot which gives maximum light. This second spot is then exactly the centre of a half-wave, and a second operation is then necessary to find the ends of the half-wave.

Construct a shorting bridge, as shown in Fig. 2, from a piece of copper wire with a loop at either end. This bridge should then be moved up and down the Lecher wire until the spot is found where a short-circuit does not have any effect. This operation must also be carried out very carefully as it can be narrowed down to less than half an inch. A point should be found on either side of the neon lamp and when these two positions have been found they will be exactly one half-wavelength apart. The distance between the two points should be measured with a yard stick, multiplied by two and reduced from inches to metres to give the wavelength of the oscillator.

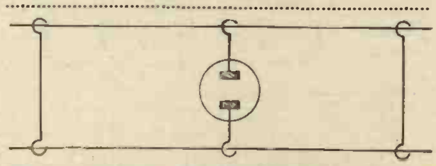


Fig. 2.—Arrange the shorting links so the neon lamp can be moved along the aerial quite easily. The lamp should be of the low wattage indicator type.

MORE ABOUT THE LEWIS DEMONSTRATIONS

Last month we gave a brief description of the transmitting arrangements used for the 30-line television demonstrations, which have been touring some of the provincial cities. Here are some details of the receiving arrangements.

This photograph shows J. H. Reyner, who was responsible for the installation at Messrs. Lewis' demonstrating one of the cathode-ray receivers.

ALTHOUGH the low-definition character of these transmissions has been emphasised, the interest displayed has been quite remarkable. The greatest interest seems to have centred round the three cathode-ray receivers which were on view. Two of these were using 8-in. sepia tubes while the third one was a 6-in. green tube. Curiously enough, although this was showing a smaller picture, the green colouration attracted many people and drew numerous expressions of approval.

The method of operation of these receivers was interesting. It was decided that instead of using three entirely separate receivers an attempt would be made to operate three tubes off one master receiver, and after a little experiment this proved to be quite easy of accomplishment.

A standard B.T.S. cathode-ray receiver was taken and slightly modified to allow of the additional requirements. This receiver contained a power unit delivering 2,000 volts with an adequate reserve for two additional tubes, and a scanning unit which provides the necessary horizontal and vertical scanning voltages.

The current taken by the deflector plates is negligible so that it should theoretically be possible to connect all the tubes in parallel and operate them from the common supply.

This proved to be practicable. The various deflector plates were all tied together as shown in Fig. 1, while separate voltage supplies were taken for the gun, focusing and shield electrodes and filaments of the various tubes. This latter arrangement was found to be necessary for, if the various tubes are not all identical in characteristic, it is necessary to control the focusing and brilliance of each tube independently. Actually, all the controls can be operated by means of potentiometers across the common power unit, so that the extra apparatus required is remarkably small.

An interesting point arose regarding the varying sensitivity of the tubes. The two large sepia tubes were found to differ slightly in sensitivity, and if the picture was made to fill one of the tubes it gave altogether too large a picture on the other and vice versa. This difficulty was overcome by using a capacity potentiometer on the more sensitive tube so that the scanning voltage applied to the deflector plates was less than the full amount. By using pre-set condensers it is possible to alter the picture shape as required, and the arrangement proved a particularly flexible one.

Other methods of reducing the voltage supply to the deflector plates were tried, but they did not prove successful and were abandoned. The only precaution necessary with the capacity potentiometer arrangement is to ensure that the condensers used are small relative to the condenser used for the time-base, since they are in parallel with the time-base condenser so that the frequency of the supply will be altered. Once the picture ratio has been adjusted, however, the value of the capacity does not change and the frequency of the time-base can be adjusted to the required value.

Modulation was applied to each tube independently through a large condenser and a volume control from the supply line. The time constant

(Continued on page 432.)

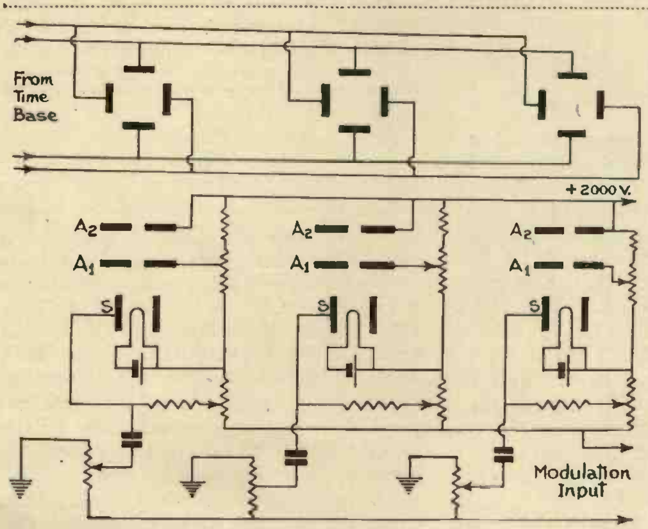


Fig. 1.—Method of tying three tubes together.

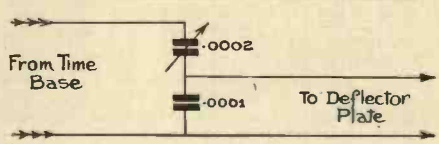


Fig. 2.—Method of altering voltage on deflector plates.

The Short-wave Radio World

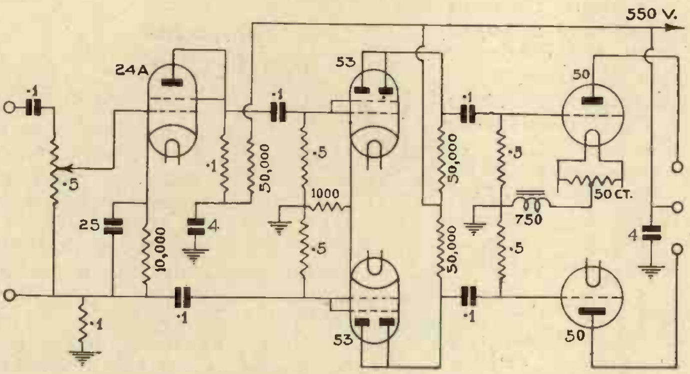
A Review of the Most Important Features of the World's Short-wave Literature

An R.C. Coupled Quality Amplifier

AMERICAN amateurs appear to specialise in unusual amplifier designs. In "Radio News" there is published a circuit using a type 24A valve followed by two 53's in push-pull driving two 50's in push-pull. Naturally, in addition to the quality being of the highest order, the hum level is exceptionally low and, owing to the fact that no transformers are used at all, the amplifier is completely stable.

The entire amplifier is resistance-coupled so that the only expensive components are the decoupling condensers. Although this type of arrangement is not popular amongst English amateurs we fail to see the reason, for no matter what other circuit is used we do not feel that the quality can be improved. The power output when using two type 50's is in the order of 10 watts, while if British valves are substituted, such as the DO26 or PP5/400, approximately 10/12 watts are available.

We have not shown smoothing arrangements for this is quite conventional, but it will be noticed that 550 volts are required instead of the usual 400-500. The idea of this is to allow for voltage drop across the anode resistances and across the primary of the output transformer. Readers who wish to obtain the maximum quality from the gramophone pick-up would be well advised to consider this type of amplifier which, if it were used in conjunction with the high-fidelity speaker, such as the Magnavox 66X, would be sure of unusually fine results. The actual valves specified are obtainable from Claude Lyons.

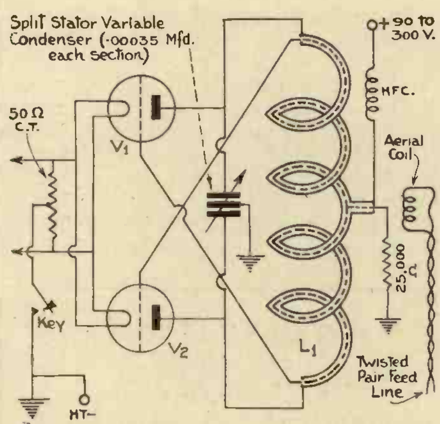


As no transformers are in this amplifier the cost is kept low while quality is of the highest order. With this amplifier the hum level is less than .5 volt R.M.S.

Battery-operated Portable Transmitter

IN view of the interest in portable transmission we took particular note of a two-valve rig published in the Australian publication, "Wireless Weekly." It consists of push-pull self-excited oscillator and can use either 2-volt battery-operated valves or any type of directly-heated triodes which will give the required wattage.

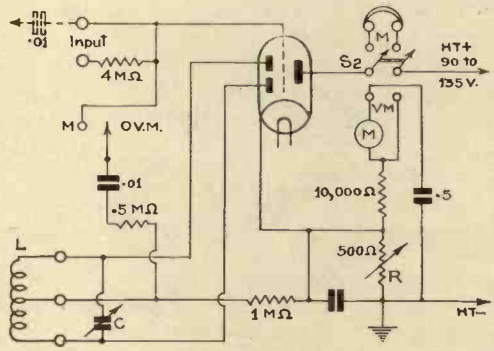
In this circuit the grid coil is wound directly inside the plate coil; the latter coil can be made of copper tubing, while the grid coil is simply threaded inside the plate coil. The coil and condenser should be designed for high-capacity operation, for this gives complete stability and maximum efficiency



By winding the grid inside the anode coil the transmitter is kept much more stable.

The grid leak of 25,000 ohms is satisfactory for American valve specified, but with English valves it may be advisable to reduce this valve to 10,000 ohms. Twisted feeders are recommended in preference to Zepp feeders, for it has been found that the Zepp arrangement causes somewhat more reaction in the aerial on the frequency of oscillation. All the components must be rigidly supported and arranged so that the leads are as short as possible. Incidentally, in some instances when the key is mounted on the same table as the transmitter the vibration set up will cause frequency variation.

The use of a self-excited oscillator is not recommended except for Q.R.P. work, because a serious compromise of power output must be made in order to get a good note with complete frequency stability.



Every station should have a meter of this type. Most of the components should already be on hand.

5-metre Ultra-audion Oscillator

WE have been hearing quite a lot about the 5-metre transmissions from W9GFZ, so we obtained some details of the apparatus in use. It turns out that a simple ultra-audion oscillator is used with a 852 valve. An unusual feature of this transmitter is the single-turn copper strip tank coil. Although the actual apparatus is used with an anode voltage of 2,500, English amateurs will no doubt make the necessary modifications so as to use British valves for low power.

An input of 300 watts is obtainable on five metres, rising to 400 watts at 10 metres. The oscillator is loosely coupled to the aerial to minimise frequency shift should the feeders or antenna move in the wind. The aerial is of a simple half-wave type with series-tuned feeders and erected so that the radiating portion is high above any near-by building. C1 has a capacity of .00005; C2, .00004; C3, .00035; C4, .0004; C5, .001; C6, .00035. L1, 2 and 3 are cut to resonate at the required frequency. As a general rule, L1 has a diameter of five inches, L3 two turns of two inches, while L2 is a high-frequency choke of the power type.

(*Continued in 3rd column of next page*)

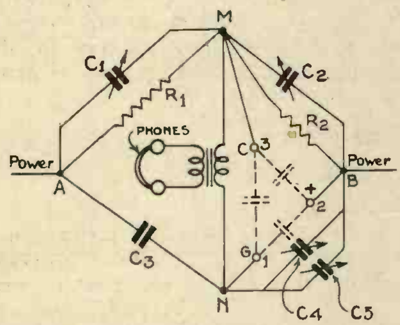
The Measurement of Valve Inter-electrode Capacity

By Malcolm Harvey

The writer spent many months measuring the inter-electrode capacities of different types of valves to find out which was the most suitable for short-wave work. A method of measuring the minute capacities was evolved, which is described here. It will prove useful to set designers and experimenters alike.

OTHER than by comparative checks with different types of valves the only reliable method of small capacity measurement is to use a bridge.

Some years ago I tried a very rough method by simply using a single valve detector circuit. With this circuit the detector valve was plugged in and the



A capacity bridge of this kind is useful to check detector valve capacity when the valve is to be used on ultra-short waves.

receiver re-tuned to a certain low wave-length. A second valve was then used and the receiver re-turned to the original wavelength. As the condenser was calibrated, the change in capacity needed to bring the receiver back to the original wavelength could be seen at a glance. The change in condenser capacity represented the inter-electrode capacity of the valve between grid and cathode.

This idea was fairly satisfactory, but not sufficiently accurate. Of course, the amateur can tell at a glance which of two valves has the higher inter-electrode capacity by noting whether the tuning condenser has to be altered up or down in capacity to retain the original signal.

The Bridge Method

If the receiver is left tuned to about 15 metres, variations will be more marked than on higher wavelengths. Any serious amateur or set designer will at once see that these methods, although being satisfactory for comparative checking, are of little practical use. In view of this, a bridge was evolved that really was efficient down to quite low capacities; in fact, capacities of the order of 2 $\mu\mu$f. were obtained without difficulty.

The actual bridge circuit used is shown in the illustration on this page. It is quite conventional and should be used in the following way.

Resistances R1 and R2 are the ratio arms and should be approximately 500,000 ohms each. The two small condensers C1 and C2 are on the same shaft as the resistances, and arranged so as the capacity of one condenser increases as the other decreases.

C3 is a fixed condenser of about 50 $\mu\mu$f. capacity. C4 is a calibrated straight-line capacity condenser of about 40 micro-microfarads, while C5 is a small uncalibrated condenser of the vernier type to make the bridge balance. With C4 set at zero—the maximum capacity—C1, C2 and C5 are varied to obtain this balance.

Any valve to be measured is then connected to the bridge at terminals 1, 2 and 3, with the plate, grid and cathode to the proper positions as marked p, g and c. Condenser C4 is then decreased in capacity to restore the bridge balance.

The amount of capacity by which C4 is decreased to obtain this balance is the capacity between the electrodes measured. That is, the electrodes connected between terminals 1 and 2.

If the special connection from 3 to M is not used, the capacity measured is Ccp. increased by that of Ccp. and Cgp. in series. (Cgp. = grid to plate capacity, Ccp. = cathode to plate capacity, and Ccg. = cathode to grid capacity.)

By re-inserting the valve across terminals 1, 2 and 3, and again balancing the bridge, other electrode capacities can be measured.

In screen-grid valves, the plate is shielded from the control grid by the addition of a screen, so reducing the capacity to a very low figure. In this case, although the anode-to-grid capacity will drop, it will be off-set by an increase in capacity from cathode to plate and cathode to grid.

The cathode-to-grid capacity Ccg. is referred to as the input capacity and is in parallel with the tuned circuit. Capacity Ccp., the output capacity, is actually a shunt to the load circuit into which the valve is feeding its output.

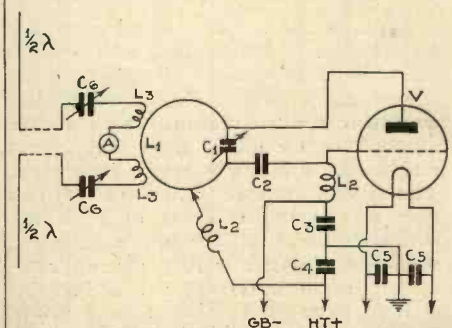
The Short-wave Radio World

(*Continued from preceding page*).

For those who are interested in 5-metre low-power transmission this circuit can be recommended. A suitable valve is the new Mullard TZO/25.

Short-wave Radio Oscillator

MANY amateurs feel the need of an instrument that will check the quality of their own transmission and at the same time work as a valve voltmeter to check signal voltage. In the current issue of Q.S.T. we notice such a piece of apparatus. It has been so arranged that the diode rectifier section can be cut in or out of circuit by S1. With the diodes cut in for monitoring, the triode section of the valve is used as an L.F. amplifier. Switch 2 in the anode circuit cuts in



The ultra-audion oscillator is very simple and capable of bridging long distances on 5 metres.

either the headphones for monitoring or an 0-1 milliammeter for voltage measurement. A 120-volt high-tension battery will be ample, while the components are of a perfectly standard type. The double diode-triode valve can be obtained from any British valve maker, while the actual 2A6 is obtainable from Claude Lyons. With 90 volts high tension an input of 2.5 volts A.C. gives a full-scale deflection on the milliamp meter, while with 120 volts high tension 2.2 volts are required to give a maximum reading.

For monitoring purposes a pick-up coil of the correct inductance should be connected across the tuning condenser in the usual way.

Amateur 5-metre Transmissions

The following information will interest readers who have built 5-metre receivers. Most of the stations mentioned will be pleased to keep listeners up to date with their latest schedules.

IN case listening stations are not fully aware that amateur transmitters are exceedingly active on five metres we have been investigating the transmissions put out in various parts of the country.

Those who live in the Birmingham area are extremely fortunate, for the Eddystone people, with their transmitter G6SL, are operating very frequently. In addition to daily tests, definite transmissions take place every Sunday at the following times: 10.30 a.m. until 12.30 p.m., with ten-minute intervals for listening or for possible two-way communication. 6SL also radiates on Sunday afternoons between 3 p.m. and 5 p.m., again with ten-minute listening periods. All transmissions are on telephony with an aerial array beamed to south-east of Birmingham.

G2DV is standing by on 40 metres for reception reports of G6SL so that other amateur stations who may not be transmitting on five metres can keep in touch.

The transmitter in use at 6SL has a power of 50 watts and uses a pair of Mullard TZO/25's in push-pull. These new Mullard valves, incidentally, are only just available and are actually the redesigned T25D's. They are also in use at G5ZJ, where an output of up to 75 watts can be obtained from two of them on 5 metres.

Other stations active in the Birmingham area are:

G5BJ.—G. Brown, 62 The Ring, South Yardley, Birmingham.

G6DL.—A. G. Lapworth, 91 Clements Road, South Yardley, Birmingham.

G6XQ.—J. S. Owner, 135 Springfield Road, Moseley, Birmingham.

G6XJ.—A. C. Edwards, 62 Wellhead Lane, Perry Barr, Birmingham.

G6XK.—A. C. Edwards, 62 Wellhead Lane, Perry Barr.

In South London, stations active are too numerous to mention, while other amateurs are dotted plentifully along the south coast.

Essex Stations

In Essex several stations are active, including 6UT, Chingford, 6NW near Leigh, 5UK in Chalkwell, and many others. 6DH in Clacton, although primarily interested in ten metres, is also active on five metres. Another good spot is in Hertfordshire, where 5FB and 5VT, Bishop's Stortford; 5HO, Hoddesden; 5RD, Abbots Langley; 6XN, Welwyn Garden City; and 5ZJ, Letchworth, are all active. In view of the fact that 5-metre stations can cover up to 100 miles or so, listeners will find plenty of stations on the band, particularly if schedules are arranged with the stations mentioned.

Scotland is another good area, particularly in Glasgow, where the Radio Society are doing great things contacting with portable listening stations. In Lancashire numerous stations have been heard at odd times, but readers are advised to get into touch with G2IN in Southport, who is situated in a fine position.

A large number of Kent stations has been doing good work during the past few months, so any readers in the Gillingham area will be sure of hearing test transmissions.

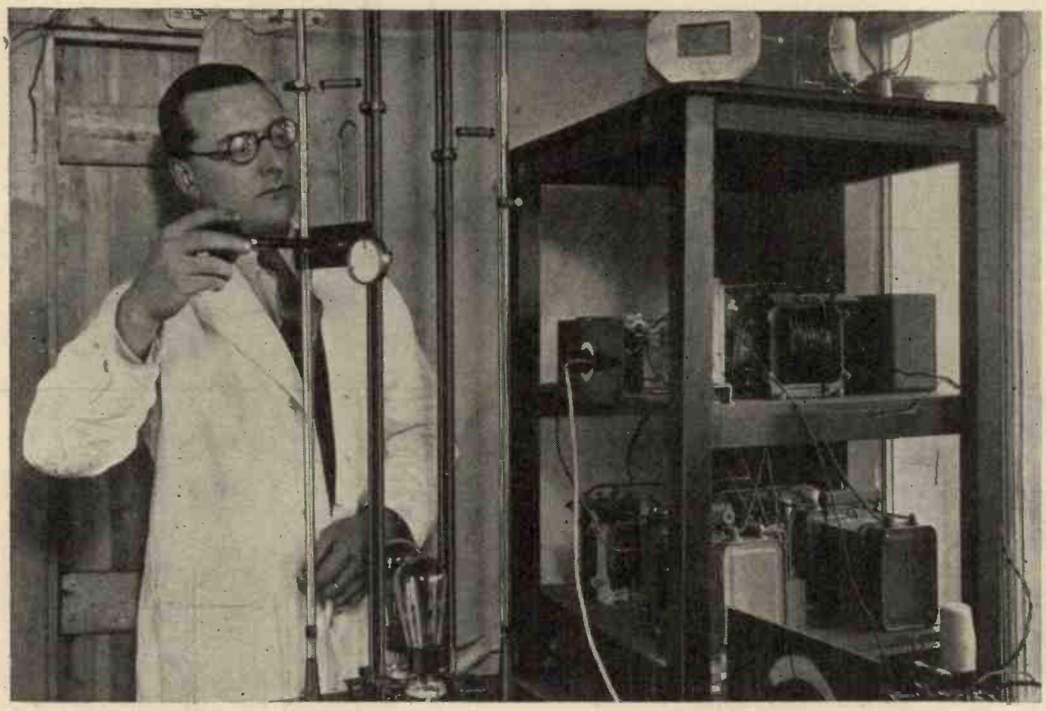
Tests from the "Daily Telegraph" Building

Tests carried out by G5KA from the roof of the *Daily Telegraph* building in Fleet Street created great interest. Signals from 5KA have been well heard, so listeners in London and the home counties are advised to look out for future schedules. Here are some details of these tests.

The chief object of the tests was to contact Stratton's station at Birmingham (G6SL), so a beam array with N-S directional properties was erected. This antenna was of the half-wave voltage-fed type, and constructed on similar lines to the one described in the current edition of the A.R.R.L. Handbook (page 148). It was originally announced that tests would also be made using a further beam antenna for E-W working, but this idea had to be cancelled as it was found impossible to erect a second beam array.

The receiver was a quenched two-valver employing a triode in the low-frequency stage. For the transmitter, the conventional T.N.T. (tuned-plate resonant-grid) circuit was used, employing as oscillators two Ediswan PV625X tubes in push-

(Continued at foot of page 423.)



This is the Eddystone station G6SL radiating with a power of 50 watts on a wavelength of 5 metres.

5-metre Aerial Systems

By Malcolm Harvey

AFTER spending some considerable time experimenting on five metres, I have come to the conclusion that the transmitter, within certain limits, is comparatively unimportant. I have been using both single-ended and push-pull oscillators with varying power from five to 100 watts, but it was not until an efficient radiator was discovered that any results at all were obtained.

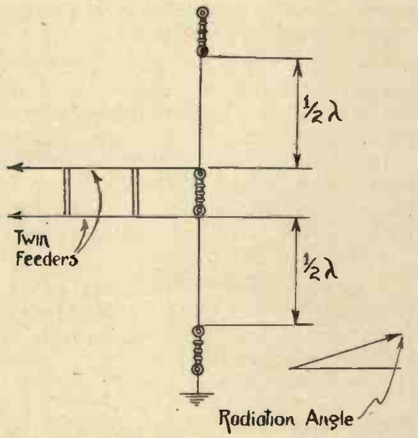


Fig. 1.—The advantage of this aerial is that th radiating portion can be well above near-by houses

During tests it was discovered that almost any sort of aerial would give a certain amount of radiation for a mile or so, while neon lamps lit up quite brightly with even the worst aerial.

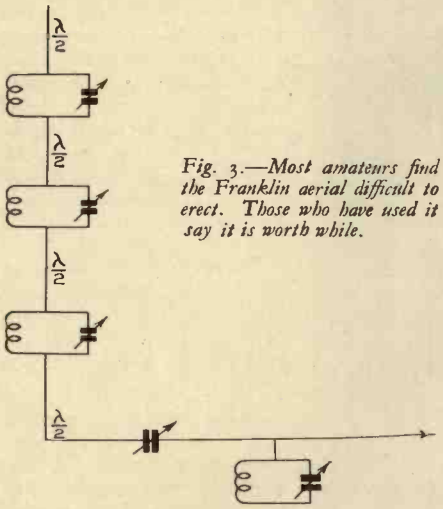


Fig. 3.—Most amateurs find the Franklin aerial difficult to erect. Those who have used it say it is worth while.

I am of opinion that the main reason for amateurs not obtaining good DX on five metres is owing to the fact that they religiously keep to half-wave feeders so that the aerial only radiates a comparatively small amount of energy. This can be proved by the fact that the service area is increased very considerably when the transmitter is moved to the top of the house.

Rumours about five-metre signals being heard from Buenos Aires, Berlin and Canada have now been proved to be correct, while the Post Office transmit up to 110 miles or so quite regularly. This does make the average amateur 30-mile radius seem rather poor by comparison.

A circuit which I have found to be unusually efficient is shown by Fig. 1. Here the twin feeders or transmission lines can be of any reasonable length. In my case they were approximately 42 feet in length and spaced three inches. This arrangement does allow one to erect the actual radiation part of the aerial high above surrounding objects and in my opinion is the most satisfactory aerial for five-metre working.

With a transmission line of up to 40 feet it is advisable to parallel-tune the aerial coil, but I noticed that with a very lengthy transmission line series tuning was more satisfactory.

A variation on this arrangement, suitable for use in congested areas, is to make the radiating portion quarter-wavelength long and to fix the aerial on to the top of a chimney. Of course, the aerial should be copper rod or tube and anchored in the centre with a common insulator.

In some cases this aerial can be fed by twin lamp flex, which is very simple to erect, but I am not quite sure as to the degree of efficiency as compared with the properly-tuned transmission line.

Matched Impedance

A correspondent in America sent me details of an aerial used over there by several commercial firms. It is virtually a matched impedance arrangement and the idea is illustrated in Fig. 2. It is a vertical half-wave aerial with a transmission line consisting of 18-gauge wire spaced three inches, terminating at one end in a parallel-tuned circuit, and fanned out in Y shape at the aerial end. This also has the advantage that the radiating section can be erected high above the ground.

The Franklin aerial used very much by the Post Office with great success is one of the most efficient aerials that can be obtained. Not only does this apply to five metres, but to the lower frequencies as well. Fig. 3 shows the theoretical construction of the Franklin aerial. The main radiator is series-tuned by a minute variable condenser of about 7 mmfd. It is also split up into half-wavelength sections coupled together with a resonant circuit between each section.

I can thoroughly recommend this type of aerial, for signal strength is very greatly increased by using three sections 8 feet long with three resonant circuits. These resonant circuits simply consist of a five-metre coil in parallel with a midget tuning condenser.

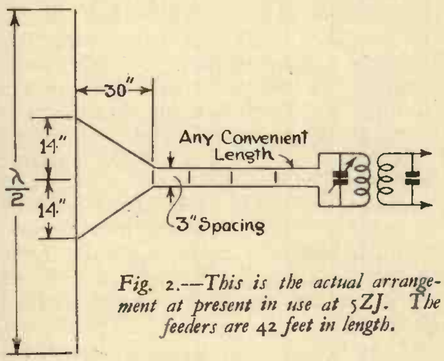


Fig. 2.—This is the actual arrangement at present in use at 5ZJ. The feeders are 42 feet in length.

For those who are not conversant with the Franklin aerial, the tuned circuits are used to prevent phase reversal of standing waves of voltage and current in an aerial of several half-wavelengths.

A doublet aerial, although being very popular, is used mainly because it is so simple to erect. Fig. 4 shows the type of circuit, the particular point being that the radiators are quarter-wavelength, while the feeders are half-wavelength and, of course, series-tuned. This type of aerial is not really satisfactory unless the receiver is high above the ground, for radiation is curtailed very badly by telephone wires or even quite small buildings.

I have not seen anybody using the Picard aerial in this country, neither have I used it myself, but the Americans are very enthusiastic about it, so here are the details, and if any one

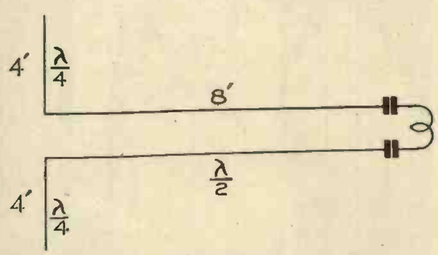


Fig. 4.—When the transmitter is on top of a high building this type of aerial is quite effective.

cares to experiment they may find it worth while. A Picard aerial is not quite half-wavelength owing to the centre loading. This is explained in

Fig. 5. Actually the loading coil is a normal five-metre inductance fitted so that it will take the strain of the aerial pulling on either end of it. The coupling coil should be resonating at $2\frac{1}{2}$ metres while the transmission line, which also terminates in a $2\frac{1}{2}$-metre coil, should be spaced $1\frac{1}{2}$-2 inches.

This type of aerial can be fitted between two chimneys of a house and

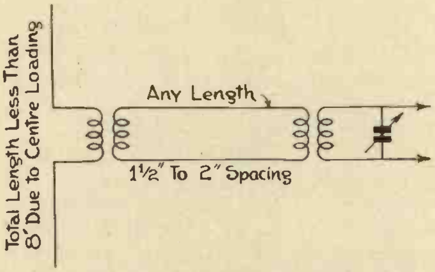


Fig. 5.—This arrangement permits of a long feeder so the radiator can be 60 or 70 feet above ground.

transmission lines brought down for as much as 100 feet.

In view of the fact that directional transmissions make so much difference to the field strength within the beam of the aerial, it is surprising that this arrangement is not used more often. A very simple type of directional aerial is shown in Fig. 6. The angle between the two limbs of the radiator should be approximately 45 degrees for five-metre transmissions, or, for those interested in 7 metres, 40 degrees. The circuit shown in Fig. 6 is again of American design and used by the Bell Telephone Co. It is important with this type of aerial that the transmission

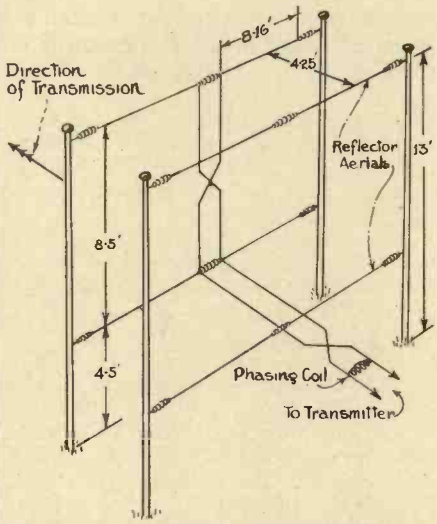


Fig. 6.—The American amateurs favour this directional array on the 5, 10, and 20 metre bands. It must be cut to length for each band.

line be tuned to an odd wavelength of the radiator.

If it is possible to erect the transmitter in a very high position it really is worth while going to the trouble of erecting a proper directional aerial. Fig. 7 shows what I have in mind. It is not by any means difficult to erect, while the circuit diagram is almost self-explanatory. The direction of radiation is approximately at right angles to the side of the radiator. This aerial was used experimentally, not for DX purposes, but to find out just how directive it was, and its use indicated that field strength within the beam area would be increased many times.

As the field strength is never likely to be great with a five-metre transmission of, say, 10 watts, it will pay to erect some satisfactory radiator. Frankly I

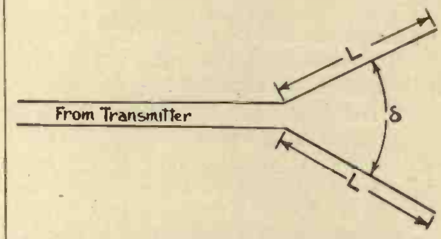


Fig. 7.—A simple directional aerial of this kind will often be ample for most low power stations.

am of the opinion that if it is intended to do any serious work on five metres the first task should be the erection of the aerial and the second to decide upon a design of transmitter.

Amateur 5-Metre Transmissions

(*Continued from page* 421)

pull. The speech amplifier comprised two resistance-coupled stages, transformer coupled to a PX4 modulator valve. Provision was also made for I.C.W. and a change-over from this to telephony could be made in a second by a throw of a switch—the only time I.C.W. was used, however, was when calling G6SL.

Power for all gear except the receiver was obtained from the 210-volt D.C. mains, "tapped" by permission of the *Daily Telegraph*.

The H.T., after smoothing, dropped to 190 volts, but with the aerial in tune there was no trouble at any time in getting the input up to 10 watts. The feeder current with this input was approximately 0.35 amperes.

The height of the *Daily Telegraph* building is 128 feet, but this height does not include the tower from which the tests took place. This tower (which is not visible from Fleet Street) rises to a height of about 25-30 feet, and to get to the top meant surmounting two wooden ladders, one of which was particularly frail, and later on in the day blew down in the strong wind, leaving one of the crew stranded for the best part of an hour in the rain! Heavy equipment such as 6-volt accumulators are no companions with which to climb ladders, and in the end all gear was hoisted up from the roof to the top of the tower by ropes.

Reports Received

As the first schedule with G6SL did not start until 10.30 a.m., it was decided at 10 o'clock to send out the first test call. This immediately brought in G6CW, who gave us a very encouraging report, and contact was maintained with this station until 10.30. Until 11 o'clock the time was devoted alternatively calling and listening for G6SL. No success was met with here, so a landline call was put through to Birmingham to see whether they had heard anything of our signals. As their reply was in the negative, a further schedule was arranged for later in the morning—this also unfortunately resulted in failure.

The only obvious thing to do then was to send out general test calls to see just how far the signals were getting out. This was done, and in a very short time a good number of stations from the South of London were lining up ready to contact. One or two reports were obtained from the east and north-east, but the majority were from the south.

During the course of these QSO's an omni-directional aerial was hastily erected, and one or two stations which reported our signals R8 on the directional array were asked to stand by for a test with the omni-directional. This was done and signals immediately dropped to R4/5.

The following reports were obtained, so stations are active, particularly in South London :—

Station.	Location.	Report
G6CW	Banstead, Surrey.	R8
G2AW	Bromley, Kent.	R7
G5LB	Beckenham, Kent.	R5/6
G5BB	Stamford Hill, N.	R7/8
G6NF	West Norwood, S.E.27.	R9 plus
G2JB	Walworth, S.E.17. (?)	R9
G5IS	Dulwich, S.E.21.	R9 plus
G6QB (Portable)	Sanderstead, Surrey.	R8
G2MK	Bromley, Kent.	R7
G5OJ	Keston, Kent.	R7
G5JM	Walthamstow, E.17.	R7/8
G6SM	Chitstead Valley.	R4/5
2AYX	Tottenham Hale, N.17.	R6

Producing and Stage Managing a Television Transmission

The production of a television programme involves a great amount of detail work and rehearsal. The routine of the programme is carefully planned out in advance and detailed instructions provided for all those concerned in its production and transmission. The following is a copy of these on the occasion of the broadcast of "SKYLINE."

Monday, 3rd June, 1935, 11.0-11.45 p.m.
Rehearsal:
Monday, 3rd June, 1935, 10.0 a.m.-1.30 p.m.

SYNchronising Card.

Opening announcement and Signature Tune,
"*Things are looking up*," Cinephonic which covers the artists taking part and their names on captions:—

Billy Milton.
Reita Nugent.
Sara Allgood.
Georgie Harris.
The Eight Good Lookers.
Rose Walker.
Charlie Woods.

At end of signature tune no music playing—Announcement about "Sky-line," covered by the caption:—
Sky-line.

Fade from "Sky-line" to the:—
Panorama—approximately 1 minute of music for the panorama—Stars and Stripes.

At the end of the panorama—fade to studio.

Rock and Roll. Sterling

Singing off stage—Rose Walker and Charlie Woods.

Entrance of the Girls—extended right.

Entrance Reita Nugent—after some dancing—in front of the Girls from the right, comes forward singing—exits to the right.

Girls dance by themselves.

Reita Nugent re-enters singing, and the Girls exit at the end of this song. Calls to Billy Milton on the right—runs up the companion way—drags him down to semi position; he walks forward with her to closest possible *without lens*—beams on to him—sings:—

Zing went the strings of my Heart, Chappells.

End of song—goes back to semi—both stand at the end of the companion way—Girls come down the companion way with boxes—go to long-shot, place boxes on the floor and dance on top of the boxes—??? beam starting from the right and travelling to the left up and down slowly according to the sequence of the dance movements. Girls then go into circular movement, during which the beam should be kept steady. After the first time round Billy Milton and Reita Nugent join and head the line, and after another circle lead the line forward to close-up, Billy Milton exits left, Reita Nugent and all the Girls—one after the other exit right. When the last girl has done her exit, Billy Milton steps back into the picture and sings last few bars of the song.

Milton re-enters after exit of Girls—fade on Milton's exit.

Announcement—Let's now take a peep at the kitchen in one of New York's greater hotels—what nationalities shall we find there?

Fade to caption:—Astor Hotel.

Chorus of Paddy, Keith Prowse played—screen, with door in it, placed just behind the back-line. At the end of the tune, discover Sara Allgood in close-up position, singing:—
into lines. Entrance of Georgie Harris through the door—she turns as he calls, after which try and show him approaching her. Dialogue between the two as close as possible, panning slightly if necessary, leading into Georgie Harris' song

"Sady O'Grady," F.D.H.

The beam must be on him. He steps on to box at side of table to sing this song. At the last chorus of song he goes back to Sara Allgood, and they dance, while he is singing—she pushes him out of the picture, and speaks her closing lines close-up.

Fade to blank.

Announcement—Working our way up town, we now find ourselves in a German Colony in Fourteenth Street, with very strong memories of the Fatherland.

Fade to caption:—Fourteenth Street.
Music "The More We Are Together" C. & C.

At the end of this music fade into the studio—Tyrolean Dance by two of the Girls—Music for this:—

Songs and Dances from the Tyrol (Fetras) Feldman

On their exit—lens in—George Harris—big close-up for song
The Night that She Cried in Her Beer, Chappells.

At the end of the song, before his exit, fade to blank.

Announcement—Still going up town, we are getting to the supper club area in the famous Forty-second Street district. Bright lights and Music.

Caption:—Forty-second Street,
and covering music—
"*Forty-second Street,*" Feldman.

At the end of this tune—fade to caption:— *El Morocco,*
and
Announcement—Ladies and gentlemen—We have great pleasure in announcing the first appearance in the El Morocco to-night of the famous English Cabaret Star, Billy Milton—presenting his latest songs at the piano.

Song—"*Chewing Gum—It's Fun*" (Milton), M.S.

Discover Billy Milton on the first run up the piano in a close-up without the hands showing, in a position to face the camera. He will sing one or two numbers according to timing. Applause from the audience—he gets off the piano stool—bows, and fade.

Announcement—Come on folks—we're taking you to Broadway, the great entertainment centre of our city.

Cue for "*Broadway Melody,*" F.D.H.

Cover with caption:—Broadway,
and then entrance of Rose Walker—semi, walks forward to close-up, sings verse and chorus of
"*Lullaby of Broadway,*" Feldman.

Steps back at the end of chorus, raises the two Girls in front of her, and creeps out of the picture—the Girls yawn and stretch for a few bars, and Reita Nugent pushes her way between them to close-up to sing verse and chorus of same number—Reita Nugent steps back at the end of the chorus, turns her back to the camera, points to the right-hand long-shot position, and exits as the Girls enter from that position. Routine of the Girls to "Lullaby of Broadway"—verse and Rumba:—

Sidewalks of Cuba, K.P.

At the end of the Rumba, Girls are grouped extended left. Pan over to the right in time to catch Billy Milton creeping on for the last chorus. He creeps up to the girls, beckons to them, and brings them all slowly forward to close-up. Fade on the last note to caption.

Cross-talk between Reita Nugent and Announcer.

Announcer—"*Say, Cutie, what's the smartest supper club in New York?*"

Reita—"*Why the Rainbow Room, of course.*"

Announcer—"*Come along honey—we had better be gettin' along then.*"

Intro: "*Here Comes That Rainbow,*" L.W.

Entrance of Reita Nugent—X to C—sings chorus and verse—exits—Three Girls in on second chorus with ribbons, pan across the Girls for their ribbon dance. Re-enter Reita Nugent singing last 16 bars of the chorus.

?Music Club Richman *"I'm on the Crest of a Wave,"* C. & C.

Announcer—*"Tell me sweetie is the Club Richman still going strong—I hit the high spots there many times in the old pre-slump days, when 'I'm on the Crest of a Wave' was all the rage."*

Reita—*"Sure and Harry Richman's singing better than ever—he's got a wonderful new hit—come along and hear him.*

Entrance of Billy Milton—back line—lens—forward as close as possible.

" When Love Comes Swinging Along," Chappells.

Exit and fade to blank.

Announcer—*" Hello—if it isn't Sara Allgood. Good evening Sally—How are you?"*

Sara Allgood—*" I'm very well."*

Announcer—*" Have you ever been to the Chinese quarter of New York?"*

Sara Allgood—*"I have—there's a queer little man down there I know—I always call him the Heathen Chinee, myself—his real name is Wong Lee—I'll take you along to see him, if you like—come along."*

Fade to caption:—Chinese Lantern.

Chinese music playing. Discover the girls on the back line dancing; lens in—if possible.

" Limehouse Blues," A.H.C.

Entrance of Georgie Harris to stand on box in close-up for song,

"Wong Lee—Heathen Chinee," M.S.

Fade to blank—few bars on the piano.

?*"Old Folks at Home."*

At end of which, fade into studio—enter Reita Nugent from the left to meet Billy Milton from the right—dialogue—lens in—forward to close-up for her song,

" It's an old Southern Custom," K. Prowse.

Billy Milton almost out of picture, *beam on her*—lines ending—" I'll take you to Harlem "—exit—fade to caption:—Harlem.

Introduction—slow music:—

" Mood Indigo," L.W.

End of " Mood Indigo," fade to studio—Entrance of Rose Walker—X to C for:—

" Dixie After Dark," K.P.

Back on the last few bars of the song, turns and beckons to Charlie Woods, who enters from the left—pan over to catch his entry as he goes right up to her, back to his dance. She re-enters and dances with him last few bars. The girls enter for their routine behind Rose Walker and Charlie Woods, and as they exit the girls enter, and they cross over and ? ? ? exit

?again *" Mood Indigo,"* L.W.

" The Man from Harlem," L.W.

?also *S.O.S.*

Sydney Jerome's Orchestra.

Piano,
1st violin,
2nd violin, doubling tenor saxophone and clarinet,
3rd violin, doubling alto saxophone and clarinet,
'Cello, doubling guitar,
Drums,
Trumpet.

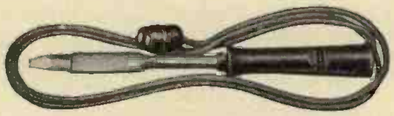
Announcer—Geoffrey Wincott.

Trade Notes of the Month

Reports on Apparatus Tested

Electric Soldering Irons

SOLDERING enters very largely into the construction of both commercial and amateur television receivers. Amateurs who have only used the gas- or fire-heated type of iron will hardly appreciate what a saving of time and trouble the electrically-heated iron will effect. Constant heat and the absence of any flame ensures that the iron is at all times clean and properly tinned—the two main points in successful soldering. We have recently made a test of the Solon electric iron,



The Solon Electric Soldering Iron.

which has some particularly good features. The bit is of oval section and so designed to provide the maximum amount of heat at the working end with a minimum of heat loss; all parts are renewable without having to send the iron to the makers and, moreover, the prices of the renewal parts are exceptionally low. Solon irons are made in three ratings—65, 125 and 240 watts, the latter, of course, being intended for heavy commercial work; the 65-watt size is the one recommended for amateur use and the price of this is 7s. 6d., complete with six feet of flexible rubber cable and plug. The makers are W. T. Henley's Telegraph Works, Ltd., Holborn Viaduct, London, E.C.1.

Westinghouse Type H Metal Rectifiers

SMALL rectifiers, such as the Westinghouse type H, can be used in numerous ways. In size, they are no larger than a thick pencil so they can be embodied in small receivers or with a cathode-ray tube when low-voltage bias is required.

The rectifiers consist of a number of copper discs which are oxydised on one side. These discs are then mounted in a long insulating tube, without spacing washers, compression being obtained by means of a spring either one or both ends.

Each end of the tube is closed by a brass plug which is also used as a terminal point. This method of construction enables rectifiers using up to 176 discs to be employed.

Taking examples at random, the H5 gives twenty volts at 5 mA, while the H75 gives 306 volts at 5 mA or 270 volts at twice that current. These figures are for half-wave rectifiers, but voltage doubler units will give up to 1,500 volts at 5 mA.

The type H10, giving 40 volts, costs 4s. 6d., while the H25, giving 102 volts, costs 4s. 8d. Makers are the Westinghouse Brake and Saxby Signal Co., Ltd., York Road, King's Cross.

Edison Mercury-vapour Rectifier Type MU2

IN view of the probability of increasingly high voltages being used for cathode-ray television working, Ediswan's have re-designed the MU2 mercury-vapour rectifier valve to withstand a maximum peak reverse voltage of 10,000. The anode is now brought to a metal cap at the top of the bulb instead of being connected to the 4-pin base. The price is raised to 17s. 6d., but a limited number of MU2's with the standard 4-pin base will still be available for replacement purposes.

The characteristics of the new valve are as follows:

Filament voltage	2.0
Filament current (approx.) ...	1.0
Maximum anode volts (r.m.s.)	4,000
Maximum rectified current for simultaneous switching of anode and filament (mA) ...	25
Peak emission current (mA)	150

Technical Books

We have received from W. & G. Foyle, Ltd., 119-125 Charing Cross Road, London, W.C.2, a copy of their latest catalogue of technical books. This catalogue covers the entire field of technical literature of about four hundred and fifty different subjects. Copies of the catalogue can be had upon application and mention of TELEVISION AND SHORT-WAVE WORLD.

Correspondence

Correspondence is invited. The Editor does not necessarily agree with views expressed by readers which are published on this page.

The Wireless Exhibition and Television :: Television in Australia Short-wave Aerials :: De Luxe Television Viewer :: Short-wave Reception

The Wireless Exhibition at Olympia

SIR,

I thank "the Looker" for the information re R.M.A. intentions as I shall now save my time and money by not going. You can see all the sets of broadcast receivers at any good dealer's showroom. Last year it was nothing but a show of cabinet work.

F. C. STIMPSON (Leytonstone).

* * * *

Television in Australia

SIR,

In the little round stone tower in which I work there is barely elbow room, yet I have achieved results with television which have caused favourable comment from all who have seen them, and I have letters from experimenters in other States in which they say they are favourably impressed by the images they have received from me. These are the only television experiments being conducted in Australia. The wavelength is 136 metres and the power input is 1 kilowatt. The station is owned by Dr. McDowall.

I do not claim that my station is anything more than a research one, and if television were started in Queensland on a commercial scale I should recommend the establishment of a transmission studio, attached to, say, Station 4QG. The studio and equipment could be constructed either by an outside concern or by the experienced engineers of the Postmaster-General's Department. All the necessary equipment could be made in Australia, except the photoelectric cells, but as all these can now be bought in Australia there need be no delay in starting television on a large scale.

Radio broadcasting in Australia has reached such a high stage of advancement that its early trials and difficulties are mostly forgotten by the general public, but I have not forgotten them, for I was one of those who established the first broadcasting station, 4CM, in Queensland. That was 11 years ago. Now I am meeting with the same form of incredulity in regard to my low-definition television experiments as I did in regard to ordinary broadcasting.

THOMAS ELLIOTT
(Observatory Tower, Wickham Park, Brisbane, Australia).

* * * *

Short-wave Aerials

SIR,

May I take the liberty of complimenting you on a most outstanding type of magazine: something entirely out of the ordinary?

The following information will no doubt be of use to Mr. Malcolm Harvey. On page 131 of the March issue, you ran a short article by W1CAA on directional aerials. It is quite a coincidence, but a week or two ago, I got the same idea of the matched impedance feed on 56 mc. as diagrammed in Fig. 2, but with reflectors spaced $\frac{1}{4}$-wave behind the radiators. To show you the efficiency of this system, on Sunday, May 5, 1935, the Sydney group of ultra-short-wave men arranged a DX test. VK2OD took portable equipment to Mount Boyce, 73 miles airline from Sydney coastline. The day before I had installed an 8-watt transmitter in a friend's home in North Sydney, under my second call sign (portable, VK2NU). This aerial system was erected *inside the roof of the two-storey house*. My own home station, VK2NO, uses a rotating "zepp" type beam with reflectors and 50 watts into two R.C.A. 801's. This station and several others with outside beams were on constantly during the test period, and VK2NU, *using the inside aerial was the one and only station heard (QSA5 R6) at the distant point!* It was the same for reception, VK2NU was the only one to definitely hear the distant station. This aerial, as outlined by W1CAA in TELEVISION AND SHORT-WAVE WORLD, but with reflectors, is by far the most efficient yet devised, and I have used every conceivable type. I can strongly recommend it to all English ultra-short-wave men. Incidentally, it should be ideal for 7-metre television reception, being easy to install in the average garden. About television: I am planning to import the necessary gear from England to make a start on high-definition experimental transmissions, and I look to your indispensable magazine for much help in the essentials.

DON. B. KNOCK, Radio Editor,
The Bulletin (Sydney, Australia).

* * * *

De-Luxe Cathode-ray Viewer

SIR,

We note from the June issue of TELEVISION AND SHORT-WAVE WORLD that the exciter unit for the above incorporates one of our L.T. rectifiers, and this is shown mounted with the spindle vertical.

We should like to point out that this is against our express instructions, as you will appreciate that the cooling fins when in a horizontal position cannot dissipate any heat developed, the function for which they are intended. It has been our practice to stress this point in all our publications, and, although the loading in this particular instance is only very small, it is likely to lead to troubles with units when giving full output.

WESTINGHOUSE BRAKE & SIGNAL Co., LTD. (London, N.).

* * * *

Short-wave Reception

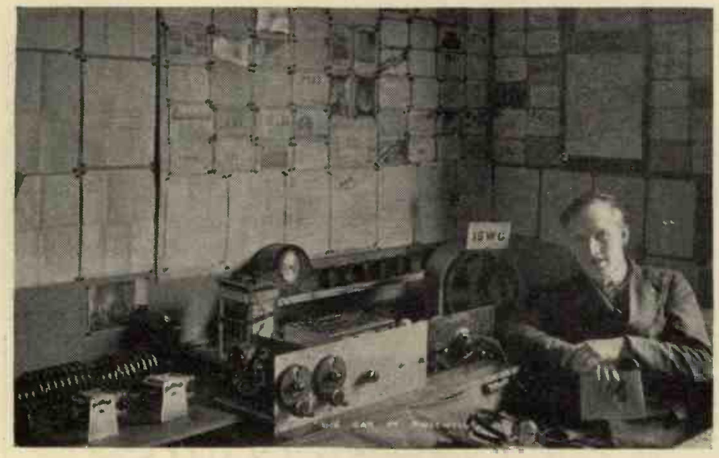
SIR,

The best local DX worked here is G6WN and G5KU, but I have received a report from Eastbourne, so my ground wave apparently extends about 40 miles in a southerly direction at any rate.

Conditions on 28 mc. seem to have been fairly good recently and I've had a good many European QSO's with 20 different stations during May.

The following list of calls heard on 28 mc. may be of interest:—(Those in brackets were not, QSO's) FF8MQ, FM8CR, FM8BG, FM8IH, FM8GT, OK1AW, OK2AK, (OK1AA), OK1FF, OE1FH, OE1ER, OE3WB, SM6VR, F8TEN, D4BBN, D4BMJ, (D4BED), D4BDF, D4BHF, D4CNF, (HB9J), YM4ZO, YM4DSH—these all being fundamentals.

NELLY CORRY (G2YL),
(Tadworth, Surrey).



Here is the gear of Ridgewell, operated by F. A. Beane, a member of the International Short Wave Club.

Heard on the Short Waves

By Kenneth Jowers

ACTIVITY on five metres is certainly on the increase and at the present moment there are more stations active than ever, and instead of being bunched around South London they are going up in all parts of the country.

In another part of the issue details will be found of some of the five-metre transmitters which are working and who would welcome co-operation from listening stations.

G5CM, operated by T. H. Streeter, from Billinghurst, Sussex, would like reports from anyone hearing his 57-mc. transmissions. Incidentally the transmitter in use is similar to the one described in the last issue. The reason for this renewed activity on five metres is not hard to discover. Amateurs are now realising that although five-metre transmissions are supposed to have a mere optical range this does not always bear out in practice. At the moment the amateur record stands at about 200 miles in this country, while commercial bodies have been able to improve upon this without much difficulty.

The achievements of the Post Office should always be borne in mind, for they have made full use of optical wavebands. Many will remember one of their earliest efforts in fitting up transmitters on either side of the Bristol Channel, linking Cardiff with Weston and avoiding the use of land-lines via Bristol. The next step was a six-circuit transmitter from Port Patrick to Belfast. To me, this is a real achievement, for I have the greatest difficulty in working two-way on five metres let alone running six transmitters and receivers simultaneously without mutual interference. Anyway, a continuous service across the Irish sea is an established fact.

110 Miles on 5 Metres

The latest service from Glastonbury to the Channel Islands, a distance of about 110 miles, is probably an English commercial record and, as the service is as reliable as a submarine cable, there is no reason at all for amateurs not being able to do equally well. It is certainly not because of the power for that the P.O. use for this rarely exceeds eight watts.

These results are not freak but are taking place every day, and should not be confused with the reception of Buenos Aires, Canada, Berlin, Rome and Copenhagen, which are more or less dependent on conditions. Anyway, I do feel that the five-metre band is worth consideration, particularly in view of the simplicity of the receivers required.

5KH, H. G. Cullum, is to deliver a lecture at the next meeting of the South London and District Radio Transmitting Society, where he will demonstrate a H.R.O. receiver and a cathode-ray oscillograph. Meetings are held on the first Wednesday of every month at the Brotherhood Hall, Knight Hill, West Norwood, at 8 p.m., and any amateurs dropping in will be assured of a welcome. In August it is intended to arrange a special overseas meeting to bring together amateurs from other countries who will be over here for the Exhibition.

Five-metre portable stations are all very well in fine weather but imagine this group caught in some of our recent weather.

The launching of the *Normandie* presented a golden opportunity for DX hunters. Many readers have commented on the strength of the *Normandie's* transmitter and Norman Brandon, writing from Barnet, mentions that he was able to follow the liner across the Atlantic during the evenings. The wavelengths used on the *Normandie* are approximately 60 and 23 metres, and signal strength varies between R9 and R3 according to location.

A New Station

A number of new stations are coming over quite well. JVA, Nagoya, Japan, on 22.1 metres is coming over R6/7 testing with Rome. If your receiver is tuned to the top end of the amateur band no trouble should be experienced in picking up this Japanese station first thing in the morning. LSY on its 14-metre channel is an R7 signal from 22.00 and, although it is usually commercial, records are occasionally broadcast.

It is unusual for T4 high-frequency stations to come in at this time in the evening for W3XAL usually fades out much earlier on; comments from listeners in different parts of the country will be appreciated.

The 20-metre amateur band is generally good, but the time for reception varies considerably. The majority of readers find the best times to be between 21.00 and midnight, although several readers in common with myself have heard W1's and W9's as early as 14.00. Several readers have heard all nine American districts, but, generally, 6's and 7's are difficult to receive. LY and LU, a big difference in location, are coming in between 01.00 and 02.30 quite reliably, but with regard to LY it depends more on whether the stations are active rather than on conditions.

Reports Wanted

Those readers who hear practically all the W stations there are to hear will be interested to know that W8AFM, whose photograph is in these pages, will be glad to have reports from G stations. It is operated by Thomas W. Connette, Lockport, N.Y., and uses a power of 750 watts. In the illustration can be seen the 160-, 80-, 40- and 20-metre transmitters with monitor receiver and operating desk.

Francis A. Beane, of Ridgewell, Essex, is doing very well on the receiving side at the moment. Although he is not particularly keen on the amateur end, his log of commercial broadcasters is the best I have seen for a long time. I do not know whether conditions are particularly good in Ridgewell, but I notice in his log stations not heard in other parts of the country.

A new Dutch station, PI1J, is operating on a frequency of 7,000 kc. requesting reports on their test transmissions. Signal strength varies between R6 and R8.

Now that the National Field Day is over we shall have to wait and see who tops the list. Essex and district finished up with 162 points, while Hertfordshire also did quite well. Incidentally 5FB, who was in charge of the 40- and 20-metre transmitter for district 8, used a Contest Three receiver described in the February issue.

(Left) Direction finding on five metres is an interesting hobby. The apparatus required is comparatively simpie.

(Right) W8AFM is situated in Lockport, New York, and reports on 20-metre phone signals will be appreciated.

I have often mestioned the Pioneer Gen-E-Motors, supplied in this country by the Rothermel Corporation. These were used throughout the Field Day by the Essex station, and they gave extraordinarily good results without any trouble at all. In view of the compactness and general efficiency these generators should be borne in mind by portable stations.

Calls Heard

MANY readers have written to us expressing their appreciation of this page and we should be glad to receive reports from listening stations in districts not already covered. We feel that the publication of these reports enables amateurs to gain some idea as to the approximate conditions for reception in the various areas.

BRS 1353, S. Bradbury, 15 Hollingwood Mount, Bradford.

(*14-mc. phone.*)

W1AJZ, W1GPE, W1CDW, W1CRW, W1CHG, W1MG, W1COS, W1AWD, W1GED, W1ARC, W1FAX, W1AHI, W1CAA, W1KZ, W1AGW, W1AKY, W1CJV, W2AMD, W2DVU, W2HS, W2CLS, W2BTV, W2AKH, W2VRX, W2AIF, W2GNQ, W2GG, W2ZB, W2FLO, W2HFK, W2CMJ, W2CRD, W2EDW, W2EZC, W2AH, W2DC, W3MD, W3APO, W3BFH, W3CIJ, W3EHY, W3EJA, W3DF, W3VX, W3AUC, W3FEU, W3AJX, W3AXT, W4EJ, W4AXZ, W4AGP, W4ZF, W4AH, W5BDV, W5BEE, W5BEQ, W8ZA, W8IV, W8FU, W8CJV, W8AOC, W8VW, W8CYP, W8BGY, W8CTF, W8GLY, W9BIF, W9RGF, W9GIT, W9AJI, VE1DR, VE1CR, VE2CA, VE2BG, CO2HY, CO2LL, CO2WW, CO6OM, K4SA, TI3AZ, HH5PA, LY1AG, VO1I, VP6YB, VP5PA, VP3BG, HI7G, HI1W, SP1LM, CT1DA? CT1GU, EA1GU, EA8AP, EA1AH, G5ML, F8NH, ON4ZA, G6NJ.

(*7-mc. phone.*)

G2XC, G2YS, G2TU, G5XG, G5YW, G5PP, G5HN, G5ZJ, G5PW, G6UG, G6GO, OZ4Q, HB9AY, EI7G, HB9Z.

(*3.5-mc. phone.*)

G2IP, G2JU, G2XS, G2XE, G2LZ, G2FC, G5JZ, G5KG, G5YA, G6UJ.

B. McDougall, 5 Hector Road, Glasgow, S.1.

(*7-mc. phone.*)

ON4AJ, G5PP, G5NX, G6UI, G2FC, G5YY, G6VF, G6YU, G2IP, G2XU, G2NN, G5ML, G5YJ, G2IL, G2XC, G5UR, G5XA, G6RS, G6TO, G5CU, G5PB, G5ZJ, G6SR, G5XG, G2MI, G6XJ, G2LU, G6CT, G5HN, G5BP, PAODK, PAOWJ, G2QV, G2OV, G6NF, G6ZZ, F8ZY, F8VX.

(*14-mc. phone.*)

W1HJZ, W3BJA, K4SA, W9BIC.

J. M. Greenshields, 4, Arundel Gardens, Burnt Oak, Middx.

14-mc. phone.)

333 stations including W4AH, W4AGP, W4AU, W4AHX, W4AHH, W4BFH, W4CP, W4CRE, W4CVO, W4EJ, W4FK, W4CFH, W4JA, W4LC, W4OC, W4UM, W4DW, W4DYA, W4UU, W4UP, W4KH, W4AZP, W5ZS, W5PMM, W5VS, W5AXC, W5CPP, W5DMG, W5VHJ, W5CTB, W6EBD, W6GOY, W6VEP, W4DGQ, W4LT, W4AJZ, W4BDV, W3ANG, W3AIR, W3AEF, W3CYK, W3CFG, W3OPO, CO2HY, CO2WZ, CO2WW, CO2WV, CO2FL, CO2FG, CO6OM, HP1A, VO1I, K4SA, EA7PI, TI2SG, TI3KV, HI7G, LU1J, ON4ZA, X1G, SP1LM, CT1BY, VP3BG, VP5RX, VP6YB, VP9R, VP6AW, VP6WJ.

(*7-mc. phone.*)

G2FC, G5BF, G5ML, G6YU, G2XC, G5HN, G5PT, G5BI, G6VF, G6MZ.

R. W. Allsop, 61 Drakefield Road, Tooting, S.W.17.

(*14-mc. phone.*)

VE3HC, W1GKE, W9CPM, W1IFA, W1BES, W1GPE, W3EFH, VE2BG, W3CRB.

7-mc C.W.)

VQ4CRL, VQ8A, VK3BO, VK3KR, W6LFG.

Reginald Watson, The School House, Wraysbury, Staines.

(*14-mc. phone.*)

W9BHT, W2DC, W3AE, W2DE, W3HY, W1DES, W2AU, W2ANN, W1AMG, W4AHH, W1DSY, W1DRL, W3AVN, W2HFF, W3PC, W3MD, W3ADN, W8GLY, W1AJZ, W8DVU, W2AN, W3BRG, W2FLO, W2HAU, W4AH, W3EHY, W9EEL, VE1DV, CO2HY.

Albert Lee. 182, Tewkesbury Road, N.15.

(*14-mc. phone.*)

87 stations including W8AVD, W3FHE, W3CRG, EA4AE, W1KZ, VE1BV, W3MD, W2AIE, CO2HY, W4BQZ, W4AHH, W4GU, W4OC, K4SA, OH8NB, W2BYK, W2BPH, W2FB, W8FC, W3CM, W9AIB, W3UX, W4GW, VE1DR, LA1G, VO1I, VO2I, VP6YB, HP1A, VE3JV, CO2LL, CO2WY, CO2WW, CO6OM, X1G, TI2FG.

F. H. Wingate, 24 Obelisk Road, Woolston, Southampton.

(*14-mc. phone.*)

W7BYM, TF3G, W6AH, HR1JB, W3BFN, W5UI, X1AC, VE2DC, W6SJ, VP9R, TY1AU, FM8JO, VP5PZ, VP3EG.

John A. Hay, 1 Stafford Street, Hull.

(*14-mc. C.W.*)

147 W's including W8CNZ, W6HJW, W9PCD, W9ADN, W5LT, W4SB, W1LZ, VE2VB, VE2DM, VE1HY, VE2HG, VP2BX, VP2AT, VP5BJ, PY2DX, LU7EF, K5AN, CO2DO, CX1CC.

BBS 1730 Claud Clackson, 15 Norval Place, Rosyth, Fife, Scotland.

(*14-mc. phone.*)

VE2BG, VE2CA, VE3CR, VE1CR, VO1I, TI2FG, CO2ON, CO2HY, HI7G, CT1BY, CT1GU, SP1OM, W1AJZ, W1HX, W1BIF, W5BDV, W5ZS, W8LUG, W3CIG, W2AKK, W2HFS, W1CHG, W2HHU, W3MD, W2GNQ, W1ING, W2FLO, W2BST, W3BSY, W9EEL, G6SR, G2TM.

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28-29, Southampton Street, Strand, W.C.2
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UNIVERSAL HIGH VOLTAGE VALVES

ALL MAINS A.C./D.C. ANY VOLTAGE
without alteration.

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Telephone : TEMple Bar 8608.

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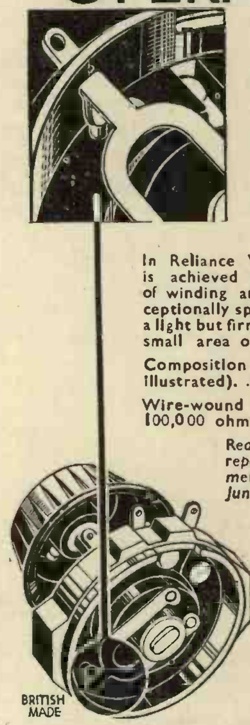
SILENT OPERATION



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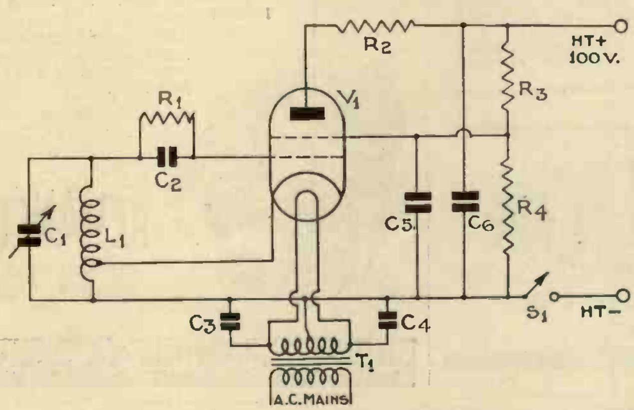
"An Electron-coupled Frequency Meter" (*Continued from page* 375.)

components firmly, and prevent any possibility of vibration affecting the frequency stability of the apparatus.

By-pass condensers and remaining resistances are mounted sub-chassis, while flexible leads to mains and H.T. supply, are carried out at rear through two ⅜ in. ebonite bushes.

The coil-base is mounted with the filament pins vertical and the grid pin facing the microdenser. Leads to this condenser are taken from the grid pin and top filament pin, a lead from the other filament pin being taken down through the chassis direct to the valve cathode.



The circuit is for mains operation but it can be adapted for a battery valve quite easily.

Three coils are necessary to cover the range, details of these being as follows:

Frequency range (kilocycles).	Total turns.	Cathode tap, turns from ground end.
3,250-6,800	31	3½
6,600-14,500	10¼	2
14,000-30,000.	3⅜	1

Coils are of 20 s.w.g. enamelled wire, space wound on grooved Eddystone DL9 four-pin formers. (They can be obtained wound to specification if desired.)

Calibration

When construction is completed the final item of calibration must be tackled. For this, three sheets of graph paper marked in tenths are necessary. The scale on each should then be marked off, allowing nine large divisions on the horizontal scale for dial readings, and using as large a scale as possible for frequency on the vertical line. Allowance should be made for slightly greater range than that given for the coil being calibrated.

The frequency meter should be connected up and left with its heater running for 5-10 minutes to allow the electrodes to reach normal temperature—this is very important, as otherwise the calibration may be as much as 30 kc. out.

A station of known frequency should then be tuned in, with the receiver in a non-oscillating condition. With the correct coil in position, the frequency meter is then switched on, and its dial rotated until a beat (whistle) is obtained in the receiver. This is tuned to the central "zero beat" position, the meter dial reading noted, and plotted against the station frequency on the graph.

As many readings as possible should be obtained for each coil, each being transferred to the corresponding graph. The points so obtained should then be joined up with a line, and the meter is ready for use.

Stations recommended for use in calibration are as follows:—

W8XK, 21,540 kc.; W3XAL, 17,780 kc.; W2XAD, 15,330 kc.; GSF, 15,140 kc.; Rabat, 12,830 kc.; W8XK, 11,870 kc.; Madrid (EAQ), 9,860 kc.; Rabat, 8,035 kc.; Radio Nations (HBP), 7,797 kc.; Moscow, 6,610 kc.; W8XK, 6,140 kc.; BSA, 6,050 kc.; Budapest, 5,400 kc.; CTTAJ, 4,000 kc.

The apparatus should, of course, be housed in some form of small cabinet, so that no possibility of movement of the components (which would upset the calibration) will be occasioned.

The component reference in the circuit diagram are as follows:

V_1 MS4B (plain bulb) (Osram).
C_1 100 mmfd. microdenser (Eddystone).
L_1 See table for coil details.
C_2 .0003 mica (T.C.C.).
C_{3-6} .01 mica (T.C.C.).
R_1 150,000 1-watt (Dubilier).
R_2 50,000 ,, ,,
R_3 30,000 ,, ,,
R_4 20,000 ,, ,,
T_1 4 V 1-amp. mains transformer (Eddystone).
S_1 S.P.S.T. on-off switch (Bulgin)

Components required in addition to those shown in circuit diagram are:

Two 5-pin chassis-type valve-holders (Eddystone DL9).
Disc-drive (Eddystone small type).
Three 2¾ in. eronoid pillars (tapped 6 BA).
One 2¾ in. eronoid pillar (¼ in. diameter) (Eddystone).

"Deflecting the Cathode-ray Beam" (*Continued from page* 382.)

So between the two of them we can shift the beam both horizontally and vertically to any amount. If we put a potential on both pairs at once the deflection of the beam will be a compromise and it will try to serve two masters. If the voltages are equal the beam will move across the screen at an angle of 45° with the vertical, like Fig. 3. If one voltage is very much greater than the other the path of the beam will be a gradual slope like Fig. 3b.

Incidentally we can make the beam draw all sorts of patterns by varying the potentials while it is moving, but that can be left for the moment since we are concerned with television.

Next time we can start the real business of making the beam draw the television screen, or scanning.

"More About the 'Lewis' Demonstrations" (*Continued from page* 418.)

of this condenser-resistance combination was made at least ½ megohm-microfarad to avoid any bass loss while, of course, the individual adjustments of the modulation allowed for the slight differences in the sensitivity of the various tubes.

A similar method was adopted to feed the other machines on view, namely, the mirror-drum and disc receivers, which were of standard type and require little comment. Small amplifiers containing a separate power supply and PX4 output valves were used for the disc receivers, the neon lamps being run in series with the output valve. This again gave an independent adjustment of the modulation on each set. Incidentally these units are very convenient for adding to the output of any normal broadcast receiver for disc reception of the B.B.C. 30-line broadcasts. These can be obtained comparatively inexpensively from B.T.S.

The photograph in the heading shows one of the cathode-ray receivers being demonstrated in Birmingham.

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