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PRACTICAL TELEVISION

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EDITOR F. J. CAMM

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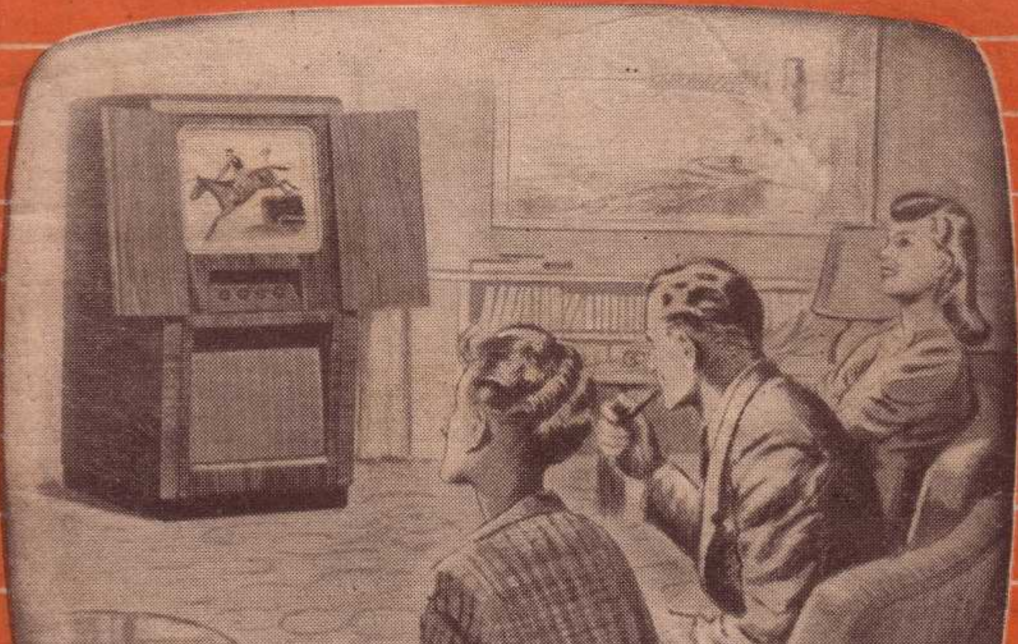

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PRACTICAL TELEVISION

Editor: F. J. CAMM

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Televiews

Our Policy

PRACTICAL TELEVISION, hitherto published as a monthly supplement to our companion journal, *Practical Wireless*, with this first issue assumes separate publication at a time when the television industry is forging ahead with plans for a nation-wide coverage. The idea of being able to see at a distance without any connecting medium except the imponderable ether was first mooted by Paul Nipkow in 1884, when he employed the scanning disc in the crude shadowgraph transmitters with which he experimented before the end of the last century. These experiments demonstrated in a crude way the practicability of radiovision. Many years elapsed before the late John Logie Baird continued the experiments and brought the 30-line scanning disc system to as high a degree of perfection as was possible within its narrow limitations.

Television as we know it to-day has been metamorphosed by the introduction of the high-definition system, improved scanning systems and electronic developments in many allied directions. The 30-line system of Baird is dead, and the missing link in radio by means of which we can both see and hear what is going on in the studio has been forged.

Television to-day is as good as any home cinematograph, but finality has not been reached. There are still the problems of colour television, shown to be practicable by Baird, and stereoscopic television, also known to be possible and by means of which we may view a three-dimensional picture. These two latter developments may not reach fruition for many years, but developments and experiments along those lines continue in the laboratories of our scientists. Television as we now know it will continue for some years, since the B.B.C. has announced that it does not propose to change the present system for at least five years.

At present we have the two stations, at Alexandra Palace and Sutton Coldfield respectively, which between them are theoretically intended to cover a service area of about 5,000 square miles, although it is known that good reception has been obtained beyond that limit. The Holme Moss station is in process of construction and it will not be many years before a chain of stations will provide everyone with the opportunity of installing television, and when that time arrives ordinary sound broadcasting as we now know it will occupy a position in radio analagous to the silent film and will be used only for such items as do not need vision, such as news and weather reports.

The whole country is alert to the possibilities of the new science, and the daily increasing numbers of viewers, totalling to-day over one million, is indicative of the ever-developing interest in this modern magic box.

This journal, therefore, has a mission not only to cater for those fortunate people living within the two service areas but also to those prospective viewers in other parts of the country for whom this journal will have an educational and an instructional interest.

Our policy will be technical without being high-brow. We shall explain not only the intricacies of television transmission and reception, in articles contributed by leading authorities, but we shall deal also with kindred subjects. We shall take the reader inside the studio and explain how programmes are transmitted. The service engineer will find regular articles on the tracing and remedying of television faults. We shall act as a filter for news of the industry and as a nerve centre for the dissemination of information concerning the latest developments of television in this country and abroad.

The latest devices and receivers will be reviewed, and we shall criticise the programmes, choosing fair words. Our pages will act as a forum for the interchange of readers' views, and our technical bureau will helpfully answer readers' television problems. The constructor will find, from time to time, instructions on building television receivers and kindred apparatus, designed in our laboratory in the same way as we produce designs for radio receivers in the laboratory of our companion journal, *Practical Wireless.*

Leading experts in the various branches of television have been retained to serve our pages, which, as with our associated practical journals, *Practical Wireless, Practical Mechanics* and *Practical Engineering*, will be liberally illustrated in line and half-tone. PRACTICAL TELEVISION will completely cover every aspect of television technique.

Although paper for periodicals became de-rationed as from March 1st, production problems still make it difficult to ensure full supplies. Therefore every reader should make sure of his copy by placing a definite order with his newsagent without delay.

—F. J. C.

The B.B.C. Television System

A Detailed Explanation of the Working of the System by the Chief Engineer, D. C. BIRKINSHAW, M.B.E., M.A., A.M.I.E.E.

THE headquarters of the B.B.C. Television Service are situated at Alexandra Palace, London, N.22, where the studios and transmitters for the London area were established as long ago as the autumn of 1936.

At Alexandra Palace there are two studios, each 70ft. long, 30ft. wide and 23ft. high. One studio contains four cameras and the other three cameras. These are, generally speaking, mounted on mobile trucks, termed dollies, enabling them to be moved smoothly to and from the scene.

Before discussing the electronic side of television, it is important to mention the studio scene in more detail. It may consist of one set, such as an interior which is required for the whole duration of a play ; on the other hand, it may consist of a number of separate sets arranged all round the studio and even at times " stacked" one in front of the other, as many as twenty such sets having been got into the studio by this means. This type of scenic manipulation is required when rapid changes of venue are required during a play or light entertainment production. In another part of the Alexandra Palace, the B.B.C. has set up a very elaborate organisation for the production, remodelling and storage of scenery, and no description of the activity at Alexandra Palace would be complete without attention being drawn to this very substantial part of the work.

Near to the studios there are all the necessary dressing rooms and make-up rooms for the artists. In addition, there is a wardrobe department which can supply dresses needed for certain productions.

Adjacent to each studio there is the electronic control room which contains a very considerable quantity of apparatus necessary for the operation of the emitron cameras. Above each control room is a gallery where what may be termed the operational control of a production takes place.

The artistic side of a production is in the hands of a producer who is responsible for the costing, cast and the basic studio requirements. These are carried out for him by the scene designer, but at a very early stage consultation takes place with the engineering department in order that the technical requirements of the production can be studied in advance and due preparation made.

Let us assume that all this has taken place and that on a given day the studio has been set up with the necessary scenery and properties for the production, and that the artists have arrived, and have dressed and made up. The first step is to light the scene, and for this purpose each studio has a lighting installation of rather more than 100 kW. at 110 volts, partly A.C. and partly D.C. This power is supplied to various parts of the studio where it is fed to lamps of various designs whose power ranges from ½ kW. to 5 kW. These lamps closely resemble those used on the stage and in a film studio, and are mostly spot lights in which either lenses or mirrors are used to produce a powerful focus beam, the limits of which can be set by fittings on the front of the lamps, called " snoots."

There are two principles to be observed in studio lighting, and the first is that enough light must be reflected from the darkest parts of the scene to activate the emitron, in which case there will be ample light reflected from the lighter part. Roughly speaking, the intensity of the incident light arriving on the scene is of the order of 200ft. candles, and the reflected light varies from perhaps 3ft. lamberts from the darkest parts of the scene to perhaps 200ft. lamberts from the lightest parts of the scene. This requires lighting power of 70 kW. for the average studio set.

The second principle to be observed is that the lighting must be so placed as to give the most artistic appearance to the picture, and in particular to give it life and depth as opposed to a flat appearance which one is often conscious of in, shall we say, the early efforts of a beginner in the field of photography. This, generally speaking, requires that the lighting shall be directed on to the subjects from the back and sides, rather than from the front, although from this position a moderate quantity of diffused lighting is also needed. The technique of lighting is elaborate and somewhat too complex to be dealt with here, and considerable time and attention are devoted to the lighting of a scene and of the artists who are to appear in it.

The Cameras

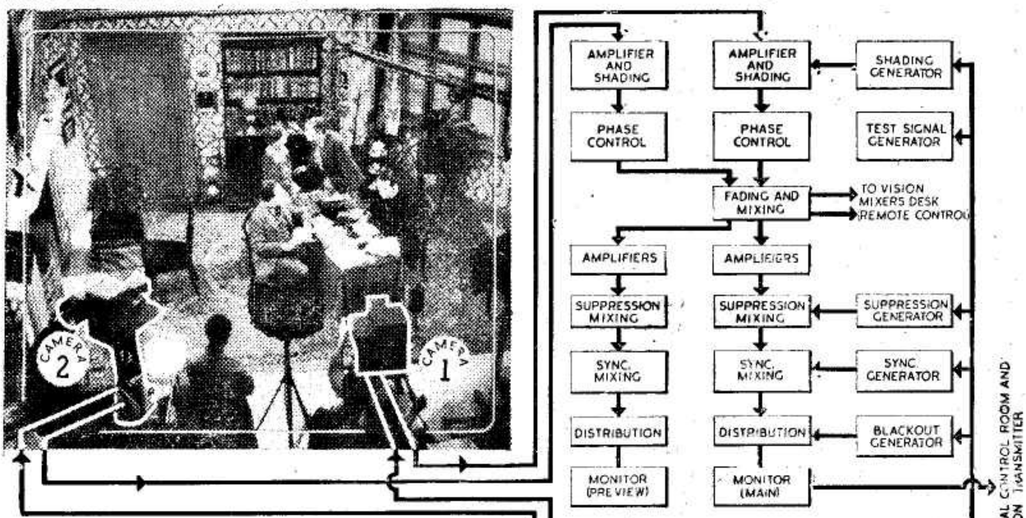
We may now consider the actual generation of the television signals on the assumption that the cameras are facing a properly lit scene.

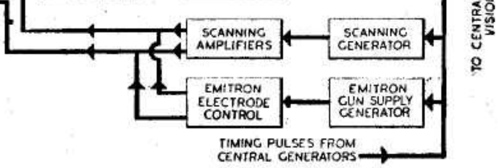
The camera is equipped with a 6½in. lens having a maximum aperture of f/3, and this lens focuses the image of the scene on to the mosaic of the emitron. This mosaic consists of a mica sheet some 5in. by 4in., on the side of which nearest to the lens is an assembly of minute silver nodules, oxidized and treated with caesium. Such a surface has the ability to emit photo-electrons under the influence of light. The rear side of the mica plate is covered with a continuous coating of silver. It is important to remember that each nodule is a separate entity, insulated and separate from its neighbour. Let us consider the action of a nodule which is under a light part of the image. It emits electrons due to photo-electric action, and since it has no connection with its neighbours and is completely insulated in space, that loss of electrons remains as a permanent deficiency until they are replaced. Such an electron deficiency is more generally termed a positive charge. The rate of emission of electrons is proportional to the strength of the light striking the mosaic, so that after a given time, for example, one twentyfifth of a second, every nodule will have lost more or less electrons depending on whether it has been under a dark or bright part of the image. It is customary to describe this state of affairs by saying that a " charge image " now exists on the mosaic having been generated by photo emission actuated by the optical image placed thereon by the lens.

The mosaic is, of course, suspended in a glass bulb which is completely evacuated, and facing the mosaic obliquely in a long glass neck provided for the purpose is an electron gun which fires at the mosaic a minute pencil of electrons. This pencil of electrons is, of course, nothing more or less than a current of electricity projected through space on to the mosaic surface. This new supply of electrons falling upon a given nodule, which has previously lost electrons by photo-emission, will fill it up again, and if the spray of electrons be moved uniformly along the mosaic from one side to another it will fill up each nodule in succession along the row. The motion of the beam is rather similar to the eye reading a line of print in a book. In point of fact, the pencil of electrons almost exactly imitates the eye, because, having moved along one row of nodules as the eye does, it flies back to the side from which it started and begins to move along the next row, just as the eye proceeds to move along the next row of print lower down. The beam is guided over the mosaic line by line just as the eye moves over a page of a book while reading. It follows, therefore, that all the nodules are filled up again with electrons in a regular order.

We have noted briefly that each nodule forms, with the back plate, a little condenser. A nodule is made of conducting material and the silver plate at the back is, of course, of conducting material, and the intervening mica is an insulator, and there we have the elements of a condenser. Now we know that if a condenser is charged or discharged, a current will flow in both the plates of it. When the beam strikes a nodule and replaces the lost electrons, we are discharging the positive charge which was formerly there, and this, of course, entails a flow of current in the other side of the condenser, which is the part of the silver backing immediately opposite the nodule. As the beam moves along the nodules, each successively causes current to flow in the back plate so that over a period of a scan, or sweep of the beam, there is a continuously varying current in the back plate of the mosaic, and this current is manifestly proportional at any instant to the positive charge which had to be discharged, which is in turn proportional to the emission which created it. This emission is similarly proportional to the brightness of the image at that particular spot. The final answer therefore is that the variations in the electric current emerging from the back plate faithfully follow the light and shade of the original scene, whose image is examined bit by bit by the little pencil of electrons, or scanning beam, which is moving over it. It is this current which after many further electronic processes is applied to the radio transmitter and sent to the receiver where it serves to regulate in intensity of a similar electric beam in the cathode ray tube of the home receiver. This beam in the home receiver, instead of discharging a mosaic, creates a moving spot of light on the fluorescent screen.

If the beam traverses the mosaic in the way described just once, we should not, of course, achieve television, which is the transmission to a distant place of moving images. It is necessary to copy the technique of the cinema and keep taking new pictures of the scene at such a rapid state that the successive pictures are able to follow the successive stages of motion within the scene.





A studio scene and a diagrammatic representation of the transmitter hook-up.

The cinema takes 24 pictures per second; television takes 25. This slight difference arises because it is desirable that the number of television pictures per second should be equal to half the periodicity of the electric mains, which is 50. The number of lines in a television picture is, of course, constant at 405.

Interlacing

In an article of this description, it is obviously impossible to give other than the simple principles upon which television works, and many practical difficulties must be passed over. For example, the lines are not actually scanned in their natural order, but the odd lines are scanned first and then the even lines are scanned. This process, called interlacing, causes the beam to make twice the number of vertical motions which it would otherwise do; and this tricks the eye into believing that 50 pictures are being transmitted instead of 25 per second, and there is a marked reduction of flicker. Also, the electrons projected on the mosaic encourage the emission from the mosaic of further electrons, called secondary electrons, which, unfortunately, splash on to other parts of the mosaic and produce imperfections in the illumination which have to be subject to electric correction, to be described below.

The small current emerging from the signal plate of the emitron is passed through a resistance, across which it generates a voltage which is a mixture of frequencies, ranging from zero to 3 Mc/s. per second. This is immediately amplified in the video frequency head amplifier embodied in the camera, and passed through a cathode follower whose output impedance is designed to feed the video-frequency current into a coaxial cable leading back to the control room.

Let us now trace onward the passage of this current, bearing in mind that the various electronic operations which are successively performed upon it requires the presence of numerous other currents, or waveforms, as they are called, the existence of which will have to be taken for granted for the time being. Upon entering the control room, the video-frequency current is amplified further, and if at this stage it were used to produce a picture in the cathode-ray tube, that picture would be unnaturally dark in one corner and unnaturally light in another. This is the defect, already mentioned, due to secondary emission in the emitron, but the effect can be corrected by mixing with the video-frequency current four other waveforms, line and frame saw-tooth, and line and frame parabola, which are available from electronic generators. These are called the shading waveforms, and the correct mixture must be individually set up for each camera and dependent upon the particular tube in use, its working conditions, and lighting conditions. These waveforms are continually under adjustment throughout the production, a matter of skilled manipulation.

The video-frequency current, after further amplification, is treated with suppression pulses at line and frame frequency, which establish between each line and between each frame, when the beam is returning after its scanning stroke, a voltage corresponding to black. From this black level may now be suspended, as it were, the synchronizing signals which are impulses sent from the transmitter to the receiver during the return stroke of the scanning beam and which operate on receiver circuits to keep its beam in step with that of the transmitting end.

It will be clear that there must be available for injection into the channel, in which the above operations are being carried out, a number of subsidiary recurrent waveforms. The shading waveforms have been mentioned, but, in addition, suppression pulses, synchronizing pulses, and black-out pulses for extinguishing the camera beam during its return stroke are also required. These waveforms are continuously generated in panels of electronic generators. Moreover, no mention has as yet been made of the means by which the camera beam is caused to scan the mosaic. The beam is moved by magnetic fields generated by iron-cored coils mounted around the neck of the tube. These coils have to be supplied with current waveforms at line and frame frequency which are basically of saw-toothed shape, but pre-distorted to allow for the obliquity of the gun. These are also generated in valve generators in the control room. Other panels provide for the generation and control of all the D.C. potentials associated with the emitron gun and for control of the amplitude and position of the scanning. Lastly, all this apparatus must be supplied with stabilised L.T. and H.T. In the aggregate all this requires a considerable mass of panel-mounted apparatus, amounting to more than 500 valves and their associated circuits.

On the sound side the studio is equipped with several mobile moving coil microphones on booms, four gramophone turntables, and these are supported by appropriate panel-mounted amplifiers and testing apparatus.

The Control Room

All this apparatus which has just been described occupies the control room proper and is under the continuous supervision of skilled engineers. In the studio each camera has its cameraman and the mobile cameras have one or more assistants to control the position of the camera. Similarly, the moving microphones and lamps are all staffed by appropriate personnel.

We may now turn our attention to the control gallery in which is centred the minute-to-minute operation of the equipment. In the centre sit the producer and senior engineer, and near them is the vision mixer who can fade into the transmission any one of the cameras; alternatively, an instantaneous fade, known as a cut, may be used. Near-by is the sound mixer, upon whose desk are the several controls required to fade in and out the various microphones and to regulate their intensity prior to fading. At one end of the gallery is the bank of turntables. All these operators can see two picture monitors, one of which shows the picture which is in transmission.

(To be continued.)

The control room and its links shown diagrammatically.

TELEVISION PRINCIPLES AND PRACTICE

This Series of Articles will Explain the Fundamentals of Television Transmission and Reception

By F. J. CAMM

TELEVISION differs from sound broadcasting in that it appeals to the senses of hearing and vision simultaneously, but in many respects sound and vision broadcasting technique is similar. Whereas, however, with sound broadcasting a concatenation of sounds such as issues from an orchestra will resolve itself into a single pressure wave representative of them all and may thus be received on a microphone and converted into an electrical waveform, vision works on an entirely different principle. It depends in essence upon a defect in our eyes known as persistence of vision. This means that the eye will see as a continuously moving picture any series of pictures which are moved and then brought to a stop at a frequency of 16 per second or more. The picture traced out on the end of a cathode-ray tube consists of a tiny spot of light which traverses the screen from side to side 405 times in one-twenty-fifth of a second, which is equivalent to a speed of 7,000 miles an hour in the case of a 12in. tube and, of course, a correspondingly higher speed in the case of a 15in. tube. Thus it differs from a photograph. When a photograph is taken the camera lens is uncovered to permit the whole of the view to be impressed upon the photographic plate at one instant and the varying degrees of light and shade are recorded by the photographic emulsion. If movement is to be recorded a cinematograph camera is employed, in which this process is carried out a number of times each second, each section of the film being exposed to the view instantaneously. It is not possible to transmit television pictures by similar means. At the back of the human eye is a focusing screen known as the retina, which consists of millions of minute cells from each of which a nerve cell connects to a similar cell in the brain. These retina cells contain a purple substance and when light falls upon it a message is sent to the brain. The eye therefore sees things as millions of tiny bits which the brain sees in their correct sequence and value of light, shade and colour. In the transmitting system a somewhat similar process occurs. The scene in the studio is merely broken up into tiny pieces and translated into an electrical waveform which is radiated through the ether and reassembled in the correct order and translated back into light and shade on the television tube.

Interlacing

The television system employed by the B.B.C. transmits 25 complete pictures per second, each of 405 lines. These lines are interlaced and the frame and flicker frequency is 50 per second. The transmitter radiates signals with side-bands extending to about 3 Mc/s on either side of the carrier frequency. Thus there are 10,125 lines per second; the scanning taking place from left to right when looking at the end of the tube of the receiver. The frame frequency is 50 frames a second, scanned from top to bottom of the received picture.

Two frames, each of 202.5 lines, are interlaced to give a total of 405 lines with a complete picture speed of 25 per second. The line component and the frame component of scanning are regularly recurrent, the interlace being derived from the fractional relationship between the line and frame frequencies. The method of interlacing is shown in Fig. 3, which represents the

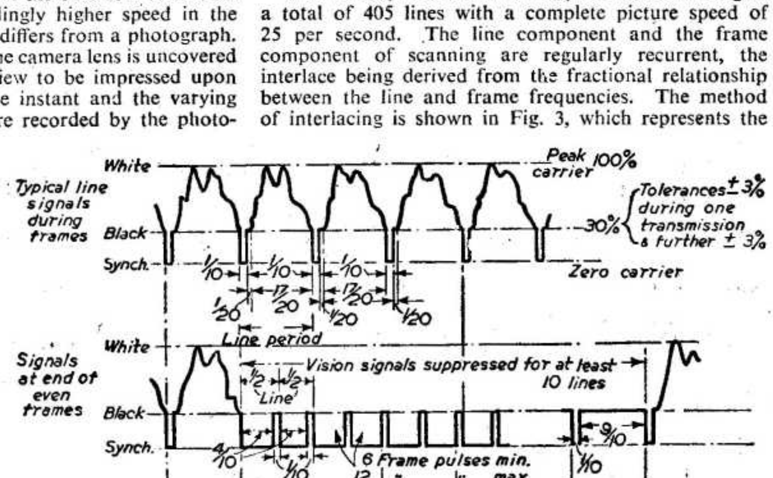


Fig. 1.—Waveform of the B.B.C. television vision signal.

top and bottom portions on the scanned area with the distance between the lines very much enlarged. The lines show the track of the scanning spot, which moves under the influence of a regular downward motion (frame scan) with quick return and a regular left to right motion (line scan) with very quick return (not shown on drawing). The combination of these motions produces the slightly sloping scanning lines. Starting at A, not necessarily at the beginning of a line, the spot couples the line AB, returns to the left and traverses the line CD, then EF, and so on down the "dotted" lines on the drawing. At the bottom of the frame the spot travels along the line GH and then starts at J and travels to K. At this point the return stroke of the frame motion begins and returns the spot to L at the top of the frame. A complete frame scan has now been made since leaving A, so that 202½ lines have been completed, and the point L is half a line away from A. The downward frame motion now starts again, causing the spot to travel along LM, completing a single line motion JKLM. The spot then returns to the left and traces out line NO, which, due to L being half a line ahead of A, will lie between lines AB and CD. Similarly the next line PQ will lie half-way between CD and EF. The spot now traces down the chain dotted lines to RS and finally traces out TU, at which latter point the frame return causes the spot to rise again to the top. When the spot reaches the top it will have completed two frames since leaving A, and, as two frames occupy the time of exactly 405 complete lines, the spot will return exactly to A, after which the cycle begins again.

From the foregoing, it will be seen that the complete picture is scanned in two frames, but as each frame contains an integer number of lines, plus a half, the two frames will interlace. The system does not require the short return times shown for the line and frame scans, nor need the lines begin in the positions shown. Provided the line and frame traversals are regularly recurrent and have the correct frequency ratio (two frames = odd number of lines), an interlaced picture will be obtained.

The result of this interlacing is to provide a picture which is crisper and which possesses much less flicker than a sequentially scanned picture of the same number of lines. Furthermore, by making use of a circuit which will more or less suppress the flyback—as described later—the double lines U-A and K-L in Fig. 3 may be to all intents and purposes obliterated, and a picture comparable with a cinema picture obtained. At the critical focal point the individual lines may be seen when the screen is viewed at close quarters, but when it is found necessary to be close to the screen the individual

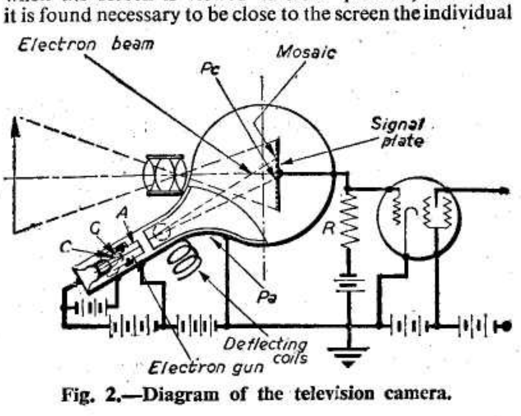


Fig. 2.—Diagram of the television camera.

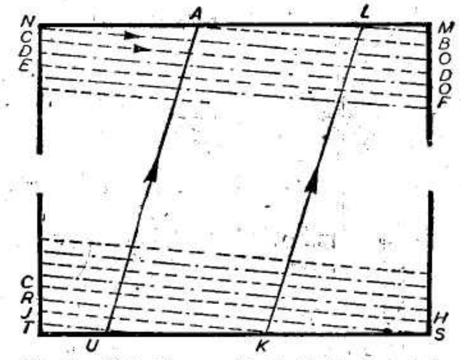


Fig. 3.—This diagram illustrates the principle of interlaced scanning.

lines may be almost eliminated by a slight out-of-focus setting without seriously impairing the sharpness of the received picture.

There are intervals between the vision signals of successive lines, which intervals provide time for the transmission of a line synchronising signal, and also provide time for the return of the cathode-ray beam to the beginning of the next line. The minimum interval between the vision signal of successive lines is 15 per cent. of the total line period (1/10, 125 sec.), the first 10 per cent. of this interval between lines being occupied by the line synchronising signal and the remaining 5 per cent. by a signal corresponding to "black" in intensity. The remaining 85 per cent. of the total line period is available for transmitting vision signals.

There are intervals between the vision signals of successive frames. The minimum interval between frames is 10 lines, leaving a maximum of 192.5 active lines per frame, or 385 active lines per complete picture.

The picture ratio is 5 : 4, that is to say, the distance scanned during the active 85 per cent. of the total line period is 5/4 times the distance scanned during the 192.5 active lines of the frame.

D.C. Component

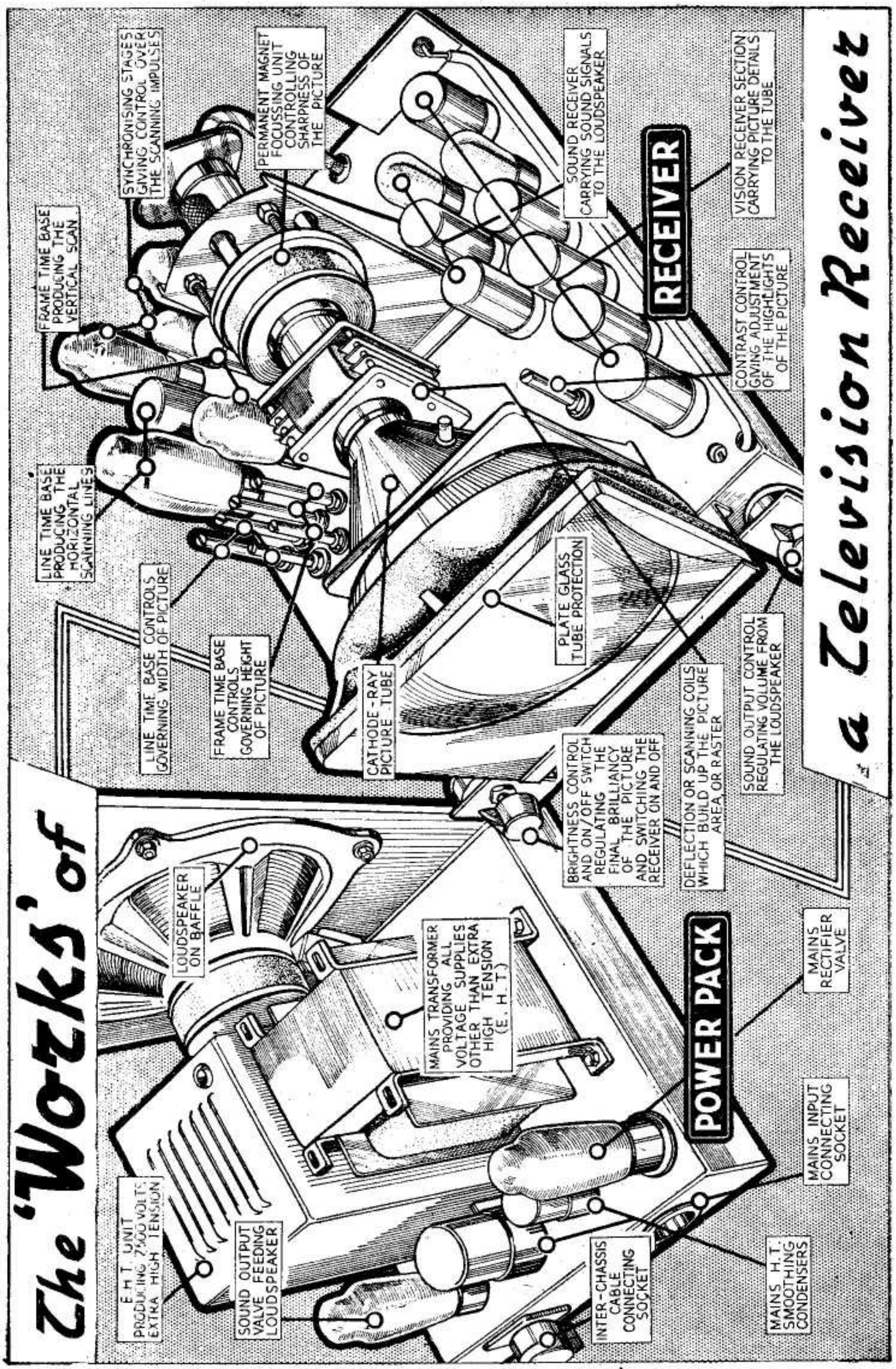
Picture brightness component (or the D.C. modulation component) is transmitted as an amplitude modulation so that a definite carrier value is associated with a definite brightness. This has been called "D.C. working," and results in there being no fixed value of average carrier, since the average carrier varies with picture brightness. The radio-frequency transmitter output is specified in what follows as a percentage of the peak output. This percentage is in terms of current (or voltage) and not in terms of power.

Vision modulation is applied in such a direction that an increase in carrier represents an increase in picture brightness. Vision signals occupy values between 30 per cent. and 100 per cent. of peak carrier. The amount by which the transmitted carrier exceeds 30 per cent. represents the brightness of the point being scanned.

Signals below 30 per cent. of peak carrier represent synchronising signals. All synchronising signals are rectangular in shape and extend downwards from 30 per cent. peak carrier to effective zero carrier.

The line synchronising signals are of one-tenth of a line duration, and are followed by a minimum of one-twentieth of a line of black (30 per cent. peak) signal.

(To be continued)

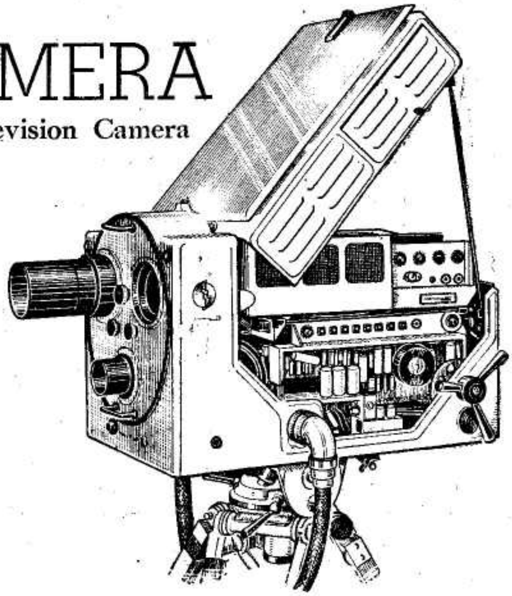

The 'Works' of a Television Receiver
E.H.T. UNIT PRODUCING 7,500 VOLTS EXTRA HIGH TENSION
SOUND OUTPUT VALVE FEEDING LOUDSPEAKER
LOUDSPEAKER ON BAFFLE
MAINS TRANSFORMER PROVIDING ALL VOLTAGE SUPPLIES OTHER THAN EXTRA HIGH TENSION (E. H. T.)
POWER PACK
INTER-CHASSIS CABLE CONNECTING SOCKET
MAINS H.T. SMOOTHING CONDENSERS
MAINS INPUT CONNECTING SOCKET
MAINS RECTIFIER VALVE
BRIGHTNESS CONTROL AND ON/OFF SWITCH REGULATING THE FINAL BRILLIANCY OF THE PICTURE AND SWITCHING THE RECEIVER ON AND OFF
DEFLECTION OR SCANNING COILS WHICH BUILD UP THE PICTURE AREA, OR RASTER
SOUND OUTPUT CONTROL REGULATING VOLUME FROM THE LOUDSPEAKER
CATHODE-RAY PICTURE TUBE
FRAME TIME BASE CONTROLS GOVERNING HEIGHT OF PICTURE
LINE TIME BASE CONTROLS GOVERNING WIDTH OF PICTURE
LINE TIME BASE PRODUCING THE HORIZONTAL SCANNING LINES
FRAME TIME BASE PRODUCING THE VERTICAL SCAN
SYNCHRONISING STAGES GIVING CONTROL OVER THE SCANNING IMPULSES
PERMANENT MAGNET FOCUSSING UNIT CONTROLLING SHARPNESS OF THE PICTURE
PLATE GLASS TUBE PROTECTION
SOUND RECEIVER CARRYING SOUND SIGNALS TO THE LOUDSPEAKER
RECEIVER
VISION RECEIVER SECTION CARRYING PICTURE DETAILS TO THE TUBE
CONTRAST CONTROL GIVING ADJUSTMENT OF THE HIGHLIGHTS OF THE PICTURE

The EMITRON CAMERA

A Description of the Present-day Television Camera

AT the present time there are in use several types of camera which differ considerably in detail but which all bear a close family resemblance to each other. This is not surprising since all of them are based upon the principles suggested by Campbell Swinton more than forty years ago in one of the most remarkably reasoned technical prophecies of all time. In England we have the Emitron and its improved descendant, the Super-Emitron; from America comes the Iconoscope, a closely similar parallel development, followed by the Orthiconoscope or Orthicon, in its turn soon to be superseded by the Image Orthicon, the type in most common use there to-day.

Before discussing the construction and characteristics of these various instruments, it is very helpful to examine the general theoretical requirements of a television system as a whole.



The camera with cover raised to give access for servicing.

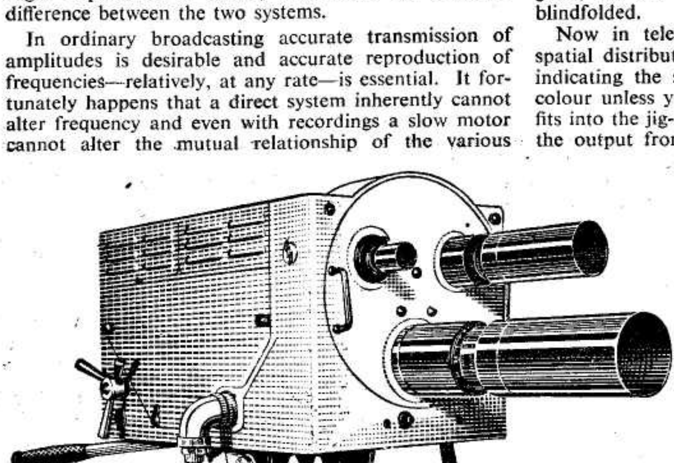
Spatial Distribution

In both sound and vision systems the received signal is made up of one or more (usually very many) periodic waveforms following a sine law; they are waves of air pressure in the case of sound, and variations of strain in what is postulated as the ether in the case of vision. In both it is necessary, for perfect reproduction, to transmit the following properties: (a) amplitude—strength or intensity; (b) frequency—pitch or colour; (c) phase—the relationship in time between one component waveform and another; and (d) spatial distribution—which signal comes from what direction. It is the vital importance of the latter in television, compared with its very slight importance in sound, that marks the principal difference between the two systems.

In ordinary broadcasting accurate transmission of amplitudes is desirable and accurate reproduction of frequencies—relatively, at any rate—is essential. It fortunately happens that a direct system inherently cannot alter frequency and even with recordings a slow motor cannot alter the mutual relationship of the various components, although their absolute values may be incorrect. Phase is quite unimportant; the ear is an analytical device which splits up the sound wave into its component frequencies and detects them independently, paying no attention to their relative phase. This is just as well because otherwise broadcasting as we know it to-day would probably be impossible. Lastly, spatial relationship is unessential though desirable; the lack of it is probably one of the two main reasons why no one could mistake the output from any loudspeaker, however good, for the real thing, even though he should be blindfolded.

Now in television reproduction it is obvious that spatial distribution is vitally important; it is no good indicating the strength of a light impulse or even its colour unless you relate it to that exact point where it fits into the jig-saw puzzle as a whole. At any one time the output from one photocell can convey one single item of information only, and it will produce exactly the same current whether it is looking at a checker-board of black and white squares or at a scene of uniform grey.

There are only two solutions to this problem: either the system may consist of a number of separate channels each confined to one small section of the picture; or, if that is impracticable because of the number—and it most certainly is impracticable—it must confine itself to one section at any one time, covering the whole scene in an orderly process called scanning, and then repeating the whole operation at a rate sufficiently fast to deceive the eye into thinking that it is viewing a continuously present picture. This is the system which is always adopted in practice.



The modern camera, known as the CPS, is a development of the Emitron camera designed over 12 years ago.

One vital point is the number of sections into which the picture must be broken up for good reproduction, or definition, as it is usually called. In the original Baird 30-line system the number was roughly 1,000 and this was at once seen to be totally inadequate. The optimum number—which in turn determines the number of lines—will perhaps be a permanent subject for difference of opinion—but as a rough guide it may be said that it clearly should not be less than 50,000 and that any increase above one million is not justified by any improvement in definition which is perceptible to a normal human eye. In the standard B.B.C. system the picture is broken up into approximately 200,000 elements.

Scanning

It is the duty of the television camera to scan the picture and at any and every instant to produce an output current which is proportional to the intensity of the light falling upon the camera at that instant.

The exact process of scanning is outside the scope of this article; no doubt all readers are familiar with it. The picture is scanned in zigzag lines from left to right; the "start" of each line is below that of its predecessor by a distance equal to twice its own thickness or depth. When $202\frac{1}{2}$ lines have been covered, the scanning spot returns to the top of the picture and scans the lines which have been missed out during the first half of the process, making 405 lines in all. The whole process is then repeated 25 times every second, which is fast enough to take full advantage of the well-known persistence of vision effect in the eye. Readers will remember that in film reproduction a similar device is used; although only 24 frames pass through the projector every second each frame is actually viewed twice, giving the same smoothness as if the frame frequency were 48. The equivalent television frequency is increased to 50 to take advantage of the controlled grid supply in this country.

With sequential scanning one difficulty which immediately arises is that of getting adequate sensitivity, bearing in mind that each individual section is only viewed for roughly one two-hundred-thousandth part of the duration of each picture, which in any case only lasts for one twenty-fifth of a second itself. Camera-minded readers will appreciate the problem of exposure times in the order of 0.0000002 second! It is this problem of combining a sensitivity high enough to overcome the inevitable background noises with the demand for a high rate of scanning, and therefore a short duration of coverage on each individual section, that has determined the characteristics of the television camera as we know it to-day.

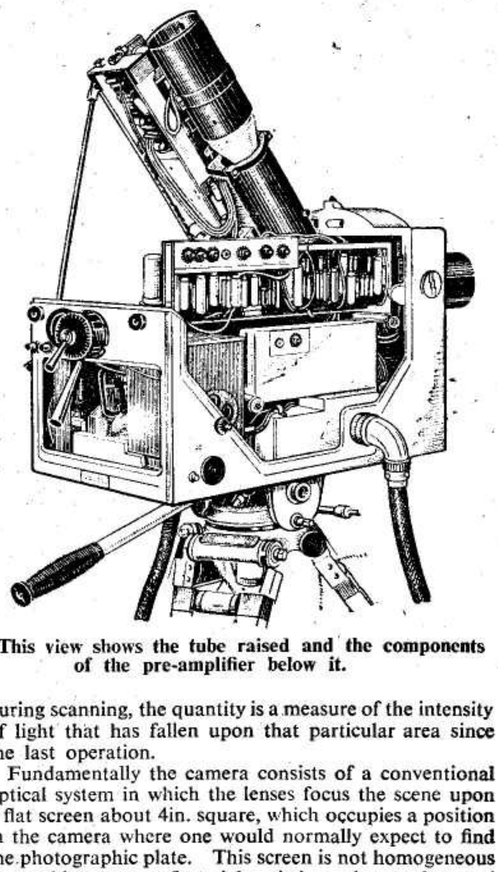
In the early days Baird produced an interesting example of what may be called solution by evasion. The scene to be televised was photographed by a fairly conventional film camera on to a continuous band of film. In a matter of seconds this continuously moving band was processed and developed, and passed through a scanning raster which directly televised it. The great practical advantage is, of course, that practically unlimited light can then be made available to illuminate it under these conditions. The film was then "washed" clean and returned via the camera head to complete a continuous moving loop; needless to say, it was necessary to delay the sound by a corresponding interval, using a magnetic tape or wire recording system also based upon a closed loop.

Ingenious as such a system was, it had many disadvantages; one outstanding one is the fact that such apparatus is too bulky and complicated to be suitable for outside broadcasts. It was also found that the loss of complete topicality, short as the actual interval was, proved an important psychological deterrent.

The first successful direct action cameras were the Emitron, produced by McGee and others for Electrical and Musical Industries, Ltd. (hence its name), and the Iconoscope, developed at about the same time by Vladimir Zworikin for RCA in America. They were not unnaturally very similar in general design, and one description will serve for both.

The Storage Principle

It has already been mentioned that one most serious problem is to get adequate sensitivity, bearing in mind that each individual section of the scene is under observation for a fraction of a microsecond. The Emitron solves it by what may be called the storage principle, in which each little section is building up a charge during the whole of the blind period between one scanning operation and the next; this charge is transferred to a small condenser and when this is suddenly discharged during scanning, the quantity is a measure of the intensity of light that has fallen upon that particular area since the last operation.



This view shows the tube raised and the components of the pre-amplifier below it.

Fundamentally the camera consists of a conventional optical system in which the lenses focus the scene upon a flat screen about 4in. square, which occupies a position in the camera where one would normally expect to find the photographic plate. This screen is not homogeneous as would appear at first sight; it is made up of several million photocells, all insulated from each other and distributed more or less uniformly over its entire surface. It will be remembered that a photocell consists essentially of some material—usually a caesium compound—which has the remarkable property of emitting negative electrons, their number increasing with the intensity of light falling upon the material. The cell is usually completed by some second electrode or anode, which collects the electrons ; they would otherwise eventually return to the emitter or cathode.

Each individual cell is connected to a small condenser ; during the whole of the blind period when other sections are being scanned in their turn, a current is flowing in, its amplitude and, therefore, that of the ultimate electrical charge that is built up, being proportional to the intensity of light falling upon that particular small emissive surface.

The construction of a system involving millions of separate photocells complete with their own load condensers, each group insulated from all the others, would appear to be extremely complicated ; in practice it is very simple. Each cell consists of a globule of pure silver coated with caesium to give it its photo-electric properties. These globules are deposited upon a mica sheet which forms the body of the screen, and on its blind side—away from that on which the scene is focused—it is backed by a supporting metal plate. Each globule is, of course, insulated from this plate by the intervening mica, and it is the self-capacitance between the two across the mica di-electric which forms the load condenser for each globule or cell.

It is interesting to note that the mosaic of globules is made by first applying a continuous film of silver ; the plate is then heated in an oven, causing the silver to break up into small separate globules because of surface tension, exactly as water collects into drops on the side of a glass. The plate is then rapidly cooled.

Electron Gun

During the scanning operation each small section is discharged in turn by an electron gun mounted in front of the photo-electric mosaic, but to one side (usually below) in order not to impede the view. This gun is very like that which forms the basis of an ordinary cathode-ray tube ; it consists of a heated cathode, a system of positive anodes and focusing electrodes which concentrate the electron emission into a beam and accelerate it to a sufficiently high velocity which ultimately carries it to the mosaic, and a deflectional system which scans the spot across and down the mosaic screen, in accordance with time-base signals generated in the control room.

When the ray plays upon any particular element, the negative electrons neutralise the positive charge which has been built up across it, or rather across its capacitance to the metal plate on the other side of the mica, and the current that flows during this brief discharging period is proportional to the intensity of light that has built up the charge during the time that has elapsed since the last scanning operation, an interval many thousands of times longer than the brief operation itself. It is this ability to store a charge which has been accumulated over a period much greater than that which is available for scanning which makes the Emitron the very remarkable instrument that it undoubtedly is ; without it and its direct successors we might not have commercial television even to-day.

Camera Details

The construction and the external appearance of the Emitron camera are clearly shown in the accompanying illustrations ; some practical details will be of interest. All power supplies together with the time-base signals which operate the scanning gun are generated in a central control room, since it is essential that all cameras should be synchronised both with each other and with the transmitted waveform. These time-base signals are saw-tooth in shape ; that which controls frame movement is at 50 cycles and the line frequency is 10,125—that is, 50 multiplied by 202½ since half the total number of lines are traversed during each frame transmission. The signal output is taken from the metal backing plate which forms one electrode common to all the individual load condensers ; it is taken direct to a cathode follower, which acts rather like a step-down transformer, but without any large reduction in voltage. The output from this is amplified several hundred times by an internal valve unit, in order to raise the signal well above any normal interference level, and then fed *via* a second cathode follower to the cable which connects the camera to the control room and ultimately to the modulation circuits of the transmitter.

All the variations to the Emitron are similar in general principle and a brief description of one will suffice. The Super-Emitron, the instrument most widely used in this country, separates the functions of photo-electric cell and storage condenser. The light is focused on to a continuous transparent sheet which emits electrons from its reverse side in proportion to the light falling upon each particular area. These electrons are drawn away in strictly parallel lines to a second sheet, which is a mosaic but without any photo-electric properties. The action of the primary electrons in striking this second screen disturb many other electrons—it is the possibility of a multiplicative effect due to secondary emission which forms the main advantage of the Super-Emitron—and each individual unit of the mosaic is sequentially scanned by a cathode-ray beam exactly as in the original instrument. The additional sensitivity which is available from this improved camera make it very suitable for use on outside broadcasts, where the intensity of illumination may well be several hundred times less than that met with in the studio.

NEWS FLASHES

Transmitter Equipment

THE B.B.C. announces that orders have been placed with Electric and Musical Industries, Ltd., for the supply of two 50-kw vision transmitters and with Standard Telephones and Cables, Ltd., for the associated two 12-kw sound transmitters for television stations to be built in Scotland and in the Bristol Channel area. It is hoped to acquire a site for the Scottish station at Kirk of Shotts, near Harthill, and almost midway between Edinburgh and Glasgow. The location of the Bristol Channel station will depend on site tests now in progress in South Wales and North Somerset.

These orders complete the transmitter equipment required for the first stage of the announced programme of television expansion, consisting of five high-power stations.

Television and the General Election

AMONGST the many Election contracts secured by E.M.I. Sales & Service, Ltd., was the installation of a 15in. tube H.M.V. television receiver in the Savoy Hotel, London, at an Election Night party.

In addition, a large-scale public address system was also installed in most of the reception rooms.

Guests, therefore, could not only hear the results as they came through, but actually see the outside broadcast television programme.

E.M.I. Sales & Service, Ltd., were also responsible for the sound-reproducing apparatus installed at Trafalgar Square for use on Election Night.

Production of Television Drama

BY S.E. REYNOLDS

Producer of "Picture Page"

Behind the Scenes in a Modern Production

IT was good news that the play, "Men of Darkness," by Armand Salacrou, was presented again on March 19th, two years after its original television production which, incidentally, was its first showing in this country. Adapted from the French by Royston Morley, it is one of the few plays to survive the Channel crossing without loss.

"Men of Darkness" is a play about the French Resistance Movement. If you are one of those persons who do not like to be reminded of the grimness of the last war, you had better avoid watching this production. It lifts the curtain on conditions we in this country were mercifully spared. We never suffered the humiliation and terror of hearing the German jackboot on the pavement outside our houses; we never experienced the disruptive effect on families and friends caused by genuine belief on the one hand that the war was irretrievably lost and, on the other, that the day of liberation would come.

These things the author, Armand Salacrou, experienced and wrote about from a full heart, taking as his examples two middle-class families in the town of Chartres in April, 1944.

This was an ambitious television production two years ago, and it is still ambitious to-day. It calls for nearly every resource of which the studios at Alexandra Palace are capable. Because of this it is proposed to trace step by step the problems and conditions encountered by the producer—Royston Morley—in staging this one and a half hours' drama.

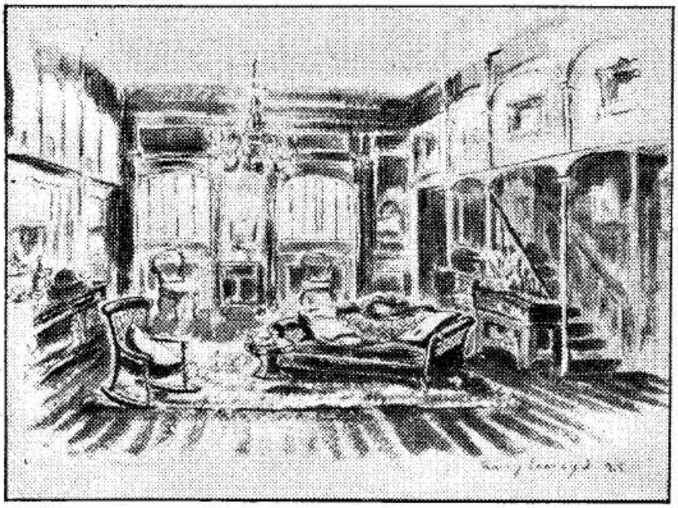
It is first necessary to examine some of the differences between play production for stage, film and television. Very few plays are being written primarily for television. The majority are written for the stage where conditions are fully understood and financial rewards greater. Although the B.B.C. occasionally televises stage plays from the theatre, these remain stage plays and are very different from plays adapted for television and produced from the studio. The theatre is like an open box in which all action must take place. Changes of scene call for intervals which may hold up the action. The stage can contain many people at one time; the television screen becomes crowded if more than a few people are shown. Television has an advantage over the stage that it can change rapidly from scene to scene and, by means of film, include shots of outdoor scenes in a smooth, flowing, logical sequence. But just as television production differs from the stage, so it is dissimilar to film production. Much of television practice has been forced on it by technical considerations. It is not practicable slavishly to copy film methods of holding any one shot for a few seconds only before changing the camera position and shooting a few more seconds of film. The television cameras have limited mobility by the expedient of pushing them around the studio, keeping them in focus all the time, and changing from camera to camera as the occasion demands. The only times which can be recalled when film and television practice were similar were in Alfred Hitchcock's production of "Rope" and the final scene in Carol Reed's "The Third Man," when the girl walked towards the camera for what seemed an interminable time.

It is not suggested that the producer of this play, or any television producer, consciously argues with himself the rival merits of stage and film methods as compared with television. He works with the knowledge of the facilities available to him and plans his production accordingly.

Responsibility

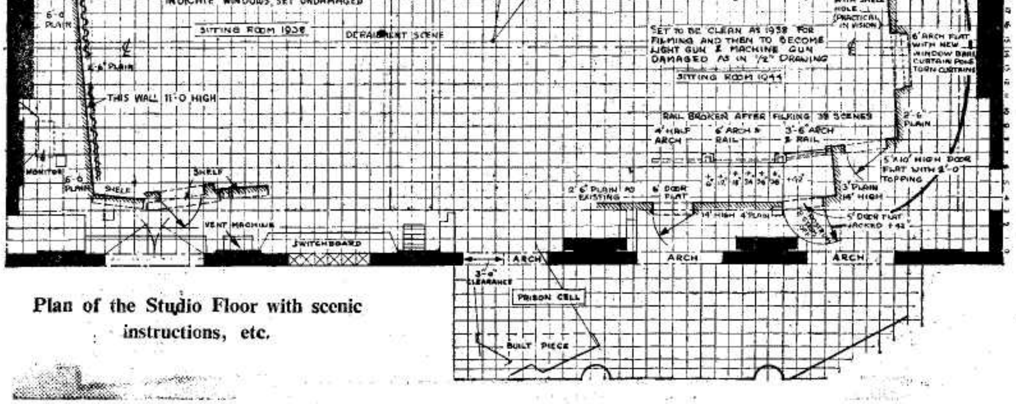
In no other known form of entertainment does so much responsibility rest on a single man as in television production. A catalogue of his responsibilities makes formidable reading. It is his initial task to adapt his material, designed for another medium, to the special requirements of television. Then to decide, with expert help from the design department, the sets and properties to clothe the action. These are set out on a ground plan (shown on p. 14) which must be vetted and passed by technical experts to ensure that the scene can be adequately lighted, that the microphones can be put in the correct positions, and that the cameras have enough room to manœuvre in. To select actors to interpret the various characters as he envisages them. To rehearse them, with all that that means in the sense of correct values for the dialogue, and actions suitable for non-existent cameras. To provide, with expert help from the wardrobe and make-up department, appropriate costumes and possibly wigs. In plays such as "Men of Darkness," a considerable amount of filming is called for; this must be done well in advance of the date of transmission so that it can be processed and edited. There are also several smaller but necessary responsibilities for captions, music and sound effects. In all he does he must keep a close watch on costs so that his budget is not exceeded.

"Men of Darkness" will be rehearsed for about three weeks, and on March 19th the cast will assemble in the studio. They will find on arrival that the set has been put into position and has been roughly lit. They will change into their costumes and begin rehearsals before the cameras for the first time. It is a perpetual miracle and tribute to a producer that actors who have practised only in a rehearsal room, with chalk marks on the floor to indicate the position of sets and with a few odd pieces of furniture, should so easily slip into their parts and face the cameras with confidence the same evening following a single hard day of rehearsal in the studio. As they rehearse throughout the day, the whole complex and efficient machinery of production gets into gear and begins to operate. The actors are watched on monitor screens by members of the wardrobe and make-up department; major adjustments such as beards are attached early in order both to make the actors familiar with them and also to enable the make-up experts to judge how best to complete the make-up. The lighting engineer watches the action and perfects the lighting, "killing" any shadows that may be thrown.



The Producer's rough illustration of a setting for use by the scenic artists.

This one day of rehearsal and transmission is the time when the work of the past few weeks is joined together in one piece for the first time. The rehearsal is for the joint benefit of the actors, the technicians and the producer. At the centre of it all is the producer. He sits in a box above the studio floor with a shooting script carefully prepared during rehearsal. Through a window at his side he can look down upon most of the studio, but in practice he seldom does so. His eyes are fixed principally upon two television screens marked respectively "Preview" and "Transmission." His secretary sits by his side. Around him are several technicians, each with an important part to play. Behind him sits the "mixer," a highly trained woman whose job it is to "mix" or "cut" from one camera to another as instructed. (A "mix" means a dissolve from one picture to another; a "cut" an immediate transfer of pictures.) In front the sound engineer sits, controlling the quality of sound from



Plan of the Studio Floor with scenic instructions, etc.

several microphones in the studio and from the gramophone records played elsewhere in the gallery by another woman operator. Also present in the flesh is a senior engineer, who is responsible for ensuring the technical excellence of the complicated equipment television requires. In another room, some distance away, an operator waits to transmit the film when instructed by the producer.

Microphone Link

The link between the producer's "box" and the studio is by microphone. Earphones are worn by the studio manager, the cameramen, boom (sound) operators and necessary studio staff. Each message from the producer is heard by them all, and, of course, he indicates the precise person for whom the instruction is primarily intended, as, for example, "Camera 2, track forward." But it is part of the complex nature of television production that frequently an instruction to one member of the team will affect other members, for example, a camera pulling back to produce what is known as a "long shot" of a scene may also show the microphone dangling over the actors' heads unless the man operating the boom, or extending arm carrying the microphone, is on his toes, and, realising the implication of the instruction, raises the microphone out of shot. Much could be written on the functions and importance of each member of the team in the producer's box and on the studio floor, but tribute must be paid to other "men of darkness," the engineers in what are known as the racks. Briefly, it is their duty to control the quality of the vision passed to the transmitter. This is a highly skilled operation because of the variable conditions constantly encountered. Cameras vary, light values change in different parts of the studio, dark, soft clothes will swallow light and rob the face of details, light clothes may "flare." All these and other difficulties have to be met and overcome within a few seconds so that the high quality of pictures transmitted can be kept constant.

The producer would be the first to acknowledge that his work, difficult though it may be, would be virtually impossible without the expert and enthusiastic co-operation always given by all members of a highly complex technical machine.

Reference has already been made to the preview and transmission screens before the producer. The purpose of these is as follows: Once the play has started, every picture, before being transmitted, is first seen on the preview screen. It may be that the picture provided by Camera 1 is being transmitted, or what is known as "on the air." The picture from Camera 2 will be required next, and so the producer calls for "Camera 2 on preview." When this appears he can talk to the cameraman if necessary and by giving him instructions ensure that he gets the precise picture he requires. At the same time the engineers in the racks are "balancing" or "shading" the picture to get the best quality from it. At the appropriate moment the producer will call "mix (or cut) to Camera 2," and the pictures shown on the preview and transmission screens will change places. Then, if required, Cameras 3 or 4 can be put on the preview screen.

Scenes from the dramatic "Men of Darkness." This production proved as exciting as a film, and the various scenes were aided by cinefilm to produce a vivid portrayal of activities by the French Underground Movement.

VISION	*SOUND*
	Fade up disc—distant small arms fire.
Cue Telecine (i.e., start film sequence, allowing 10 seconds time lag before transmitting).	(Pause)
	Fade up film sound. Burst of Sten gunfire.
CUT to Telecine (i.e., start showing picture)	Sound on film.
	Studio sound up.
Cue Studio Manager for Rivoire to move to window crouching.	
CUT to Camera 3. Long shot (i.e., whereas previous pictures have been on film, now they come from live action in studio. We now see Rivoire in position previously arranged.).	
	Fade up disc : distant small arms fire, followed by sound of seven-pounder shell exploding fairly close.
Cue Studio Manager Shower of plaster to fall, chandelier to sway a little.	
Cue Telecine (i.e., start projector).	
CUT to Telecine (i.e., start showing film picture).	

It will be appreciated that a producer has to cultivate a divided mind which enables him not only to direct the picture being transmitted, but also to prepare in advance for the scene which is to follow. This, however, is not all. He is also responsible for giving cues at the appropriate moments for film, music and sound effects. How complicated this can be can best be illustrated by the first page of the script of " Men of Darkness," following immediately upon the showing of the title of the play. Where necessary, an explanation has been added to make the meanings clearer.

So the opening action continues, with pictures alternating between those coming from film and those from live action in the studio with no discernible difference between them as they reach you, and with sound and visual effects that require precise timing to be effective.

It is right that viewers should know something of the immense effort, skill and care that goes to the making of a television play. It may at first appear absurd that so much work should result in not more than two performances. The justification is that these two performances are seen by more people than see the greatest successes in the West End theatres. It is to be hoped that televised plays from Alexandra Palace will foster the love of drama that is inherent in us all, and that as more and larger studios and better equipment become available, television producers will take full advantage of these to bring us even better plays than they have delighted us with in the past.

IMPORTANT DATES IN THE HISTORY OF TELEVISION

1884

Nipkow invented the scanning disc.

1926

January—First demonstration of real television.

December—Television in total darkness (Noctovision).

1928

February—First transatlantic television transmission.

June—First daylight television.

August—Colour and stereoscopic television.

1929

September—Inauguration of first experimental television service from B.B.C.

1931

January—First zone television demonstration.

June—Derby first televised.

1932

August—First complete B.B.C. service at low definition.

1933

September—High definition television demonstrated to the British Association.

1934

March—First public high definition television demonstration.

May—Appointment of Television Committee by the P.M.G.

1935

January—Television Committee's Report.

1936

November—Alexandra Palace opened by P.M.G.—high and low definition systems being used during alternate weeks.

1937

February—Commencement of the present high definition from A.P.

1939

September—B.B.C. closed down for the war.

1946

June—B.B.C. reopened.

1949

December—Sutton Coldfield opened.

1950

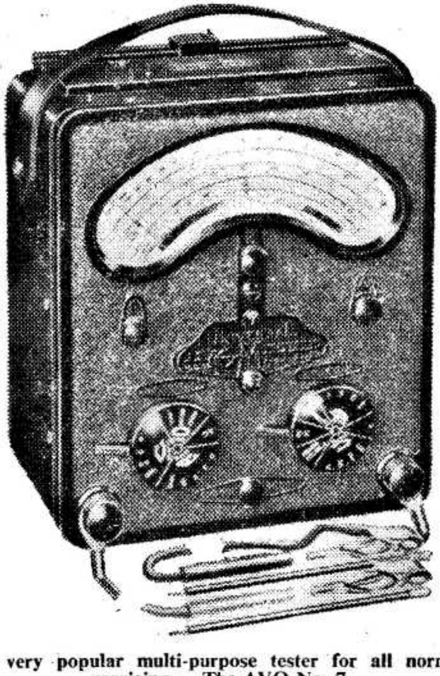
Construction commenced on further station at Holme Moss, Huddersfield—to be completed in 1951.

Servicing Television Receivers

How to Locate Faults and Cure them in Commercial and Home-made Equipment

By W. J. DELANEY (G2FMY)

BEFORE setting out to describe the methods of fault location and cure it is necessary to point out that with every type of television receiver there are troubles which are inherent in the equipment until certain adjustments have been carried out. In commercial receivers these adjustments are made by the manufacturer before leaving the works, and readjustments are made as required by the dealer who sells the receiver. Thus, when installed in the home, all that should be necessary



A very popular multi-purpose tester for all normal servicing. The AVO No. 7

is to turn up the picture just as one turns up the sound volume on a normal broadcast receiver. But valve deterioration or perhaps component value variations may take place during the useful life of the receiver, and will call for additional adjustments. These have been provided for in practically every receiver on sale to-day, in the form of pre-set controls situated at the rear of the receiver or in some other position.

The builder of a home-made receiver has, therefore, not only to provide for similar adjustments to be made but must also be in a position to make those preliminary adjustments which the commercial manufacturer carries out in the factory. But he has the added difficulty that one or more of his components may be faulty (unless he adopts the manufacturers practice of testing all parts before inclusion in the receiver), and thus he starts off with a fault which will have to be located just as if a working receiver had developed trouble.

Instruments Required

Contrary to the belief of many amateurs all television servicing can be done with one single instrument (which will be described later), but for regular servicing a fairly exhaustive range of instruments must be on hand. Apart from a multi-purpose test meter suitable for measuring all the A.C. and D.C. voltages in the receiver, a special meter capable of measuring the E.H.T. is required, and this should be capable of reading up to 25 kV—which is the voltage used in a modern projection television receiver. Further, a valve tester and resistance and capacity bridge will be needed, but it is possible to carry out reliable work with only one meter such as the Avo No. 7 illustrated on this page. Any similar instrument can be used, of course, provided that it covers D.C. voltages up to 500, A.C. voltages up to normal mains range (250 v.), and also has a low-reading scale to cover normal heater circuits. E.H.T. voltages may be calculated without measuring: faulty components may be located in many cases by valve performance, and, although it will not be possible to measure their actual value, they can be proved faulty and replaced. A modern electronic meter, however, will enable E.H.T. to be measured and will carry out practically all of the required measurements for regular work. One other instrument will be found valuable to those who are able to use it quickly and understand its indications. This is the oscilloscope. It will indicate the output of the time base valves and assist in locating some of the odd faults which turn up from time to time, but it is not essential except for those building experimental time base circuits.

Sectional Units

As the majority of readers probably know, the modern television receiver can be divided into units or sections. There is a power supply comparable with that used in standard broadcast equipment, delivering H.T. up to perhaps 450 volts, and supplying all of the valves in the receiver. There is a vision receiver, a sound receiver and the time bases, and an E.H.T. supply which may be a separate unit, or be part of the time base circuits. In many receivers these units are all on separate chassis which are bolted together, or connected together with multiple cables and plugs. The power unit is sometimes separate, and the tube unit also sometimes has its own individual chassis. In spite of this apparent complication it is quite a simple matter to locate the *source* of a fault, and the fact that a television receiver may employ 20 to 30 valves is no indication that the tracing of a fault is a difficult matter.

Finding the Source

The cathode-ray tube is fed from the time bases in such a manner that, even without a signal, a rectangular picture area (the raster), is built up on the end of the tube. This area of light is modulated by the output from the vision receiver to produce a picture, and the loudspeaker is fed with impulses from the sound receiver to give us the speech or music. Consequently, therefore, if there is a raster and a signal is obtainable from the loudspeaker, then the chances are that the fault is in the vision receiver. Alternatively, a good picture and no sound will indicate that the sound receiver is faulty, whilst no picture or raster and a sound signal will point to the tube or time bases. As, however, the horizontal and vertical time bases are independent it is unlikely that both would fail together, and thus no raster would indicate a fault in the tube, or in the power supply to both time bases (if it had a supply separate from that of the receivers). A horizontal line only on the tube would indicate failure of the frame time base, and a vertical line would indicate failure of the line time base, and so on. It will thus be seen that once the functioning of the receiver is understood, no matter of what make or design, a little reasoning will quickly point to the part of the circuit in which to look for a fault, and then the cure should not be difficult. It should be assumed that all commercial receivers which have worked satisfactorily and then developed a fault will only need a replacement, but a home-built receiver may have trouble from incorrect design or values, and it is here that the most difficult servicing work arises. Unfortunately it would not be possible to deal with every possible fault which can arise as there are so many different ways of arriving at a desired object, but in the notes which will follow, some attempt will be made to indicate the lines of attack in curing troubles, taking as a basis experimental apparatus which may be assumed to contain all the possible faults which would be met with in any type of receiver.

Power Supply

To enable fault finding to be covered efficiently it is necessary to start from the input or mains side. If the receiver is switched on, and after the customary warming-up period has elapsed no illumination appears on the screen, and no sound of any kind can be heard from the speaker with the volume control at maximum, then the inference is that the power supply has failed, but not necessarily due to a defect. Many service engineers will confirm that they have often been called out to service a television receiver showing the symptoms mentioned, only to find that either the mains plug has not been inserted in the mains socket, or that the mains switch has not been switched on. This may sound ridiculous, but it is a point which is easily overlooked, so that the first thing is to check that this is in order. It should be assumed that the mains socket has been tested, either by checking that other apparatus or lights fed from the same source are working, or by plugging in an electric fire, standard-lamp, etc., in the socket. The house fuse feeding that particular circuit may, of course, have blown. The absence of power can generally be ascertained by looking at the valves in the set. The mains rectifier can be seen glowing in practically every type of receiver, whilst in most, at least one of the valves will be of a type where the upper part of the heater may be seen glowing when the valve is working. Therefore, if none of the valves may be seen alight it will indicate that the mains transformer is not being fed or has broken down. A faulty heater winding is unlikely, as the heater windings are of heavy wire and to have broken down there would have been prior warning in the form of crackling accompanied by flashes on the picture. It should be obvious that failure of the H.T. winding alone on the transformer would still leave the heaters glowing, and furthermore the rectifier would be seen alight. We therefore arrive at the point where we can safely diagnose the fault as failure of any power to reach the receiver and this must be due to a faulty lead from mains plug to receiver, or a blown fuse where such is fitted.

Power Pack Faults

If the receiver fuse has blown this may be due to an overload due to a surge which can arise on switching off (but seldom on switching on), or to a breakdown of some part of the power pack. As fuses are comparatively cheap it is worth while replacing the fuse and switching on again. If it blows, then steps can be taken to look further, but the receiver might then function satisfactorily. As the blowing of the fuse *may* be due to a fault in the power pack no attempt should be made to use a substitute piece of wire, etc., for the fuse proper.

A modern tester for electronic equipment. It can be used for practically every purpose and takes negligible current.

Electrolytics

This may lead to considerable damage and expensive replacements. The commonest cause of a breakdown in the power pack is a failure of the electrolytic condenser—usually the reservoir component. Care should be taken in choosing this component to allow for sufficient tolerance of the working voltage. The manufactured receiver will, of course, have components which have been suitably chosen, but after some period of use they may break down. Usually this form of breakdown is in the nature of a short circuit, the inner part being punctured by the overload, and the resultant short circuit overloads the rectifying valve. Warning of this is usually given (if the power pack can be seen when the receiver is working) by a blue glow in the rectifier bulb. If a resistance meter is available, or any simple test-meter which will indicate a short-circuit, then it is worth while checking the electrolytics before replacing a blown fuse. Where test meters are available, the obvious point at which to check is at the terminals or tags on the mains transformer, and the tester should be set to a 250 or 500 volt A.C. range and the voltage read at the various points on the transformer, starting with the mains input points. If there is the correct A.C. voltage across the input lugs but no voltage at any of the output lugs, then obviously the primary of the transformer has broken down and is open-circuited. If the mains voltage reads very low on the transformer primary, the indication is either shorted turns due to burnt-off insulation on the primary, or perhaps a faulty soldered connection between the input mains socket on the receiver, or somewhere in the link from the socket to the transformer, and this obviously includes the on/off switch. It may also be caused by a ruptured flex lead in that chain, where perhaps only one or two strands of wire are left intact. *(To be continued.)*

Building the "Viewmaster"

An Amateur Describes his Experiences in Building this Popular Home-constructor Set

By ALAN CHISHOLM

TO give a twist to an old saying, we are a nation of handymen. How else can one explain the popularity of the small-tool and electrical fittings counters of the "sixpenny" stores; the numbers of semi-technical and practical publications published for the amateur, and the various examples of individual craftsmanship to be seen in the average home.

In most of us is the desire to create, to see something grow under our hands, and to be able to say, possibly with ill-concealed yet justifiable pride, "I built it."

There are many outlets for the inexhaustible energy of the handyman, each demanding various degrees of manual skill and "know how," but it is no exaggeration to say that no hobby offered so much reward and enjoyment to the individual and his family, in return for ordinary proficiency with the contents of the household tool box, as did radio.

Those of us who grew up with the century were fortunate in being in on the "ground floor." It was radio in easy stages. We quickly mastered the simple principles and construction of the crystal set, and quite naturally graduated to the one, two and multi-valve straight sets. But as radio became more of an exact science, and the building of successful receivers required technical ability and expensive calibrating instruments, many erstwhile enthusiasts found the going too difficult and reluctantly downed tools.

I was one of them.

As a spectator I watched the march of the industry, growing more than ever conscious of my limitations with the advent of television.

The old enthusiasm gripped me. I couldn't afford a television receiver; could I build one? One glance at a chassis almost frightened me and quickly dispelled the forlorn hope I entertained of becoming an early "viewer."

A number of books appeared on television-receiver construction, but all demanded rather more skill and knowledge than I, and many more like me, possessed.

And so to Radiolympia 1949.

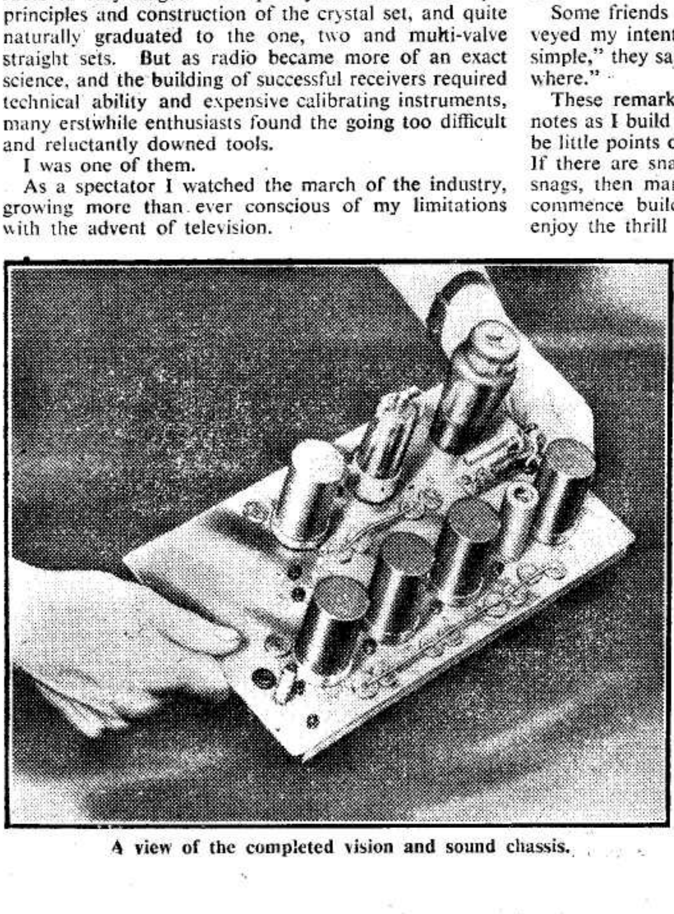
I must confess that when I saw the "Viewmaster" Envelope on the T.C.C. Stand I imagined it to be directed to the more advanced amateur. Only by chance did I catch a glimpse of the full-sized stage-by-stage wiring diagrams. Here was something I did understand. Moreover, the sound and vision reproduction on the demonstration receiver was undoubtedly of a very high standard.

A close and more leisurely examination later of the contents of the envelope so impressed me with the extreme simplicity of construction that I decided to build the "Viewmaster."

Some friends to whom I showed the charts and conveyed my intentions were sceptical. "It all looks too simple," they said. "There must be some snags somewhere."

These remarks gave me an idea. "Why not make notes as I build the receiver?" I thought. "There may be little points on which my experience will help others. If there are snags, I shall find them. If there are no snags, then many hesitant ones will be encouraged to commence building the 'Viewmaster' and ultimately enjoy the thrill of proudly saying, 'Yes, I built it.'"

Hence this series of articles. A running commentary, so to speak, on "A Handyman's Adventure into Television."



A view of the completed vision and sound chassis.

The "Viewmaster" Envelope contains seven full-size stage-by-stage, easily understood wiring diagrams and a full-size and dimensioned paper template for those who wish to make their own chassis. Unless one has the facilities for accurately cutting the numerous holes and, incidentally, the time to spare, I strongly advise intending builders to obtain the precision pressings offered by Whiteley Electrical Radio Co. In addition to the foregoing, there is a 32-page book which in itself I consider to be worth the 5s. charged, for it gives a simple explanation of how television works, a fully detailed semi-technical description of the sound, vision and power sections, complete instructions for aligning the finished receiver and an article on television aerials and their correct choice to meet different conditions.

Two envelopes are available; A for the Alexandra Palace transmission and B for the Sutton Coldfield station. Living on the north-western outskirts of London, I am, of course, building the A receiver, but the differences are minor ones only and do not affect these general instructions which I hope will assist other builders in both areas. I shall refer later to certain differences, as I have been able to obtain a B envelope.

If I enumerate the simple tools required to construct the "Viewmaster" it is solely to emphasise the fact that no expensive items or instruments are required for aligning the receiver. A small screwdriver, a pair of small-nosed pliers, wire cutters and an electric soldering iron comprise the lot. If you haven't an electric iron you will be well advised to invest in one, as an ordinary one easily burns and requires frequent re-tinning. The Solon iron with pencil bit, at 21s., is an excellent tool, with a reversible bit giving a cone or chisel point. The latter I found most suitable for the job.

On each chart for each stage of construction is a detailed list of the parts required for that stage. They are all standard parts obtainable at any radio and television dealer who sells components. The values of all Morganite carbon resistors are given and also the capacity and type of all condensers.

It may be that amongst the spares that one accumulates over a period there may be items that are suitable for use. Unless, however, you possess the instruments for checking with absolute certainty that any component on hand is 100 per cent. perfect, you will be well advised to buy all new standard parts. In any case the low cost of such items as resistors and condensers, for instance, seems to me to be no justification for "spoiling the ship, etc." These are the very components which are extremely difficult for the amateur to check and which can give the sort of trouble on which one may waste hours of time. The low cost of Government surplus components may likewise be very tempting, but remember that such parts carry no guarantee.

For my part, I set myself rigidly against the use of second-hand parts, for in my opinion it is foolish to put such a low value on one's work as to be prepared to endanger the successful completion of the receiver for the sake of saving what may only amount to a few shillings.

A half-hour can be spent profitably in sorting out the condensers and resistors in order of capacity and type and in value respectively. They can then be placed in small envelopes which should be marked with the circuit reference number, i.e., C_1, C_2, C_3, R_1, R_2, R_3, etc. Where more than one identical condenser or resistor is called for at any one stage the envelope would carry each reference number.

It is a simple matter, then, to withdraw the part from the appropriate envelope as required without any further reference to the colour code or external markings.

In all references to the work of wiring up I shall, of course, assume that the chassis is lying in a position corresponding to that shown on the chart.

The Whiteley sound/vision chassis is complete with eight valveholders and rubber grommets and the only additions for Stage 1 before wiring are two 3-way and one 7-way Bulgin terminal strips, and 16 Micadiscs.

If you wish to make up a console model i.e., as a double-decker with the power pack and time-base chassis above the sound/vision chassis, two further holes should be drilled in the latter and fitted with grommets; the first, ¼in. in diameter, to the lower left of V4, and the second, ⅜in. in diameter, to the upper right of V5. The slight alterations in the wiring I will cover later.

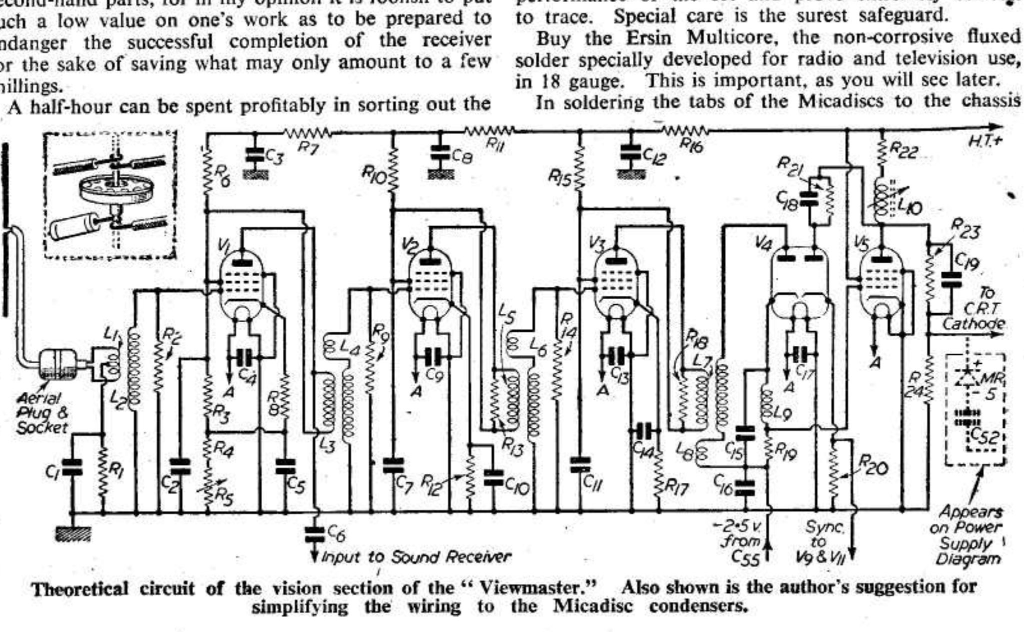
Make certain that the correct terminal strips are fitted. You will notice that the 3-way strip at the top left and that at the bottom middle right are different. One strip has terminals bent up at right angles and on the other they are flat, ignoring, of course, the earthing terminals by which the strips are mounted.

On the Micadiscs, the centre terminal is bent round to form a tube, the edges, however, do not quite meet and leave a gap or slot. When inserting the condensers from the top of the chassis, position these slots all facing either to the right or to the left. The reason will be obvious later. The three tabs of each Micadisc must be firmly pressed back over the chassis and then soldered securely into position.

At this point I must emphasise that a badly soldered or "dry" joint can completely ruin the subsequent performance of the set and prove extremely difficult to trace. Special care is the surest safeguard.

Buy the Ersin Multicore, the non-corrosive fluxed solder specially developed for radio and television use, in 18 gauge. This is important, as you will see later.

In soldering the tabs of the Micadiscs to the chassis



Theoretical circuit of the vision section of the "Viewmaster." Also shown is the author's suggestion for simplifying the wiring to the Micadisc condensers.

it is difficult to draw the solder over them. The best way is to place the chisel bit of the iron on the chassis and touching one side of a tab and to hold the Multicore against the other side. On reaching the correct heat the solder will be induced to run under and round the tab, making a clean and perfect joint. When all Micadiscs have been secured, wiring can be commenced.

It will be obvious that the risk of a bad or dry joint is perhaps greatest at the tubular centre terminals of the Micadiscs; moreover, in some instances, there are two and sometimes three connections to be made at that point. The method I adopted has three advantages. It ensures a perfect joint. It makes multi-connections simple. It facilitates the replacement of resistors should it ever become necessary. For the latter reason I do not wrap a resistor lead round a terminal tag when soldering, but merely make a sound soldered joint.

To commence operations on the Micadiscs, screw a block of wood on the left-hand edge of the chassis (the right-hand edge if the slots in the centre terminals of the condensers face left) so that it will stand firmly upright on the end.

It will be seen that condensers C_4, C_9, C_{13}, C_{17}, C_{23} and C_{28} also have connections on the top of the chassis. Cut off 16 1½in. lengths of tinned copper connecting wire and 16 pieces of 18-gauge "Multicore" solder ¼in. long. Insert a piece of solder in the terminal tube of each condenser. (It will just fit snugly—hence the stipulation of 18 gauge.) Hold a piece of wire ready in the pliers and place the soldering iron under the centre terminal. Immediately the solder melts, push the wire down the tube, remembering that for those condensers with top connections the wire must protrude about ⅜in. above the top of the chassis.

Make small loops at the end of any resistor leads or wires to be connected and slip them over the condenser centre wires (see Page 22). When all connections have been made, solder the whole joint in the usual way and snip off any excess wire. The loops can be formed by bending the wire round a panel pin of suitable size driven into a block of wood, the head of the pin having, of course, been removed.

Proceed systematically with all the wiring for Stage 1, ticking off each connection on the chart in coloured pencil as made. On completion, re-check and cross-tick to be absolutely sure that no errors or omissions have been made.

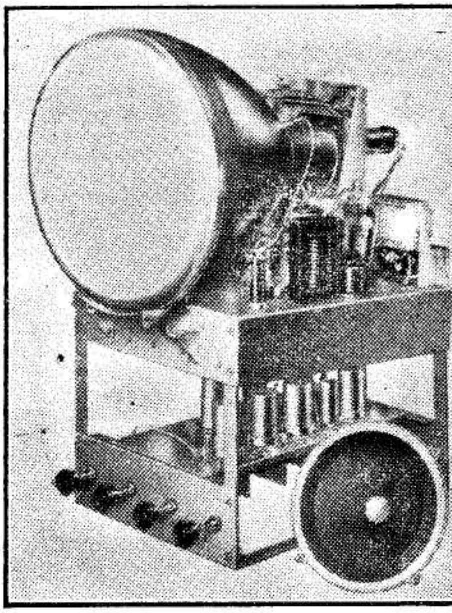
Standard components manufactured or marketed by the undernoted concerns have been tested and examined and found to be suitable for use in the "Viewmaster."

Belling & Lee, Ltd.
A. F. Bulgin & Co., Ltd.
Colvern, Ltd.
Edison Swan Electric Co., Ltd.
Telegraph Condenser Co., Ltd.
Westinghouse Brake & Signal Co., Ltd.
Whiteley Electrical Radio Co., Ltd.
Wright & Weaire, Ltd.

It will be noticed that the leads from terminals 1, 2 and 9 of V_5 are left free, and their length will depend on whether you are building a table or console model. Allow, say, 6in. or 14in. respectively. Use different coloured systoflex for each lead to facilitate identification later.

The leads through the rubber grommet at the bottom right-hand corner are later connected to the loudspeaker transformer, and should be left long enough to allow for positioning as desired.

Stage 2 consists in mounting and connecting the Wearite iron-cored coils, the Plessey boost choke, and various condensers and resistors. Twenty-two 8BA screws and nuts will be required for mounting. The charts for both A and B models are perfectly straightforward, but a word on connecting the various coils will assist generally. Gently straighten each lead by pulling it out between thumb and finger, taking care to hold the wire where it leaves the former to avoid tearing it from the anchoring point. Connections should be made without slack.



The double decker chassis with a 12in. tube which fits the special "knock-down" cabinet.

The actual wiring of the coils, is quite clear from the chart, but in both the A and B models mount them so that the point where a lead leaves a coil is positioned near the tag to which it is to be connected. In this way the leads fall almost naturally into position without change of direction.

Measure off the approximate position of a connection and remove the insulation from that point for about ¾in. towards the end of the wire. Thread the wire through the hole in the terminal tag, lightly pull to take up all slack, and wrap one or two turns round the terminal. Solder the joint and then cut off the excess wire. With the paired coils, however, make the bottom connection of the primary coils only. Then wind the coupling turns from the secondary coils round the paper covering of the primary coils and secure as directed. Finish by connecting the top leads of the primary coils to the appropriate terminal tags.

The next stage covers the fitting of further resistors and condensers, which present no difficulty, and the fixing of the four small screens. Each of these carries a Micadisc condenser, which is more easily fitted before the screens are soldered into position. The wiring of the Micadiscs is carried out as previously described. The screens are rigidly mounted by soldering to the earthing tags, the centre tag and pins 5 and 8 of the valveholders.

(To be continued)

PROJECTION

Details of the Latest Large

THE Mullard projection television system was shown at the Radio Component Manufacturers' Federation exhibition and at the Physical and Optical Society's exhibition last April, and was demonstrated in a range of prototype receivers at Radiolympia.

The principle employed is to produce a miniature picture of very great intrinsic brightness on the screen of a 2½in. diameter picture tube operated at an anode voltage of 25 kV., and to project an enlarged image of this picture by means of a system of mirrors and lenses on to a flat screen.

The essential equipment for the system, which Mullard

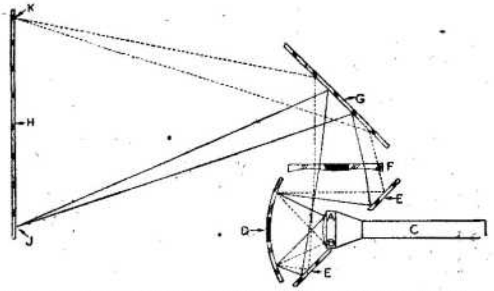


Fig. 1.—The optical principle of the Mullard projection television system.

Electronic Products, Ltd., are now making available to television manufacturers, comprises three units: the 2½in. screen cathode ray tube itself (Mullard Type MW6-2); an optical unit incorporating also the tube mounting, and focus and deflecting coils; and a compact E.H.T. supply unit. This apparatus relieves the set designer of all the special problems associated with projection television as such, leaving him only those more familiar problems connected with circuit design.

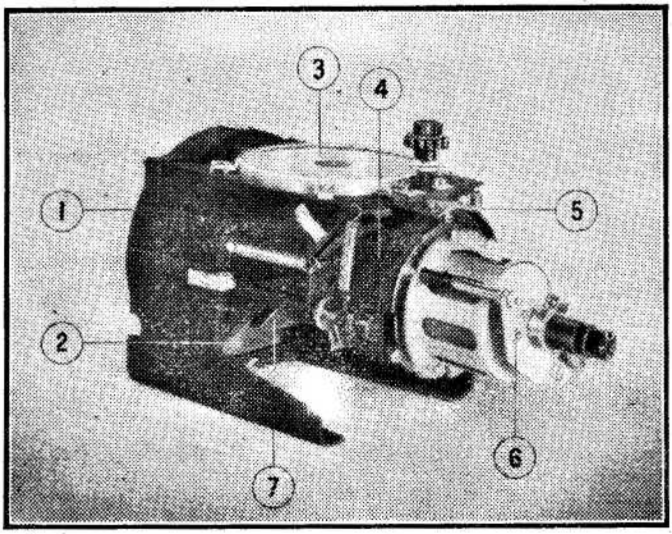


Fig. 2.—Optical unit of the system illustrated in Fig. 1. 1. Spherical Mirror; 2. Plane Mirror; 3. Corrector Lens; 4. Yoke carrying the Tube mounting, focus and deflection coils; 5. Yoke Locking Plate; 6. Focus coil locking screw; 7. Dust-proof grommet.

Optical System

Fig. 1 is a simplified diagram of the optical system, which is a "folded" version of the mirror-lens system devised for use in astronomical telescopes. Its operation can best be understood by considering a single picture element A situated at the top of the raster in the picture tube C.

Light radiated forward from picture element A is collected by spherical mirror D and reflected as a convergent beam on to plane mirror E mounted at an angle of 45 deg. to the axis of the tube. It will be observed that there is a central aperture in mirror E, through which the end of the cathode ray tube protrudes slightly.

The light reflected from spherical mirror D on to plane mirror E is again reflected, still as a convergent beam,

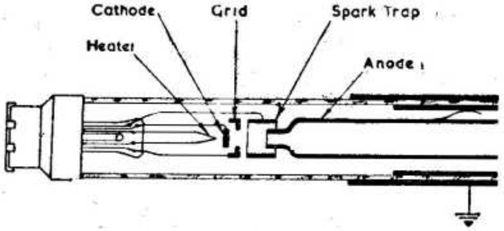


Fig. 4.—A sectional drawing of the MW6-2 tube.

vertically upward through corrector plate F, on to a second plane mirror G, arranged at right angles to E; and from mirror G the light is re-directed to screen H, which is located at such a distance that the magnified spot is accurately focused at J.

Similarly, light from a picture element B at the bottom of the raster is brought to a focus at point K on the viewing screen.

Corrector Plate

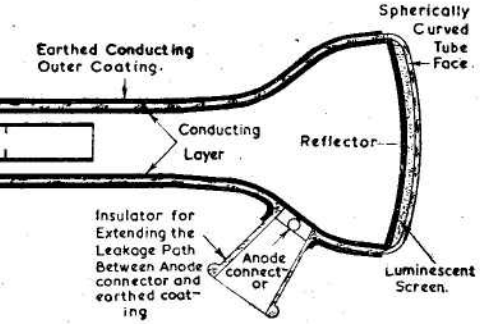
The corrector plate F is a lens of special contour which compensates for spherical aberration, i.e., the property of a spherical mirror whereby the reflected light does not all come to focus at the same point. By introducing the corrector plate accurate focus at the screen surface is assured. The production of this component presented a major technical and economic problem. If the lens had been made in glass by the normal grinding technique, or even if a plastic lens were used, the cost would have been prohibitive. The solution was found in moulding the lens in gelatine on to a glass plate.

TELEVISION

screen Domestic Equipment

Fig. 2 is a photograph of the complete optical unit with the picture tube in position. The optical components are factory-adjusted and need no further attention. Simple mechanical adjustments are, however, provided for centering the picture and for final focus.

The MW6-2 picture tube is illustrated in Fig. 3. It is a 2⅜in. screen triode tube designed for operation at an anode voltage of 25 kV. The heater is rated at 6.3 v., 0.3 A. The luminescent screen is backed by a very thin layer of aluminium which, by reflecting outward much of the light which would otherwise be directed to the rear of the tube, increases the output of forward-going light by some 75 to 80 per cent. It also eliminates internal reflections and thus improves picture



contrast. Furthermore, the metallising also serves as an effective ion trap.

Safety Devices

Special features of the tube include a spark trap—a ring-shaped electrode located between anode and grid, and connected to earth through one of the base contacts. It thus safeguards the cathode in the event of a discharge due, for example, to the release of a small amount of gas as the result of unintentional overload.

Another feature is a glass shield surrounding the anode terminal to eliminate risk of flash-over or leakage from the E.H.T. connection.

The external surface of the neck and cone is coated with a graphite preparation. This coating forms, with the glass envelope and the internal metallisation of the tube, a capacitor of about 450 $\mu\mu$F which, with a 1 megohm resistor in the 25 kV. lead, serves as the final smoothing of the E.H.T. supply.

Because it would be neither economic nor safe to produce the 25 kV. E.H.T. supply from the 50 cycle mains in the conventional manner, an E.H.T. unit operating on the "ringing choke" principle has been adopted. A blocking oscillator (the triode section of an EBC33 double diode triode) generates a voltage of approximately saw-tooth form. This voltage is applied to the control grid of an EL38 pentode which is biased well below cut-off so that anode current flows during only part of the saw-tooth cycle. Each time anode current ceases, the energy stored in the inductive component of the anode circuit is released as a damped train of high-frequency oscillations. The peaks of these

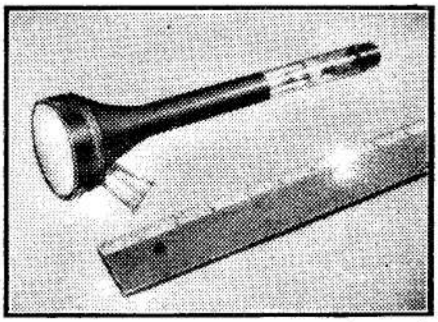


Fig. 3.—The MW6-2 Cathode ray tube with a standard rule to give some idea of its size.

oscillations are rectified and smoothed to produce the E.H.T. supply.

These peaks are of approximately 8 to 9 kV., and a voltage tripler rectifying circuit, employing three EY51 rectifiers, is used to produce a rectified output at 25 kV. Good regulation of the E.H.T. voltage is ensured by using the diode sections of the EBC33 to produce an automatic variation of the grid bias on the EL38 driver valve. As will be seen from Fig. 5, the E.H.T. unit is very compact, and all parts carrying E.H.T. potentials are oil-immersed in a sealed can.

It has only been possible in this article briefly to outline the principles of the optical projection system, but in later issues articles will explain in greater detail this important development in television reception.

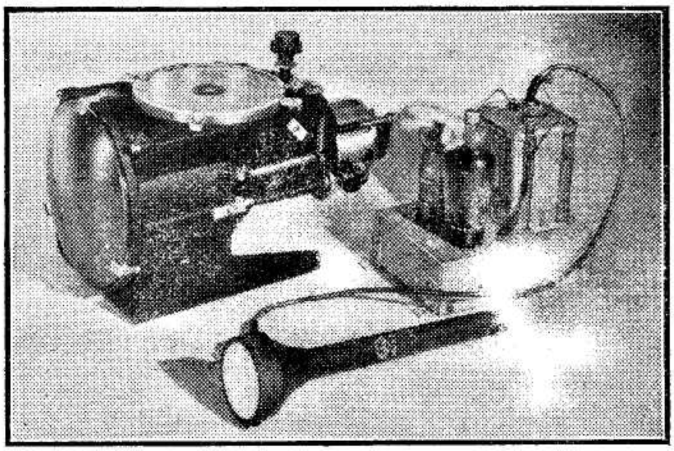


Fig. 5.—The components of the complete projection system.

Television Personalities

(Left) CECIL McGIVERN, Director of Programmes

(Right) S. J. de LOTBINIERE, Head of Outside Broadcasts

(Left) NORMAN COLLINS, Controller of Television

(Right) MRS. MARY ADAMS, Head of Television Talks

(Left) VAL GIELGUD, B.B.C. Head of Drama

(Right) PAT HILLYARD, Head of Television Light Entertainment

Television Aerials

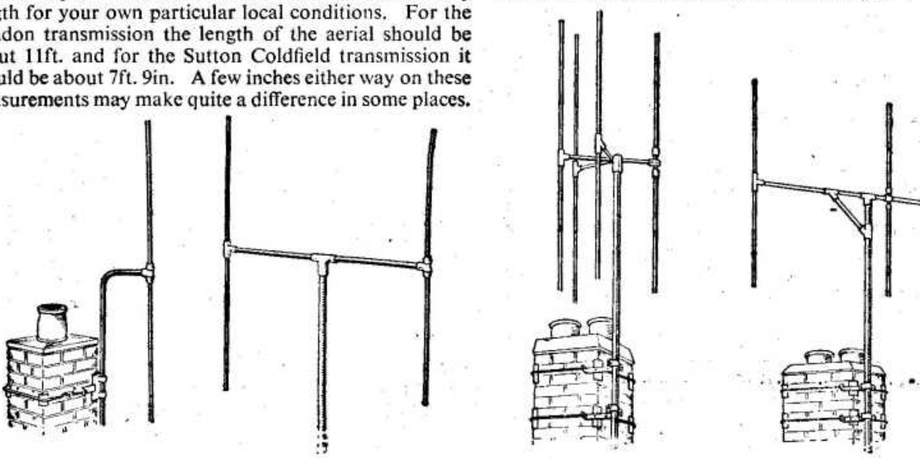
How to Choose the Correct Type of Aerial for any Locality

THE idea that the aerial in the form of a letter "H" is the correct type for television reception is not now so common as it was in the early days of television. Many viewers have had this type of aerial fitted and are not getting the best from their receiver, whilst others have found that after fitting such an aerial they have had to pay to have a special fitment included between the aerial and their receiver. To-day many viewers are using indoor aerials and various unusual shapes are making their appearance on the rooftops.

Dipoles

Basically, any television aerial consists of a rod cut to one-half the wavelength of the television transmitter, with a connection taken from the centre. As, however, the sound and vision are transmitted on different wavelengths, or frequencies, the aerial is cut to a point mid-way between the two in most cases, although some aerial manufacturers cut for vision, as this is the most critical part of the received signal. If you make your own aerial you can experiment and find which is the most satisfactory length for your own particular local conditions. For the London transmission the length of the aerial should be about 11ft. and for the Sutton Coldfield transmission it should be about 7ft. 9in. A few inches either way on these measurements may make quite a difference in some places.

will be found in such cases that a ghost image will be received with the picture. The actual space separating the proper picture from the fainter ghost will vary according to the distance away of the reflecting surface. A gasometer, a large sports grandstand and similar structures are the most common cause of reflections. These may be avoided by placing a similar but smaller reflector near the aerial but spaced from it at a certain distance which will ensure that the reflection is in phase, or step, with the required picture, and then no ghost image will be seen. For this reason such a device is known as a reflector, and it consists of a rod exactly similar to the aerial rod but a few inches longer, and it is usually placed half, quarter or one-eighth of a wavelength behind the aerial—behind, that is, in relation to the direction of the transmitter. A further advantage of this arrangement is that it prevents the aerial picking up energy from the rear, and the reflected signal being added to that on the aerial proper results in this type of aerial, which, it will be seen, is the familiar "H," giving a much stronger signal at the receiver end.



A typical range of modern television aerials. On the left the simple dipole for short-range reception and on the right two long-range types of aerial, or models for use in areas where interference is bad.

Reflectors

The type of aerial just mentioned is not directional—that is to say, it picks up energy from all directions round it. If, therefore, this type is erected on a house which has a main road on the side of the house opposite to that in which the transmitter is situated it will pick up interference radiated by traffic on that road as well as the required signal. As most commercial television receivers are provided with interference suppressors that may not matter much, but there is another fault which can be experienced with this type of aerial and which cannot be cured in the receiver. The television signal can be reflected or re-radiated if it strikes a large metallic surface (or even a small one such as a domestic stack-pipe at short distance from the transmitter), and it

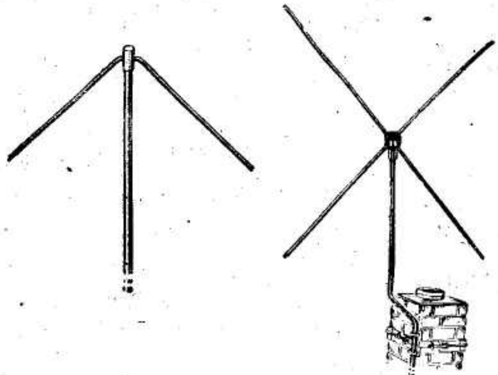
From what has just been said it will be obvious that this type of aerial is only needed where serious interference *from the rear* is experienced or in locations where the signal is very weak and requires boosting. If a serious reflection or interference is experienced and you are situated within, say, five miles of either transmitter and have to fit the "H" type of aerial to remove the trouble, then it will almost certainly be found that the signal is so strong that the controls on the receiver will not permit it to be reduced sufficiently to provide a satisfactory picture.

Overloading

The contrast control is generally supplemented in commercial receivers by a further gain control of a pre-set type, and if this is set to a position giving minimum gain, and when the contrast control is at minimum the picture is lacking in dark tones and badly defocused, it will be necessary to fit what is known as an attenuator. This is a small resistance-network connected between the aerial lead and the receiver and reduces the signal strength to a desired value depending upon the values of the resistances employed.

Directors

At greater distances it may be found that the "H" type of aerial still gives insufficient signal strength to provide a satisfactory picture, and the system may be



On the left a loft or attic aerial, and on the right the latest "X"-type aerial described below.

improved by adding two further reflectors spaced at critical distances in the form of an arc behind the aerial. A still further arrangement consists of placing another rod *in front* of the aerial, and this acts as a director. Thus, at long distances from a transmitter, and where interference from the rear is serious, an aerial may consist of no less than five elements,—a director, aerial proper, and three reflectors, but such a system may obviously be very cumbersome and heavy, and certain manufacturers are now producing this type of aerial made into compact form by the simple expedient of folding the aerial into two or three, and this enables the other elements to be shortened and still maintain high efficiency.

"X" Aerial

A new type of aerial has recently made its appearance, but full details of its working are not yet properly understood, although it functions very well. It is in the outward form of a letter X, and consists of two "Vs," one functioning as the aerial and the other as a reflector, although its working appears to be such that it cannot strictly be divided up into separate elements. When the shorter pair of rods, i.e., the director element, are pointed towards the transmitter, maximum pick-up is obtained and pick-up from the rear is even less than with the "H" type. This aerial thus gives a very much better directional effect and, consequently, signal-to-noise ratio than other aerials, but the makers (Antiference Ltd.) state that this explanation is only an approximate one and further investigation, both practical and mathematical, is required to explain completely its properties.

Indoor Aerials

At short distances it may be found that satisfactory pictures may be obtained without having to place the aerial outside, and there are now several types of indoor aerial available. The most elaborate consists of a "V" dipole which may be fitted in the apex of the roof, or, where space permits, a standard dipole may be placed in the loft or attic. Short dipoles on floor-stands, dipoles with one flexible arm and similar devices may be used in the same room as the receiver, but care must be taken with all forms of indoor aerial to see that they are placed in such a position that they are not subjected to changing capacity effects. That is to say, if an aerial is fitted to a wall, that wall should not be a party wall between houses, where people may be moving about on the other side of the wall. If that is the case, it will be found that the picture strength will vary as people approach and recede from the aerial. Similarly, an aerial placed on a wall behind which is a large water cistern will give varying effects as the water level rises and falls, and therefore some care is necessary in siting the indoor type of television aerial.

TV in Western Union

WITHIN the framework of the Brussels Treaty Organisation, television and cultural experts of Belgium, France, the Netherlands, Luxembourg and the United Kingdom met in London recently to discuss the difficult problems which have arisen in regard to the unification of the television systems already existing in France and the United Kingdom with those the other Continental powers are contemplating starting.

The present situation is as follows. Great Britain, for reasons of continuity, has maintained the use of a 405-line system. France carried out studies during the war and decided to establish a television service of 819 lines, while continuing the 450-line broadcasts already in use before 1940. The Netherlands has rejected both the 450-line system as being of an inadequate quality, and the 819-line system, which would not allow the setting-up of a sufficient number of stations to cover the whole country.

At the Zurich Conference, France agreed to transform her 450-line broadcasts to 405 lines in order to enable direct exchanges to be made with the United Kingdom. She confirmed her decision to maintain her old system for at least 10 years so that the present 20,000 viewers should not be forced to discard their present sets. Further, she confirmed her decision to establish without delay a final network on the 819-line system.

Great Britain confirmed her intention to continue her 405-line broadcasts for several years. She stated, however, that if she were asked to make an independent choice she would prefer a system of 800 lines at the lowest.

The Netherlands, together with the great majority of other countries including the United States, was in favour of a 625-line system for Europe, on the grounds that the quality of this system would be sufficient and would allow a greater number of broadcasting stations to operate.

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From SOUND to VISION

Announcer MARY MALCOLM Describes her Transfer from Ordinary Radio to the Television Service

A recent portrait of Lady Bartlett, known to viewers as Mary Malcolm.

"IT'S a piece of cake," said the gentleman as he opened the door of the Make-up Department at Alexandra Palace. "Just talk to the camera as you've been talking to me and you'll be O.K."

The make-up artist was very charming. She studied my face in the brightly lit mirror and discussed its possibilities and its limitations. "Just lean back and relax," she said. I leant back and began to wonder what on earth I was doing up in this B.B.C. Television wonderland. I suppose it is "a piece of cake" for me, I thought; I've had five years of radio experience beginning as one of the first women Home Service announcers, transferring from there to the Overseas Division where I became what the papers described as a "Forces Sweetheart," and now—Television. Like quite a few other people I had become fascinated with this new medium, and like quite a few other people I had applied for the job of announcer. This was my audition.

"Will you do your own lips?" I looked in the mirror and saw that I had become pleasantly tanned, with blue-shaded eyes and most elegant eyebrows. My lips completed, I stepped out into the studio corridor in search of somewhere quiet in which to learn the announcement I had been given. Somewhere quiet! The corridor was bedlam. The afternoon transmission was over and while one half of the studio staff were trying to get downstairs for tea the other half were busily engaged in removing, or "striking," the scenery. Muttering to myself, I picked my way along, saying my announcement over and over again. It was full of tongue-twisters and unnatural phrases (written, as I afterwards discovered, to test one's ability to say with conviction things which are not part of normal conversation).

"We're ready for you now, Miss Malcolm," said a voice, and I was ushered into Studio B. Through the maze of cameras, arc lights and microphones I saw a pleasant set with an open french window, a garden backcloth and, in the foreground, an armchair. There were dozens of men standing around, mostly with headphones on and the whole studio was bathed in blinding light.

"Just stand on this mark, please, and look into the camera while we light you." Not *more* light, surely? The camera was wound slowly up and down like a dentist's chair while some invisible person in a gallery above the studio decided how much of me they wished to see on the screen and while I decided that the whole idea had been a big mistake and that I should be much better off in my cosy little studio.

"Would you sit down, please?" They indicated the armchair. I sank gratefully into it and immediately someone said in polite but unmistakably horrified tones, "Is that how you'll sit on transmission?" I straightened up at once and tried to look as though I had spent all my life being inspected by total strangers at a distance of two feet. After twenty minutes of this agony, during which I stared glassily at the camera lens and forgot my words, the audition began. I walked slowly through the french windows, down stage to the mark on the floor and said my piece. I said it again sitting in the chair so that they could see me in close-up, I had a pleasant conversation with a young man they called the Studio Manager and then just as I was beginning to get used to the lights he said "Thank you, that's all." It had been half an hour's rather hair-raising fun, and at least I could go back to my colleagues in the Overseas Service and boast that I had been inside a Television Studio. I took a breath to thank the gentleman when he said, "What did I tell you—a piece of cake." I was in.

Experientia Docet!

It sounds simple enough. People said, "Of course it will be easy for you with your experience of broadcasting." I thought so, too, but after two years I know better. There were so many things to learn and so many other things to unlearn. For years I had been preoccupied with time, saying so many words in so many seconds. In Television I discovered that nobody minded in the slightest how long it took me to say something, all they asked me was that I should say it naturally and look happy about it (little did they know what they were asking . . .). I had always had a microphone to talk to, now it was suspended above my head and the cold camera lens had replaced it. I found it hard to look into that small round of glass and imagine on the other side of it the people to whom I was talking.

Perhaps the worst horror of all was the lighting sessions. Imagine yourself sitting in a chair looking steadily into the camera with what you hope is a natural expression on your face while half a dozen people mill around you shifting lights, peering at you and muttering to each other, "... must avoid her left eye ... spot it up well on her chin, Charlie ... suppose we'd better highlight the hair—it'll take away from that nose." After three of these sessions I had decided that my face was a failure and that my morale was sagging, so I suggested that I might resign. "Nonsense," they said, "you wait." Worse was to come.

After ten days of wandering round tripping over camera cables, getting in the way of lights and exasperating everyone with my questions, I made my first appearance on the screen (only they call it a "tube" just to confuse you). My knees trembled violently, butterflies fluttered around in my stomach and I blinked wildly in the lights. My announcement was soon over, but it had seemed like an age to me. An age during which I heard a hundred voices saying to one another, "... so that's the new announcer ... well, I'm sure our Elsie would look better than she does." "... Bit stuck-up, isn't she? She looks scared to me. ..." Scared? I should think so. "Just be natural," they said. It is difficult to be natural when you mustn't move your head more than a few inches in any direction because of the lighting, when you have a chalk mark to stand on or else you are out of focus; an unaccustomed hair-do to give your face extra length on the slightly convex tube, a blinding light just above your left eye and a firm conviction that your nose is shining. The first time that I was really natural was when I said—in a crowded studio—"That's the end of Television for to-day, in a few moments you'll hear the nine service home o'clock news. ..." I paused aghast and then, overcome by laughter, I said, "Oh *dear*!" and tried again. I had visions of the sack, but all they said was "How nice to see you smile, dear."

That incident was for me "the end of the beginning." I began to gain confidence and to lose my terror and glassy smile.

In the past two years I have had some awkward moments and difficult assignments, but once one has evolved one's own technique for this new medium, and viewers write to say that we have become part of the family and that they always reply to our "good evening," I think each of us feels that this job, exacting and exhausting as it often is, is one of the best.

Standard Frequency Transmissions

IN September, 1948, the Department of Scientific and Industrial Research announced that arrangements were being considered for an experimental service of standard frequency transmissions from the United Kingdom. A committee, under the chairmanship of Dr. R. L. Smith-Rose, established the need for such a service and at the request of the department the General Post Office has assumed technical responsibility for the transmissions, which will take place from the Rugby radio station. The service began on 1st February, 1950. The frequencies used are 60 kc/s., 5 Mc/s. and 10 Mc/s. The transmissions on 60 kc/s. should be received throughout the United Kingdom and Western Europe and enable local standards to be calibrated with high precision. The transmissions on 5 and 10 Mc/s. form part of an international programme designed to give reliable world coverage on one or other of the frequencies 2.5, 5, 10, 15, 20, 25 Mc/s. which have been allocated to standard frequency services. The transmissions on these frequencies from the U.S.A. National Bureau of Standards station WWV are not always satisfactorily received in the United Kingdom and farther east. It is hoped to learn from the experimental service now being initiated to what extent reception in the European area is improved by transmissions from the United Kingdom and also to what extent the usefulness of both the U.S.A. and U.K. transmissions may be impaired by mutual interference.

Monitored at Teddington

The frequencies, which are to be maintained within two parts in one hundred million of the nominal values, will be monitored at the National Physical Laboratory, and all enquiries or comments concerning the transmissions should be addressed to the Director, National Physical Laboratory, Teddington, Middlesex, England. Information about reception conditions and interference with the U.S.A. transmissions will be particularly useful.

Details of the daily experimental service are given below. It is regretted that at present it is not possible to transmit on 5 and 10 Mc/s. at times more convenient to users in the United Kingdom.

Experimental Service of Standard Frequency Transmissions

G.M.T.	*Carrier Frequency*	*Power*
05.44-06.15	5 Mc/s.	10 kW.
06.29-07.00	10 Mc/s.	10 kW.
10.29-10.45	60 kc/s.	10 kW.

Each transmission will be modulated in accordance with the following 15-minute cycle where applicable.

Minutes past the hour	
59—00, 14—15, 29—30, 44—45	Slow morse call sign MSF followed by a speech announcement.
00—05, 15—20, 30—35, 45—50	Carrier modulated with 1,000 c/s. tone.
05—14, 20—29, 35—44, 50—59	Carrier unmodulated.

It is proposed to add in due course 1 c/s. pulses during the first five minutes of each period at present unmodulated.

Television M.P.

TELEVISION will have a highly qualified representative in the new Parliament in the person of Ian Orr Ewing, who captured the North Hendon seat for the Conservative Party.

Mr. Orr Ewing was associated with the Television Outside Broadcasts Department from its early days up to the outbreak of war, during which he served in the R.A.F. on radar. He rejoined the B.B.C. after the war, but left subsequently to join Messrs. Cossors.

Experiments with the MILLER TIME-BASE

How this Popular Integrator Functions, and Some Modifications

By D. CAVE

THE usual circuit of the Miller Integrator is as shown in Fig. 1 and operates roughly as follows:

A negative-going sync pulse is usually applied to the suppressor grid and the leading edge of the pulse drives the suppressor below zero potential, thereby cutting off sharply the current to the anode. In consequence, the anode voltage rises steeply to H.T.+ since there is now no loss of volts in R_L+R_S. All the valve current

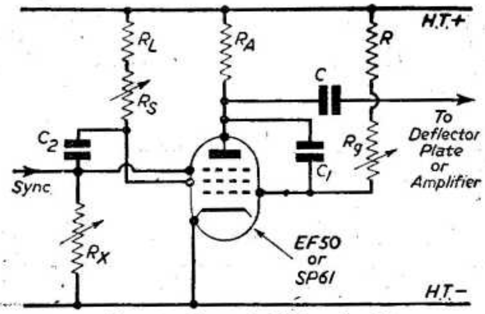


Fig. 1.—Normal Miller circuit.

diverts to the screen grid and the screen potential falls sharply owing to the voltage drop in R_S. This sharp fall of potential, coinciding with the sync pulse, is transmitted to the suppressor grid via C_2 and drives it more negative.

Due to the positive potential on the control grid of the valve via R_g grid current flows and C_1 charges. The charging circuit being cathode—grid—C_1—R_a and H.T. The time taken for the condenser to charge occupies the flyback time, represented by the duration of the sync pulse.

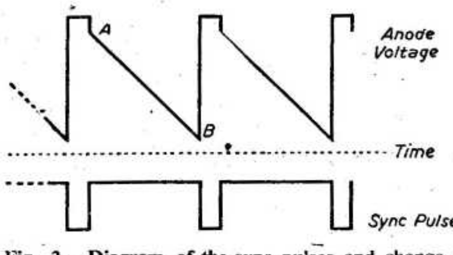


Fig. 2.—Diagram of the sync pulses and change of anode voltage.

The rear edge of the sync pulse now drives the suppressor grid towards zero potential, releasing the lock on the anode current. A large anode current flows suddenly and there is a sharp fall in voltage at the anode, transmitted to the grid via C_1, causing the grid to go negative, thereby arresting the large anode current and also the flow of grid current into C_1. The grid condenser thus ceases to charge and slowly discharges via R_g, R and R_A.

When the large anode current commenced the screen voltage rose sharply, due to loss of current to the screen. This sharp rise was transmitted to the suppressor grid via C_2, thus assisting the effect of the rear edge of the sync pulse on the suppressor grid rise of potential.

As the grid condenser C_1 discharges the anode voltage falls, giving the scan stroke; the change in potential of the anode plate of the condenser being much greater than the change in potential of the grid plate of the condenser due to the high magnification of the valve.

Mathematically the change of voltage at the anode (A to B, Fig. 2) is the integral of the change of voltage at the grid (hence the name Miller Integrator). For AB to be linear the voltage at the grid would have to be constant, but then the time-base would not function. Fortunately the change of grid potential is small and the line AB is nearly linear.

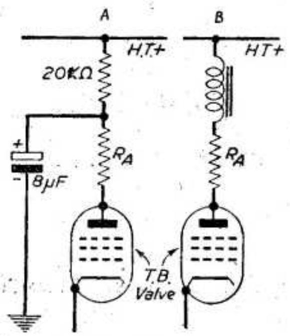
When the grid condenser C_1 has discharged the anode potential has fallen very low and the valve current is diverted to the screen grid, which is still at a high potential. This results in a fall of screen voltage due to the presence of R_S and R_L, transmitted to the suppressor grid and coinciding with the leading edge of the next sync pulse.

Safeguards

It is thus important to see that the condensers and resistances associated with the valve and the potentials on the electrodes are correctly proportioned to ensure that the valve operation coincides with the time duration of the sync pulse and scan period.

To ensure this it is wise when setting up the circuit to make R_S and R_X variable. When the time-base is working satisfactorily their values may be measured and fixed resistances substituted.

R_S should be about 50,000 ohms wire wound, and R_L should be set to such a value that adjustment of R_S covers the range required. To commence with R_L may be 100,000 ohms, its purpose is to prevent the full H.T. being applied to the screen.



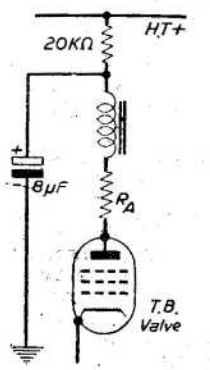


Fig. 3 (left).—Two different types of anode circuit for the time-base valve. Fig. 4 (right).—The two circuits of Fig. 3 may be combined as shown here to effect an improvement.

R_X may be 500,000 ohms and can be increased with a series resistance if needed.

At line frequency C_2 can be 100 pF-500 pF. R_A about 20,000 ohms (2 watts). C_1 may be 50 pF-100 pF. R_g 2 megohms, and the limiter resistance R about 1 megohm or more.

At frame frequency R_A can be increased to 250,000 ohms ; C_2 about .02 μF ; C_1 500 pF to 1,000 pF, whilst the limiter resistance R may be increased to 8 megohms.

Faults

Generally speaking the troubles experienced with this circuit are :

(1) Poor line synchronism.

(2) Too slow a flyback resulting in fold over of the picture.

(3) Non-linearity, most noticeable in the frame at the top.

The first two are often the result of a weak sync pulse and every effort should be made to get a well-shaped pulse of adequate voltage. To this end the frequency response of the receiver should be good and should be preserved right up to the time-base, and the gain of the receiver should be ample.

Too slow a flyback is revealed as an amount of fold over so that one of the castellated edges of the test card appears folded back over the picture.

The flyback time is governed to a large extent by the speed with which the suppressor circuit recovers to zero potential, and to that end the time constant C_2 R_X should be kept small. This is best achieved by reducing C_2 in value and R_X by adjustment.

In like manner C_1 R_A controls the charge time of C_1 and hence affects the flyback period ; and these should be reduced. Reduction in R_A, however, may ruin the valve if the time-base stops working and the H.T. supply is high. Furthermore, reduction in R_A reduces the output voltage. If the time-base is followed by an amplifier, so that ample scan is available, it may be possible to reduce R_A and insert a decoupling circuit to keep the anode voltage down as in Fig. 3A.

If it is found that the required improvement is obtained when R_A is reduced in this manner, but that the loss

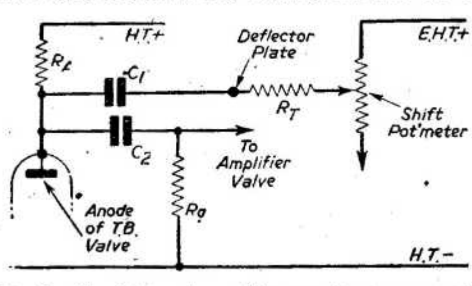


Fig. 5.—The tube and amplifier couplings are actually part of the time anode circuit as may be seen here.

of scan is severe, then, if an amplifier is not already in use, the extent of scan may easily be increased by the use of a see-saw amplifier (described later).

In attempting to improve synchronism it may be worth while experimenting with application of the sync pulse to the control grid instead of the suppressor grid, since a smaller amplitude of sync pulse is needed at the control grid. Connection should be made through a 500 pF. condenser to the control grid to avoid grounding the grid by a resistor in the sync separator circuit.

Non-linearity is usually most evident in the frame time-base at the top of the picture where the raster lines appear wider apart than at the bottom. It will be recalled that perfect linearity requires that the control grid voltage should remain constant, consequently, the

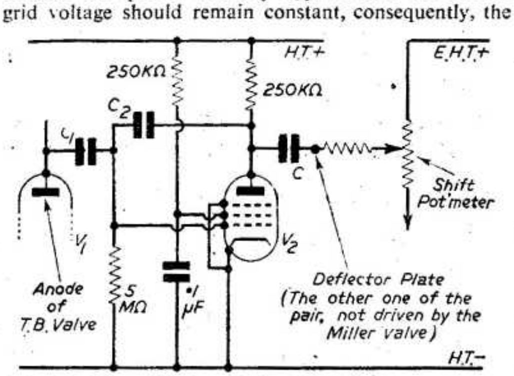


Fig. 6.—The addition of the valve V_2 to the circuit of Fig. 1 as recommended by the author.

sum of R_g and R (Fig. 1) should be made as high as possible, which may require reduction of C_1. R should be connected to the highest available H.T.

In the case of the line time-base much improvement may often be affected by using a series anode choke of 10 H. or more as shown in Fig. 3B. Since a choke opposes a changing current, any variations in the anode current will tend to be smoothed out. The use of the choke will be accompanied in most cases by a large increase in the output. Owing to the increased scan obtained, it may be possible to sacrifice some of it and reduce R_A to shorten the flyback time by combining Figs. 3A and 3B as in Fig. 4. This may not overcome the difficulty however, due to the back E.M.F. of the choke, so various values should be tried, from 1 H. upwards.

The use of a choke in the frame time-base circuit will usually improve the linearity a little, but not to any marked extent.

An important point which is often forgotten is the effect of the coupling circuit to the deflector plate and amplifier (if one is used) as illustrated in Fig. 5.

These coupling circuits are C_1 R_T, to the C.R. Tube circuit and C_2 R_g to the amplifier valve. In both cases these couplings are in parallel with the anode load of the time-base valve, and should be of such high impedance as to have negligible effect on the output of the valve. In particular the coupling resistances R_g and R_T should be 5 megohms or more, and the effect of increasing their sizes should be noted. This adjustment may have more result at frame frequency since the anode load R_A used there may be as high as 250,000 ohms.

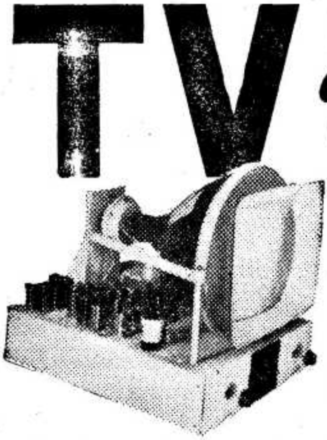
At frame frequency also, the effect of increasing the capacitances of C_1 and C_2 should be tried, since they should have low reactances to the lowest frequencies (of which the saw-toothed waveform is composed) if the saw-tooth shape is to be kept.

See-saw Amplifier

If the scan output is insufficient when using the one valve Miller time-base, it may easily be doubled by using an additional valve in the " see-saw " circuit.

The Miller Integrator circuit which we have discussed is not altered in any way other than by the addition of the circuit shown in Fig. 6.

(*To be continued.*)



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Details of Design, Screen Size, etc., and Technical Data of Some of the Principal Commercial Models

By "THERMION"

TELEVISION receivers are available on the market in various styles, sizes of tube, and in consoles and table models. Some receive only the television programmes, whilst the more expensive receivers are all-wave radio receivers, television receivers and radiograms combined. They are supplied in cabinet designs and woods to fit in with most furnishing schemes.

The screens also vary in colour; some are bluish, others cream and some sepia. Each of these has its adherents.

Before making a final decision it is wise to witness demonstrations of several makes. In many districts dealers have demonstration vans which, upon request, they will bring to your door so that you can witness the quality of reception more or less under the conditions which will apply in your own home. Dealers who have not this facility would willingly demonstrate in your own home the receivers they handle. As picture brightness is of importance make sure that the receiver does not need the brilliancy turned up to its fullest extent all the time, as this may materially shorten the life of the tube. Tubes are expensive to replace, costing approximately £1 per inch of screen size. The average life of a tube, presuming that the receiver is used regularly every day, is about 1,200 hours, or, roughly, two years. They are guaranteed for six months from the date of installation. Remember that a screen *appears* to be bigger when a picture is received on it, and, therefore, do not judge the size of the tube except when it is in operation.

The price you are prepared to spend will naturally decide the tube size. The cheaper receivers either in console or table model have 9in., 10in. or 12in. tubes. The more expensive receivers have 15in. tubes. It must not be assumed that the larger the tube the better the picture. A larger tube would not necessarily portray the scene with more detail. Indeed, a large tube in a small room can be a disadvantage. A larger tube does, of course, allow more people to look-in in comfort, and that perhaps is its main advantage. Moreover, it can be viewed from a greater distance; indeed, must be viewed from a greater distance. Thus, a large tube is of little, if any, advantage in a small room. Our television transmitting system makes use of a 405-line scan, and these lines can be seen on the screen as a series of equi-spaced horizontal lines. The correct viewing distance is such that these lines just merge and become practically invisible. If you can see them plainly you are sitting too close to the screen. Of course, the viewing distance will vary according to one's eyesight, and therefore it is not possible to lay down hard and fast rules for viewing distances for particular sizes of tube. So the viewing distance for a 10in. tube, that is to say, the distance when the lines just merge, will be less than for a 12in. tube.

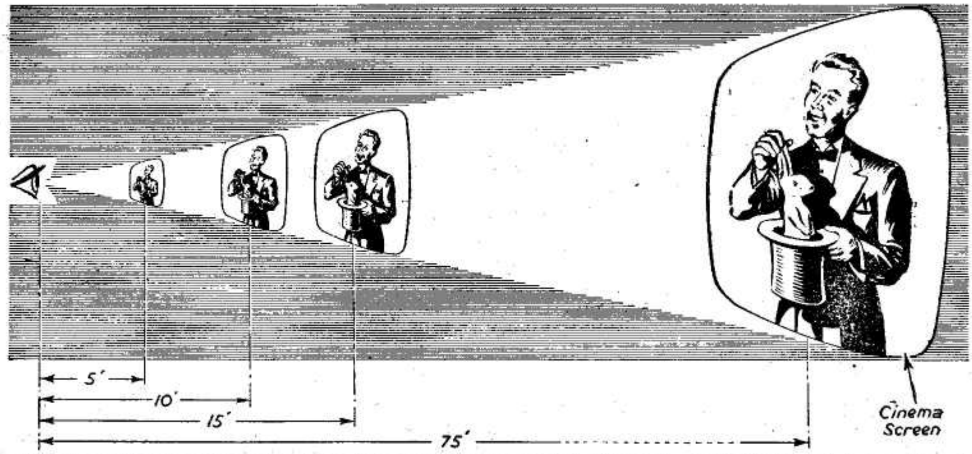
Lens attachments are available for some of the smaller tubes to give a big screen effect. These lens attachments are available as separate fitments, and readers with small screens are well advised to investigate the possibilities. Dealers will demonstrate them.

Whether television should be viewed in a completely darkened or a semi-darkened room is debatable. To obtain the best effects of contrast one should simulate as near as possible the conditions of a cinema, but at the same time the social atmosphere of a home demands subdued lighting, and it is best, therefore, to examine the receiver under subdued lighting conditions before making a purchase.

Those who object to outside television aerials should remember that there is an excellent portable television receiver on the market which makes use of a mains aerial. Thus, the receiver may be used in any room in the house.

Aerials

The installation of the aerial is a matter of importance, and the dealer from whom you purchase the receiver will complete the installation for you. There is, however,



This diagram shows the relative sizes of screens and optimum viewing distances. It should be noted that the relative size to the eye is constant.

an extra charge for this, varying from about 30s. to several pounds. This is an item to consider in purchasing a receiver. A shorter aerial is required for the Sutton Coldfield area than for the Alexandra Palace area because Sutton Coldfield transmits on a shorter wavelength. There are various types of television aerial, the "H" being the most popular. Good results, however, have been obtained by a single rod of the correct length divided into two at the centre and known as a dipole. In this type the lead into the set is connected to the two centre ends of the two halves, and it may, of course, be fitted either indoors or out of doors—a decided convenience for flat dwellers. In certain instances landlords and councils are banning the use of outside aerials and this point should therefore be investigated before the aerial is erected. An indoor aerial is best erected in the loft.

The best reception areas are from five to 10 miles from the transmitter. If the location is reasonably interference-free, indoor aerials are quite satisfactory. A much stronger signal is obtained, of course, from an outdoor aerial. The "H" type of aerial is less responsive to interference than other types, because its second link, so to speak, is a reflector, which makes it more efficient in one direction than another. This means that whilst interference can come from all directions the television signals come from only one direction. The subject of aerials is fully dealt with in another article in this issue.

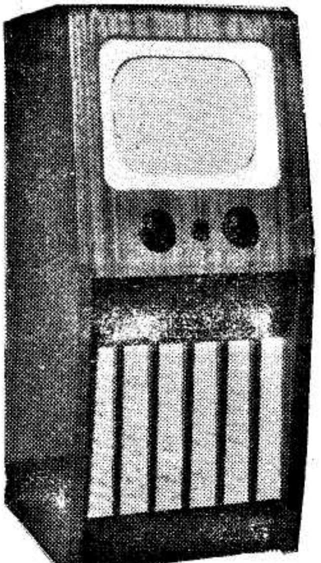
Adjusting a Television Receiver

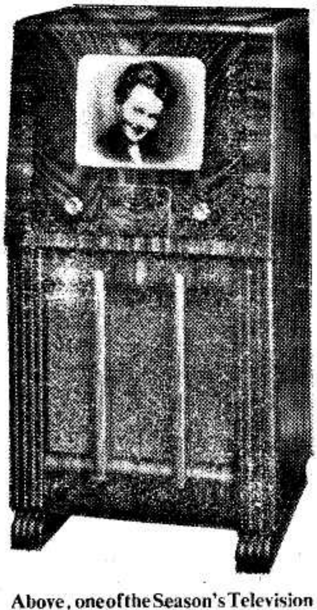
To assist viewers in adjusting their receivers every week-day morning a still pattern known as a test card is radiated by Alexandra Palace and Sutton Coldfield. This test card is used to check the performance of the television receiver, but it must also be remembered that this card will also indicate defects in the transmission itself, such as ghost images. Of course the test card is only of use for checking the initial adjustment. The main controls should be adjusted by means of the tuning signal radiated for several minutes prior to the commencement of each programme.

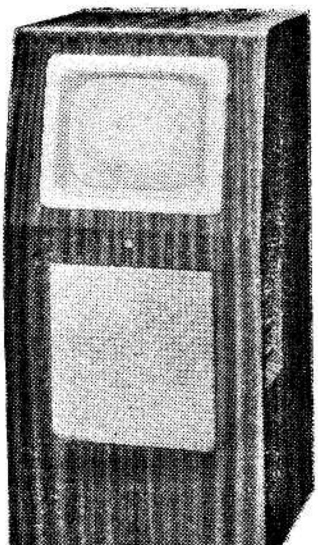
The controls on television receivers vary and so general instructions cannot be given. The most important adjustments for satisfactory viewing are those which set the brightness and contrast, and they are inter-related. Failure to get this adjustment correct will mean that the brightness of the picture will change in accordance with the amount and position of the high-lights in the studio. Unfortunately some instruction books are not particularly helpful, so the B.B.C. has devised the following procedure. It is presumed that the subsidiary controls are correctly set.

1. Switch on the receiver 15 minutes before the start of the programme, in order that the circuits may have enough time to reach their normal working temperature. It is not, of course, necessary to allow so much time in the ordinary way, but only when the full adjustment is to be made.
2. Turn the contrast and brightness controls fully down.
3. Turn the brightness control slowly up until a very faint glow is just visible on the screen; then turn it down slightly until the glow just vanishes.
4. Turn the contrast control up until the topmost shapes on each side of the circle on the tuning card are white, and the shapes next below them are light grey.
5. Re-adjust the brightness control so that the bottom shapes are black and the shapes above them are dark grey.
6. Make a slight adjustment to the contrast control to get the best contrast between the white and pale grey shapes.
7. Adjust the focus control to give the clearest definition to the vertical lines in the centre of the clock.

Three Modern TV Consoles







Above, one of the Season's Television Consoles. This is from the Alba range. On the left is Model T. 129 in the Ferranti range, and on the right Ekco Model TSG. 93 with 9in. tube

TELEVISION PICK-UPS AND REFLECTIONS

UNDERNEATH THE DIPOLE

By Iconos

THIRTY years ago practically every town in Britain with more than 30,000 inhabitants possessed a music hall or a theatre. Larger towns and cities had many of them, ranging from aristocratic Theatres Royal and Palaces of Variety to small repertory theatres, melodrama houses (" blood tubs ") and music halls of the rougher type. In the smaller towns, there were Mechanics' Institutes, Corn Exchanges and Assembly Rooms which offered regular " live " performances at least once a week and, of course, the seaside resorts had their minareted pier pavilions, with concert parties, pierrots or dignified Sunday Concerts.

CANNED COMPETITION

UNFORTUNATELY for this thriving industry, the age of mechanised entertainment arrived. First came the cinema, with its entertainment delivered fresh every three days in a can at a bargain price, and the " live " theatre started to decline. The smaller and the second-rate houses began to drop out or to show pictures themselves. Even the first-class variety halls at seaside towns found they were unable to weather the bleak winter months against cinema competition, and turned over to films. Then came the radio craze in 1923-1924, when the B.B.C.'s first main and relay stations were opened and the cat's whisker started to take its toll of both theatre and cinema audiences.

Even the mighty Moss and Stoll variety " tours " began to feel the draught, and some lesser circuits simply folded up. Plymouth, for instance, had a fine Theatre Royal and five other theatres or variety houses, each seating about 2,000, and nearby Devonport had two or three more. Few survived pre-war competition with the film shows or 5PY, the little 200 watt Plymouth B.B.C. relay station, and the terrible blitz on the town finished off some of these. Now there are only two big " live " houses left. It is the same story elsewhere.

TV COMPETITION

FACED with further competition from television, proprietors of the few theatres and music halls which have survived both blizzard and blitz are making frantic efforts to hold on to their audiences. The fact is, of course, that live entertainment houses outside the West-End of London depend upon their regular customers to keep them in business. Without the continued support of the patrons who book their favourite seats on one special night each week and are on nodding acquaintanceship with the manager, they are finished. The weekly visit to the local Hippodrome or Empire is a habit, and a high standard of entertainment each week will retain the goodwill of the " regulars." Cinema managements are also filled with forebodings, and recent news of falling attendances at American cinemas as a result of television competition, has made them gloomier still. " Thank goodness we've only the B.B.C. here," said one leading exhibitor, " that'll give us a few years respite." But in comparing the hundred or so American television transmitters with our two stations, he did not take into account the much higher power and consequent coverage of the Alexandra Palace and Sutton Coldfield stations.

TV AS A HABIT

TELEVISION has indeed made its mark on the furrowed brows of the amusement caterers of all types. Circus, fairground, dog track and waxworks are likely to be affected in some way or another. Apart from TV viewing becoming a new habit, the instalments on the newly purchased set will restrict for some time the " stepping out " activities of a great many new viewers. There just isn't the spare money. And while the cinema owners grimly survey the increasing forest of TV aerials above the houses of Birmingham and London, they are acutely aware of the fact that they are indirectly paying to their " competitor " no less than 40 per cent. of their takings, in the form of Entertainment Tax, in addition to Income and other taxes. Live theatres and music halls are taxed much less, however, and it is quite possible that television may not prove to be such a deadly competitor after all.

THE PLAY'S THE THING

THE fact is that new generations of entertainment seekers, quite familiar with television, may never have visited a theatre, seen a first-class musical comedy or a music hall. Presentation of variety acts, dramatic plays and ballets on TV will surely induce in these viewers a desire to see the real thing. Even the most ardent TV enthusiast will admit that a really good live show cannot be beaten, and that the very act of taking the trouble to get up from the armchair and *go out* to a show is a form of relaxation which TV cannot give. My forecast is that a diet of television plays will induce in the viewers a hunger for the " real thing," and that patronage of theatres and music halls in the London and Birmingham areas will increase as a result.

A really good play can be seen many times with sustained interest. *Hindle Wakes*, Stanley Houghton's Lancashire play, was first produced on the London stage in about 1913. Since then it has been toured in practically every theatre in the country, has been made twice into a silent film and once into a talkie. It has been broadcast three or four times and now it has been televised. It is curious that this play never seems to " date," though times have changed and high heels have taken the place of clogs. There were many fine performances in the TV *Hindle Wakes*, especially Edward Chapman's " Nat Jeffcote " and Ernest Butcher's " Christopher Hawthorn."

COMPETITION—IN COLOUR

AS for the cinema industry, this is sufficiently vigorous to sustain itself against TV competition. " There is no trouble that a really good picture can't cure " is an old cliché of the industry, but an up-to-date version of this old chestnut would add "—if it's coloured." Recent improvements in technicolor and also a new British system, Dufaychrome, have given the film people an opportunity of presenting something that television will not be able to do for a long time—present pictures in pleasant, natural colour. Then there is the making of subjects quite out of the range of ordinary television. I refer particularly to stories having a large percentage of exterior and foreign location scenes, such as "The Third Man," "Overlanders" or "Whisky Galore." The last-named picture, made entirely on the Island of Barra, Outer Hebrides, was produced on completely new lines, with a film studio improvised in a church hall for use when the weather was too bad to shoot outside. These pictures have all been a tremendous success in Britain and in the U.S.A. and are a type of subject which, even in black and white photography, are able to compete with television. It is the routine ordinary picture which will leave the audiences cold—or rather, leave them warm, near their home fires, looking at their television screens.

There has been a great deal of friction between the B.B.C. and the entertainment industry. My feeling is that the latter should capitalise on the publicity value of television. A specially edited long "trailer" of selected productions would be of interest to TV viewers, and might well induce many of them to see the film later on at their local cinemas.

LARGE SCREEN TELEVISION

MEANWHILE the use of large-screen television is still under consideration by many cinema owners. Provision is already being made at several cinemas for the installation of the complicated and expensive equipment, which will enable important national and sporting events to be reproduced by TV before large audiences. The late Captain A. G. D. West, formerly the B.B.C.'s Head of Research, made great progress in this particular field. If and when the problems of land-lines and special transmitters are solved, together with agreements with the Performing Rights Society, various trade unions which ban television, and other interested parties, then the film industry could compete with the B.B.C. for television rights of big fights and other important sporting events which the B.B.C. cannot afford.

LIME GROVE IMPROVEMENTS

THE B.B.C. seem to be keeping very quiet about what they are going to do with their recently acquired ex-Gainsborough Pictures studio at Lime Grove, Shepherds Bush. Apart from the meagre information that special children's programmes will be transmitted from there, little information is forthcoming. Even various sections of the B.B.C. seem to differ on the name of the place. Some call it "Lime Grove Studios," while others say "the new Shepherds Bush Studios." In view of the fact that the second television site at White City will also be proceeded with in due course, and that both places will be in Shepherds Bush, it would appear obvious that the names should be respectively "Lime Grove" and "White City." Both will be household words before long. And in the meantime, Norman Collins must be nostalgically looking out of the window of his comfortable office in the S.E. Tower of Alexandra Palace, which has just about the finest view in London. In the course of time he will leave its hallowed precincts and remove to the more mundane atmosphere of Lime Grove, with a view of the war-damaged Public Baths. His removal will, in fact, signify the growing-up of British television and become a symbol for the enthusiastic B.B.C. television engineers, marking the end of the days of ingenious improvisation, cramped quarters and the glamour of being a pioneer.

405 LINES

THE ultimate has not yet been reached with the 405 lines standard. Some of the results I have seen lately on closed-circuit under laboratory conditions indicate that great improvements in definition are on the way, without any increase in the number of lines. The big-screen television demonstrations by Cintel have been of quite astonishing quality. I hear that great efforts are being made to eliminate the line structure of the picture, visible when viewed close to the screen. One method is to superimpose a 10 M/c ripple on the line scan, thus wobbling the spot sufficiently to overlap slightly in the darker areas between the lines. Another problem yet to be solved is to obtain a really satisfactory intensity of light on a screen 10ft. or more wide. The intensity of light falling on the matt white screen of a cinema varies from 8 to 30ft. candles in different houses, according to the efficiency of the generator or rectifier, the carbon arc and its mirror, or the lens system of the projector. The reflected light is reduced by the small holes perforated in the screen for sound purposes (with the loud speaker behind the screen). It is still further reduced by dust and dirt, and by the cigarette smoke in the auditorium which absorbs light from the beam of the projector.

In the course of time, the picture at a given cinema may become slowly darker and duller, until the manager suddenly realises what has happened. Then he may have the screen washed, the arc changed, a new mirror fitted and the projector lens "bloomed"—usually doing all of these things at the same time. Suddenly, the patrons are amazed and dazzled by a picture three or four times as bright as it was in the previous week. With big-screen television, there is little or no margin to play with at present, and everything has to be working at maximum efficiency to obtain sufficient illumination. An unperforated silver-coloured screen gives good results for those viewers seated directly in front of the screen.

REAR PROJECTION

IT is largely owing to these screen illumination problems that the intermediate film process still survives in America. The English Scophony system, a mechanical one which makes use of mirror-drum scanning, is able to make use of a high-intensity carbon arc and project a bright beam on to the screen. I haven't seen this system since before the war, when I thought the results were very encouraging indeed. The demonstrations were then carried out with a rear-projection screen, however, a method which introduced a completely new set of problems—diffusion, soft-focus and a centre hot-spot. Rear projection systems do, however, allow the equipment to be set up at the back of a theatre stage thus obviating the siting of the television projector amongst the audience in the auditorium. Rear-projection on very small home receivers is a very different proposition. Here it is possible to make the screen fabric of sufficient density to eliminate the hot-spot effect without loss of much brilliancy. But do we really want big screens in the home? Without the use of projection systems, a 15in. picture fitted with a magnifier gives a spectacular result.

SOUTHERN RADIO'S wireless bargains: Television Masks, rubber, for 9in. tubes, **10/-**. Westectors, WX6 and W112 types, **7/6** per doz. Resistances, 100 assorted values from ¼ watt to 3 watt, all useful capacities, **9/-** per 100. Condensers, 100 assorted values, all useful capacities, mica and tubular, **15/-** per 100. Crystals, American and British, 2-pin types, a fair assortment of frequencies from 2,100 kcs to 6973 kcs, and from 30.1 mcs to 38.2 mcs, **6/-** each; 12 assorted frequencies **£3**. Crystal Monitors, type 2, complete in case less crystals, **6/6**; with two crystals, **16/6**. Contactor Time Switches, 10-hour movement with thermostatic control, 2 impulses per second, complete in sound-proof case, **10/-** plus 1/4. Television Servicing Manual, latest complete publication, **4/6**. R.A.F. Bombsight Computers, complete with motors, gyro, bellows, etc., etc., ideal component value for all experimenters and builders, **55/-**, plus 5/-. Periscopes ex-U.S.A. type M.8, complete with removable telescope, **17/6**. Camera Control Units, type 35 No. 26, complete in case, **20/-**. Crystal Detectors, semi-permanent type, **2/6**. Crystal Diode Valves, type CV102, **3/6**. Lufbra Hole Cutters, adjustable from ⅞in. to 3½in., for use on metal, wood, plastics, etc., **5/6**. Throat Microphones, complete with plug and lead, **3/6**. Electro-voice, lightweight carbon microphones, **5/6**. Carbon Hand Microphones, complete with long lead and plug, **5/6**. Microphone Transformers, **3/6**. Commando Receivers, B.C.454/455, complete with 6 valves, easily convertible to broadcast receivers, car radios or television sound, **35/-** plus **1/6**; conversion chart to mains, etc., **1/6**. Drive Cables for **B.C.454/5** Receivers, 14ft., with adaptors at either end, **9/6**. Aerials, sectional, extends to 8ft., **3/6**; base for same, **2/6**. Receivers, type R1125, complete in case with 2 valves, brand new, **17/6**. Thousands of bargain lines for callers. SOUTHERN RADIO SUPPLY LTD., 46, Lisle Street, London, W.C. (Gerrard 6653.)

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BRAND NEW Guaranteed Goods.—Mains Transformers, fully interleaved and impregnated primaries, 200-230-250v., 50 c/cs., screened, half-shrouded drop-through types, 260-0-260v., 70m.a., 6.3v., 3a., 5v., 2a., **13/6**; 250-0-250v., 80m.a., 6.3v., 6a., 5v., 3a., for 1355 conversion, **21/9**; 260-0-260v., 80 m.a., 6.3v., 3a., 5v., 2a., **17/6**; 350-0-350v., 80m.a., 6.3v., 3a., 5v., 2a., **17/6**; 350-0-350v., 100m.a., 6.3v., 3a., 5v., 2a., **19/9**; 350-0-350v., 150m.a., 6.3v., 4a., 5v., 3a., **26/9**. Electrolytics, 32mfd., 350v., cans, **1/11**; 8-8mfd., 450v., cans **3/6**. Ex-Gov. Valves, D1, EB34 (6H6), **1/9** ea.; SP41, VT61A, 12J5GT, **2/3** ea. Full list of bargains, 2½d. Trade supplied. E. POWELL, 3, Rockingham Street, Leeds, 2. Callers: 15, Queen Square, Leeds, 2.

VALVES, 6V6, 6K7, 6K8, 6Q7, 6N7, 6J5, 6J7, 6F6, KTW61, 5Z4, 5U4, U50, KT33c, H63, L63, and many others, all at **6/3** each. Speakers: L/weight, anti-magnetic field, 5in. **10/6**, 6½in. **11/6**, 8in. **13/6**, 10in. **16/6**; with trans. **3/6** extra Condensers, Resistors, etc., at less than wholesale. 1d. stamp list. Return of post service. RADIO UNLIMITED, Elm Rd., London, E.17. (Phone: **KEY 4813.**)

YOU may have TV, but you'll still need a Personal Portable for the holidays. Build yours from "Personal Portables," the first book to give complete constructional data for a whole range of sets, **2/8** post free from BRADBOOKS, Sennen, Penzance, Cornwall. "Portable TV" ready soon.

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TELEVISION.—Deflector Coils, Focus Coils, Frame Oscillator Transformers, Time Base Components, Receiver Coils London and Birmingham, Coil Formers, Chassis Kits. Send S.A.E. for details. R. F. SHILTON, 19, Clarendon Rd., Salisbury, Wilts.

WANTED, Cathode Ray Tube for Murphy A42V or alternative V1073 Tube. LANCEFIELD COACHWORKS, 71, Herries St., London, W.10.

EDUCATIONAL

TELEVISION.—The Gothic Television School specialises solely in training in television. Principals: M.B.E., B.Sc., M.Brit.I.R.E., education committee members, etc. Courses assume no previous television knowledge and provide guaranteed training for Brit.I.R.E. and R.T.E.B. examinations. All tutors possess university degrees and/or corporate membership of professional institutions and are appointed individually to postal course students to ensure complete and thorough training. Numerous well-known companies have adopted the School's Basic Television Course as standard television training for their staffs. Moderate fees. Details from the Secretary, GOTHIC TELEVISION SCHOOL, 13, North Ave., London, W.13.

TELEVISION Servicing and Theoretical (postal) Courses at extremely moderate fees are available from the Institute of Practical Radio Engineers, either for study or as reading matter only. Syllabus, post free, from the Secretary, I.P.R.E., 20, Fairfield Road, London, N.8.

Efficiency in Scanning Circuits

A Method of Obtaining Additional H.T. for a Line-scan Amplifier

By R. SANVOISIN

IN television receivers employing magnetic deflection a large voltage pulse is produced across the line-coils on the line flyback, and this pulse will shock-excite the coils into oscillation at a frequency dependent on their inductance and distributed stray capacitance. Thus it is customary to include some form of damping circuit to prevent this oscillation taking place. The damping circuit commonly consists either of a condenser and resistor arranged in series across the line-coils (Fig. 1) or a diode in series with a resistor, the diode (a mains rectifier type) being so connected as to conduct only on the flyback pulse. No damping is present on the scan stroke in this case, consequently a slightly larger scan is obtainable than that given by Fig. 1.

Both the above circuits succeed in preventing self-oscillation taking place in the line-coils, hence eliminating the attendant troubles of non-linearity and a bright streak on one side of the picture, but both also possess the disadvantage that power is dissipated in the resistance R.

This energy may usefully be harnessed to provide additional high-tension for the line output valve, which commonly requires a higher anode voltage than any other valve in the receiver. Instead of dissipating the energy in a resistance, it is rectified as in Fig. 2, and applied in series with the normal H.T. supply to the line amplifier.

Circuit Details

The basic circuit, capable of providing an extra 160 volts at about 50 mA, is shown in Fig. 3.

The action is as follows. During the period of the scanning stroke point Y is slightly positive with respect to Z, but X is much more positive, so the diode does not conduct. On the flyback, Y is driven violently negative with respect to X and Z, the diode still not conducting. Oscillations are now set up in the line-coils and Y becomes positive with respect to both X and Z, due to the large oscillatory voltage set up by the flyback pulse. As soon as Y is positive to X, the diode conducts, effectively damping out any further oscillation and charging the reservoir condenser C_2 to the potential of the applied high-tension plus that derived from the energy-pulse of the oscillation. By employing a sufficiently large reservoir condenser, this potential is maintained during the period of the next scan until the condenser is recharged on the flyback. For example, with $C_2 = 2\mu F$, $V_a = 500$ volts and mean $i_a = 50$ mA., charge σQ removed from C_2 during one scanning period of 72 μ sec $= \frac{50 \times 72}{1,000}$ μcoulombs, while total charge Q present on $C_2 = 2 \times 500$ μcoulombs. Therefore ratio of potential on C_2 at end of stroke to potential at commencement

$$= \frac{V - \sigma V}{V} = \frac{Q - \sigma Q}{Q} = \frac{1,000 - 3.6}{1,000} = 0.9964$$

representing a drop in high-tension on the valve of 1.8 volts, or 0.36 per cent., which has a negligible effect on the working of the valve.

The diode is passing current for a short period during the 8 μsec. flyback time; say, for example, 3.6 μsec. Then the charge transferred to C_2 during this period must make up for that lost during the scan, i.e., charge gained by C_2 in this time $= 3.6$ μcoulombs, or the mean current passed by the diode $= 1$ amp. This value may seem prohibitive, but it must be realised that it is a pulse value, the mean value being 50 mA. over the whole cycle of scan and flyback. This is well within the capacity of a small rectifier such as a 6X5G or 5Z4G. No trouble has been experienced using a 6X5G.

No Interaction

The fact that it is energy stored in the line-coils and transformer that is utilised need not deter anyone at present deriving E.H.T. for the cathode-ray tube from trying the circuit, no interaction having been found to take place between the two circuits. In the writer's case, replacing a conventional 500-volt supply by a 340-volt supply with this boost made no appreciable change to the E.H.T. available at the anode of the picture tube.

One slight disadvantage of the circuit lies in the fact that D.C. is caused to flow in the line-coils, so causing a lateral shift of the picture. This is not serious, however, since the resistance of the line-coils is usually greater than that of the transformer secondary, the bulk of the current thereby flowing through the transformer, and the slight picture-shift caused by the current in the coils themselves is easily counteracted by a slight tilting of the deflection yoke.

The choke L is a small choke of low resistance,—inductance required is small, as the frequency is of the order of 50 kc/s. The secondary of a heater transformer is satisfactory, or one of the windings of a transformer employed to power Service equipment from high-frequency supplies.

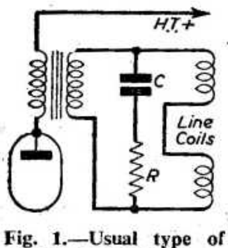


Fig. 1.—Usual type of line-feed circuit.

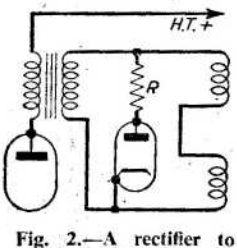


Fig. 2.—A rectifier to replace the linearity control of Fig. 1.

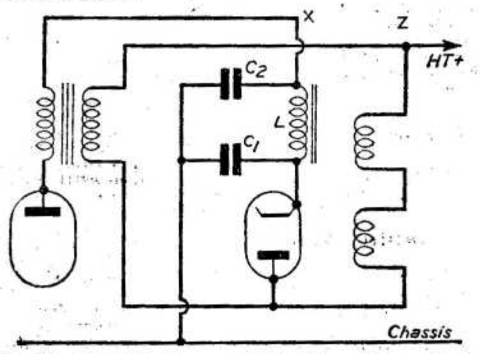


Fig. 3.—New circuit suggested in this article. C_1 is 0.1 μF, 1,000v. working, and C_2 2μF at a similar rating.

Television Station for the North

THE next television station, intended to serve the North of England, will be located at Holme Moss, near Huddersfield and construction commences this year.

Scotland, South Wales and S.W. England

A SITE for a station to serve Southern Scotland has already been surveyed and the search continues for a location for a South Wales station and one for South West England. In addition stations will be built to serve North East England and also Southampton, Belfast, Aberdeen and Plymouth.

Limiting Factors

THE number of television transmitting stations that can be built in this country is not limited by economic condition alone. Technical reasons set the limit, that technical limit being the extent of the frequency band allocated to the B.B.C. This has been settled by the recommendation of the Atlantic City conference of the International Telecommunication Union, which has allocated a frequency band of 41 Mc/s to 68 Mc/s. The B.B.C. has prepared a plan agreed to by the Television Advisory Committee and the Radio Industry Council in accordance with these recommendations. The plan is for a full band up to 68 Mc/s.

How Many Viewers?

THERE are approximately 285,500 television receivers in use at the present time and as the B.B.C. estimates that at least four people look in to each receiver, the total number of viewers is reasonably accurately estimated to be 1,142,000. The sales of television receivers has not yet overtaken the demand and these figures therefore will continue to rise week by week as production catches up with demand.

Seventeenth National Radio Exhibition

THE radio and television exhibition to be held at Castle Bromwich, Birmingham, from September 6 to 16, 1950, is to be the seventeenth National Radio Exhibition. Previously the exhibition, which is being organised by the Radio Industry Council on behalf of the British Radio Equipment Manufacturers' Association, has been announced only as a radio and television exhibition to be held in the Midlands, and not as the National Radio Exhibition.

All previous National Radio Exhibitions have been held in London—at Olympia since 1926 and previously at various other halls (1922, Horticultural Hall; 1923, White City; 1924-5, Royal Albert Hall).

The Exhibition Organising Committee, under the chairmanship of Mr. F. W. Perks, is substantially the same as that which organised the last two very successful National Radio Exhibitions at Olympia, London.

TV Aerials on Council Houses

BEFORE banning or discouraging the use of outdoor television aerials on council houses a number of local authorities consult a special panel of aerial experts formed by the Radio and Electronic Component Manufacturers' Federation. The majority of other councils who discourage outdoor aerials without technical advice, prove very amenable to reason and willing to be guided when approached by the panel.

This information was given recently by Mr. D. S. A. Gardner, lecturing on behalf of the R.E.C.M.F. to the London branch of the Institute of Housing. He was explaining the various types of aerials on the market and their functions in regard to good television reception.

What Type of Aerial?

IN his talk Mr. Gardner emphasised that no hard and fast rule for aerials could be laid down. Every case must be judged on local conditions, and the amount of electrical interference in the area. It was impossible to predict the minimum standard of aerial which would give satisfactory reception in any area. A case was on record of an indoor aerial giving very satisfactory results while on the other side of the street an outdoor television aerial was absolutely necessary.

Mr. Gardner suggested that other councils and local authorities might follow the lead given recently by the L.C.C. who have indicated that they will consult the R.E.C.M.F. panel if difficulties are encountered in the choice of aerials. The panel were prepared to carry out tests and make recommendations for aerial installations which would provide adequate reception for tenants without interfering more than was absolutely necessary with the architectural amenities of the building concerned.

Mr. Gardner also dealt with communal aerials, a system whereby one aerial could be used to serve a row of terraced houses or a block of flats.

Housing and municipal organisations and authorities interested in the problem of television aerials are invited to contact the Secretary, R.E.C.M.F., 22, Surrey Street, London, W.C.2, who will be pleased to provide a speaker or offer technical advice.

Sutton Coldfield

SUTTON COLDFIELD is a transmitting station only; it is not equipped with studios for the production of television programmes. It is the most powerful television transmitting station in the world. There are two transmitters, one for the vision component and one for the sound component, operating on carrier frequencies of 61.75 Mc/s and 58.25 Mc/s respectively. The vision transmitter employing amplitude modulation is capable of a peak output power of approximately 40 kW. The sound transmitter has a carrier wave power of 12 kW. and employs high power class B modulations.

The London Television Station

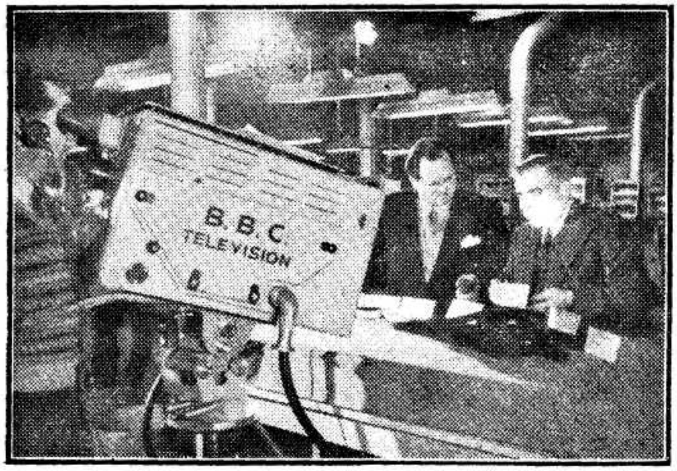
THE London television station is situated at the Alexandra Palace, which was erected in 1874 as an exhibition centre. It houses two studios, including control rooms and film scanners, dressing, make-up and wardrobe rooms, local scenery and property storage, central control and apparatus rooms, the general cable and radio receiving room, the vision and sound transmitters, the film dubbing suite, review theatre, projection theatre, cutting rooms, scene carpenter shop, the scene painting area and scene store. The aerial is designed and trued to operate on a frequency of 45 Mc/s with a band width of ± 2.75 Mc/s. Below this aerial assembly is one for the sound transmission, tuned to 41.5 Mc/s and of somewhat narrow band width.

New E.M.I. Service Depot for Midlands

MIDLAND televiewers will expect from "His Master's Voice" and Marconiphone the unsurpassed service for their television sets to which they have become used for the many other electronic products marketed by these companies.

E.M.I. Sales & Service, Ltd., are ensuring that owners of "His Master's Voice" and Marconiphone television sets in the Midlands will have the same facilities as viewers in the London area.

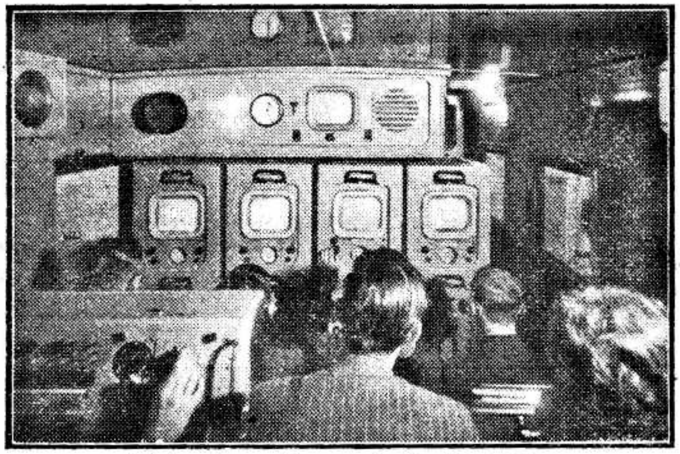
Mr. L. W. Saunders, previously in charge of the Anti-Interference Division at the E.M.I. Service organisation at Perivale, has been appointed Manager of the Midland Television Depot, responsible to Mr. F. W. Goodman, the General Service Manager of E.M.I. Sales & Service, Ltd.



A broadcast from the H.M.V. works, commentator Richard Dimbleby learning some of the intricacies of gramophone record making.

To this end, a separate E.M.I. Sales & Service, Ltd., Midland Television Service Depot at City Chambers, 111-117, John Bright Street, Birmingham, is being opened.

This new depot, equipped with the latest servicing aids and manned by fully qualified engineers, will shortly provide service and dealer training facilities for "His Master's Voice" and Marconiphone television.



Interior of a mobile van, showing the monitors.

Thermovent Heating at Sutton Coldfield

THE Sutton Coldfield Television Station is heated throughout by Thermovent Electric Space Heating Equipment (E. K. Cole, Ltd.), having a total loading of just over 100kW and consisting mainly of type "S" metal-cased wall-mounting convectors, specially modified to suit B.B.C. requirements, each heater having its own built-in thermostatic control.

A temperature of 65 deg. F. is maintained in the Transmitter Hall and Power Enclosures as well as in the offices and other principal rooms, but in the Transmitter Hall supplementary heat is available during transmission hours by using the waste heat from the valve-cooling equipment, thus reducing the consumption of electricity through the operation of the thermostats on the convector heaters.

The corridors and workshops are maintained at 60 deg. F. and sufficient heat is provided for frost prevention by means of "Thermotube" tubular heaters in the lavatories and stores.

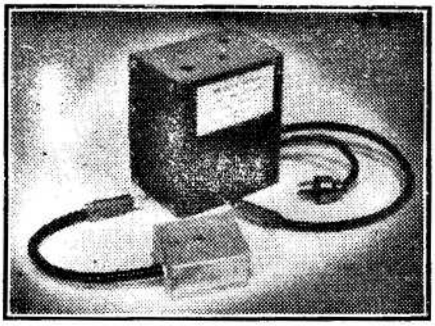
The layout of the installation was designed by the Thermovent Technical Advisory Service in co-operation with the B.B.C. engineering staff.

TRADE TOPICS

Ekco Pre-amplifier

IN view of the many new near-transmitter and fringe area problems arising nowadays since the opening of the Midland Television Service, E. K. Cole Ltd. draw attention to their two accessories, the pre-amplifier and the attenuator.

These compact Ekco accessories are easily fitted by a simple slide-on arrangement. They are inexpensive and will assist greatly in producing normal viewing



The new Ekco Pre-Amplifier and Attenuator.

conditions when signal strength is either too high or too low.

Amplifier: LGA108 (London), LGA1108 (Midland), £2 (no tax).

Dimensions: 3½in. high by 3in. wide by 2¼in. deep.

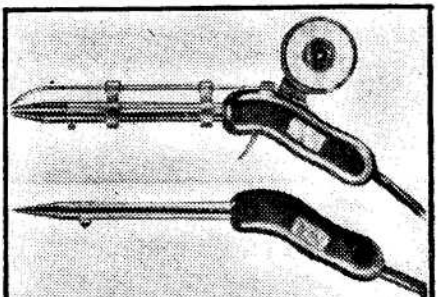
Attenuator: Suitable for London and Birmingham, 7s. (no tax).

Dimensions: 9/10in. high by 1⅜in. deep by 1⅞in. long.

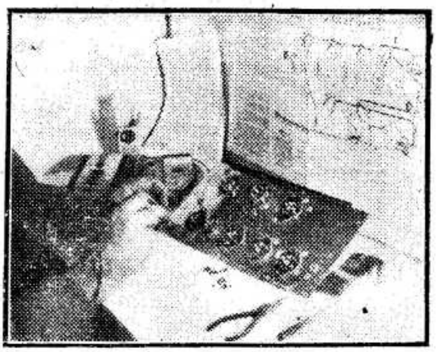
E. K. Cole Ltd.,
Southend-on-Sea.

Wolf Electric Solder Guns

A NEW introduction by Wolf Electric Tools Ltd., the famous manufacturers of portable electric tools, is a range of electric solder guns which they claim will



Two of the new Wolf Soldering Guns.



Working on the first stage of the Viewmaster.

overcome hitherto common criticism of this type of equipment.

Industrial soldering requirements have long called for soldering tools which will reach operating temperature quickly, will maintain a correct constant heat, prove economical in current consumption and are "easy in the hand" for long production periods.

The illustration in column 1 shows two irons from their range of six hand models, and particular attention is directed to the off-straight hand grip which lends to much more comfortable control. By an ingenious arrangement within the heating element, the heat is localised around the copper bit, and with the elimination of wasted heat areas considerable economy in current consumption has been effected. At the same time any tendency towards excessive temperature rise is avoided and this in turn prolongs heating element life and saves oxydisation of the copper bits.

Wolf solder guns can be supplied for the following voltages: 24, 50, 100/110, 115/130, 200/220, 225/250, and each gun is fitted with 6ft. of three-core cable. Models are available for a wide range of purposes from fine instrument to heavy duty work.

Wolf Electric Tools Ltd.,
Pioneer Works, Hanger Lane, London, W.5.

Multicore Literature

MULTICORE have just issued two compact but, nevertheless, extremely interesting publications which will be of special interest to our readers.

A reference card incorporates useful data and tables of Ersin Multicore Solder and radio and electrical data, including resistor colour code and other useful tables for radio technicians. Supplies of this card, reference RPE 849, are available from certain retailers, and in case of difficulty, can be obtained free of charge on receipt of a stamped, addressed envelope by Multicore Solders Ltd.

A 6-page leaflet, "Hints on Soldering," is available for less technical readers. It contains much useful information regarding soldering in general and the specific uses of Ersin and Arax Multicore solders.

Multicore Solders Ltd.,
Melliner House,
Albemarle Street, W.1.

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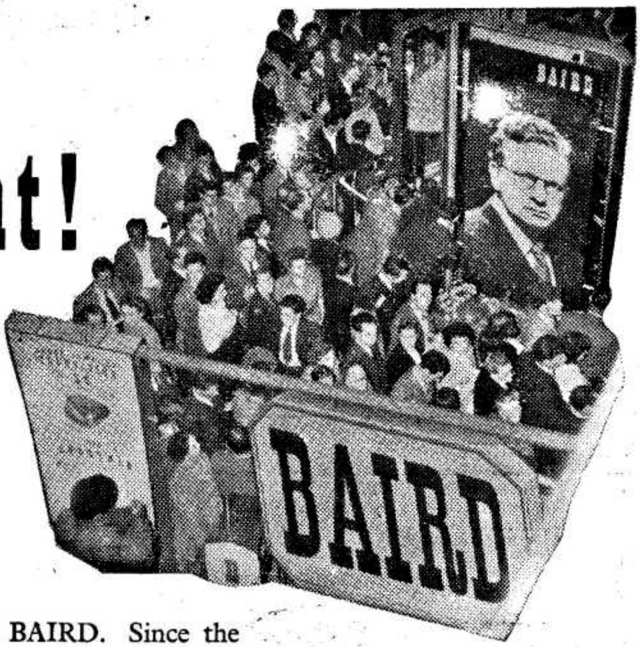

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12" tube console. Needs no aerial

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EVERYMAN
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