

PICTORIAL OUTLINE OF TRANSMISSION & RECEPTION

Television

and *SHORT-WAVE WORLD*

1/-

MONTHLY

FEBRUARY, 1937

No. 166, Vol. x.

THE CATHODE-RAY TUBE

SIMPLY
EXPLAINED
for the
BEGINNER



PYE RECEIVER CHASSIS

CATHODE-RAY TUBE :—

Articles
Diagrams
Pictures
Data

SHORT-WAVE
Experimenters'
Test
Equipment

£2-2-0 for an Idea

(page 88)

BERNARD JONES PUBLICATIONS LTD.
CHANSITOR HOUSE, CHANCERY LANE
LONDON W.C.2.

THE FIRST TELEVISION JOURNAL IN THE WORLD

U.S.A. AND THE PROBLEMS OF TELEVISION

PROSPECTS FOR 1937—BY OUR AMERICAN CORRESPONDENT

A VERY large amount of interest in television in the United States now centres round the work of the Philco Radio & Television Corporation. For the past year this company has been making field tests from its experimental station in Philadelphia, using 345 lines interlaced and obtaining high definition pictures of an excellent quality ten miles from the transmitter. The tests have been

vision engineer of the Philco Radio & Television Corporation, in an interview with our correspondent, outlined five essential points that must be cleared up and settled before commercial television will be possible in the United States:

(1) Technical standards for television transmission will have to be approved by the Federal Communications Commission so that any receiver

vision, that is, in the 42-90 megacycle band.

(4) A source of programmes will have to be developed. In putting on a short sketch by television more is required in the way of costumes, rehearsal and stage properties than for any other known entertainment field. Actors can no longer read their scripts. Both appearance and voice will be necessary for the television star. The problem of giving the American people television programmes 365 days a year assumes staggering proportions.

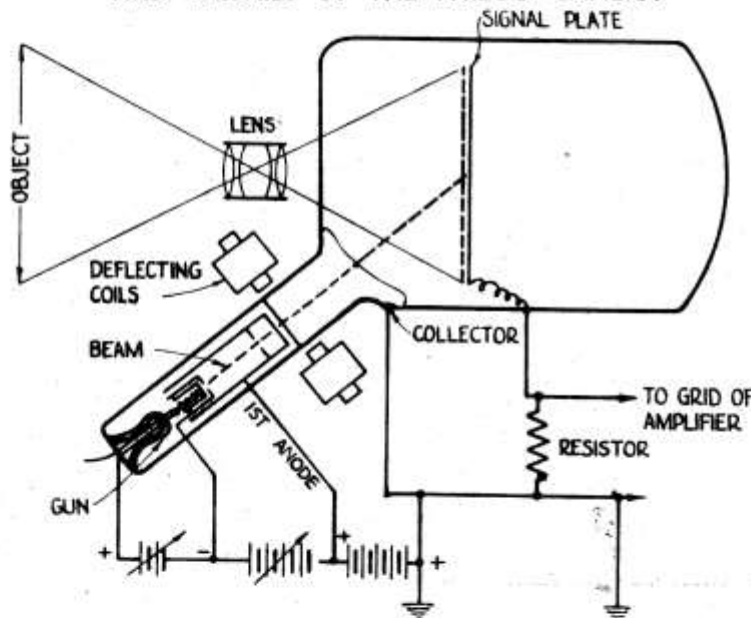
(5) Reduction in the cost of television receivers.

Mr. David Sarnoff, president of R.C.A., said: "In co-operation with the industry, we have recommended to the Federal Communications Commission the adoption of 441-line definition as a standard for commercial operation. Our New York transmitter will be rebuilt to conform to the recommended standards. That also means building receivers to conform to the new standards of the transmitter. The necessity of synchronising transmitting and receiving equipment carries with it serious responsibilities. On the one hand, standards cannot be frozen prematurely or progress would be prevented; on the other hand, frequently changing standards would mean rapid obsolescence of television equipment."

The Farnsworth Station, in Philadelphia, will "go on the air" some time during the spring of 1937, and will open using 441 lines definition. Thus it will be seen that the United States is assured a standard television, one in which any receiver will receive any programme from any transmitter within range.

Probably one of the most interesting developments in television in the United States is the perfection of the image-dissector-tube in the Farnsworth pick-up camera to a sensitivity where powerful lights are no longer necessary in a studio. A new Farnsworth image dissector tube operates very well with only four 100-watt electric light bulbs as illumination for a picture of the head and shoulders of a subject, such as an announcer.

FIRST DETAILS OF THE PHILCO CAMERA



This drawing is the first published of the camera used by the Philco Radio and Television Corporation which has been so successful in the U.S.A.

temporarily discontinued, while improvements are being made in the apparatus, but in a short time the station will reopen using 441 lines interlaced. When the Philco station reopens, it is expected that it will be the first television station in the U.S.A. operating on the television standards proposed to the Federal Communications Commission by the Radio Manufacturers Association. In short, Philco will present the television that is proposed as the future standard for the United States.

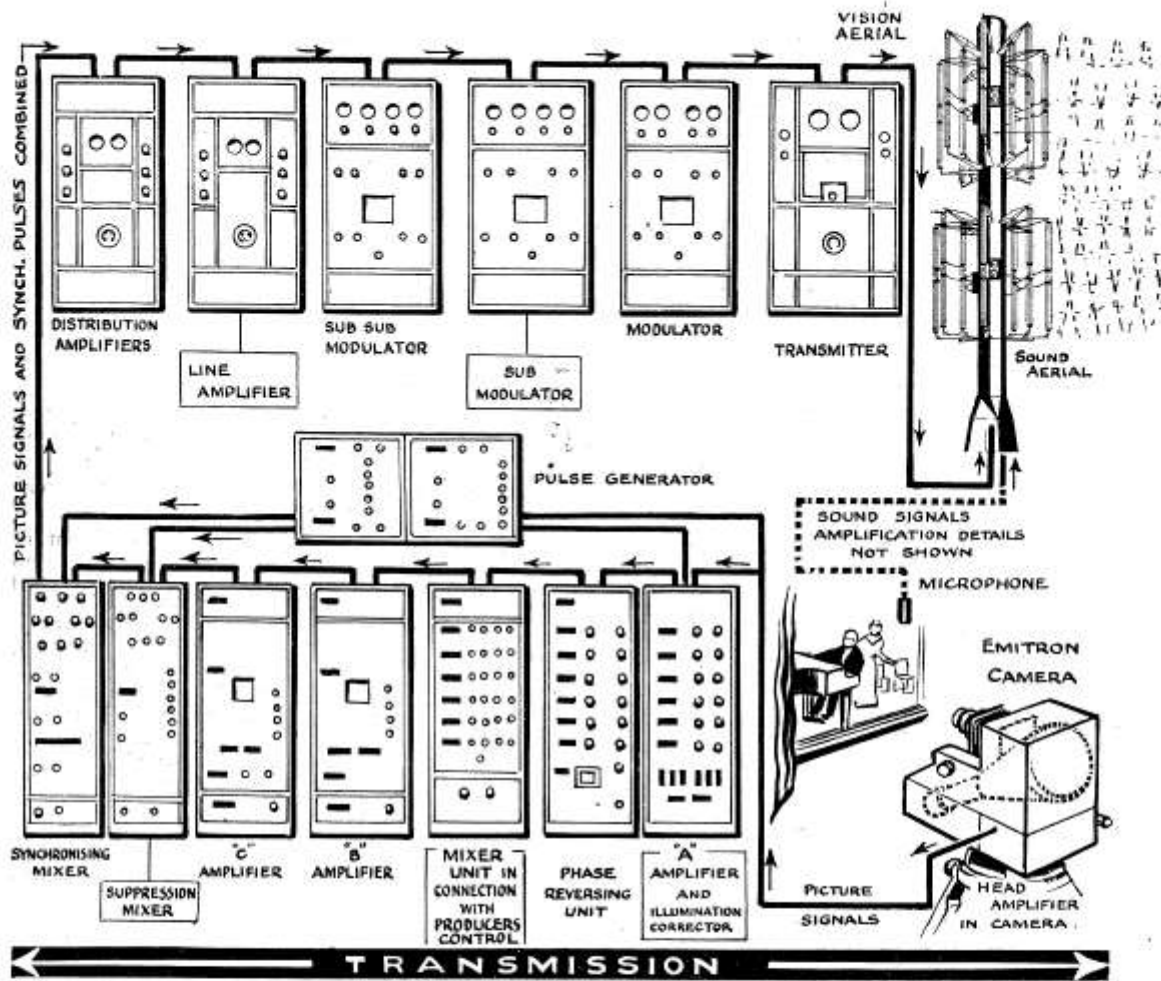
Mr. Albert F. Murray, chief tele-

will receive any transmitter within range. The Radio Manufacturers' Association has drawn up a set of these standards which have been offered to the F.C.C. for its approval.

(2) The present limited range of television, averaging about 25 miles, will have to be increased. Key cities, such as New York, San Francisco, Philadelphia, Washington, Boston, etc., will have television first.

(3) Before there can be commercial television in the United States, the Government will have to issue commercial licences suitable for tele-

FROM STUDIO TO PICTURE—A PICTORIAL OUTLINE



A SIMPLE EXPLANATION

The Camera

THE scene to be transmitted is focused through a lens system on to the sensitive plate of the Emitron Transmitting Camera in exactly the same way as the image is projected in a photographic camera. The camera converts what it sees into electric signals at once.

The camera has an electric memory, that is it will store up and retain a scene after that scene has ceased to be presented to it. If, for instance, after a momentary exposure to a scene, the lens is capped and the camera left for a period, it will, when switched on, faithfully transmit what it saw before the lens was capped.

The Head Amplifier

The picture signals from the camera plates are fed

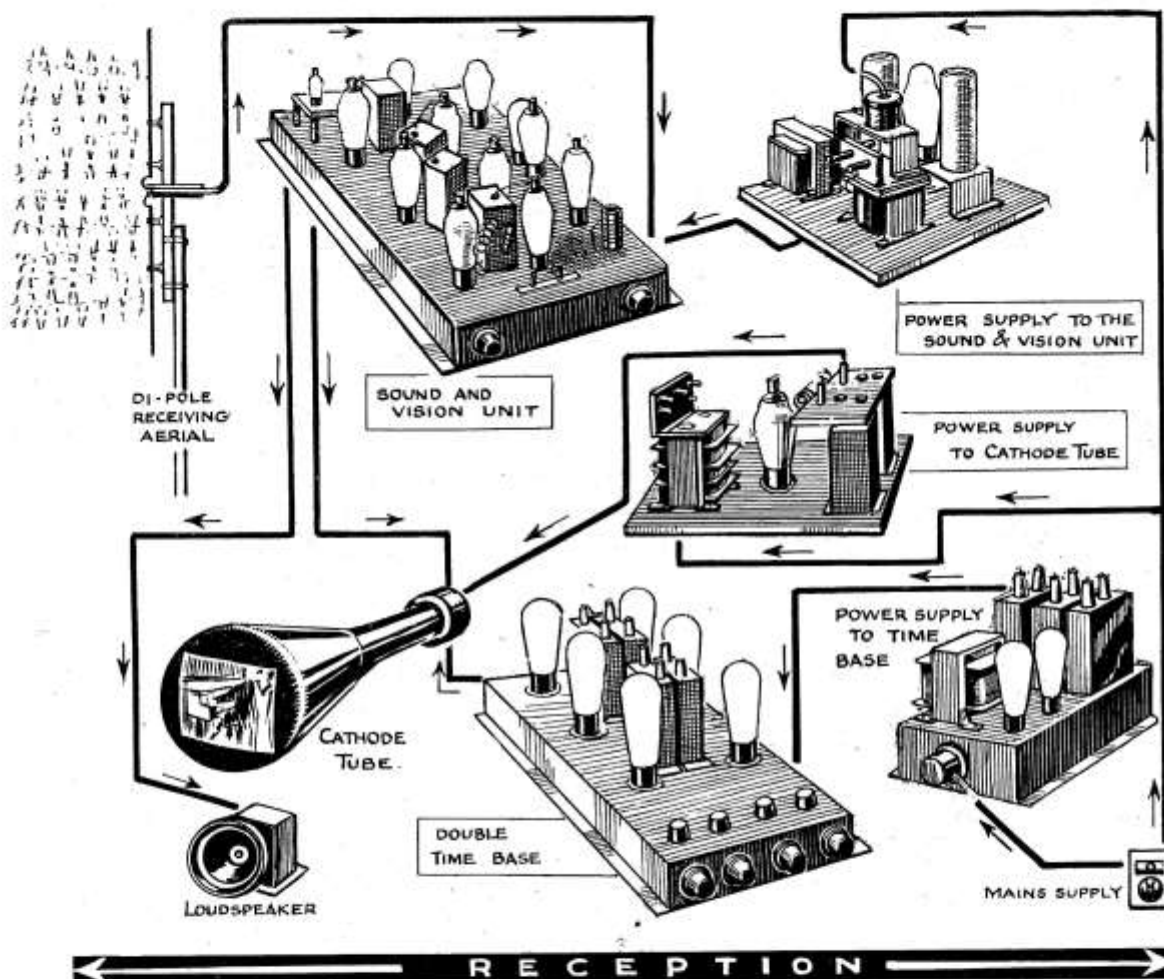
straight into the head amplifier. This amplifier strengthens the minute signal from the photo-sensitive plate of the camera sufficiently for them to pass down as much as 1,000 ft. of cable until they reach the main valve amplifying equipment.

After passing through the multi-core connecting cable from the head amplifier in the camera, the picture signals enter the picture illumination corrector unit (one for each of six cameras). This unit arranges that any inequalities which may have developed in the picture signals, are corrected. By this means a faithful reproduction of the light and shade over the whole picture is ensured.

The Phase Reverse Unit

After this the signals enter the phase reverse unit. This unit has been provided because it is sometimes

OF ELECTRONIC TRANSMISSION AND RECEPTION



necessary to use either positive prints or negatives of films at will

The Mixer Unit

The foregoing description has dealt with one camera channel only. Six cameras can, however, be used and the mixer unit sorts out the picture signals from the six cameras by means of electric remote control from the programme producer's control desk. A producer can fade out from a close-up to a long-shot or other scene.

B Amplifier

Further amplification of the picture signals from the particular camera selected by the producer occurs in the B amplifier unit.

C Amplifiers

The partially cleansed and amplified picture signals are fed into the duplicate C amplifiers. In the C amplifiers further extraction of unwanted interference, due possibly to the situation of the camera, is effected in

addition to further amplification of the picture signal.

Suppression Mixer Units

The camera signal, which has now passed through two preliminary stages of interference reduction, passes into the duplicate suppression mixer units. Final removal of any interference from the picture signals is effected in the suppression mixer units (a five-stage amplifier).

Syn. Mixer Unit

The picture signals from the Emitron camera have now been amplified and cleared of any unwanted interference. It is now necessary to add to these picture signals the synchronising impulses which are to be transmitted with the picture signal. This is done in the synchronising mixer unit. As the picture signals pass through the synchronising mixer unit synchronising pulses from the pulse generator (see over) are added. The signal going forward to the transmitter

is now a combination of picture signal and synchronising pulses.

The Pulse Generator

The function of the pulse generator is to produce all necessary pulses and frequencies for picture synchronisation and the operation of the cameras throughout the system. The pulse generator is in two bays. In the first of these the basic frequencies are generated by multiplying the frequency of the supply mains or of a generator which can be independent of the supply mains. The second bay further amplifies and selects the correct pulses (which are multiples of those generated in the first bay) and amplifies, corrects and inverts them to whatever part of the system requires them.

Distribution Amplifier

The complete signals to be radiated are now fed to the distribution amplifier. Each of these duplicate amplifiers feeds a channel to the transmitter and in addition channels for monitor picture receivers wherever they are required.

Line Amplifier

From this point we are concerned only with the picture signals to be radiated as they pass into the amplifier. A number of these amplifiers may be used for accepting picture signals from mobile vans or outside broadcast points.

Modulator Units

Three modulator units follow. These three units raise the picture signals to high power, and consist of eight valves passing a high-power modulating signal to the vision transmitter.

THE RECEIVER

The Receiving Aerial

This consists of two copper tubes generally one half wavelength long and used as a di-pole with two feeder lines coming from the centre. This aerial picks up both sound and vision signals and passes them on to the receivers.

Television on Suppressed Side-bands

AT the last 1936 meeting of the Institute of Radio Engineers (U.S.A.) D. W. Epstein, of the R.C.A. Manufacturing Co., presented the paper "Sideband Suppression in Television Reception." Experience showed, the author said, that a better image often resulted if the circuit was tuned to one side or the other of the carrier, resulting in a partial suppression of one of the sidebands.

The increased detail obtainable under this condition was explained in this manner: The bandwidth passed by the receiver was narrower than that transmitted. By detuning, more "highs" were accepted by the receiver, at the expense of signal

strength, resulting in a more detailed image with a lower signal-to-noise ratio. Such detuning retained double side-band reception on the low (overall scanning line) frequencies, which were proportionately stronger than the highs.

If the receiver band-width is widened in the attempt to accept both transmitted side-bands fully, the gain per stage decreases in direct proportion to the band-width, necessitating more stages. Hence to make the most economical use of the band-width available at the receiver, single side-band transmission is highly desirable.

The effect of single side-band reception on frequency (fidelity) and phase response was examined theoretically and experimentally. The transmitter and receiver in the ex-

Sound and Vision Receivers

The vision signals are fed into the high-frequency stage of a multi-valve receiver which is capable of reproducing up to two million cycles. As a rule 9-10 valves are needed, which includes four intermediate frequency stages. Sound signals are at the same time fed into the first valve of a simple 4- or 5-valve super-het receiver which rectifies and amplifies before passing the signals into the loud-speaker.

Power Supply

A common unit provides high- and low-tension for both the sound and vision receivers. As the power pack is energised from A.C. mains the receivers are independent of batteries as grid bias is obtained automatically by means of cathode bias resistors.

The Cathode-ray Tube

The output from the vision receiver is fed into the cathode-ray tube on the end of which the picture is seen. The electrical impulses from the vision receiver are converted into light in the cathode-ray tube and are controlled by a double time base.

Double Time Base

The time base controls the formation of the picture both horizontally and vertically and synchronises the receiver with the transmitter. High-tension and low-tension for the energising of the time base are obtained from a special power pack.

The Time Base Power Pack

This pack is a simple unit giving high voltage at low current and is made up of two half-wave rectifying valves, a small transformer and three or so high voltage condensers.

Tube Power Pack

The final unit in the chain is the power pack for the cathode-ray tube. It supplies up to 5,000 volts according to the type of tube, but at a low current of about 2-3 ma. A half-wave mercury vapour valve is used in this circuit.

perimental set-up were equipped with rejector circuits which lowered the energy transfer in the lower frequency side-band. Among other things it was found that distortion in the second (linear) detector circuit under these conditions did not become serious up to the maximum modulation level of the transmitter (about 80 per cent.). Wave-form distortion in a television image due to the presence of second and third harmonics seemed, in fact, to be less serious than it is in audible reproduction.

Further research along these lines, it is thought, may materially alter the present concepts now current on television-band dimensions, since in the ideal case a given picture could be sent in half the band-width used for the usual double-side-band method.

Scannings and Reflections

STANDARD OF TRANSMISSION

THE decision of the Television Committee to employ two standards of transmission has been the subject of criticism from the very start. The two systems use different picture or signal standards, a point which this journal in common with all those who wish for the rapid progress of television deplore. It is now understood that a decision to use one standard is imminent and likely to be announced shortly after these notes are in print.

It has been obvious that both standards have their particular advantages and it would seem desirable that some compromise should be arrived at, though whether this is what the Television Committee have in mind we are not at present in a position to state. Certainly a picture frequency of 50 per second is desirable on account of flicker. As to the number of lines, the results given by 240 or 405 lines appear identical when transmitting films, which provide a good comparison as the subject matter in all news reels are of the same type. This points to the idea, which seems pretty common, that when electronic devices are used for scanning at both ends (transmitting and receiving) a higher number of lines is better than when the transmitting end is mechanically scanned. We would also hazard a guess that manufacturers would prefer sequential scanning as against interlaced. There is also the matter of mechanical receivers. Although an odd number of lines does not present an insuperable obstacle in the development of these—and they are being developed—matters would be simplified if a figure were used which would provide a more convenient multiple.

THE PROGRAMMES

There has been a noticeable improvement in the programmes and their presentation of late. The long periods of a picture of a clock, which rarely showed the correct time, are now gone and the blank screens never take more than one of the sixty minutes. Unfortunately those who

criticise rarely make any suggestions as to what will improve the subject of their criticism. Television is always compared with the cinema and comparison at the present time is most unfair. The programmes have, however, most definitely been very poor; we have yet to come across anyone who is interested in seeing muffin men, flower sellers, shrimpers and the like. There is also far too much repetition both in the case of artists and fifth-rate films. The "Picture Page," although all right in its conception, would bear revision in its presentation. The constant repetition with the very dummy-looking switchboard begins to jar.

"EFFECTS"

How many lookers realised that in the recent programme entitled "Paleface" an attempt was made, which was fairly successful, to superimpose the pictures from two sources. The scene was a Gainsborough picture, but unfortunately, the lady in the picture did not quite register in the frame and a short or double exposure effect resulted. Incidentally, in the same programme the artist's model scene was considered most daring—for the B.B.C.

FILM OF REALITY?

There is much controversy in television circles as to whether viewers prefer to look at a television image reproducing "live" artists in the studio or film. Actually, as both are just shadow images via television it seems that provided it entertains the origin does not matter. There is little doubt that the average film is superior to the average television studio fare from live artists, though, unfortunately, the majority of the films shown so far have been most uninteresting. It was possible, however, to make a comparison in the recent programme in which Sir Malcolm Campbell and his famous Bluebird were featured. One first saw the actual car with Sir Malcolm at Alexandra Palace and then a film during its record-breaking runs at Daytona and Salt Lake. Similar scenes such as close-ups of the car and Sir

Malcolm were in no way comparable, the film being vastly superior in every way.

FARNSWORTH TO COME ON THE AIR

The Farnsworth Television Corporation have announced that a studio has now been equipped with two electron cameras and transmitting gear erected with the object of putting out programmes in the near future.

Mr. A. H. Brolly, chief engineer of the Farnsworth Company, in his announcement for the company, said: "In our experimental broadcasting from the Philadelphia station, we plan to meet in every respect the requirements for television broadcasting, recommended to the F.C.C. by the Radio Manufacturers' Association Committee on television standards. This means that the picture that we will broadcast will have 441 lines and use interlaced scanning.

"The Farnsworth transmitter is located on one of the highest points in the Philadelphia area, and the studio has been located on the outskirts of the city purposely to try out the use of directional broadcasting to cover a populated area from the outskirts of a city rather than for the broadcast from a transmitter located in the centre of the city."

THE SERVICE AREA

The service area of the Alexandra Palace has proved to be greater than was anticipated. The G.E.C., for example, have already installed standard home sets in ten counties within an area embracing about a quarter of the population of the United Kingdom and covering more than 3,000 square miles. At each point reception is well up to standard.

Outside the 25-mile radius these installations include not only such places as Luton, Camberley, Dorking and Woking, but towns nearly 40 miles away, such as Reading (Berks.), East Grinstead (Sussex), Tunbridge Well (Kent), and the environs of Southend-on-Sea (Essex). In these fringe towns along the popu-