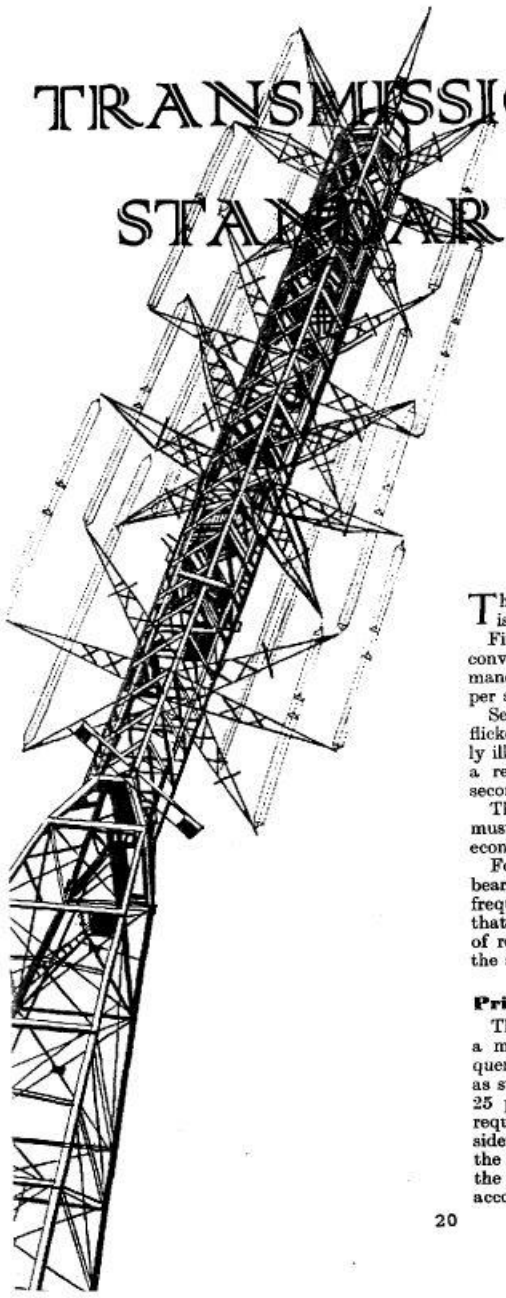
TRANSMISSION STANDARDS



The choice of picture repetition frequency is governed by four considerations.

Firstly, it must be sufficiently great to convey movement satisfactorily; this demands the transmission of 20 to 30 pictures per second.

Secondly, there must be no appreciable flicker on the receiver screen, when adequately illuminated. This consideration demands a repetition frequency of about 50 per second.

Thirdly, the picture repetition frequency must be kept as low as possible in order to economise in transmission bandwidth.

Fourthly, the repetition frequency should bear some simple relation to the mains supply frequency, in order that it may be locked to that frequency and thus minimise the effect of residual hum in receivers operated from the supply mains.

Principle of Interlaced Scanning

The first of the above considerations sets a minimum for the picture repetition frequency, and in the Marconi-E.M.I. system as standardised in Great Britain it is set at 25 per second. The conflict between the requirements of the second and third considerations is resolved by the adoption of the principle of interlaced scanning, whereby the scanning of each complete picture is accomplished by means of two interlaced

traversals. By this means the frequency of presentation on the receiver screen, or " frame frequency " of the system, is 50 per second and the flicker effect is completely eliminated.

London Television Station Standards

The significant figures, 25 pictures and 50 frames per second, were chosen with regard to the fourth consideration, since the frequency of the supply mains in this country is 50 cycles per second. The Marconi-E.M.I. system is, however, perfectly flexible in this respect, and in the event of a service being required in a territory where the mains supply frequency is other than 50 cycles per second, these standards would be suitably modified. For example, if the supply is at 60 cycles per second the corresponding figures chosen would be 30 pictures and 60 frames per second.

The Marconi-E.M.I. system employs unidirectional constant-velocity scanning, the lines being traced horizontally. The vertical definition available is proportional to the number of lines per complete picture, and equal horizontal definition is ensured by careful circuit design.

The 1935 Television Committee recommended a 405-line system for the London Television Station, and this standard has proved eminently satisfactory in practice. Experience has shown the transmitted picture to be of very good entertainment value, and the 1943 Commission recommends the resumption and extension of the service without modification.

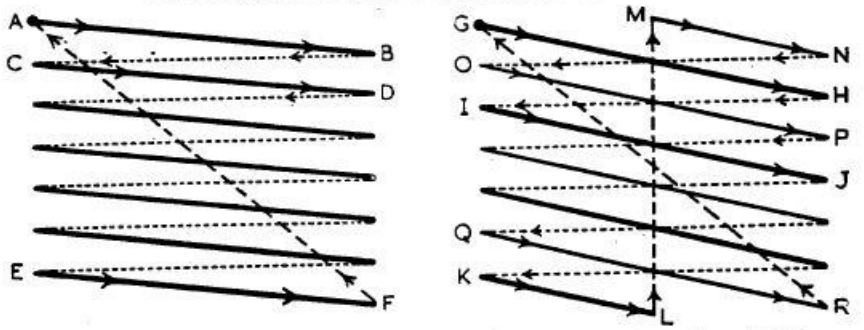
Nevertheless, the system is capable of higher definition, and the Company is prepared to supply equipment adapted for the transmission of pictures with a line definition of the order of 600.

The vision signals to be transmitted represent from instant to instant the point to point brightness of the image of the scene being transmitted, as this image is scanned in the Emitron camera or film scanning unit. The instantaneous signal may have any amplitude between a value representing black and a value representing the brightest part of the picture, or " peak white." The signals are liable to change with extreme rapidity, and essentially contain all frequencies down to zero; they lie on one side of the datum level, which is black.

Constant Amplitude Synchronising Signals

Synchronising signals are transmitted in the intervals between the vision signals of successive lines and frames. They take the form of rectangular pulses suitable for the accurate timing of the scanning circuits of receivers, and are comparable in sharpness with the vision signals. They lie on the side

THE PRINCIPLE OF INTERLACED SCANNING



The essential difference between the method of sequential scanning and the Marconi-E.M.I. system of interlaced scanning is illustrated in these simplified comparative diagrams of just a few lines. In sequential scanning (left) the spot traces the picture line by line from A to F and then flies back to A to commence another complete frame. By causing the spot to interlace as shown, starting from G, in the right hand diagram, two complete traversals are made to each frame. This enables flicker to be completely eliminated with maximum economy in transmission bandwidth, as explained in the text.

of the datum opposite to the vision signals, and do not appear upon the receiver screen.

It is an essential feature of the Marconi-E.M.I. system that the black level is rigidly maintained at a definite fraction of peak carrier amplitude, irrespective of the proportion of black to white in the televised scene. Constant amplitude synchronising signals are transmitted on one side of this datum, and vision signals of amplitude corresponding to instantaneous brightness on the other, the amplitude of " peak white " signals being constant. No wander is possible, and the transmitter is operated at maximum efficiency. Furthermore, the fixing of the black level ensures absolute reliability of signal separation at the receiver.

"Peak White" and Synchronising Ratio

The ratio of the amplitude of " peak-white " signal to the amplitude of synchronising signal is fixed at 7 to 3, and the carrier may be modulated in the positive or negative direction. In the case of positive modulation, the black level is fixed at 30 per cent peak carrier and the vision signals extend upwards, reaching 100 per cent carrier at " peak white," whilst the synchronising signals extend downwards to zero carrier. In the case of negative modulation, the black level is fixed at 75 per cent peak carrier and the synchronising signals extend upwards to 100 per cent carrier, whilst the vision signals extend downwards, reaching substantially zero carrier at " peak white."

System of Modulation employed

The system of positive modulation has the advantage that the amplitude of the synchronising signal cannot be increased by spark interference, and the scanning of receivers of the simplest design is therefore not disturbed. On the other hand, the interference appears on the screen in the form of white flashes. In the case of negative modulation, the interference cannot produce flashes of excessive brightness, but it is liable to cause breaking-up of the picture due to the production of synchronising pulses of excessive amplitude unless limiting circuits are incorporated in the receiver, the complexity of which is therefore increased.

The system of positive modulation was chosen for the London Television Station in the interests of simplicity and cheapness in receiver design, but in cases where this is not a prime consideration, negative modulation may be preferred in view of the reduction in the effect of interference which it offers to the viewer.

A TYPICAL TELEVISION TRANSMITTED WAVEFORM