TELEVISION DEVELOPMENTS

Sound and Vision on One Carrier

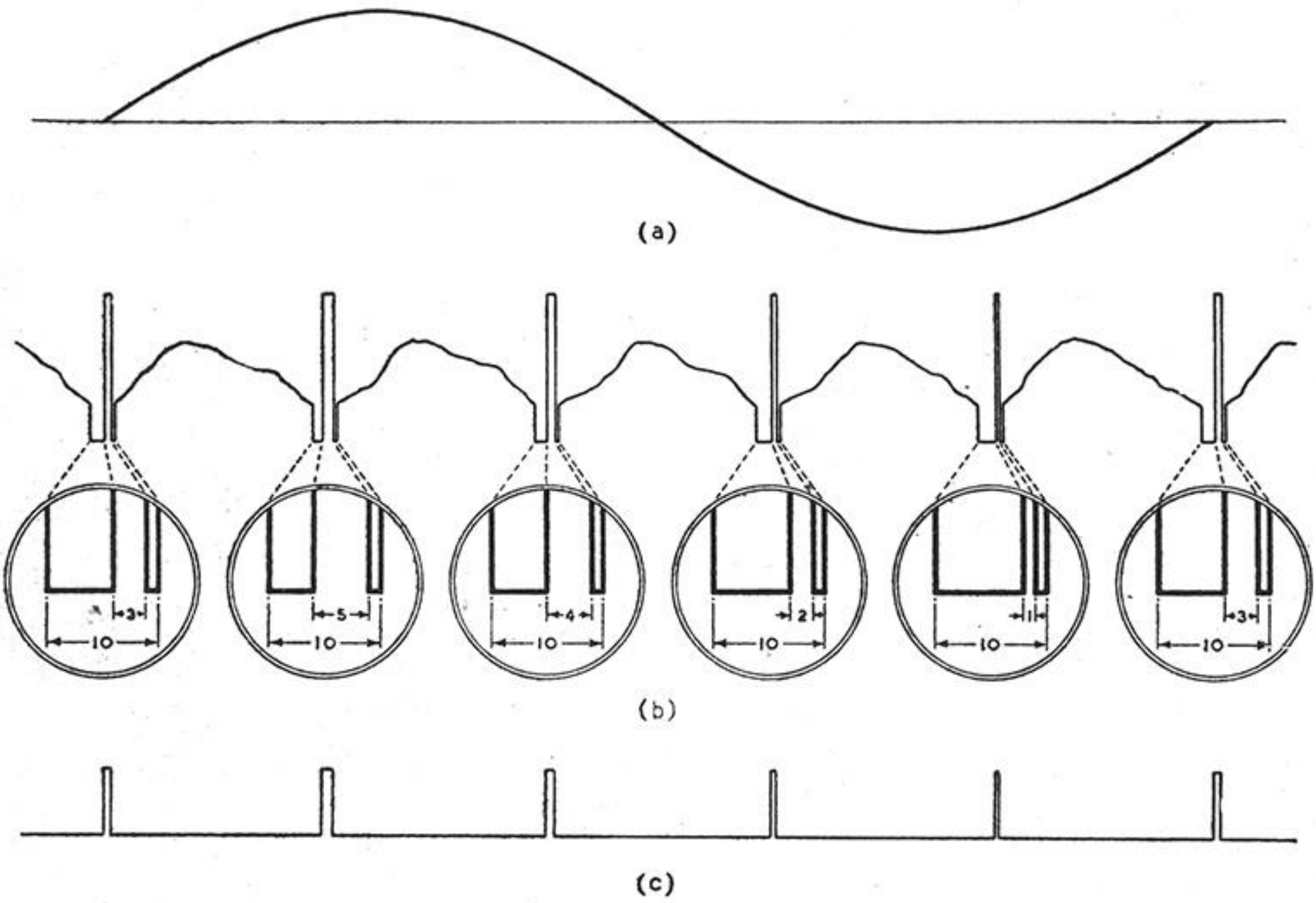
AN extremely interesting development in television technique was recently demonstrated by Pye, Ltd. It consists in utilising the time normally wasted by the transmission of synchronising pulses for the sound accompaniment. This not only saves the separate sound transmitter normally required but much of the sound receiver, and at the same time it reduces the total frequency band occupied by a complete television system.

The television signal itself is quite unchanged. The scanning system and video signals, and general form of the synchronising pulses are the same as in pre-war transmission. This means that the line scanning frequency is 10,125 c/s, so that the time available for scanning each line and transmitting the line sync pulse is 98.5 μsec. Of this time the sync pulse itself occupies 10 μsec., and it is obtained by suppressing the carrier of the vision transmitter for this period.

The leading edge of the pulse triggers the time-base in the receiver at the end of the line and the pulse itself also suppresses the spot on the cathode-ray tube during the fly-back. While a pulse length of 10 μsec. is not necessary for synchronising, a time interval of this order is needed for the fly-back, and it is difficult to reduce it economically. It does, however, represent waste time as far as the actual picture is concerned.

This time, however, can now be utilised to convey the sound programme without detriment to the picture. Within the period devoted to the line sync pulse, a pulse-duration modulated signal can be inserted. This is a series of pulses with a mean duration of 3 μsec. and a recurrence frequency of 10,125 c/s—the same as the line frequency. These pulses are all of constant amplitude, but their duration varies, within the limits of 1 μsec. to 5 μsec., in accordance with the amplitude of the sound signal at the instant of their occurrence.

The pulse amplitude is greater than the maximum video amplitude, and if the former is taken as 100 per cent. of the RF carrier, the maximum video amplitude corresponding to a peak " white "



This diagram shows how a width-modulated pulse carrying the sound programme is inserted within the line sync pulse.

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signal is about 75 per cent. The waveform is shown in the figure where (*a*) shows one cycle of the audio wave and (*b*) illustrates a few lines of the complete television signal. The video signal and line sync pulses are clearly seen, and within the latter are the large-amplitude pulses conveying the sound signal.

Separation of the sound signal in the receiver is accomplished by a simple limiter which passes only signals of greater amplitude than the level corresponding to peak white. It thus provides an output only on the sound pulses of greater amplitude, and this separated waveform is shown at (*c*).

The sound causes no interference with the vision signal because it is non-existent during the scan time. It occurs during the fly-back, and it is necessary only to ensure that the scanning spot is completely blacked out during this time to avoid any trace of the sound signal on the picture.

This entails some slight complication in the receiver, for the sync pulse itself is usually employed to suppress the spot during the fly-back. It will no longer do this because of the sound pulse within it, but other methods of blacking out the spot are not hard to find.

The advantages of the system are obvious. Applied to a system such as that used before the war it would reduce the frequency band from 6 Mc/s to 5 Mc/s, since, as there is no separate sound transmitter, the 1 Mc/s guard band between the two is abolished also. This eases the design of the receiving aerial.

There is an obvious saving in the transmitter, since no separate sound transmitter is required and there is also a saving in the receiver. This is not quite so obvious, for many sets had several valves common to both sound and vision. The chief saving comes about through the easier separation of the sound and vision signals. With separate transmitters this must be effected by tuned circuits, and it is not always easy to secure adequate selectivity. With the new system only a simple limiter is needed. A further advantage is that with the pulse system ignition interference on sound should be less. The large amplitude sound pulses also provide an easy way of obtaining automatic gain control.

The sound frequency response obtainable is, of course, limited by the recurrence frequency of the pulses and this in turn is fixed by the number of lines in the picture. Sound and picture quality thus becomes intimately tied together. With the 10,125-c/s pulse frequency set by a 405-line picture, the sound frequency limit is about 5,000 c/s and in practice would probably be somewhat less. The system is, therefore, one which lends itself better to very high definition television. With a 1,000-line 25-frame system, for instance, the pulse recurrence frequency would be 25 kc/s and there should then be no difficulty in obtaining high quality sound with a response up to 10,000 c/s.

The system was demonstrated using a local transmitter and gave exceedingly good results. Picture and sound were normal and free from mutual interference. The sound quality was of the standard reached in ordinary broadcasting and it was impossible to tell by looking or listening that sound and vision were on a common carrier.

The principle of inserting pulses within the time allocated to sync pulses is one which can be carried further. It would, for instance, be quite possible to insert two pulses in each line pulse and so obtain two independent sound channels which could be used to give binaurial sound. Such pulses could also be used for conveying some of the additional information required in colour television.