July 5, 1949. M. ARDITI ET AL 2,474,810

MULTICHANNEL CYCLOPHON

Filed March 22, 1947

Fig. 1.

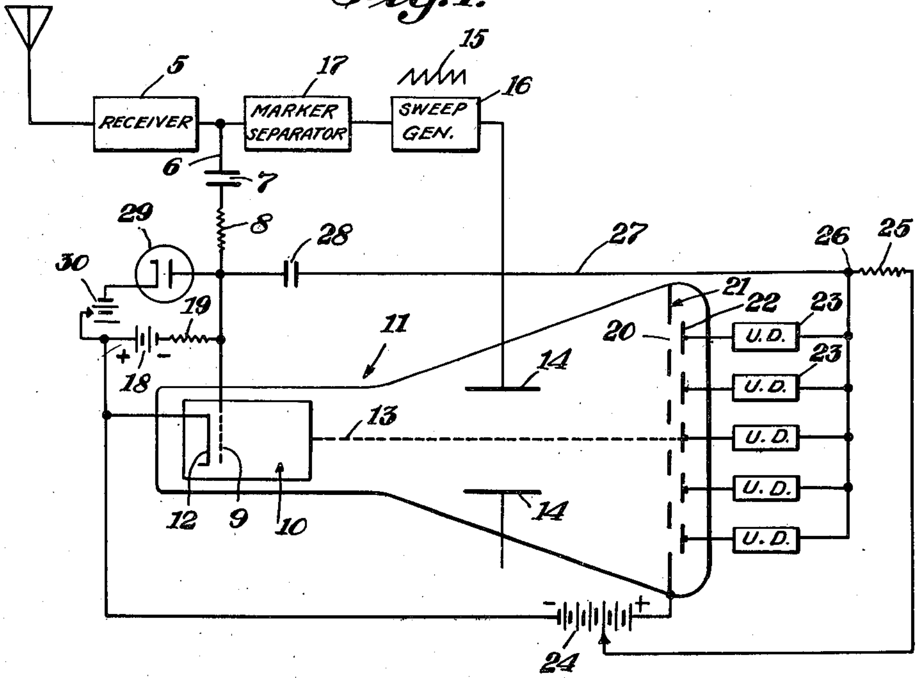


Fig. 2.

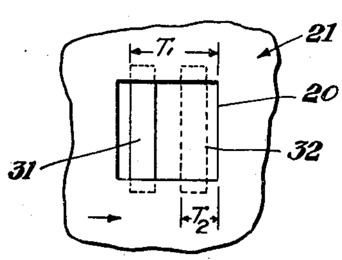
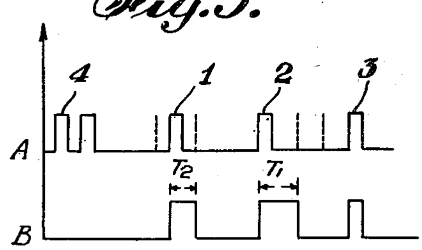


Fig. 3.



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MULTICHANNEL CYCLOPHON

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4 Claims. (Cl. 177—353)

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This invention relates to demodulators and distributors for time displaced multi-channel pulses, and particularly to a system using a single cathode ray tube to demodulate the pulses and distribute them.

In the copending application, M. Arditi-J. Feinstein, for "Demodulator," Serial No. 701,437, filed October 5, 1946, there is described a demodulator using a single cathode ray tube which is also used to select one of a plurality of channels of time displaced pulses. Where a plurality of channels are to be selected, it becomes necessary, in said system, to utilize a plurality of cathode ray tubes.

In the system of said application, time displaced pulses are translated into pulses of variable width by providing voltages for cyclically deflecting a beam over a secondary emitting target element and having the beam turned on by the incoming pulses. Depending on the time displacement of the incoming pulses, the beam initially strikes different portions of the target element. Thereafter, as the beam is swept over the rest of the target element, it is maintained turned on by means of a feed-back voltage developed between the target element and the collector element until the beam is swept off the target element whereupon the feed-back ceases and the beam is turned off. The variable width output pulses thus produced may be integrated to produce amplitude-modulated energy.

An object of the present invention is the provision of an improved demodulator and distributor system for multi-channel time displaced pulses in which a single cathode ray tube is used to distribute and demodulate the pulses belonging to a number of channels.

Another object is the provision of a demodulation and distributor system of the type described in the foregoing paragraph in which use is made of the translating arrangement hereinabove mentioned in connection with the copending application.

The above mentioned and other features and objects of this invention will become more apparent and the invention itself, though not necessarily defined by said features and objects, will be best understood by reference to the following description of an embodiment of the invention taken in connection with the accompanying drawings, wherein:

Fig. 1 is a schematic and block diagram of a demodulator and distributor system indicating its arrangement in a multiplex receiver;

Fig. 2 is a schematic view of an aperture and the impingement of the beam thereon; and

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Fig. 3 is a set of curves used in explaining the operation of the system of Fig. 1.

The present invention is herein described in relation to a multiplex time displaced pulse communication system of the type having recurrent series of pulses such as for example, the series shown in curve A, Fig. 3, each series including a plurality of signal pulses as for example, pulses 1, 2, 3, etc. following a marker signal 4, which latter may consist for example, of a pair of pulses having a different spacing from each other than the signal pulses. The successive signal pulses of a series each form part of a different channel. Thus for example, pulses 1, 2 and 3 are each part of a different channel. The signal pulses are time displaced with relation to their position following the marker signal, with pulse 1 being represented in its unmodulated position, and the vertical dotted lines on either side thereof indicating the limits of its modulation, while pulse 2 is represented at one extreme of modulation and pulse 3 at the other extreme. These pulses which may be transmitted via any suitable transmission medium, may be received on a receiver 5 in which they may, for example, be amplified and have their carrier frequency removed. The output pulses are fed over a line 6 through a blocking condenser 7 and resistor 8 to the control element or control grid 9 of an electron gun 10 in a cathode ray tube 11. The gun 10 also includes a cathode 12. The system is arranged so that the output pulses from receiver 5 are used to turn on the beam. The beam 13 is deflected by any suitable means, such as, for example, a pair of electrostatic deflecting plates 14, to which sweep voltages 15 are applied from a sweep voltage wave generator 16. To synchronize the deflection of the beam with the marker signal 4, a marker separator 17 may be also coupled to the output of the receiver 5 and serve to separate the marker signal. The output of marker separator 17 is then used to trigger or control the sweep generator 16 and thereby produce synchronization.

The grid 9 is preferably normally biased to cut-off as for example, by means of a source of D. C. potential 18 in series with a resistor 19 applied between the cathode 12 and grid 9. The pulses delivered across line 6 and applied to the grid 9 are, however, sufficient to overcome this bias and cause the beam to be turned on.

As the beam is deflected, it passes, providing the beam is turned on, through the apertures 20, in an aperture plate 21, which plate also serves as a collector for the secondary electrons emitted by the secondary electron emitting target elements

22 which are mounted behind the apertures 20 to be struck by the beam as it is directed into the apertures. A separate target element is provided for each channel, each of the target elements being connected in series with the input of a separate utilization device 23 which may be for example, a loud-speaker, amplifier, etc. The aperture plate 21 is at a higher positive potential than the target elements 22, as represented in Fig. 1, in which the highest positive point of the source of D. C. potential 24 is connected to the aperture plate 21, with an intermediate positive point connected through a resistor 25 in series with the inputs of the various utilization devices 23 to the target elements 22.

Each time the beam hits any of the target elements, producing a flow of secondary electrons between that target element and the aperture plate, current will flow through resistor 25, producing a voltage drop thereacross with the potential of end 26 rising in a positive direction. End 26 is coupled by means of a line 27, and a blocking condenser 28, back to the grid 9 and this positive potential causes an increase of the current in the primary beam until a point of equilibrium is reached. The beam continues at this level even though the pulse, which initially turned on the beam, has ceased, until the beam is finally deflected off the target element when the current flow across resistor 25, falls with extreme rapidity.

In order to regulate the maximum current in the beam, use may be made of means such as for example, a diode 29, in series with an adjustable source of bucking potential 30, which elements are arranged in parallel between the grid 9 and the cathode 12, being likewise parallel with the line consisting of resistor 19 and source of potential 18. By varying the amount of the value of the bucking voltage 30, the potential drop between resistor and cathode may be limited to the maximum level desired, and thereby limit the maximum beam current.

The system operates as a distributor, inasmuch as the pulses belonging to the different channels are applied to different target elements which have separate utilization devices, each forming part of a separate channel. The system operates as a demodulator in a manner that may be readily understood in connection with the following description referring to Fig. 2. The beam is turned on by the incoming signal pulse applied to grid 9. Depending on the time of arrival of the pulse, that is its time displacement, the time when the beam is turned on will vary. Thus the beam will initially strike the target element at any one of a number of points. The beam will continue to remain on until it has been deflected all the way across the aperture from the initial point of impingement to the end of the aperture. This would require a given length of time and the output pulse applied to the utilization device 23 would have a width or duration equal to said time. For example, designating the interval required to move the beam from its position at 31, Fig. 2, to the end of the aperture as T_1, and assuming that it is pulse 2 which causes the beam to flash on in the position 31, the output pulse obtained will have a duration or width determined by the time required to move the beam from its position at 21 until it has passed out of the aperture 20. Pulse 2 is at one extreme of time displacement. Assuming on the other hand, that a pulse having another modulation, as for example, pulse 1, which is in the center of its modulation

limits, such a pulse might turn the beam on in the position indicated in dotted lines at 32. Due to the feedback voltage to the grid, the beam will remain on until it has passed the rest of the aperture and the duration of the output voltage produced, will occupy a time T_2. Thus the corresponding output pulse fed to the utilization device 23, would have a width corresponding to T_2, as indicated in curve B, Fig. 3.

From the foregoing it will be seen that the output pulses will vary in width according to the time displacement of the signal pulses. These output pulses may be integrated in any suitable integrating device which may form part of each of the utilization devices 23.

While we have described above the principles of our invention in connection with specific apparatus, it is to be clearly understood that this description is made only by way of example and not as a limitation on the scope of our invention.

We claim:

1. A cathode ray tube system for translating and distributing multi-channel time displaced pulses comprising, a cathode ray tube having beam forming means, a plurality of target elements, means for deflecting said beam over the target elements successively, means responsive to each of the incoming pulses for turning on the beam so that the beam strikes different positions of the target element associated with its channel depending on the time displacement of the pulse turning on the beam, means responsive to the impingement of the beam on a target element for maintaining the beam turned on until the beam has been deflected past said target element, whereby pulses of variable width are produced at the output of the utilization devices, and a plurality of target elements each having their inputs coupled to the output of a separate one of the target elements.

2. A cathode ray tube system according to claim 1, further including means for coupling one end of the input of said utilization devices to a separate one of said target elements, and means for coupling the other ends of said inputs together and to the beam forming means to feed back voltages to said beam forming means to maintain it in operation while the beam is impinging upon the target.

3. A cathode ray tube system according to claim 1 wherein said target elements are secondary electron emitting electrodes, and further including a collector for collecting said secondary electrons.

4. A cathode ray tube system according to claim 1 wherein said target elements are secondary electron emitting elements, and further including a single collector electrode for collecting the secondary electrons, a source of potential, means including a resistor coupling said target elements to one point on said source, means coupling a higher point of potential of said source to said collector, and means for feeding the potentials developed across said resistor upon impingement of the beam on any one of the target elements, back to the beam forming means, to maintain the beam forming means in operation until the beam moves away from a target element.

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