Dec. 9, 1941. W. A. BEATTY 2,265,337

PULSE GENERATING AND PULSE MODULATING SYSTEM

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Fig. 1.

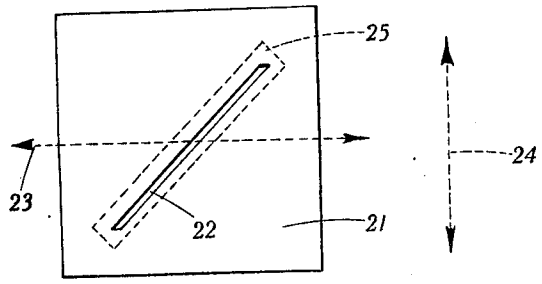
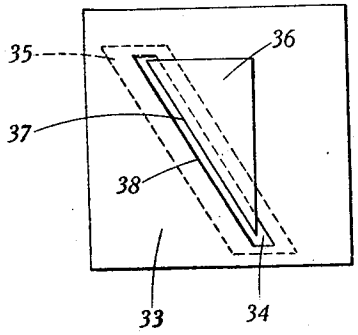


Fig. 3.



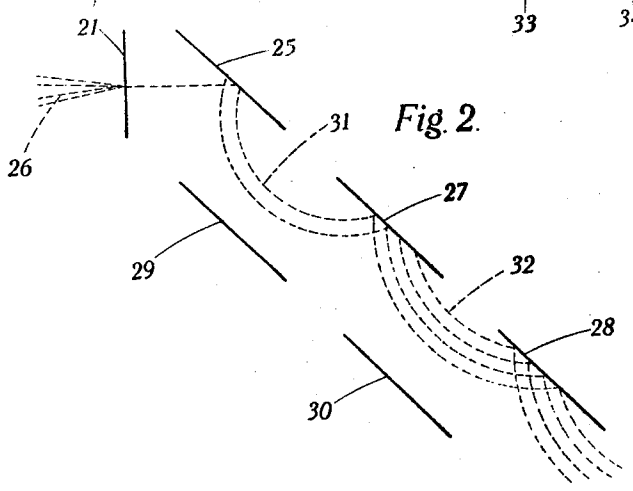


Fig. 2.

Inventor
W. A. Beatty
by R. C. Hopgood
Attorney

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Fig. 4.

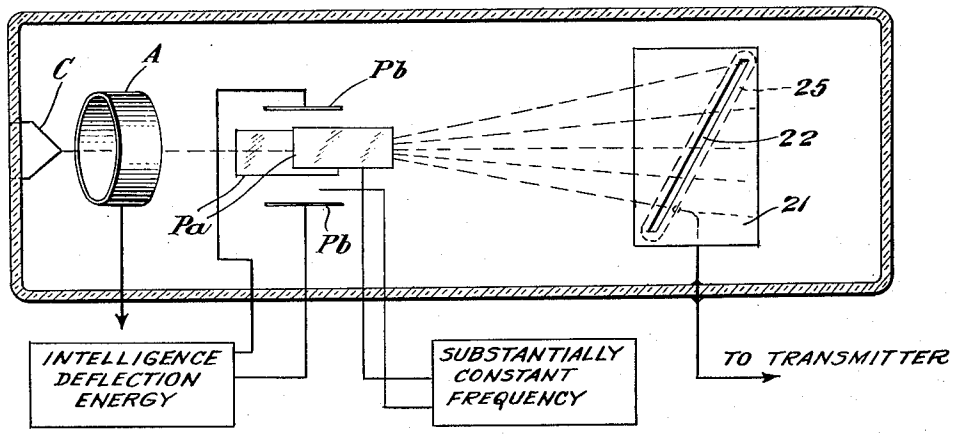
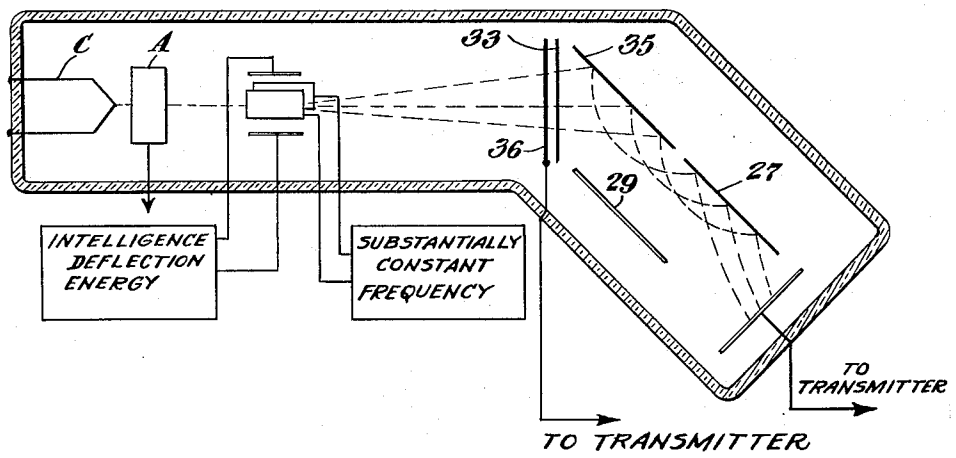


Fig. 5.



Inventor.

W. A. Beatty

By Paul R Adams

Attorney

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UNITED STATES PATENT OFFICE

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PULSE GENERATING AND PULSE MODULATING SYSTEM

William Arnold Beatty, Sidcup, England, assignor to International Standard Electric Corporation, New York, N. Y.

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In Great Britain May 24, 1939

4 Claims. (Cl. 179—171.5)

In the pending U. S. Patent applications Serial Nos. 313,041, filed January 9, 1940, Patent No. 2,256,336, September 16, 1941 and 312,645, filed January 6, 1940 there are described various types of pulses used for methods for pulse modulation. The present invention comprises novel methods of generating pulses having characteristics similar to those described in the above mentioned patent applications, which methods are modifications of or improvements over the methods already described.

In said prior patent applications identification codes have been given to various types of pulses and the same pulse identification codes will be utilised throughout this specification. These two patent applications deal with methods of pulse generation in which an electron beam is deflected repeatedly across a target under the control of a wave of constant form and is deflected transversely under the control of a sound or like wave, a feature of these proposals being that the target plates are so shaped that the desired pulses are obtained.

It is an object of the invention to provide improved means for the generation of impulses for time-modulated impulse transmission.

Another object is to provide improved means for time-modulating impulses in an impulse transmission system.

A further object is to provide relatively simple, compact, and efficient means for generating impulses and for time-modulating the same in accordance with an intelligence signal.

It is also an object to provide improved means for producing relatively high-power time-modulated impulses in an impulse transmitting system.

Another object resides in the provision of improved means for generating and modulating impulses of complex configurations.

Other objects and various further features of novelty and invention will hereinafter be pointed out or will become apparent from a reading of the following specification taken in conjunction with the drawings included herewith. In said drawings

Fig. 1 shows schematically in front view an electrode arrangement for the generation of one form of impulse in accordance with the invention;

Fig. 2 shows schematically in side elevation an electrode structure for the generation of higher power impulses in accordance with the invention; and

Fig. 3 shows an arrangement for the generation of pulses of complex configuration in accordance with the invention.

Figure 4 shows a transmitter tube construction embodying the anode arrangement shown in Figure 1; and

Figure 5 shows a transmitter tube construction embodying the anode arrangement shown in Figure 3.

Figure 4 shows a transmitter tube embodying the anode arrangement shown in Figure 1. The electron beam is produced by the usual cathode C and the accelerating and concentrating electrode A and passes between two sets of deflecting plates P*a* and P*b*. The beam is deflected horizontally at a high frequency by supplying a substantially constant frequency voltage to the plates P*a*, and the beam is shifted vertically by applying to the plates P*b* a variable potential derived from a suitable source S*b* such as a modulating wave or other intelligence signals. The horizontal deflection of the beam produces periodic pulses of uniform shape and amplitude in the output circuit connected to an anode **25**, and deflection of the beam in a vertical direction by means of the intelligence signal causes a shift in the phase of the uniform pulses produced by the horizontal deflection.

In accordance with features of this invention, it is now proposed that the target be placed behind an apertured screen, the shape of the aperture determining the form of the pulse. Thus pulses similar to those described in the above-mentioned patent application No. 313,041 can be generated by scanning a plate which has a slit or aperture. The electrons passing through the slit or aperture are collected on a target or collector anode which is located behind the plate having the said slit or aperture, thus making the duration and time of occurrence of pulses dependent upon the shape of the slit or aperture. In order to obtain a higher impulse output from such an electron discharge structure the collector anode may be arranged as the first secondary emitting anode of an electron multiplier.

In accordance with further features of the invention it is proposed that pulses derived from a target located behind an apertured screen be combined with pulses derived from the apertured screen. Thus complex pulses having two amplitudes, such as those coded as RT+S/RT (Rectangular trailing edge fixed + double pulse rectangular trailing edge suppressed) or RL+S/RL (Rectangular leading edge fixed + double pulse rectangular leading edge suppressed), may be generated by a combination of the above-indicated method employing a slit or aperture and the former method employing a shaped target plate.

Referring to Fig. 1, there is shown a plate **21** with a relatively narrow slit **22** of substantially uniform width. The plate **21** is preferably located in the path of an electron beam and so arranged that the slit **22** extends at some angle other than a right angle with the axis of a pair of deflection plates for deflecting the beam. The

disposition of slit 22 may thus be in a manner similar to that already described in connection with Fig. 8 of the above-mentioned patent application No. 313,041, the electron beam being linearly deflected across the plate 21 in directions indicated generally by arrows 23. Deflection in directions indicated generally by arrows 24, preferably at right angles to the directions 23, may be controlled by a signal characteristic of a sound or like wave.

Electrons from the beam pass through the slit 22 and are collected on a collector plate 25 located behind the plate 21, the plate 25 being shown by dotted lines and being of such dimensions that it completely covers the slit 22.

It can be seen that when utilizing methods similar to those already described pulse signals can now be taken from the collector plate 25, and that these pulses have characteristics similar to those derived from the target plate 41, shown in the said Fig. 8.

If desired the plate 25 can be made the first secondary emitting anode of an electron multiplier. One such arrangement is partially illustrated by means of Fig. 2. An electron beam 26 strikes the plate 21, and as already described electrons pass through the slit 23 and strike the plate 25 which in the preferred form shown is located at an angle of 45° with reference to plate 21. The plate 25 comprises the first secondary emitting anode of an electron multiplier arrangement which follows. Further secondary emitting anodes 27 and 28 and deflector plates 29 and 30 are also shown. The external envelope, voltage supplies and magnetic field required for the deflection of the secondary beams 31 and 32, and output anodes are not shown as these arrangements are well known. It can be seen that with this latter arrangement pulses of large amplitudes can be obtained.

A further embodiment of the proposal is to employ an electron multiplier arrangement combined with a target plate in such a manner that there are generated RT+S/RT or RL+S/RL pulses, that is, pulses of forms which may be described as rectangular trailing edge fixed plus double pulse rectangular trailing edge suppressed, or as rectangular leading edge fixed plus double pulse rectangular leading edge suppressed, respectively, as will be clear.

Referring to Fig. 3, a plate 33 with slit 34 has a collector plate 35 shown by dotted lines of such a size that it covers the slit 34 located behind the plate 33. A further triangular plate 36 is located in front of the plate 33, the edge 37 of the plate 36 running parallel to the edge 38 of the slit 34 and partially obscuring the said slit. The plate 35 can comprise the first secondary emitting anode of an electron multiplier system as shown and described having reference to Fig. 2 of the drawings accompanying this specification, and such an arrangement is illustrated in Figure 5. The various elements in this Figure 1 corresponding to elements having the same function in Figures 1 to 4 are indicated by the same reference numerals.

Using scanning methods as previously described, it can be seen that electrons passing through the slit 34 give pulses of relatively large amplitude at the output of the electron multiplier, while pulses of smaller amplitude are derived from the plate 36. These pulses can now be combined in any known manner giving an RT+S/RT type of pulse.

It can be seen from the foregoing description that this method can be utilised for the generation of any combination of pulses having different amplitudes, but having definite time relationships, such as pulses used for television synchronising.

It should be understood throughout the foregoing description that any or all the collector and screening plates are suitably insulated from one another, such insulation requirements and methods being well known to those skilled in the art.

What is claimed is:

1. An electron discharge device for generating time-modulated impulses, said device including a source of electrons supplying a beam of electrons, at least two pairs of deflection plates in the path of said beam, and a target electrode, said target electrode comprising a plate member generally transversely disposed with respect to said beam, said plate member having a straight narrow aperture of substantially uniform width extending at an angle other than a right angle with respect to the deflecting axis of one of said pairs of deflection plates, a conductive member adjacent said plate member overlying said aperture on the side of said plate remote from said source of electrons, and an output connection from said conductive member, a source of high frequency current for energizing one pair of deflecting plates to cause said beam to repeatedly traverse said aperture along one deflection axis, thereby producing periodic uniform pulses in said output connection; and a source of lower frequency current for shifting said beam at right angles to said one axis to thereby shift the phase relation of said pulses.

2. An electron discharge device according to claim 1, in which said conductive surface is adapted for secondary emission, and in which said output means includes electron multiplier means, whereby the magnitude of current obtained by said conductive surface intercepting said beam is increased.

3. An electron discharge device for generating complex time-modulated impulses including means for generating an electron beam, deflection means in the path of said beam for deflecting said beam in a two-coordinate system, a conductive surface disposed to intercept deflected electrons from said beam, output means associated with said conductive surface, a masking plate supported in front of said conductive surface and having a narrow aperture of uniform width formed therein and extending diagonally with respect to the axes of said deflecting system, a second conductive surface insulatingly supported in front of said masking plate and having a straight edge arranged adjacent to and parallel with said narrow aperture in said masking plate and having two additional edges arranged parallel to the deflecting axes of said deflecting system, respectively, and an output connection to said second conductive surface.

4. An electron discharge device according to claim 3, in which one of said conductive surfaces is adapted for secondary emission, and in which the output means associated with one of said conductive surfaces includes electron multiplier means, whereby the magnitude of current obtained by said one of said surfaces intercepting said beam is increased to a value greater than the magnitude of current obtained in the other of said output means.

WILLIAM ARNOLD BEATTY.