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C. J. FITCH

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SIGNALING SYSTEM

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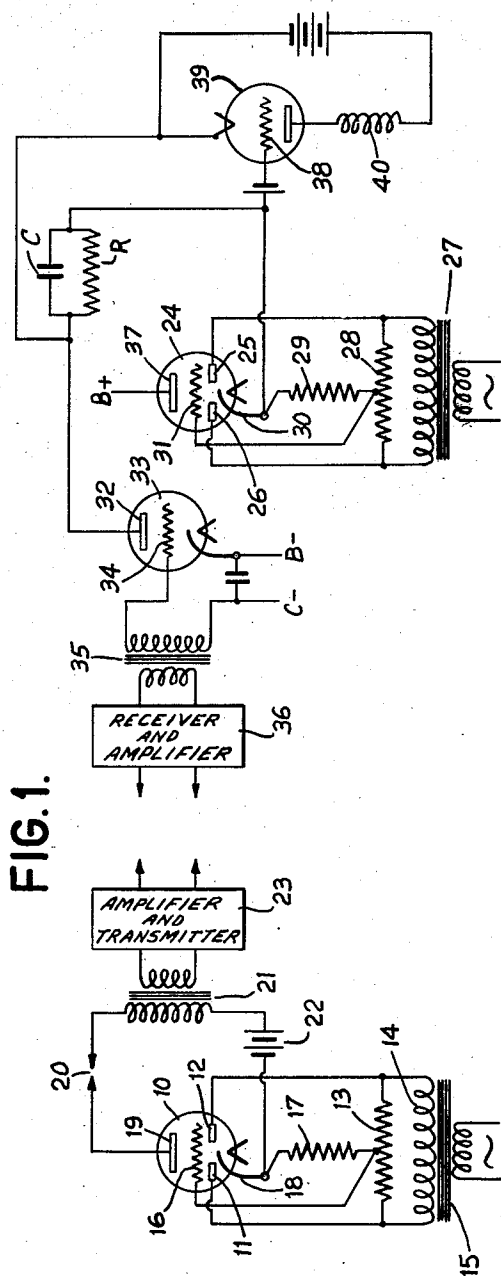


FIG. 1.

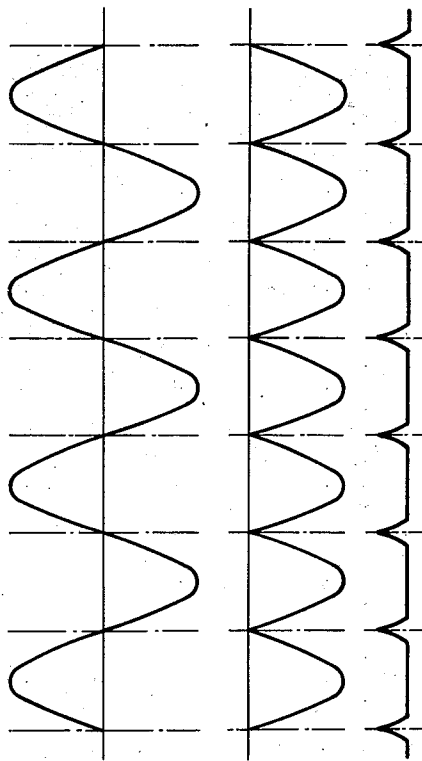


FIG. 2.

FIG. 3.

FIG. 4.

INVENTOR  
Clyde J. Fitch  
W. M. Wilson  
ATTORNEY

## UNITED STATES PATENT OFFICE

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## SIGNALING SYSTEM

Clyde J. Fitch, Endicott, N. Y., assignor to International Business Machines Corporation, New York, N. Y., a corporation of New York

Original application December 7, 1934, Serial No. 756,443, now Patent No. 2,153,178, dated April 4, 1939. Divided and this application December 21, 1937, Serial No. 180,968

## 5 Claims. (Cl. 178-67)

This invention relates broadly to signaling systems and more particularly to an electronic impulse generating and selecting system, and is a division of the co-pending application Serial No. 756,443, filed December 7, 1934, now Patent No. 2,153,178, granted April 4, 1939.

An object of the present invention is to provide a signaling system utilizing timed signals comprising entirely electronic control means and associated circuits to initiate and receive the control signals.

Another object is to provide a system in which a predetermined number of timed signals are initiated and a receiver adjusted to be operated only when the said predetermined number of signals are received.

Another object is to provide a synchronously operated system without utilizing mechanical mechanisms thus providing a system embodying static elements having less inertia.

Further objects of the instant invention reside in any novel feature of construction or operation or novel combination of parts present in the embodiment of the invention described and shown in the accompanying drawing whether within or without the scope of the appended claims and irrespective of other specific statements as to the scope of the invention contained herein.

The present invention is shown and described in the said co-pending application in conjunction with a printing telegraph system; however, it is obvious to those skilled in the art that this invention is not limited solely to application in such systems. For example, the circuit arrangement shown per se in the present application may be used to control the operation of any number of indicating devices utilizing individual control impulses or a series of timed control impulses.

In the drawing:

Fig. 1 shows diagrammatically a preferred arrangement of the electronic impulse generating and selecting system.

Figs. 2 to 4 show graphic representations of the different wave forms existing in different sections of the circuit arrangement.

Referring now to Fig. 1, the signal generator is shown in one form to comprise an electric discharge device 10 comprising the combination of a full wave rectifier and triode in one envelope and is a type known in the art as a duplex diode triode type. The diode plates 11 and 12 are joined to the terminals of a resistance 13 which is connected in shunt relationship with the secondary winding 14 of transformer 15. The center

tap of the said resistance is connected to the grid element 16 of the tube and is also connected to a second resistance 17 inserted between the said center tap and the cathode element 18. The triode plate 19 is connected to a set of control elements such as contacts 20 which are included in a circuit comprising the primary winding of transformer 21 and battery 22 connected to the said cathode element. The secondary winding of the transformer 21 is associated with any desirable type of transmitting device known in the art or may be connected directly to the transmission medium whenever it is suitable to do so.

It is evident from the description of the circuit connections just set forth that normally the grid element 16 of the tube is at zero bias, due to the fact that no current is passing through the resistance 17; therefore, upon closure of the contacts 20 current flow will be established in the triode plate circuit as follows: from the positive terminal of battery 22 through the primary winding of transformer 21, contacts 20, anode 19 and cathode 18 of the tube to the negative terminal of the said battery. However, the condition just described exists in the said circuit for only a comparatively short time, because the bias on the grid 16 is not a constant factor but varies in a timed relationship with the frequency of the A. C. supply source. The said supply is impressed upon the full wave rectifier and, therefore, the rectified voltage impressed on the resistance 17 immediately drives the grid bias negative with respect to the cathode which is of sufficient value to prevent further flow of plate current in the triode output circuit, but as mentioned before the grid bias becomes effective to reduce the plate current to substantially zero value, a pulse is impressed upon the output circuit of the triode in which the transformer 21 is included so that a control pulse or signal is impressed either directly or indirectly by means of well known transmitting means 23 on the transmission medium. If the contacts 20 are maintained in an operated condition for a number of complete cycles of the current supply source, a control pulse is initiated automatically each time the current value of the rectified supply passes through zero, thus initiating a series of equally spaced and timed control impulses. By referring to the graphic representations in Figs. 2 to 4 the voltage conditions in the various sections of the circuit are shown; Fig. 2 shows the alternating voltage supply wave forms impressed on the diode plates; Fig. 3 shows the rectified voltage wave forms impressed on the resistance 17;

and Fig. 4 shows the series of short equally spaced and accurately timed pulses or control signals impressed on the triode output circuit.

The circuit just described has shown one method of converting a single phase sinusoidal wave into a series of short impulses having non-sinusoidal wave forms, all of which are similar, and that in the said circuit two impulses are initiated for each complete cycle of the alternating voltage supply.

The signal receiving means comprises in part an electric discharge device 24 similar to the device 10 described hereinabove, and similar associated control circuits so as to control the operation or conductivity thereof similarly as described in respect with the device 10. The diode plates 25 and 26 are connected to the secondary winding of transformer 27 and the shunt connected resistance 28. The primary winding of the transformer 27 is connected to an A. C. supply source which is in synchronism with the supply source connected to the primary winding of transformer 15. Thus, the said supply is impressed on diode plates 25 and 26 exactly in synchronism with the A. C. supply impressed on plates 11 and 12. A resistance 29 is connected from the cathode element 30 to the center tap of resistance 28 and the grid element 31 is also connected to the said center tap, so that the rectified supply is impressed on the resistance 29 to condition the grid element 31 periodically to render the tube 24 conductive similarly as described hereinabove.

It is evident that the grid bias of tube 24 varies similarly as the grid bias of tube 10 and in exactly the same time relationship; that is, when the grid bias of tube 24 is practically zero, this exact condition is present in tube 10. Thus, it is seen that the grids of tubes 10 and 24 are conditioned in synchronism to render the respective tubes conductive (when the grid bias approaches zero value) and that the bias on the said grids at all other times are of such value as to control the conductivity of the tubes so as to suppress the flow of current in the associated output circuits. A condenser C and resistance R are included in the output circuit of the electric discharge device 24, and are connected to the cathode element 30 of tube 24 and the anode element 32 of the tube 33. The grid element 34 of the last mentioned tube is connected to the secondary winding of transformer 35 and a source of supply to normally bias the tube 33 so that no current flows in its output circuit.

Now, let it be assumed that the contacts 20 are maintained in an operated position to initiate a series of short, equally spaced control signals which are received by any desired known type of receiving system 36 associated with the secondary winding of transformer 35 or which may be impressed directly on the said transformer in certain cases. The received signals are effective to reduce the bias on the grid element 34 of tube 33 and render this tube conductive at the particular intervals the signals are received. During the said intervals the control signals are received, it is understood that the grid element 31 is so conditioned as to permit current to flow in the output circuit of tube 24, for it was described how the tube 24 is rendered conductive at the same intervals the tube 10 is conditioned to initiate the control signals. A circuit is now established momentarily from the negative potential supply associated with the cathode element of tube 33, anode element 32 thereof, condenser C and resistance R to cathode and anode elements

30 and 37, respectively, to a positive potential supply associated with said anode element. Energization of the described circuit charges condenser C and the resulting voltage drop across the resistance R is effective to reduce the bias on the associated grid element 38 of tube 39 permitting current to flow in its output circuit including the control device 40 such as a relay or solenoid device or any other desired element, thereby controlling the operation of the device by virtue of the current flow established in the said output circuit. The values of C and R may be adjusted to control the operation of the tube 39 in different ways, namely, the said elements may be of such values that the reception of the first signal of the series transmitted on a single signal impulse is effective to charge the condenser sufficiently and effect a voltage drop across the resistance to render the tube 39 conductive immediately to activate the associated control device and be maintained charged sufficiently by the following impulses or signals to maintain the bias on the grid element 38 reduced sufficiently to allow a virtually steady current to flow in the output circuit of tube 39; or the values of the condenser and resistance may be so adjusted, for example, that a predetermined number of signal impulses are necessary to be received to charge sufficiently the condenser C to render the tube 39 conductive. It is evident that such changes in values of the control elements described to effect operation of the electric discharge devices in a predetermined manner are encompassed in the scope of the present invention.

It has now been shown how the control or grid elements of two remotely situated electric discharge devices are conditioned or controlled in exact time relationship by certain voltage conditions of a synchronous alternating voltage supply to control the conductivity of the said devices when the conditions of the said supply attain predetermined values so as to initiate automatically control signals, either singly or in a series which are equally spaced and timed with respect to each other, to render the other said device effective to control the operation of an associated control element or device. It has been shown that a single signal impulse is effective to render the controlled element operative or that a series of predetermined timed signal impulses is necessary to render operative the said control element to control the element in a predetermined manner.

While there has been shown and described and pointed out the fundamental novel features of the invention as applied to a single modification, it will be understood that various omissions and substitutions and changes in the form and details of the device illustrated and in its operation may be made by those skilled in the art without departing from the spirit of the invention. It is the intention therefore to be limited only as indicated by the scope of the following claims.

What is claimed is:

1. A system of the character described comprising a signal transmitting and receiving station, electric discharge means and a source of sinusoidally varying voltage at each station, individual means for impressing the voltage at each station upon the electric discharge means thereat, means associated with each electric discharge means to condition them in timed relationship when the voltages are impressed thereupon so that each discharge means can be ren-

dered conductive only at such timed intervals when the voltage attains a predetermined potential during each positive and negative period of each cycle, means at the transmitting station to render the discharge means thereat conductive at the said timed intervals to initiate control signals, means for impressing the signals upon the discharge means at the receiving station to render it conductive, and control means at the receiving station controlled by the last-mentioned discharge means whenever it is rendered conductive.

2. A system of the character described comprising a signal transmitting and receiving station, electric discharge means at each station, sources of sinusoidally varying voltages and individual means at each station to connect a voltage source to each discharge means, individual means to render the said discharge means at each station conductive only at such timed intervals when the voltage attains a predetermined potential during each positive and negative period of each cycle, and means for transmitting and receiving signal impulses respectively at said transmitting and receiving stations whenever the said discharge means are rendered conductive.

3. A system of the character described in claim 2 wherein each of the said electric discharge means is provided with a control grid element and means for varying the bias on said element in timed relationship with the said varying voltage which is impressed on the discharge means for controlling the conductivity thereof.

4. A system of the character described having a signal transmitting and receiving station, individual means at the said stations for controlling the initiating and receiving of signal impulses respectively comprising a source of sinusoidally varying voltage, means for rectifying the voltage supply, an electric discharge device having a grid and anode circuit, means for varying the bias impressed on the grid circuit in timed relationship with the said rectified voltage for rendering the device conductive each time the rectified voltage passes through zero, and control means, included in the anode circuit, energized each time the device is rendered conductive.

5. A system of the character described comprising a signal transmitting and receiving station, electric discharge means and a source of sinusoidally varying voltage at each station, individual means for impressing the voltage at each station upon the electric discharge means thereat, means associated with each electric discharge means to condition them in timed relationship when the voltages are impressed thereupon so that each discharge means can be rendered conductive only at such timed intervals when the voltage attains a predetermined potential each positive and negative period of each cycle, means at the transmitting station to render the discharge means thereat conductive at the said timed intervals to initiate a series of timed control impulses, means for impressing the impulses upon the discharge means at the receiving station for controlling the conductivity thereof including additional means to render the last-mentioned discharge means conductive only upon receipt of a predetermined number of impulses of the said series, and control means at the receiving station controlled by the said last-mentioned discharge means whenever it is rendered conductive.

CLYDE J. FITCH.