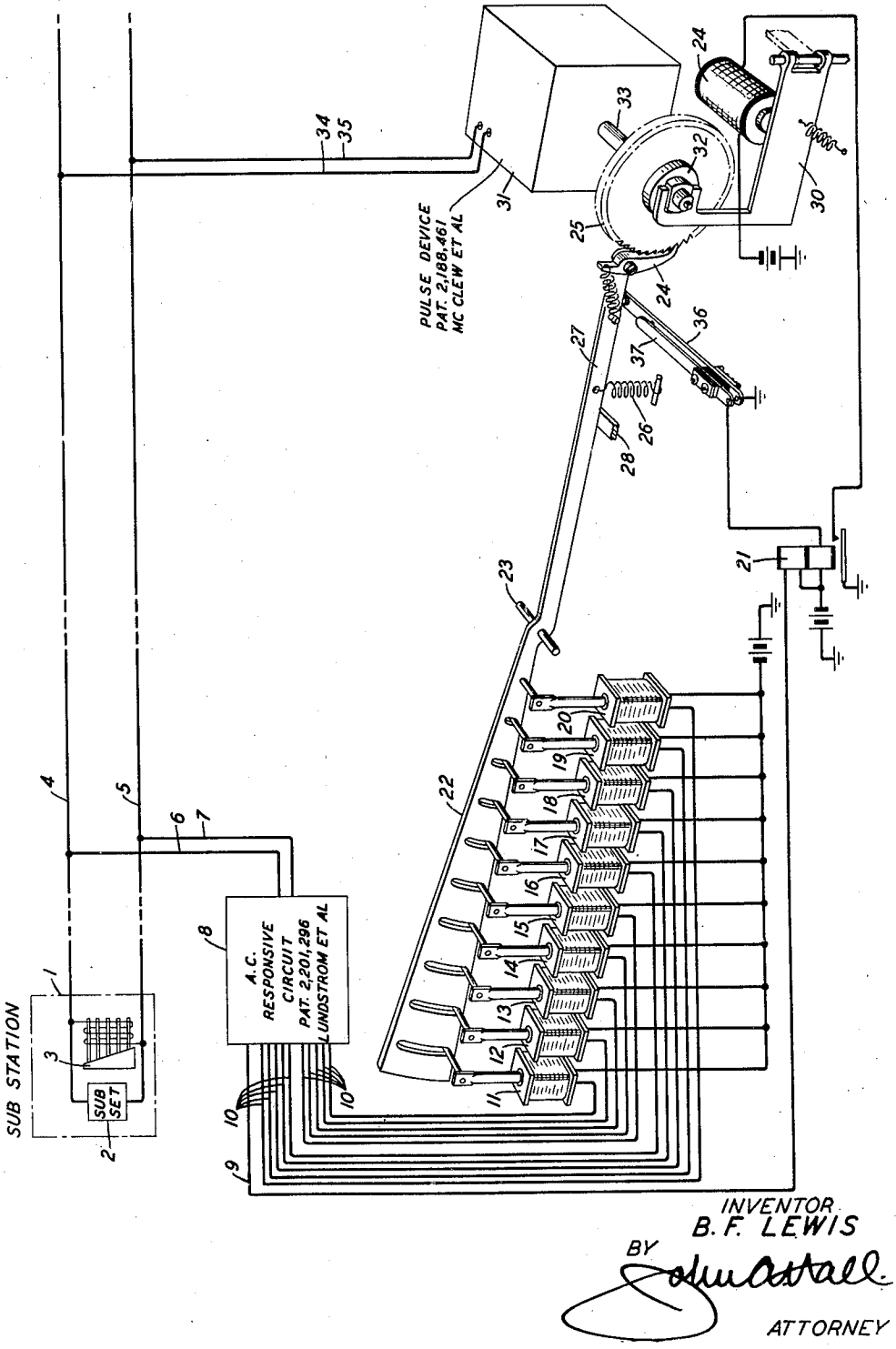
Aug. 17, 1943. B. F. LEWIS 2,327,275

SIGNALING SYSTEM

Filed Aug. 28, 1941



Patented Aug. 17, 1943

2,327,275

UNITED STATES PATENT OFFICE

2,327,275

SIGNALING SYSTEM

Benjamin F. Lewis, Bayside, N. Y., assignor to Bell Telephone Laboratories, Incorporated, New York, N. Y., a corporation of New York

Application August 28, 1941, Serial No. 408,597

5 Claims. (Cl. 179—16)

This invention relates to signaling systems and particularly to means for controling communication system switching devices.

For many years communication system switching devices have operated on a decimal basis in response to digital trains of pulses. Recently, in an effort to reduce the time consumed in transmitting signals from subscriber premises, a system based on permutation code signals has been developed. This system employs a subscriber controlled attenuating current generator comprising essentially a magnetic circuit interlinked with an electrical circuit with a plurality of reeds each of a different natural period of vibration and means to selectively pluck said reeds whereby the magnetic circuit is affected and alternating currents of correspondingly different frequencies are produced in said electrical circuit for transmission over the line. The time for sending the different digital impulses is thus very brief and uniform in every case. Thereby an improved system is produced in that the time consumed by the subscriber in dialing is greatly reduced.

As these new systems are installed there will of necessity be an interim period during which both the old and the new systems are in operation and translating devices will have to be employed—devices which will respond to the new substation apparatus for controlling the old type switching apparatus. Devices of this general nature have heretofore been devised but they have so far been of a complicated and expensive nature.

The object of the present invention is to provide a translator for this purpose of a simple and economical nature. Accordingly, a well-known mechanical pulse regenerator has been used as a basis for transmitting digital trains of pulses and has been modified by making it responsive to incoming signals in the form of coded alternating current signals.

A feature of the invention is a pawl and ratchet wheel combination in which the pawl may be moved over a variable number of teeth of the ratchet wheel in response to variable incoming signals of the coded attenuating current type, the variable number of teeth advanced corresponding to the variable length trains of pulses to be transmitted.

Another feature of the invention is a pawl and ratchet wheel combination in which the pawl is moved by a plurality of magnets, each said magnet moving it a distance corresponding to a different number of teeth of said ratchet wheel.

Other features will appear in the following description.

The drawing is a single sheet having a single figure showing the invention in schematic form. A telephone substation and line are shown in schematic circuit diagram, an alternating current responsive device is indicated, the mechanism embodying the novel features of the invention is shown in a perspective view also in schematic form and the pulse generating unit operated by the said mechanism is indicated by a box.

A telephone or other substation in a signaling system is indicated by the rectangle 1, and contains the two essential elements a substation set 2 for communication purposes and an alternating current generator 3 capable of sending out alternating currents of several different distinct frequencies. A pair of lines 4 and 5 extend to a distant point and by being broken at several points indicate length and the usual circuit arrangements employed in switching operations. A pair of wires 6 and 7 lead from the signaling channel provided by the wires 4 and 5 to an alternating current responsive device 8. This device is well known and operates to translate signals sent by the generator 3 into digital signals. Such a device is disclosed in Patent No. 2,201,296 granted May 21, 1940, to A. A. Lundstrom and E. L. Norton. The usual arrangement is to provide a generator 3 which will transmit five different frequencies and to operate this generator by a reed plucking mechanism by which ten different combinations of two different frequencies are simultaneously transmitted. These ten different signals will operate the device 8 to affect a common wire 9 and a selected one of the leads 10 as clearly shown in the above-noted Lundstrom et al. patent.

Upon the receipt of a signal transmitted from the station 1, therefore, the wire 9 will be grounded to operate the relay 21 and a selected one of the wires 10 will be grounded to operate a corresponding one of the solenoids 11 to 20 inclusive.

These solenoids operate on a lever arm 22, pivoted at 23 and provided with a pawl 24 at its opposite end. The pawl 24 cooperates with a ratchet wheel 25 and the arrangement is such that each solenoid will advance the pawl 24 over a different number of teeth of the ratchet wheel 25. If the solenoid 11 is operated then the pawl 24 will advance over only a single tooth of the wheel 25. If the solenoid 20 is operated then the pawl 24 will advance over 10 teeth of the ratchet wheel 25. The last digit of the number

indicating each of said solenoids indicates the number of teeth over which the said pawl will advance. Appropriate slots for the plungers of the different solenoids are formed in the vane 22 so that the other nine plungers will not be disturbed when the tenth is moved.

When the selectively energized solenoid is deenergized a spring 26 will move the lever arm 27 back to its normal position marked by a stop 28 and thereby rotate the ratchet wheel 25 a distance corresponding to the number of teeth over which the pawl 24 has been advanced.

The ratchet wheel 25, the marking or pin setting magnet 24, its armature 30 and the box 31 represent in schematic form a mechanical impulse repeater according to the disclosure in Patent No. 2,188,461, granted January 30, 1940, to John William McClew and Cecil Robert Woodland, which device is commonly known as the English type regenerator.

Generally stated, the operation of this device involves the steady operation of the marker or pin setting magnet 29 whereby a collar 32 on a shaft 33 is pushed in while the ratchet wheel 25 is being set. When the ratchet wheel 25 is fully set then the armature 30 is retracted, the collar 32 is released to its normal position and a selected pin in the device 31 is set after which the device operates to send out a train of pulses over the wires 34 and 35 corresponding in number to the distance the ratchet wheel 25 has been moved. Thus a signal is sent from the station 1 in the form of a combination of two selected frequencies of alternating current which is translated by the arrangement here disclosed into a corresponding digital train of direct current pulses.

Upon the operation of the generator 3, therefore, the conductor 9 is grounded, resulting in the operation of relay 21 whereupon the marker magnet 29 is operated. At the same time a selected one of the solenoids 11 to 20 is operated and the lever comprising the two arms 22 and 27 is rotated a corresponding distance in a counterclockwise direction. The off normal contacts 36 and 37 close to maintain the relay 21 operated. In a very short time, since the operation of the generator 3 is only transitory the ground connection to conductor 9 and the selected one of the conductors 10 is removed. The spring 25 returns the lever comprising the arms 22 and 27 to normal and thereby rotates the ratchet wheel 25 a predetermined distance. When such normal position has been reached the circuit through the off normal springs 36 and 37 is opened with the result that relay 21 and then magnet 29 are released, resulting in the setting of the device 31 which thereupon operates as fully described in the above-noted McClew et al patent.

The break in the conductors 4 and 5 between the point where the conductors 6 and 7 and the point where the conductors 34 and 35 represent the usual circuit arrangements for preventing interference between the incoming alternating current signals and the outgoing digital trains of direct current pulses.

What is claimed is:

1. In a signaling system a line, a signal transmitter at one end of said line, said transmitter comprising means to send digital signals the elements of each signal being transmitted simultaneously, signal controlled means at the other end of said line comprising means responsive to digital signals, each said signal comprising a train of sequentially arranged impulses, and a translator in said line for changing said first type of signals to corresponding numerical trains of impulses, said translator comprising a plurality of magnets each responsive to a different incoming signal, a pivoted bar, lost motion connections between said magnets and said bar whereby each said magnet may move said bar through a correspondingly different arc, a pawl controlled by said bar and a transmitter for sending trains of sequentially arranged impulses having a ratchet wheel controlled by said pawl.

2. In a signaling system, a line, a signal transmitter at one end of said line, said transmitter comprising an alternating current generator arranged to produce a plurality of different alternating current signals and means for operating said generator to transmit said signals in a permutation code, the elements of each said permutation code being simultaneously transmitted, step-by-step apparatus at the other end of said line responsive to numerical trains of direct current pulses sequentially transmitted and a translator in said lines responsive to said coded alternating current signals for changing said signals into corresponding numercial trains of direct current signals, said translator comprising a plurality of magnets each responsive to a different incoming signal, a pivoted bar, lost motion connections between said magnets and said bar whereby each said magnet may move said bar through a correspondingly different arc, a pawl controlled by said bar and a transmitter for sending trains of sequentially arranged impulses having a ratchet wheel controlled by said pawl.

3. In a signaling system, a line, a signal transmitter at one end of said line, said transmitter comprising an alternating current generator arranged to produce a plurality of different alternating current signals and means for operating said generator to transmit said signals in a permutation code, the elements of each said permutation code being simultaneously transmitted, step-by-step apparatus at the other end of said line responsive to numerical trains of direct current pulses sequentially transmitted and a translator in said lines responsive to said coded alternating current signals for changing said signals into corresponding numerical trains of direct current signals, said translator comprising a step-by-step device operated by a pawl and ratchet wheel and means responsive to different incoming coded alternating current signals for advancing said pawl in a single stroke over the said teeth of said ratchet wheel, a number of teeth corresponding to the number of pulses to be transmitted by said translator.

4. In a signaling system, a line, a signal transmitter at one end of said line, said transmitter comprising an alternating current generator arranged to produce a plurality of different alternating current signals and means for operating said generator to simultaneously transmit the elements of said signals in a permutation code, step-by-step apparatus at the other end of said line responsive to numerical trains of direct current pulses sequentially transmitted and a translator in said lines responsive to said coded alternating current signals for changing said signals into corresponding numerical trains of direct current signals, said translator comprising a step-by-step device operated by a pawl and ratchet wheel combination, a plurality of magnets for moving said pawl each said magnet advancing said pawl

in a single stroke a different number of teeth over said ratchet wheel and means responsive to said incoming coded alternating current signals for selectively operating said magnets.

5. A mechanical arrangement for translating simultaneously transmitted permutation coded alternating current signals into sequentially transmitted trains of direct current signals, comprising a plurality of magnets each responsive to a different incoming signal, a pivoted bar, lost motion connections between said magnets and said bar whereby each said magnet may move said bar through a correspondingly different arc, a pawl controlled by said bar and a transmitter for sending trains of sequentially arranged impulses having a ratchet wheel controlled by said pawl.

BENJAMIN F. LEWIS.