Jan. 9, 1940. W. T. REA 2,186,150

REGENERATIVE REPEATER

Filed March 3, 1938

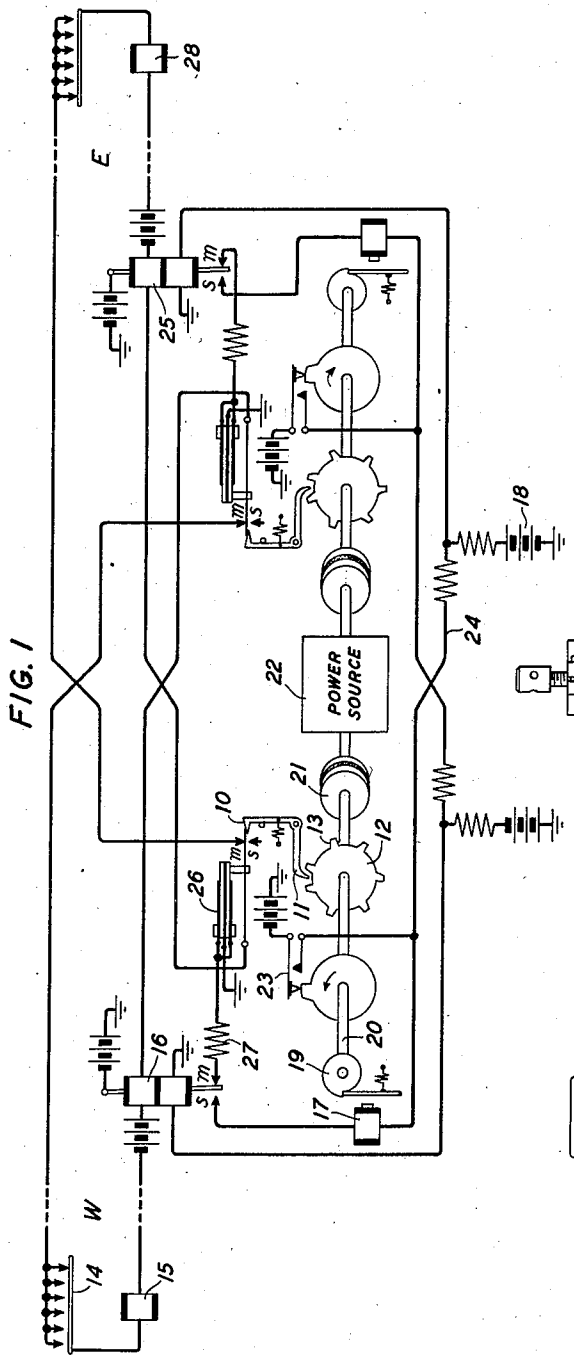

FIG. 1

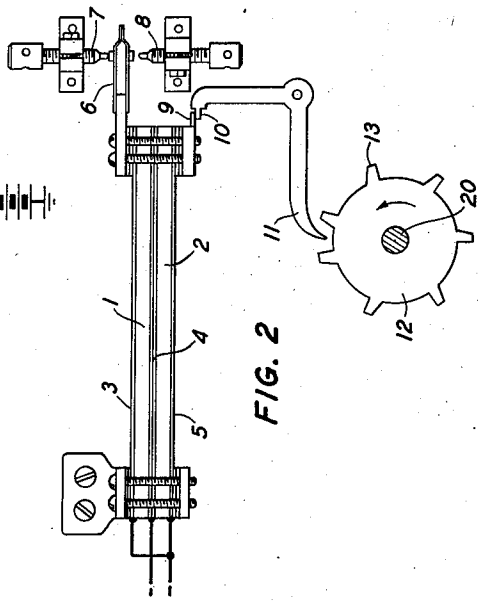

FIG. 2

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REGENERATIVE REPEATER

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3 Claims. (Cl. 178—71)

This invention relates to signaling systems and particularly to methods and means for repeating signal impulses.

An object of the invention is to provide means responsive to signals in the form of potential changes which will mechanically repeat signal impulses and at the same time correct mutilated impulses with regard to their time elements. The invention will be understood by those skilled in the art when it is termed a mechanical regenerative repeater, by which is meant in general terms a repeater which, responding to an impulse, will mechanically lock in for the full duration of the impulse whether or not the impulse continues to last at full strength during such time. Thus when impulses are distorted by transmission sent over a line or affected in such a manner that they are received in mutilated form they may be mechanically corrected and retransmitted in perfect form as regards both their intensity and timing.

A further object of the invention is to control a mechanical regenerative repeater by means requiring a minimum of energy.

A feature of the invention is the use of responding means having substantially no electrical impedance. By way of example such a device is shown as a crystal element interleaved with conducting elements in the manner of an electrical condenser and which will respond with great rapidity to a difference in potential impressed on such conducting elements by a warping or bending action which is translated into a mechanical movement sufficient to close electrical contacts and move a stop pin to either side of a locking cam. Such a device requires for its operation that amount of energy only which may be measured by the charge of the condenser-like conducting elements and since its response is due to the potential difference set up on said conducting elements it does not require a flow of current.

Also by way of example the invention is shown as applied to a start-stop signaling system where the rapidity of action and the response to potential difference is peculiarly appropriate.

The drawing consists of one sheet containing two figures.

Fig. 1 is a circuit diagram showing a completed connection between two signaling stations which are conventionally illustrated as teletypewriter circuits. This completed connection includes a mechanical regenerative repeater shown at a central point.

Fig. 2 is an illustration of some of the mechanical details of the crystal relay forming the novel features of this invention.

The relay consists of two pieces 1 and 2 of Rochelle salt or piezoelectric body having similar properties and having conducting sheets 3, 4, and 5 facing them with sheets 3 and 5 connected together so that a potential difference may be established between sheet 4 and sheets 3 and 5. The relay is rigidly mounted at its left-hand end and carries a contact 6 at its right-hand or free end which contact 6 may cooperate with the stationary contacts 7 and 8. There is also a pin 9 mounted on the free end of the crystals which will cooperate with the pin 10 on the end of an arm worked by a pawl 11. In operation a wheel 12 having mounted thereon a number of cams 13 will rotate and by elevating the pawl 11 move the pin 10 to such a position that the pin 9 may move either above or below it. As the wheel 12 revolves and the pin 10 moves out of the path of pin 9 the relay may be energized to move to either one position or the other and immediately thereafter the pin 10 will be moved to such a point that if the relay is as shown in Fig. 2, it will be mechanically locked to contact 7. If during the time that the pawl 11 was riding on one of the cams 13 the relay was moved to its contact 8 then the pin 10 would, through cooperation with pin 9, hold the relay mechanically locked in this position.

Let us assume that the contacts 14 are operated to send a series of signals. Some of these signals will be closed-circuit and some open-circuit signals. When the circuit is closed, then current will flow through the winding of relay 15 and the upper winding of relay 16 and hold this relay to its right-hand or marking contact. When the signals are open-circuit signals, then the armature of relay 16 will be moved to its left-hand or spacing contact. Since the first signal in a train of permutation code signals is always a spacing signal, the relay 16 will close the circuit from battery, its armature and left-hand or spacing contact, winding of magnet 17 to positive battery 18. Magnet 17 moves its armature out of the path of cam 19 and allows shaft 20 to be energized through the clutch 21 by the power source 22. As soon as the shaft 20 is moved off normal, contacts 23 will be closed and will remain closed until the shaft 20 has completed one revolution. During this period, negative battery is connected through the contacts 23 to line 24 and thence through the lower winding of relay 25. This will keep relay 25 on

its marking contact even though the circuit through its upper winding is open.

The relay 26 is a crystal relay such as that shown more in detail in Fig. 1. It is normally energized by potential from ground on its inner conducting surface to negative battery on its two outer conducting surfaces derived through the resistance 27 and marking contact of armature relay 16. When the impulse being sent is a marking impulse, then the relay will be energized and will move its armature to its upper or marking contact and pin 10 will maintain it in this position mechanically for the full length of the impulse. When a spacing signal is sent, however, the potential difference on the conducting sheets of this relay is removed and the relay moves its armature to its spacing contact so that pin 10 will maintain it in this position. The wheel 12 and the cams 13 are so proportioned that the pawl 11 will be moved at the beginning of the proper interval for each of the usual seven impulses forming the train of a permutation code.

The movement of relay 26 opens and closes the circuit for relay 28 at the distant end so that relay 28 will be energized in accordance with the operation of the permutation code contacts 14.

Thus, if the station represented by contacts 14 and relay 15 transmits over a particularly long line or if there is any other effect present which would cause distortion of the signals received by relay 16 the arrangement of the pins 9 and 10 for operating through the movement of the crystal relay 26 will correct the defect and send out toward the right-hand distant end impulses of full strength and correct timing.

The operation in the reverse direction is of a similar nature and will not be further described.

What is claimed is:

1. A signal repeating device comprising a condenser type relay comprising crystal elements interleaved with conducting elements responsive only to potential changes and requiring for its operation only that amount of energy measured by the charging current of a small condenser, said relay being responsive to incoming signals and operating to transmit corresponding outgoing signals and mechanical timing means cooperating with said relay for locking the armature of said relay in either its operated or its released position after the response to each incoming signal for a period of time corresponding to the normal length of a signal whereby said transmitted signals will be of normal length regardless of the distortion in length of said incoming signals.

2. A signal repeating device as claimed in claim 1 wherein said relay crystals consist of piezoelectric material.

3. A signal repeating device as claimed in claim 1 wherein said relay crystals consist of Rochelle salt.

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