Oct. 17, 1933. E. P. BANCROFT 1,931,099

REGENERATIVE REPEATER

Filed Feb. 26, 1932

FIG. 1

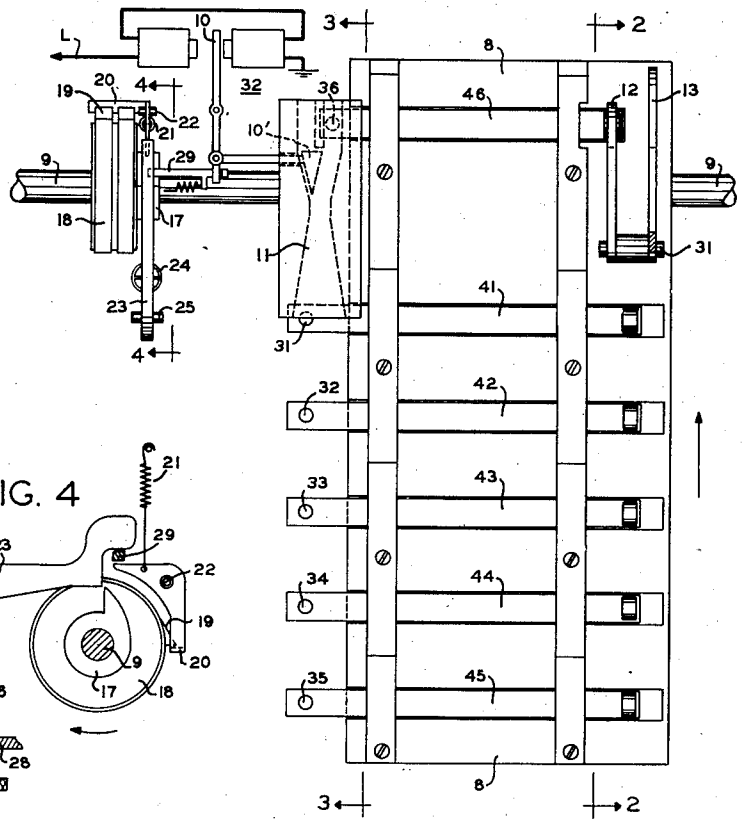


FIG. 4

FIG. 3

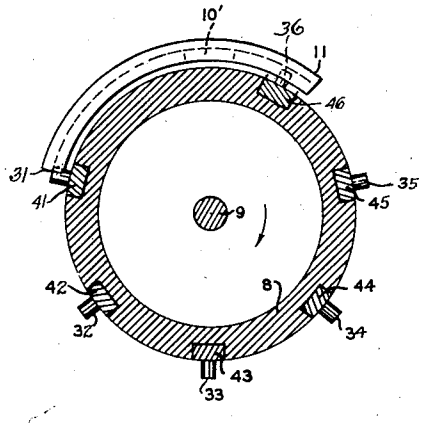
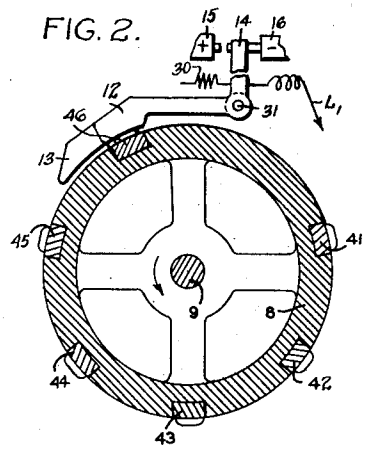


FIG. 2.



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REGENERATIVE REPEATER

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6 Claims. (Cl. 178—70)

This invention relates to regenerative repeaters of the start-stop type, in which are used simple, inexpensive mechanisms that are easy to adjust and maintain. It is designed primarily for use with what are known as Baudot or equal element codes.

Start-stop regenerative repeaters heretofore proposed have consisted essentially of two start-stop mechanisms, one used in connection with receiving and distributing incoming signals and one used in retransmitting them, together with intermediate elements for storing the signals during the interval between the reception and the retransmission. The mechanisms have been complex, expensive and, in many cases, difficult to maintain.

In start-stop systems, the code signals representing the characters transmitted are usually preceded by a start impulse and followed by a stop impulse. In such systems, the transmitter is arranged to stop in a position corresponding to the stop impulse, while the receiver, since it is set in motion by the start impulse, is adjusted to stop in a position corresponding roughly to the mid-portion of the start impulse. Thus, between the transmitter and the receiver there is a phase difference approximately equal to one impulse of the code. This phase difference may be increased somewhat by having the transmitter stop in a position corresponding to the beginning of the stop impulse and the receiver start from a position corresponding approximately to the end of the start impulse. In the repeater described herein, this phase difference between the receiving and transmitting distributors is utilized to set the individual elements of the transmitter in positions for retransmitting the signal completely regenerated.

My invention is illustrated in the accompanying drawing, wherein:

Fig. 1 is a developed plan view of the single rotating element, showing the receiving distributor and the receiving relay diagrammatically;

Fig. 2 is a view of the end of the unit of Fig. 1 on the line 2—2, and shows the relative positions of the single transmitting contact and rotating element;

Fig. 3 is a view of the opposite end of the unit of Fig. 1 on the line 3—3; and

Fig. 4 shows the start-stop clutch mechanism.

Referring now to Fig. 1, 8 is a hollow cylinder shown developed, in which slides 41 to 46 are mounted to slide parallel with the axis of the cylinder. At one end of each of these slides a pin is mounted. A grooved cam 11 is fixedly mounted on the frame (not shown) in such a position that as the cylinder rotates the pins 31 to 36 on the ends of slides 41 to 46, respectively, will pass through the grooved portion 11 of the cam and, at one instant, be centered between their extreme right- and left-hand positions. Located just past this centering point is a knife-edged wedge 10′ carried by the armature 10 of a power relay 32. The wedge 10′ is arranged to guide the slides 41 to 46 into either their left- or right-hand positions in accordance with the positioning of armature 10. In case it is desired, the pin 36 may be omitted from slide 46 and the latter permanently positioned in its right-hand position.

Located opposite one another at the end of the drum 8 are two cam levers 12 and 13 which operate in conjunction with slides 41 to 46. These levers are rigidly fastened to the contact arm 14 shown in Fig. 2. The whole assembly is pivoted at 31 and is biased to rotate in a clockwise direction (Fig. 2) by a spring 30. Contact arm 14 co-operates with fixed contacts 15 and 16. The arm 14 is connected to line L′ over which the regenerated signals are set by the arm engaging contacts 15 or 16. The angular relation between the groove 11, the switch 10′, the levers 12, 13 and contact arm 14 is such that the arm 14 is operated to the position determined by the position of the slide, immediately following the positioning of the slide.

It will be noted that cam lever 12 is shorter than lever 13. In the system with which this repeater is particularly designed to operate, it is proposed to operate with an equal element code, for example, seven equal units in case the five-element Baudot code is used. It is further proposed to obtain the full length stop pulse by having the transmitter stop for at least a definite period at the conclusion of the transmission of each code signal. It is, therefore, necessary, in such a system, to have the cam which co-operates with the slide which controls the stop pulse shorter than the cam which co-operates with the remaining slides. Therefore, in this arrangement, cam lever 12 is constructed to co-operate with slide 46 only while cam lever 13 co-operates with the remaining slides. With such an arrangement, it is possible to have the transmitting and receiving distributors operating at the same speed and still transmit over the line an equal element code signal. It is obvious, of course, that, if the stop impulse from the transmitting station is made longer than the other impulses, cam lever 12 can

be dispensed with and all operations of the contact lever 14 controlled by cam lever 13.

As has already been explained, slides 41 to 45, or 46, are disposed in their right- or left-hand positions, as the cam drum 8 rotates, by means of the wedge 10' controlled by the armature 10 of relay 32. Relay 32, in turn, is under control of the received signals. If now the slides are positioned toward the left, as by a spacing signal, their right-hand ends will miss the cam surfaces 12 and 13 as they pass the latter, and the contact arm 14 will be rotated by spring 30 to close contact 15. If, however, any of the slides are positioned toward the right by a marking signal, their right-hand ends will pass beneath the cam 12 or 13, causing them to rotate about pivot 31 to close contact 16. It will thus be seen that contact 15 or 16 will be closed in accordance with the setting of the slides 41 to 46, which in turn is determined by the position of the wedge 10' at the time the pins on the ends of slides 41 to 46 pass the wedge 10'.

The drum 8 is mounted on a shaft 9 which is driven through a clutch mechanism 18, shown in Fig. 4, from any suitable source of power, such as a constant speed electric motor. In order to increase the time allowed for the setting of slides 41 to 46 by the received signals over line L, it is proposed to delay the start of the drum 8 by means of a delay mechanism shown in Fig. 4. In this figure, any standard clutch, such as shown in United States Patent No. 17,725 of July 8, 1930, may be used.

Pawls 19 engage a stop pawl 20 to disengage the clutch mechanism from the driving shaft. The stop pawl 20 is held in a position to engage pawls 19 by means of a spring 21. The stop pawl 20 is arranged to be disengaged from clutch pawls 19 by means of a lever 23 normally held in the position shown by stop 29. Lever 23 is under constant tension of spring 24 and rotates in a clockwise direction about its pivot 25. Stop 29 is under control of the armature 10 of relay 32. The operation of this armature to the spacing position (right-hand position of wedge 10', Fig. 1) will disengage the stop 29 from lever 23, allowing the latter to operate and disengage stop lever 20 from clutch pawls 19. As shown, there is a clearance between lever 23 and stop lever 20. Some time, therefore, will elapse between the time lever 23 is released for operation and the time at which stop lever 20 releases pawls 19, thereby allowing the clutch mechanism to engage. The amount of time required for this operation will be determined by the clearance between lever 23 and stop pawl 20, the weight of lever 23 and the tension of spring 24. It is evident, therefore, that the interval between the receipt of the start pulse and the time at which the shaft 9 starts to rotate can be varied within certain limits by changing either the weight of lever 23 or the tension of spring 24. Preferably, the arrangement should be such that shaft 9 will start to rotate at a time corresponding approximately to the beginning of the #1 selecting impulse, that is, the end of the start impulse. Lever 23 is returned to its normal position of rest by means of a cam 17 carried on shaft 9. Lever 23 and stop 29 are arranged so that when the latter releases the former, stop 29 will be held clear of the armature 10 of relay 32 during the signalling period and will come into position to be operated by the armature 10 only during the stop interval.

It will be noted that the operation of this regenerative repeater is entirely mechanical and that it employs a single receiving magnet in series with the first line and a single transmitting contact for transmitting signals to the second line. No other electrical circuits are required for the operation of the repeater except those which may be required in connection with the source of power used for driving the mechanism. If a two-way repeater is desired, two elements, exactly like those described, and driven from a common source of power, may be used.

While I have shown my invention applied to a start-stop system, it may be equally well applied to a synchronous system as the slides would be equally spaced, one for each element of the code.

As in synchronous systems, a corrector mechanism would be added to maintain the repeater in synchronism with the received impulses.

United States patents to York and Benjamin, Nos. 1,191,933 of July 18, 1916, 1,215,605 of February 13, 1917, and 1,298,622 of March 25, 1919, show corrector mechanisms as applied to rotating commutators, which corrects by moving the brushes in proper relation to the commutators. Such a corrector mechanism may be applied to my type repeater by having the corrector mechanism move the rotating element which carries the slides 41 to 46 to its proper position.

What is claimed is:

1. In a regenerative repeater, the combination of a relay for receiving signals, a rotatable device provided with a plurality of slides adjustable to one of two operating positions, means for positioning said slides intermediate said operating positions, switching means associated with said receiving relay and placed immediately subsequent to said slide positioning means with respect to the rotation of said rotatable device to position said slides in one of said operating positions, a set of transmitting contacts, and means associated with said slides to operate said contacts immediately following the positioning of said slides.

2. In a regenerative repeater for operation with start-stop signals, the combination of a rotatable member having mounted thereon a number of slides equal to the number of signal elements of the code employed, a relay for receiving signals of two different characters, means operated by said relay to start the rotation of said rotatable member, means controlled by said relay for setting said slides in accordance therewith, a set of contacts adapted to transmit signals, and means associated with said slides for operating said transmitting contacts.

3. In a start-stop regenerative repeater, a rotary member carrying on its surface members slidable in the direction of the axis of rotation, a receiving relay, means for starting a rotation of said rotatable member, means under control of said receiving relay for initiating operation of said starting means, and means interposed between said relay controlled means and starting means to delay the operation of said starting means.

4. In a start-stop regenerative repeater, the combination of means for receiving signals of two different characters, a rotatable member carrying movable slides, means controlled by said signal receiving means to cause a single rotation of said rotatable means, a positioning member moved to one or the other of two positions of said receiving means in accordance with the character of each signal thereby to control the positioning of said slides during said rotation according to the character of the received sig-

nals, and a set of contacts operable by said slides to transmit signals similar in character to those received but of regenerated shape and duration.

5. In a regenerative start-stop repeater, the combination of means for receiving signals, a rotatable member carrying a plurality of slides axially positionable along said member, means for positioning said slides in accordance with received signal impulses, a set of transmitting contacts, means comprising bell crank levers operable by said slides as said rotatable member revolves for connecting said transmitting contacts to line, one of said levers being positioned for operation by one only of said slides, and the second lever being positioned for operation by the remaining ones of said slides.

6. In a regenerative device for repeating signals each of which is composed of a start element, signal elements and a stop element, a rotatable member carrying slidable members on its surface, means to initiate a rotation of said member a definite time after reception of a start impulse, means to move said slides to position corresponding to the character of said signal elements a definite time after reception thereof in order, a set of transmitting contacts, means comprising a bell crank lever operable in accordance with the positioning of said slides to transmit signals corresponding to said received signal elements in character but depending on the length of contact of said slides and levers for their duration, and means comprising a bell crank lever to transmit a stop pulse from said contacts said pulse depending both upon the length of contact of said lever and one of said slides and upon the time intervals between the reception of a start pulse and the initiation of rotation of said rotatable member for its duration, and means to stop said rotatable member after each revolution thereof.

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