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TELEGRAPH REPEATER  
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1,944,218

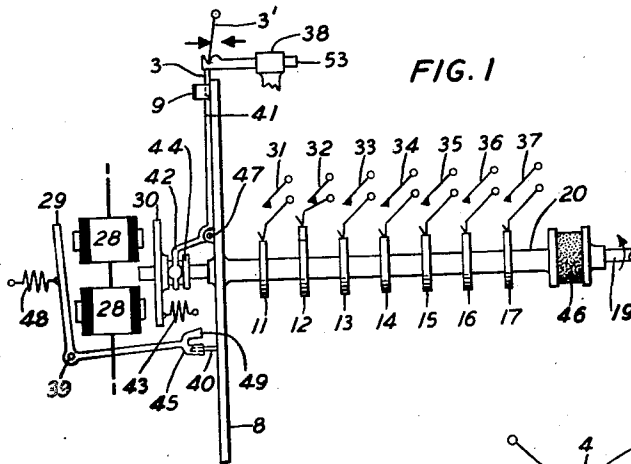


FIG. 1

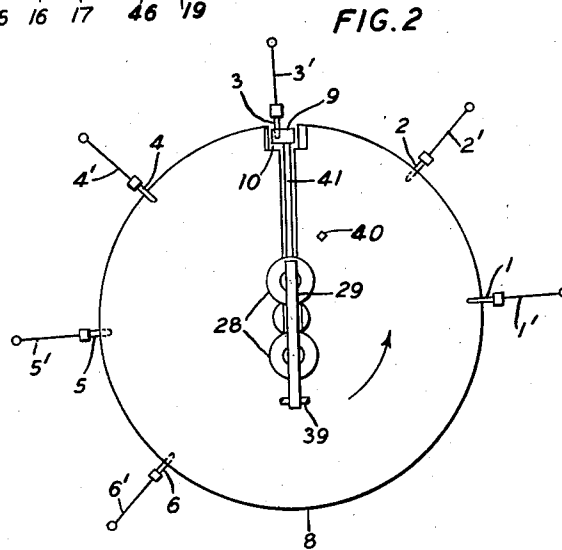


FIG. 2

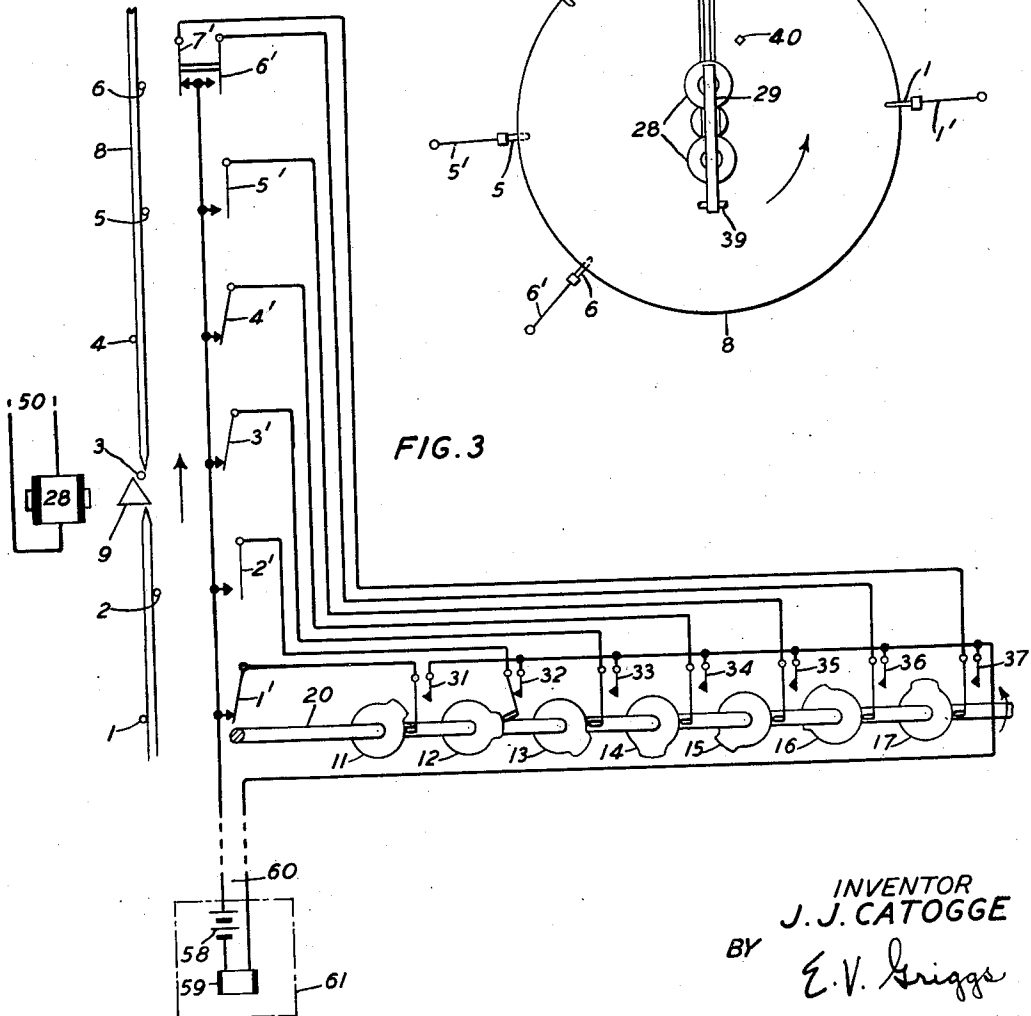


FIG. 3

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## UNITED STATES PATENT OFFICE

1,944,218

## TELEGRAPH REPEATER

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Application February 10, 1932. Serial No. 591,935

4 Claims. (Cl. 178—70)

This invention relates to signaling systems in which letters or other characters are represented by code combinations of selecting impulses.

An object of this invention is to provide a repeater for reforming and regenerating these impulses to render the signals free from mutilations or any distortion in their form which may have taken place in the original impulses during their transmission.

Another object of this invention is to store the impulses received by the repeater and retransmit the stored impulses in an undistorted form without requiring any elaborate or complicated electrical storing devices.

A feature of this invention is a series of storing armatures each corresponding to one of the impulses of the combination received and adapted to be locked in one or the other of two positions during the receipt of a cycle of impulses but released once during each cycle and actuated so as to occupy a position corresponding to the polarity of the received impulses at the time the armature is released.

A further object of the invention is to provide a repeater for regenerating signals transmitted according to a start-stop system of the type in which a single impulse is added to the code impulses for controlling the starting and the stopping of the distributor at the receiving station. A system of the type referred to is described in Patent 1,479,845, issued January 8, 1924 to G. S. Vernam.

A still further object of this invention is to simplify the receiving mechanism for a system such as described in Vernam Patent 1,479,845. In Vernam's disclosure the receiving distributor is started or held at rest depending upon the likeness or difference of the position of two relays corresponding to two consecutive impulses. In accordance with the present invention electrical relays are eliminated as far as possible so that it is not necessary to provide a local source of direct current for the receiving or repeating apparatus. In the present application the latch which releases the distributor once per revolution is connected directly to the receiving magnet without the interposing of any electrical relays.

The term "start-stop repeater" as used in this application refers to a repeater which receives start-stop impulses directly from a start-stop line and repeats them directly into another start-stop line.

In the form disclosed in the present application there are six selecting pulses for determining the character to be printed and a seventh pulse

opposite in polarity to the preceding pulse which controls the starting of the distributor mechanism at the receiving and repeating stations. By employing six selecting pulses instead of the conventional five-unit code the number of characters from which a selection can be made is thereby doubled. However, it is to be understood that the invention is not limited to six-unit codes but may be applied to any uniform code.

A feature of the present invention is an arrangement for anticipating the first impulse of a combination which is to be retransmitted. The six selecting impulses upon being received actuate storing devices, and the output side of the repeater is connected to the respective storing devices one at a time. As soon as the sixth selecting pulse is received and the corresponding storing device is actuated thereby, a switch is thrown to the proper position to prepare to transmit the next impulse before it has actually been received. The sixth selecting impulse may be of indefinite duration and following its receipt a start impulse of opposite polarity is received which actuates the starting mechanism of the repeater. Thus it is not necessary to provide the usual storing device for the start impulse.

The invention may be more fully understood from the following description together with the accompanying drawing which illustrates one embodiment of the invention. It is to be understood, however, that this description is not to restrict or limit the scope of this invention as defined in the appended claims.

Fig. 1 shows a side view of the invention which illustrates the construction and relationship of the various parts of the repeater.

Fig. 2 shows an end view of the invention which illustrates the relative positions of the impulse storing devices.

Fig. 3 illustrates one form of a repeater circuit embodying the invention.

Referring to Fig. 1, disc 8 is mounted on sleeve 20, which in turn is supported by shaft 19 and driven thereby through friction clutch 46. Cams 11 to 17 are also mounted on sleeve 20. The receiving magnet 28 is shown as having armatures 29 and 30 with restoring springs 48 and 43, respectively. Armature 29 is pivoted on pin 39 and has a bifurcated end 45 and 49. As shown, in the spacing position prong 45 engages pin 40 on disc 8 to stop and hold disc 8. In the marking position of this armature prong 49 will engage pin 40 so that disc 8 will be stopped with armature 29 in either the spacing or the marking position. However, as it moves from one posi-

tion to the other the disc will be released since pin 40 will pass through the space between these prongs 45 and 49. Attached to armature 30 is collar 44 which engages the forked end 42 of lever 41. Pivot 47 of lever 41 is mounted upon disc 8 so that as disc 8 rotates the triangular shaped member 9 attached to the end of lever 41 is carried past contact pins 1 to 6 in succession. As shown, member 9 is engaging contact pin 3 to move it from the marking to the spacing position. Pin 3 is attached to contact bar 53 which slides in bearing 38 and actuates contact 3'.

Fig. 2 shows an end view of the invention with contact pins 1 to 6 located around the periphery of disc 8 and the associated contact members 1' to 6'. The triangular shaped member 9 on the end of lever 41 pivoted in slot 10 of disc 8 is shown moving contact pin 3 from the marking position to the spacing position. Magnets 28 are shown with armature 29 pivoted at 39 which engages the stop pin 40 to stop disc 8 after transmitting each signal or character. It may be noted that contact pins 1 and 4 are shown in the marking position while pins 2, 5 and 6 are shown in the spacing position. Also, that the surfaces of disc 8 holds these pins locked in position except during a small portion of a revolution of the disc during which time member 9 may transfer them from one side of the disc to the other, or not, depending upon the polarity of the received impulses.

Fig. 3 shows a schematic circuit of a repeater which illustrates one embodiment of the invention. Here disc 8 is shown developed with contact pins 1 to 6 and associated contacts 1' to 6', respectively. Contacts 1' and 4' are shown in the marking position while contacts 2', 5' and 6' are shown in the spacing position and contact 3' is being transferred from the marking to the spacing position. Line magnet 28 is shown connected to the incoming line 50. The transmitting cams 11 to 17 are mounted on sleeve 20 and actuate contacts 31 to 37, respectively, to transmit desired signals to line 60. A receiving station is shown at 61 comprising a battery 58 and printing magnet 59 connected to line 60.

As illustrated in Fig. 3 the third contact pin 3 is being transferred from the marking position to the spacing position in accordance with the third impulse of the signal now being received. Had this pin been on the spacing side and the third impulse of the signal being received a spacing impulse pin 3 would remain on the spacing side of disc 8. At the same time that the third impulse of the signal is being received by magnet 28 and the storing contacts 3' are being actuated thereby, the second impulse is being reconstructed and transmitted to line 60 by cam 12, and contacts 32 and 2' as shown. A circuit can be traced from battery 58 at station 61 through printing magnet 59, over line 60, through contacts 32 to the armature of contacts 2', also from the opposite terminal of battery 58 at station 61 over line 60 to the marking contact of 2'. However, since the second impulse of the received signal was a spacing impulse contacts 2' are in the spacing position so that the second impulse of the signal transmitted over lines 60 to printing magnet 59 is spacing. In a similar manner the first and the remaining impulses of the signal are received and transmitted. After the sixth impulse has been transmitted armature 29 of the line magnet 28 engages the stop pin 40 on disc 8 which stops the disc.

Assume that the last or sixth impulse of the signal was a spacing impulse. Then prong 45 of armature 29 will engage the stop pin 40 as shown in Fig. 1. Also, cam 16 is designed to hold the contact 36, shown in Fig. 3 closed when disc 8 and cams 11 to 17 are not rotating so that a spacing signal will be applied to line 60 as long as a spacing signal is received from line 50. When the start impulse, which will be marking in this case, is received and magnet 28 operates armature 29, and pin 40 will pass between prongs 45 and 49 of this armature. This allows the disc 8 and cams 11 to 17 to rotate, which causes springs 36 to break and springs 37 to make and send a marking start impulse to the printing magnet 59 at station 61 over line 60. This path may be traced from battery 58, through printing magnet 59, over line 60, through contact 37, and contact 7' and over the other side of line 60 to the opposite terminal of battery 58. Had the sixth impulse of the preceding signal been marking then the start impulse would be spacing, in which case contacts 6' would be in the marking position and contacts 7' in the spacing position, so that a spacing start signal would have been transmitted to line 60 when the start signal is received from line 50. It should be noted that since the start impulse is always opposite in character from the sixth or last impulse of the preceding signal contacts 7' may be controlled and set by contact pin 6 as shown. While the start impulse is being transmitted to line 60, the first impulse is being received and contact pin 1 positioned by it. Then cam 17 opens contact 37 and cam 11 closes contacts 31, which cause the first impulse of the signal to be repeated to line 60 as the second impulse is being received from line 50. In this manner the signal is received and repeated to line 60 during one revolution of disc 8 and cams 11 to 17 after which they are stopped until the next signal is received which will be repeated to line 60 in the same manner.

While the above specification describes one specific embodiment of the invention as applied to a start-stop telegraph system, it is to be understood that the same results may be obtained with many different forms of embodiment without departing from the spirit of this invention as defined in the appended claims. For example, the repeater may be easily adapted to transmit signals of marking and spacing current instead of "current" and "no current" signals as described. In this case spacing contacts would be provided for contact springs 1' to 7' in addition to the marking contacts, or the repeater might be adapted to repeat multiplex signals.

What is claimed is:

1. A regenerative start-stop telegraph repeater comprising a receiving electromagnet responsive to telegraph signal impulses, an armature cooperating therewith adapted to engage and actuate successively a series of impulse storing devices in accordance with the received signal impulses, a rotatable disc in engageable relationship with said impulse storing devices whereby said storing devices are locked on either side of said disc in the position in which they are set by said magnet until they are reset during the next series of impulses, a series of rotatable cams electrically connected to said storing devices whereby the received impulses are reconstructed and retransmitted, means for stopping said disc and cams after the last signal impulse has been retransmitted, and means to start said disc and cams rotating when an impulse of opposite character

from the last impulse of the last signal is received.

2. In a telegraph system, a regenerative start-stop repeater comprising a magnet responsive to telegraph signals, a rotatable disc, a series of contacting devices for storing signal impulses located around the periphery of said disc, means whereby said contacting devices are successively actuated by said magnet and locked by said disc in accordance with the received signal impulses, and a series of cam actuated contacts electrically connected to said storing contacts to reconstruct and repeat said signal impulses, means for stopping said disc and cams after each signal combination has been repeated, and means to release said disc and cam when a signal impulse of an opposite character from that of the last impulse is received.

3. A regenerative mechanical start-stop repeater comprising a receiving electromagnet, an armature associated therewith, a disc, means to rotate said disc, a plurality of signal impulse storing devices located around the periphery of said disc, means associated with said disc and said armature for successively actuating said storing

devices, contacts associated with said storing devices, a group of transmitting cams electrically connected to said contacts, means for rotating said cams in unison with said disc, a second armature associated with said receiving magnet, means whereby said second armature will stop and hold said disc and cam after the last signal impulse has been retransmitted, and means to release said disc and cam when an impulse of opposite polarity from the last impulse is received.

4. A regenerative start-stop repeater comprising a receiving electromagnet, a disc, a group of transmitting cams, means for mechanically connecting and rotating said disc and said group of cams, impulse storing devices and contacts cooperating therewith located around the periphery of said disc, means connecting said disc to said receiving magnet for successively actuating said storing devices to either side of said disc in accordance with the received impulses, electrical connection between said contacts and transmitting cams whereby the signal impulses are reconstructed and retransmitted.

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| 40 | 115 |
| 45 | 120 |
| 50 | 125 |
| 55 | 130 |
| 60 | 135 |
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| 70 | 145 |
| 75 | 150 |