March 18, 1941. E. F. WATSON 2,235,411

REGENERATIVE REPEATER

Filed Feb. 25, 1939

FIG. 1

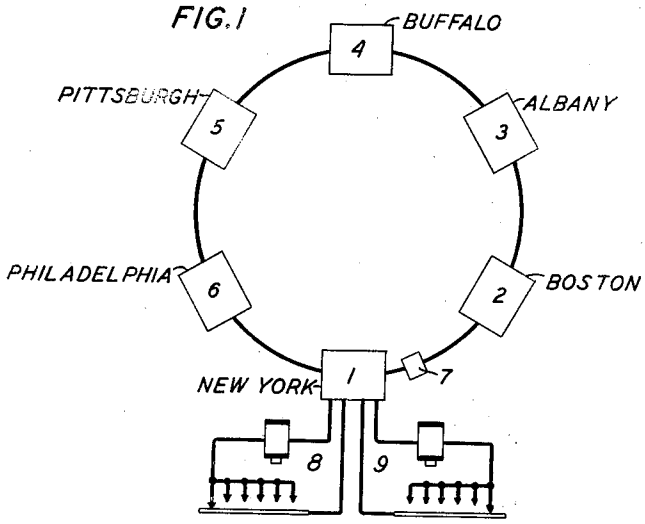
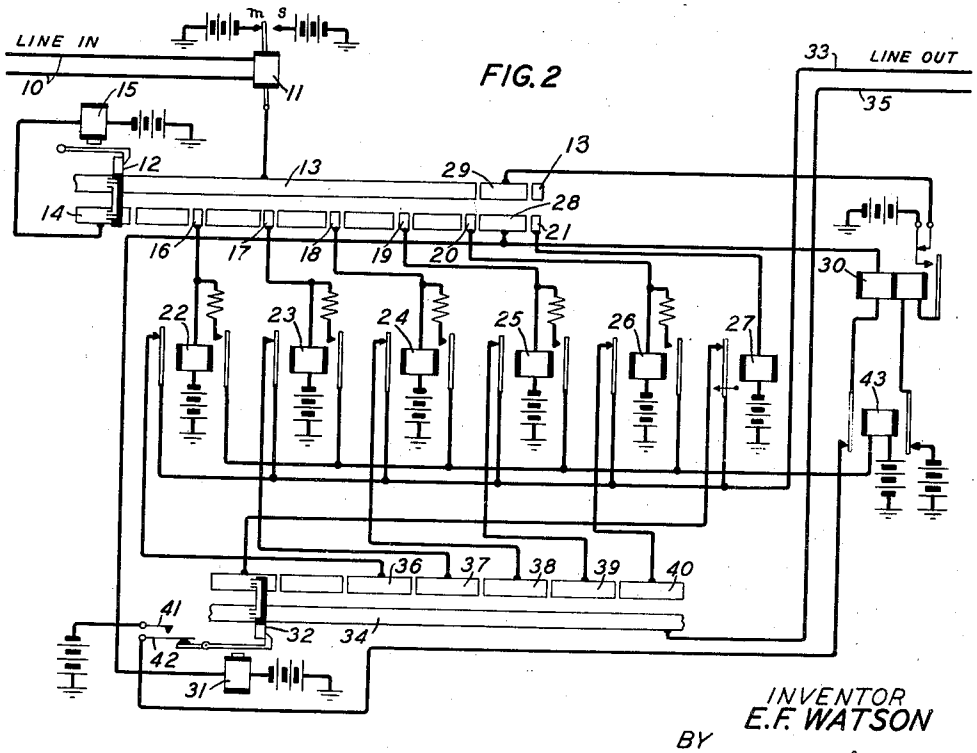


FIG. 2



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REGENERATIVE REPEATER

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11 Claims. (Cl. 178—70)

This invention relates to telegraph systems and particularly to systems wherein a common transmission channel is provided for a plurality of stations, any one of which may broadcast messages into said channel for simultaneous reception by all of said stations. The invention is an improvement on the system disclosed in Patent 2,111,685 granted March 22, 1938, to C. R. Walker.

In ring type circuits, sometimes known as "round robin circuits," having even a measurable propagation time signals transmitted at one point in the ring will traverse the ring and return to such point and since they are not synchronous at the incoming and outgoing terminals of the station forming such point, must be separated. Hence, during transmission the normally closed connection between the incoming and outgoing terminals of the circuit must be opened. This has been done in various ways, all devised to either manually and according to schedule or automatically close the ring only after the last impulse has completely traversed the ring so as not to set up a traveling or stray impulse which will traverse the ring indefinitely. However, even though such means are efficient and effective, a hit or accidental opening of the circuit for even an extremely short time interval will start a traveling stray impulse around the closed ring and which will be objectionable as it will operate receiving apparatus at all the stations in some manner and make the circuit appear busy. In order to suppress such stray signals counting means have been devised and placed in one or more of the station circuits, which means after the stray signal has traversed the circuit for a predetermined number of times will automatically open the ring and hold it thus opened for a period greater than the propagation time of the ring.

An object of the present invention is to obviate the necessity for using station circuits of more than one type and to render them uniform and as simple as possible by placing the means for counting out stray impulses at a point where such means will be under the supervision of expert maintenance men rather than under the supervision of telegraph machine operators. Accordingly, a feature of the present invention is a regenerative repeater for use in a ring circuit and having means to prevent the continued repetition of stray signals.

Such a repeater consists in general of a means to receive and segregate incoming code signals, a means for storing the individual signals forming the permutation code, and a means for later sending out corresponding signals. When the repeater is started in action by the reception of a stray impulse which will have the effect of the start impulse of a code, the transmitting means will at the proper time start in action and will send out a starting impulse which will be equivalent to a hit or stray impulse. However, the starting means for the transmitting means will lock up through a circuit controlled by the storing means and hence, if no actual permutation code signals have been stored, will remain locked up so that no matter how many times the repeater is started in action by the reception of hits, the transmitting means will refuse to function. Thus a stray signal going about the ring circuit will be repeated once but will be suppressed thereafter. As soon as a code signal having a message significance is received and stored, the starting means for the transmitting means is released for proper operation at the appropriate time and thus normal permutation code signals are properly repeated without mutilation.

The drawing comprises two figures, the first of which is a schematic diagram and the second is a circuit diagram, both illustrating the present invention.

Fig. 1 represents a ring circuit such as that fully disclosed and explained in the Walker patent hereinbefore mentioned. It is assumed that a telegraph circuit of this kind will extend through cities such as New York, Boston, Albany, Pittsburgh and Philadelphia. Each one of the rectangles 1, 2, 3, 4, 5 and 6 represents station circuits at those points. The smaller rectangle 7 represents other apparatus in the line, such as a regenerative repeater subject of the present invention. From each one of the station circuits one or more subscribers' lines, such as 8 and 9, may extend.

Due to the distance over which one of these ring circuits may extend and to other time consuming factors if the ring is completely closed then a hit or open circuit extending over a very short period of time, such as a spacing impulse, will travel around the circuit again and again. Depending on the length of the circuit and the other time consuming factors therein the propagation time, as it is called, may be in the nature of several seconds so that if the ring at any time becomes completely closed a single spacing signal will continue to travel indefinitely. The invention shown in detail in Fig. 2 is a regenerative repeater providing means for stopping the travel of such a spacing signal. The normal

condition of the line is marking, so that current flowing over line 10 will hold the receiving relay 11 in the position shown, that is, on its marking contact. Therefore as the brush 12 makes contact between the ring 13 and the segment 14 the latch magnet 15 will not be energized. When permutation code signals are to be sent the starting signal is a spacing signal so that relay 11 moves its armature to its opposite contact and connects the latch magnet 15 in a circuit from positive to negative battery. Latch magnet 15 releases the brush 12, which is engaged by the well-known clutch, and the brush travels over the ring 13 and the various segments shown until it returns to the position shown herein. It will be understood that the ring 13 and the various segments are developed for clearer explanation whereas actually they are in the form of a circle or drum. They may also be in the form of cams and cam-actuated contacts.

As the brush 12 travels over the segments such as 16, 17, 18, 19 and 20 the relays 22, 23, 24, 25 and 26, respectively, will be energized whenever a spacing signal is being sent.

Thus as brush 12 moves over the various segments it stores upon the relays 22 to 27 such spacing signals as have been encountered. When the brush 12 gets to a point between segments 20 and 21 it closes a circuit between segments 28 and 29 whereupon a circuit is established from battery, the normal contacts of relay 30, segment 29, brush 12, segment 28, winding of latch magnet 31 to battery of the opposite polarity, whereupon the brush 32 is released to travel over the various segments illustrated. After leaving the position shown it first encounters a segment to which there is no connection and hence the normal connection extending from line 33 over the armature and back contact of relay 27 or the armature and back contact of any one of the other storing relays through the brush 32, ring 34 to line 35 is broken and thus a spacing impulse for a starting impulse is transmitted to the outgoing line. As brush 32 then in turn travels over the segments 36, 37, 38, 39 and 40 it will cause the transmission of either marking or spacing signals in accordance with the normal or operated positions of the storing relays 22 to 26, inclusive.

When the latch magnet 31 became energized a path was established from battery, the contacts 41 and 42, operated by the latch magnet 31, to the back contact of relay 43. Relay 43 is controlled over a circuit extending to an armature of each one of the storing relays 22 to 27, inclusive, so that if any one of these relays has become energized then relay 43 will be energized and the path established by the latch magnet 31 will be ineffective. However, if no one of the relays 22 to 27 has been energized this path will then be extended as a circuit through the left-hand winding of relay 30, the segment 28, brush 12, segment 29, normal contacts of relay 30 to battery of the opposite polarity, whereupon relay 30 becomes energized and immediately locks itself in a circuit from battery, the back contact and right-hand armature of relay 43, the right-hand winding of relay 30, front contact and armature of relay 30 to battery of the opposite polarity. This circuit will remain in this condition until some one of the recording relays 22 to 27 becomes energized.

Thus it will be seen that if a single short spacing impulse, such as a hit or accidental opening of the line, operates the relay 11 the result will be that the latch magnet 15 is energized and brush 12 allowed to make a complete circuit of its segments. Since this is a single hit no one of the relays 22 to 27 will become energized and hence when the latch magnet 31 becomes energized the circuit established through its contacts 41 and 42 will be effective to cause relay 30 to lock up. The brush 32 will then travel over its segments once and coming to rest again in the position shown will not be released a second time because although the hit has been transmitted from the incoming line to the outgoing line as the brush 32 started its travels, the relay 30 has become locked up. Therefore, when this hit transmitted to the outgoing line returns through the ring to the incoming line to operate relay 11 again and start brush 12 on its travels a second time, the circuit for the operation of the line magnet 31 will be ineffective as the brush bridges segments 28 and 29.

In this manner, then, a hit or accidental opening of the line will be repeated by this regenerative repeater but a single time.

Similarly, in case of a group of "letters" signals, which in the usual 5-unit code have pulses 1, 2, 3, 4 and 5 all marking and which due to the usual spacing start signal therefore appear as a whole as a single spacing signal or a hit, the first of such signals will be transmitted, but further "letters" signals will be suppressed until some other signal having one of the 5-units spacing, is received. This suppression of successive "letters" signals following the first one is not objectionable because they are normally ineffective in causing any further operation of teletypewriters after the first one has been received.

At any time after this and when relay 30 is still locked up, if actual signaling takes place some one of the storing relays 22 to 26 will be operated, whereupon relay 43 will operate and release relay 30 so that the latch magnet 31 may be properly operated.

During operation with normal message signals relays 22 to 26, inclusive, normally operate if relay 11 is on its spacing contact when brush 12 passes over segment 16 in the case of relay 22, for example. This relay will then remain operated until some succeeding revolution of brush 12 when relay 11 may be on its marking contact as the brush passes over segment 16, thus short-circuiting relay 22 and releasing it.

Relay 27 normally remains unoperated except when a "break" signal (long spacing signal), is transmitted. Then it operates as brush 12 passes over segment 21. Relay 27 is of a slow-release type specially adjusted so it will not release until after retransmitting brush 32 has passed over its stop segment thus retransmitting a continuous "spacing" signal to correspond with the signal received by relay 11.

What is claimed is:

1. A regenerative repeater, comprising means for receiving, distributing, storing and transmitting permutation code signals, said storing means comprising a relay for each signal of the permutation code, a starting magnet for said transmitting means, means controlled by said distributing means for energizing said starting magnet, a relay responsive to said last means and interacting with said starting magnet to lock the circuit of said starting magnet open thereafter, and means under control of each of said storing

relays for unlocking said relay to close the circuit of said starting magnet.

2. A signaling system comprising a one-way transmission channel closed upon itself in a ring, a plurality of serially included station circuits and a serially included circuit for suppressing stray signals, said suppressing circuit comprising means for receiving, distributing, storing and transmitting signals, means controlled by said distributing means for starting said transmitting means, and means controlled by said storing means and responsive to non-operation thereof for preventing the operation of said starting means.

3. A signaling system comprising a one-way transmission channel closed upon itself in a ring, a plurality of serially included station circuits, and a serially included regenerative repeater having means responsive to a single stray signal for repeating said signal once and for thereupon locking itself to prevent further repetitions of said signal.

4. A regenerative repeater, comprising means for receiving, distributing and storing permutation code signals, a start-stop distributor for retransmitting said stored signals and means controlled by said storing means for locking said retransmitting distributor against movement.

5. A regenerative repeater, comprising means for receiving distributing and storing permutation code signals, a start-stop distributor for retransmitting said stored signals and means responsive to the receipt of a single spacing signal or a permutation code containing but a single spacing signal for retransmitting said single signal and then locking said retransmitting distributor against further movement.

6. A regenerative repeater, comprising means for receiving, distributing and storing permutation code signals, a start-stop distributor for retransmitting said stored signals, means responsive to the receipt of a single spacing signal or a permutation code containing but a single spacing signal for retransmitting said single signal and then locking said retransmitting distributor against further movement and means thereafter responsive to the receipt of any different permutation code for unlocking said retransmitting distributor.

7. A regenerative repeater, comprising means for receiving, distributing and storing permutation code signals, a distributor for retransmitting said stored signals, and means responsive to the receipt of a single spacing signal or a permutation code containing but a single spacing signal for retransmitting said single signal and then rendering said retransmitting distributor ineffective to retransmit further successively received like signals.

8. A regenerative repeater, comprising means for receiving, distributing and storing permutation code signals, a distributor for retransmitting said stored signals and means controlled by said storing means responsive to the receipt of a succession of codes of a particular predetermined signal permutation for retransmitting said predetermined code once and then locking said retransmitting distributor against further operation.

9. A regenerative repeater, comprising means for receiving, distributing and storing permutation code signals, a distributor for retransmitting said stored signals, means controlled by said storing means responsive to the receipt of a succession of signals of a predetermined character for retransmitting the first of said signals and then locking said retransmitting distributor against further operation and means thereafter responsive to permutation code signals of other than said predetermined character for unlocking said retransmitting distributor.

10. A signaling system comprising a one-way channel of transmission closed upon itself in a ring, a plurality of station circuits included therein in tandem relation, said transmission channel and included apparatus being effective for transmitting permutation code combinations around said channel, a repeating mechanism for code combinations at a point in said channel, said mechanism including means operable by repeating a specific code combination over said mechanism to inhibit further repeating of that identical code combination arriving at said point until some other code combination or signal simulating some other code combination is received at said point.

11. A system in accordance with claim 10 wherein the inhibiting code combination is one consisting of a spacing start pulse followed by a complete series of marking pulses for the remainder of the code and in which the inhibiting function of said repeating mechanism is actuated thereby.

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