March 12, 1940. D. E. BRANSON ET AL 2,192,961

SIGNALING SYSTEM

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FIG. 1

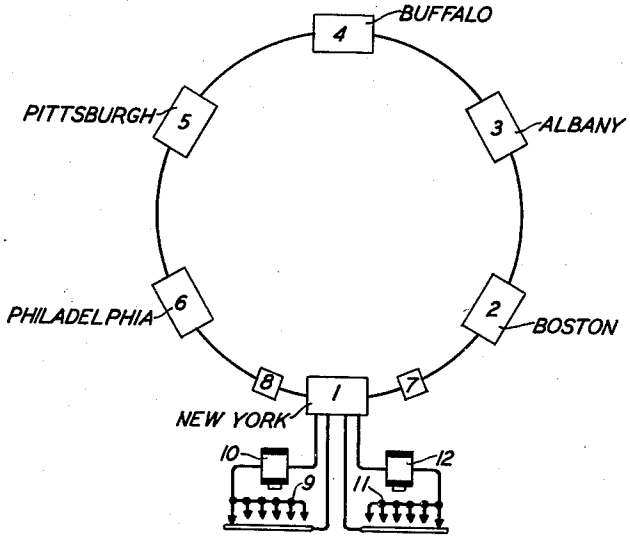
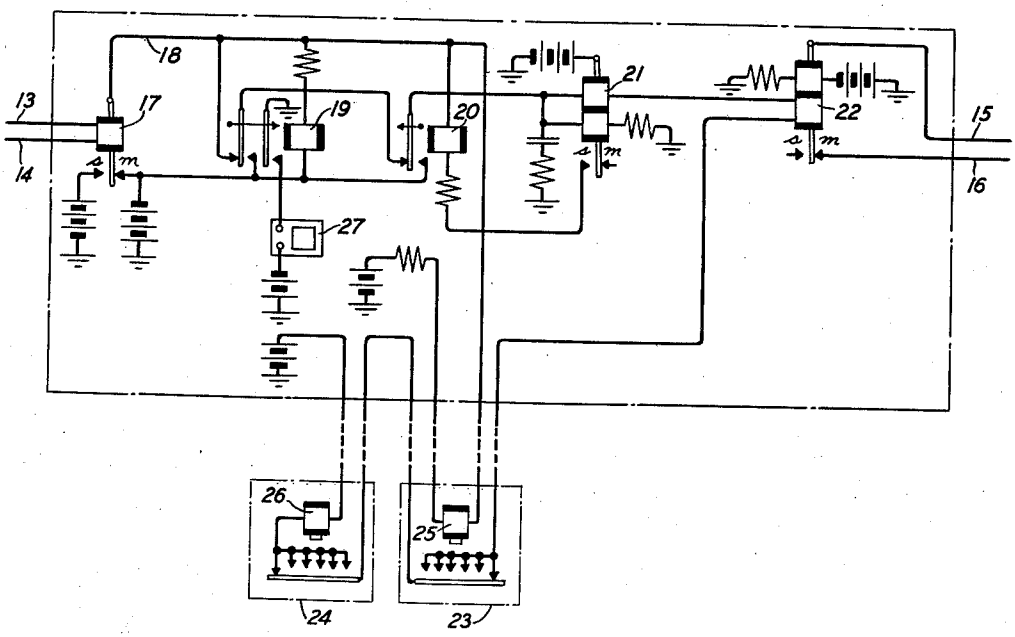


FIG. 2



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SIGNALING SYSTEM

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10 Claims. (Cl. 178—2)

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. This invention is an improvement on the system disclosed in Patent 2,111,684 granted March 22, 1938, to C. R. Walker.

As in the Walker patent a series of stations is arranged in a circuit which is closed upon itself in a ring and transmission is always in a single direction so that the message transmitted by one station traverses all the others and is finally received by the station which transmits it. Due to the length of the circuit and the inclusion of repeaters of various types and other electrical devices, such a circuit has a definite propagation time which may be several seconds and hence the ring must be broken at the transmitting station to prevent a returning message from interfering with that being transmitted. Heretofore the ring was broken by a manual operation and an elaborate time schedule had to be established and rigidly observed to prevent the ring ever being completely closed. An object of the present invention is to render this operation automatic. The propagation time of the circuit which is readily obtained by completely closing the ring and then observing the speed with which a signal travels around the circuit is determined and a means which is slow releasing for a period somewhat longer than such propagation time is provided. This slow-releasing means is provided to open the ring and is made responsive to the signals from the transmitting apparatus at a station. Hence, so long as a station is transmitting and for a period somewhat longer than the propagation time of the ring thereafter, the ring is opened. Since complete closure does not take place until the last impulse sent has completely traversed the ring, a continuously traveling signal is automatically prevented.

Another object of the invention is to provide means in a circuit of this nature responsive to a standard practice "break" signal used in other types of circuits. Accordingly, a feature of the invention is a slow-acting means unresponsive to incoming signals of normal length but responsive to abnormal length signals such as a "break" signal whereby another station may signal the transmitting station that it is desired to use the ring presumably for more important messages. Such means will automatically stop transmission at the transmitting station and close through the ring thereat.

Still another object is to provide means to give an alarm indicating a line failure at a station adjacent to the section of the line in trouble. Accordingly, another feature of the invention is a means responsive to a prolonged open circuit similar to but of much longer duration than a break signal for operating an alarm. Each station circuit then in accordance with these features will respond to an open circuit condition at its incoming terminal but will in time automatically present a closed circuit condition at its outgoing terminal. However, the closed circuit condition presented by the station just preceding the point of the trouble cannot be transmitted to the station next adjacent thereto and hence an open circuit condition will be presented to the incoming terminal of this next adjacent station and so an alarm will be given at only this station.

In the drawing:

Fig. 1 is a schematic representation of the complete system in which the invention is employed; and

Fig. 2 is a circuit diagram showing the details of a station circuit embodying the present invention.

In Fig. 1 there is shown a ring circuit including rectangles 1, 2, 3, 4, 5 and 6 which represent station circuits at as many different cities, such, for instance, as New York, Boston, Albany, Buffalo, Pittsburgh and Philadelphia. There is also shown in the circuit a rectangle 7 and another rectangle 8 which may indicate repeaters or other time consuming transmission apparatus. To each station circuit at the different points in the ring one or more separate stations may be connected. The transmitting contacts 9 and the magnet 10 represent in the usual form a subscriber's teletypewriter station. The transmitting contacts 11 and the magnet 12 represent a similar subscriber's station connected to the same station circuit 1.

Fig. 2 represents a station circuit such as in one of those represented generally by the rectangles 1 to 6, inclusive. Conductors 13 and 14 represent the incoming terminal and conductors 15 and 16 represent the outgoing terminal. Marking pulses coming in on conductors 13 and 14 will move the armature of relay 17 to its right-hand or marking contact and spacing impulses likewise will move the armature to its left-hand or spacing contact. The marking and spacing impulses from the armature of relay 17 flow

over conductor 18 through the back contact and outer, left-hand armature of relay 19, the back contact and armature of relay 20 through the upper winding of relay 21, the lower winding of relay 22 and thence through the circuits of subscribers' stations 23 and 24 to battery. Relay 22 will respond and will open and close the circuit of conductors 15 and 16 representing the outgoing terminal and thus create opened and closed conditions denoting marking and spacing pulses transmitted beyond this station. The magnet 26 of subscriber's station 24 will respond and record any messages being transmitted over the ring. Magnet 25 of subscriber's station 23 will also respond to the action of receiving relay 17 so that any message being transmitted over the ring will also be recorded at this station. Relay 21 does not respond in this circuit.

When either of subscriber's station 23 or 24 transmits, relay 21 responds and this in turn causes the operation of delay 20 which therefore effectively opens the ring circuit at its armature. This relay is slow to release and may be designed to be slightly greater in its releasing time than the propagation time of the entire ring circuit. During the time relay 20 is operated it holds steady marking potential on the upper winding of relay 21 and the lower winding of relay 22 so that either of the stations 23 and 24 may transmit uninterruptedly.

Under normal conditions when a steady marking impulse is received over conductors 13 and 14 or while regular transmission is taking place no spacing impulse of greater than signal length is received, relay 19 which is slow to operate, does not move its armatures. This is also true while either one of the subscriber's station 23 or 24 is transmitting, since the transmission eventually returns on the ring and manifests itself in conductors 13 and 14 and operates relay 17.

Relay 19 is arranged to operate on a signal similar to a "break" but of longer duration. While the energizing circuit of relay 19 is closed on a break signal this relay is timed not to respond until a period of five seconds for example has elapsed and thus this relay differentiates between a normal break signal and a similar but longer signal denoting an unstandard condition.

If some station before conductors 13 and 14 transmits a prolonged spacing signal or if trouble occurs and manifests itself as a prolonged spacing signal, then relay 19 will become operated and thus will connect marking battery through the front contact and outer armature of relay 19 and thence to the relay 21, moving the armature of relay 21 to its marking contact, provided the circuit of this relay is properly closed through the transmitting contacts of subscribers' stations 23 and 24. Relay 19 will also close a circuit to cause the operation of an alarm 27.

If, during transmission from one of the stations 23 and 24 and while relay 20 is operated, a break signal is transmitted by some other station in the ring, relay 17 will move its armature to its spacing contact so that relay 20, which has heretofore been periodically energized by the armature of relay 21 which is connected to a current source of spacing potential, will release its armature. This prolonged spacing or "break" signal will then manifest itself at stations 23 and 24 and thus the subscribers will be notified that a break is being made by some other subscriber and they will act accordingly, that is close the circuit by ceasing to transmit.

If this break signal persists longer than normal and thus denotes an unstandard condition, relay 19 will operate and place marking potential on the line again so as to close the circuit through conductors 15 and 16 and at the same time operate the alarm 27. The marking condition on conductors 15 and 16 will then be passed around the ring circuit to the station making the break. If a break is made through line failure then through the means described the circuit will adjust itself so that in time only the station next adjacent the break will be affected and transmission may proceed around the remaining part of the circuit. For instance, if a break occurred in conductor 13 just to the left of the relay 17 then it would be possible for subscribers' stations 23 and 24 to transmit to all the other stations in the ring but it would not be possible for any one of the stations to transmit to the subscribers' stations 23 and 24.

Various arrangements of the subscribers' stations may be had. For instance,, subscribers' station 24 has its transmitting contacts and its receiving means both in the same circuit. In such a case the receiving means will record transmitted messages (generally referred to as local copy) but will not record what is transmitted from its associated transmitting contacts after this has been transmitted completely around the ring. On the other hand, the receiving means 25 of the subscribers' station 23 will not make local copy but will record only messages coming in on the receiving terminals 13 and 14. If it were so desired a subscriber's station could be equipped with both types of receiving means so that local copy as well as the message traversing the entire ring could be recorded.

With subscribers' stations such as 23 at New York and Buffalo for example a two-way "conversation" could be carried on because what is transmitted from New York will be recorded at Buffalo as well as at Boston and Albany while simultaneously therewith a subscriber at Buffalo could be transmitting to New York as well as to Pittsburgh and Philadelphia.

What is claimed is:

1. In a signaling system, a station circuit having incoming and outgoing terminals normally connected for through transmission, transmitting apparatus and means responsive to signals from said transmitting apparatus for opening said normal connection between said terminals for the over-all period of the successive transmission of a plurality of signals.

2. In a signaling system, a station circuit having incoming and outgoing terminals normally connected for through transmission, receiving apparatus connected to said incoming terminal, transmitting apparatus and means responsive to signals from said transmitting apparatus for opening said normal connection between said terminals for the over-all period of the successive transmission of a plurality of signals.

3. In a signaling system, a station circuit having incoming and outgoing terminals normally connected for through transmission, transmitting apparatus, and means responsive to signals from said transmitting apparatus for opening said normal connection between said terminals for the over-all period of the successive transmission of a plurality of signals, said last means including slow-acting means for maintaining said open connection for a predetermined period after said transmitting apparatus has ceased to operate.

4. A signaling system comprising a plurality of station circuits connected in a closed ring,

each said station circuit having incoming and outgoing terminals normally connected for through transmission, transmitting apparatus, and means responsive to signals from said transmitting apparatus for opening said normal connection between said terminals for the over-all period of the successive transmission of a plurality of signals, said last means including slow-acting means for maintaining said open connection for a period greater than the propagation time of said closed ring after said transmitting apparatus has ceased to operate.

5. A signaling system comprising a plurality of stations so connected that any one station transmitting will receive the transmitted message through the remainder of all of said stations, a station circuit for each said station having incoming and outgoing terminals normally connected for through transmission, transmitting apparatus and means responsive to signals from said transmitting apparatus for opening said normal connection between said terminals, said last means being slow acting by a period greater than the time taken for a transmitted signal to traverse said stations and reach said receiving apparatus.

6. In a signaling system, a station circuit having incoming and outgoing terminals normally connected for through transmission, transmitting apparatus, means responsive to signals from said transmitting apparatus for opening said normal connection between said terminals, and means responsive to signals received at said incoming terminal, said last means being slow acting and responsive only to signals of more than normal length, said last means operating to render said first means ineffective.

7. In a signaling system, a station circuit having incoming and outgoing terminals normally connected for through transmission, transmitting apparatus, means responsive to signals from said transmitting apparatus for opening said normal connection between said terminals, said means automatically maintaining said open connection for a predetermined period after said transmitting apparatus has ceased to operate and slow-acting means responsive to signals of greater than ordinary length connected to said incoming terminal for disabling said first means.

8. A signaling system comprising a series of stations in a closed ring, each said station having incoming and outgoing terminals normally connected for through transmission, transmitting apparatus, means responsive to signals from said transmitting apparatus for opening said normal connection between said terminals, said means automatically maintaining said connection open for a time greater than the propagation time of said closed ring, and means connected to said incoming terminal unresponsive to normal signals but responsive to a signal of greater than normal length for disabling said first means.

9. In a signaling system, a station circuit having incoming and outgoing terminals normally connected for through transmission, transmitting apparatus, means responsive to signals from said transmitting apparatus for opening said normal connection between said terminals and for automatically maintaining said open circuit for a predetermined time after said transmitting apparatus has ceased to operate, means connected to said incoming terminal unresponsive to incoming signals of normal length but responsive to a signal of more than ordinary length to disable said first means, an alarm and slow-acting means responsive after a predetermined period to said last means for operating said alarm.

10. A signaling system comprising a series of stations in a closed ring, each said station having incoming and outgoing terminals normally connected for through transmission, transmitting apparatus, means responsive to signals from said transmitting apparatus for opening said normal connection between said terminals, said means being slow releasing, means connected to said incoming terminal unresponsive to incoming signals of normal length but responsive to an open circuit maintained for a period greater than the normal length of incoming signals to disable said first means so as to transmit a closed circuit signal from said outgoing terminal, an alarm and slow-acting means responsive after a predetermined period to said open circuit responsive means for operating said alarm, whereby an open circuit in said closed ring will eventually operate said alarm in the station adjacent to said break and will cause a steady closed circuit condition at all other said stations in said closed ring.

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