Jan. 16, 1940. V. P. THORP 2,187,104

SIGNALING SYSTEM

Filed Feb. 11, 1939

FIG. 1

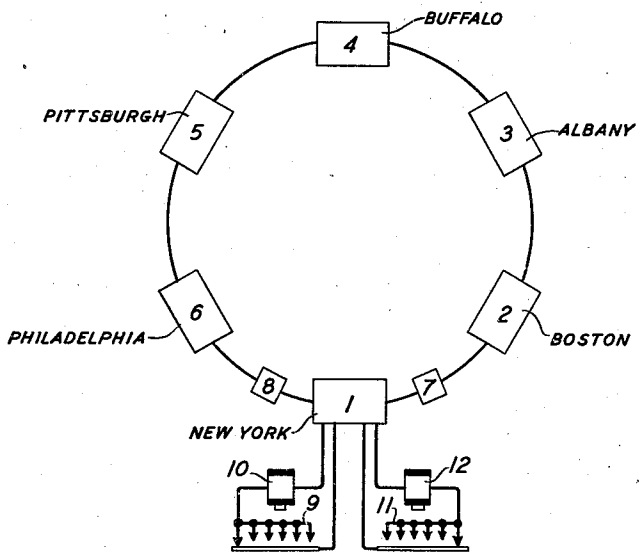
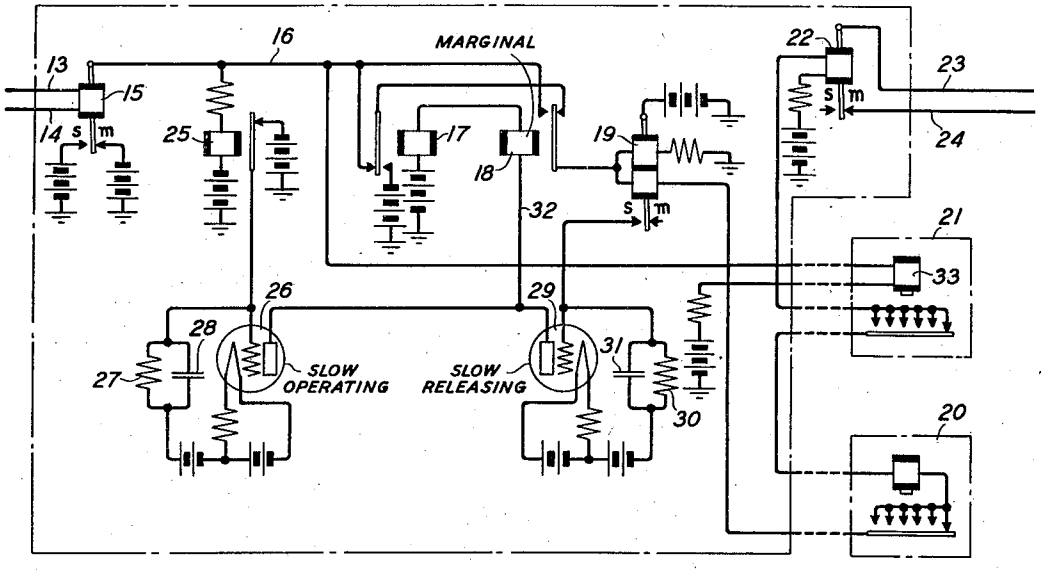


FIG. 2



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Patented Jan. 16, 1940

2,187,104

UNITED STATES PATENT OFFICE

2,187,104

SIGNALING SYSTEM

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Application February 11, 1939, Serial No. 255,814

6 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. The invention is an improvement on the system disclosed in Patent 2,111,684 granted March 22, 1938 to C. R. Walker and is a specific improvement in the system disclosed in the application of Branson et al. Ser. No. 255,820 filed on Feb. 11, 1939.

In ring type circuits having even a measurable propagation time, signals transmitted from one station in the ring will traverse the ring and return to that station at a later time. Since our signals at the outgoing terminals of the station and the same signals at the incoming terminals of the same station are not in synchronism it follows that the circuit at such station must be broken in order to avoid interference. The outgoing and incoming terminals of the transmitting station must be separated. Hence, during transmission the normally closed connection between the incoming and outgoing terminals of the station circuit must be automatically opened. Moreover, this open condition must be maintained for a period longer than the propagation time of the ring to prevent closure until after the last impulse has completely traversed the circuit in order to prevent the establishment of a traveling impulse which might otherwise continue to traverse the ring indefinitely. Thus a slow-releasing means for opening the normal connection between the incoming and outgoing terminals is provided and made responsive to impulses from the station transmitting apparatus. An object of the present invention is to improve on the means heretofore used to perform this function by providing less expensive, more accurately operating and adjustable apparatus. Accordingly, a feature of this invention is a quick-acting slow-releasing vacuum tube circuit whose releasing time may be accurately and easily adjusted to be a definite time interval longer than the propagation time of the particular ring circuit in which it is to be used.

Another object of the invention is to provide improved means to respond to break signals for notifying a transmitting operator that use of the circuit is desired by another and to automatically close through the normal connection between the incoming and outgoing terminals which has been opened in response to the operation of the transmitting apparatus.

Another feature of the invention then, is a slow-acting quick-releasing vacuum tube circuit unresponsive to incoming signals of normal length but responsive to signals of abnormal length such as "break" signals or other prolonged open circuit conditions.

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 subscriber 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.

In Fig. 2, conductors 13 and 14 represents the incoming terminal and marking and spacing currents in these conductors cause the relay 15 to move its armature either to its marking or spacing contact. Under normal conditions, marking and spacing impulses received by the relay 15 will be transmitted over the conductor 16 through the back contact and armature of relay 17, the back contact and armature of relay 18 to the apex of the windings of relay 19, thence over the subscriber stations 20 and 21 and the winding of transmitting relay 22 to ground. Relay 19 does not respond to this circuit and hence the transmission coming in on conductors 13 and 14 will be repeated over conductors 23 and 24, representing the outgoing terminal of this station circuit.

Relay 25 follows signals coming in over conductors 13 and 14 and is operated when relay 15 goes to its spacing contact. Since under normal telegraph signal transmission conditions relay 15 does not remain for any great length of time on its spacing contact, relay 25 does not remove battery from the grid of tube 26 for any length of time. The grid of this tube being kept negative, does not allow space current to flow of sufficient value to operate either relay 17 or 18. Through the resistance 27 and capacity 28 and the normal

connection of the grid to positive battery the tube 26 is effectively rendered a slow-operating relay.

When either subscriber's station 20 or 21 is transmitting both relays 19 and 22 respond. Relay 22 by opening and closing the connection between the outgoing conductors 23 and 24 effectively relays the code impulses sent by one of the subscribers' stations 20 or 21. The armature of relay 19 moves to its spacing contact in response to spacing impulses and during these short intervals places battery on the grid of tube 29 which through the resistance 30 and condenser 31 effectively becomes a slow-releasing relay. Therefore, under normal transmission from either subscriber's station 20 or 21, tube 29 will deliver enough current to conductor 32 to cause the operation of relay 17, which effectively opens the line from the incoming terminals and places marking battery through its front contact and armature and the back contact and armature of marginal relay 18 to the apex of the coils of relay 19. This marking battery renders it possible for subscriber's station 20 or station 21 to transmit uninterruptedly unless a long break signal is received.

The characteristic of the vacuum tube 29 is such that after subscriber's station 20 or 21 has ceased to transmit, the relay 17 will be held operated for a period somewhat greater than the propagation time of the entire ring.

If while either subscriber's station 20 or 21 is transmitting, a break is made in the ring circuit so that a permanent spacing signal appears on conductors 13 and 14 then relay 25 in responding for a period longer than normal will allow vacuum tube 26 to transmit enough additional current in conductor 32 to cause the operation of marginal relay 18, whereupon a spacing signal is connected from the armature of relay 15 to the front contact and armature of relay 18 to the apex of the coils of relay 19. This will appear in the subscribers' stations 20 and 21 as a spacing signal and the operator thereat will accordingly cease transmitting. Relay 19 going to its marking contact will deenergize the tube 29 so that in a period somewhat greater than the propagation time of the circuit this tube will cease to supply current to conductor 32. When vacuum tube 29 ceases to function, the current supplied by vacuum tube 26 becomes only sufficient to hold relay 17 operated and marginal relay 18 thereupon deenergizes. Thereupon marking battery through the front contact and armature of relay 17 is again connected to the back contact and armature of relay 18 to the apex of the coils of relay 19 and thus marking current manifests itself as marking signals in subscribers' stations 20 and 21 and affects the relay 22 to transmit a marking signal into the ring circuit beyond. In time this marking signal appears in the receiver of the breaking station and this station thereupon goes on with its transmission. As soon as marking signal appears on conductors 13 and 14 relay 25 will again place negative battery on the grid of tube 26, causing the release of relay 17 and restoring the circuit to its normal condition.

Thus vacuum tube 29 constitutes a quick-acting and slow-releasing means responsive to transmission from a local station for opening the ring in this station circuit. Vacuum tube 26 constitutes a slow-operating and quick-releasing means for controlling the station circuit in response to break signals and other prolonged open-circuit conditions manifesting themselves on the incoming terminal conductors 13 and 14.

Subscribers' stations 20 and 21 are shown differently. Subscriber's station 20 has its transmitting and receiving apparatus both in the same subscriber station loop while subscriber's station 21 has a separate loop for each. Thus, if it is desired to receive a record of what is transmitted from subscriber's station 21 after the signals have traversed the entire ring then the receiving device represented by the receiving magnet 33 is connected to the incoming terminal and this device, while cut off from the transmitting apparatus locally, will be of utility in proving the continuity of the circuit.

It should further be noted that a simultaneous two-way "conversation" can be carried on between two stations such, for instance, as between New York and Buffalo, in Fig. 1. In this case while subscriber's station 21 is transmitting from New York to Buffalo, this message being received also by Boston and Albany, Buffalo may be transmitting to New York, the Buffalo message being received on the device 33 as well as at Pittsburgh and Philadelphia. Such a connection is spoken of by telegraphers operating this type of facility as a two-way "conversation" because from the operating standpoint the effect is the same as two-way communication over the same circuit as in duplex and other well-known types of system. Actually, the transmission from New York to Buffalo in the example given is over an entirely different circuit, including the Boston and Albany stations, than the transmission from Buffalo to New York which includes the Pittsburgh and Philadelphia stations. Since, while the operator at New York is transmitting, his station circuit is effectively opened so as not to repeat incoming signals he may receive one message from Buffalo while at the same time he is transmitting an entirely different message to Buffalo, and the same effect holds at Buffalo. In other words, when this is done with the aid of equipment shown in Fig. 2 both at New York and at Buffalo, the ring in effect becomes disrupted and two independent one-way circuits are established.

Further, it is possible, due to this automatic separation of the incoming and outgoing terminals in a station circuit, for one message to be transmitted from a first to a second station, such as from New York to Boston in Fig. 1, another from a second to a third station, such as from Boston to Albany in Fig. 1, another from a third to a fourth or a fifth station, such as from Albany to Buffalo or Pittsburgh in Fig. 1, and so on. It will be appreciated that the system is flexible and capable of being operated in a variety of ways, all consistent with the incoming terminals being effectively connected to the outgoing terminals under normal conditions and with this connection broken when signals are being transmitted.

What is claimed is:

1. In a signaling system, a station circuit having incoming and outgoing terminals normally connected for through transmission, transmitting apparatus associated with said outgoing terminal, means for opening said normal connection between said terminals and a quick-operating slow-releasing vacuum tube circuit responsive to signals from said transmitting apparatus for operating said means.

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 associated with said out-

going terminal, means for opening said normal connection between said terminals and a quick-operating slow-releasing vacuum tube circuit responsive to signals from said transmitting apparatus for operating said means.

3. In a signaling system, a station circuit having incoming and outgoing terminals normally connected for through transmission, transmitting apparatus associated with said outgoing terminal, means for opening said normal connection between said terminals, a quick-acting slow-releasing means responsive to signals from said transmitting apparatus for operating said means and a slow-acting quick-releasing vacuum tube circuit responsive to signals received over said incoming terminal for closing said normal connection between said terminals when opened by said means.

4. In a signaling system, a station circuit having incoming and outgoing terminals normally connected for through transmission, transmitting apparatus associated with said outgoing terminal, means for opening said normal connection between said terminals, a quick-acting slow-releasing vacuum tube circuit responsive to signals from said transmitting apparatus for operating said means, and a slow-acting quick-releasing vacuum tube circuit responsive to signals received over said incoming terminal for closing said normal connection between said terminals when opened by said means.

5. In a signaling system, a station circuit having incoming and outgoing terminals normally connected for through transmission, transmitting apparatus associated with said outgoing terminal, means for opening said normal connection between said terminals, a quick-acting slow-releasing vacuum tube circuit responsive to signals from said transmitting apparatus for operating said means, and a vacuum tube circuit unresponsive to normal signals and responsive to abnormal signals received over said incoming terminal for closing said normal connection between said terminals when opened by said means.

6. In a signaling system, a station circuit having incoming and outgoing terminals normally connected for through transmission, transmitting apparatus associated with said outgoing terminal, means for opening said normal connection between said terminals, a quick-acting slow-releasing vacuum tube circuit responsive to signals from said transmitting apparatus for operating said means and a slow-acting quick-releasing vacuum tube circuit responsive only to signals of abnormal length received over said incoming terminal for releasing said means.

VAUGHN P. THORP.