March 22, 1938. W. W. CRAMER 2,111,615

SIGNALING SYSTEM

Filed May 18, 1937

FIG. 1

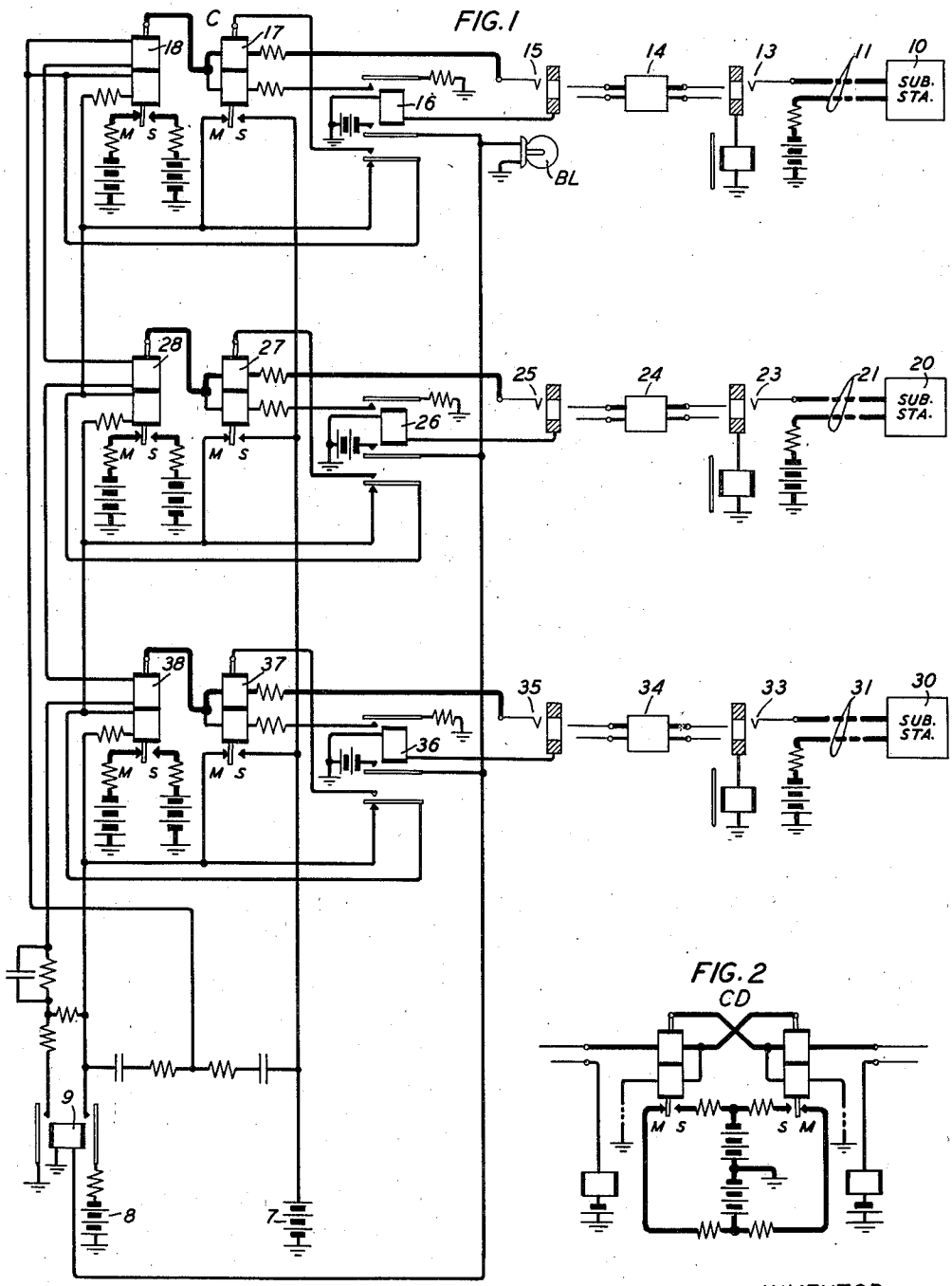

FIG. 2

INVENTOR
W. W. CRAMER
BY J. W. Schmied
ATTORNEY

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SIGNALING SYSTEM

Walter W. Cramer, Rutherford, N. J., assignor to Bell Telephone Laboratories, Incorporated, New York, N. Y., a corporation of New York

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5 Claims. (Cl. 178—73)

This invention relates to signaling systems and particularly to telegraph systems arranged for transmitting and receiving polarized signals.

It is an object of the invention to provide a simple, efficient and reliable conference circuit for interconnection of three or more signaling stations in a polar telegraph system.

This invention is a telegraph repeater circuit comprising a polarized receiving relay and a polarized sending relay for each of a plurality of branches, one winding of each of the sending relays being connected in series in a local circuit, the other winding of each sending relay being normally short-circuited by contacts of the associated receiving relay. Operation of any receiving relay reverses the current in the series circuit to operate all of the sending relays except the one associated with the operated receiving relay, operation of the last-mentioned sending relay being prevented by current through its normally short-circuited winding.

The invention will be further described by considering the conference circuit shown in the drawing which forms a part of this specification. The invention is, however, not limited in its application to the specific arrangement shown but is applicable to any polar telegraph system in which conference circuits or multiline repeaters are provided.

Referring to the drawing:

Fig. 1 shows schematically three telegraph stations **10**, **20** and **30**, three cords **14**, **24** and **34** for use in interconnecting stations for communication, and a conference circuit C comprising jacks **15**, **25** and **35**, receiving relays **17**, **27** and **37**, sending relays **18**, **28** and **38**, and a common control relay **9**; and

Fig. 2 shows a cord circuit CD of a type suitable for use with the conference circuit C.

The conference circuit C is arranged for interconnecting only three stations but may be arranged for interconnecting more than three stations by providing another jack and set of relays for each additional branch of the circuit. The switchboard, at which the conference circuit C is provided, is shown as a manually operated board, but the manually operated equipment can, of course, be replaced by automatic switching equipment. Each of the double-ended cords shown schematically in Fig. 1 are used for interconnecting subscribers' loops and interoffice trunks as well as for establishing conference connections. Polarized repeating relays are provided in each of the cords as shown in Fig. 2. The operators' positions may be equipped with teletypewriter equipment for communicating with subscribers and other operators, and the subscribers' stations may be similarly equipped for communicating with operators and other subscribers. For a more complete description of such a system reference may be had to the copending application of G. A. Locke et al. Serial No. 459,684, filed June 7, 1930. The line jacks **13**, **23** and **33** and conference circuit jacks **15**, **25** and **35** may be multipled to a plurality of positions. A busy lamp BL is associated with the first jack of the conference circuit at each position to which the conference jacks are multipled.

Assume that an operator has received a request for the interconnection of stations **10**, **20** and **30**, and that the desired interconnection is provided by plugging one end of cord **14** into jack **13** and the other end into jack **15**, by plugging one end of cord **24** into jack **23** and the other end into jack **25** and by plugging one end of cord **34** into jack **33** and the other end into jack **35**. The sleeve relays **16**, **26** and **36** associated with jacks **15**, **25** and **35** are thereby operated; and each of these relays closes a circuit for operating the common control relay **9**. Each of the operated sleeve relays opens a normally closed short circuit around the lower winding of the associated sending relay, which short circuit is independent of the associated receiving relay, and substitutes a short circuit which is under control of the associated receiving relay. With common relay **9** operated, a circuit is closed from negative battery **8** through the right front contact of relay **9**, normally closed contact of relay **37**, and front contact of relay **36**, normally closed contact of relay **27** and front contact of relay **26**, normally closed contact of relay **17** and front contact of relay **16**, upper winding of relay **18**, upper winding of relay **28** and upper winding of relay **38** to ground through the left front contact of relay **9**. The current in this circuit is effective to hold the armatures of relays **18**, **28** and **38** on the marking contact as shown in the drawing. The biasing winding of each of the receiving relays **17**, **27** and **37** is energized in a circuit from negative battery at the normally closed contact of the associated sending relay to ground at the upper front contact of the associated sleeve relay; and the upper windings of receiving relays **17**, **27** and **37** are energized in circuits from negative battery at the normally closed contact of the associated sending relay, through the tip conductors of the associated one of jacks **15**, **25** and **35**, through the winding of one repeating relay and contact of the other repeating relay in the associated cord,

to positive battery. The current through the windings of receiving relays 17, 27 and 37 holds the armatures of these relays on their marking contacts as shown in the drawing.

When any one of the interconnected stations starts sending a message, the signals are repeated through the cord to the associated receiving relay of the conference circuit and operation of any one of the receiving relays causes the operation of all of the sending relays except the one associated with the operated receiving relay, the signal from the sending station being thereby repeated through the other cords to all other interconnected stations. For instance, assume that the station 10 is sending. The signals are repeated through the cord to the receiving relay 17. A spacing signal moves the armature of relay 17 to its spacing contact and a marking signal moves the armature of relay 17 to its marking contact. When the armature of relay 17 moves from its marking to its spacing contact, the upper winding of relay 18 is disconnected from negative battery 8 and connected to positive battery 7 thereby causing a reversal of the energization of the upper windings of relays 18, 28 and 38. The armatures of sending relays 28 and 38 are thereby moved to their spacing contacts, sending a spacing signal to and through cords 24 and 34 to stations 20 and 30. The operation of receiving relay 17 opens the short circuit around the lower winding of sending relay 18 and the resulting energization of this winding opposes the reversed energization of the upper winding and is effective to maintain the armature of relay 18 on its marking contact. When relay 17 next responds to a marking signal, the energization of the upper windings of relays 18, 28 and 38 is again reversed and the armatures of relays 28 and 38 move to their marking positions thus sending a marking signal to stations 20 and 30. The operation of either of receiving relay 27 or 37 when station 20 or 30 is sending a message causes a similar signal repeating operation. If one or more branches of the conference circuit are not used in any given conference connection, the associated sleeve relay will not be operated and operation of its sending relay is, of course, without effect.

When the plugs are removed from jacks 15, 25 and 35, sleeve relays 16, 26 and 36 release.

Patching cords may be used to interconnect the subscribers' jacks with the conference circuit, but in this case the conference circuit is modified so that positive battery is connected to the marking contact and negative battery to the spacing contact of each of the sending relays of the conference circuit.

What is claimed is:

1. In a telegraph system, subscribers' stations, a conference circuit, and means including said conference circuit for interconnecting a plurality of said stations, said conference circuit comprising a receiving relay and a sending relay for each interconnected station, the operating winding of each of said sending relays being connected in a series circuit and the holding winding of each of said sending relays being normally short-circuited by contacts of the associated receiving relay, the operation of any one of the receiving relays being effective to reverse the current in said series circuit and to open said short circuit around the holding winding of the associated sending relay.

2. In a telegraph system, subscribers' stations, a conference circuit having a plurality of branches, means for connecting a plurality of said stations to said conference circuit, a polarized signal receiving relay and a polarized signal sending relay for each of said branches, a series circuit for energizing one winding of each of said sending relays, circuits each including another winding of said sending relays, and contacts for each of said receiving relays for reversing the current in said series circuit.

3. In a telegraph system, subscribers' stations, a conference circuit having a plurality of branches, means for connecting a plurality of said stations to said conference circuit, a polarized signal receiving relay and a polarized signal sending relay for each of said branches, an operating winding and a biasing winding for each of said sending relays, a series circuit for energizing the operating winding of each of said sending relays, and contacts for each of said receiving relays for reversing the current in said series circuit and for opening and closing a short circuit around the biasing winding of the associated sending relay.

4. In combination in a telegraph system, a plurality of signaling circuits, a repeater having a plurality of branches, means for connecting each branch to a different signaling circuit, a pair of polarized sending and receiving relays for each of said branches, means comprising contact springs of each of said receiving relays for energizing one winding of each of said sending relays in series, said contact springs of each of said receiving relays also being effective to short-circuit the other winding of the associated sending relay, and means comprising another contact of each receiving relay for reversing the current in the series connected windings of said sending relays and for energizing said other winding of the associated sending relay.

5. In combination in a telegraph system, a plurality of pairs of polarized sending and receiving relays, a plurality of signaling circuits, each pair of sending and receiving relays being connected to receive signals from and send signals to a different one of said signaling circuits, means comprising contacts of each of said receiving relays for energizing one winding of each of said sending relays in series, said contacts of each of said receiving relays also being effective to open and close a short circuit around another winding of the associated sending relay, and other contacts of each of said receiving relays for reversing the current in the series connected windings of said sending relays and for energizing said other winding of the associated sending relay.

WALTER W. CRAMER.