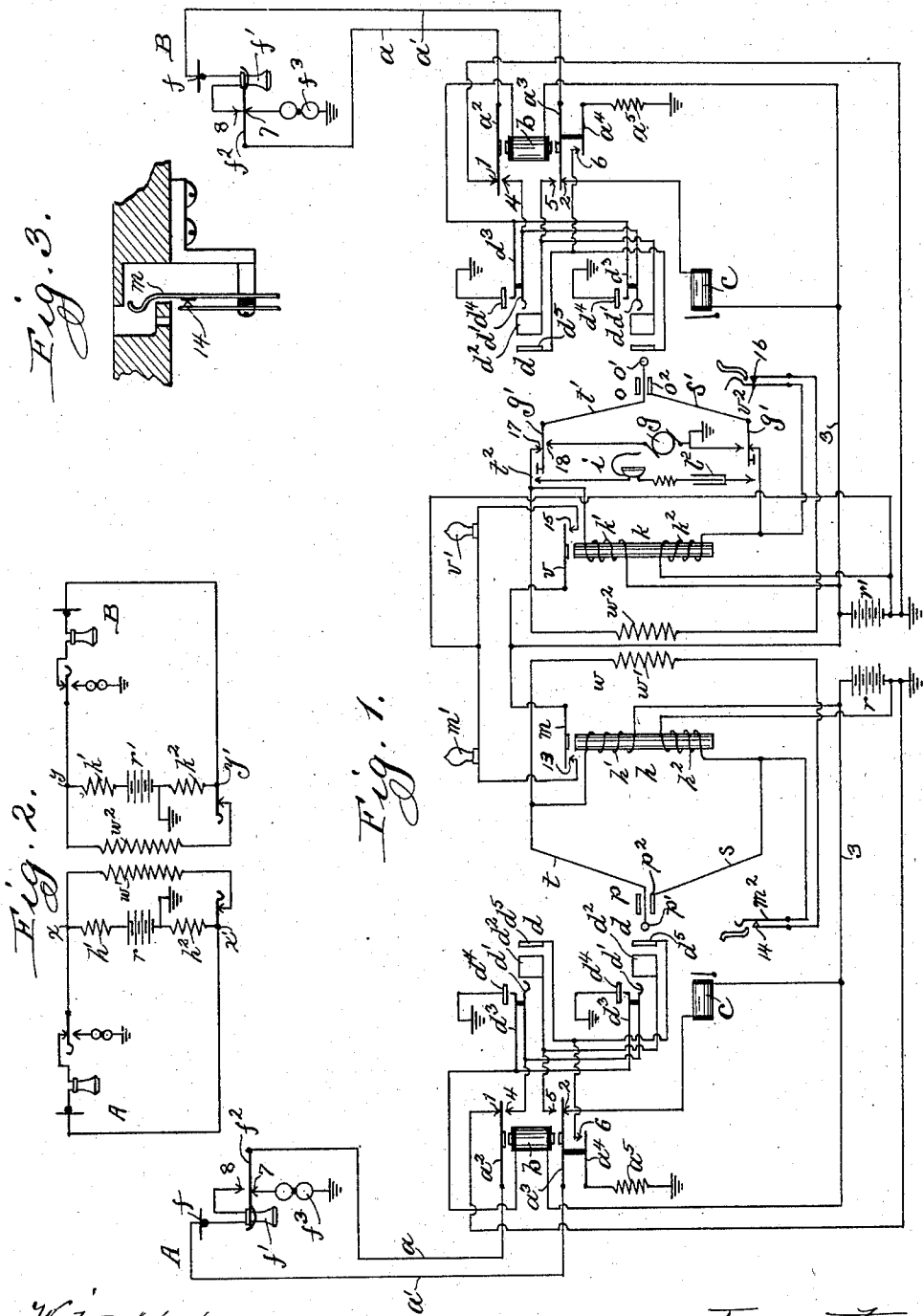


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CENTRAL ENERGY TELEPHONE SYSTEM.

APPLICATION FILED FEB. 4, 1901.

NO MODEL.



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# UNITED STATES PATENT OFFICE.

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## CENTRAL-ENERGY TELEPHONE SYSTEM.

SPECIFICATION forming part of Letters Patent No. 741,807, dated October 20, 1903.

Application filed February 4, 1901. Serial No. 45,928. (No model.)

*To all whom it may concern:*

Be it known that I, KEMPSTER B. MILLER, a citizen of the United States, residing at Chicago, in the county of Cook and State of Illinois, have invented a certain new and useful Improvement in Central-Energy Telephone Systems, of which the following is a full, clear, concise, and exact description, reference being had to the accompanying drawings, forming a part of this specification.

My invention relates to a central-energy telephone system, my object being to provide an improved form of signaling apparatus at the central station.

In an application filed by me February 4, 1901, Serial No. 45,928, I have disclosed a telephone system in which a relay for actuating the supervisory signal is bridged between the talking-limbs of the telephone-circuit, said relay being placed in parallel with the winding of the repeating-coil which serves to unite the two connected subscribers. A source of electricity is associated with the relay to traverse the coils thereof, and in said application above mentioned I have disclosed means for preventing the currents from said source of electricity from traversing the windings of the repeating-coil to thereby short-circuit the source of electricity. In said prior application I have specifically illustrated a condenser interposed in the circuit of the repeating-coil to prevent the current from said source of electricity from passing therethrough.

The present invention relates to a modification wherein the condenser is replaced by the contacts of a plug-seat switch, whereby the circuit through the repeating-coil is closed when the telephone-lines are connected for conversation and is opened to prevent the waste of current when the lines are disconnected.

I have illustrated my invention in the accompanying drawings, in which—

Figure 1 is a view of two telephone-lines and the connecting apparatus at the central station for uniting the same for conversation. Fig. 2 is a diagram showing the talking-circuits of two connected telephone-lines. Fig. 3 is a detail view of a plug-seat switch which

may be employed in connection with my invention.

Like characters refer to like parts in the several figures.

The telephone-line A extends in two limbs  $a$   $a'$  to the central station, where said limbs terminate, respectively, in the springs  $a^2$   $a^3$ , the spring  $a^2$  normally resting against back contact 1, which is connected to ground, the spring  $a^3$  normally resting against back contact 2, which is connected, through individual annunciator  $c$ , to conductor 3. The springs  $a^2$  and  $a^3$  carry armatures resting opposite the poles of a relay-magnet  $b$ , and the spring  $a^2$  when attracted is adapted to engage contact 4, which is connected with the line-springs  $d'$   $d'$  of the spring-jacks or switch-sockets  $d$   $d$ . The spring  $a^3$  is adapted when attracted to engage contact 5, which is connected with the sleeves  $d^2$   $d^2$  of the spring-jacks. Moving with spring  $a^3$ , but insulated therefrom, is a spring  $a^4$ , connected to ground through a resistance  $a^5$  and adapted when the relay is energized to engage contact 6, which is connected with the test-rings  $d^5$   $d^5$ . One end of the winding of relay  $b$  is connected with conductor 3 and the other end is connected with the contact-springs  $d^3$   $d^3$ , which springs are mounted to move with but insulated from the line-springs  $d'$   $d'$ , respectively. When the plug is inserted in the spring-jack, the line-spring  $d'$  is moved by the tip thereof to carry the spring  $d^3$  into engagement with the grounded contact  $d^4$ .

The subscriber is provided at the station with the usual microphone  $f$ , receiver  $f'$ , and switch-hook  $f^2$ , adapted when the line is not in use to engage contact 7, which is connected, through bell  $f^3$ , to ground. When the telephone is removed from the hook, the hook engages contact 8, which is connected with the telephone transmitter and receiver. The telephone-line B (shown at the right of the drawings) is like the telephone-line A and is provided with the same parts and mechanism, and like parts have been indicated by the same reference characters employed in connection with line A.

The answering-plug  $p$  is provided with a

tip  $p'$  and a sleeve  $p^2$ , the former being connected with the strand  $t$  and the latter with the strand  $s$ . Likewise the calling-plug  $o$  is provided with a tip  $o'$ , connected with strand  $t'$ , and a sleeve  $o^2$ , connected with strand  $s'$ . The strands  $t$  and  $s$  are united through a repeating-coil  $w$ , having a winding  $w'$ , connected between the strands  $t$  and  $s$ . In circuit with the windings  $w'$  are the contacts  $m^2$  and 14 of a plug-seat switch, adapted to be operated by the plug  $p$ . The winding  $w^2$  of the repeating-coil is connected between the strands  $t'$  and  $s'$ , and in circuit therewith are the contacts  $v^2$  and 16 of a plug-seat switch controlled by the calling-plug  $o$ . Between the strands  $t$  and  $s$  are the windings  $h'$  and  $h^2$  of a relay  $h$ , and between said windings is interposed a battery  $r$ . Likewise between the strands  $t'$  and  $s'$  the windings  $k'$  and  $k^2$  of a relay  $k$  are connected, a battery  $r'$  being interposed between said windings. The windings  $h'$  and  $h^2$  of the relay  $h$  are wound upon the core in such a manner that when the battery-current flows through one of said windings  $h'$ , thence over the telephone-line and back through the other winding  $h^2$ , the current will be in such a direction as to neutralize the core. Therefore while the battery-current flows through both windings the relay  $h$  remains unenergized. When, however, current is passed through one of the windings alone, the core will be polarized to attract its armature. Since the windings  $h'$  and  $h^2$  are wound upon opposite ends of the core and are not superimposed, the talking-currents will meet impedance which will prevent the same passing through the windings  $h'$  and  $h^2$ . The relay thus opposes the passage of the talking-current, is neutralized during the passage of the battery-current through both windings, and is energized by the passage of the battery-current through one of the windings. The relay  $k$  is wound and constructed in the same manner as relay  $h$ . Opposite the pole of relay  $h$  a spring  $m$  is provided, carrying an armature and adapted when the relay is energized to engage contact 13. Contact 13 is connected, through the lamp  $m'$ , with one pole of the battery  $r'$ , and the spring  $m$  is connected with the opposite pole of said battery. Likewise the spring  $v$  of the relay  $k$  is connected with one pole of battery  $r'$ , and the contact 15 is connected, through lamp  $v'$ , to the opposite pole of said battery.

In the strand  $t'$  a ringing-key  $g'$  is provided, normally resting against contact 17 and adapted when depressed to engage contact 18, which is connected to ground through generator  $g$ . The operator's telephone set  $i$  is adapted to be connected between the strands  $t'$  and  $s'$ , and a condenser  $l^2$  is interposed in the circuit of the telephone set.

If subscriber A desires to converse with subscriber B, he lifts his receiver from the hook, thereby closing together the limbs  $a$  and  $a'$  at the substation. The circuit of battery  $r$  is thus closed over conductor 3, annunciator  $c$ ,

contacts 2 and  $a^3$ , limbs  $a$  and  $a'$ , contacts  $a^2$  1, thence to the opposite pole of battery  $r$ . The individual annunciator  $c$  is thus actuated to convey to the operator the signal for connection, and the operator thereupon lifts the answering-plug  $p$  and inserts the same in the spring-jack belonging to subscriber A. When the plug  $p$  rests in its seat, the contacts  $m^2$  and 14 of the plug-seat switch are separated, thereby opening the circuit through the winding  $w'$  of the repeating-coil to prevent the wasting of the battery-current while the cord connector is idle. When, however, the answering-plug is removed from its seat, the contacts  $m^2$  and 14 are closed together, and the continuity of the circuit through the winding  $w'$  is thus completed to connect the repeating-coil operatively in circuit. The insertion of the answering-plug in the spring-jack belonging to subscriber A moves contact  $d^3$  against contact  $d^4$ , thereby energizing the relay  $b$ , the circuit through said relay being traced from battery  $r$  through conductor 3, relay  $b$ , spring  $d^3$ , contact  $d^4$  to ground and back to the battery. The relay being thus energized attracts the armatures and moves springs  $a^2$  and  $a^3$  out of engagement, respectively, with contacts 1 and 2, thus disconnecting the annunciator  $c$  from circuit, and moves said springs into engagement, respectively, with contacts 4 and 5, thus connecting the terminals of the spring-jacks with the limbs of the telephone-line. The insertion of the answering-plug also connects battery  $r$  in circuit through the windings  $h'$  and  $h^2$  of relay  $h$  and through the strands  $t$  and  $s$  of the cord-circuit and the limbs  $a$  and  $a'$  of the line. Since the battery-current traverses both of the windings  $h'$  and  $h^2$ , the core of the relay remains neutral and the relay remains unactuated. The operator then connects her telephone set  $i$  in circuit and receives the number of the called subscriber. Learning that connection is desired with subscriber B, she lifts the answering-plug  $o$  and touches the tip  $o'$  thereof to the test-ring  $d^5$  belonging to the spring-jack of subscriber B. If subscriber B is busy, his relay  $b$  will be energized, and test-ring  $d^5$  will be connected to ground through contact 6 and spring  $a^4$ . If the line be thus busy, the operator upon touching the tip  $o'$  of the plug  $o$  to the test-ring will hear a click in her telephone-receiver; but, on the other hand, if the line be idle she will hear no click and will know that the line is not busy. The click in the telephone is due to the fact that by touching the tip of the plug to the test-contact the potential at the point  $t^2$  of strand  $t'$  is lowered, thereby permitting a current to flow through the operator's telephone-receiver. When the tip  $o$  is not in contact with the test-ring, the battery  $r'$  is on open circuit, and the point  $t^2$  is therefore of the same potential as the pole of the battery. When, however, the tip of the plug is touched to the test-ring, the circuit of battery  $r'$  is closed from ground through winding  $k'$ , strand  $t'$ ,

tip  $o'$ , test-ring  $d^5$ , contacts 6 and  $a^4$  to ground. The resistance interposed between the pole of the battery and the point  $t^2$  by the winding  $k'$  lowers the potential of the point  $t^2$  on closed circuit, and this difference of potential of point  $t^2$ , with which the operator's telephone set is connected, causes a momentary current to flow through the receiver, thereby causing a click therein.

Assuming that the operator finds the line of the called subscriber idle, she inserts the plug  $o$  in the jack thereof and then depresses ringing-key  $g'$ , thereby sending current from generator  $g$  over strand  $t'$ , tip  $o'$ , spring  $d'$ , contacts 4 and  $a^2$ , limb  $a$ , through bell  $f^3$  to ground. When the subscriber responds, he lifts his receiver from the hook, thus closing together the limbs  $a$   $a'$  at the substation. The circuit of battery  $r'$  is thus closed through windings  $k'$  and  $k^2$ , strands  $t'$   $s'$ , and limbs  $a$   $a'$ . Since the current flows through both of the windings of the relay, the relay remains unactuated. The circuits during conversation are shown in Fig. 2. When subscriber A is talking and his microphone is actuated, variations of resistance therein cause a corresponding variation of the difference of potential between the points  $x$  and  $x'$ , and this variation of difference of potential causes a correspondingly-varying current to traverse winding  $w'$ , thereby inducing a correspondingly-varying current in winding  $w^2$ , which passes through the receiver to the substation B. Likewise when subscriber B is talking the difference of potential between the points  $y$  and  $y'$  is varied and correspondingly-varying currents are caused to traverse the receiver of subscriber A.

When the subscribers have completed their conversation and desire disconnection, they hang up their telephone-receivers, thereby separating limbs  $a$   $a'$  at the substation and connecting limb  $a$  with ground. Lamps  $m'$  and  $v'$  are thus lighted to convey to the operator the signal for disconnection. Thus when subscriber A hangs up his telephone-receiver the circuit of battery  $r$  is closed from ground through winding  $h'$ , strand  $t$ , limb  $a$  to ground at the substation. Since but one of the windings of the relay  $h$  is thus energized, the core of the relay is polarized to attract its armature and close together contacts  $m$  and 13, thereby lighting lamp  $m'$ . Similarly the lamp  $v'$  is lighted by subscriber B in hanging up his telephone. The operator thereupon removes the plugs  $p$  and  $o$  from the respective sockets, and the circuit of the batteries are opened at the plug-terminals and the relays are deenergized to extinguish the lamps. If one of the subscribers should desire an immediate reconnection with another subscriber, he may by vibrating the switch-hook in the usual manner cause the lamp to be alternately lighted and extinguished to thus convey the signal to the operator for reconnection.

I disclaim herein the matter claimed in the

patent to Francis W. Dunbar for telephone-switchboard systems No. 686,272, dated November 12, 1901.

Having described my invention, what I claim as new, and desire to secure by Letters Patent, is—

1. The combination with a telephone-line, of a repeating-coil through which the same is adapted to be united with another telephone-line, a signal-controlling electromagnet bridged between the two limbs of the talking-circuit of said line, a source of electricity, a switch at the substation for closing the circuit of said source through said electromagnet, and a switch having its contacts interposed in the bridge containing the repeating-coil winding associated with said line and normally opened to prevent the passage of current through said winding when the lines are unconnected, substantially as described.

2. The combination with a telephone-line, of a repeating-coil through which the same is adapted to be united with another line, a source of electricity and an impedance element bridged between the two limbs of the talking-circuit of said line, and a manually-operated switch having its contacts interposed in the bridge containing the winding of said repeating-coil to render the same opaque to current from said source when desired, substantially as described.

3. The combination with a telephone-line, of a repeating-coil through which the same is adapted to be united with another telephone-line, a signal-controlling electromagnet and a source of electricity bridged between the two limbs of the talking-circuit of said line and a normally open switch having its contacts interposed in circuit with the windings of said repeating-coil and closed throughout the connection whereby the current from said source may be prevented from normally passing through said winding, substantially as described.

4. The combination with a telephone-line, of cord connectors and a repeating-coil through which said line is adapted to be connected with another line, a signal-controlling electromagnet and a source of electricity bridged between the two limbs of the talking-circuit of said line and a plug-seat switch having the contacts thereof connected in the bridge containing the winding of said repeating-coil which is associated with said line, substantially as described.

5. The combination with a pair of telephone-lines, of a repeating-coil through which the same are adapted to be united for conversation, a signal-controlling electromagnet and a source of electricity bridged between the two limbs of the talking-circuit of each of said lines, a switch at each substation for controlling the circuit of said source through the electromagnet connected with said line, and switch-contacts interposed in each of the bridges containing the windings of the repeating-coil, substantially as described.

6. The combination with a telephone-line, of a repeating-coil through which the same is adapted to be united with another telephone-line, a signal-controlling electromagnet bridged between the two limbs of the talking-circuit of said line, said magnet having differential windings possessing impedance to the passage of voice-currents, a source of electricity adapted to send current through said windings in a direction to cause the same to neutralize each other and over the metallic line, means at the substation for closing the circuit of said source through both of said windings, and over the metallic line, or through one of said windings with return over a third conductor, and a switch controlling the continuity of the branch containing the repeating-coil winding associated with said line to prevent the current from normally passing therethrough, substantially as described.

7. The combination with a telephone-line, of a repeating-coil through which the same is adapted to be united to another telephone-line, a signal-controlling electromagnet bridged between the two limbs of the talking-circuit of said line, said magnet having two differential windings possessing impedance to the passage of voice-currents, a grounded source of current connected between said windings and adapted to send current through them in a direction to cause them to neutralize each other and over the metallic telephone-line for conversation, means at the substation for closing the circuit of said source through said electromagnet and over the metallic line whereby said magnet is rendered inoperative, or to close circuit from said source through one winding of the electromagnet and over one line-wire with ground return to actuate the same, and a switch controlling the continuity of the branch containing the repeating-coil winding associated with said line to normally prevent the passage of current from said source through the said repeating-coil winding, substantially as described.

8. The combination with a telephone-line, of a repeating-coil by which the same is adapted to be united with another telephone-line, a signal-controlling electromagnet bridged between the two limbs of the talking-circuit of said line, said magnet having two differential windings possessing impedance to the passage of voice-currents, a source of current connected between said windings and adapted to send current therethrough in a direction to neutralize each other and over the metallic line for conversation, means at the substation for controlling the circuit of said source over the metallic line at which time said electromagnet is inoperative or through one winding of said magnet to actuate said electromagnet, a switch interposed in the branch containing the repeating-coil winding that is associated with said line, and means for automatically closing and opening said switch in making and unmaking connec-

tions with the line for conversation, whereby the circuit of said source is normally open through said repeating-coil winding, substantially as described.

9. The combination with a pair of telephone-lines, of a repeating-coil through which the same are united for conversation, a signal-controlling electromagnet bridged between the two limbs of the talking-circuit from each line, said electromagnet having differential windings and possessing impedance to the passage of voice-currents, a source of current interposed between the windings of each electromagnet, means at each substation for controlling the flow of current from said source through both windings and over the metallic line during conversation, or through one winding and over one line conductor when the parties are not conversing, and a switch interposed in the circuit of each winding of said repeating-coil to normally open the same to prevent the passage thereof of current from said source, substantially as described.

10. The combination with a telephone-line, of cord connectors and a repeating-coil through which said line is adapted to be united with another line, a signal-controlling electromagnet and a source of electricity bridged between the two limbs of the talking-circuit of said line, said electromagnet having two differential windings possessing impedance to the passage of voice-currents, means for sending current through said windings in a direction to neutralize each other or through one winding to actuate the electromagnet, and a plug-seat switch having the contacts thereof connected in the bridge containing the winding of said repeating-coil which is associated with said line, whereby when the cord connector is not in use the path for current through the repeating-coil winding is interrupted, substantially as described.

11. The combination with a pair of telephone-lines, of a cord-circuit to unite said lines for conversation, a repeating-coil to inductively connect the two ends with the cord-circuit, a signal controlling the electromagnet and a source of current bridged between the two limbs of the talking-circuit of each line, and a plug-seat switch for the plug of each end of the cord-circuit, the contacts of each said switch being in the bridge containing the winding of said repeating-coil that is associated with said end of the cord connector whereby when the cord connector is not in use and the plugs are in their seats the said repeating-coil bridges are open and prevent waste of current from said source, substantially as described.

12. The combination with telephone-lines, of a cord-circuit to connect said lines together for conversation, a repeating-coil conductively uniting the two ends of the cord-circuit, a differential supervisory-signal-controlling electromagnet bridged across each end of the

cord-circuit and in parallel with one winding of the repeating-coil, a source of current having one pole grounded connected between the windings of each electromagnet, means 5 under the control of the subscribers for controlling the passage of current from said source through both windings of the corresponding electromagnet whereby the same is rendered inoperative, or through one winding 10 whereby the said electromagnet is actuated, a plug-seat switch for the plug at each end of the cord-circuit, said switches being arranged when the plugs are seated therein to open the bridge containing the associated 15 winding of said repeating-coil, substantially as described.

13. The combination with a pair of telephone-lines, of a repeating-coil through which the same are adapted to be united for conversation, a separate source of electricity and 20 an impedance-coil bridged between the two limbs of the talking-circuit of each said line whereby each line is independently supplied with current for conversation, and a switch 25 interposed in the bridge containing each winding of said repeating-coil to open the same when desired to the passage of current from the corresponding source, substantially as described.

30 14. The combination with a pair of telephone-lines, of a repeating-coil through which the same are adapted to be united for conversation, a supervisory-signal-controlling electromagnet having differential windings possessing impedance to the passage of voice- 35 currents, and a separate source of electricity bridged between the two limbs of the talking-circuit of each of said lines, a switch at each substation for controlling the circuit of the

corresponding source through one or both 40 coils of the electromagnet connected with the line, and switch-contacts interposed in each of the bridges containing the windings of the repeating-coil, substantially as described.

15. The combination with a pair of telephone-lines, of a cord-circuit through which the same are adapted to be united for conversation, a repeating-coil interposed between the plugs of the cord-circuit, a supervisory-signal-controlling electromagnet having differential windings possessing impedance to 50 the passage of voice-currents bridged between the two limbs of the talking-circuit of each of said lines, a separate source of electricity having one pole grounded and interposed between 55 the two windings of each of said electromagnets, a switch at each substation for controlling the circuit of the corresponding source through both windings of the associated electromagnet and over the metallic line for conversation, said magnet being at this time un- 60 actuated, said switch also serving to normally connect one side of the line to ground to actuate the electromagnet by current over one line-wire from said source, and a plug- 65 seat switch for each of the cord-circuit plugs and having their contacts interposed in the bridges containing the corresponding windings of the repeating-coil, substantially as described. 70

In witness whereof I have hereunto subscribed my name in the presence of two witnesses.

KEMPSTER B. MILLER.

Witnesses:

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