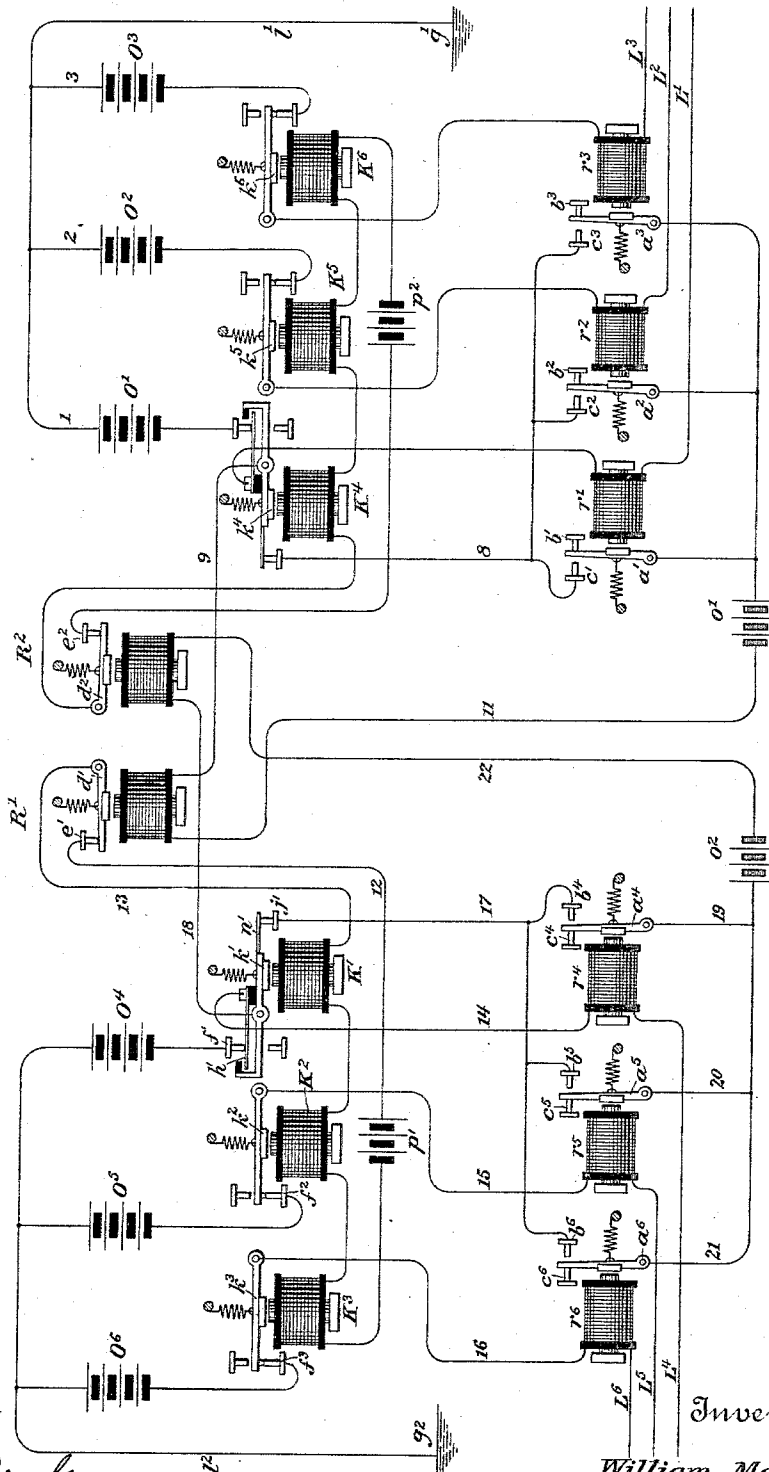


W. MAVER, Jr.
MULTIPLE TELEGRAPHIC REPEATER.

No. 339,449.

Patented Apr. 6, 1886.

Fig. 1.



Witnesses
Geo. W. Buck.
Jos. S. Latimer

By his Attorneys

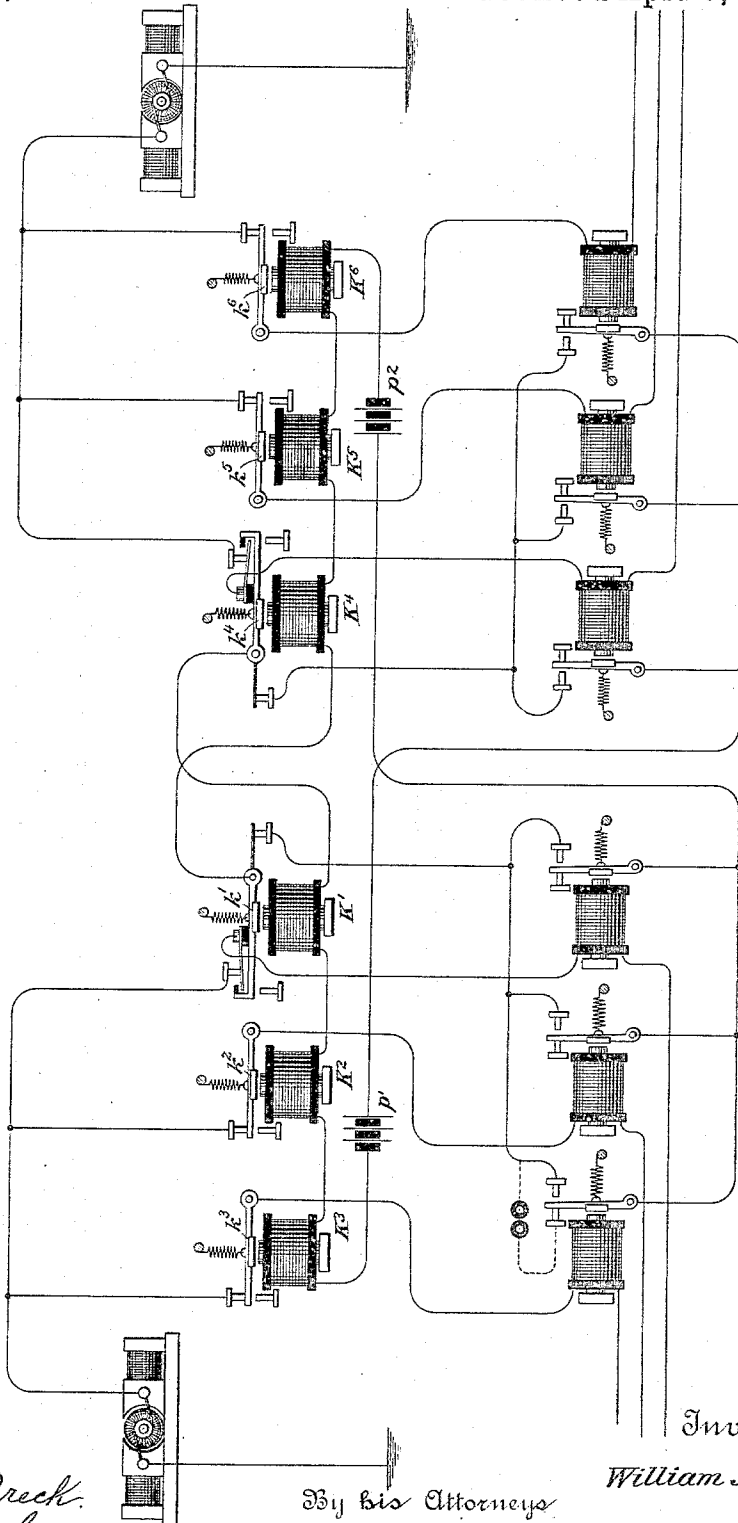
Inventor
William Maver, Jr.
Pope & Edgcomb

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MULTIPLE TELEGRAPHIC REPEATER.

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Fig. 2.



Witnesses

Geo. W. Breck.
W. W. Cook.

By his Attorneys

Cope & Edgcomb

Inventor

William Maver, Jr.

UNITED STATES PATENT OFFICE.

WILLIAM MAVER, JR., OF JERSEY CITY, NEW JERSEY.

MULTIPLE TELEGRAPHIC REPEATER.

SPECIFICATION forming part of Letters Patent No. 339,449, dated April 6, 1886.

Application filed April 22, 1885. Serial No. 163,063. (No model.)

To all whom it may concern:

Be it known that I, WILLIAM MAVER, JR., a citizen of the United States, residing in Jersey City, in the county of Hudson and State of New Jersey, have invented certain new and useful Improvements in Multiple Automatic Telegraph-Repeaters, of which the following is a specification.

The invention relates to the class of apparatus employed for repeating into one electric circuit the messages or signals transmitted over another electric circuit.

The object of the invention is to provide means automatically controlled for repeating from any one of a given series of conductors into any or all of a second series, and vice versa. This organization of apparatus involves the possibility of at any time signaling back from any one of the receiving series of lines or conductors to the line from which the signals are being repeated.

The invention consists, generally, in so organizing the apparatus at the repeating-station that a current coming over any one of either series of lines will control the connections of a corresponding local circuit in which there is included an electro-magnet serving in its turn to control the connections of a corresponding second local circuit. In each of these second local circuits there is included a repeating-magnet. The one series of repeating-instruments serves to control the connections of the main-line batteries applied to the respective lines of the series controlling the other series of repeating-instruments, and vice versa.

The electro-magnets mentioned as controlling the local-circuit connections for the repeating-magnets are employed for the especial purpose of reversing the signals as received from the transmitting-lines, and may be termed "reversing-magnets." These may, however, be dispensed with by placing the series of repeating-magnets in the first-named local circuit. By making and breaking the connections of any one of either series of lines at a transmitting-station signals will be repeated into each of the other series of main lines. If, however, a receiving operator of the one series desires to break in upon and to signal back to the transmitting operator, an interruption of the circuit at his station will cause the reversing-

magnet applied to the corresponding series to interrupt the circuit of the main line from which the message is being repeated, and a signal will then be given to the transmitting operator. As already stated, the reversing-magnets may be dispensed with, but usually they are preferred for the purpose of rendering it possible to readily adapt the existing apparatus to this system.

For the purpose of preventing the relay-instruments of either series of lines from operating the series of repeating-instruments of the other series of lines in response to the movements of their levers, occasioned by the repeated signals, a circuit-interrupting device is applied to one of the repeating-instruments of each series, whereby the connections of the local circuit employed for actuating the repeaters of the transmitting-lines are kept from being completed while the receiving-repeaters are in operation.

I am aware of the existence of other multiple repeaters, such for instance as described in the patents of Smithers, Nos. 268,561 and 279,670; Ballou, No. 250,774, and Gally, No. 158,927.

In the accompanying drawings, Figure 1 is a diagram of the general organization of apparatus at the repeating-station. Fig. 2 represents the modification in which the reversing-magnets are dispensed with at the repeating-station.

Referring to Fig. 1, two series of main lines are shown, each series being three in number in this instance, the conductors L^1 , L^2 , and L^3 constituting the first series, and the conductors L^4 , L^5 , and L^6 the second series. These series may, however, be indefinitely extended, as will hereinafter appear. It is designed that the movements of the transmitting-keys which are applied to these two series of lines, respectively, shall control the movements of one or the other of two reversing-magnets, R^1 and R^2 , respectively, accordingly as the key belongs to one or the other of the two series of lines. The coils of the electro-magnets R^1 and R^2 are respectively included in the circuits of local batteries o^1 and o^2 . Included in each of the main-line conductors there is a relay-magnet, as shown at r^1 , r^2 , and r^3 , and r^4 , r^5 , and r^6 . The main line L^1 leads from the coils of the electro-magnet r^1 to one

pole of a main-line battery, O^1 , in a manner which will be hereinafter described. The remaining pole of this battery is connected through a conductor, l , with a conductor, l' , leading to the earth at g' . In like manner the conductors L^2 and L^3 are connected through the coils of the electro-magnets r^3 and r^4 , with the poles of the main-line batteries O^2 and O^3 , the remaining poles of which are connected through conductors 2 and 3, respectively, with the conductor l' , and thus with the earth. It is evident that a single battery might be placed in the conductor l' , in place of the separate batteries in the conductors 1, 2, and 3.

One pole of the local battery o' , which has been referred to, is connected with the respective armature-levers a^1 , a^2 , and a^3 of the relay-magnets r^1 , r^2 , and r^3 . The front contact-stops, b^1 , b^2 , and b^3 of the armature-levers are insulated, while the back contact-stops, c^1 , c^2 , and c^3 , are all connected through a conductor, 8, in a manner which will be hereinafter described, with a conductor, 9, leading to one terminal of the coils of the reversing-magnet R^1 . The remaining terminal of these coils is connected through conductor 11, with the remaining pole of the battery o' . When therefore the main-line connections of all the first series of lines are complete, the armature-levers a are in their forward positions, and the circuit of the battery o' is interrupted. The armature-lever d' of the reversing-magnet R^1 , therefore, rests against its back contact-stop. By interrupting the connections of any one of the main lines of the first series the corresponding armature-lever will fall back, and thus complete the connections of the battery o' . The armature-lever d' will thereby be drawn forward.

Normally, the circuit of the battery o' being interrupted, the lever d' rests against its rear contact-stop, e' , and thereby completes the circuit-connections of a battery, p' , one pole of which is connected by the conductor 12 with the contact-stop e' , while the other pole is connected through the coils of a series of repeating-magnets, K^1 , K^2 , and K^3 , and with the armature-lever d' by a conductor, 13. As long, therefore, as the circuits of the main line L^1 , L^2 , and L^3 are complete the circuit of the battery p' will also be complete, and the armature-levers k^1 , k^2 , and k^3 will be drawn into their forward position, as shown in the drawings. When, however, the connections of any one of the main lines are interrupted, then the armature-lever d' being drawn away from its point e' , the electro-magnets K^1 , K^2 , and K^3 will be demagnetized, and the corresponding armature-lever will fall away. The movements of the armature-levers k^1 , k^2 , and k^3 thus occasioned serve to make and break the circuit-connections of the main-line batteries O^1 , O^2 , and O^3 , which are applied to the second series of lines, L^4 , L^5 , and L^6 , respectively, and which correspond to the batteries O^1 , O^2 , and O^3 . To this end the battery O^4 has one pole connected with a contact-point, f' , which is preferably

applied to an insulated contact-spring, h' , carried upon the armature-lever k^1 . This spring is in turn connected by a conductor, 14, through the coils of the electro-magnet r^4 , and thus with the main line L^4 . The remaining pole of the battery O^4 is connected by a conductor, 4, with the conductor l' , leading to the earth at g' . It will be observed, therefore, that the movements of the armature-lever k^1 in response to the movements of the armature-lever d' will serve to make and break the connections of the battery O^4 in a manner corresponding precisely to the completions and interruptions of the connections of the main line L^4 , or L^5 .

The battery O^5 has one pole connected with the contact-point f^2 , and the battery O^6 has a corresponding pole connected with the stop f^3 . The stops f^2 and f^3 are respectively applied to the levers k^2 and k^3 , and these levers are connected by conductors 15 and 16, respectively, through the coils of the relay-magnets r^5 and r^6 with the main lines L^5 and L^6 .

It will be readily understood from the foregoing description that any signals which are transmitted upon any one of the main lines L^1 , L^2 , and L^3 , constituting the first series, will be thus retransmitted by currents from the batteries O^4 , O^5 , and O^6 into all of the second series of lines L^4 , L^5 , and L^6 , respectively.

It will be observed that the interruptions of the circuits of the batteries O^4 , O^5 , and O^6 which are thus occasioned will cause the armature-levers a^4 , a^5 , and a^6 of the relay-magnets r^4 , r^5 , and r^6 to fall backward against their rear contacts, b^4 , b^5 , and b^6 , respectively. These contacts are connected through conductors 17 and 18 with the coils of the second reversing-magnet, R^2 , and they serve to perform the same functions as the armature-levers a^1 , a^2 , and a^3 . They would therefore serve to operate the reversing-magnet R^2 when a message is being transmitted from the first series of main lines, unless some means were provided to obviate this difficulty. One pole of the battery o^2 is connected with the armature-levers a^4 , a^5 , and a^6 by conductors 19, 20, and 21, while the remaining pole is connected with the conductor 18 by a conductor, 22, leading through the coils of the reversing-magnet R^2 . It is necessary, therefore, that the circuit of the battery o^2 should be interrupted at some other point before it is completed by the falling of any armature a^4 , a^5 , and a^6 away from its front contact-stop, e^4 , e^5 , or e^6 , against its back stop, b^4 , b^5 , or b^6 . For this reason the conductor 17 preferably leads to a contact-stop, j' , applied to a contact spring or extension, n' , carried upon the armature-lever k^1 . This spring is in connection through the armature-lever with the conductor 18, leading to the reversing electro-magnet R^2 . When the armature-lever k^1 is in its forward position, as shown in the drawings, the conductor 17 is thus connected through the contact-stop and spring with the conductor 18; but by the movement of the armature d' of the reversing-magnet R^1

the circuit of the battery p' is interrupted, and likewise the circuits of the batteries O^4 , O^5 , and O^6 , causing the armature-levers a^4 , a^5 , and a^6 to fall against their back-contact stops; but the connection between the conductors 17 and 18 is also interrupted, so that the circuit of the battery o^2 remains incomplete.

The reversing-magnet R^2 serves, in response to the movements of the keys applied to the lines L^4 , L^5 , and L^6 of the second series, to control the movements of the armature-levers k^4 , k^5 , and k^6 of the electro-magnets K^4 , K^5 , and K^6 . These last magnets are employed for repeating from the first series to the second series of main lines. The electro-magnet K^4 corresponds precisely to the electro-magnet K' , and likewise the magnets K^5 and K^6 correspond to the magnets K^2 and K^3 , and a detailed description is therefore unnecessary.

The movements of the lever d^2 of the reversing-magnet R^2 serve to control the circuit-connections of a local battery, p^2 , corresponding to the battery p' . The armature-levers k^4 , k^5 , and k^6 respond to the movements of the armature-lever d^2 , and repeat from the batteries O^4 , O^5 , and O^6 into the lines L^4 , L^5 , and L^6 .

It frequently occurs that during the signaling from one line through a repeating-instrument into a second line it is necessary for the receiving operator to communicate back to the transmitting operator—as, for instance, when it is desired that some portion of the message be retransmitted. To accomplish this, it will be necessary only for the receiving operator to employ his key in the usual manner. Considering that the operator upon the main line L' is transmitting, and that the operator upon the line L^6 wishes to communicate with the transmitting operator, then, by the interruption of the main line L^6 at the receiving-station the armature-lever a^6 of the magnet m^6 will be allowed to fall back against its rear contact-stop b^6 . The circuit of the battery o^2 will then be completed through the coils of

the reversing magnet R^2 , the conductor 18, armature-lever k' , stop j' , conductor 17, contact-stop b^6 , lever a^6 , and conductor 21. Should the armature k' chance to be away from its electro-magnet at the moment the circuit of the line L^6 is interrupted, then the circuit of the battery o^2 will not be completed until the armature-lever of k' is returned to its forward position, which it is evident it will do immediately upon the transmission of a signal from the line L' . The circuit of the battery o^2 being thus completed, the armature-lever d^2 will be drawn forward, interrupting the circuit of the battery p^2 , thereby causing all the armature-levers K^4 , K^5 , and K^6 to fall back and interrupt the circuits of the batteries O^4 , O^5 , and O^6 . The movements of the key of the transmitting operator upon the line L' will therefore produce no effect upon the instrument at his station, and he will thus be notified that some one of the receiving operators desires to communicate back. The operator upon the line L^6 is then enabled to transmit as follows: The line from the main

line L^6 is complete through the conductor 16 to the armature-lever k^6 , thus to the battery O^6 , and from the battery to the earth through the conductor l^6 . The movements of the lever a^6 in response to the movements of the key included in the line L^6 cause the circuit of the battery o^2 to be made and interrupted, and the signals to be retransmitted through the line L' in a manner readily understood.

It should be here noted that one essential feature of a repeating apparatus is that it should be so organized that by no possible act can the various parts come into such position that it is impossible to complete the circuit-connections from any one of the main lines. It is evident that this end is attained in the present instance, for, as has already been shown, the circuit of the battery p' must be closed before the circuit of the battery p^2 can be interrupted, and vice versa; but if by any chance the circuits of both batteries p' and p^2 should become interrupted at the same time immediately the corresponding reversing-instrument, R^2 or R' , will serve to again complete the connections, for the reason that the circuit of the battery o' or o^2 will be interrupted at the point j' or j^2 , thereby causing the armature-lever d' or d^2 to fall against its back contact-stop, and to complete the connections of the corresponding battery, p' or p^2 .

In Fig. 2 a modification is shown in which the reversing-magnets R' and R^2 are dispensed with. In this instance the relay-magnets K' , K^2 , and K^3 are included in the circuit of the battery p' , while the corresponding magnets, K^4 , K^5 , and K^6 , are included in the circuit of the battery p^2 . The circuits of these batteries being open when the main-line connections are complete, the levers k will be away from their electro-magnets, and the parts are so organized that the respective circuits of the batteries O will be completed through the rear contact-stops of these levers.

A circuit-connection may be completed from the conductor leading to the back contact-stops to the front contact-point of one or more of the relay-magnets and a sounder included therein, as shown in dotted lines, for the purpose of affording opportunity for the messages to be read at the repeating-station. The same local battery will, it is evident, serve to operate this sounder.

It is evident that a single repeater may be operated upon this principle without departing from the spirit of the invention, a transmitter and a relay being employed for each main-line circuit, each transmitter being organized to break the local circuit of the other before the main-line circuit-connections are interrupted, so that each transmitter will be kept idle while the other is being operated.

I claim as my invention—

1. The combination, substantially as herebefore set forth, with two series of main-line conductors, of a source of electricity applied thereto, and means, substantially such as described, for automatically repeating from

any line of either series into all of the lines of the other series.

2. The combination, substantially as here-
inbefore set forth, with two series of main lines,
5 of a repeating-magnet applied to each of said
lines, means for automatically operating the
repeating-magnets of either series by currents
from any one of the lines of the other series,
and means, substantially such as described,
10 whereby the operation of one series of repeat-
ing-magnets temporarily prevents the opera-
tion of the other series.

3. The combination, substantially as here-
inbefore set forth, of two series of lines, two
15 series of repeating-magnets, means for repeat-
ing from any line of either series into all the
lines of the other series, means, substantially
such as described, whereby the operating-
repeaters prevent the other repeaters from
20 operating, and means, substantially such as
described, whereby a receiving-line prevents
the operation of its repeater at the completion
of a signal.

4. The combination, substantially as here-
inbefore set forth, of a main line, a relay-
25 magnet included in the circuit thereof, a bat-
tery the connections of which are made and
interrupted by the movements of the key ap-
plied to said main line, a reversing-magnet, a
30 battery applied thereto, the circuit-connections
of which are made and interrupted by the
operation of said relay, and a series of repeat-
ing-instruments, all of which are controlled by
the operation of said reversing-instrument.

5. The combination, substantially as here-
inbefore set forth, of two reversing-instru-
35 ments, two series of main lines respectively
corresponding to said instruments, means,
substantially such as described, operated by
currents traversing said main lines for operat-
40 ing said instruments, and means, substantially
such as described, for normally preventing
one of said instruments from operating while
the other instrument is in use.

6. The combination, substantially as here-
inbefore set forth, of two series of lines, two
45 reversing-instruments respectively corre-
sponding thereto, means for operating either
of said instruments by currents traversing one
50 of the lines of the corresponding series and for
preventing one of said instruments from oper-
ating while the other is in use, and means
for interrupting the operation of the first in-
strument and bringing the second into opera-
55 tion at the termination of a signal.

7. The combination, substantially as here-
inbefore set forth, with a telegraphic main
line, of an electro magnet included therein, a
60 series of lines, a battery for applying currents
to said series of lines, a local battery and its
circuit, the connections of which are controlled
by said electro-magnet, an electro-magnet
included in said circuit, and a series of circuit-
controlling magnets applied to series of lines,
65 respectively, and controlled by the operation
of the last-named electro-magnet.

8. The combination, substantially as here-

inbefore set forth, with a series of main lines,
of a reversing-instrument, means, substantially
70 such as described, for actuating the same, a
local battery, its circuit, the connections of
which are controlled by said reversing-magnet,
armature-levers respectively applied to elec-
tro-magnets and serving to control the connec-
75 tions of the series of main lines, respectively,
a second reversing-instrument, a local circuit
for operating the same, and means, substan-
tially such as described, applied to one of said
series of electro-magnets, whereby the circuit-
80 connections of said second local battery may
be interrupted when the circuit of said first-
named local battery is interrupted.

9. The combination, substantially as here-
inbefore set forth, of the main-line battery O' ,
and the electro-magnet r' , its armature and
85 rear contact-point, the local battery o' , the
reversing-magnet R' , included in the circuit of
said local battery, a main line, the local bat-
tery p' , the circuit-connections of which are
controlled by the operation of the repeating-
90 magnet R' , the series of electro-magnets in-
cluded in the circuit of said battery p' , and
the series of main lines having their circuit-
connections controlled by the armature-levers
of said series of electro-magnets, respectively. 95

10. The combination, substantially as here-
inbefore set forth, of a main line, a battery,
an electro-magnet included in the main-line
circuit, its armature and rear contact-point,
the local battery o' , the circuit-connections of
100 which are controlled by the operation of said
electro-magnet, the series of electro-magnets
controlled by the opening and closing of the
circuit of said local battery, a series of main
lines having their circuit-connections con-
105 trolled by the armature-levers of said series
of electro-magnets, respectively, a second local
battery having its circuit-connections sub-
stantially the same as those of the first-named
local battery, and means, substantially such as
110 described, for preventing the second local cir-
cuit from being completed by the operation of
the first-named electro-magnet.

11. The combination, substantially as here-
inbefore set forth, of the instruments R' and
115 R^2 , the two series of instruments K' , K^2 , and
 K^3 , and K^4 , K^5 , and K^6 , means, substantially
such as described, for operating the instru-
ments R' and R^2 , and thereby controlling the
120 movements of the two series of instruments,
respectively, and two series of main lines, the
connections of which are controlled by the
respective armatures of said series of electro-
magnets.

12. The combination, substantially as here-
inbefore set forth, with two independent series
125 of telegraphic main lines, of means for repeat-
ing from any line of one series into the other
series of lines, and means, substantially such
as described, whereby signals may be auto-
130 matically transmitted from any of the last-
named series of lines back into the first-named
line.

13. The combination, substantially as here-

inbefore set forth, of two series of lines, a relay-magnet included in the circuit of each of said lines, two series of repeating-instruments respectively applied to the lines of said series, 5 two local batteries respectively controlled by any relay of the corresponding series, and two circuit-controlling devices respectively controlled by the local batteries, whereby during the operation of a relay belonging to 10 one series of lines the repeating-instruments of that line are prevented from operating.

14. The combination, substantially as here-
inbefore set forth, with two independent series
of main lines, of a transmitter, a reversing-
15 magnet, and a relay for each series, a local cir-

cuit for each reversing-magnet, each trans-
mitter being arranged to break the local cir-
cuit of the reversing-magnet of the other trans-
mitter before the main-line circuit is broken,
whereby one transmitter is inoperative while 20
the other is being operated, substantially as
described.

In testimony whereof I have hereunto sub-
scribed my name this 20th day of April, A.
D. 1885.

WILLIAM MAVER, JR.

Witnesses:

CARRIE E. DAVIDSON,
CHARLES A. TERRY.