(No Model.) 3 Sheets—Sheet 1.

R. J. McILHENNY.

TELEGRAPH REPEATER.

No. 415,417. Patented Nov. 19, 1889.

Fig. 1.

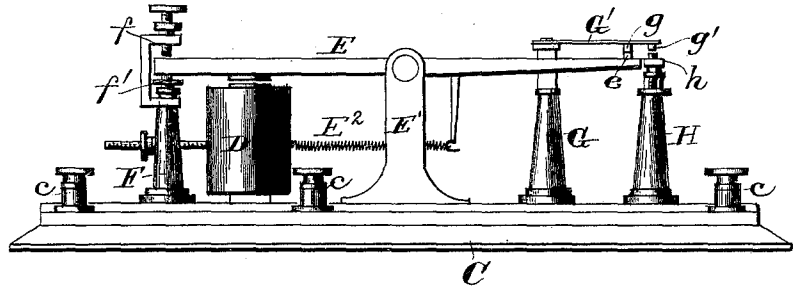
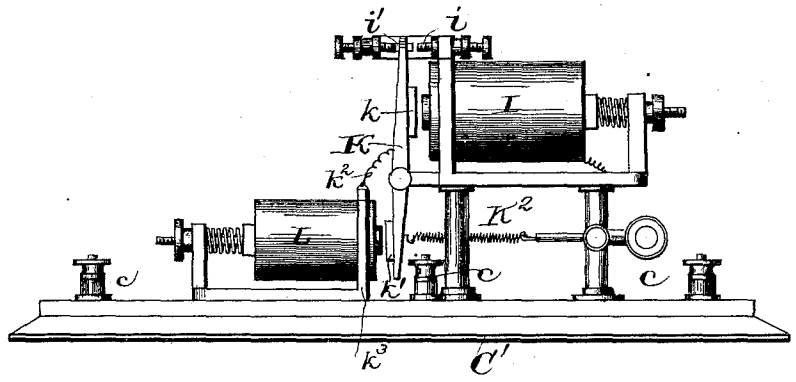


Fig. 2.



Witnesses

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(No Model.) 3 Sheets—Sheet 2.

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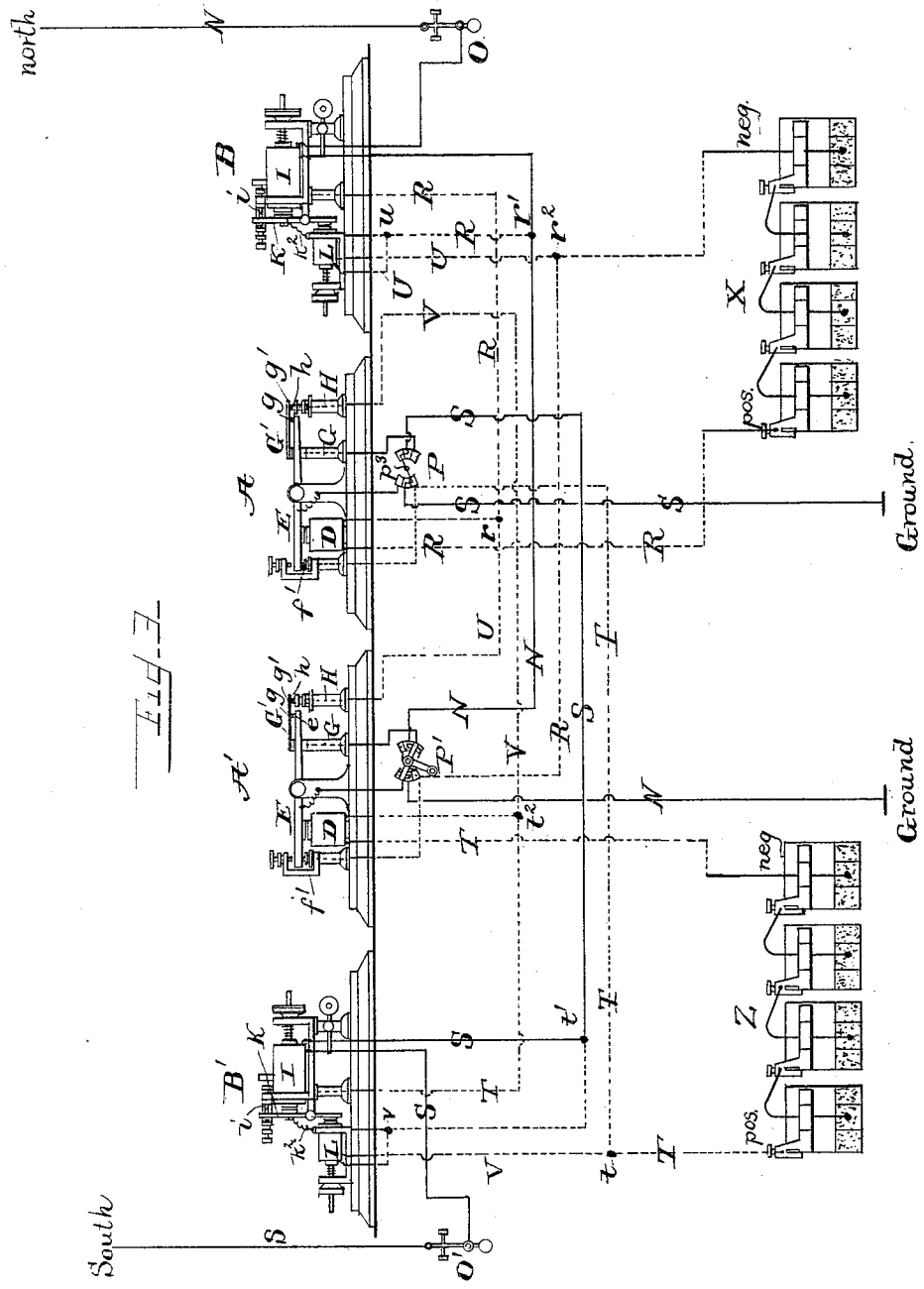

FIG. 2.

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(No Model.) 3 Sheets—Sheet 3.

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TELEGRAPH REPEATER.

No. 415,417. Patented Nov. 19, 1889.

Fig. 4.

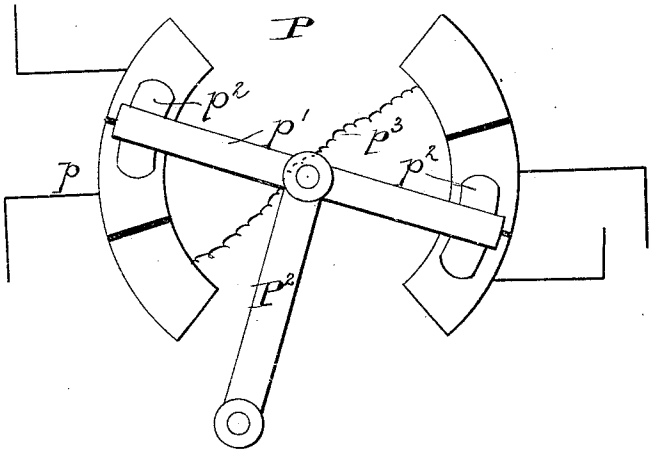
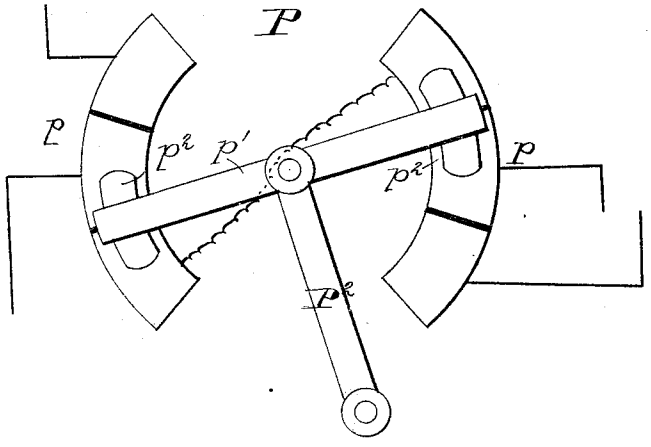


Fig. 5.



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UNITED STATES PATENT OFFICE.

RICHARD J. McILHENNY, OF WILMINGTON, NORTH CAROLINA.

TELEGRAPH-REPEATER.

SPECIFICATION forming part of Letters Patent No. 415,417, dated November 19, 1889.

Application filed June 6, 1889. Serial No. 313,320. (No model.)

To all whom it may concern:

Be it known that I, RICHARD J. McILHENNY, a citizen of the United States, residing at Wilmington, in the county of New Hanover and State of North Carolina, have invented certain new and useful Improvements in Telegraphic Repeaters; and I do hereby declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same.

My invention relates to telegraphic repeaters; and it consists in certain novel features of construction of the same in connection with a novel arrangement of circuits, which will be hereinafter fully described.

In the drawings I have illustrated my invention, and it is fully disclosed in the following specification and claims.

In the said drawings, Figure 1 is a view of my improved transmitter. Fig. 2 is a similar view of the relay employed by me. Fig. 3 is a diagrammatic view showing the arrangement of the circuits. Figs. 4 and 5 are views of the form of switch employed by me in two different positions.

My invention has for its object to simplify the construction and operation of telegraphic repeaters so that any operator can attend to the same to prevent "kicks" in the instrument and to provide a construction whereby the operator receiving when the repeater is repeating can break the sender, if desired, without rendering the line inoperative. A construction is also provided whereby the instrument may be switched off and used as independent transmitters when desired.

In the diagrammatic view, Fig. 3, the instruments are shown arranged at an intermediate station on a line which extends between two stations "north" and "south," said line passing through the said intermediate station. At the intermediate station the instruments are preferably arranged as shown in the drawings, there being two transmitters A A′ and two relays B B′.

The transmitters are constructed as shown in Fig. 1, as follows: Upon a bed-plate C is mounted a magnet D, adapted to operate an armature-lever E, which is pivoted near its center in stanchions E′. Adjacent to the magnet D is a post F, secured to the bed-plate and provided with two adjustable contacts *f f′*—one above and the other below the armature-lever E—the point *f* being provided with suitable insulation. Two posts G and H are secured to the bed-plate at or near the opposite extremity of the lever E. A spring G′, having a contact-point *g* near its free end, is secured to the post G, and a contact *e* on lever E engages the contact *g* when the lever E is drawn to its magnet. A second contact *g′* is secured to the said spring-arm G′ and engages an adjustable contact *h* on the post H when the lever E is released by its magnet. These contact-points are preferably so arranged that the contact *g′* will strike the point *h* before the circuit through the points *g* and *e* is broken. A spring E^2 holds the armature-lever E normally away from its magnet D, and suitable means are provided for adjusting the tension of said spring. The bed-plate C is provided with suitable binding-posts *c*, through which the electrical connections may be made.

The relays B B′ are constructed preferably as shown in Fig. 2. A vertical armature-lever K is pivotally mounted at or near its center in suitable stanchions and provided with two armatures on opposite sides of said lever and on opposite sides of its point of pivoting. A magnet I is supported from the bed-plate C′ by suitable standards to attract the armature *k*, located on the upper portion of the lever K, and the upper extremity of said lever plays back and forth between two adjustable contact-points *i i′*. The portion of lever K which engages the contact *i′*, or said contact itself, is provided with insulation, so that said point merely serves as a stop to limit the rearward movement of said lever when the circuit through the point *i* is broken. A magnet L is mounted on the bed-plate C′ in a position to attract the armature *k′* on the lower end of the lever K. It will be seen that the magnets I and L, although located upon different sides of lever K, are one above and the other above its pivoting-point; hence they will both draw said lever in the same direction, and if a current be sent through first one and then the other the second magnet will tend to hold the lever from falling away from the first magnet when the current through the latter is broken. A

spring K′ holds the lever K normally away from both magnets, and the tension of this spring may be adjusted by any preferred means. A wire k^2 connects the lever K with a standard k^3 on the bed-plate. The bed-plate C′ is provided with suitable binding-posts c in the usual manner.

While I have shown the lever K mounted vertically, it is obvious that it might be mounted horizontally, if desired.

I prefer to provide switches P P′, for the transmitters A A′, whereby they may be disconnected from the repeating-circuit and used as ordinary sounders while a message is being sent by the hand-keys O and O′. One of these switches is shown in two positions in Figs. 4 and 5. These switches consist of two segments p p, each provided with three contacts separated by suitable insulation. A wire p^3 connects the lowest contact of one segment with the upper contact of the other segment. A lever p' is pivoted at its center between the two segments, and is provided at each end with a bridge p^2 insulated from said lever, and of such width as to cover two parts of one of the segments p, thus connecting the central contact with either the upper or the lower contact, as desired. A lever-handle P^2 is provided for throwing the switch-bridges into engagement with different pairs of contacts or the segments p when desired to change the electrical connections.

Referring to the diagrammatic view, the courses of the various circuits are as follows: The main line from station north passes along wire N, through transmitting-key O, which is normally closed, through magnet I of relay B, along wire N to switch P′, across the bridge p^2, and up to the post G of transmitter A′, thence along spring G′, through contacts g and e, lever E, and stanchion E′, thence down to switch and across bridge, thence to ground. The other main line passes along line S from station south through key O′, which is closed, through magnet I of relay B′, along wire to switch P, across bridge, up to post G of transmitter A, along spring G′, through contacts g and e, thence through lever E and stanchions E′ to switch P, and thence to ground. I employ a local circuit with each side of this repeating mechanism, which circuits are as follows: Starting from local battery X, the circuit passes from positive pole along wire R (represented by dotted lines) to magnet D of transmitter A, thence to tap-point r, thence to point i of relay B, thence along lever K across wire k^2 to standard k^3, thence down to a tap-point r' on the wire N, thence along wire N, through switch P′, to standard G of transmitter A′, thence through contacts g and e and lever E to contact f' on post F, thence on wire R to lowest point of switch-segment of switch P′, thence to tap-point r^2, thence to negative pole of battery.

The local circuit from battery Z on south side of the line is similar to the one just described, and passes from positive pole along wire T (represented by dotted lines) to tap-point t, thence to lowest point of switch P, thence through post F of transmitter A, through point f', to lever E, thence through points e and g and post G to switch on part of main wire S, across on bridge and along main wire S to tap-point t', thence on wire T to standard k^3 of relay B′, through wire k^2, lever K, and contact i, thence along wire T to tap-point t^2, thence to magnet D of transmitter A′, thence to negative pole of battery.

The local circuits R and T are governed by the relay-points i of relays B and B′, respectively. When the circuit R is broken, the magnet D of transmitter A will release its armature-lever E, thereby breaking the contact between lever E and contact f'. The opening of the circuit T at f' of transmitter A throws the current of battery Z through the extra magnet L of relay B′, and the breaking of circuit R at f' of transmitter A′ throws the current of battery X through the extra magnet L of relay B. The current R, when broken at f' of transmitter A′, will pass from positive pole of battery X on wire R, through magnet D of transmitter A, down to tap-point r, thence through relay-point i of relay B, down lever K, across wire k^2 down to tap-point i i, thence on wire U through magnet L down to tap-point r^2, thence on wire R to battery.

The circuit T, when broken at f' of transmitter A, will pass from positive pole of battery Z on wire T up to tap-point i, thence on wire V, through magnet L of relay B′, to tap-point v, thence to relay-point i through wire k^2 and lever K, thence on wire T to tap-point t^2, thence to magnet D of transmitter A′, thence to battery.

When the lever E of one of the transmitters is released and raised by its spring it will first break contact at f' and make the circuit through the magnet D of the other transmitter and the magnet L of the relay connected therewith, as just described. A further movement of the lever will next close the contacts g' and h of the transmitter, which acts as a cut-out to cut the relay-point i out of the circuit R or T, with which it is connected. The circuit from battery Z, for example, will then pass from positive pole up to magnet L of relay B′, thence to tap-point v, thence down to tap-point t', thence along main wire S to switch P, across bridge and up to post G of transmitter A, across spring and through contacts g' and h, thence on wire V back to tap-point t^2, thence through magnet D of transmitter A′ to battery. The loop on the northern side that enables the points g' and h of transmitter A′ to cut out relay-point i of relay B is similar to the one just described and extends from tap-point u down to tap-point r', thence on main wire N to switch P′, thence through post G, spring G′, contacts g and h, and post H, along wire U to tap-point r. This loop permits the current from battery X to pass through magnets D and L without passing over the relay-point i.

The operation is as follows: The main circuits N and S and the local circuits R and T being closed, the magnets D will hence be energized and the levers E will be held down, thereby making contact at points f' and g on the transmitters A and A'. Suppose that the operator at station north desires to send a message to station south, which is to be repeated at the intermediate station. All circuits being closed, the operator must first open the circuit N at his key. This will break circuit N, demagnetize magnet I of relay B, and release the lever K, thereby breaking the main local circuit R at i. The breaking of local circuit R demagnetize magnet D of transmitter A, thereby releasing the armature-lever E, which breaks contact at f'. This shunts the local circuit T through the magnet L of relay B' without demagnetizing the magnet D in its circuit. As lever E rises contact g' h will be brought together and relay-point i of relay B' cut out of circuit. The main circuit S is then broken by a further movement of the lever at g e, the magnet I of relay B' demagnetized, and the signal or break repeated to the southern station. When the magnet I is demagnetized, however, the lever K will not fall away and open the local circuit at i, for the reason that extra magnet L is energized by said local circuit and holds the lever K in a closed position. When the operator at the northern station closes his key, the armature K of relay B will be drawn up and the local circuit R made at i, thereby energizing magnet D of transmitter A and drawing down the lever E. This lever breaks contact at g' h, thereby restoring the relay-point i of relay B' into circuit, makes contact at g e, thereby repeating the signal on to the southern station and making contact at f', thereby demagnetizing magnet L of the relay B, the magnet I being now energized and capable of holding its armature in place.

When it is desired to use the instruments independently to send a message by either of the keys O O' or both of them, the switches P P' are turned to the position illustrated in Fig. 5. The switches serve to cut out the extra magnet L and to disconnect each transmitter from the main line of the opposite side.

If it is desired to send a message with the key O' on southern line, the switch will be turned to the position shown in Fig. 5. The switch P is shown in Fig. 3 with the lever P^2 and bridges removed. The local circuit T will then pass from the positive pole of battery Z on wire T to tap-point t, along wire to switch P', across fixed wire p^3 to upper point of opposite segment, thence on main wire S to tap-point t', thence on wire T through relay-point of relay B', thence on wire T to tap-point t^2, thence through magnet D of transmitter A to battery. The switch P' being turned in the same manner, the two main-line circuits will be completely disconnected and the instruments may be used separately, like ordinary telegraph-instruments. The point f' and points g' h act together to prevent the breaking of the local circuit, which passes through magnet D and through magnets D L alternately. It will thus be seen that when the circuit is broken at f' the magnet L is instantly energized and the relay-points held together until the said points are cut out of circuit by the points g' h. If the relay-points were not cut out of the local circuit at this period, any disturbance of the said local circuit, caused by lightning or by the operator breaking the main circuit on the receiving side, would open the relay-point slightly and the extra magnet L being in such case wholly dependent on the local circuit through said relay-point, it would become demagnetized. Magnet D would also become demagnetized and the relay-point would fall open. The relay-points of the sending side being also open at this period, both main circuits would be broken and remain in this condition until the operator at the intermediate station closed them. This difficulty is obviated by the points g' h.

Care should be taken where two circuits pass over the same wire simultaneously that they both flow in the same direction; otherwise they would neutralize each other.

It will be observed that the contact-points of the transmitter are so arranged that there is no insulation or other obstruction upon the levers E, and they are thereby enabled to give a clear and sharp sound.

It will be seen that the instruments A A', which are herein denominated "transmitters," act both as transmitters and as sounders, and when separated from their respective repeating-circuits they may each be used as a sounder in sending and receiving messages.

What I desire to secure by Letters Patent is—

1. In a repeating telegraphic system, the combination of a relay in a main-line circuit and a local circuit closed through the relay-contacts when its armature is in its attracted position, said relay being provided with a magnet located in a branch of said local circuit of greater resistance than the main local circuit and adapted to hold the armature-lever in its attracted position, substantially as described.

2. In a repeating telegraph system, the combination of a relay in a main-line circuit said relay being provided with an armature, lever provided with two armatures on opposite faces and on opposite sides of its pivot, and a local circuit closed through the relay-contacts when the armature of the relay is in its attracted position, said relay being provided with a supplemental magnet located in a branch of said local circuit of greater resistance than the main local and adapted to act upon one of the armatures of the relay, substantially as described.

3. In a repeating telegraph system, the combination of a relay in the main-line circuit, having a supplemental magnet for hold-

ing the relay-armature in its attracted position, a combined sounder and transmitter, a main local circuit through the said sounder and transmitter-magnet, and relay-points having a branch through the supplemental relay-magnet and through the magnet of the said sounder and transmitter, a repeating line-circuit and a local repeating-circuit, and an electric circuit-controller in the local repeating-circuit for closing the branch local circuit of the main line, substantially as described.

4. In a repeating telegraph system, the combination of a relay in the main-line circuit having a supplemental magnet for holding the relay-armature in its attracted position, a combined sounder and transmitter, a main local circuit through the sounder and transmitter-magnet and through the relay-points, having a loop or branch through the sounder and transmitter-magnet and through the supplemental magnet, a repeating line-circuit, and a local repeating-circuit, and an electric circuit-controller in the local repeating-circuit for closing the branch of the main-line local through the main-line sounder and transmitter, and the supplemental relay-magnet, substantially as described.

5. In a repeating telegraph system, the combination, with a relay and transmitter in the main-line circuit and a relay and transmitter in the repeating-circuit, of a supplemental magnet for each relay, adapted to close the relay-points, a main local circuit through the relay-points and the magnet of the main-line transmitter having a branch circuit through the supplemental relay-magnet and through the magnet of the main-line transmitter, a local repeating-circuit through the repeating relay-points, and the magnet of the repeating-transmitter having a branch through the supplemental magnet of the repeating-relay and the magnet of the repeating-transmitter, the main-line transmitter being provided with a circuit-controller for closing the branch local of the repeating-line, and the repeating-transmitter having a circuit-controller for closing the branch local of the main line, substantially as described.

6. In a repeating telegraph system, the combination of a relay in the main circuit having a supplemental magnet for holding the relay-armature in its attracted position, a combined sounder and transmitter, a main local circuit through the sounder and transmitter-magnet and through the relay-points, having a loop or branch through the sounder and transmitter-magnet and through the supplemental magnet, a repeating line-circuit, a relay in the main local circuit, a local repeating-circuit, a circuit-controller in the local repeating-circuit for closing the branch of the main-line local through the main-line sounder and transmitter-magnet, the supplemental magnet of the main-line relay, and points located on the main-line transmitter for cutting the relay-points of the main repeating-line relay out of circuit when the circuit-controller is operated to make the branch local, substantially as described.

In testimony whereof I affix my signature in presence of two witnesses.

RICHARD J. McILHENNY.

Witnesses:

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THOS. C. McILHENNY.