(No Model.)

W. W. DEAN.

TELEPHONE SYSTEM.

No. 546,731. Patented Sept. 24, 1895.

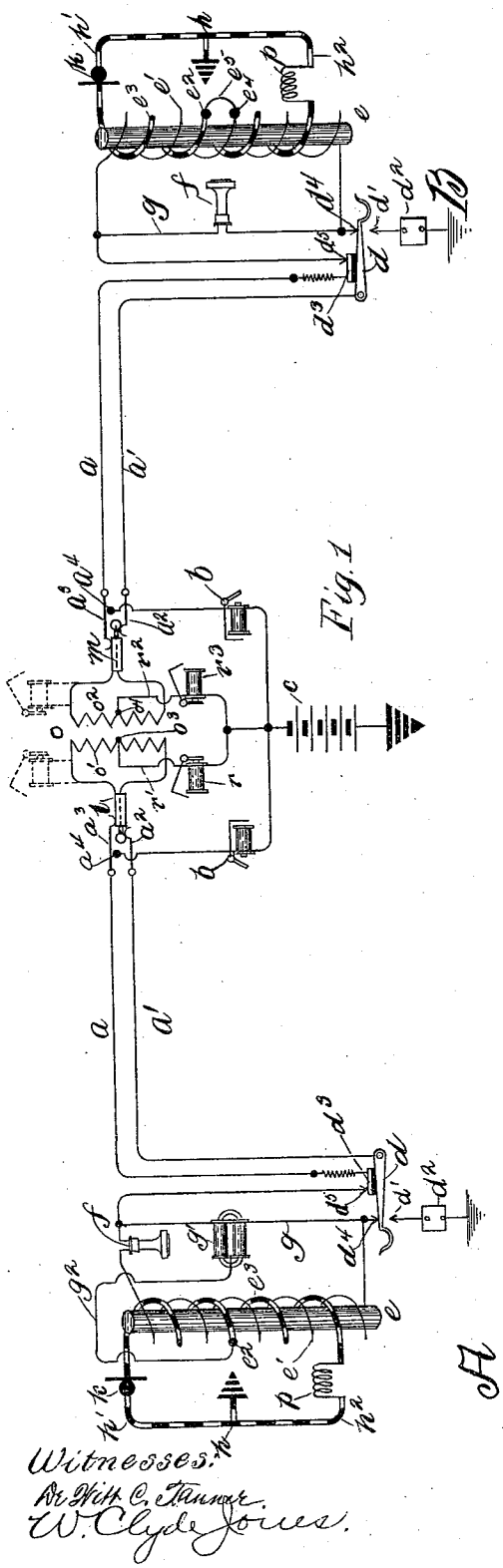

Fig. 1.

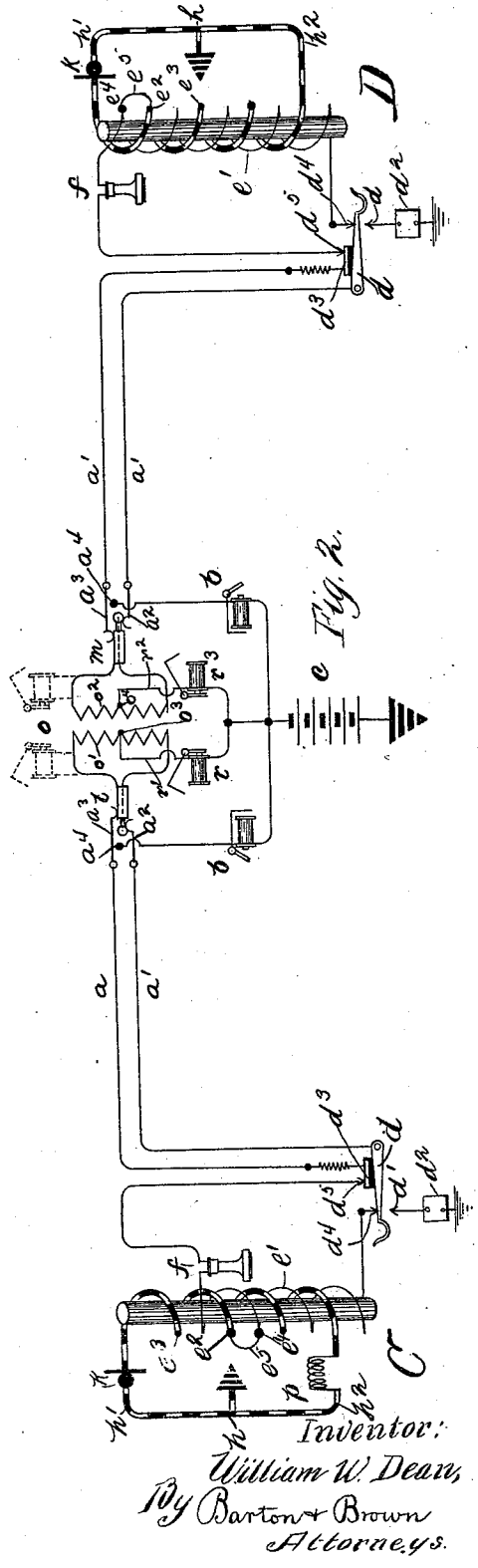

Fig. 2.

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UNITED STATES PATENT OFFICE.

WILLIAM W. DEAN, OF ST. LOUIS, MISSOURI, ASSIGNOR TO THE BELL TELEPHONE COMPANY OF MISSOURI, OF SAME PLACE.

TELEPHONE SYSTEM.

SPECIFICATION forming part of Letters Patent No. 546,731, dated September 24, 1895.

Application filed May 18, 1895. Serial No. 549,777. (No model.)

To all whom it may concern:

Be it known that I, WILLIAM W. DEAN, a citizen of the United States, residing at St. Louis, in the State of Missouri, have invented a certain new and useful Improvement in Telephone Systems, (Case No. 5,) 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 telephone system, and its object is to provide improved switching apparatus at the central station and an improved form of local transmitter-circuit at the sub-stations.

In an application, Serial No. 539,209, filed February 21, 1895, I have described a telephone system in which a local transmitter-circuit is provided at each sub-station comprising two parallel branches, in which are contained the microphone and the primary windings of induction-coils, the secondary windings being included in circuit with the telephone-line, which extends in a metallic circuit to the central station. At the central station switching apparatus is provided, adapted to connect the line with another line for conversation, the switching apparatus serving to unite the two limbs of the metallic-circuit at the central station and to connect the same to a grounded battery-current, thus traversing the two limbs of the telephone-line in parallel and passing through the two branches of the local transmitter-circuit to ground at the sub-station.

In accordance with the present invention, I provide in the cord-conductors, employed for looping two lines together for conversation, a repeating-coil, thus isolating the two lines and rendering it possible to connect the metallic circuit and grounded lines without unbalancing the talking-circuit. The windings of the repeating-coil are connected at the middle with the grounded battery, whereby current from the battery may traverse the two limbs of the circuit in parallel, the clearing-out indicators, one for each of the connected subscribers, being included between the windings of the repeating-coil and ground, whereby the entire current passing over any particular telephone-line traverses the clearing-out annunciator.

In said application I have described a form of local transmitter-circuit in which the primary winding of an induction-coil is included in each of the two parallel branches constituting the circuit, the secondary windings being included in series in the telephone-line, whereby the currents induced in the windings of the two coils are added.

It is the object of the present invention, in this particular, to provide means whereby a single induction-coil may serve the purpose of the two coils illustrated in said application, the primary winding of the induction-coil being connected with the line at an intermediate point, whereby a portion of the winding is included in each of the parallel branches, as will be more particularly described hereinafter.

Referring to the accompanying drawings, Figure 1 is a diagram illustrating two telephone-lines connected together after the manner of my invention. Fig. 2 is a similar view illustrating modifications of the local transmitter-circuit at the sub-stations.

Like letters refer to like parts in both figures.

The telephone-line extends in two limbs a a' from the sub-station A to the central station, the limb a' terminating in a line-spring a^2 at the central station, while the limb a terminates in a line-spring a^3, normally resting upon a contact a^4, connected through an individual indicator b and the battery c to ground. The limb a' is connected at the sub-station with a telephone-hook d, normally resting upon a contact d', connected through a bell d^2 to ground. The limb a terminates in a contact-piece d^3, carried upon but insulated from the hook d. When the telephone is removed from the hook, the hook d closes against contact d^4 and the contact-plate d^3 closes against the contact d^5. Between the contacts d^4 and d^5 are included the secondary e' of an induction-coil e and the telephone-receiver f. In a bridge-wire g is included a retardation-coil g', from the center of which extends a conductor g^2 to the middle point e^2 of the primary winding e^3 of the induction-coil e, the said primary winding being included in a local transmitter-circuit, indicated by heavy lines, the local transmitter-circuit being connected with ground at the

point h. In one branch of the local transmitter-circuit is included the microphone k. A portion of the primary winding of the induction-coil is thus included in each of the branches h' h^2 of the local transmitter-circuit. The sub-station B is similarly connected with the central station by the limbs a a', terminating in line-springs a^3 a^2, respectively, the line-spring a^3 normally resting against contact a^4, connected through indicator b and battery c to ground. Limbs a a' are connected, respectively, with hook d and contact-plate d^3 at the sub-station, the hook d being adapted to normally rest upon contact d', connected to ground through the bell d^2. When the telephone is removed from its hook, the hook d closes against contact d^4 and the plate d^3 against contact d^5, between which contacts the primary winding e' of the induction-coil e is included in circuit. The telephone-receiver f is included in the bridge-wire g. The middle point e^2 of the primary winding e^3 of the induction-coil is connected with the middle point e^4 of the secondary of the induction-coil by a conductor e^5, the point h of the local transmitter-circuit being connected to ground, whereby a portion of the primary of the induction-coil is included in each of the branches h' h^2 of the local transmitter-circuit. The microphone k is included in one of the branches of the local transmitter-circuit. At the central station a number of pairs of plugs l m are provided, a repeating-coil o being included in the cord-circuit, one winding o' being connected between the terminals of the plug l, while the other winding o^2 is connected between the terminals of the plug m. From the middle point o^3 of the winding o' extends a conductor r' to ground through the battery c, a clearing-out indicator r being included in the conductor r'. Likewise a conductor r^2 extends from the middle point o^4 of winding o^2, in which conductor is included the clearing-out indicator r^3. The clearing-out indicators r and r^3 are constructed to have sufficient retardation effect to prevent the leakage of the voice-currents.

By the arrangement as above described the telephone-lines are completely balanced, and the interposition of the repeating-coil o isolates the two connected lines, so that if one of the lines should be from any cause unbalanced it will not affect the balance of the other line. Furthermore, the provision of the repeating-coil renders it possible to unite a metallic circuit-line with a grounded line without disturbing the balance of the line. When two lines are connected for conversation, the plugs l and m are inserted in the spring-jacks of the respective lines, as illustrated, and current flows from the battery c over the two telephone-lines in multiple to ground at the sub-stations and back to the battery through the ground return. Tracing the circuit over the line at sub-station A, current from battery c passes through the clearing-out indicator r by conductor r' to the middle point o^3 of the winding o' of the repeating-coil, thence by two paths over the limbs a a' of the telephone-line in parallel to the contact-points d^4 d^5, thence through the bridge-conductor g to the repeating-coil, by conductor g^2 to the middle point e^2 of the primary winding e^3 of the induction-coil, thence over the two halves of the induction-coil and the two branches h' h^2 of the local transmitter-circuit in parallel to the point h, and thence to ground. The entire current of the battery c, passing over any particular line, thus traverses the clearing-out indicator, and a more effective operation of the indicator may be obtained than when the indicator is situated in one of the strands of the cord-conductors, as indicated by dotted lines. Furthermore, the location of the clearing-out indicators in the ground branches r' r^2 permits the use of the clearing-out indicators as retardation-coils to prevent the leakage of the voice-currents.

When, as indicated at sub-station B, the middle of the primary winding of the induction-coil is connected with the middle of the secondary winding, the telephone receiver f is preferably included in a bridge, in order that the line may be balanced. At sub-station C, Fig. 2, I have illustrated the receiver f as included in series with the secondary winding of the induction-coil; but in this instance the primary winding is not connected with the middle of the secondary winding, but is connected at a point such that the resistance of the portion of the secondary winding upon one side of the connection is substantially equal to the resistance of the portion of the winding upon the other side, plus the resistance of the telephone receiver, a balance of the line being thus secured.

At sub-station D, Fig. 2, I have illustrated the primary winding of the induction-coil connected with the end of the secondary winding, the resistance of the secondary winding being in this instance equal to the resistance of the telephone receiver, whereby a balance of the line is effected. In this instance the conductor e^5, joining the primary and secondary windings, is not connected with the middle portion of the primary winding, but is connected to one side of the middle, the resistance of the microphone, plus the resistance of the portion of the primary winding in that branch, being adjusted to equal the resistance of the portion of the primary winding in the other branch of the local transmitter-circuit.

At sub-stations A, B, and C, I have illustrated a resistance p, in the branch h^2 of the local transmitter-circuit, adjusted to equal the resistance of the microphone k, whereby the line may be completely balanced.

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

1. The combination with a telephone line extending in two limbs to the central station, said limbs being united at the sub station, of a connection to ground or a common return from said united limbs at the sub-station, a local transmitter circuit included in said connection and comprising parallel paths in which are included the microphone and the primary inductive winding, switching apparatus at the central station comprising a repeating coil, through one winding of which the limbs of the telephone line are adapted to be united a connection to ground from the united limbs of said telephone line, a battery and a clearing out indicator included in said connection to ground or common return and means for preventing the leakage of voice currents through said ground connection; substantially as described.

2. The combination with a telephone line extending in two limbs to the central station, said limbs being united at the sub-station, of a connection to ground or common return from said united limbs at the sub-station, a local transmitter circuit included in said connection and comprising parallel paths in which are included the microphone and the primary inductive winding, switching apparatus at the central station comprising a repeating coil, through one winding of which the limbs of the telephone line are adapted to be united, a connection to ground or a common return from the middle of said winding, a battery and a clearing out indicator included in said ground connection, said indicator possessing retardation effect to prevent the leakage of voice currents; substantially as described.

3. The combination with a local transmitter circuit, comprising two parallel branches, of an induction coil, the secondary winding thereof being included in the telephone circuit, a portion of the primary winding thereof being included in each of the two branches of the local transmitter circuit, a microphone included in said local transmitter circuit and a battery adapted to direct current over the branches of said local transmitter circuit in parallel; substantially as described.

4. The combination with a telephone line, of an induction coil, the secondary winding thereof being included in circuit with the telephone line, a local transmitter circuit containing the microphone, the primary winding of said induction coil being included in said local transmitter circuit, said secondary winding being connected with an intermediate point of said primary winding, and a battery adapted to direct current over the telephone line and from the point of connection with the primary winding over the two portions of the primary winding through the transmitter circuit in parallel; substantially as described.

In witness whereof I have hereunto subscribed my name this 13th day of May, A. D. 1895.

WM. W. DEAN.

Witnesses:
PAT'K BYRNE,
WM. E. HARKNESS.