

No. 706,318.

Patented Aug. 5, 1902.

M. H. HOWELL.
COMPOSITE ELECTRIC CIRCUIT.

(Application filed June 24, 1901.)

(No Model.)

2 Sheets—Sheet 1.

Fig. 1.

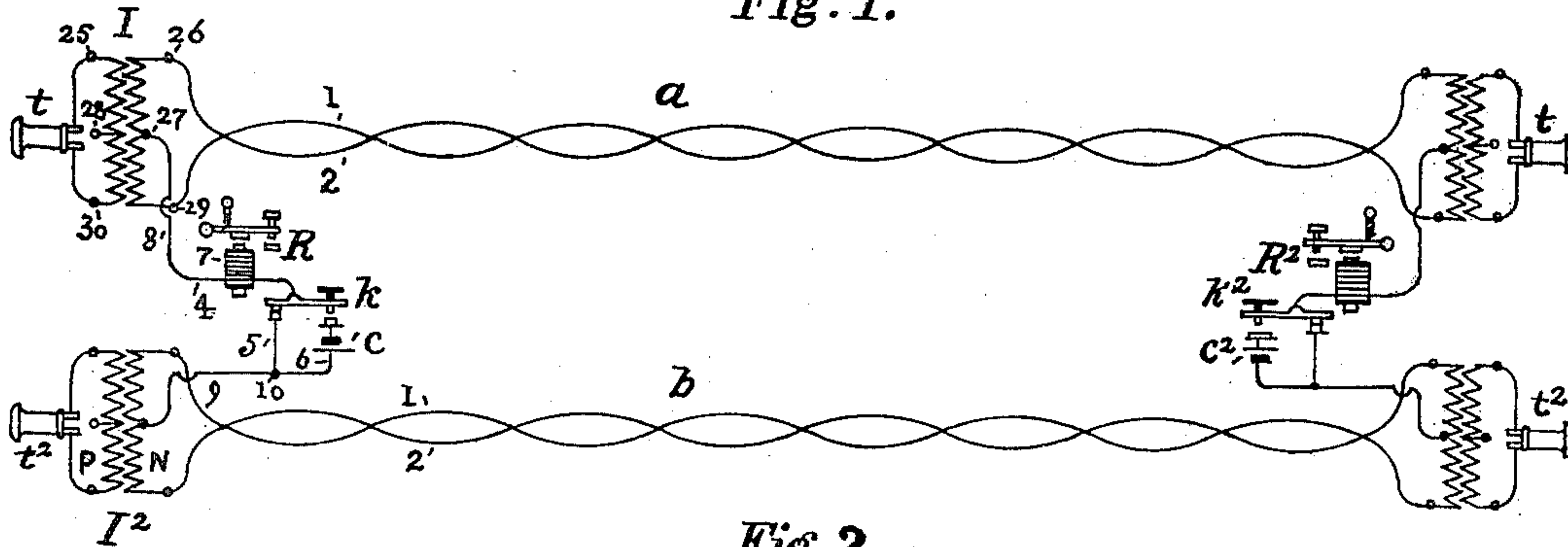


Fig. 2.

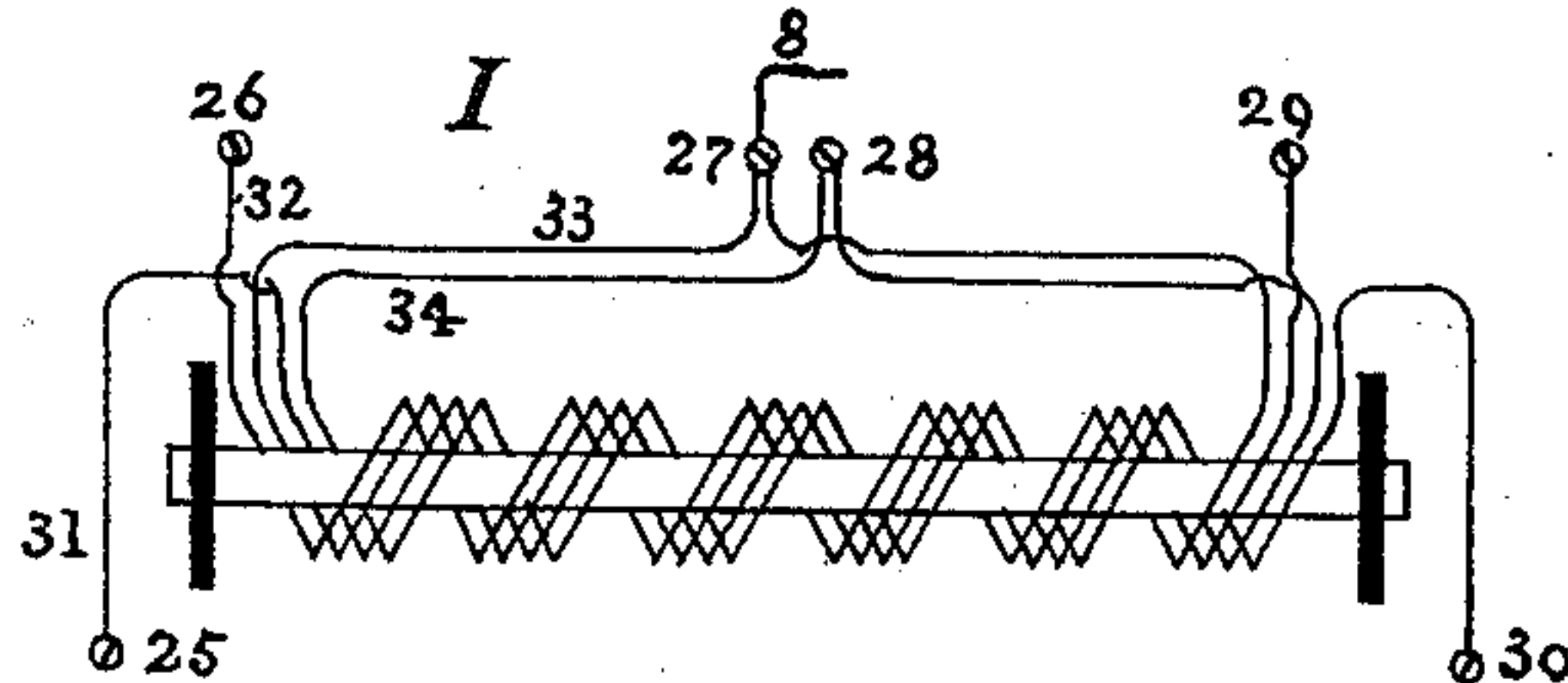
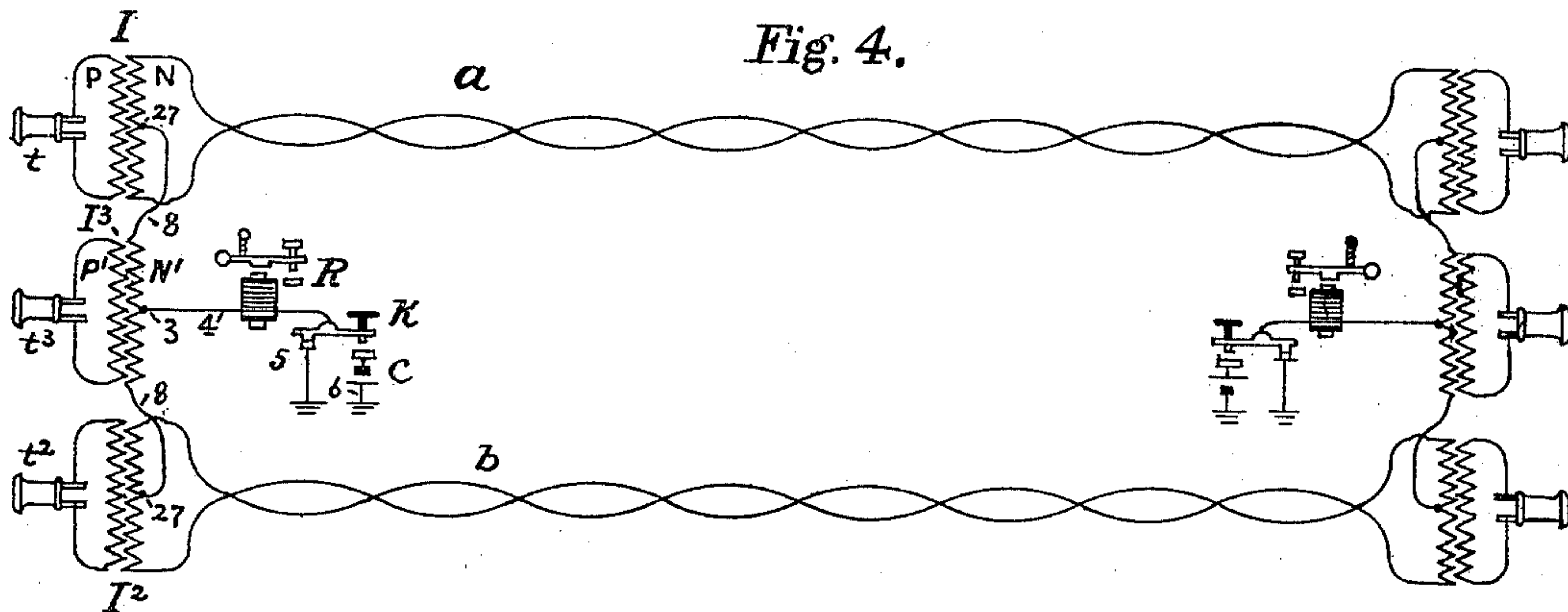


Fig. 4.



WITNESSES:

Bertha M. Sonart.
L. May Crawford.

Martin A. Howell
INVENTOR.

M. H. HOWELL.
COMPOSITE ELECTRIC CIRCUIT.

(Application filed June 24, 1901.)

(No Model.)

2 Sheets—Sheet 2,

Fig. 3.

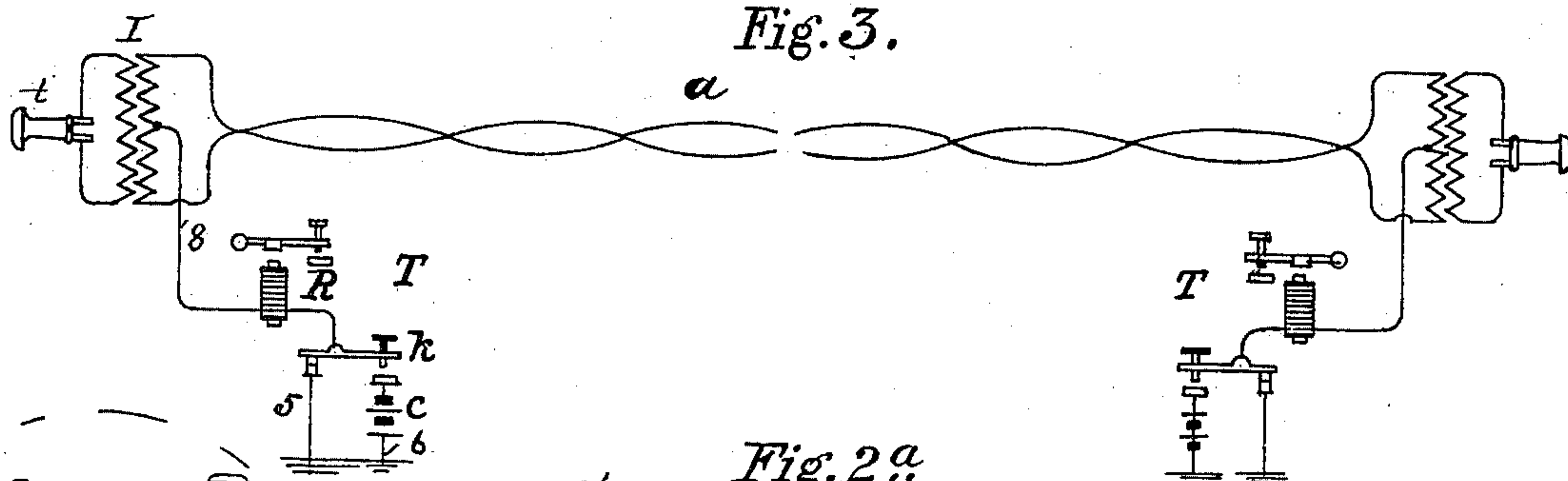


Fig. 2a.

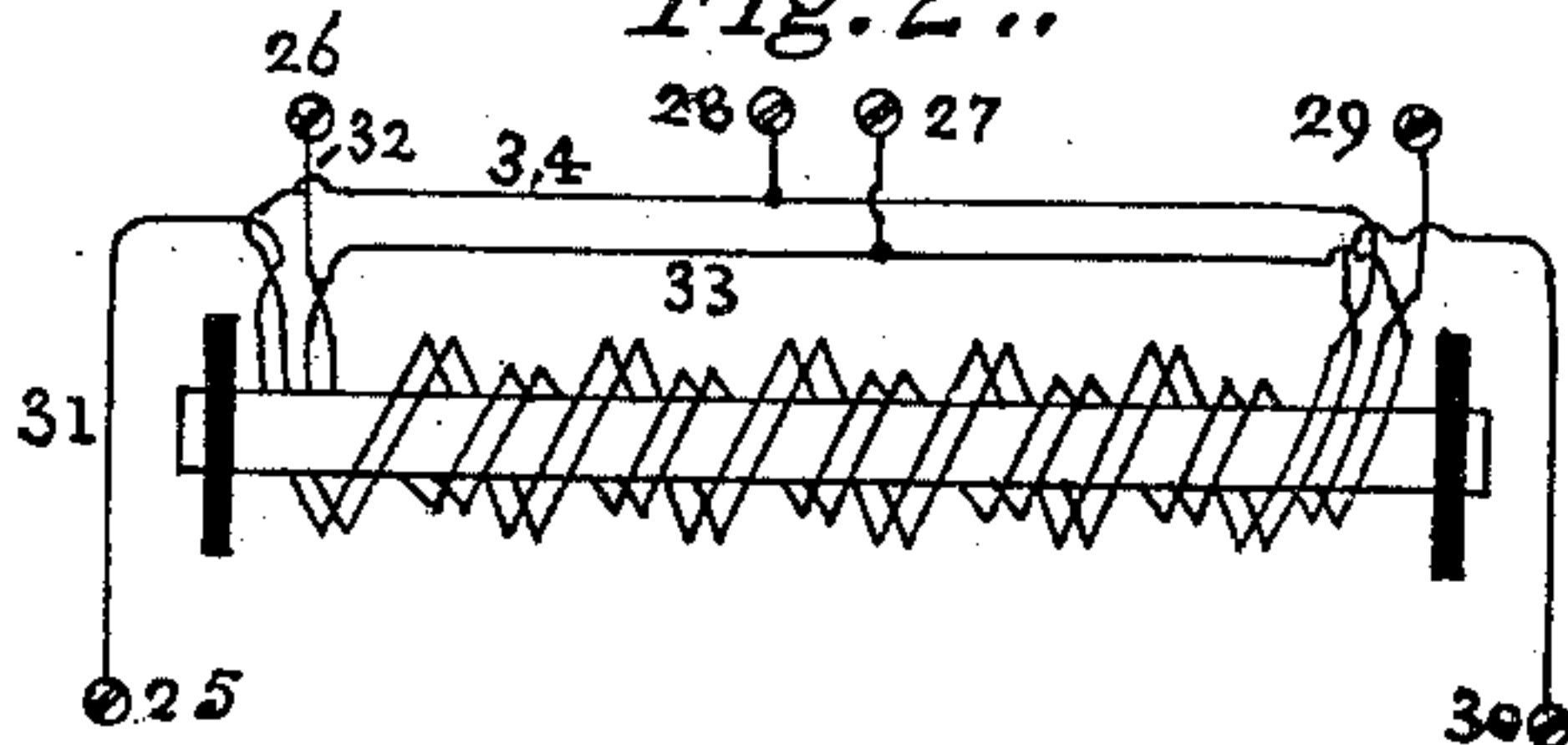
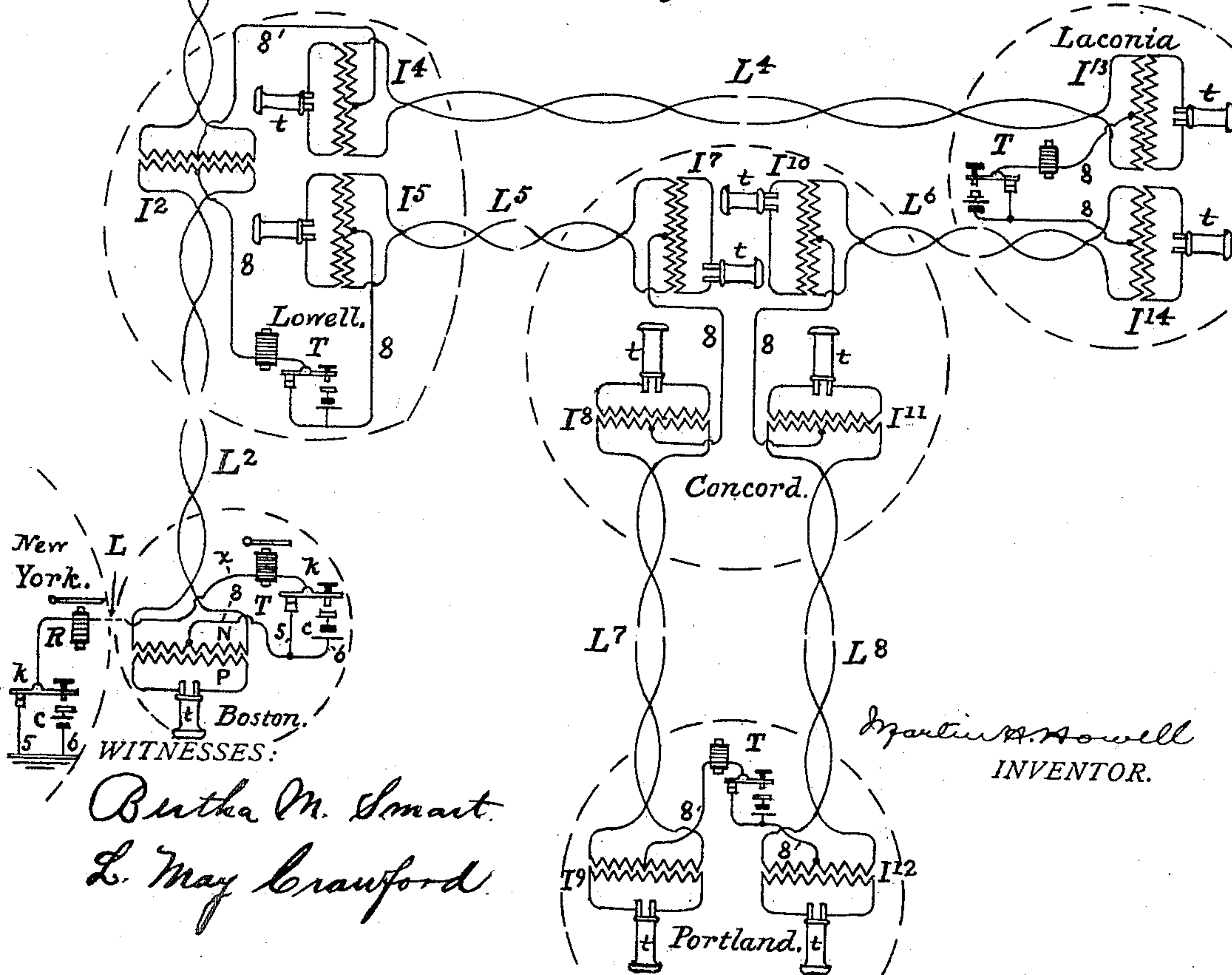


Fig. 5.



UNITED STATES PATENT OFFICE.

MARTIN H. HOWELL, OF MELROSE, MASSACHUSETTS, ASSIGNOR TO NEW ENGLAND TELEPHONE AND TELEGRAPH COMPANY, A CORPORATION OF NEW YORK.

COMPOSITE ELECTRIC CIRCUIT.

SPECIFICATION forming part of Letters Patent No. 706,318, dated August 5, 1902.

Application filed June 24, 1901. Serial No. 65,803. (No model.)

To all whom it may concern:

Be it known that I, MARTIN H. HOWELL, residing at Melrose, in the county of Middlesex and State of Massachusetts, have invented certain Improvements in Composite Electric Circuits, of which the following is a specification.

The present invention relates to composite electric circuits in which telephone and telegraph messages are transmitted and received over the same conductors without interruption with one another. The invention contemplates new and novel means for carrying out such transmission of messages, with which I may employ insulated conductors inclosed in a protective sheath and supported upon poles or drawn into conduits under ground. The conductors may be uninsulated or bare and elevated upon poles and cross-arms. In any case the conductors are transposed relatively to each other and all inductive effects are eliminated. I employ in connection with the composite circuits repeating-coils similar to those referred to in my application for United States Letters Patent filed June 19, 1901, Serial No. 65,137, to which reference is made.

The invention has especial adaptation for transmitting market quotations of various sorts to adjacent towns and cities from a central source, as a plurality of telephone toll-lines extending between said towns and cities may be utilized and be made to serve as telegraph-circuits, all of which I will now proceed to describe, and point out in the claims.

Figure 1 of the drawings illustrates the invention and is a diagram of two metallic telephone-circuits whose conductors are employed for a metallic-circuit telegraph-line. Figs. 2 and 2^a are diagrams of the repeating-coils employed in the invention. Fig. 3 is a diagram of a metallic telephone-circuit whose conductors are employed as one side of an earthed telegraph-line. Fig. 4 is a diagram of two metallic telephone-circuits, from which is arranged a phantom telephone-circuit and also a telegraph-line which employs the two metallic telephone-circuits as one side of its line and the earth as the other side of the line.

Fig. 5 is a diagram showing several telephone-circuits and the utilization of the same as a distributing telegraph-circuit.

Referring to Fig. 2, which represents a form of repeating-coil employed in the invention, 31, 34, 32, and 33 are insulated conductors which are twisted together and have their right-hand ends respectively brought out to the screw-posts 28, 30, and 29 and their left-hand ends to the screw-posts 25, 28, 26, and 27, respectively, so that each conductor passes through the coil in two windings in series with one another, the points 27 and 28 being in the center of the respective windings, both sides of which are balanced and symmetrical. These coils are referred to in Fig. 1 and in the other figures of the drawings by the reference-letter I, and the extensions 8 from the point 27 on the side N of the coils at each end of the circuit *a* connect with the electromagnet of the sounder R and then to the keys *k* of the telegraph apparatus T, whose back and front contacts are connected by the wires 5 and 6 with the extensions 9 from the point 27 of the repeating-coils I² of the circuit *b*. Batteries *c* and *c*² are included in the wires 6 at each end of the main circuit. By this arrangement the circuit *a* serves as one side or limb and the circuit *b* the other side or limb of the telegraph-line.

The telephones *t* and *t*² are in a local circuit comprising one side or winding of the repeating-coils I and I².

In the operation of the telegraph apparatus when the key is pressed current from battery *c* passes by conductor 8 to point 27 on the N winding of the coil, where it splits, going through the helices in opposite directions and coming out at the points 26 and 29 and continues over the respective conductors 2 and 1 to the points 26 and 29 at the opposite end of the circuit and thence through the helices of the winding N of the coil in opposite directions to the point 27, where the current unites and continues by conductor 8 to the helices of relay R², and in case of the metallic-circuit return shown in Fig. 1 the current passes by the rear contact of the key to the sides of the metallic circuit *b* to the op-

posite pole of the battery, and in the grounded circuits shown in other figures the return is by the earth. As the current splits at the point 27 and goes in opposite directions through the helices, as described, one side neutralizes the other. Therefore no inductive effect is produced in the core, and consequently there is no disturbance in the telephones at either end, and when the telephone is used the currents generated thereby enter the P winding of the coil and traverse the windings thereof in series and an inductive effect is produced in the core of the coil, and similar currents are induced in the winding N of the coil, which traverse the helices thereof in series and are propagated over the conductors 1 and 2 of the circuit and pass through the helices of the winding N of the coil at the opposite end of the circuit and are inductively transferred to the winding P, through whose helices they circulate in series and are received by the telephone in the local circuit of the winding. The impedance of the telegraph instruments prevents any leakage therethrough of the telephone-currents.

Fig. 3 represents the telegraph-line utilizing one telephone-circuit as the metallic side and the earth as the opposite side thereof. In this case the wires 5 and 6 extend to the earth.

In Fig. 4 there are shown the two metallic telephone-circuits *a* and *b*, and between the points 27 of the repeating-coils I and I² are the extensions 8 8, which include in circuit one winding N' of a third repeating-coil I³, from the center point 3 of which is an extension 4 to the electromagnet of the telegraph-sounder R and to the key *k* of the telegraph apparatus T, whose rear and front contacts are connected to earth by the wires 5 and 6. The second windings P of the three repeating-coils are provided with telephones *t*, *t*², and *t*³, and this arrangement of circuits provides two telephone-circuits *a* and *b*, a third telephone phantom circuit which employs the circuits *a* and *b* for its respective sides or conductors, and a fourth or telegraph circuit which utilizes the two circuits *a* and *b* as one side thereof and the earth as the remaining side.

Fig. 5 represents a number of telephone toll-circuits between several cities, L² extending from Boston to Lowell and repeating as L³ to Lawrence, L⁴ extending from Lowell to Laconia, L⁵ extending from Lowell to Concord, L⁶ from Concord to Laconia, L⁷ from Concord to Portland, L⁸ from Portland to Concord. These circuits are provided with repeating-coils by means of which they are adapted to successfully operate as telephone-circuits. L represents an earthed telegraph-line from New York to Boston, the conductor *x* extending from earth at New York to the electromagnet of relay R of the telegraph apparatus T in Boston, and then to the key *k* and by wires 5 and 6 to the extension 8 from the winding N of the repeating-coil I of the telephone-circuit L². At the other end of cir-

cuit L² the extension 8 from the repeating-coil I² connects one side of the telegraph instruments T at Lowell, whose other side is connected by the extension 8 from the repeating-coil I⁵ of the telephone-circuit L⁵, which at its Concord end is connected by extension 8 from the repeating-coil I⁷ to repeating-coil I⁸ of circuit L⁷, at the Portland terminal of which it is connected by extension 8 from repeating-coil I⁹ to repeating-coil I¹² of circuit L⁸ and includes in said extension the telegraph instruments T. The repeating-coil of said circuit at Concord connects with repeating-coil I¹⁰ of circuit L⁶. At Laconia the repeating-coil I¹⁴ of circuit L⁶ is joined to that of the circuit L⁴ and has in circuit there the telegraph instruments T, and at Lowell the said circuit L⁴ is provided with an extension from the repeating-coil I⁴ to the repeating-coil I² of the circuit L³ going to Lawrence, where from the repeating-coil I³ is the extension 8 to the telegraph apparatus T and earth. Telegraph apparatus may be located at Concord; but none is represented, in order that connections may be shown through a way-station.

It will be seen that the ordinary service toll-telephone circuits between cities may be utilized by the invention to any extent to provide a telegraph-line between widely-separated places in which the metallic conductors of the telephone-circuits constitute one or both sides of the telegraph-line at the same time the telephone-circuits are being employed in their usual service.

I prefer to use the form of coil shown in Fig. 2 at all of the stations, (except coil I² at Lowell,) in which the conductors are all twisted together. The twisting is not shown for the sake of clearness; but as the coil I² has an extension 8 from the center of each winding, from which circuits lead in different directions, I prefer to use the coil shown in Fig. 2^a, in which the two conductors of each winding are separately twisted with one another and then one of the twisted pairs wound upon the bobbin and the second twisted pair wound over the first. By this system of winding there is absolutely no cross interference between the windings.

I claim as my invention—

1. The combination in composite telephone and telegraph circuits, of a metallic circuit whose conductors are transposed relatively to each other between their terminals, a repeating-coil at each end of the circuit whose windings are inductive to telephone-currents and non-inductive to telegraph-currents, the telephone-currents adapted to traverse the helices of the windings in series, and the telegraph-currents adapted to circulate in the helices of the windings differentially, with telephones in series with one of the windings of each coil, and telegraph instruments connected to the center of the second winding of the coil, as set forth.

2. The combination in composite telephone

and telegraph circuits, of a metallic circuit whose conductors are transposed relatively to each other between their terminals, a repeating-coil at each end of the circuit whose
5 windings are inductive to telephone-currents and non-inductive to telegraph-currents, the telephone-currents adapted to traverse the helices of the windings in series, and the tele-
10 graph-currents adapted to circulate in the helices of the windings differentially, telephones in series with one of the windings of each coil, and telegraph instruments connected to the center of the second windings of each coil, with one or more repeating-coils
15 in the line-circuit between the said end coils having extensions from the centers of both windings of each coil adapted to include telegraph instruments.

3. The combination in composite telephone
20 and telegraph circuits; of a metallic circuit whose conductors are transposed relatively to each other between their terminals; a repeating-coil at each end of the circuit whose windings are inductive to telephone-currents
25 and non-inductive to telegraph-currents, the former currents being adapted to traverse the helices of the windings in series, and the latter currents adapted to circulate in one of said windings differentially; with telephones
30 in a local circuit with one of said windings,

and telegraph instruments connected to the center of the second winding, as set forth.

4. The combination in composite telephone and telegraph circuits, of a metallic circuit whose conductors are transposed relatively
35 to each other between their terminals, a repeating-coil at each end of the circuit whose windings are inductive to telephone-currents and non-inductive to telegraph-currents, the telephone-currents adapted to traverse the
40 helices of the windings in series, and the telegraph-currents adapted to circulate in the helices of the windings differentially, telephones in series with one of the windings of each coil, and telegraph instruments con-
45 nected to the center of the second windings of each coil, with one or more repeating-coils in the line-circuit between the said end coils the centers of the windings of each coil being connected and including in circuit tele-
50 graph instruments, as set forth.

In testimony whereof I have signed my name to this specification, in the presence of two subscribing witnesses, this 21st day of June, 1901.

MARTIN H. HOWELL.

Witnesses:

BERTHA M. SMART,
L. MAY CRAWFORD.