(No Model.)

2 Sheets—Sheet 1.

T. D. LOCKWOOD.

TELEPHONIC REPEATING CIRCUIT.

No. 290,898. Patented Dec. 25, 1883.

Fig. 1.

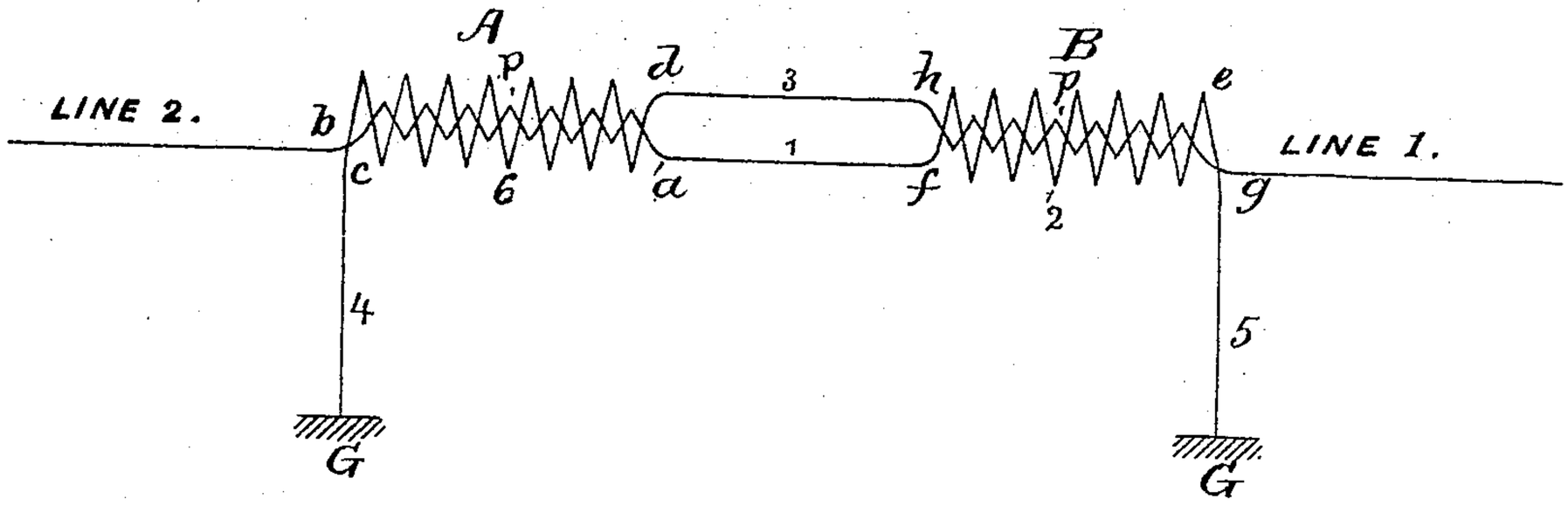


Fig. 2.

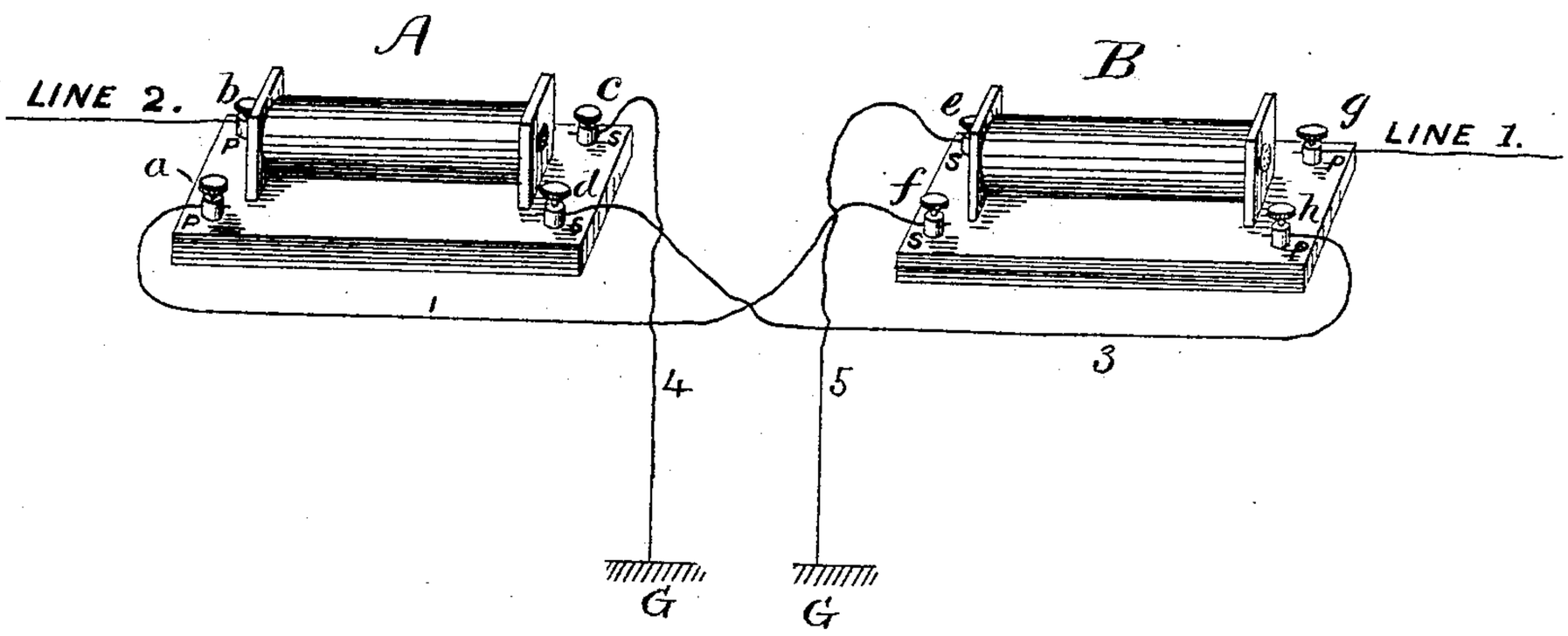
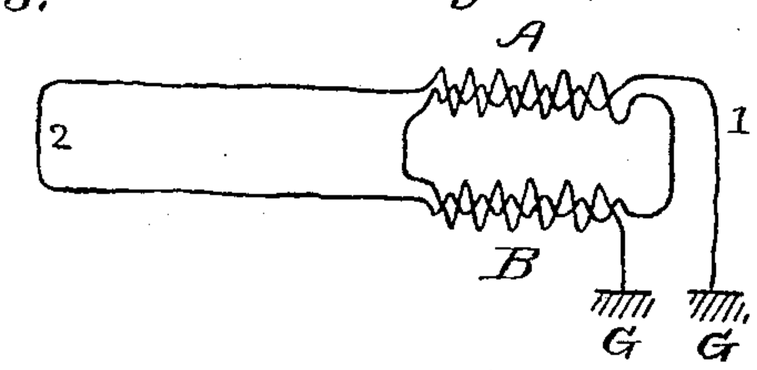


Fig. 3.



Witnesses.
Geo. Willis Pierce.
J. H. Cheever.

Inventor.
Thos. D. Lockwood

(No Model.)

2 Sheets—Sheet 2.

T. D. LOCKWOOD.

TELEPHONIC REPEATING CIRCUIT.

No. 290,898. Patented Dec. 25, 1883.

Fig. 4.

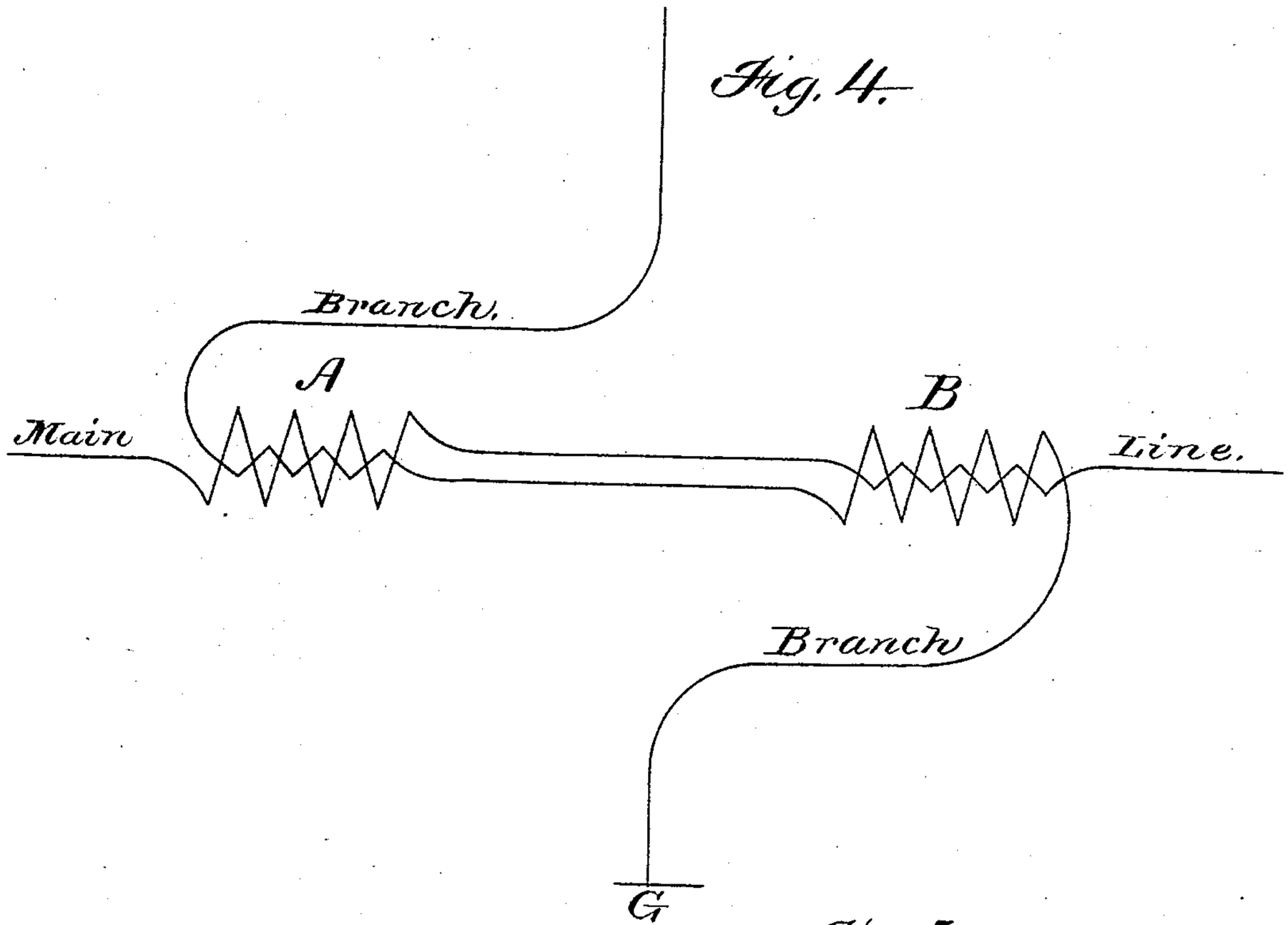
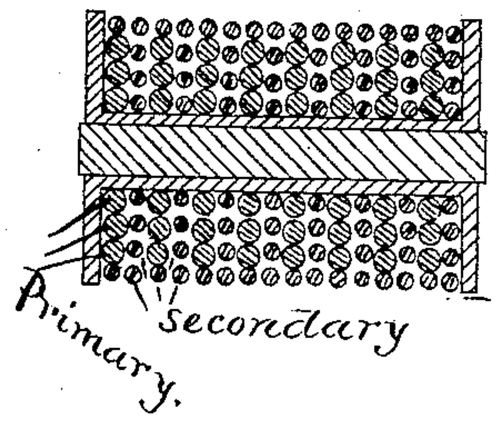


Fig. 5.



Witnesses.
C. J. Hedrick
L. B. White

Inventor:
Thos. D. Lockwood.
by A. Pollok
his attorney

UNITED STATES PATENT OFFICE.

THOMAS D. LOCKWOOD, OF MALDEN, MASSACHUSETTS.

TELEPHONIC REPEATING-CIRCUIT.

SPECIFICATION forming part of Letters Patent No. 290,898, dated December 25, 1883.

Application filed April 13, 1883. (No model.)

To all whom it may concern:

Be it known that I, THOS. D. LOCKWOOD, of Malden, in the county of Middlesex and State of Massachusetts, have invented certain Improvements in Telephonic Repeating-Circuits, of which the following is a specification.

My invention relates to telephonic circuits; and its object is to arrange such circuits in such a manner as to enable the telephonic communications passing upon and over one of them to be inductively repeated upon the other, and vice versa. A second object is to furnish a device whereby the telephonic messages may be mutually exchanged between metallic and earth circuits. The plan I adopt, broadly stated, is to provide at each repeating-station, or each place where metallic and earth circuits center for the interchange of business, a pair of induction-coils constructed and wound in a special and peculiar manner, and to so connect them with reference to any two circuits that each circuit passes first through the primary circuit of one of the coils, and then through the secondary circuits of the other coil, proceeding thence either to the earth or to a ground-wire. In a patent granted September 28, 1880, to Thomas A. Watson, and numbered 232,788, a somewhat similar method is shown and described. I have, however, demonstrated by experience that the results attained by the use of the devices therein described are not practically successful, inasmuch as though one of the lines is fully enabled to repeat into the other, the repetition is by no means reciprocated, and the second line is not able to repeat into the first advantageously and economically, so far as regards the volume of sound and clearness of articulation transmitted. In view of this disadvantage and of the failure of reciprocity, I have conceived the following improvement, which I find in practice to be most effectual in overcoming the defect I have mentioned.

The accompanying drawings show the arrangement and illustrate my invention.

Figure 1 is a diagram showing the route of the several circuits. Fig. 2 shows the mechanical connections with the coils in perspective; and Fig. 3, an adaptation of the invention to the combination of a metallic with a ground circuit. Fig. 4 is a diagram showing an arrangement of a main and a branch line, and Fig. 5 is a sectional view of the induction-coil.

I will first describe the mechanical construction of the induction-coils. Each of the coils is identical in character with the other, and each is composed of a primary and secondary circuit, and a core of oxidized iron wires. I have in every case found the best results to accrue when the resistance of the secondary coil bears the same proportion to that of the primary coil that 2.70 does to 1. Both coils are preferably made of silk-covered copper wire, and instead of winding the primary coil first over the core, I wind the two wires of the primary and secondary circuits together until the last convolution is reached, when I wind a complete layer of the secondary coil over all. This construction is clearly shown in Fig. 5, in which the larger wires indicate the primary and the smaller the secondary of the induction-coil. I have found a coil of eleven inches in length, having a primary resistance of sixty ohms and a secondary resistance of one hundred and sixty-two ohms, to answer well. In no case should the combined convolutions reach a greater distance from the core than half an inch. The coils thus made are mounted upon a suitable base of wood or other similar material, and the terminals of both primary and secondary circuits fitted with binding-screws for the convenient attachment of the external conducting-wires. The binding-screws forming the terminals of the primary coil are marked with the letter *p*, and the secondary terminals are designated by the letter *s*.

The connections are made as shown in Fig. 2. Line No. 1 is represented as entering from the right, and is connected with the induction-coil B at the primary binding-screw *g*. The other primary screw, *h*, of the same coil is united by wire 3 with the secondary coil of the induction-coil A, which the said wire 3 enters at the secondary binding-screw *d*, the other secondary binding-screw, *c*, of the second induction-coil A being then connected to earth by the wire 4. The second line, entering from the left in like manner, connects with the primary coil of the induction-coil A, being united

with the primary screw *b*. The other primary screw, *a*, is united by wire 1 with the secondary coil of coil B at *f*. The other terminal, *e*, of this secondary coil connects by the wire 5 with the earth. The absolute and complete route of the circuits is shown in Fig. 1, in which line 1 may be traced as follows: line 1, post *g*, primary coil of apparatus B, post *h*, wire 3, post *d*, secondary coil 6 of apparatus A, post *c*, and thence by wire 4 to earth. Line 2 may be similarly traced from the entering line by screw-post *b*, primary *p* of apparatus A, post *a*, connecting-wire 1, post *f* of coil B, secondary coil 2 thereof, post *e*, and wire 5 to ground. Thus each line-wire entering the repeating-station passes first the primary circuit of the first induction-coil, and then through the secondary coil of the second. Consequently each line is adapted and enabled to impart inductive impulses to, as well as to receive inductive impulses from, the complementary line with which it may be for the time associated.

In Fig. 3 I show an application of my invention wherein a metallic circuit and an earth-circuit are made to repeat into one another. The connections are made exactly as in the other figures, each circuit passing successively through a primary coil and through the secondary circuit of another coil. The metallic line-circuit is marked 2, the ground-circuit 1, and the respective coils A and B.

It is of course understood that my invention is applicable to telephone-lines only, although I have not considered it necessary to show a telephone or telephones in the drawings.

In Fig. 4 an arrangement of a branch line working in connection with a main line is shown. The main line passes through the primary of one coil and the secondary of the other in an indifferent order.

I claim—

1. A telephone-repeater consisting of two induction-coils constructed substantially as hereinbefore described, and connected in circuit between any two main circuits, each of the said two main circuits passing first through the primary circuit of one of the coils, and then through the secondary circuit of the other coil, as set forth.

2. An induction-coil constructed substantially as described, the primary and secondary circuits being wound together and covered by a final layer of the secondary circuit, substantially as described.

3. An induction-coil consisting of a primary and secondary circuit, the resistance of the primary circuit bearing an approximate ratio to that of the secondary circuit of 1 to 2.70, and the two circuits being wound together side by side, and covered with a final layer of the secondary circuit, as described.

In testimony whereof I have signed my name to this specification, in the presence of two subscribing witnesses, this 10th day of April, 1883.

THOS. D. LOCKWOOD.

Witnesses:
J. H. CHEEVER,
GEO. WILLIS PIERCE.