

(No Model.)

T. D. LOCKWOOD.

TELEPHONE SYSTEM.

No. 260,883.

Patented July 11, 1882.

Fig. 1.

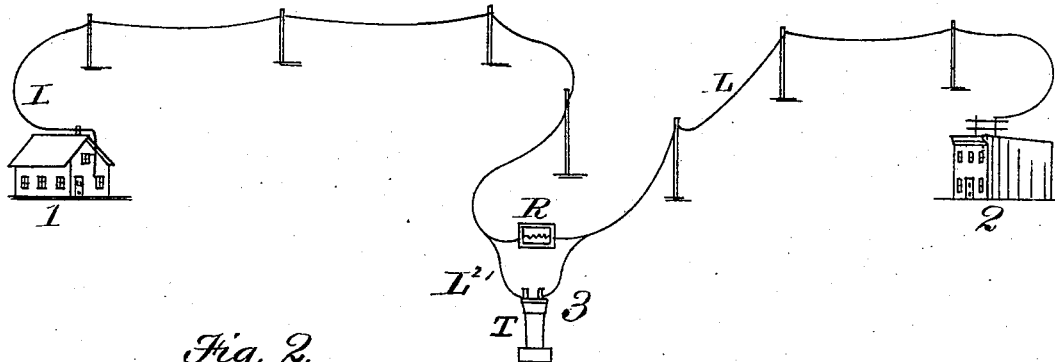


Fig. 2.

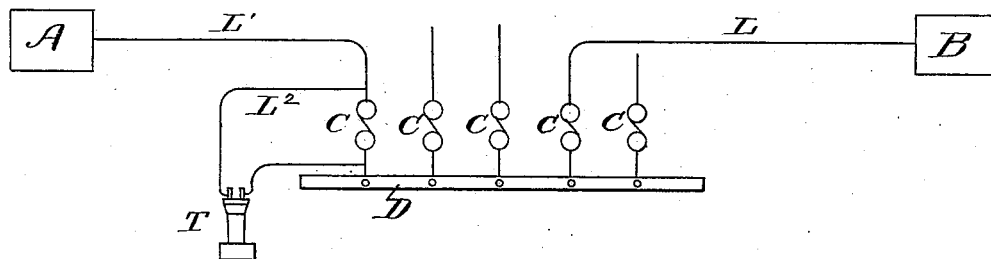


Fig. 3.

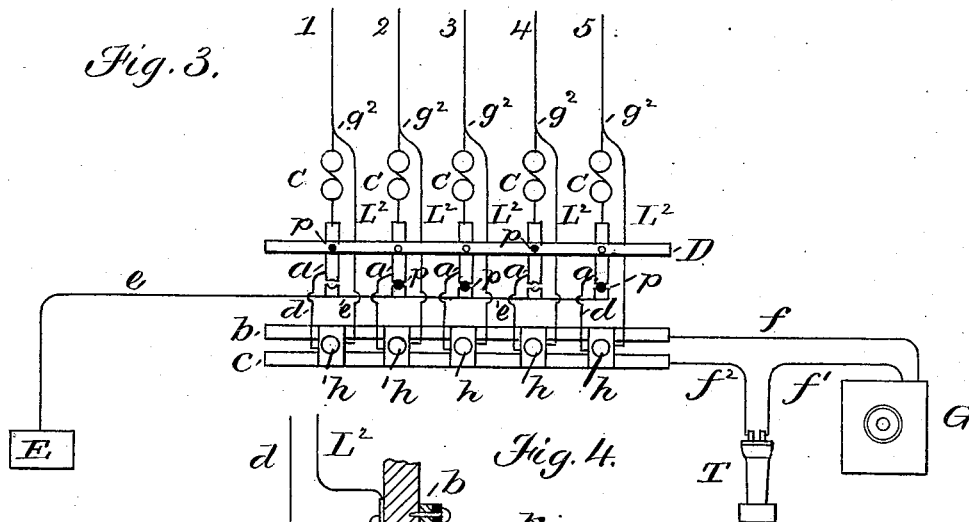
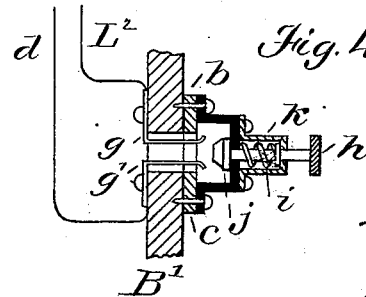


Fig. 4.



Witnesses.  
J. H. Cheever  
Geo. Willis Pierce

Inventor.  
T. D. Lockwood

# UNITED STATES PATENT OFFICE.

THOMAS D. LOCKWOOD, OF MALDEN, MASSACHUSETTS.

## TELEPHONE SYSTEM.

SPECIFICATION forming part of Letters Patent No. 260,883, dated July 11, 1882.

Application filed January 27, 1882. (No model.)

*To all whom it may concern:*

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

My invention relates to telephonic circuits, and especially to their arrangements in the central station of a telephone-exchange, where-  
10 by the operator at the said central station is enabled to supervise the proper interconnection of any two lines to communicate orally with the substations on either or both of the lines, and to connect his speaking and listen-  
15 ing apparatus at the junction of the said connected lines, for the purpose of ascertaining whether the conversation is concluded.

The object of my invention is to effect this in such a manner that the union of the two  
20 lines is in nowise interfered with, and that the volume and distinctness of the vocal sounds received at the substations on either line shall remain unimpaired.

Heretofore one of two methods has been em-  
25 ployed for the accomplishment of this end. Either the supervising telephones of the operator have been arranged normally in a loop with terminals close to one another, and separated by a thin insulator, in which case they  
30 are inserted into the circuit of the main line by means of a spring-jack and double wedge, in a manner well understood, or they have been included in a branch circuit to earth, which is, when desired, placed in contact with  
35 the united circuits, forming a third leg to the circuit, and receiving its proper proportion of the telephonic currents. There are certain practical defects in both of these systems which by my invention are obviated. In the use of  
40 the former plan the circuit is momentarily interrupted when the wedge is inserted in the spring-jack, or at the moment when in any manner the insertion is made, and thus the respective subscribers who are in communication are correspondingly interrupted and annoyed. When the latter method is adopted,  
45 although the effect of the intermediate ground-branch in diminishing the volume of current reaching the substations, and as a consequence  
50 the volume of sound received, is, when the lines connected are both short, inappreciable, it

becomes a serious matter, when a long and short line are connected or when two long lines are connected together for intercommu-  
55 nication, because the ground-branch, including the operator's instruments, leaks away so much of the working-current as to weaken the received sounds at either end very much. By the use of my invention these defects are dispensed with.

My invention consists in the use at the central station of a telephone-exchange, or at other  
60 necessary points, of a telephone or telephones in a derived circuit, which, branching away from the line-circuit at any given point, returns to it again at another point, thus furnishing a second or alternative route for the current of electricity flowing in the main line.

It also consists in apparatus whereby such a device may be practically and conveniently  
70 applied.

My invention is based upon the principle that when two routes are open for the passage of electricity the electricity will divide at the  
75 point of junction, each route or conductor conveying a portion of the current. This division is further governed by the laws of electrical resistance, the quantity of electricity passing over each line being inversely proportional to the resistance of that line. Thus, if a con-  
80 ductor be at some point of its extent split up into two, and one of the split branches have a resistance of ten ohms and the other of twenty ohms, two-thirds of the current will pass through the ten ohms and one-third through  
85 the twenty ohms. It is evident that by availing myself of this principle I may in practice operate a line telephonically without at any time disturbing its continuity.

In the drawings which form a part of this  
90 specification, Figure 1 is a diagram illustrating the principle which I have hereinbefore enunciated, and represents a resistance-coil, R, at an intermediate station in the circuit of a main line, L, connecting two terminal sta-  
95 tions, 1 and 2, with a telephone, T, in a derived circuit, L<sup>2</sup>, bridging the resistance-coil. Fig. 2 is also a diagram, showing a method of applying my invention at a central telephone-station, dispensing with a resistance-coil by  
100 using in lieu thereof the regular signal-receiving annunciator C. The two stations A and

Bare connected by their respective line-wires L and L' with a central-station connecting switch-bar, D, and the telephone T is shown in the derived circuit L<sup>2</sup> looped round one of the annunciators. Fig. 3 is a drawing of suitable appliances whereby my invention can be conveniently carried out, and the telephones of the operator at a central station be readily interposed in a normally-open derived circuit round any annunciator in the system; and Fig. 4 is a detail view of a simple device which I attach to each line-wire, and employ as a circuit-closer to include the common telephones in the derived circuit of any individual line.

Recurring now to Fig. 3, 1, 2, 3, 4, and 5 are lines entering a central station from a series of substations. The circuit of each line, after passing through its annunciator-magnet C and switch-strip *a*, is normally terminated by means of metal plug *p* at the ground-plate *e*, leading by the wire *e* to earth at E.

D is a connecting-strip, with which lines 1 and 4 are electrically connected, having been disconnected from the ground-plate *e* for the purpose of uniting them by means of the strip D for intercommunication.

It is obvious that any or all of the lines can similarly be disengaged from their normal termination at the ground-plate and placed in contact with the strip D, or with similar strips (not shown) for the above purpose.

A wire, L<sup>2</sup>, branches away from each line-wire at a point, *g*<sup>2</sup>, just outside of the annunciator C, and is led below the surface to the spring *g*, Fig. 4. A second wire is attached to each circuit-plate *a* and led to the opposing spring, *g*'. These springs—a pair for each circuit, placed uniformly in line with their respective circuit-plates *a*—are fastened to a base-board, B, and extend upward between a pair of metal strips, *b c*. The ends of the vertical springs *g g'* are curved slightly over the upper surface of the metal strips *b c*, so that pressure applied to their curved ends brings the springs into contact with the horizontal strips. The required pressure is, when desired, applied by means of the press-button *h*, which slides in a socket, *k*, and is normally kept elevated and kept away from the curved ends of the springs by the spiral spring *i*. One press-button is arranged immediately over each pair of springs, and each button is employed exclusively for its own line, except that, when two lines are connected through, the button of either line will answer the purpose.

The two horizontal metallic strips *b* and *c* form the terminals of a telephone-loop. To the plate *b* is attached a wire, *f*, leading to transmitter G, and from thence a second wire, *f'*, leads to the receiving-telephone T, and from thence a third wire leads to the plate *c*. Thus the office telephones are placed on a normally-open loop-circuit, and it is obvious that by pressing any one of the keys *h* the foot *j* is forcibly pressed upon the curved ends of the springs *g* and *g'*. The springs are by the said pressure caused to make contact with the two

plates *b* and *c*, and by such contact the derived circuit around the annunciator C is closed through the telephones. The course of the derived circuit is then as follows: Commencing on any line-circuit at the point *g*<sup>2</sup>, the circuit continues by wire L<sup>2</sup>, spring *g*, plates *b*, and wire *f* to transmitting-telephone G, returning through wire *f'*, telephone T, wire *f*<sup>2</sup>, plate *c*, spring *g'*, and wire *d* to the line-plate *a*.

Any other resistance may be substituted for the annunciator-magnet, or may be added thereto or included in circuit therewith, if found desirable, as may be in the case of long circuits.

I do not claim broadly the open telephone-loop, extending by metallic plates into proximity with or across the vertical line of the line-circuits, and adapted for inclusion in any of the said line-circuits, as I am aware that such a device is not new; but

I claim as of my invention—

1. In a telephone-exchange system, the combination, with the switch-board for connecting the terminals of subscribers' lines at the central office, of a supervising and listening circuit, and means, substantially as described, for connecting the said circuit with the several subscribers' lines around a resistance, as set forth.

2. The combination, substantially as hereinbefore described, of a series of main lines, each having a resistance-coil in the main circuit, a normally-open derived circuit for each line bridging the resistance-coil, a normally-open telephone-loop common to the series of main lines, and means for connecting the said telephone-loop with any one of the derived circuits, whereby the said derived circuit may be closed and the listening-telephones adapted to communicate with the main line connected therewith.

3. The combination, in a telephone-exchange, of a main line, an annunciator included in the circuit of said main line, listening-strips forming the open terminals of a telephone, a derived circuit, normally open, bridging the annunciator of each line and terminating in springs extending between the two listening-strips, and a key circuit-closer, whereby the listening-strips are connected with and into the derived circuit, for the purpose described.

4. In a system of telephonic communication, a line and terminal station and station apparatus, in combination with a resistance in said line at an intermediate point or way-station, and a derived circuit connected at both ends with the line and bridging or shunting the resistance, substantially as described.

In testimony whereof I have signed my name to this specification, in the presence of two subscribing witnesses, this 25th day of January, 1882.

THOS. D. LOCKWOOD.

Witnesses:

J. H. CHEEVER,  
GEO. WILLIS PIERCE.