

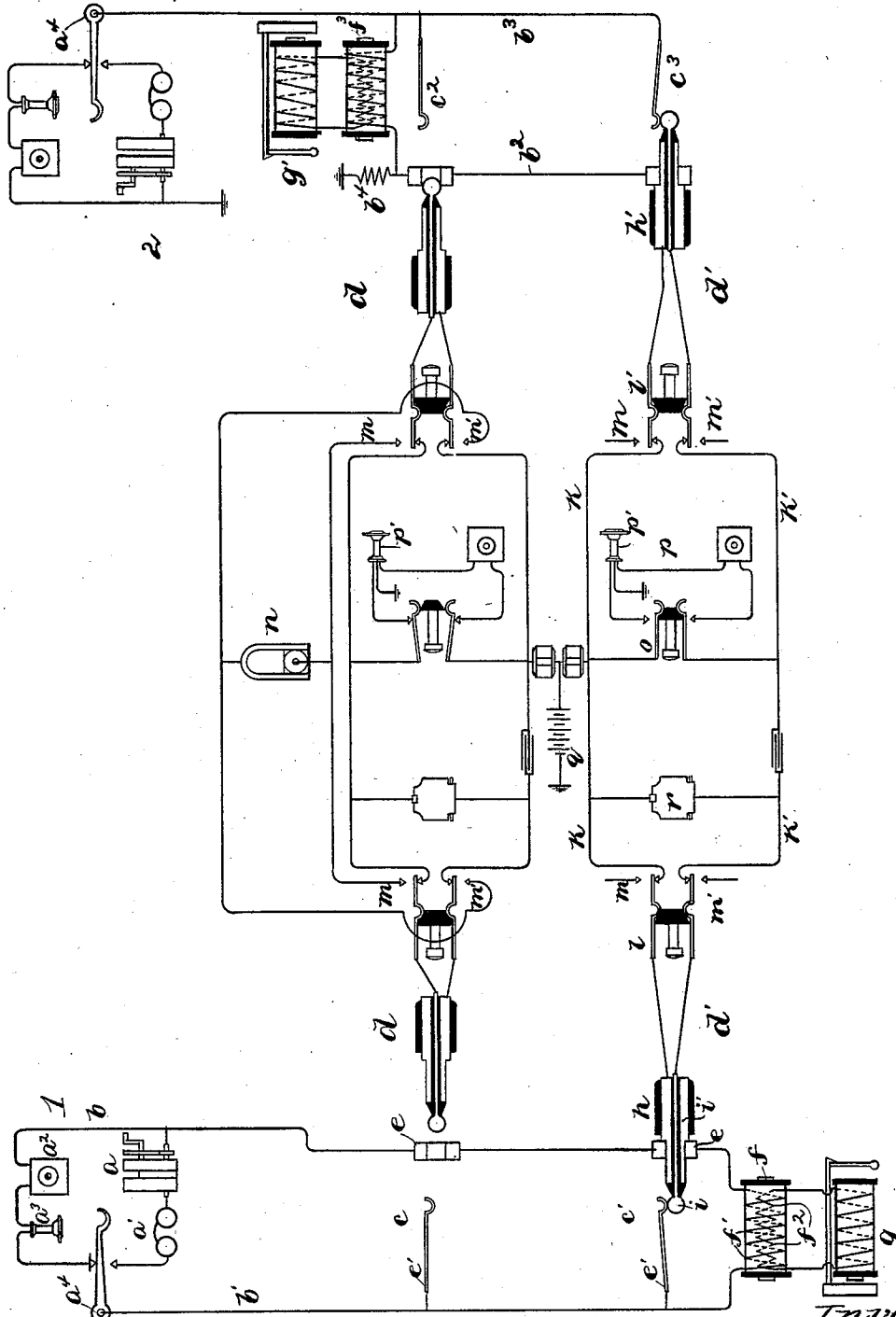
(No Model.)

C. E. SCRIBNER.

MULTIPLE SWITCHBOARD SYSTEM FOR TELEPHONE EXCHANGES.

No. 593,611.

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MULTIPLE-SWITCHBOARD SYSTEM FOR TELEPHONE-EXCHANGES.

SPECIFICATION forming part of Letters Patent No. 593,611, dated November 16, 1897.

Application filed May 13, 1892. Serial No. 432,898. (No model.)

To all whom it may concern:

Be it known that I, CHARLES E. SCRIBNER, a citizen of the United States, residing at Chicago, in the county of Cook and State of Illinois, have invented a certain new and useful Improvement in Multiple-Switchboard Systems for Telephone-Exchanges, (Case No. 293,) of which the following is a full, clear, concise, and exact description, reference being had to the accompanying drawing, forming a part of this specification.

My invention relates to multiple-switchboard systems in which the individual annunciator of a telephone-line is permanently connected with the line and is shunted by a clearing-out annunciator or its equivalent resistance in the cord-circuit when connection is established with the line in order to prevent the operation of the individual annunciator by subsequent calling-signals, as by a signal for disconnection.

The object of my invention is to provide means for adjusting the amount of current taken by the permanently-closed branch, including the annunciator, in relation to that taken by the occasionally closed or shunting branch when connection is established to a line, so that the individual annunciator shall be certainly prevented from responding to clearing-out signals without making the permanently-closed branch of very high resistance.

In a former application, Case No. 276, filed October 29, 1891, I have described such a multiple-switchboard system in which the individual annunciator is constructed of very high resistance and retardation, the clearing-out annunciator or shunting-annunciator in the cord-circuit being of relatively low resistance, and in another, Case No. 282, Patent No. 483,175, issued September 27, 1892, I have described a system of the same general type in which a condenser is included in the permanently-closed branch with the individual annunciator of such capacity as to transmit only so small a portion of the signaling-current as to operate the individual annunciator when no connection exists to line, the remainder of the current being forced to traverse the shunting-circuit after a connection ex-

ists. In the invention herein I have accomplished the same general result by causing the signaling-currents to act inductively instead of directly to operate the individual annunciator. The mutual induction between the permanently-closed branch or loop of the line-circuit and the local circuit containing the annunciator may be so determined or adjusted as to transmit only so much of the signaling-current as is necessary to operate the annunciator, and, if desired, the permanently-closed loop may be constructed of high resistance and retardation, the local annunciator-circuit being of relatively low resistance. The size of the annunciator may thus be reduced to within moderate limits, so as not to occupy much space in the switchboard, the induction-coil or equivalent in the permanently-closed loop being disposed in some convenient locality outside of the switchboard.

In my invention I provide an induction or repeating coil having one of its windings included in the permanently-closed loop of the line and the other in a permanently-closed local circuit with the individual annunciator of the same line. A clearing-out annunciator or retardation-coil is placed in a bridge connection between the different sides of the cord-circuit used in establishing connection with the line. The relative resistances of the permanently-closed loop and the clearing-out annunciator in the cord-circuit may be so adjusted that the permanently-closed loop will be shunted to a considerable extent when the cord-circuit is connected to the line and the inductive relation of the two windings of the repeating-coil in the line-circuit may be so arranged as to the number of windings, their size, and the magnetic conductivity of their magnetic circuit that the local circuit containing the annunciator shall receive sufficient current to operate it satisfactorily when the line is unconnected, but shall receive insufficient current to operate it under any circumstances when the line is connected or shunted.

A feature and peculiar advantage of my invention consists in the fact that "leak" or stray currents finding circuit through the line, such as shunted portions of the current

of grounded electric-railway systems, do not affect the annunciator in my invention, since such steady currents are not repeated into the annunciator-circuit. Similarly a much heavier test-battery may be employed than heretofore, because whatever current from the test-battery finds circuit through the induction-coil in a grounded line does not affect the annunciator. A test-battery which will give a much more satisfactory test than has been possible heretofore may thus be employed in connection with my invention.

My invention is illustrated in the accompanying drawing. Therein I have shown two telephone-substations connected by line-circuit, which are metallic and grounded circuits, respectively, with their particular spring-jacks and individual annunciators upon two sections of multiple switchboard, the two lines being connected together by means of loop-plugs and a cord-circuit of the usual construction upon one of the boards. An additional plug-and-cord circuit is shown at the other board, one of its plugs being shown in the position of testing a line to determine whether it is already in use or not.

The apparatus at the substation—for example, substation 1—is of the usual character. It consists briefly of a calling-generator a and signal-bell a' and a telephone-transmitter a^2 and receiver a^3 , connected in different branches from one side b of the line, and a gravity-switch a^4 , connected to the other side b' of the line, adapted to connect the telephone apparatus or the signaling apparatus alternately into the line-circuit, according to the position of the switch-lever. The lines b and b' extend to the telephone-exchange, where they are connected to spring-jack switches c and c' upon two sections of multiple switchboard d and d' , respectively. The spring-jacks are of well-known construction. Each consists of a line-spring e' and a test-ring e , which are connected to the different sides b' and b of the line-circuit, respectively. The line-circuit is continued at the exchange through a permanently-closed loop, including one winding f' of the repeating-coil f . The other winding f^2 of the repeating-coil is included in a local circuit with the winding or coil of the individual annunciator g , of well-known construction, situated upon the board d' near the jack c' of its line. The apparatus connected with substation 2 is of similar construction and arrangement, the individual annunciator g' , however, being placed upon the other section d of switchboard near its jack c^2 , so as to be under the care of another attendant operator. The line-circuit of this station is shown as grounded, the conductor b^2 being continued through earth and a resistance b^4 instead of being a continuous metallic conductor. The cord-circuits or connecting appliances are of well-known arrangement. Two loop-plugs h and h' are provided, each having two contact-points, a tip i , and sleeve i' , adapted to make contact with the line-

spring e' and the test-ring e , respectively, of the jack, into which the plug may be inserted. Like contact-pieces of the two plugs are connected together through conductors k and k' . Two calling-keys l and l' are included in the circuit joining the two plugs, each arranged to disconnect both contact-pieces of one of the plugs from those of the other and to connect them to the two terminals m and m' of the calling-generator n , whereby the generator n may be looped into any line-circuit to send a call to the substation.

A listening-key o is provided in connection with each cord-circuit, adapted to connect an operator's telephone set p in a cross-wire or bridge between the different conductors k and k' , joining the plugs. A grounded battery q is connected to the sleeve-strand k of each cord-circuit to create a difference of potential between the test-rings e of a line, into which any plug may be inserted, and the earth and a ground connection is extended from the middle of the operator's telephone-receiver p' to earth in order that an existence of the difference of potential between the test-rings of the connected line and earth may be determined by applying one of the loop-plugs to the test-ring in the ordinary manner. A clearing-out annunciator r is included in another cross-wire or bridge connection between the conductors k and k' .

Suppose that subscriber at station 1 desires to communicate with another subscriber of the exchange system—for example, at station 2. His telephone-switch a^4 being in its lowest position, he rotates the calling-generator a , thus sending current over lines b and b' to the exchange, where it finds circuit through the coil f' of the repeating-coil f . The alternating or pulsating current flowing in this coil produces a corresponding current in the coil f^2 of the repeating-coil, thereby energizing the electromagnet of annunciator g and operating the annunciator. The attention of the operator at board d' being thus attracted to the line to station 1, the operator inserts the plug h into the jack c' of that line at her board and depresses the plunger of listening-key o , thus connecting her telephone set p in a loop with the line-circuit to substation 1. Having received the order from subscriber at substation 1, the operator proceeds to test the spring-jack c^2 of line to station 2 at her board d' to determine whether the line is already in use or not by applying the tip of her loop-plug h' to the test-ring of the spring-jack in the well-known manner. If the line were in use, the test-ring would possess a difference of potential from the earth on account of a battery q being connected to it, and current would flow from the test-ring, tested through one side k' of the cord-circuit, to the testing operator's telephone-receiver p' and thence to earth, causing a click in the telephone, whereby the operator would be apprised that the line was already in use. Having found the line to be idle, the operator at board d' in-

serts the plug h' into the jack c^3 and depresses the plunger of her calling-key l' , sending a calling-signal to station 2. When the subscriber at station 2 has removed his telephone from the switch-hook a^4 , the two subscribers are in communication over a circuit which may be traced over lines $b\ b'$ to the contact-pieces of spring-jack c' , thence to the corresponding contact-pieces of plug h , thence through the cord-circuit to the similar contact-pieces of plug h' to the line-contacts of spring-jack c^3 , thence over lines $b^2\ b^3$ to substation 2. The telephone set p of operator at board d' remains in a bridge connection between the two sides of this loop-circuit.

When the subscribers have finished their conversation, one of them, say that one at station 1, replacing his telephone upon the switch-hook a^4 , again turns the generator a , sending a signal to the exchange for disconnection. The larger part of this current finds circuit through the plug h to the cord-circuit $k\ k'$, thence through the low-resistance clearing-out annunciator r , thus operating that annunciator and indicating the disconnection-signal to the operator at board d' . A small portion of the calling-current will find circuit through the high-resistance coil f' of repeating-coil f and will induce a slight current in the local circuit containing the annunciator g ; but this current will be wholly insufficient to operate the annunciator. Another inconsiderable portion of the signaling-current will escape through the cord-circuit to the lines $b^2\ b^3$, thence through the repeating-coil f^3 of that line, but the annunciator g' will remain similarly unresponsive.

The coils f' of the repeating-coils f may be readily constructed of very high retardation, so as to shunt an inappreciable portion of the telephonic current. Much higher self-induction may be attained in the repeating-coil than would be possible in the annunciator g within a reasonable space.

The clearing-out annunciator r is preferably of high retardation, so as not to interfere with telephonic transmission. This coil r may be replaced, if desired, by a retardation-coil or resistance-coil without departing from the spirit of my invention, since its particular function therein is to shunt the coil f' of the repeating-coil f when connected to the line-circuit.

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

1. The combination with a telephone-line and spring-jacks connected therewith in a switchboard, a repeating-coil and a line-annunciator, a bridge of the line-circuit including one helix of the repeating-coil, and a local circuit including the other helix of the

repeating-coil and the line-annunciator, substantially as described.

2. The combination with a telephone-line circuit of a repeating-coil, one of whose coils is included permanently in the line-circuit and the other of whose coils is included in a local circuit with an individual annunciator, and means for shunting the first-mentioned coil of the repeating-coil when connection is established with the line, substantially as described.

3. The combination with a telephone-line extending from a substation to an exchange of spring-jack switches at the exchange each having two contact-pieces connected to the different sides of the line-circuit respectively, a repeating-coil having one of its windings included in a permanently-closed loop of the line-circuit, an individual annunciator included in a local circuit with the remaining coil of said repeating-coil, a loop-plug adapted for insertion into any one of the spring-jacks, and a retardation-coil in a branch between the different contact-pieces of the loop-plug, the resistance of the permanently-closed loop of the line-circuit containing the winding of the repeating-coil, and the resistance of said retardation-coil being so adjusted with relation to each other as to cause current insufficient to operate said annunciator to flow in said local circuit when a call-signal is sent in the line-circuit, when the loop-plug is inserted in a spring-jack of the line, substantially as described.

4. The combination with a line-circuit extending from a substation to an exchange, spring-jacks at the exchange, a repeating-coil having two helices one included in a permanently-closed loop of the line-circuit, and the other included in a local circuit with an individual annunciator, a loop-plug adapted for insertion into any spring-jack, a resistance in circuit between the different contact-pieces of the loop-plug, the resistance of the helix of the repeating-coil included in the line-circuit being so adjusted with relation to the resistance included in circuit between the contact-pieces of the loop-plug, and the mutual induction between the two helices of the repeating-coil being so adjusted that alternating current call-signals sent upon the unconnected line-circuit shall operate said annunciator, but that such current shall fail to operate said annunciator when said repeating-coil is shunted by the resistance, substantially as described.

In witness whereof I hereunto subscribe my name this 10th day of March, A. D. 1892.

CHARLES E. SCRIBNER.

Witnesses:

M. J. TALLETT,
GEORGE W. MCMAHON.