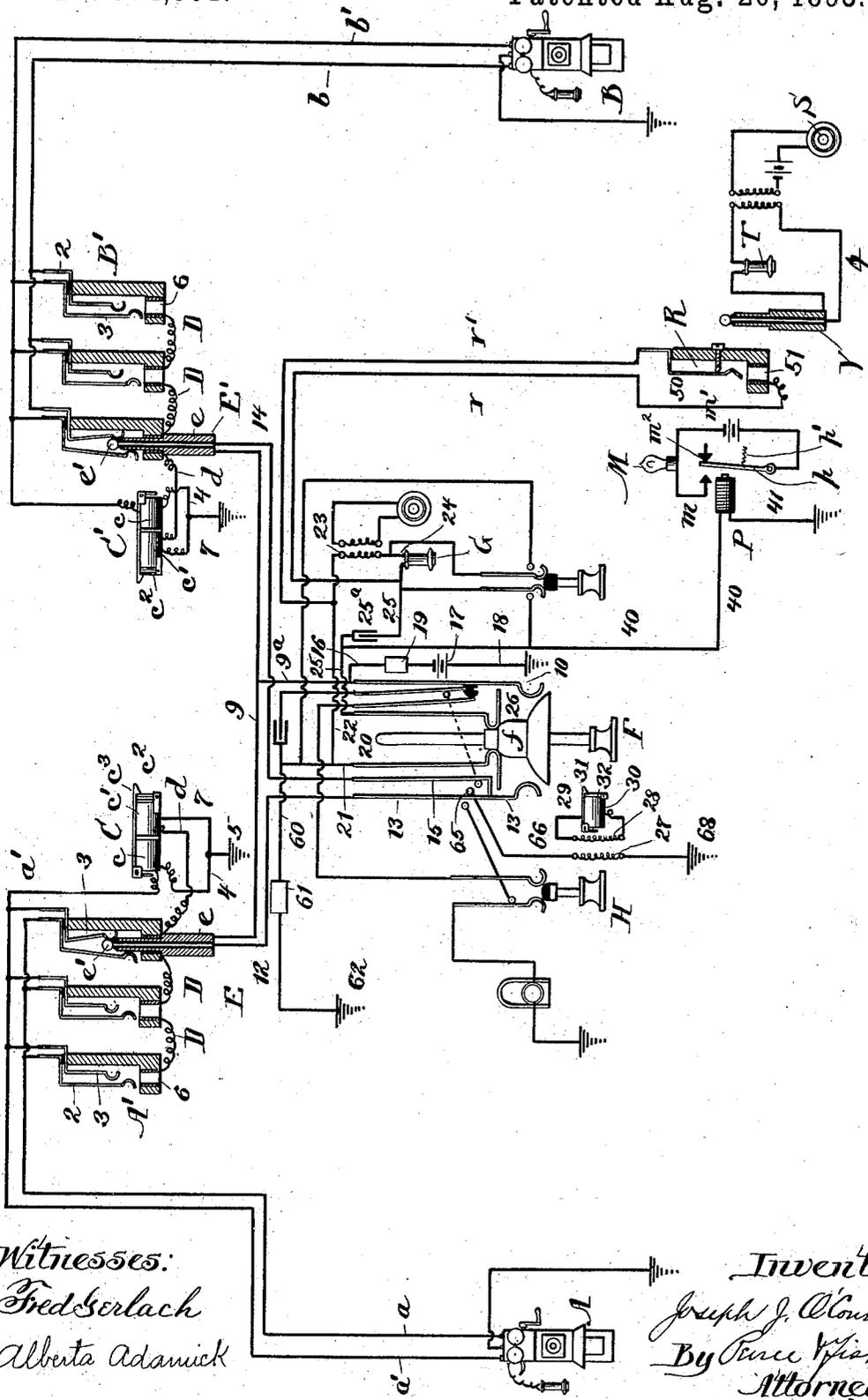


(No Model.)

J. J. O'CONNELL.
TELEPHONE EXCHANGE APPARATUS.

No. 544,901.

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TELEPHONE-EXCHANGE APPARATUS.

SPECIFICATION forming part of Letters Patent No. 544,901, dated August 20, 1895.

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To all whom it may concern:

Be it known that I, JOSEPH J. O'CONNELL, a citizen of the United States, residing at Chicago, county of Cook, and State of Illinois, have invented certain new and useful Improvements in Telephone-Exchange Apparatus, of which I do declare the following to be a full, clear, and exact description, reference being had to the accompanying drawing, forming a part of this specification.

The object of this invention is to provide means whereby an attendant whose duty it is to supervise various operators throughout an office can be informed as to the work being done by the individual operators, in order that such attendant may thereby know whether the work of the office is fairly distributed, and may know also whether the operators are neglecting their work or not. This object of invention I have accomplished by providing for each of the operators a signal conveniently located for the inspection of the supervising attendant and suitably connected with the telephone-circuit of the corresponding operator in such manner that when the operator shifts a key to throw her head-telephone into or out of a subscriber's circuit the signal at the supervising attendant's office will indicate such fact, showing also the length of time consumed by the operator in making such connection.

The accompanying drawing illustrates in diagrammatic manner a telephone-exchange system embodying my improvement.

A and B designate two subscribers' telephones of usual construction. The telephone A is connected by line-wires a and a' with the spring-jacks A' , the wire a connecting with the spring-contact plate 2 and the wire a' connecting with the spring-contact plate 3 of each of the corresponding spring-jacks of the several switchboard-sections. The line-wire a' also leads to the releasing-coil c of the self-restoring annunciator C, a wire 4 leading from the opposite terminal of such coil to ground at 5. The several rings 6 of the spring-jacks A' are connected by a supplemental wire D, and a wire d connects one of the rings 6 to the restoring-coil c' of the annunciator C, from which restoring-coil a wire 7 leads to ground at 5. The

annunciator C is of familiar construction, having a shutter c^2 , controlled by a pivoted hook c^3 , this hook being shifted by the releasing-coil c of the annunciator in manner well understood. The telephone B is connected by line-wires b and b' with the spring-jacks B' , the line-wire b connecting with the contact plates or springs 2 of the jacks B' , and the line-wire b' connecting to the contact plates or springs 3 of the jacks B' . The line-wire b' also leads to the releasing-coil c of the annunciator C', from which coil a wire 4 leads to ground. The rings 6 of the several spring-jacks are connected by the supplemental wire D, a wire d leading from one of the rings to the restoring-coil c' of the annunciator C', from which coil a wire 7 leads to ground.

E and E' designate the switch-cord plugs, whereby connection is made between spring-jacks of different subscribers. A wire 9 connects the sleeves e of the plugs E and E', a branch 9^a of this wire extending to a contact-plate 10 of the operator's listening and ringing key F. From the tip e' of the plug E a wire 12 leads to the contact-plate 13, and from the tip e' of the plug E' a wire 14 leads to the contact-plate 15 of the key F. The wire 9^a is connected by a wire 16 with a test-battery 17, from which a wire 18 leads to ground, a retardation-coil 19 being preferably interposed between this battery and the wire 9^a .

From the foregoing description it will be seen that if the plugs E and E' are assumed to be out of the spring-jacks A' and B' and the subscriber at the telephone A operates the generator of such telephone current will pass over wire a' to the releasing-coil c of the annunciator C and from such releasing-coil by the wire 4 to ground at 3. The hook c^3 will be lifted and the shutter will drop, thereby indicating to the operator that the subscriber at the telephone A desires a connection. The operator will then force inward the listening and ringing key F, so as to cause the contact-plate 20 of the key F to be moved outward by the shoulder f of the key until the free end of this contact-plate 20 bears against the contact-plate 13 and forces this plate 13 outward to break its contact with the plate 15. The contact-plate 20 is connected by wires 21 and

22, coil 23, and wire 24 with the operator's head-telephone G, from which telephone a wire 25 leads through a condenser 25^a to the contact-plate 26 of the listening and ringing key F. When the key F is thus forced inward until its shoulder *f* passes between the ends of the contact-plates 20 and 26, the plates 20 and 26 will be forced out, so as to contact, respectively, with the plates 13 and 10. The operator will now insert the plug E in the spring-jack A' to ascertain from the subscriber at the telephone A what connection is desired, and it will be seen that current from the telephone A will pass as follows: by wire *a'* to contact-spring 3, to tip *e'* of plug E, by wire 12 to contact-plate 13 of the key F, thence to contact-plate 20, and by wires 21 and 22, coil 23, and wire 24 to the operator's head-telephone G, thence by wire 25 to contact-plate 26, thence by contact-plate 10 and wire 9^a to wire 9, to sleeve *e* of plug E, to contact-plate 2 of spring-jack A', and finally by wire *a* back to telephone A. The operator, having ascertained what connection is desired, will place the cord-plug E' in the desired spring-jack B', in order to connect the subscriber, and will thereafter, by means of the ringing-key H, signal the subscriber at the telephone B in manner well understood. It will be seen that when the plug E has been inserted in the spring-jack A' current will pass from the battery 17 by wire 16 and wires 9^a and 9 to the sleeve *e* of the plug E and thence by wire *d* to the restoring-coils *c'* of the annunciator C, from which coil current will pass by wire 7 to ground at 5. The shutter *c*² will thus be closed and will be held in closed position by current from battery 17 so long as the plug E is in the spring-jack A'. This holding of the annunciator-shutter in closed position by means of the battery connected with the plug-cord is particularly important in the construction hereinbefore defined, because there is no break between the telephone line-wire *a'* and the annunciator C, and consequently the releasing-coil *c* of the annunciator is at all times connected with the line-wire and is free to be energized by passage of generator-current thereover. Hence it is that if no provision were made for constantly energizing the restoring-coil *c'* of the annunciator during the time that the plug E is within the spring-jack A' any operation of the generator at the telephone A—as, for example, by a second ringing of the bell—would cause the shutter *c*² of the annunciators C and C' to drop. So, also, it is plain that so long as the plug E' is within the spring-jack B' the current of battery 17 will pass by wires 16, 9^a, and 9 to sleeve *e* of plug E', and by wires *d* to releasing-coil of the annunciator C', whence it will pass by wire 7 to ground. The shutter *c*² of annunciator C' will thus be held by current from battery 17 through coil *c'* so long as the plug E' is within the spring-jack B'. It will thus be seen that without complicating the spring-jacks, but simply leading a wire

from the rings to the restoring-coil of the annunciator, I am enabled to employ a self-restoring annunciator and to control the restoring-coil of this annunciator or by battery connected with the plug-cord circuit.

From the foregoing description it will be also seen that when any line is busy—as, for example, the lines of the telephones A and B—and the operator touches a cord-plug to the ring 6 of either of the spring-jacks A' or B', a "click" will be heard, because the several rings 6 of the spring-jacks are connected by wires D, which wires, when a plug E is within either of the rings, will receive current from the sleeve of such plug and the connections leading from such sleeve to the test-battery 17. Consequently if we assume that the operator, in making a busy test, uses a plug corresponding with the plug E and in like manner connected with a listening and ringing key, like key F, and if we assume, also, that at the time of making such test such key of the testing-plug is pushed inward, so as to cause the adjacent contact-plates corresponding to the plates 20 and 26 of key F to bear against the plates corresponding to the plates 13 and 10, then when the tip of such testing-plug touches the ring 6 of one of the spring-jacks A' current from the ring 6 will pass to the tip of the testing-plug, then, by a wire corresponding to the wire 12, to a contact-plate corresponding to the plate 13, to a contact-plate corresponding to the plate 20, and thence, by wire 60, through self-induction coil 61, to ground at 62, thereby making a click or noise, showing to the operator that the tested line is busy.

It will be seen that when the subscribers at the telephones A or A' operate their generators to "ring off" current will pass from the generator by wires *a'* (if the generator of the telephone A be operated) to contact-plate 3, to tip *e'* of plug E, to wire 12, to contact-plate 13, and by contact-point 65 to wire 66 and through primary coil 27 to ground at 68. The passage of generator-current through the primary of the induction-coil 27 will induce a current in the secondary 28 of the coil, the induced current being passed by the wire 29 to the helix of the "clearing-out" drop 30. The current of this clearing-out drop will thus be energized, causing the hook 31 to be lifted, so as to permit the shutter 32 to fall and signal the operator that the disconnection is to be made. While by means of the induction-coil the clearing-out drop can be readily operated, it is obvious that inasmuch as a steady current of a battery will not affect the induction-coil there is no danger of the clearing-out drop being accidentally operated on, except when the generators of the subscribers' telephones are brought into action to signal for disconnection.

In order to indicate to the supervising attendant or other proper person when any operator is busy and the frequency with which such operator makes connections, I provide for

each operator a signal in convenient view of such supervising attendant, this signal being connected with the circuit of the corresponding operator's head-telephone. Any convenient type of signal may be employed; but in the accompanying drawing I have shown an incandescent lamp M, that is placed in a local circuit *m*, having battery *m'* therein, this circuit being normally open at the contact-point *m*². Within the local circuit *m* is interposed the armature *p* of the electromagnet P, whereby the local circuit is closed. This electromagnet P is connected by wire 40 with the circuit of the operator's head-telephone, the wire 40 being shown as connected to the wire 25. A spring *p'* serves to normally retract the armature *p*, so as to leave the local circuit *m* in open condition. When, however, the operator forces inward the listening and ringing key *f* at the time of making a required connection between subscribers and in doing so causes the contact-plate 26 to bear against the contact-plate 10, current will pass from battery 17 by wire 16 to contact-plate 10, thence to contact-plate 26, to wire 25, to wire 40, through the coil of the electromagnet P, and by the wire 41 to ground. The magnet P will thus be energized, thereby attracting the armature *p*, and causing this armature to close the local circuit *m* and bring the signal-lamp M into action, so as to indicate to the attendant that an operator is making a connection. When the operator has made the desired connection and has withdrawn the key F to throw her head-telephone out of circuit, contact will be broken between the plates 26 and 10, and consequently current can no longer pass from battery 17 to the electromagnet P. This magnet therefore becomes de-energized and the spring *p'* retracts the armature and breaks the local circuit *m*, so as to extinguish the lamp M. The attendant is thus enabled to determine when any operator is making any connection, the frequency of such connections, and to know also

when any operator is listening on a subscriber's line longer than is required in making a connection.

In order to enable the supervising attendant to communicate with any operator, I prefer to provide a switchboard having a series of spring-jacks, one for each of the operators, each of the spring-jacks R being connected by wires *r* and *r'* to the circuit of the corresponding operator's head-telephone. In the drawing the wire *r'* is shown as connecting the spring 50 of the spring-jack R with the wire 22 of the operator's head-telephone circuit, and the wire *r* is shown as connecting the ring 51 of the spring-jack R with the wire 25 of the operator's head-telephone circuit. The supervising attendant will be provided with a transmitter S and a receiver T, the circuit *t* of the receiver being provided with a switch-cord plug V, adapted to enter either of the spring-jacks, such as R, so as to permit the attendant to communicate with any of the operators.

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

In a telephone exchange system comprising a multiple switch-board and suitable adjunctive apparatus, the combination with the operator's telephone circuit and a key whereby said circuit is thrown into and out of circuit of subscriber's line of a signal and means for controlling said signal connected with said key, whereby when said key is shifted to throw the operator's telephone into the subscriber's circuit, said signal will be brought into action to indicate that the operator is busy and when the operator's telephone is cut out of the subscriber's circuit, said signal will indicate that said operator is idle.

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