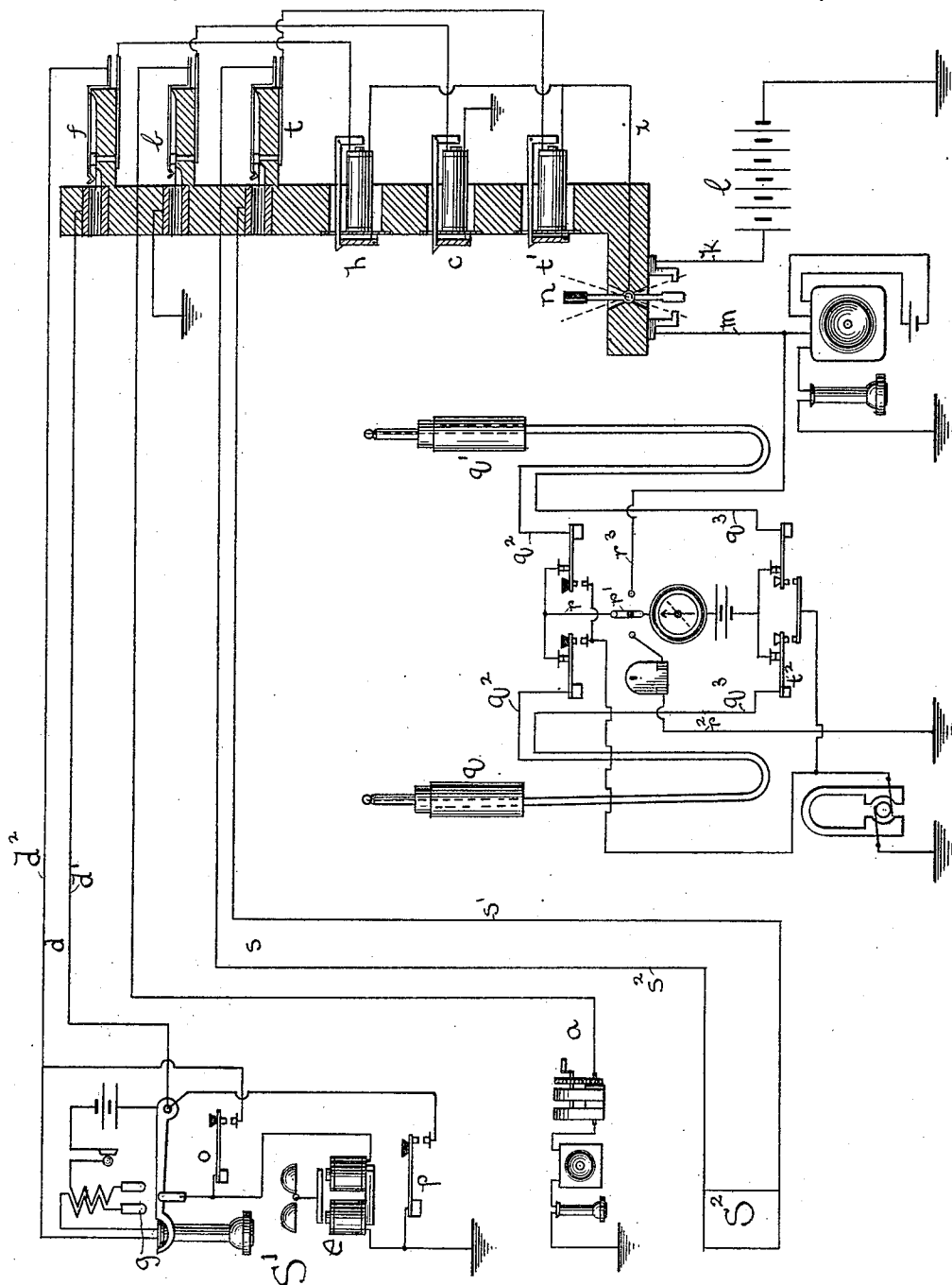


(No Model.)

F. G. BEACH.
TELEPHONE EXCHANGE APPARATUS.

No. 438,982.

Patented Oct. 21, 1890.



Witnesses:
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UNITED STATES PATENT OFFICE.

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TELEPHONE-EXCHANGE APPARATUS.

SPECIFICATION forming part of Letters Patent No. 438,982, dated October 21, 1890.

Application filed February 5, 1889. Serial No. 298,747. (No model.)

To all whom it may concern:

Be it known that I, FRANKLIN G. BEACH, 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 Telephone-Exchange Apparatus, (Case 7,) 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.

In one system of telephone-exchange as heretofore used it has been common to provide individual telephone-lines for the different subscribers and a signal-circuit common to several subscribers, the listening operator at the central office being provided with a telephone included in the signal-circuit. The subscriber's apparatus has been so arranged that any subscriber on taking down his telephone might speak directly over the signal-circuit to the listening operator. This system has been known as the "Firman" or "Law" system. In other systems, however, which have been more largely and generally used the signals have been sent over the individual telephone-lines, an individual annunciator being included in each telephone-line at the central office, no special signal-circuit being required. Each of these systems possesses its own peculiar advantages and defects. It is sometimes desirable to combine certain features of these two systems in the same exchange, and with this end in view I have provided telephone-line circuits adapted to be used either upon the plan of individual-annunciator calls or upon the plan of speaking directly to a listening operator.

This system, as hereinafter described, is especially designed for use in exchanges in which metallic circuits are employed. I have, however, made provision for its use in exchanges having metallic-circuit lines and grounded lines connected with the same switch-board—that is to say, in "mixed" systems, as those systems are sometimes termed—having metallic telephone-lines and grounded telephone-lines connected with the same switch-board.

My invention consists, first, in metallic-circuit telephone-lines in which one side or limb

of each is grounded at the subscriber's station thereon and connected through a signal-receiving device and switch at the subscriber's station to a normally-open connection of the switch of the line upon the switch-board at the central office, the other branch of each circuit being normally open at the subscriber's station and extending through the switch and an individual annunciator at the central office to a common line in combination with two ground branches at the central office, one containing a battery or generator and the other the listening operator's telephone and a switching device in the common line for connecting the same, as desired, either to the branch containing the battery or to the branch containing the listening operator's telephone; second, in pairs of loop plugs and cords, with a galvanometer and battery bridged between the cords to serve as a clearing-out signal; third, in a branch to ground containing an annunciator and a switch for connecting said branch to one of the strands of the pair of connecting-cords when used in connecting grounded lines with one another or with metallic-circuit lines; fourth, in a common line to which one side of each of several metallic circuits is connected, and a switch and a listening operator's telephone, with which said common line is adapted to be connected by the switch and switching apparatus at the different subscribers' stations of said telephone-lines arranged to permit any subscriber to connect his telephone into the side of his metallic circuit, which connects with the listening operator's telephone; fifth, in metallic circuits, each having one side grounded at the subscriber's station thereon and the other side normally open, said metallic circuits extending each to a switch on the switch-board, the side of each which is grounded at its subscriber's station being normally open at its switch-board switch and the other side passing through said switch and an individual annunciator to a common line, a switch for connecting said common line with the battery at the will of the operator, and switches or keys at each of the subscribers' stations, whereby any subscriber on closing his proper key or switch may bring the bell at his station and

his individual annunciator at the central office into a circuit closed through said battery, and, sixth, in certain details of construction and combinations of circuits hereinafter described and claimed.

My invention will be more readily understood by reference to the accompanying drawing, which is a diagram showing two metallic-circuit lines and one grounded-circuit line connected with a central station, together with the central-station apparatus.

It will be understood that the grounded telephone-line a extends from ground at its subscriber's station through a switch b upon the switch board and its individual annunciator c to ground in the usual manner. The insulated frame or tube, in multiple systems called the "test portion," of switch b is provided with a ground-connection, as has been usual in some cases heretofore. The subscriber's outfit upon line a consists of the usual telephone-transmitter and magneto-generator. Metallic circuit d consists of the two sides or limbs d' d'' . The subscriber's apparatus of a metallic circuit is illustrated in detail at the subscriber's station S' of line d .

When the telephone is hung upon the hook, as shown, limb d' will be connected through the bell e to ground at station S' and will be open at the switch f of the line at the central office, said limb d' being connected with the insulated frame or ring of switch f . The other limb d'' will be open at the telephone-switch of station S' , and its circuit may be traced from the open contact g through the secondary of the induction-coil and the telephone to the spring of switch f , and thence through the contact of said switch, and thence through the individual annunciator h , and thence to the common line i . This line i is connected either with the branch k , containing the battery l , or with the branch m , containing the operator's telephone, by the switch n . Thus the branch d'' when the telephone is on the switch is open at S' and closed at the central office, in some cases to a branch k , containing battery, and in some cases to branch m , containing the operator's telephone.

The subscriber at S' by closing key o connects branch d'' through bell e to ground, in this manner completing the circuit of said branch d'' through the annunciator h and battery l , provided branch k is connected with common wire i . Thus the subscriber may throw down his individual annunciator h , the bell e responding, at the same time indicating to the subscriber that the battery l is in circuit. Suppose, however, that the switch n is in position to close branch m to common wire i . In this case subscriber at S' , on taking down the telephone and depressing key p , may speak directly to the operator listening at telephone in branch m . The circuit thus closed would be from ground at S' through key p , thence to contact g , thence over branch d'' through switch f and annunciator h to common wire i , and thence to

branch m , including the operator's telephone.

I have found that in the day-time it is desirable in moderate-sized exchanges to have an operator at the central office with her telephone constantly in circuit, so that she will be ready to receive any communication from any subscriber which may require service. At night, however, I prefer to depend upon the individual-annunciator-call system, the annunciators being arranged in a well-known way to close a local circuit when operated, in which local circuit is included an alarm-bell. Therefore in actual practice I have the telephone branch m connected with the common wire i during the day and the battery branch k connected with said wire i at night. Either of the two systems—that is, the listening-operator system or the individual-annunciator system—may be used in connection with the same telephone-circuits.

I have shown a pair of loop-plugs q q' connected with a pair of cords, the strand q^2 of the cords being connected with the tips of the plugs, while the strand q^3 is connected with the sleeves of said plugs. I have shown a generator with usual call-keys in the different strands so arranged that current from the generator may be sent at will to the tip or sleeve of either of the plugs. The bridge r across the strands q^2 q^3 should be of high resistance—say three hundred ohms. In this bridge I have included a battery and a galvanometer, designed as a clearing-out signal when the plugs are used to loop together two metallic circuits.

When grounded lines are used in the same exchange with metallic circuits, I provide a switch r' and a branch r'' , containing a clearing-out annunciator so arranged that the annunciator may be connected to the strand q^2 when grounded lines are connected or when a metallic circuit is connected with a grounded line. I also provide a connection r^3 with the operator's telephone, so arranged that the operator may connect her telephone with strand r^2 by means of switch r' or by other suitable apparatus. It will be understood that the apparatus at station S^2 is the same as hereinbefore described at S' . The circuit s consists of two sides or branches s' s'' , branch s' being connected with the insulated portion of switch t and branch s'' being connected through switch t and individual annunciator t' to common wire i . If the exchange is too large for one operator, the lines will be arranged in groups, so that each operator will have only as many lines as she can conveniently attend to. If the exchange is so large that one board will not be large enough to give room for the operators required to do the work, I use multiple switch-boards.

The adaptation of my system herein to multiple switch-boards being so well understood, I have not deemed it necessary to make any detailed description of the manner of such adaptation.

It will be understood that the operator will

have as many pairs of plugs and cords as may be required, and that the particular forms of switching apparatus herein shown may be varied without departing from my invention.

5 Suppose S' takes down his telephone, at the same time grounding branch wire d^2 . He may then speak directly to the operator listening at the telephone in branch m , provided line i is connected with said branch. He thus
10 gives his order, we will say, for S^2 . The operator thereupon inserts one of the plugs q or q' in switch t and, closing the generator to strand q^3 in the proper direction, calls up S^2 . The other plug of the pair being inserted in
15 switch f , the two subscribers will be looped together in metallic circuit as soon as S^2 has taken down his telephone. The galvanometer included in bridge r will then be deflected and remain deflected until both subscribers
20 hang up their telephones.

The insertion of the plugs in switches f t cuts off the annunciators h and t' . The subscriber of the grounded line a in order to call turns the magneto-generator, sending
25 current through annunciator c in the usual manner. The operator, observing the signal, inserts a plug of a pair, as plug q' , in switch b , bringing switch r' into connection with telephone-connection r^3 , and is ready to receive the order. The order being received, we
30 will say, for connection with line d , she inserts plug q in switch f of line d , and, depressing calling-key t^2 , throws the generator onto branch d' , thus ringing bell e . The subscribers being connected, she moves switch r'
35 from telephone-connection r^3 to clearing-out annunciator connection or branch r^2 . The subscribers' lines a and d are then connected together. The circuit thus formed would be traced from ground at subscriber's station of
40 line a to spring of switch b , thence to tip of plug q' , thence through strand q^2 to tip of plug q , thence to spring of switch f , thence over limb d^2 through station S' and back over
45 limb d' to sleeve of switch q , and thence over strand q^3 to sleeve of plug q' , said sleeve being in contact with the insulated piece of switch b , which is grounded, and the circuit would be complete. The disconnecting-signal would
50 be sent by the subscriber of line a , who is provided with the magneto-generator. Two single lines could be connected together in substantially the same manner.

It is obvious that either portion of my invention would be a complete system in itself—that is to say, the branch k , containing the battery l , together with the individual annunciators h t' , might be dispensed with—and the system would be operative, the line i being
55 connected with the branch m . On the other hand, the means for connecting the operator's telephone with line i might be dispensed with, and the system would be operative according to the individual-annunciator
60 plan; but, as hereinbefore stated, I prefer to combine the two systems in the same apparatus in order that the individual-annuncia-

tor system may be used at night and the listening-operator system during the busy portions of the day.

It will be seen that no provision is made
70 for the operator to connect her telephone into the circuit of two subscribers when connected together in metallic circuit. The conversation may thus be carried on secretly between
75 the subscribers. When both hang up their telephones, the clearing-out signal will be indicated by the pointer of the galvanometer in the bridge returning to zero. It is obvious, however, that provision might be made for
80 bridging the operator's telephone between the strands in place of the galvanometer so that the operator might listen in. If desired, the clearing-out annunciator might be placed in a bridge-wire instead of the branch wire
85 r^2 . The switch r' may be in the form of a listening-key adapted to be operated most conveniently to bring the required instrument into connection with the talking-circuit, whether metallic or grounded.
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I have sometimes placed an annunciator in the branch wire k , thus dispensing with the individual annunciators h t' of the metallic circuits. In such case the night operator, seeing the shutter in wire k fall, would immediately switch over to branch m , and the subscriber, taking down his telephone and depressing his appropriate key, as key p , would give his order.

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

1. The combination, with two telephone-lines looped together in metallic circuit, of a galvanometer and battery in a bridge including resistance bridged across the strands of the cords by which the lines are connected at the central office, whereby said galvanometer is deflected while the circuit remains complete, the pointer of the galvanometer returning to zero when the subscribers hang up their telephones.
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2. The combination, with a pair of loop-plugs of double-stranded cords, with which strands the different terminals of the loop-plugs are respectively connected, of a bridge across the strands including a battery and an electric indicating device, a switch in said bridge, and a branch to ground including an annunciator, with which branch the switch is adapted to be connected to open the bridge and form an electrical connection with one of the strands through the annunciator to ground, substantially as and for the purpose specified.
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3. An operator's telephone connected with a common line branched through different switches on a switch-board and each branch extending to a different subscriber's station and being there normally open, said branches each forming one limb of the metallic circuit of the station to which it is extended, the other branch of which circuit being normally grounded at its subscriber's station and ex-
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tending to the insulated portion of the switch
of its line upon the switch-board at the cen-
tral office, a subscriber's outfit at each sta-
tion, consisting of a bell, telephone, and tele-
5 phone-switch, together with a circuit-closing
device for connecting the telephone-switch
directly to ground when the telephone is re-
moved from the hook to bring the telephone
into circuit, a pair of loop-plugs and double-
10 stranded flexible cords with which the plugs
are connected, and a high-resistance bridge,
including a galvanometer and battery, con-
necting the two strands, whereby any sub-

scriber may speak directly over one branch
of his telephone-line to the listening operator, 15
and whereby the operator may loop any two
lines together, while upon the subscribers
hanging up their telephones the clearing-out
signal will be indicated.

In witness whereof I hereunto subscribe 20
my name this 24th day of January, A. D. 1889.

FRANKLIN G. BEACH.

Witnesses:

ELLA EDLER,

GEORGE P. BARTON.