

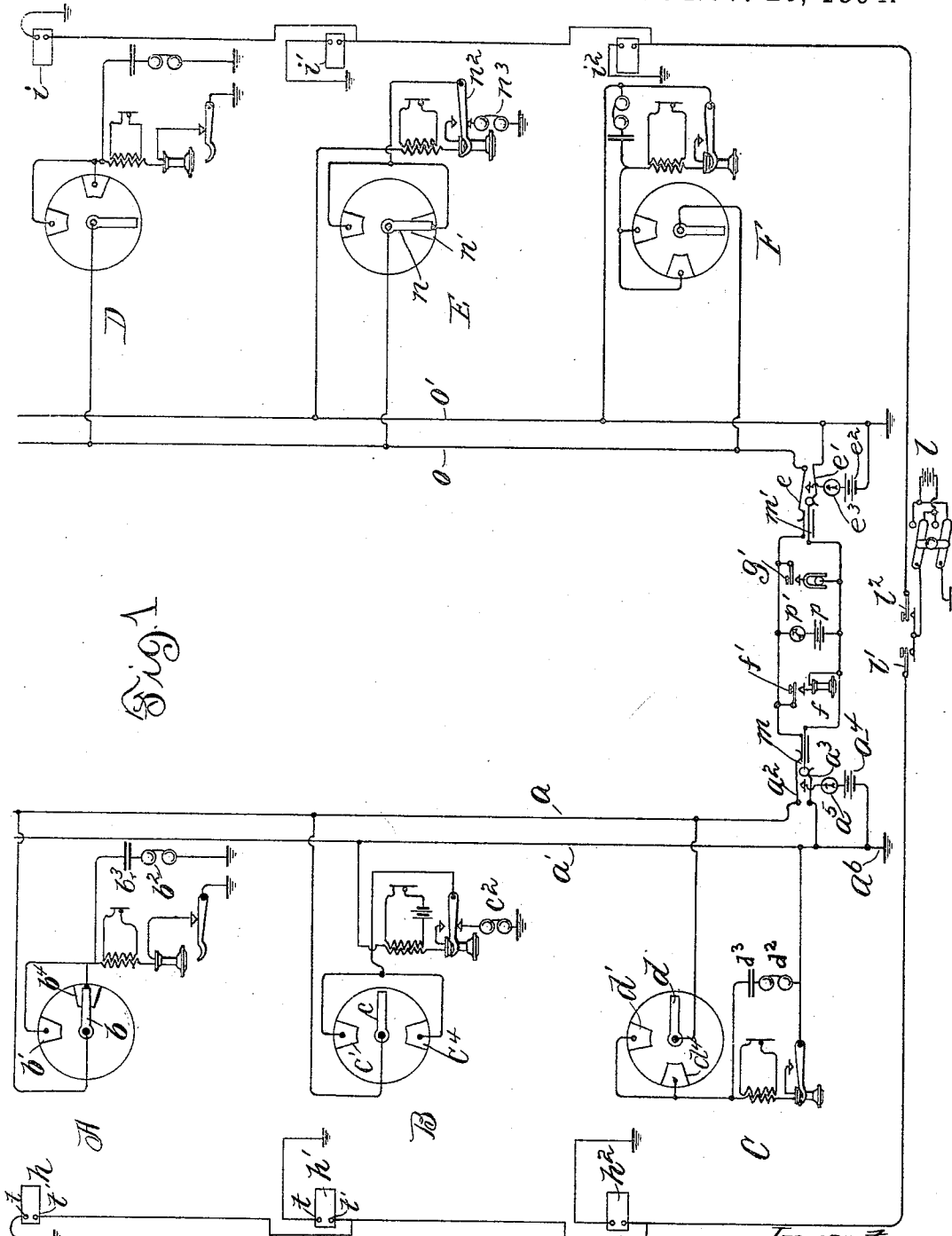
(No Model.)

2 Sheets—Sheet 1.

J. I. SABIN.
TELEPHONE SYSTEM.

No. 529,465.

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TELEPHONE SYSTEM.

SPECIFICATION forming part of Letters Patent No. 529,465, dated November 20, 1894.

Application filed April 14, 1894. Serial No. 507,570. (No model.)

To all whom it may concern:

Be it known that I, JOHN I. SABIN, a citizen of the United States, residing at San Francisco, in the county of San Francisco and State of California, have invented a certain new and useful Improvement in Telephone Systems, (Case No. 10,) of which the following is a full, clear, concise, and exact description, reference being had to the accompanying drawings, forming a part of this specification.

My invention relates to telephone systems with bridged sub-station apparatus, and its object is the provision of means whereby the sub-station apparatus of two or more subscribers may be connected with a single telephone line, the sub-station apparatus being under the control of the operator at the central station in such a manner that the telephone line may be placed at the exclusive use of any one of said subscribers so connected.

My invention, in its preferred form, comprises a telephone line extending to contact terminals at the central station, one side of the telephone line at each sub-station being connected with a contact arm thereat, which is under the control of the operator at the central station and is adapted to be moved step-by-step over a series of contact points, the contact arms at all of the sub-stations so connected being adapted to be moved in unison. Normally the contact arms at the several stations rest upon contact terminals connected respectively through the telephone sets of the several subscribers to the other side of the line, the circuits, however, being normally open so long as the telephones hang upon their hooks. Any one of the subscribers by removing his telephone from its hook closes circuit through an indicator at the central station, thus calling the attention of the operator who bridges her telephone set into circuit and receives the call. Thus the connections are normally such that any one of the subscribers may place himself in communication with the operator. The operator, having learned the identity of the calling subscriber then proceeds to place the line exclusively at his control, by rotating the contact arms at the several stations step-by-step until the contact arm at the station of the calling subscriber rests upon a contact terminal

which is connected through the telephone set of such subscriber, the circuit through the contact arms at the other sub-stations being at this time open. In this manner all of the subscribers except the calling subscriber are cut from the line and are unable to signal the operator until the calling subscriber has finished his conversation and the operator has brought the contact arms back to their normal positions.

My invention will be more readily understood by reference to the accompanying drawings, in which—

Figure 1 is a diagrammatic view of a number of sub-stations connected after the manner of my invention, two of the substations being illustrated as connected for conversation. Fig. 2 is an elevational view of the step-by-step relay located at each of the sub-stations. Fig. 3 is a diagrammatical view thereof, illustrating the electrical connections. Fig. 4 is a detached plan view of the synchronizing device for bringing the contact arms at the several stations into unison.

Like letters refer to like parts in the several figures.

The limbs $a a'$ of the telephone line extend to line springs $a^2 a^3$ at the central station, a battery a^4 and calling indicator a^5 being normally included in a bridge between the two limbs $a a'$ but cut therefrom when a plug is inserted in the spring jack. The contact arms b, c, d , at sub-stations A, B and C, respectively, are connected with the limb a , and normally rest against contact terminals b', c', d' , respectively, said terminals being connected through the normally open circuits, containing the telephone sets of the respective sub-stations, with the other side of the telephone line. Thus, at sub-stations B and C the circuits extend from the contact terminals to limb a' , the talking circuits through these stations being thus metallic, while the terminal b' at sub-station A is connected to ground, the talking circuit thus having a ground return, and, to complete the ground circuit, line spring a^3 is connected to ground by a branch a^6 .

At sub-stations A and C the call devices b^2 and d^2 are included in bridges about the telephone sets, condensers $b^3 d^3$ being included in circuit therewith to prevent the normal pas-

sage of current from battery a^4 through indicator a^5 .

At sub-station B the call device c^2 is included in a ground from one side of the metallic circuit. Thus as the contact arms b, c, d , rest normally upon terminals b', c', d' , either of the subscribers may, by removing his telephone from its hook, close the circuit of battery a^4 through indicator a^5 to signal the operator.

In addition to the terminals b', c', d' , at the several stations against which the contact arms normally rest, an additional terminal is provided at each station, but so situated that as the contact arms are rotated step-by-step circuit will be closed through but one of such terminals at a time. Thus, sub-station A is provided with terminals b^4 against which arm b rests when the arms have been rotated a quarter revolution, circuit being thus closed through the apparatus of station A, while circuit is open through each of the other stations. A half revolution of the arms brings arm c in contact with terminal c^4 , thus closing station B in circuit and cutting out the others, while a three-quarter revolution brings arm d in contact with terminal d^4 , thus closing station C exclusively in circuit.

The sub-stations D, E, and F are connected in a like manner with line springs e, e' , a battery e^2 and indicator e^3 being likewise included normally in a bridge between the opposite sides of the telephone line. The operator's telephone set f is adapted to be bridged between the strands of the cord connectors by a key f' , a key g' being also provided for bridging in circuit the generator g to send calling currents over the lines.

The relays h, h', h^2 for actuating the arms b, c, d are connected in circuit with a battery l , a key l' being provided for successively closing the circuit to actuate the relays in a manner hereinafter to be described. Likewise the relays i, i', i^2 of the stations D, E and F are connected in circuit with battery l , a key l^2 being provided for actuating the same.

Subscriber A, desiring to converse with subscriber E, removes his telephone and, the contact arms b, c, d resting respectively on terminals b', c', d' , circuit is closed through battery a^4 and indicator a^5 , thus actuating the indicator and calling the attention of the operator, who inserts plug m between springs a^2, a^3 , thus cutting indicator a^5 from the line. She then depresses key f' and is in communication with subscriber A, who conveys to her his own number as well as that of the called subscriber. She then depresses key l' thus rotating the contact arms into the position shown in Fig. 1, the apparatus of sub-stations B and C being thus cut from the line, and the line placed exclusively at the use of subscriber A. She then inserts plug m' between line springs e, e' , and in order to place sub-station E individually in connection with the telephone line so that the calling current shall traverse the call device of sub-station

E only, depresses key l^2 twice, thus rotating the contact arms at sub-stations D, E and F half a revolution and bringing contact arm n of sub-station E in contact with terminal n' . She now depresses key g' and sends calling current from generator g , over limb o , through arm n and terminal n' , thence to telephone hook n^2 and call device n^3 to ground and return by ground connection e^2 . Subscriber E removes his telephone from its hook and subscribers B and E are in communication over a private line, all other subscribers being cut therefrom. The circuit of battery p is now closed through clearing-out indicator p' , and when subscribers B and E hang up their telephones, the circuit of battery p will be opened, thus actuating the indicator p' and informing the operator of the desire for disconnection. She then actuates keys l' and l^2 to bring the contact arms back to their normal positions and removes the plugs m and m' , and the lines are in condition for a new connection.

Should a subscriber desire to converse with another on the same party line, as B with C, he may do so by removing his telephone to signal the operator who will insert plug m to inquire the number of the called subscriber. Learning that C is the subscriber called, she will bring arm d into contact with terminal d^4 , thus connecting C with the line and disconnecting A and B therefrom. By means of generator g she will then send current through the call device of C, and C having responded she will bring the contact arms back to their normal positions, then connecting A and C into circuit. When they have completed their conversation, and hang up their telephones, the clearing-out indicator p' will be actuated to inform the operator who will remove the plug m , and the line is in condition for another call, the contact arms being already at their normal positions.

The step-by-step relay by means of which the movement of the contact arm is effected, comprises a stationary disk r upon which are mounted contact terminals r', r^2, r^3, r^4 , &c., with which the brush s carried upon contact arm s' is adapted to make contact. The contact arm s' is mounted upon a shaft s^2 which carries a ratchet wheel s^3 , the teeth of which are adapted to be engaged alternately by the ends s^4, s^5 of the bifurcated lever s^6 which is pivoted at s^7 and provided upon its end with an armature s^8 which is attracted by the electro-magnet s^9 when the same is energized. A spring s^{10} opposes the action of the electro-magnet to return the lever to its normal position when the magnet is de-energized. The operator by depressing the key provided at her station closes circuit through magnet s^9 , thus causing the armature s^8 to approach and the detent s^5 to engage the ratchet wheel to move it one step. The operator releases the key, and magnet s^9 is de-energized thus permitting spring s^{10} to return the lever to its former position and causing detent s^4 to engage

the ratchet wheel to move the same another step, the contact arm s' being thus moved from one contact terminal to another whenever the key is twice depressed, as there are double the number of teeth on the ratchet wheel that there are contact terminals on the disk. Were the numbers the same, one depression of the key would, of course, move the arm from one terminal to the next. The conductors connecting the step-by-step relays with the central station, are connected with the binding posts t t' while the binding posts t^2 t^3 are connected respectively with the opposite sides of the telephone line, circuit thus extending from one side of the line a to binding post t^3 and to the metallic support s^{11} which is in electrical connection with contact arm s' , as indicated by dotted lines. Circuit is traced thence to terminal v^2 , terminal r' and thence to binding post t^2 and to the other side a' of the telephone line.

To provide for synchronizing the several relays from time to time to bring the contact arms into unison, an electro-magnet v v' is employed, provided with a polarized armature v^2 , the end v^3 thereof being normally attracted to maintain the spring w , mounted upon the block w' which is carried upon armature v^2 , out of contact with pin w^2 . When, however, the end v^4 of the armature is attracted, said spring w is moved into contact with said pin w^2 which is electrically connected with pin w^3 , said pin w^3 being continuously in contact with spring w^4 . Current is normally from binding post t through magnet s^9 , thence by conductor x through coils v v' and to binding post t' , circuit through spring w being open since the end v^3 of armature v^2 is attracted. When, however, current is reversed the end v^4 of the armature is attracted and the spring w thrust forward into the path of pin w^2 . When said pin in the rotation of the ratchet wheel, by the successive closing of the circuit by the operator, comes in contact with spring w , circuit is closed from binding post t through conductor x' to the spring w , pin w^2 , pin w^3 , spring w^4 , coils v v' , conductor x^2 to binding post t' , the magnet s^9 being thus shunted so that as the operator successively closes the circuit insufficient current traverses magnet s^9 , and, consequently, its armature remains at rest and the ratchet wheel is not rotated. The circuit having been thus successively closed a number of times until the ratchet wheels, and, consequently, the contact arms, have been brought to the positions where the pins w^2 engage the springs w , the contact arms are in unison, and the current may now be reversed moving the springs w out of contact with the pins w^2 , opening the shunt circuits, and permitting the forward movement of the contact arms as the circuit is successively closed.

To reverse the current a reversing switch y , Fig. 1, may be provided at the central station.

Instead of providing a shunt to be closed

about the magnet s^9 , the spring w may be made long enough and rigid enough to arrest the pin w^2 in its travel and resist the tendency of magnet s^9 to rotate the ratchet wheel until the current is again reversed.

It is evident that my invention is susceptible of modifications, and I do not, therefore, desire to limit myself to details, but

What I claim as new, and desire to secure by Letters Patent, is—

1. The combination with a telephone line extending to the central station, of contact arms, one at each of several sub-stations, connected with one side of said line, contact terminals against which said contact arms normally rest connected respectively through the sub-station apparatus with the opposite side of the line, means under the control of the operator at the central station for rotating said contact arms in unison, and a second or individual contact terminal at each of said sub-stations connected through the sub-station apparatus with the opposite side of the line, said individual terminals being so situated that as the arms are rotated circuit is closed through but one at a time, substantially as described.

2. The combination with a telephone line extending to the central station, of contact arms, one at each sub-station, connected with one side of said line, contact terminals normally in contact with said arms, sub-station telephone sets connected in normally open circuits between said contact terminals and the opposite side of the line, a battery and an indicator connected between the two sides of the line at the central station, means at each sub-station for closing the telephone circuit to operate said indicator, and means under the control of the operator at the central station for rotating said contact arms to close one of the sub-stations individually in circuit with the telephone line, substantially as described.

3. The combination with a telephone line extending to the central station, of contact arms, one at each sub-station, connected with one side of said line, contact terminals normally in contact with said arms, sub-station telephone sets in normally open circuits between said terminals and the opposite side of the line, a battery and indicator connected between the two sides of the line at the central station, a call device at one of said sub-stations in a shunt circuit about the telephone set, a condenser, or equivalent device, to prevent the operative closing of said battery circuit, in circuit with said call device, and means under the control of the operator at the central station for moving said contact arms to close one of the sub-stations individually in circuit, substantially as described.

4. The combination with a telephone line extending to the central station, of contact terminals, one at each substation, connected with one side of said line, contact terminals normally in contact with said arms, substa-

tion telephone sets in normally open circuits between said terminals and the opposite side of the line, one of said telephone sets being thus connected between two metallic limbs
5 extending to the central station, a call device between said limb and ground, a battery and indicator connected between the two sides of the line at the central station, a call device at one of the substations, included with a con-
10 denser, or equivalent device in a shunt circuit about the telephone set, and means, under the control of the operator at the central station, for moving said contact arms to close the apparatus of one of the substations individually
15 in circuit, substantially as described.

5. The combination with a contact arm adapted to be moved over a series of terminals of an electro-magnet adapted to be suc-

cessively actuated to rotate said contact arm, a disk rotatable with said contact arm and carrying an eccentrically situated pin, a spring carried upon the polarized armature of an electro-magnet, and normally out of the path of said pin, and means for reversing the direction of the current through said electro-
25 magnet to cause the same to attract said armature and move said spring into contact with said pin to shunt said first mentioned electro-magnet, substantially as described.

In witness whereof I hereunto subscribe my name this 4th day of April, A. D. 1894.

JOHN I. SABIN.

Witnesses:

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