

(No Model.)

2 Sheets—Sheet 1.

M. BROOKS.
AUTOMATIC TELEPHONE SYSTEM.

No. 570,840.

Patented Nov. 3, 1896.

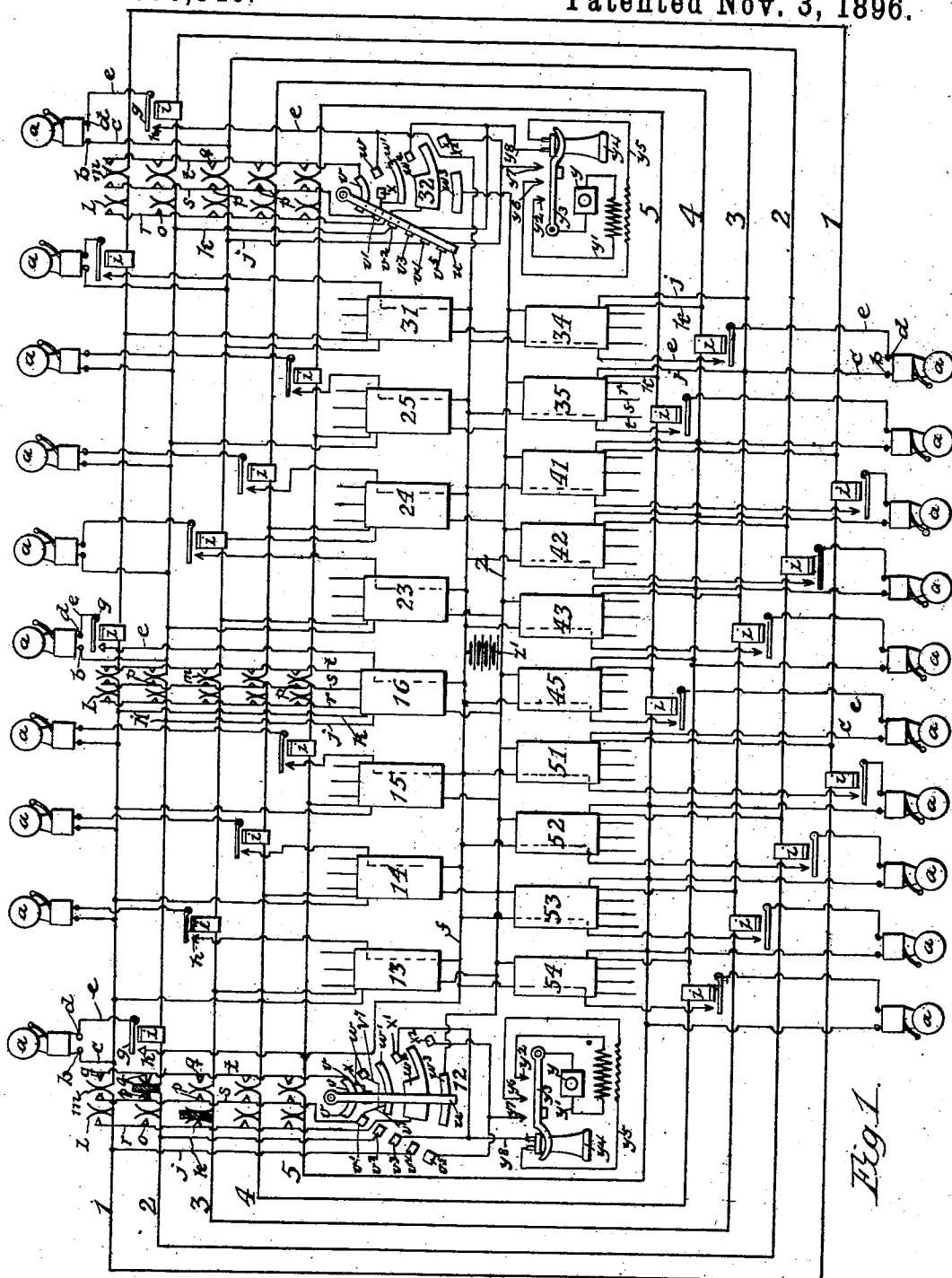


Fig. 1.

Witnesses
J. J. J. J.
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Inventor.
Morgan Brooks.
By Paul Hawley his attorneys.

(No Model.)

2 Sheets—Sheet 2.

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Fig. 2.

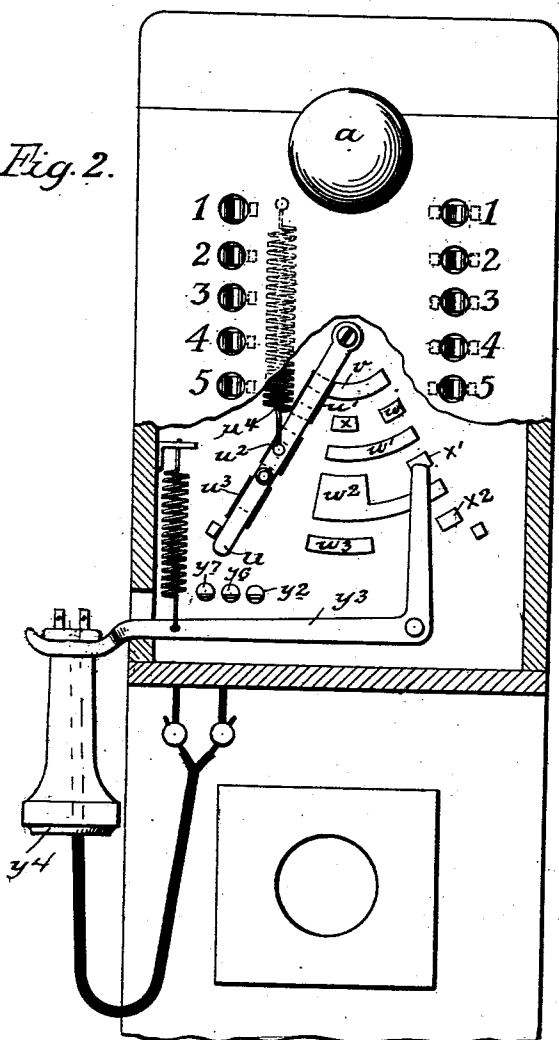


Fig. 3.

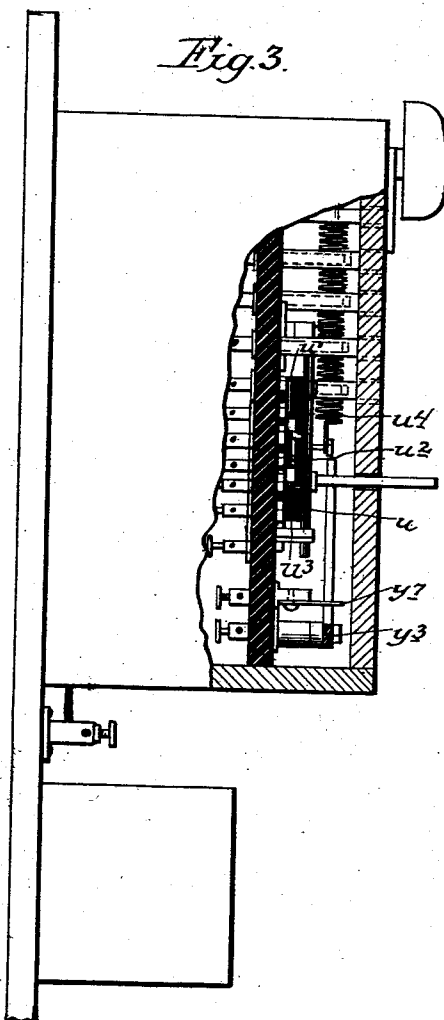
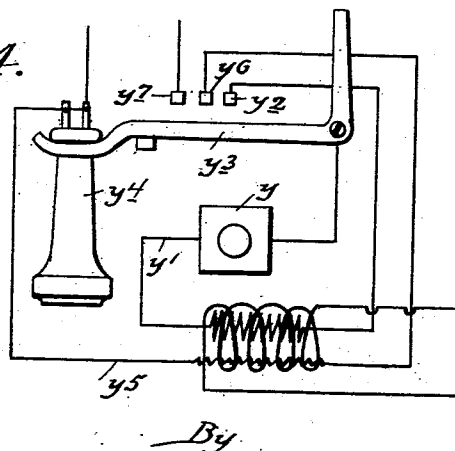


Fig. 4.



Witnesses
J. J. J.
J. J. J.

By

Inventor.
Morgan Brooks.
Paul & Hawley
his Attorneys.

UNITED STATES PATENT OFFICE.

MORGAN BROOKS, OF MINNEAPOLIS, MINNESOTA.

AUTOMATIC TELEPHONE SYSTEM.

SPECIFICATION forming part of Letters Patent No. 570,840, dated November 3, 1896.

Application filed January 26, 1895. Serial No. 536,295. (No model.)

To all whom it may concern:

Be it known that I, MORGAN BROOKS, of the city of Minneapolis, county of Hennepin, State of Minnesota, have invented certain new and useful Improvements in Automatic Telephone Systems, of which the following is a specification.

My invention relates to telephone systems, and particularly to that class of telephone systems ordinarily termed "automatic," wherein the usual central exchange-switchboard is dispensed with and each subscriber enabled to connect his own instrument with that of another subscriber.

The object of my invention is to provide an automatic or selective telephone system whereby subscribers may call and talk with one another without the interposition of a central switchboard or the aid of a central operator, and, further, to provide a system wherein few main wires are required, and yet one by which a particular subscriber wanted may be called without disturbing others or even notifying others that calling or talking is going on. I may thus accomplish that particular end so much desired, namely, an inexpensive system which will be for all practical purposes "confidential."

A further object which I have in view in this invention is the attainment of means whereby a subscriber may receive a second call during the time when he may be in conversation with a first subscriber and yet avoid all buzzing or cross-talk in his telephone-receiver, the subscriber thus called by a third party being notified of the call simply by the operation of the calling device (bell-buzzer or like instrument) belonging to his own telephone set.

A further object is to enable a subscriber thus interrupted to speak with the said third party for the purpose of inquiring his number or asking him to wait.

A further object of my invention is to so arrange and connect the various devices throughout the system that a subscriber cannot cut himself off from being called or interrupt the working circuits by failure on his part to remove the switch-plugs or hang up his receiver.

A further object of my invention is to provide a telephone system of the class described

which will be of low cost with respect to both manufacture and installation and with which the expense of maintenance will be nominal, whereby telephone service will be placed within the reach of even a small number of persons.

The principal feature of my invention may be said to consist in the selective system of calling; but my invention consists, further, in simple and easily-operated means for throwing the telephone instruments into the circuit over which the calling is done, and, further, in various details of construction, all as hereinafter described, and particularly pointed out in the claims.

The invention will be more readily understood by reference to the accompanying drawings, forming part of this specification, and in which—

Figure 1 is a diagrammatic view of an automatic telephone system embodying my invention. Fig. 2 is a detail view of the main switch of a subscriber's set. Fig. 3 is a side and sectional view thereof. Fig. 4 is a diagram showing an additional coil about the transmitter induction-coil.

My system, which is based upon a number of parallel wires in combination with as many stations as may be desired, and each station being connected with two of the wires with the several stations adapted to be called by combinations of numbers taken two at a time, will be readily distinguished from those systems embodying the well-known clock or step-by-step movements and those of the other class wherein a number of instruments are placed in series in one line, the calling being done by repeated rings of the bells of all instruments, it being expected that the subscriber whose number is rung will alone answer the call, though all others on the line are disturbed. Further, in such systems but a single conversation may go on at one time, though there may be quite a large number of subscribers on the line.

In Fig. 1 of the drawings I have shown in diagram a system made up of five wires running through all of the stations and preferably forming complete metallic circuits. The telephone outfits, which may be twenty in number upon a five-wire system, are each connected with two of the wires, the several sets

being arranged in different combinations, whereby they are made distinct from one another. It is possible to increase this number of twenty instruments or twenty-five by arranging means for looping in the additional telephone sets on single wires, but such an increase is, for a number of reasons, undesirable.

It is most convenient to number the telephone instruments in accordance with the numbers of the two wires with which each is connected. Thus the instrument connected with lines 1 and 2 would be numbered "12," the lines 3 and 4 "34," the lines 4 and 3 "43," as the order of connections with the wires is reversed, and with the lines 5 and 4 the number would be "54." Leaving out the combinations of similar numbers, such as 1 and 1, 2 2, 3 3, 4 4, 5 5, the numbers of a complete five-wire system would be 12, 13, 14, 15, 21, 23, 24, 25, 31, 32, 34, 35, 41, 42, 43, 45, 51, 52, 53, 54.

In the drawings I have shown electromagnetic bells *a* as signaling or calling devices. To facilitate the tracing of circuits throughout the system, I have shown each bell as having one of its terminals *b* connected by a short line *c* to the main line 1, 2, 3, 4, or 5 of the same number as the first figure of the telephone-number to which the bell belongs. The other terminal *d* of each bell is connected by a shunt-line *e* to a return or ground wire *f* common to all the instruments, or these shunts or short-circuit lines may be connected directly to ground. Each shunt-line includes circuit-closer contacts *g* and *h*, which are normally separated, the line being open at this point. These contacts are adapted to be closed together by an electromagnet-relay *i*, and the line-wire 1, 2, 3, 4, or 5 in which this relay is included in circuit determines the remaining figure of the telephone-number, and hence the combination of numbers or connections to be used in calling that particular station. The direct lines *j* *k* of each telephone set are connected, respectively, with the lines containing the bell and the relay of that set, and are the lines over which conversation is carried on when the subscriber to whom the set belongs is called. Each subscriber's outfit includes two sets of spring clips or jacks *l* *m*, the springs of which are connected in the lines 1, 2, 3, 4, and 5, the springs of each jack being normally closed upon one another, so that normally there is no break in any of the main lines. The springs of the jacks are adapted to be separated by small insulating-plugs to be inserted between them and one of which is provided for each set of jacks.

When a plug is inserted between the springs of a jack in the set *m*, the main line is opened and the springs closed upon contact-points *p* *q*, connected by lines *s* and *t*, respectively, to those contacts of the subscriber's main switch which are used in calling over one of the main lines. The other main line, which it is necessary to employ in calling a subscriber,

(a combination of two being necessary,) is connected with the switch by the insertion of a plug in the required jack in the set *l*, which results in making a connection between the main line and a contact *o* in a line *r*, extending to a battery connection of the main switch when the switch is in the calling position. These connections, so far as the plugs are concerned, are not changed after calling, but remain as means for connecting the subscriber's transmitter and receiver in circuit by a change of contacts in said main switch. This main switch is illustrated in the diagram and further in Figs. 2 and 3, and comprises three series of contacts, the connections to which are controlled by a simple bridging device. These contacts are respectively *v* *v'* *v''* *v³* *v⁴* *v⁵*, which constitute the first series, *v*, *x*, *w'*, *w''*, and *w³*, which constitute the second or middle series, and *v*, *w*, *w'*, *x'*, *w''*, and *x''*, which constitute the third series. The contact *v* is extended to be used in all three series, and the contacts *w'* and *w''* extended to be employed in the second and third series.

The movable arm *u* carries three metal strips *u'* *u''* *u³*, which are insulated from one another, and in the left-hand position of the arm are adapted to bridge the contact *v* *v'*, the contact *v²* *v³*, and the contact *v⁴* *v⁵*, respectively, in the other positions to bridge oppositely-situated contacts.

The telephone set comprises the transmitter *y* in a local circuit *y'*, containing battery and one section of the induction-coil, said circuit terminating in the contact *y²*, and the switch *y³* adapted to engage, when the receiver *y⁴* is removed from said hook, switch *y³*. The receiver-circuit *y⁵*, including the other part of the induction-coil and the receiver, contains the contact *y⁶* and *y⁷* to be bridged by the hook-arm. From the contact *y⁷* the line divides and is connected to the contacts *v³* and *x²* in said first and third series. The direct connection *y⁸* from the other side of the receiver is also divided to contacts *v³* and *x'* in the first and third series, so that upon lifting the receiver from the hook the same and the transmitter will be connected with the main lines through the legs *j* and *k*, which are the permanent connections to the main lines. This is the condition when the subscriber has taken down his receiver *y⁴* to answer a call, his switch *u* at such time remaining in the first position, namely, over contacts *v* to *v⁵*. On the other hand, when the subscriber has just called another his switch *u* will have been moved into the third position over contacts *v*, *w*, *w'*, *x'*, *w²*, and *x²*. At such a time the circuit may be traced from the receiver-line *y⁸* to the contact *x'*, then through the bridge-strip *u²* to contact *w'* and by common connections *v⁷* to *v'*, thence to line *s* by plug-contacts *p* and *q* to circuit 2. Now as lines 2 and 3 are joined through the permanent connections of the subscriber called the circuit will return over the line 3 to the plug-switch in that line, and, following

contact o , will pass over line r to the switch-contact w^2 . From this point the return to the receiver y^4 is made by bridge w^3 on the lever u to x^2 , to contact y^7 , hook y^3 , contact y^6 , and line y^5 , attached to the receiver y^4 .

For the purpose of calling and to insure a uniformity of service I preferably employ a return or ground wire f , with which the open contact-legs e are all connected, and an independent battery-wire z , with which the battery-terminals w^3 of each subscriber's main switch is directly connected. The main battery z' is arranged between the ground and battery lines f and z . In each case the second or middle series-contact x is connected with the shunt-line e belonging to its set, and the contacts v' , w , and w' are connected v^7 with one another, these being employed to complete the various circuits at different times. The normal position of the main-switch arm is that over the contacts v to v^5 , it being expected that the subscriber will return the arm to this position after he completes the conversation with the person he has previously called. In returning the arm it passes over the battery-contacts, and in this way the subscriber rings off. To insure the return of the arm, I may provide a dead-center spring, as shown in Fig. 2, and further arrange such means as are shown in connection with the receiver-hook for tripping the arm u when the receiver is hung up, thereby allowing the spring to act and draw the arm back to the first position. When a subscriber is called, it is not necessary for him to manipulate either the main switch or the jack-plugs. This may be more clearly understood by reference to the diagram and the following description of the operations in calling and being called.

Assume that the subscriber No. 12 desires to talk with subscriber No. 32. He will first insert the switch-plugs into the spring-jacks l^3 and m^2 in the main lines, respectively. These main lines and the lines j k of subscriber 32 are joined permanently, while the bell connection b of subscriber 32 is joined with the line 3 and the relay i , contained in the line 2. Subscriber 12 then moves his switch-arm u into the middle position, wherein its contacts or plates bridge the contacts v , x , w' , w^3 , and w^3 , respectively. Hence the circuit starting from the battery z' may be traced by line z to contact w^3 , thence to contact w^2 , from thence to w' , thence to v' through common connections v^7 , thence by lines s to contact p and the jack-spring in engagement therewith. From thence current will follow the line 2 around to the relay i , energizing the same and drawing down the armature to connect contacts g and h , passing through the relay-current continues on the line 2 until the spring and contact q are reached. Thence current passes by line t direct to switch-contact v , thence by bridge-piece w' to contact x and the ground-wire f , back to the battery. Thus by the action of the relay the bell-circuit is completed

and at the same time current from the battery passes from the contact w^3 , line r , contact o , and jack-spring to main line 3, whence it flows directly to the junction of that wire with the bell-leg b , through the bell, ringing the same, and through the relay-contacts, thence by line e of the outfit 32, and thence to ground-wire f and opposite side of the battery. After thus calling subscriber 32 by ringing his bell subscriber 12 will move the switch-arm u into the third position, thereby cutting out the battery and releasing the relay, whereby contacts are broken and the ringing of the bell stopped. By moving the arm to this position the talking-circuits are established through the telephone instruments proper belonging to the two subscribers when these persons take down their receivers. At this time the circuit would be traced from the transmitter and receiver to the contacts x' x^2 , connected, respectively, with the contacts w' and w^3 , and, in the first case, to x and v v' . Thus v and w^3 may be for convenience regarded as the terminals of the talking-circuit at the calling subscriber's instrument, while in instrument 32 contacts v^3 and v^5 may for convenience be regarded as the corresponding terminals. The connections between these are the line r from w^3 in instrument 12 to line 3, thence by line j of instrument 32 to v^4 and v^5 , thence to receiver and transmitter. The return is traced from said instrument to v^3 , line k , and main line 2, to jack and contact q , and thence by line t to terminal-contact v , and, as traced thus, to the opposite side of the calling subscriber's receiver-circuit. When subscriber 32 calls subscriber 12, these conditions are reversed.

The spring-jacks are shown in connection with instrument 16 to illustrate the fact that they do not in any way interrupt the main circuit, and this is the case even when plugs are negligently left in the spring-jacks, for it will be seen that a plug inserted in a jack of the set m simply opens the main line locally, it being at once closed or bridged through the springs and contacts p q and the lines s t , which to all intents and purposes are connected in the main switch. It will further be observed that a person cannot place his instrument in connection with the lines over which other parties are talking without notifying one or both by ringing their bells when he moves his switch-arm u in position over the third series, as in doing so the arm necessarily passes the ringing-contacts and throws the main battery at least momentarily onto the busy lines. Thus the system is rendered confidential.

The above is not strictly true when taken in connection with instruments bearing reverse numbers, as it is obvious that the same main lines are employed for such instruments, but the slight difficulty here encountered may, so far as this point of secretness is concerned, be very practically overcome by appropriating such common-line instruments to

subscribers who call one another most frequently, as in the case of a person's office and his residence.

It is not intended that the bell of a subscriber shall ring when he is calling another, and as a subscriber usually wishes to be sure that the bell of the distant station rings when he makes his connection I preferably, therefore, provide one or more turns of wire around the transmitter induction-coil and connect the ends into either the battery or the ground wire, as shown in Fig. 4, the result being that sufficient current is induced in the transmitter local circuit and in the receiver to vibrate the diaphragms thereof slightly as the circuit is rapidly closed and opened at the distant vibrating bell, thus assuring the calling subscriber of the proper working of said bell.

As the transmitter and receiver connections are duplicated in the first and third series of each subscriber's main switch, and as a subscriber's bell may be rung at any time, whether the instrument is in use or not, a person thus notified of a second call while he is already engaged in talking may, by throwing a switch into the first position, communicate with the second party and ask him to wait until he has finished talking with the first party. Further, as this system embodies full metallic circuits, or, in fact, double metallic circuits, and as no grounds are used except at the moments of calling, all cross-talk is avoided and the system is at all times capable of use for as many conversations and calls as there are pairs of subscribers.

By the introduction of polarized bells and relays it is obvious that I may double the number of instruments which may be used upon a system of a given number of main wires, and I have not deemed it necessary to either explain or show such a multiplied system in detail.

It is further obvious that by suitable looping-in or connecting means this system may be connected with another of the same or a different construction.

It is obvious, further, that the various switches which I have illustrated may be replaced by others, that closed circuits may be made to take the place of open circuits, and that various other changes and modifications may be made in my system as herein particularly specified without departing from the spirit of my invention, and I therefore do not confine the same to such specific constructions or arrangements.

Having thus described and ascertained the nature of my said invention and the manner in which the same is to be performed, I claim as new and desire to secure by Letters Patent—

1. The combination, with a return connection and three or more lines or circuits normally distinct, of translating devices, each represented by two of said lines, a source or sources of energy, and means for energizing

any combination of two lines, and means connected with the energized lines whereby the circuit of the translating device represented by said two lines will be closed through one of said lines to said return connection, substantially as and for the purpose specified.

2. The combination in an automatic telephone-exchange, of a number of normally distinct main lines or circuits with a number of telephone instruments, each connected with two of the main lines or circuits, a calling device for each instrument, and means for impressing distinct currents upon any two lines, whereby the calling device represented by the instrument connected to said two lines is energized.

3. A selective calling system which consists in a series of three or more main lines, in combination with a series of calling devices therein, adapted to be influenced by electrical impulses on one or another of said lines respectively, and relays or electromagnetic circuit-closers included in said main lines, but each in a different line from that whereto its respective calling device is connected and by which the circuits of said calling devices may be completed individually, whereby one device may be operated without disturbing another which may be on the same line or another, substantially as described.

4. A selective calling system comprising three or more lines or circuits in combination with means for energizing either and any of the same, calling devices connected with said lines, a return or ground leg extending from each said calling device, respective relays for said calling devices but each in a different line from that wherewith its said calling device is connected and said relays when energized adapted to close the return connections of the calling devices whereby two lines being selected and energized will result in the operation of that calling device which is connected with one of the same and whose relay or circuit-closer is contained in the other, substantially as described.

5. The combination, in a telephone system, of three or more main lines or circuits with a number of telephone instruments, each having its terminals permanently connected with two of said lines respectively, different combinations being adopted in the connections of different instruments, and switches included in said lines at each telephone instrument whereby such instrument may be temporarily connected with the two lines wherewith the desired distant instrument is permanently connected, substantially as described and for the purpose specified.

6. The combination, in a telephone system, of a number of main lines or circuits, a number of telephone instruments, each permanently connected with two of said lines, different combinations being adopted in such permanent connections, a switch or switches at each station whereby its instrument may be temporarily connected with the two lines

wherewith the desired distant instrument is permanently connected, and calling and circuit-closing devices in said lines and each pair of said devices adapted to be operated by the use of combinations of said main lines in a similar manner, substantially as described.

7. The combination, in an automatic telephone system, of a number of main wires or circuits with telephone-stations, each having permanent connections with two of said wires, said connections being made in different combinations, switches in the lines near each telephone instrument, whereby connections may be made for that instrument with any of the said main wires or circuits in combinations of two corresponding to the wires or number of the instrument or station with which it is desired to make talking or calling connections, substantially as described.

8. The combination, in an automatic telephone system, of a number of main wires or circuits, with a number of telephone stations or instruments, each connected with two of the main wires, a calling device for each station and connected with one of the wires representing said station, a ground or return connection for such calling device, a circuit-closing device operatively connected in the other line representing the station and adapted to complete the circuit of said calling device, looping-in switches at each station and in each main wire, whereby the station may be connected with the wires representing any other station, and means whereby a battery or other source of electricity may be connected with the selected wires to operate a distant circuit-closer and calling device, and further means for cutting out the battery and connecting the calling subscriber's telephone instrument with the selected lines, in order that conversation may be carried on over the same, substantially as described.

9. The combination, in an automatic telephone-exchange, of a number of main wires or circuits, with a number of telephone stations or instruments, each connected with two of the main wires, a calling device for each station and connected with one of the wires representing said station, a ground or return connection for such calling device, a circuit-closing device operatively connected in the

other line representing the station and adapted to complete the circuit of said calling device, looping-in switches at each station and in each main wire, whereby the station may be connected with the wires representing any other station, and means whereby a battery or other source of electricity may be connected with the selected wires to operate a distant circuit-closer and calling device, further means for cutting out the battery and connecting the calling subscriber's telephone instrument with the selected lines in order that conversation may be carried on over the same, the induction-coil of each subscriber's set and an extra winding provided about the same and always in circuit when calling is being done, and whereby the operation of the distant calling device is indicated in the calling subscriber's telephone instrument, substantially as described.

10. The combination, in a telephone system, of a main circuit, a telephone instrument to be connected therewith, calling devices for said instruments, means for operating the calling device of one from the other, the device belonging to the calling subscriber adapted to remain silent, and an extra winding included in the circuit and arranged about the induction-coil of each instrument, whereby the operation of the distant calling device is indicated to the calling subscriber through his telephone instrument, substantially as described.

11. The combination, in a telephone system, of three or more main lines, with a number of telephone instruments or stations each permanently connected with two of said lines, different combinations being adopted in such permanent connections, a switch or switches at each station whereby its instrument may be temporarily connected with the two lines wherewith the desired distant instrument is permanently connected, and a calling or signaling apparatus provided in connection with the foregoing, substantially as described.

In testimony whereof I have hereunto set my hand this 16th day of January, A. D. 1895.

MORGAN BROOKS.

In presence of—

C. G. HAWLEY,
FREDERICK S. LYON.