No. 789,350. PATENTED MAY 9, 1905.

A. K. ANDRIANO.

INTERCONNECTING TELEPHONE SYSTEM.

APPLICATION FILED FEB. 18, 1904.

2 SHEETS—SHEET 1.

Fig. 1.

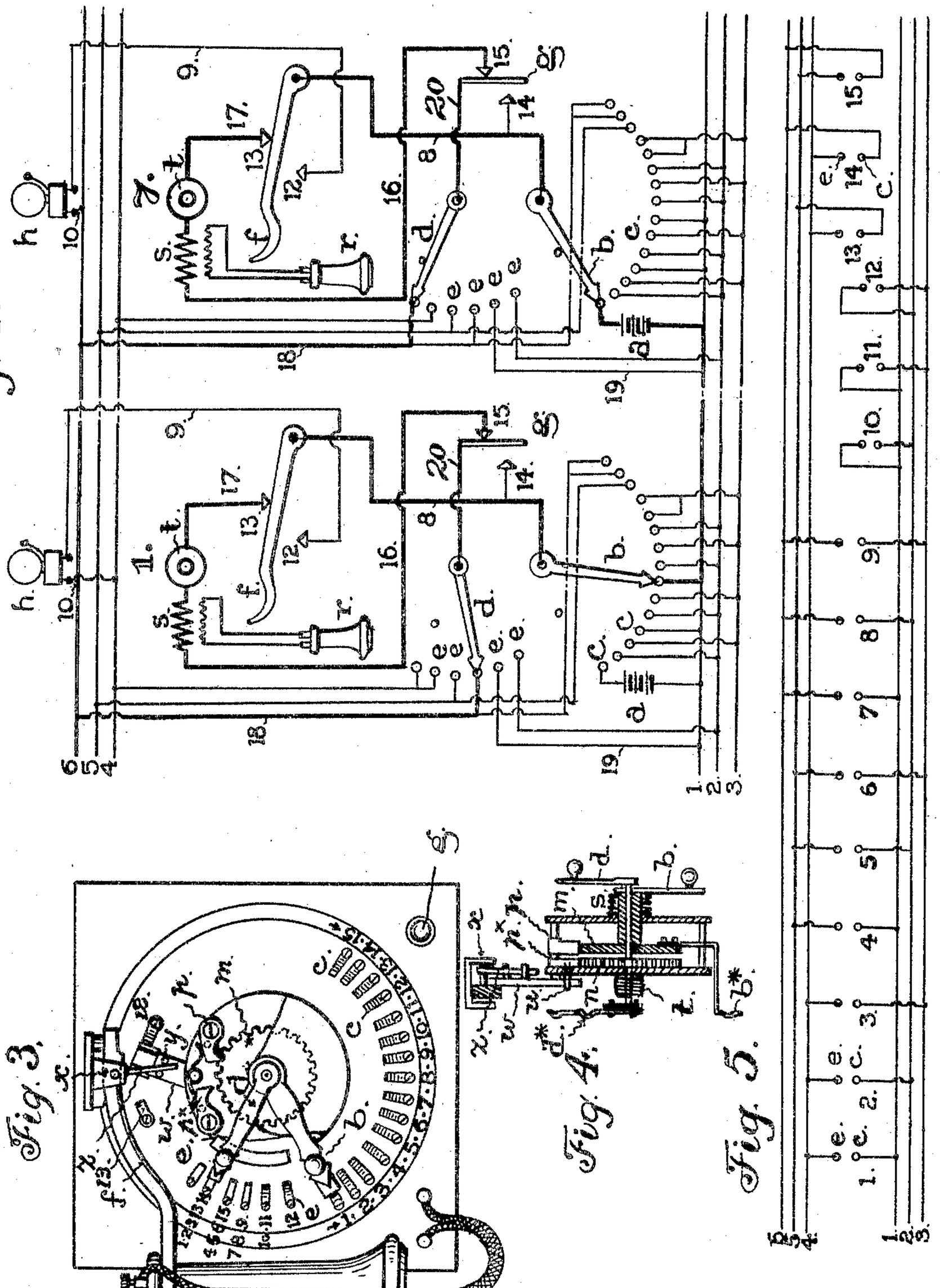

Fig. 3.

Fig. 4.

Fig. 5.

Witnesses

J. S. Barker.

Geo. B. Pitts.

Inventor

Albert K. Andriano

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2 SHEETS—SHEET 2.

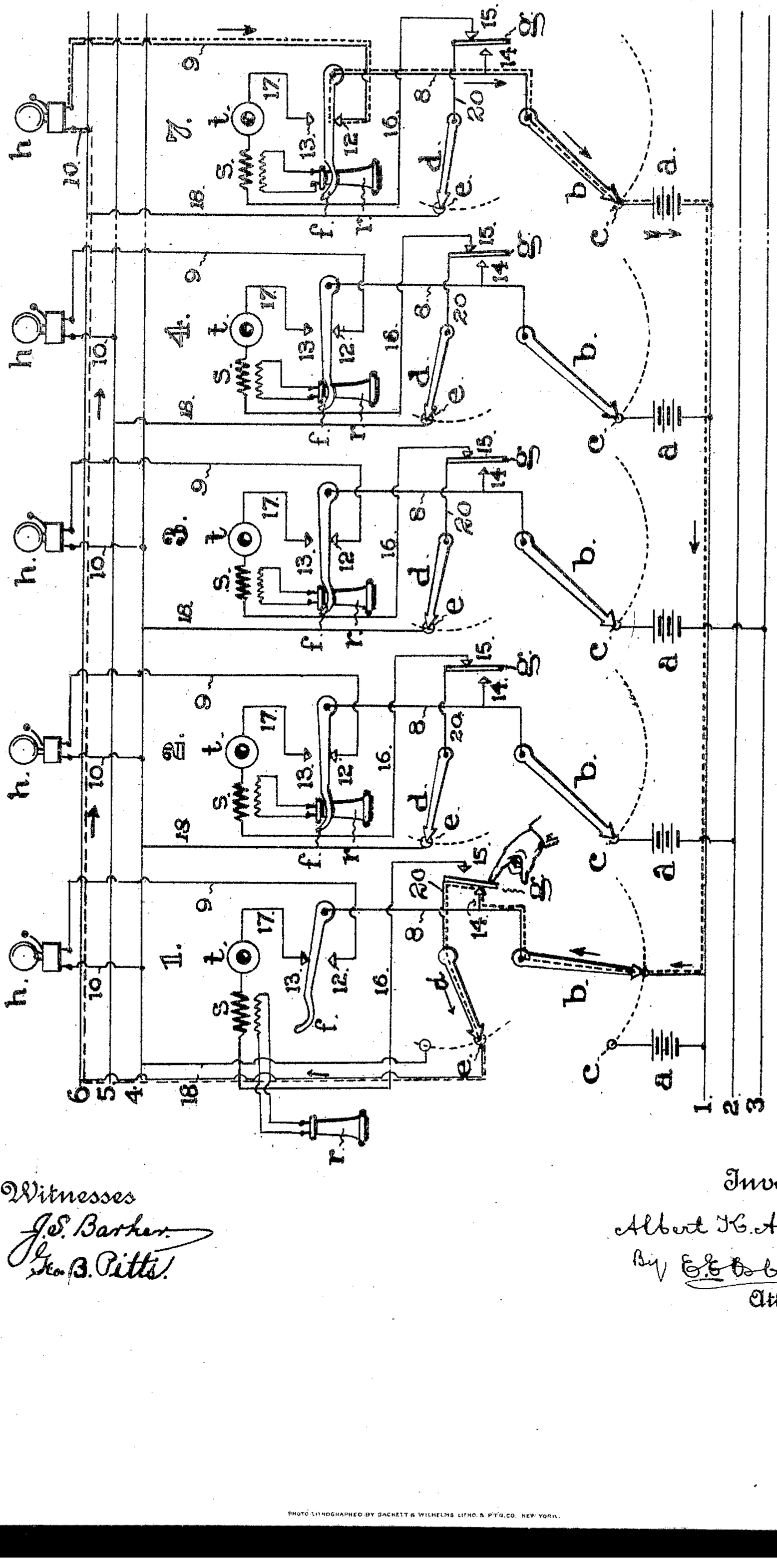

Fig. 2.

Witnesses
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UNITED STATES PATENT OFFICE.

ALBERT KOCH ANDRIANO, OF SAN FRANCISCO, CALIFORNIA, ASSIGNOR TO DIRECT-LINE GENERAL TELEPHONE COMPANY, OF SAN FRANCISCO, CALIFORNIA, A CORPORATION.

INTERCONNECTING TELEPHONE SYSTEM.

SPECIFICATION forming part of Letters Patent No. 789,350, dated May 9, 1905.

Application filed February 18, 1904. Serial No. 194,186.

To all whom it may concern:

Be it known that I, ALBERT KOCH ANDRIANO, a citizen of the United States, residing at San Francisco, in the county of San Francisco and State of California, have invented new and useful Improvements in Interconnecting Telephone Systems, of which the following is a specification.

This invention relates to improvements in telephone systems wherein each station is provided with a switching and a signaling means that enable it to connect with and call up for communication any other station not in use at the time.

In a system containing a small number of stations arranged on the "interconnecting" plan, as it is generally termed, and where the service on such a system is comparatively light there is found to be little or no interference between the talking-circuits completed and in operation between several sets or pairs of stations at the same moment; but in a system involving a considerable number of stations that are in operation at the same time, and especially where the same return-wire is combined or connected at the same moment with two or more direct line-wires to form different metallic circuits for several pairs of telephones or stations, it has been found that the talking-circuits sometimes interfere with and set up such inductive conditions on the lines as to cause the talking on one circuit to be heard on another circuit. In addition to this objectionable feature the signaling-circuits over which one station calls up another are also liable to affect the talking taking place on other lines at the moment of signaling by causing the pulsations of the current on the signaling-circuit to act on the talking-circuits then in use.

My present invention has for its object to provide a system of metallic circuits for talking and signaling that shall be free from the above-mentioned defects and objectionable features and by means of which also a considerable number of stations may be connected in one system, with a capacity for setting up a number of metallic circuits for signaling and talking without interference or disturbance between one circuit and another.

A further and important object of the invention is to economize the battery force and to utilize the batteries for signaling as well as for talking purposes, thereby greatly simplifying the construction and reducing the cost of setting up and supervising a large number of lines.

A further object of the invention is to prevent waste of battery in case the receiver may be left off the hook instead of being hung up after use.

These and other objects incidental to the present system I attain and secure in and by means of the construction and arrangements of apparatus as herein shown and described.

Figure 1 is a diagram illustrating the circuits for talking between stations numbered 1 and 7 when the switches are set for connecting one with the other, the intermediate stations not being represented. Fig. 2 is a diagram illustrating the signaling-circuits between the same stations when station No. 1 is calling No. 7. Several of the intermediate stations are represented in this diagram. Fig. 3 is a front view of one of the local switch-boxes containing the switching mechanism, the circuit making and breaking connections controlled by the telephone-hook, and other connections, the front of the box being removed. Fig. 4 is a central vertical sectional view through part of the mechanism shown in Fig. 3. Fig. 5 is a simplified diagrammatic view illustrating the manner in which by varying combinations of conductors fifteen separate metallic circuits may be obtained with six conductors, the home contacts only of both the direct and the return conductors being indicated.

In the following description the terms "direct conductor" and "return-conductor" are used arbitrarily to designate the two sides of the circuit that unite two connected stations; but it will be understood that the lines primarily used as direct conductors in one set or group of circuits illustrated in the diagrams may be simultaneously used as return-

conductors for other circuits, this fact being illustrated by Fig. 5.

The grouping of the stations in the manner illustrated in this case and the connecting of them by direct and return conductors and the means for selecting one wire for use as a direct conductor and another for use as a return-conductor, so that a circuit so completed for use becomes individual to the particular connected stations, are not herein claimed, but are the subject of claims in another application filed by myself and Hermann Herbstritt, November 21, 1903, and serially numbered 182,092.

The invention that forms the subject-matter of the present case is shown as applied to an interconnected system, for which it is particularly well adapted, and when so applied each station is provided with switching devices by means of which a metallic circuit may be completed between that one and any other selected station of the system. As shown in the drawings, the selecting devices by which one station is connected with another are preferably divided into two sets, one controlling the connection of the local station with the direct line conductors and herein designated, for the purposes of description, as the "direct-line switch" and the other controlling the connection with the return-conductors, this being herein designated the "return-line switch." The direct-line switch consists of a set of stationary contacts or points *c*, constituting the terminals of the direct line-wires that enter the station, and a movable contact or switch-arm *b* for making contact with such stationary contacts, one side of the local circuit of the station being connected with the said movable contact, while the return-line switch consists of a set of stationary contacts or points *e*, constituting the terminals of the return-conductors that enter the station, and a movable contact or switch-arm *d* for making contact with these stationary contacts, the other side of the local circuit being connected with the movable contact *d*. These two arms or movable contacts *b* and *d* may be and preferably are so mounted as to turn about a common axis, as indicated in Fig. 4, and are normally maintained upon certain of the stationary contacts, commonly called the "home" contacts. Spiral springs *s* and *t* are employed to automatically return them to normal positions of rest, as is customary in apparatus of the kind to which mine belongs. The movable contacts have connected with them ratchet-wheels *m* and *n*, with which coöperate detents *p* $p^{\times}$ for locking the movable contacts upon the stationary contacts, to which they may be set until they are released upon the hanging of the telephone-receiver *r* upon the hook *f*. The telephone-hook or arm *f* is provided with a tripping-arm *z*, mounted in a suitable support *x* and extending between studs *y*, carried by an arm *w*, that operates to throw off the detents when the telephone is hung up. Further description of these parts is not necessary, as they form no part of the present invention and may be of any usual or approved character.

Referring now to the diagrammatic views, Figs. 1 and 2, wherein my present invention is illustrated, 1, 2, 3, 4, 5, and 6 designate the conductors interconnecting the stations. Any of these may be used both as a return-conductor for one station and as a direct conductor for another, as indicated in Fig. 5. Those wires or conductors that terminate at the points or contacts *c* of the station are the direct conductors for that particular station, while those that terminate at the contacts *e* are the return-conductors, though, as already indicated, the terms "direct" and "return" are herein used arbitrarily to facilitate description of the system. The essential features of a local talking-circuit are represented in these views, and I have chosen, for the sake of illustration, an arrangement in which the receiver *r* is in a closed circuit containing the secondary winding of the induction-coil. Starting from the movable contact or switch-arm *b* of the direct-line switching or selecting device with which one lead of the local circuit is connected, that circuit when connected up for talking may be traced as follows: the switch-arm *b*, the conductor 8, uniting the switch-arm with the telephone-hook *f*, the contact 13, with which the telephone-hook engages when the receiver is taken down, the wire or conductor 17, the transmitter *t*, the primary winding *s* of the induction-coil, the conductor 16, leading to the front stop 15 of the ringing-key *g*, the movable member of the ringing-key, and the conductor 20, uniting the latter with the switch-arm *d* of the return-line switch. It will thus be seen that the two switches, which when connected as described constitute the two terminals of the local circuit, make it possible to connect the local circuit with any of the lines that enter the station and terminate at the contacts *c* and *e* and through these lines or conductors with any of the other stations. The complete talking-circuit between two connected stations is indicated in this view by the heavy line and may be further traced as follows, beginning with the stationary contact to which the movable contact *d* has been set: the wire 18, uniting the said stationary contact with that conductor 6 which is individual to or a common conductor for the connected station No. 7, the conductor 6, the wire 18 at station No. 7, uniting the conductor 6 with the home contact of the return-line switch, the arm *d* of that switch, the conductor 20, the movable member of the ringing-key, the front stop 15, the conductor 16, the primary winding *s*, the transmitter, the conductor 17, the contact 13,

with which the telephone-hook engages when the receiver is taken down, the telephone-hook *f*, the conductor 8, the movable contact *b* of the direct-line switch that is resting on its home contact, the wire that unites this contact with the direct conductor that is individual to station No. 7, the battery *a*, the conductor 1, and the wire uniting this conductor with that stationary contact at station No. 1 that is individual to station No. 7 and to which the switch-arm *b* has been moved and from which the tracing of the talking-circuit began. The electrical energy for operating this circuit is obtained from the battery *a*, which, it should be observed, is directly upon the line. It is located outside the local circuit of the station and in one of the lines or conductors terminating, respectively, at the home contacts *c* and *e* of the called-up station, preferably in the line that goes to the direct-line switch. The advantages of this arrangement are apparent, as thereby battery force directly on the line may be obtained, provided the movable contacts of the switches of the called-up station are on their home contacts, as they should be except when that station is itself making connection with another station, no matter what other station in the system may be connected therewith.

The ringing-circuit is indicated in Fig. 2, wherein station No. 1 is represented as calling up station No. 7. Referring to this view, the calling-circuit may be traced as follows, starting with the movable contact *b* at station No. 1: the switch-arm *b*, the conductor 8, the back stop 14 of the ringing-key *g*, the movable member of the latter, which when pressed engages with such back stop, the conductor 20, the switch-arm *d*, which has been adjusted to that contact *e* of the return-line switch that is individual to the station being called up, in this instance station No. 7, the wire 18, the conductor 6, the wire 10, the bell *h* of station No. 7, the wire 9, the contact 12, upon which the telephone-hook *f* rests when the receiver is hung up, the telephone-hook *f*, the conductor 8, the movable contact *b* of the direct-line switch now resting upon its home contact *c*, the battery *a*, and the direct line conductor 1, to back the movable contact *b* at station No. 1, this circuit being indicated by the dotted line. When this circuit is thus completed, the bell at station No. 7 will ring so long as the push-button is pressed or until one or both the receivers are removed, thus breaking the circuits at contacts *f*-12.

The electrical force for operating the calling-circuit is obtained from the battery *a*, which, as has already been stated when describing the talking-circuit, is on the line outside the local circuit and is on the line individual to the called-up station, so as to be always ready for use in making a call when the station is not busy. This disposition and arrangement of battery permits the system to be operated without a common ringing battery and circuit and makes it possible to utilize the same battery both for calling and for talking purposes.

It will be seen by reference to the diagrams that in each line or conductor individual to a station there is a battery that serves to operate the instruments in that station whenever it is called, but that whenever a call is sent from such station the connection with such battery is broken in the act of making connection with the distant station. It will be observed that each battery is connected into the line in the same manner as each other battery—that is to say, if the positive pole of one battery be toward the home contacts *c* of the line individual to that station then each other battery will have its positive pole disposed in the same relation to the home-contact of the station the instruments of which it serves to operate. This disposition of the batteries renders it impossible for the current from any battery to find a circuit through a loop including a bell of a station other than the one intended to be called, which might otherwise take place should a strong battery be employed for ringing purposes. If the circuits be traced in the present case, it will be seen that whenever a loop is formed other than the one intentionally made by the act of connecting two stations it will include two of the batteries *a*, and these batteries will have like poles connected together, thus opposing one another and preventing a flow of current or so retarding the flow of current as to render it ineffectual for operating a bell or other calling instrument.

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

1. In a telephone system the combination with a station, of a plurality of other stations connected therewith by conductors individual to such other stations and terminating at contacts at the first-named station, means for completing an electrical circuit between any station of the system and the first-named station, means at the first-named station for selecting the conductor individual to any other station and completing a circuit therewith over such conductor, and a source of electrical energy in the conductor individual to a station situated outside the selecting means of the station.

2. In a telephone system the combination of a plurality of stations connected with each other by direct line conductors and switching devices, and a source of electrical energy in the direct line conductor of each station situated outside the switching device of the station.

3. In a telephone system, the combination of stations connected by direct line conductors having terminals at the stations, a mov-

able conductor at each station connected with one side of the local circuit of that station and arranged to normally connect with the line individual to that station, or by adjustment to connect with the line of any other station, a source of electrical energy in each direct line conductor situated outside the movable conductor of its station, and a return-conductor with which the opposite side of each local circuit is connected.

4. In a telephone system, the combination of a plurality of stations connected through switching devices and line conductors having terminals at the stations, a movable conductor for connecting one side of the local circuit at a station with the line conductor individual to the station and also by adjustment for connecting it with the line conductor of any other station, a return-conductor for completing the circuit with which the opposite side of each local circuit is connected, and a source of electrical energy for each completed circuit arranged outside the local circuit of the station, the connection with such source of energy being maintained while the movable contact is in connection with the line individual to its station and broken when moved to the line individual to any other station.

5. In a telephone system, the combination of a plurality of stations connected with each other by direct line conductors and switching devices, and a battery in the direct line conductor of each station situated outside the switching device of the station, the said batteries being similarly disposed with reference to the lines in which they are located.

6. In a telephone system, a plurality of stations connected through switching devices and direct line conductors having terminals at every switch, a source of current in every direct line conductor arranged outside the switching device, a local circuit at every station, means for normally connecting one side of the local circuit with a direct line conductor individual to the station, and also by adjustment for connecting it with the direct line conductor of another station, a return-conductor to which the circuit of the station is connected on its opposite side, and a circuit-closer in the local circuit arranged to unite the terminals of the local circuit and cut out the local instruments.

7. In a telephone system, stations interconnected through individual switching devices and metallic circuits, each composed of a direct conductor and a return-conductor, a local circuit at each station and a source of current in every direct conductor arranged outside the switching device, the latter operating to connect one side of the local circuit normally with the source of current, or by adjustment to cut out the source of current and connect the local circuit directly with the line of another station.

8. In a telephone system, a plurality of stations each having a local circuit, direct line conductors between the stations terminating at contacts individual to the several stations, a switching device connected with the local circuit and arranged to make connection with any of the direct-line contacts, a battery situated in each direct line and connected on one side with the home contact of its line, a return-conductor common to the station, and means for connecting the local circuit with the said return-conductor.

9. In a telephone system, a plurality of stations interconnected through direct line conductors and individual switching devices, a local circuit at each station, a battery in each line individual to a station, and means at each station for normally connecting the local circuit with the direct line individual to that station and with the battery in such line, and adapted by adjustment to cut out the said battery and connect the local circuit with the corresponding battery in another line.

10. In a telephone system, a plurality of interconnectible stations, an electrically-actuated signaling device at each station, switching devices adapted to connect the signaling device of the station at will with either the signaling or the talking circuit of another selected station, and a source of electrical energy in the direct line conductor of every station situated outside the switching device of the station.

In testimony whereof I have hereunto set my name to this specification in the presence of two subscribing witnesses.

ALBERT KOCH ANDRIANO.

Witnesses:

JOHN S. PARTRIDGE,

M. REGNER.