(No Model.) 2 Sheets—Sheet 1.

C. HERZ.

TELEPHONE SYSTEM.

No. 349,042. Patented Sept. 14, 1886.

Fig 1.

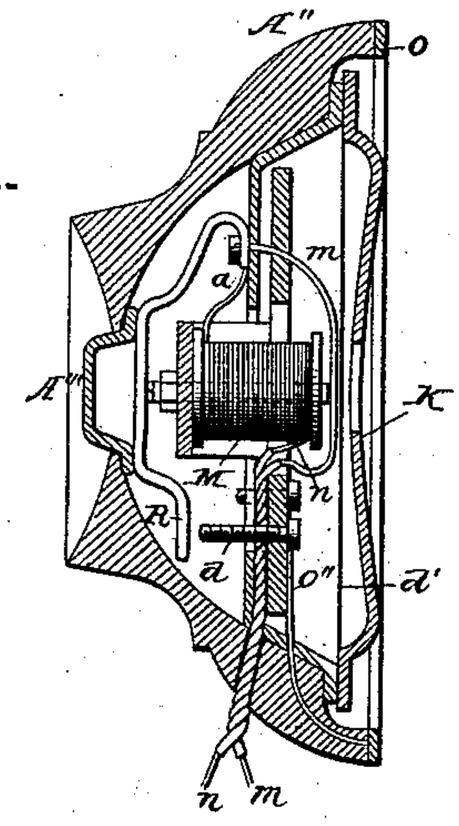

Fig 2.

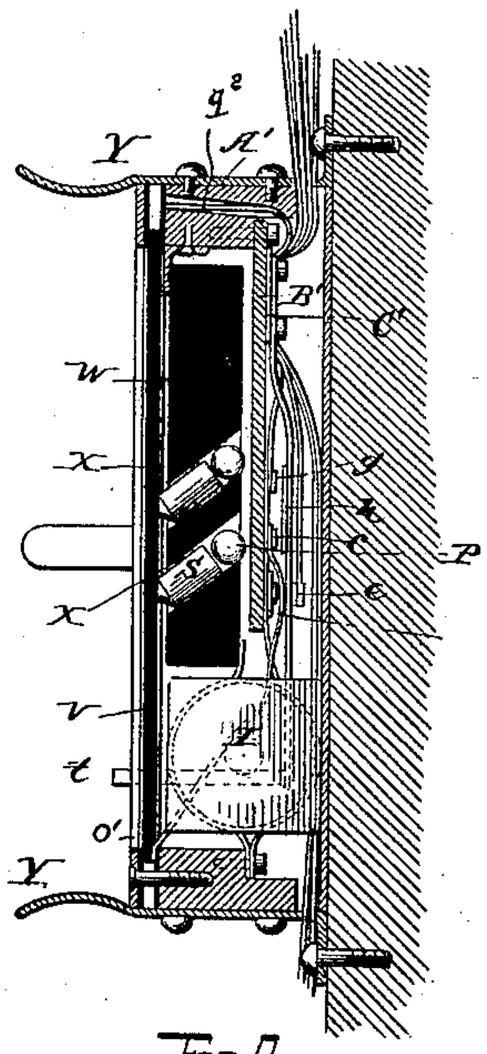

Fig 3.

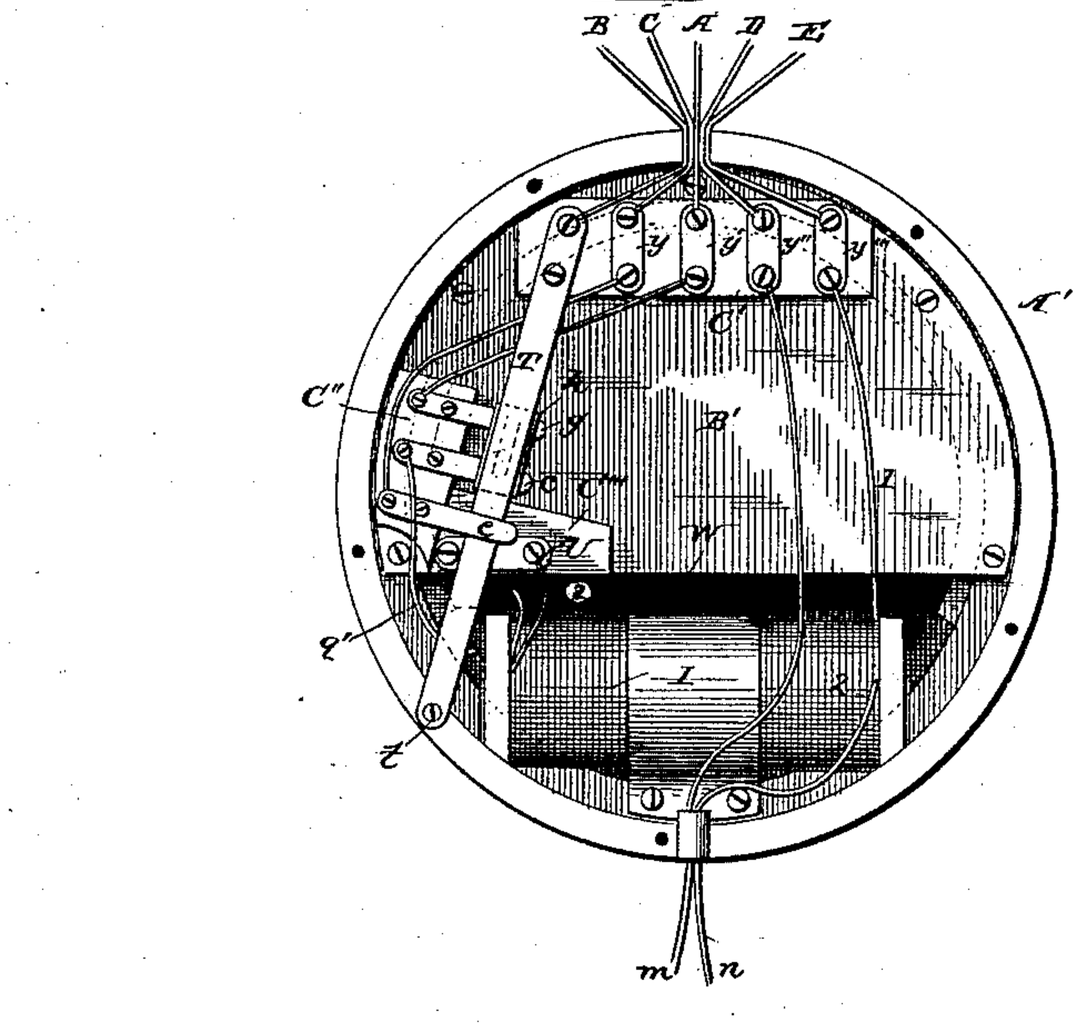

Fig 4.

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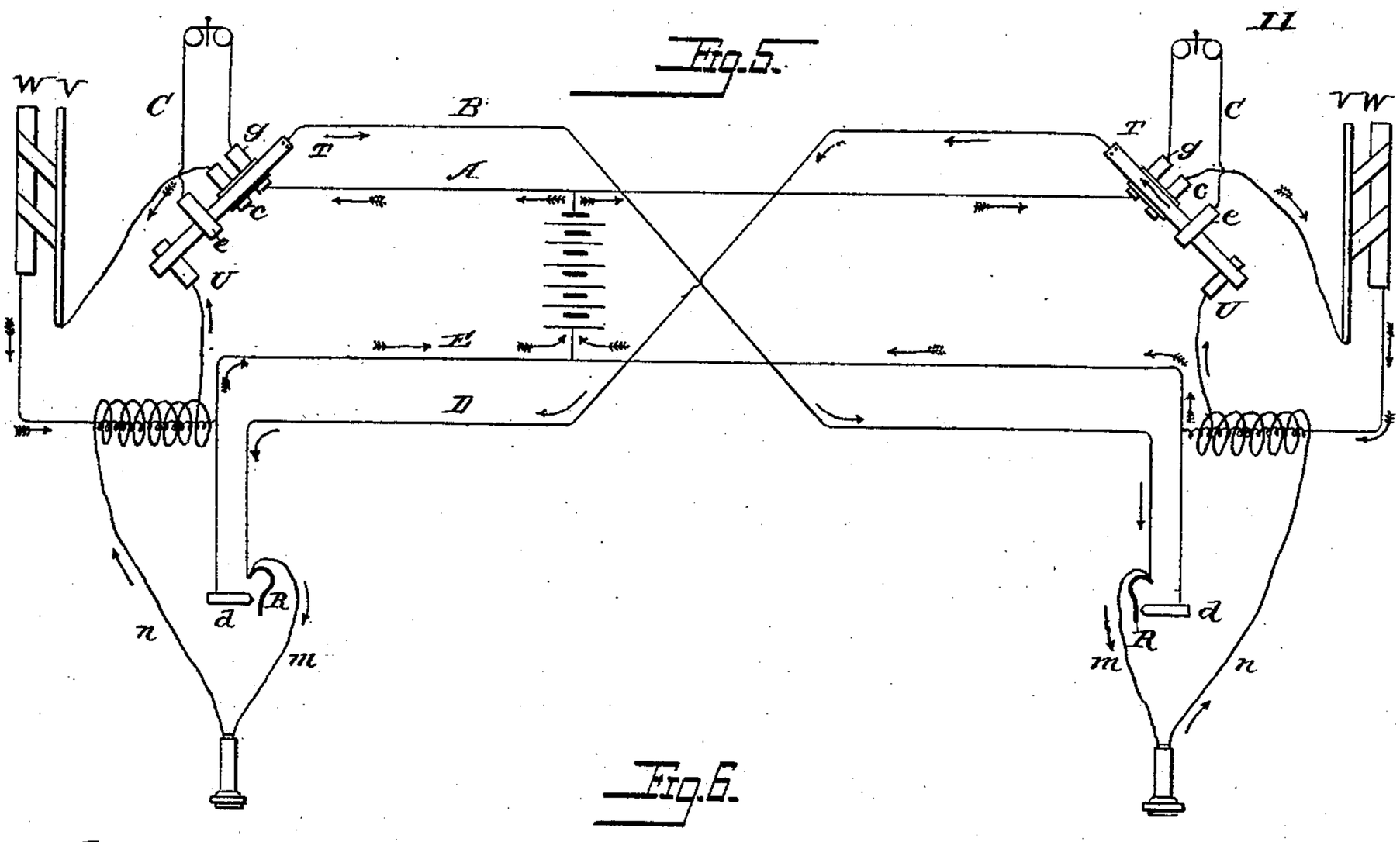

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UNITED STATES PATENT OFFICE.

CORNELIUS HERZ, OF PARIS, FRANCE.

TELEPHONE SYSTEM.

SPECIFICATION forming part of Letters Patent No. 349,042, dated September 14, 1886.

Application filed February 18, 1886. Serial No. 192,416. (No model.) Patented in France January 9, 1886, No. 160,785.

To all whom it may concern:

Be it known that I, CORNELIUS HERZ, a citizen of the United States, residing at Paris, in the Department of the Seine, France, have invented new and useful Improvements in Telephone Systems, of which the following is a specification, and for which I have received Letters Patent in France, No. 160,785, dated January 9, 1886.

Under the general term "telephone system" the public, and more especially those familiar with the art of telephony, understand a combination of apparatus dependent upon each other and operating to transmit to and reproduce at a distance vocal and other sounds telegraphically.

The distinctive parts of the telephone system are: first, the transmitter, or the apparatus which receives the impact of sound-waves and converts the same into electrical undulations; second, the receiver, or the apparatus which converts the electrical undulations into sound-waves, and, third, the circuit-connections, by means of which the transmitter at one station is electrically connected with the receiver at another station. These are the three essential parts of a telephone system, and none of them can be made practically useful without the others. As a rule, however, there is a transmitter and a receiver at each station, and a signaling-bell is added for greater convenience. According to the relative locations of these parts at a station, the circuit-connections must be varied.

My invention relates to improvements in the whole system of vocal intercommunication, or in the telephone as a whole; and it has for its object, more especially, the production of a house-telephone, which is designed to take the place of speaking-tubes, although it may with advantage be used for oral communication with more distant points. The reduction of the size of the station apparatus is an essential requirement of a house-telephone, and for this reason I have contrived an apparatus which embodies in a structure of the size of an ordinary push-button a microphonic transmitter, a magneto-receiver, and a push-button, all these parts being related to each other for successive or simultaneous operation by means of suitable switches. A single battery is used with my system, no matter how numerous the stations may be, and the microphones are all in multiple-arc branches from this battery. In addition to this, the arrangement is such that each station can call every other station without the intervention of a central station, whereby the expense involved in the maintenance of the latter and the delays and misunderstandings incidental thereto are avoided. A combined magneto-telephone and push-button in a system of intercommunication has heretofore been suggested; but my invention differs radically therefrom, in that it introduces an effective microphonic transmitter as an essential organic element of a telephone, which at the same time admits of independent intercommunication between all stations upon the line. All this will appear more clearly from the following description, in which reference is made to the accompanying drawings, which form a part thereof, and in which—

Figure 1 represents a central vertical section of the receiver and push-button; Fig. 2, a similar sectional view of the microphone-transmitter; Fig. 3, a bottom view of the transmitter, showing induction-coil and switches; Fig. 4, a similar perspective view; Fig. 5, a diagram, with the essential parts of the instruments indicated by conventional or illustrative signs, showing two stations connected in circuit; and Fig. 6, a similar view showing four stations connected in circuit.

Referring now more especially to Figs. 2, 3, and 4, there is a cylindrical box, A′, secured with one end to a wall or to some piece of furniture, as shown in Fig. 2. To a partial partition, B′, in said box is secured a carbon-plate, W, which, in the form shown in the drawings, extends below the partition and has one or more perforations, X, at an angle of preferably forty-five degrees to the plane of the plate. A diaphragm, V, which I make of carbon or other conducting material, is placed in front of and parallel to the plate W, and in each of the perforations of said plate rests loosely a carbon pencil, S, and a weight, P, preferably a small leaden ball, is placed on the top of each pencil, which makes gravity-con-

tact with the plate W and with the diaphragm V.

The elements W, S, and V constitute the microphone of my apparatus, the circuit-connections being on one side with the partition B′, which is of metal, and on the other side with a metal ring, *o′*, which secures the diaphragm in place. These connections will be presently described.

A plate, C′, of insulating material, arranged behind the carbon plate W and near the top of the box, has four metal strips, *y y′ y″ y‴*, secured upon its face, and a spring-arm, T, extending with its free end into a slot, *s′*, in the body of the box, is with its other end likewise secured to plate C′. Within the slot *s′* the body of the box is perforated, and through said perforation passes a pin, *t*, which is secured to the spring-arm T, and which projects beyond the outer face of ring *o′*, as is clearly shown in Fig. 2.

Another plate, C″, of insulating material, carries three spring-contacts, *e*, *c*, and *g*, the first of which, *e*, is arranged in the path of spring-arm T, so as to make contact with the same on one side, when the latter is depressed, (as will be presently explained,) while contacts *c* and *g* make contact with a small contact-plate, *h*, attached to but insulated from the other side of spring-arm T.

A third plate, C‴, of insulating material, carries a spring contact-plate, U, which is also in the path of spring-arm T, and makes contact with the same on the side to which plate *h* is attached.

An induction-coil, I, of ordinary construction, is secured to the lower part and within the box A′, and the circuit-connections are as follows: From spring-arm T and from plates *y y′ y″ y‴* proceed the wires B C A D E, respectively, which pass together through a hole in the upper part of the box, and of which B, A, D, and E constitute the line or part of the line, as will be explained further on. Plate *y* is connected with spring-contact *e;* plate *y′* with *g*. One end of the primary of the induction-coil (marked 1) is connected with plate *y‴*, and the other end with carbon-plate W, or with its metallic support B′, as desired, one terminal of the secondary of the inductorium (marked 2) is connected with spring-plate U, while the other terminal, passing through a hole in the lower part of the box, leads by a wire, *n*, to the receiver, and, returning therefrom, connects by a wire, *m*, with plate *y″*. The diaphragm or its clamping-ring *o′* is connected by a wire, *q′*, with a spring-contact, *c*, and by a wire, *q″*, with plate *y‴*.

It must be remarked that the tendency of spring-arm T is to establish contact with spring-plates *c*, *g*, and U. In the condition shown in the drawings such contact is established; but when spring-arm T is bent rearwardly, as by pressure of the receiver upon pin *t*, the contacts with *c*, *g*, and U are broken, and contact with *e* is established. This is accomplished when the receiver shown in Fig. 1 is applied to the transmitter just described.

The receiver consists of a cup, A″, one side of which is shaped like the push-buttons in ordinary calls. A push-button, A‴, in fact, projects through an opening on that side of the receiver, said button being mounted, as usual, upon a spring, one end of which, R, is in relation to a contact-pin, *d*, to make contact with the same when depressed. The other side of the receiver-cup is provided with a diaphragm, *d′*, and an ear-piece, K, with an opening in the center, as usual. The magnet M is suitably mounted behind the diaphragm, and its core is adjustable toward and from the diaphragm, as in ordinary receivers. This side of the receiver-cup is made of a size to correspond to the size of the transmitter-box, and when applied to the latter it is held thereto by a number of clamping-springs, Y Y. To the edge of the receiver-cup is secured a contact-ring, *o*, having the size of the clamping-ring *o′* on the transmitter. This ring *o* is electrically connected with the contact-pin *d* by a wire, *o″*. The wires *m* and *n*, coming from the transmitter, enter through a hole in the side of the receiver-cup. One of them, *n*, includes the coil of the magnet, and is then connected with the spring of the push-button at *a*, while the other, *m*, is directly connected with the push-button spring at that point.

It should be added that a signal-bell of ordinary construction is included in the conductor C, which, after leaving the bell, joins the conductor A, which proceeds from spring-contact *g*. The conductors B D A E constitute the line; but upon reference to Fig. 5 it will be seen that B and D are crossed, so that the conductor B at one station becomes conductor D at the other station, and vice versa. The battery is in a cross-wire connecting the conductors A and E. In said Fig. 5 the essential parts of the apparatus are diagrammatically developed, and the operation may be traced on said figure. Supposing the receiver-cups at both stations are applied to their respective transmitter-boxes, the edges of the cups will then press upon the pins *t*, and the spring-arm T in each instrument will make contact with its respective spring-contact *c*, while contact at U, *c*, and *g* is broken. Both instruments are now in condition to call or to receive a call.

If station I calls, by depressing the push-button contact is made between R and *d* at that station. This closes the bell-circuit of station II as follows: from the positive pole of the battery over conductor A, spring-contact *g*, bell, conductor C, spring-contact *c*, spring-arm T, conductor B of station II, conductor D of station I, wire *m*, push-button R *d*, and through conductor E back to the negative pole of the battery. If station II calls, the bell-circuit of station I is closed, which

need not be described, since it is in all repects like that of bell-circuit of station I I. After an exchange of signals each operator removes the receiver-cup from the transmitter-box, whereby the telephone-circuits are established. These circuits are traced for both stations with arrows, feathered arrows indicating the microphone-circuits and unfeathered arrows the receiver-circuit, which is common to both stations.

For station I, the microphone-circuit is from the positive pole of the battery over conductor A, spring-contact *g*, insulated contact-plate *h*, (see Figs. 2 and 4,) spring-contact *c*, to the diaphragm of the microphone; from plate W of the microphone to and through the primary of the inductorium, and by conductor E back to the negative pole of the battery. For station II the microphone-circuit is quite similar.

The receiver-circuit is from the secondary of inductorium at station I, to spring-contact U over spring-arm T, line B of station I, line D of station I I, through the receiver of that station, to and through the secondary of the inductorium to spring-contact U and spring-arm T, over line D of station I, its receiver, and back to the secondary of the inductorium.

If more than two stations are established, the connections are as indicated in Fig. 6, in which four stations are represented; but, as will be clear upon inspection, any number of stations may be installed upon the same principle. There are two conductors, A and E, which constitute the battery-line, the same as in Fig. 5, the bells as well as the microphones being charged by a battery through multiple-arc branches. In Fig. 6 I have shown the extension of the primary of the induction-coil at each station connected with the spring of the push-button, and the terminal of the receiver-coil with contact-pin *d*. This is the reverse of what is shown in Fig. 5; but such change is not at all necessary, and is of no consequence whatever. To the contact-pin *d* is connected a switch-arm, Q, which may be turned, and will make contact with any one of a number of points which constitute the terminals of lines leading to the stations with which communication is desired. The stations are marked I, II, III, and IIII, and there are four lines, L', L^2, L^3, and L^4, which run through all stations, but only one of them is permanently connected with the apparatus at each station—viz., L', with spring-arm T at station I, L^2 with spring-arm T at station II, &c. The other lines terminate at each station in contact-points 1, 2, 3, and 4, with which the switch-arm Q is caused to make contact.

The operation is quite simple. Suppose station I desires to communicate with station III. The operator at I turns the switch-arm Q to contact-point 3, and then pushes his push-button R to make contact with pin *d*. This completes the bell-circuit for station III, as follows: from the positive pole of the battery to and through the bell at station III, spring-contact *e*, spring-arm T, down to line L^3, switch-arm Q, pin *d*, push-button R, and through line E, back to the negative pole of the battery. It will be seen upon inspection that the circuits of all other bells are open, so that only that of station III can respond. In order that the operator at station III may know by whom the call has been made, it is necessary that the calling operator cause the bell to ring as many times as the number of his own station indicates. Thus the operator at station I will depress his push-button once, the operator at station II twice, &c. The operator at station III being thus informed that he is called by station I will turn his switch-arm Q to contact-point I, and will then depress his push-button three times, which informs the operator at station I that III is ready. Both operators now remove the receiver-cup from the microphone-box, and thereby the circuits of both microphones, as well as the common receiver-circuit, are closed, and the conversation may proceed. It is not necessary to describe these circuits, since they are in all respects like those delineated in Fig. 5.

It will thus be seen that by my apparatus I am enabled to establish a system of intercommunication between any desired number of stations, and that any one of these stations may put itself in circuit with any other station without disturbing the remaining stations, and all this without the intervention of a central office or station.

Having now described my invention, with reference to a special embodiment of the same, I desire it to be understood that I do not limit myself to the details of construction shown, since the same may be widely varied without departing from the spirit of my invention.

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

1. A telephone-station apparatus comprising a microphonic transmitter, a compound receiver and push-button serving as a cover to the transmitter, and a switch actuated by the body of the receiver for establishing the signaling-circuit.

2. A telephone-station apparatus comprising a microphonic transmitter, a cover to the same containing a compound receiver and push-button, and a switch actuated and released by the body of the cover, substantially as described.

3. In a telephone system, a series of station apparatus, each comprising a compound transmitter, receiver, and push-button and a bell, a single-battery main circuit including all stations, and a speaking-line for each station, substantially as described.

4. In a telephone system, a series of station apparatus, each comprising a transmitter, a receiver, push-button and bell, a single battery charging the transmitters and bells through multiple-arc branches, and a switch

at each station operated by the body of the receiver to close and to open said branches, substantially as described.

5. In a telephone system, a series of station apparatus, each comprising a transmitter, a receiver, push-button and bell, a single battery charging the transmitters and bells in multiple-arc branches, a number of lines, one for each station and permanently connected with the same, and a hand-switch at each station for connection with any one of the other lines, whereby each station may call to and speak with any other station without disturbing the remaining stations.

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

CORNELIUS HERZ.

Witnesses:
GEORGE WALKER,
JOSEPH LYONS.