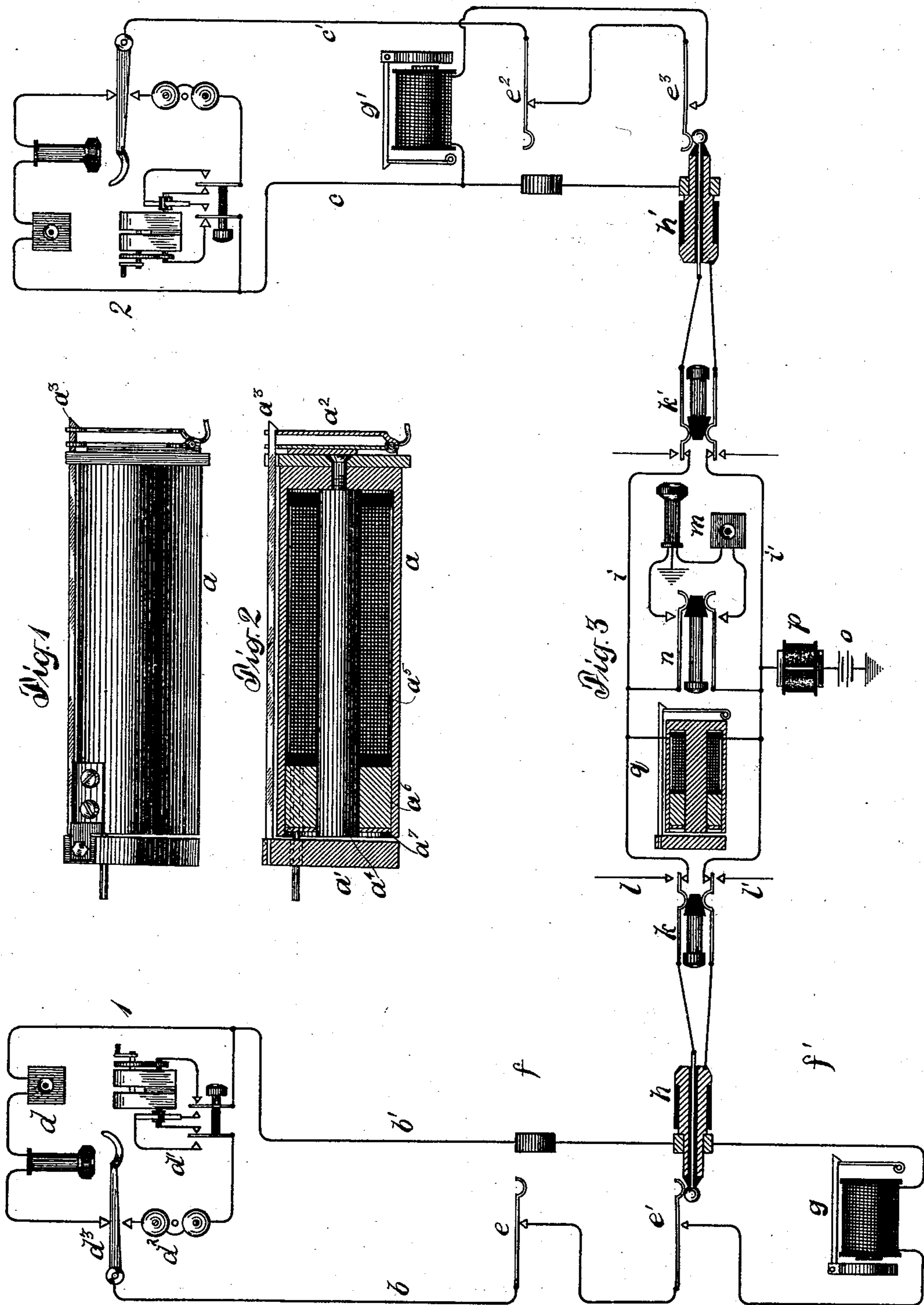


(No Model.)

C. E. SCRIBNER.  
TELEPHONE EXCHANGE APPARATUS.

No. 509,186.

Patented Nov. 21, 1893.



WITNESSES  
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# UNITED STATES PATENT OFFICE.

CHARLES E. SCRIBNER, OF CHICAGO, ILLINOIS, ASSIGNOR TO THE WESTERN ELECTRIC COMPANY, OF SAME PLACE.

## TELEPHONE-EXCHANGE APPARATUS.

SPECIFICATION forming part of Letters Patent No. 509,186, dated November 21, 1893.

Application filed February 21, 1893. Serial No. 463,222. (No model.)

*To all whom it may concern:*

Be it known that I, CHARLES E. SCRIBNER, 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 No. 322,) 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 exchange switch board apparatus, and consists, first, in a clearing out annunciator adapted to respond to pulsating currents and continuous currents, but not to currents of the alternating type, which annunciator is adapted to be included between a pair of telephone lines at the central office to serve as a clearing out annunciator.

My invention consists, second, in telephone lines extending each from a subscriber's station thereon to the central office, a switching apparatus combined with a clearing out annunciator, said annunciator being adapted to respond to continuous or pulsating currents, but not to alternating currents sent over the lines with which the annunciator may be connected. This annunciator may be connected at the central office between the different sides of the circuit formed by connecting two telephone lines together, and when so connected, while serving its function of a clearing out signal receiving instrument to respond to continuous current or pulsating current, as the case may be, sent over the circuit from either subscriber's station, does not permit the voice currents or telephonic currents to be shunted through the same from one side of the circuit to the other; nor will the said annunciator respond so as to be operated by any alternating currents that may be sent to line.

In the drawings which are illustrative of my invention, Figure 1 is a side elevation of my annunciator. Fig. 2 is a longitudinal central sectional view thereof. Fig. 3 represents diagrammatically the line circuits extending from two substations to the switching apparatus at the central office.

The annunciator, as illustrated in Figs. 1 and 2 comprises a tubular electromagnet  $a$

provided with a pivoted armature  $a'$  opposite its poles, and a pivoted indicating shutter  $a^2$ , the latter being normally engaged and held in its vertical position by a catch  $a^3$  controlled by the armature  $a'$ , but being adapted to fall into a horizontal position when disengaged. Upon the core  $a^4$  of the annunciator is wound the usual helix  $a^5$  of fine wire. Encircling the core at its extremity, nearest the armature  $a'$ , is a cylinder or thick tube  $a^6$  of copper; and outside of this, next the armature, is placed a thin disk or washer  $a^7$  of iron.

In the operation of this device a continuous current finding circuit through the coil  $a^5$  magnetizes the coil  $a^4$ , the lines of force finding a return circuit therefrom through the armature  $a'$  and the shell of the tubular electromagnet, a small proportion of them being shunted from the armature by the thin iron disk  $a^7$ ; hence the armature is attracted, disengaging the shutter  $a^3$ , and the latter falls into its horizontal position. Again, when a pulsating current of constant direction traverses the helix  $a^5$ , the latter tends to magnetize the core  $a^4$ , as before, but the first pulsation of the magnetism generates a current in the cylinder  $a^6$  which opposes the further magnetization of the core. Most of the lines of force set up in the nearly closed magnetic circuit of the coil persist, however, and the magnetizing force of the succeeding pulsation of current encounters less opposition. Thus successive pulsations of current finally produce a full magnetization of the core, and the armature is attracted, releasing the shutter as before. On the other hand, when an alternating current finds circuit through the helix  $a^5$ , each pulsation or half wave of current produces an induced current in the copper cylinder, tending to demagnetize the core, or that extremity of it which is most immediately influenced by the copper cylinder; and as each pulsation or half wave differs in direction from the preceding pulsation, its magnetizing effect is opposed not only by the counter effect of the current in the copper cylinder, but also by the more or less intense magnetization of the core in the opposite direction. Thus the alternating current pro-

duces but a very feeble magnetization of the core, and the armature remains inert.

The copper cylinder constitutes a mass of metal of low magnetic permeability, which is adapted to be threaded by the magnetic lines of force of the magnet. In Fig. 3 are shown two substations 1 and 2 connected by telephone line circuits  $b b'$  and  $c c'$ , respectively, with springjacks and annunciators at the central office. The substations are equipped with apparatus of ordinary character.

A telephone set  $d$  is provided, a calling generator  $d'$  with its switch key, a signal bell  $d^2$  and a switch  $d^3$ . The circuit connections are so arranged that when the telephone rests upon the switch hook  $d^3$ , the bell  $d^2$  and the calling generator  $d$  are connected in circuit between the different sides  $b b'$  of the line circuit, but when the telephone is removed from the hook, as shown in the drawings, the bell and generator are disconnected from the line, and the telephone and microphone are connected with it. The generator is so connected with its switch key that in the normal position of the latter, alternating currents are sent to line when the generator is operated; but when the key is depressed, the springs thereof are connected with a commutator upon the generator and receive a pulsating current of continuous direction.

The line circuit  $b b'$  is shown connected with two spring-jacks  $e$  and  $e'$ , which may be assumed to be upon different sections  $f$  and  $f'$  of a multiple switchboard, and with a calling annunciator  $g$  which is supposed to be located upon the section  $f'$  of the switchboard. The line circuit  $c c'$  from substation 2 is likewise connected with two springjacks  $e^2 e^3$  and with an annunciator  $g'$ , which, however, is placed at the switchboard  $f$  so as to be under the care of a different attendant. The lines are shown connected together into a continuous metallic circuit through connecting cords at the section  $f'$  of the switchboard by means of the terminal plugs  $h h'$  of the cord circuit and the springjacks of the different lines. Each terminal plug is provided with contact pieces adapted to make connection with corresponding contact pieces of a springjack into which it may be inserted; like contact pieces of two plugs  $h h'$  are connected together by means of conductors  $i i'$ . Two calling keys  $k$  and  $k'$  have their contact points included in the cord circuit  $i i'$  so that by depressing the corresponding key either plug  $h$  or  $h'$  may be disconnected from the other and connected with the poles  $l l'$  of a calling generator, not shown, to send calling signals over a line with which the cord is connected. A telephone set  $m$  is provided for the attendant operator, connected with contact points of a listening key  $n$  by which she is enabled to connect the telephone with the cord circuit, or to disconnect it therefrom.

To that strand of the connecting cord which joins the sleeves of the two connecting plugs one pole of a battery  $o$  is connected, the other

pole being grounded; a retardation coil  $p$  is included in the branch between the battery and the cord circuit in order that when several cord circuits are connected with the same battery  $o$ , leakage of telephonic currents from one cord circuit to another shall be prevented. This battery is provided for testing purposes, its function being to electrify the exposed ferules or test rings of all the springjacks of the line to which the cord circuit is connected, to a difference of potential from the earth, in order that an operator at another switchboard may determine that the line is in use before attempting to make connection with it, by testing the electrical condition of the test rings of the line by means of a grounded telephone. A clearing-out annunciator  $q$ , such as that shown in Figs. 1 and 2 and hereinbefore described, is permanently connected in a bridge or branch circuit between the different sides  $i i'$  of the cord circuit.

In the normal condition of the line circuits no connecting plug is inserted into any springjack of the line. A subscriber—for example, subscriber at station 1—desiring to have connection established between his line and some other terminating at the central office, rotates his calling generator, sending a signaling current over the lines  $b b'$ , which finds circuit through the annunciator  $g$  at the central office. The annunciator is thus actuated and indicates the signal to the operator at the section  $f'$  of the switchboard. The operator thereat at once inserts one plug  $h$  of a pair into the springjack  $e'$ , whereby the annunciator  $g$  is disconnected from the line circuit, and the circuit from station 1 is continued to the cord circuit  $i i'$ . The operator then depresses the plunger of her listening key  $n$ , connecting her telephone with the cord circuit, and receives the order for the connection desired,—in this instance, with the line to station 2. She then tests the springjack of that line at her section  $f'$  of the switchboard to determine whether the line is already in use or not, by applying the tip of the other plug  $h'$  of the pair to the thimble or test ring of the springjack  $e^3$ . If the line be already in use, the test rings are connected at some other switchboard with a grounded battery  $o$ , and hence a current will find circuit from the test ring through the telephone of the operator making the test, and will give a click in the telephone which will signify to the operator that the line is already in use. Assuming, however, that the operator finds the line to station 2 not in use, she inserts the other connecting plug  $h'$  of the pair fully into the springjack  $e^3$ , whereby the circuit of the annunciator  $g'$  of that line is opened, and the line circuit is connected with corresponding portions of the cord circuit  $i i'$ . The two substations are now connected together in a continuous metallic circuit. The operator may send a calling signal to station 2 by depressing the plunger of ringing key  $k'$ , and when the subscriber at station 2 has responded and

removed his telephone from its switch hook, the apparatus is in position to permit of communication between the two subscribers. The operator, after sending the calling signal, disconnects her telephone set from the cord circuit and proceeds to attend to other business. If, however, the subscriber at station 2 fails to respond to the call signal sent by the operator, the subscriber at station 1 may replace his telephone upon the switch hook, and, without depressing the key of his generator, may again rotate his generator to send an alternating current upon the lines. This current will find circuit to station 2 and will operate the call bell thereat; a portion of the signaling current will be shunted through the clearing-out annunciator *q*, but will not operate this annunciator, as explained in connection with Figs. 1 and 2. When the subscribers have finished their conversation, either of them may send a pulsating signaling current upon the line circuit by rotating his generator, and, at the same time, depressing the key, which pulsating current, finding circuit through the annunciator *q*, will operate the same and indicate the signal for disconnection to the attendant operator, who will thereupon remove the plugs from the springjacks.

In some exchange systems it is customary for the calling subscriber to send the call signal over the completed circuit to the station with which his line is connected, the operator merely establishing connection between the two lines. My invention is particularly useful in such a case. The calling keys *k* and *k'* may then be omitted, if desired, the operator simply establishing connection between two lines in response to a request from the subscriber of one of them, and informing the calling subscriber that such connection has been made; the calling subscriber then sends an alternating calling current upon the line to call the subscriber with whom he is connected.

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

1. The combination with two telephone lines each extending from a substation to a central station, of conductors joining the telephone lines at the central station, and a clearing-out drop connected with the said conductor comprising an electromagnet having a movable armature for completing its magnetic circuit, and an auxiliary closed conducting circuit encircling some portion of said magnetic circuit, whereby alternating signaling currents may be sent over connected lines without operating the clearing-out annunciator, substantially as described.

2. The combination with two telephone lines each extending from a substation to a central station, of conductors joining two telephone lines at the central station, a clearing-out annunciator connected with the said con-

ductors comprising an electromagnet and armature therefor, a tube or cylinder of conducting material closely surrounding the core of said electromagnet, and sources of pulsating or alternating signaling current adapted to be connected with the said line, substantially as described.

3. The combination with two telephone lines each extending from a substation to a central station, of a conductor at the central station joining the two telephone lines into a continuous circuit, and a clearing-out annunciator connected in a bridge between the different sides of said circuit, said annunciator being provided with a tube or cylinder of conducting material closely encircling some portion of its core to prevent the full magnetization thereof by alternating currents, substantially as described.

4. The combination with a cord circuit of a telephone switchboard, of a clearing-out annunciator connected in a bridge between the different conductors or strands of the cord circuit, said bridge circuit being of high resistance and retardation, said annunciator having a conducting tube or cylinder closely encircling a portion of the magnetic circuit of its electromagnet to prevent the full magnetization thereof by alternating currents, and having also a bridge of magnetic material partially completing the said magnetic circuit independently of the armature, substantially as described.

5. The combination with a telephone circuit provided with means for sending calling currents either constant or alternating in direction, of an annunciator connected in a bridge between the different sides of the circuit, said annunciator being arranged to be irresponsive to alternating currents by encircling a portion of the magnetic circuit of its electromagnet by an auxiliary closed conducting circuit, substantially as described.

6. In a telephone exchange system, the combination with a telephone circuit and means for sending current over said circuit of constant direction or of the alternating character, at will, of a clearing out annunciator in a bridge between the different sides of the circuit at the central office, said annunciator being provided with a mass of metal of low magnetic permeability adapted to be threaded by the magnetic lines of force of the magnet of said annunciator; and provided also with a drop controlled by the armature thereof; whereby on sending current of constant direction over the line the drop is thrown down, and whereby voice currents or alternating currents sent over the line are retarded and prevented from passing from one side of the circuit to the other through the bridge, while the annunciator remains acquiescent, substantially as specified.

7. The combination in an electric annunciator, of the drop or target controlled by the armature lever, the core provided with a copper

cylinder near the armature, and the disk or washer of iron placed next to the armature, substantially as and for the purpose specified.

5 8. The tubular electro magnet provided with the pivoted armature opposite the poles thereof and a pivoted indicating shutter, in combination with the core of the annunciator and the helix wound about the core, means for sending alternating current through said helix, and the cylinder or thick tube of copper  
10 outside this core and near the armature; whereby the force of an alternating current

sent through the helix is expended in producing current in the said copper cylinder, thereby maintaining the pole presented to the armature practically neutral, substantially as  
15 and for the purpose specified.

In witness whereof I hereunto subscribe my name this 6th day of January, A. D. 1893.

CHARLES E. SCRIBNER.

Witnesses:

ELLA EDLER,  
A. P. BENNOCK.