

(No Model.)

2 Sheets—Sheet 1.

M. G. KELLOGG.
TELEPHONE EXCHANGE.

No. 587,004.

Patented July 27, 1897.

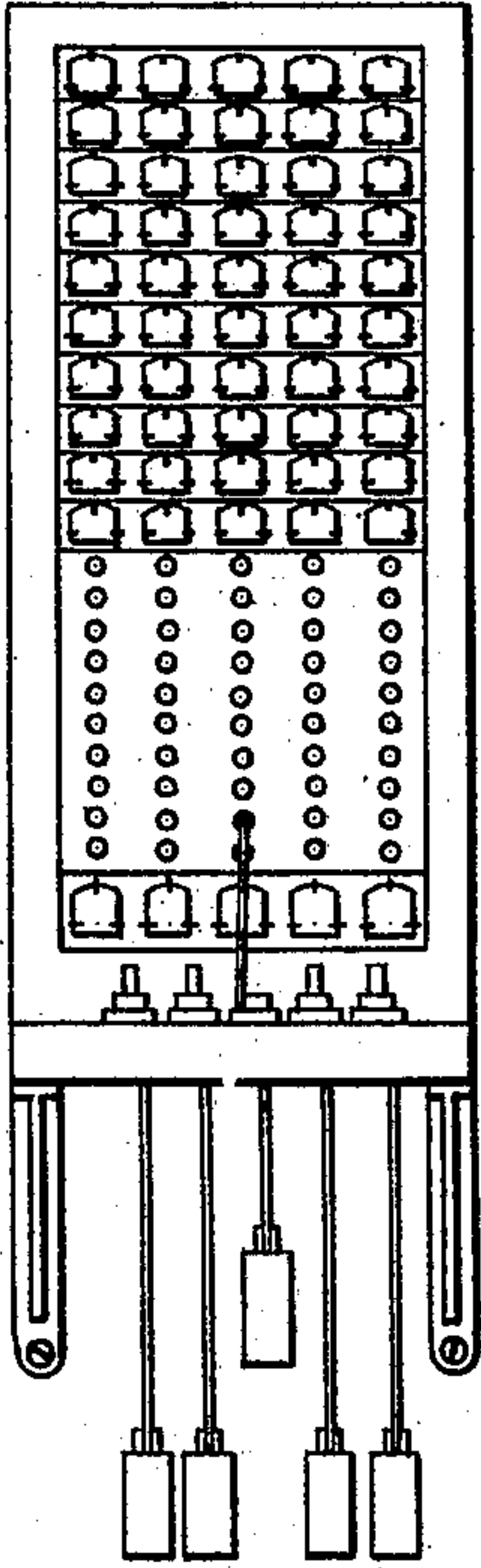


Fig. 1

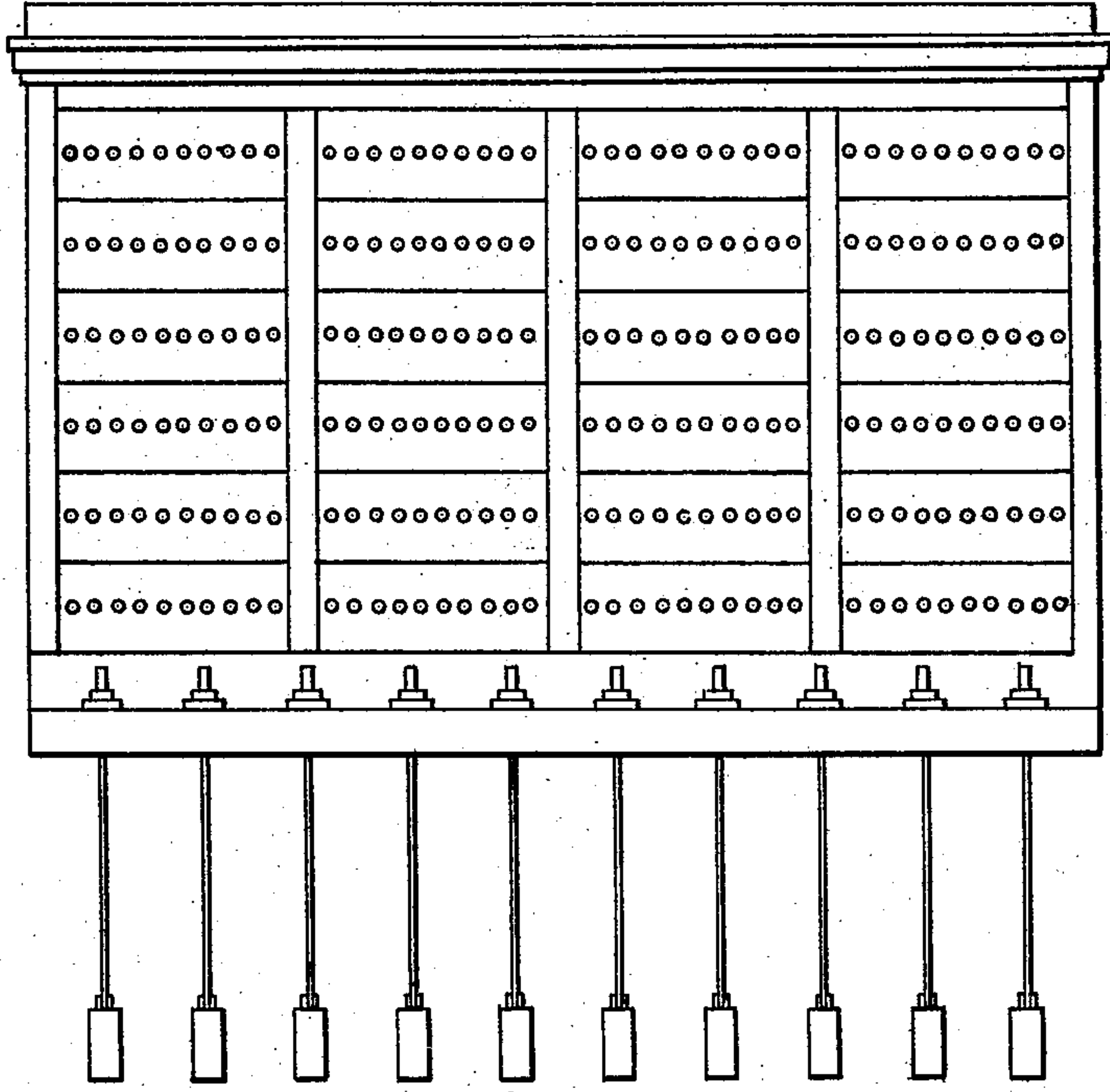


Fig. 2.

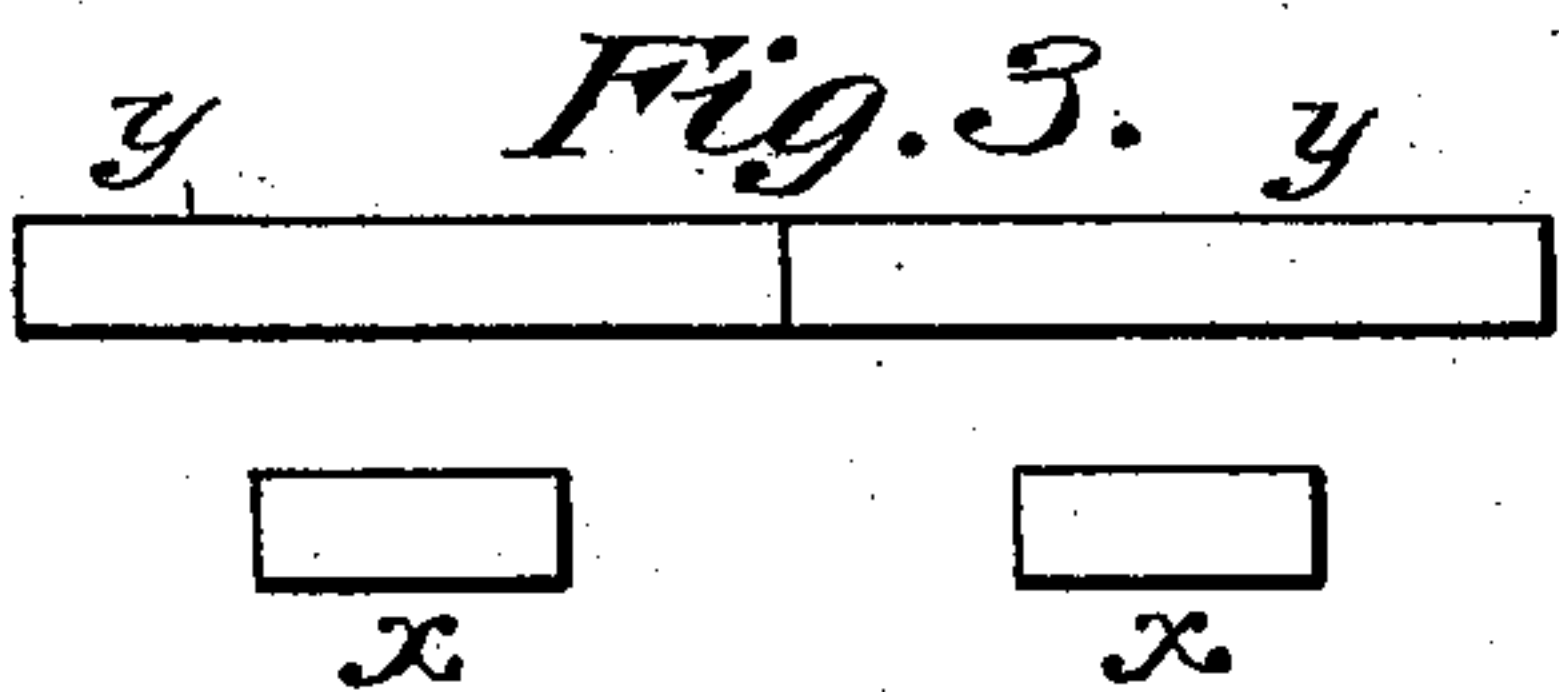


Fig. 3.

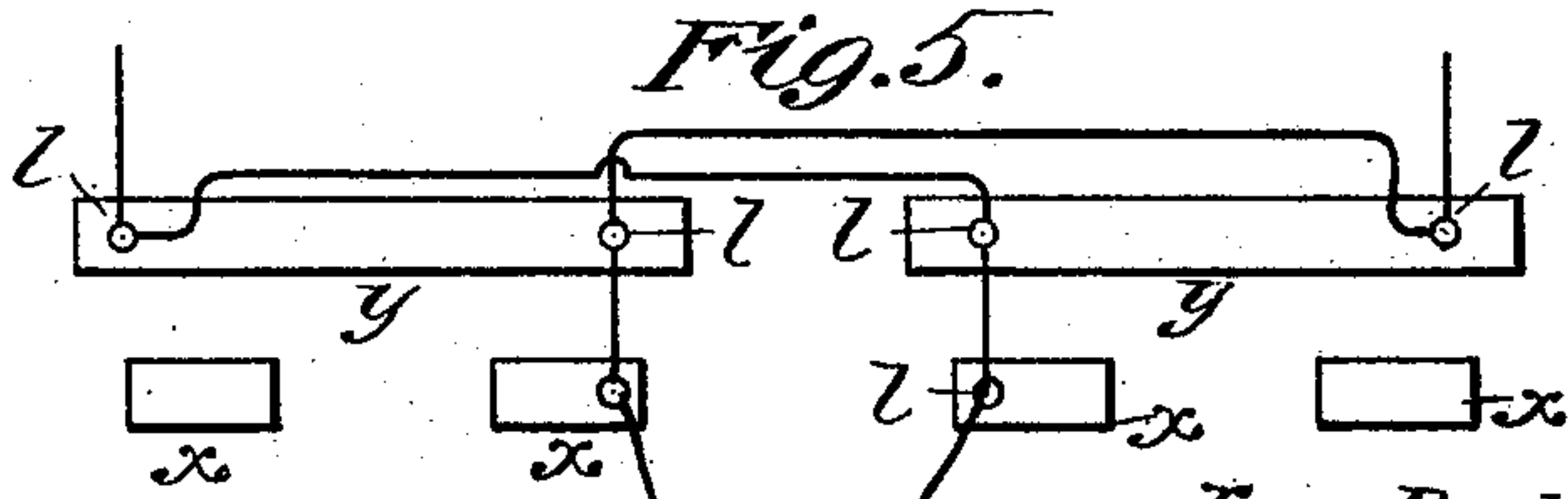


Fig. 5.

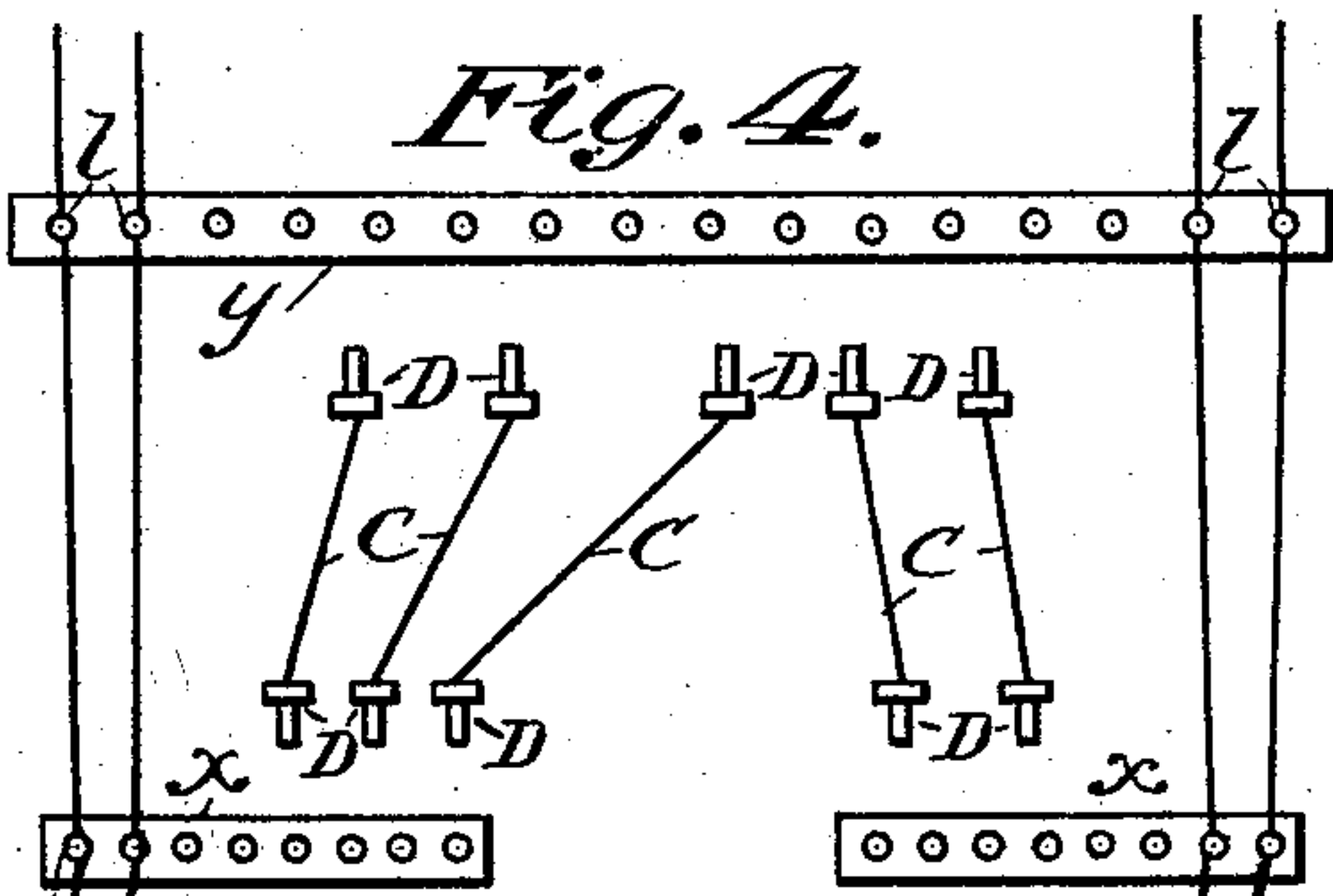
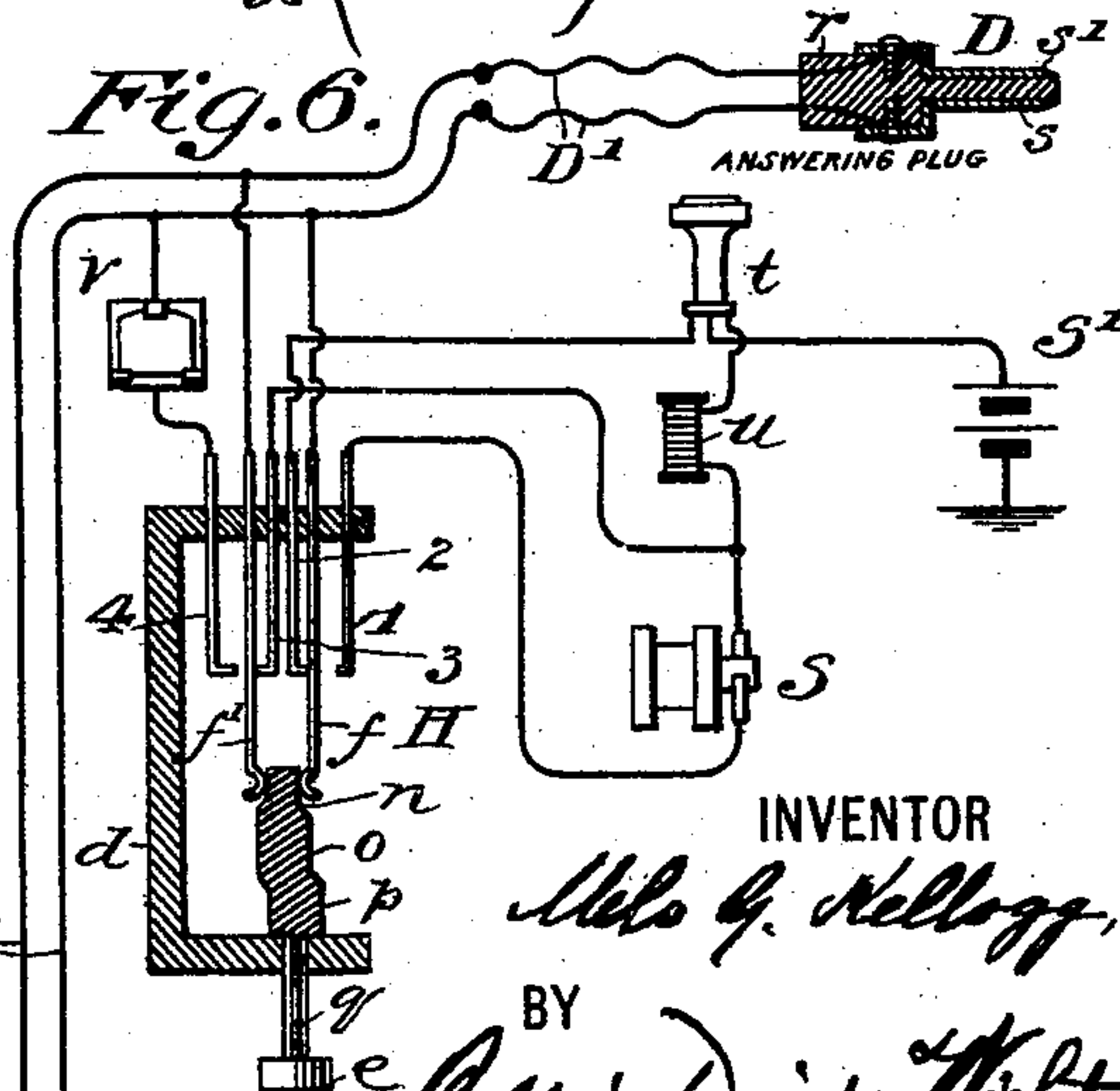


Fig. 4.

Fig. 6.



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ATTORNEYS

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2 Sheets—Sheet 2.

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Fig. 7.

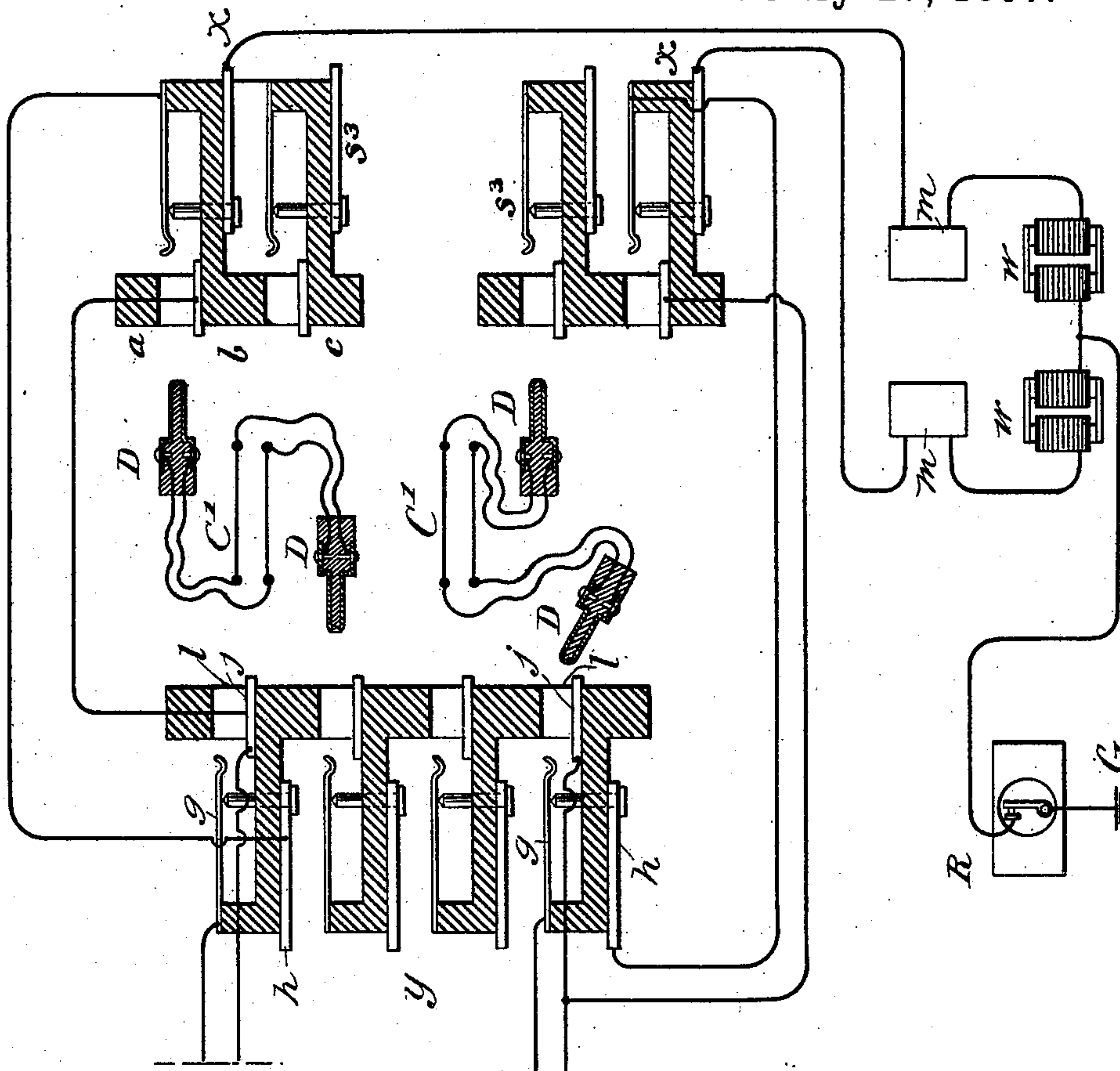
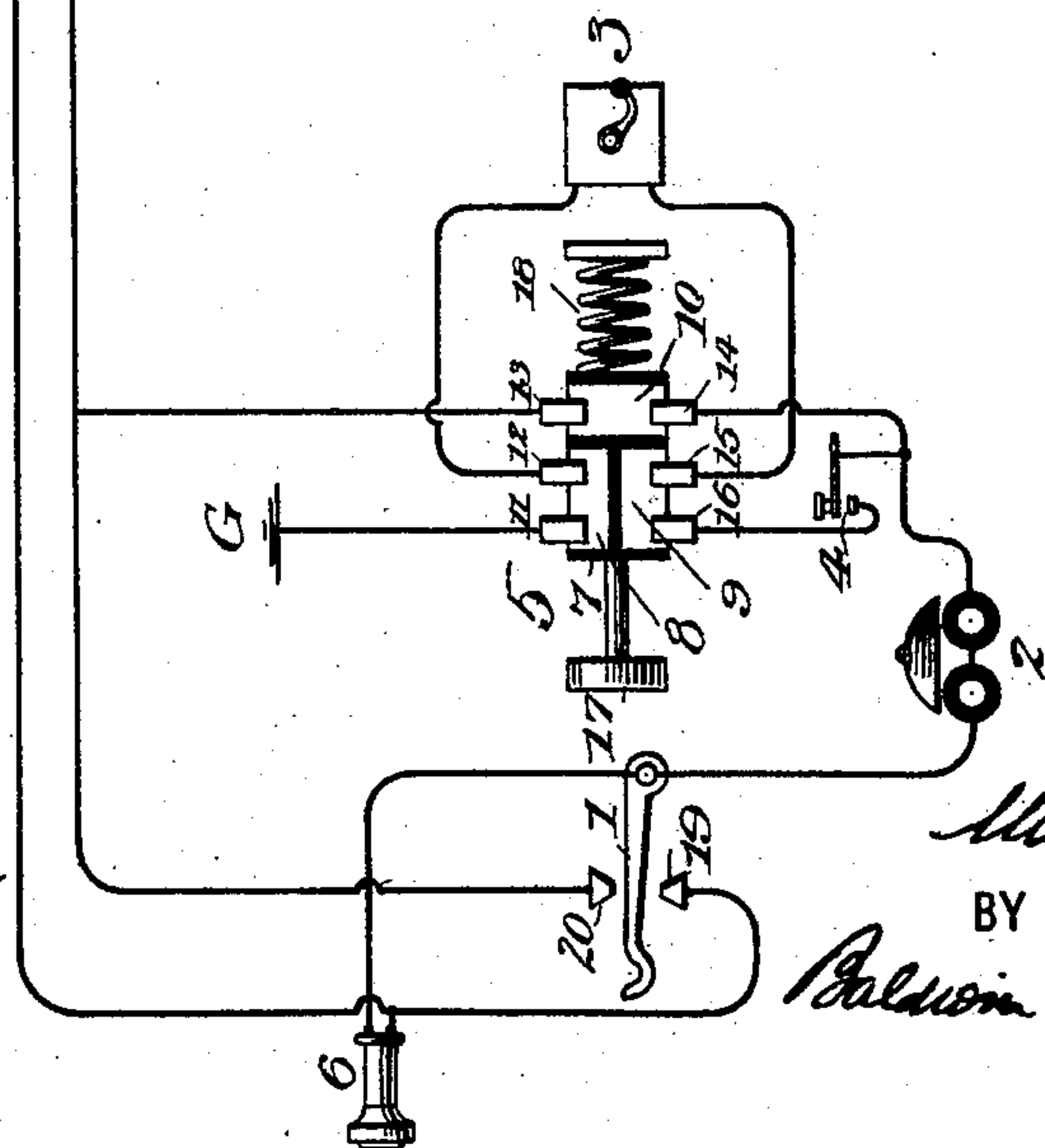


Fig. 8.



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UNITED STATES PATENT OFFICE.

MILO G. KELLOGG, OF CHICAGO, ILLINOIS.

TELEPHONE-EXCHANGE.

SPECIFICATION forming part of Letters Patent No. 587,004, dated July 27, 1897.

Original application filed July 26, 1890, Serial No. 360,083. Divided and this application filed June 15, 1895. Serial No. 552,919. (No model.)

To all whom it may concern:

Be it known that I, MILO G. KELLOGG, a citizen of the United States, residing at Chicago, Cook county, State of Illinois, have invented certain new and useful Improvements in Telephone-Exchanges, of which the following is a full, clear, exact, and concise description, reference being had to the accompanying drawings.

My invention consists in a telephone-exchange system which I shall herein describe and claim in detail.

The number of lines which can be conveniently operated in a multiple-exchange system is limited by the number of line-switches and apparatus which can be placed on the front of a board sufficiently small for the operator to conveniently reach any switch to make the test and switching connections with it.

I plan an arrangement of the calling and switching apparatus which will increase the number of lines which can be conveniently operated at a board. It is applicable to the system hereinafter described and also to other multiple systems and to systems which are not multiple.

Heretofore the spring-jack switches, calling-annunciators, clearing-out annunciators, and answering-switches which belong to an operator or board have generally been arranged in a vertical space or frame as high and as long as the operator can conveniently reach. The calling and clearing-out annunciators are generally placed near the bottom of the frame and the answering-switches are placed near them. The other switches are placed above, and the number of lines which can be operated is limited by the remaining space in the framework.

I plan to divide the switchboard apparatus into two parts or sections, which for convenience I designate the "answering-section" and the "calling-section" of the board. At the answering-section are placed in convenient arrangement all the calling-annunciators located at the board and a switch for each line which has its calling-annunciator at the board. Preferably, also, I locate the clearing-out annunciators at the answering-section. On the calling-section of the board are switches, one for each line of the exchange,

which the operator may require to connect to in order to answer calls from other lines. One plug and cord of each pair of cords and plugs and its switching device is located at the answering-section and the other cord and plug is located at the calling-section of the board. The calling-sections of a class of boards in the system described in this application and of all the boards in the usual exchange system should preferably be placed side by side in a row and the answering-section of a board placed in front of the calling-section, either facing it or at right angles to it, with just enough space between the two so that the operator can conveniently move and work between them. Where two operators work at one board, the answering-section may be divided into two parts, each with the switches and annunciators of the lines assigned to one operator to answer and with her complement of cords and plugs and their switching devices.

In some forms of switchboards one calling-section may contain switches for all the lines of the exchange. In other forms of switchboards the calling-sections may be duplicated according to the multiple-switchboard form of operation, each duplicate board having a switch for each line of the exchange.

In the form of multiple switchboards known as the "divided-exchange system," described in my Patent No. 424,310, the lines of only one division of boards may have switches on any particular calling-section.

In the drawings illustrating my invention, Figure 1 is a front view of an answering-section, and Fig. 2 is a front view of a calling-section, of the switchboard which is my invention. Fig. 3 is a ground plan showing the relative arrangement and position in the telephone-office. Fig. 4 is a ground plan showing the relative arrangement and position where several answering-sections are used with one calling-section. Fig. 5 is a ground plan showing the arrangement where the multiple-switchboard system of operation is employed. Fig. 6 shows a pair of operator's switch-plugs adapted to be placed in the switches of the lines at the sections where they are placed, together with the flexible cord-conductors, the clearing-out annunci-

ators, the switching device belonging thereto, the operator's telephone and calling-generator, and the office-connecting circuit. Fig. 7 is a diagram showing the connections of two lines to a calling-section and to two answering-sections of the exchange, one line being connected to each answering-section, together with two pairs of switch-plugs, each pair acting as terminals of a connecting-circuit, one plug of each pair being located at the calling-section, while the other plug of one pair is located at one answering-section and the other plug of the other pair is located at the other answering-section. Fig. 8 is a diagram of the subscriber's-station apparatus which may be used to illustrate my invention.

In the drawings, G is in each case a ground connection, y y calling-sections, and x x are answering-sections of the switchboard. The sections x form the answering-section of the board where the calls of subscribers are indicated, and the section or sections y form the calling-section of the board at which the lines of wanted subscribers are connected. These sections are interconnected by conductors C C , terminating at each end in connecting-plugs D . In the arrangement shown in Fig. 3 there will be switch-plugs at each answering-board x and at each calling-board y , and the corresponding plugs between the respective boards will be connected by their connecting-conductors C . In Fig. 4 there are plugs and connecting-conductors C between each answering-board x and the calling-board y . In Fig. 5 there are like connections between each answering-board and its calling-board y , but not to other calling-boards.

In Fig. 3 each line will have a switching device on each board x and y . In Fig. 4 each line has a jack on one section x of the answering-division of boards and one jack only on the calling-division y . In Fig. 5 each line has a jack on one section x of the answering-division of boards and on each section or boards y of the calling-division.

It is customary in multiple-switchboard operations to place two and more generally three operators at each section or board. When two operators in my system work at one board, the answering-section may be divided into two parts, each with the switches and annunciators of the lines assigned to one operator to answer and with her complement of cords and plugs and their switching devices. In Fig. 3 there may thus be one, two, or more operators making plug connections on x y , and in Figs. 4 and 5 the number of operators at the two divisions of boards may be similarly arranged, according to the amount of work for them to do.

In the operator's cord system shown in Fig. 6 are a pair of double or loop switch-plugs adapted to be inserted into the spring-jack switches of the boards. When a plug is inserted into a switch, it operates it as heretofore indicated. The two contact-pieces of each plug are connected to the other apparatus, as

will be described, by the two insulated conductors of a loop flexible switch-cord.

r is the rubber insulation of the plug, and s s' are its two insulated contact-pieces.

H is a switching device for the pair of plugs and cords. This switching device has a rubber frame (marked d) which supports and insulates the various parts.

f f' are two contact-springs.

1, 2, 3, and 4 are contact-points located and insulated as shown and which form connections with the springs f f' , as will be described.

q is a sliding rod which passes through the standard of the frame d . It terminates at one end in the knob e , which is placed in a convenient position for the operator to manipulate to draw the rod in and out to carry on the switching operations, as will be described.

n o p is an irregularly-shaped rubber piece placed at the end of the rod q . The different sections or divisions of this rubber piece are marked n , o , and p , respectively, as indicated. The rod q carries them in its reciprocating movement, and altogether they may be called the "commutator-piece" of the switching device.

All the parts are constructed, insulated, mounted, and adjusted to perform the switching operations which I shall describe.

The button e and the piece p furnish stops for the commutator-piece, which limit its inward and outward motions.

When the commutator-piece is pushed in until its outer stop is close to or against the standard of the frame d , the springs f f' rest on piece p , and f' is in contact with 3 and f is in contact with 1. When the commutator-piece is pulled out into its central position and the springs rest on o , spring f is out of contact with 1 and 2 and spring f' is in contact with 4. When the commutator-piece is pulled still farther out and the springs rest on n , f' is in contact with 3 and f is in contact with 2.

t is the operator's telephone. S is her calling generator or battery. S' is her test-battery, and u is a resistance-coil. Each operator has one telephone and resistance-coil and may have one generator and battery.

y is a clearing-out annunciator, which may be unpolarized. There is one such annunciator for each pair of connected plugs.

The connections of the operators's cord system are as follows: The two contact-pieces s s of the pair of plugs are connected together by means of their connecting-conductor. The other two contact-pieces of the plugs s' s' are connected together by their connecting-conductor. The two conductors or circuits which connect said pairs of plug contact-pieces are connected to the contacts f f' of the switching device, spring f being connected with s s and f' with s' s' . The contact-points 2 and 3 of the switching device are connected together through the operator's telephone and resistance coil and 1 and 3 are connected to-

gether through her calling-generator. The clearing-out annunciator is connected on one side to spring 4 and on the other side to the circuit which connects *s s*. The test-battery is grounded on one side and connected on the other side to the circuit-wire which connects the two telephone-coils.

The operators have as many pairs of switch plugs and cords with their switching devices and clearing-out annunciators as they may need for their work. The cords should be long enough so that an operator can reach any switch at her board and the apparatus should be suitably mounted for her work. The commutator-piece of each switching device should stand normally, or when it is not in use for switching a pair of lines, in its outer position, so that its springs rest on *n*. The switching devices *H H* of the pairs of cords are located at the answering-section.

In Fig. 7, *y* is the calling-section, and *x x* are the two answering-sections shown. In section *y* four line-switches are shown, (marked *S*²), and in each section *x x* two line-switches are shown, each marked *S*³. Each of the switches, as shown, has a contact which normally bears on a contact-point, but is separated from the point while a switch-plug is inserted into the switch, and has a third or insulated contact-piece insulated from the rest except by the circuit-connections. This third or insulated contact-piece is placed along the switch-hole, so that a plug can be applied to it for testing and so that one of the contact-pieces of a loop switch-plug inserted into the switch will form connection with it. The switches are adapted to receive the loop switch-plugs shown in Fig. 6, and when a plug is inserted in a switch it raises the spring from the contact-point on which it normally bears, and the two contact-pieces of the plug form connection with the spring and third or insulated piece of the switch, respectively.

g g are the contact-springs of the switches, *h h* the contact-points on which the springs normally bear, and *j j* the third or insulated contact-pieces of the switches.

a b c are rubber strips of the shape substantially as shown on which the metal parts of the switches are mounted and through the fronts of which are the switch-holes *ll*. These holes are rectilinear and are adapted to receive and guide the switch-plugs and cause them to operate the switches, as indicated.

The calling-annunciators *m* (shown in Fig. 7) are annunciators of known construction. Each annunciator responds or indicates a call when an electric current passes through it. *ww* are retardation-coils, one for each line of the exchange. Each of these retardation-coils contains two spools or helices of insulated wire, each helix surrounding an iron core. The two cores are connected at their two ends by two cross-bars of iron. The helices are so connected together as to magnetize in the same direction the closed magnet-circuit made by the iron pieces of the coil.

R is an electric rheotome or circuit-breaker, which may be of substantially the shape shown or of other forms by which an electric circuit may be alternately made and broken. In the rheotome shown there may be a gear movement actuated by a spring, which in its operation alternately makes and breaks the connection between two insulated contact-points. The metallic-circuit lines are connected to the central-office switchboards and apparatus as follows: One side or branch of a line is connected to all the contact-pieces *j j* of the switches of the line on the different boards. The other side or branch of the line passes normally successively through the several pairs of contacts *g h* of the switches of the line on the different boards, passing in each case to the spring *g* first and then successively through the annunciator *m* and resistance *w* of the line to one of said insulated contact-points of the rheotome *R* common to all lines. The other contact-point of the rheotome is connected to the ground. The last pair of contacts *g h* of the line is situated at the answering-board, and the annunciator of the line is located at this same board.

In Fig. 7 the two lines shown are first connected to the calling-board *y*, and each of them is then connected to an answering-board.

The subscriber's outfit shown in Fig. 8 includes his telephone-switch 1, the bell or signal receiver 2, the calling-generator 3, a calling-key 4, a disconnection or clearing-out switch 5, and the subscriber's telephone 6. The switch 5 is a reciprocable block of insulating material 7, upon which are mounted conducting-plates 8 9 10. The grounded contact 11 and generator-contact 12 are normally crossed by the plate 8. The contact 16, connected to the contact-anvil of the key 4, and the generator-contact 15, are normally crossed by the plate 9. The line-contacts 13 14 are crossed, normally, by the plate 10. These connections are not altered when the subscriber operates the generator 3 for a call. When, however, the clearing-out signal is sent, the button 17 is pushed, thereby reciprocating the switch against the push of the spring 18, and the contacts 12, 13, 14, and 15 are crossed, respectively, by the plates 8 and 9, thereby introducing the generator into the metallic circuit of the line.

Normally or while the subscriber's telephone is not in use the contact 19, connected to lever 1, short-circuits the telephone set 6. While the telephone is in use, the contact 20, connected to the lever 1, short-circuits the bells 2.

The calling-key 4 has two points normally out of contact, but brought into contact by the subscriber when he wishes to call the central office. The clearing-out switch may be of the well-known form which switches an instrument from one circuit to another. The circuits, contacts, and connections are substantially as shown. The subscriber's sta-

tion apparatus should be so connected into the line-circuit that when the calling-key 4 is depressed the calling-generator 3 will be between the ground connection thereby established and the normal ground connection of the line at the central office through the line-annunciator.

The line-annunciators, as heretofore stated, are distributed among the answering-sections of the board, and each annunciator is at an answering-section where its line has a switch. Each line also has a switch at its answering-section and a switch at the calling-section of the exchange. When the calling-section is duplicated or has multiple boards or sections, each line has a switch upon each of the multiple sections, as required for the operation of the multiple-board system.

The operation of the system is as follows:
 20 When a subscriber desires to call the central office, he depresses his calling-key, which establishes a closed circuit from his earth connection and one limb of the line and his annunciator at the central office, thereby operating
 25 his annunciator located at one of the answering-sections. The operator at this section sees the signal and places one of her switch-plugs D, located at the answering-section, into the switch of the line at that section, thereby dis-
 30 connecting the line from its normal ground connection through its annunciator and the rheotome. She then, with her telephone bridged across between the two cord-conductors of the plug and thereby in the metallic
 35 circuit of the line, finds out what line is wanted. She then turns to her calling-board and completes the connection in the usual manner with the other plug. Then by mov-
 40 ing the commutator-piece of the switching device H, belonging to the plugs used in making the connection and which device is located at the answering-board, she loops or
 bridges her calling-generator between the two cord-conductors and sends a calling-current,
 45 which will ring the bells of the subscriber wanted. She then moves the commutator-piece, so that the calling-generator is disconnected, and the clearing-out annunciator of the pair of plugs is bridged across the circuit,
 50 and the two lines are then connected into a complete metallic circuit for conversation, and the circuit is bridged at the central office by the clearing-out annunciator. In this way
 her three independent supervisory appli-
 55 ances (telephone, generator, and clearing-out signal) are looped or bridged into the metallic circuit.

The test system is as follows: The operator desiring to test any line to determine whether
 60 it is in use at any board places a contact-piece of the switch-plug to which her telephone may be connected on the contact *j* of the switch of the line. If, then, the line is not switched for conversation, there is a closed circuit estab-
 65 lished from ground through the test-battery and the coil of her magneto-telephone to the contact-piece of the plug and thence to the line

and through the circuit of the line, by way of the subscriber's station, back to the central office and successively through the closed
 70 pairs of contacts *g h* of the switches of the line and thence through the rheotome to ground. The operator will then distinguish in her telephone the makes and breaks of the
 75 rheotome and will know that the line is not in use. Should, however, the line be in use, by the placing of a switch-plug in one of the
 switches of the line this closed circuit will be interrupted by the opening of the pair of con-
 80 tacts *g h* of the switch and the operator will not be able to distinguish the make and break of the rheotome. She will then know that the line is switched for use.

In my invention herein described the two sections—that is, the answering-section and
 85 the calling-section—are distinct and apart from each other over different floor-spaces, so that the several parts of the two are not in the same vertical space and frame of a switch-
 board over which an operator must reach the
 90 several parts. It therefore is distinguished from such organizations as that shown in O'Connell's patent, No. 430,748, in which the
 calling-switches and the answering-switches
 95 of the lines are not in two sections of the switchboard which are distinct and separately placed apart from each other, as in the system herein described, but are in the same
 framework, over the front surface of which,
 up and down and sidewise, an operator must
 100 reach in making the switchboard connections and answering the calls.

This application is a division of my application, Serial No. 360,083, filed July 26, 1890.

I claim as my invention—

1. In a telephone-exchange system, multiple switchboards each divided into two sections, which are distinct and placed apart
 105 from each other over different floor-space, an answering-section containing the annunciators and switches of the lines whose calls are to be answered at the board and a calling-section containing two switches on which the op-
 110 erator may call and connect any line which she has answered, the calling-sections being placed end to end and the answering-sections each convenient to and in front of its calling-section, substantially as set forth.

2. In a telephone-exchange switchboard system, the combination of the switchboard
 120 apparatus divided into two parts or sections, an answering-section and a calling-section which are placed apart from each other and occupy different framework placed over dif-
 125 ferent floor-space, telephone-lines each having a terminal at the answering-section and a terminal at the calling-section and circuit connections between the two sections, by which a terminal of one line at the answer-
 130 ing-section may be connected with the terminal of another line at the calling-section.

3. In a telephone-exchange switchboard system, the combination of the switchboard apparatus divided into two parts or sections,

an answering-section and a calling-section which are placed apart from each other and occupy different framework placed over different floor-space, telephone-lines, each having a terminal at the answering-section and a terminal at the calling-section and an annunciator at the answering-section, and circuit connections between the two sections whereby the terminal of a line at the answering-section whose annunciator indicates a call may be connected with the terminal of another line at the calling-section.

4. In a telephone-exchange switchboard system, the combination of the switchboard apparatus divided into two parts or sections, an answering-section and a calling-section which are placed apart from each other and occupy different framework placed over different floor-space, telephone-lines, each having a terminal at the answering-section and a terminal at the calling-section and an annunciator at the answering-section, central-office telephone apparatus and switching apparatus at the answering-section to at will connect operator's telephone apparatus with any line having an annunciator there, and circuit connections between the two sections whereby the terminal of a line at the answering-section whose annunciator indicates a call may be connected with the terminal of another line at the calling-section.

5. In a telephone-exchange switchboard system, the combination of the switchboard apparatus divided into two parts or sections, an answering-section and a calling-section, the two sections being placed apart from each other and occupying different framework placed over different floor-space, telephone-lines, each running to the answering-section and to the calling-section, and circuit connections between the two sections whereby a connection may be made from a line at the answering-section to a line at the calling-section.

6. In a telephone-exchange switchboard system, the combination of the switchboard apparatus divided into two parts or sections, an answering-section and a calling-section, the two sections being placed apart from each other and occupying different framework placed over different floor-space, telephone-lines, each running to the answering-section and to the calling-section and having an annunciator at the answering-section, and circuit connections between the two sections whereby a connection may be made from a line at the answering-section to a line at the calling-section.

7. In a telephone-exchange switchboard system, the combination of the switchboard apparatus divided into two parts or sections, an answering-section and a calling-section which are placed apart from each other and occupy different framework placed over different floor-space and each of which is provided with switches, telephone-lines, each running to a switch at the answering-section and also to a switch at the calling-section,

and circuit connections between the two sections by which a line at the answering-section may be connected with another line at the calling-section.

8. In a telephone-exchange switchboard system, the combination of the switchboard apparatus divided into two parts or sections, an answering-section and a calling-section which are placed apart from each other and occupy different framework placed over different floor-space and each of which is provided with switches, telephone-lines, each running to a switch at the answering-section and also to a switch at the calling-section, and having an annunciator at the answering-section, and circuit connections between the two sections by which a line at the answering-section may be connected with another line at the calling-section.

9. In a telephone-exchange switchboard system, the combination of the switchboard apparatus divided into two parts or sections, an answering-section and a calling-section which are placed apart from each other, and occupy different framework placed over different floor-space, telephone-lines each having a terminal at the answering-section and a terminal at the calling-section, circuit connections between the two sections, by which a terminal of one line at the answering-section may be connected with the terminal of another line at the calling-section, two of said lines being thus connected together in a circuit for conversation and a clearing-out annunciator being then or while thus connected together in circuit with them.

10. In a telephone-exchange switchboard system, the combination of the switchboard apparatus divided into two parts or sections, an answering-section and a calling-section, the two sections being placed apart from each other and occupying different framework placed over different floor-space, telephone-lines, each running to the answering-section and to the calling-section, circuit connections between the two sections whereby a connection may be made from a line at the answering-section to a line at the calling-section, two of said lines being thus connected together in a circuit for conversation, and a clearing-out annunciator being then or while thus connected together in circuit with them.

11. In a telephone-exchange switchboard system, the combination of the switchboard apparatus divided into two parts or sections, an answering-section and a calling-section which are placed apart from each other, and occupy different framework placed over different floor-space, telephone-lines each having a terminal at the answering-section and a terminal at the calling-section, circuit connections between the two sections, by which a terminal of one line at the answering-section may be connected with a terminal of another line at the calling-section, two of said lines being thus connected together in a circuit for conversation and a clearing-out an-

nunciator being then or while thus connected together bridged across between the two sides of their combined circuit.

12. In a telephone-exchange switchboard system, the combination of the switchboard apparatus divided into two parts or sections, an answering-section and a calling-section, the two sections being placed apart from each other and occupying different framework placed over different floor-space, telephone-lines, each running to the answering-section and to the calling-section, circuit connections between the two sections whereby a connection may be made from a line at the answering-section to a line at the calling-section, two of said lines being thus connected together in a circuit for conversation and a clearing-out annunciator being then or while thus connected together bridged across between the sides of their combined circuit.

13. In a telephone-exchange system, a switchboard divided into two sections, an answering-section and a calling-section, on said answering-section the annunciators and switches of the lines whose calls are to be answered at the board, and on the calling-section the switches of the lines with which the operator may connect the calling-lines, in combination with pairs of switch-plugs adapted to be inserted for switching into said

switches, the contact-pieces of each pair being connected by flexible conducting-circuits, one plug of each pair being located at the answering-section, and the other plug of the pair being located at the calling-section, substantially as set forth.

14. In a telephone-exchange system, multiple switchboards, each divided into two sections, an answering-section and a calling-section, on said answering-section, the annunciators and switches of the lines whose calls are to be answered at the board, and on the calling-section, the switches of the lines with which the operator may connect the calling-lines, the calling-sections being placed end to end and the answering-sections near their calling-sections, in combination with pairs of switch-plugs adapted to be inserted for switching into said switches, the contact-pieces of each pair being connected by flexible conducting-circuits, one plug of each pair being located at the answering-section, and the other plug of the pair being located at the calling-section, substantially as set forth.

In testimony whereof I have hereunto subscribed my name.

MILO G. KELLOGG.

Witnesses:

E. S. WALKER,

H. M. WALKER.