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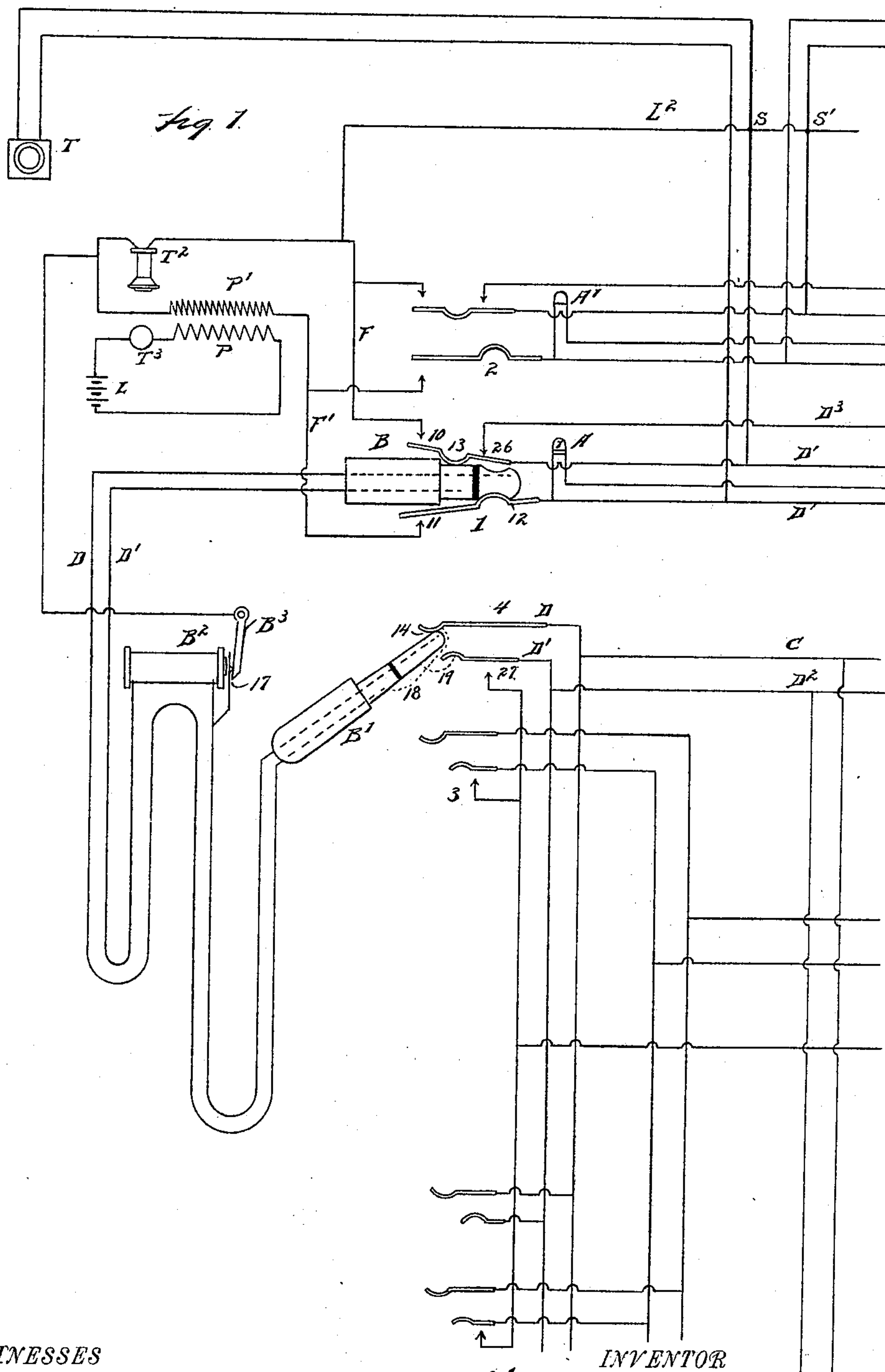
Patented Dec. 13, 1898.

T. F. AHERN.
TELEPHONE SWITCHBOARD.

(Application filed May 27, 1897.)

(No Model.)

6 Sheets—Sheet 1.



WITNESSES

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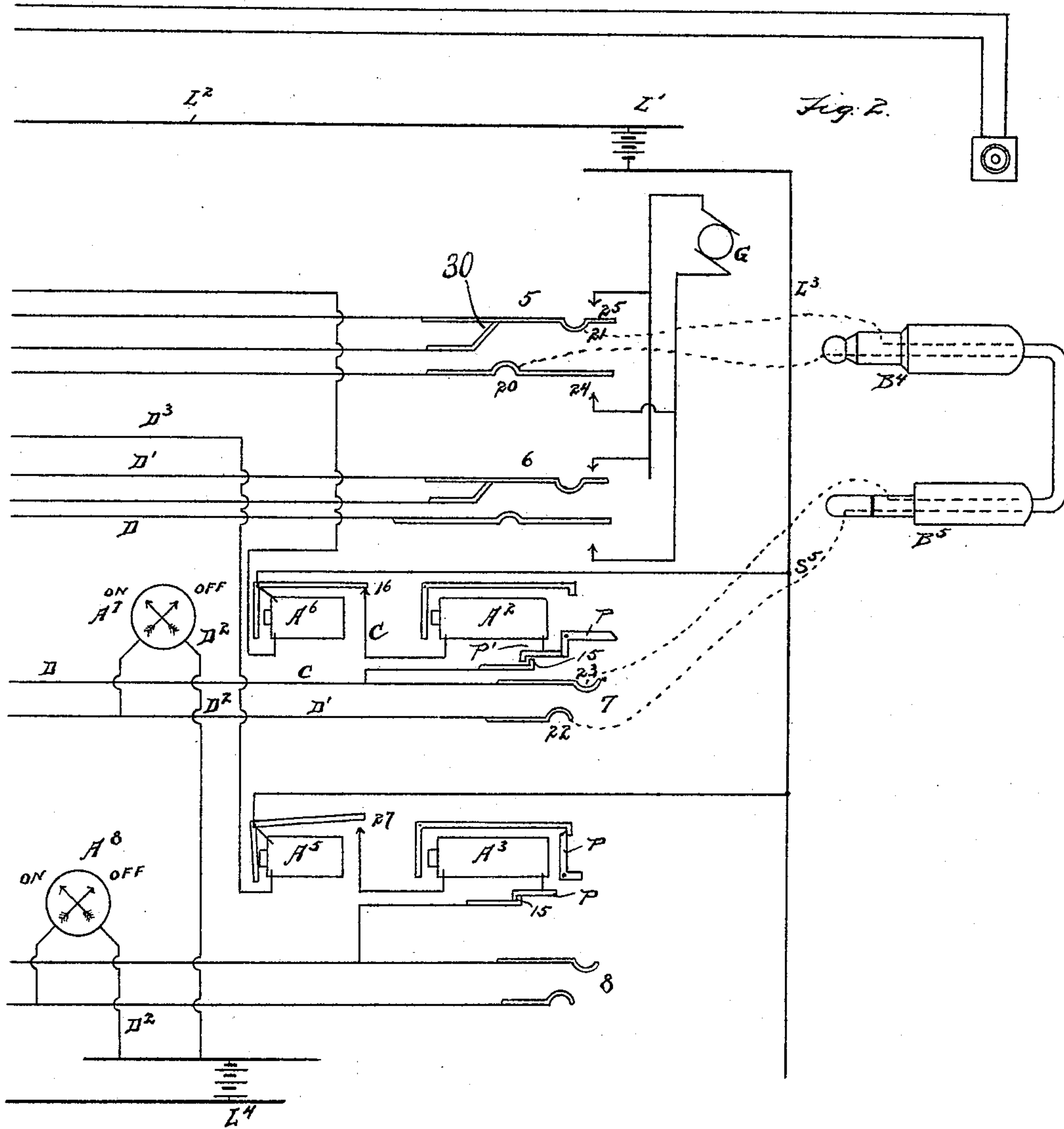
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6 Sheets—Sheet 2.



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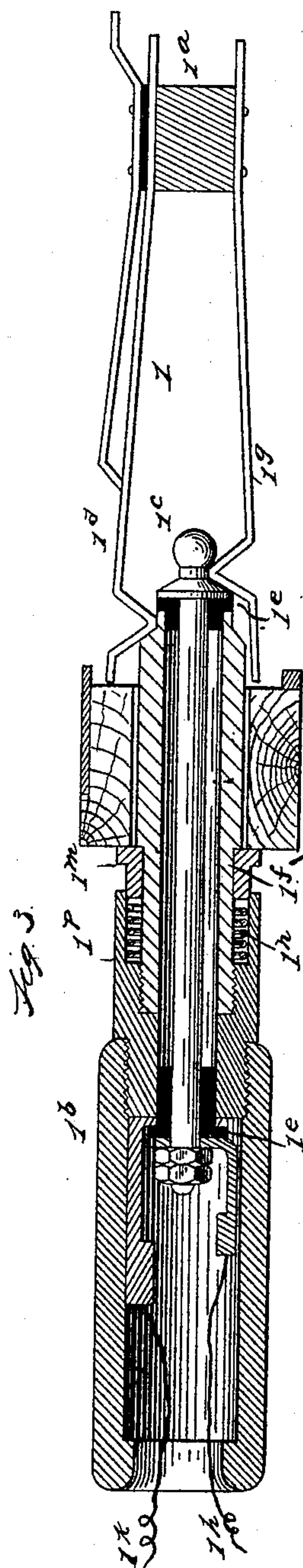
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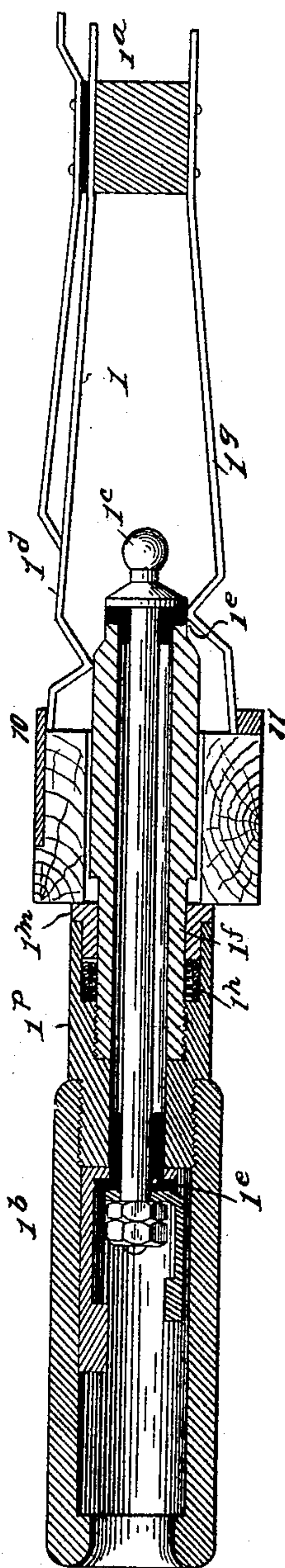
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6 Sheets—Sheet 3.



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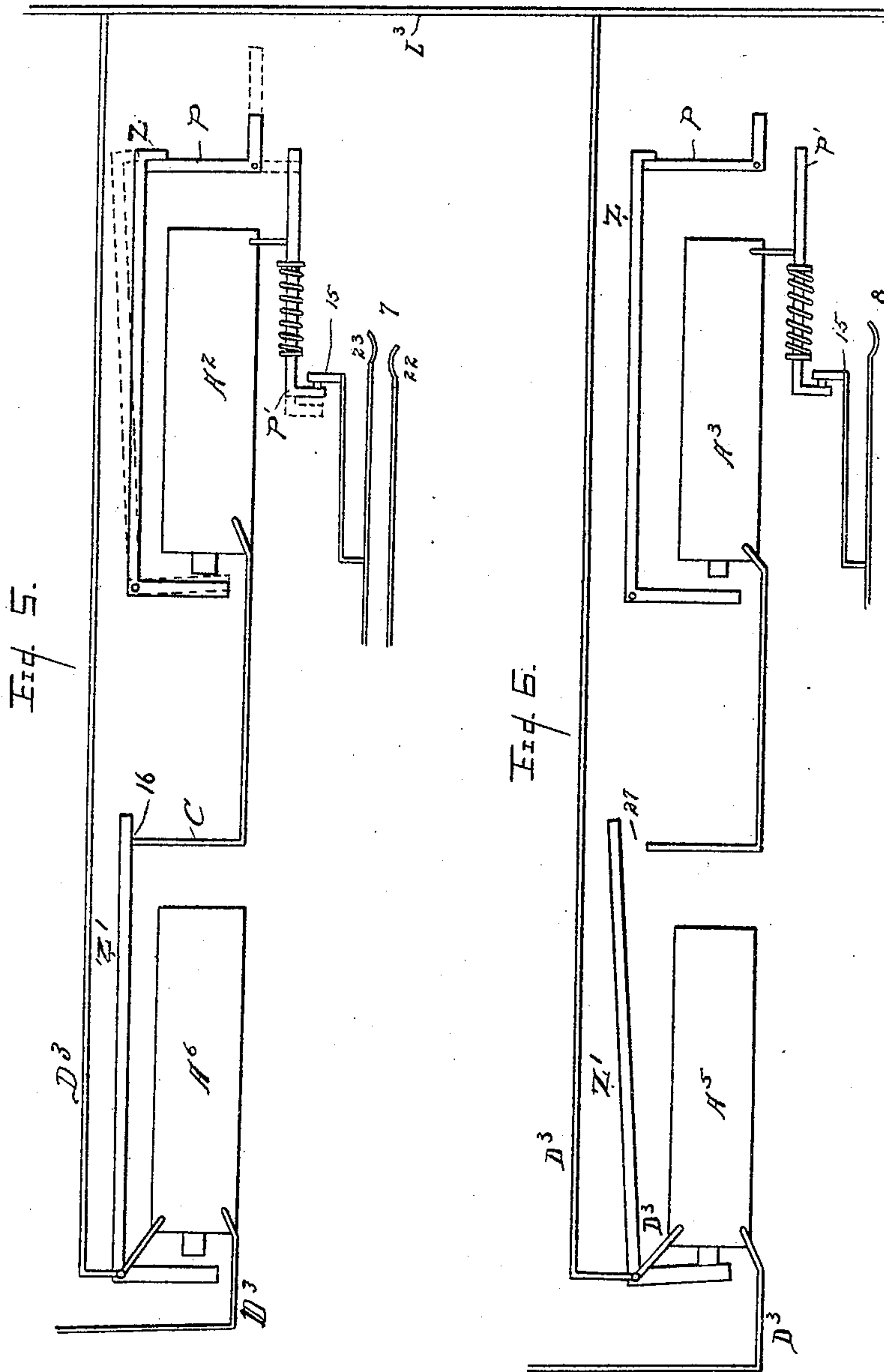
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6 Sheets—Sheet 4.



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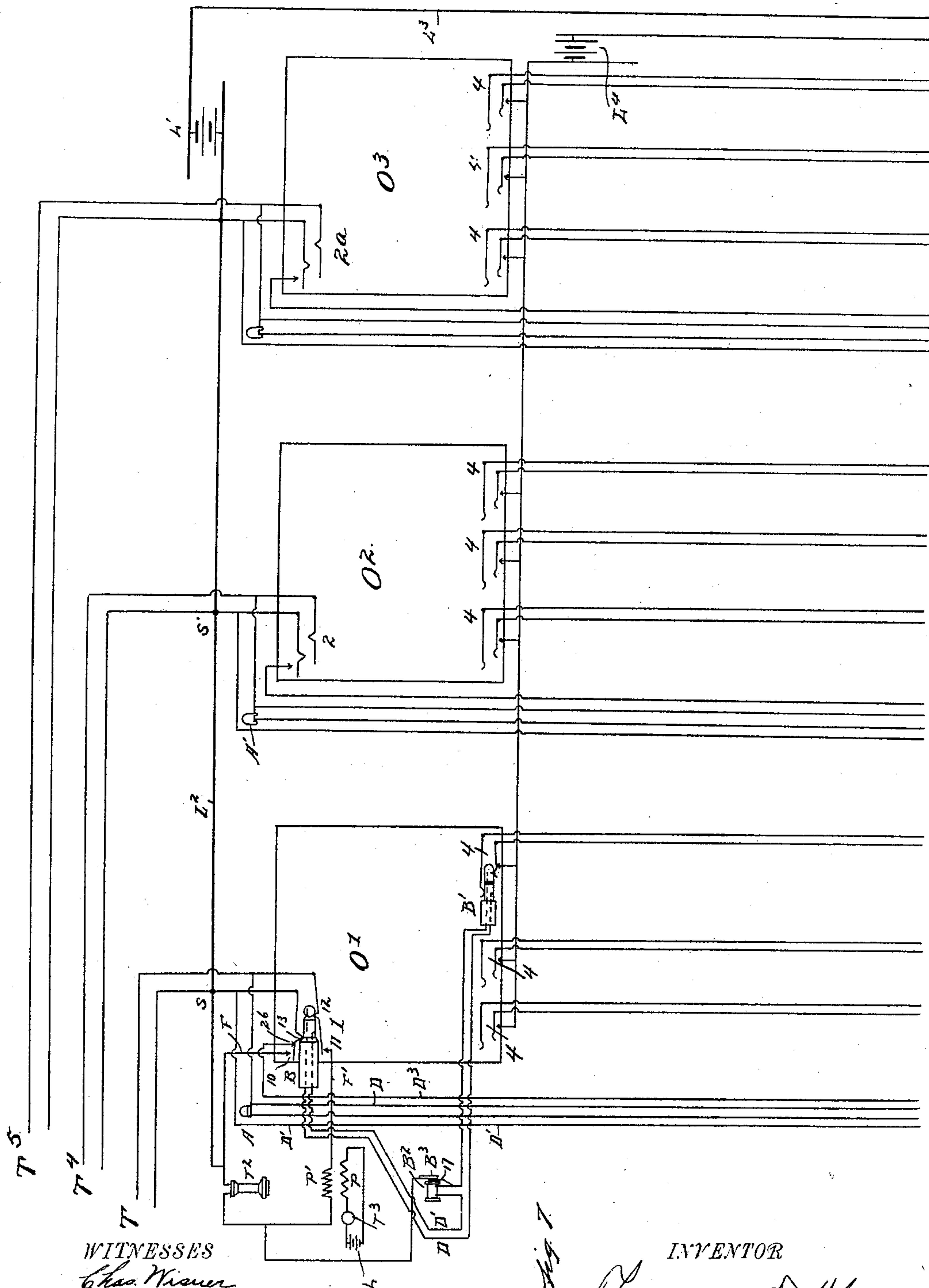
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6 Sheets—Sheet 5.



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6 Sheets—Sheet 6.

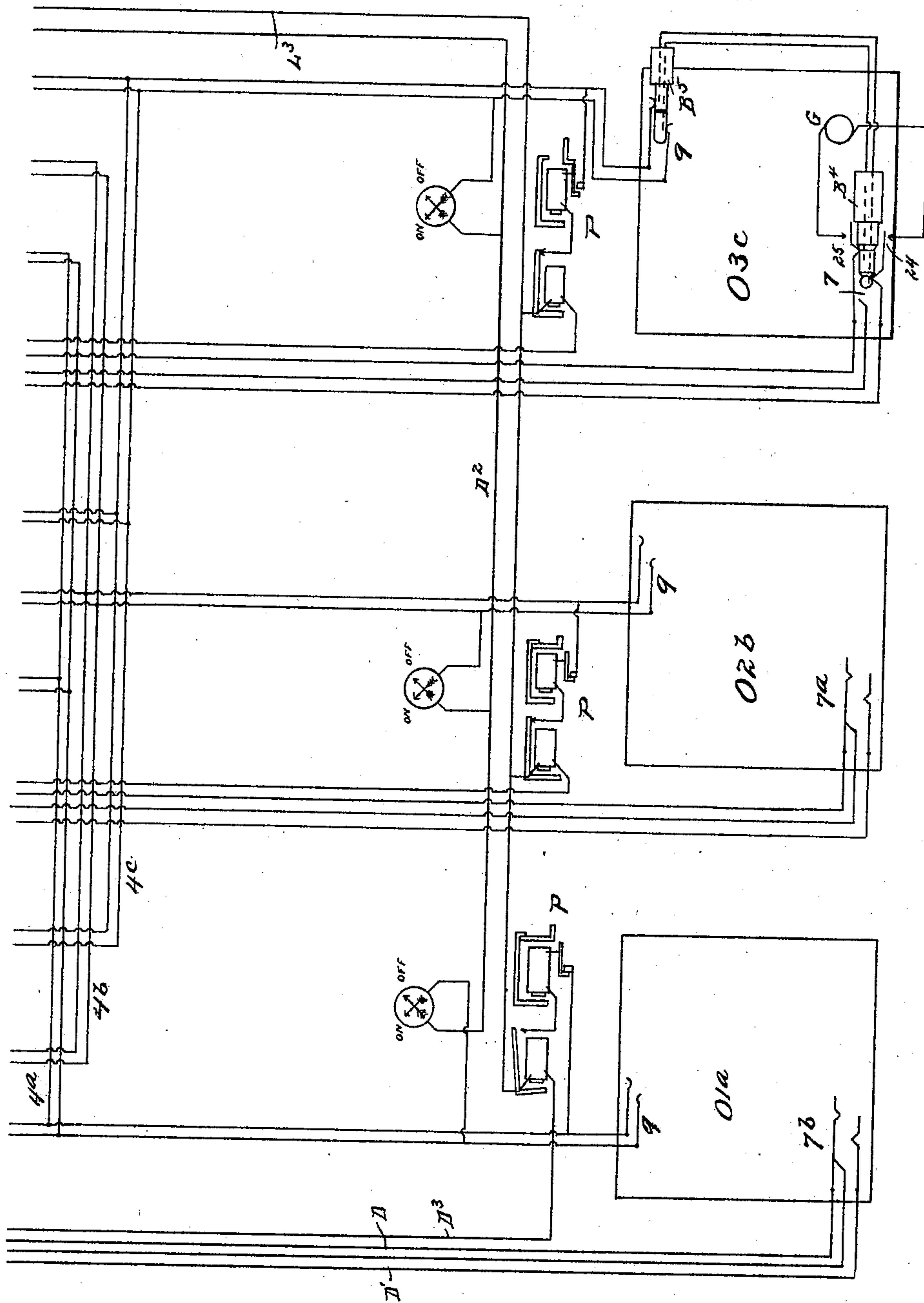


Fig. 8.

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UNITED STATES PATENT OFFICE.

THOMAS F. AHERN, OF DETROIT, MICHIGAN, ASSIGNOR TO THE DETROIT SWITCHBOARD AND TELEPHONE CONSTRUCTION COMPANY, OF SAME PLACE.

TELEPHONE-SWITCHBOARD.

SPECIFICATION forming part of Letters Patent No. 616,046, dated December 13, 1898.

Application filed May 27, 1897. Serial No. 638,330. (No model.)

To all whom it may concern:

Be it known that I, THOMAS F. AHERN, a citizen of the United States, residing at Detroit, county of Wayne, State of Michigan, have invented a certain new and useful Improvement in Telephone-Switchboards; and I declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it pertains to make and use the same, reference being had to the accompanying drawings, which form a part of this specification.

My invention relates to telephone-switchboards or switching apparatus for telephone-stations, and has for its object a division of labor on the switchboard, so that the work of the operators is very much simplified, the liability of errors very much decreased, and a construction of switchboard permitted which will accommodate a much larger number of subscribers than those ordinarily in use.

It consists in improved means for connecting any two subscribers' lines for conversation, to make the "busy" test by the operator for answering the subscriber's call, and in having the subscriber's call transferred from the operator at one division of the switchboard to the operator at another division of the switchboard, who connects with the called subscriber; also, improved means for disconnecting and ringing off when subscribers are through talking.

It also consists in various other combinations, all of which are hereinafter specified and claimed.

The system hereinafter described I designate as a "duplex-switchboard" system, and its general features consist in two separate series or banks of jacks, one of which is termed the "answering" division and the other the "connecting" division. Each subscriber's line enters the board and terminates in a pair of jacks, one in each section of the board. There is also a local jack in each section corresponding to each subscriber, such pair of local jacks being connected by trunk-lines. In addition thereto are annunciators in each division peculiar to each subscriber's line, so that in each division each subscriber has a terminal jack to his line, also a local jack and

an annunciator with appropriate switches, connections, and wiring, all as hereinafter more fully described.

There have heretofore been attempts to divide the labor between operators, one set answering calls and another set connecting called subscribers; but in none of these has the necessity of using common independent line-connecting speaking-telephones between the operators on each of these divisions been avoided. By my apparatus I enable the operator on the answering division not only to attract the attention of the operator on the connecting division, but to by one and the same signal indicate to such operator the subscriber called for.

In the drawings, Figures 1 and 2, Sheets 1 and 2, taken together, constitute a diagrammatic view of the two divisions of my improved switchboard, together with the connections, the two lines being placed as though they were joined at the right hand of Sheet 1 and at the left hand of Sheet 2 and the figures being enlarged for purposes of clearness and convenience. Fig. 1 represents the spring-jacks of the answering division, and Fig. 2 the spring-jacks of the connecting division. Fig. 3 is a detailed sectional view of an elastic plug and so much of a spring-jack as shows its operation. Fig. 4 shows the same plug in a slightly different position in the spring-jack from that of Fig. 3. Figs. 5 and 6 are enlarged views of the relays and annunciators upon the connecting division of the board. In these figures no attempt has been made to show their mechanical construction, only so far as is necessary to indicate the mode of operation. Figs. 7 and 8 are really one figure, representing my invention as applied and extended to a multiplicity of sections of a large board and illustrating a busy test.

Similar letters and numerals refer to similar parts.

In the drawings, Figs. 1 and 2, illustration is only made of so much of the switchboard and its sections as would indicate the common lines, trunk lines, and the lines of one calling and one called subscriber, with sufficient duplication to illustrate my invention and its mode of operation with any number of sub-

scribers, as it will be understood that the apparatus can be expanded by duplication to any assignable degree. No attempt is made to show specific features of mechanical construction which are common to all switchboards, annunciators, telephones, &c., as they do not in themselves constitute any portion of my invention, and the detail construction of these elements is fully understood by electricians.

In the drawings, T represents the telephone set of the calling subscriber, and T' the telephone set of the called subscriber.

T² is a telephone of the receiving-operator on the answering division, by means of which she communicates with the calling subscriber.

T³ is a transmitter on a local-battery circuit, of which L is the local battery, in which a primary coil P actuates the secondary of an induction-coil P' in the circuit of the operator's telephone in the usual manner, the whole constituting what is commonly known as the "operator's" set.

L' in Fig. 2 is a common generating-battery yielding power to a common line L².

In Fig. 1, 1 and 2 represent answering-jacks upon the answering division connected, as will be seen by tracing the lines, to the subscribers' sets on a metallic circuit. 3 and 4 are local spring-jacks, also located upon the answering division, and, as will hereinafter be described, constitute the switching means by which connection is made with the connecting division. The answering division of the switchboard, therefore, is comprised of two series of jacks, those called "answering-jacks" communicating with the subscribers' lines and those called "local jacks" communicating with the other division of the switchboard. 5 and 6 are spring-jacks on the connecting division, and also form terminals of lines from the subscribers' sets corresponding in this division to the spring-jacks 2 and 1 in the answering division. 7 and 8 are local jacks in the connecting division corresponding with the local jacks 4 and 3 in the answering division. It will be noted that all of these jacks are connected between the answering and the connecting divisions by the lines represented. I prefer not to give designating numbers or letters to the lines, but to describe them by letter by reference to circuits, and as the circuits may vary through the same line the line might be designated by different letters. By following the same letters through circuits any particular circuit can be understood.

In the answering division it will be noted that the calling-subscriber's set T ends in the answering-jack 1 and the called subscriber's set T' ends in the answering-jack 2.

A and A' are annunciators placed in the circuit of each subscriber's line, respectively, and located upon the answering division of the switchboard.

A² and A³ are diagrammatic views of drop-annunciators, called "local" annunciators

in the circuit between the two divisions and indicating upon the connecting division of the board.

In Fig. 1, on the answering division, B is the answering-plug; B', the local connecting-plug. The answering-plug B is constructed as shown in Figs. 3 and 4 and will be hereinafter described. There is, however, nothing new about the plug in itself. Double lines connect the two plugs B and B', which form at times parts of different circuits, to be hereinafter described. One line connects the tip of the plug with the collar of its companion. The other line connects the collar of the first plug with the tip of its companion, it being understood that the collars and tips are insulated and are adapted to make contacts in the usual manner in the spring-jacks. In one of the lines connecting the two plugs is a test-relay B², which is of the usual construction and actuates an armature B³. By means of this test-relay the operator set is thrown in parallel with a circuit, to be hereinafter described, and enables the operator's telephone to transmit the busy test to the operator in a manner to be hereinafter described. B⁴ is a local calling-plug, and B⁵ a local connecting-plug, upon the connecting division. These plugs are also connected by double line from the tip of one to the collar of the other, and vice versa. A⁵ is a relay located in line with a local drop-annunciator A³. A⁶ is a corresponding relay located in line with the local drop A². A⁷ and A⁸ are galvanometer-indicators connected and operating as described. L' is an independent local common battery to energize the connecting lines of a local portion of the two divisions of the switchboard. The solid lines between the parts specified indicate connecting wiring. Lines which have no terminals simply indicate continuations and duplications of the like parts in the switchboard.

In Figs. 3 and 4, 1 indicates a spring-jack; 1^a, the frame holding the same; 1^b, a sectional view of the plug inserted in the spring-jack in Fig. 3 and an outline view of a slightly different position when it is so inserted in Fig. 4. 1^c is the tip of the plug, forming a metallic contact with the upper spring 1^g. The black portions 1^e 1^e are insulating-blocks. 1^f is a metallic portion constituting the body of the plug. It will be noted that the tip 1^c is continued through and forms a continuation of the cord 1^h, and the body of the plug is continued by connection in the cord 1^k. Surrounding the body portion of the plug is a collar 1^m. This is loosely fitting and adapted to slide reciprocally, but is held forward by means of a coiled spring 1ⁿ, which also surrounds the body of the plug and fits in a recess from inside of a casing 1^p. This spring has sufficient resiliency to withdraw the plug in the position shown in Fig. 3 from a position shown in Fig. 4. It will be observed that the collar 1^m in Fig. 4 is compressed back against the casing 1^p, so that no

contact is made with the tip of the plug by the springs in the spring-jack. The springs, however, are forced outwardly until contacts are made at 10 and 11, as shown also in Fig.

1. The mode of operation of this spring-collared plug would therefore be that when the operator pressed it home, as hereinafter described and as shown at Fig. 4, contacts 10 and 11 would be made; but immediately upon withdrawing the pressure forcing the plug inward the spring-collar would automatically retract it, thus making the contacts with the tip and the collar of the plug, as shown in Fig. 3. To this construction of the plug I lay no claim in this application. Its general features are well known to all electricians, and I utilize its features of construction and mode of operation in effecting the tests and making and breaking connections that are peculiar to this divisional switchboard, and therefore describe it with sufficient particularity, so that it will be readily seen how its automatic action varies the connections.

The relays and annunciators are shown enlarged on Figs. 5 and 6, Fig. 5 showing the shutter P closed and held by the bell-crank armature Z of the relay A², and also showing contact 15 closed. The electric circuit derived from the common line L³ passes through the arm 21 of the armature of the relay A⁶, contact 16 being closed, energizes the relay A², and thence passes to the spring-actuated bar P' through contact 15 to line leading to spring-jack 7; but the energization of the relay A² actuates the bell-crank armature Z, allowing the shutter P to fall. This shutter on falling mechanically, coming in contact with the spring-actuated bar P', breaks contact 15. Thus, although indicating the station called for, it breaks the corresponding line, and no further impulse can be sent through the relay A². It will be noticed that this action of the relay A² is momentary. Fig. 6 shows the relay A⁵ and annunciator A³ of the supposed calling-line in its relation to the relay and annunciator of the called line, Fig. 5, where the entry of the plug in jack 1 makes contact 26, thus putting relay A⁵ on a line leading to common line L³, or in the circuit D³, which passes through the relay and by way of the pivot of its armature. The energizing of the relay actuates the armature and breaks contact 30 or the circuit from the common line L³, through the annunciator A³, preventing the actuating of the shutter P so long as contact 27 is open.

In describing how this apparatus operates it will only be necessary to describe and trace out the mode of operation on, first, the calling of one subscriber by another; second, placing the two in connection and discontinuing the special connection and restoring the normal connections after communication is closed; third, intermediately effectuating a busy test to ascertain if a subscriber is busy. Involved in these are the simultaneous cutting out of the subscribers' lines from all other lines on

the switchboard during the time they are in use and restoring them to normal conditions on the ceasing of communication, together with the operation of the indicators and indicator-circuits. Assuming that the calling subscriber at T calls the operator through the subscriber's circuit D D', this circuit, if traced out, will when in a normal condition pass through the annunciator A and operate the shutter, which drops and exposes the number of the calling subscriber, as shown in Fig. 1. Thereupon the operator inserts the inserting-plug B into the spring-jack 1, which belongs to that of the calling subscriber. She pushes it home against the force of the spring-collar, making contacts 10 11, which, by means of the circuit F F', puts the operator's telephone or set in line with the calling subscriber, which circuit is parallel to that through the annunciator A, there being sufficient impulse diverted by reason of the resistance of the annunciator to operate the operator's set. The office of the plug and spring-jack in making these two connections 10 and 11 is purely mechanical. So long as its corresponding plug B' of the pair is not in connection there can be no passage of current through the plug or its special connections. Through her set the operator ascertains the number of the called subscriber, which we will assume to be No. 2, with set T'. After ascertaining the called subscriber she releases the answering-plug, which, by the elasticity of the coiled spring 1ⁿ and the collar 1^m, (shown in detail in Figs. 3 and 4,) the plug is withdrawn from the extreme position to that shown in Fig. 1, thereby breaking the contacts 10 and 11, making a contact with the tip of the plug at 12 and with the collar at 13 preparatory to effecting a communication with subscriber's set T'. The dotted lines in the plug show the continuation of the circuit D and D'. The circuit D would therefore be continued on the lines connecting the plug to the local connecting-plug B', the return-circuit D' being also provided with and continuous through a test-relay B². The first thing the operator has to do after ascertaining the called subscriber's number is to ascertain if the line of that called subscriber is busy or to make a busy test. By reference to Fig. 2 it will be noticed that the common line from the common battery L' is connected at S on Fig. 1 with the line of the calling subscriber and at S' with the line of the called subscriber, and also through, by the continuation L³ at S⁵, with the local jack of the called subscriber in the connecting division of the switchboard on Fig. 2. This makes a circuit C, Fig. 2, through the armature of the relay A⁶, through contact 16, and the local drop-annunciator A² and a contact 15 (when closed, but shown open) with local jack No. 7, Fig. 2, thence through on the line C in Figs. 1 and 2 to contact 14, local jack 4, when the local connecting-plug B' has its tip presented to the opening of the local jack No. 4, and thence through the test-relay B² to the

collar of the answering-plug B. If the contact 15 is open, no action will take place in the test-relay, and the operator will get no response. If the contact 15 be closed, so as to make this circuit just described, the test-relay B² will be energized, drawing the armature B³, so as to make contact 17. This, it will be noticed, puts the operator's set in connection on circuit C back to the common line L², and its instantaneous action gives a click in the operator's telephone. At the same moment this constitutes the test, indicating to the operator that the line of the called subscriber is not busy, while the absence of the click indicates that the contact 15 is open, and hence that the line is busy. The action of the current, however, through the circuit C energizes the annunciator of the local drop A², withdraws the catch from the shutter in the usual manner, and its dropping downward longitudinally actuates a plunger p' and opens the contact 15, as shown in the drawings, Fig. 2, at the same time indicating to the operator on the answering division by the exposed number that the corresponding subscriber is called for. Hence after the call from whatever source, as these lines are trunk-lines connected to the common battery, the contact 15 is open while the shutter exposes the number and the subscriber's line is busy. To return to the function of operator No. 1 for the moment. As soon as she has indicated to the operator of the connecting division by opening the shutter of annunciator A² she manually replaces the shutter of the annunciator A, which is then ready to act as a disconnecting or ring-off signal, as hereinafter described. On so ascertaining that the line of the called subscriber is not busy the operator on the answering division proceeds to insert the plug B' into the local jack No. 4, Fig. 1, and in doing so breaks the contact 14, makes the contact 18 with the collar of the plug, as indicated by the dotted line, and contact 19 with the tip of the plug, as also indicated by the dotted line. Thus the circuits D D' are continued, ending in the local jack No. 7 upon the connecting division. In the meantime on ascertaining that the subscriber is called for the operator upon the connecting division takes one of a pair of plugs B⁴, which are connected by two lines in the usual manner, one having connection with the collar and the other with the tip, and vice versa, and inserts it into the calling-jack belonging to the called subscriber and marked upon the diagram as calling-jack No. 5. This, it will be noted, corresponds to the called subscriber's answering-jack 2 in the answering division, Fig. 1. Contact is made at 20 with the tip of the plug, as shown by dotted line connecting the two points, and at 21 with the collar of the plug, also shown by connections in dotted line. The opposite one of the pair of plugs, called a "local connecting-plug" B⁵, is inserted into the local jack No. 7 upon the answering division, as shown by the connect-

ing dotted lines. This insertion makes a contact 22 with the tip of the plug and continues circuit D' through the collar of a local connecting-plug B⁴, becomes circuit D' through the test-relay, and to the answering-plug B. This continues on circuit D', as marked, to the calling-subscriber's telephone set. Circuit D is continued to the called-subscriber's telephone set T', and circuit D' back to contact 21 on calling-jack 5. Thus the two subscribers are put in connection through the circuit D D', as described. When the calling-plug B⁴ is pushed home against the force of the spring-collar thereon, (it being constructed like the plug shown in Figs. 3 and 4,) it pushes out the springs on the spring-jack, making contacts 24 and 25, creating a circuit energized by the generator G, placing the generator-current on the called-subscriber's circuit, and indicating to the subscriber at his set that he is called. Contacts 20, 21, and 30 are at that instant broken; but the retraction of the plug by its automatic withdrawal, due to the action of the spring-collar, restores the connections 20 and 21 and breaks contacts 24 and 25. Contact 30 remains open, which cuts out the annunciator A' of the called subscriber, and as this contact is not restored by the retraction of the plug it remains out so long as the plug is in the spring-jack. The two subscribers then communicate. While they are communicating, the operator on the answering division having restored the drop of the annunciator A, as already stated, an impulse given by either subscriber (as it is now on the circuit of both subscribers) drops it the second time, which indicates that they are through. The circuit through the annunciator A being bridged between the circuits D and D' a sufficient impulse passes through this bridge to actuate the annunciator, the operator's set on the answering division being during this division cut out by the breaking of contacts 10 and 11. It is understood that when the plugs are removed the lines are restored to their normal position, the operator on the answering division again restoring the annunciator-shutter at A. Considering the line in its normal position and that the calling subscriber has called, as hereinbefore stated, and that the answering-plug B has been inserted in spring-jack 1, as hereinbefore stated, and the test for "busy" having already been made, as stated, the further insertion of the local connecting-plug into the spring-jack 4, Fig. 1, makes a connection 27 with circuit D², which is continued on the diagram Fig. 2 to an independent local common wire and to an independent local common battery L⁴. The circuit D² then continues to a galvanometer-indicator A⁷, this indicator being of the usual form of such indicators. Through this the circuit D² returns on Fig. 1 to contact 27, this circuit being energized by the local battery L⁴. The office of this battery is to energize galvanometer-indicators for each subscriber, as is shown at A⁷ and A⁸,

they being typical of all of them. It will be noted that this circuit returns upon the same path as the circuit D' through a portion of the line. The passage of the current through the indicator A⁷ shifts the needle from the word "Off," where it should be in a normal position, to the word "On," and thus affords a continuing indicator to the connecting operator in addition to that of the local drop A², the office of the galvanometer-indicator being to indicate at all times the fact that the connections are made in the local jack 4 by the insertion of a local connecting-plug B' and that the line of the called subscriber is thus continually in operation. The withdrawal of local connecting-plug B' would of course break the connection at 27, and at once the indicator would respond, and thus by the word "off" indicate to the operator in the connecting division that the line was no longer in use. So long, therefore, as the subscribers remain in connection the galvanometer indicates the fact by the indicator-finger pointing to the position "on." The operator at the answering division withdraws the plugs, which action indicates to the operator at the connecting division, by means of the galvanometer, which changes to "off," that she is also to withdraw the plugs B⁴ B⁵ and restore the line to the normal position. The operator on the connecting division also closes the local drop P to its original position, which restores contact 15 by virtue of a spring connection, forcing the plunger p' forward until the contact is made.

The original insertion of the answering-plug B into spring-jack 1 makes contact 26 in a circuit which will be marked D³. This circuit passes through relay A⁵, Fig. 2, and on common line L² on Fig. 1, (where it is also marked D³), through contact 26 in spring-jack 1, and on Fig. 2 to common line L³, the circuit being energized by the battery L'. This circuit is in operation while the plug B is inserted. On the withdrawal of the plug it is broken. This circuit energizes relay A⁵, which then withdraws the armature from contact 27, thus cutting off the relay A³. This relay A³ in Fig. 2 is the relay belonging to the calling subscriber. Therefore the entering of the inserting-plug B on the answering division, Fig. 1, operates to cut out this subscriber's local drop in the connecting division, Fig. 2, so that while he is in conversation no signal from any other bank of the switchboard that such subscriber is wanted can be sent to the operator on the connecting division, and, as already hereinbefore described, any other operator in any other bank on the connecting division, Fig. 2, will be unable to plug in and interfere with the talking subscribers, and at the same time by virtue of the test-circuit being open the absence of the click to the answering operator of Fig. 1 would indicate to that operator that the calling subscriber was busy. Thus the mistakes which are always inadvertently made

on switchboards do not annoy the talking subscribers, as both of their lines are cut out from all others on the board when they are communicating.

Figs. 7 and 8 represent three sections of a switchboard constructed on my plan, and thus representing an indefinite extension of the same to as many sections as may be in practice desired. In these drawings, O, O², and O³ represent three sections on the answering side of the board and O^{1a}, O^{2b}, and O^{3c} represent corresponding sections on the connecting side of the board, Fig. 8. T, T⁴, and T⁵ represent three telephone-station lines, respectively, each line being double with a metallic circuit, T lines ending in section O', T⁴ lines ending in section O², and T⁵ lines ending in section O³. These lines of course are representative of any number that may enter the sections. All of the lines entering in the board are grouped, so that a convenient number enters each section and there terminate in the answering-jacks 1 2 2^a. Annunciators are bridged across the lines, as already described. Lines D D' D³ connect the answering and connecting divisions O' O^{1a}, already described. These are duplicated for each telephone-line entering on each section, the connections being readily traced by reference to Figs. 1 and 2. As already stated, as many lines enter each section of the board (each comprising the two duplex divisions described) as may be desired, each of the lines T' T⁴ T⁵ being representatives of those comprising the groups. In addition to the answering-jacks on the answering division of each section for the group of lines entering that section there are local jacks 4 4 on each section for all the lines entering the board, while each connecting-section of each division contains local jacks 9 9, corresponding to the connecting-jacks 7 7^a 7^b. The local jacks 4 4 on the answering divisions of each section are respectively connected, one in each section, by the trunk-lines 4^a 4^b 4^c, each trunk-line being double to correspond with the metallic return. It will be observed, therefore, that each connecting division of a section has grouped upon it, first, the connecting-jacks of the lines grouped in the section; second, local jacks 9 9, and, third, local annunciators P P, corresponding thereto; also, fourth, a set of galvanometer-indicators, also corresponding to the numbers of the group. If, therefore, we assume that line T desires connection with some line not entering on section O', but upon any other section, as O³—say line T⁵ on section O³ O^{3c}—the operator would insert the plug B' into the jack 4 corresponding to and connecting with, through the trunk-line 4^c, the corresponding jack on the connecting division, in which line T⁵ entered, which in the case supposed would be division O^{3c} of section O³. The local annunciator P of that section would fall and indicate that line T⁵ was desired, whereupon the connecting-operator would connect jacks 9 and 7 in the same

manner and with the result of connecting T with T⁵, as already explained with regard to the connection of lines in one section only. In the case just supposed the connection
5 would be over the trunk-line 4^c.

What I claim is—

1. In an electrical switchboard, the combination of two divisions, an answering division and a connecting division, each division
10 having an independent line-jack for each subscriber's line-circuit and permanently connected therewith, and each division having a companion local jack for each subscriber's line, said local jacks being permanently con-
15 nected between the divisions by trunk-lines through which the talking-circuit is made, and means for electrically connecting the line-jacks and the local jacks, substantially as described.

2. In an electrical switchboard, the combination of two divisions, an answering division and a connecting division, each division
20 having an independent line-jack for each subscriber's line-circuit and permanently connected therewith, and each division having a companion local jack for each subscriber's line, said local jack being permanently connected between the divisions by lines through
25 which the talking-circuit is made, means for electrically connecting the line-jacks and the local jacks, and an annunciator corresponding to and for each subscriber, located in the connecting division, and adapted to be operated from his corresponding local jack in
30 the answering division, substantially as described.

3. In an electrical switchboard, composed of an answering and a connecting division, lines permanently terminating in two jacks
40 one in each division, an additional local jack for each line in each division, said pair of local jacks being electrically connected, a relay for each line, which relay is electrically connected and operated by a plug when con-
45 nected to the line-jack on the answering division, whereby the operated line is broken by said relay, and is restored by withdrawing the said plug from said line-jack, substantially as described.

4. In a divisional switchboard having an answering and a connecting division, the combination of lines ending in, and permanently connected to line-jacks, one in each division,
50 local jacks corresponding to the line-jacks, one in each division, said pair of local jacks being permanently electrically connected, local drop-annunciators in the connecting division, one for each line, and means for energizing the annunciators, substantially as de-
55 scribed.

5. In a divisional switchboard having an answering and a connecting division, the combination of lines ending in and permanently connected to line-jacks, one in each division,
65 local jacks corresponding to the line-jacks, one in each division, local drop-annunciators in the answering division, one for each line,

said local annunciators being normally electrically connected to the corresponding line-jack in the connecting division, substantially
70 as described.

6. In a duplicate-switchboard system for telephones and analogous devices, the combination of a multiplicity of outlying-station lines entering therein, each line being per-
75 manently connected to a pair of jacks, one in an answering and one in a connecting division of said board; a pair of local jacks corresponding to and for each line, one in each division of said board, said jacks being permanently
80 connected together, but normally disconnected from any operative circuit; and means for connecting any one of the terminal jacks and any one of the local jacks upon each division of the board for completing the talking-cir-
85 cuit, substantially as described.

7. In a duplex-switchboard system for telephones and analogous devices, the combination of a multiplicity of outlying-station lines entering therein, each line being permanently
90 connected to a pair of jacks, one in an answering and one in a connecting division of said board; a pair of local jacks corresponding to and for each line, one in each division of said board, said jacks being permanently
95 connected together, but normally disconnected from any operative circuit; means for connecting any one of the terminal jacks and any one of the local jacks upon each division of the board for completing the talking-circuit,
100 and suitable switches actuated by such means, for cutting out and isolating said talking-circuit when the same is formed, and for restoring it to its normal connections when said talking-circuit is discontinued, substantially
105 as described.

8. A duplex-switchboard system for telephones and analogous devices, consisting of a multiplicity of lines leading in from out-
110 lying stations, each station-line terminating in a divisional switchboard in two line-jacks to which said line is permanently connected, one being in an answering division and one in a connecting division of said board; an an-
115 nunciator visible upon the answering division and normally forming a part of the circuit leading from and returning to the corresponding outlying station, but adapted to be disconnected at the corresponding line-
120 jack upon the connecting division; a pair of connected local jacks, one in each division, corresponding to and for each entering station-line, but normally disconnected there-
125 from; a connected pair of plugs in each division adapted to connect the line-jacks and the local jacks therein, but normally disconnected therefrom; and means for energizing the circuits, substantially as described.

9. In a duplex-switchboard system for telephones or analogous instruments, the combi-
130 nation of outlying-station lines entering therein, each station-line terminating in a divisional switchboard in a pair of line-jacks to which said line is permanently connected,

one jack in an answering division and one in a connecting division of said board; a corresponding pair of connected local jacks for each line, one in the answering and one in the connecting division; an annunciator upon the connecting division corresponding to each line; said annunciator being located in a line connecting a common battery-line and the corresponding local jack on the answering division, and adapted to be operated from said local jack; means normally disconnected from but adapted to connect the line-jack and a local jack on the answering division and complete a circuit therethrough; and means connected with said annunciator whereby, on completing said circuit, it simultaneously operates a signal on the connecting division and breaks its own circuit, substantially as described.

10. In a duplex switchboard for telephones and analogous devices, the combination of a multiplicity of station-lines entering therein, each line being permanently connected to a pair of jacks, one in the answering and one in the connecting division of said board; a pair of permanently-connected local jacks corresponding for each line, one in each division of said board, but normally disconnected from any operative circuit; means for connecting any one of the terminal jacks and any one of the local jacks upon each division of the board for completing the talking-circuit; an annunciator on the connecting division for each station-line, located on a line leading from a battery common line to the line connecting the local jacks; a relay in a line connecting said annunciator-line and the corresponding line-jack upon the answering division, but not normally connected thereto, and means whereby said relay is adapted, on being energized, to break the circuit from the said common line to the local-jack line, substantially as described.

11. In a switchboard divided into a receiving division and an answering division, the combination and arrangement of answering-jacks and local jacks on the receiving division corresponding to subscribers' lines, answering-plugs adapted to enter the answering-jacks on the answering division, each answering-plug having connected therewith a local plug by a double line as described, a test-relay located in one of the lines, a circuit between the plugs, an operator's set on a line connecting a common source of energy and

the test-relay, a local relay and a local drop in series with the armature of a local relay in the answering division, means for energizing the lines through the test-relay, whereby the entry of the answering-plug and the answering-jack and the touch of the tip of a local plug to the local jack energizes for an instant the test-relay, closes contact therethrough with the operator's telephone in parallel with the circuit through the answering-jack, thus indicating to the operator that the line is not busy, substantially as described.

12. In a telephone-switchboard, the combination of an answering division; a connecting division; a local relay, normally closed, located in the connecting division; a line connecting the division through the local relay; means for energizing the same; a spring-jack in the answering division; a plug adapted to enter the same and mechanically make a contact, whereby the circuit is closed through the local relay in the connecting division; a local drop in series with the armature of the local relay; lines normally connecting the same; and a contact adapted to be broken by the action of the armature of the local relay when the contact is effected by means of the plug in the answering division, substantially as described.

13. In a divisional telephone-switchboard, having an answering division and a connecting division, the combination and arrangement of answering-jacks and local jacks corresponding to subscribers' lines, plugs adapted to enter the answering-jacks on the answering division, each answering-plug having connected therewith a local plug by a double line, a local relay, and a local drop in series with the armature of the local relay on the answering division, means whereby the actuating of the local drop breaks connections and opens the line to the local jack when the line is closed by contact with the local plug on the answering division, whereby the subscriber called is disconnected from the means energizing the lines, so that another call cannot be made while his line is "busy," substantially as described.

In testimony whereof I sign this specification in the presence of two witnesses.

THOMAS F. AHERN.

Witnesses:

R. A. PARKER,
MARION A. REEVE.