

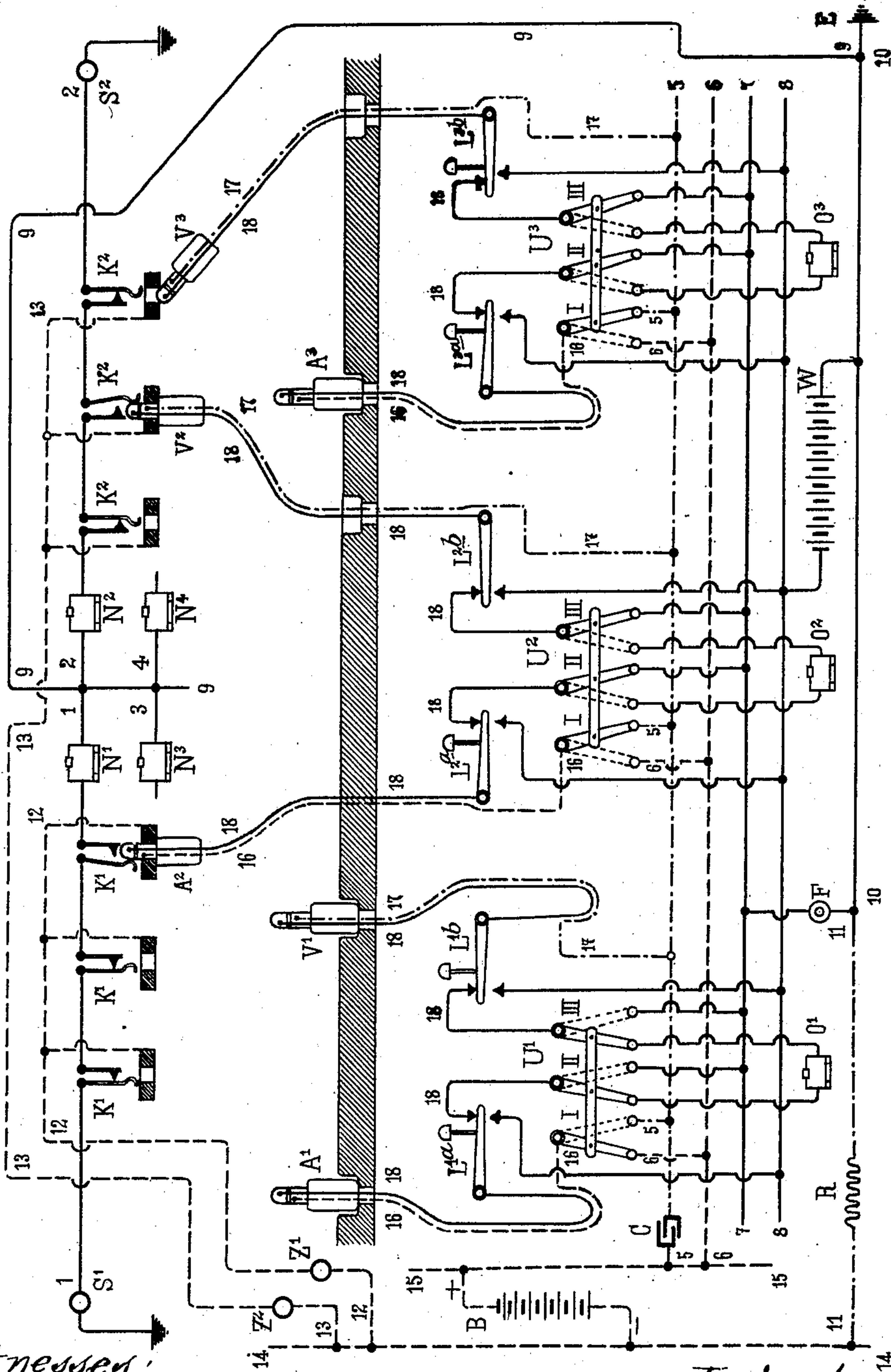
G. RITTER.
TELEPHONE SYSTEM.

APPLICATION FILED AUG. 16, 1898.

NO MODEL.

5 SHEETS—SHEET 1.

Fig. 1.



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5 SHEETS—SHEET 2.

Fig. 3.

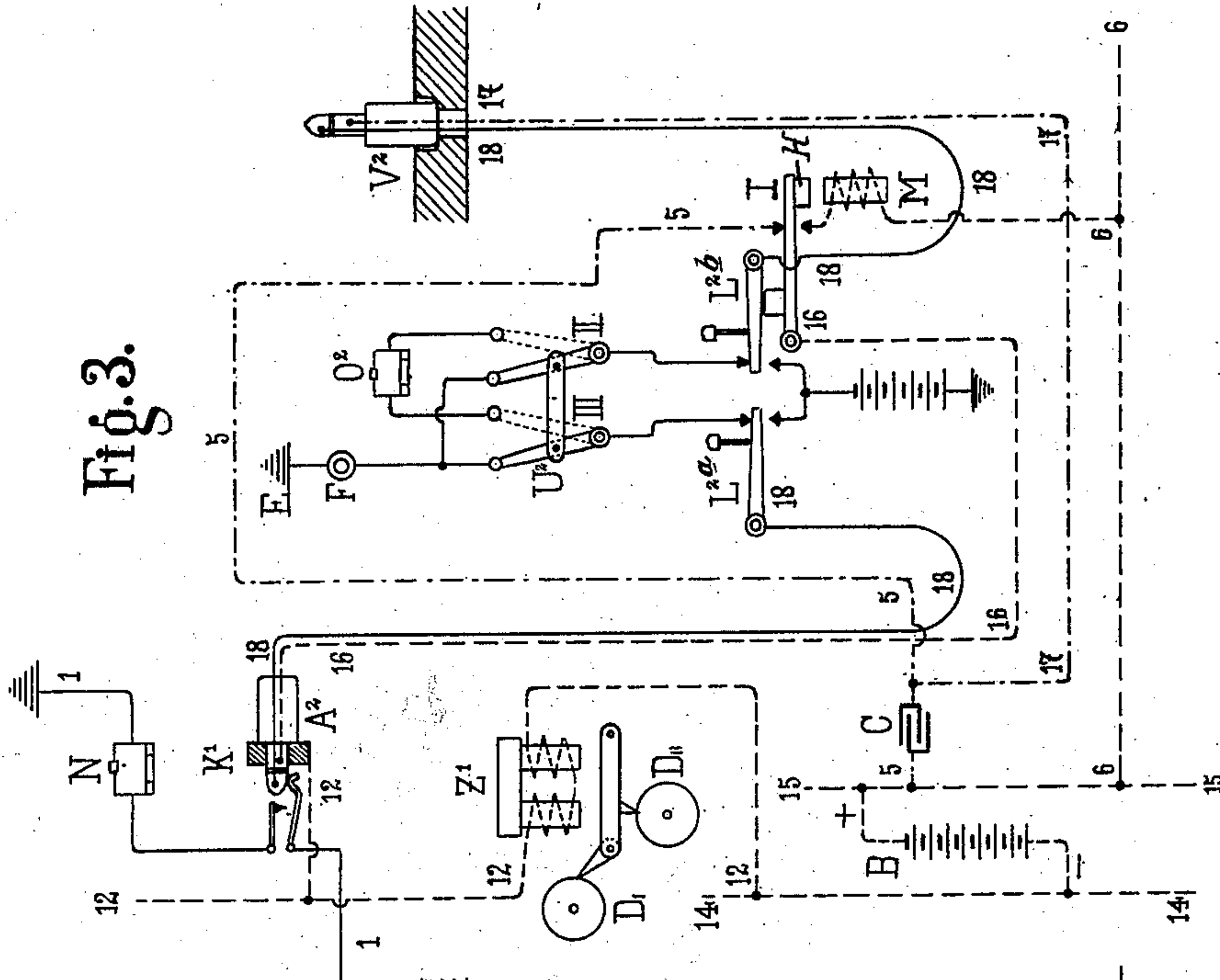
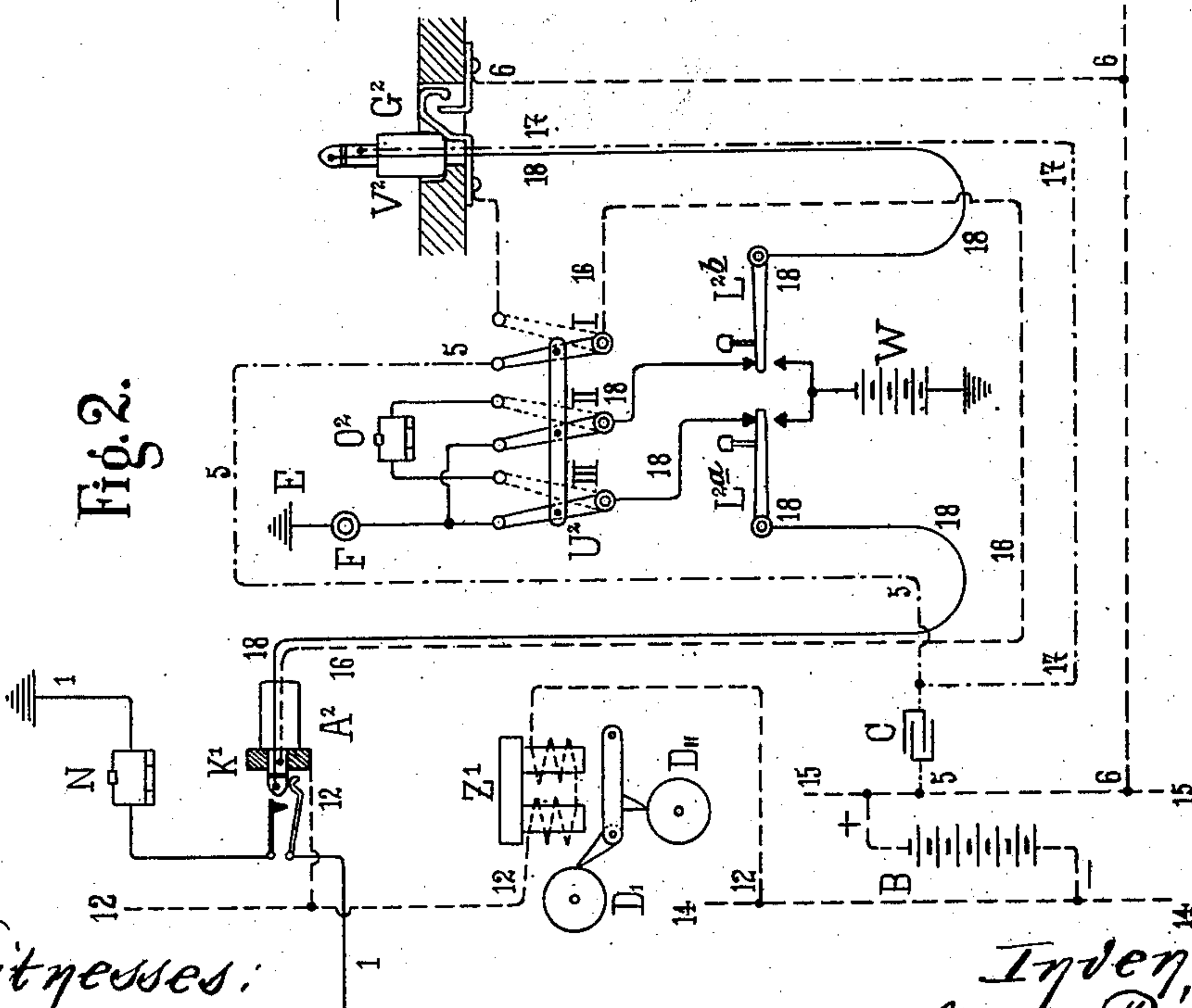


Fig. 2.



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No. 745,388.

PATENTED DEC. 1, 1903.

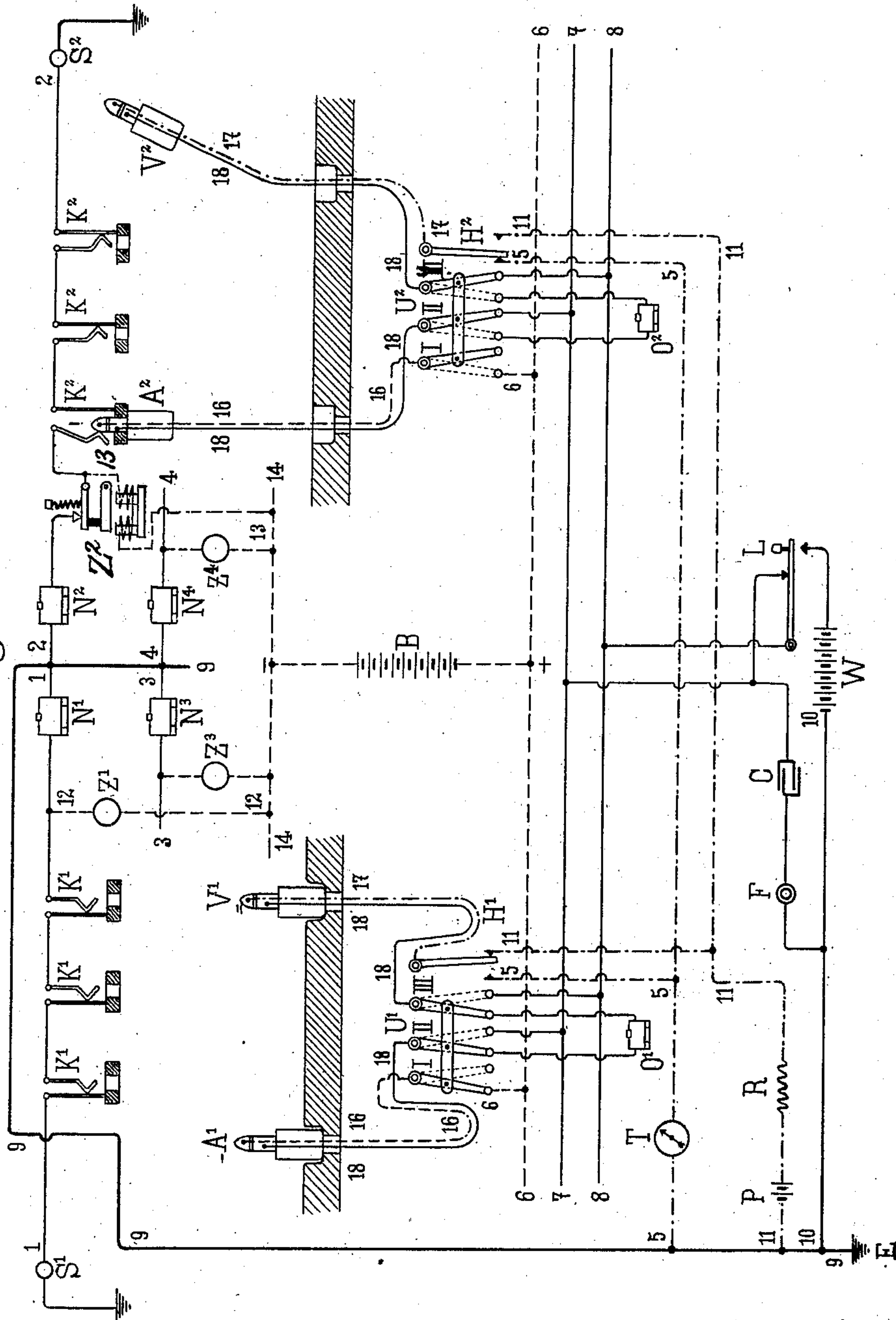
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NO MODEL.

6 SHEETS—SHEET 3.

Fig. 4.



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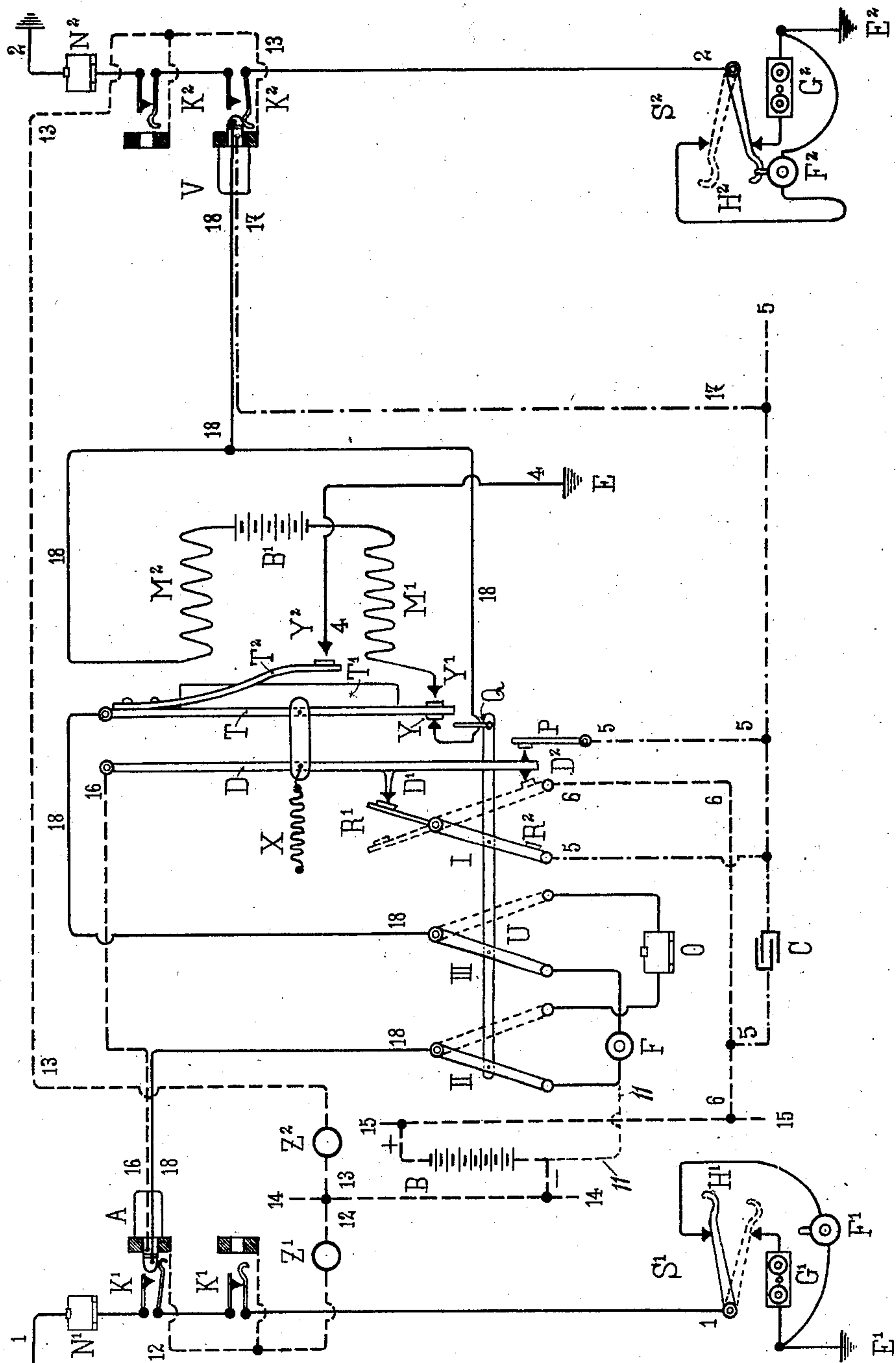
G. RITTER.
TELEPHONE SYSTEM.

APPLICATION FILED AUG. 16, 1898.

NO MODEL.

5 SHEETS—SHEET 4.

Fig.



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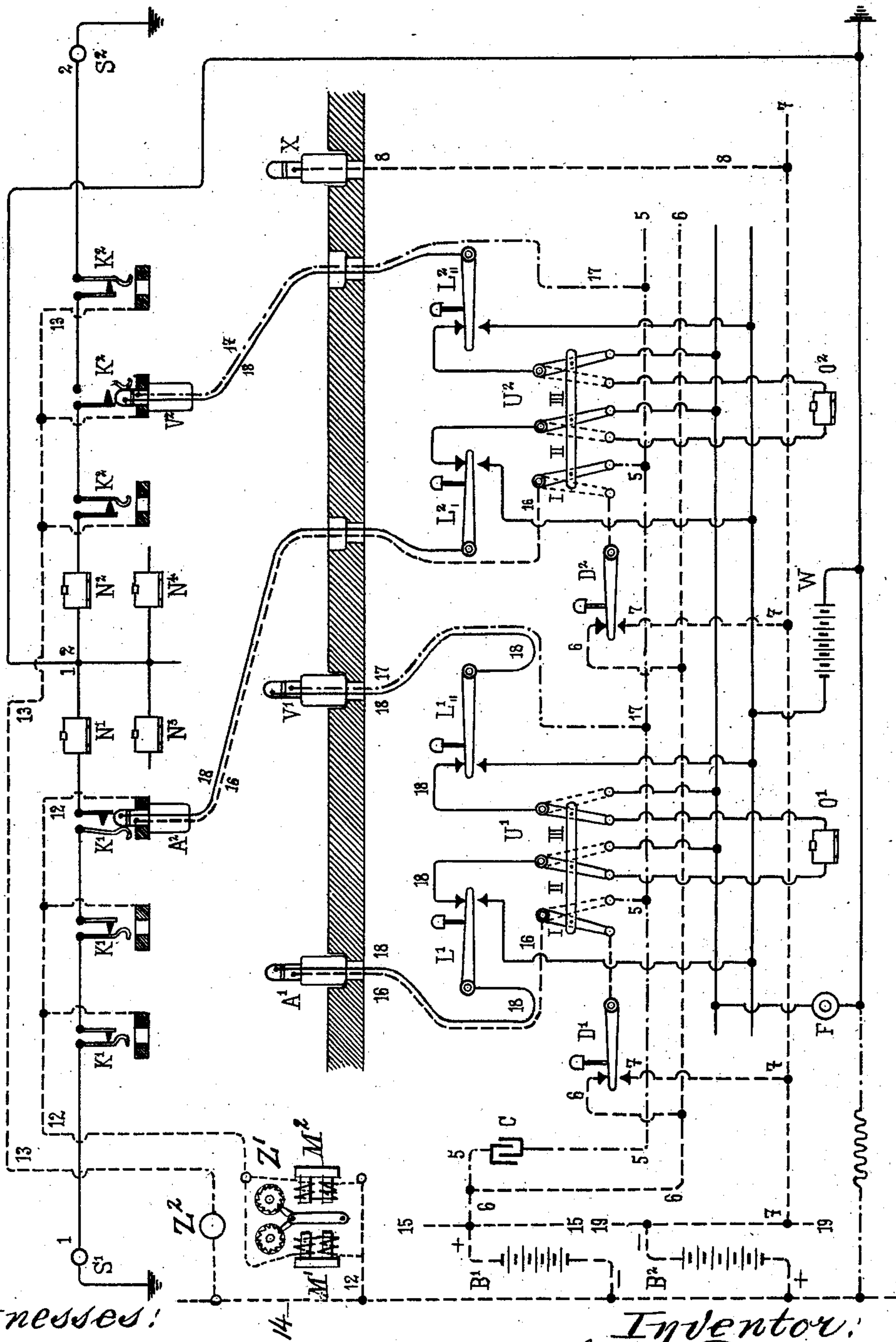
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APPLICATION FILED AUG. 16, 1898.

NO MODEL.

5 SHEETS—SHEET 5.

Fig. 6.



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UNITED STATES PATENT OFFICE.

GEORG RITTER, OF STUTTGART, GERMANY.

TELEPHONE SYSTEM.

SPECIFICATION forming part of Letters Patent No. 745,388, dated December 1, 1903.

Application filed August 16, 1898. Serial No. 688,683. (No model.)

To all whom it may concern:

Be it known that I, GEORG RITTER, a citizen of the Empire of Germany, residing at Stuttgart, in the Empire of Germany, have invented certain new and useful Improvements in Telephone Systems; and I do hereby 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 appertains to make and use the same.

My invention relates to improvements in telephone systems, and in particular to systems in which is employed a register device for registering the number of messages sent over the subscriber's circuit to which said register device relates.

The object of my invention is to provide a system in which a record is automatically produced showing the number of times a subscriber's telephone-line is used.

An apparatus embodying my invention comprises the combination, with a telephone system, of an electrically-operated register device for each subscriber's line, a circuit in which said register device is included, and means operated by the switchboard mechanism employed in making the connection between said subscriber's line and the central station or other stations for closing the circuit of the register device.

Among the many advantages of my invention are the following: The register device and its circuit may be introduced into telephone systems already in operation, as well as into new systems, with a minimum cost and in systems of the former class without interfering with the regular operation of the lines. Moreover, no separate or special circuit-closing apparatus is needed in the switchboard for use in the register-circuit.

My invention will first be described in connection with the accompanying drawings and then particularly pointed out in the claims.

In the drawings, Figure 1 is a diagrammatic view of a telephone system embodying my invention. Figs. 2 to 6, inclusive, are similar views showing other forms of telephone systems embodying my said invention.

In Fig. 1 is shown a system of circuits embodying a central station, a plurality of substations, (two being shown,) a register device for each substation, and circuits for the reg-

ister devices. In this figure the full lines indicate the talking-circuits, the broken lines show the circuits for the register devices, and the dot-and-dash lines the testing-circuits for testing the talking-circuits. As above stated, in this figure two substations S' and S^2 are illustrated, which are connected to the central station by conductors 1 1 and 2 2. In each of these conductors are included three jacks, (indicated at K' and K^2 , respectively,) as well as calling-annunciators N' and N^2 , respectively. For making connections between the substations the plug-connector pairs $A' V' A^2 V^2 A^3 V^3$ are employed, while for calling the substations the switches $L'^a L'^b L^{2a} L^{2b} L^{3a} L^{3b}$, as well as the circuit-changers $U' U^2 U^3$, are provided, the circuit-changers serving to cut in and out the central-station telephone F and the respective clearing-out annunciators $O' O^2 O^3$. A battery or other source of electricity (indicated at W) is also supplied for the purpose of calling the subscribers.

Referring now to the means for registering the number of times a subscriber's line is in use, B is a battery for the registers, having its negative pole connected to the registers (indicated at Z' and Z^2) by means of a conductor 14 and branches 12 and 13, which extend to the sockets of the jacks $K' K^2$, respectively, and include the coils of the corresponding registers, which may be of any suitable and well-known construction. The positive pole of the battery B is connected, through the connections 15 and 6 and the branches of the latter, with the corresponding points or contact-pieces of the levers I of the circuit-changers $U' U^2 U^3$, in this case with the left-hand series of such points. The fulcrums of the levers I are connected by conductors 16 with the contact rings or shells of the answer-plugs $A' A^2 A^3$, which contact rings or shells, it is to be noted, fit snugly into the sockets of the jacks, so that upon the insertion of a plug the circuit of the register-battery is closed. For the purpose of testing the talking-circuits the right-hand points or contact-pieces of the levers I of the circuit-changers $U' U^2 U^3$ are connected by the conductor 5 5 and its branches with the positive pole of the register-battery B across the condenser C . It is to be understood, of course, that the said

condenser serves to prevent the direct electrical communication through said conductor 5 5. Furthermore, the said conductor 5 5 is in electrical communication through the conductors 17 17 with shells or rings on the plugs of the calling-plug connectors $V^1 V^2 V^3$, which serve for making connections between two subscribers' lines. These plugs when inserted also make electrical connections with the sockets of the jacks $K^1 K^2$, thereby closing the register-battery circuit at the jacks, although said circuit is not complete, owing to the fact that the condenser C is included in it. The negative pole of the battery B is connected, by means of the conductor 11, which includes a resistance R, to the grounded pole of the central-station telephone. It is to be understood that the shells or rings on the plugs of the plug-connectors $A^1 A^2 A^3$ and $V^1 V^2 V^3$, at which terminate the conductors 16 and 17, respectively, are insulated from the points of said plugs.

The production of connections between two substations follows in general in the same manner as other exchange systems, it being borne in mind, however, that the answering of a substation cannot be done indiscriminately with either of the two plugs of a pair of plug-connectors, as in other systems, but must always be done with one of the answer-plugs $A^1 A^2 A^3$.

The method of testing a conductor to ascertain whether or not it is in use prior to making a connection is similar to that in previous systems, being done by touching one of the jack-sockets of the desired line, which produces a "click" in the operator's telephone. The circuit for producing this test is, however, quite different from the usual testing-circuit and will now be described. Let it be assumed that substations S^1 and S^2 are connected as shown in Fig. 1 and that the operator has touched the jack-socket K^2 with the tip of the plug V^3 . It will be seen that the testing-circuit, when the tip of the plug V^3 is touching the jack-socket K^2 , is as follows: from the positive pole of battery B to the conductor 15, thence over the latter to one side of the condenser C, from the other side of condenser C, along conductor 5 to the cord 17 of plug V^2 , through the corresponding jack-socket to conductor 13, to the jack-socket, which is touched by the tip of the plug V^3 , along cord 18 of said plug to switch L^{3b} , thence through the upper contact-point to lever III, over the same and its corresponding branch wire to conductor 7, thence to and through the operator's telephone F to the junction of conductors 10 and 11, over conductor 11 and the resistance R to conductor 14, and thence to the negative pole of the battery B. From this it will be seen that the testing-circuit included the condenser C. Consequently at the moment of touching the jack-socket K^2 with the tip of the plug V^3 the condenser will be charged, and at the moment of removal of the tip of said plug V^3

from said socket the condenser will be discharged, thereby producing a click in the operator's telephone and giving notice that the line 2 is busy.

Instead of a condenser a high resistance may be employed, as will be fully understood by those skilled in the art, it being obvious that the purpose of the condenser is to prevent the closure of the register-circuit over the testing-circuit, while at the same time allowing the testing-circuit to give a sound in the operator's telephone when a test is made if the line tested is then in use. The high resistance operates in substantially the same manner.

In describing the operation of the register device it will be assumed that the substation S^1 desires to communicate with the substation S^2 and that therefore the register Z^1 , belonging to the first-mentioned substation, must register one conversation or use of the line chargeable against substation S^1 in case the connection with substation S^2 is made. For the purpose of doing this the pair of plug-connectors $A^2 V^2$ are employed. Before taking the plug A^2 away from its seat the central-station telephone F is connected to the conductors 18 and 18 by moving the levers I, II, and III of circuit-changer U^2 to the right, (in the present construction,) so that by the insertion of the plug A^2 in the socket of the jack K^1 the register Z^1 is connected over conductors 12 12 and by means of the socket of the jack K^1 the contact ring or shell of the plug A^2 and conductor 16 with the conductor 5 5 through the lever I of the circuit-changer U^2 , and, furthermore, is also connected with the positive pole of the battery B in open circuit through the condenser C. The latter, however, does not allow any current to flow over the circuit just described, so that therefore the register Z^1 does not operate. The connection with the positive pole of the battery B is only for the purpose of rendering possible the testing of the conductor 1 1 for a purpose hereinafter explained. After the central-station operator has learned from the subscriber at substation S^1 that the latter desires to converse with the subscriber at substation S^2 the plug V^2 , after the previously-described test has been made, is inserted in a socket of the jack K^2 , the station S^2 called by pressing the switch L^{2b} , and then by moving the circuit-changer U^2 to the left the clearing-out annunciator O^2 is switched onto the conductor 18 18 and the central-station telephone thereby cut out. Upon the shifting of the circuit-changer U^2 to the left, as above mentioned, its lever I becomes included in circuit with conductor 6 instead of with conductor 5, as before, whereby the circuit of the register-battery is closed and the register operated to register one use of the line to station S^1 .

The course of the current of the register-circuit is as follows: from the negative pole of the battery B through conductors 14 and 12, over the coils of the register to the socket

of the plugged jack K' , from there through the contact ring or shell of the plug A^2 , along the conductor 16 to the lever I of the circuit-changer U^2 , over said lever to its left-hand point, and along conductors 6 and 15 to the positive pole of the battery B. By this closure of the circuit the current from the register-battery B continues to flow during the entire period that the line to substation S' is in use, so that by a suitable construction of the register apparatus not only the number of conversations chargeable to substation S' , but also the duration of each, may be recorded.

The above-described register system illustrated in Fig. 1 assumes either that the central-station telephone is connected when not in use with the conductors 18 18 of the plug-connector conductors or that said telephone is switched onto said conductors before taking a calling-plug into use, which may be done simultaneously with the switching off of the clearing-out annunciator, as shown in Fig. 1. If, however, the central-station telephone is not normally in connection with the conductors 18 of all the plug-connectors when the latter are out of use and if, also, there is no means operated by the operation of the circuit-changer for closing the particular conductor 18 onto the central-station telephone when taking such conductor into use, then it is preferable to employ an automatic circuit-closer for the register-circuit, one form of which is shown at G^2 , Fig. 2, and another form at I, Fig. 3, each of which is arranged to close the register-circuit at that point. The reason for this is that if my invention be applied to a system employing a clearing-out annunciator always in circuit with the plug-connectors then upon the insertion of a calling-plug, as V^2 , the current in the register-circuit would flow over the conductors 15 and 6, lever I of the switch V^2 , conductors 16, 12, and 14, and thereby cause the register to operate, which is a disadvantage to be avoided, since it is not desired to register a conversation until a connection between two stations has been completed.

The above-mentioned course of the current in the register-circuit is not possible in the construction shown in Fig. 1 if the switch U^2 is kept in its left-hand position before the completion of a connection or if a separate circuit-closer is used, as at G^2 in Fig. 2.

In Figs. 2 and 3 are shown register-circuits provided, respectively, with the above-mentioned separate circuit-closers. These figures correspond exactly with regard to the illustration in Fig. 1 of the separate parts and are altered from this only with regard to the arrangement relative to each other. In both figures the register-magnet together with its armature are shown, the latter being so arranged that upon being attracted by its magnet it will turn the wheel D' forward one tooth and release the wheel D^2 (which represents the escapement-wheel of a clockwork) during the time that said armature is at-

tracted, so that not only will the conversation be counted, but also the duration of the same will be recorded. A jack K' of the conductor 1 is shown, with a corresponding answer-plug A^2 inserted, the calling-plug V^2 being still upon its seat out of operation, while the circuit-changer U^2 is turned one hundred and eighty degrees with relation to its arrangement in Fig. 1, wherefore the clearing-out annunciator O^2 , as well as the central-station telephone, are arranged at the upper part of the figures. In Fig. 2 the additional circuit-closing device G^2 is so arranged at the seat of the plug V^2 and in the conductor 6 6, between the right-hand contact piece or point of the lever I of the circuit-changer U^2 and the positive pole of the register-battery B, that this additional circuit-closing device will be open during the time when the said calling-plug V^2 rests in its seat and closed when the said plug is lifted from said seat. Furthermore, so long as the calling-plug V^2 is not in use and not lifted from its seat a closure of the circuit between conductors 6 and 16 does not produce an operation of the register Z' .

In order to call the substation connected with conductor 1, it is necessary to switch the central-station telephone onto the conductors 18 18 of the pair of plug-connectors in use, from which it results that the circuit-changer U^2 in Fig. 2 must be maintained in its position to the left from immediately after the answer-plug A^2 is inserted in its jack up to the time when the calling-plug V^2 is inserted in its corresponding jack, in which position of the circuit-changer its lever I connects the conductors 16 16 with the conductors 5 5, whereby, as follows from the description in Fig. 1, no operation of the registers takes place. The latter can only occur after the circuit-changer U^2 has been shifted to its right-hand position, whereby the lever I connects the conductors 16 16 with the conductor 6 6 and the current of the register-battery takes the following course: from the negative pole of the battery B, over the conductors 14 14 and 12 12, through the register Z' to the socket of the jack K, and from there to the contact-ring of the plug A^2 , through the same, and through conductors 16 16, lever I, conductors 6 6, and circuit-closing device G^2 to the positive pole of the battery B.

In the central station, where the calling of the desired substation is done by the operator, the lever I may be arranged so as to be mechanically operated by the operation of the switch L^{2b} of the calling-plugs V^2 , and this arrangement is shown in Fig. 3. This corresponds in general with Fig. 2.

Under the switch L^{2b} a lever I is so arranged that by means of a block of insulating material arranged between the two the downward movement of the said switch must cause the movement of the lever I. In the normal position the lever I contacts with a point or contact-piece which is in connection with the conductor 5 5, while when moved downward

it contacts with a point or contact-piece connected to the conductor 6 6. After the production of a connection between two substations and for the purpose of calling the desired substation the switch L^{2b} is pressed down, whereby the lever I contacts with the contact-piece of the conductor 6 6, and the battery B is in a closed circuit with the register Z' , whereupon the current of the register-circuit travels exactly as described with relation to Fig. 1. In order to hold the levers I and L^{2b} so as maintain the register-circuit closed during the whole time of a conversation in order that the register may record the duration of a conversation, the lever I is connected with the armature H of an electromagnet M, the latter magnet being included in the conductors 6 6 between the contact-piece of the lever I and the positive pole of the battery B, the said electromagnet being energized by the current from the register-battery, and thereby holding its armature and the lever I downward during the time of the connection of the two substations.

In the above-described arrangements the registers $Z' Z^2$ are connected with the sockets of the jacks and the connector-conductors are used also as test-conductors. In those exchange systems which do not possess special (or separate) testing-conductors the registers may be connected with the jacks by means of the talking-conductors, as shown in Fig. 4. In this figure, as in Fig. 1, there are two substations S' and S^2 , which are united to the central station by conductors 1 1 and 2 2, and at the latter place all the substation-conductors are connected to a common grounded conductor 9 9.

For the purpose of making connections between two substations the pairs $A' V' A^2 V^2$ of plugs are provided, which are in turn connected to the circuit-changers $U' U^2$. The levers I of these circuit-changers serve for the control of the register-circuit, while the levers II and III are employed for alternately cutting in or out the clearing-out annunciators $O' O^2$ of the central-station telephone F. The lever $H' H^2$ serves for throwing the test-battery P or the galvanometer T onto or off from the calling-plugs $V' V^2$. It is to be observed, moreover, that levers I II III are connected so as to move simultaneously, whereas the lever H^2 may be independently moved. The switch L is common to all the pairs of plug-connectors. The plugs $A' V' A^2 V^2$, the first of which serve as answer-plugs, the latter as calling-plugs, have their shafts divided, as in Figs. 1 to 3, into two parts insulated from each other. The points of the plugs $A' A^2$ are connected to the register-conductors 16 16, while the points of plugs $V' V^2$ are united to the arms $H' H^2$ of the circuit-changer $U' U^2$ through the conductors 17 17. In both species of plugs the rear parts of the shafts are connected with the conductors 18 18 of the plug-connectors. The construction of the plugs is such that

their points contact with the springs while their rear portions contact with the sockets of the jacks into which they may be inserted.

The registers $Z' Z^2 Z^3 Z^4$ are connected on one side with the negative pole of the battery B and on the other side with the respective substation-conductors 1, 2, 3, and 4 between the calling-jacks and the calling-annunciators $N' N^2 N^3 N^4$. The positive pole of the battery B is connected to the left-hand contact-point of the levers I of the circuit-changers $U' U^2$ by means of the conductors 6. Furthermore, the pivotal point of the lever I is in electrical communication with the points or ends of the answer-plugs $A' A^2$ through the conductors 16 16.

In this exchange system the production of connections between two substations and the necessary testing of the conductors as to whether in use or not takes place in the usual manner, and may therefore be assumed to be understood.

A description of the register apparatus will now be given, it being assumed that substation S^2 desires to communicate with another substation. In order to ascertain what is the number of the substation desired by the subscriber at substation S^2 , the operator places the answer-plug A^2 in one of the sockets of the jacks K^2 , whereby the register Z^2 is connected with the pivotal point of the lever I of the circuit-changer U^2 through the conductors 13 and 2, the spring of the plugged jack K^2 raised by the point of the plug A^2 , and through the conductor 16 connected to said point of plug A^2 and to the said pivotal point of the lever I. The central-station telephone F is presumed to be in connection with the conductors 18 18 of the pair of plug connectors which are to be used before the plug A^2 is inserted in the proper jack-socket, the levers of the circuit-changer U^2 occupying their right-hand position, whereby the register-circuit is interrupted at the lever I of said circuit-closure. The switching of the telephone F onto the conductor of the substation desired by substation S^2 , tested in advance by means of the plug V^2 , is necessary, whereby it results that after a complete connection the switching off of the telephone and the simultaneous switching on of the clearing-out annunciator by shifting the circuit-closer U^2 to the left may then follow. By this shifting of the lever to the left the conductor 16 16 is electrically connected over the lever I of the circuit-closer U^2 with the conductor 6 6, and thereby with the positive pole of the register-battery, whereby the latter is in a closed circuit with the register and is thus operated to register one number. The course of the current is as follows: from the negative pole of the battery B over the conductors 13 13 and 2 2 to the raised spring of the plugged jack K^2 , from there over the point of the plug A^2 , along the conductor 16 16, over lever I of the circuit-closer U^2 to conductor 6 6, and from there to the positive pole of the battery B.

Since all the talking-circuits and therewith all the registers are connected with the grounded conductor 9 over the calling-annunciators, therefore by the closure of the register-battery circuit over any one of the registers a branch current would also flow over all the other registers. As will be understood from the foregoing description, if the current from battery B is allowed to pass, for example, over the register Z^2 a current from conductor 14 14 may also flow through the registers Z' Z^3 Z^4 , as well as through the corresponding calling-annunciators N' N^3 N^4 , to the grounded conductor 9 and from this through the annunciator N^2 over conductor 2, the raised spring of the jack K^2 , and the point of the plug A^2 to conductor 16, and thence to lever I of the circuit-closer U^2 and by way of the same and conductor 6 to the positive pole of the battery B. As the branch currents would not only flow over the registers Z' Z^3 Z^4 , but also over the calling-annunciators N' , N^3 , and N^4 , there would be a false registry upon said registers and an undesirable falling of the corresponding annunciators, to overcome which the latter are constructed to have a high resistance, the registers a low resistance, and the battery B is adapted only for the resistance of the latter.

If it is desired to avoid the loss of current from the battery B, due to the branch currents above referred to, a circuit interrupter or breaker may be united to the armatures of the register-magnets, by which for the time being the corresponding talking-conductor between the calling-annunciator and the point of closure of the register is interrupted during the period of registration. This form of apparatus, however, is only shown in the drawings for the register Z^2 in order not to complicate the illustration of the general construction.

In the above-described register apparatus a registration follows upon the completion of a connection between two substations, whereby it remains unconsidered whether the called substation answers or not. This sort of apparatus will be used at those places where the administration of the telephone system is so conducted that a separate fee is charged as a remuneration for employment of the operator in making a connection; but in the places where only those conversations which actually take place are counted the closing of the register-battery must be postponed until the called substation makes answer. This requirement may be accomplished by so connecting a battery and an electromagnet to the conductor uniting the substations that the magnetic condition of said electromagnet will be altered by alterations in the electric conditions of the line-wire to one of the two connected substations, a circuit-closing apparatus being so connected to the armature of the said electromagnet, which circuit-closing apparatus is arranged to close the register-circuit, whereby upon an alteration of the attractive power of the electromagnet the

said circuit-closing apparatus is operated. The completion of the registration by means of the above-described apparatus is done best by the substation called and in the simplest manner by the lifting of the telephone of said substation from its hook, as that is the proper point of time for the registration.

The practical construction of an apparatus corresponding to the above-described systems permits various arrangements of the electromagnets and battery for effecting the closure of the register-circuits, and the advantage of one or the other arrangement depends upon the kind of telephone system to which it is to be applied.

In Fig. 5 an arrangement is shown which is well adapted for illustrating and practically carrying out the above-described form. In this figure the switches, calling-batteries, and other devices and circuits not necessary for explaining the register apparatus are omitted for the sake of perspicuity. In said figure it is assumed that the substation S' desires to communicate with substation S^2 , and the making of a connection between the two has progressed so far that it only remains to switch in the clearing-out annunciator.

In addition to the register apparatus thus far described the following supplementary apparatus is shown in Fig. 5, viz: In the talking-conductors 18 18 of the pair of plug-connectors A V a pivoted lever T is so inserted that in its normal position it contacts with the circuit-closer Y, while an armature T' of an electromagnet M^2 is positively connected to said lever T. Furthermore, the lever T is coupled by a link of insulating material to a lever D, so that both levers T and D will move simultaneously. To the link is connected one end of a spring X, which tends to draw both levers away from the magnet M^2 . The conductor 16 is connected to the said lever D, which is provided with two circuit-closing pieces D' and D^2 . The lever I of the circuit-closer U consists of two arms R' and R^2 , which are arranged to come into contact with two contact-points, of which the left-hand one is connected with the conductor 5 5, the right-hand one with the conductor 6 6. The link which connects the three levers I II III of the circuit-closer U carries on its right-hand end a leaf-spring which contacts with the lever T upon the movement of the circuit-closer U toward the right while the said lever T upon being forced toward the right contacts with the contact-point which is connected to the coils of the magnets M' and M^2 and upon being forced to the left contacts with the contact-point connected to the conductor 18 18. In the position of the circuit-closer U indicated in Fig. 5, in which the telephone F is connected to the conductor 18, the circuit-closing point D' of the lever D lies against the spring end R' of the lever I, and the arm T lies against the contact-point Y, whereby the conductor 16 is connected to the positive pole of the battery B over the lever D, con-

tact-point D', arms R' and R² of the lever I, conductor 5, condenser C, and conductor 6, so that the conductor 1 can be tested by an operator other than the one who answers the call of substation S'. The reason for this is that systems such as just described are commonly very extensive and require the attention of several operators. Consequently it might occur after substation S' had notified the central that it desired to be connected to some other substation—say substation S², for example—and while waiting for such connection that another operator would receive a request from still another station for a connection with station S', and it is important that the construction be such that a test of the conductors to substation S' will show it to be busy even though it is not then actually connected with the substation (as S²) for which it called. If the circuit-closer U is moved to the right for the purpose of switching in the clearing-out annunciator, the spring Q forces the lever T and D to move with it toward the right until the lever T is stopped by the contact Y', whereupon the spring bends or yields and finally slips past the end of said lever, whereby the magnets M' and M², together with the battery B', are inserted in the conductor 18 of the talking-circuit, over lever T and the contact-point Y'. Furthermore, the lever D lies with its contact-point D² against the contact-point P, which is connected to the conductor 5 in order to preserve the possibility of testing the conductor 1 for the purpose hereinbefore described. In consequence of the switching of the battery B' onto the talking-conductor 18 the current of said battery passes through the magnet M', contact-point Y', lever T, conductor 18, clearing-out annunciator O, the point of the plug A, the lifted spring of the plugged jack K', conductor 1, lever H' of the substation S', telephone F', earth-plate E', to and through earth-plate E² of the substation S²; thence over bell G², lever H², conductor 2, the spring of the plugged jack K², the point of the plug V, conductors 18, and magnet M² back to the battery B'. Thereupon as soon as the substation-telephone F² is lifted from its hook in order that the subscriber may answer his call the circuit of the battery B' is broken during the time that the lever H² moves from the contact-point of the bell G² to the contact-point of the telephone F², whereby the magnet M² is demagnetized, and the arm T contacts with the contact-point Y, and the arm D is moved so that its contact-point D² rests against the arm R² of the lever I. Thereupon the register-battery circuit is closed over the register Z', the current taking the following course: from the negative pole of the battery B, over conductors 14 and 12, through register Z' to the socket of the plugged jack K', thence through the plug A, conductor 16, lever D, contact-point D², arm R² of the lever I, conductors 6 and 15, to the positive pole of the battery B.

It is to be understood that when the switch U is thrown to the left the spring on its end will pass the end of the lever T, owing to the fact that movement of the lever T to the right is prevented by the contact-point Y, thereby compelling the said spring to yield and slip under the end of the said lever T, thereby resuming its original position.

In order to prevent the clearing-out annunciator from being released by the battery B', the armature T' is so arranged that when drawn up it will close a grounded circuit through spring T², contact-point Y², conductor 4, and ground E. This grounding of the circuit has in view also the preventing of a false registration, which would otherwise occur through the breaking of the circuit of battery B' at the time of hanging up the telephone F' upon the hook H' at the end of a conversation, which breaking of the said circuit will be without effect upon the battery B', where the grounded circuit is provided. By this means the current of battery B' is divided through two grounded circuits, a small part of the current flowing through the clearing-out annunciator to the ground at substation S', while the remainder flows to the ground through the conductor 4, the earth forming a common return for both portions of the current to the ground connection of substation, from which place the current returns to the battery B' over conductors 2 and 18, whereby the current of battery B' cannot be interrupted by an interruption of the circuit at substation S', since it may still flow through conductor 4 to the ground.

Although by a proper operation of the above-described apparatus a false registration is practically excluded, yet as in practice errors may occasionally occur which will require a negative operation of the register in order to correct its error I provide a device for this purpose which may be actuated by the operator without inconvenience. This is shown in Fig. 6, which figure corresponds in general arrangement to the construction shown in Fig. 1, the operation of the register system being readily understood from the description heretofore given in connection with said Fig. 1. The correcting or negative-registering apparatus will now be described.

Referring to Fig. 6, D' D² are switches inserted between the left-hand contact-points of the levers I of the circuit-changers U' U² and the conductors 6 6, which lead to the positive pole of the register-battery B'. These switches D' D² are arranged when in their normal positions to connect the said left-hand contact-points of levers I with the said positive pole of the register-battery B', and, when pressed downward, to contact with a point forming the terminal of a conductor 7, which leads to the negative pole of another battery B², which I will term the "correction-battery." By this arrangement if an error has been made on one of the registers it may be corrected by pressing the corresponding

switch D' or D^2 , thus sending a reverse current over the corresponding register and operating it in a negative direction, the positive pole of the correction-battery B^2 being permanently connected through conductor 14 with the negative pole of the register-battery B' in order that the circuit may be complete. As, however, when the switches D' or D^2 , respectively, return to their normal position the corresponding register-circuit will again be closed and again register another number, it is necessary to press downward the switch D' or D^2 , respectively, twice without allowing it to return to its normal position between such two downward movements, whereby two negative registrations will be made, and then when the one positive registration is made by the return of the respective switch D' or D^2 to its normal position one of the two negative registrations will be counterbalanced, and the final result in the register will be one number less than before the correcting operation was commenced, which is here assumed to be the result intended. Instead of employing the switches D' or D^2 a special plug connector X may be used, which is connected to the conductor 7. By inserting this plug in one of the jacks of the line whose register it is desired to operate negatively the current from the correcting-battery B^2 will be sent out over said register and the previous erroneous registration deducted. In a register apparatus employed in connection with such a correcting device it is necessary that polarized armatures be used for the register-magnets, and either two register devices must be employed for each system, one to record the positive registrations and the other the negative registrations or errors made, or the register must have two electromagnets, these magnets being arranged to move the register-dials in opposite directions, as will be plain from Fig. 6, which shows the register Z' provided with two electromagnets operating in conjunction with a common polarized armature, each magnet being included in the conductor 12 in parallel. The magnet M' attracts the armature by

the current from the battery B' , while the magnet M^2 repels said armature. When the battery B^2 is thrown onto the register-circuit by pushing down the key D' , the reverse operation of the armature occurs.

At L' L^2 in the drawings are shown keys included in the circuit with the answering-plugs A' A^2 , respectively. The function of these keys is to enable the central exchange-operator to call the subscriber again to the telephone when such subscriber has asked for a connection which could not be made at once.

Having thus fully described my invention, what I claim as new, and desire to secure by Letters Patent of the United States, is—

1. In a telephone system, the combination with a jack, a register-circuit open only at the jack and at one other point, a register device included in said circuit and means for energizing the circuit, of a plug insertible in the jack and arranged to close the register-circuit at that point, and means operated in completing the connections between substations and arranged to close the register-circuit at the other point where it is open, whereby the circuit is closed.

2. In a telephone system, the combination with a jack, a register-circuit open only at the jack and at another point, a register device included in said circuit, and means for energizing the circuit, of a plug insertible in the jack and arranged to close the circuit at that point, means for closing the register-circuit at the second point, mechanism operated in completing the connections between substations for placing in operative condition the said means for closing the register-circuit, and means operated by the subscriber at the called substation for setting in operation the said register-circuit-closing means.

In testimony whereof I affix my signature in presence of two witnesses.

GEORG RITTER.

Witnesses:

AUGUST DRANTZ,
H. WAGNER.