

W. C. RUNGE.

TELEPHONE SYSTEM AND APPARATUS THEREFOR.

APPLICATION FILED DEC. 6, 1902.

NO MODEL.

4 SHEETS—SHEET 1.

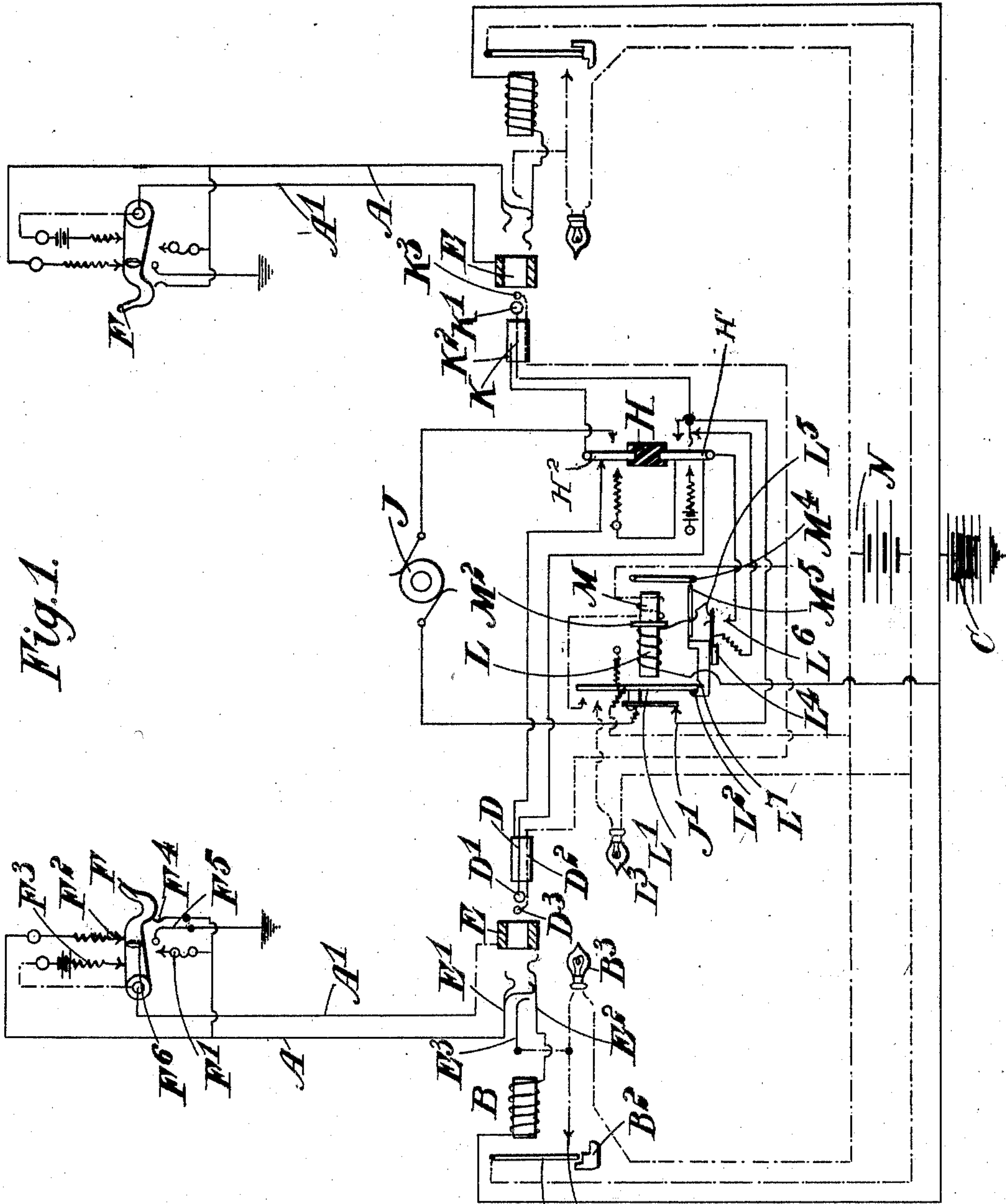


Fig. 1.

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No. 776,090.

PATENTED NOV. 29, 1904.

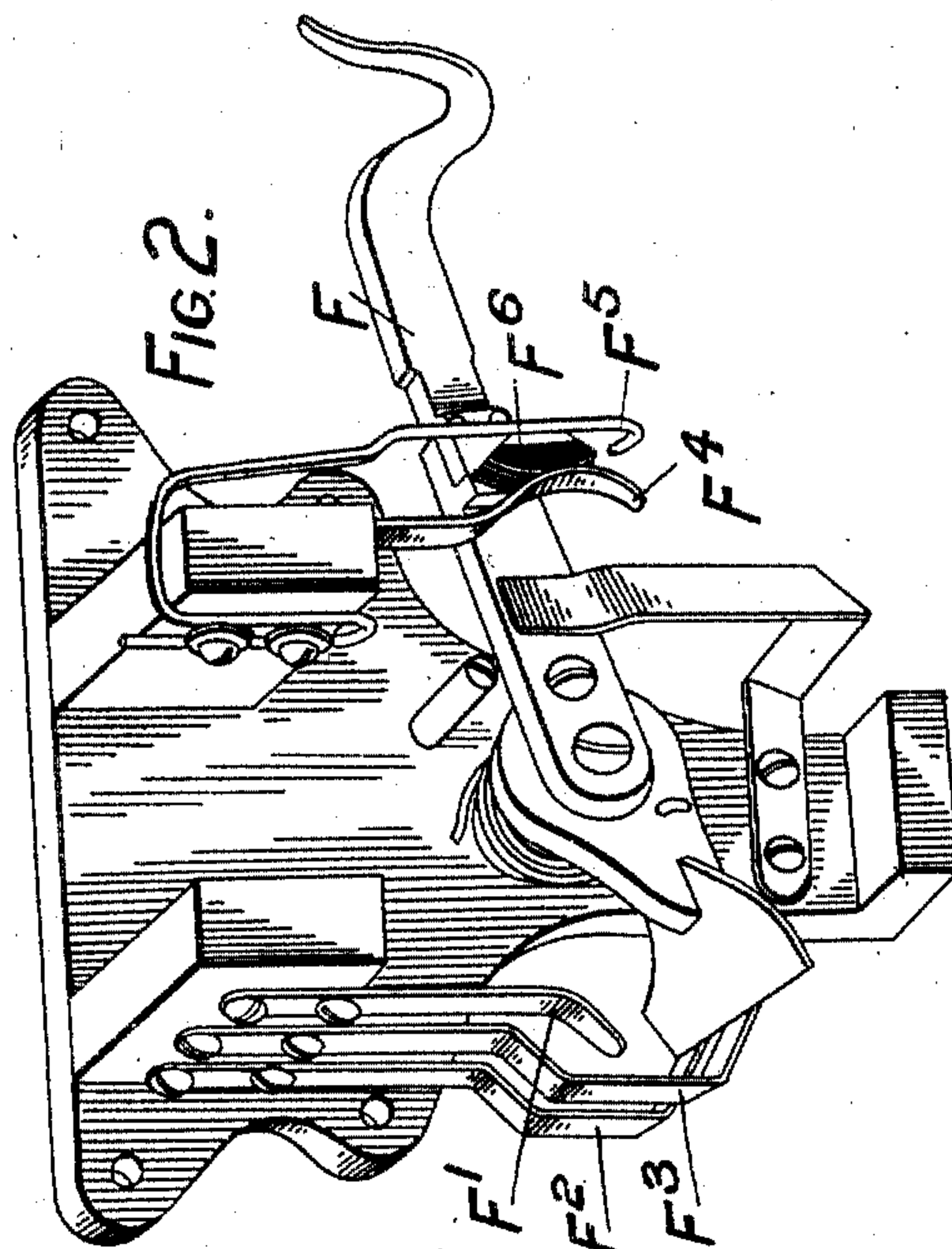
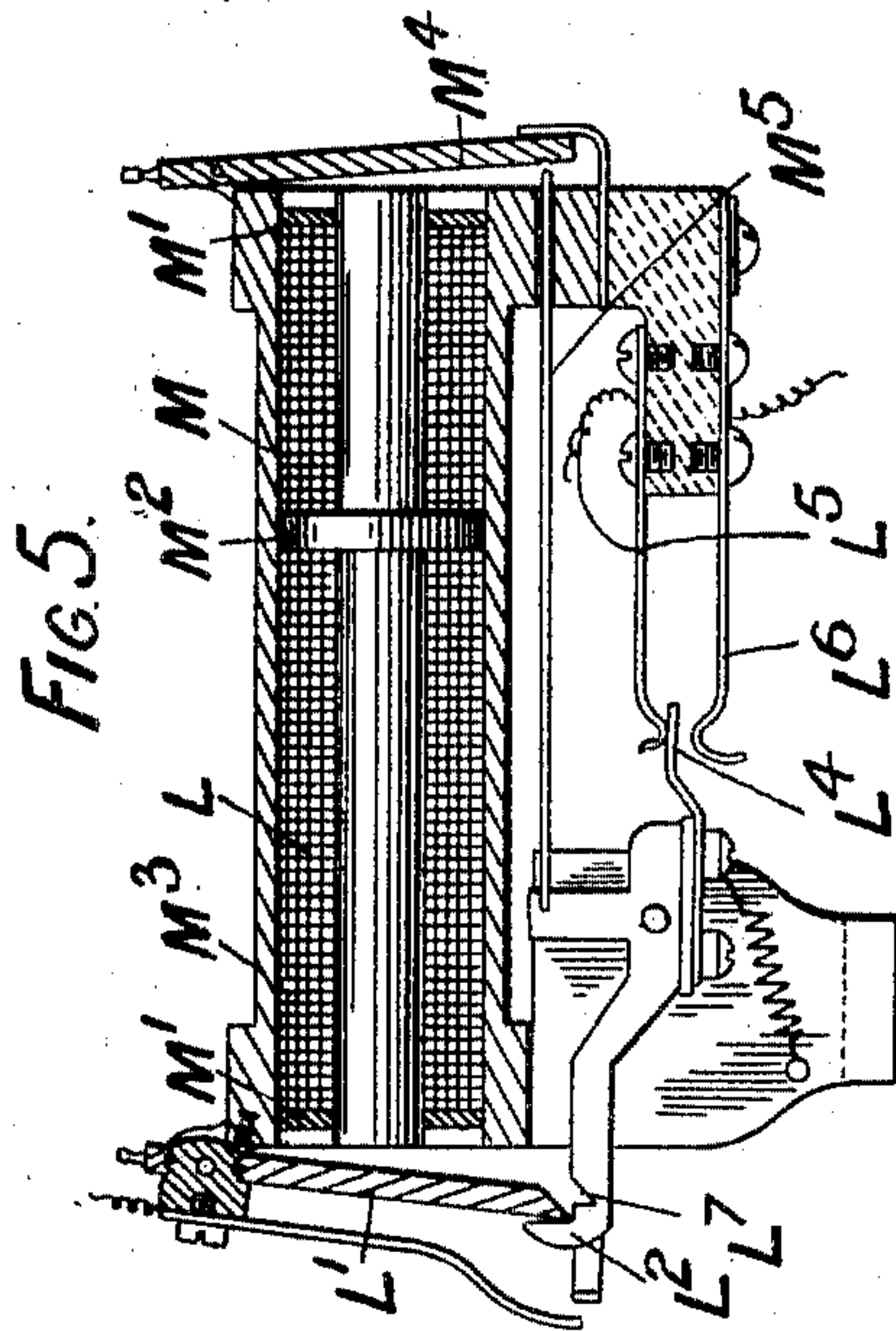
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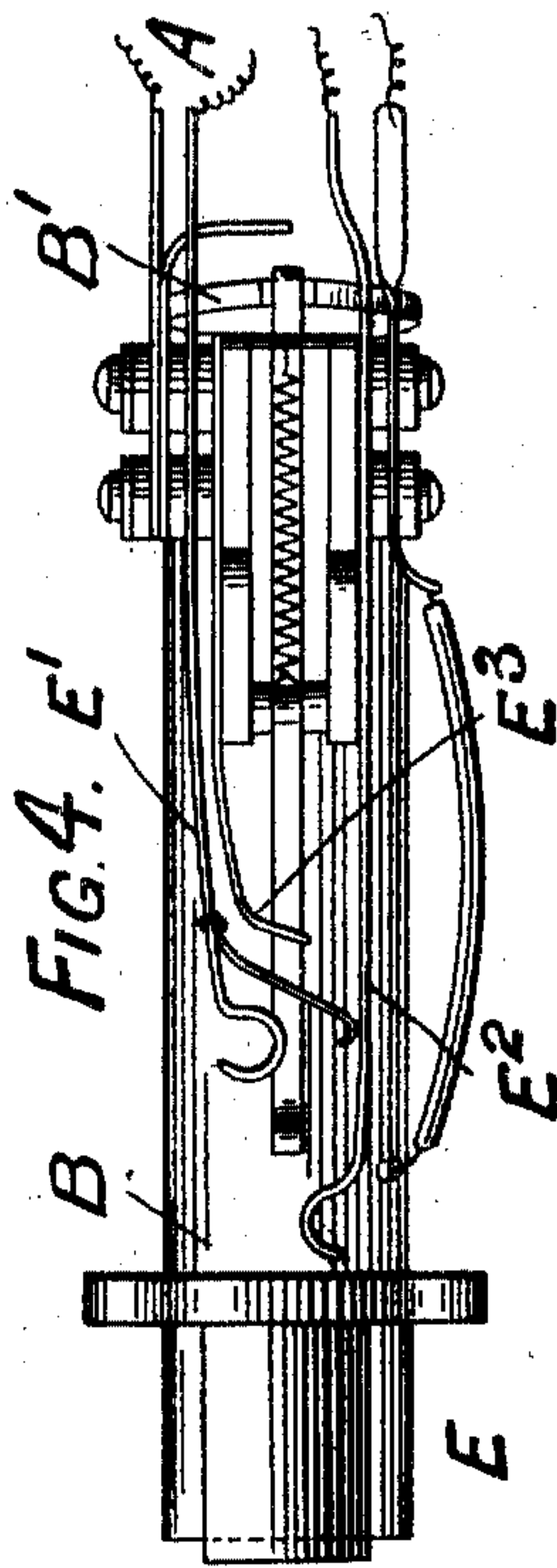
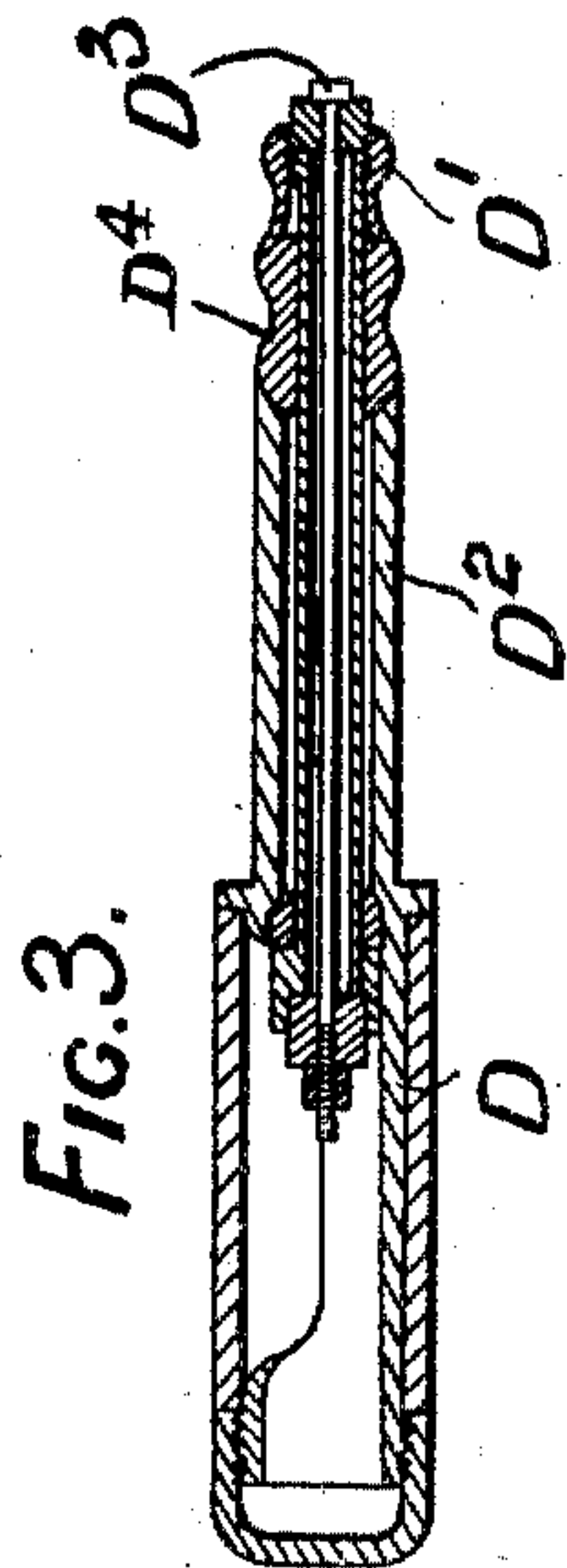
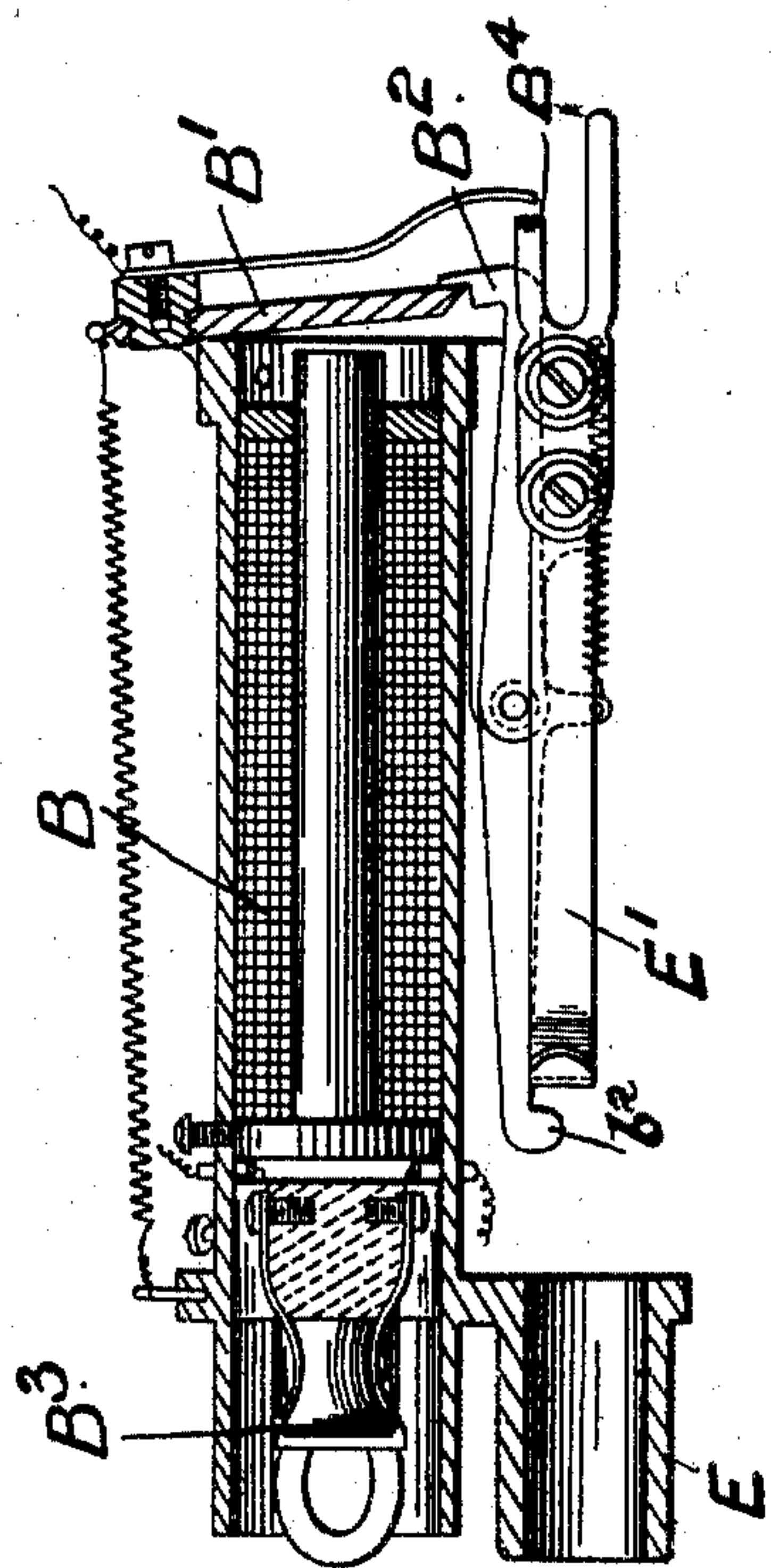
W. C. RUNGE.

TELEPHONE SYSTEM AND APPARATUS THEREFOR.

APPLICATION FILED DEC. 8, 1902.

NO MODEL.

4 SHEETS—SHEET 3.



Witnesses:
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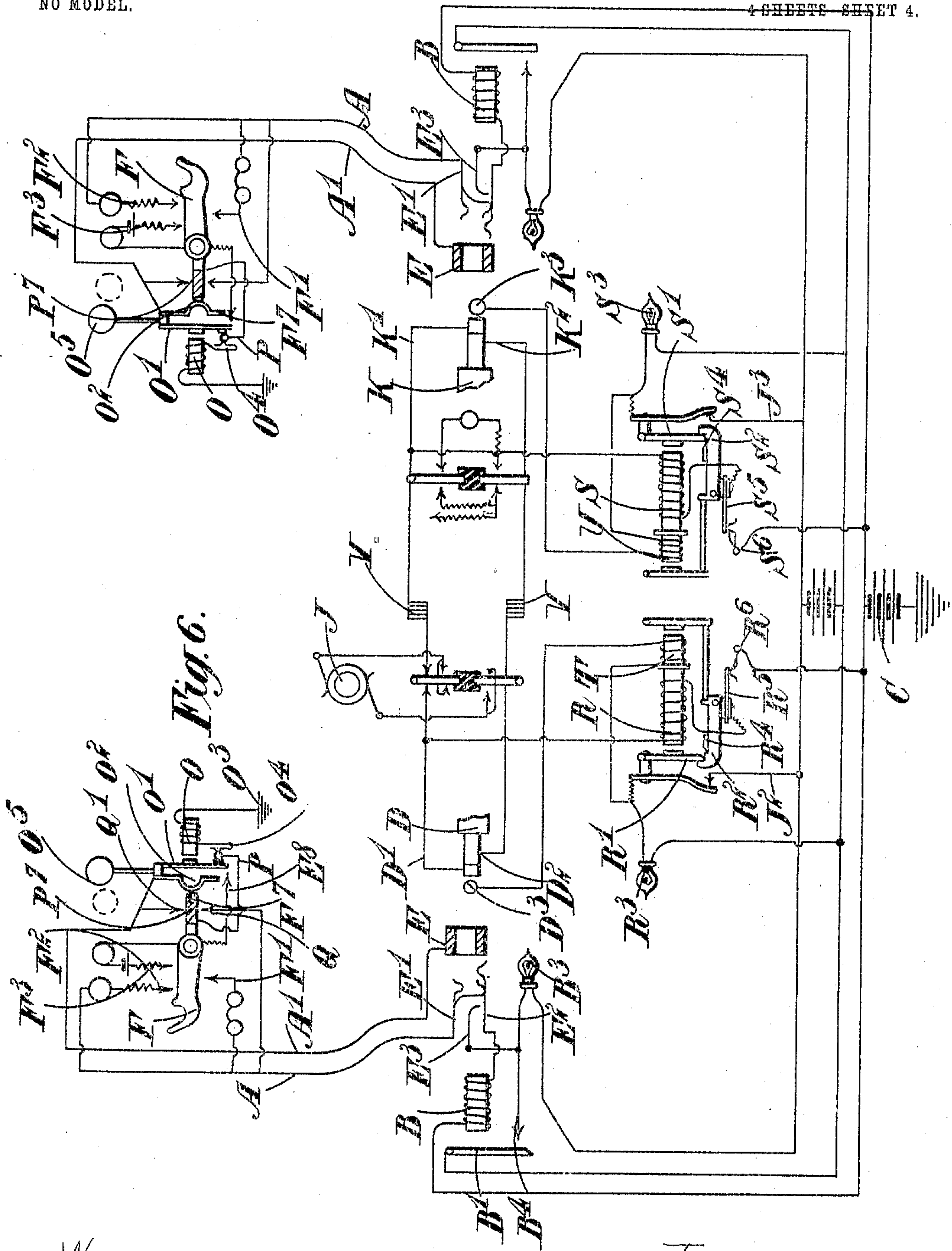
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4 SHEETS SHEET 4.



Witnesses:
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UNITED STATES PATENT OFFICE.

WALTER C. RUNGE, OF LONDON, ENGLAND.

TELEPHONE SYSTEM AND APPARATUS THEREFOR.

SPECIFICATION forming part of Letters Patent No. 776,090, dated November 29, 1904.

Application filed December 6, 1902. Serial No. 134,155. (No model.)

To all whom it may concern:

Be it known that I, WALTER C. RUNGE, a citizen of the United States of America, residing at London, England, have invented certain new and useful Improvements in or Relating to Telephone Systems and Apparatus Therefor, of which the following is a specification.

This invention relates to improvements in telephone systems, the object being to simplify the installation and to provide certain apparatus in a convenient form for this purpose.

The system is one of the type in which the removal of the subscriber's receiver from its hook momentarily earths one line-wire and actuates an annunciator, such as an electric lamp, in the exchange. In addition to this usual annunciator for each subscriber an "engaged" signal is provided in the exchange, such as another electric lamp. This engaged signal is only actuated when both the calling and called subscribers have taken their receivers off their hooks, and an arrangement is made whereby the engaged signal is released when either subscriber hangs up his receiver.

The separate parts of the system will now be described with reference to the accompanying drawings, in which—

Figure 1 is a diagram of the system. Fig. 2 is a perspective view of a switch-hook. Fig. 3 is a longitudinal section through the combined jack and relay. Fig. 4 is an inverted plan of the same, and Fig. 5 is an elevation of an engaged relay and releasing electromagnet with part of the outer shield removed. Fig. 6 is a diagram of a modification of the system.

Referring to Fig. 2, the switch-hook F is connected to one line-wire A. When the receiver is on the hook, the rear end of the hook touches the usual bell-terminal F', so that the subscriber can be rung up. When the receiver is off the hook, the rear end of the hook touches the two talking-circuit contacts F² F³ in the usual way. Two resilient contact-arms F⁴ F⁵ are arranged side by side on one side of the hook normally out of contact with the hook or with one another. The arm F⁴, conveniently a flat spring, is connected to a line-wire A. The other arm, F⁵, consists of a wire having

its lower end bent in horizontally at right angles toward the hook. On the side of the hook F is a double-beveled projection F⁶, one side of which is in metallic connection with the hook, and therefore with the line-wire A', while the other side is of non-conducting material. The arms F⁴ F⁵ and the projection F⁶ are so arranged that when the receiver is on the projection F⁶ is below the bent end of the wire F⁵ and no contacts are made, and when the receiver is off the projection F⁶ is above the bent end of F⁵ and no contacts are made. When the receiver is being taken off, the hook passes upward and the projection F⁶ (on account of its upper beveled end) passes outside the bent end of the wire F⁵ and presses it momentarily against spring F⁴, thus earthing the spring F⁴ and line-wire A for a purpose to be hereinafter explained. When the receiver is being put on, the hook passes downward, and its projection F⁶ (on account of its lower beveled end) passes between the spring F⁴ and the bent wire F⁵. The metallic part of the projection thus momentarily comes in contact with the bent wire F⁵, thus earthing the hook and line-wire A' for a purpose to be hereinafter explained.

Referring to Figs. 3 and 4, the annunciator comprises a line-relay B, having an armature B', which when attracted by the core is retained by a detent B². The detent B² comprises a pivoted lever having a projection b² on the end. The armature carries a spring which when the armature is attracted touches a lamp-terminal B⁴, and thus closes the circuit of a lamp B³ or other well-known line-signal. Immediately below the annunciator is the metallic plug-socket E, which is connected to one line-wire A'. Behind the socket are three springs. The first, E¹, is connected with a line-wire A. The second, E², forms the terminal of the line-relay B and is normally in contact with E¹, and the third, E³, is connected to the lamp B³. The plug D comprises one talking-circuit terminal at the projection D', a second talking-circuit terminal D², and an inside metallic portion D³. A depression D⁴ is formed in the plug. Before the plug is inserted the wires E¹ E² are in contact and the detent B² is in its highest position, (if the ar-

mature is attracted.) The plug and socket are so arranged that when the plug is inserted the wire E' is pushed out of contact with line-relay terminal E^2 and the wire E' comes into
 5 contact with terminal D' . The socket E is joined to the line-relay terminal E^2 through the outer part of the plug D^2 . The inside metallic portion D^3 of the three-way plug makes contact with the spring E^3 . When the pro-
 10 jection D' engages the end b^2 of the detent-lever B^2 , the lever is tilted so as to release the armature B' , as shown in Fig. 3. When the projection D' passes the end b^2 , the latter falls into a depression D^4 in the plug, and the lever
 15 is then free to act as a detent for the armature B' again, although the plug is in the socket.

Referring to Fig. 5, to indicate that both subscribers' receivers are off the hooks F a supervisory relay L and signal L^3 are em-
 20 ployed, hereinafter called the "supervisory" signal. One end of this supervisory relay L is connected to an earthed battery C and the other end is arranged in proximity to a contact-breaker L^4 , the blade of which forms one
 25 talking-circuit terminal. When, therefore, the second-subscriber's plug K is in the jack and he removes the receiver from the hook F , one line-wire A is earthed, as above described, and a circuit is completed through the battery
 30 C and the supervisory relay L , and the supervisory signal L^3 remains in engaged position so long as both receivers are off, since the supervisory-relay armature L' is retained by a detent L^7 after its momentary attraction. The
 35 detent L^7 is so connected to the contact-breaker L^4 that its retention causes the blade to leave the supervisory-relay terminal L^5 and come into contact with a second talking-circuit terminal L^6 . When clearing out, if one sub-
 40 scriber hangs up his receiver on the hook F the supervisory signal L^3 is put out of action by means of an electromagnet M , which releases the armature detent-lever L , as herein-
 45 after described. The electromagnet-circuit has a gap which is closed by the relay-armature L' when in the supervisory position, a second gap at the central terminal D^3 of the three-way plug, and a third gap at B^4 , which is
 50 closed by the subscriber's line-relay B when the receiver is either taken off or put on its hook F . The closing of the third gap B^4 puts the electromagnet M in circuit with the battery N and energizes it. The hanging up of
 55 one subscriber's hook F puts the second line-wire A' to earth, as explained above, and completes a circuit through the line-relay B , thereby actuating the subscriber's line-signal B^3 . The removal of the plug D from the jack E releases the detent-armature B' of the line-
 60 relay B and leaves the jack in its normal unconnected position in which no current is being used at all. Preferably both the subscribers' line-signals B^3 and the supervisory signal L^3 are small incandescent lamps. The
 65 earthed wires may obviously be replaced by

metallic connections. An important advantage of this invention is that as few relays are employed the number of contacts is considerably less than in former systems. The super-
 70 visory signal-relay L and releasing-electromagnet M are conveniently formed on one core and are single-wound. The ends are covered by fiber or the like M' , and the coils are separated by a magnetic screen M^2 , of iron, to prevent any lines of magnetic force pass-
 75 ing from one coil to the portion of core within the other coil. The two coils are incased in an iron tube M^3 , which, with the screen, forms a path for the lines of force outside the coils. One end of the supervisory relay-coil, L , is
 80 connected to an earthed battery C . The other end forms one side, L^5 , of a contact-breaker. The blade L^4 of the contact-breaker is in one main wire, K' , of the second plug K and the
 85 other side, L^6 , of the contact-breaker is in the other main wire, K^2 , of the second plug K . The supervisory relay has an armature L' , which when attracted is retained by a detent-lever L^2 , and when this occurs the armature
 90 falls into a recess L^7 in the detent and allows the blade L^4 of the contact-breaker to come into contact with the main-wire terminal L^6 , thus closing the talking-circuit. The arma-
 95 ture L' at the same time closes the circuit of the engaged supervisory signal L^3 and lights a lamp or the like and also closes one gap in the circuit of the electromagnet M . The second
 plug K is provided with an electromagnet-terminal K^3 in the same way as the first, and therefore if either receiver is hung up on the
 100 hook F the corresponding line-relay B closes the electromagnet-circuits B^4 and its armature M^4 is attracted. This motion actuates a rod M^5 , which releases the detent L^2 of the arma-
 105 ture L' of the supervisory relay L through a bell-crank lever or similar device.

Referring to Fig. 1, the connections of the system are as follows: One line-wire, A , extends from terminal F^4 and subscriber's instru-
 110 ment to jack-terminal E' . Another line-wire, A' , extends from the hook F to the socket E . One plug-wire, D' , extends from the plug to the upper hand-lever terminal H^2 . Another
 115 plug-wire, D^2 , extends from the plug to the lower hand-lever terminal H' . The hand-lever when pressed over to the left side puts these two plug-wires into connection with the operator's instrument. When the hand-lever
 120 is pressed to the right, the called subscriber is put into connection with the magneto J . A third plug-wire D^3 K^3 extends from each plug to the releasing-electromagnet M . One main
 125 earthed battery, C , is in connection with the line-relays B and also with the supervisory relay L . A second battery N is connected with one terminal of the engaged lamp L^3 and
 130 with a terminal on the armature L' , so that when the armature L' is attracted the supervisory lamp L^3 is lighted. The battery N is also connected with the releasing-electromagnet

M. In addition to being connected to a contact at the hand-lever H the magneto J is joined to a spring-contact J', operating in conjunction with the armature L' of the supervisory relay, so that the magneto is cut out when the supervisory lamp is lighted and the subscribers are talking.

The operation of the system is as follows: When the first subscriber takes the receiver off the hook F, his bell-circuit is broken at F' and the talking-circuit made at F² F³. On passing upward the projection F⁶ on the hook presses the earthed spring F⁵ against the first line-wire terminal F⁴ and completes the circuit of the line-relay B, which operates the line-signal B³. The circuit is then as follows: from the earthed battery C, through line-relay B and springs E² and E' and line-wire A, through spring F⁴ and earthed terminal F⁵. This circuit is only momentary; but as the line-relay armature B' is caught by the detent B² the lamp-circuit remains closed and the lamp B³ lighted. The circuit of the lamp is from the battery N to the armature B', to contact B⁴, and thence by a wire to the lamp B³ and back to the battery N. The operator then inserts the first plug D in the first-subscriber's jack E and joins the line-wires D' to E' and D² to E², throws the line-relay out of contact with the first line-wire A by separating spring E' from E² and into contact with the second line-wire A' by contact of D² and E², and completes part of the electromagnet-circuit through the inner portion D³ of the plug. At this stage the talking-circuit is from F², through hook F and line-wire A', to socket E, thence through plug D to the second terminal H² of the operator's hand-lever H, also from F², through the line-wire A and jack-spring E', into plug-wire D' and thence to the first terminal H' of the operator's hand-lever. The hand-lever is then pressed into contact with the terminals of the operator's instrument in the usual way. The operator being now in talking connection with the first subscriber obtains the required number and inserts the second plug K in the socket of that number and then moves the hand-lever H, so as to cut out the operator's telephone and to put the magneto J in connection with the wires of the second plug K in the usual way to ring up the second subscriber. The circuit is from the magneto J, through the spring J', to the first hand-lever terminal H', through plug-wire K' and line-wire A to the called subscriber's bell, and back through the line-wire A', socket E, plug K² to the second hand-lever terminal H² and back to the magneto J. The hand-lever H springs back or is moved back so as to put the second plug-wires into contact with the talking-circuit. The talking-circuit is now from the calling-subscriber's instrument, through the two line-wires, to the terminals H' H² of the hand-lever, as above described. One branch of the talking-circuit is complete

from the second hand-lever terminal H² through plug K² and socket E to the called instrument. The other branch of the talking-circuit passes from the first hand-lever terminal H' to the contact L⁶, where there is a gap. From the other side of the gap—namely, the blade L⁴—the circuit is completed through the plug-wire K' to the called instrument. It only therefore remains to close the gap L⁴ L⁶ to complete the talking-circuit. The second subscriber then removes his receiver from the hook F, and in doing so puts to earth his first line-wire A, as above described, and energizes the supervisory signal-relay L. The plug K being in its socket, the energizing of the supervisory relay is through the following circuit: from the earthed battery C, through the coil L and terminal L⁵, to the blade L⁴ and thence through the plug-wire K' and line-wire A to the spring, which is momentarily earthed as the called-subscriber's hook F rises. The supervisory relay L being earthed attracts its armature L' and actuates the supervisory signal L³, the lighting-circuit being from battery N, through lamp L³ and contact on the armature L', back to the battery N. The armature L' then engages the recess L⁷ in the detent L² and allows the contact-breaker blade L⁴ to complete the talking-circuit by leaving L⁵ and coming into contact with L⁶. The supervisory signal L³ is thus in operation while the subscribers are talking. The talking-circuit is as follows: from the calling-subscriber's instrument, through line-wire A, spring E', plug-terminal D', to hand-lever terminal H', to contact L⁶, blade L⁴, and through the plug-wire K' and line-wire A to the called subscriber's instrument and back through line-wire A' and plug-wire K² to the second hand-lever terminal H², through plug-wire D, socket E, and line-wire A' to the calling-subscriber's instrument. When one or other of the subscribers hangs up his receiver on the hook F, the projection F⁶ on the hook makes contact with the earthed wire F⁵, and therefore completes the line-relay circuit B through the second line-wire A', the circuit being from battery C, through line-relay B, spring E², plug D², and socket E, line-wire A', hook F, and projection F⁶, to the earthed wire F⁵. The line-signal B³ is then operated and the electromagnet-circuit is completed at B⁴, so that the supervisory signal L³ is put out of operation, as above described. The circuit of the releasing-electromagnet is from the battery N, through the armature L' and through an armature-contact, to coil M, thence to the plug-terminals D³ and K³, through the spring-contact E³, contact B⁴, and line-relay armature B', back to the battery N. The operator on seeing that the subscriber's lamp B³ is lighted removes the plug D from the socket E and by so doing replaces all the contacts in their original positions, as the armature B is me-

chanically released from its detent B^2 and the spring E' again comes into contact with the spring E^2 . When it is necessary to make a connection between two operators, the apparatus of the second operator acts in the same way as that of a called subscriber.

Referring to Fig. 6, instead of using a mechanical detent B^2 and actuating the line-relay B by a momentary current the detent may be dispensed with. In this case the hook F is provided with an extension F^7 , which in moving up or down is arranged to come into contact with a projection O^2 on the armature O' of a relay O. One end, O^3 , of the relay-winding is earthed, and the other end, O^4 , terminates in a contact-piece in proximity with a spring P, connected with an insulated metallic piece P^7 on the hook extension F^7 . The metallic piece is arranged to come into contact with a terminal Q of the line-wire A when the extension F^7 moves downward and also to come into contact with a terminal Q' of the other line-wire, A' , when the extension moves upward. The terminal O^4 and spring P are pressed together when the relay O attracts its armature O' , which is, however, insulated from these. The hook F is also provided with a contact-piece E^8 , which touches the armature when it is not attracted, the armature being permanently connected with the second line-wire A' . In this arrangement when the first subscriber removes his receiver from the hook F the extension F^7 , moving downward, pushes the armature O' up to the relay O. Contact is thus made between the spring P and the terminal O^4 . At the same time the metallic piece P^7 comes into contact with the terminal Q, and therefore through the line-wire A, springs E' E^2 , and relay B to the earthed battery C. The relays B and O are energized and the armatures are held up. When, however, the plug D is inserted in the jack E, the spring E' leaves the spring E^2 and the relay-circuits are broken, with the result that the signal-lamp B^3 is extinguished and the armature O' falls back, breaking the connection O^4 P and making the connection E^8 O' , thereby closing the talking-circuit. The armature O may be provided with a signal-disk O^5 , the movements of which indicate to the subscriber the state of his circuit. In this case two supervisory signal-relays R S are used, the talking-circuit wires of the two plugs being provided with condensers V, which separate the engaged signal-relays. The windings of one supervisory relay R are connected with a talking-circuit wire D' of one plug D, and the windings of the other supervisory relay S are connected with one talking-circuit wire K' of the answering-plug K. The supervisory relays are provided, as before, with armatures R' S' , having detents R^2 S^2 , with beveled edges R^4 S^4 , which cause the detents to move downward when the armatures R' S' are attracted,

thus raising the blades R^5 S^5 of the contact-breakers. Before the armatures are attracted the blades R^5 S^5 are in contact with terminals R^6 S^6 in connection with an earthed battery C. The windings of the releasing-electromagnets T U, as before, are connected with the tips D^3 K^3 of the plugs and with the springs on the armatures R' S' , battery connections J^2 J^3 being arranged to come into contact with the springs when the armatures R' S' are attracted. When the operator inserts the plug D in the calling-subscriber's jack, the winding of the supervisory relay R is connected through the talking-circuit wire D' , the line-wire A, and the contact O^4 P to earth and the supervisory signal-lamp R^3 is actuated, the armature R' is held up, and the circuit is broken at R^5 . The operator obtains the required number in the usual way and inserts the second plug K in the jack of the answering-subscriber. When the answering-subscriber takes his receiver off the hook F, the corresponding armature O' is pushed against the relay and the contacts O^4 P and Q P^7 are made and the line-wire A is earthed. The supervisory signal-relay S then attracts its armature and the lamp S^3 is lighted. When either subscriber hangs up his receiver, the line-wire A' is earthed through the contacts O^4 P and P^7 Q' and the releasing-electromagnet is energized, thereby extinguishing the corresponding supervisory signal-lamp R^3 , say. Owing to the fact that the supervisory signals are separate from one another the remaining supervisory signal S^3 still remains in operation, so that the operator does not remove the plugs until both supervisory signals R^3 S^3 have been extinguished and both the line-signals B^3 have been lighted.

What I claim as my invention, and desire to secure by Letters Patent, is—

1. A subscriber and exchange telephone system comprising two line-circuit wires between the subscriber's station and the exchange, two plug-circuit wires in the exchange connectible respectively with the two line-circuit wires, a supervisory signal-relay at the exchange in circuit with the first circuit-wire and with an earthed battery, means for earthing the first circuit-wire at the subscriber's station, means for retaining the supervisory signal in operation when actuated, and an electromagnet for releasing the supervisory signal in circuit with the second circuit-wire and a battery.

2. A subscriber and exchange telephone system comprising two line-circuit wires between the subscriber's station and the exchange, two plug-circuit wires in the exchange, connectible respectively with the two line-circuit wires, a supervisory signal-relay at the exchange in circuit with the first circuit-wire and with an earthed battery, means for earthing the first circuit-wire at the subscriber's station, means for retaining the supervisory signal in operation when actuated, an electromagnet for re-

leasing the supervisory signal in circuit with the second circuit-wire and a battery, one gap in the circuit and means controlled by the subscriber for closing the gap.

5 3. A subscriber and exchange telephone system comprising two line-circuit wires between a subscriber and the exchange, a subscriber's signal-relay at the exchange in circuit with the first line-wire and an earthed battery, two
10 plug-circuit wires in the exchange connectible respectively with the two line-circuit wires, a supervisory signal-relay at the exchange in circuit with the first circuit-wire and with an earthed battery, means for earthing the first
15 circuit-wire at a subscriber's station, means for retaining the supervisory signal in operation when actuated, an electromagnet for releasing the supervisory signal in circuit with the second circuit-wire and a battery, a gap
20 in the circuit and means controlled by the subscriber for closing the gap.

4. A subscriber and exchange telephone system comprising two line-circuit wires between a subscriber and the exchange, a subscriber's
25 signal-relay at the exchange in circuit with the first line-wire and an earthed battery, two plug-circuit wires in the exchange connectible respectively with the two line-circuit wires, means controlled by the plug for putting the
30 subscriber's relay out of circuit with the first line-wire into circuit with the second, a supervisory signal-relay at the exchange in circuit with the first circuit-wire and with an earthed battery, means for earthing the first circuit-
35 wire at a subscriber's station, means for retaining the supervisory signal in operation when actuated, an electromagnet for releasing the supervisory signal in circuit with the second circuit-wire and a battery, a gap in the
40 circuit and means controlled by the subscriber for closing the gap.

5. A subscriber and exchange telephone system comprising two line-circuit wires between a subscriber and the exchange, a subscriber's
45 signal-relay at the exchange in circuit with the first line-wire and an earthed battery, two plug-circuit wires in the exchange connectible respectively with the two line-circuit wires, means controlled by the plug for putting the subscriber's relay out of circuit with the first line-wire into circuit with the second,
50 a supervisory signal-relay at the exchange in circuit with the first circuit-wire and with an earthed battery, means for earthing the first circuit-wire at a subscriber's station, means for retaining the supervisory signal in operation when actuated, an electromagnet for releasing the supervisory signal in circuit with the second circuit-wire and a battery, a gap
55 in the circuit, means controlled by the subscriber for closing the gap, means at the subscriber's station for earthing the first line-wire and means for earthing the second line-wire.

6. A subscriber and exchange telephone system comprising two line-circuit wires between

a subscriber and the exchange, a subscriber's signal-relay at the exchange in circuit with the first line-wire and an earthed battery, two plug-circuit wires in the exchange connectible respectively with the two line-circuit
70 wires, means controlled by the plug for putting the subscriber's relay out of circuit with the first line-wire into circuit with the second, a supervisory signal-relay at the exchange in circuit with the first circuit-wire and with an
75 earthed battery, means for earthing the first circuit-wire at a subscriber's station, means for retaining the supervisory signal in operation when actuated, an electromagnet for releasing the supervisory signal in circuit with
80 the second circuit-wire and a battery, a gap in the circuit, means controlled by the subscriber for closing the gap, means at the subscriber's station for earthing the first line-wire when the receiver is removed from the hook
85 and means for earthing the second line-wire when the receiver is replaced.

7. A subscriber and exchange telephone system comprising two line-circuit wires between a subscriber and the exchange, a subscriber's
90 signal-relay at the exchange in circuit with the first line-wire and an earthed battery, two plug-circuit wires in the exchange connectible respectively with the two line-circuit wires, means controlled by the plug for putting the subscriber's relay out of circuit with
95 one line-wire into circuit with the second, a supervisory signal-relay at the exchange in circuit with the first circuit-wire and with an earthed battery, means for earthing the first
100 circuit-wire at a subscriber's station, means for retaining the supervisory signal in operation when actuated, an electromagnet for releasing the supervisory signal in circuit with the second circuit-wire and a battery, one gap
105 in the circuit and means controlled by the plug for closing the gap, a second gap in the circuit and means controlled by the armature of the engaged relay for closing it, means at the subscriber's station for earthing the first line-
110 wire when the receiver is removed from the hook and means for earthing the second line-wire when the receiver is replaced.

8. A subscriber and exchange telephone system comprising two line-circuit wires between
115 a subscriber and the exchange, a subscriber's signal-relay at the exchange in circuit with the first line-wire and an earthed battery, two plug-circuit wires in the exchange connectible respectively with the two line-circuit
120 wires, means controlled by the plug for putting the subscriber's relay out of circuit with one line-wire into circuit with the second, a supervisory signal-relay at the exchange in circuit with the first circuit-wire and with an
125 earthed battery, means for earthing the first circuit-wire at a subscriber's station, means for retaining the supervisory signal in operation when actuated, an electromagnet for releasing the supervisory signal in circuit with
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the second circuit-wire and a battery, one gap in the circuit and means controlled by the plug for closing the gap, a second gap in the circuit and means controlled by the armature of the engaged relay for closing it, a third gap in the circuit and means controlled by the armature of the subscriber's relay for closing it, means at the subscriber's station for earthing the first line-wire when the receiver is removed from the hook and means for earthing the second line-wire when the receiver is replaced.

9. A subscriber and exchange telephone system comprising two line-circuit wires between a subscriber and the exchange, a subscriber's signal-relay at the exchange in circuit with the first line-wire and an earthed battery, two plug-circuit wires in the exchange connectible respectively with the two line-circuit wires, means controlled by the plug for putting the subscriber's relay out of circuit with the first line-wire into circuit with the second, a supervisory signal-relay at the exchange in circuit with the first circuit-wire and with an earthed battery, means for earthing the first circuit-wire at a subscriber's station, means for retaining the supervisory signal in operation when actuated, an electromagnet for releasing the supervisory signal in circuit with the second circuit-wire and a battery, a gap in the circuit, means controlled by the subscriber for closing the gap, means at the subscriber's station for earthing the first line-wire and actuating the subscriber's signal-relay when the receiver is removed from the hook, means for releasing the subscriber's relay when the plug is inserted in the jack, means for earthing the second line-wire and actuating the subscriber's signal-relay when the receiver is replaced and means for releasing the subscriber's relay when the plug is removed from the jack.

10. A subscriber and exchange telephone system comprising two line-circuit wires between a subscriber's telephone and an exchange-jack, two plug-circuit wires in the exchange which can be connected respectively with the two line-circuit wires by inserting a plug in the jack, a supervisory signal-relay at the exchange in circuit with the first circuit-wire and with an earthed battery and means at the subscriber's telephone for earthing the first circuit-wire and actuating the supervisory signal-relay, an armature-detent for retaining the supervisory signal in operation when actuated and an electromagnet for releasing the armature in circuit with the second circuit-wire and a battery.

11. A subscriber and exchange telephone system comprising two line-circuit wires between a subscriber's telephone and an exchange-jack, two plug circuit-wires in the exchange which can be connected respectively with the two line-circuit wires by inserting a plug in the jack, a supervisory signal-relay at

the exchange in circuit with the first circuit-wire and with an earthed battery, means at the subscriber's telephone for earthing the first circuit-wire and actuating the supervisory signal-relay, an armature-detent for retaining the supervisory signal in operation when actuated, an electromagnet for releasing the armature in circuit with the second circuit-wire and a battery, a gap in the circuit and means controlled by the subscriber for closing the gap.

12. A subscriber and exchange telephone system comprising two line-circuit wires between a subscriber's telephone and an exchange-jack, a subscriber's signal-relay at the exchange in circuit with the first line-wire and an earthed battery, two plug-circuit wires in the exchange which can be connected respectively with the two line-circuit wires by inserting the plug in the jack, a supervisory signal-relay at the exchange in circuit with the first circuit-wire and with an earthed battery, means at a subscriber's telephone for earthing the first circuit-wire and actuating the supervisory signal-relay, an armature-detent for retaining the supervisory signal in operation when actuated, an electromagnet for releasing the armature in circuit with the second circuit-wire and with a battery, a gap in the circuit and means controlled by the armature of the subscriber's relay for closing the gap.

13. A subscriber and exchange telephone system comprising two line-circuit wires between a subscriber's telephone and an exchange-jack, a subscriber's signal-relay at the exchange in circuit with the first line-wire and an earthed battery, two plug-circuit wires in the exchange which can be connected respectively with the two line-circuit wires by inserting the plug in the jack, means controlled by the plug for putting the subscriber's relay out of circuit with one line-wire into circuit with the second, a supervisory signal-relay at the exchange in circuit with the first circuit-wire and with an earthed battery, means at a subscriber's telephone for earthing the first circuit-wire and actuating the supervisory signal-relay, an armature-detent for retaining the supervisory signal in operation when actuated, an electromagnet for releasing the armature in circuit with the second circuit-wire and with a battery, a gap in the circuit and means controlled by the armature of the subscriber's relay for closing the gap.

14. A subscriber and exchange telephone system comprising two line-circuit wires between a subscriber's telephone and an exchange-jack, a subscriber's signal-relay at the exchange in circuit with the first line-wire and an earthed battery, two plug-circuit wires in the exchange which can be connected respectively with the two line-circuit wires by inserting the plug in the jack, means controlled by the plug for putting the subscriber's relay out of circuit with one line-wire into

circuit with the second, a supervisory signal-relay at the exchange in circuit with the first circuit-wire and with an earthed battery, means at a subscriber's telephone for earthing the first circuit-wire and actuating the supervisory signal-relay, an armature-detent for retaining the supervisory signal in operation when actuated, an electromagnet for releasing the armature in circuit with the second circuit-wire and with a battery, a gap in the circuit, means controlled by the armature of the subscriber's relay for closing the gap, means controlled by the subscriber's hook for earthing the first line-wire and means controlled by the subscriber's hook for earthing the second line-wire.

15. A subscriber and exchange telephone system comprising two line-circuit wires between a subscriber's telephone and an exchange-jack, a subscriber's signal-relay at the exchange in circuit with the first line-wire and an earthed battery, two plug-circuit wires in the exchange which can be connected respectively with the two line-circuit wires by inserting the plug in the jack, means controlled by the plug for putting the subscriber's relay out of circuit with one line-wire into circuit with the second, a supervisory signal-relay at the exchange in circuit with the first circuit-wire and with an earthed battery, means at a subscriber's telephone for earthing the first circuit-wire and actuating the supervisory signal-relay, an armature-detent for retaining the supervisory signal in operation when actuated, an electromagnet for releasing the armature in circuit with the second circuit-wire and with a battery, a gap in the circuit, means controlled by the armature of the subscriber's relay for closing the gap, means controlled by the subscriber's hook for earthing the first line-wire when the receiver is removed from the hook and means controlled by the subscriber's hook for earthing the second line-wire when the receiver is replaced.

16. A subscriber and exchange telephone system comprising two line-circuit wires between a subscriber's telephone and an exchange-jack, a subscriber's signal-relay at the exchange in circuit with the first line-wire and an earthed battery, two plug-circuit wires in the exchange which can be connected respectively with the two line-circuit wires by inserting the plug in the jack, means controlled by the plug for putting the subscriber's relay out of circuit with one line-wire into circuit with the second, a supervisory signal-relay at the exchange in circuit with the first circuit-wire and with an earthed battery, means at a subscriber's telephone for earthing the first circuit-wire and actuating the supervisory signal-relay, an armature-detent for retaining the supervisory signal in operation when actuated, an electromagnet for releasing the armature in circuit with the second circuit-wire and

with a battery, a gap in the circuit, means controlled by the armature of the subscriber's relay for closing the gap, means controlled by the subscriber's hook for earthing the first line-wire and actuating the subscriber's signal-relay, means for releasing the subscriber's signal when the plug is inserted in the jack, means controlled by the hook for earthing the second line-wire and actuating the subscriber's signal-relay when the receiver is replaced and means for releasing the subscriber's signal when the plug is removed from the jack.

17. A subscriber and exchange telephone system comprising two line-circuit wires between a subscriber's telephone and an exchange-jack, a subscriber's signal-relay at the exchange in circuit with the first line-wire and an earthed battery, two plug-circuit wires in the exchange which can be connected respectively with the two line-circuit wires by inserting the plug in the jack, a supervisory signal-relay at the exchange in circuit with the first circuit-wire and with an earthed battery, means at a subscriber's telephone for earthing the first circuit-wire and actuating the supervisory signal-relay, an armature-detent for retaining the supervisory signal in operation when actuated, an electromagnet for releasing the armature in circuit with the second circuit-wire and with a battery, a gap in the circuit, means controlled by the armature of the subscriber's relay for closing the gap, a second gap in the circuit and means controlled by the plug for closing the gap.

18. A subscriber and exchange telephone system comprising two line-circuit wires between a subscriber's telephone and an exchange-jack, a subscriber's signal-relay at the exchange in circuit with the first line-wire and an earthed battery, two plug-circuit wires in the exchange which can be connected respectively with the two line-circuit wires by inserting the plug in the jack, a supervisory signal-relay at the exchange in circuit with the first circuit-wire and with an earthed battery, means at a subscriber's telephone for earthing the first circuit-wire and actuating the supervisory signal-relay, an armature-detent for retaining the supervisory signal in operation when actuated, an electromagnet for releasing the armature in circuit with the second circuit-wire and with a battery, a gap in the circuit, means controlled by the armature of the subscriber's relay for closing the gap, a second gap in the circuit, means controlled by the plug for closing the gap, a third gap in the circuit and means controlled by the armature of the engaged relay for closing it.

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

WALTER C. RUNGE.

Witnesses:

WILLIAM H. BALLANTYNE,
HARRY W. SLEDGE.