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5 Sheets—Sheet 1.

F. J. HOLMES.

SIGNALING APPARATUS FOR TELEPHONE SYSTEMS.

No. 596,509.

Patented Jan. 4, 1898.

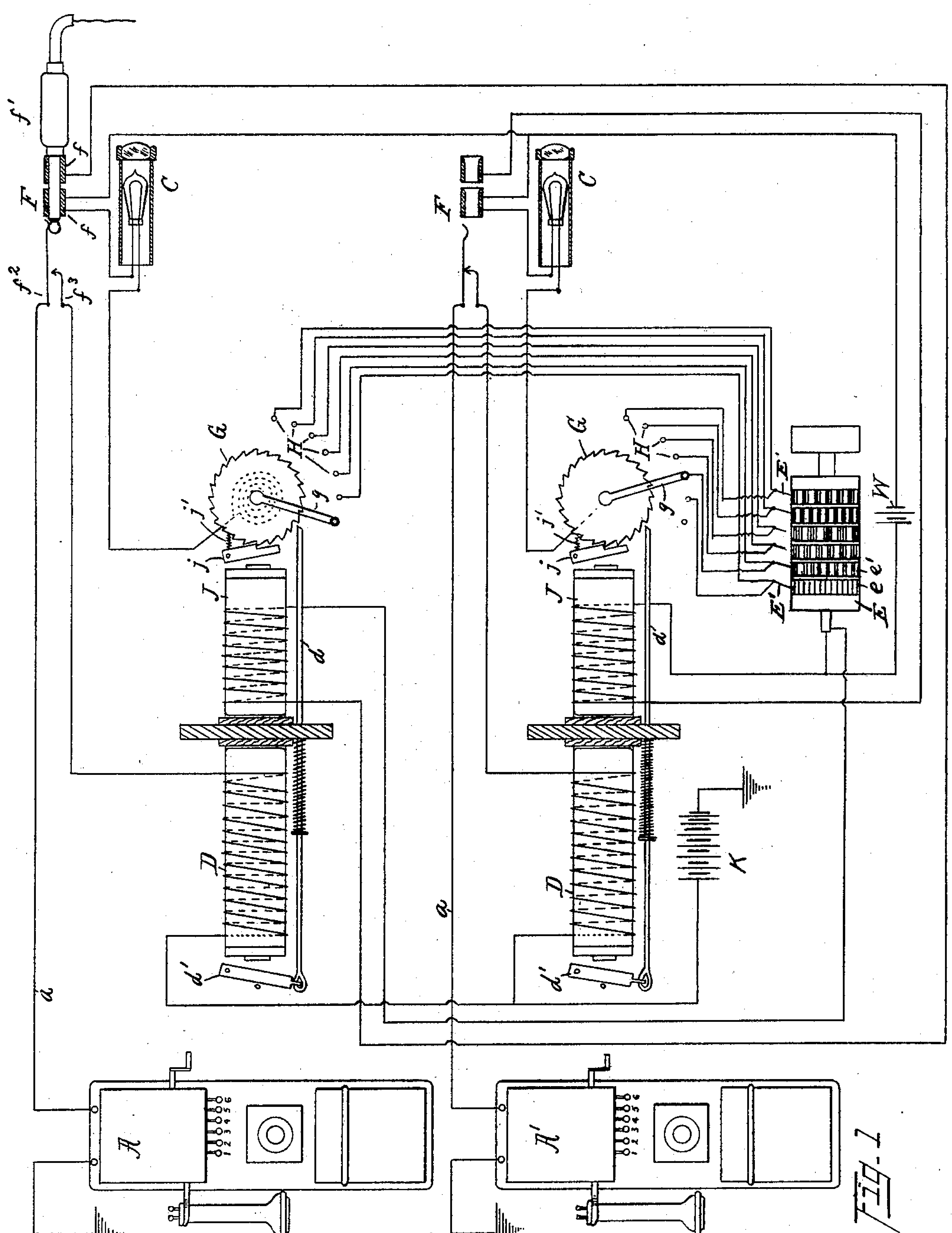

Fig. 1

Witnesses.

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(No Model.) 5 Sheets—Sheet 2.

F. J. HOLMES.

SIGNALING APPARATUS FOR TELEPHONE SYSTEMS.

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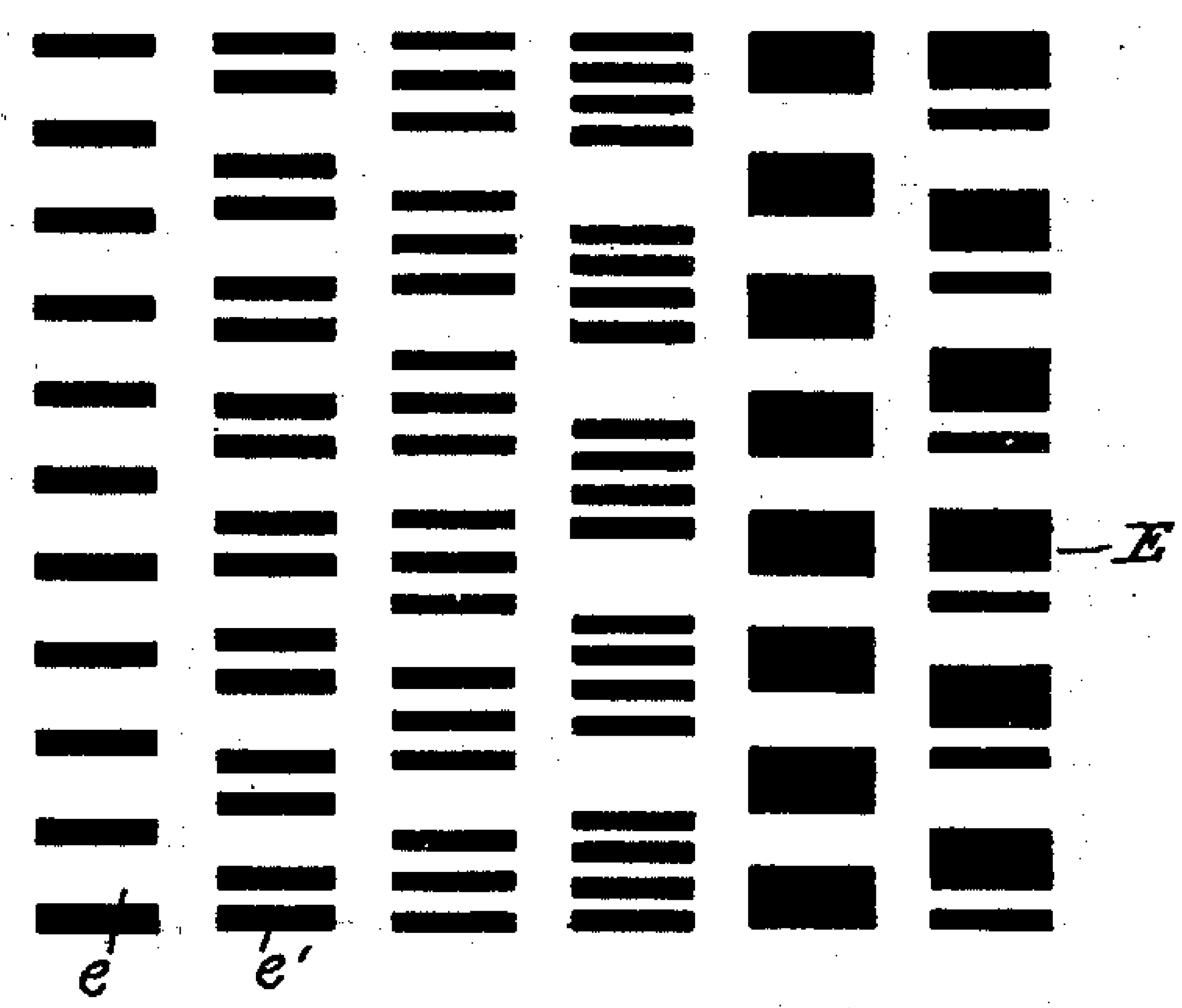

Fig. 2

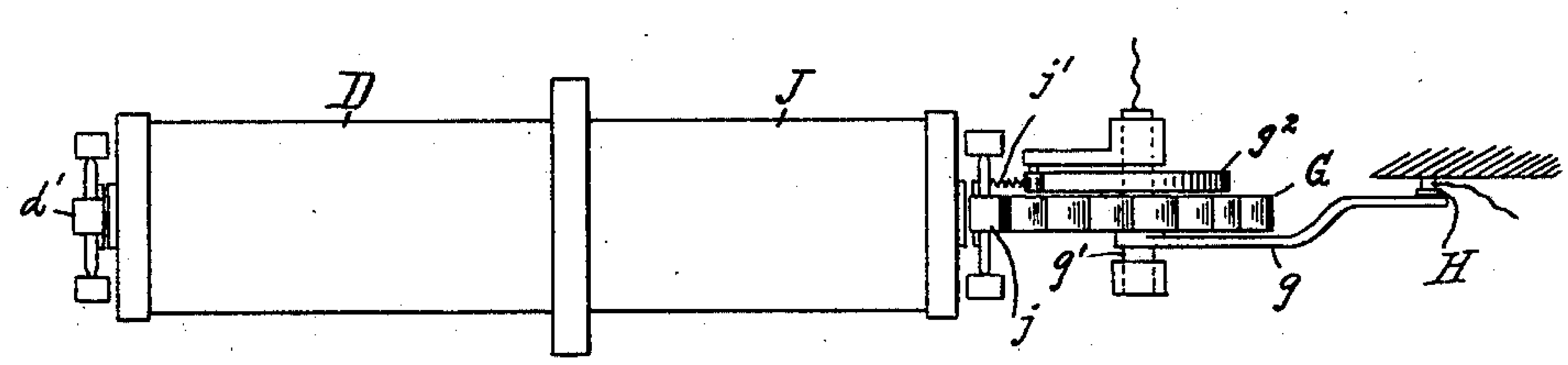

Fig. 3

Witnesses.

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(No Model.) 5 Sheets—Sheet 3.

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SIGNALING APPARATUS FOR TELEPHONE SYSTEMS.

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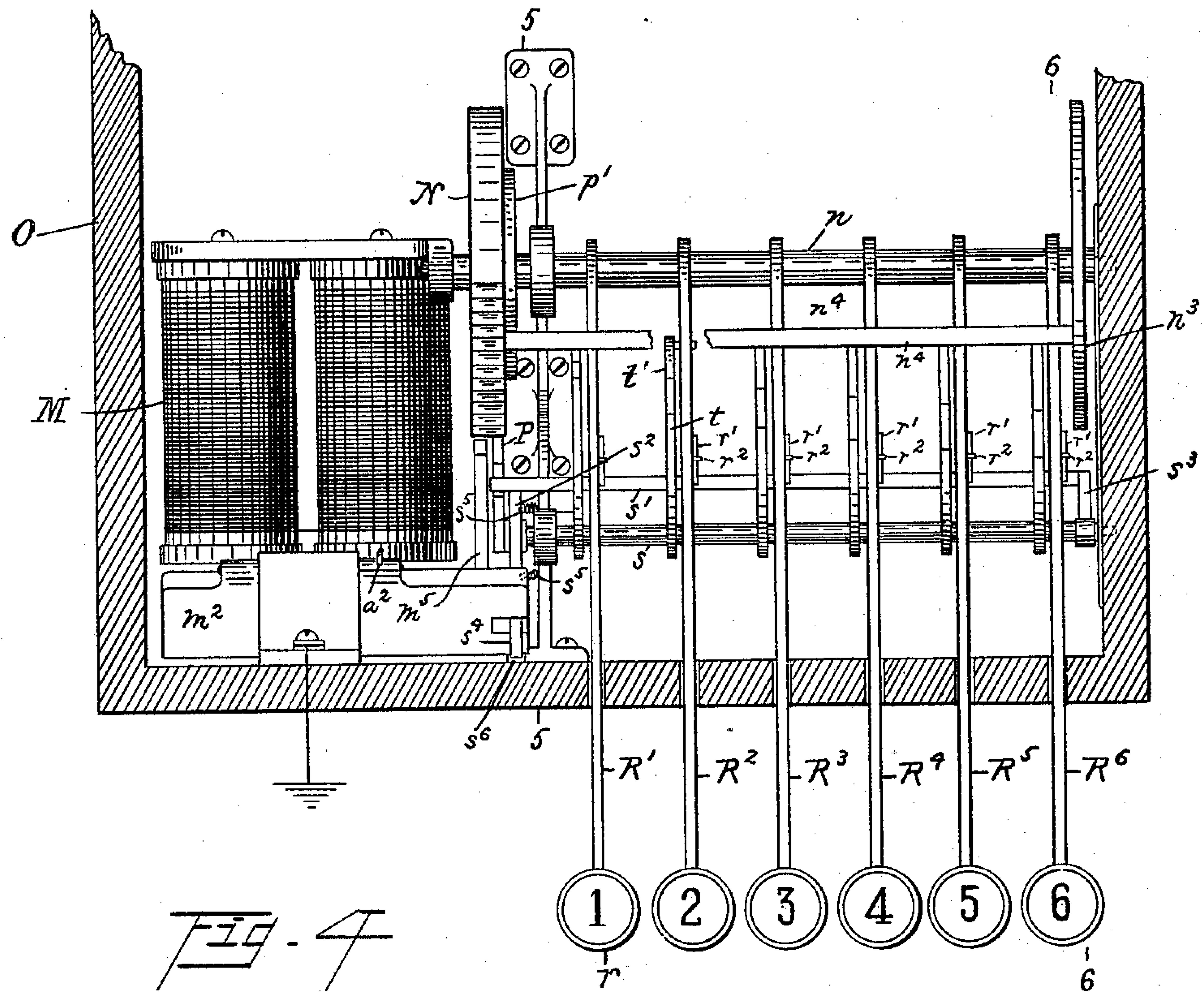

Fig. 4

Witnesses.
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(No Model.) 5 Sheets—Sheet 4.

F. J. HOLMES.

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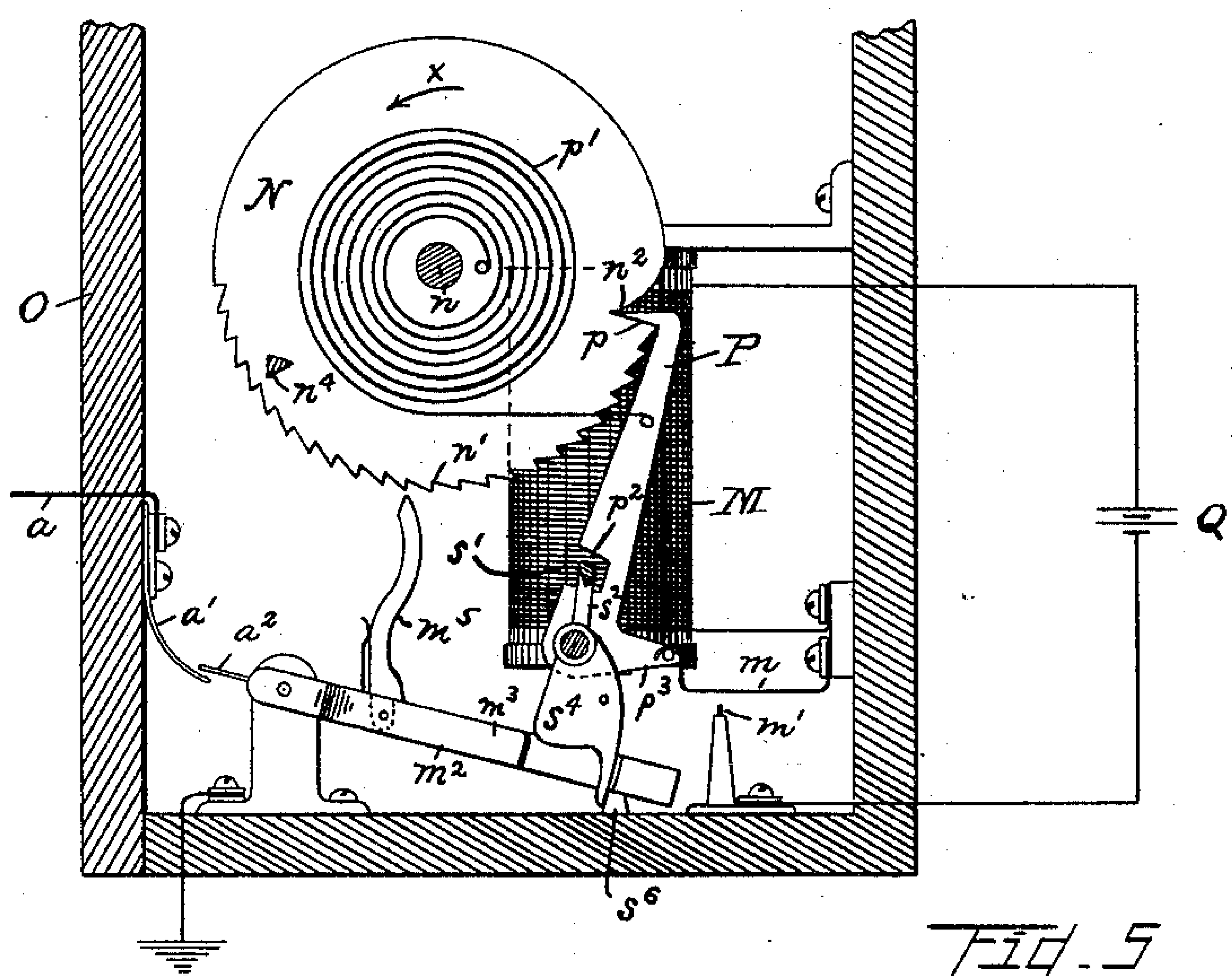

Fig. 5

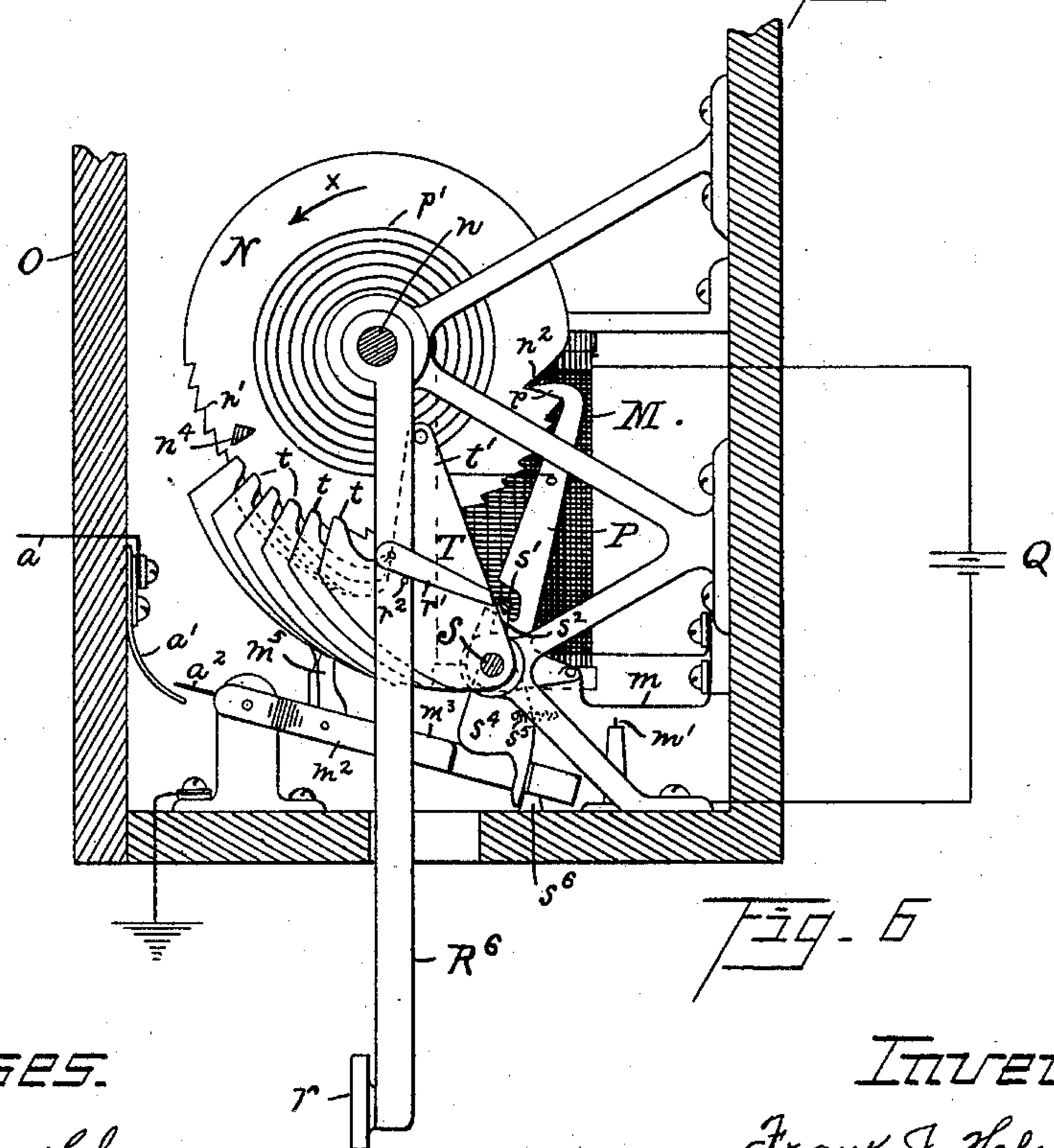

Fig. 6

Witnesses.

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(No Model.) 5 Sheets—Sheet 5.

F. J. HOLMES.

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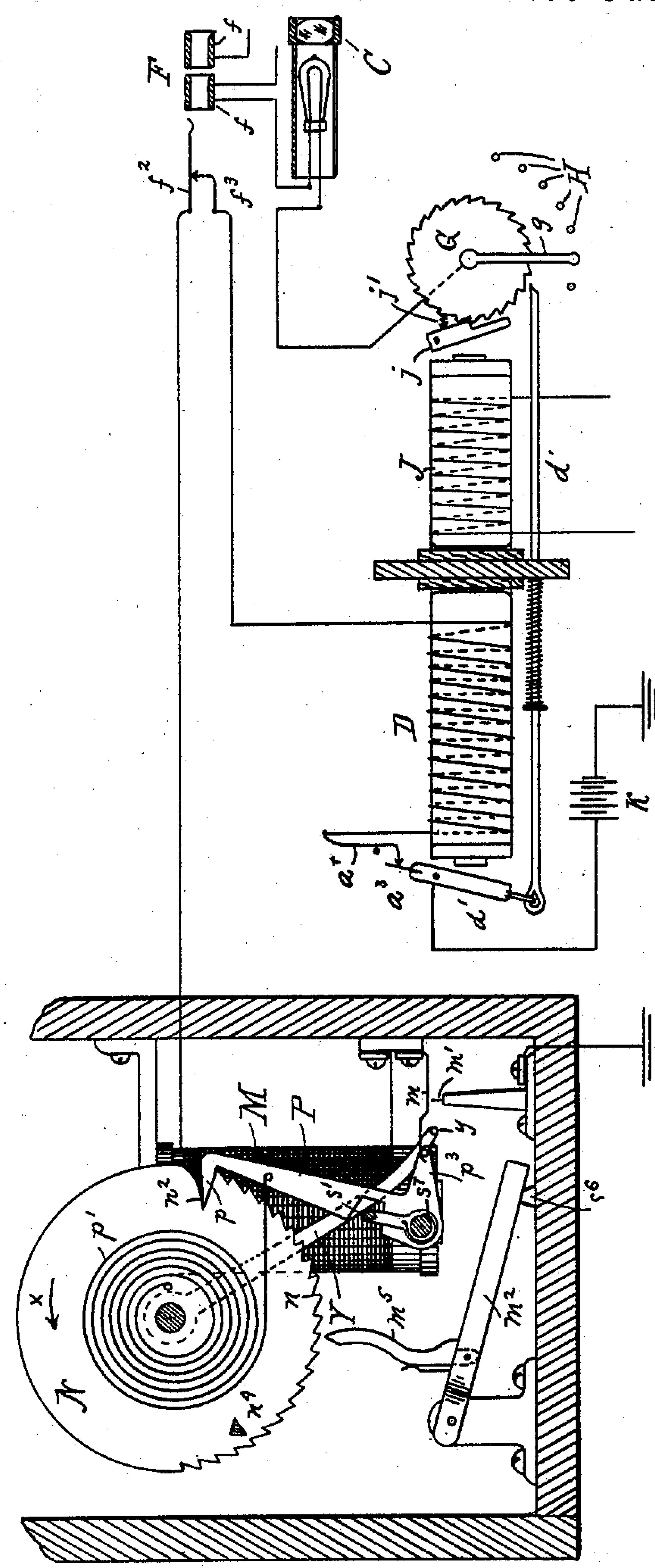

Fig. 7

Witnesses.

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UNITED STATES PATENT OFFICE.

FRANK J. HOLMES, OF CLEVELAND, OHIO.

SIGNALING APPARATUS FOR TELEPHONE SYSTEMS.

SPECIFICATION forming part of Letters Patent No. 596,509, dated January 4, 1898.

Application filed March 25, 1896. Serial No. 584,884. (No model.)

To all whom it may concern:

Be it known that I, FRANK J. HOLMES, a citizen of the United States, residing at Cleveland, in the county of Cuyahoga and State of Ohio, have invented certain new and useful Improvements in Signaling Apparatus for Telephone or Telegraph 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.

The object of the invention is to provide means whereby a telephone subscriber or telegraph-operator may by the actuation of simple mechanism cause the production and continuance at a distant exchange or office of code-signals which have definite and understood significance to the receiving-operator, indicating, for example, the service which the calling subscriber or operator desires.

The invention may be used in connection with either a telephone or telegraph system, but it is especially useful in a telephone system as a means whereby any subscriber who may wish to talk to other subscribers of different exchanges in the system or in other divisions or in other classes of service may automatically indicate such facts to an operator at his exchange by means of a code of signals. The advantage of this system of signaling is that the operator may, immediately the signal is completed and without any other communication with the calling subscriber, extend his line to the exchange, division, or class of service indicated by the signal, whereupon the operator to whose board the line is so extended may answer the subscriber and connect his line with the instrument of the subscriber called for. The apparatus embodying my invention by which this result is secured includes means whereby each subscriber may produce in his line-circuit any number of electrical pulsations, either by varying the resistance in or actually making and breaking the circuit. It also includes an associated signaling device at the exchange or division of which he is a subscriber, and it also includes devices by means of which the electrical pulsations in subscriber's-line circuit cause the operation of said signaling device in accordance with an understood code; and while the signal in each case is dependent upon the number of pulsations created in said line-circuit it does not necessarily have any apparent relation to said number of pulsations. The subscriber does not need to understand the code, nor need he be concerned with the number of pulsations he causes upon his circuit-wire.

In the embodiment of the invention shown in the drawings the subscriber operates that one of the several devices (buttons or levers) before him which corresponds with the exchange, division, or class of service to which the subscriber he wants belongs. The movement of each of said devices causes its characteristic number of pulsations on the line-circuit, and these different numbers of pulsations are automatically translated by the intermediate mechanism into their corresponding codified signals, which are produced on the signaling apparatus and repeated until said translating devices are restored to their normal position or the signaling-circuit is broken either by the subscriber or by the operator.

The invention consists in the construction, combinations, and subcombinations of devices and mechanisms hereinafter described, and pointed out in the claims.

In the drawings, Figure 1 is a partly-diagrammatic view of a signaling system embodying my invention. Figure 2 is a development of the commutator which causes the proper makes and breaks in the local signaling-circuit to produce the codified signals. Fig. 3 is a plan view of the mechanism whereby the electrical pulsations on the subscriber's line cause the proper row of commutator-strips to be connected into the local signaling-circuit. Fig. 4 is a front view of the preferred mechanism forming a part of each subscriber's instrument whereby the pulsations on his line are produced. Fig. 5 is a sectional side view of said mechanism on line 5 5 of Fig. 4. Fig. 6 is a sectional side view on line 6 6 of said Fig. 4, and Fig. 7 is a view (partly diagrammatic) of a modified construction of an apparatus embodying the invention.

I will now describe in detail the embodiment of the invention shown in Figs. 1 to 6, inclusive, although the specific construction of many of the parts, as shown, is not, as I will indicate from time to time, material to the invention as defined in the claims.

The subscriber's instruments, of which two are shown, are indicated by A A'. Each instrument is connected by a suitable line-wire *a* (or wires) with the exchange. The instruments may be on a "grounded circuit" or on a "metallic circuit," as desired, the former being shown in the drawings.

The line-wire (or wires) of each instrument terminates in a jack F or its equivalent at the switchboard. A signaling device C is placed in close relation to said jack. This signaling device for a telephone system is preferably an electric light. For a telegraph system a sounder might be substituted; but for a telephone system an electric light is believed to be the best and is perhaps the only device which can be used practically and within the space allowable in large exchanges without danger of several signals being confounded. These signaling devices are connected in an independent circuit, which includes a battery of sufficient power to operate as many of the signals as will be operated at one time. The signal-circuit also includes a commutator (or commutators) E, which is a part of the apparatus which translates the pulsations on the subscriber's-line circuit into code-signals. This commutator is preferably cylindrical, and it is revolved constantly by suitable mechanism. On this commutator are as many rows *e* of commutator contact-strips *e'* as there are exchanges, divisions, or classes of service in the system. The contact-strips in each row are differently grouped, substantially as shown in Fig. 2—that is to say, in the first row the strips are placed equal distances apart. In the second row two strips placed close together form each group, and these groups are placed equal distances apart. In the third row each of the groups includes three strips. In the fourth row each of the groups includes four strips. In the fifth row wide strips are used and placed equal distances apart. In the sixth row each group consists of one wide strip and one narrow strip, &c. Of course the groups may be formed in any desired manner to conform to the code of signals which is to be employed. All of these groups are electrically connected, preferably through the commutator-shaft, with the battery W, which operates all of the signals with which said commutator is associated. Instead of all of these strips being on one cylinder it is obvious that each row could be upon a separate commutator, provided the commutators were connected as described. A brush E' is associated with each row of commutator-strips, and these brushes are connected each with one of the contact pieces or springs H, which may be of any suitable form and have any suitable support.

Associated and connected with each subscriber's signal is a contact-making device which may be moved into contact with any of the contact-pieces H, and mechanism adapted to be operated by the pulsations on the subscriber's-line circuit is provided for actuating said contact-making device. In the form shown a ratchet-wheel G is suitably mounted in front of a restoring-electromagnet J, the armature *j* of which is held by spring *j'* in engagement with the ratchet-teeth so long as said magnet is not energized. A sliding operating-pawl *d* is connected with the armature *d'* of an electromagnet D, which is connected in the subscriber's-line circuit. The contact-arm *g* is secured to the shaft *g'* of this ratchet G, and as the ratchet is moved step by step forward by pawl *d* this arm *g'* is brought successively into contact with the contact-pieces H. The shaft of this ratchet and contact-arm *g* form part of the circuit which includes subscriber's signal C, said circuit being completed when the contact-arm *g* is in contact with any of the pieces H. An independent signal, contact-arm *g*, ratchet G, pawls *d* and *j*, and magnets D and J or the equivalents of such parts are provided for each subscriber, while one commutator E and battery W are common to many signals.

I do not intend to limit my invention to the specific mechanism described, operated by the magnet D, for connecting the subscriber's signaling device with any of the commutator-brushes or contact-strips. Any suitable mechanism for the purpose is included in the invention, except as said invention is defined by claims which positively and specifically include the particular mechanism shown.

The operation of the parts described is as follows: The subscriber produces in his line-circuit some definite number of pulsations. Each pulsation energizes the magnet D, wherefore each pulsation causes one movement of the armature forward and backward. Each movement of the armature moves the ratchet G forward one tooth, thereby moving the contact-arm *g* into contact with the proper contact-piece H, depending upon the number of said pulsations. This completes the local signal-lamp circuit, which circuit includes the brush which is associated with said contact-piece H, and also, therefore, includes the corresponding row of contact-strips upon the commutator. The signal-lamp thereupon begins to flash the code-signal which corresponds to said row of strips. For example, if two pulsations were produced on subscriber's circuit the contact-arm *g* would be moved forward into contact with the second contact-piece H. This connects into the lamp-circuit the second brush E', whereupon the lamp shows two quick flashes, which are repeated at intervals until the described mechanism is restored to its original position. By "flashes" is to be understood any operation of the signaling device which is appreciable to the sense of the operator.

The restoring of the mechanism to its original position may be effected in many ways. As shown, it is effected automatically when the operator, after reading the signal, inserts into the subscriber's jack F a plug f', which extends his line to the exchange division or class of service which his signal called for. The insertion of the plug completes the circuit of the restoring-coil J. This coil or magnet retracts the armature j, releasing the ratchet, which thereupon is returned to its normal position by a spring g^2. This restoring-coil is connected in the local circuit, which includes the battery W, and the wires terminate in the two jack-contacts $f f$, which are electrically connected by the plug f'. The insertion of the plug likewise lifts the spring f^2, which is connected with subscriber's-line wire, out of contact with the point f^3, thereby breaking the circuit of the magnet D and separating it from the talking-circuit until the plug is removed from the jack. The subscriber's disconnecting-signal may be received on a signaling device in the circuit of the operator's connecting-cord in the usual manner.

It is clear that a great variety of mechanisms could be employed to produce on the line-wire a the electrical pulsations which will cause the operation of the mechanism heretofore described or its equivalent. It is obviously possible to provide mechanism which the subscriber could operate once to produce one pulsation, twice to produce two pulsations, &c.; but it is believed that so many errors would result from the use of such mechanism by the subscriber that in the aggregate very little advantage would be gained; wherefore it has seemed desirable to provide at each subscriber's instrument a series of levers or their equivalents marked to represent the different exchanges or divisions or classes of service, whereby the subscriber, by one movement of the proper lever, will cause upon the line-wire the corresponding and proper number of pulsations. Such mechanism is shown in Figs. 4, 5, and 6 and is described as follows:

O represents a box or case which forms a part of the subscriber's instrument, and it serves to support, conceal, and protect the inclosed mechanism. Within the box an electromagnet M is fixed and it is supplied with current from a local battery Q. The magnet-circuit is normally open, but it is closed when the movable spring contact-piece m touches the fixed contact-piece m'. The movable contact-spring m is extended into the path of the vibrating armature m^2, wherefore every time the circuit is closed the armature is moved by the magnetic attraction and brought into engagement with the contact-spring m, which is thereby moved and the circuit is broken, demagnetizing the coil and allowing the armature to fall back out of engagement with said contact-spring, the described action being repeated automatically until the contact-spring m is permanently held out of contact with the piece m', as hereinafter described. The armature m^2, when drawn toward the magnet, closes a normal break in the subscriber's signaling line-circuit by bringing the contact-piece a^2, carried by the armature, into contact with the fixed contact-piece a', thus creating an electrical pulsation on the subscriber's-line circuit a.

A ratchet-wheel or segment of a wheel N is secured to the shaft n, which is suitably mounted at its ends. This ratchet has one deep notch n^2 and a plurality of shallow notches n'. An escapement-pawl P is pivoted so that the tooth p on its end may engage in the said notches. A watch-spring p', which is secured at its ends to the said wheel and escapement-pawl, respectively, acts to impart to the wheel a tendency to revolve in the direction of the arrow x and also to hold the pawl in engagement with the ratchet-teeth. Any form of spring or springs or other mechanism may be employed instead of the specific spring shown for producing these results.

Pivoted on the shaft n and extending out through the bottom of the box are the levers R' R^2, &c. Any number of these levers may be employed—corresponding with the number of commutator-rows—six being shown in the drawings, and each has on its outer end a button or finger-piece r, on which appears a distinguishing character, as the figures "1" to "6," inclusive.

Associated with each lever R' to R^6 is a stop-lever T, which is in the form of a bell-crank. These levers are pivoted upon the rod S. On one arm t' of these stop-levers is a pin which lies behind the associated levers R' to R^6 and in contact with them. The other arms t of the levers T are of various lengths and serve as stops to limit the rotation of the ratchet N.

Secured to the ratchet N and to an arm n^3 (which is also secured to the shaft n) is a transverse stop-bar n^4. Now when any lever R is moved backward it swings the corresponding lever T so that the arm t thereof is brought into the path of this stop-bar n^4, wherefore when the ratchet is released, and consequently turns in the direction of the arrow, its movement is stopped by the contact of said bar with said stop-arm t. The lengths of said stop-arm are such that the one which is associated with lever R' permits the ratchet to move a distance of one tooth, with lever R^2 two teeth, &c., up to six teeth, which is permitted by the stop-arm t, associated with lever R^6. The movement of any of the levers R' to R^6 moves the escapement-pawl P to release said ratchet by the mechanism as follows: A transverse bar s' is secured to two arms s^2 s^3, which are pivoted on the rod s, and this bar s' is so placed that it lies in the path of the pawls r', one of which is pivoted to each lever R' R^6 and rests upon the pin r^2. This bar s' extends into a slot p^2 in the escapement-pawl P, wherefore after certain preliminary movement it engages with said pawl and withdraws it from engagement with the ratchet, which ratchet thereupon revolves until stopped by one of the arms t. It should be here stated that an angle-arm p^3, which is rigid with said stop-pawl P, engages beneath and upholds the contact-spring m so long as the pawl-tooth is seated in the deep notch n^2, but permits it to move and make contact with the piece m as soon as the pawl has partially completed its releasing movement out of said notch and at all other times. Such being the case, it is clear that the armature might be attracted by the magnet M before the ratchet has made its movement, unless the said armature were held for a time. To accomplish this result, an arm s^4 is rigidly secured to the arm s^2, and as said arm s^2 is moved the other arm s^4 passes over a projection m^3 on the armature m^2 and holds it down. Just as one of the levers R′ to R^6 is completing its stroke (the pawl P having been entirely withdrawn from notch n^2) the pawl r' slips over the bar s', whereupon a spring s^5 draws the arm s^4 backward against a stop s^6 and releases the armature. Before the armature is thus released the ratchet has been turned by its spring until it was stopped by the engagement of the bar n^4 with one of the stop-arms t; but when the pawl r' slips off the bar s' the escapement-pawl P flies back into one of the shallow notches n' in the ratchet-wheel. So long as the tooth of the pawl is in one of the shallow notches the contact-spring m may make contact with the contact-piece m'. It is only when the tooth of pawl P enters the deep notch n^2 that the contact-spring m is permanently held out of contact with the piece m'.

To return now to a consideration of the movement of the mechanism, as soon as the armature m^2 is released by the arms s^4 it is attracted by the magnet M, the circuit of which is closed. The movement of the armature produces three results—viz., first, it closes and consequently creates an electrical pulsation on the line-circuit a by moving the contact-piece a^2 against the piece a'; second, it causes a spring-pawl arm m^5, which it carries, to engage with the ratchet and mechanically move it back one tooth toward its original position, and, third, it lifts the contact-spring m and breaks the circuit of the magnet M, whereupon the armature drops, being no longer attracted by the magnet. This permits the spring m to again make contact with the piece m' and complete the magnet-circuit, whereupon the described movements are repeated. The armature continues to vibrate as and with the results described until the ratchet N has been moved to its original position, when the tooth p of the pawl P enters the deep notch n^2. This lifts the contact-piece m and permanently opens the magnet's circuit, and the parts are in their normal position ready to be again actuated.

The number of pulsations on the line-wire a correspond to the number of times the armature m^2 is attracted by its magnet, and this corresponds with the number of teeth the ratchet n was allowed to move away from its normal position, and this is in turn regulated by the stop-arm t, which corresponds with the particular lever R′ to R^6 which was operated. I have heretofore explained the mechanism whereby these electrical pulsations are translated into the corresponding code-signal, wherefore it is unnecessary here to repeat this explanation.

It will be understood by those familiar with this art that the magnet M is not necessarily connected in a local circuit. It may be connected in the subscriber's signaling-circuit. It is also clear that the vibrating armature which makes and breaks the circuit, thereby causing the pulsations, need not be the armature of the magnet M, nor any magnet which is a part of the subscriber's instrument. It may be the armature of a magnet at the exchange—as, for example, the armature of the magnet D. In Fig. 7 such modification is shown. In that view the magnet is connected in the line-circuit. Its armature performs no function except to mechanically move the ratchet N to restore it to its normal position. The arm p^3 on the escapement-pawl P holds the spring-contact piece m out of contact with the contact-piece m' so long as the pawl-tooth p is in the deep notch n^2, but permits said pieces to remain in contact at other times. In order to prevent the electrical pulsations before the ratchet N has completed its movement and pawl-tooth p engages in the proper notch n', the arm Y is pivoted, preferably, on the shaft of the said ratchet. This arm passes over and rests upon the bar s'. It has a pin y, which lies beneath but normally out of contact with the spring m. When said bar s' is moved, through the engagement therewith of one of the pawls r' when one of the levers R′ R^6 is moved, the first result is to move the arm Y, the pin y of which is thereby brought into engagement with the spring m. This spring is thus lifted and upheld until the escapement-pawl is moved out of engagement with the ratchet, the ratchet has moved, as hereinbefore described, and the escapement-pawl has entered one of the notches n'. Then, as before explained, the said pawl r' slips over the top of bar s', which is then moved back to its normal position by spring s^7 or other suitable means. The bar Y consequently moves back to its original position, which permits the spring m to make contact with the piece m', thus completing the circuit and creating the first pulsation on the line-circuit.

At the exchange the electromagnet D is connected in the circuit as before; but the circuit includes two separable contact-pieces a^3 a^4, one, a^3, of which is carried by the armature d' of said magnet D. The other contact-piece, a^4, is a spring which remains in contact with the piece a^3 until said armature has nearly completed its forward movement, due to the magnetic attraction. Then the contact is broken, the magnet is demagnetized, and said armature returns to its original position, thus again making the connection at this point. The armature d' is therefore, in the construction shown in Fig. 7 and last described, the vibrating armature, which in its movement makes and breaks the circuit and thus causes the electrical pulsations. Each pulsation causes the movement of the armature m^2 at the subscriber's instrument and the consequent mechanical actuation of the ratchet N until the escapement-pawl tooth p enters the deep notch n^2 therein, when, as before explained, the circuit is permanently broken by the separation of the contacts m and m'. The movement of the armature d' has in this case, as before explained, the function of moving the ratchet G and attached contact-arm g step by step into engagement with the several contact-pieces H, and the number of vibrations of said armature d' will, as before, be equal to the number of teeth which the ratchet N was permitted to move.

Having described my invention, I claim—

1. In a telephone or telegraph system, the combination of a device for varying the resistance in the line-circuit one or more times, an electrically-operated signal-indicator connected in a local circuit, a plurality of devices which are adapted when connected severally in said local circuit to vary the resistance in said circuit according to a code, and mechanism adapted to be operated by varying the resistance in the line-circuit for connecting in the local circuit any desired one of said devices, substantially as and for the purpose specified.

2. In a telephone or telegraph system, the combination of a device for varying the resistance in the line-circuit, an electrically-operated signal-indicator connected in a local circuit, a plurality of commutators each having a row of commutator-strips arranged thereon in codified groups several times repeated, the groups being different in the different commutators, brushes for the several commutator groups, an electromagnet which is energized a number of times corresponding to the number of variations in the resistance in the line-circuit, a switch for connecting any one of said commutator-rows and associated brushes into said local circuit, and mechanism operated by said electromagnet for moving said switch, substantially as and for the purpose specified.

3. In a telephone or telegraph system, the combination of a signal-indicator responsive to electric impulses connected in a local circuit, a plurality of indicator-controlling devices adapted to distinctively excite said indicator, and a switch for connecting any one of said indicator-controlling devices in said local circuit, and an electromagnet for operating said switch, substantially as and for the purpose specified.

4. A commutator or associated series of commutators having a plurality of contact-strips, each row consisting of similar groups of strips several times repeated, the groups in each row being different from the groups in the other rows, and brushes for said several rows combined with a signal-indicator responsive to electric impulses, a switch for connecting any row of commutator-strips and its brush in the circuit of said signal-indicator, substantially as and for the purpose specified.

5. In a telephone or telegraph system, the combination of a device for varying the resistance in the line-circuit, an electromagnet connected in said circuit, and its armature, with an electrically-operated signal-receiving device, a commutator or commutators having several rows of contact-strips arranged thereon in groups according to a code, brushes associated with said several rows, and mechanism adapted to be operated by said armature for connecting into the signal-receiving circuit any one of said rows of strips and its associated brush, substantially as and for the purpose specified.

6. In a telephone or telegraph system, the combination of a device or devices for varying the resistance in the line-circuit, an electromagnet connected in said circuit, and its armature, a ratchet-wheel, an operating-pawl actuated by said armature, a signal-receiving device, a commutator or commutators having several rows of differently-grouped contact-strips, brushes associated with said rows of strips, a series of contact-pieces which are connected with the several brushes, a contact-piece operated by said ratchet and adapted to make contact successively with the contact-pieces first named, substantially as and for the purpose specified.

7. In a telephone or telegraph system, the combination of a signal-receiving device, a plurality of brushes, a commutator or commutators having several rows of differently-grouped contact-pieces which are severally connected with said brushes, a contact-piece adapted to be brought successively against said first-named contact-piece, and electrical connections between the signal-receiving device and (1) the signal contact-piece, and (2) all of the rows of commutator-strips, the connection being through an electrical generator substantially as and for the purpose specified.

8. In a telephone or telegraph system, the combination of a plurality of line-wires, independent devices for independently varying the resistance in the several lines any number of times, and corresponding signal-receiving devices, with a commutator or commutators having rows of differently-grouped contact-strips, all of said rows being connected with said signal-receiving devices, brushes associated with said rows, an independent electromagnet in each line-circuit, and devices operated severally by said electromagnets for connecting the corresponding signal-receiving device with any one of the said brushes, substantially as and for the purpose specified.

9. In a telephone system, the combination of a device at each subscriber's station with which he may vary the resistance in his line-circuit any desired number of times, with the following devices located at the exchange of which he is a subscriber, viz., an electromagnet connected in his line-circuit, the armature of said magnet, a commutator or commutators having rows of differently-grouped contact-strips, an electrical signal-lamp which is connected through the brushes with every row of contact-strips, and a device operated by said armature for connecting any one of said brushes with said lamp, whereby the light will flash a code of signals corresponding with the associated row of contact-strips, substantially as and for the purpose specified.

10. In a telephone signaling device, the combination of a subscriber's-line circuit, a series of levers, a movable device which by the operation of said several levers is caused to move different distances, mechanism for returning said device to its normal position, and means whereby said device in so returning to its normal position causes electrical impulses on the main circuit corresponding to the distance it theretofore moved away from its normal position, with a signal-indicator in a local circuit, a plurality of commutators having differently-grouped contact-strips, and their brushes, and a switch operated by said movable device for connecting any commutator and its brush in said local circuit substantially as and for the purpose specified.

11. In a telephone system, the combination of a subscriber's-line circuit, a spring-actuated ratchet, an escapement-pawl, a movable stop for said ratchet, and a device for moving said stop and withdrawing said pawl, with an electromagnet in a circuit which includes separable contact-pieces, a vibrating armature adapted to engage with one of said contact-pieces and thereby break the magnet-circuit, a pawl actuated by said armature for moving the ratchet step by step, and a device operated by said armature for creating one electrical pulsation on the subscriber's-line circuit for each complete movement of the armature, substantially as and for the purpose specified.

12. In an electrical signaling device, the combination, of a spring-actuated ratchet, its escapement-pawl, an electromagnet connected in a circuit which includes two separable contact-pieces, and a vibrating armature adapted to engage with one of said contact-pieces and break the circuit, with a series of different movable stops to stop the ratchet at different points, and a series of operating devices associated severally with said movable stops, mechanism intermediate of each of said operating devices and the escapement-pawl whereby it is withdrawn from engagement with said ratchet, a pawl operated by said armature for moving the ratchet step by step to its original position, and mechanism actuated by said armature for creating electrical impulses in an independent electrical circuit, substantially as and for the purpose specified.

13. In an electrical signaling apparatus, the combination of a spring-actuated ratchet having one deep notch and a plurality of shallow notches, an escapement-pawl adapted to engage in said notches, an electromagnet in a circuit which includes two separable contacts, a device operated by said escapement-pawl for holding said contacts apart when the said pawl is in engagement with the deep notch, a vibrating armature adapted to engage with one of said contacts and move it away from the other and mechanism operated by said armature for producing electrical pulsations on the line-circuit, with a series of stops associated with and adapted to be moved severally by said levers into position to engage with said ratchet, a device operated by each lever for withdrawing the escapement-pawl from the ratchet, and mechanism actuated by the armature for moving the ratchet step by step back to its normal position, substantially as and for the purpose specified.

14. In a telephone or telegraph system, the combination of the main circuit, and mechanism for creating a definite number of electrical pulsations in said main circuit, and an electromagnet connected in said circuit, with a local circuit at the receiving-station, a signaling device in said local circuit, a series of devices for creating electrical pulsations in said local circuit, and mechanism operated by said electromagnet for connecting any of said last-named devices in the local circuit, substantially as and for the purpose specified.

15. In a telephone or telegraph system, the combination of the line-circuit, a spring-actuated ratchet, an escapement-pawl, a movable stop for said ratchet, and mechanism for moving said stop and withdrawing said pawl, with an electromagnet in a circuit having separable contact-pieces, the vibrating armature of said magnet adapted to separate said contact-pieces, wherefore electrical pulsations are automatically produced in said circuit, and mechanism operated by said pulsations for returning the said ratchet to its normal position, substantially as and for the purpose specified.

16. In an electrical signaling device, the combination of a spring-actuated ratchet having one deep notch, and a plurality of shallow notches, an escapement-pawl for engagement with said notches, an electrical circuit, two separable contact-pieces therein, an arm on the escapement-pawl engaging with one of said contact-pieces and adapted to hold it out of contact with the other contact-piece while the pawl is engaging in said deep notch but permits it to touch said other contact-piece at other times, an electromagnet connected in said circuit, its armature, mechanism operated by said armature for moving the ratchet step by step back to its normal position, and

means for producing electrical pulsations in said circuit until the pawl enters the said deep notch, thereby permanently breaking said circuit, and means for causing said ratchet to move definite distances away from its normal position, substantially as and for the purpose specified.

17. In a telephone or telegraph system, the combination of a device whereby any subscriber may produce any desired number of electrical pulsations in his line-circuit, with a signal-circuit at the exchange, a single electric signal-lamp connected in said circuit, a plurality of circuit-closers each adapted to close and break the signal-circuit in a characteristic manner according to a code, and to repeat said characteristic make and break indefinitely so long as it is connected in the signal-circuit, and means whereby different numbers of pulsations on the line-circuit will cause different circuit-closers to be connected into the signal-circuit, whereby the different pulsations on the line-circuit will cause a repetition of different characteristic series of flashes of the lamp, substantially as and for the purpose specified.

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

FRANK J. HOLMES.

Witnesses:

E. L. THURSTON,

L. F. GRISWOLD.