No. 723,048. PATENTED MAR. 17, 1903.

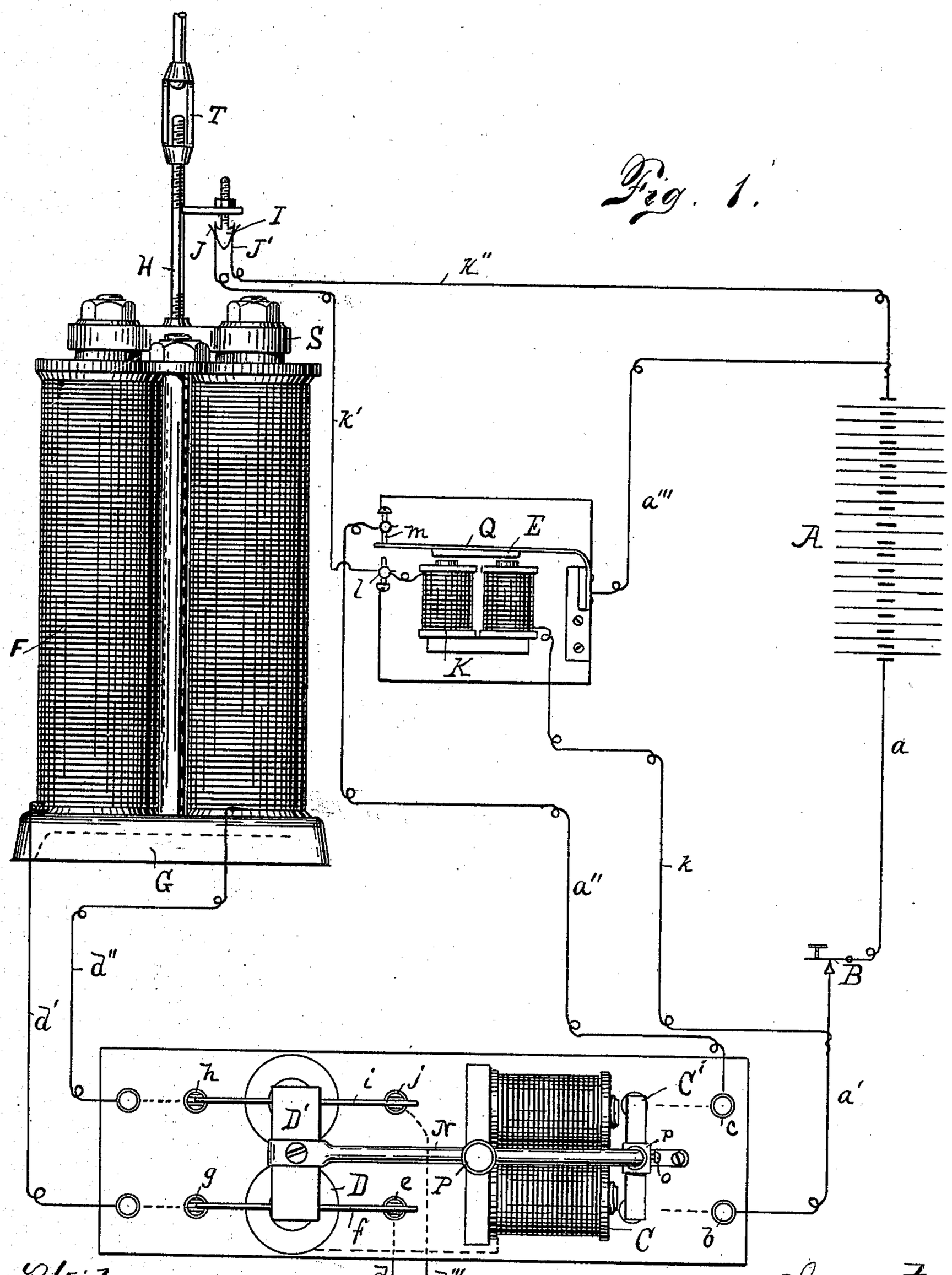
J. J. SHEAHAN.

ELECTROMAGNETIC BELL RINGING MECHANISM.

APPLICATION FILED NOV. 3, 1899.

NO MODEL. 4 SHEETS—SHEET 1.

Fig. 1.



Witnesses:
Myra E. Snyder
Frank H. Calhan.

Inventor
John J. Sheahan
By
Macomber & Ellis Attorneys

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NO MODEL. 4 SHEETS—SHEET 2.

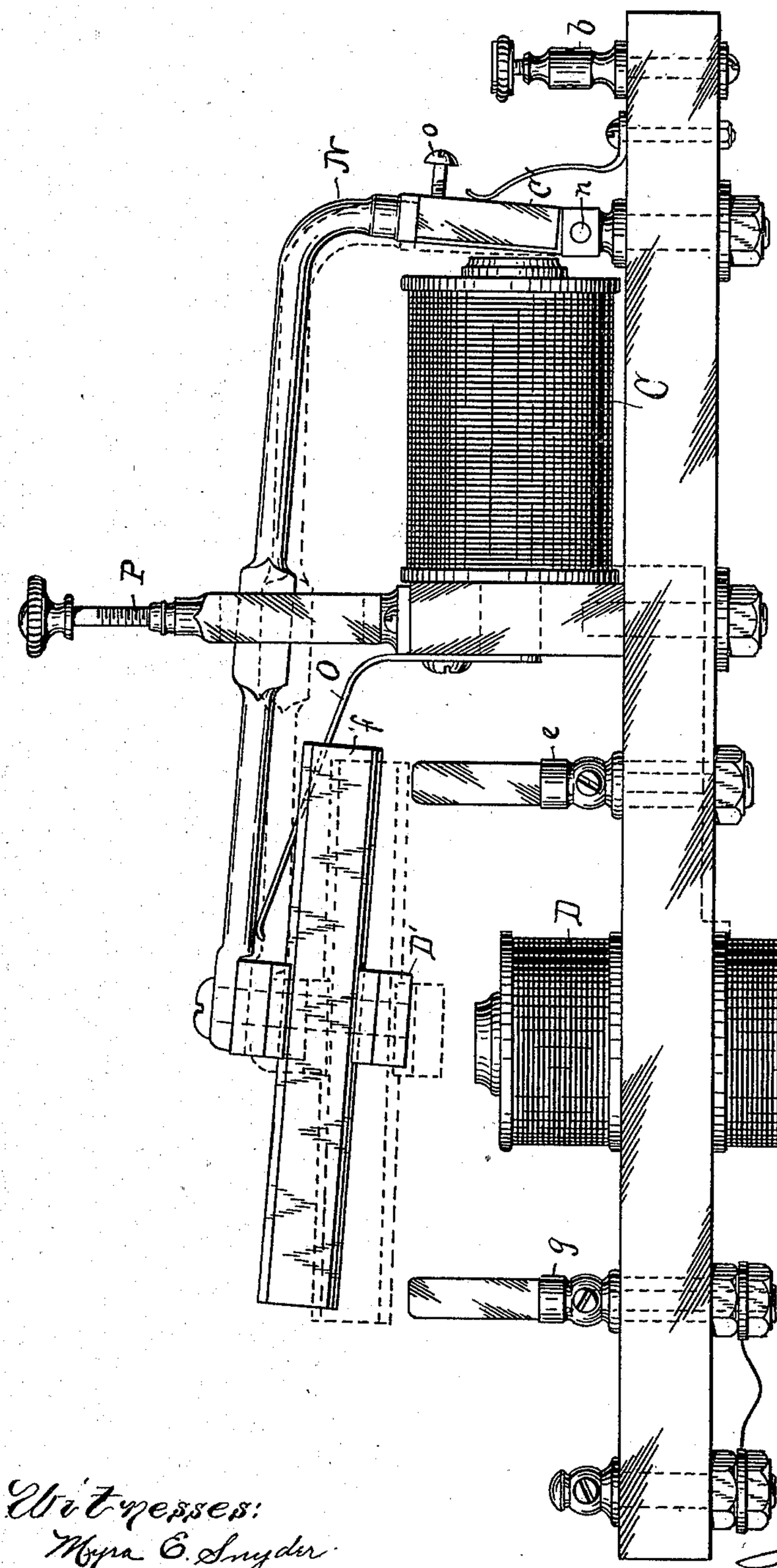

Fig. 2.

Witnesses:
Myra E. Snyder.
Frank H. Callan.

Inventor:
John J. Sheahan
By
Macomber & Ellis
Attorneys

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NO MODEL. 4 SHEETS—SHEET 3.

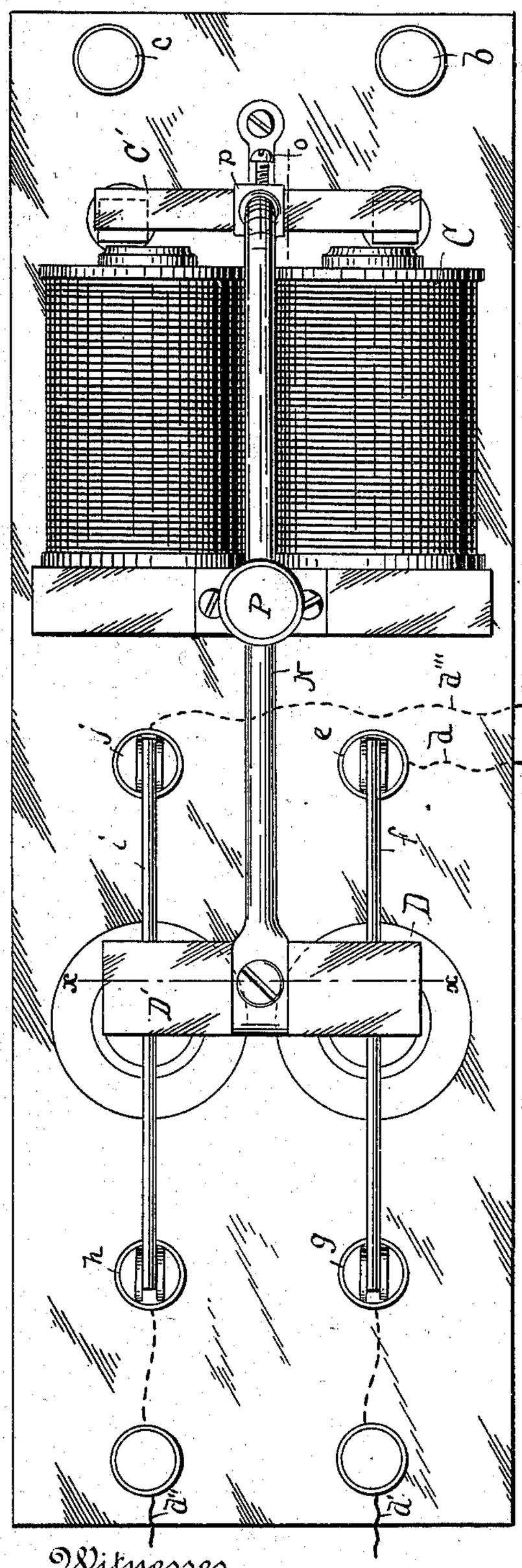

Fig. 1.

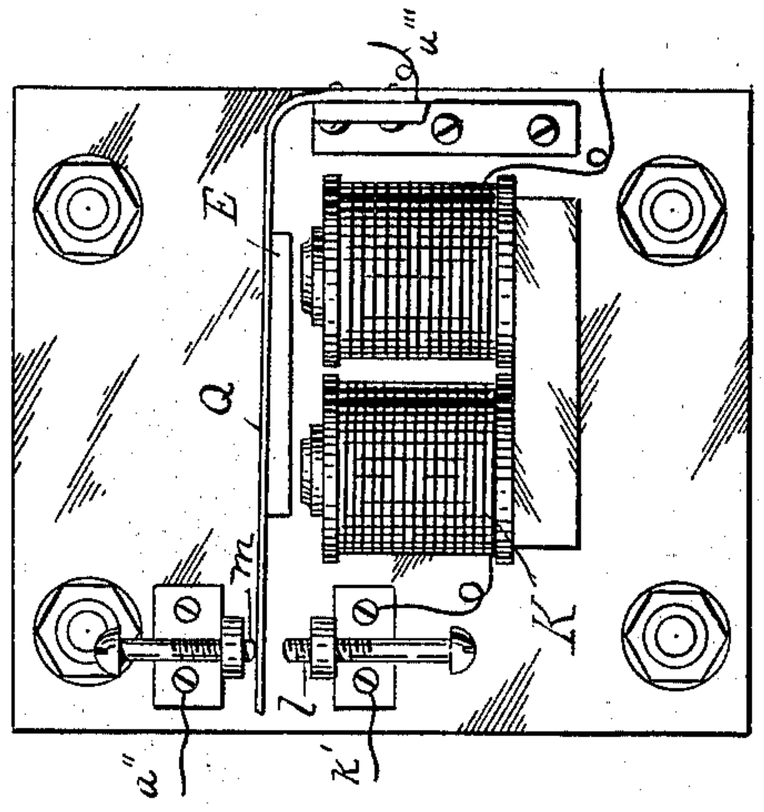

Fig. 2.

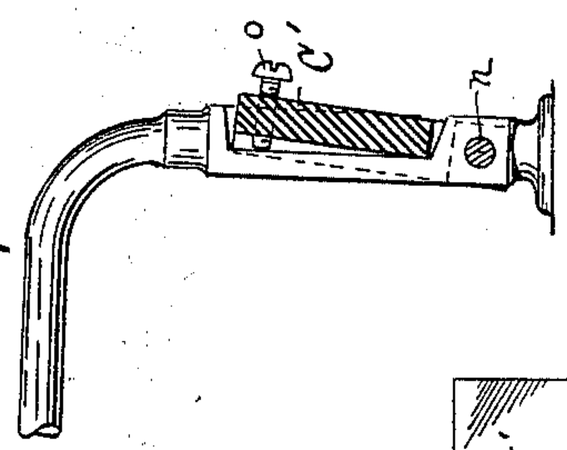

Fig. 3.

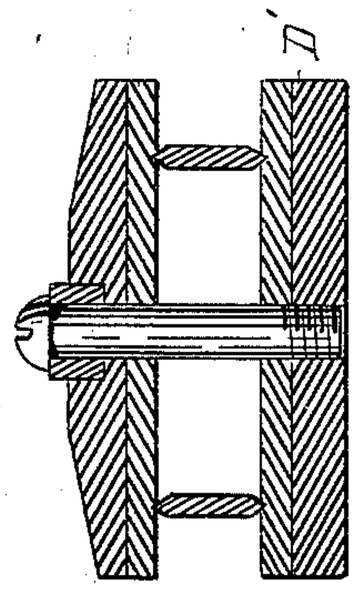

Fig. 4.

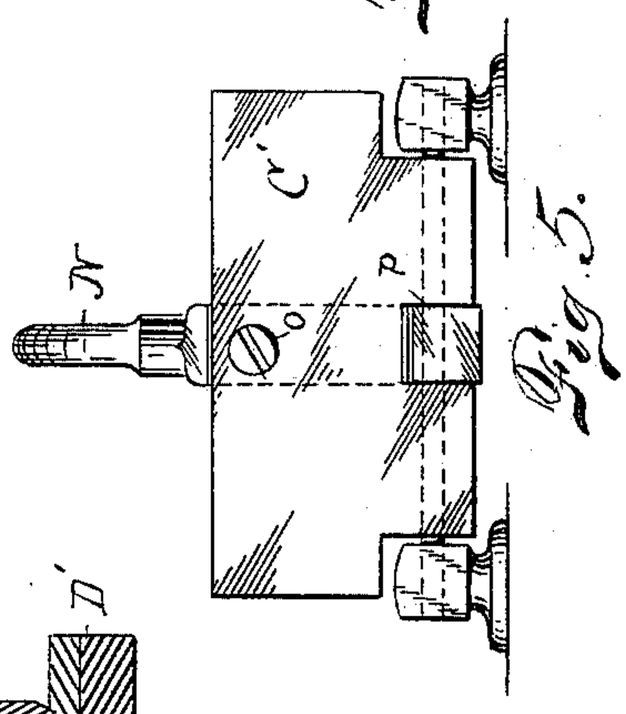

Fig. 5.

Witnesses
Myra C. Snyder,
Frank B. Allan.

John J. Sheahan Inventor
By his Attorneys
Macomber & Ellis

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J. J. SHEAHAN.

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NO MODEL. 4 SHEETS—SHEET 4.

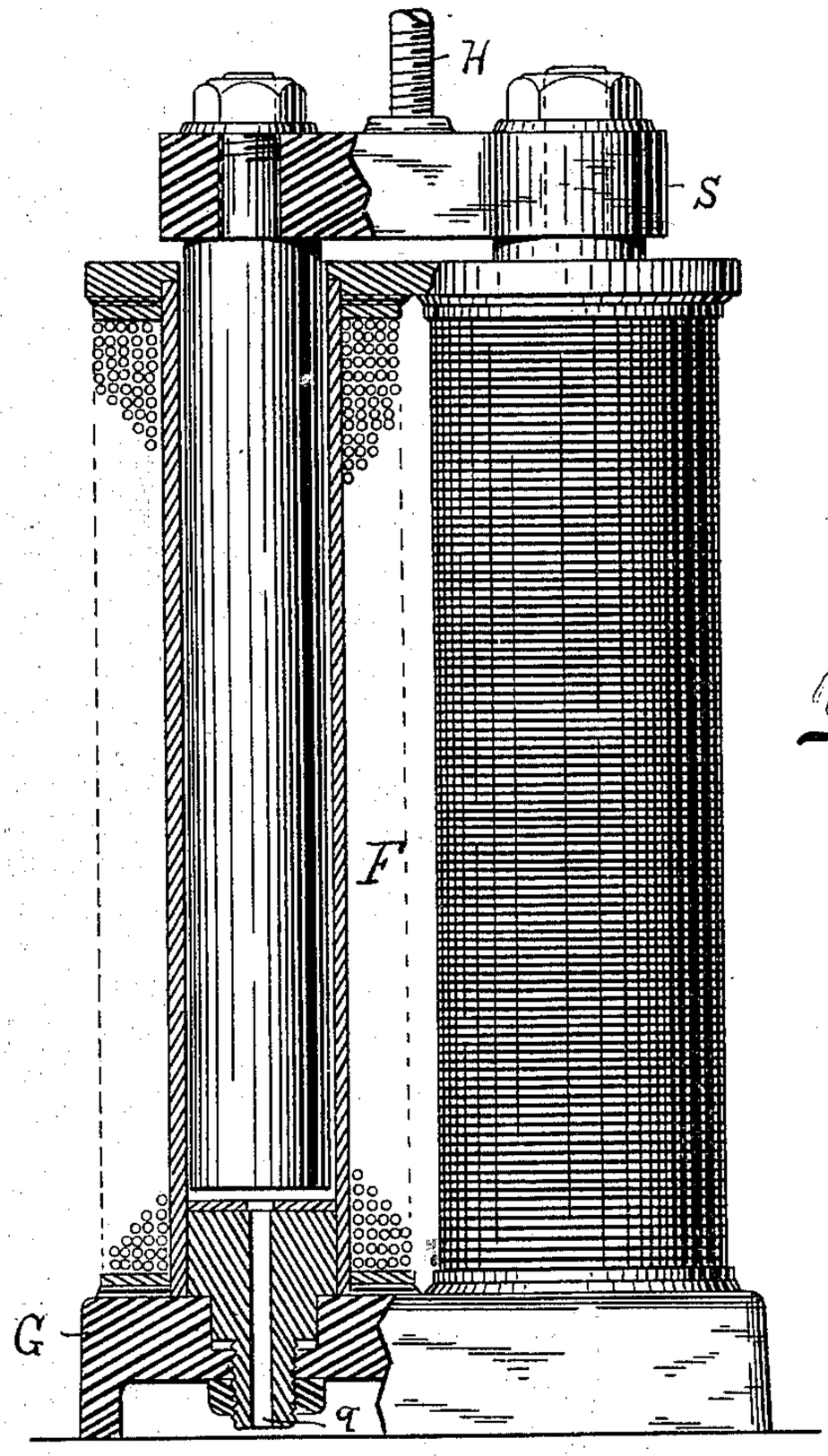

Fig. 8

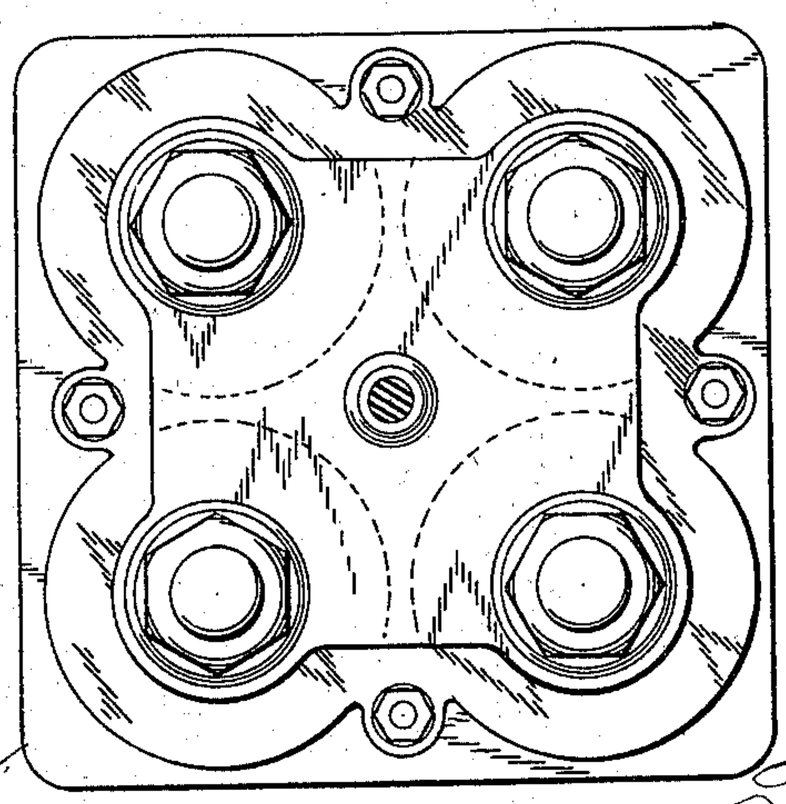

Fig. 9.

Witnesses:
Myra E. Snyder.
Frank H. Callan.

Inventor
John J. Sheahan
By
Macomber & Ellis
Attorneys.

UNITED STATES PATENT OFFICE.

JOHN J. SHEAHAN, OF BUFFALO, NEW YORK.

ELECTROMAGNETIC BELL-RINGING MECHANISM.

SPECIFICATION forming part of Letters Patent No. 723,048, dated March 17, 1903.

Application filed November 3, 1899. Serial No. 735,678. (No model.)

To all whom it may concern:

Be it known that I, JOHN J. SHEAHAN, a citizen of the United States, residing at the city of Buffalo, in the county of Erie and State of New York, have invented certain new and useful Improvements in Electromagnetic Bell-Ringing Mechanism, of which the following is a full, clear, and exact description.

My invention relates to a mechanism for ringing bells, and more particularly to an electromagnetic system for ringing bells.

My invention has for its object the adaptation of electricity as a motive power for ringing bells.

The difficulties hitherto existing in bell-ringing may be briefly mentioned in order that the advantages of an electromagnetic system may be the better understood. In the system where a direct mechanical system has been employed it has been found that where the bells are of large size or of large number any mechanism hitherto devised has been inadequate to make the ringing of the bells successful, for it is to be observed that in ordinary cases it is not possible to employ a skilled mechanic solely for the purpose of maintaining such an elaborate mechanism in working order. Various other expedients have been attempted, among which may be noted the various pneumatic systems. From the nature of the situation and the conditions of climate pneumatic systems are invariably liable to inoperativeness or breakdown, due to moisture or cold or similar causes, and have been found inadequate and unreliable, and it may be observed that in the electric or electromagnetic systems heretofore employed it has been impossible to utilize electric power so as to employ a current of sufficient power to perform the act of striking the bell and at the same time control and utilize the power by the delicate and rapid means necessary to the art of musical production. It therefore follows (and herein is the main object of my invention) that I am able to employ a current of sufficient power to successively ring the bells and at the same time so govern and control the same with such delicacy and rapidity that the delicate technique of musical production may find its full expression through the power employed.

My invention therefore consists in the utilization of a comparatively light primary current in connection with a keyboard or its equivalent and the employment of a secondary current of sufficient power to ring the bells, which is completely under the control of the primary current.

Referring to the drawings herewith, consisting of five sheets, in which like letters refer to like parts, Figure 1 is a diagrammatic view of my invention, showing the relay in plan view and the solenoid and circuit-breaker in connection. Fig. 2 is an elevation of my relay, showing the armature thrown upward and in dotted lines showing its first position when going into operation. Fig. 3 is a top plan view of the relay. Fig. 4 is a detail section taken on the dotted line *x x* of Fig. 3. Fig. 5 is an end elevation of my relay, showing one of the armatures and a pivot-arm of my relay-magnet. Fig. 6 is a detail elevation, partly in cross-section, of the parts shown in Fig. 5. Fig. 7 is a plan view of my circuit-breaker. Fig. 8 is an elevation, partly in section, of my multiple solenoid. Fig. 9 is a top plan view of the same.

Referring now to Fig. 1, I will describe first in general terms the principal parts of my invention and their operation. A represents a primary battery or any convenient source of current of proper strength, which should be of sufficient power to actuate the relay-magnet, as hereinafter more fully described. I have found in practice that a battery of from four to six cells of the ordinary type is sufficient to actuate this magnet. Leading from the battery A is the wire *a*, which is connected to a circuit-closer B. It will at once be understood that this circuit-closer B may be operated directly by the hand of the operator substantially the same as the key of an organ is operated, and it will also be understood that it may be actuated by any mechanical contrivance. It will also be understood that while I have shown a simple construction in diagram I may employ in connection therewith for the purpose of establishing a sufficient interval of contact to insure the operation of the coils of the relay-magnet any of the well-known mechanisms, such as a dash-pot construction or other mechanical device. The actuating-current which operates

the solenoid is opened and closed by the relay-magnet, hereinafter more fully described, which consists of magnets C and D, with armatures C′ and D′. These actuate the arm N. Secured to the armature D′ are switch-arms *f* and *i*. These are knife-edged and engage with contact-springs connected with the binding-posts *e g* and *h j* upon the actuating-circuit. *a′* is a continuation of the circuit *a* when the circuit is closed by the circuit-closer B, which connects to a binding-post *b* of the relay. From this binding-post the circuit passes through the coils C and D of the relay-magnet, which are clearly shown in Figs. 2, 3, and 4. From the magnet-coils D the current passes to the binding-post *c* and thence passes out through the circuit *a″* to a metallic arm carrying the armature E of the circuit-breaker. Passing through the arm of the circuit-breaker, it passes through the circuit *a‴* and from thence to the primary battery A. When this circuit passing through *a* by the closing of the contact B is in operation, the coils C and D are energized and the armatures C′ and D′ are thrown into contact with the cores of their respective coils, closing the switch. The secondary or actuating current, which rings the bell, enters at *d*. The switch operated by the relay-magnet being closed, the current passes from the binding-post *e* through the switch-arm *f* to the binding-post *g* and from thence through the circuit *d′*. The circuit *d′* connects directly with the coils of the solenoid F and from thence returns by the circuit *d″* to the binding-post *h* and through the switch-arm *i* to the binding-post *j* and thence outward through the circuit *d‴*. The coils of the solenoid may be connected up in any desired form so long as they are all in the path of the actuating-circuit. When the secondary or actuating circuit is closed from *d* to *d‴*, the coils of the solenoid F are energized and the cores are drawn down adjacent to the armature of the coils G, but adjusted and insulated from actual contact with the armature. The cores being properly united at their upper ends connect with a rod H, which connects with and operates the bell or bell-hammer. Thus it will be seen how the relay-magnet is thrown into action and how the secondary or actuating current produces the stroke of the bell.

I will now explain the important and delicate mechanism by which the primary and secondary circuits are quickly broken preparatory to the next succeeding operation. I is a contact-point which is made adjustable and which is connected to the rod H or to the yoke of the solenoid. J and J′ are contact-points which are respectively connected to the circuit about to be described. Leading from the circuit *a′* is the circuit *k*, which passes through the coils K of the circuit-breaker and out through the contact-point *l* and thence through the circuit *k′*. The circuit *k′* leads directly to the contact-point J. From the contact-point J′ the circuit *k″* leads directly to the battery A. Assuming that the circuit-closer B is closed and the circuit *a* is closed, the relay-magnet is energized, and the actuating-circuit *d* is closed through the solenoid, the primary current will continue to energize the relay-magnet flowing from *a* to *a‴* and passing through the arm Q of the circuit-breaker, while the actuating-current will pass through the switch-arms *f* and *i* upon the relay. The stroke of the bell is produced by the solenoid-cores carrying the rod H, which brings the contact-point I into contact with the contact-points J and J′. Instantly the circuit from *a* is closed through the magnet-coils K of the circuit-breaker and thence back through *k″* to the primary battery A, and the armature E of the circuit-breaker is drawn downward, breaking the circuit *a* to *a‴* at the contact-point *m*. The circuit *a* to *a″* being thus broken, the coils of the relay-magnet are deënergized, and through the instrumentality of a spring, as hereinafter more fully described, the actuating-current from *d* to *d‴* is instantly broken by the releasing of the armature of the relay-magnet and the cutting out of the circuit through the switch-arms *f* and *i*. Thereupon the solenoid is deenergized and the cores are carried upward by gravity or counterbalance or such mechanism as may be required. The chief function of the relay is after completing the circuit to break this current independently of the operator or operating mechanism at the proper moment.

It now remains to describe in greater detail the particular mechanism by which the successful performance of these functions is attained. Referring first to my relay, it will at once be apparent that in order to make and break a current of sufficient power to ring a very large and heavy bell an air-gap of considerable extent is necessary, and consequently the armatures of the relay-magnet must travel over a considerable distance. Therefore in order to energize the magnets of the relay if but a single coil be used current of large power must be used in the primary, which would interfere with the delicacy of the operation of the contact-maker, or else the construction of the coil must be so large as to cause considerable lag in the operation of the relay-magnet in order to develop sufficient magnetic energy. In order to avoid difficulties, I provide the construction which is shown in Figs. 2 to 7, inclusive. C is a coil through which the circuit *a* passes. The pole of this magnet is presented toward an armature C′, which is pivoted to the base of the relay at *n*, and in moving toward its coil-carries with it the arm N into the field of action of the magnet D, the arm being free to move still farther in the same direction when operated by the magnet D.

Referring particularly to Figs. 5 and 6, it will be seen that the armature C′ is pivoted to the pivot *n*, carrying the arm N. When the coil C is energized, the armature C′ is

drawn forward until the adjustable screw *o* strikes the arm N and carries it forward, whereupon the arm N is carried forward and its horizontal portion consequently downward to a position indicated by the broken lines in Fig. 2. Thus the gap between the core of the coil D and its armature D′ is reduced, and by means of the circuit *a* passing through and energizing the magnet D the armature D′ is drawn downward and into contact with the core D. This brings the switch-arms *i* and *f* into contact with the points connected with the actuating-circuit, thus closing the actuating-circuit. In order to return the armatures D′ and C′ and to break the contact of the actuating-circuit through the switch-arms, I provide a spring O, which throws the arm N upward when the coils C and D are deënergized. For the purpose of regulating and limiting the extent of the gap between the magnets D and C and their respective armatures I provide an adjustable screw P, which bears upon the upper portion of the arm N and acts against the spring O. It will at once be understood by one skilled in the art that the arm N should be constructed of a non-magnetic metal. It will thus be seen that by the use of two sets of magnets and the mechanism above described I am able to move the switch-arms with a minimum primary current sufficiently to overcome the arc of the actuating-circuit.

Referring now to the circuit-breaker, I will more particularly describe the construction and operation of the same. Referring particularly to Fig. 7, it will be seen that the armature E is secured to a swinging spring-arm Q, which will swing the armature E out of contact when the magnets are deënergized. The swinging arm Q is extended so as to swing between the two contact-points *m* and *l*. These contact-points are made adjustable through adjusting-screws to regulate the length of the air-gap and to regulate the sensitiveness and rapidity of the operation of the armature.

Referring now to my multiple solenoid, I will describe the same and its method of operation; but the novel construction of the same is properly the subject-matter of a separate application for a patent, inasmuch as the same has a wide range of use. The coils R of the solenoid F are mounted upon a common base G of iron. To facilitate the rapid operation of the cores within the coils, openings *q* are provided to permit of the rapid inlet and outlet of the air. The cores of the several coils are united and secured to a yoke S, which at its center is directly connected to the rod H, which is connected to the bell-striking mechanism. By this construction of a multiple-coil solenoid I am able to secure a complete magnetic ring of magnetic material and its consequent advantages, which would be impossible if I used but a single coil and a single core to perform the work required. The importance of this construction will be evident when it is considered that in the ringing of a large set of bells a sufficient force must be exerted to produce a stroke by a hammer of great weight.

For the purpose of a perfect adjustment of the solenoid with the bell, so that the force to be exerted can be increased or diminished within the capacity of the solenoid by regulating the depth to which the cores can be drawn into the coils, I provide between the rod H and the connection with the striking mechanism of the bell a turnbuckle T. By the adjustment of this turnbuckle the force of the stroke upon the bell may be regulated.

Special reference should be made at this point to the adjustable contact-points at I, J, and J′ In order that the breaking of the primary circuit may be made at the proper moment with reference to the stroke of the bell, it is necessary that the contact I, which closes the circuit through J and J′, should be easily adjustable. In the drawings herewith I have shown what I have found to be a simple and effective device, which is clearly shown in Fig. 1.

Having thus described my invention and its method of operation and without limiting myself to the particular construction herein shown and described, what I claim as new is—

1. In an electromagnetic bell-ringing mechanism, a circuit carrying an actuating-current, and a solenoid, in combination with a primary circuit, and a circuit-breaking circuit closed by the action of said solenoid and energized by the battery energizing the primary circuit, substantially as and for the purposes set forth.

2. In an electromagnetic bell-ringing mechanism, the combination of a relay, a low-potential primary circuit for actuating said relay, a contact mechanism for closing said primary circuit, an actuating-circuit of high potential, a solenoid energized thereby, and a circuit-breaking circuit closed by the action of said solenoid and energized by the battery energizing said primary circuit, to break said primary circuit, substantially as and for the purposes set forth.

3. In an electromagnetic bell-ringing mechanism, a relay, consisting of two sets of coils and two armatures, an arm actuated by said armatures, and contacts for opening and closing the actuating-circuit, both of said sets of coils energized by the primary current, and one set actuating the armature and partially closing the air-gap between the cores and the armature of the second magnet, and the second magnet and its armature completing the swing of the arm to close the actuating-circuit, and means for returning the arm and releasing the armatures from contact with the cores when the coils are deënergized, substantially as and for the purposes set forth.

4. In an electromagnetic bell-ringing mechanism, the combination of a primary circuit, a switch, and a relay consisting of two magnets, the one actuating an armature to par-

tially close the switch and the second operating to complete the closing of the switch, with an actuating-circuit and a solenoid for producing the stroke upon the bell, substantially as and for the purposes set forth.

5. In an electromagnetic bell-ringing mechanism, the combination of a primary circuit, a contact for opening and closing the same, a relay, a secondary or actuating circuit, and a solenoid, and a circuit-breaker, a circuit opened and closed by the action of the solenoid to break and close the primary circuit, substantially as and for the purposes set forth.

6. In an electromagnetic bell-ringing mechanism, in combination with a circuit-closer, relay and solenoid, of a circuit-breaker, consisting of a magnet, armature and arm actuated by the armature, a primary circuit through the arm controlled by the circuit-closer, and a second circuit including the said magnet closed by the action of the solenoid and energized by the battery supplying current to the primary circuit, the said magnet, when energized, breaking the primary circuit including the relay by attracting its armature thus actuating the said arm.

7. In an electromagnetic bell-ringing mechanism, the combination of a primary circuit and a circuit-closer for opening and closing the same with a multiple-magnet relay for opening and closing the actuating-circuit, and a multiple solenoid energized by the actuating-current for actuating the bell mechanism, and a circuit-breaker actuated by said solenoid for breaking said primary circuit through the relay, and thus breaking the actuating-circuit, substantially as and for the purposes set forth.

8. In an electromagnetic bell-ringing mechanism, the combination of a primary circuit, a multiple-magnet relay in combination with an actuating-circuit, and means for closing the same upon said relay, a solenoid actuated by the actuating-current, and a circuit-breaker, and a circuit-breaker circuit, closed by the action of the said solenoid, and a swinging contact upon said circuit-breaker for breaking the primary circuit through the relay while the contact upon the primary circuit is closed, and deënergizing the relay-magnet when the primary current is closed through the said circuit-breaker circuit, substantially as and for the purposes set forth.

In testimony whereof I have hereunto set my hand this 30th day of October, 1899.

JOHN J. SHEAHAN.

Witnesses:
GEORGE A. LEWIS,
C. M. MORSE.