No. 719,465. PATENTED FEB. 3, 1903.

VITALIS HIMMER & VITALIS HIMMER, Jr.

ELECTRIC CLOCK.

APPLICATION FILED MAR. 15, 1902.

NO MODEL. 2 SHEETS—SHEET 1.

FIG. 1.

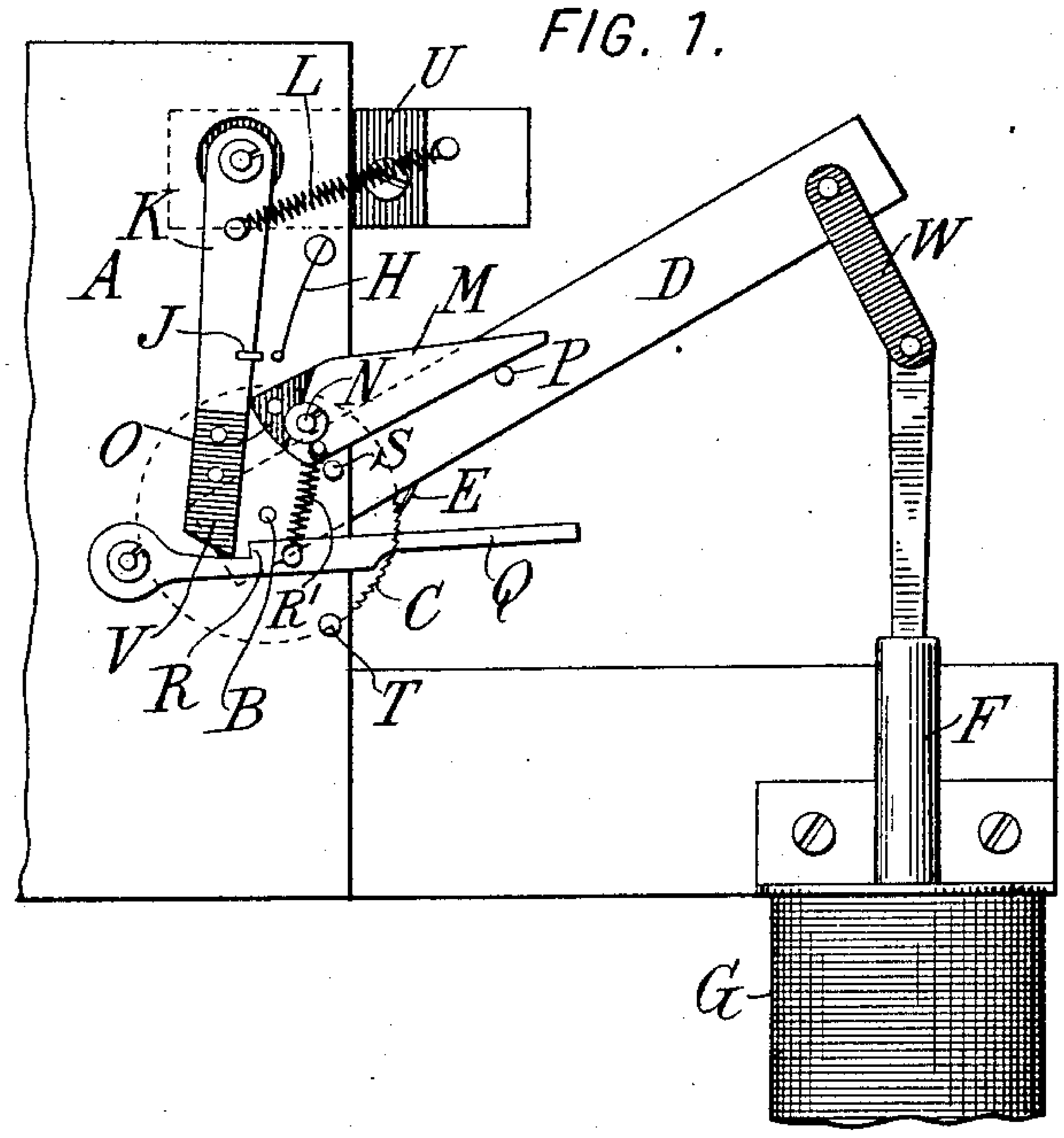


FIG. 2.

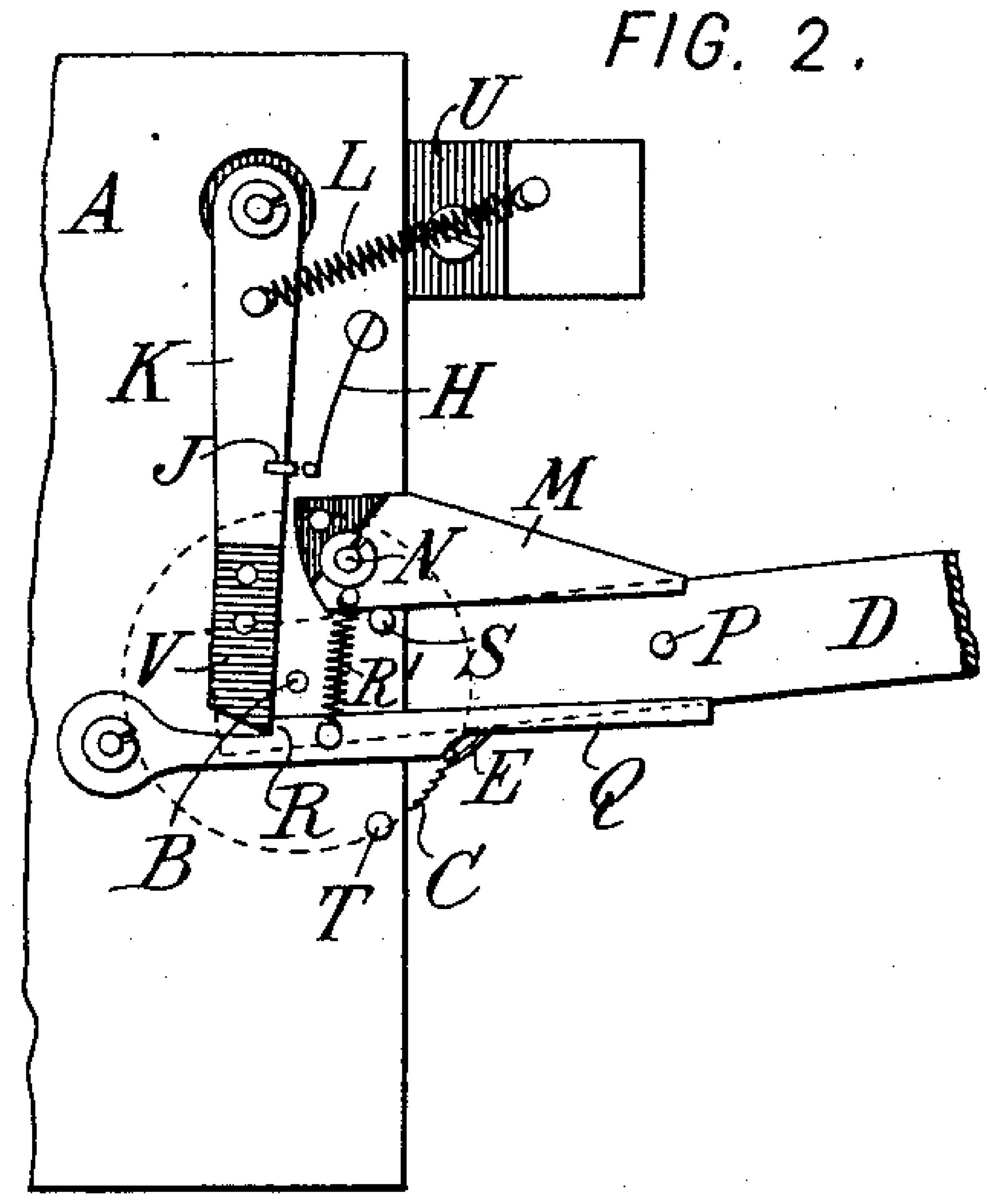


FIG. 3.

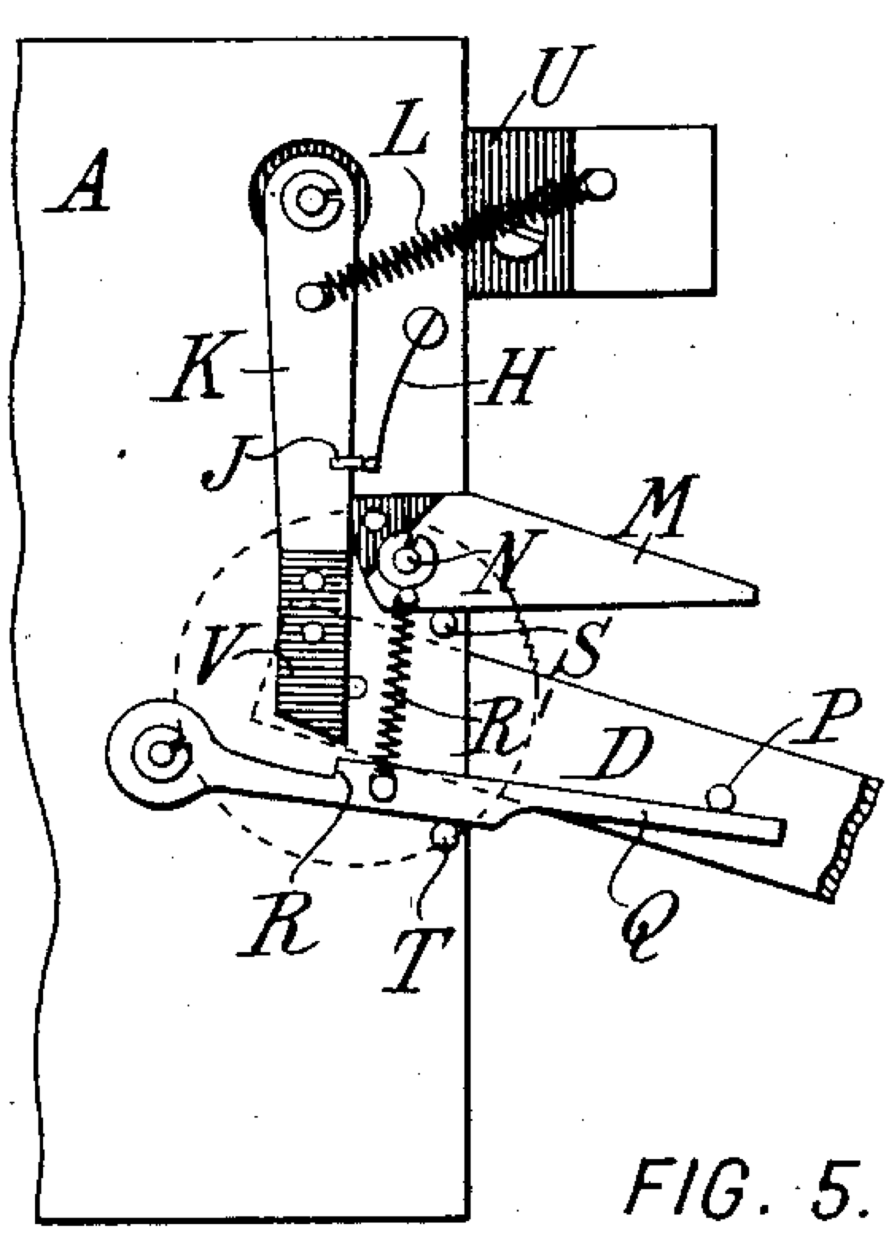


FIG. 4.

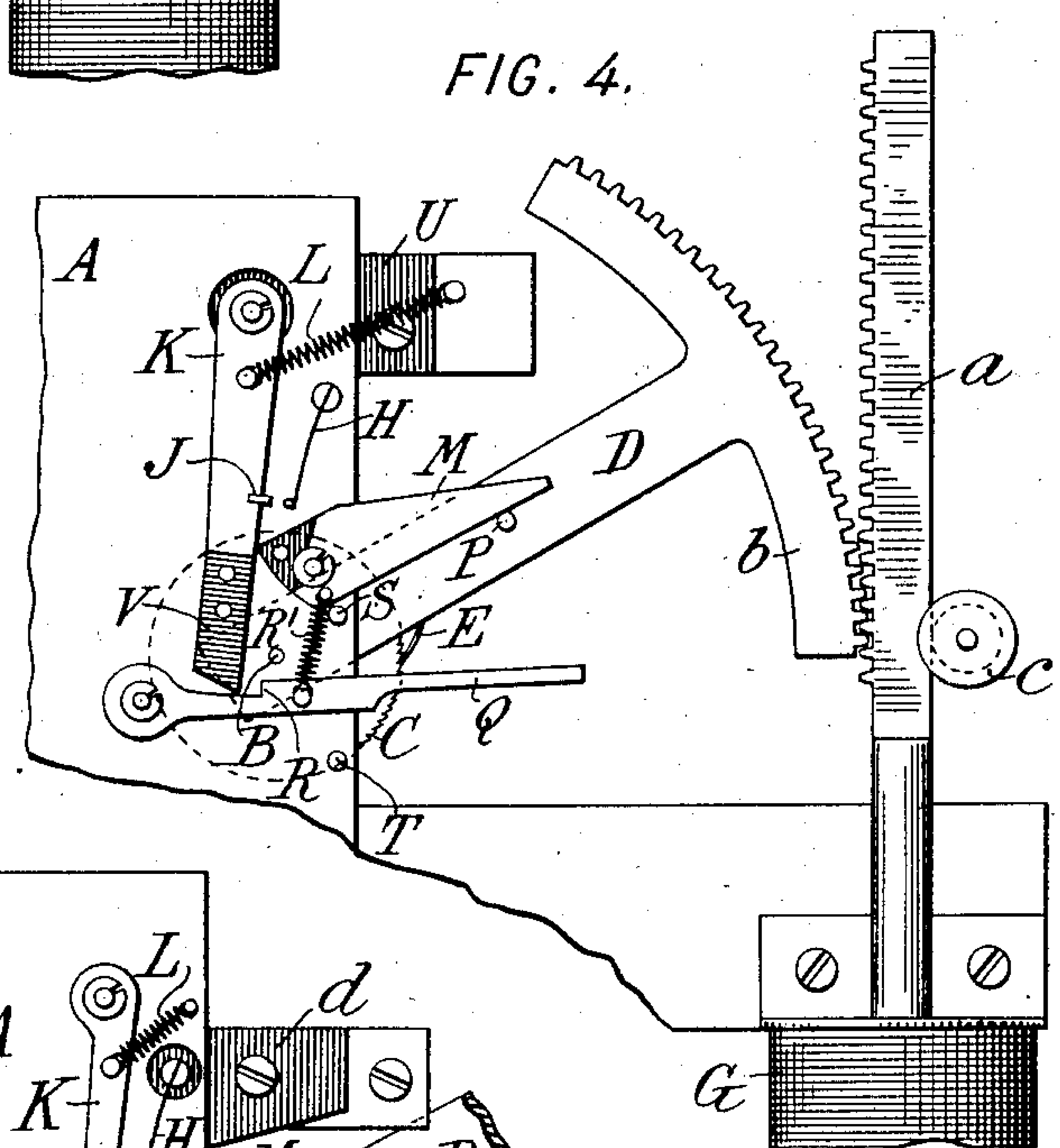
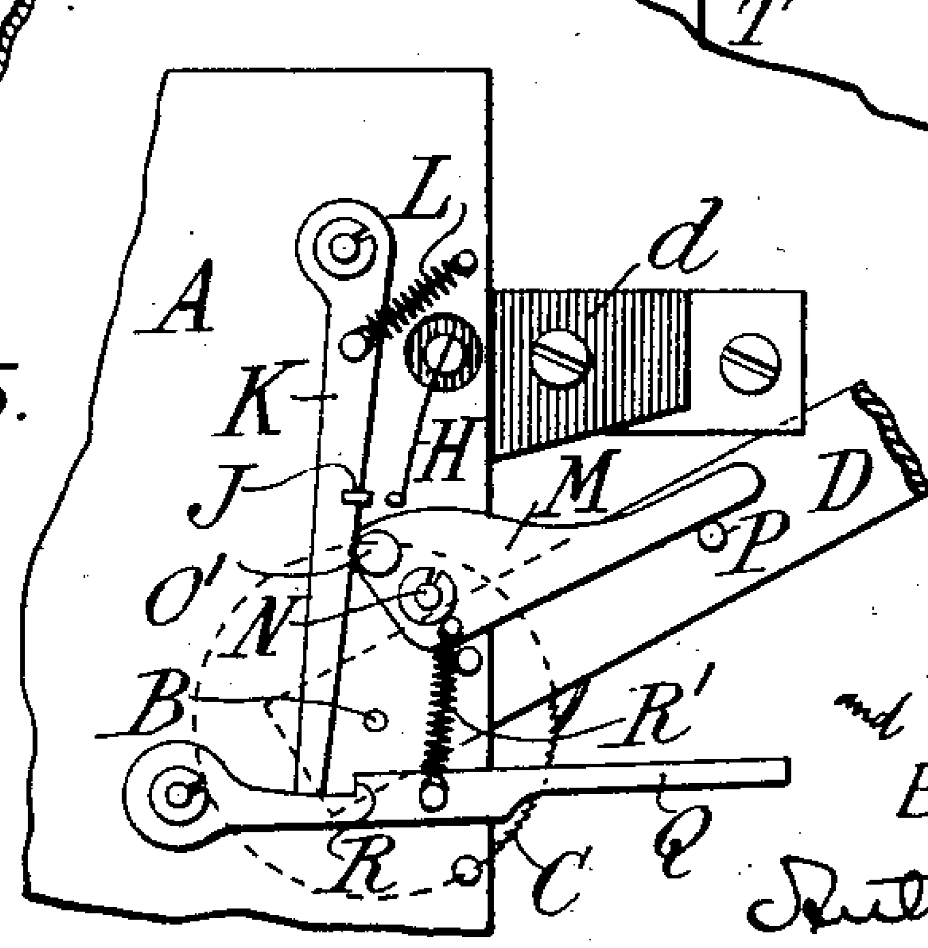


FIG. 5.



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NO MODEL. 2 SHEETS—SHEET 2.

FIG. 6.

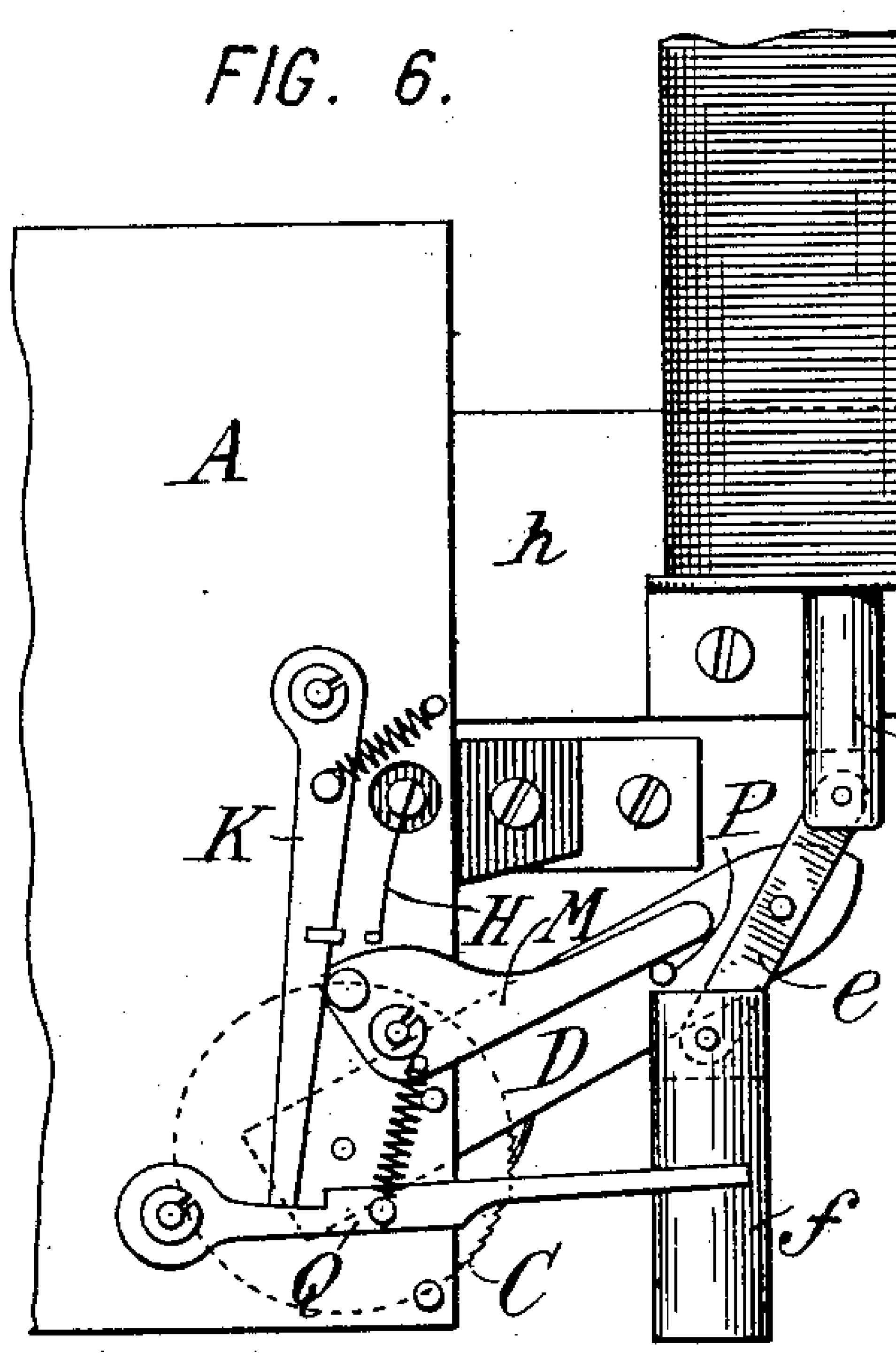


FIG. 9.

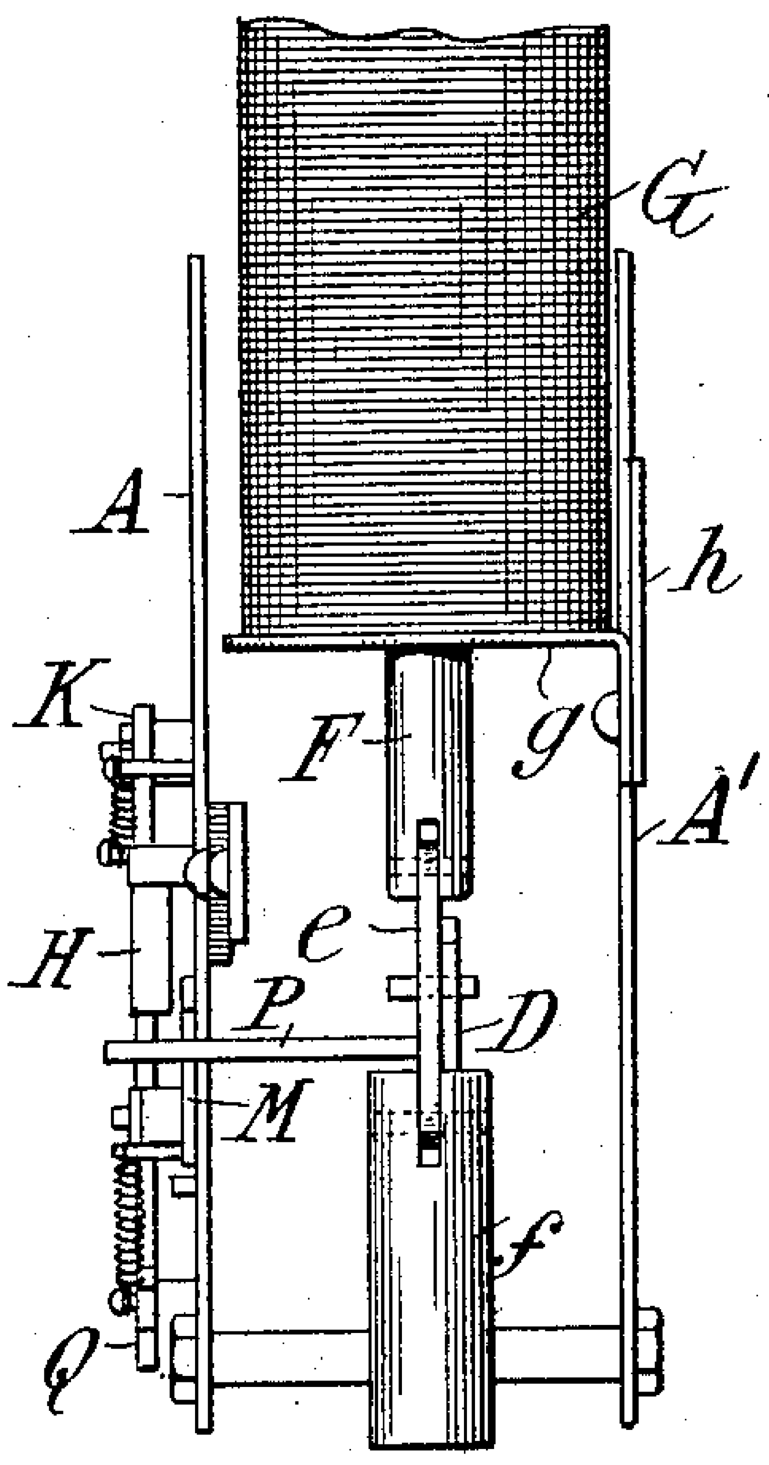


FIG. 8.

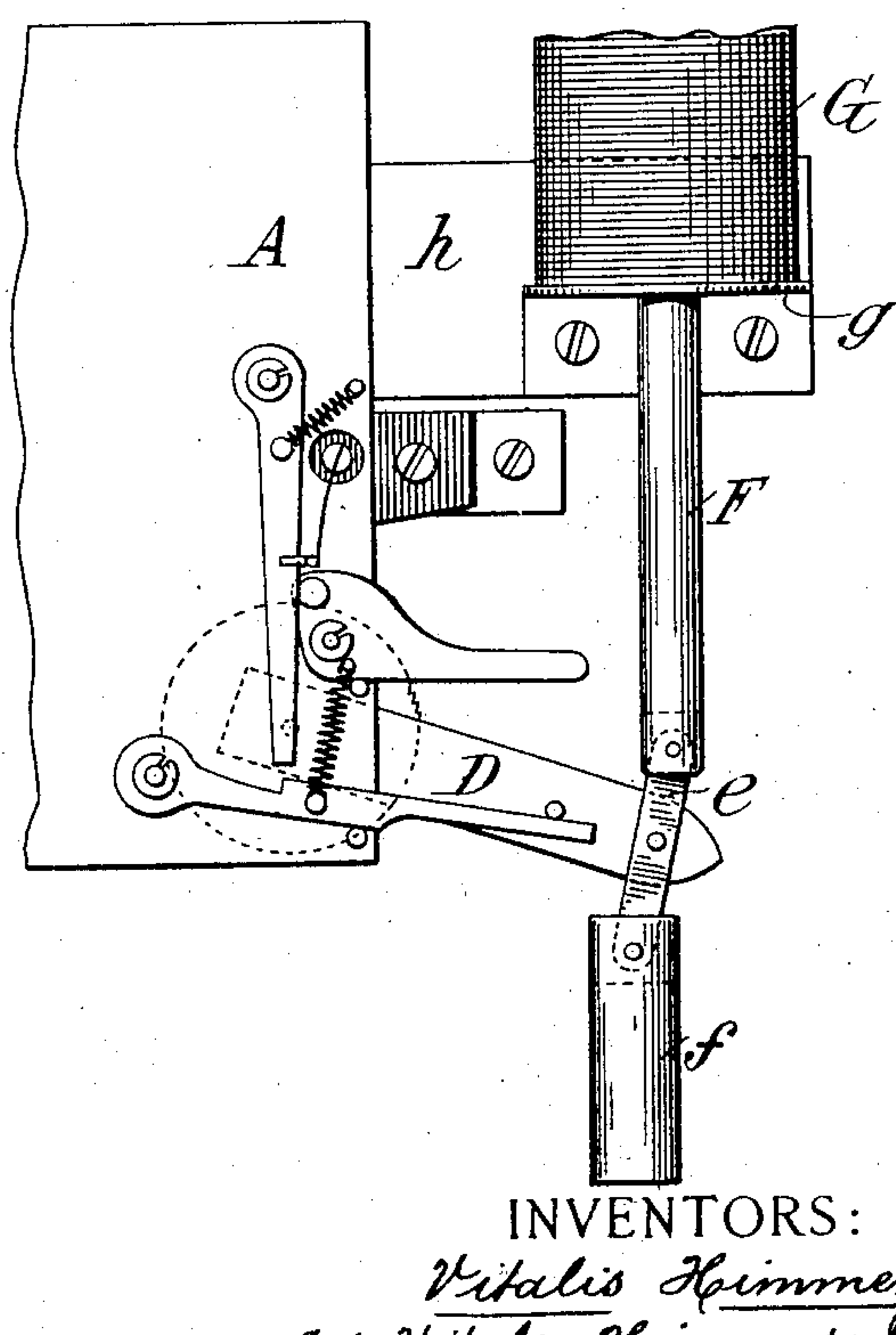
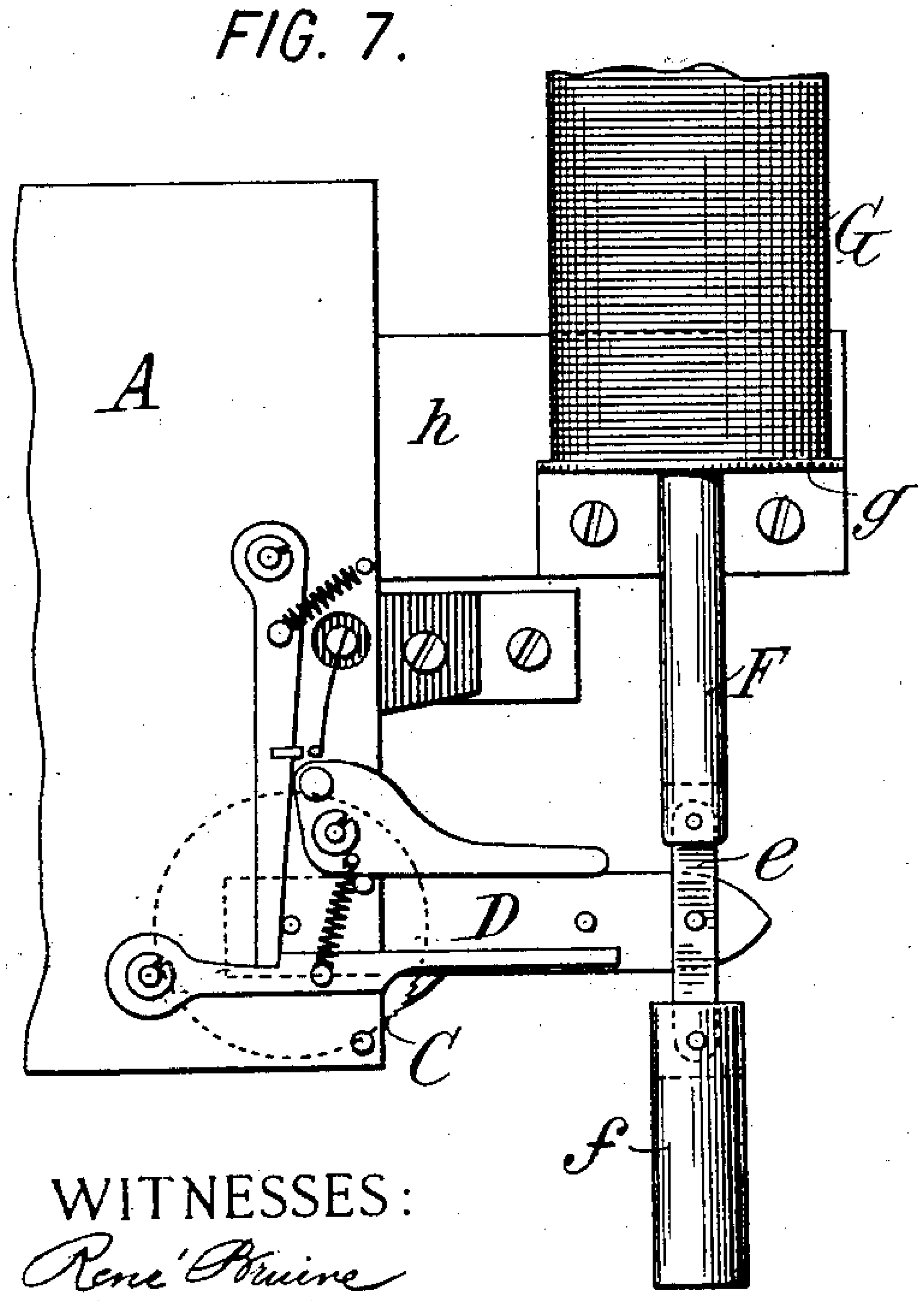


FIG. 7.



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UNITED STATES PATENT OFFICE.

VITALIS HIMMER AND VITALIS HIMMER, JR., OF BAYONNE, NEW JERSEY; SAID VITALIS HIMMER, JR., ASSIGNOR TO SAID VITALIS HIMMER.

ELECTRIC CLOCK.

SPECIFICATION forming part of Letters Patent No. 719,465, dated February 3, 1903.

Application filed March 15, 1902. Serial No. 98,367. (No model.)

To all whom it may concern:

Be it known that we, VITALIS HIMMER and VITALIS HIMMER, Jr., citizens of the United States, residing at Bayonne, in the county of Hudson and State of New Jersey, have invented certain new and useful Improvements in Electric Clocks, of which the following is a specification.

Our invention aims to provide certain improvements in clocks in which the power of the driving means is generated by electricity, and aims especially to provide means which insure certainty of operation, exactness of regulation, and the use of a minimum amount of current, so that with a given current-supply the clock will run for a very long time.

Our invention aims particularly to provide improvements applicable to electric clocks of the type disclosed in a prior application for patent by Vitalis Himmer.

Our invention aims also to provide various features of improvement which will be hereinafter referred to in detail.

Referring to the accompanying drawings, illustrating embodiments of our invention, Figures 1, 2, and 3 are front elevations of a current-controlling mechanism and connected parts, showing three successive positions of the same. Fig. 4 is a front elevation of another form in which the invention may be embodied. Fig. 5 is a similar view of a third form. Figs. 6, 7, and 8 are similar views of still another form. Fig. 9 is an elevation at right angles to Fig. 6, omitting the clock-train.

Our improvements are applicable to clocks operated by any usual or suitable driving means, such as a spring or a weight, the power of such driving means being generated—that is to say, the clock being "wound up"—by an electrically-operated mechanism—such, for example, as the solenoid illustrated. When the power of the driving means has been generated, such means operate for a certain interval, and then before their power has been quite exhausted set in operation the generating mechanism, which then regenerates the power of the driving mechanism and at the same time cuts itself out of operation, the driving operation then commencing again.

As in the previous application above referred to, the operation of the electric mechanism of our present invention is preferably controlled by means independent of the clock-train—as, for example, by a pair of terminals which are independent of the clock-train and are operated by the movement of the generating mechanism. This independence insures a certainty of action and a better control of the action of the circuit and insures also a greater simplicity in construction and an easy adaptation of our improvements to clocks now in use.

Our present improvements are designed especially for use in portable clocks to be operated by a battery, and since the battery capacity is limited by considerations of size and weight it is of the greatest importance to waste as little current as possible, so that the clock shall run as long as possible without renewing the battery.

Our present improvements provide a current-controlling mechanism whose operation wastes almost none of the power. A circuit-breaking lever is operated at or near the end of the generating movement of the generating mechanism and is returned to its starting position by a spring or the like, which is so placed as to oppose substantially no resistance to such circuit-breaking lever until the latter has been moved a considerable distance from its normal position. A spring or similar device tends to press the terminals together to complete the circuit. A restraining means, preferably in the form of a shouldered lever, prevents the terminals from coming together to complete the circuit when the circuit-breaking lever is free from the pressure produced by the generating movement. The spring which returns the circuit-breaking lever to its normal position is preferably connected to react against the restraining-lever, so that as the latter is moved to release the terminals and permit them to close the circuit an additional force is exerted upon the circuit-breaking lever to move it to its proper inactive position and so that as the circuit-breaking lever is operated to break the circuit the spring exerts an extraordinary pull on the restraining-lever to hold it more surely in the restraining position. This connection induces a certainty of operation. The terminals which make or break the circuit are preferably separate from the circuit-closing lever and the restraining-lever described. In the construction illustrated one of the terminals is fixed to the frame of the clock and the other is carried upon a lever, which receives the desired movements from the circuit-breaking lever and the spring and restraining-lever above described.

Referring specifically to the construction illustrated in the accompanying drawings, A is one of the plates which carry the clock-train, and B is an arbor which receives, in the first instance, the movement of the driving means and which transmits the same to the clock-train. The arbor B is driven, preferably, through the medium of a ratchet-wheel C and lever D, having the spring-pawl E engaging the ratchet-teeth, and a weight F, which is connected to the end of the lever D to pull the same downward. The lever D is preferably pivoted on the arbor B, and the movement of the ratchet-wheel C is preferably transmitted to the arbor B by means of a yielding connection—such, for example, as that described in our previous application above referred to. The power of the weight F is generated by the lifting movement given to it by a solenoid G, of which the weight forms the core and which solenoid is interposed in the clock-circuit in a manner obvious to those skilled in the art. It is thought unnecessary to illustrate the electric circuit. The circuit passes also through a spring-terminal H, fixed at one end to the plate A, and a complementary terminal J, carried at an intermediate point of a lever K, which latter is pulled by the spring L in a direction to complete the circuit. For breaking the circuit we preferably use a lever M, pivoted at N, having its inner end O arranged to bear against the terminal-carrying lever K, so as in the position of Fig. 1 to hold the terminals H and J apart. The lever M is moved to its position preferably by means of a pin P on the lever D, which engages the under edge of the outwardly-extending portion of the lever M. As the lever D moves downward during the driving movement the lever M is released and moves downward at its outer end also, as hereinafter explained, Fig. 2, so as to release the terminal-carrying lever K; but the latter is held against sufficient movement to complete the circuit by means of a restraining-lever Q, upon which there is a shoulder R, engaging the end of the lever K for such purpose. It is only when the driving means has nearly completed its operation that the pin P engages the restraining-lever Q and presses it downward, Fig. 3, to release the terminal-carrying lever K and permit it, under the action of the spring L, to close the circuit. The reactions of the circuit-breaking lever M and the restraining-lever Q in opposite direction to the movements induced by the pin P are effected by a very simple and efficient means, comprising a spring R′, which is connected at its opposite ends, respectively, to these two levers. The point of connection of the spring R′ to the circuit-breaking lever M is such that the pull of the spring is normally, Fig. 3, substantially in line with the pivot N of the lever, so that the resistance which the lever opposes to the upward movement of the pin P is initially zero. The resistance of the spring to such movement would increase as its point of attachment to the lever is moved out of line with the pivot of the lever by the movement of the lever; but here again another reduction of the force of the spring occurs as soon as the lever K is pressed outward far enough to cause its end to pass over the shoulder R of the lever Q, the lever Q then moving upward and inducing a corresponding release of strain on the spring R′. The spring then opposes almost no resistance to further upward movement of the weight F under the momentum acquired during the pull of the solenoid. The downward movement of the lever M is limited by a pin S, located at a suitable point on the plate A. As soon as the restraining-lever Q is carried downward far enough to permit the escape of the lever K from the shoulder R the contacts come together, when the pin P is thrown upward; but if the current should be exhausted or the generating mechanism should fail to act the pin P will continue moving downward, and in order to prevent excessive movement we may provide also a pin T on the plate A below the lever Q, so as to stop the same against any excessive downward movement.

Preferably the current is insulated from the clock-train, the lever K being carried on a block of insulating material U and the bearing ends of the levers M and K being formed of insulating material, as indicated at O and V. Preferably, also, a link of insulating material W is interposed between the weight F and the lever D to avoid the passage of any current into the clock-train.

By the construction shown we secure a perfect contact between the terminals H and J. The spring L may be made of considerable strength, so as to insure good contact, and the nature of the operative connection between the lever K and the lever M is such that very little force is required to operate the lever K from the lever M, even against the resistance of a strong spring L. The contact-breaking lever M and the restraining-lever Q are also arranged to move through very slight distances, so as to utilize a minimum amount of current for their operation. The saving of power by these means is of course very slight at each operation of the mechanism, but in the aggregate the length of time during which the clock will run with a given battery is very considerably augmented as compared with the operation of the more wasteful mechanisms previously proposed. The fact that the circuit-breaking lever M and the restraining-lever Q are connected also makes more certain their operation. This is an important feature, because the clock is designed to operate for very long periods—such, for example, as a year—without inspection, and the parts may in the meantime become dirty or worn, so that any means for insuring a certainty of operation is valuable. The present mechanism aids in this purpose by the increased tension put upon the spring R′ by the upward movement of the lever M, which makes more certain the upward movement of the lever Q, and by the similar stretching of the spring on the downward movement of the lever Q to render more certain the return of the lever M against any accidental resistance of dirt or the like which may occur, so that in insuring the operation of the levers the spring has a very strong effect; but in resisting their operation under the action of the pin it opposes but a slight resistance.

Though we have described with great particularity a device embodying our invention, yet it is to be understood that the invention is not limited to the specific embodiment described. Various modifications in the details and in the arrangement and combination of the parts may be made by persons skilled in the art without departure from the invention. For example, an ordinary horseshoe-magnet may be used instead of the solenoid shown, the movement being transmitted to the clock-train either with or without intermediate multiplying-gear, and the other parts of the device being either as shown or modified in construction or proportions to suit the case. Likewise the transmitting mechanism between the power-generating mechanism and the clock-train may be varied within a considerable range. For example, in Fig. 4 we show the oscillating lever D connected to the core of the solenoid by means of a toothed rack *a*, which is in engagement with a correspondingly-toothed segment *b*. The rack *a* is held against the segment *b* and is held from lateral movement by any suitable means—such, for example, as a grooved roller *c*. The supports of the several parts are not shown fully, the figure being in the nature of a diagram. The other parts of the device are shown the same as in the previous figures, the parts being in the position of Fig. 1; but these, of course, may also be varied without departure from the invention.

Fig. 5 shows another form of the invention differing in certain details from the forms previously described. In this case the fixed terminal H is carried on an insulated block *d*, the movable terminal J being electrically connected to the plate A. In this construction we dispense with several of the insulating connections shown in Figs. 1 to 4, and thereby cheapen the construction without any reduction in efficiency. Preferably the lever M is provided with a pin O′, which bears against the lever K to effect the movement thereof, as explained. In other respects the construction and operation are substantially identical with that previously described.

An advantageous feature which may be used with any of the circuit-controlling mechanisms above described or with any similar mechanisms is illustrated in Figs. 6, 7, 8, and 9 and is designed particularly to increase the uniformity of power exerted by the driving means by eliminating certain frictional resistances therefrom. By this means the regulation of the clock is made more perfect. By the mechanism shown in these figures also a heavier driving means is provided than in the constructions shown in the previous figures; also, the lever operated by the generating and driving devices may be shorter than with the previously-described mechanisms, so as to move through a greater arc for a given linear movement of the solenoid, and the coil may be arranged closer to the plate carrying the circuit-controlling devices, so as to provide a more compact and self-contained structure, including the works, the circuit-controlling devices, and the generating and driving devices.

With the arrangement of parts illustrated in Fig. 1 the lever D when it moves above or below a horizontal position is subjected to a sidewise strain from the weight F, which increases the friction upon the several pivots connecting the weight F, link W, and arm D, and the arbor B. This frictional resistance being greater at one time than another causes the clock to run with a slight irregularity and makes it difficult to regulate. It can be reduced by making a long arm D; but this necessitates placing the coil G at a distance from the works and makes the entire structure less compact. (Compare in this respect Figs. 1 and 6.) We provide means for eliminating this objectionable lateral pressure and consequent friction. Preferably we provide a connection, including a link *e*, to an intermediate point of which the arm D is pivotally connected, a pair of weights F and *f* being pivotally connected to the link *e* on opposite sides of the connection to the arm D. The weights F and *f* together constitute the driving means, the lifting of which is preferably effected by the action of the coil G upon only one of the weights, as F. The relative weights of the two members F and *f* and the relative distances from their points of connection to the link to the point of connection of the arm D to the link are such that they balance each other and produce only a downward pull on the arm. Preferably the arm D is connected at the center of the link *e*, and the weights F and *f* are equal. As the weights fall during the driving movement the weight *f* moves outwardly and reaches its outermost position when the arm D is horizontal, Fig. 7, returning inwardly again as the arm passes below the horizontal, Fig. 8. In all positions, however, the two driving-weights F and *f* balance each other and produce a direct vertical pull upon the arm D. The core F is preferably guided so as to have a substantially vertical line of movement. As previously explained, the arm D may be made quite short with this mechanism, so that for a given up-and-down movement of the core F the arm D will swing through a considerable arc, and will consequently drive the ratchet-wheel C a greater distance between successive generating movements.

It is desirable that the clockworks, the circuit-breaking mechanism, and the generating and driving mechanism should be combined in one structure, which may be taken out or put into a clock-case as a unit. We prefer, therefore, to mount the coil G on a bracket *g*, which is attached to an extension *h* (either integral or otherwise) from a back plate A'. The position of the coil by means of this construction is easily arranged so as to locate the core F in a proper line of movement relatively to the arm D, and the entire structure is a unit with all the parts in proper position relatively to each other and has only to be fastened into the case of a clock and connected into the electric circuit.

The advantages of the particular driving means illustrated in Figs. 6 to 9 may obviously be present where the generating mechanism is quite different from that illustrated. For example, clocks having a similar oscillating arm D, driven by a weight or its equivalent, may be provided with such a balanced connection between two parts of the driving means, and the power of the driving means may be generated by any suitable mechanism.

What we claim is—

1. In an electric clock, the combination of a driving means, electrically-operated mechanism for generating the power of said driving means, a pair of terminals in the electric circuit, a terminal-carrying lever carrying one of said terminals, a lever oscillated by the driving means, and a circuit-breaking lever separate from said terminal-carrying lever, and arranged to transmit the movement of said oscillated lever to said terminal-carrying lever to separate said terminals.

2. In an electric clock, the combination of a driving means, electrically-operated mechanism for generating the power of said driving means, a pair of terminals in the electric circuit, a terminal-carrying lever carrying one of said terminals, a spring pressing said terminal-carrying lever in a direction to complete the circuit, a circuit-breaking lever adapted to move said terminal-carrying lever to break the circuit, a restraining-lever normally holding said terminal-carrying lever in a position to open said circuit, and a lever oscillated by the driving means, and adapted when moved in one direction to operate said circuit-breaking lever, and when moved in the opposite direction to operate said restraining-lever to release said terminal-carrying lever and close the circuit.

3. In an electric clock, the combination of a driving means, electrically-operated mechanism for generating the power of said driving means, a lever adapted to be moved in a direction to break the electric circuit by a generating movement of said mechanism, and a spring tending to move said lever yieldingly in the opposite direction, the line of action of said spring passing through the pivot of said lever when the latter is in its normal position, so as to oppose the least resistance to said mechanism.

4. In an electric clock, the combination of a driving means, electrically-operated mechanism for generating the power of said driving means, a circuit-breaking lever adapted to be moved in one direction to break the electric circuit, a second lever adapted to be moved in the opposite direction to cause the completion of the circuit, and a spring connection between said levers.

5. In a clock the combination of a driving means, an oscillating arm for transmitting movement from said driving means to the clock-train, the said driving means being divided into two parts, and connecting means between said arm and the two parts of said driving means, whereby the driving means act on said lever in the same direction and without lateral pressure in all positions of the arm.

6. In a clock the combination of a driving means divided into two parts, an oscillating arm for transmitting the movement of said driving means to the clock-train, and a link connected at an intermediate point to said arm and on opposite sides of said arm to the two parts respectively of said driving means.

7. In an electric clock the combination of a driving means formed in two parts, one of said parts constituting the core of a solenoid, an oscillating arm for transmitting the movement of said driving means to the clock-train, and a link connected at an intermediate point to said oscillating arm, and on opposite sides of said arm to the respective parts of said driving means.

8. In an electric clock the combination of a pair of plates A A', a clock-train carried by said plates, circuit-controlling mechanism carried by one of said plates, and generating mechanism comprising an electromagnet carried by one of said plates, all said parts being in operative, relative positions and forming a unitary structure.

In witness whereof we have hereunto signed our names in the presence of two subscribing witnesses.

VITALIS HIMMER.
VITALIS HIMMER, Jr.

Witnesses:
DOMINGO A. USINA,
FRED WHITE.