No. 859,284. PATENTED JULY 9, 1907.

F. P. COX & A. A. BALL.

PREPAYMENT METER.

APPLICATION FILED MAY 26, 1897.

2 SHEETS—SHEET 1.

FIG. 1.

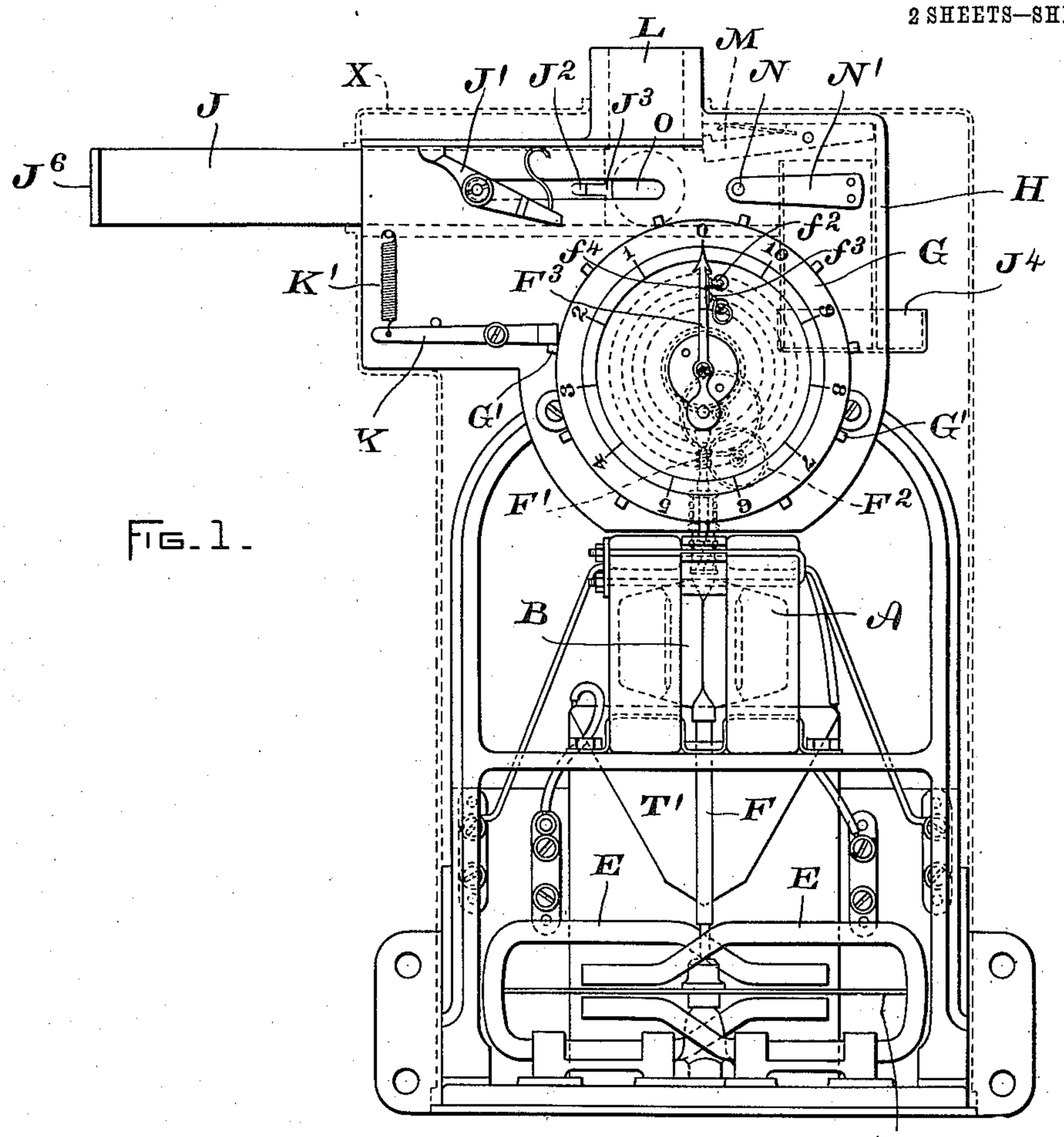
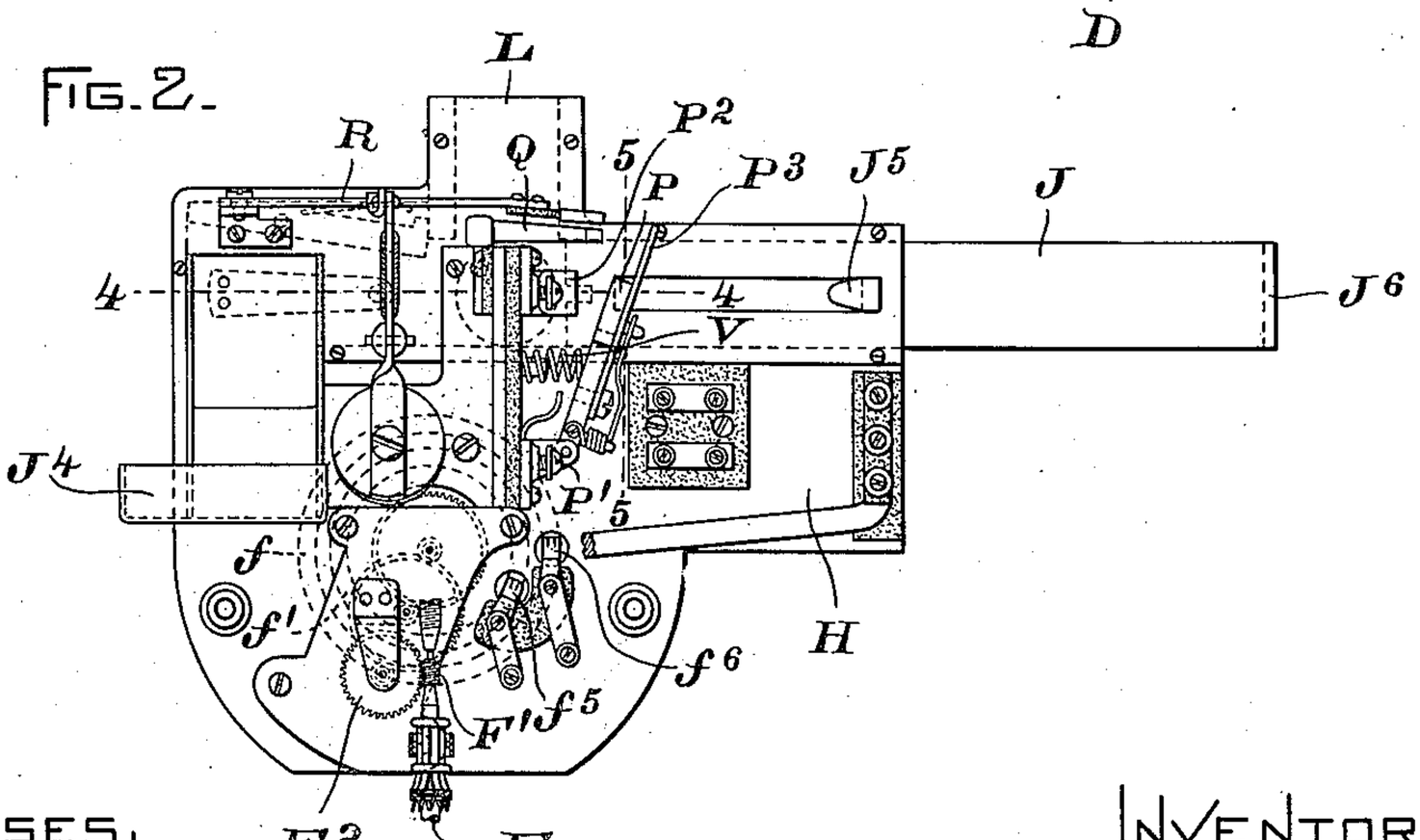


FIG. 2.



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2 SHEETS—SHEET 2.

FIG. 3.

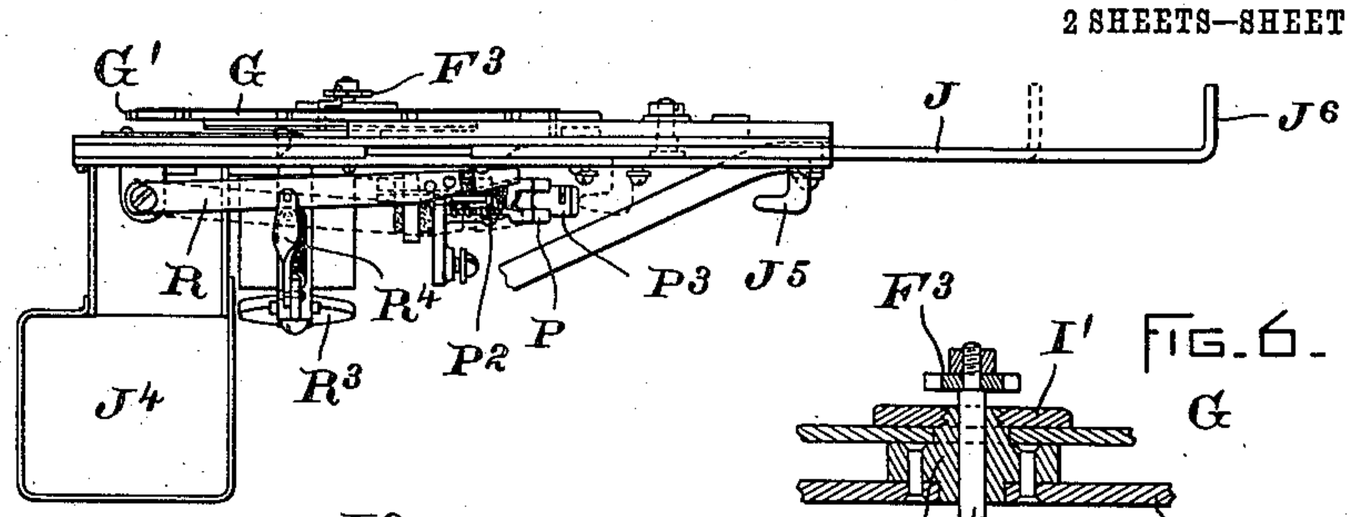


FIG. 6.

FIG. 4.

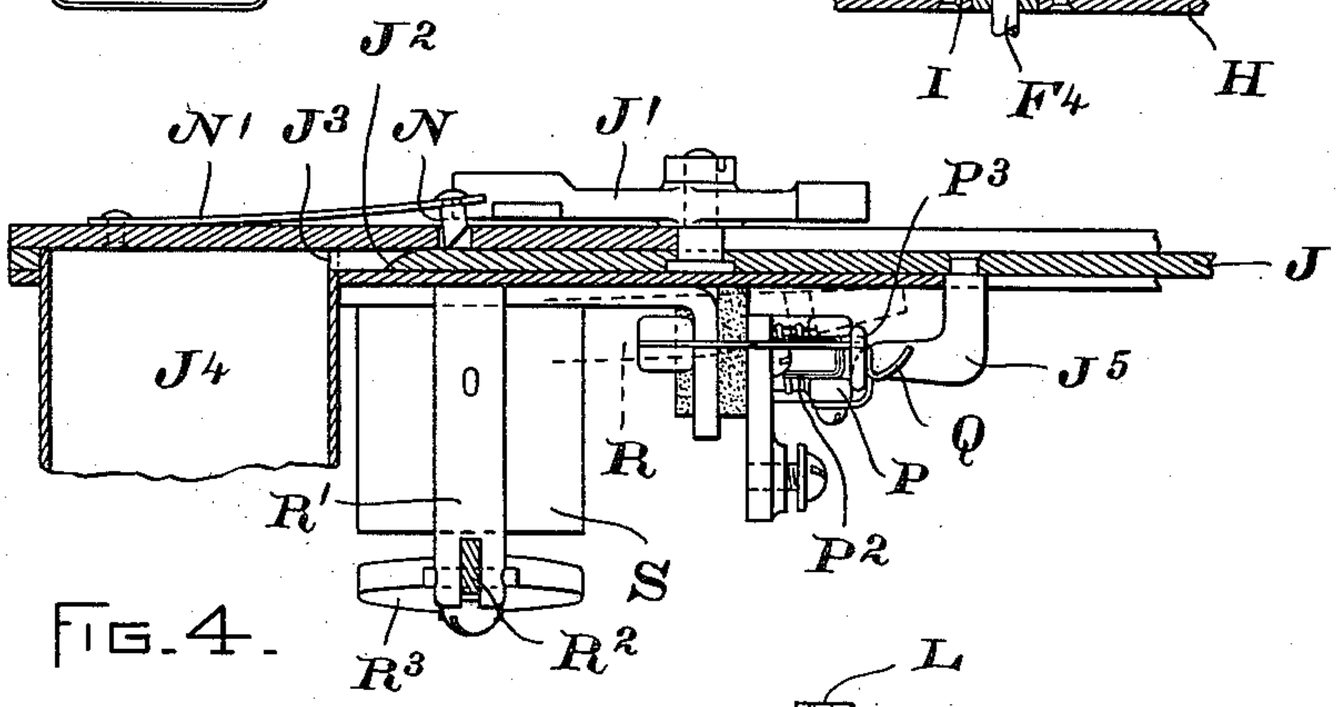


FIG. 5.

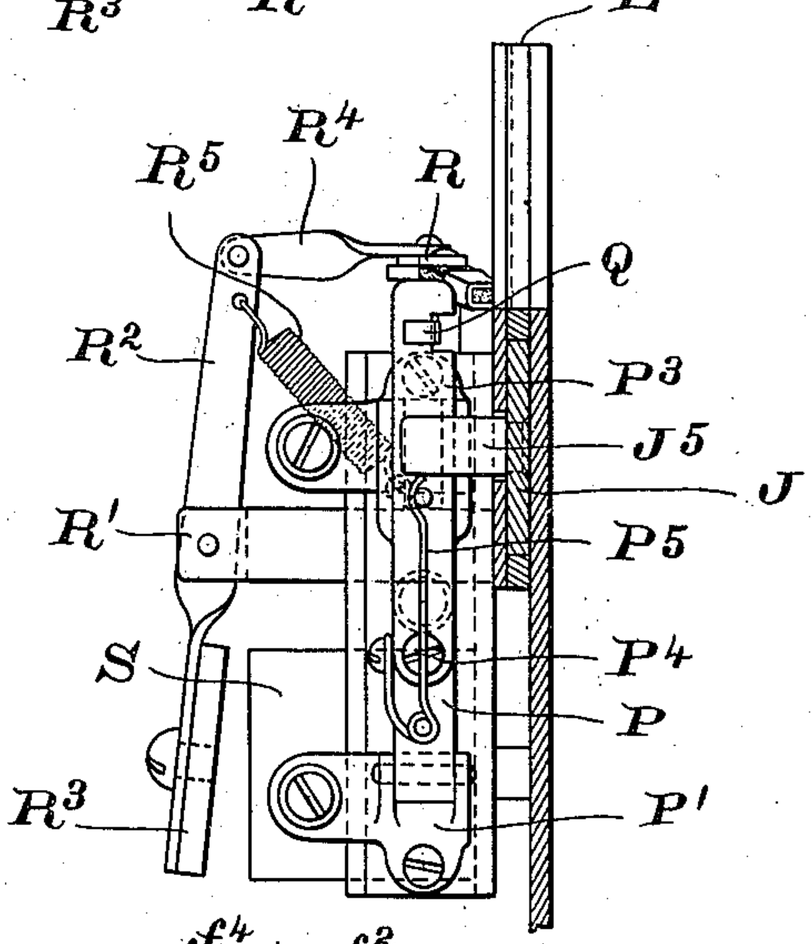
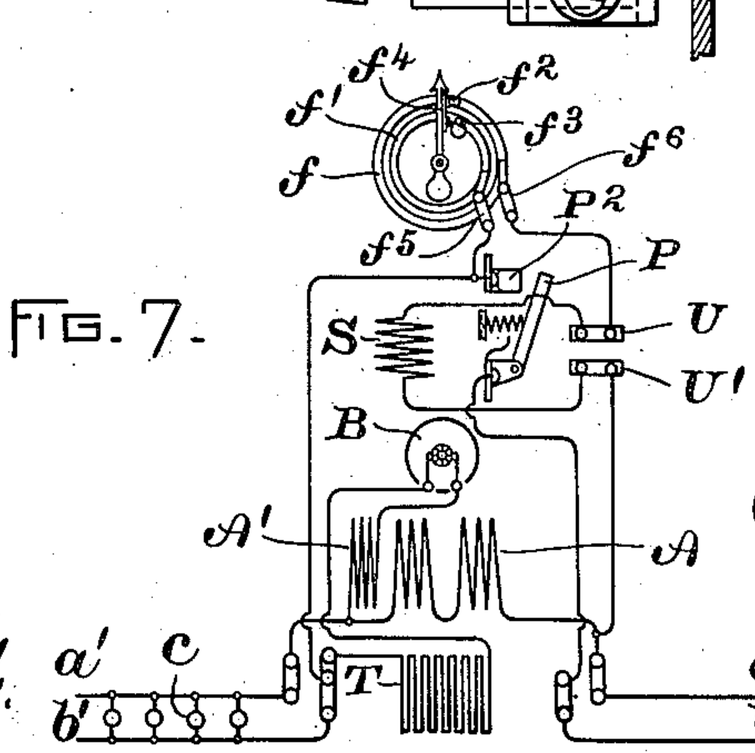


FIG. 7.



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UNITED STATES PATENT OFFICE.

FRANK P. COX AND AUGUSTUS A. BALL, OF LYNN, MASSACHUSETTS, ASSIGNORS TO GENERAL ELECTRIC COMPANY, OF SCHENECTADY, NEW YORK, A CORPORATION OF NEW YORK.

PREPAYMENT-METER.

No. 859,284. Specification of Letters Patent. Patented July 9, 1907.

Application filed May 26, 1897. Serial No. 638,242.

To all whom it may concern:

Be it known that we, FRANK P. COX and AUGUSTUS A. BALL, citizens of the United States, residing at Lynn, in the county of Essex, State of Massachusetts, have invented certain new and useful Improvements in Prepayment-Meters, of which the following is a specification.

The present invention relates to prepayment electric meters employed in measuring in volt, ampere or watt hours the consumption of energy in electric circuits.

The object of the invention is to provide an electric meter such that the consumer may, by the insertion of a coin or coins of the proper size into the meter, receive a certain amount of electric energy and which will, after the prepaid amount of energy has been consumed, automatically interrupt the consumption circuit.

In the accompanying drawings attached to and made a part of this specification, Figure 1 is a front elevation of an electric meter embodying our invention; Fig. 2 is a partial rear elevation; Fig. 3 is a plan view of the switch and operating device; Fig. 4 is an enlarged sectional view taken on the line 4—4 of Fig. 2; Fig. 5 is a sectional view of the switch mechanism taken on the line 5—5 of Fig. 2; Fig. 6 is a sectional detail showing the dial support, and Fig. 7 is a diagram of the circuit connections.

The invention is shown as applied to a well-known Thomson watt meter, in which A represents the field-magnet coils, B the rotating armature, and D a copper disk revolving wthin the field of stationary magnets E, and forming a magnetic damper.

Upon the upper end of the armature shaft F is a worm F^1 meshing with the worm wheel F^2, which in turn is geared to the hand F^3. Surrounding the meter and inclosing all the parts with the exception of the coin chute L and the sliding piece J, is a casing X (shown in dotted lines).

Thus far the construction is very similar to a standard watt meter, but instead of the usual stationary dial a rotary dial G is employed. Referring to Fig. 6, the means for supporting the dial will be explained. Secured to the frame H is a stud I having a shoulder upon which is supported the dial G, so arranged that it is free to rotate. The outer end of the stud I is screw-threaded and a nut I^1 holds the dial in place. Extending through the stud and free to rotate therein is the shaft F^4 which carries the hand F^3; the hand is secured to the shaft by a frictional engagement. Upon the back of the dial are two concentric rings f and f^1, which are electrically connected respectively with contacts f^2 and f^3 located on the front of the dial Each contact is provided with a small silver tip, and connection is established between them by a silver contact f^4 carried by the moving hand. Fixed brushes f^5 and f^6 (Figs. 2 and 7), which are connected to the circuit, make contact with the rings f and f^1. The dial is divided into any number of sections, ten being the number in the present instance; and in the center of each section on the outer periphery is a radial pin G^1. By gearing the shaft F^4, which carries the hand, directly to the armature shaft, and mounting the dial for movement independent of the hand, no additional friction is interposed to the operation of the meter, and when running on a circuit in which few lights are burning, this becomes a matter of importance.

A piece J having a handle J^6 slides horizontally in the frame H and carries a spring-pressed arm J^1. When the slide J is moved to the right (Fig. 1), the arm J^1 strikes one of the pins G^1 and rotates the dial. To prevent the dial from being moved through a greater angular distance than that between two of the pins at each movement of the sliding piece, and to hold the dial in place, a friction device is employed, consisting of a pivoted lever K, controlled by the spring K^1. If for any reason the dial moves too far, the outer end of lever K engaging with one of the pins will return the dial to the proper position and hold it by reason of the frictional engagement therewith. The right-hand end of the lever K is so positioned with respect to the dial that it will engage with the periphery thereof, and the friction between the parts is sufficient to prevent the dial from moving except under the action of the coin-slide J.

At the upper end of the frame H is a coin chute L connecting with the slot J^3 in which the slide J travels. To the right of the coin chute, and extending into the slot, is a combined coin gage and locking device M, standing normally in the position shown. Upon the front of the frame H is a flat spring N^1 to which is secured a beveled pin N (Figs. 1 and 4), which is struck by a bevel surface J^2 on the slide J, when the latter moves forward. By this arrangement the coin O cannot be withdrawn by a string or similar means after the coin has lifted the lock M. Coins of a single size alone will render the meter operative. If too large the coins cannot of course be fed through the chute. Too small a coin will not lift the lock M, and hence the end of slide J will strike the lock and cannot move far enough forward to rotate the dial. The locking device serves as a coin gage, and is not injured by hammering with the sliding piece J, as the blow will be received by the end of the lock and the gage remain unchanged by wear or otherwise.

On the back side of the meter, and communicating with the slot J^3, is a receptacle J^4 receiving the coins after they have actuated the locking device.

The arrangement of the dial and the hand is such that the consumer can by inspection readily ascertain the amount of energy which remains to his credit; this is an

important feature, for it enables the consumer to judge accurately how much more energy he is entitled to, and avoids the unpleasantness of having the lights suddenly go out.

In addition to rotating the dial, the manually operated slide J closes the circuit of the meter. Secured to the back of the slide J, and working in a slot in the frame H, is an L-shaped setting lug J^5 which strikes and closes the switch P. This switch is pivoted on an insulated base P^1, and closes the electric circuit through the fixed contact P^2. The spring V tends to hold the switch in the open position.

On the outer surface of the switch is a locking device consisting of a plate P^3 (Figs. 2 and 5); this is pivoted to the switch blade at its lower end, P^4, and is held in the position shown by spring P^5. Situated above the contact P^2, and insulated therefrom, is a spring catch Q, which engages with the plate P^3, and holds the switch P in its closed position. Pivoted on the left of the frame H is a lever R (Figs. 2 and 3), employed to release the switch locking device. Pivoted upon a base R^1 (Fig. 5), is a lever R^2 provided with an armature R^3 at its lower end, and a link R^4 at its upper end connecting it with the releasing lever R. A spring R^5 is employed to return the parts to the position shown. To actuate the armature R^3 an electric magnet S is employed, and is mounted upon the frame H.

The action of the releasing mechanism is as follows: When the magnet S is energized, it attracts the armature R^3, and motion is transmitted to the pivoted releasing lever R through the lever R^2 and link R^4; this causes the free end of the lever R to move the spring-pressed plate P^3 out of engagement with the spring catch Q, and the switch P opens under the action of the spring V. As soon as the magnet is de-energized, the spring R^5 returns the releasing mechanism to the position shown in the figures, and the meter is in readiness to receive a coin or token.

In Fig. 7 the circuit connections are shown; *a* and *b* indicate the supply mains, a^1 and b^1 the auxiliary mains supplying current to lamps *c*. The field coils A of the meter are connected in series circuit with the main *a*, and the armature B is coupled in shunt across the mains a^1 and b^1.

To reduce the current flowing in the armature circuit, a resistance T is employed, which is placed in an envelop T^1 (Fig. 1) and mounted on the back of the meter casing. To compensate for friction of the moving parts, an auxiliary field coil A^1 is employed, which is connected in series with the armature. Connected with the binding posts U, U^1 are the terminals of the magnet S. The brush f^6 is connected to the binding post U, and brush f^5 to terminal P^2. The switch P is in the negative side of the circuit, and when in the open position the meter circuit is interrupted, as well as that of the lights.

The operation of the meter is as follows: the coin or token O, on being inserted through the slot L, drops into the position shown (Fig. 1); the slide J is then moved to the right, and the coin raises the end of the locking device M, permitting the slide to move to a point where the arm J^1 will strike one of the pins G^1 on the dial, and advance it one division. At the same time the bevel surface J^2 on the slide raises the beveled end of the pin N (Fig. 4); when the slide is withdrawn, the pin N springs back into place, and prevents the removal of the coin. The pin N will cross the slot and make it impossible to draw a coin back through the passageway to the chute. Simultaneously with the advancing of the dial the circuit is closed, for the L-shaped piece J^5 strikes the switch blade P and forces it against the fixed terminal P^2, and the spring catch Q holds the switch in the closed position. The consumer may now turn on the lamps *c*, and current will be supplied thereto for one thousand watt hours, that being the equivalent of one section or division on the dial. As herein described each division on the dial represents a thousand watt hours, but this may be varied at will; and if desired the meter may not register in watt units, but in ampere or volt hours. As soon as the hand arrives at a point where the silver contact f^4 bridges the fixed contacts f^2, f^3, a circuit is established from terminal P^2, brush f^5, contact ring f^1, contact f^3, by silver contact f^4 to contact f^2, to ring *f*, brush f^6, binding post U, magnet S, binding post U^1, to main *a*. This energizes the magnet, which attracts its armature and moves the lever to the left, releasing the plate P^3 from the spring catch Q. The switch P then is thrown open by the spring V, and the circuit of the lamps *c* is opened until the consumer again inserts a coin in the slot, and actuates the slide to rotate the dial still further forward.

By the arrangement shown, a number of coins can be fed to the machine in succession, the dial advancing one division each time a coin is inserted, and the slide J actuated. When the first coin is inserted, the dial is advanced one division and the circuit is closed; inserting more coins and actuating the slide J will advance the dial, but will have no further effect on the switch mechanism.

The present meter is designed to receive from one to ten coins at a time, but this may be changed without departing from the spirit of our invention. Assuming that the maximum is ten coins at a given time, and an extra coin is inserted, the dial will be advanced as before, but the contacts f^2, f^3 will engage with the hand on the opposite side from contact f^4 and carry it along with them. This will do no injury to the meter, as the hand is secured to its spindle by a frictional engagement, but the extra coin will be lost by the consumer.

What we claim as new and desire to secure by Letters Patent of the United States is,

1. In a prepayment electric meter, the combination of a switch, a field coil, an armature acted upon by the coil, a movable dial, a coin-controlled device adapted to engage and move the switch and the dial, a pointer which moves over the dial, contacts on the dial, and contacts carried by the pointer adapted to engage the dial contacts.

2. In a prepayment electric meter, the combination of a manually-actuated coin-controlled switch for closing the consumption circuit, an indicator for indicating the watt energy consumed in the load circuit, a recording dial, a manually-actuated device for adjusting the dial with respect to the indicator and closing the switch, a magnet controlled by the relative movement of the indicator and dial, and operative connections between said magnet and said switch for opening said switch.

3. In a prepayment electric meter, the combination of an indicator, a movable dial, a coin-controlled device for moving the dial, contacts carried by the dial, a magnet in

circuit with the contacts, and means controlled by the indicator for completing the circuit through the magnet.

4. In a coin-controlled electric meter, the combination of an element arranged to rotate proportionately to the energy consumed in the load circuit, a normally stationary dial, means for adjusting the relation between the dial and the element by moving the dial, and means for interrupting the load circuit when the rotation of said element brings said element and the dial into a predetermined relation.

5. In a coin-controlled electric meter, the combination of an indicator arranged to rotate at a speed corresponding to the consumption of energy in the consumer's circuit, a circuit-closing switch, a dial mounted for step-by-step rotary movement, contacts on the dial, means for establishing electrical connection between the contacts and the source of supply, a magnet in circuit with said contacts, means actuated by the indicator coöperating with said contacts for closing the circuit through the magnet and operative connections between said magnet and said circuit-closing switch for opening said switch.

6. In a prepayment electric meter, the combination of an armature actuated by the energy consumed in the metered circuit, a switch for closing the circuit, a spring for moving the switch in one direction independent of its actuator, an indicator positively connected to the armature, a dial mounted for movement independent of the indicator, coin-controlled means for moving the dial away from the indicator and closing the switch as a coin is fed into the meter; the arrangement of the indicator and dial being such that the indicator moves in the same direction as the dial, so that the difference in position between the indicator and zero on the dial indicates the amount of energy remaining to the credit of the consumer.

7. In a prepayment electric metering system, a consumption circuit, a switch for opening and closing said circuit an element moving in response to the energy consumption in said circuit, a second element, coin-controlled means for closing said switch and moving said second element, a circuit derived from the consumption circuit for controlling the release of said switch, and means carried by said elements for closing said derived circuit when said elements are in a predetermined relation to each other.

8. In a prepayment mechanism, the combination of two elements mounted for rotary and concentric movements, means for imparting movement to said elements, a pair of contacts carried by one of the elements and arranged to be bridged by a contact on the other element, a switch, a coin-actuator for moving one of said elements and the switch, and a switch-releasing magnet controlled by the contacts.

9. In an electric metering system, the combination with a consumption circuit, of an element, coin-controlled means for giving said element step-by-step movements in one direction, means for positively limiting each movement of the element, a second element moving in response to the energy consumption of the consumption circuit, and circuit closing means carried by said elements said circuit closing means becoming operative when said elements are in a predetermined position with respect to each other.

10. In a prepayment mechanism, the combination of a rotary disk which moves always in the same direction, a manually actuated slide, a spring-pressed arm carried by the slide and arranged to move the disk on the movement of the slide in one direction only, a pointer which follows the movements of the disk, circuit closing means carried by the pointer and disk, said circuit closing means being operated by a movement of the pointer into a predetermined position with respect to the disk.

11. In a prepayment mechanism, the combination of a coin or token controlled actuator, a combined coin gage and lock acting on the end of the actuator, and a spring and pin carried thereby and situated in the path of the coin for preventing the withdrawal of the coin or token.

12. In a prepayment electric metering system, a consumption circuit, a switch in said circuit, coin-controlled means for closing said switch, a locking plate carried by the switch, a magnet, a pivoted armature therefor, a lever actuated by the armature for moving the locking plate in a manner to release the switch, and means for energizing said magnet from the consumption circuit.

13. In a prepayment mechanism, the combination of a disk loosely mounted for angular movement, coin-controlled means for imparting a step-by-step movement thereto, a device which engages with the disk and limits the movement of each step to the proper amount, a pointer, contacts on the disk and pointer, and means for moving the contacts into operative relation.

In witness whereof we have hereunto set our hands this 22d day of May 1897.

FRANK P. COX.
AUGUSTUS A. BALL.

Witnesses:
HENRY O. WESTENDARP,
JOHN W. GIBBONEY.