C. I. HALL.

PRINTING MECHANISM FOR METERS.

APPLICATION FILED NOV. 22, 1912.

1,223,384.

Patented Apr. 24, 1917.

3 SHEETS—SHEET 1.

Fig. 1.

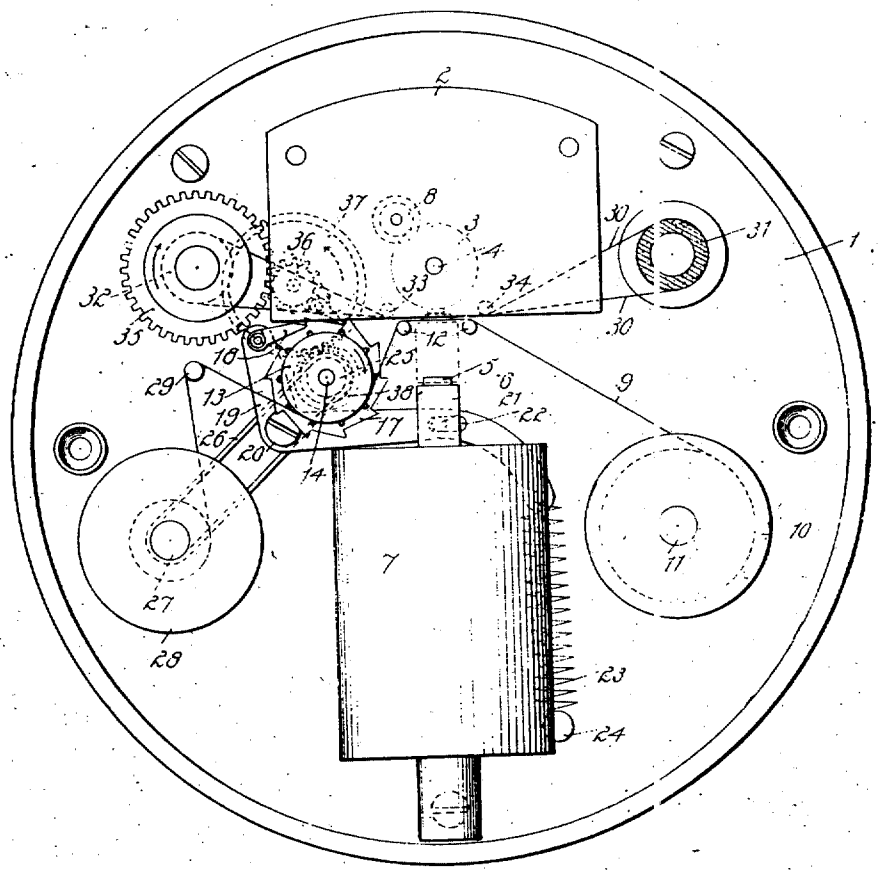
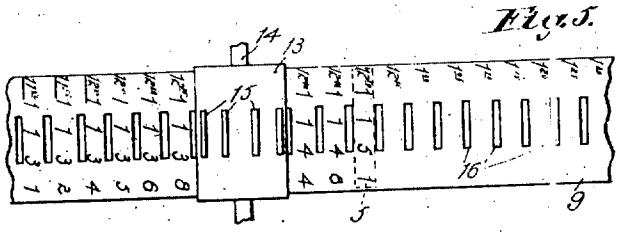


Fig. 5.



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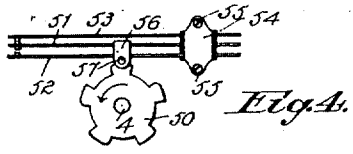


Fig. 4.

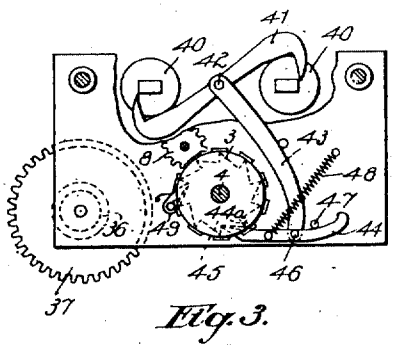
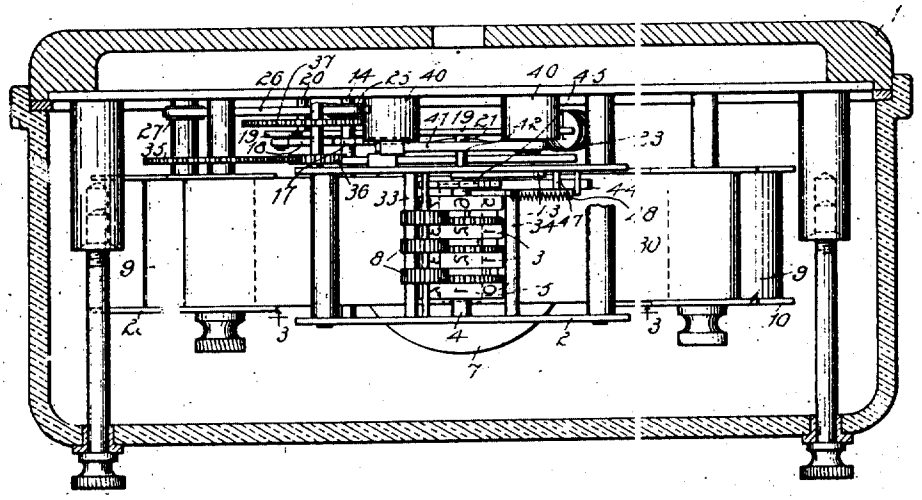


Fig. 3.

Fig. 2



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3 SHEETS—SHEET 3.

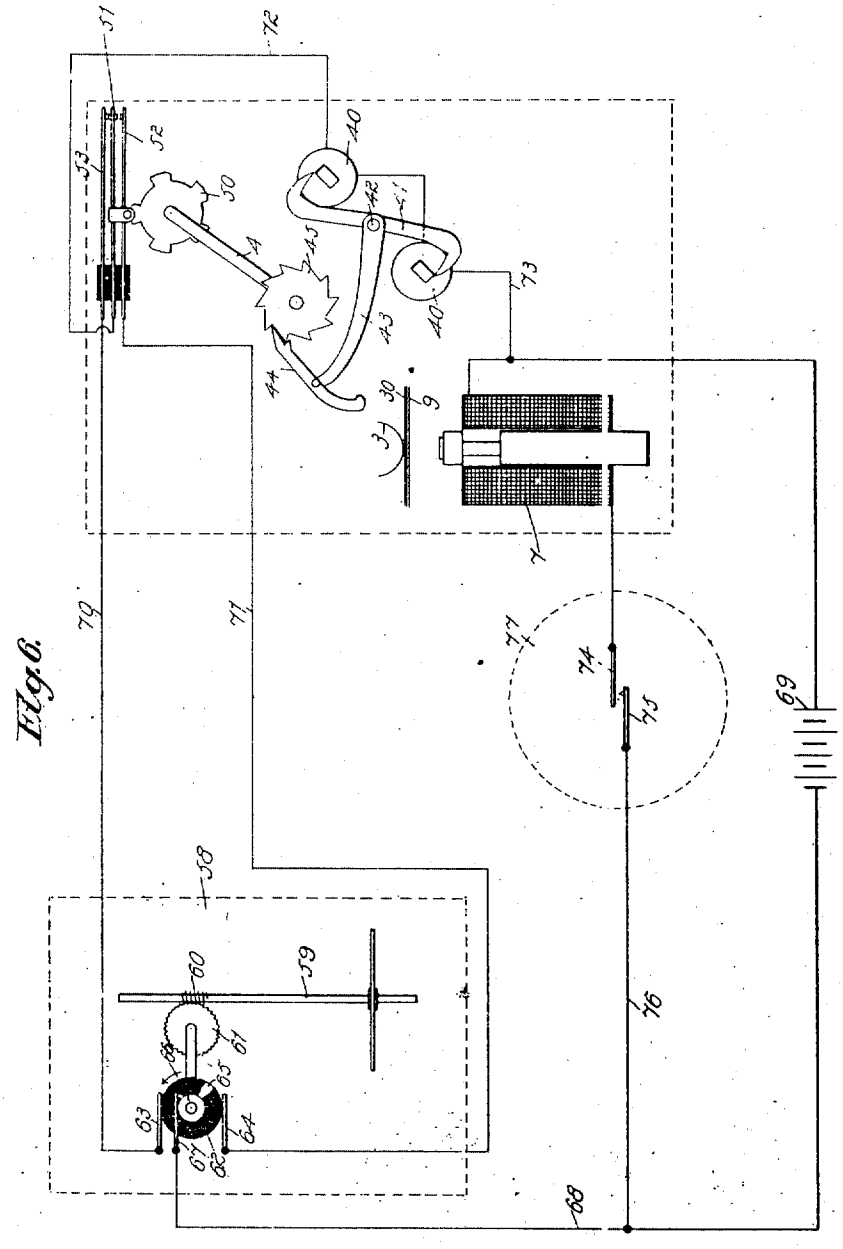

Fig. 6

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UNITED STATES PATENT OFFICE.

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PRINTING MECHANISM FOR METERS.

1,223,384. Specification of Letters Patent. Patented Apr. 24, 1917.

Application filed November 22, 1912. Serial No. 732,854.

To all whom it may concern:

Be it known that I, CHESTER I. HALL, a citizen of the United States, residing at Chicago, in the county of Cook and State of Illinois, have invented a certain new and useful Improvement in Printing Mechanisms for Meters, of which the following is a full, clear, concise, and exact description, reference being had to the accompanying drawings, forming a part of this specification.

My invention relates to an improved printing mechanism for meters, by which the construction of the devices is simple and the number of parts few, in order to accomplish the successive printing of meter readings and to afford an indication of the time of the printing without the use of special mechanism for printing the time. My invention is further characterized by the use of improved contact mechanism for controlling the operation of the electric circuits energized by commutating devices operated by the meter. My invention further embodies novel printing wheel actuating devices, by which positive operation of these devices is secured without danger of improper operation, the action being directly upon the printing wheels and all gearing being eliminated. My invention further provides improved paper feeding devices and ribbon feeding mechanism.

The several drawings illustrating my invention are as follows:

Figure 1 shows, in elevation, my printing mechanism complete;

Fig. 2 is a top view of the parts shown in Fig. 1;

Fig. 3 is a sectional view of the parts shown in Fig. 2, taken along the line 3, 3;

Fig. 4 is a back view of the housing of the printing wheel mechanism, showing the electric contacts used to control the circuits of the device;

Fig. 5 is a view of a detached portion of the paper tape and the feed roller in operative relation to said tape;

Fig. 6 is a diagrammatic circuit drawing showing the relation of the magnets and the contact mechanism of the printing device to the meter and clock mechanism controlling its operation.

Similar numerals refer to similar parts throughout the several views.

As shown in Fig. 1, the printing mechanism consists of a casing and base 1, within which a housing 2 is mounted, which housing has printing wheels 3 pivotally supported upon a shaft 4 carried by the housing. The printing wheels are disposed over a movable platen 5 operated by the plunger 6 of a solenoid 7 in such manner that when the solenoid is energized the platen 5 is moved upward against the lower faces of the printing wheels 3. There may be as many of the printing wheels as it is desired to have orders of figures represented in the amount printed, and these are connected together in the usual manner by Geneva carry-over wheels 8. By its operation the solenoid 7 makes a record on a paper tape 9 supplied from a roller 10 pivotally mounted at 11 upon the base 1. The tape 9 is led over guide pins 12 and around the feed roller 13 mounted upon a stud 14 carried by the base. The roller 13, as more clearly shown in Fig. 5, is provided with driving projections 15, which enter corresponding apertures 16 in the paper tape 9, and thus a positive drive of the tape is produced, depending upon the rotation of the feed roller 13. The feed roller 13 has rigidly secured thereto a ratchet wheel 17 engaged by a spring pawl 18 carried by the upper end of a bell crank lever 19, pivotally supported upon the base at 20. The right-hand end of said bell crank lever is extended and secured by means of a pin 21 to the upper end of the plunger 6, the engagement being through a slot 22 formed in the bell crank lever, which is extended beyond the pin 22 to engage the upper end of a returning spring 23 the lower end of which is secured to the base at 24.

As a result of the construction described, when the solenoid is operated to move the platen 5 against the tape 9 and thus make a record from the type wheels 3, the pawl 18 is moved around to the left upon the ratchet wheel 17 into engagement with the next tooth thereof, and when the solenoid 7 is de-energized the spring 23 returns the plunger 6 to its normal position and at the same time rotates the feed roller 13, thus advancing the tape a space of one reading.

The feed roller also has rigidly secured thereto a small driving pulley 25 connected by a belt 26 with a somewhat smaller pulley 27 secured to the receiving roller 28, as a result of which the paper tape 9 is wound

upon the receiving roller as fast as it is printed. Before passing to the receiving roller the tape is led around a guide pin 29 so as to give a large arc of contact on the feed roller, and also to present to view a considerable length of the printed tape, so that at a glance the operation of the meter with which the printing mechanism is connected may be observed. The ink for making the record upon the paper tape 9 is furnished by an endless ribbon 30, which passes around felt covered rollers 31 and 32, the felt being saturated with suitable ink for keeping the ribbon in proper condition for making a record, and from these rollers the ribbon is guided around the pins 33 and 34 so as to occupy a proper position below the printing surfaces of the type wheels 3, at which point it is double and thus produces a better record than as though it were but single. The roller 32 has rigidly secured thereto a gear 35 meshing with a pinion 36 rigidly secured to a gear 37. The gear 37 meshes with a pinion 38 rigidly secured to the feed roller 13. As a result, the gearing described constitutes a reducing train from the feed roller 13 to the ribbon roller 32, which causes the ribbon 30 to be moved slightly for each printing operation. The belt 26 used to drive the receiving roller 28 is so arranged relatively to the pulleys upon which it rests that it drives the receiving roller 28 with sufficient rapidity when the paper tape is first placed upon the core of the roller, and as the diameter of the roller increases, due to the tape being wound thereon, the driving belt 26 will slip somewhat, but at all times will maintain the tape taut between the receiving roller and the feed roller.

As shown in Fig. 3, the operating mechanism for the printing wheels consists of two electromagnets 40 cooperating with a hook-shaped armature 41, pivoted at 42 so as to oscillate around the pivot when the magnets are energized. The armature 41 has extending downwardly therefrom a lever 43, to which is pivoted a pawl 44. The left-hand end of the pawl just mentioned engages the ratchet wheel 45, which is rigidly secured to the units printing wheel 3. The portion of the pawl 44 which is to the right of its pivot 46 is conformed on its upper surface so that by engagement with the pin 47 the pawl 44 is retained in engagement with the ratchet wheel 45 during its entire advance. In this manner, when the magnets 40 are energized, overthrow of the ratchet wheel 45 is prevented, since as soon as it, by its inertia and the inertia of the parts with which it is connected, endeavors to advance ahead of the pawl 44, the flat surface of the ratchet tooth engaging the pawl prevents undue rotation of the ratchet wheel and thus limits its motion to the motion of the pawl 44. The end of the pawl 44 is formed so as to constitute a stop against the pin 47, which limits the total amount of the motion of said pawl. The operating end of the pawl 44 may be provided, if desired, with an additional pawl tooth 44ª for engaging the next tooth of the ratchet wheel so that a complete operation of the ratchet wheel is assured. A returning spring 48 is provided which returns the pawl and armature to their normal position when the magnets 40 are deënergized. This spring also serves to move the pawl into engagement with the next tooth when the electromagnet 40 is deënergized. A spring holding pawl 49 is provided to hold the ratchet wheel 45 in any position to which it may be advanced by the pawl 44.

As shown in Fig. 4, the shaft 4, upon which the printing wheels are mounted, has rigidly secured to its rear end a disk of insulating material 50 for operating the middle one, 51, of the contact springs 51, 52 and 53, which are mounted in a block of insulating material 54 and secured to the back plate of the printing wheel housing by screws 55. The contact spring 51 carries a yoke 56, which spans the contact spring 52 so that an insulating roller 57 carried by the ends of the yoke engages the periphery of the disk 50, which is toothed as indicated, the leading edges of the teeth being slightly rounded so as to readily engage and lift the roller 57 and thus move the contact spring 51 from engagement with the contact spring 52 into engagement with the contact spring 53. The outer ends of the teeth of the disk 50 and the spaces between the teeth are of circular conformation, so that when the roller 57 is either between the teeth or upon the teeth the spring 51 is at rest and the change from one position to the other is abruptly made so as to give as long a time interval in either position as is possible in view of the rate at which the disk 50 is rotated. The disk 50 and the ratchet wheel 45 are so disposed angularly that the roller 57 first rests upon one of the teeth and then for the next position of advance it rests between the teeth and then upon one of the teeth, and so on. As a result of the construction described, it will at once appear that when it is necessary to repair or replace the contact mechanism, all that is necessary is to take out the two screws 55, which permits the removal of the assembled contact springs, which may be replaced by another similar unitary structure. While I have referred to the cam 50 as made of insulating material, it will be understood that this cam may be made of metal and the roller 57 may be made of insulating material, if preferred, the only essential being that the contact spring 51 shall be insulated so that there will be no chance for the closing of improper circuits through the framework of the mechanism.

As shown in Fig. 5, the tape 9 has printed upon it, opposite each printing position, time indications, so that when the tape is printed each record will bear an indication opposite it of the time at which it was made. This is possible since each printing mechanism is designed to have its recording mechanism operated at regularly recurring intervals which are perfectly definite and can be readily fixed for any particular working condition, as a result of which tape that is prepared and printed with time indications to meet those working conditions can be used, since there will be no need for other indications until the time intervals between the printing operations are changed. The tape is printed, as indicated, with the time indications in Arabic numerals, as for example, 12:45, 12:50, 12:55, etc., and the morning hours may be distinguished from the afternoon hours by any suitable device, as for example, by underscoring the afternoon hours as indicated. The tape shown in Fig. 5 is designed for five minute intervals between the printing operations.

The circuit connections in connection with the printing mechanism are shown diagrammatically in Fig. 6. The meter with which the apparatus is to be used is shown at 58 and may consist of a rotating part 59 driving by means of a worm 60 and worm wheel 61, a commutator 62, which has resting upon opposite sides of its periphery brushes 63 and 64 so that they may be alternately engaged by the single conducting segment 65 of the commutator. The conducting segment 65 is in electrical contact with the conducting hub 66 upon which a spring 67 rests, said spring being connected by wire 68 with one terminal of the battery 69. The brushes 63 and 64 are connected by wires 70 and 71 with the contact springs 53 and 52. The contact spring 51 is connected by wire 72 with one terminal of the magnets 40, the other terminal of which is connected by wire 73 with the other terminal of the battery 69. From the above description it will be seen that as the commutator 62 is driven by the meter 58 in the direction indicated by the arrow, the conducting segment 65 of the commutator will eventually move to a point connecting the hub 66 and contact brush 63, thus causing the circuit to be completed from the battery 69, through wire 68, brush 67, hub 66, conducting segment 65, brush 63, wire 70, contact spring 53, contact spring 51, wire 72, magnets 40, 40 and wire 73, back to battery. As current flows through the magnets 40, 40, the ratchet wheel 45 and disk 50 are advanced causing the contact spring 51 to disengage contact spring 53 and engage contact spring 52, thus breaking the electric circuit and allowing the armature 41 to return to its original or home position. As the commutator 62 continues to rotate 180° the conducting segment 65 of the commutator will connect the hub 66 and brush 64 completing an electric circuit through the contact springs 51 and 52 and causing the ratchet wheel 45 and disk 50 to be advanced one step, after which step the springs 51 and 52 are again separated and springs 51 and 53 brought into engagement with each other. The printing solenoid 7 has one of its terminals connected with the battery 69 and the other with the contact 74 adapted to be engaged by the contact 75 connected by wire 76 with the other terminal of battery 69. The contacts 74 and 75 are shown diagrammatically, but in practice are operated by time-controlled mechanism indicated diagrammatically by 77, so that they will be closed at regularly recurring intervals which may be changed to suit any particular conditions.

The functions of the contact springs 51, 52, and 53 are two-fold. Firstly, they serve to prevent arcing at the meter contacts, and secondly, to prevent a continued closed circuit condition should the meter driven commutator stop with the live segment 65 thereof engaging one of its coöperating brushes 63 and 64. The circuit closing devices operated by the meter are necessarily quite light and it is desirable to avoid arcing at the brushes 63 and 64 when the energizing circuit for electro-magnets 40—40 is open. By providing the three springs 51, 52, and 53 and the coöperating cam 50 the energizing circuit closed through either of the commutator brushes 63 and 64 is opened by the electro-magnets 40—40 through the agency of cam 50 as soon as the electro-magnets have been energized. Consequently, no arcing occurs at the brushes 63 and 64 and for the same reason a closed circuit condition cannot exist for any considerable length of time even should the meter commutator stop with the conducting segment thereof in engagement with one of the brushes 62 or 63.

One of the advantages secured by the mechanism constructed as described above is that it may be operated with great rapidity, and furthermore that the indications are as accurate for such operation as when the devices are operated slowly.

While I have shown my invention in the particular embodiment herein described, I do not, however, limit myself to this construction, but desire to claim any equivalents that may be known to those skilled in the art.

What I claim is:

1. In an apparatus of the class described, the combination of a supply roller for a paper tape adapted to receive a record, a receiving roller for the paper tape, a feed roller having projections thereon for engaging apertures in the paper tape, mecha-

nism operated by the printing mechanism adapted when operated to rotate the feed roller an amount to advance the paper tape a distance of one record, and frictional driving connections between the feed roller and the receiving roller.

2. In a device of the class described, the combination of an electromagnetic operating device, a lever actuated by said operating device, a pawl carried by said lever, a feed roller for moving the record tape from a supply roller to a receiving roller, a ratchet wheel carried by said feed roller to be actuated by said pawl, and a friction drive actuated by the feed roller for winding the paper tape upon the receiving roller.

3. In an apparatus of the class described the combination with a supply roller for a paper tape adapted to receive a record, a receiving roller for the paper tape, a feed roller adapted to coöperate with the tape, printing means and mechanism operated by the printing means adapted when operated to rotate the feed roller an amount to advance the paper tape a distance of one record, and frictional driving connections between the feed roller and the receiving roller.

4. In an apparatus of the class described, the combination of printing wheels, electromagnetic mechanism arranged when actuated to advance the printing wheels, integrating mechanism controlling the operation of the electro-magnetic mechanism, and circuit breaking devices controlled by the electro-magnetic mechanism to break the energizing circuit by the operation of the electro-magnetic mechanism, said circuit breaking devices comprising a rotary cam actuated simultaneously with the printing wheels, three contact springs and a roller carried by one of said springs engaging said cam, rotation of said cam serving to make and break contact between said springs.

5. In an apparatus of the class described, the combination of printing wheels, electromagnetic mechanism arranged when actuated to advance the printing wheels, integrating mechanism controlling the operation of the electro-magnetic mechanism, and circuit breaking devices controlled by the electro-magnetic mechanism to break the energizing circuit by the operation of the electro-magnetic mechanism, said circuit breaking devices comprising a rotary cam actuated by the electro-magnetic mechanism, said cam having alternate spaces and teeth of circular conformation relatively to the center of motion of the cam, three contact springs, and a roller carried by one of said springs in engagement with the surface of the cam, rotation of the cam serving to make contact between said first spring and a second one of said springs when said roller is upon a tooth at the same time to interrupt connection between said first spring and the third one of said springs and to make connection between said first spring and the third one of said springs when the roller is in a space of the cam and at the same time interrupt connection between said first spring and the second one of said springs.

6. In an apparatus of the class described, the combination of printing wheels, electromagnetic mechanism arranged when actuated to advance the printing wheels, integrating mechanism controlling the operation of the electro-magnetic mechanism, and circuit breaking devices controlled by the electro-magnetic mechanism to break the energizing circuit by the operation of the electro-magnetic mechanism, said circuit breaking devices comprising a rotary cam actuated by the electro-magnetic mechanism, said cam having alternate spaces and teeth of circular conformation relatively to the center of motion of the cam, three contact springs, and a roller carried by one of said springs in engagement with the surface of the cam, rotation of the cam serving to make contact between said first spring and a second one of said springs when said roller is upon a tooth and to make connection between said first spring and the third one of said springs when the roller is in a space of the cam.

7. Apparatus of the class described comprising the combination of a device arranged to be actuated each time a certain quantity of energy has been consumed, electro-magnetic mechanism for actuating said device, integrating mechanism controlling the operation of said electro-magnetic mechanism, and circuit breaking devices controlled by the electro-magnetic mechanism to break the energizing circuit by the operation of said mechanism, said circuit breaking devices comprising three contact springs, and means operated by the electro-magnetic mechanism for alternately moving one of said springs into engagement with the other two springs.

8. Apparatus of the class described comprising the combination of a device arranged to be actuated each time a certain quantity of energy has been consumed, electro-magnetic mechanism for actuating said device, integrating mechanism controlling the operation of said electro-magnetic mechanism, and circuit breaking devices controlled by the electro-magnetic mechanism to break the energizing circuit by the operation of said mechanism, said circuit breaking devices comprising three contact springs, a cam arranged to be advanced when the electro-magnetic mechanism is operated, said cam provided with alternate projections and depressions, and a follower for said cam

fixed upon one of said springs whereby the spring provided with the cam follower engages one of its associated springs when the follower rides on a cam projection and engages the other of its associated springs when the follower lies in a depression between two cam projections.

In witness whereof, I hereunto subscribe my name this 16th day of November, A. D. 1912.

CHESTER I. HALL.

Witnesses:
ALBERT C. BELL,
MARY A. COOK.