

Dec. 30, 1941.

A. W. WELCOME

2,268,494

DEVICE FOR CONTROLLING ELECTRIC CIRCUITS

Original Filed Aug. 23, 1937

3 Sheets-Sheet 1

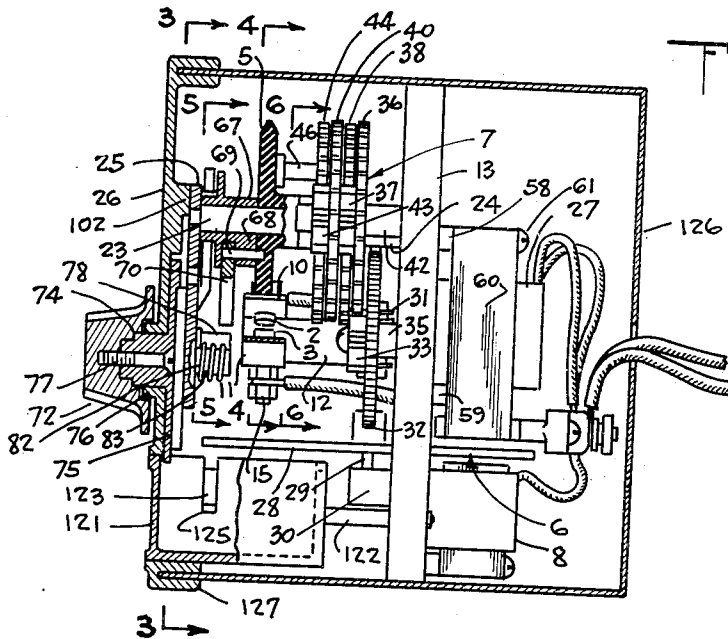


Fig. 2

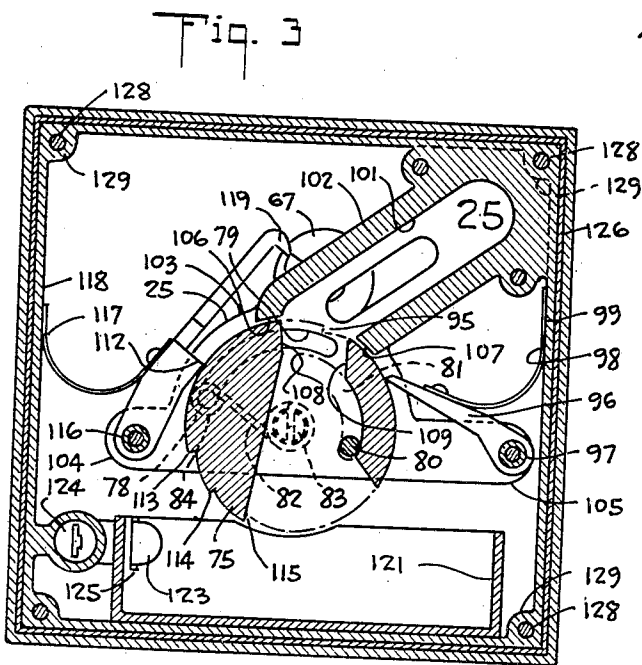


Fig. 3

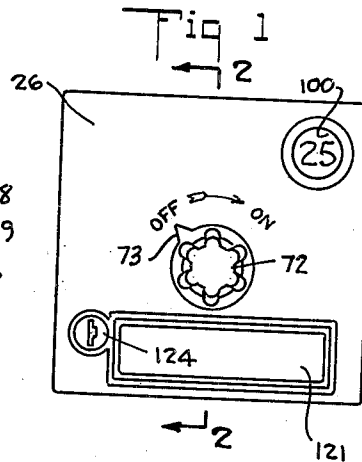


Fig. 1

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3 Sheets-Sheet 2

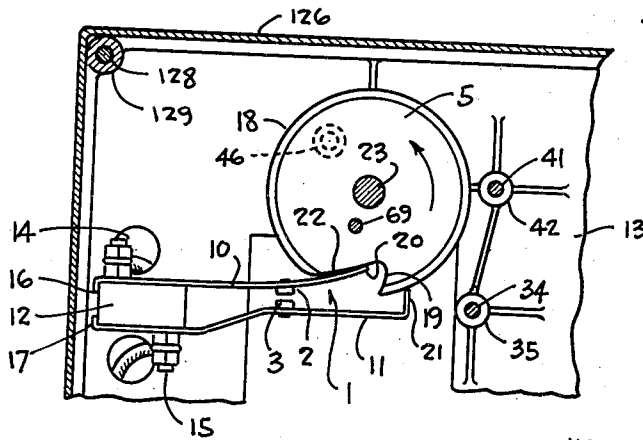


Fig. 4

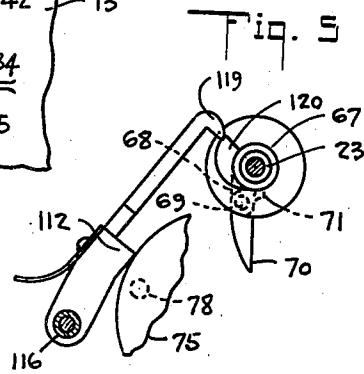


Fig. 5

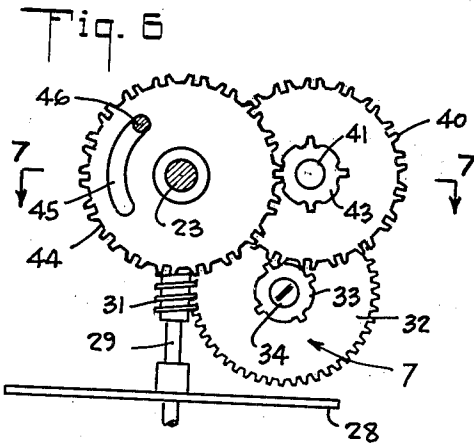


Fig. 6

Fig. 13

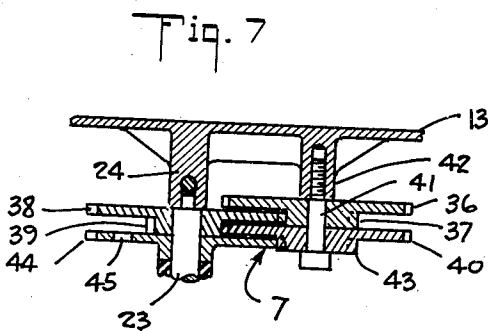
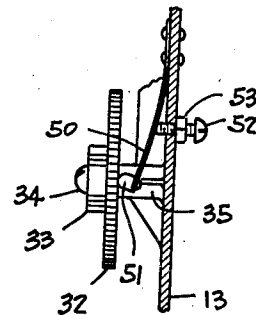


Fig. 7

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Fig. 8

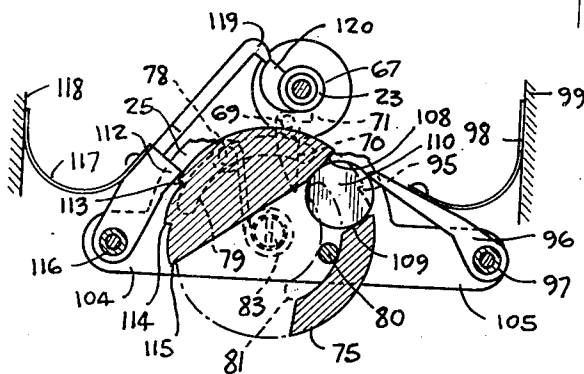


Fig. 9

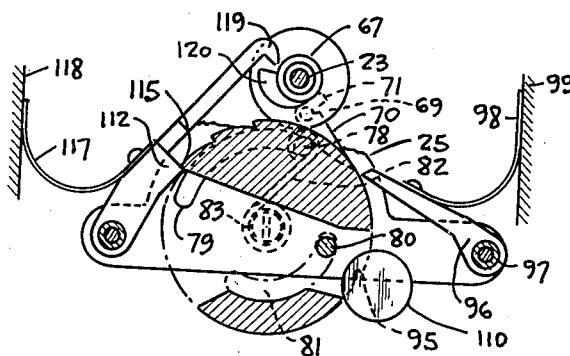


Fig. 11

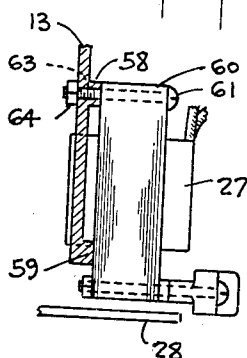


Fig. 10

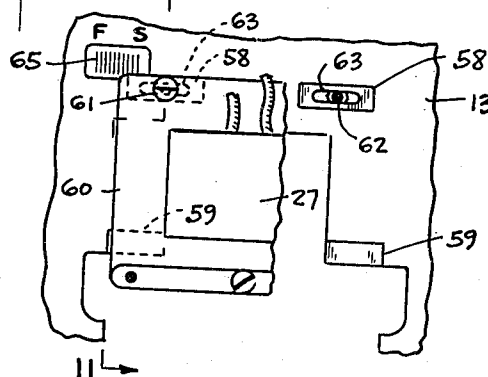
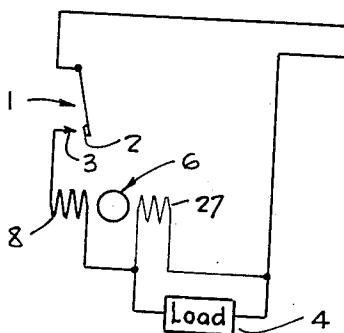


Fig. 12



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UNITED STATES PATENT OFFICE

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DEVICE FOR CONTROLLING ELECTRIC CIRCUITS

Arthur W. Welcome, Alhambra, Calif.

Application August 23, 1937, Serial No. 160,367
Renewed October 26, 1939

9 Claims. (Cl. 171—34)

This invention relates to a device for controlling an electric circuit, and particularly by the aid of a coin controlled mechanism.

This application is a continuation in part of an application for Coin controlled time switch, filed in the name of Arthur W. Welcome, August 3, 1934, Serial No. 738,247, which has since matured into U. S. Patent No. 2,144,172, granted January 17, 1939.

Mechanisms for timing the period of use, or the amount, of electric power are now well known. It is also known to provide a coin-in-the-slot device whereby a coin must be deposited as prepayment for the use of the power.

It is a principal object of this invention to provide a device of this character which, upon the proper prepayment, will pass electric power at a rate below a predetermined value without operating the meter, but in which, if the current exceeds this value, the meter will operate. This electric power which is insufficient to operate the meter may be conveniently termed "free current."

It is another object of this invention to provide a device of the character described in which the period of time during which current will be delivered in response to a given prepayment is a function of the rate of use and is determined automatically by the load.

It is another object of this invention to provide a device of the character described incorporating a motor having simple, rugged and inexpensive mechanism.

It is another object of this invention to provide a device of the character described, in which mechanical friction of the meter parts serves to determine the maximum "free current."

It is a further object of this invention to provide a device of the character described, in which the electrical characteristics of the motor that drives the device, determine the "free current."

Such a circuit controller is especially useful in connection with trailer courts, where for a small sum trailers are allowed to park. The trailers are arranged to be connected to a supply circuit, available in the parking area. The occupants of a trailer may wish to use the circuit only for lights; that is of inconsequential cost, and the parking charge can absorb it. But if, as often happens, the occupants use heating devices such as flat irons, hot plates or toasters, the energy consumption becomes prohibitive. By the aid of this invention the trailer occupant is not charged for any energy used at a lower rate of consumption, but is automatically charged when he exceeds this low rate.

This invention possesses many other advantages, and has other objects which may be made more easily apparent from a consideration of several embodiments of the invention. For this

purpose there are shown a few forms in the drawings accompanying and forming part of the present specification. These forms will now be described in detail, illustrating the general principles of the invention; but it is to be understood that this detailed description is not to be taken in a limiting sense, since the scope of the invention is best defined by the appended claims.

Referring to the drawings:

Figure 1 is a front elevation of a device incorporating the invention;

Fig. 2 is a sectional view taken substantially along plane 2—2 of Fig. 1;

Fig. 3 is a sectional view taken along plane 3—3 of Fig. 2, certain parts being omitted for clarity;

Fig. 4 is a fragmentary sectional view taken along plane 4—4 of Fig. 2, certain parts being omitted for clarity;

Figs. 5 and 6 are fragmentary detail views taken along correspondingly numbered planes of Fig. 2;

Fig. 7 is a detail cross-section taken along plane 7—7 of Fig. 6;

Fig. 8 is a fragmentary view similar to Fig. 3, showing one stage in the operation of the coin control mechanism;

Fig. 9 is a view similar to Fig. 8, but showing a later stage of operation of the coin control mechanism;

Fig. 10 is a fragmentary rear elevation showing the method of mounting one of the motor coils;

Fig. 11 is a section as seen on plane 11—11 of Fig. 10;

Fig. 12 is a schematic wiring diagram of the apparatus; and

Fig. 13 is a fragmentary detail view showing a modified form of the device.

The main function of the device is to control a load circuit by the aid of a switch 1, which may include a pair of contacts shown at 2 and 3 (Figs. 2, 4 and 12). As indicated in Fig. 12, when the switch is closed and the contacts are in engagement, the load 4 is energized. The period during which the switch is closed, therefore, determines the period of energization of the load. This load may be any translating device, such as lamps for illuminating purposes, a radio receiver, an electric iron, an electric grill, or any other electrical apparatus.

The switch 1 is arranged to be closed by manual rotation of a cam member 5 (Figs. 2 and 4). The closing of this switch energizes the load, as well as an induction disc motor 6, which is adapted to impart further rotation to member 5 by a gear train 7. After further rotary movement of the cam member 5 to a definite point, switch 1 is opened, deenergizing the load and stopping the motor 6. To permit the manual rotation of

the cam to institute a cycle of operation, the gear train 7 is operatively connected to the cam member 5 through a lost motion connection. Further, a coin control mechanism is incorporated in the device, whereby a coin of a predetermined denomination must be inserted before it is possible to close the switch.

An inspection of Fig. 12 will show that the motor 6 has one of its primary coils, as 8, in series with the load, making the power output, as well as the energization of coil 8, proportional to current consumption of load 4. Thus, by any of several expedients to be presently set forth, it is possible to prevent rotation of the motor unless the current consumption of the load reaches some predetermined value. By this means, it is possible to permit current to pass the device at any desired low rate, without operating it to open the switch. But if the current exceeds this amount, the device will operate to rotate cam member 5 toward switch opening position. And as the motor speed is dependent on the amount of current flow, the switch will always be opened when a predetermined quantity of current, used at a rate higher than a predetermined "free" rate, has been delivered.

The device is intended for use where it is desired to permit unlimited consumption of electric current at a rate not exceeding some desired value, but if the current is consumed at a more rapid rate, then only a total amount previously determined can be used without making an additional payment.

The device is especially useful in connection with rental property, particularly auto trailer camps, where it is desired to furnish a relatively small amount of current, say sufficient to operate a lamp and a radio, free of charge and without operating the meter. But when the current consumption exceeds this amount, as by the inclusion of a flat iron or other high current consumption apparatus in the circuit, the meter will operate; and when the total energy consumed at a high rate reaches a predetermined value, the switch will be opened. No further current is then obtainable until a further payment has been made, when the device will operate as before.

As shown in Figs. 2 and 4, the contact points 2 and 3 of switch 1 are mounted respectively on resilient arms 10 and 11, suitably secured to a block 12 of insulating material. This block is fastened to the wall of a supporting frame 13, which can conveniently be a die casting and, as will be described later, serves as a main support for many of the parts utilized in the device. Appropriate terminal posts 14 and 15 connect respectively with arms 10 and 11. The arms are furthermore provided with right-angled extensions 16 and 17 for maintaining them in position on block 12.

Each arm is so formed that its resilience urges its free end upwardly into engagement with the surface of the rotatable cam member 5. This member is formed of insulating material, such as "Bakelite" and has a circular portion or periphery 18, terminating in an undercut shoulder 19. When the extremity 20 of arm 10 rests on circular portion 18, the arm 10 is depressed, bringing the contacts 2 and 3 into engagement and holding the extension 21 of arm 11 away from this circular portion. As member 5 rotates in a counterclockwise direction to a definite point, the extremity 20 drops off the circular portion 18. This allows arm 10 to move upwardly. The

extremity 21 of arm 11 remains on surface 18, preventing movement of this arm and resulting in separating contacts 2 and 3, breaking the circuit. This position is shown in Fig. 4.

To reengage the contacts, member 5 must be advanced in the same (counter-clockwise) direction. This motion causes surface 22 to gradually depress the end 20 of arm 10, bringing the contacts closer together, but they are not engaged to form the circuit until extension 21 drops off shoulder 19, resulting in an abrupt contact. Thus the circuit is made and interrupted in a quick, positive manner, which minimizes arcing and sparking. Further rotation of member 5 causes surface 22 to bend members 10 and 11 downwardly with contacts 2 and 3 in engagement. The points of flexure of the arms are so positioned that a sliding or wiping action between the contacts occurs, serving to clean the points and make a better contact. As the rotation continues, extremity 20 again rides upon circular portion 18. The surface 22 is made at an appropriate angle to make it possible to effect this engagement of the contacts by advancing member 5 through a relatively small angle. Further rotation of member 5 to the definite point previously mentioned will again cause the contacts to separate in the manner before described. Thus the contacts stay in engagement for somewhat less than one complete revolution of the cam member.

The cam member 5 is supported on a stationary shaft 23 which is fastened at one end in a boss 24 (Figs. 2 and 7) and has its other end supported in a plate 25 carried by the front cover member 26.

As previously mentioned, the rotatable cam member 5 is arranged to be driven by a motor 6 through a gear train 7. The motor is of the induction disc type and has the usual coils 8 and 27, mounted on laminated cores that are supported on the back of the main frame 13. The induction disc 28 is mounted between these coils on a shaft 29, supported in an appropriate step bearing located in a boss 30 on the front of frame 13. The coils and the cooperating motor parts form a quite common type of watt-hour meter element.

An appropriate upper bearing for the shaft is supported in the boss 24 which supports shaft 23. Shaft 29 carries a worm 31 (Fig. 6). This worm may be joined through appropriate gear reduction to cam member 5. For example, worm 31 engages a worm wheel 32 to which is rigidly fastened a pinion or toothed member 33, which may be of the intermittent gearing, or of the Geneva type. The gears 32 and 33 are journaled on a stub shaft 34, supported in a boss 35 on frame 13 (Fig. 4). Pinion 33 serves to drive the intermittent gear 36 (Fig. 7) to which is secured a pinion 37, which in turn drives a gear 38 supported on shaft 23. A pinion 39 secured to the latter gear drives gear 40, supported coaxially with gear 36 on a common stub shaft 41. This shaft is supported in a hub 42 formed on the frame 13. Gear 40 has a pinion 43 attached to it, which drives gear 44, supported on shaft 23, and adapted to drive the cam member 5 by means of a lost motion connection, including a slot 45 in the gear (Fig. 6) and a pin 46 on member 5 engaging the slot. This connection is to permit the cam member 5 to be advanced manually to close the switch and institute a cycle of operation.

As just noted, gear wheel 44 is provided with an arcuate slot 45 in which is engaged the pin 46

with its axis parallel to shaft 23 (see Fig. 6). It is apparent that, within the angular limits of slot 45, member 5 can be advanced in a direction to cause energization of the load circuit from the position of Fig. 4. In the advanced position pin 46 is away from the upper end of slot 45. Load 4 and motor 6 are now energized, but member 5 cannot be driven by the motor until the upper end of the slot engages the pin. Accordingly, the period of energization of the load circuit is again accurately determined by one complete revolution of wheel 44, irrespective of the fact that member 5 is moved by independent means from the open circuiting position of Fig. 4. In other words, the lost motion connection 45 and 46 makes it possible to restart the cycle of operations without disturbing the energy measuring functions of the apparatus.

It will be clear upon brief consideration that the gear train 7 and rotatable member 5 involve certain frictional losses, and a definite amount of power must be exerted by the motor 6 to set them in motion and keep them rotating. Thus a certain amount of current must flow in coils 8 and 27 in order to start the motor and gear train, and the speed at which they will run depends on this current. If the current at any time falls below this amount, the motor will stall; when the current again reaches this amount, the motor will restart. Since, as shown in Fig. 12, one of these coils is in series with the load 4, the current flowing through it will be proportional to the size of the load; the other coil being in parallel with the load, the current flowing in it will always be substantially constant, irrespective of the load. Since the power consumed in the gear train and associated parts is readily ascertainable, and by careful workmanship may be made substantially uniform for any chosen combination of gearing, the size of the required starting current may be readily determined by appropriate winding of these coils. Thus, if it is desired to deliver a relatively large amount of "free current" without the meter becoming active, the series coil 8 would have a small number of turns. Conversely, if it is desired to keep the free current to a small amount, this coil would have a large number of turns.

Coil 27 is mounted for adjustment with respect to coil 8. Referring to Figs. 10 and 11, it will be seen that frame 13 has pads 58 and 59 formed on its back surface, against which the laminated core 60 of coil 27 is secured. Screws 61 and 62 in the upper part of the core pass through slots 63 in the frame 13 and are engaged by nuts 64 on the front of the frame, the nuts serving to secure the core to the frame. Thus, by loosening these nuts the coil assembly may be shifted parallel to the plane of disc 28. These nuts when tight secure the core against movement, as well as clamping the laminations together. By adjusting the relative positions of coils 8 and 27, the resultant drag on disc 28 can be varied, making it possible to alter the torque which the disc will exert for a given current. A scale 65 with appropriate indicia may be provided to assist in making such adjustment. In this manner the meter may be accurately regulated and the "free current" closely determined. The amount of "free current" may be determined initially by the relative proportions of coils 8 and 27.

Obviously, variations in the amount of "free current" can also be had by altering the power requirements of the gear train. One way in which this can be accomplished is shown in Fig.

13. A spring finger 50 is shown there as secured at one end to frame 13, as by rivets. The free end of finger 50 carries a button 51 of fibre or felt, which is pressed against the back surface of gear wheel 32 by the resilience of this finger. The pressure exerted by the button may be adjusted by a screw 52, adapted to urge finger 50 toward the gear wheel. A lock nut 53 serves to secure the screw in adjusted position. By this means the power required to operate the meter may be adjusted within close limits, and the amount of starting current required may be varied without altering the coils.

The manner in which the independent advancing of member 5 to initiate a cycle of operation can be accomplished, will now be described. Shaft 23 carries a bushing or sleeve 67 (Figs. 2 and 5) immediately adjacent the front face of member 5. Bushing 67 has an ear 68 through which passes a pin 69, carried by the member 5 (Figs. 2, 4 and 5). Accordingly sleeve 67 is in driving relation with cam member 5, and if sleeve 67 is advanced in a counter-clockwise direction, as viewed in Fig. 4, then member 5 will be correspondingly advanced. This advance is accomplished by the aid of a swinging pawl 70, which is pivoted on pin 69 and has a short extension 71 adapted to engage against the outer surface of sleeve 67 (Figs. 2, 5, 8 and 9). Accordingly when the pawl 70 is urged in a counter-clockwise direction, as viewed in Figs. 5, 8 and 9, it acts as a rigid radial extension, and a corresponding counter-clockwise movement is imparted to bushing 67 and cam member 5.

In order to start a cycle of operations, pawl 70 must be advanced sufficiently to move member 5 to a position where extension 21 of switch arm 11 may slip off tooth 19, causing the engagement of contacts 2 and 3. In order to advance pawl 70 to accomplish this, use is made of a knob 72 (Figs. 1 and 2). This knob is located on the outside of cover 26, and carries a pointer 73 cooperating with the legends "Off" and "On." In order to begin a cycle of operations, the knob 72 is turned from the "off" position to the "on" position and, as hereinafter described, at the end of the cycle of operations the knob is automatically returned to the "off" position.

Knob 72, as shown in Fig. 2, has a hollow portion accommodating the boss 74 of a disc 75. This boss serves as a journal for the knob assembly in a boss 76 on cover 26. Disc 75 is rigidly fastened to knob 72, as by the aid of a flat headed screw 77 and has a face substantially in contact with the inner surface of the cover. The disc carries a pin 78 parallel to its axis of rotation projecting rearwardly through an arcuate slot 79 formed in plate 25. This pin is adapted, upon clockwise rotation of the disc, to engage pawl 70 (see Figs. 3, 5, 8 and 9). In Fig. 8 the pin has not yet contacted the pawl; in Fig. 9 the pin has reached the end of its movement and has moved the sleeve 67 and cam member 5 in a counter-clockwise direction sufficiently to cause contacts 2 and 3 to engage. The end of slot 79, by engaging pin 78, serves to limit the angular movement of disc 75. A stationary pin 80 fastened to cover 26 projects into an arcuate slot 81 formed in the disc, and is for a purpose to be presently described.

Clockwise rotation of the knob assembly is resiliently opposed by a helical spring 82, wound around a stationary anchor piece 83, fastened to the inner surface of plate 25. One end of the spring is connected to this anchor piece and the

other end is formed into a hook extension 84, engaging pin 78. Accordingly when knob 72 is turned in a clockwise direction (from "off" to "on"), the spring is wound up. When the cam member 5 nears the angular position of Fig. 4, the knob assembly is released, as will be hereinafter described, and is returned to the "off" position of Fig. 3.

The knob 72 may be prevented from turning clockwise unless a proper coin is deposited in a manner now to be described. Disc 75 has a notch or tooth 95 (Fig. 3) in its periphery, adapted to be engaged by a pawl 96. This pawl permits only a small angular movement of the disc in a clockwise direction unless it is lifted out of the way. Pawl 96 is journaled on a stub shaft 97 fastened to the back of cover 26, and is urged toward engaging position, as by a leaf spring 98 fastened to the pawl at one end and confined against a vertical wall 99 formed on the cover.

A coin must be utilized to lift the pawl 96 out of the way of notch 95 and to permit rotation of the knob and disc assembly past the pawl. For this purpose the coin must be deposited in an opening 100 (Fig. 1) in the cover 26. This opening leads to a coin chute 101 (Fig. 3) formed between an integral boss 102 on the inside of cover 26 and plate 25. This plate is provided with an arcuate intermediate portion 103 in which the slot 79 is formed, as well as oppositely extending side arms 104 and 105 by means of which it is attached to cover 26. Disc 75 rotates between overhanging shoulders 106 and 107 of boss 102. The disc is provided with converging surfaces 108 and 109 which are perpendicular to the plane of the disc. They are so spaced as to provide, together with plate 25 and disc 75, a pocket for the coin 110, as shown in Fig. 8. Chute 101 is just large enough to accommodate this coin. A coin smaller than the desired denomination will pass through the space between surfaces 108 and 109 without lodging between them.

In the "off" position surfaces 108 and 109 form virtually a continuation of chute 101 (Fig. 3). The size of the required coin can be marked conveniently on plate 25 so as to be visible through opening 100. In the present instance the mechanism is intended to be operated by a twenty-five cent piece, thus the numeral "25" appears through the opening. The seating of the coin 110 between surfaces 108 and 109 is such that the edge of the coin extends slightly above the disc. Further, the coin pocket so formed falls in line with notch 95. Thus, as the disc is rotated in a clockwise direction with a coin in the pocket, pawl 96 rides on the exposed edge of the coin and is prevented from engaging the notch 95 (see Fig. 8). Thus the knob and disc assembly can be turned the full distance allowed by pin 78 and slot 79. It is to be noted that the engagement of pawl 96 by the coin is prior to the engagement of the arm 70 by pin 78. In this way it is ensured that a proper coin must have been deposited before it is possible to initiate a cycle of operation.

As soon as actuating pin 78 approaches closely to the arm 70, another pawl 112 engages the first tooth 113 of a series of ratchet teeth on disc 75, preventing backward rotation of the disc. This ensures that the disc 75 can be turned only toward coin discharge position after pawl 96 is once lifted. A succeeding tooth 114 is provided for preventing it being turned back after pin 78 engages arm 70. The last tooth 115 is to hold the

disc in its "on" position against the action of spring 82.

These teeth and pawl 112 ensure that when the knob and disc are turned after the insertion of a proper coin, the knob can only be turned ahead. Thus all possibility of initiating a cycle and then retrieving the coin is eliminated. Also, should the user accidentally let the knob slip in his grasp after depositing a coin, the action of these parts makes it possible to complete the operation of turning the meter to "on."

The pin 80 serves the purpose of positively ejecting the coin from its seat in disc 75 when this disc reaches the "on" position, as will be readily understood from an inspection of Figs. 8 and 9. This serves to prevent the use of some sticky substance, such as chewing gum, on the coin to hold it in its seat and permit repeat operation with the same coin.

Pawl 112 is shown as rotatably mounted on a stub shaft 116, fastened to the inside of cover 26. A leaf spring 117 is fastened at one end to the pawl, the other end abutting the vertical wall 118 formed on the cover. Stub shaft 116, as well as stub shaft 97 can be hollow for the accommodation of screws to secure plate 25 to cover 26 in accurate relationship to disc 75.

Disc 75 is held in the position of Fig. 9 until near the time when the period of energization of the load circuit expires. To release the disc it is necessary to lift pawl 112 out of engagement with tooth 115. For this purpose, pawl 112 has an extension 119 disposed in the path of a cam 120 fastened to sleeve 67. Accordingly as rotatable member 5 carries sleeve 67 in a counter-clockwise direction, cam 120 engages extension 119, raising the pawl and releasing the disc, which at once is returned to the "off" position by spring 82 (see Figs. 2 and 4).

Preferably the lifting of pawl 112 to permit the return of the knob and disc assembly is arranged to occur a short time prior to the opening of switch 1. Therefore, it is possible to start a new cycle immediately by inserting an additional coin without waiting for the load circuit to be deenergized. The additional coin can be deposited through the opening 100 and knob 72 returned to the "on" position. This results in immediately advancing member 5 to and through the definite position of Fig. 4 with only a momentary interruption in the circuit. The angular extent of slot 45 and its position with respect to pin 46 must be arranged with due regard for the position of member 5 when the knob assembly is released, to permit member 5 sufficient movement to close switch 1 under these circumstances.

A coin box 121 (Figs. 1, 2 and 3) is provided to receive the coins as they are discharged from the pocket. A leaf spring 122 is secured to frame 13 at one end, its free end engaging the coin box. This spring serves to urge the coin box outwardly through an appropriate opening formed in cover 26, unless restrained. A bar 123 rotatably supported by a cylinder lock 124 and engaging a slot 125, serves to lock the coin box in place. It can be removed by inserting a key in the lock and rotating it to lift the bar out of the slot.

A sheet metal box or casing 126 can be provided for housing the whole structure. The open end of this box is closed by the cover member 26, which is provided with a rabbeted flange 127 to receive it. The main frame 13 is attached to cover 26 by screws 128 disposed in suitable bosses 129 located at the corners thereof. Cas-

ing 136 may be held in place by a couple of screws secured to the inside of its back and projecting through the main frame 13 when they are engaged by hollow nuts, accessible only through the opening formed by the removal of the coin box 121. This makes it impossible to tamper with the mechanism or connections unless lock 124 is manipulated to release the coin box.

The device is operated in the following manner: A coin of the proper denomination is inserted in the coin opening 100 and knob 72 is turned to "on." Current is now delivered to the load circuit and the motor. If the current requirements of the load are below the predetermined value, the motor will remain stationary and the current can be used as long as desired. If, however, the load requirements are in excess of this value, the motor will operate and rotate cam member 5 at a speed dependent upon the amount of current being drawn. If the current consumption falls below this predetermined value, the motor will at once stall and remain stationary until the load requirements again exceed this value, when the motor will again start. This action will be repeated as often as required by the load current, until a total predetermined amount of electrical energy has been consumed, when the mechanism will cause the switch 1 to open, the motor operating in the manner of a watt-hour meter. The load then will be deenergized and no more current can be obtained until another coin has been deposited and the knob 72 again turned to "on."

What is claimed is:

1. In a device for selectively measuring electrical energy consumed in a load circuit, a rotatable motor assembly having elements adapted to respond in accordance with said consumption, means adapted to exert a frictional drag on said motor assembly to restrict response for all energy consumption below a predetermined minimum rate of consumption, and a circuit controller for the load adapted to be operated to disconnect the load upon a predetermined integrated motion of said motor.

2. In a device for selectively measuring electrical energy consumed in a load circuit, a rotatable motor assembly having elements adapted to respond in accordance with said consumption, means associated with said motor assembly to exert a continuous and uniform frictional drag on the motor, whereby to restrict response of the motor for all energy consumption below a predetermined minimum rate of consumption, a circuit controller for the load adapted to be operated to disconnect the load upon a predetermined integrated motion of said motor, and a coin controlled mechanism for operating said circuit controller to connect the load.

3. A consuming circuit control switch, mechanism for operating said switch to open position, including a motor energized through said switch, means including a coin control mechanism whereby said switch may be closed and reenergize the motor, a load in series with the switch, and means to render the motor inactive under a predetermined load, said means including a friction brake applied to the motor.

4. A consuming circuit control switch, mechanism for operating said switch to open position,

including a motor energized through said switch, means including a coin control mechanism whereby said switch may be closed and reenergize the motor, a load in series with the switch, said motor including a rotary member and a pair of coils to rotate said member, one of said coils being in series with the load and the other being in parallel with the load, said coils being so proportioned that their combined effects will cause rotation of said member only when the load exceeds a predetermined value.

5. A consuming circuit control switch, a rotatable member for actuating said switch to inactive position, said rotatable member being so constructed that as it advances through a definite position with respect to the switch, it first causes said switch to become inactive and then causes said switch to be again active, mechanism for operating said rotatable member, including a gear train of a known power consumption and a motor, said motor being energized through said switch and being effective to rotate said member only to the point where the switch becomes inactive, said mechanism including means for rotating said member independently to cause said switch to become active and to reenergize the motor, a load in circuit with said switch, the motor being so connected in the circuit as to develop power in accordance with the size of said load, whereby the period the switch is closed is proportional to the size of the load.

6. A consuming circuit control switch, a rotatable member for actuating said switch, mechanism including a gear train and a motor having a rotor for operating said member to actuate said switch to open position, as well as means for operating said member independently of said motor to actuate said switch to closed position, a circuit controlled by said switch and including a load and said motor, the motor having a coil in series with the load, and adapted to rotate said rotor, and means to prevent rotation of the rotor until the current consumption of the load exceeds a predetermined figure.

7. The combination set forth in claim 6, in which said means includes the friction of the gear train.

8. In combination with a gear train adapted to operatively connect a motor with a rotatable member operating a switch, said gear train comprising intermittent gearing as well as continuous gearing, means comprising an adjustable friction brake engaging said continuous gearing, whereby the power consumption of the gear train may be altered.

9. In combination with a switch operated by a rotatable member and controlling a circuit including a variable load, a motor for operating said member to open the switch, means to operate said member independently of the motor to close the switch, said motor including a pair of magnetizing windings as well as a rotor, said windings being so connected in the circuit as to cause said rotor to revolve when the current flowing in said circuit exceeds a predetermined amount.

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