Oct. 11, 1932. J. METTLER 1,882,333

MEANS FOR TIMING AND CONTROLLING ELECTRICAL CIRCUITS

Filed Aug. 30, 1927

Fig 1

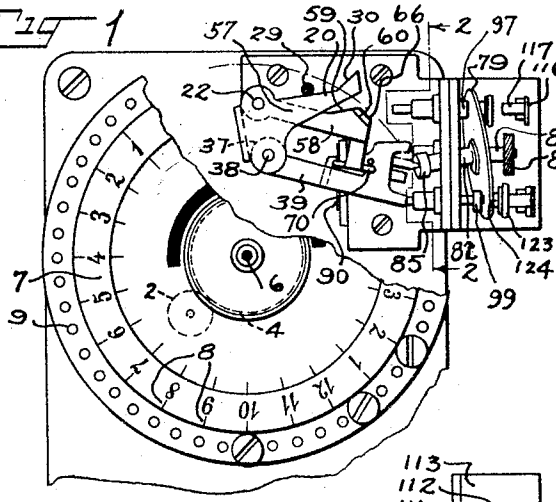


Fig 2

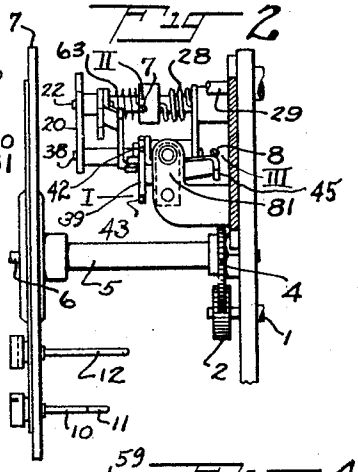


Fig 3

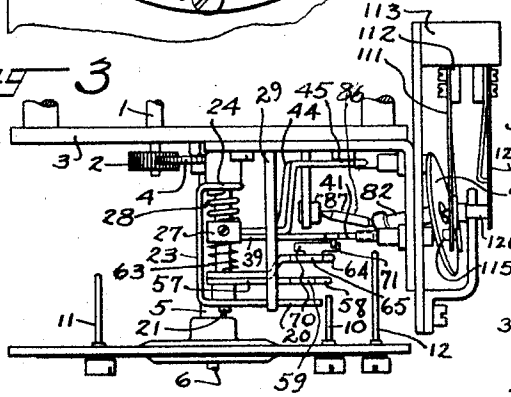


Fig 4

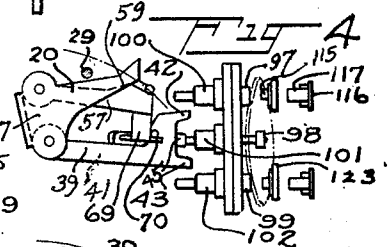


Fig 5

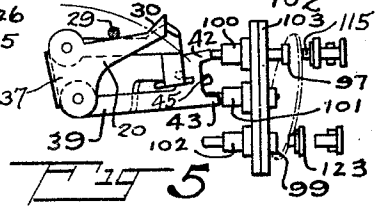


Fig 6

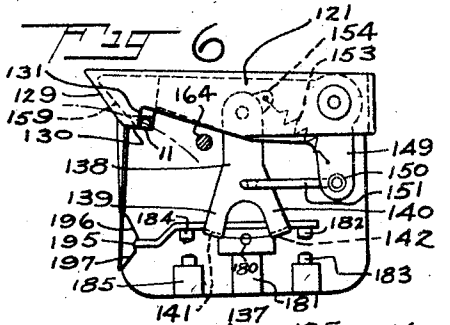


Fig 7

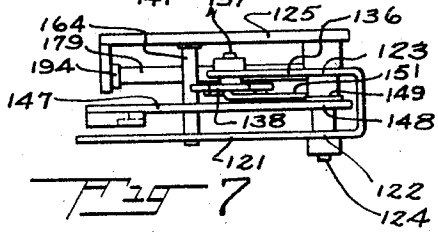


Fig 8

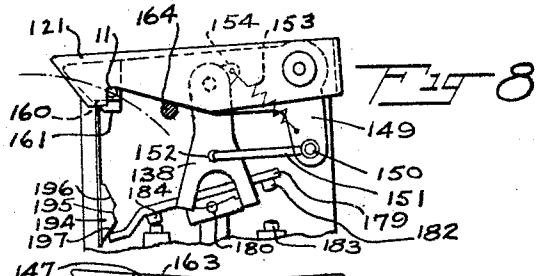
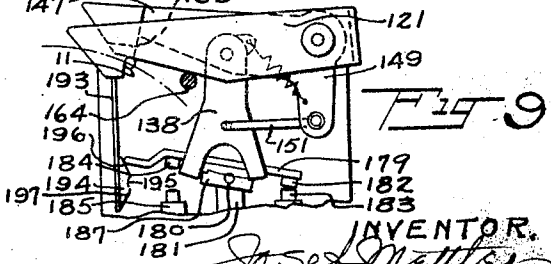


Fig 9



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UNITED STATES PATENT OFFICE

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MEANS FOR TIMING AND CONTROLLING ELECTRICAL CIRCUITS

Application filed August 30, 1927, Serial No. 216,390, and in Switzerland September 8, 1926.

The invention relates to novel settable and selectively time-controlled means for governing electric circuits, and more particularly in certain aspects thereof to such mechanisms adaptable for controlling meter circuits, such as variable or multi-tariff meters, although in other aspects thereof the invention has other and various applications.

Objects and advantages of the invention will be set forth in part hereinafter and in part will be obvious herefrom, or may be learned by practice with the invention, the same being realized and attained by means of the instrumentalities and combinations pointed out in the appended claims.

The invention consists in the novel parts, constructions, arrangements, combinations and improvements herein shown and described.

The accompanying drawing, referred to herein and constituting a part hereof, illustrates one embodiment of the invention, and together with the description, serve to explain the principles of the invention.

Of the drawing:

Fig. 1 is an elevation, with parts broken away and parts in section, of a mechanism embodying the invention;

Fig. 2 is a partial elevation and a partial section, substantially on the line 2—2 of Fig. 1 looking in the direction of the arrows;

Fig. 3 is a top plan corresponding to Fig. 1;

Fig. 4 is a fragmentary detail corresponding to the upper right-hand part of Fig. 1, but showing the circuit-actuating mechanism in a different position;

Fig. 5 is similar to Fig. 4, but shows the circuit-actuating mechanism in a still different position;

Fig. 6 is an elevation of a different mechanism embodying the invention;

Fig. 7 is a top plan corresponding to Fig. 6;

Fig. 8 shows the same mechanism as Fig. 6 but, in a different circuit-operating position; and

Fig. 9 shows the same mechanism as Figs. 6 and 8 but in a different circuit-operating position.

The invention is directed to providing a selectively settable mechanism for controlling a plurality of electrical circuits under the control of a clock mechanism, whereby the various circuits are openable and closable in any desired sequence of a plurality of possible sequences, and with variable intervening time periods between such operations. Thus the order in which the circuits are actuated and the time during which any particular circuit is opened or closed can be predetermined by setting certain devices in connection with the clock mechanism, which devices control the circuit actuating means.

One valuable commercial application of the invention is to the control of variable rate meters or variable tariff meters, as where different rates are charged, say during peak load hours, and certain other variably determinable time periods, having particular relations to the varying total station load, or other load conditions. The particular embodiment shows circuit controls for a three-tariff meter.

In the present preferred and illustrated embodiment of the invention, circuit-actuating means for selectively actuating any one of a plurality of circuits, that is, to open or close same are provided, including a device variably positionable with respect to the selected circuits for this purpose, and an actuating mechanism for effecting the opening or closure of the selected circuit when said device has been so positioned. The actuating mechanism also retracts said variably-positionable device so that it may be moved from operative relation with one or the other of the respective circuits. Cooperating therewith are means, settable by the attendant, to select the sequence of the circuits and the opening or closing thereof. Said settable means are also positionable to variably predetermine, as desired, the time at which these circuit selecting and controlling operations shall occur, and the time which shall elapse between the successive operations on the circuits; the mechanism being capacitated to repeat these operations in any of these predetermined sequences and time relations repeatedly and continuously until a new setting is made by the attendant.

Referring now in detail to the embodiment of the invention illustrated by way of example in the accompanying drawing, and having reference to the embodiment shown in Figs. 1 to 5, suitable driving and timing connections to the clock mechanism are provided, comprising an arbor 1 to which is fixed a pinion 2, the arbor being journaled in the frame plate 3 of the frame of the clock mechanism. Meshing with the pinion 2 is a gear wheel 4, fixed on a sleeve 5 mounted loosely on a rod 6, carried by the frame structure.

In the embodied means for selecting the sequence of circuit-controlling operations and predetermining the intervening time periods is a dial 7 fixed to sleeve 5, and provided with time markings 8. A plurality of pin-receiving, screw-threaded openings 9 are arranged about the dial numbers 8 and pins 10, 11 and 12, of different lengths, may be screwed into any selected openings 9, the difference in length of the various pins effecting the circuit selecting function already described. The order in which these pins are placed in the holes 9 will effect the selection of circuits.

Cooperating with the pins 10, 11 and 12, is a lever 20, pivoted at 21 upon a supporting rod 22, which is fixed to the clock-frame 3 and projects outwardly therefrom. Lever 20 is bent in a reach 23 parallel to supporting rod 22, and is bent in the opposite direction, as at 24, this portion of the lever being also pivoted on rod 22. A collar 27 is angularly adjustable about the rod by a set screw, and a torsion spring 28 has one end fixed in the collar 27 and the other end fixed in the part 24 of lever 20, thereby impelling the lever 20 in counter clockwise direction in Fig. 1. A stop pin 29 is fixed in the plate 3 and projects outwardly above the lever 20 to act as a stop therefor. The lever 20 is provided at its outer end with a beveled cam portion 30 to coact with any of the pins 10, 11 or 12 to rock the lever about its axis 22 and then return it against stop pin 29 through the action of spring 27.

The portion 24, and the rear of the portion 20 of said lever have downwardly-projecting arms 37, and a supporting rod 38 extends across between, and is mounted in these projections. The rear end of lever 39 is pivotally mounted on the rod and a forwardly-projecting arm 41 of this lever is bifurcated at its forward end, terminating in two fingers 42 and 43. The other arm 44 of lever 39 extends laterally and is upwardly inclined, and terminates in a finger 45.

The lever 39 is variably positionable, so as to bring any one of the circuit and function controlling fingers 42, 43 or 44 into actuating or operating position. For effecting this positioning of the lever 39 a lever 57 is loosely mounted upon the supporting shaft 22, and has two arms 58 and 64 in fixed relation to each other. A cam surface 59 on arm 58 engages with one or more of the pins 10, 11 and 12, and just outside the cam face 59, lever arm 58 is provided with a face 60. While the pin is passing over this face 60, it causes a dwell or pause for the lever, just before the lever is released to be returned to initial position against the stop 29. A spring 63 is coiled about shaft 22, with one end fixed to the collar 27 and the other end to the lever 57, to hold the lever resiliently in initial position against the stop rod 29.

The other arm 64 of lever 57 is likewise provided with a camming surface 65, with which one of the settable pins engages to rock the lever downwardly, and also has a surface 66 to cause a dwell of the lever 57 at the bottom of its movement. The shortest of pins 10, 11 and 12 will engage only with lever 20, the one of intermediate length with levers 20 and 58 and the longest pins with levers 20, 58 and 64.

The positioning connections between the mechanism just described and lever 39 comprises a short supporting arm 69 fixed to and extending downwardly from the arm 64, and terminating in a laterally extending shelf 70. A pin 71 projects from the side of the arm 41 of lever 39 and rests upon shelf 70, so that the lever 39 will move with the lever 57.

The camming surfaces 59 and 65 are so shaped and positioned that lever 57 will be rocked different distances about its pivot.

In the embodied form of switch actuating means, a non-conducting disc 79 is mounted on a jointed and longitudinally-resilient shaft, so that the disc may be moved into various positions thereby to actuate the selected switch, and to either open or close the switch. Disc 79 is recessed on one side to receive the pointed end of a supporting stub shaft 80, mounted in a support 81 carried by the frame, the disc being thereby supported but being freely angularly movable. A shaft 82 projects from the other side of disc 79, and terminates in a universal joint 85, with a shaft 86 extending from the joint 85, and having a pointed bearing in a support 87. This support is longitudinally and resiliently movable in its mounting in the frame, against the action of a spring 90. The flexible shaft is thus movable from one position to the other through the yield and pressure of spring 90, and is impelled to remain in one position until positively moved to another selected position.

The means for moving the disc 79 cooperate directly with the switch actuating fingers 42, 43 and 45, when any one of these switch actuating fingers is in operative position. Said means comprise a plurality of longitudinally-slidable actuating rods 97, 98

and 99, corresponding, respectively, to the actuating fingers 42, 43 and 45, and are longitudinally slidable in bushings 100, 101 and 102 mounted in a frame plate 103. When projected by the corresponding actuating fingers, these fingers will move the disc from one selected position to another.

The switches or circuit opening and closing devices cooperating with the disc 79 are shown as two in number. One switch mechanism comprises a spring circuit terminal plate 111, mounted at 112 insulated upon a support 113, the switch having an actuating pin 115, adapted to cooperate with the disc 79. Cooperating with terminal 111 is a spring terminal plate 116, likewise insulated on the support 113, and having a contact pin 117, adapted to close the circuit with plate 111. Disc 79 in one position presses the resilient switch member 111 against the contact piece 117. Another switch mechanism is shown comprising a like resilient circuit terminal plate 123 supported and insulated from the member 113, and having an actuating pin 124 adapted to engage with the actuating disc 79. A cooperating resilient circuit terminal plate 125 is carried by and insulated from the support 113 and has a contact point 126 adapted to close the circuit with plate 123. The disc 79 in one position moves the plate 124 to close this circuit. When disc 79 is moved away from either pin 115 or pin 124 the corresponding circuit is opened by its spring terminals.

The manner of operation of the mechanism just described is substantially as follows:—

We may regard dial 7 as traveling in clockwise direction in Fig. 1, and any one of the pins 10, 11 or 12 as engaging with the cam face 30 on the lever 20, and thereby rocking the lever 20 in clockwise direction until the pin rides off the end of the cam face 30. During this movement the lever 41 is retracted, so that all of the actuating fingers 42, 43 and 45 are moved clear of the pins 97, 98 and 99. Pin 10 will actuate only the lever 20, and lever 57, and lever 41 will either remain in the top-most position with lever 57 against stop-rod 29, or the mechanism will be raised to this position by spring 63. Finger 42 will be in operative relation with pin 97 at position II in Fig. 2. As pin 10 rides off the cam surface 30, spring 28 will swing back lever 20, and swing lever 39 forwardly and pin 97 will push disc 79 to the position of Fig. 5, thereby closing the circuit.

When the pin 11 thereafter actuates lever 20, the actuating fingers 42, 43 and 45 are drawn backwardly with their lever 39, away from the corresponding pins 97, 98 and 99, and the depression of lever 57 will bring the fingers into a new selective relation. That is, finger 45 will be in register with pin 98 at III in Fig. 2 and as shown in Fig. 4. As the pin 11 passes to the surface 60, the pin rides off the cam surface 30, spring 28 moves lever 39 forward and pins 98 will be actuated to move disc 79 to the position of Fig. 4 in which position both circuits are open. One of the switches may be opened by this movement, dependent on the pin sequence in the dial.

Considering the remaining actuating pin 12, the time interval may be variably determined as before, and lever 39 is depressed. One of the fingers 42, 43 and 45 is brought into operative relation with its pin 97, 98 and 99. That is, finger 43 is in register with pin 99, being position I in Fig. 2. As pin 12 passes from the cam surface 65 to surface 66, pin 12 moves past the end of the cam surface 30, lever 20 is released, and spring 28 moves lever 39 forward, and pin 99 is pushed out, to move the disc 79 and to effect the desired circuit opening or closing operation. With the arrangement shown the circuit is closed at 124, 126, position I.

Referring now to the embodiment of the invention exemplarily shown in Figs. 6 to 8, the clock controlled rotatable disc 7, and the actuating pins 10, 11 and 12 will be considered to be the same as in Figs. 1 to 3. In said embodiment a lever 121 (corresponding generally to lever 20) of substantially J shape, is pivoted at 122 and 123 upon a stud-shaft 124 mounted on and projecting outwardly from a frame plate 125. Lever 121 on its outer end is provided with a cam face 129, and a short dwell-effecting face 130, and with a succeeding depressed or notched space 131, which permits the return movement of the lever to effect the switch actuating operation. The lever 121 will be provided with an actuating spring or other actuating device, similarly to the lever 20 in the previously-described embodiment, the same being omitted from the drawing for the sake of clearness. The end 136 of lever 121 projects inwardly beyond its pivot-point 123 and pivotally supported from the end of lever arm 36, at 137 is a downwardly-depending lever 138, which is variably positionable to select the particular desired switch actuating operation. Lever 138 is bifurcated and the terminal arms 139 and 140 thereof are provided respectively, with inwardly-extending, switch-actuating projections 141 and 142, which cooperate with actuating devices on the switch mechanism, as will be later described.

The here-embodied form of circuit and circuit controlling function selecting means comprises a lever 147, pivotally supported at 148 upon the supporting rod 124, this lever having integral therewith, or fixed thereto, a downwardly-extending arm 149. Pivotally connected to this arm at 150 is a positioning rod 151, having a hooked end which projects into an elongated opening 152 in the

switch-selecting lever 138 to permit relative movement of the two in certain positions, and effecting movement together in other positions. A spring 153 is connected between a lug 154 on the upper end of lever 138 and the arm 149 to hold the hooked end of connecting link 151 normally in the right-hand end of elongated slot 152 (in Fig. 6).

Referring now to the means on lever 147 for co-operating with the pins 10, 11 and 12 to selectively position lever 138, lever 147 is provided at its forward end with a camming face 159, which for part of its length is of double width, the face for a part of its width terminating in a flat dwell-producing surface 160, the remainder of the face being longer and germinating in a dwell-producing surface 161. Thus the dial pin cooperating only with the shorter of these faces will lift lever 147 a shorter distance, and the dial pin cooperating with the longer of these faces will lift lever 147 a longer distance. Beyond the two-dwell producing surfaces is a recession or notch 163, to permit the return movement of the lever. A stop pin 164 projects from the supporting plate 125 beneath levers 121 and 147 to support and initially position them.

In the embodied form of switch mechanism, a switch lever 179 is pivotally mounted at 180 upon a support 181. At one end of the switch lever are a pair of circuit contacts 182 and 183, and near the opposite end thereof are a pair of circuit contacts 184 and 185. An actuating block or arm 187 is fixed to the switch lever 179, and is adapted to be actuated by either the projection 131 on arm 139 or by projection 142 on arm 140 of the switch selecting lever 138, dependent upon the positioning of the latter from the pins 10, 11 and 12. Means for holding the switch mechanism in any of its positions are provided, and as embodied a spring arm 193 is mounted on the frame and upon the end thereof is a block 194, having a central notch 195, and oppositely inclined surfaces 196 or 197. This device operates, as will be clear from the drawing, to hold the switch in either the open position, or the closed position for either circuit.

The manner of operation of this mechanism will be generally clear from the description already given, and may be summarized as follows:—

In Fig. 8 the short pin 10, as it moves in clockwise direction, will engage only with lever 121, and riding along the cam face 129 will rock the lever upwardly, switch selecting lever 138 will be drawn to the right, finger 141 will be brought above the left-hand end of the switch-actuating block 187, and when the pin rides into the recess 131, lever 121 will be moved downwardly, and the circuit will be closed at the switch points 184 and 185.

Considering the pin 11 (Fig. 6) as moving in the clockwise direction, it will engage the camming face 129 of lever 121 and also the broader and shorter camming face 159 of lever 147. As lever 121 is raised, the switch-selecting lever 138 is raised also, but the switch will be held in its previous position by the spring detent 193. Lever 147 will be rocked upwardly, and the hooked end of rod 151 will move a slight distance in the elongated slot 152, to such extent that lever 138 will be suspended in central position, and the switch will be either left in or moved to the open circuit position of Fig. 6.

Considering now the longest pin 12, this will engage the cam face 129 of lever 121 and also the long cam face 159 of lever 147, and will rock the latter to its full extent. This movement, through arm 149 and link 151, which is moved into engagement with the far side of slot 152 will rock switch-selecting lever 138 to the left, as shown in Fig. 9 and finger 140 will engage the right-hand end of switch-actuating block 187, and as lever 121 is returned to position by its actuating device, the circuit contacts 182 and 183 will be closed.

It will be clear that the mechanism could be utilized to actuate other devices and electrical circuits within the broader aspects of the invention.

What I claim is:—

1. In combination in a circuit controlling mechanism, a plurality of circuit terminals, means for selectively actuating said terminals including a device variably positionable to bring it into operative relation with one or another of said terminals, means for variably positioning said device and means for causing it to selectively open or close the selected terminal.

2. In combination in a circuit controlling mechanism, a plurality of circuit terminals, means for selectively actuating said terminals including a device variably positionable to bring it into operative relation with one or another of said terminals, means for variably positioning said device, means for causing it to actuate the selected terminal, and means for causing successive operations of the mechanism after predeterminably variable time periods.

3. In combination in a circuit controlling mechanism, circuit terminals, means for selectively actuating said terminals including a device variably positionable to bring it into operative relation with one or another of said terminals, means for variably positioning said device and cooperating to effect the selected circuit controlling function including a time controlled device and function selecting devices in settable relation with a member moving with the time controlled device.

4. In combination in a circuit controlling mechanism, a plurality of circuit terminals,

means including a device variably positionable to select a terminal to be actuated, means for variably positioning said device to select a circuit terminal and cooperating to control the selected terminal, said means including a time-controlled device and devices in settable relation to said time controlled device to predetermine the time relation of successive operations of the mechanism.

5. In combination in a circuit controlling mechanism, circuit terminals, means settable to select a particular circuit, means for retracting the settable means and returning it to a new set position, a time controlled moving dial and means variably settable in relation to the time indications of the dial and to control said settable means to select a desired circuit.

6. In combination in a circuit controlling mechanism, circuit terminals, means settable to select a particular circuit, a time controlled moving dial and means including a plurality of pins of different lengths variably settable in relation to the time indications of the dial and to control said settable means to select a desired circuit.

7. In combination, a plurality of controlled devices, controlling means therefor including a device variably positionable to select a particular device to be controlled, and means traveling in timed relation with a clock mechanism and settable to control said variably positionable selecting device, and the function to be performed on the selected one of said controlled devices.

8. In combination in a circuit controlling mechanism, circuit terminals, means settable to control a particular circuit, a time controlled moving dial, and a plurality of variably positionable members thereon each to effect a different operation of the settable means.

9. In combination, circuit terminals, means settable to select a particular circuit, means for retracting the settable means and returning it to a new set position, a time controlled moving member and means including a plurality of pins variably settable thereon to control said settable means to select a desired circuit.

In testimony whereof, I have signed my name to this specification.

JOSEF METTLER.