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H. S. CHILDERS

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CIRCUIT CONTROLLER

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*Fig. 1.*

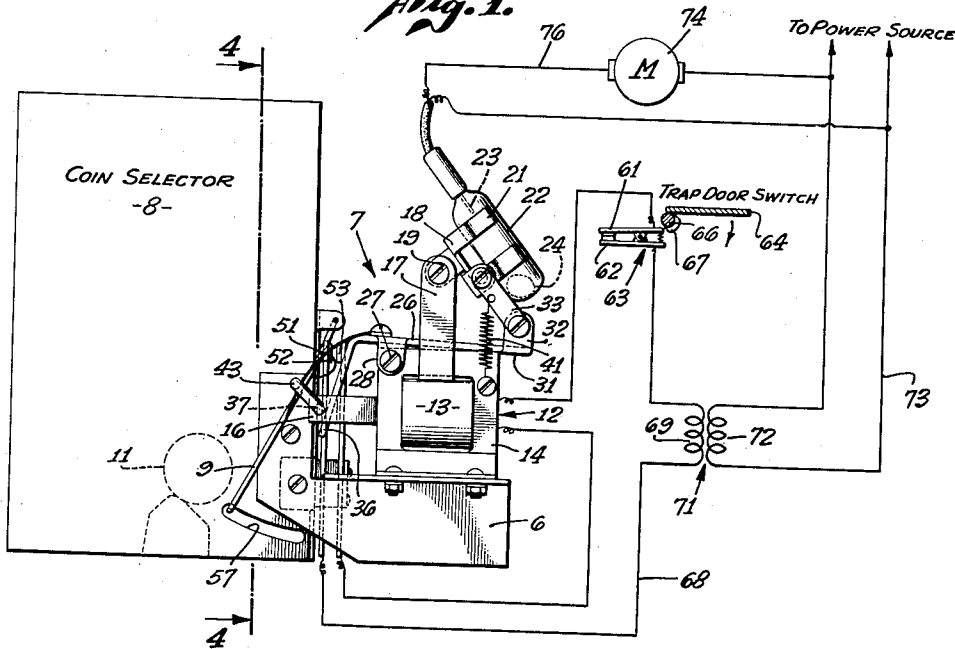


*Fig. 2.*

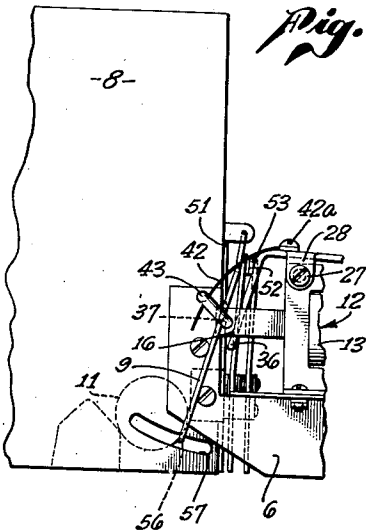


*Fig. 3.*

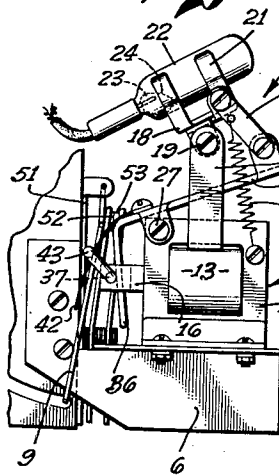
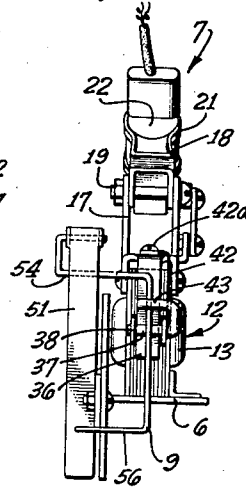


*Fig. 4.*



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## UNITED STATES PATENT OFFICE

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## CIRCUIT CONTROLLER

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8 Claims. (Cl. 194—9)

This invention relates to electricity—circuit makers and breakers, and more particularly to coin-operated switches, the principle of operation and details of construction of which particularly adapt them for use in connection with coin-controlled vending machines.

An object of my invention is the provision of an electrical circuit controller of such a high degree of sensitivity that although it is dependent for its actuation upon the small amount of kinetic energy which can be delivered by a falling or rolling coin, complete and efficient operation of the switch is assured each time its trigger is engaged by a coin.

A more detailed object in this connection is the provision of a circuit controller of the general character described, which includes a main, or dispensing switch, the actuation of which is controlled by an auxiliary, or starting switch, the former being characterized by construction designed principally for assuring positiveness of operation and accordingly including relatively heavy and massive parts which travel through a relatively wide range of movement, whereas the latter is of very light construction and requires movement through a very short distance and thus capable of being moved by a force of minimum magnitude.

A further object of my present invention is the provision of means for applying supplementary force to the starting contacts and thereby assuring electrical efficiency of the engagement between its contacts, and also assuring maintenance of their interengagement until completion of a cycle of operation of the vending machine.

Another object is so to design the switch mechanism that each actuating coin is arrested in its passage through the coin chute at least until the supplementary pressure is applied to the starting switch and completion of a cycle of operation of the vending mechanism is thereby assured, whereupon the trigger initially engaged by the coin and since then functioning as the arresting detent, is positively withdrawn from the path of the coin without having to depend upon the kinetic force deriving from the weight of the coin to push the trigger aside far enough to liberate the coin.

A more general object of the present invention is the provision of a coin-operated switch of the character indicated, wherein the main, or dispensing switch is of the well known "mercury switch" type, but wherein the starting switch is of the spring contact type, thus eliminating the possibility of setting the machine in operation

by shaking or tipping the entire vending machine.

A still further object is the provision of a coin-actuated switch as described, comprising both a working switch and a starting, or holding switch as well as a solenoid electrically connected to the holding switch to be controlled thereby, and suitable interconnecting mechanism for operating the working switch upon energization of the solenoid, which is of simple, unitary construction, all its parts being compactly arranged upon a single frame adapted for expeditious mounting in operative relation to the vending machine the operation of which it is to control.

The invention possesses other objects and valuable features, some of which, with those enumerated, will be set forth in the following description of the preferred embodiment of my invention illustrated in the drawing accompanying and forming part of the specification. It is to be understood that I do not limit myself to the showing made by the said drawing and description, as I may adopt variations of the preferred form in the scope of my invention as defined by the claims.

Referring to the drawing:

Figure 1 is a view in front elevation of a switch embodying the principles of the present invention and showing the switch mounted in operative relation to the coin-selector of the vending machine, the operation of which it is to control. The electrical connections of the switch are also shown in the accompanying wiring diagram.

Fig. 2 is a fragmentary view similar to Fig. 1 but showing only that part of the switch which includes a coin-engaged trigger and the starting or holding contact actuated thereby. The parts are shown in the relative positions occupied thereby after the coin has actuated the trigger far enough to engage starting contacts but before the working, or vending switch has completed its movement to closed position.

Fig. 3 is a view similar to Fig. 1, portions of the figure being broken away to reduce its size and showing the vending switch moved to its closed position.

Fig. 4 is a side elevation of the switch which may be considered as a vertical, sectional view taken upon the lines 4—4 of Fig. 1.

Specifically describing that embodiment of my invention which has been chosen for illustration in the accompanying drawing, my improved switch is carried by a suitable frame 5 affording convenient means of attachment for the switch in operative relation to the other part of the

vending machine whose operation it is to control. Preferably the switch which is indicated in its entirety at 7 is mounted adjacent the coin selector 8 of the vending machine so that the trigger 9 of the switch 7 can extend into the coin chute of the device so as to extend across the path of coin 11 deposited by an operator in the machine for the purpose of actuating the vending mechanism.

Carried by the frame 6 is an electro-responsive device, which may be a solenoid 12 comprising a winding 13, and an external laminated core 14 preferably of U-shape, and a movable armature or plunger 16 so associated with the winding 13 that it is adapted to be drawn inwards of the winding, i. e., toward the right as viewed upon Fig. 1 and approximately to the position which is illustrated in Fig. 3, upon energization of the winding 13.

Rigidly secured to and extending upwards from the core 14 of the solenoid 12 is a frame or bracket 17 preferably in the form of two spaced, parallel legs, between the upper ends of which a cradle 18 is pivotally mounted for rocking movement as by a pintle pin 19. The cradle 18 is provided with a suitable number of resilient clips 21 adapted to releasably engage a mercury switch 22 of suitable and preferably conventional design. The parts are so proportioned and arranged that the cradle 18 is adapted to swing about the axis of its supporting pin 19 from the position in which it is illustrated in Fig. 1 wherein the mercury switch is tipped to approximately 45° with respect to the horizontal with the electrodes 23 at the upper end so that the globule 24 of mercury is removed from the electrodes and the switch is consequently open, to its opposite extreme of pivotal movement as illustrated in Fig. 3 wherein a mercury tube 22 is swung past the horizontal and steeply enough in the other direction to insure that the globule 24 of mercury makes contact with and thus electrically interconnects the two electrodes 23. The mechanism for effecting this swinging or pivotal movement of the cradle 18 and the mercury switch 22 carried thereby comprises a lever 26 pivoted intermediate its end as by a pintle pin 27 extending through aligned ears or lugs 28 integral with or at least rigid with the body of the lever 26. This pintle pin 27 extends through the external core 14 of the solenoid 12 preferably adjacent its forward upper corner; and one leg 31 of the lever 26 extends along the top of the core 14 preferably to a position slightly beyond the other end of the core where this leg 31 is provided with preferably a pair of spaced lugs or ears 32 to which one end of a link 33 is pivotally connected. The other end of this link 33 is pivotally connected to the cradle 18 at a point offset from the axis of the pivotal mounting thereof so that when the end 31 of the lever is raised, the corresponding end of the cradle will likewise be raised. It should be observed that the point of attachment of the link 33 to the cradle is relatively close to the axis of the cradle's pivotal movement and also that the leg 31 of the lever which effects such movement of the cradle is relatively long, the purpose being to amplify the range of movement of the mercury switch 22 and thereby provide positive assurance that electrical contact is made when the switch is closed and that when the switch is open the globule 24 of mercury is far enough removed from the electrodes 23 to make positive that the circuit controlled thereby will be open. The steep inclination to which the mercury switch 21 is tipped when in its open position also aids in providing

insurance against setting the machine in operation by shaking the entire machine so as to splash the mercury sufficiently to establish electrical interconnection between the spaced electrodes 23.

The other end 36 of the lever 26 is deflected downward and is caught behind a pin 37 (see Fig. 4) which extends across the space between two opposed ears or lugs 38 on the forward end of the armature 16 with the result that when the armature 16 moves to the right as viewed upon Fig. 1 to the position illustrated in Fig. 3 this end 36 of the lever also will be carried to the right causing the entire lever 26 to move about its pintle pin 27 in a counterclockwise direction, elevating the end 31 and effecting tipping of the mercury switch 22 from its Fig. 1 position wherein it is opened to its Fig. 3 position where it is closed.

The mercury switch 21, the armature 16, and the parts mechanically interconnecting them are continuously urged to the respective positions thereof in which they are illustrated in Fig. 1 as by a coil spring 41 under tension between the core 14 of the armature 12 and the link 33 adjacent its upper end, i. e., the end which is attached to the cradle 18. Supplementary to the action of the spring 41 in moving the mercury switch 32 to its open position is that of a piece of spring wire 42 secured at one end as by a screw 43 to the lever 26 adjacent the pintle 27 thereof. This spring wire 42 is deflected downwards from its point of attachment to the lever and is caught behind a pin 43 rigid with one of the lugs 38 of the armature 16 and extending obliquely upward and forwards therefrom and then deflected laterally across the longitudinal axis of the armature so as to form a more or less hook-shaped pin behind which the spring wire 42 conveniently can be engaged. It will be observed that as the lever 26 swings upwards toward its Fig. 3 position the intensity of force exerted by the spring wire 42 against the pin 43 is decreased with the result that it has relatively little effect in urging the armature 16 toward the left as viewed upon Fig. 1 when the mercury switch 22 is closed. However, when the mercury switch is open and the lever 26 in its lowest position the spring wire 42 is more sharply bent and therefore exerts a stronger push against the pin 43 and assists in urging the armature 16 to its withdrawn or idle position.

The trigger 9 which is substantially S-shape in configuration (see Fig. 4) is supported by having its upper end pivotally engaged adjacent the upper end of a supporting bracket 51 secured to the frame 6 in such position that it is offset laterally from the path of the armature 16, the plane of the bracket 51, however, being substantially perpendicular to that path. The bracket 51 also serves as the support for a pair of normally separated spring contacts 52 and 53 which constitute the auxiliary or starting switch as will be more fully explained hereinbelow. The horizontal portion 54 of the S-shape trigger 9 extends across the spring contacts 52 and is so positioned with respect thereto that when the trigger 9 moves from the position shown in Fig. 1 to its Fig. 2 position it presses the contact 52 into engagement with the associated contact 53 thereby closing the circuit with which those contacts are associated. The range of movement of the trigger 9 necessary to effect such engagement between contacts 51 and 52 is that which is effected by impingement of a coin 11 against the

lower horizontal portion 56 of the trigger 9, it being understood that this portion 56 of the trigger extends through a suitably disposed slot 57 in the coin selector and across the coin chute therein so that this horizontal portion 56 of the trigger intersects the path of the coins 11 as they traverse the coin selector. The trigger 9 is also engaged behind the pin 43 in much the same manner as is the spring 42. The purpose for this interengagement between the trigger 9 and the pin 43 of the movable armature 16 will be readily apparent from the ensuing description of the operation of the device.

The spring contacts 51 and 52 are electrically connected in series with the winding 13 of the solenoid 12 and with the normally closed contacts 61 and 62 of a trap door switch 63 which is shown more or less diagrammatically in Fig. 1. This trap door switch 63 is provided with a flap 64 mounted upon a suitable rock shaft 66 having a cam 67 adapted to separate the contacts 61 and 62 when the flap 64 is depressed. The trap door switch 63 is so disposed with relation to the remainder of the dispensing mechanism that as each article is dispensed thereby it engages the flap 64 and depresses it in such a manner as to separate the contacts 61 and 62 and thus open the circuit 68 in which the auxiliary contacts 51 and 52 and the winding 13 of the solenoid 12 are connected. This circuit 68 receives its energizing current from the secondary winding 69 of a transformer 71, the primary winding 72 of which are energized by a suitable circuit 73 connecting it to any suitable source of power. Preferably this is the same source of power as that depended upon to actuate the motor 74 which operates the vending mechanism, hence the circuit 76 whereby the motor 74 and the spaced electrodes 23 of the mercury switch 22 are electrically interconnected in series, also receives its energizing current from the same power source.

#### Operation

When a coin of suitable denomination is placed in the coin chute of the coin selector 8 it falls by gravity until it engages the horizontal arm 56 of the trigger 9, suitable guiding devices (not shown) being employed to insure passage of the coin 11 along the necessary path. The effect of such engagement of a coin 11 with the trigger is to move the trigger 9 substantially to the position in which it is illustrated in Fig. 2 wherein it effects closing of the auxiliary contacts 51 and 52. This completes the circuit 68 and results in energizing the winding 13 of the solenoid 12. However, it is preferred that this initial movement of the trigger 9 is not sufficient to permit the horizontal arm 56 thereof to be withdrawn completely from the path of the coin 11 with the result that the coin 11 is trapped until the trigger 9 subsequently caused to move further.

Upon energization of the winding 13 in the described manner, the armature 16 will be drawn to the right from the position illustrated in Fig. 1 to that of Fig. 3 wherein the lever 26 is swung to that position in which its end 31 is elevated thus effecting closing of the mercury switch as hereinabove described. This completes the circuit 76 energizing the motor 74 of the dispensing mechanism and causes it to deliver the article for which the operator has deposited his coin 11. It should be observed, however, that as the armature 16 moves to the right it carries with it the trigger 9 owing to the interengagement between the trigger 9 and the pin 43 which is carried by the arma-

ture. The purpose for this arrangement is threefold—first, it presses the contact 51 against the opposed contact 52 with a greater pressure than that which is obtained by engagement of the coin 11 against the lower end of the trigger 9 and thereby insures sufficient intimacy of contact therebetween to insure good electrical interengagement whereby electrical resistance of the contact is minimized and full amperage is delivered to the winding 13. Closely associated with this function of the interengagement between the pin 43 and the trigger 9 is that it insures maintenance of engagement between the contacts 51 and 52 even after the coin 11 has been released by the trigger 9 thus insuring that the motor 74 will remain in operation long enough to dispense the goods for which the coin 11 has been deposited, i. e., until the trap door switch 63 has been actuated to break the circuit 68. The second function of the interengagement between the pin 43 and the trigger 9 is to dispense with the necessity depending upon the kinetic energy of the coin 11 entirely to move the trigger 9 far enough to permit the coin to move on therepast. Hence, the trigger 9 serves as a trap to retain the coin 11 against passing on through the coin selector until enough of the switch mechanism has been actuated to insure complete operation of the vending mechanism through one complete cycle. The third function of the pin and trigger interengagement is positively to withdraw the trigger 9 from the path of the coin 11 after enough of the switch mechanism has been actuated to insure subsequent complete operation of the vending mechanism and thereby insure that the coin 11 will be released, i. e., the influencing force which withdraws the detent, i. e., the horizontal arm 56 from the path of the coin 11 is not the relatively small amount of kinetic force deriving from the weight of the coin 11 but rather from the much greater force of the moving armature 16. It is thereby provided positive assurance that the coin 11 will be released when complete operation of the vending mechanism through a full cycle is assured. The principal importance of this arrangement is that it permits utilizing the trigger 9 as a trap to retain the coin 11 against ultimate delivery to the coin pocket until such time as complete actuation of the vending mechanism is assured—a feature most difficult to make provision for when it is recalled that it is most desirable to make those portions of the switch which are actually moved by the kinetic force of the actuating coin of such small size and light weight that their movement through the necessary range by the coin is definitely assured. It is believed apparent, therefore, that the interengagement between the pin 43 and the trigger 9 permits construction of the coin sensitive part of such light weight and small size that the switch is amply sensitive to insure its operation by each coin as it traverses the coin selector and yet it insures such positive pressure between the contacts 51 and 52 that energization of the solenoid with full efficiency is made very positive.

I claim:

1. A coin-operated circuit controller adapted to be associated with a coin chute and comprising a switch, means supporting said switch for rocking movement and continuously urging said switch to its open position, an electro-responsive device comprising a winding and an armature movable upon energization of said winding, means connecting said switch-supporting means to said

armature to be moved thereby to that position wherein said switch is closed when said armature is actuated by said winding, a pair of normally open switch contacts electrically connected in series with said winding, a member in said chute operatively associated with said switch contacts to close the latter by a coin deposited into said chute and to retain the coin in the chute, and means operable by said armature as it approaches the end of its movement for moving said member to release the coin.

2. A coin-operated circuit controller adapted to be associated with a coin chute and comprising a switch, means supporting said switch for rocking movement and continuously urging said switch to its open position, a solenoid comprising a winding and an armature movable upon energization of said winding, means connecting said switch-supporting means to said armature to be moved thereby to that position wherein said switch is closed when said armature is actuated by said winding, a pair of normally open switch contacts electrically connected in series with said winding, a member in said chute operatively associated with said switch contacts to close the latter by a coin deposited into said chute and to retain the coin in the chute, means operated by said armature for moving said member to release the coin, and means operated by said armature for imposing additional closing pressure upon said switch contacts.

3. A coin-operated circuit controller adapted to be associated with a coin chute and comprising a switch, means supporting said switch for rocking movement and continuously urging said switch to its open position, a solenoid comprising a winding and an armature movable upon energization of said winding, means connecting said switch-supporting means to said armature to be moved thereby to that position wherein said switch is closed when said armature is actuated by said winding, a pair of normally open switch contacts electrically connected in series with said winding, means extending into said chute and operable by a coin deposited into the latter for closing said switch contacts, and for retaining the coin in the chute and means operated by said armature for imposing additional pressure upon said switch contacts and thereby assuring efficient electrical connection therebetween and for withdrawing said contact-closing means from said coin path as said armature approaches the end of its working stroke.

4. A coin-operated circuit controller adapted to be associated with a coin chute and comprising a switch, means supporting said switch for rocking movement and continuously urging said switch to its open position, a solenoid comprising a winding and an armature movable upon energization of said winding, means connecting said switch-supporting means to said armature to be moved thereby to that position wherein said switch is closed when said armature is actuated by said winding, a pair of normally open switch contacts electrically connected in series with said winding, means extending into said chute and operable by a coin deposited in the latter for closing said switch contacts and for retaining the coin in the chute, and means operated by said armature for retaining said switch contacts closed after said coin has been released by said contact-closing means and for moving said contact-closing means out of said coin path as said armature approaches the end of its working stroke, and

means operable subsequently to closing of said switch for deenergizing said winding.

5. In a circuit controller adapted to be associated with a coin chute, an electro-responsive device comprising a winding and an armature movable upon energization of said winding, a main switch operably coupled to said armature to be closed thereby, a normally open auxiliary switch electrically connected in series with said winding, means actuated by a coin in passing through said chute for closing said auxiliary switch and for arresting said coin against continuation of its passage through said chute, and means actuated by said armature as it approaches the end of its working stroke for withdrawing said coin-arresting means from coin-arresting position.

6. In a circuit controller adapted to be associated with a coin chute, a solenoid comprising a winding and an armature movable upon energization of said winding, a main switch operably coupled to said armature to be closed thereby, a normally open auxiliary switch electrically connected in series with said winding, means actuated by a coin in passing through said chute for closing said auxiliary switch and for arresting said coin against continuation of its passage through said chute, and means actuated by said armature for imposing additional closing pressure upon said auxiliary switch to assure efficient electrical closing thereof, and for withdrawing said coin arresting means from coin-arresting position as said armature approaches the end of its working stroke.

7. A circuit controller, comprising a starting switch and a vending switch, both of said switches being yieldably and continuously urged to their respective open positions, a solenoid comprising a winding electrically connected in series with said starting switch to be energized upon closing thereof and an armature resiliently urged in one direction and associated with said winding to be moved in the opposite direction upon energization of said winding, coin-actuated means for initially closing said starting switch, and for arresting said actuating coin, means actuated by said armature in moving in said opposite direction for closing said vending switch, and means actuated by said armature during the initial part of its working stroke for imposing supplementary closing pressure upon said starting switch and during the final part of its working stroke for withdrawing said arresting means from coin-arresting position.

8. In a circuit controller adapted to be associated with a coin chute, a solenoid comprising a winding and an armature movable upon energization of said winding, a main switch operably coupled to said armature to be closed thereby, a normally open auxiliary switch electrically connected in series with said winding, means actuated by a coin in passing through said chute for closing said auxiliary switch and for arresting said coin against continuation of its passage through said chute, means actuated by said armature as it approaches the end of its working stroke for withdrawing said coin-arresting means from coin-arresting position, and a spring actuated by said armature during its working stroke to place it under tension such that when said winding is deenergized the spring will assist in urging the armature back to its normal position.

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