

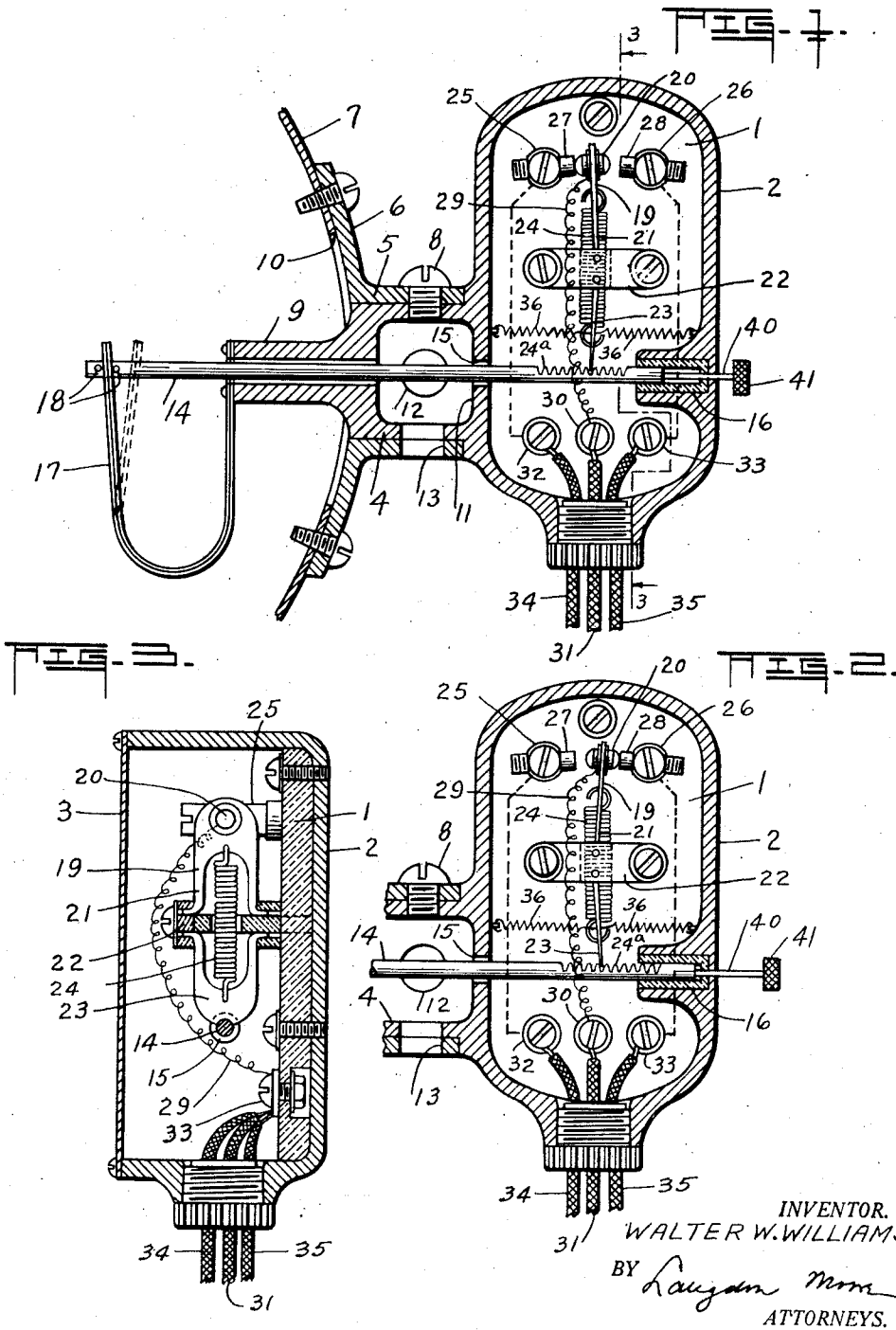
May 8, 1934.

W. W. WILLIAMS
ELECTRIC SWITCH MECHANISM

1,957,516

Filed Aug. 8, 1932

3 Sheets-Sheet 1



May 8, 1934.

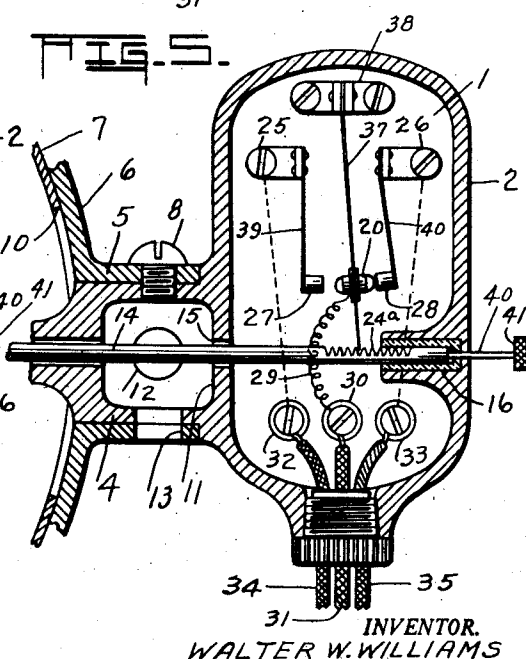
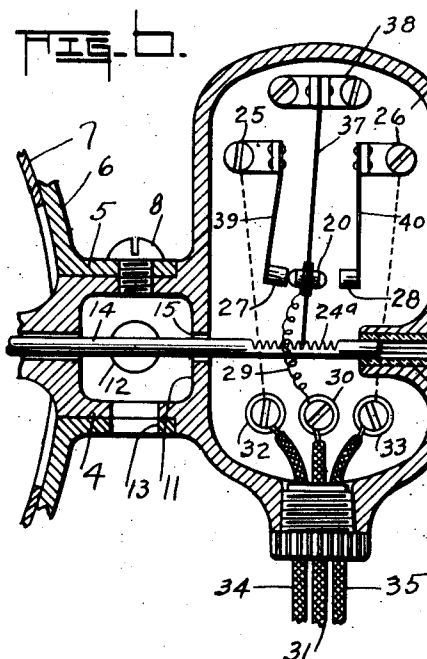
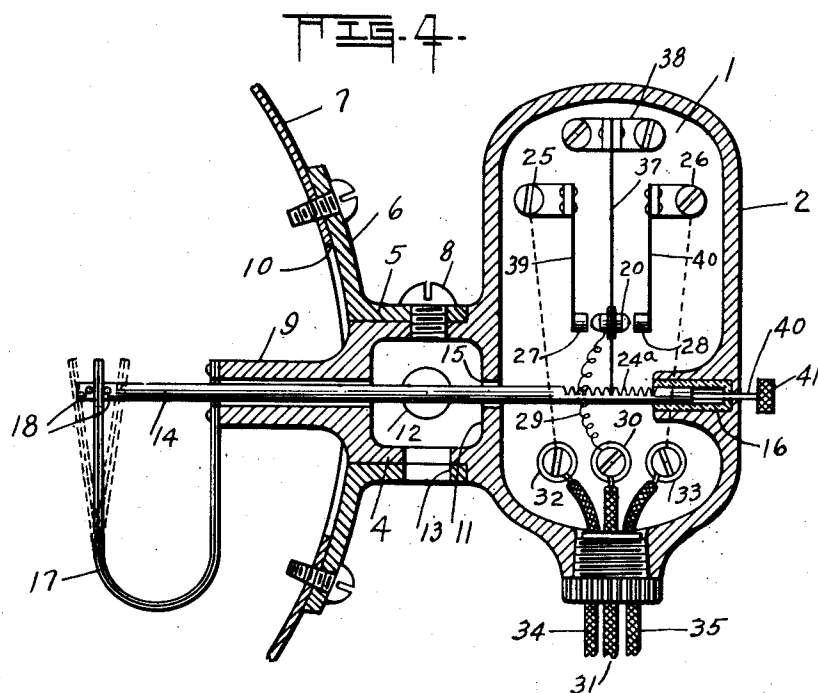
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ELECTRIC SWITCH MECHANISM

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3 Sheets-Sheet 2



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3 Sheets-Sheet 3

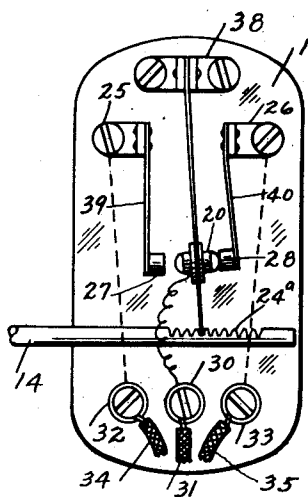


FIG. 7.

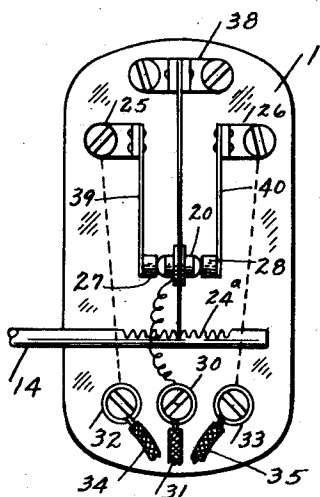


FIG. 8.

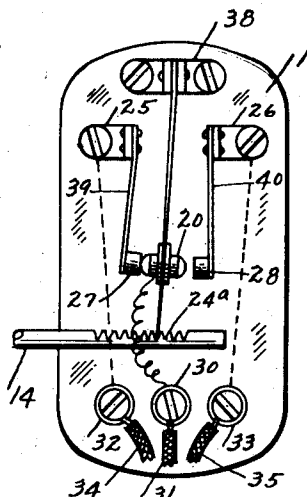


FIG. 9.

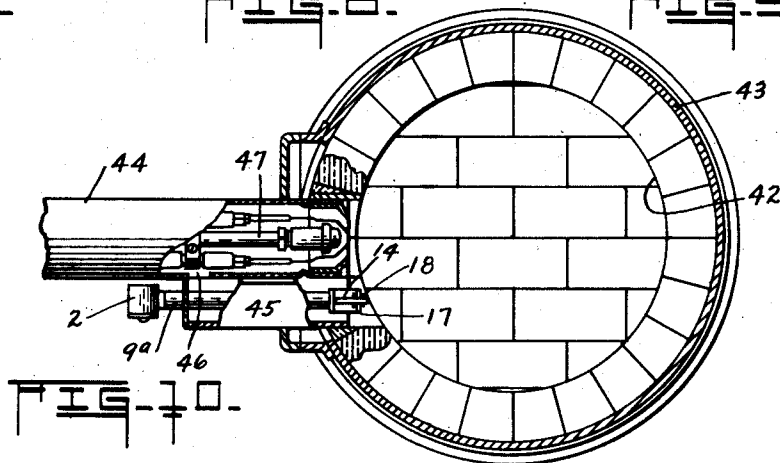


FIG. 10.

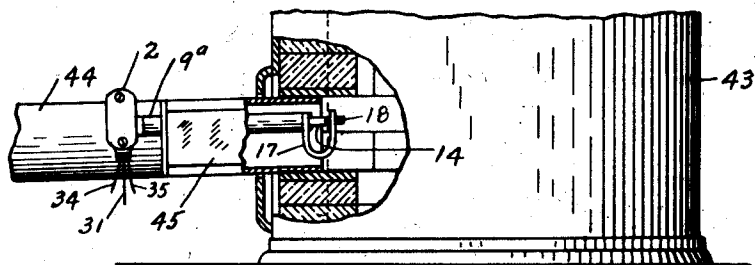


FIG. 11.

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UNITED STATES PATENT OFFICE

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ELECTRIC SWITCH MECHANISM

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Application August 8, 1932, Serial No. 627,861

1 Claim. (Cl. 200—138)

This invention relates to electric switches and more particularly to a thermally actuated switch mechanism particularly adapted as a control in an electrically operated fluid fuel heating system, but may be employed wherever it is desirable to control an electric circuit or operate an electric switch by temperature changes.

It is an object of this invention to provide mechanism responsive to temperature changes for opening and closing an electric switch which is simple and positive in its operation. It is a further object of this invention to provide a reciprocating actuating element for throwing the switch from one extreme position to the other and thereafter allow further movement of the actuating element in the same direction without any undue strain upon the switch operating mechanism and immediately throw the switch to the other position upon movement of the actuating element in the opposite direction.

With these and other objects in view, reference is made to the accompanying sheets of drawings which illustrate a preferred form of this invention with the understanding that minor detail changes may be made without departing from the scope thereof, and that while an embodiment of this invention is illustrated as applied to a stack safety, it is not limited to this single use.

In the drawings;

Figure 1 is a view in longitudinal central section through the casing containing a preferred form of this invention as applied to the stack of a furnace, with parts shown in side elevation, illustrating the switch in the end of its movement in one direction.

Figure 2 is a fragmentary view similar to Figure 1, illustrating the switch at the end of its movement in the opposite direction.

Figure 3 is a transverse vertical sectional view taken on the line 3—3, Figure 1, looking in the direction of the arrows.

Figure 4 is a view similar to Figure 1 of a modified form of this invention illustrating the switch in an intermediate position with the circuits therethrough open.

Figure 5 is a fragmentary view similar to Figure 4 illustrating the switch at the end of its movement in one direction and Figure 6 is a similar view illustrating the switch at the end of its movement in the opposite direction.

Figures 7, 8 and 9 are detailed views of the insulated plate 1 in elevation, illustrating the positions assumed by the contacts when operated by the actuating arm of a structure slightly modified from that illustrated in Figures 4, 5 and 6.

Figure 10 is a top plane view with parts broken away and partly in section, illustrating the application of a commercial oil burner to a commercial furnace or heater to which this invention has been applied.

Figure 11 is a view in side elevation of Figure 10, with parts broken away and partly in section.

As above stated, this type of switch mechanism may be advantageously employed as a part of the control system of an electrically operated and controlled fluid fuel burner mechanism and such an embodiment is illustrated upon the accompanying drawings. As shown in Figures 1 and 2 the switch mechanism is mounted upon an insulated plate 1 carried within the casing 2 preferably provided with a removable front plate 3 and with a tubular extension 4 extending from one side thereof adapted to be received within the tubular portion 5 of a bracket 6 adapted to be secured to the stack 7 of a furnace, not shown. The tubular portion 4 is preferably secured by screws 8 to the bracket 6 which may be attached to the stack 7 in any preferred manner and the tubular portion 4 is preferably provided with a reduced portion 9 passing into the interior of the stack through the opening 10 provided therein for that purpose. As shown, it is preferable to provide the tubular portion 4 with an enlarged chamber 11 adapted to communicate with the outside air through a plurality of passageways 12 registering with corresponding passageways 13 in the tubular portion 5 of the supporting bracket 6, for purpose hereinafter described.

An actuating rod 14 is mounted to reciprocate horizontally through the bore of the tubular portion 9, an aperture 15 in the wall of the casing 2 adjacent thereto, and in a bearing 16 mounted in the opposite wall of the casing 2, as shown in Figure 1. One end of the U-shaped bi-metallic thermal element 17 is secured to the end of the portion 9 extending within the stack and the opposite end of the thermal element is attached to the inner end of the actuating rod 14 as by perforating or bifurcating the end of the thermal element to pass about the actuating rod 14 between horizontal pins 18 on the actuating rod so that upon expansion and contraction of the thermal element, a horizontal, longitudinal movement will be imparted to the actuating rod.

In the form illustrated in Figures 1, 2, and 3 the switch is of the over-throw, off-center, spring type including a contact carrying arm 19 mounting the contact 20 which passes through the top of the switch arm, is insulated therefrom, and extends on both sides thereof as shown in Figures

1 and 2. The opposite end of the switch carrying arm 19 is bifurcated with the ends of both legs 21 mounted to rotate in the bracket 22 mounted upon the insulated plate 1. On the opposite side of the bracket 22, a similarly shaped switch arm 23 is mounted in the same manner and the main bodies of the two switch arms are connected by a coil spring 24 which passes through an aperture provided therefore in the bracket 22. The lower end of the switch arm 23 is adapted to engage between the teeth 24a forming a rack upon the upper surface of the actuating rod 14 so that reciprocation of the actuating rod 14 imparts a rotation to the switch arm 23 placing the spring 24 under tension so that when the lower end passes the center thereof, the upper switch arm is caused to rotate with a quick movement in the direction of travel of the actuating rod 14. To limit the amount of movement imparted to the upper switch arm, binding posts 25 and 26, carrying contacts 27 and 28 adapted to be engaged by the contact 20, are mounted upon the insulated plate 1. It is preferable to connect the contact 20 by a flexible lead 29 to the binding post 30 which in turn is connected to the wire 31 of the control circuit. The binding posts 25 and 26 are preferably connected to the binding posts 32 and 33 which in turn are connected to the wires 34 and 35 of the control circuit in case it is desired that the switch normally closes one circuit in one position and closes another circuit in the other position. If it is desired merely to open and close a single circuit, one of the wires 34 or 35 may be omitted.

The teeth 24a of the rack on the actuating rod 14 are of sufficient depth and are sufficiently uniformly spaced to receive the lower end of the switch arm 23 and impart a positive movement to the switch arm as the actuating rod reciprocates and the length of the switch arm 23 is such that after sufficient positive movement is imparted to the lower end of the switch arm 23 to throw the spring off center and thereby bring the contact 20 against one of the contacts carried upon the binding posts 25 or 26, continued movement of the actuating rod 14 will allow the tooth of the rack in engagement with the switch arm to ride thereunder and be engaged by the corresponding side of the next adjacent tooth. It is preferable to provide the springs 36 connected to the lower portion of the switch arm 23 and the opposite sides of the casing 2 which will place the switch arm 23 under tension as the lower end is moved away from the side of the casing to which the spring is attached so that upon movement of the actuating rod 14 in the opposite direction, the teeth between which the lower end of the switch arm 23 is received will immediately impart a rotation to that switch arm in the opposite direction and upon continued movement, will throw the switch to contact 20 to engage the other contact upon the other binding post and thereafter allow the tooth engaged with the switch arm 23 to ride thereunder in the manner above described.

In electrically operated and controlled fluid fuel burner mechanism, the stack safety forming a part of the control is responsive to the presence or absence of combustion of the fluid fuel within the combustion chamber, the heat of which passes out through the stack of the furnace to the chimney so that the thermal element 17 is responsive to combustion conditions and expands or contracts as the case may be, upon temperature changes within the stack. The expansion and contraction of the thermal element 17 imparts a

horizontal reciprocation to the actuating rod 14 and thereby throws the switch to open one of the circuits herebefore described and close the other when two circuits are employed, or when one circuit is employed, the switch may be so connected that when the fuel burner is idle, one circuit may be normally opened or closed, as desired, and when combustion occurs, the mechanism will be operated to reverse the position of the switch.

It is preferable to provide the air chamber 11 with the registering ports 12 and 13 to set up a circulation of atmospheric air therethrough to reduce the transmission of excess heat from the interior of the stack through the tubular members 9 and 4 to the walls 2 of the casing surrounding the switch mechanism.

Figures 4, 5 and 6 illustrate a modified form of this device which differs only from that above described in that the contact 20 is mounted upon a single arm 37 which is preferably of resilient metal having one end rigidly mounted in a bracket 38 mounted on the insulating plate 1 with the other end bearing the same relation, as heretofore described, to the teeth 24a of the rack upon the actuating rod 14. In this case, the contacts 27 and 28 are each mounted on resilient arms 39 and 40 respectively, with the other ends rigidly connected to the binding posts 25 and 26 as shown in Figures 4, 5, and 6 so that when the actuating rod 14 is reciprocated, the tooth 24a in engagement with the end of the switch arm 37 will carry the contact 20 into engagement with one of the contacts 27 or 28, as the case may be, and further movement of the actuating rod in the same direction will place the resilient contact carrier under tension so that the tooth in engagement with the end of the switch arm 37 may pass thereunder and movement of the actuating rod in the opposite direction will immediately cause the opposite face of the next adjacent tooth to engage the switch arm 37 and carry it therewith until the first contact is broken and the contact 20 is brought into engagement with the other contact mounted upon the other binding post.

If desired, a manual actuator may be provided by extending a reduced portion 40 of the actuating rod 14 through the end of the bearing 16 and adjacent wall 2 of the casing and providing a button 41 upon the exterior end thereof. Figure 1 illustrates the contact 20 in engagement with the contact 27 when the thermal element 17 is at the end of its normal movement in one direction, and Figure 2 shows the position of the switch with the contact 20 in engagement with the contact 28 as caused by the movement of the thermal member 17 when at the end of its normal movement in the opposite direction, as indicated by the dotted lines in Figure 1. Figure 4 illustrates an intermediate position of the thermal element 17 in passing from the end of its normal movement in one direction to the end of its normal movement in the opposite direction in which the contact 20 is out of engagement with both the contacts 27 and 28. Figure 5 illustrates the position of the switch arm 37 as the contact 20 has engaged the contact 28 and the thermal element has caused a movement of the actuating rod 14 beyond its normal position, so that one or more of the teeth 24a have passed under the end of the switch arm 37, while Figure 6 illustrates the position assumed by the parts where the actuating rod 14 has travelled beyond the end of its normal movement in the opposite direction; the positions of movable end of the thermal element

17 for these two positions, illustrated by dotted lines on Figure 4.

The actuating rod 14 is mounted in any desirable manner to prevent a rotation of said rod during reciprocation so as to always maintain the teeth of the rack 24a in the same relation to the bottom of the arms 23 and 37.

In the application of this invention to various types of controls a single circuit may be closed through the lead 29 and contact 20 by engaging and disengaging one of the contacts 27 or 28 which may be connected through their respective binding posts to either of the wires 34 or 35. One circuit may be closed while another circuit is broken as shown in Figures 5 and 6 and in this form when the arm 37 is in its intermediate position, both circuits are broken as shown in Figure 4. It may be desirable to close one circuit before the other is opened and this may be accomplished by mounting the resilient arms 39 and 40 so that when the switch arm 37 is in its intermediate position, the contact 20 thereon will engage both contacts 37 and 38 as shown on Figure 8. Figure 7 shows this modified construction after one contact has been broken by movement of the actuating rod in one direction and Figure 9 shows the other contact broken by movement of the actuating rod in the opposite direction.

Figure 1 illustrates the application of this invention to the stack of a furnace and Figures 10 and 11 illustrate the application of this invention to the combustion chamber 42 of a commercial furnace or heater 43. In these figures a portion of the draft pipe 44 of a commercial fluid fuel burner is shown entering the combustion chamber in the usual manner and is provided with a box-like housing 45 on one side thereof which extends within the walls of the combustion chamber flush with the extremity of the draft pipe. The outer end is closed and a passageway 46 is provided adjacent this end in the wall of the draft pipe whereby a portion of the air passing through the draft pipe may be diverted to pass over the thermostatic element 17 which is mounted within a projection 9a of the casing 2 and may be formed integral therewith, if so desired, and may be secured in any manner desired to the

closed end or other portion of the housing 45 to support the end of the actuating rod 14 in engagement with the thermostatic member 17 within the open end of the housing and preferably extending a slight distance within the combustion chamber as shown in Figures 10 and 11.

Figure 10 illustrates a burner assembly 47 including a fluid fuel nozzle and electrodes for igniting the fluid fuel to burn within the combustion chamber, such as found on commercial oil burners. Oil burners of the type illustrated employ a fan blower, not shown, for forcing air under pressure through the draft pipe to mix and form a combustible mixture with the fluid fuel issuing from the nozzle. The heat within the combustion chamber is excessive and while bi-metallic thermal members, such as 17, have been developed to withstand excessive heat, yet it is preferable to divert a portion of the air when forced through the draft pipe by the blower to pass through the opening 46 and over the projection 9a and thermostatic member 17 to prevent the deterioration of the thermostatic material.

What I claim is:

An electric switch mechanism including a reciprocating actuating rod having a plurality of teeth forming a rack thereon, temperature responsive means for reciprocating said rack, a plurality of electric contacts, one of said contacts mounted upon a bifurcated pivoted arm, another bifurcated pivoted arm having a free end adapted to be engaged between adjacent teeth of said rack, the legs of both bifurcated arms being pivoted adjacent each other, a spring passing between the legs and secured to the body of each arm whereby reciprocation of the rod moves the contact upon the arm into and out of engagement with another contact and after said engagement and upon further movement of the rod in the same direction allows the teeth of the rack to travel under the end of the engaging arm, and means yieldingly holding the free end of the arm in engagement with the rack against the arm spring after the engagement of the contacts first made.

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