

[54] **PLUNGER TYPE RELAY**

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3,617,957 11/1971 Brighenti 337/77
3,587,023 6/1971 Goessler 337/103
3,458,675 7/1969 Del Gaudio 337/77 UX
2,302,924 11/1942 Valverde 337/95 X

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[56] **References Cited**

UNITED STATES PATENTS

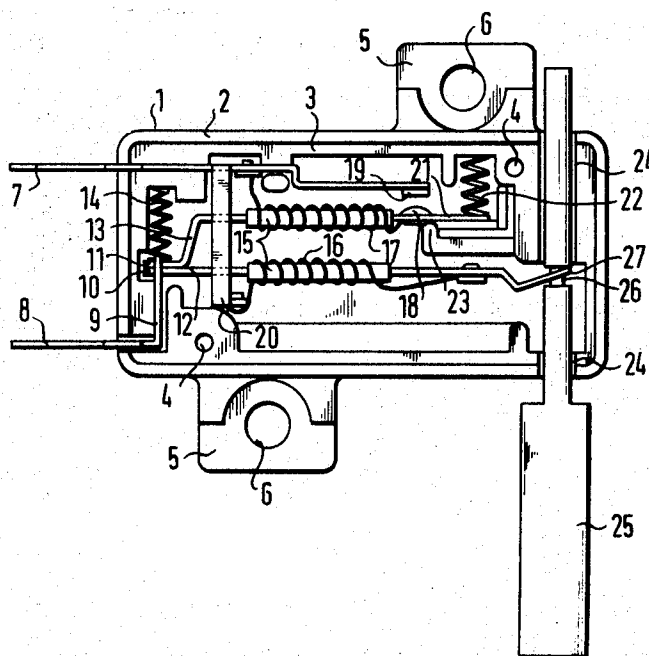
3,624,579 11/1971 Carlson 337/95 X

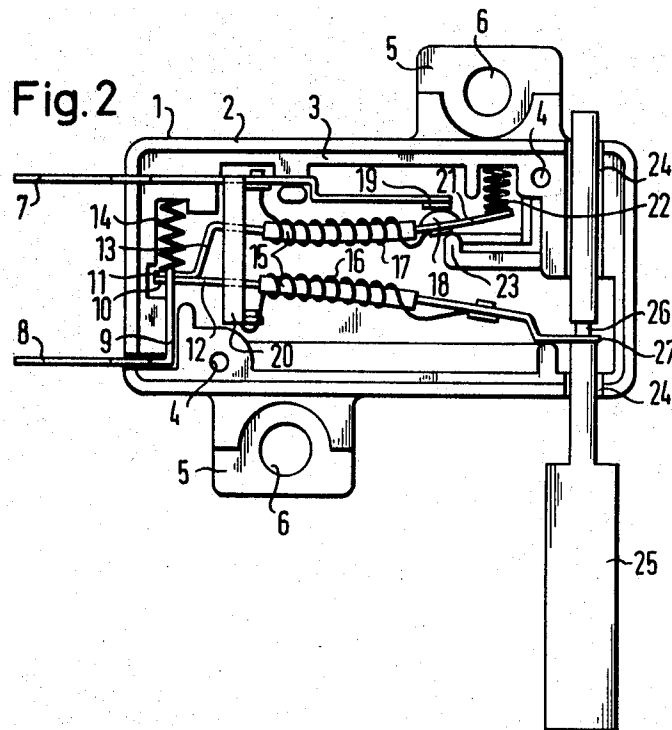
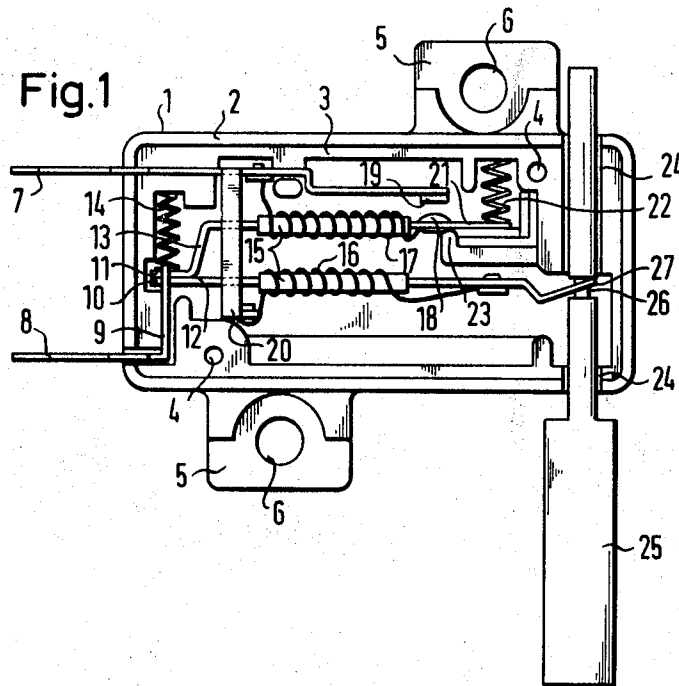
[57]

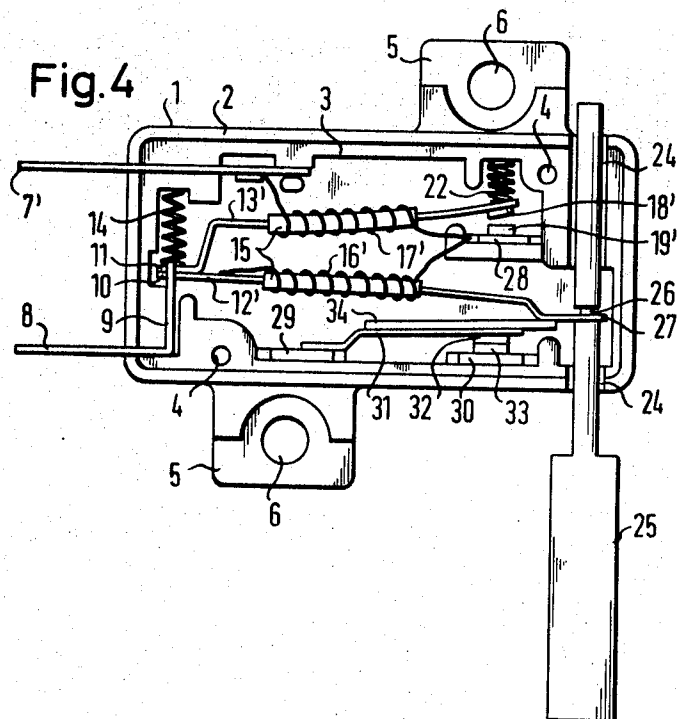
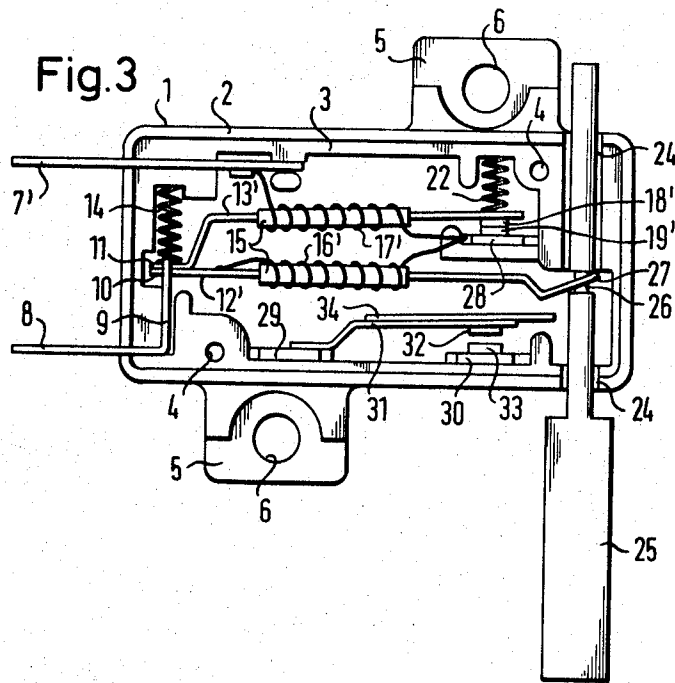
ABSTRACT

A plunger type relay for locking the door of a washing machine. Such a relay includes first and second bimetal strips, at least one heating winding for heating the bi-metal strips, a fixed contact and a movable contact actuatable by the second bimetal strip to co-operate with the fixed contact to short circuit the heating winding.

8 Claims, 4 Drawing Figures







PLUNGER TYPE RELAY

The invention relates to a plunger type relay for locking the doors of washing machines or the like, and more especially to such a relay having a bimetal strip heated by a heating winding, the plunger being shifted into its locking position when the bimetal strip is bowed, the relay further having a movable contact member cooperating with a stationary contact member for shorting the heating winding.

In a known plunger type relay of this kind the movable contact member is secured to the bimetal strip adjacent the plunger which is itself directly displaced by the bimetal strip. The movable contact member only contacts the stationary contact member when the plunger is in its locking position. If this plunger is in any way jammed in an intermediate position during its movement, then the movable contact member does not reach a position of contacting the stationary contact member, so that the heating winding remains switched on. The bimetal strip is thereby progressively heated, thermally overloaded and destroyed.

According to one aspect of the present invention there is provided a plunger type relay for locking the door of a washing machine, such a relay comprising first and second heatable bimetal strips, at least one of the said bimetal strips being provided with a heating winding, a locking plunger adapted to be moved into its locking position by deflection of the first bimetal strip, a fixed contact, and a movable contact adapted to be actuated by the second bimetal strip to co-operate with the fixed contact to short circuit the heating winding.

According to another aspect of the present invention there is provided a plunger type relay for locking the door of a washing machine, such a relay comprising a first bimetal strip, a heating winding adapted to heat the first bimetal strip, a locking plunger adapted to be moved into its locking position by deflection of the first bimetal strip, a fixed contact, a movable contact adapted to co-operate with the fixed contact to short circuit the heating winding and a second bimetal strip for actuating the movable contact.

In one form the movable contact member is disposed at a free end portion of the second bimetal strip, while the other end of the second bimetal strip is connected to a corresponding end of the first bimetal strip in a manner which is mechanically firm and electrically conducting, for instance, by welding. Thus it is possible to arrange the heating winding only on one of the two bimetal strips, the bimetal strip devoid of heating winding serving for temperature compensation. Because of the good conductivity of the electrical connection of the two bimetal strips the bimetal strip provided with the heating winding also heats the other bimetal strip.

Of course, both bimetal strips may each carry a heating winding one end of which is electrically connected to the associated bimetal strip. The movable contact member of the second bimetal strip is then spaced from the stationary contact member when the second bimetal strip is cold. As a result of this construction both heating windings are connected in parallel. When a potential is applied to the plunger type relay both heating windings simultaneously heat their respective bimetal strips so that the latter are bowed and the plunger is moved into its locking position and the contact member of the second bimetal strip comes to contact the stationary contact member. Both heating windings are

thus shorted so that they can cool off and overloading of both bimetal strips is prevented.

In another form each bimetal strip is provided with a heating winding, the heating windings of the bimetal strips each have one end connected to their associated bimetal strip and the other end thereof connected to the fixed contact, the movable contact contacting the fixed contact when the second bimetal strip is cold. As a result in this construction the two heating windings are connected in series. When a potential is applied to the plunger type relay the heating winding of the first bimetal strip is first shorted. The heating winding of the second bimetal strip is so rated that relatively soon the second bimetal strip, and via the latter also the first bimetal strip, is heated to such a degree that both bimetal strips bow. The first bimetal strip brings the plunger into its locking position, the second bimetal strip lifts its movable contact member off the stationary contact member so that both heating windings are then connected in series. As a result of the reduced heat output the mobile contact is held in the lifted off state and further the plunger is maintained in its locking position.

It is also possible to provide a further movable contact member co-operating with a further stationary contact member and actuated in dependence on the deflection of the first bimetal strip. This additional pair of contacts may serve as a pair of signal contacts or it may serve to switch on the motor of a spin-drier.

Illustrative embodiments of the invention will now be described with reference to the accompanying drawings, in which:

FIG. 1 shows a view of one form of open plunger type relay with both bimetal strips being cold,

FIG. 2 shows the same view as FIG. 1 but with both bimetal strips being in the heated state,

FIG. 3 shows a view similar to that of FIG. 1, of a further plunger type relay, and

FIG. 4 shows a view similar to that of FIG. 2, of the plunger type relay of FIG. 3.

The plunger type relay illustrated comprises a housing 1 of creep resistant and flameproof synthetic material having a surrounding raised rim 2. A shallow depression 3 is thus formed into which depression a plate-like cover can be laid, the upper surface of this cover is flush with the upper edge of the rim 2. The cover can be secured in position on the housing 1 by means of hollow rivets engaging in bores 4 of the housing 1. The housing 1 is provided with two flanges 5 having bores 6 for attaching the housing in position.

Two terminals 7 and 8 for the electric connection of the plunger type relay project from the housing 1. These terminals 7 and 8 are inserted in corresponding recesses of the housing 1 and are secured in position by the cover. The terminal 8 is of angular form. The upper end of its inner right-angled leg 9 has a U-shaped slot into which the two ends 10, 11 of two bimetal strips 12, 13 are inserted. The two ends 10, 11 of the two bimetal strips 12, 13 are welded together whereby they are connected to one another in a mechanically firm and electrically good conducting manner. A compression spring 14 urges the ends 10, 11 of the bimetal strips 12, 13 into the U-shaped slot of the leg 9. A strong contact pressure is thus created and good electrical connection of the two bimetal strips 12, 13 to the terminal 8 is obtained. Both bimetal strips 12, 13 are provided with insulating sheaths 15 onto which heating windings 16 and 17 are wound. The lefthand end of the heating winding

17 is connected to the terminal 7 and its righthand end to the bimetal strip 13 or to a mobile contact member 18 secured to the bimetal strip 13 and co-operating with a stationary contact member 19 of the terminal 7. The heating winding 16 is electrically connected to a bent portion of the terminal 7 on the one hand and to the bimetal strip 12 on the other hand. The righthand end 21 of the bimetal strip 13 is urged against a protuberance 23 of the housing 1 by a compression spring 22.

A plunger 25 of thermoplastic synthetic material is slideably mounted in a guideway 24 of the housing 1. The plunger 25 is of rectangular cross section and has, interiorly of the housing 1, a circumscribed groove 26 into which the fork-shaped end 27 of the bimetal strip 12 engages.

When the circuit to which the terminals 7, 8 of the plunger type relay are connected is closed, the two heating windings 16, 17 of the bimetal strips 12, 13 are energised so that these two bimetal strips are heated. The bimetal strip 12 bows downward as shown in FIG. 2 and entrains the plunger 25 into the locking position. The bimetal strip 13 also bows, in the opposite direction, but the compression spring 22 urges it against the protuberance 23 until the bimetal strip 12 has brought the plunger 25 into the FIG. 2 locking position. Only then does the bimetal strip 13 depart from the protuberance 23 and bring the contact member 18 to adhere to the stationary contact member 19 so that both parallel connected heating windings 16, 17 are short circuited and can cool down. Upon such cooling the movable contact member 18 lifts off the stationary contact member 19 so that both heating windings 16, 17 are again energised and the movable contact member 18 again adheres to the stationary contact member 19. With this action of the contact members 18, 19 an oscillating operational condition develops in which condition the electrical energy supplied arrives at equilibrium with the heat radiated to the surroundings. Thermal overloading of the two bimetal strips 12, 13 is thus precluded.

The terminal 7 may be of reduced thickness at the inside of the bend so that it is possible to pivot the end connected to the stationary contact member 19 by means of an adjustment screw (not shown) and thus the position of the stationary contact member 19 can be accurately set.

If the plunger 25 were to be impeded during its travel to the locking position, short circuiting of the two heating windings 16, 17 will nevertheless occur since the second bimetal strip 13 can bend quite independently from the bimetal strip 12 restrained by the jammed plunger 25. Short circuiting occurs then more rapidly than in an unjammed condition.

In the plunger type relay of FIGS. 1 and 2 the two heating windings 16, 17 are connected in parallel while the two heating windings 16' and 17' of the two bimetal strips 12', 13' of the plunger type relay of FIGS. 3 and 4 are connected in series. The left hand end of the heating winding 16' is in this embodiment electrically connected to the bimetal strip 12' and its righthand end to a contact carrier 28 inserted in a suitable recess of the housing 1, while the contact carrier is provided with a stationary contact member 19' to which, as shown in FIG. 3, a movable contact member 18' of the bimetal strip 13' adheres. A compression spring 22 retains the bimetal strip 13' in this position. The heating winding

17' is by its lefthand end electrically connected to a terminal 7' and by its righthand end to the contact carrier 28. Additionally, terminals 29 and 30 are inserted in suitable recesses of the housing 1. A contact spring 31 is secured to the terminal 29 and carries a movable contact member 32 co-operating with a stationary contact member 33 of the terminal 30. An insulating strip 34 is attached to contact spring 31.

In the cold condition of the bimetal strips 12', 13' the plunger type relay is in the position illustrated by FIG. 3. The heating winding 16' is here short circuited via the bimetal strip 13' and the two contacts 18', 19' and the contact carrier 28. When a voltage is applied to the two terminals 7', 8 the heating winding 17' is first energised. The resistance of this heating winding 17' is so rated that a comparatively rapid heating of the bimetal strip 13', and thereby of the bimetal strip 12', results. Thus both bimetal strips 12', 13' are bowed in the manner shown in FIG. 4, whereby the plunger 25 arrives in its locking position, because of the bimetal strip 12', and the mobile contact member 18' is lifted off the stationary contact member 19'. Both heating windings 16', 17' are now connected in series and receive only so much current as suffices to maintain the FIG. 4 position of the plunger type relay. Thermal overloading and destruction of the bimetal strips is thus precluded.

As the bimetal strip 12' bends it meets the insulating strip 34 of the contact spring 31 so that the latter's movable contact 32 comes to adhere to the stationary contact 33. These two contacts 32, 33 can be signalling contacts or they may serve to switch on the motor of a spin drier. Opening contacts may replace these closing contacts. The insulating strip 34 serves to electrically separate the contact spring 31 from the bimetal strip 12.

I claim:

1. A plunger type relay for locking the door of a washing machine in its closed position, said relay comprising a housing, first and second heatable bimetal strips fastened at one end in the housing, a heating winding for at least one of the bimetal strips, the other bimetal strip being heated depending on the heating of the bimetal strip for which the heating winding is provided, a locking plunger movable into its locking position by deflection of said first bimetal strip, a fixed contact fastened in said housing, and a movable contact actuated by said second bimetal strip and cooperating with said fixed contact to short circuit the heating winding.

2. A plunger type relay according to claim 1 in which the movable contact is arranged in the other end of the second bimetal strip.

3. A plunger type relay according to claim 2 in which the movable contact is spaced from the fixed contact when the second bimetal strip is cold.

4. A plunger type relay according to claim 1, wherein the movable contact is arranged on the free end portion of the second bimetal strip.

5. A plunger type relay according to claim 1, comprising means electrically connecting the fastened end of the second bimetal strip to the fastened end of the first bimetal strip.

6. A plunger type relay according to claim 1 in which both bimetal strips comprise heating windings, one end of each heating winding being connected to its associated bimetal strip and the other end thereof being connected to the fixed contact, the movable contact being

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spaced from the fixed contact when the second bimetal strip is cold.

7. A plunger type relay according to claim 1, in which both bimetal strips are provided with heating windings, one end of each heating winding being connected to the fixed contact, the other end of the heating winding of the first bimetal strip being connected to the fastened end of the first bimetal strip and the other end of the heating winding of the second bimetal strip being

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connected to a terminal, the movable contact contacting the fixed contact when the second bimetal strip is cold.

8. A plunger type relay according to claim 1 which includes a further movable contact and a further fixed contact, the further movable contact being co-operating with the further fixed contact on deflection of the first bimetal strip.

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