

[54] **PUSH BUTTON RELAY**

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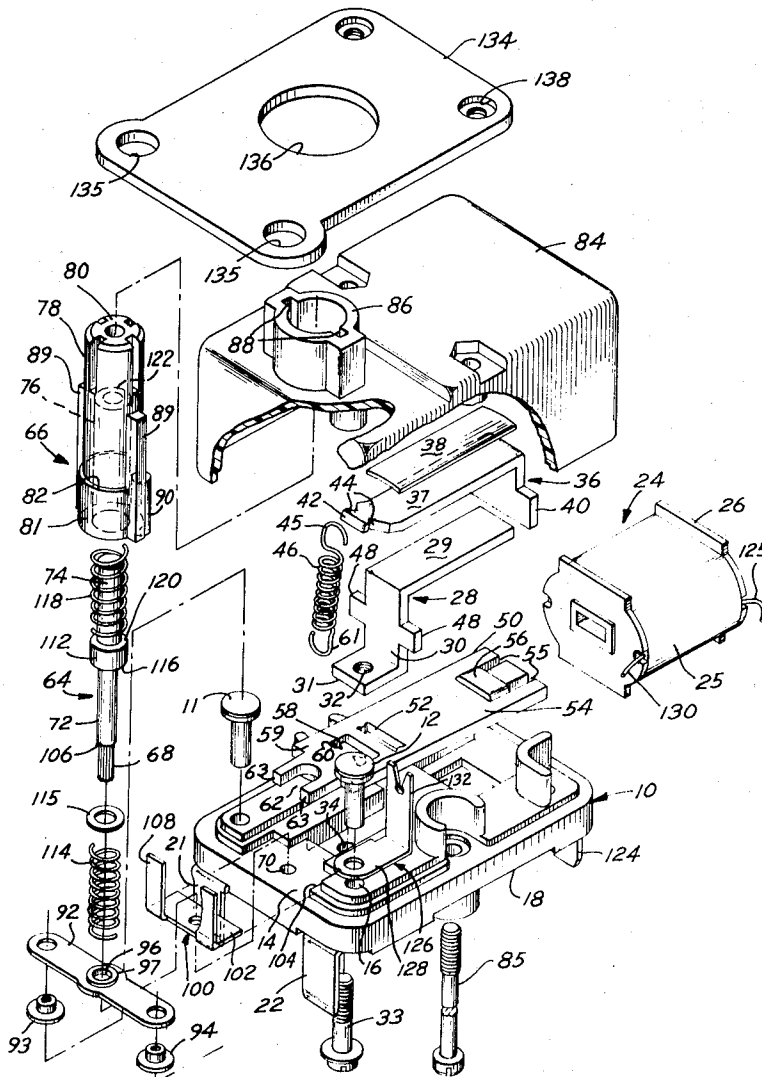
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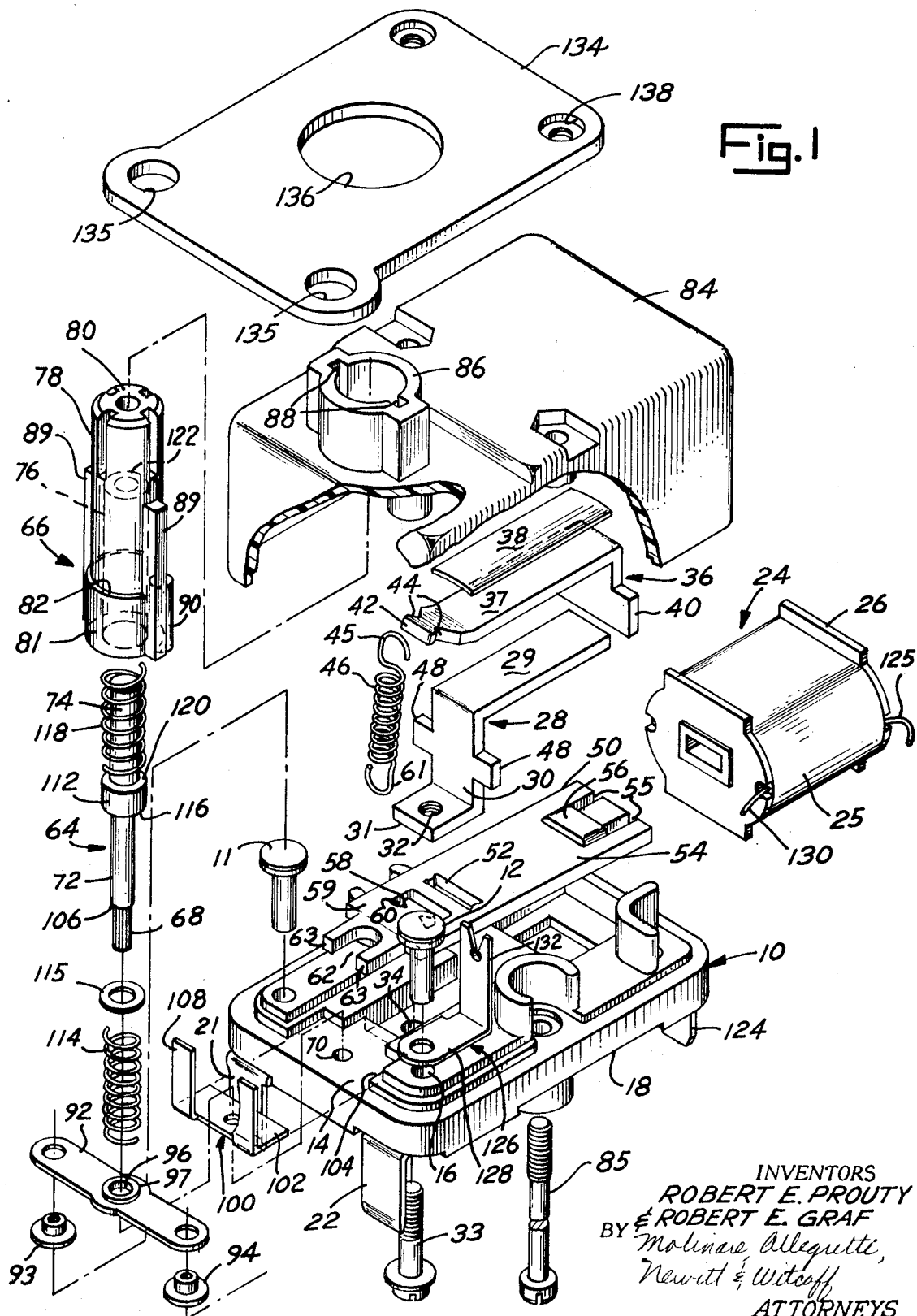
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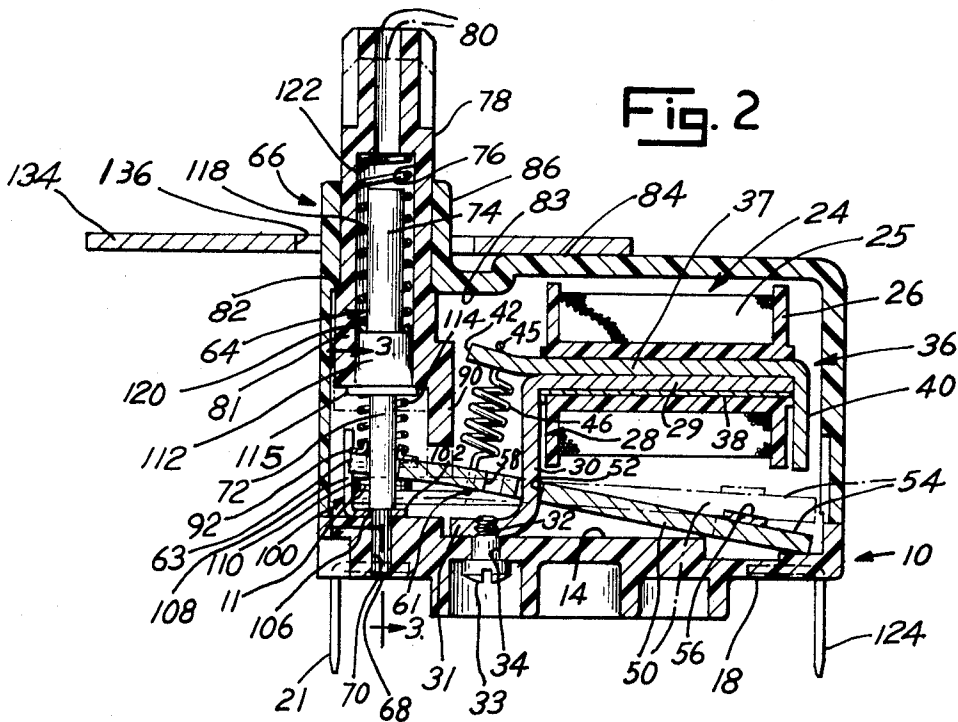
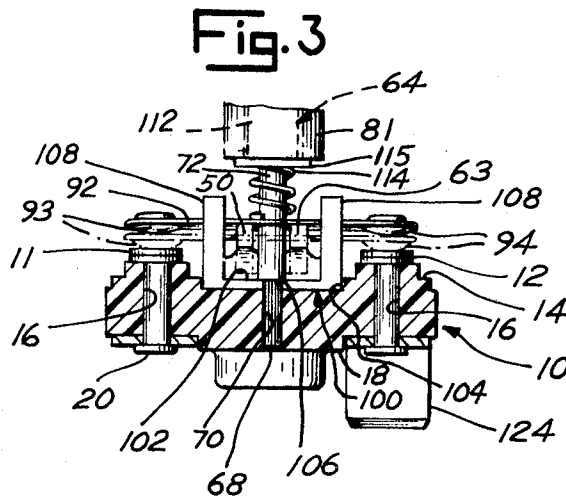
ABSTRACT

A push button relay, in which the closing of the relay contacts is independent of the magnetic circuit of the relay, includes a coil, a magnetizable armature, one end of which normally exerts a force upon a movable contact carrying member to move its contacts out of contact with the stationary contacts of the relay, and a manually operable push button which, when depressed, contacts the armature to overcome the contact opening force exerted by the armature upon the movable contacts, and urges the contact carrying member and its contacts toward the stationary contacts. When the contacts are closed and when the push button is returned, the coil is energized to maintain the armature out of contact opening relationship with the contact carrying member. The armature is preferably maintained in spaced relationship to the contact carrying member by energization of the coil, such that when the coil is deenergized, the armature impactingly opens the contacts.

11 Claims, 3 Drawing Figures







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PUSH BUTTON RELAY

BACKGROUND AND SUMMARY OF THE INVENTION

This invention relates to relays and, more particularly, to a manually operable push button relay.

In the electrical circuits of various devices, such as the controls of dryers, electronic ovens, and air conditioners, it is frequently necessary to employ suitable electrical control mechanisms and components which may be manually actuated and will continue to remain energized through a predetermined cycle after manual actuation. Such circuits in the past have included manual actuation switches and relays, each of which were separate and mechanically independent from each other. In such circuits when the manual switch has been actuated, the relay of the circuit will maintain the circuit closed for a predetermined cycle or period of time which is determined by a timer in the circuit. When the timer has run, the electromagnetic coil of the relay in such circuits is deenergized to open the circuit. These circuits which employ separate manual actuation switches and relays are costly, as well as space consuming, and present mounting problems, particularly where space is an important consideration, such as in modern appliances and the like.

In an attempt to overcome some of the disadvantages of such separate component circuits, integrally mounted manual switches and relays have come into existence. However, in these integrally mounted assemblies, the movable contacts have either been mounted directly on the armature of the relay or have been pinned to the armature for operation and in most of these prior assemblies manual actuation is not independent of the electromagnetic coil or magnetic circuitry in positioning and action.

The push button relay assembly constructed in accordance with the principles of the present invention is capable of the integral mounting of both the manual and electromagnetic components of the assembly and is relatively simple and inexpensive in construction, is compact, and overcomes the mounting problems associated with the prior separate component circuits. The push button relay assembly constructed in accordance with the principles of the invention includes a manually operable member which is operable to close the contacts of the present invention independently of the electromagnetic components of the assembly in both positioning and action. Moreover, the relay assembly of the present invention is reliable over extensive periods of use, and contact wear does not adversely affect the calibration of the assembly. In the assembly of the invention the movable contacts are positively and continuously guided into opening and closing orientation with each other and are moved into closing relationship and maintained in such position by a spring which also acts independently of the electromagnetic components of the assembly. In the push button relay assembly of the present invention, the armature normally maintains the contacts of the relay open, but is overcome by the operation of a manual push button which also exerts a force upon the contacts to close same and to complete a circuit through the coil of the relay to prevent the armature from opening the contacts once the contacts have been manually closed. Moreover, in the present invention a desirable hammer opening action is also realized by the unique construction of the armature and its rela-

tionship to the movable contacts. Finally, hum is substantially reduced by an armature shading feature of the invention and the relay of the present invention is rendered both durable and compact by the frame and coil mounting construction of the invention.

In a principal aspect of the present invention, an electromagnetic relay assembly includes electromagnetic coil means and stationary and movable contact means, the latter of which are mounted for movement relative to the stationary contact means and into an out of contact with same. Magnetizable armature means is mounted for cooperation with the coil means and normally exerts a force on the movable contact means so as to urge the latter out of contact with the stationary contact means, and force exerting means urges the movable contact means into contact with the stationary means independently of the coil and armature means.

These and other objects, features and advantages of the present invention will be more clearly understood through a consideration of the following detailed description.

BRIEF DESCRIPTION OF THE DRAWING

In the course of this description, reference will frequently be made to the attached drawing in which:

FIG. 1 is an exploded view of a preferred embodiment of push button relay assembly constructed in accordance with the principles of the invention;

FIG. 2 is a cross-sectioned side elevation view of the assembled relay shown in FIG. 1; and

FIG. 3 is a cross-sectioned end elevation view taken substantially along line 3—3 of FIG. 2.

DESCRIPTION OF THE PREFERRED EMBODIMENT

Referring to FIGS. 1 and 2, a preferred embodiment of push button relay assembly is shown. The relay assembly includes a non-conductive base member 10 upon which the electrical components of the relay are fixedly mounted. The base member 10 is formed of a suitable non-conductive material and preferably of a molded phenolic plastic or other plastic composition.

A pair of stationary pin-type electrical contacts 11 and 12 are mounted upon the upper face 14 and at one end of the base member and extend through holes 16 to the under side 18 of the base member. Each of these contact pins 11 and 12 is fastened by suitable fastening means, for example by peening their ends at 20 as shown in FIG. 3 in a rivet fashion, to suitable conductive terminals, such as tab terminals 21 and 22, respectively.

An electromagnetic coil 24, comprising a plurality of conductive turns 25 upon a bobbin 26, is also mounted to the upper face 14 of the base by way of an angular member 28, which is of generally L-shaped configuration, and which includes an elongate leg portion 29 which extends axially into the core of the coil 24, a shorter leg portion 30 which extends vertically upward from the base member 10, and a foot portion 31. The foot portion 31 is attached to the upper face 14 of the base, as shown in FIG. 2, by way of suitable mounting means, such as a threaded aperture 32 in the foot and a bolt 33 which extends through a hole 34 from the under side 18 of the base and which is threaded into the aperture 32.

A second L-shaped elongate member 36 also includes a longer leg 37 which extends axially through

the core of the coil 24 in overlying relationship to leg 29, as shown in FIG. 2. The coil 24 is firmly attached to the oppositely axially extending legs 29 and 37 preferably by way of a curved resilient shim piece 38 and the shorter leg 40 of L-shaped member 36 preferably extends downward in exterior relationship to the other end of the coil 24, as shown in FIG. 2, to firmly secure the coil against axial movement between legs 30 and 40. The longer leg 37 of L-shaped member 36 is longer than the length of the coil 24 so as to define an extended spring mounting portion 42 which extends from the coil, as shown in FIG. 2. This extended portion 42 is suitably notched at 44 so as to receive the end 45 of a spring 46. L-shaped members 28 and 36 are preferably formed of a suitable magnetizable material, such as steel, and may be formed by stamping into the shapes shown in FIGS. 1 and 2.

A pair of laterally extending tabs 48 are formed on the edges of the shorter leg portion 30 of member 28 so as to provide a pivotal mounting upon which an elongate, generally rectangular, armature 50 is pivotally mounted as shown in FIG. 2. The armature 50 is also formed of a suitable magnetizable material, such as steel, and includes a lateral slot 52 through which the leg 30 of member 28 extends. The distance between the ends of tabs 48 is greater than the width of the slot 52 such that when the armature is positioned upon the member 28 and its tabs 48, the armature is mounted for pivotal movement relative to the member 28.

When assembled, one end 54 of the armature 50 extends for a substantial distance beneath the coil 24 and between the coil and the upper face 14 of the base. This end 54 of the armature is preferably slotted at 55 as shown in FIG. 1 and a non-magnetizable shading ring or piece 56, preferably formed of copper, is positioned in the slot on the side of the armature which faces the coil. This shading ring 56 substantially reduces the likelihood of objectionable hum in the relay when the coil is energized.

A generally C-shaped slot 58 is also formed in the armature 50 between slot 52 and the other end 59 of the armature. This slot 58 is also notched at 60 so as to receive the other end 61 of spring 46 and thus spring 46 exerts a force on the armature such that the armature tends to pivot clockwise as viewed in FIG. 2 and assume the position shown in solid. End 59 of the armature 50 is formed with a U-shaped notch 62 having a pair of legs 63 which are adapted to straddle the pin 64 of a force exerting push button assembly 66 which will now be described.

The push button assembly 66 comprises the guide pin 64, one end 68 of which is knurled and adapted to be press fitted into an opening 70 in the base, such that the pin is stationary and extends vertically upward from the base. The pin 64 includes a portion 72, slightly larger in diameter than end 70, and which extends upward from the base through the U-shaped notch 62 of the armature. The top portion 74 of the pin is adapted to axially extend into a cylindrical cavity 76 in a hollow push button 78 which is formed of a non-conductive material, such as a suitable phenolic plastic or the like.

The push button 78 includes a flat surface 80 at its upper end and a slightly enlarged portion 81 is formed at its lower end so as to define an annular shoulder 82 which is adapted to engage the under side 83 of a housing cover 84 which fits over the assembled relay, as shown in FIG. 2. The housing in turn, is firmly secured

to the base by screws 85 in the assembled relay. Engagement of the shoulder 82 with the under side of the housing prevents accidental removal or ejection of the push button 78 in an upward direction from the housing, as viewed in FIG. 2. The housing 84 also preferably includes a tubular bushing 86 which is integrally molded to the top side of the housing and which is adapted to receive the push button 78 therethrough. A pair of opposed vertically extending slots 88 are formed on the interior of the bushing and are adapted to receive corresponding vertically extending opposed ribs 89 which are formed integrally on the exterior surface of the push button 78. The ribs 89 and slots 88 cooperate to guide the movement of the push button 78 in the vertical, as viewed in FIG. 2, and into and out of the housing 84.

An armature contacting member 90 is also formed adjacent the bottom of the push button 78, as shown in FIG. 2, and is adapted to engage the upper side of the armature 50 between the spring 46 and the end 59 of the armature when the push button is depressed into the housing. The armature contacting member 90 and the push button 78 are also preferably molded into integral one piece design of a non-conductive material.

An elongate, laterally extending, movable contact carrying arm 92 is positioned between the bottom of the push button 78 and the upper face of the armature 50 in overlying relationship to the U-shaped notch 62 in the end of the armature. The contact carrying arm 92 is formed of an electrically conductive material, preferably a springy resilient copper, and a pair of contacts 93 and 94 are mounted adjacent the opposite ends of the arm in vertical alignment with the stationary contacts 11 and 12, respectively. Portion 72 of the pin 78 extends through an aperture 96 in the center of the contact carrying arm. The aperture 96 is preferably slightly larger than the diameter of the portion 72 of the pin and is also preferably surrounded by a small annular bushing 97 such that the contact carrying arm 92 is easily moved and axially guided relative to the pin.

An L-shaped contact guide member 100 is also provided, having a leg portion 102 which is adapted to lie in a depression 104 and upon the upper face 14 of the base and which is held to the base by way of a shoulder 106 defined at the junction between the portion 72 and the knurled end 68 of the pin 64 as shown best in FIGS. 2 and 3. The guide member 100 also includes a pair of vertically upstanding legs 108, the inner surfaces 110 of which form a vertical guide against which the left edge of the contact carrying arm 92 is guided during movement of its contacts 93 and 94 into and out of contact with the stationary contacts 11 and 12 and as shown in FIG. 2.

The push button guide pin 64 also includes an enlarged ferrule portion 112 intermediate its length and a compression spring 114 is axially positioned below the ferrule about portion 72 of pin 64 and bears against a washer 115 which is positioned between the lower shoulder surface 116 of the ferrule and the upper surface of the contact carrying arm 92 as shown in FIG. 2. Washer 115 is preferably formed of an insulative material and is of a larger diameter than the ferrule 112 such that it contacts the bottom of the push button 78. Thus spring 114 continuously exerts a downward force between washer 115 and shoulder 116 against the contact carrying arm in a direction so as to tend to continuously close the contacts 11, 12, 93, 94. However, this

force is insufficient to close these contacts when the push button 78 is in its fully extended solid position as shown in FIG. 2 and the armature 50, which is pivoted by spring 46 to the position also shown in solid in FIG. 2 maintains the contacts open. Another spring 118 is also positioned between the upper shoulder surface 120 of the ferrule portion 112 of pin 64 and the upper end 122 of cavity 76 in the push button 78 to normally maintain the push button in its fully extended inoperative position as shown in solid in FIG. 2.

A terminal 124 is also mounted in depending relationship from the under side 18 of the base member 10 and is adapted to be electrically connected to one of the leads 125 of the coil 24 for completing the circuit through the coil. An L-shaped terminal 126, having a horizontally extending leg 128 through which the contact pin 12 extends, electrically connects contact 12 to the other conductor lead 130 of the coil through the upstanding end 132 of terminal 126. Thereby, when a circuit has been completed through terminals 21 and 22, the coil will also be energized via contact 12, terminal 126, leads 130 and 125 and terminal 124.

It will be understood that the push button assembly thus far described may be mounted to a panel, appliance or the like by any one of a wide variety of suitable mountings. For example, a mounting plate 134, having suitable bolt receiving openings 135 therein, may be attached to the top of housing 84 as shown in the drawings. This plate 134 is preferably apertured at 136 to provide for the passage of push button 78 and bushing 86 therethrough and may also contain threaded apertures 138 for receipt of the ends of housing bolts 85 whereby the housing is firmly clamped between the base member 10 and plate 134 in the final assembly.

The operation of the preferred embodiment of push button relay assembly of the invention which has thus far been described is as follows:

Initially, it will be assumed that the primary circuit through terminals 21 and 22 is opened by the biasing of the movable contacts 11 and 12 upward, as shown in FIG. 2, due to the upward force exerted by the U-shaped end 59 of the armature and its legs 63 which contact the under side of the contact carrying arm 92. This armature end 59 is pivoted upward to the solid position shown in FIG. 2 by the tensile force exerted by spring 46. The push button 78 will also be positioned, as shown in solid in FIGS. 2 and 3, by the action of spring 118 such that it is fully extended from the housing 84. Since the circuit between contacts 11 and 12 is broken, the coil 24 will be deenergized.

If it is now desired to energize the circuit, a manual force is exerted against the surface 80 of the push button 78 so as to depress the push button and urge the button into the housing. When the button 78 is moved into the housing, springs 114 and 118 will be compressed and the end of the armature contacting member 90 will come into contact with the upper surface of the armature 50 and will exert a force upon that surface, between the spring 46 and the U-shaped end 59. This force will pivot the armature 50 in a counterclockwise direction toward the dot and dash position shown in FIG. 2. In this position the upward pivoting force exerted by spring 46 is diminished and overcome, such that the now increasing force exerted by spring 114 will be directed to act against the contact carrying arm 92 and will urge the latter to the dot and dash position shown in FIG. 3. It will be seen that not only is the en-

ergy stored in spring 114 utilized to urge contacts into their closing position at this point, but also this spring energy is further supplemented by the increasing compression of spring 114 due to the depression of the push button against washer 115. Thus, the movable contacts 93 and 94 will now contact the stationary contacts 11 and 12 and the primary circuit will be completed between terminals 21 and 22.

Since contact 12 is also electrically connected to the coil 24, a circuit will also now be completed through the coil to energize the coil. Energization of the coil magnetically attracts the end 54 of armature 50 and maintains it in the dot and dash position shown in FIG. 2, and will also maintain the other end 59 of the armature in the lowered dot and dash position also shown in FIG. 2. In this position, the end 59 of armature 50 is prevented from exerting any substantial upward force upon the under side of the contact carrying arm 92 when the depressing force is removed from the push button 78 and the push button is returned to its extended position by way of spring 118. In the substantial absence of the contact opening force which might otherwise be exerted by the end 59 of the armature if the coil was not energized, the contacts 93 and 94 are firmly maintained in the closed position by the downward urging action which spring 114 continues to exert on the contact carrying arm 92, even though this force has been somewhat diminished by the return of the push button.

Once the timer (not shown), which is located in the primary circuit, has run, it will deactivate the primary circuit and will thereby deenergize the coil 24, since contact 12 will no longer be energized. When the coil has been deenergized, it will no longer attract the end 54 of the armature, and the spring 46 will now pivot the armature 50 in the clockwise direction as viewed in FIG. 2, to the solid position. When the armature 50 returns to this position, it will lift the contact carrying arm 92 to the solid position shown in FIG. 3 and against the force exerted by spring 114 and the contacts 11, 12, 93, 94 will be opened.

The magnetic force exerted by the coil 24 upon the end 54 of the armature should be sufficient so as to maintain the armature such that the legs 63 of the U-shaped end 59 actually are out of engagement with the under side of the contact carrying arm 92 and are separated therefrom, as shown in FIG. 3, when the coil is energized. It will be seen that when the coil is now deenergized and the armature 50 is positively returned by the action of spring 46 to its initial position, it will not only urge the contacts 11, 12, 93, 94 into opening relationship, but will impact the contact carrying arm 92 so as to provide a hammer blow action upon opening of the contacts.

It will also be seen from the aforesaid description of the invention, that the manual operation by which the contacts are initially closed is completely independent both of the structure and action of the electromagnetic coil. Moreover, the contacts 11, 12, 93 and 94 are both initially positioned and also maintained in contacting relationship by spring 114 which acts independently of the armature 50, the latter of which has been separated from the contact carrying arm 92. In addition, it has been found that the dual leg frame construction of members 28 and 36 not only enhances the durability of the assembly of the invention, but also results in a strong electromagnetic circuit which enables the coil to

be substantially reduced in size without an attendant loss in positive and rapid action of the electromagnetic components of the invention.

It should be understood that the preferred embodiment of the present invention which has been described is merely illustrative of one of the applications of the principles of the invention. Numerous modifications may be made by those skilled in the art without departing from the true spirit and scope of the invention.

What is claimed is:

1. An electromagnetic relay assembly comprising: electromagnetic coil means, stationary and movable contact means, said movable contact means being mounted for movement relative to said stationary contact means into and out of contact with said stationary contact means, magnetizable armature means cooperating with said coil means and normally exerting a force on said movable contact means which urges said movable contact means out of contact with said stationary contact means, and force exerting means for urging said movable contact means into contact with said stationary means independent of energization of said coil means, said force exerting means including first urging means which exerts a counteracting force on said armature means to substantially diminish the force exerted by said armature means on said movable contact means, and second urging means which also exerts a force on said movable contact means to urge said movable contact means into contact with said stationary contact means, said second urging means also serving to maintain said movable contact means in contact with said stationary contact means when said first urging means no longer exerts its said force on said armature means, and said coil means being responsive to the contact between said stationary and movable contacts to maintain said armature means in a position in which said force exerted upon said movable contact means by said armature means remains substantially diminished when said first urging means no longer exerts its said force on said armature means.

2. The assembly of claim 1 wherein said coil means is responsive to the contact between said stationary and movable contact means to maintain said armature means and movable contact means separated from each other when said force exerting means no longer exerts its said force upon said armature means.

3. The assembly of claim 1 wherein said force exerting means comprises a manually movable push button, said push button being movable from a first position toward a second position in which said push button contacts and moves said armature means relative to said movable contact means and overcomes said force exerted by said armature means on said movable contact means, said force exerting means also including urging means which exerts a force on said movable contact means to urge said movable contact means into contact with said stationary contact means and to maintain said contact independently of said armature means.

4. The assembly of claim 3 wherein said push button is movable in a direction substantially parallel to the movement of said movable contact means, and wherein said urging means comprises compression spring means

between said push button and said movable contact means.

5. In the assembly of claim 3 wherein said coil means is energized when said push button is moved to said second position to maintain said armature means in a position in which said force exerted by said armature means is overcome, whereby said stationary and movable contact means remain in contact with each other when said push button returns to said first position.

6. The assembly of claim 5 wherein said coil means maintains said armature means in a position in which said armature means is spaced from said movable contact means when said coil means is energized, and urging means associated with said armature means for urging said armature means into impacting contact with said movable contact means to urge said stationary and movable contact means out of contact with each other when said coil means is deenergized.

7. The assembly of claim 1 wherein said armature means comprises an elongate magnetizable member which normally contacts said movable contact means to urge said contact means out of contact with said stationary contact means, slot means on said elongate member spaced from said movable contact means and adjacent said coil means, and shading means adjacent said slot means between said elongate member and said coil means.

8. The assembly of claim 1 including frame means for mounting said coil means relative to said armature, said frame means comprising a first L-shaped member the longer leg of which extends axially into said coil means over substantially the length of said coil means and the shorter leg of which extends at a substantial angle to the axis of said coil means and external of said coil, and a second elongate member also extending through said coil means, the axially extending portion of one of said members overlying and contacting the axially extending portion of the other of said members.

9. The assembly of claim 8 wherein said shorter leg of said first L-shaped member includes pivotal mounting means about which said armature means is pivotally mounted, said second member extends from an end of said coil means adjacent said shorter leg of said first L-shaped member, and spring means mounted between the extended end of said second member and said armature to normally urge said movable contact means out of contact with said stationary contact means.

10. An electromagnetic relay assembly comprising: base means, an electromagnetic coil mounted on said base means, a pair of stationary contacts mounted on said base means in spaced relationship to said coil, a pair of movable contacts mounted upon elongate contact carrying means and movable into and out of contact with said stationary contacts to complete a circuit therebetween, first and second terminals mounted on said base means and electrically connected to said stationary contacts, respectively, a third terminal mounted on said base means, electrical conductor means connecting said second terminal with said coil and said coil with said third terminal, an elongate magnetizable armature mounted for pivotal movement on said base means, one end of said armature extending between said elongate contact carrying means and said base means and the other

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end extending between said coil and said base means,
 first spring means connected to said armature and exerting a force there-on to pivot said armature to a first position in which said one end of said armature contacts said elongate contact carrying means to move said movable contacts out of contact with said stationary contacts,
 manually operable force exerting means including a push button, armature contacting means on said push button and second spring means mounted between said push button and said elongate contact carrying means, said force exerting means being mounted on said base means for movement relative thereto between a first position in which the force exerted by said armature contacting means on said armature and said second spring means on said elongate contact carrying means is diminished and said movable contacts are out of contact with said stationary contacts, and a second position in which

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said armature contacting means urges said one end of said armature toward a second position adjacent said base means and said second spring means exerts a force on said elongate contact carrying means to move said movable contacts into contact with said stationary contacts, whereby a circuit is completed between said first and second terminals and said coil to energize the latter, said energized coil maintaining said one end of said armature in its said second position when said force exerting means is returned to its said first position.

11. The assembly of claim 10 wherein said one end of said armature is spaced from said elongate contact carrying means when said one end is in its said second position and said stationary and movable contacts are in contact with each other, whereby said one end of said armature impacts said elongate contact carrying means when said coil is deenergized.

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