

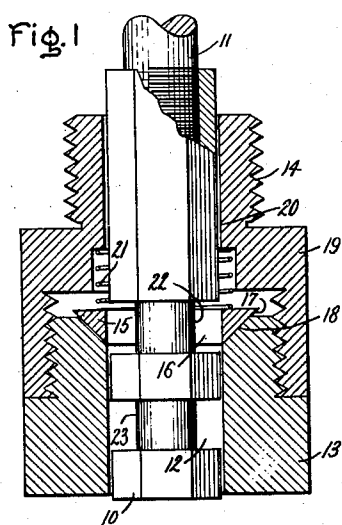
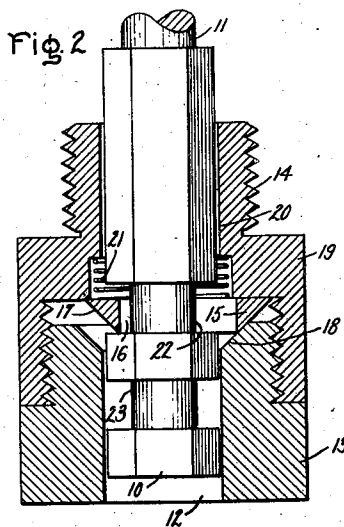
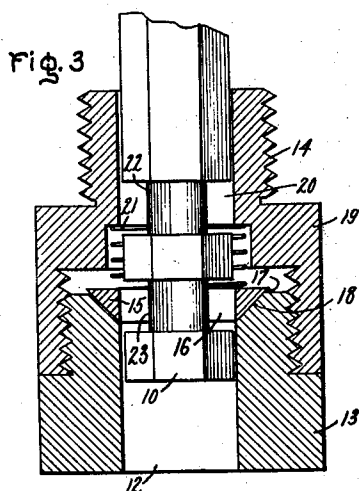
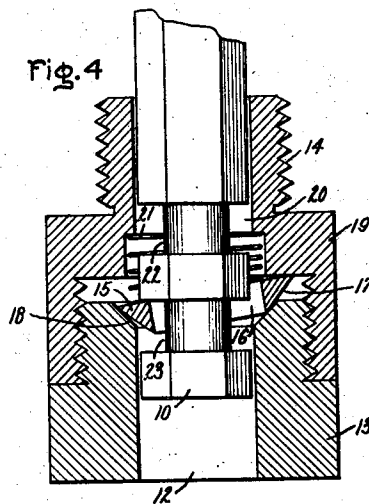
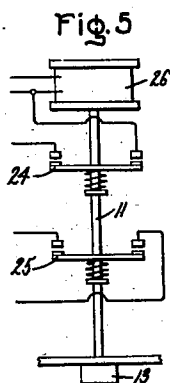
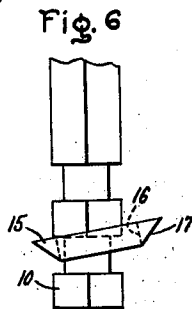
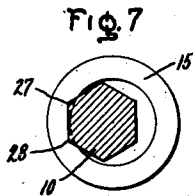
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LATCH MECHANISM

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2,378,173

LATCH MECHANISM

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10 Claims. (Cl. 188—67)

My invention relates to latch mechanism and has for its object a simple and reliable latch mechanism which operates in response to shocks to secure a movable member against movement as a result of such shocks.

More particularly, my invention relates to shock responsive latch mechanism for latching a reciprocable switch member in the position, either the open circuit or closed circuit, in which it happens to be when the shock occurs. Thus, if the switch member is in its closed circuit position, it is held in that position, and if the switch member is in its open circuit position, it is secured against movement to its closed position.

In carrying out my invention in one form, I provide a latch member in the form of a ring which surrounds the member to be secured and which is displaced laterally by a shock with respect to the member to be secured thereby to engage a latching projection on the member. This ring is normally in a central position concentric with the member to be secured so that the member is free to move through the ring. The ring is biased to that position by means of a beveled bearing surface on the periphery of the ring which cooperates with a similar beveled bearing surface on the support for the ring. Preferably, a light spring is provided to center the ring on this bearing surface.

For a more complete understanding of my invention, reference should be had to the accompanying drawing, Fig. 1 of which is a view in section of latch mechanism embodying my invention; Fig. 2 is a view similar to Fig. 1 but showing the mechanism in one latching position; Fig. 3 is a view similar to Fig. 1 but showing the reciprocable part in its raised position; Fig. 4 is a view similar to Fig. 3 but showing the reciprocable part latch in its raised position; Fig. 5 is a diagrammatic view showing the application of my invention to an electric relay; while Figs. 6 and 7 are fragmentary views showing details of construction.

Referring to Fig. 1 of the drawing, in one form of my invention I provide a reciprocable rod 10 which is arranged to be secured to the movable part or member to be latched, such as the operating plunger 11 (Fig. 5) of an electric relay. This member 10 extends slidably into a bore 12 in a normally stationary supporting member 13 which is arranged to be secured to the supporting body (not shown) for the relay and the plunger 11. Thus the supporting member 13 is provided with a threaded boss 14 at one end around the bore 12 which can be screwed into a tapped hole in the supporting body so as to secure the member 13 in place on the supporting body.

For the purpose of securing the rod 10 against movement in the event of shocks, I provide a ring or collar 15 constituting an inertia latch

member which is mounted on the member 13 and surrounds the rod 10. The central aperture 16 in the ring is somewhat larger than the rod and when the ring is in its normal position concentric with the rod shown in Fig. 1, the rod is free to move normally upward or downward through the ring between its closed circuit and open circuit positions provided, of course, that such movement is not accompanied by shocks sufficient to displace the ring from its normal position shown. Thus the walls of the bore 12 form a mechanical connection between the members 10 and 13 whereby the member 10 is guided by the walls and caused to move longitudinally in a constrained path relative to the member 13.

For the purpose of centering the ring in this normal position shown in Fig. 1, its periphery is provided with a beveled edge 17 forming a beveled or truncated cone-shaped seat having its smaller end lowermost. This seat on the ring bears on a concentric matching cone-shaped seat 18 on the member 13. The seat 18, as shown, is provided by beveling or reaming out the upper end of the bore 12, a cap 19 being provided on the member 13 above the bearing seat 18 and containing a bore 20 which is in effect a continuation of the bore 12. As shown, the beveled angles of these two seats are complementary so that when the ring is in a horizontal position, as shown in Fig. 1, it fits on the seat 18. Preferably, as shown, the angle of the seats is about 45 degrees with the longitudinal center line of the rod 10 and bore 12.

Preferably, the ring is held against the seat 18 by a fragile helical spring 21 which surrounds the rod 10 and bears at its lower end on the ring, the spring lying in an enlarged portion of the bore 12 in the cap 19. The strength of this spring will be determined by the violence of the shock required to displace the ring laterally to a latching position. A circular groove (not shown) may be provided in the top of this ring to form a seat for the lower end of the spring and hold the spring in concentric relation with the ring.

In the operation of the device, I have found that a shock applied to the normally stationary member 13 in any direction, whether lateral or vertical, or a component of such shocks, produces a lateral displacement of the ring so that one side of the ring moves into one or the other of the latching grooves 22 and 23 in the rod 10, depending upon the position of the rod. When this lateral displacement of the ring occurs, a wall of the groove constituting a latching projection engages the ring and the rod is thereby prevented from further movement in that direction. Thus, if the rod is in its lowermost position, as shown in Fig. 1, corresponding to its relay open circuit position, when the shock occurs the ring effectively prevents upward move-

ment of the rod 10 sufficient to close the relay, as shown in Fig. 2. Moreover, if the rod is in its raised or closed circuit position, as shown in Fig. 3, the ring moves into the groove 23 and thereby secures the rod in its raised or closed circuit position, as shown in Fig. 4.

It will be understood that apparently this lateral displacement of the ring is in reality produced by movement of the rod and member 13 by the shock independently of the ring which tends to remain stationary by reason of its inertia. This action seems clear when the shock is applied in a horizontal direction to the member 13 thereby giving the apparent horizontal displacement of the ring. Apparently, however, shocks in a vertical direction have a substantial component in a horizontal direction for I have found that the latching ring is just as effective in its latching action for vertical as for horizontal shocks. To a certain extent, the relatively light ring has a bouncing action on the relatively heavy supporting member 13 which tends to displace the ring laterally.

In the latching action shown in Fig. 2 the shock has been in such a direction as to move the ring laterally toward the right hand as well as to move the rod 10 upward. The rod, of course, was before the shock in its lowermost position and therefore was free to move only in an upward direction. It will be observed that the left-hand side of the ring has moved into the upper groove 22 and the lower wall of the groove has engaged the lower side of the ring and has raised the ring against the cap 19. The rod is thus latched effectively against upward movement. It has, it is true, moved upward somewhat to the extent necessary to take up the lost motion between the parts but it is contemplated that this upward movement is not sufficient to move the bridging contacts 24 and 25 (Fig. 5) to their closed circuit positions into engagement with the stationary contacts.

It will be understood that the latching condition illustrated in Fig. 2 exists momentarily, only, in view of the fact that the rod 10 is of course biased by gravity to its lowermost position, shown in Fig. 1. Immediately after the shock, or series of shocks, the rod 10 drops and the ring is moved both by gravity and by the centering spring 21 back to its normal position of Fig. 1.

When the rod 10 is in its raised position, as shown in Fig. 3, the lower groove 23 is inside the ring and the upper wall of the groove is preferably, as shown, somewhat below the upper surface of the ring thereby to limit the downward movement of the rod to the least amount possible. Upon the occurrence of a shock, the ring is apparently displaced laterally to the right, as seen in Fig. 4. This would be caused by a shock applied to the member 13 toward the left. To effect this lateral displacement, the ring must also tilt itself somewhat, as shown in Fig. 4, whereby the left-hand edge, as seen in Fig. 4, moves downward underneath the upper wall of the groove 23. Thus the rod is latched in its raised position. This latching action is very effective in limiting the downward movement of the rod to a very small amount.

Again the latching condition of Fig. 4 will exist only momentarily. Upon the cessation of the shock, the relay operating means, as shown the magnet coil 25, lifts the member 11 and with it the rod 10 back to its raised position. This releases the ring which is recentered by the spring.

Preferably, as shown in Figs. 6 and 7, the rod 10 is made with a polygonal cross-section, as shown a hexagonal cross-section, at least adjacent the grooves, for I have found that a hexagonal wall provides a more effective latching engagement with the ring. This is particularly true in latching the rod in its raised position, as shown in Fig. 4. Thus, as shown in Figs. 6 and 7, the ring moves under two corners 27 and 28 on the upper wall of the groove 23 thereby effectively latching the rod. If the rod were circular at this point, it would be possible for the ring to move under only one point of the wall instead of the two points 27 and 28.

While I have shown a particular embodiment of my invention, it will be understood, of course, that I do not wish to be limited thereto since many modifications may be made, and I therefore contemplate by the appended claims to cover any such modifications as fall within the true spirit and scope of my invention.

What I claim as new and desire to secure by Letters Patent of the United States, is:

1. A shock responsive latch mechanism comprising two members arranged to be connected respectively to supported and supporting bodies, a first of said members being movable with respect to the second of said members, a latching projection on said first member, and an inertia member substantially and loosely surrounding said first member providing for normal movement of said first member but moved relatively by a shock into an engaging position with said projection so as to prevent movement of said first member.

2. A shock responsive latch mechanism comprising two members arranged to be connected respectively to supported and supporting bodies, a first of said members being slidably movable with respect to the second of said members, a latching projection on said first member, a ring surrounding said first member, and means normally holding said ring in a position laterally to provide for normal movement of said first member, said ring being moved relatively by a shock into an engaging position with said projection so as to prevent slidable movement of said first member with respect to said second member.

3. A shock responsive latch mechanism for a movable part comprising a rod arranged to be attached to the movable part, a peripheral latching projection on said rod having a polygonal cross-section, a member arranged for attachment to the support for the movable part, means slidably mounting said rod on said member, and a ring surrounding said rod having an aperture larger than said rod to provide for normal freedom of movement of said rod independently of said ring, said ring being displaceable laterally with respect to said rod and said member in response to a shock whereby said latching projection engages said ring and is secured by said ring against movement.

4. A shock responsive latch mechanism comprising a rod, a member provided with a bore forming a guide for said rod whereby said rod is slidably mounted on said member, a peripheral latching projection on said rod having a polygonal cross-section, a latch member surrounding said rod having an aperture larger than said rod to provide for normal freedom of movement of said rod independently of said latch member, means normally holding said latch member in a position laterally to provide for normal movement of said rod, said latch member being displaceable

laterally into the path of movement of said projection in response to a shock thereby to secure said rod against longitudinal movement.

5. A shock responsive latch mechanism for a movable part comprising a rod arranged to be attached to the movable part, said rod being provided with a groove, a member arranged for attachment to the support for the movable part, said member being provided with an aperture through which said rod extends and the wall of said aperture being beveled to form a seat, a ring surrounding said rod having an aperture larger than said rod to provide for normal freedom of movement of said rod independently of said ring, a seat on said ring engaging said first seat, said groove being inside of said ring when said rod is in one position whereby a shock applied to said member displaces said ring with respect to said member to bring a side of said ring into said groove thereby to latch said rod in said predetermined position against its bias.

6. A shock responsive latch mechanism for a movable part comprising a rod arranged to be attached to the movable part, said rod being provided with a peripheral groove, a member arranged for attachment to the support for the movable part, said member being provided with an aperture through which said rod extends and the wall of said aperture being beveled around said groove to form a cone-shaped seat surrounding said groove, a ring surrounding said rod having an aperture larger than said rod to provide for normal freedom of movement of said rod through said ring, a beveled edge on the periphery of said ring forming a cone-shaped seat fitting on said first seat, and a helical spring surrounding said rod bearing on said ring thereby to bias said ring on said first seat to a position concentric with said rod, said groove being inside of said ring when said rod is in a predetermined position whereby a lateral shock applied to said rod and member displaces said ring with respect to said rod and member to bring one side of said ring into said groove thereby to latch said rod in said predetermined position.

7. A shock responsive latch mechanism for a movable part comprising a rod arranged to be attached to the movable part so as to be movable lengthwise therewith in a substantially vertical direction, a member arranged to be attached to a support for the movable part, said member being provided with a bore forming a guide for said rod whereby said rod is slidably mounted on said member, two peripheral grooves on said rod forming between them a peripheral latching projection, said latching projection having a hexagonal cross-section, a ring surrounding said rod having an aperture larger than said rod to provide for normal freedom of movement of said rod independently of said ring, said ring being provided with a beveled edge on its periphery forming normally a supporting seat for said ring and said bore being provided with an enlarged portion forming a space for said ring having a cone-shaped seat normally engaged by the beveled edge of said ring thereby to hold said ring in a central position and provide for freedom of movement of said rod in said bore, a spring surrounding said rod for holding normally said ring in a central position on said seat, said ring being displaceable laterally with respect to

said rod and member in response to a shock applied to said member whereby said ring is engaged by the top or bottom of said latching projection in dependence upon whether said rod is in a raised or a lowered position thereby to prevent movement of said rod to the other of said positions.

8. A shock responsive latch mechanism for a movable part comprising a rod arranged to be attached to the movable part so as to be movable lengthwise therewith in a substantially vertical direction, a member arranged to be attached to a support for the movable part, said member being provided with a bore forming a guide for said rod whereby said rod is slidably mounted on said member, two peripheral grooves on said rod forming between them a peripheral latching projection, said latch projection having a polygonal cross-section, a ring surrounding said rod having an aperture larger than said rod to provide for normal freedom of movement of said rod independently of said ring, said bore being provided with an enlarged portion forming a space for said ring and with top and bottom seats for said ring, means for holding said ring in a central position to provide for freedom of movement of said rod in said bore, said ring being displaceable laterally with respect to said rod and member in response to a shock applied to said member whereby said ring is engaged by the top or bottom of said latching projection in dependence upon whether said rod is in a raised or a lowered position thereby to prevent movement of said rod to the other of said positions.

9. The combination with a supporting member, of a second member mounted for movement with respect to said supporting member, latching projection means on said second member, a latch member substantially and loosely surrounding said second member mounted on said supporting member for displacement laterally in response to a shock applied to said supporting member into engagement with said latching projection means thereby to secure said second member against movement by the shock, and means for positioning said latch member in spaced relation with said second member to provide for normal movement of said second member independently of said latch member.

10. The combination with a supporting member of a second member mounted for movement with respect to said supporting member back and forth in a substantially vertical plane between two positions, latching projection means on said second member, a substantially ring-shaped latch member loosely surrounding said second member mounted in a substantially horizontal position on said supporting member for displacement laterally in response to a shock applied to said supporting member into engagement with said latching projection means thereby to secure said second member against movement by the shock, and a substantially cone-shaped seat on said supporting member for said latch member for positioning said latch member normally in spaced relation with said second member to provide for normal movement of said second member independently of said latch member.

CARL E. BAZLEY.