

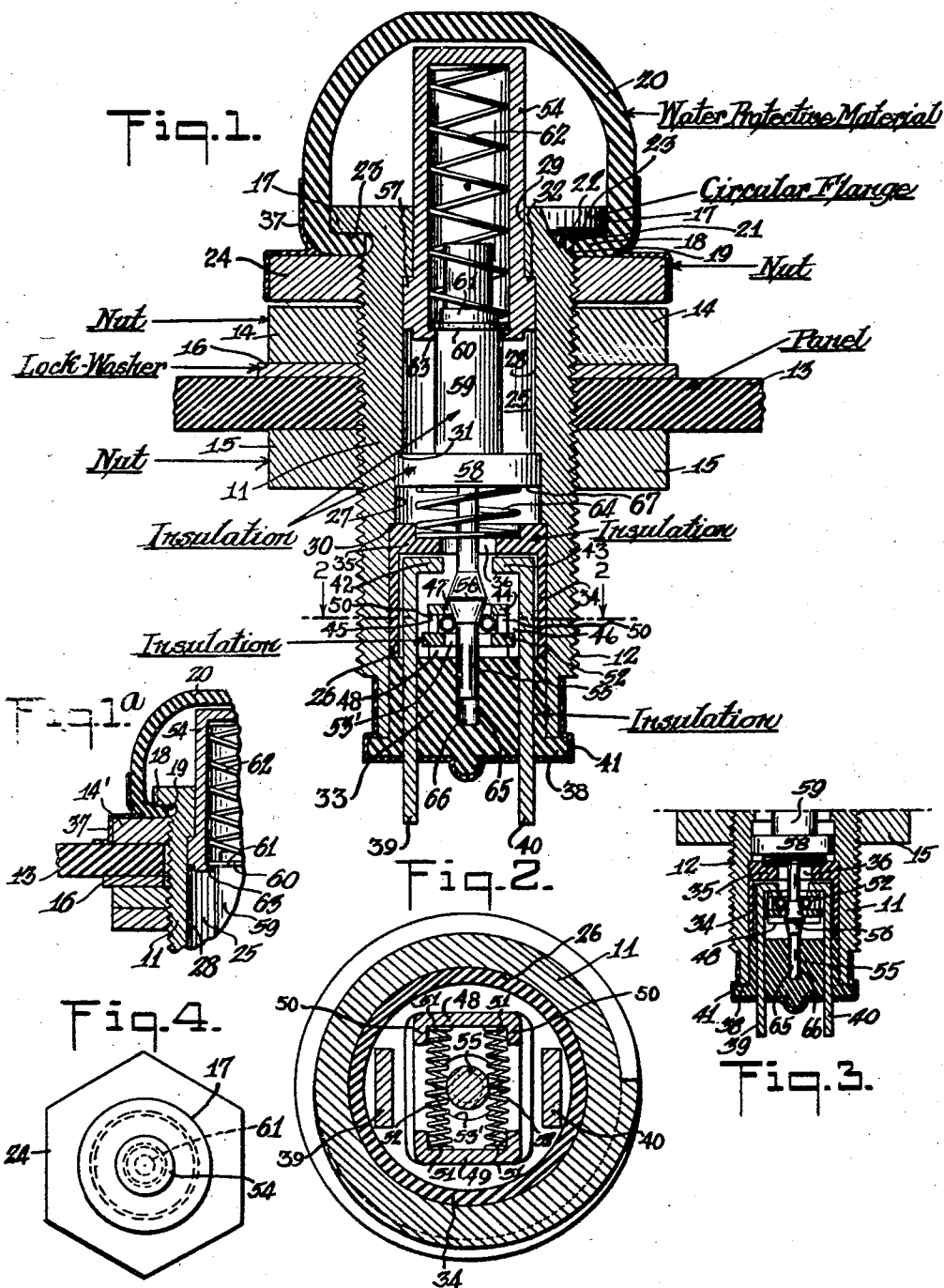
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MOISTURE-PROOFED PLUNGER SNAP SWITCH

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MOISTURE-PROOFED PLUNGER SNAP
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4 Claims. (Cl. 200-168)

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My invention relates to switches of plunger type.

A purpose of my invention is to protect a switch from injury by moisture.

A further purpose is to cover the press button of a switch by a moisture proof cap which is flexible enough to permit the button to be pushed through the protecting cap and in which the cap is sealed against the switch casing by axial clamping of the border of the cap.

A further purpose is to provide a plunger switch with a complete water-tight protection which shall not interfere with proper operation of the switch.

A further purpose is to maintain approximately atmospheric pressure upon the switch contacts to be broken, even at high altitudes.

A further purpose is to cut off oxygen supply from switch contacts to be broken.

A further purpose is to limit exactly the forward and rearward strokes of the plunger so as to maintain cam or wedge pressure upon a shorting bar at either or at both ends of the plunger stroke.

Further purposes will appear in the specification and in the claims.

Figure 1 is a longitudinal, central section of one form of my invention applied to a plunger switch, in open position. The size is greatly exaggerated as compared with that of the present product.

Figure 1a is a fragmentary, longitudinal section of a modified form.

Figure 2 is a section of Figure 1 taken upon line 2-2, enlarged as compared with Figure 1.

Figure 3 is a fragmentary section corresponding generally with Figure 1, but showing to a reduced scale the switch parts in closed position.

Figure 4 is a front end elevation to reduced scale of the structure of Figure 1.

In the drawings similar numerals indicate like parts.

It makes but little difference in the use of the flexible and resilient cap or cover features of my invention as to the character of the interior of the switch, provided the casing terminates in an outwardly flaring flange to which the cap is clamped and, contain radially within this flange, an automatically retracted button, plunger or lever which can be operated through the flexible cover, so that the only hand or machine operation required is the movement by which the switch is thrown.

The invention has been illustrated in connection with a simple form of fully operative spring-

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retracted plunger switch in order that the showing may be complete.

The outer casing 11 carrying the entire switch operating construction is threaded at 12 in order that conveniently it may be mounted upon a panel 13 by which the casing may be either grounded or insulated as desired. If it be the intention to ground the casing, this casing will be electrically conducting; if it is to be insulated, the material of the casing need not be electrically conducting. This same threading is used in applying the present invention.

The switch is held against the panel between two nuts 14 and 15 in connection with which, on one side or other of the panel, but preferably on the forward side, a washer 16 may be used. The panel opening will ordinarily be threaded, in which case the nuts will be lock nuts and in Figures 1 and 1a the washer may be a lock washer.

In the figures, the front of the casing is provided with a circular flare or flange 17 against the rear wall of which and about which is clamped the border 18 near the edge 19 of a flexible and resilient waterproof cap or cover 20, which is preferably made of rubber, natural or synthetic.

The border at and near the edge is sprung over the flange so as by its retraction to fit within and against the inner diameters of the flange springing into the annular space 21 axially back of the flange. This space has been accentuated by grooving the casing at 22 immediately back of the flange, in order to enlarge the area of the back or rear face 23 of the flange to which the cap border is to be clamped.

The border is clamped against the rear face of the flange by a nut 24. In Figure 1a the nut effective for this purpose is shown at 14'.

Clamping the cap against the flange of the outer casing effectively seals the front end of the switch, protecting the interior of the cap and all within it against moisture. In addition to this mechanical clamping of the resilient cover to the casing, this joint between the parts is additionally protected by bridging the clamped joint by an insulation type seal about what I have called a plunger 25. The cap might be thrown about another type of switch operating mechanism than a direct plunger, though not to the same advantage.

In order that I may show a complete switch operating mechanism—even though it be one only of many switch mechanisms that can be protected by the cap and sealing—I describe it in connection with a plunger type of switch shown.

In the structure of the figures, the body of the

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switch is tubular and is bored at 26 and counter-bored at 27, 28 and 29 forming shoulders 30, 31 and 32. The largest diameter of cylindrical opening is at the rear.

The body is desirably metallic. It is insulated at the rear by the insulating block 33 and rearwardly-open cup insulation 34, both within the bore. The forwardly facing bottom 35 of the cup closes the bore forwardly except for aperture 36. The two parts of the insulation indicated are separate because of requirements for assembly. The front about the cap and clamping nut and permissibly about the entire mount is sealed against moisture by latex or synthetic rubber or other similar protective material in the form of a coating 37, which most desirably is vulcanized in place. A carboxyl polyvinyl chloride acetate is excellent for this purpose.

The cup insulation is fixed in position at its front edge by shoulder 38. The rear block 39 is set by engagement of the outer flange 38 with the rear end of the casing or body.

The connection between the rear block and the casing and the connection between the molded-in terminals 39, 40 and the rear block are protected against moisture by a coating, 41 of latex or synthetic rubber or other suitable compound, which with latex or rubber is vulcanized in place.

The terminals are supported by block 35 and are turned radially across toward each other as at 42, 43 so as to be connected by the front plate 44 of a shuttle or shortening bar 45, moving longitudinally of the casing within a space 46. The shorting bar comprises said electrically conducting front face plate 44, apertured at 47 in line with aperture 36. The plate is turned rearwardly at its ends 48, 49 and in rear position of the bar, engages the front face of the block insulation by the ends 48, 49 to limit the rearward movement of the bar.

Both side edges 50 of each of the rearwardly turned ends 48, 49 are turned, one toward the other, to constrict or at least limit the side movement, away from each other, of the ends 51 of transversely extending parallel spiral springs 52.

The extent of this constriction or restriction is capable of adjustment during assembly by turning the side edges to different extents so as to accommodate the same shorting bar size and construction to switches in which the lateral pressure of the springs against the cams of a hill and valley plunger may be quite different, making it possible by adjustment of the extent of inturning of the edges to make quite a considerable difference in the resistances offered by the side springs to lateral flexure of the springs by engagement of the plunger cam.

The rear of the shuttle or shorting bar is preferably formed by a plate of insulation, apertured at 53.

In considering the "plunger" 25 above, I have contemplated the entire plunger system, from the push button 54 to the plunger shaft 55, which carries the hill and valley operating cam 56.

The pushbutton is externally flanged at the rear at 57 to slide within the middle counterbore and the body of the button is guided within the front counterbore. The piston-like plunger guide 58 is rigid with shaft 55 and provided with a cylindrical stem 59 and front collar 60 fitting within the recess of the button and is reduced in diameter at 61 at the front end so as to fit within the overtravel spring 62.

After the parts are assembled, the rear end of

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the button about the recess is peened at 63 to hold the collar within the button. Travel of the button first moves the plunger stem against the resistance of the retraction spring 64 until the plunger is stopped.

This movement of the plunger must be enough to pass the crest of the hill and valley cam between the centers of the shorting bar springs, causing the shorting bar to shift forwardly and close the switch. Travel of the button beyond the point at which the plunger stops causes compression of the overtravel spring 62 to begin. The crest of the double cam 56 is located at the point where the two truncated cones come together, base to base. The slopes of the two cams are different.

During movement of the plunger rearwardly, to cause forward (switch closing) movement of the shorting bar, when the double cam is pushed so that the crest of the cam passes downwardly, rearwardly in Figure 2, past the plane between the center lines of the shorting bar springs, the shorting bar shifts forwardly and travels down the long forwardly facing slope to closure, giving a relatively slow movement and providing conveniently for overthrow of the plunger after the shorting bar has been seated against the contacts.

On the retraction stroke the piston-like guide engages the shoulder 31 at the front end of the guide's travel, preventing excessive forward travel of the stem.

The plunger shaft is guided at its rear end by the walls of the recess 65 whose bottom 66 can be used to limit the extent of travel of the plunger. The travel can be limited also by complete compression of the retraction spring or, where the seat of the spring is deep enough to permit the spring to compress within it, the travel can be limited by engagement of the rear face 67 of the piston-like guide with the front face 68 of the cupped insulation.

Positive limitation of the rearward movement of the plunger shaft permits the shaft to be stopped reliably while the shorting bar transverse springs are still engaged by the front slope of the hill and valley cam, thus maintaining pressure upon the shorting bar to hold it firmly against the contacts 42 and 43, holding the switch closed.

Both of the means for limiting the plunger stroke stop it where the piston-like guide engages the shoulder at 31. On the rear stroke the plunger is stopped by the bottom of the guide opening.

Complete protection against moisture, involving as it does complete protection against admission and outward flow to and from the interior of the switch has several distinct advantages. Wherever used the maintenance of a uniform atmosphere about the arc is quite desirable, not only as regards the moisture, but as regards the oxygen content. Where the space is closed, the oxygen is soon completely burned out leaving an inert gas in which the spark cannot find fuel.

When the switch is surrounded by rarified atmosphere, as in high altitude airplane use, the inert gas, even without its oxygen content, maintains a pressure within the enclosure greatly in excess of the pressure of the surrounding air and which is maintained at nearly the same reduced pressure by the resistance of the cap expansion.

The protection against moisture means also protection against ice, which would otherwise form upon the contacts. It also avoids ignition

of dangerous gases by contact of the gases with the switch arc.

When the rubber cap is slightly collapsed during the pushing of the plunger from the outside of the cap, the pressure about the hill and valley switch contacts is relatively slightly increased, this additional pressure is maintained while arcing takes place. At high altitudes the one pushing upon the button through the rubber cap thus slightly corrects and makes more nearly normal the pressure at the time the switch is closed and hence continues to maintain the higher pressure during the time when the push button pressure is released and at the beginning of which releasing the arc is made.

It will be evident that various forces are at work in determining the conditions inside of the switch. This pressure will be less in rarified atmospheres because the outside pressure is very much less than the approximately 15 pounds pressure per square inch at normal atmospheric pressure.

The reduction in pressure is offset by the resistance of the cap material to stretching, by the burning out of the oxygen from the atmosphere—on the other hand it is increased by the reduction of volume of the space inside of the switch by collapse of the cap when the plunger is thrown rearwardly, which relative compression continues when the button is released and the switch is opened.

It is to be noted that on the reverse movement, when the pressure upon the push button is released the short and relatively steep rearward-facing slope of the cone becomes effective.

In Figure 1^a the cap and the manner of cap fastening as well as the structure inside the casing is intended to be the same as that shown in Figure 1. The casing is flared and grooved and externally threaded, as in Figure 1, the only difference being in the manner of the attachment to the panel. In this case the panel is not threaded, the cap is held in place by a nut 14' threaded upon the casing and compressing the border end of the cap adjacent its edge.

When the acetate is used the sealing material is not vulcanized.

The forwardly facing slope of the hill and valley switch is more gradual (i. e. less steep), than the rearwardly facing slope. At the switch closing end of the shorting bar movement, the springs 52 rest upon the forwardly facing slope so as to maintain forward pressure upon the shorting bar to keep the contact firmly closed.

In view of my invention and disclosure variations and modifications to meet individual whim or particular need will doubtless become evident to others skilled in the art to obtain all or part of the benefits of my invention without copying the structure shown, and I, therefore, claim all such insofar as they fall within the reasonable spirit and scope of my claims.

Having thus described my invention, what I claim as new and desire to secure by Letters Patent is:

1. In a switch, an automatically retractable

switch having a threaded exterior and an outwardly flaring flange upon the front and a spring-retracted operating member moving forward and back at the front, a waterproof, flexible and elastic cup surrounding the flange and operating member and engaging the rear of the flange and a nut mounted upon the casing and pressing the edge of the cup against the rear of the flange.

2. In a switch, a casing having a threaded exterior flanged at the front, a resilient, moisture-proof cap of smaller edge circumference than that of the inside of the front flange, a nut mounted by the casing, axially engaging the edge of the cap and pressing it tightly axially against the rear face of the flange and switch mechanism terminating in an operating plunger within the cap, adapted to be operated from the outside through the cap, thus taking advantage of the flexure of the cap.

3. In a switch, an automatically retractable switch having a threaded exterior and an outwardly flaring flange upon the front and a spring-retracted operating member moving forward and back at the front, a waterproof, flexible and elastic cup surrounding the flange and operating member and engaging the rear of the flange, a nut mounted upon the casing and pressing the edge of the cup against the rear of the flange, and a waterproof coating extending from the nut to the cup and over the joint between the nut and the cup to seal the same.

4. In a switch, a casing having a threaded exterior flanged on the front, a resilient, moisture-proof cap of smaller edge circumference than that of the inside of the front flange, a nut mounted on the casing, axially engaging the edge of the cap, and pressing it tightly axially against the rear face of the flange, switch mechanism terminating in an operating plunger within the cap, adapted to be operated from the outside through the cap, thus taking advantage of the flexure of the cap, and a waterproof coating of vulcanizable material extending over the outside of the nut and over the cap, sealing the joint between the nut and the cap and vulcanized in place.

JOSEPH H. SCHELLMAN.

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