May 29, 1956 E. H. BLOCK 2,748,229

WATER TIGHT SWITCH

Filed Dec. 1, 1953

FIG.1.

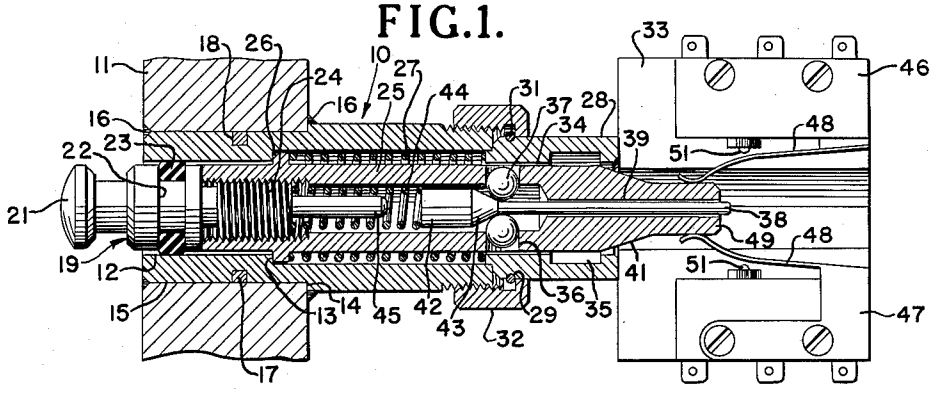


FIG.2.

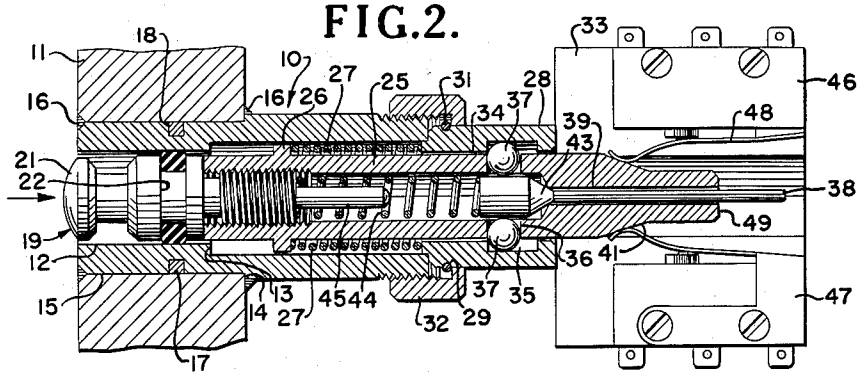


FIG.3.

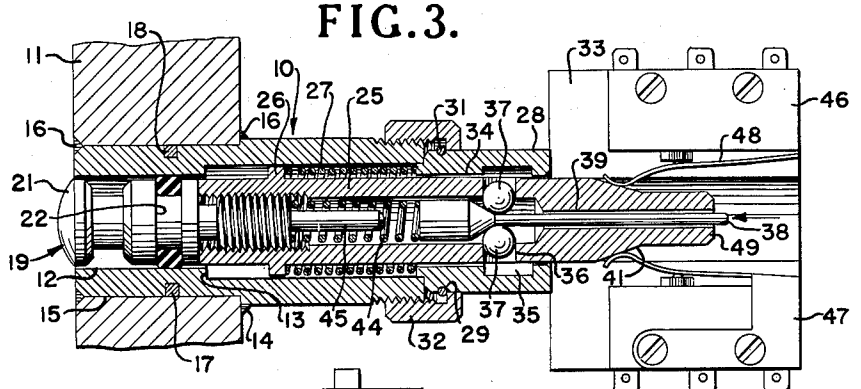
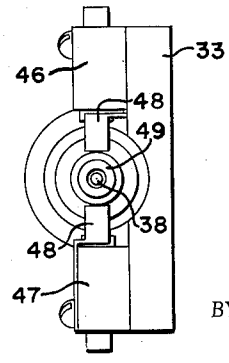


FIG.4.



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WATER TIGHT SWITCH

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2 Claims. (Cl. 200—169)

The present invention relates to a cam operated switch. More particularly the invention relates to a cam operated water-tight switch mechanism wherein one or more micro-switches are operated by depressing a plunger mounted exteriorly of the casing in which the switch is mounted, the mechanism being held in the operated position by a ball lock which may be released by depressing a second plunger mounted interiorly of the casing. In the locked or operated position the micro-switches are held positively by the ball lock to prevent further actuation thereof by shock or vibration or by accidental contact with the first plunger.

An object of the present invention is to provide a new and improved switch mechanism which is locked positively in the operated position thereof.

Another object is to provide a new and improved switch mechanism which while positively locked against release from the operated position by shock and vibration is readily released manualy to the unoperated position, if desired.

Other objects and many of the attendant advantages of this invention will be readily appreciated as the same becomes better understood by reference to the following detailed description when considered in connection with the accompanying drawings wherein:

Fig. 1 is a longitudinal sectional view of the switch mechanism of the present invention in the unoperated position;

Fig. 2 is a view similar to Fig. 1 and showing the device in the operated position;

Fig. 3 is a view similar to Fig. 1 and showing the release position for the ball lock; and

Fig. 4 is an end elevation of the device.

Referring more particularly to the drawings wherein like numerals indicate like parts throughout the several views, **10** indicates generally a switch casing which is mounted in wall **11** of a device which is utilized in water. Casing **10** has formed therein an axial bore **12** having a shoulder **13** spaced from the outer end thereof. The casing **10** is also formed with an external shoulder **14** which abuts the inner face of wall **11** adjacent a bore **15** through which casing **10** extends. The outer end and shoulder **14** of casing **10** may be welded or otherwise secured to wall **11** as at **16**. In order to ensure a water-tight connection between casing **10** and wall **11** a ring of silver solder **17** is heat sealed in groove **18** in casing **10** and engages bore **15**.

Slidably mounted in bore **12** is a plunger **19** having a head or pushbutton **21** initially extending exteriorly of bore **12** and beyond the outer face of wall **11**. Plunger **19** is provided with a groove **22** in which is mounted an O ring gasket **23** for preventing ingress of water to the interior of casing **10**. Plunger **19**, at the inner end thereof, is provided with a reduced threaded extension **24** and a tubular member **25** which is threaded on extension **24**, the member **25** having an annular member **26** formed integrally thereon and intially engaging the shoulder **13** of bore **12**. A spring **27** is interposed between member **26**

and a hollow substantially cylindrical plug **28** set in the inner end of casing **10** to normally urge member **26** against the shoulder **13**. Plug **28** is provided with a circumferential groove **29** containng a ring **31** which is engaged by a nut **32** threaded on the inner end of casing **10**. Plug **28** has integrally formed thereon and extending to one side of the axis thereof a switch supporting plate **33**.

Plug **28** is provided with an axial bore **34** to receive tubular member **25**, bore **34** being formed with an enlarged ball-receiving groove or recess **35** for a purpose to be hereinafter more fully described.

Tubular member **25** has a plurality of transverse bores **36** formed therein, each of which receives a ball **37**, the balls **37** intially engaging rod **38**. Rod **38** is mounted in reduced bore **39** formed in the end of tubular member **25** which projects exteriorly of plug **28**, this portion of member **25** having a cam surface **41**, the purpose of which will be hereinafter more fully described. Rod **38** is provided with a head **42** having a tapered portion **43** which also engages balls **37**. Rod **38** and tapered portion **43** of head **42** are urged in a direction toward balls **37** by spring **44** interposed between threaded portion **24** of plunger **19** and head **42**. Adjustment of the compressive strength of spring **44** may be accomplished by relative movement between threaded extension **24** and tubular member **25**. Plunger **19** has extending into spring **44** a reduced extension **45** which limits the motion of rod **38**. Extension **45** may also serve to engage and positively move head **42** should the urging of spring **44** be insufficient to do so because of inertia and/or friction when the plunger is moved inwardly.

Mounted on supporting plate **33** are a pair of micro-switches **46** and **47**, each switch having mounted thereon a spring arm **48** which engages reduced end **49** of tubular member **25**, as shown particularly in Fig. 1. Spring arms **48** overlie operating pins **51** in switches **46** and **47** whereby pressure thereon by arms **48** operate the mechanisms of the switches (not shown) to open or close the contacts thereof, as the case may be, thus to open or close electrical circuits controlled by the switches.

In operation, the plunger **19** is moved inwardly, in any desired manner, compressing spring **27**, until balls **37** reach recess **35**, whereupon tapered portion **43** of head **42** urged by spring **44** or moved by extension **45**, as the case may be, forces balls **37** outwardly, the balls being part way into recess **35** and part way in bores **36**, the head **42** moving to the position indicated in Fig. 2, thus to lock the balls in the recess **35** and bores **36**. As plunger **19** is moved inwardly, cam surface **41** of tubular member **25** forces springs **48** against operating pins **51**, as aforedescribed, to operate switches **46** and **47**.

As shown in Fig. 2 of the drawings, the springs **48** are held firmly against operating pins **51** when tubular member **25** is locked against movement by balls **37**, thus preventing chattering or accidental operation of the switches by vibration or shock.

If desired the switch mechanism may be returned to the initial position by pressing in the direction of the arrow on the end of rod **38**, compressing spring **44** and moving head **42** from the retaining position with respect to balls **37**, as shown in Fig. 3. Spring **27** returns tubular member **25** to the initial position and springs **48** are released by cam surface **41** to the position of Fig. 1, freeing pins **51** to return switches **46** and **47** to the unoperated position. Should the static friction of O ring gasket **23** and the inertia of the plunger be so great that the spring **27** is unable initially to overcome the same, continued pressing in the direction of the arrow, Fig. 3, will cause end **49** to be engaged and tubular member **25** to be moved toward the initial position.

It will thus be seen that the apparatus of the present invention provides a switch mechanism which locks posi-

tively in the operated position against movement caused by vibration or shock and which is readily resettable to the initial or unoperated position.

Obviously many modifications and variations of the present invention are possible in the light of the above teachings. It is therefore to be understood that within the scope of the appended claims the invention may be practiced otherwise than as specifically described.

What is claimed as new and desired to be secured by Letters Patent of the United States is:

1. Apparatus for operating and locking electrical switches comprising, in combination, a hollow cylindrical housing, means on one end of said housing for supporting said switches thereon, said switches having spring actuating arms mounted thereon, a hollow plunger slidably mounted in said housing, said plunger including a tubular member and a pushbutton member threaded in one end of the tubular member, cam means on the other end of said tubular member, a spring sleeved about said tubular member and adapted to urge the plunger into an unoperated position, said plunger being adapted to be manually moved into an operated position by pressure on the pushbutton member from the exterior of the apparatus, said cam means being adapted to engage said spring actuating arms when the plunger is in the operated position thereby to energize the switches, a ball locking groove in the housing, ball locking means in said plunger and adapted to move into locking engagement with the ball locking groove when the plunger is in the operated position, yieldable means in said tubular member for urging the ball locking means into engagement with said ball locking groove, said yieldable means including a movable element engaging the ball locking means and a compression spring interposed between said element and pushbutton member, relative movement between the threaded pushbutton member and tubular member serving to adjust the compression of the compression spring, and a rod-like extension on said element passing through said cam means and adapted to receive pressure from the exterior of the apparatus for moving the element toward the pushbutton member against the urging of the compression spring and unlocking the ball locking means; thereby allowing the plunger to return to an unoperated position and deenergizing the switches.

2. Apparatus for operating and locking electrical switches comprising, in combination, a hollow cylindrical housing, means on one end of said housing for supporting said switches thereon, spring actuating arms for said switches mounted on said means, a hollow plunger slidably mounted in said housing, a spring sleeved about said plunger and adapted to urge the plunger into an unoperated position, said plunger being adapted to be manually urged to an operated position from the exterior of the apparatus, cam means on one end portion of said plunger and adapted to engage said spring actuating arms when the plunger means is in the operated position thereby to energize the switches, support means fixed in the other end portion of said plunger and including an element extending toward the cam means, a ball locking groove in the housing, ball locking means within said plunger and adapted to move into locking engagement with the ball locking groove when the plunger is in the operated position, rod means slidably mounted within said plunger, said rod means having a tapered portion and a portion of reduced diameter extending through the cam means, and spring means in said plunger encircling said element and urging the tapered portion of said rod means into engagement with said ball locking means, the tapered portion of said rod means being effective to urge the ball locking means into engagement with said ball locking groove when said plunger is moved to an operated position, said element being effective to engage and positively move the rod means should the same fail to move under the urging of the spring means, said portion of reduced diameter of the rod means being adapted to receive pressure thereon from exterior of the apparatus in a direction opposite to the urging of said spring means for manually moving said tapered portion and thereby rendering the ball locking means ineffective and releasing the plunger for return to an unoperated position.

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