

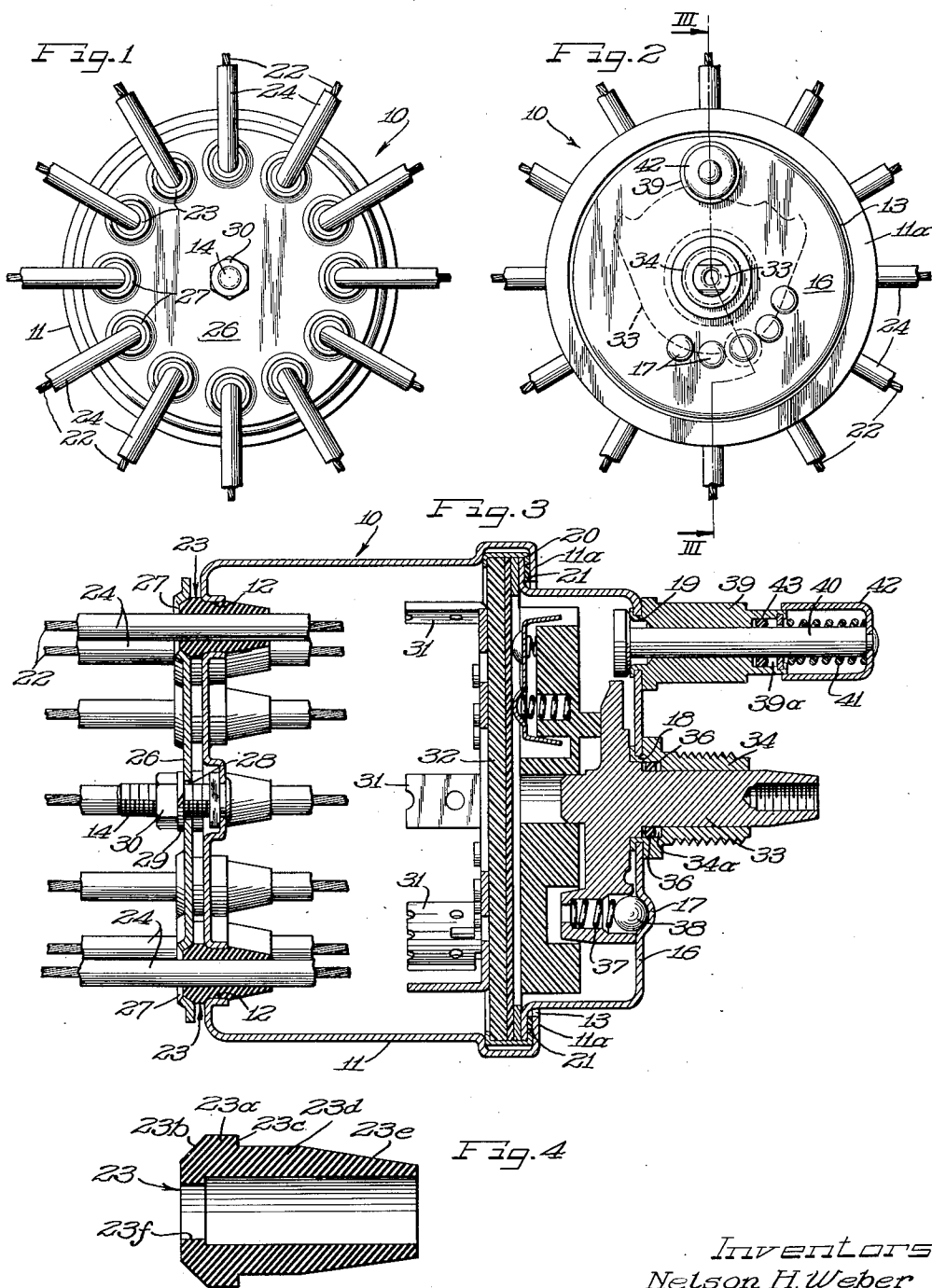
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WATERPROOF SWITCH ASSEMBLY

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WATERPROOF SWITCH ASSEMBLY

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This invention relates generally to a waterproof switch assembly and more particularly to a novel and improved arrangement of an enclosure assembly for waterproofing a switch or other electrical apparatus.

The widespread use of electrical apparatus in environmental conditions of a most adverse nature has given rise to the need of enclosure assemblies which are capable of remaining waterproof when subjected to abnormal internal or external pressures in the presence of water or vaporous air.

For example, military equipment is frequently employed in jungles under humid climatic conditions where leakage of water into a conventional electrical switch assembly will cause the production of fungus or will promote an electrolytic action; both of which eventualities ultimately resulting in the destruction of the switch assembly insofar as its usefulness is concerned. It will be readily understood that equally adverse environmental conditions are encountered when it is necessary to employ military equipment in a strategic land-sea locale involving amphibious operations.

It is an object of the present invention to provide an arrangement for waterproofing electrical apparatus and particularly a switch mechanism in such a manner as to preclude the formation of fungus and the deterioration of elements through electrolysis.

A particular object of this invention is to provide novel and improved means whereby a plurality of insulated conductors, or lead-wires may be waterproofed at the point of entry into a cup or shell housing by means of elastic resilient grommets.

According to the features of this invention, an arrangement for waterproofing a rotary multiple-position safety-lock switch of the class having a safety-lock plunger and a rotary shaft extending into a cup enclosure and a plurality of insulated lead-wires extending away from the cup enclosure is provided which includes resilient grommets to be elastically deformed at the locale of the lead-wire point of entry into the cup by means of a grommet retainer adjustably carried by the cup and by resilient O rings carried by the plunger of the safety-lock and the shaft of the rotary switch and seatable in bushings.

Many other objects and advantages of the instant invention will become manifest to those versed in the art upon making reference to the detailed description which follows and the annexed sheet of drawings in which

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Figure 1 is an end elevational view of a waterproof switch assembly incorporating the principles of our invention;

Figure 2 is an elevational view of the opposite end of the switch assembly shown in Figure 1;

Figure 3 is a cross-sectional view partially broken away and with parts disconnected for the sake of clarity taken on line III—III of Figure 2, and

Figure 4 is a cross-sectional view, greatly enlarged, of a resilient grommet incorporated as a part of the present invention.

As shown on the drawings:

The waterproof assembly described herein by way of illustrative example comprises a rotary, multiple-position, safety-lock switch indicated generally by the reference numeral 10.

Referring particularly to Figure 3, the switch 10 is shown as including a cup 11 formed from steel which may be zinc or cadmium plated and shaped to define a plurality of flanged apertures 12 at one end thereof and a large aperture 13 at the other end thereof for receiving a switch sub-assembly. A centrally disposed positioning stud 14 may be firmly affixed by brazing or the like to the end of the cup 11.

A cap 15 for housing the switch elements is shaped to define a plurality of radially spaced ball seating detents 17 (Figs. 2 and 3) and is also suitably apertured as at 18 and 19 for purposes which will become evident presently.

A stake ring 20 is provided and may be used to position and support elements of the switch structure relative to the cap 15.

It will be noted that the end of the cup 11 at the locale of the aperture 13 is bent out to form a stake-ring seating recess. In order to produce a water-tight juncture between the cup 11, the stake ring 20 and the cap 15, the various elements are positioned relative to one another at the locale of the stake-ring seating recess and the ends of the cup 11 are flanged over.

An oil-resistant resilient gasket 21 made of neoprene rubber or the like is arranged to lie adjacent the stake ring 20 and between the flanges formed on the edge of the cup 11 and the cap 15. Thus, when the flanged portion of the cup 11 is indicated by the reference numeral 11a is turned over, a water-tight seal will be produced between the cup 11 and the cap 15.

As will be apparent from the drawings, it may be necessary to introduce a large number of conductors, or lead-wires indicated generally by the reference numeral 22 into the housing formed by the cup 11 and the cap 15. To promote a water-

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tight seal at the various points of entry, the present invention contemplates the utilization of a novel and improved resilient grommet indicated generally by the reference numeral 23.

The details of construction of a grommet 23 may be seen by making reference to Figure 4 where the grommet 23 is shown as comprising an integral element formed of a soft molded oil-resistant rubber-like material such as neoprene or the like and shaped to define an enlarged retainer seating portion 23a suitably skived as at 23b and terminating in a square annular shoulder 23c.

A substantially cylindrical sleeve portion 23d extends rearwardly from the enlarged portion 23a and may be tapered as at 23e. A restricted aperture 23f may be formed in the enlarged portion 23a in communication with the bore extending generally through the cylindrical portion 23d of the grommet 23.

A grommet 23 may be placed around each conductor or lead-wire 22, which is assumed to be suitably covered by an insulation 24, and the grommets are arranged to seat in the apertures 12 formed in the cup 11.

It will be noted that the tapered portion 23e formed on each grommet 23 facilitates the seating operation and the edges of the apertures 12 formed in the cup 11 will be fitted on the sleeve portions 23d and will engage and abut the square shoulder 23c formed on the enlarged portion 23a.

Referring particularly to Figures 1 and 3, a grommet retainer is indicated by reference numeral 25 and comprises a plate-like member having a plurality of radially spaced apertures 27 formed therein.

In this particular embodiment, the edges of the apertures 27 are flared or extruded outwardly so as to develop an included angle of approximately 90°, or in other words, a conical bearing surface for engaging the skived edge 23b formed on the grommet 23.

In any event, the edges of the apertures 27 formed in the grommet retainer 25 should be arranged to lie in engaging registry with the enlarged portion 23a of the various grommets 23.

The grommet retainer 25 is also provided with a centrally disposed aperture 28 which passes the positioning stud 14. A conventional lock washer 29 and a nut 30 may be placed on the positioning stud 14 and by drawing the nut 30 up on the stud 14, the grommet retainer 25 may be adjustably positioned relative to the cup 11 against the inherent resilience of the grommets 23.

When the grommet retainer 25 is adjusted inwardly, the grommets 23 will be elastically deformed in such a manner as to snugly engage the edges of the apertures 12 formed in the cup as well as the surface of the insulation 24 on each of the conductors or lead-wires 22 to produce a water-tight seal at the locale of the point of entry of each conductor 22 into the cup 11.

Making particular reference to Figures 2 and 3, it will be noted that the switch mechanism includes suitable terminals 31 mounted on an insulating spacer 32 made of non-conductive material. The conductors or lead-wires 22 are not shown in connected relationship to the terminals 31 inasmuch as the switch mechanism, per se, does not constitute a part of this invention and is illustrated herein for the sake of clarity only.

Those versed in the art will recognize that instant switch mechanism comprises a rotary multiple-position safety-lock switch which includes an angularly displaceable shaft 33 jour-

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naled in a threaded stem 34 tightly staked to the edges of the aperture 18 formed in the cap 16. The stem 34 is suitably counterbored as at 34a to position an O ring 35 made of resilient material and adapted to surround the angularly displaceable shaft 33.

The angularly displaceable shaft 33 is provided with an enlarged portion, which defines an irregular shape best seen by the dotted line showing made in Figure 2. In order to lock the shaft 33 in any selected position, a locking spring 37 carried by the enlarged portion is provided to resiliently bias a ball 38 into a selected detent 17 formed in the cap 16.

A safety-lock is provided for the switch mechanism 10 and is shown as including a bushing 39, which is tightly staked to the edges of the aperture 19 formed in the cap 16 and through which passes a plunger 40 actuatable against the resilient bias of a spring 41 contained in a push-button cap 42 adapted to reciprocate over an end portion of the bushing 39.

It will be noted that bushing 39 is suitably counterbored as at 39a to define a recess for receiving an O ring 43 made of resilient material and adapted to snugly surround the plunger 40.

The enlarged end of the plunger 40 comes in registry with the irregular cam-like periphery of the enlarged portion of the shaft 33. Thus, a switch handle (not shown) attached to shaft 33 may be moved to actuate the switch mechanism from an off position to only one contact position, but to reach other contact positions, the plunger 40 must be depressed, thereby allowing free angular displacement of the shaft 33.

It will be evident that the switch arrangement herein described comprehends a sealing problem which has at least three different aspects—namely, the relatively stationary relationship of the conductors 22 to the cup 11, the rotative relationship between the shaft 33 and cap 16 (or to be more precise the threaded stem 34), and the reciprocative relationship between the plunger 40 and the bushing 39.

The novel arrangement of elements contemplated by the present invention solves the sealing problem by adequately safe-guarding against inadvertent leakage of moisture into the interior of the switch mechanism, or the housing enclosure with respect to all three aspects.

Therefore, it should be apparent to those versed in the art that we have described a novel and improved waterproofing arrangement for electrical apparatus which can be made of relatively simple parts thereby effecting efficient waterproofing with great economy.

It will be readily understood that persons versed in the art will recognize the possibility of making certain modifications to the present invention, however, it should be clear that we do not wish to be limited to the specific embodiment herein shown by way of preferred example, but wish to obtain protection with respect to all embodiments which fall within acknowledged spirit and scope of our invention.

We claim as our invention:

1. An arrangement for waterproofing an electrical apparatus having a perforated enclosure to be entered by conductor wires, a rotary shaft and a plunger, comprising a resilient grommet around each conductor wire seatable in conductor wire perforations defined by said enclosure, a grommet retainer plate, a retainer plate stud carried by said enclosure and means to adjustably position said plate on said stud relative to

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said enclosure to elastically deform all of said grommets for watertight sealing at the locale of the points of entry of said conductor wires into said enclosure, resilient O rings carried by said plunger and said shaft, and bushing means carried by said enclosure cooperable with said O rings to produce a sealing relationship between said shaft and said plunger at the locale of said O rings.

2. An arrangement for waterproofing a rotary multiple-position safety-lock switch of the class having a bushinged safety-lock plunger and a bushinged rotary shaft extending into a perforated cup and plurality of insulated lead-wires extending away from said cup, said arrangement comprising a resilient grommet around each lead-wire seatable in the lead-wire perforations defined by said cup, a grommet retainer adjustably carried by said cup to compressibly deform all of said grommets for watertight sealing at the locale at the point of entry of said lead-wires into said cup, and resilient O rings carried by the plunger of said safety-lock and the shaft of said rotary switch cooperable with the bushing means carried by said cup to form a water-tight seal at the locale of the points of entry of said plunger and said shaft into said cup.

3. In a sealing arrangement for a waterproof switch assembly, a housing having one end defining a plurality of grommet apertures, a plurality of insulated lead-wires extending through said apertures, a resilient grommet around each of said lead-wires and seated in each of said apertures, an adjustable grommet retainer defining a plurality of lead-wire apertures engaging the ends of said grommets and adjusting means between said end of said housing and said grommet retainer, whereby said grommets may be elastically deformed against their inherent resilience to produce a water-tight seal at the locale of said grommet apertures.

4. In a waterproofing arrangement for an electrical apparatus, a housing having one wall formed with a plurality of spaced apart apertures therein, an insulated conductor wire passing through each of said apertures, a stud mounted on said one wall and arranged in a relatively centrally disposed position with respect to the said apertures, a grommet around each of said conductor wires, each of said grommets being made of a flexible material and being generally tubular with one end forming an enlarged seating portion and the other end forming a tapered sleeve portion, there being an annular shoulder between the ends of said grommet, the tubular bore of said grommet having a reduced diameter portion at the enlarged seating portion end of the grommet, a plate having a plurality of apertures arranged to correspond to the apertures in said one wall of said housing, and means to adjustably position said plate on said stud, the enlarged seating portion of each of said grommets being seatable on the edge portions of said plate apertures, said plate being positionable to move the tapered portions of the grommets through the apertures

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in said wall and engage the said shoulders of each of said grommets against the edge portions of said apertures in said housing wall, whereby each of said grommets will be elastically deformed to snugly engage and seal the housing and the conductor wires.

5. In a waterproof electrical assembly having a lead-wire entering a shell housing, an improved water-proofing arrangement including a resilient grommet defining a shell housing seating portion and an enlarged head portion adjacent thereto, said grommet having a lead-wire-receiving bore extending therethrough, an adjustable grommet retainer defining a lead-wire aperture, the edges of said aperture being arranged to shoulder against said enlarged head portion or said grommet when said grommet is seated in said shell housing, said grommet retainer arranged for adjustable positioning relative to said shell housing, and means to draw up said grommet retainer in firm assembly with said shell housing to elastically deform said grommet into seal forming relationship with said shell housing.

6. In a sealing arrangement for a water-proof electrical assembly, a housing defining a plurality of grommet apertures, a plurality of insulated lead-wire extending through said apertures, a resilient grommet around each of said lead-wires and seated in each of said apertures, an adjustable grommet retainer defining a plurality of lead-wire apertures engaging the ends of said grommets and adjusting means between said housing and said grommet retainer, whereby said grommets may be elastically deformed against their inherent resilience to produce a water-tight seal at the locale of said grommet apertures.

7. In a sealing arrangement for an electrical apparatus, an electrical device having an aperture therein, an insulated lead-wire extending into said electrical device through said aperture to establish electrical communication therewith, a resilient grommet surrounding said lead-wire and having one end thereof seated in said aperture, a grommet retainer having an aperture therein to surround and engage the other end of said grommet, and locking means between said electrical device and said grommet retainer selectively engageable with one another to elastically deform said grommet against the inherent resilience thereof for sealing said lead-wire at the locale of said grommet, thereby to preclude leakage to said electrical device.

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