Nov. 23, 1965 C. S. YOUNG 3,219,811

WATERTIGHT FLASHLIGHT WITH MAGNETIC SWITCH

Filed Feb. 5, 1963

Fig. 1

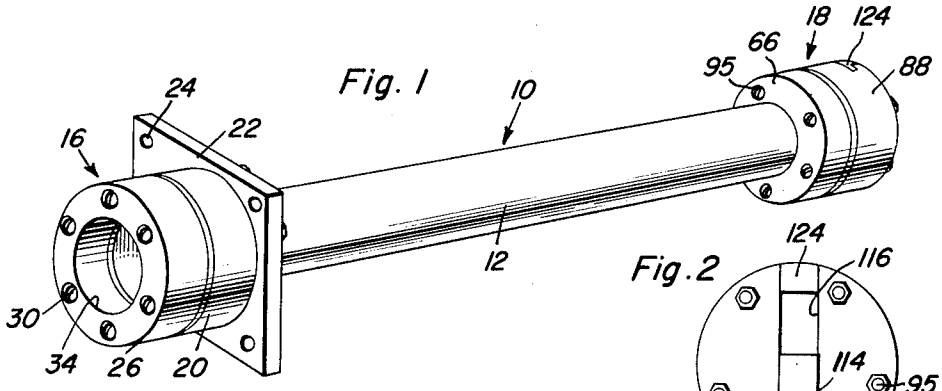


Fig. 2

Fig. 3

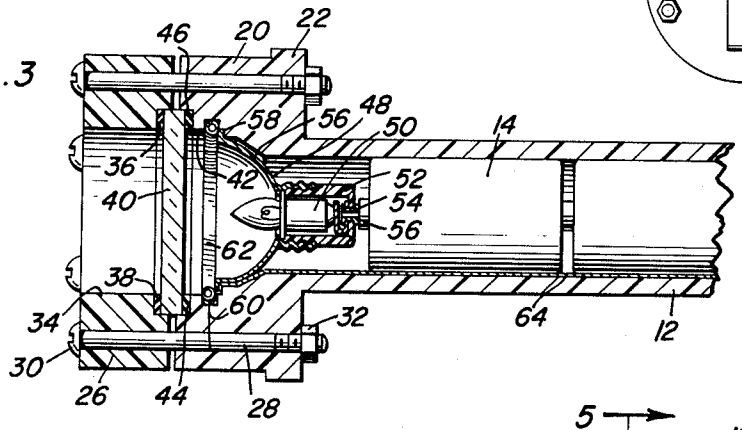


Fig. 4

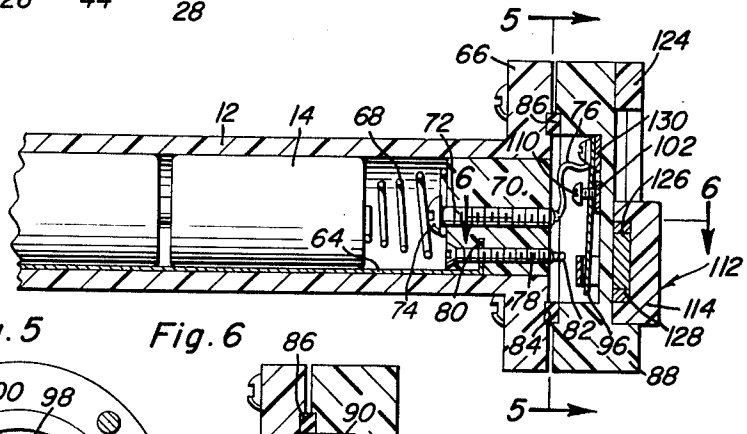


Fig. 5

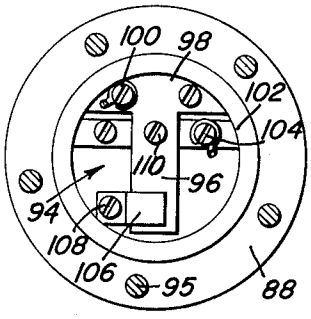
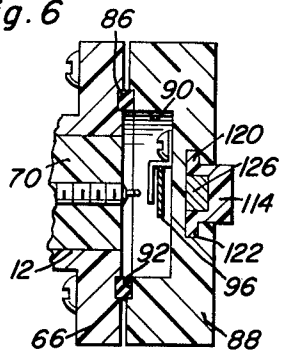


Fig. 6



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WATERTIGHT FLASHLIGHT WITH MAGNETIC SWITCH

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The present invention generally relates to a flashlight constructed in a manner to be completely sealed to prevent the entry of various types of fluids such as water, gases or the like even at relatively high pressures thereby enabling the flashlight to be effectively employed by skin divers or other persons requiring the use of a light under water even at great depths and also facilitating the use of the device by persons encountering explosive gaseous mixtures and the like since the entire apparatus is completely sealed from the surrounding atmosphere.

An object of the present invention is to provide a flashlight constructed in such a manner that the components thereof are securely and positively sealed against entry of fluids even at high pressure.

Another object of the present invention is to provide a flashlight having a slidable permanent magnet mounted exteriorly of the casing which will operate a switch mechanism disposed interiorly of the casing, the particular construction of the switch being such as to prevent any possible flashing of the light when the switch is in both the "on" position and the "off" position.

A further object of the present invention is to provide a flashlight in accordance with the preceding objects having a novel head construction provided with facing flanges each having an annular recess therein for receiving a seal and partially receiving a plate glass lens thereby effectively sealing the lens and the head of the flashlight.

Still a further feature of the invention is to provide a flashlight having a head in accordance with the preceding object together with a novel resilient coil spring which retains the reflector assembly in place and also assures positive contact between the reflector assembly which holds the light bulb and the conductor which extends rearwardly of the casing for contact with the base of the dry cell battery through the switch mechanism.

Yet another important feature of the present invention is to provide a flashlight having a permanent magnet movable to control an interior switch with the permanent magnet being held by its own magnetic qualities in both positions thereby preventing the flashlight from accidentally being turned on or off by vibration or the like.

Still other features of the invention reside in its extreme simplicity of construction, dependability, ease of operation, effectiveness in providing a fluidtight seal, capability of being manufactured in different sizes and its relatively inexpensive manufacturing cost.

These together with other objects and advantages which will become subsequently apparent reside in the details of construction and operation as more fully hereinafter described and claimed, reference being had to the accompanying drawings forming a part hereof, wherein like numerals refer to like parts throughout, and in which:

FIGURE 1 is a perspective view of the flashlight of the present invention;

FIGURE 2 is a rear end view illustrating the switch operator assembly;

FIGURE 3 is a detailed longitudinal sectional view through the head portion of the flashlight;

FIGURE 4 is a detailed longitudinal sectional view through the switch portion of the flashlight;

FIGURE 5 is a transverse, sectional view taken substantially upon a plane passing along section line 5—5 of

FIGURE 4 illustrating the structural details of the switch mechanism; and

FIGURE 6 is a detailed plan sectional view taken substantially upon a plane passing along section line 6—6 of FIGURE 4 illustrating further structural details of the switch mechanism.

Referring now specifically to the drawings, the numeral **10** generally designates the flashlight of the present invention which is constructed with an elongated tubular casing **12** preferably but not limited to a cylindrical configuration. The casing **12** is preferably constructed of insulating material and such material may be in the form of a plastic having any suitable color or being transparent if desired. The length of the casing **12** may vary depending upon the number of conventional dry cells **14** which are to be employed. The flashlight of the present invention may be effectively used with a single dry cell or any desired number of dry cells and the dry cells may be of any conventional size although the standard "D" size battery is preferred. The interior size of the casing **12** is just sufficient to closely receive the dry cell batteries **14** but still sufficient in size to enable them to be readily slid into and out of the casing **12** in a conventional manner.

At one end of the casing **12** there is provided a watertight head generally designated by the numeral **16** and at the other end there is provided a watertight switch assembly generally designated by the numeral **18**.

The head assembly is illustrated in FIGURE 3 and includes an enlarged cylindrical portion **20** having a square or rectangular flange **22** at the inner end thereof. The flange **22** provides a supporting surface for the flashlight to prevent it from rolling when resting upon a supporting surface. This is significant especially when used on a boat or the like which is subject to considerable movement due to wave action and the like. Thus, the flange **22** provides stability for the flashlight so that it will stay in the position in which it is laid. Also, the flange **22** is provided with apertures **24** therein for receiving a suitable tether line, hook or the like for securing the flashlight to a support such as some portion of the equipment of a skin diver or the like. This also will enable the flashlight to be supported on a vertical wall surface such as the bulkhead of a ship, boat or the like thereby facilitating the storage of the flashlight when not in use.

Disposed outwardly of the enlarged portion **20** is a similar enlarged cap **26**. The enlarged cap **26** and the portion **20** are both of cylindrical configuration although this configuration may vary if desired. Extending between and through the cap **26** and portion **20** are a plurality of clamping bolts or screws **28** having rounded heads **30** on one end thereof and retaining nuts **32** on the other which may be conventional polygonal nuts, wing nuts or any other suitable types of clamping nuts. Also, the heads **30** may vary between the round headed arrangement illustrated to any other conventional head. The bolts **28** are constructed of material impervious to corrosive action of sea water such as brass, bronze, nonmagnetic stainless steel or the like.

The retaining cap **26** has an enlarged central bore **34** which terminates at its inner end in a recess **36** receiving an annular gasket or seal ring **38** and receiving a portion of the periphery of a plate glass lens **40** which is circular in configuration. The cylindrical portion **20** includes an enlarged central bore **42** in alignment with the bore **34** and the outer end of the bore **42** is provided with an annular recess **44** comparable to the recess **36** and the recess **44** receives an annular sealing gasket or seal ring **46** similar to the seal ring **38** and also a portion of the periphery of the plate glass lens **40**. This prevents the seal rings from slipping out under high pressures. The combined thicknesses of the lens **40** and the seal rings **38**

and 46 is more than the distance between the opposed surfaces of the recesses 36 and 44 thus spacing the cap 26 from the portion 20 and enabling the clamp bolts 28 to be tightened evenly thereby compressing the seal rings 38 and 46 for effectively sealing the plate glass lens to the cylindrical portion 20 and forming a fluidtight closure for the bore 42 thereby preventing entry of liquids, gases or other pressurized fluids even at relatively high pressures.

Disposed in the cylindrical portion 20 is a reflector assembly 48 having a conventional bulb 50 mounted therein and retained in position by a screw-threaded base 52 having a contact grommet 54 engaging the center terminal 56 on the dry cell 14. The reflector assembly is of conventional construction and is received in a corresponding recess or bore 56 in the cylindrical portion 20 which forms a transition from the interior bore of the casing 12 to the bore 42 for removably receiving the reflector assembly 48.

The outer end of the reflector assembly 48 is provided with a flange 58 disposed at one edge of an annular groove 60 formed at the inner end of the bore 42. The groove 60 receives a retaining coil spring 62 which is snapped into the grooves 60 and due to its natural resiliency expands into the groove 60 which is sufficiently deep to receive a major portion of the cross-sectional area of the spring 62 thereby serving to retain the spring within the groove and at the same time retain pressure against the outer face of the flange 58 as illustrated in FIGURE 3. This assures contact between the reflector assembly 48 and an elongated conductor 64 extending rearwardly of the casing and having a forward end extending partially around the flange 58 and in surface-contact therewith which enables the reflector assembly to be removed without disturbing the conductor 64. Thus, by removing the spring 62 which has the ends thereof slightly spaced, the reflector assembly may be removed for replacing the bulb and also for repolishing the reflector surface if this becomes necessary although the reflector surface will not corrode due to the fluidtight condition of the flashlight. The resilient character of the spring 62 will assure that the reflector always contacts the conductor 64 thereby assuring proper completion of the electrical circuit insofar as the conductor 64 and reflector assembly including the bulb is concerned.

The switch assembly at the opposite end of the casing 12 is illustrated in FIGURES 4–6 and includes a peripheral flange 66 integral with the casing 12 together with a spiral coil compression spring 68 engaging the base of the exterior casing of the dry cell battery 14. A plug 70 is disposed in the end of the casing 12 in a permanent manner and includes a central screw-threaded member 72 extending therethrough which has the headed end 74 engaging the base of the spring 68 for securing the spring to the plug 70 and at the same time forming an electrical connection with the spring 68. The other end of the screw 70 is connected to a short flexible insulated conductor wire 76. Also disposed in the plug 70 is a screw-threaded member 78 extending through and electrically connected with the rear end of the conductor 64 by virtue of an offset flange 80 being formed on the conductor 64 with the screw-threaded member 78 extending therethrough. The outer end of the member 78 is provided with an insulated flexible conductor wire 82 connected thereto.

The rear flat surface of the flange 66 is provided with a peripheral groove 84 for receiving an annular sealing gasket or sealing ring 86 therein. Also engaging the sealing gasket or sealing ring is a sealing and retaining cap 88 having a central recess 90 communicating with the rear surface of the plug 70. The surface of the cap 88 facing the flange 66 includes an annular recess 92 matching the groove or recess 84 thereby further receiving the annular sealing gasket or sealing ring for sealing the cap 88 to the flange 66 by virtue of a plurality of clamp bolt assemblies 95 similar to the clamp bolt 28 but shorter in length.

Disposed in the recess 90 is a switch assembly generally designated by numeral 94 and including a resilient arm 96 having an arcuate base 98 conforming with the curvature of the recess 90 and secured to the bottom of the recess 90 as by screws 100. One of the screws 100 receives thereunder the conductor 76 whereby the resilient arm 96 is electrically connected to the conductor 76. A transverse bar 102 underlies the resilient arm 96 in spaced relation to the base 98 and also in spaced relation to the free end of the arm 96. The bar 102 is secured in place by screws 104 and one of the screws 104 receives the end of the conductor 82 thereby electrically connecting the bar 102 to the conductor 64 while the arm 96 is electrically connected to the base of the dry cell batteries 14. A retaining clip 106 is provided in overlying relation to the free end of the resilient arm 96 to prevent its outward movement beyond a particular point and the clip 106 is secured in place by a suitable screw 108. The resilient arm 96 is provided with a screw-threaded contact member 110 extending therethrough in alignment with the bar 102 so that when the inner end of the screw 110 contacts the bar 102, the electrical circuit between the batteries 14 and the light bulb will be completed thereby illuminating the light bulb in a known manner. The screw 110 is capable of adjustment so that the movement of the resilient arm 96 will cause a positive contact between the screw contact 110 and the bar 102 as clearly illustrated in FIGURE 4. Inasmuch as all of the screws are relatively short, the surface of the cap 88 which forms the recess 90 is continuous and uninterrupted.

For operating the resilient arm 96 of the switch assembly 94, there is provided a switch operator generally designated by numeral 112 which includes a casing 114 slidable in a groove 116 defined in the rear surface of the cap 88. The casing 114 is provided with laterally extending flanges 120 slidable in corresponding undercut grooves 122 formed in the bottom of the transverse groove 116. A closure plug 124 is provided for the end of the groove 116 to form a closure therefor after the switch actuator 112 has been assembled therein. The casing 114 is provided with a recess 126 in the inner surface thereof receiving a permanent magnet assembly 128 which is of the Alnico type and is relatively strong for its size. As illustrated, the permanent magnet 128 is relatively adjacent to the resilient arm 96 and the outer end portion of the resilient arm 96 is constructed of a ferrous material or a ferrous material may be attached thereto if the resilient arm is constructed of brass material. In either event, the free end of the resilient arm will be attracted by the magnet field produced by the permanent magnet 128 when the permanent magnet 128 is moved into alignment with the free end of the resilient arm 96. This will draw the resilient arm towards the magnet thus causing the contact screw 110 to positively engage the contact bar 102 for completing the circuit. As the permanent magnet 128 is moved to its opposite position from that illustrated in FIGURE 4, the magnetic field will no longer influence the free end of the resilient arm 96 whereby the natural resiliency thereof will cause it to move away from the bottom of the recess thus moving the contact screw 110 away from the contact bar 102 for breaking the circuit. An insert of ferrous material 130 is provided under the base 98 so that the permanent magnet 128 will be retained in its off position. Also, the ferrous material forming the end of the resilient arm 96 or attached thereto will serve to retain the permanent magnet 128 in the on position to prevent accidental movement of the permanent magnet from either of its extreme positions due to vibrations or the like thereby requiring manual force to be exerted on the housing 114 to manually move the magnet. Also, since the permanent magnet 128 is exposed to the exterior surface of the flashlight, the components of the magnet will be electroplated with a corrosive resistant material which will not materially affect the magnetic field produced thereby.

Thus, with the construction of the present invention, a

completely watertight and fluidtight flashlight is provided which is capable of use by divers under water at relatively great depths without leakage and also capable of being used in atmospheres of inflammable or explosive gases or the like and yet which is relatively simple in construction and easy to operate and constructed of a minimum number of parts.

The conductor **64** may conveniently be embedded in the casing when the casing is formed. While various types of plastics or equivalent materials may be used, it is desirable that the material be of the high impact type capable of withstanding rather rough usage such as might occur when the device is used by skin divers, fishermen or the like. One type of material that has been found acceptable is "Plexiglas," a thermoplastic acrylic resin manufactured by Rohm & Haas Co.

The dimensions of the various components of the flashlight may vary depending upon the overall size characteristics desired. For example, the dimensions of a five or six cell flashlight would be considerably larger throughout as compared with a one or two cell flashlight. A plate glass lens is employed to eliminate scratching which would occur if a transparent plastic lens was employed. While such scratches could be polished out of a plastic lens, such polishing introduces optical distortions thereby reducing the effectiveness of the light especially when used under water.

The foregoing is considered as illustrative only of the principles of the invention. Further, since numerous modifications and changes will readily occur to those skilled in the art, it is not desired to limit the invention to the exact construction and operation shown and described, and accordingly all suitable modifications and equivalents may be resorted to, falling within the scope of the invention as claimed.

What is claimed as new is as follows:

1. A flashlight comprising a casing for receiving dry cell battery means therein, said dry cell battery means having a center terminal, a watertight head at one end of said casing, said head including a cap removably attached thereto, said cap and head including opposed surfaces having recess means therein receiving an annular seal ring, a plurality of clamp bolts extending through the cap and head for rigidly clamping the cap thereto for retaining the seal ring in compression for sealing the head, the other end of said casing having internal switch means mounted thereon, a reflector assembly having a conventional bulb mounted therein, said bulb contacting said reflector assembly and said reflector assembly engaging said center terminal of said dry cell battery means, and said reflector assembly being in contact through an elongated conductor to said internal switch means, and an externally mounted movable magnetic means, said switch means including means responsive to movement of the externally mounted magnetic means for operation of the switch from the exterior of the flashlight thereby retaining the flashlight in fluidtight condition at relatively high pressures, said external magnetic means including a permanent magnet, a housing of insulative material for said magnet, said housing being transversely slidable on the end of the flashlight remote from the head, said switch means including a ferrous component movable in response to attraction of the magnetic means when moved to a particular position, and a ferrous insert in remote relation to the switch means whereby the magnetic means will be attracted thereto and retained in an inoperative position thereby assuring that the magnetic means will not move from either of its two positions during normal handling of the flashlight.

2. A flashlight comprising a casing for receiving dry cell battery means therein, a watertight head at one end of said casing, said head including a cap removably attached thereto, said cap and head including opposed surfaces having recess means therein receiving an annular seal ring, a plurality of clamp bolts extending through the cap and head for rigidly clamping the cap thereto for retaining the seal ring in compression for sealing the head, said head including a removable reflector assembly and bulb, said bulb being mounted in said reflector assembly and retained in position therein by a screw threaded base, said screw-threaded base having a contact grommet thereon for engaging the center terminal on a dry cell battery, the other end of said casing having internal switch means mounted thereon, said switch means being electrically connected to the base terminal of the battery means, a conductor extending from the switch means to engagement with the reflector assembly for completion of the circuit by the base terminal of the dry cell battery means when the switch means is closed thereby completing a circuit and illuminating the bulb, and an externally mounted movable magnetic means, said switch means including means responsive to movement of the externally mounted magnetic means for operation of the switch from the exterior of the flashlight thereby retaining the flashlight in fluidtight condition at relatively high pressures, said head having an annular groove forwardly of the reflector assembly and receiving a peripheral flange on the reflector component of the reflector and bulb assembly, said peripheral flange being adjacent to the open concave side of the reflector, said conductor engaging the reflector adjacent to the peripheral flange thereof, and an annular coil spring received in the groove for retaining the reflector and bulb assembly in position and also resiliently biasing the flange of the reflector against the end of the conductor thereby assuring electrical contact therebetween.

3. A flashlight comprising an elongated tubular casing for housing a number of conventional dry cells, a watertight head disposed at one end of the casing, a watertight switch assembly disposed at the other end of said casing, said watertight head including a cap, said cap having an enlarged central bore therein terminating at its inner end in a recess, an annular gasket received within said recess and a plate glass lens received within said recess, said head assembly including an enlarged cylindrical portion, said cylindrical portion including an enlarged central bore in alignment with said bore in said cap, the outer end of the bore in said cylindrical portion being provided with an annular recess comparable to the annular recess in the cap, said annular recess in the cylindrical portion receiving an annular sealing gasket and a portion of the periphery of the plate glass lens, means joining said cap to said cylindrical portion for compressing the annular sealing gasket within the recess in the cap and in said cylindrical portion for effectively sealing the plate glass lens to the cylindrical portion, a reflector disposed in the central portion, said reflector having a conventional bulb mounted therein and being retained in position by a screw threaded base on said bulb, said screw threaded base having a contact grommet thereon for engaging the central terminal on the dry cell, said reflector being received within a second bore in the cylindrical portion forming a transition from the first bore in the cylindrical portion for removably receiving the reflector, said reflector being provided at its outer end with a flange, an annular groove formed in the inner end of the first bore in said cylindrical portion, said groove receiving a retaining coil spring snapped into the groove, said coil spring serving to retain said reflector and to hold said reflector in contact with an elongated conductor extending rearwardly of the casing, said switch assembly including a peripheral flange integral with the casing and a spiral compression spring engaging the base of a dry cell battery retained within the flashlight casing, a plug disposed in the end of the casing, said plug including a central screw threaded member extending therethrough, said screw threaded member having a headed end engaging the base of the coil compression spring forming an electrical contact with the coil spring, the other end of the screw threaded member being connected to a conductor wire, a second screw

threaded member extending through said plug and being in electrical contact with the rear end of the elongated conductor, the other end of said second screw threaded member being provided with a flexible conductor wire connected thereto, said flange being provided with a peripheral groove in the rear flat surface thereof for receiving an annular sealing ring therein, a retaining cap having a central recess therein engaging the sealing ring, said central recess in said retaining cap communicating with the rear surface of said plug, an annular recess in said retaining cap for receiving said annular sealing ring for sealing the cap to the flange, means in said cap and flange for compressing the cap and flange together in sealing relationship against said sealing ring, said switch assembly being disposed in the recess having an arcuate base conforming with the curvature of the recess and being secured to the bottom of the recess by screws, one of said screws receiving thereunder the conductor connected to the end of said first screw threaded member to electrically connect the resilient arm to the conductor, a transverse arm underlying the resilient arm in spaced relation to the arcuate base and also in spaced relation to the free end of the arm, said transverse arm being secured in place by screws one of which receives the end of the conductor connected to the second of said screw threaded members thereby electrically connecting the transverse bar to the elongated conductor, a screw threaded contact member in said resilient arm extending therethrough in alignment with said bar to provide an electrical circuit between the

batteries and the light bulb when the inner end of said screw contact member contacts said bar, a switch operator slidably disposed in a groove defined in the rear surface of said cap, a permanent magnet assembly in said switch assembly for attracting the resilient arm of said switch assembly when the permanent magnet of said switch assembly is moved into alignment with the free end of the resilient arm thereby drawing the resilient arm towards the magnet and thus causing the contact screw to positively engage the transverse bar for completing the circuit.

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