April 8, 1947. D. F. GEIGER 2,418,631

UNDERWATER TORCH LIGHTER

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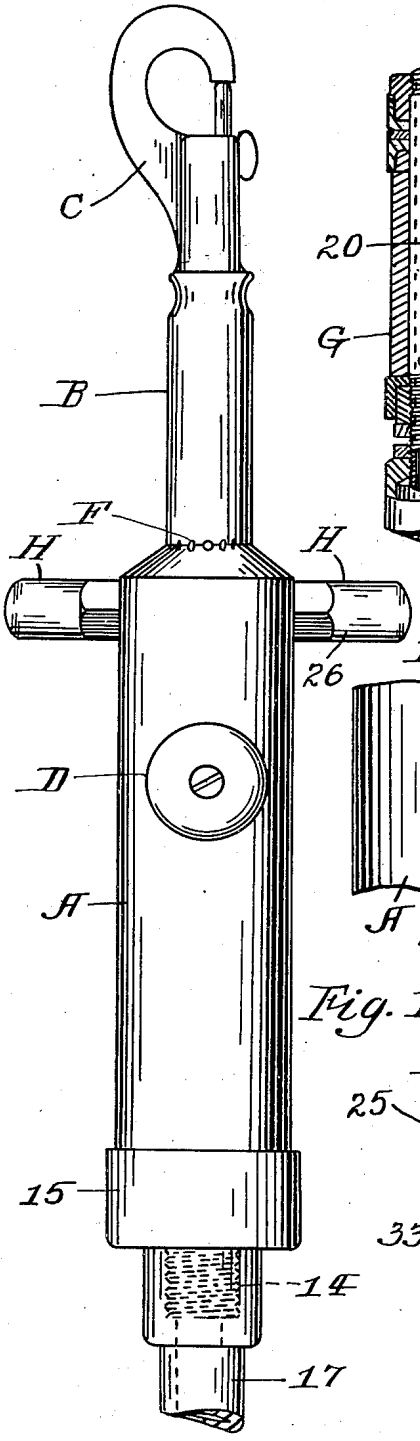

Fig. 1.

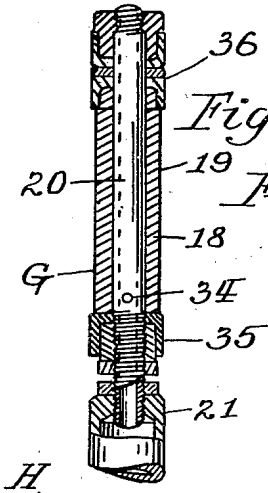

Fig. 4.

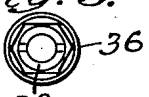

Fig. 5.

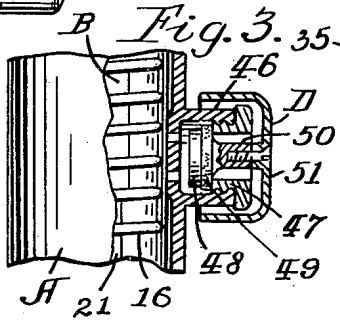

Fig. 3.

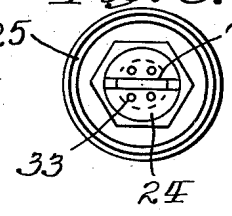

Fig. 6.

Fig. 2.

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UNDERWATER TORCH LIGHTER

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4 Claims. (Cl. 67—20.1)

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This invention relates to improvements in torch lighters and more particularly to that type which is adapted for use by an operator for cutting or welding while submerged at any depth in water to inflame an acetylene or other type of gas torch, thereby eliminating the necessity of the operator returning to the surface for the purpose of lighting the torch. The invention further relates to the improved method employed for creating inflaming means for the aforesaid use. One of the objects of the invention is dependability in operation and the production of a device of its kind which is not liable to get out of order and which is thoroughly protected against the effect of water at any depth when an operator is submerged. A further object is the production of a device of its kind which can be carried by an operator in readiness for instant use and which when not in use can be carried in such manner as to be out of the way. Among further objects and features of advantage are maximum simplicity of construction and effectiveness in use.

In the accompanying drawing forming part of this specification, Fig. 1 is a side elevation of my improved torch lighter; Fig. 2 is a central longitudinal section of my improvement, portions of the inner structure being shown in full; Fig. 3 is a side elevation of a detail, partly in central longitudinal section showing the construction of the hand operable actuating valve by the use of which the operation of the tool is controlled; Fig. 4 is a central longitudinal section of the spark generator; Fig. 5 is an end view of the spark generator, and Fig. 6 is an end view of the propeller head when removed from the structure.

In the drawing, A is an outer cylindrical shell which can be used as a handle for conveniently handling my improved torch lighter. The upper end of this shell has a tubular extension B of reduced diameter and forming an inner cylinder 10. On the outer extremity of the tubular extension is a clasp C resembling a snap hook which is secured thereto by the swivel 11 (see Fig. 2), whereby the device can be secured to a belt or other wearing apparel and carried by the body of the user out of the way but in readiness for instant use. Reciprocably disposed in the outer chamber 12 which is formed by the cylindrical shell A is a propelling piston 13 which is reciprocated in the cylinder by the positive force of air or other fluid which is maintained under suitable pressure, that is a predominating pressure greater than that of the pressure of water, according to the depth at which the torch lighter is

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used, and admitted through the supply nipple 14. The latter is formed with a cup 15 which is threadedly engaged over the lower end of the cylindrical shell A. The propelling piston 13 reciprocates forwardly against the tension of a helical spring 16 which is held while compressed by the piston in the outer cylinder and functions to return the piston to inactive position during the return stroke of each complete cycle of operation of the device.

A hand operable relief valve D in the side of the exhaust end of the outer cylindrical shell A serves when operated by depressing to release fluid medium under compression from ahead of the piston and within the shell outwardly, thus permitting fluid under suitable pressure entering the outer cylinder through the nipple 14 to propel the piston forwardly. Normally when not depressed the relief valve seats automatically by the force of the fluid within the outer cylinder and checks the escape of fluid medium. The nipple 14 is adapted to be coupled to a flexible hose or other duct such as indicated at 17 leading from a suitable source of pressure fluid supply (not shown), thus enabling an operator to carry the torch lighter under or out of water in readiness for lighting a gas actuated cutting torch or other type of tool.

The reciprocable movement of the piston 13 is utilized to motivate a spark or flame generating unit by which a torch can be ignited, the igniting incandescent particles being projected from the device through the cluster of orifice ducts F in the side of the outer cylinder and entering the inner cylinder 10. The igniting means thus produced is through the use of friction between the equivalent of flint and abrasive surfaces, the latter as shown consisting of coacting movable abrasive and stationary units G and H.

One form of the abrasive unit G may comprise a sleeve 18 such as a file composed of steel or other suitable material and having a cylindrical abrasive or cutting surface 19. This sleeve is held rigidly over a longitudinal tubular shaft 20 which in turn is threadedly secured in the forward end of a tubular shaft section 21 of enlarged diameter, the latter being rigidly connected to and coaxial with the inner end of the propelling piston 13. The tubular shaft section 21 telescopes closely but freely in the inner cylinder 10, the latter projecting longitudinally into the outer cylinder 12 sufficiently to form a bearing for the movement of the abrasive unit G. Reciprocable

movement is imparted to the abrasive unit G against the tension of the helical spring 16 by piston 13 when the relief valve D is depressed. Simultaneously while the abrasive unit is advancing, rotary movement is imparted to the abrasive sleeve 18 by the helical blade 22 which is held as hereinafter described in the cup 15 and slides freely through a transverse slot 23 in a cap nut 24. The latter is threadedly secured over the rearward end of the tubular shaft section 21 and in addition to acting as a rotary motion transmitting element to the movable abrasive unit G as the propelling piston 13 advances also serves to firmly secure a compression packing ring 25 on the piston 13.

The stationary abrasive unit H is composed of one or more spring pressed brush elements, two being shown of similar construction. Each brush element consists of a chambered body 26, the open end of which is secured by threaded engagement at 27, while its axis is transverse to the axis of the sleeve 18. In this manner the brush body 26 is readily removable or can be replaced from time to time for the purpose of replacing worn brushes. The chambered body contains a spark producing brush 28 which is freely socketed in a brush holding cup 29 and is normally pressed with its inner end contacting the abrasive surface of the movable sleeve 18 by a compressed helical expansion spring 30. A stem 31 assists in holding the spring in place so that the latter will press the cup with its brush firmly in contact with the abrasive surface of the movable sleeve 18. The material out of which the spark producing brush is made may be flint either in solid or finely divided or ground condition pressed into a solid, or any other suitable material which will produce a spark by friction, grinding, impact or cutting action. Thus as the abrasive sleeve 18 is thrust forward and revolved a stream of incandescent particles is projected by contact with the brushes.

The abrasive sleeve 18 is of less diameter than the inner diameter of the outer cylinder 10, thus assisting in forming a spark chamber 32 with which the orifice ducts F connect when the piston is thrust forwardly and through which the exhaust stream or blast of inflaming medium produced by the sparks is projected by the force of fluid which is employed to reciprocate the piston 13. Propelling fluid such as air under suitable compression to overcome the force of water in which the device is used is admitted by the nipple 14 against the actuating piston 13 and enters the tubular shaft member 21 through the slot 23 in which the propeller blade 22 slides loosely and perforations 33. The compressed fluid enters the spark chamber 32 from the tubular shaft members 20 and 21 through the transverse duct 34. Suitable bearings 35 and 36 on the tubular shaft member 20 at the opposite ends of the abrasive sleeve 18 provide free but close sliding and rotating bearings for the abrasive sleeve and also serve to complete a closed spark chamber 32.

A suitable ratchet mechanism is provided in the stopper cup 15 which changes the abrading surface of the cylinder 18 as related to the brushes 28 each time the manually operable check valve D is operated, thereby changing the path of contact on the sleeve and evenly distributing wear. The ratchet means consists of a baffle disk 40 placed over the orifice through the nipple 14 and having perforations 41 through which the flow of fluid medium against the piston 13 has somewhat impeded passage. This disk rigidly carries the helical propeller blade 22 by which rotary movement is imparted to the shaft member 21 and abrading sleeve 18. A flat ring 42 is clamped below a packing washer 43 in the cup 15 between the end of the cylinder 12 and the cup, in spaced relation to the side of the disk 40 and is provided with a catch pin or dog 44 on its side facing the disk which is engaged in one of a circumferential series of openings 45 through the disk when the latter is moved ahead by the force of the operating fluid. In this manner during the forward movement of piston 13, when the check valve D is depressed and opened the pin 44 is engaged and the helical blade 22 is thus held stationary by the ratchet causing the abraiding sleeve to revolve. When the check valve D is released and closes automatically by fluid pressure the compression spring 16 returns the piston 13 and friction between nut 24 and the side of the helical blade 22 is sufficient to release the disk 40 from engagement with the pin 44, thus permitting the helical blade together with the friction sleeve 18 to revolve freely and frequently change the rotative position as related to the brushes. In this manner the friction surface on sleeve 18 is worn evenly and maintains effective sparking.

It will be noted that when the piston assumes returned position, that is when the admission of compressed fluid is checked by the release outwardly of valve D the forward bearing 36 assumes a position closing the spark orifice ducts F, thus preventing any liquid from outside entering the spark chamber 32 when the device is inactive.

The manually releasable check valve D by which the operation of the device is controlled consists of an annular nipple 46 which is integral with and connected with the chamber 12 within the cylindrical casing A. A cylindrical valve seat 47 is secured by threading into the outer end of nipple 46. A valve head 48 carrying a seating washer 49 normally closes the inner end of the valve seat by the force of fluid pressure in the chamber 12. A stem 50 projects outwardly through the valve seat and is secured to a freely movable hand operable depressing cup 51 over the outer end of the nipple and valve seat. By depressing this cup the check valve can be operated to allow the escape of fluid and release sufficient fluid back pressure within chamber 12 to cause the piston and the abrading sleeve 18 to be reciprocated forwardly and the latter rotated. In depressed position the hand operable depressing member 51 impinges against the side of the cylindrical shell A but in as much as it is cylindrical in shape free space is provided for the outflow of compressed fluid which is released from chamber 12. It will be noted that a port passage 52 through the side of the tubular shaft section 21 is for the free passage of compressed fluid, whereby the pressure between the inner and outer chambers within the cylindrical shell A is equalized to permit effective functioning of the device.

Operation

During the use of my improved lighter the flexible duct 17 is connected with a source of air or other fluid under sufficient pressure to overcome the predominating pressure of water in which a diver is submerged and who carries his torch and the lighter. When is is desired to inflame the torch the lighter is held by hand and

the check valve D depressed thus releasing the operating fluid against the piston 13 in cylinder 12 and causing the piston and the abrasive sleeve 18 to reciprocate forwardly and rotate. This action against the flint brushes produces a stream of sparks which are projected by the force of the compressed fluid in chamber 32 in a stream outwardly through the orifice ducts F in the side of the outer shell. The air or other fluid which is projected through said ducts with the stream of sparks forms a cluster of bubbles in the water enveloping the sparks which are projected and protected from the water by the air. The bubbles of air enclose the sparks and protect them from the water and also assist in supporting combustion, thereby maintaining the sparks in incandescent condition and alive over a prolonged period. The air in which the sparks are enveloped while traveling from the region of the sparking elements outwardly through the ducts F into the water tends to maintain the sparks alive. The speed at which the sparks are conducted by the air also assists in accomplishing this result. In this manner the incandescent spark particles produce an effective igniting flame by which the gases which are projected from the tip of the torch in the water can be readily ignited. During the forward stroke of the piston the abrasive sleeve is rotated by the engagement of the ratchet pin 44 and when reversed by the compression spring 16 the sleeve returns without rotating due to disengagement of said pin, whereby wear of the abrading surface of the sleeve is evenly distributed and the abrasive surface is maintained clean and sharp.

During the return stroke of the piston and the abrasive sleeve the flow of compressed fluid continues outwardly through the orifice ducts F and prevents the flooding of the spark chamber 32 until the forward bearing 36 closes said ducts at or near the end of the return stroke.

Where I have used the term "flint" in the specification and claims following, I mean it to include hard rock or any substance which is capable of generating sparks when subjected to the action of cutting, grinding, rubbing or striking by a coacting movable member including or in place of the abrasive cylinder G. The term "spark generator" is also intended to mean any set of relatively movable cooperating contact members capable of producing a mass of sparks which can be projected into the water in which the device is employed. It is further contemplated that the spark generator can be composed of members G and H in reversed condition, that is the sleeve 18 can be composed of flint or equivalent material and the brushes 28 constructed and used to abrade or cooperate with the flint to produce sparks within the spirit of the invention.

It will be understood that the device is not confined for use in water alone as it can be employed equally well in the outer atmosphere for igniting purposes.

In accordance with the patent statutes, I have described the principles of operation of my invention together with the construction thereof which I now consider to represent the best embodiment thereof, but I desire to have it understood that the structure shown is only illustrative and that the invention can be carried out by other means and applied to uses other than those above set forth within the spirit of the invention and within the scope of the following claims.

I claim:

1. An underwater torch lighter, comprising, a cylindrical enclosing shell structure connected with a source of fluid under pressure exceeding that of the water in which the torch lighter is submerged and having an egress duct at a point of ignition by the torch lighter, a plunger reciprocable forwardly in said cylindrical shell by the action of said pressure fluid in an actuating chamber formed by said shell and plunger, a compression spring in said shell for automatically returning the plunger to normal inactive position, manually operable means for releasing fluid from the cylindrical shell on the side of the plunger opposite said actuating chamber to cause the forward movement of the plunger, a spark generator actuated by the reciprocation of the plunger for producing inflaming medium in the cylindrical shell, said spark generator consisting of a friction cylinder rotatively mounted upon said plunger and a brush composed of flint bearing upon the moving surface of the cylinder to produce a stream of inflaming particles, means actuated by the source of pressure fluid for simultaneously ejecting a stream of the inflaming medium through said egress duct at said point of ignition into the water in which the torch lighter is submerged, and ratchet controlled means for causing the friction cylinder to rotate during its forward stroke and to idle during its return stroke, whereby the path of contact between the friction cylinder and said brush is periodically changed for the purposes specified.

2. A subaqueous torch lighter, comprising, a normally closed cylindrical casing having an ingress duct for propelling fluid under pressure exceeding the pressure of the water in which said cylindrical casing is submerged and a valved egress duct, torch lighting spark generating means in said cylindrical casing to be actuated by the release of pressure of said fluid through the opening of said valved egress duct, said cylindrical casing having an orifice in proximity to said spark generating means and entering the water in which said cylindrical casing is submerged, and said spark generating means having a valve normally closing said orifice and opened automatically by the actuated movement of the spark generating means to simultaneously release a stream of said fluid accompanied by said igniting sparks into the water in which said cylindrical casing is submerged.

3. An underwater torch lighter, comprising, a cylindrical casing having an ingress duct for the admission of air under pressure exceeding the pressure of the water in which the casing is submerged, a piston reciprocable by the force of air admitted into said casing, resilient means urging the piston into normal inactive position, a relief valve controlling the release of air pressure from a portion of said casing opposite that to which air pressure is applied to overcome the tension of said resilient means opposed to the air admitted into said casing and cause the forward reciprocation of said piston, spark generating means having a pyrophoric sparking plunger, means interposed between said plunger and said piston for causing the rotation and reciprocation of the plunger and the simultaneous production of igniting sparks by the forward reciprocation of the piston, said casing having an orifice in advance of said plunger and said plunger having a valve normally closing said orifice during the inactive position of the plunger and opening said

orifice when the plunger is reciprocated forwardly to transmit spark laden air into the water in which the casing is submerged.

4. A self-contained subaqueous torch lighter, comprising, a normally closed cylindrical casing to be submerged in water, having an inlet for a stream of air under pressure in excess of the pressure of water at predetermined depth and an orifice for delivering a stream of air into the water, a reciprocable actuating piston in the cylindrical casing, vent valve means in the cylindrical casing, resilient means for returning the piston to normal inactive position, said vent valve when opened releasing air from said cylindrical casing to cause the forward reciprocation of the piston and when closed permitting said resilient means to return the piston to normal inactive position, pyrophoric sparking means in said cylindrical casing connected with said inlet and reciprocated forwardly and rotated simultaneously by the forward reciprocation of said piston, valve means actuated by the pyrophoric means for opening said orifice when the pyrophoric means is reciprocated forwardly to discharge a stream of air and sparks into the water in which the torch lighter is submerged and normally closing said orifice when the pyrophoric means returns to inactive position.

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