June 12, 1962 L. ALPERT 3,038,973

IMPACT SWITCH

Filed Feb. 6, 1961

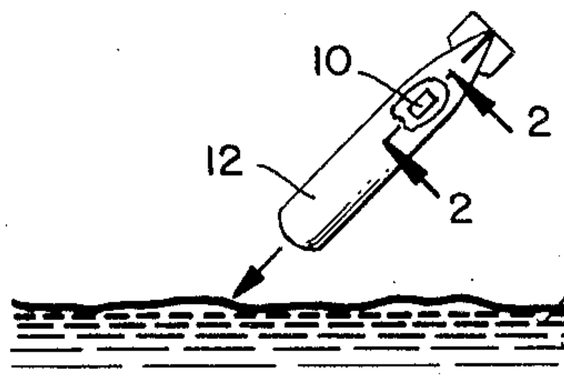

FIG. 1.

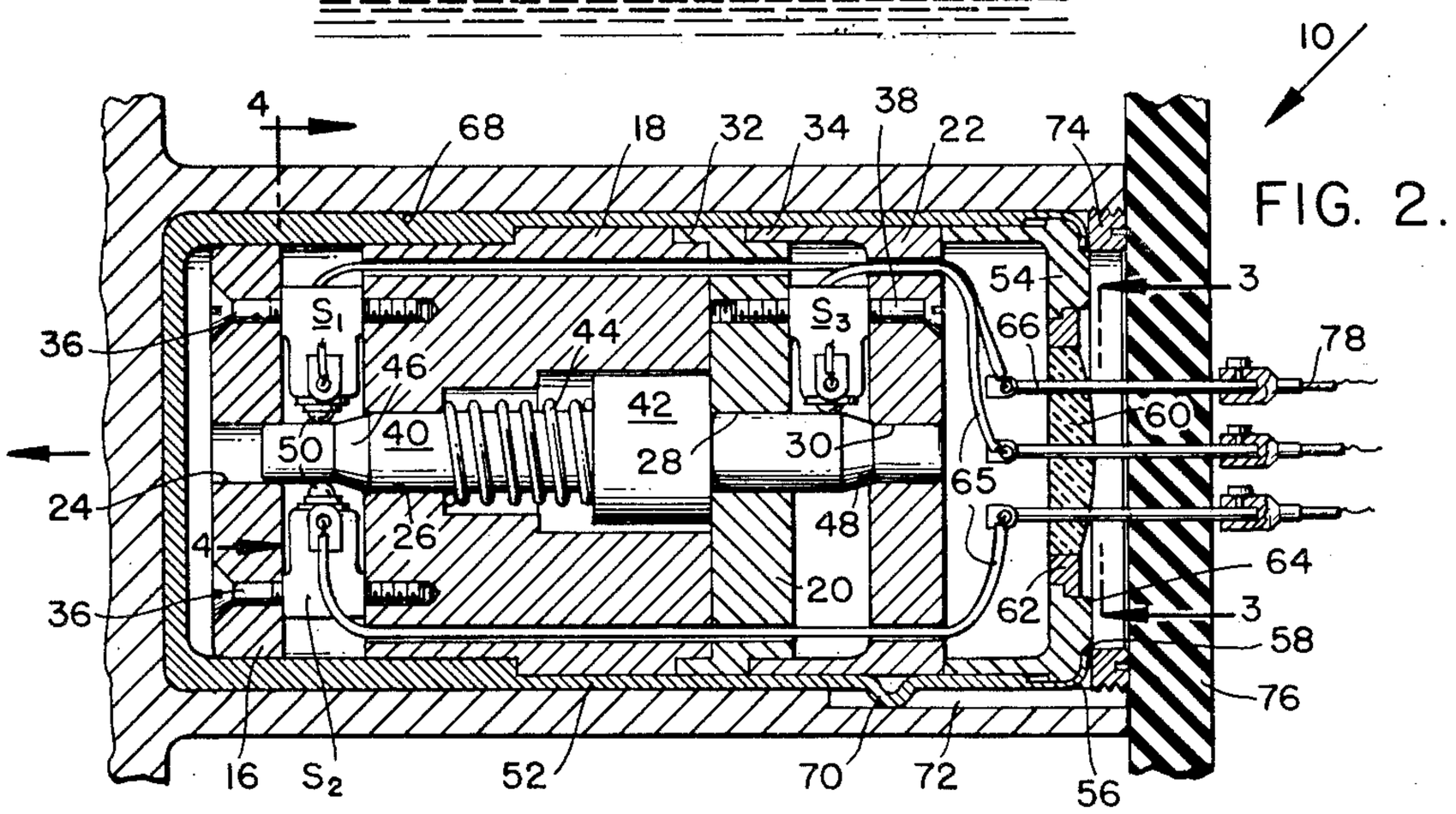

FIG. 2.

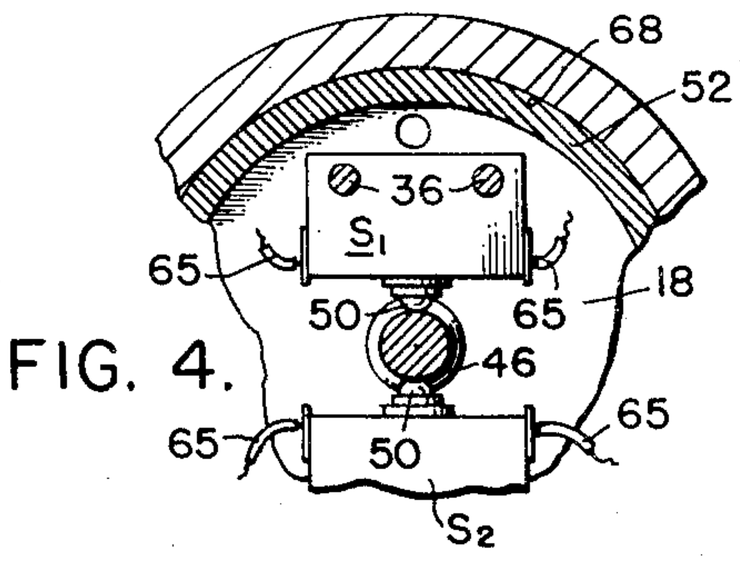

FIG. 4.

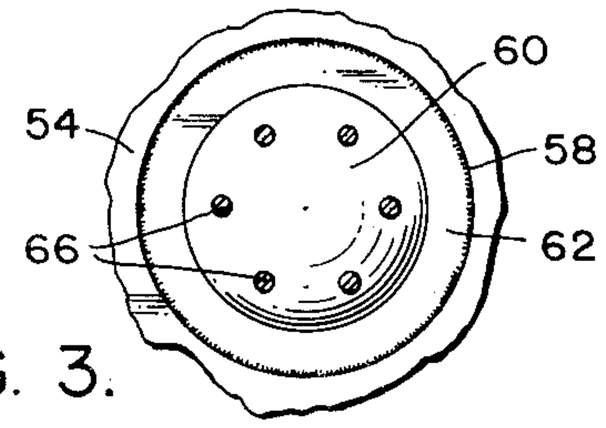

FIG. 3.

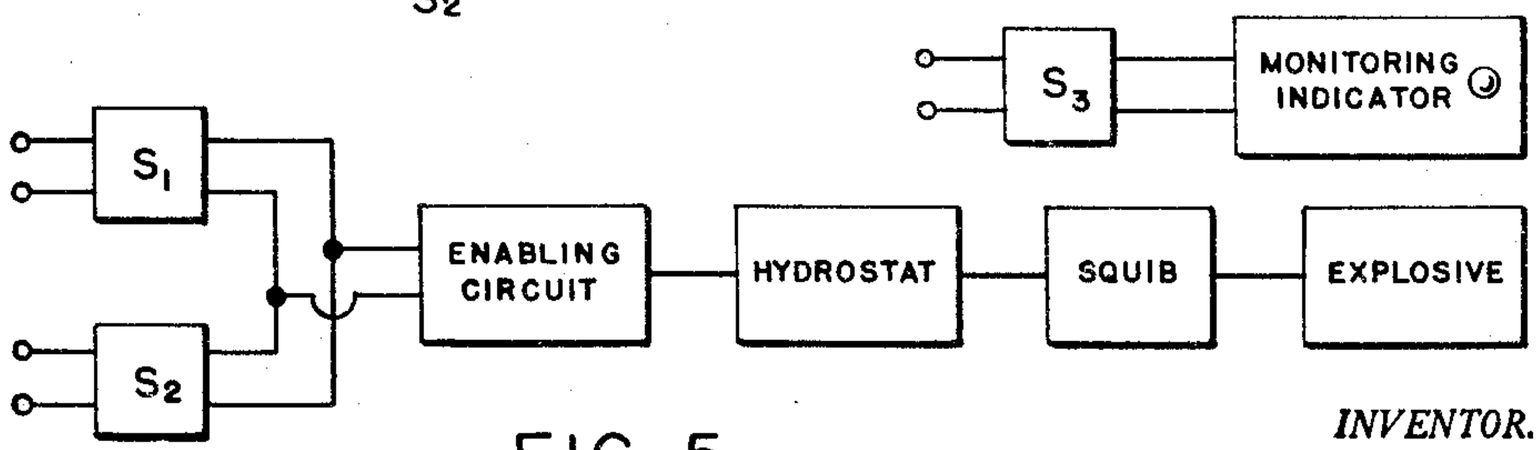

FIG. 5.

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IMPACT SWITCH

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This invention relates to air dropped underwater ordnance, such as depth charges, and more particularly to an inertia actuated enabling switch, actuated by water entry impact, employed in a depth charge fuzing system.

A relatively new technique of delivering depth charges to submerged targets, such as enemy submarines, is by rocket motor which carries the depth charge from a launching ship through an air trajectory of substantial range to the desired point of water entry, exemplary of which is disclosed in the patent application of Saholt et al. for Rocket Thrown Missile, Serial No. 8,201, filed February 11, 1960. While water entry impact switches have heretofore been employed with such missiles they have not been entirely satisfactory due to unreliability, difficulties encountered in surveillance tests and costs of manufacture.

One of the objects of this invention is to provide a momentary contact impact switch device which will simultaneously and independently energize a plurality of enabling fuse arming circuits.

Another object is to provide monitoring intelligence for such switch device.

Another object is to provide a hermetically sealed switch device which may be readily tested without subjecting it to a destructive test.

Further objects are to provide a switch device which is simple in construction, economical of manufacture, and highly reliable in operation.

Still further objects, advantages, and salient features will become more apparent from the description to follow, the appended claims and the accompanying drawing in which:

FIG. 1 is a side elevation of a missile employing the subject of the invention;

FIG. 2 is an enlarged section of the switch device, taken on line 2—2, FIG. 1;

FIG. 3 is a section taken on line 3—3, FIG. 2;

FIG. 4 is a section taken on line 4—4, FIG. 2; and

FIG. 5 is a simplified circuit in which the switch device is employed.

Referring in detail to the drawing, and first to FIG. 1, the subject of the invention comprises a switch device 10, carried by a missile 12, such as a rocket launched depth charge, which is to be actuated at the instant the missile impacts the surface of the water 14. As best shown in FIGS. 2, 3 and 4, the switch device comprises a plurality of axially aligned circular members 16, 18, 20, 22, having central bores 24, 26, 28, 30. Member 20 is provided with a circular flange 32 which engages one end of member 18 and member 22 is provided with a similar flange 34 which engages member 20.

A pair of switches S_1, S_2 are disposed between members 16, 18, these parts all being secured together by a plurality of screws 36 which threadedly engage member 18. A similar switch S_3 is disposed between members 20, 22 and these parts are similarly secured together by screws 38 which threadedly engage member 20.

A shaft 40 is supported for axial movement in the

bores of the various members, the shaft having an affixed weight 42 which is urged rearwardly by a spring 44, the ends of which abut the weight and a shoulder within member 18. Shaft 40 is provided with frusto-conical portions 46, 48 which actuate the switches. The switches are of the conventional micro-switch type having button actuators 50. As shown in FIG. 2, switches S_1, S_2 are open with the buttons suitably gapped from the actuator shaft and switch S_3 is closed, the button having ridden up the conical surface and onto the uniform diameter portion of the shaft.

The switch actuator parts so far described may be temporarily assembled within a suitable cylindrical container and tested for proper operation. In one particular environment the switches must be actuated by the shaft and weight when the impact acceleration is in excess of 60 G's and not actuate to a 20 G impact shock or when impact shock is not applied along the axis of the shaft. When the parts so far described have passed their inspection test they are then disposed within a cylindrical casing 52. A cup-shaped closure member 54 is then disposed within the casing and its end 56 is spun over the closure, solder 58 being applied to hermetically seal the joint.

The closure member is provided with a central glass portion 60, suitably fused or cemented to a metal ring 62, the joint between the ring and closure being similarly sealed by solder 64. Lead wires 65, a pair for each switch, terminate at terminals 66, these being hermetically sealed where they pass through the glass portion.

The entire casing is next disposed within a cylindrical cavity 68 in the depth charge, a dimple 70 being provided to slide into a groove 72 to orient the terminals in a desired relationship. A ring-shaped nut 74 secures the casing within the cavity. An electrical insulating plate 76 is next applied and coded wires 78 are attached to the terminals.

In operation, when missile 12 strikes the water shaft 40 and weight 42 move forwardly against the urge of spring 44 and conical portion 46 momentarily actuates switches S_1, S_2 simultaneously. As shown in FIG. 5, both switches actuate an enabling switch or circuit which is the first step in arming the depth charge. When it sinks to desired depth a hydrostat effects operation of a suitable squib which causes detonation of the explosive, these operations being conventional.

During the handling and surveillance of the device, it may be tested at any time by suitable apparatus adapted to produce the impact forces which it will experience at water entry to determine operability of the various switches. If, for reason during such handling, switch S_3 should become actuated a monitoring indicator will record such event to thus indicate that the device might be faulty.

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 is:

1. Inertia actuated apparatus comprising a shaft mounted for axial movement and having an inertia weight affixed thereto, a spring urging said shaft in one direction of movement to a predetermined limit position, a pair of axially spaced conical switch actuating surfaces on said shaft, a pair of normally open switches carried by said apparatus adapted to be simultaneously actuated to closed position by one of said conical surfaces in response to movement of said shaft in its opposite direction of movement, and a normally open switch carried by said apparatus adapted to be actuated to open position in response to movement of said shaft and the other of said conical surfaces in said opposite direction, said weight

and spring being disposed between said conical surfaces and said conical surfaces being of reducing diameter in directions toward opposite ends of said shaft.

2. Apparatus in accordance with claim 1 wherein the other of said conical surfaces is disposed adjacent a portion of said shaft of uniform diameter, whereby said shaft may move axially a predetermined amount before said second switch cooperates with said other conical surface.

3. Inertia actuated apparatus comprising a plurality of stacked separable axially aligned circular disk-like members having aligned central bores, a shaft supported for axial movement by said bores, a first annular space between a first and second of said members, a pair of normally open switches disposed within said first space, means securing the first and second of said members and said switch together, an inertia weight affixed to said shaft and disposed within the second member, a spring surrounding said shaft urging said weight against a third of said members, a second annular space between the third and a fourth of said members, a third switch disposed within said second space, means securing the third and fourth members and said third switch together, a fifth

of said members having an end wall spaced from the fourth of said members, a cup-shaped cylindrical casing telescopically containing all of said members having its edge hermetically engaging said fifth member and securing all of said members together within same, said shaft having a first conical portion disposed within said first space and arranged to simultaneously actuate said pair of switches and a second conical portion disposed within said second space adapted to permit the third switch to open.

4. Apparatus in accordance with claim 3 wherein said fifth member is provided with a central portion of electrical insulating material, and terminals extending through said material having their inner ends electrically connected to all of said switches.

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