

Feb. 3, 1970

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3,493,902

SELECTOR SWITCH AND CONNECTOR

Filed July 19, 1968

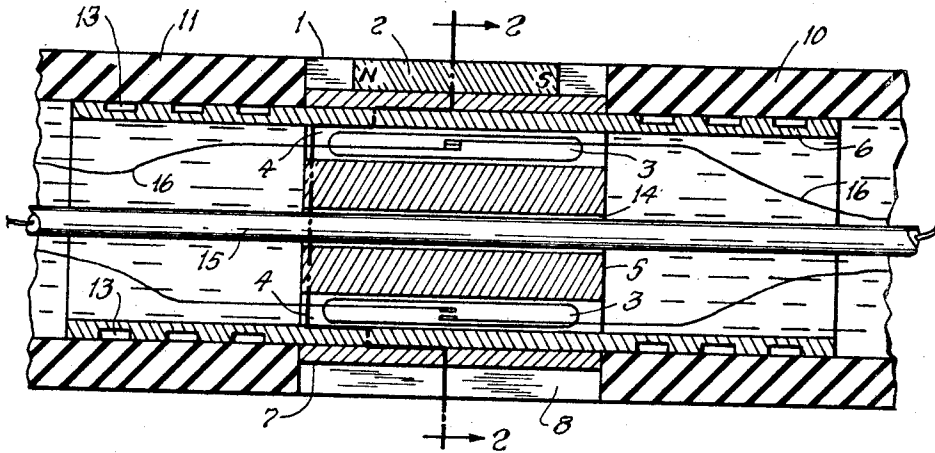


Fig. 1

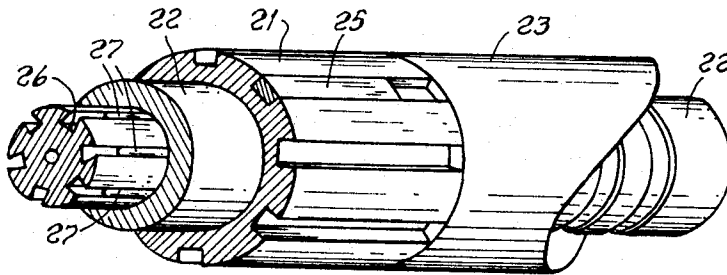


Fig. 2

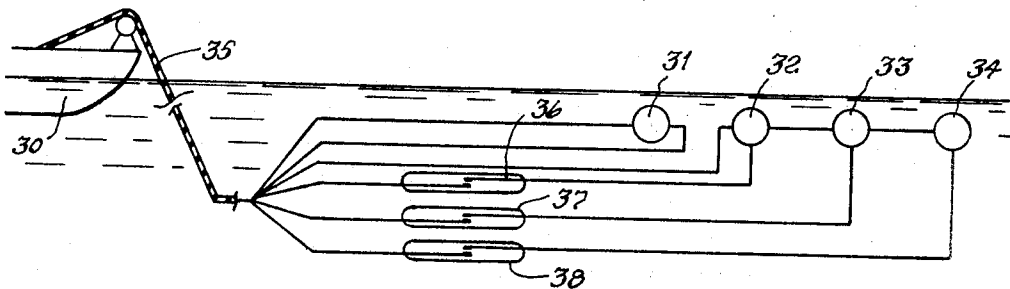


Fig. 3

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Filed July 19, 1968, Ser. No. 746,232

Int. Cl. H01h 9/00, 45/00

U.S. Cl. 335—1

6 Claims

ABSTRACT OF THE DISCLOSURE

A combined switching device and cable connector is disclosed for use in interconnecting oil-filled multiconductor cables. The switching elements of the apparatus are magnetically operated reed switches which permit the switching operation is to be performed by the selective disposition of external magnets. Thus, access to the interior of the cables is not required. The connector also includes a provision for isolating the different fluids which may be present within the two cable lengths which are to be interconnected.

The invention described herein may be manufactured and used by or for the Government of the United States of America for governmental purposes without the payment of any royalties thereon or therefor.

This invention relates to underwater cable connectors and more particularly to a connector which functions as a selector switch, an electrical connector and a mechanical barrier for separating the fluids in two oil-filled underwater cables.

In geophysical prospecting and underwater surveillance systems, towed arrays of hydrophones are used. The hydrophones used in these arrays are usually enclosed in a length of cable filled with an acoustic impedance matching oil. This prefabricated structure is then joined to an oil-filled towing cable which contains the conductors necessary to connect the hydrophones in the array to shipboard instrumentation. Often it is desirable to change the particular pattern of the array by activating only certain of the hydrophones in the prefabricated cable. Because only certain of the hydrophones are utilized at one time, fewer connecting conductors need be carried in the towing cable when the switching is done at the point of connection between the towing cable and the prefabricated array. Since the multiconductor towing cable is often the most expensive item in the prospecting system, reduction of the number of conductors in this cable represents a considerable saving to the prospecting or surveillance operation.

The subject invention is directed to a magnetically actuated switch and cable connector combination. As a connector, the device functions as a mechanical barrier between the liquids in each of the cables to be joined so as to preserve the impedance characteristic of the oil in the prefabricated cable. As a switching device, the connector contains glass-enclosed reed switches, actuated by permanent magnets. These magnets are accessible from the exposed portion of the connector-cable assembly and may be inserted or removed to actuate various of the reed switches accommodated within the connector without disconnecting the cables.

It is therefore an object of this invention to provide a device which contains a series of magnetically actuated switching devices and which serves as a mechanical connector for use with undersea cables.

It is another object of this invention to provide an undersea cable connector which includes a fluid barrier between two oil-filled cables.

It is a further object of this invention to provide apparatus for connecting and switching hydrophones at a location remote from a towing vehicle.

Other objects, advantages and novel features of the invention will become apparent from the following detailed description thereof when considered in conjunction with the accompanying drawings in which like numerals represent like parts throughout and wherein:

FIG. 1 is a cross-sectional view of the connector taken along its longitudinal axis;

FIG. 2 is an isometric view of the connector taken along section line 2 of FIG. 1; and

FIG. 3 is a schematic diagram showing the underwater switching device connecting a hydrophone array to a towing cable.

Referring to FIG. 1, it will be seen that the apparatus is composed of three subassemblies: a core member 5, an inner sleeve 6 and an outer sleeve 7.

Core 5, in the preferred embodiment, is a cylinder which may be fabricated from aluminum or similar nonmagnetic material. This core has longitudinal slots 4 spaced about its outer surface for accommodating reeds switches 3. Each reed switch is housed in an evacuated glass chamber and is cemented into one of the slots. In order to prevent passage of liquid from one cable to another, each of these slots may be filled with cement prior to insertion of the core into inner sleeve 6 or subsequent thereto. Leads 16 are sealed by the cement and are attached to the appropriate conductors in each of the cables. Those conductors which are excluded from the switching operation are sequestered in a cable 15 which passes through a central orifice 14 in core 5. After cable 15 is in place, cement is introduced into orifice 14 to seal the core.

Core 5 is accommodated in an inner sleeve 6 which is also constructed of a nonmagnetic material. The inner walls of this sleeve and the outer surface of the core coact to form a leak-free barrier to any oil which may be present at either end of the sleeve. Sleeve 6 is made longer than the core so that the ends of the sleeve extend beyond the core. Grooves 13 are formed in the sleeve at either end to hold cable casings 10 and 11 in place. These casings are slipped over and clamped to the grooved portion of the sleeve by circular bands (not shown).

Surrounding inner sleeve 6 is an outer sleeve 7. As are the other two subassemblies, this sleeve may be made of aluminum, brass or other nonmagnetic material. This outer sleeve is positioned directly over the core and, in the preferred embodiment, is the same length as the core. In the outer surface of sleeve 6 are slots 8, arranged around the sleeve to correspond in angular position to the slots in the core. Directly over every slot in the core is a corresponding slot in the outer sleeve. When a permanent magnet 2 is placed in one of these outer slots, it actuates a switch in the corresponding slot in the core to complete the desired circuit. The slots in the outer sleeve may be tapered so that the magnet will not slip out. Alternately, these slots may be formed with straight sides to facilitate removal of the magnet.

Cable casings 10 and 11 may be made to abut this outer sleeve to provide increased protection against leakage. The assembly thus constructed forms a smooth fitting liquid-tight connector as well as a multiple selector switch.

FIG. 2 is an isometric view of the connector in FIG. 1 showing inner sleeve 22 fitted within outer sleeve 21. Cable 23 is shown slipped over one end of sleeve 22 until it meets the outer sleeve. The outer surface of this outer sleeve is exposed to permit insertion of permanent magnets into the slots provided. As an example of the alignment of the two sets of slots, permanent magnet 25 is shown aligned with one of the six slots in core 26. These slots have tapered channels to receive reed switches shown at 27.

Before the cable is towed, the outer sleeve is either wrapped with tape or provided with an additional outer

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sleeve of flexible construction (not shown) to secure the switching magnets to the outer sleeve.

As will be appreciated, the connector thus constructed consists of a core centered in an inner sleeve. An outer sleeve accommodates the switching magnets and is centered on the inner sleeve above the core such that the slots in both the core and the outer sleeve are aligned. It will be further appreciated that each of the mechanical components, core 26, sleeve 22 and sleeve 21, must be constructed of a nonmagnetic material such as aluminum or brass so that only the switch directly beneath the inserted magnet is actuated.

While this connector was conceived for use in towed underwater hydrophone arrays, it will be appreciated that its application extends to such other filled cable applications as telephone cables, oil rig instrumentation cables, deep submersible communication links and the like.

FIG. 3 shows a ship 30 towing hydrophones 31, 32, 33 and 34 by means of cable 35. A hydrophone system removed from the vicinity of the noisy ship is necessary to detect acoustic disturbances in the ocean. The present invention allows the connection of towed hydrophones in any order to give directional characteristics to the array. As is common practice, directional characteristics of towed arrays are varied by activating different sensors in the array. While activation of these hydrophones was previously accomplished by use of an expensive multiconductor cable, merely removing or adding magnets to the exposed portion of the subject connector economically and efficiently activates the desired hydrophones without need for disassembly of the cable.

A single conductor containing the return for the hydrophone circuits is shown branched and connected to reed switches 36, 37 and 38. Activation of any one of these switches will activate the corresponding hydrophone which may be used in combination with hydrophone 31 to complete the array. By activating various of switches 36, 37 and 38, the distance between the elements in the array may be conveniently varied. It will be appreciated that magnets placed adjacent to reed switches 36, 37 or 38 will activate corresponding hydrophones 32, 33 and 34.

In one embodiment the hydrophones are encased in polyvinylchloride flexible tubing filled with a liquid such as castor oil. The joining of this tube with the connector described herein not only allows for ease of switching but also for isolation of the liquid contained in the tubing. As mentioned above, this isolation preserves the impedance match between the oil in the array and the surrounding liquid medium.

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. A device for connecting and disconnecting internal cable circuits by means external to said cable comprising:

- a core member having a plurality of circuit switching means disposed therein;
- said switching means connecting internal circuits in said cable and operable by means remote from said core member;

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sleeve means disposed intermediate said core member and the outer sheath of said cable; and means disposed within the periphery of the outer sheath of said cable for actuating said switching means, each of said actuating means disposed opposite a respective one of said switching means, said pairs of actuating means and switching means spaced to prevent one actuating means from actuating more than one switching means.

2. A combined multiple selector switch and cable connector for mechanically connecting the outer casings of first and second liquid-filled cables and for electrically connecting the conductors of said cables comprising:

a core member having a first set of longitudinal slots at a plurality of angular positions about the outer surface thereof;

a magnetically actuated reed switch accommodated within each slot and having two leads at either end thereof connected to that pair of conductors in said cables which are to be switched;

an inner sleeve having a length greater than said core member for centrally accommodating said core member such that end portions of said inner sleeve extend on either side of said core member; and

an outer sleeve positioned on and secured to said inner sleeve above said core so as to leave exposed a portion of said inner sleeve on either side of said outer sleeve whereby said portion provides a clamping surface for said outer casings,

said outer sleeve having a second set of longitudinal slots in the outer surface corresponding in number and angular position to said first set of slots,

each of said second set of slots being adapted to receive a magnet for actuating the reed switch accommodated in that slot which is in radial alignment with and adjacent to said magnet.

3. The device as recited in claim 1 wherein said core, said inner sleeve and said outer sleeve are constructed from nonmagnetic metals.

4. The device as described in claim 2 wherein said core is cylindrical and wherein said core has a channel through the center thereof to pass unswitched conductors from said first cable to said second cable.

5. The device recited in claim 4 wherein said channel and the slots in said core are sealed whereby said core forms a barrier between the liquids in said first and second cables.

6. The device as recited in claim 5 wherein said inner sleeve has annular grooves at the extremities thereof.

References Cited

UNITED STATES PATENTS

55	3,253,338	5/1966	Burnette	335—152
	3,261,941	7/1966	Shlesinger	335—107
	3,387,240	6/1968	Koppensteiner	335—153

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U.S. Cl. X.R.

174—70; 335—206