

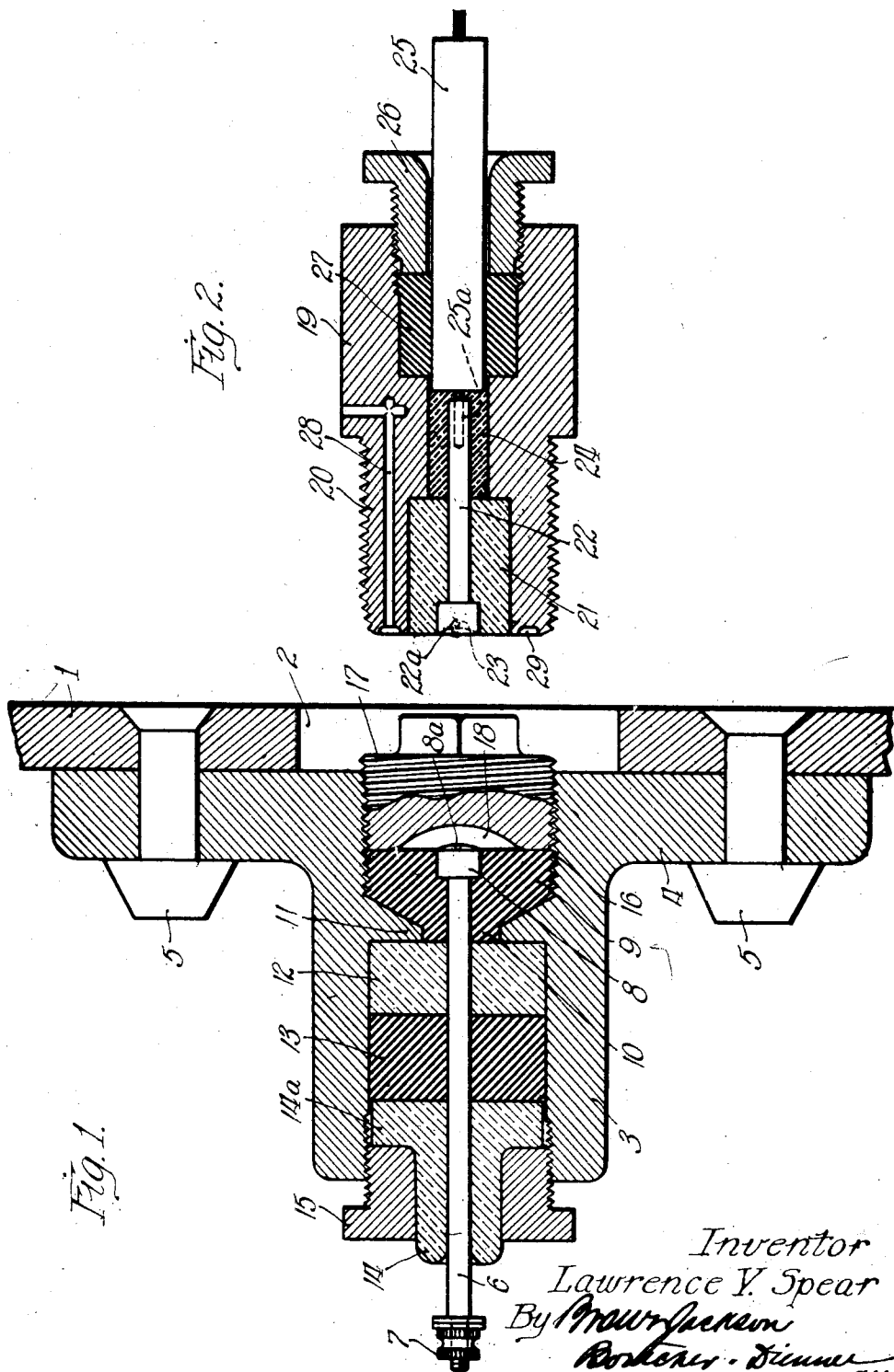
Oct. 15, 1929.

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1,731,597

WATER TIGHT ELECTRICAL CONNECTION

Filed Feb. 20, 1928



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WATER-TIGHT ELECTRICAL CONNECTION

Application filed February 20, 1928. Serial No. 255,681.

This invention relates to electrical connections, and more particularly to a connection of this character which is adapted for use when immersed in a fluid or liquid which is a conductor of electricity, such as salt water.

This device is particularly adapted for use with submarine boats which, due to injury or defective apparatus, are unable to rise to the surface. Under such conditions, the boat may be submerged at a considerable depth at which the water pressure is comparatively high. This renders it difficult to communicate with the occupants of the boat, or to furnish electric current to the boat, by means of a direct mechanical and electrical connection. Such connection must be water-tight both mechanically and electrically under the conditions of high pressure referred to. I have found that by properly constructing the cooperating members of the connecting device, a direct mechanical and electrical connection can be effected between a conductor within the boat and a conductor exterior thereto in such manner as to exclude the water or surrounding medium from the contacting surfaces of the two conductors and prevent any appreciable current leakage. As noted, my device is particularly adapted for use in connection with submarine boats, but it can also be used to advantage in connection with other structures where it is desired to effect an electrical connection between conductors surrounded by or immersed in a medium which is also a conductor of electricity. Further objects and advantages of my invention will appear from the detailed description.

In the drawing:

Fig. 1 is an axial sectional view through the receptacle member of a connecting device constructed in accordance with my invention as applied to the hull of a submarine boat, parts being shown in elevation.

Fig. 2 is a sectional view through the plug member of the connection constructed in accordance with my invention.

For purposes of illustration I have shown my invention as used in connection with a submarine boat, the hull 1 of which is shown fragmentarily and in section. The hull 1

is provided with an opening 2 disposed in alinement with a sleeve 3 having a base flange 4 which is secured by rivets 5, or in any other suitable manner, to the inner face of hull 1. In practice, any suitable or preferred number of the sleeves 3 will be provided, there being preferably at least one sleeve in each of the main compartments of the boat. This sleeve forms, in conjunction with suitable terminal and insulating members associated therewith, a receptacle structure adapted for cooperation with a plug exterior of the boat whereby current can be supplied to one or more, selectively, of the compartments of the vessel, or a metallic telephonic connection can be made with such compartment.

A terminal member 6 in the form of a rod of suitable conducting material, such as copper, is mounted within sleeve 3 and extends inwardly beyond the inner end thereof, this rod being reduced and threaded at its inner end for reception of a knurled nut 7 for attaching the conductor within the vessel to the rod or terminal member. At its outer end the rod 6 is provided with an enlarged head 8 having a convexed outer contact surface 8^a. This head 8 seats in a packing member 9 which fits tightly in the outer end portion of sleeve 3. This packing member is formed of a suitable compressible and resilient electrical insulating material, this material being also non-absorbent. I have found rubber well suited for this purpose, though any other suitable material may be employed. The member 9 fits tightly about head 8^a and the outer end portion of rod 8, and is provided with a restricted neck 10 which extends through an opening disposed centrally in an inner annular shoulder 11 of sleeve 3. The outer face of this shoulder is inclined so that the shoulder tapers inwardly in thickness, and the compressible resilient member 9 seats on the outer inclined face of this shoulder so that, when pressure is exerted on the outer face of this member, it is compressed tightly about the rod 6 so as to form a fluid tight closure about the same. A disc 12 of a relatively hard insulating material, such as porcelain, seats upon the inner face of shoulder 11 and fits snugly about rod 6. A disc 13 formed of a

material similar to that of the member 9, fits snugly about rod 6 and is confined between disc 12 and the base flange 14^a of an insulating thimble 14 formed of suitable relatively hard insulating material. The flange 14^a and discs 13 and 12 all fit the interior of the sleeve 3 snugly and thimble 14 is forced toward disc 13 by a packing nut 15 which screws into the inner end of sleeve 13. By turning the nut 15 into the sleeve the disc 13 is subjected to pressure and is caused to expand radially so as to form a fluid tight closure with the interior wall of the sleeve and about the rod 6. The member 9 also provides a fluid tight closure about the rod and with the outer face of shoulder 11, as previously described. In this manner, the terminal member or rod is supported in the sleeve and is effectively insulated therefrom, the means for supporting and insulating the rod also acting to effect a fluid tight closure of the sleeve and about the rod. The sleeve 3 is interiorly threaded at its outer end, at 16 for reception of a cooperating connecting plug member. Preferably, though not necessarily, the outer end of the sleeve is normally closed by a closure plug 17 which screws into the sleeve and is provided in its inner face with a recess 18 to accommodate the contact head 8. By removing the closure plug 17, the contact plug which cooperates with the sleeve can be readily screwed into the outer end thereof.

The contact or connector plug includes a body 19 provided with a reduced exteriorly threaded neck 20 adapted to be screwed into the outer end of the sleeve 3. The body of this plug, as well as the sleeve 3, is constructed of a suitable metal, such as steel, so as to readily withstand the rough usage to which it is subjected and effectively protect the parts enclosed by the body and the sleeve. An insulating member 21, preferably of porcelain or other suitable relatively hard material, is mounted in neck 20 and receives the outer portion and head 22^a of a terminal member or rod 22. Head 22^a is preferably provided in its outer face with a recess 23 shaped to receive the outer face 8^a of head 8 of the receptacle terminal member. The outer end portion of terminal member 22 is surrounded by an insulating member 24 which may be formed of any suitable material. I preferably employ for the insulating member 24 a material which melts at approximately 200 degrees F., such as a synthetic resin known commercially as bakelite. This material, in its molten condition, can be poured into the body 19 about the outer portion of rod 22 and permitted to set, thus serving to secure the rod in the body as well as to effectively insulate the rod from the body and also provide a fluid tight closure of the body and about the rod. A suitably insulated flexible conductor 25 extends through a packing nut 26 threaded into the outer end of the body

and through a packing ring 27 which seats in the outer end of the body, the inner end 25^a of this conductor being bared and secured in the outer end of rod 22. The packing ring 27 is formed of a suitable compressible and resilient and non-absorbent insulating material, such as rubber. When the packing nut 26 is turned into body 19, the ring 27 is expanded radially so as to provide a fluid tight closure of the body and about the conductor. The terminal member and associated parts of the connecting plug are thus effectively housed within the body 19, so as to be protected thereby from mechanical injury, and the parts are so mounted and insulated as to effectually prevent current leakage or the leakage of fluid under pressure through the plug structure.

The outer face of member 9 of the receptacle is flat or plane, and the inner face or end of the plug structure is also flat or plane, as illustrated, to fit tightly against member 9 when the plug is screwed into the receptacle. The body 19 is provided with a vent or escape duct 28 of substantially L-shape, the outer end of which is disclosed beyond the outer end of neck 20, the inner end of this duct opening into a channel or groove 29 in the inner end of the neck. In effecting the coupling, assuming that the closure plug 17 is used, the plug 17 is first removed, after which the connecting plug is screwed into the receptacle. As the plug moves inwardly of the receptacle, the water between the inner end of the plug and the member 9 is expelled through the duct 28. When the inner end of the plug comes into contact with the outer face of member 9, upon further screwing in of the plug, pressure is exerted on member 9 and the rounded contact surface 8^a of head 8 enters the recess 23 of head 22^a, head 8 being held pressed in contact with head 22^a by the resiliency of member 9 which, at this time, is under pressure. The pressure exerted by the flat inner end of the connecting plug against the outer face of member 9 is also of assistance in expelling any moisture between these two members and eliminating the possibility of water entering between such members by way of the duct 28. In this connection, the inner portion of neck 20 beyond the channel 29 presses into the compressible member 9 so as to effect a fluid tight closure therewith and prevent water which enters this channel 29 from escaping therefrom between the inner face of member 21 and the outer face of member 9. In this manner, proper contact is assured between the two conductors or terminal members, and current leakage due to water entering between or into these members is avoided.

This connection is of value as providing simple and efficient means for supplying electric current to a compartment of a submarine boat or other structure surrounded by an electrical conducting medium under

pressure. When used in connection with a submarine boat which is unable to rise to the surface, the conductor 25 is of such length as to reach from the surface of the water to the boat and is connected to a suitable source of supply of electrical energy whereby electric current can be supplied to the compartment of the submarine for operating lights, motors, or other purposes. It is also possible, by this connecting means, to establish metallic telephone connection with the occupants of the compartments of the boat. In the form of the connector illustrated and described, I have shown but one side of a circuit connected to the receptacle and plug member. The other side of the circuit is completed through a ground which, in the case of a submarine boat, may consist of the water in which the boat is submerged, the hull 1, being formed of metal and submerged in the water, forming an excellent ground connection. If desired, however, the socket member and the plug member may be each provided with two or more terminal elements which are properly disposed for electrical connection with each other in proper relation when the plug is screwed into the socket into full operative position, as will be readily understood by those skilled in the art.

What I claim is:

1. In combination, a receptacle, a terminal member mounted within and insulated from said receptacle, a plug having threaded engagement with the receptacle, a terminal member carried by and insulated from the plug and disposed for cooperation with the first terminal member, and means for removing fluid entrapped between the plug and the receptacle and for effecting a fluid tight closure about the terminal members as the plug is threaded into full operative relation to the receptacle.

2. In combination, a receptacle structure including a terminal member mounted therein and means for effecting a fluid tight closure of said structure and about the terminal member and for insulating said member from the structure, a plug structure including a terminal member mounted therein and means for effecting a fluid tight closure of the plug structure and about the terminal member thereof and for insulating said plug structure from its associated terminal member, said structure having threaded engagement with the receptacle structure and one of the structures having a vent disposed to permit escape of fluid entrapped between the structures, and means for effecting a fluid tight closure about the contacting surfaces of said terminal members as the plug structure is threaded into full operative relation to the receptacle structure.

3. In combination, a support of conducting material, a fluid tight receptacle on the support, a fluid tight plug screwing into the receptacle, a terminal member carried by the

receptacle and insulated from said support, a second terminal member carried by the plug and insulated therefrom, and means for expelling entrapped fluid and for effecting a fluid tight closure about the contacting surfaces of the terminal members as the plug is threaded into full operative position in the receptacle.

4. In combination, a fluid tight receptacle, a terminal member within and insulated from the receptacle, a fluid tight plug screwing into the receptacle, a terminal member carried by and insulated from the plug and cooperating with the receptacle terminal member, and means for expelling the entrapped fluid and for effecting a fluid tight closure about the contacting surfaces of the terminal members as the plug is threaded into full operative position in the receptacle.

5. In combination, a fluid tight receptacle, a terminal member within and insulated from the receptacle, a fluid tight plug screwing into the receptacle, a terminal member carried by and insulated from the plug and cooperating with the receptacle terminal member, said plug having an escape duct opening through its inner end, and means for effecting a fluid tight closure about the contacting surfaces of the terminal members as the plug is threaded into full operative position in the receptacle.

6. In combination, two fluid tight connecting members having relative movement, conductors carried by and insulated from said members, means for securing the connecting members together and for causing movement thereof one toward the other into abutting relation with the conductors disposed in contact one with the other, and means for expelling the fluid from between said members and for effecting a fluid tight closure about the contacting surfaces of said conductors as the members are moved into full operative relation to each other.

7. In combination, a receptacle member open at one end, a terminal member within the receptacle member, means for effecting a fluid tight closure of the other end of the receptacle member and about the terminal member, a resilient and compressible member in the receptacle member adjacent the open end thereof, the terminal member having a contact head at the outer face of said resilient and compressible member, a plug member screwing into the open end of the receptacle member, and a terminal member carried by and insulated from said plug member and disposed to contact with the head of the first mentioned terminal member, the outer face of the resilient and compressible member being flat and the inner end of the plug being flat, the inner end of the plug terminal member being substantially flush with the inner end of the plug and

said plug having an escape duct opening through its inner end.

8. In combination, a receptacle, a terminal member within the receptacle, means for effecting a fluid tight closure of the receptacle and about said member and for insulating the terminal member from the receptacle, a plug screwing into the receptacle, a terminal member carried by the plug and having its inner end substantially flush with the inner end of the plug, means for effecting a fluid tight closure of the plug and about the terminal member associated therewith and for insulating the terminal member from the plug, and a compressible and resilient member in the outer portion of the receptacle and having a flat outer face, the receptacle terminal member extending through said compressible and resilient member and having an enlarged head seating therein, the inner end of the plug being flat and said plug having an escape duct opening through its inner end.

9. In a receptacle structure, a sleeve, a terminal member within the sleeve, means for effecting a fluid tight closure of the sleeve and about the terminal member and for insulating said member from the sleeve, said sleeve being open at one end for reception of a cooperating plug, and a compressible and resilient insulating member in the open end portion of the sleeve, the end portion of the terminal member being embedded in said insulating member and having an enlarged head seating in the insulating member with its outer contact face exposed at the outer face of said insulating member.

10. In a plug structure, a body member, a terminal member having a contact element, a conductor connected to the terminal member, and means for securing the terminal member and the conductor in the body and for effecting a fluid tight closure of the body and about said conductor and terminal member, said contact element being at one end of the body and said body having an escape duct opening through said end thereof.

In witness whereof, I hereunto subscribe my name this 2nd day of February, 1928.

LAWRENCE Y. SPEAR.