

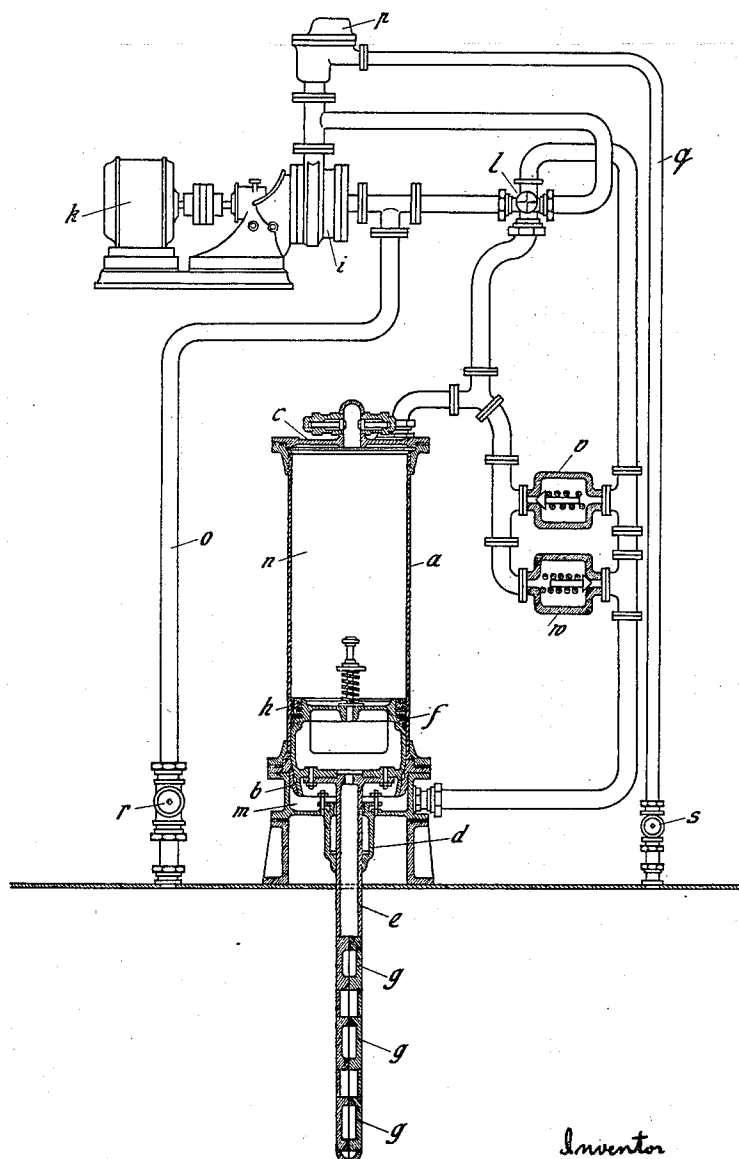
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HYDRAULIC PROTRUDABLE DEVICE FOR SOUND APPARATUS

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UNITED STATES PATENT OFFICE

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HYDRAULIC PROTRUDABLE DEVICE FOR SOUND APPARATUS

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The invention relates to a protrudable device which is the carrier of subaqueous sound apparatus, particularly for apparatus which are to be used on craft which occasionally travel at great depths, such as submarine vessels. It has already been proposed to move such devices by means of a liquid or gaseous pressure medium. The difficulty of sealing the inner casings of such devices against the outer water would require, in the case of a pneumatic drive, the consideration of variable and unknown counter-forces, which are exerted at varying depths against the operating pressure. Therefore, a hydraulic drive is chosen here according to the invention. An important feature of the invention, in this case, is that the entire circulation system of the hydraulic operating medium is connected with the outer water through a conduit or conduits, so that the prevailing water pressure outside of the vessel exerted against the protrudable carrier is neutralized with respect to the pressure produced by the pump. By this means the result is obtained that always only constant relative operating pressures are to be reckoned with inside the protrudable system, and more so, that the pressures produced by the system need not be greater than is necessary for moving the members to be protruded.

Further details of the invention are explained in the following description of the drawing, which represents a practical layout, partly shown in longitudinal section.

The protrusion mechanism proper consists of the following main parts: The cylinder *a*, its base member *b*, the cover *c*, the stuffing box *d* and the sword *e* with the piston *f*.

The sword carries the sending/receiving devices *g*. The piston is provided with suitable piston rings in the form of resilient leather rings *h*. A centrifugal pump *i*, which is driven by the motor *k*, serves to operate the water which moves the sword in and out. The reversing cock *l* is connected on one hand to the delivery side and, on the other hand, to the intake side of the centrifugal pump and bored in such a way that these two outlets can alternately be connected to the cylinder chambers *m* and *n* located on opposite sides of

the piston *f*. Since it is necessary for operating the device to work always with a constant difference of pressure in these two chambers, which must not vary when the vessel operates at different depths, the whole pipe system and the interior of the protrusion device is connected with the outer water through a compensating conduit *o* which is connected at the intake side of the pump. By these means the pressure head produced by the pump remains constant with respect to the varying water pressure outside the vessel, so that at no time the operation of the sword is affected by this outside pressure, and only enough energy is required for operating the pump to produce sufficient hydraulic pressure to overcome the frictional resistances and the weight of the movable sword mechanism.

At the highest point of the pipe system, a trap *p* is provided in which any small amount of air can collect, which might separate from the water when the system stands unused for some time. This air can be discharged into the outside water by way of pipe *q* and sea cock *s*, which must be closed however as soon as the system is put into use. For safety, a sea cock *r* is also provided at the outside water intake of pipe *o*, which however, except in case of repairs or emergencies, must always be left open for the reasons of the function of pipe *o* explained hereinbefore.

In an arrangement so far described the following difficulty may arise. When the sword *e* is completely protruded, the piston *f* is pressed into the conical seat of the base member *b* and held there by the full pressure of the water delivered by pump *i* into the chamber *n*. For lifting the device out of the seat, and for withdrawing it inwardly, there is however no more than the full operating pressure of the pump available, but in this case the weight of the device must also be lifted and the possibly existing resistance in the seat itself must be overcome. It therefore could happen that the full pressure developed by the pump is not sufficient to lift the device.

According to the invention care is taken that, in protruding the device, the latter

cannot be driven into the seat with the full pump pressure by arranging check valves by which the maximum pressure used in the protruding operation for pressing the device into the conical seat is limited and is kept
 5 below the operating pressure necessary for lifting the device. This can be accomplished chiefly by check valves which are arranged parallel to the cylinder of the protrusion device between the conduits leading to the chambers above and below the piston.
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If it is desired to limit also the pressure with which the piston is held against its abutment in the withdrawn position of the
 15 sword, a valve or a valve combination with a resistance which is different for both directions of piston motion is placed parallel to the chambers.

Such an arrangement is shown in the drawing. Between the pipes leading to the chambers *m* and *n* can be seen two oppositely acting spring controlled check valves *v* and *w*, connected so that each valve permits fluid passage opposite to the direction permitted
 25 by the other valve. Valve *v* serves to limit the pressure used in seating the piston on its lower seat, and valve *w* limits the pressure at which the piston is seated against the cylinder cover *c*. Thus, assuming for instance
 30 the piston about to be seated on its lower seat, the spring of valve *v*, having a tension which permits the valve to open before the maximum pump pressure is reached, will permit the valve to open as soon as the piston is seated with only a moderate pressure, and discharge water into the intake side of the pump. When the piston is seated against the cover *c*, valve *w* acts vice versa in a similar manner. The spring of valve *w* is tensioned more strongly than that of valve *v*,
 40 because for lifting the piston out of its lower cone-shaped seat, and for balancing the piston and sword weight in addition, a greater force is necessary than for protruding the valve.
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The valves can be replaced by equivalent mechanisms. It is generally sufficient, however, to limit only the pressure for seating the piston on its lower seat so that only
 50 one valve in the arrangement of valve *v* is necessary. Valves of this type may be arranged of course in any other suitable part of the pressure fluid circuit, so long as the aforementioned effect of pressure limitation is attained.
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I claim:—

A hydraulically operated protrudable carrier for submarine sound apparatus on vessels or the like, comprising a sword of stream-
 60 line cross-section carrying the sound apparatus within its body, a cylinder disposed within the vessel near its bottom and containing a piston attached to the upper end of the sword and adapted to protrude and withdraw
 65 this sword through the vessel bottom out of

and into the cylinder, a stuffing box for said sword at the lower cylinder end, a hydraulic pressure system including a pump, a conduit connection between the pump and said cylinder at both side of the piston, and means
 70 for directing the pressure fluid delivered by said pump to one or the other side of said piston at will and to return the fluid from the respectively opposite piston side to the intake side of the pump when the piston
 75 moves in the desired direction, and a conduit connection between the intake side of the pump and the water outside the vessel for neutralizing, with respect to the pump pressure, the prevailing outside water pressure
 80 exerted upon the sword and tending to move it into the cylinder.

In testimony whereof I affix my signature.
 WILHELM RUDOLPH.

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