No. 821,895. PATENTED MAY 29, 1906.

L. Y. SPEAR.

DUCT KEEL FOR SUBMARINE BOATS.

APPLICATION FILED JUNE 26, 1905.

Fig. 1.

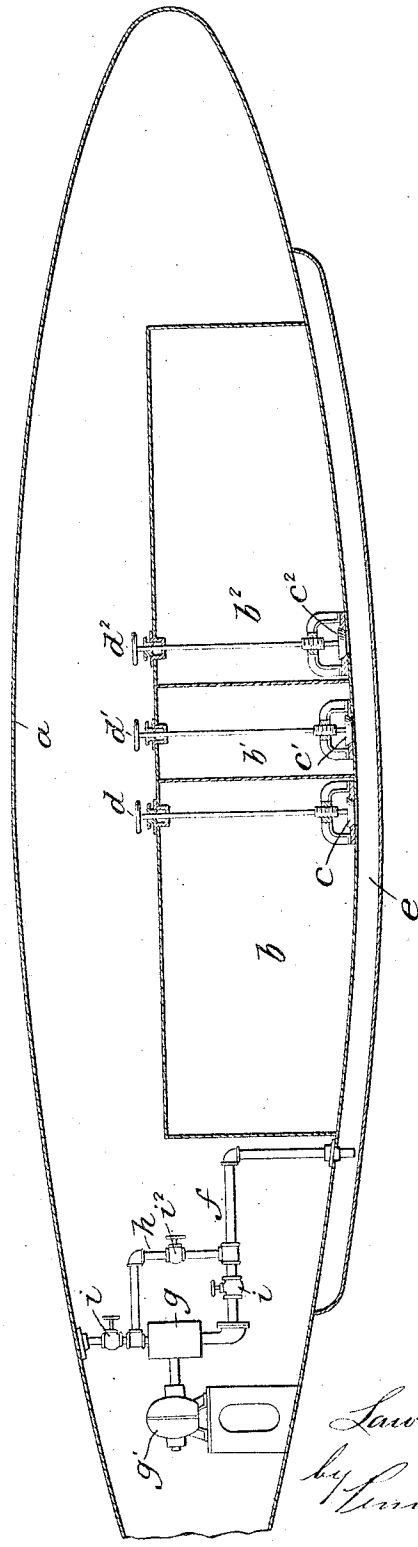
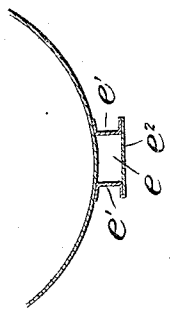


Fig. 2.



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UNITED STATES PATENT OFFICE.

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DUCT-KEEL FOR SUBMARINE BOATS.

No. 821,895. Specification of Letters Patent. Patented May 29, 1906.

Application filed June 26, 1905. Serial No. 267,024.

To all whom it may concern:

Be it known that I, LAWRENCE Y. SPEAR, a citizen of the United States, residing at Quincy, county of Norfolk, State of Massachusetts, have invented certain new and useful Improvements in Duct-Keels for Submarine Boats; and I do hereby declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same.

The invention relates to submarine or submergible boats, and has for its object to greatly simplify the apparatus by means of which the water-ballast tanks are filled and emptied; and to this end the invention comprises a hollow keel secured to the bottom of the boat and constituting a duct communicating with the several water-ballast tanks and with the exterior of the boat, together with pumping apparatus in the connection between the hollow keel and the exterior of the boat, by means of which the contents of any or all of the water-ballast tanks may be discharged by way of said keel, and a by-pass around the pump for admitting water to the several tanks at will.

In the accompanying drawings, Figure 1 is a vertical longitudinal section of a submarine boat embodying the invention. Fig. 2 is a transverse section through the lower portion of the boat and the duct-keel.

Referring to the drawings, *a* indicates the hull of the boat, which may be of any approved form.

b, *b'*, and b^2 indicate the usual water-ballast tanks, which may be so disposed within the interior of the boat as to best subserve the requirements of economy of space and facilitate the trimming and maneuvering of the boat under all conditions of operation. As illustrated in the drawings, the tanks are located in the mid-ship section, running fore and aft; but it is to be understood that the invention is not limited to any particular location of said water-ballast tanks.

Secured to the under side of the hull of the boat and extending longitudinally thereof to any desired distance is a closed hollow keel *e*, which constitutes a duct or conduit. Said keel is preferably composed of metallic channel-sections *e'*, bent to conform to the shape of the boat's bottom, to which said sections are riveted, and a cover-plate e^2, riveted to the lower flanges of said channel-sections and turned over the ends of the latter to meet the hull, so as to constitute a water-tight duct running fore and aft.

The several water-ballast tanks are directly connected to the hollow keel *e*, preferably by passage-ways opening through the bottom of the boat directly into the keel, which passage-ways are closed by valves *c*, *c'*, and c^2, operated by suitable handles *d*, *d'*, and d^2, passing through the tanks, so as to be readily accessible to the operator within the boat.

The hollow keel *e* is connected to the exterior of the boat, so that water ballast may be admitted to or exhausted from said tanks as the conditions of operation may require. In the form of the invention illustrated communication between the hollow keel and the exterior of the boat is effected by piping *f*, opening into the keel and having its outboard end open to the sea. In said piping *f* is an exhaust-pump *g*, preferably driven by an electric motor *g'*, and said piping is provided with cut-off valves *i* and *i'*. A by-pass *h* around the pump, provided with a cut-off valve i^2, enables the pump to be thrown out of commission.

With the installation as above described when the valve i^2 in the by-pass *h* is closed it will be seen that the water ballast or any portion thereof may be discharged from any or all of the tanks *b* *b'* b^2 by opening the valves *c* *c'* c^2, or any of them, which control the communications between the respective tanks and the hollow keel, opening the valves *i* and *i'*, and starting the pump. The water ballast is thereby drawn from the tanks through the hollow keel and discharged by the pump through the piping *f* into the sea. When it is desired to admit water to the tanks *b* *b'* b^2, or any of them, the appropriate valves *c* *c'* c^2 are opened, and likewise the valve i^2 in the by-pass *h* and the valve *i'* in the piping *f* beyond the pump are opened, so that direct communication is established between the exterior of the boat and the several water-ballast tanks, and the hydrostatic pressure outside the boat forces the water through the valve *i'*, by-pass *h*, piping *f*, and hollow keel into the tanks which are in communication with the latter. After sufficient water ballast has been taken aboard the valves controlling

communication between the tanks and the hollow keel are closed.

It is to be noted that by providing the boat with a duct-keel of the general character above described the installation for controlling the water ballast is greatly simplified, much space in the interior of the boat is saved by dispensing with complex systems of piping for controlling the water ballast, and the hull of the boat is materially strengthened to resist crushing strains.

Having thus described my invention, what I claim is—

1. A submarine or submergible boat, having a hollow keel constituting a longitudinal duct communicating with the several water-ballast tanks, and with the exterior of the boat.

2. A submarine or submergible boat, having a hollow keel, constituting a duct, communicating with the several water-ballast tanks and with the exterior of the boat, and a discharge-pump connected with said keel.

3. A submarine or submergible boat, having a hollow keel, constituting a duct, communicating with the several water-ballast tanks, a discharge-pump connecting with said keel and with the exterior of said boat, and a by-pass around said pump to admit water to said keel and ballast-tanks.

4. A submarine or submergible boat, having a hollow keel, constituting a duct, communicating with the exterior of the boat, and valved connections between the water-ballast tanks and said hollow keel.

5. A submarine or submergible boat, having a hollow keel constituting a duct, a valve-controlled communication between the keel and the exterior of the boat, and valved connections between the several water-ballast tanks and said hollow keel.

In testimony whereof I affix my signature in presence of two witnesses.

LAWRENCE Y. SPEAR.

Witnesses:
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