(No Model.)

F. G. WATERHOUSE.

HYDRAULIC PROPULSION.

No. 431,090. Patented July 1, 1890.

Fig. 1.

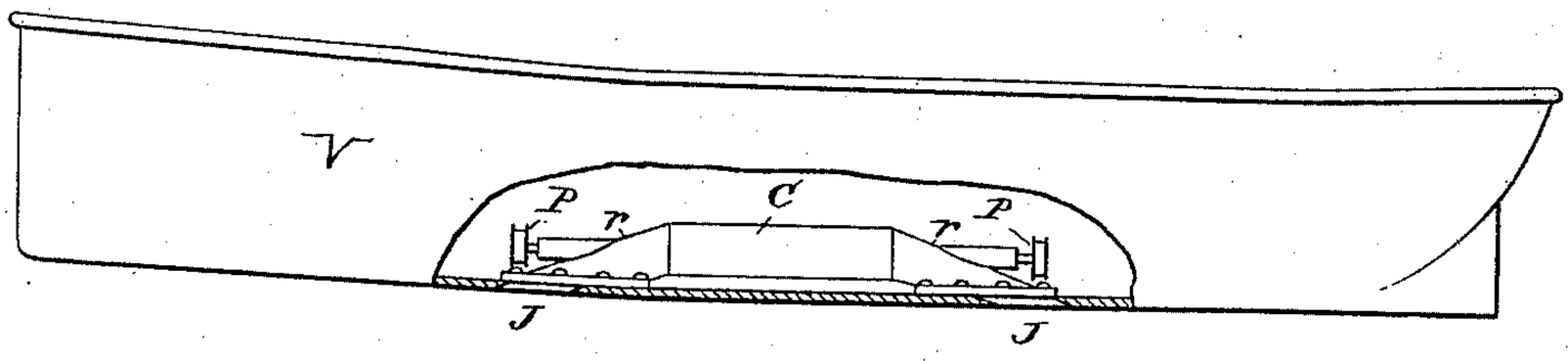

Fig. 2.

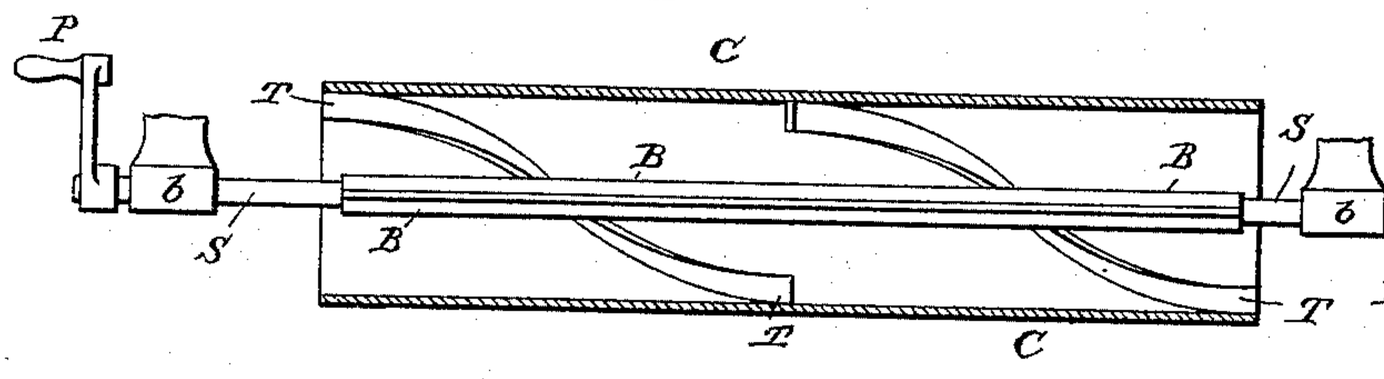

Fig. 3.

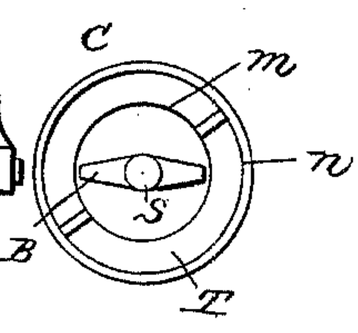

Fig. 4.

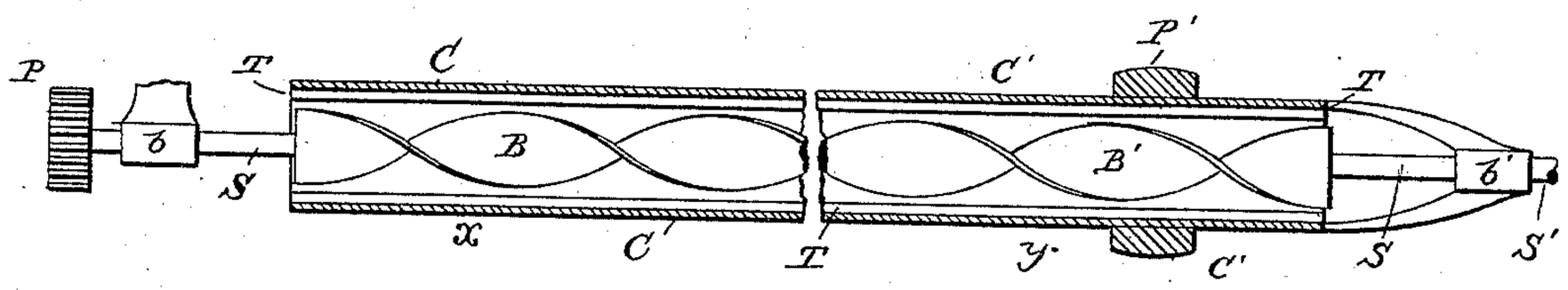

Fig. 5.

Fig. 6.

Fig. 7.

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HYDRAULIC PROPULSION.

SPECIFICATION forming part of Letters Patent No. 431,090, dated July 1, 1890.

Application filed October 3, 1889. Serial No. 325,944. (No model.)

To all whom it may concern:

Be it known that I, FRANK G. WATERHOUSE, of the city of Pittsburg, State of Pennsylvania, have invented a new and useful Improvement in Hydraulic Propulsion, of which the following is a specification, reference being had to the accompanying drawings.

My invention relates to an apparatus adapted to propelling vessels by using the reactive force of water drawn in at one end of a cylinder and expelled at the opposite end, and also, generally, to a device for forcing fluids or other matter through a cylinder or closed channel, or utilizing the force of such matter when driven through a closed channel to produce rotary mechanical motion.

My invention consists of a blade mounted upon a longitudinal axis within a cylindrical case, which case is provided with internal threads or ribs which form grooves on the inner surface of said cylinder; and it further consists in various modifications and arrangements of devices, as will be hereinafter fully set forth.

Referring to the accompanying drawings, in which like letters of reference indicate like parts throughout the several views, Figure 1 is a side view of a boat partly broken away, and showing my invention in use as a propeller. Fig. 2 is a longitudinal central section of a cylinder, showing the internal ribs and the blade. Fig. 3 is an end view of the parts shown in Fig. 2. Fig. 4 is a sectional view showing two modifications; and Figs. 5, 6, and 7 show modifications of the internal blade.

In Fig. 1, I have represented the side of a boat with part cut away, showing the apparatus embodying my invention, consisting of a cylinder C, with inclined passages *r r* at each end leading to openings J J through the bottom of the boat, into one of which the water is drawn, while it is expelled from the other by means of a rotary motion imparted through one or both of the pulleys P P, thereby causing a similar motion to an internal blade, to be explained hereinafter.

In Fig. 2, I have shown a sectional side elevation of a device embodying my invention, in which B is an edge view of a rotating blade provided with a shaft S, each end of which rests in bearings *b b*, which are placed coaxial with the cylinder C. At one end of the blade-shaft S is a crank P for rotating the blade B. The width of the blade is made nearly equal to the diameter or clearance-space left by the inner edges of the spiral ribs T, which are placed on the inner surface of the cylinder C. The ribs T correspond to the inner threads of a screw-nut and can be made of any pitch and be of any number required.

Fig. 4 is another form of mechanism, consisting of a twisted blade B, mounted upon a shaft S and supported by bearings *b b'*, and surrounded by cylinder C, which is provided with internal radial ribs T, which run longitudinally through the cylinder C. In this case the twisted blade B and cylinder C are shown cut in two parts in order to show two equivalent forms of the same device. The left half X is supposed to have the cylinder C stationary, while the blade B is rotated by power applied to the crank P, while the right half Y is supposed to have the blade B' held stationary by the shaft S', while the cylinder C is supported on the shaft S by means of the bearing *b'* and made to rotate by power being applied to the pulley P', fixed around the cylinder C'.

Fig. 5 shows an end view of a blade B, its width forming but half the diameter of the circular space, which it sweeps, and of which the shaft S is the center.

Fig. 6 shows a blade B B', the width of which is equal to the diameter of the space swept.

Fig. 7 shows a double blade or cross composed of four radial blades B B B B, the advantage of this form being its lateral strength. All these blades may be either straight or twisted, to suit the purposes to be explained.

In describing the practical operation of this invention it will be remembered that one of the objects is to cause the rotation of the blade B to force a current of water to pass through the tube or cylinder C. This is performed in the following manner: We will refer to Fig. 3 and suppose the blade B rotated within a smooth cylinder filled with water and represented by the circle M. In such a case the rotation of B would cause the water to revolve with it, and the only loss of power

would be that caused by the friction of water against the inner surface of the tube. Now if we remove the ribs T and leave the smooth inner surface N of the cylinder C filled with water the rotation of B would carry the water around nearly as fast as B revolved, and the only impediment the water would meet would be caused by its friction against the surface N. Now we will return to the ribs T and suppose several were inserted in a latitudinal position, then the water would revolve with only the additional impediment caused by the friction against the sides of the ribs T. Now we will suppose these ribs were placed in the cylinder C spirally, the motion imparted to the water by B would be the same, except that the water passing in the grooves between the ribs T would move endwise with a speed corresponding to the rotation of the water and the length of the pitch or angle at which the ribs T were set. Of course if the pitch is very small the longitudinal motion of the water would be very slight, and if the pitch is so great as to cause the ribs to lie nearly lengthwise the turning motion of the water would be interrupted without much tendency to force it through the cylinder C; therefore there is a proper angle corresponding to the kind of work to be done which will vary each side of forty-five degrees, and in some cases a progressive pitch can be used—that is, so that the ribs T become nearer parallel to the axis of the cylinder at the end where the water passes out, so as to produce a constant acceleration to the motion of the water while passing through the cylinder.

I have shown in Fig. 2 about the proportion of parts adapted for hydraulic propulsion, with the blade B made straight, so that there will be no end-thrust on its bearings, all the end-thrust caused by the motion of the water within the cylinder being on the working or propelling sides of the ribs T, so that the forward action of this device, when used as a propeller, will be, first, the forward suction of the water being drawn in; second, the reaction of the water being forced through and expelled from the cylinder, and, third, the impact or pressure of the revolving water against the propelling sides of the ribs T without producing an end pressure on the bearings of B. The same result as above stated would be produced if the blade B remained stationary and the cylinder C revolved. And the same can be said of Fig. 4, which has a twisted blade B, with the disadvantage of causing an end-thrust on its bearings as a result of its angular or inclined action on the water. I have shown forms with a straight blade and a cylinder with spiral ribs, also a twisted blade and straight ribs; and it is also understood that a form may be made having the blade twisted and the ribs spiral. It is evident that as the rotation of B will cause a flow of water through C the reverse effect can be used as a motor by causing a rapid flow of water through C to cause B to revolve.

I do not confine myself to any form of blade B, as any form adapted to cause water to rotate in C will do.

What I claim as my invention is—

1. In combination, a cylinder having internal ribs, and a blade within said cylinder, said parts having relative rotary movement, substantially as described.

2. In combination, a cylinder having internal ribs, and a blade within said cylinder, said ribs and blade being arranged angularly to each other, and said cylinder and blade having relative rotary movement, substantially as described.

3. In combination, a cylinder having internal spirally-disposed ribs, and a blade within said cylinder, said parts having relative rotary movement, substantially as described.

4. In combination, a cylinder having internal spirally-disposed ribs and a straight blade, said parts having relative rotary movement, substantially as described.

5. In combination, a cylinder having internal spirally-disposed ribs and a straight blade adapted to rotate within said cylinder, substantially as described.

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