Jan. 22, 1924. 1,481,270

W. F. PURCELL

PROCESS AND DEVICE FOR OBTAINING A RECIPROCATING MOVEMENT

Filed Dec. 18, 1920

Fig. 1.

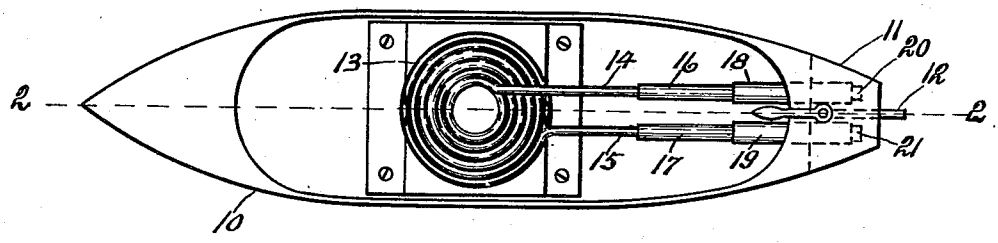
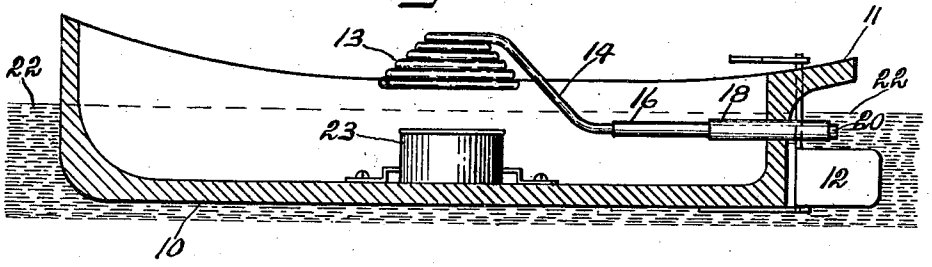


Fig. 2.



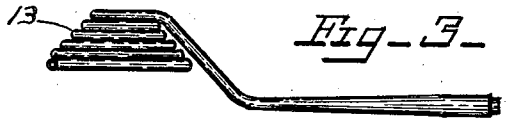


Fig. 3.

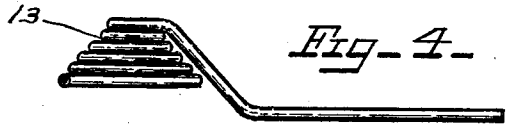
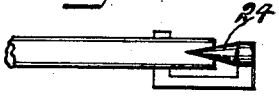


Fig. 4.

Fig. 5.



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Patented Jan. 22, 1924. 1,481,270

UNITED STATES PATENT OFFICE.

WILLIAM F. PURCELL, OF HOBOKEN, NEW JERSEY, ASSIGNOR TO HYDROMOTOR COMPANY, INC., A CORPORATION OF NEW YORK.

PROCESS AND DEVICE FOR OBTAINING A RECIPROCATING MOVEMENT.

Application filed December 18, 1920. Serial No. 431,759.

To all whom it may concern:

Be it known that I, WILLIAM F. PURCELL, a citizen of the United States, residing at Hoboken, in the county of Hudson and State of New Jersey, have invented new and useful Improvements in Processes and Devices for Obtaining a Reciprocating Movement, of which the following is a full, clear, and exact specification.

My invention relates to means for obtaining a reciprocating movement and refers particularly to a process for obtaining a reciprocating movement by means of a liquid column and apparatus for obtaining said movement.

One object of my invention is a process whereby a liquid within a conduit can be given a uniform, or approximately uniform, reciprocating movement, through the medium of the application of heat to the conduit.

Another object of my invention is a device in which a liquid can be given a uniform, or approximately uniform, reciprocating movement by the process of my invention.

I have found that if a conduit be only partially filled with a liquid, a reciprocating movement can be given the liquid by the application of heat to that portion of the conduit not occupied by the liquid.

I have found that if a conduit, such as a pipe, be partially filled with a liquid and the exit, or exits of the pipe be so arranged that all of the liquid will not be expelled therefrom during the process, the application of heat, and preferably direct heat, to the unfilled portion of the conduit will cause the liquid to have a more or less reciprocating movement through the conduit, such movement being of considerable length and force, dependent upon the relative conditions of the conduit, heat and liquid.

The reciprocating movement thus produced can be utilized in many of the ordinary and well-known applications of reciprocating motions, and is particularly adaptable for the purpose of boat propulsion.

The accompanying drawings, in which similar parts are designated by similar numerals, clearly illustrate modified forms of the apparatus necessary for the carrying out of the process of my invention as a boat propelling means.

Figure 1 is a top plan view of a boat carrying one form of the device of my invention.

Figure 2 is a section through the line 2—2 of Figure 1.

Figure 3 is a modified form of my device.

Figure 4 is a modified form of my device.

Figure 5 is a broken view of a modified form of the exit end of the conduit of my device.

Figures 1 and 2 illustrate the hull 10 of a boat, the stern 11 of which carries an ordinary rudder 12. Carried by the boat is a coiled conduit 13 having the two exit pipes 14, 15, which are enlarged by the pipes 16, 17, 18 and 19, and the exit ends restricted by the smaller pipes 20 and 21. The conduit and its parts are so positioned that the two exits 20 and 21 will be beneath the waterline 22—22 when the boat rests in the water.

Situated within the boat and beneath the coiled conduit 13 is a receptacle 23 for containing the fuel, which may be of any suitable material, but I prefer to use the so-called "solid alcohols" for safety and efficiency.

When the boat is placed in the water, the water will enter the two exit pipes of the conduit, thus leaving the coiled portion 13 and a portion of the extensions 14 and 15 unoccupied by water. When heat is applied by means of the fuel in the receptacle 23, the water in the conduits 14, 16, 18, 20 and 15, 17, 19, 21 gradually assumes a regular reciprocating movement, with the consequent expulsion of a portion of the thus contained water into the water volume in which the boat floats and a following flow of water back into the conduits.

A column of water, which may be termed a "water piston," is thus caused to reciprocate with great rapidity within the conduit and the ends of these water pistons impacting against the ouside water will propel the boat.

By the proper construction of parts, these propulsions may be caused with uniform rapidity.

Similar results may be obtained by having only one exit to the conduit, but I prefer to use a plurality of exits.

As all of the water does not leave the conduit during the operation, it is evident that a solid piston placed within the water column would move with a reciprocating movement in unison with the water movement.

In the modification shown in Figure 3, the exit pipes of the conduit 13 are of a gradual expanding size instead of being stepped as in Figures 1 and 2.

In the modification shown in Figure 4, the exit pipes are of a uniform size throughout.

In the modification shown in Figure 5, the exit end of the conduit pipe carries a conical member 24, capable of being placed at various distances from the exit, in order to form a variable restriction to the exit.

The shown modifications have more or less effect upon the propulsive force against the water volume and hence affect the speed of boat movement.

The advantages of the described method of boat propulsion are evident. There are no moving parts, no complicated and intricate machinery, no possibility of explosions, no stuffing boxes and no possible leakage, and in its use as a toy boat, in addition to the above advantages, it possesses the great advantage of practical freedom from fire, as "solid alcohol" may be employed as a heating medium.

The actual reasons for the results produced are problematical, but it would seem that the vapor within the coil 13 becomes expanded, forcing the water outwardly until the heated vapor comes into contact with a cooled portion of the conduit, causing a sudden condensation, or contraction, of the vapor, with a resulting in-rush of water, which, through its momentum, is carried to a portion of the conduit heated sufficiently to vaporize it, which vapor becomes superheated in the coil 13 and is expanded with considerable force, forcing the water column outwardly, the heated vapor again being cooled and contracted, this operation being intermittently performed to produce the results described above.

The coil 13 may be replaced by a receptacle, but, I prefer the coil, as my experiments thus far have shown more satisfactory results.

The coil 13 may be placed below the water-line, instead of above the water-line, as shown, but, for the purposes designated, I prefer the position shown in the drawings and described. Liquids other than water, may be employed under proper conditions for the production of similar results.

While I have shown a device, and the process of invention applied to a boat, I do not limit myself thereto, as this illustration is given simply for ease of demonstration.

I do not limit myself to the particular size, shape, number or arrangement of parts, nor to the particular liquids or applications of my process and device, as shown and described, all of which may be varied without going beyond the scope of my invention as shown, described and claimed.

What I claim is:—

1. In a device of the character specified, in combination, a boat, a conduit having a coiled portion and expanded non-coiled portions carried by the boat, the non-coiled portions being extended rearwardly and outwardly of the boat below its water-line and means for applying heat to the coiled portion to cause a reciprocating movement to the liquid within the non-coiled portion.

2. In a device of the character specified, in combination, a boat, a conduit having a coiled portion and stepped expanding non-coiled portions carried by the boat, the non-coiled portions being extended rearwardly and outwardly of the boat below its water-line and means for applying heat to the coiled portion to cause a reciprocating movement to the liquid within the non-coiled portion.

3. In a device of the character specified, in combination, a boat, a conduit having a pyramidal coiled portion and expanded non-coiled portions carried by the boat, the non-coiled portions being extended rearwardly and outwardly of the boat below its water-line and means for applying heat to the coiled portion to cause a reciprocating movement to the liquid within the non-coiled portion.

4. In a device of the character specified, in combination, a boat, a conduit having a pyramidal coiled portion and stepped expanding non-coiled portions carried by the boat, the non-coiled portions being extended rearwardly and outwardly of the boat below its water-line and means for applying heat to the coiled portion to cause a reciprocating movement to the liquid within the non-coiled portion.

5. In a device of the character specified, in combination, a boat, a conduit having a coiled portion and expanding non-coiled portions carried by the boat, the non-coiled portions being extended rearwardly and outwardly of the boat below its water-line, restricted exits to the non-coiled portions and means for applying heat to the coiled portion to cause a reciprocating movement to the liquid within the non-coiled portion.

6. In a device of the character specified, in combination, a boat, a conduit having a pyramidal coiled portion and expanding non-coiled portions carried by the boat, the non-coiled portions being extended rearwardly and outwardly of the boat below its water-

line, restricted exits to the non-coiled portions and means for applying heat to the coiled portion to cause a reciprocating movement to the liquid within the non-coiled portion.

7. In a device of the character specified, in combination, a boat, a conduit having a coiled portion and expanding non-coiled portions carried by the boat, the non-coiled portions being extended rearwardly and outwardly of the boat below its water-line, means for producing a predetermined restriction of the exits of the non-coiled portions and means for applying heat to the coiled portion to cause a reciprocating movement to the liquid within the non-coiled portion.

8. In a device of the character specified, in combination, a boat, a conduit having a pyramidal coiled portion and expanding non-coiled portions carried by the boat, the non-coiled portions being extended rearwardly and outwardly of the boat below its water-line, means for producing a predetermined restriction of the exits of the non-coiled portions and means for applying heat to the coiled portion to cause a reciprocating movement to the liquid within the non-coiled portion.

9. In a device of the character specified, in combination, a boat, a continuous conduit having expanded end portions, the end portions being extended rearwardly and outwardly of the boat below its water-line and means for applying heat to a portion of the conduit to cause a reciprocating movement to the liquid within the expanded portions of the conduit.

10. In a device of the character specified, in combination, a boat, a continuous conduit having expanded end portions, the end portions being extended rearwardly and outwardly of the boat below its water line, means for producing a predetermined restriction of the exits of the conduit and means for applying heat to a portion of the conduit to cause a reciprocating movement to the liquid within the expanded portions of the conduit.

Signed at New York, in the county of New York and State of New York, this 17th day of December, 1920.

WILLIAM F. PURCELL.