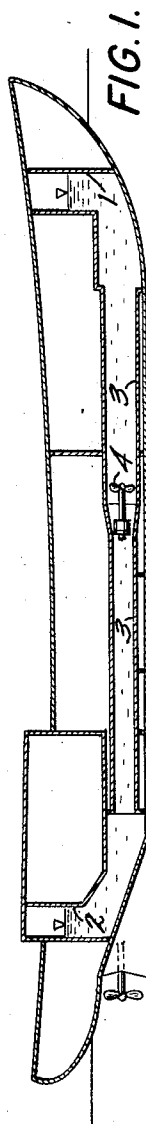
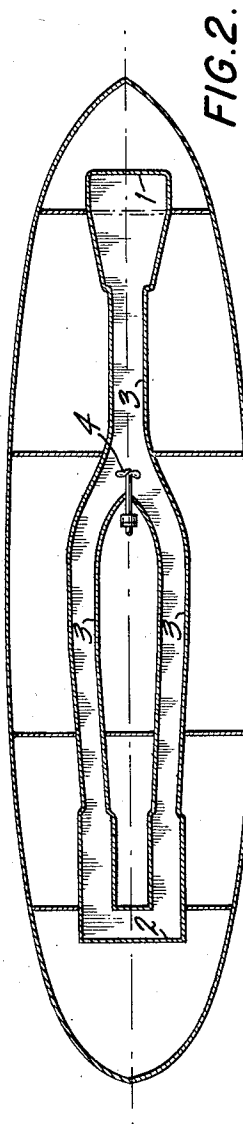
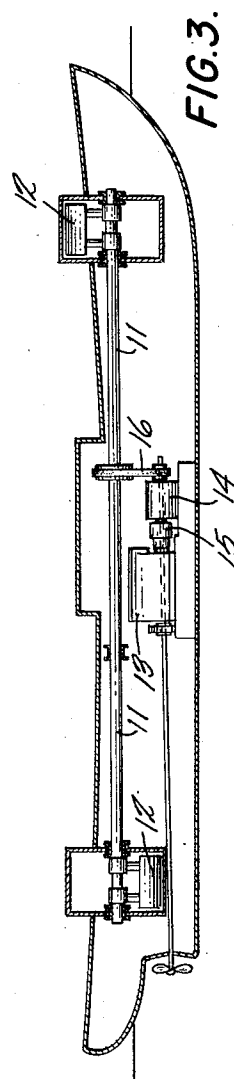


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ICE BREAKING SHIP
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ICE BREAKING SHIP

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Floatable crafts, particularly ice breakers, are known. They serve for breaking up the ice, for example, in the mouth region of ice covered rivers, which is important for draining off large volumes of water in event of a sudden thaw to prevent floods. The breaking up of ice is of similar great importance to navigation. These vessels or ice-breakers have a drive of their own and a special shape, and are of strong and rigid design. To break up the ice, the ship moves with full engine power against the sheet of ice, and owing to its particular bow shape the ship moves a bit on to it. By reason of the heavy weight of the bow which is thus lifted out of the water, the ice is broken. Hereafter, the ship moves a certain distance backward, then once more with full power on to the ice, and so forth, until all of the ice is broken.

The breaking up of ice thereby depends on the thickness of the ice sheet and its power of resistance, and will not occur until the weight of the bow is applied to the ice-sheet.

It is the object of the present invention to improve the mode of operation of an ice breaker as described in the foregoing text. For attaining this purpose, the ship shall be provided with additional arrangements forcing upon her a pitching or punching movement which is approximately in resonance with her natural pitching period.

During the starting period, for instance, a living force is generated in the ship's body by the alternating emersion of the bow and immersion of the stern, thus increasing considerably the ice breaking effect while the bow is moving on to the ice-sheet. Besides this effect, it will be furthermore accomplished that the undular motion of the water, generated by the pitching of the ship, will further crush the broken ice, so that the pitching arrangement will be advantageously maintained also during the running off of the ship. On the other hand, the wave motion thus generated, may also be used to break up an ice sheet or to disengage any frozen up vessels.

In the enclosed drawings, for example, are shown some embodiments of the invention, viz.

Figure 1, showing an ice breaker in longitudinal section, and

Figure 2 being a plan view of it,

Figure 3 representing a second embodiment in longitudinal section.

In Figures 1 and 2 the pitching arrangement consists of two tanks, 1 and 2 which are partly filled with any liquid, and a pipeline 3 connecting them and having a pump 4. With the aid of pump 4 a quantity of liquid corresponding to the desired pitching angle, is periodically pumped from the stern to the bow and vice versa, and thereby the ship is stimulated to pitching or punching. The pump is thereby periodically reversed from "suction" to "pressing" (for example in a simple manner by a propeller with adjustable blades accomplishing the reversal at a constant direction of rotation by

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adjusting the blades from the right-hand spiral to the left-hand spiral, and vice versa).

In order to be able to operate at the highest possible efficiency, i.e. with a minimum in power consumption for the pitching, it is appropriate to form the period of pumping in such a manner that it will correspond approximately to the natural pitching period corresponding to the ship's dimensions. If this is done, and if the dimensions of the tanks and of the connecting pipe-line, as well as the air-cushion above the liquid, are selected so that the number of proper vibrations of the liquid in this tank system corresponds to the number of proper vibrations of the ship, then a swinging of the ship onto the ice-sheet around her transverse axis (in longitudinal direction) will be accomplished, and thereby a pitching moment will be attained with a minimum in power consumption, the size of which pitching moment will be a multiple of the moment caused by the oscillating to and fro motion of the quantity of liquid.

Without changing the essence of this invention, the oscillating to and fro motion of the liquid from the bow to the stern and vice versa, may be also attained by methods other than by a pump, as for example by periodic action of compressed air on the tank surfaces. Likewise, it is not absolutely necessary to press the liquid from the bow to the stern and vice versa, for the effect in accordance with this invention may also be attained by changing only the contents of the tanks in the bow or in the stern. In this case, the connecting pipe lines could be eliminated by operating with the swelling and scudding of each single tank for itself.

Figure 3 shows another embodiment of the ship in accordance with the invention. A shaft 11, supported in longitudinal direction of the ship, carries on its ends weights 12 which are displaced by 180° and are attached to the lever arms. The shaft is put into rotation so that the time of one revolution will approximately correspond to the time of the natural pitching period of the ship. Through these revolving weights radial centrifugal forces will be generated towards the shaft center, acting as free forces upon the ship and the components of which in vertical direction will stimulate her to pitching. By lateral agreement of these centrifugal force components with the natural pitching period of the ship, amplification will be attained and a greater pitching moment will result than that which would correspond to the centrifugal force of the weights in themselves.

The horizontal centrifugal forces coming forth in addition to the vertical forces will effect an additional periodic yawing, preventing the ship from sticking fast in the ice sheets and contributing greatly towards disengaging herself more easily.

In the event of a ship sticking fast in the ice, the manifestations of forces of the foreweight may not so easily be converted into any motion of the ship than those of the stern weight owing to the bow being kept by the ice. In this condition, therefore, the ship will perform a pitching, rolling and yawing movement. These motions are particularly of great advantage for the further breaking up of the ice as well as for the ship's getting free of the ice.

In the construction of Figure 3, the main motor 13 is employed for driving the weight pitching arrangement, driving the shaft 11 by means of a gear mechanism 14 with coupling 15 and belt drive 16. Of course, any other type of drive may be also applied—even without the shaft 11—for driving the weights 12 which are displaced by 180°, without changing anything in the essence of this invention; likewise, the weights 12 may, if it is desired, be made in different sizes, thus to effect, besides the pitching movement, a rolling of the ship also. Both things may be accomplished also by different lengths

of the lever arms for the weights, or by applying only a single weight in the bow or in the stern. After all, instead of the angle of 180° any other deviating angle may be applied for the weights, in a given case, any angle being adjustable in operation may be selected for attaining a combined rolling and pitching.

The craft according to this invention may, for example, be also employed as an amusement craft or as a toy.

What we claim is this:

1. A process for increasing the pitching movements of an ice breaker to effect substantially complete breaking of the ice against which the ice breaker is brought which comprises, providing a body having substantial weight in said ice breaker and positively moving said body in resonance with the natural pitching period of the ice breaker, said body being moved independently of the movements of said ice breaker.

2. A process for increasing the pitching movements of an ice breaker to effect substantially complete breaking of the ice against which the ice breaker is brought which comprises, establishing a confined zone in the fore part of the vessel, establishing a confined zone in the after part of the vessel, said two zones being in fluid communicating relationship, and causing a substantial body of liquid to move back and forth rapidly between said two zones, in resonance with the natural pitching period of the vessel.

3. A process for increasing the pitching movements of an ice breaker to effect substantially complete breaking of the ice against which the ice breaker is brought which comprises establishing a first mass rotatable on an axis in the fore part of the vessel, establishing a second mass rotatable on an axis in the after part of the vessel, said masses being simultaneously rotatable and being relatively disposed upon their respective axes to lie in axial planes displaced by an angle of 180° , and positively causing said masses to rotate in resonance with the natural pitching period of the ice breaker, said masses being rotated independently of the movements of said ice breaker.

4. A process for increasing the pitching movements of an ice breaker to effect substantially complete breaking of the ice against which the ice breaker is brought which comprises, establishing a first mass rotatable on an axis in the fore part of the vessel, establishing a second mass rotatable on an axis in the after part of the vessel, said masses being simultaneously rotatable and being relatively disposed upon their respective axes to lie in axial planes displaced by an angle of about 180° effective to induce combined pitching and rolling movements and being of different weights, and positively causing said masses to rotate in resonance with the natural pitching period of the ice breaker, said masses being rotated independently of the movements of said ice breaker.

5. In an ice breaker, a first tank in the fore part of the vessel, a second tank in the after part of the vessel, conduit means interconnecting said first tank and said second tank, said conduit means being of sufficient volume to accommodate all of the liquid in one of said tanks at one time, and means for transferring liquid between said tanks rapidly and in large volumes in resonance with the natural pitching period of the ice breaker.

6. In an ice breaker, a first weight mass rotatable on a shaft in the fore part of the vessel, a second weight mass rotatable on a shaft in the after part of the vessel, said weight masses being simultaneously rotatable and being relatively disposed upon their respective shafts to lie in axial planes displaced at an angle of 180° , and means in said vessel for positively rotating said weight

masses in resonance with the natural pitching period of the ice breaker, said masses being rotatable by said means independently of the movements of said ice breaker.

7. In an ice breaker, a first weight mass rotatable on a shaft in the fore part of the vessel, a second weight mass rotatable on a shaft in the after part of the vessel, said weight masses being simultaneously rotatable and being relatively disposed upon their respective shafts to lie in axial planes displaced at an angle of about 180° effective to induce combined pitching and rolling movements and having different relative weights, and means in said vessel for positively rotating said weight masses in resonance with the natural pitching period of the ice breaker, said masses being rotatable by said means independently of the movements of said ice breaker.

8. In an amusement device, a body in the form of a marine vessel, a first tank in the fore part of the vessel, a second tank in the after part of the vessel, conduit means interconnecting said first tank and said second tank, said conduit means being of sufficient volume to accommodate all of the liquid in one of said tanks at one time, and means for transferring liquid between said tanks rapidly and in large volumes in resonance with the natural pitching period of the vessel.

9. A toy marine vessel comprising a first tank in the fore part of the vessel, a second tank in the after part of the vessel, conduit means interconnecting said first tank and said second tank, said conduit means being of sufficient volume to accommodate all of the liquid in one of said tanks at one time, and means for transferring liquid between said tanks rapidly and in large volumes in resonance with the natural pitching period of the vessel.

10. In an amusement device, a body in the form of a marine vessel, a first weight mass rotatable on a shaft in the fore part of the vessel, a second weight mass rotatable on a shaft in the after part of the vessel, said weight masses being simultaneously rotatable and being relatively disposed upon their respective shafts to lie in axial planes displaced at an angle in relation to one another effective to produce pitching movements of said vessel when said masses are simultaneously rotated, and means in said vessel for positively rotating said weight masses in resonance with the natural pitching period of the vessel, said masses being rotatable by said means independently of the movements of said vessel.

11. A toy marine vessel in the form of an ice-breaker comprising a first weight mass rotatable on a shaft in the fore part of the vessel, a second weight mass rotatable on a shaft in the after part of the vessel, said weight masses being simultaneously rotatable and being relatively disposed upon their respective shafts to lie in axial planes displaced at an angle in relation to one another effective to produce pitching movements of said vessel when said masses are simultaneously rotated, and means in said vessel for positively rotating said weight masses in resonance with the natural pitching period of the vessel, said masses being rotatable by said means independently of the movements of said vessel.

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