April 30, 1935. F. RANK 1,999,255

APPARATUS FOR DRIVING AND STEERING SHIPS

Original Filed Nov. 16, 1931

Fig.2

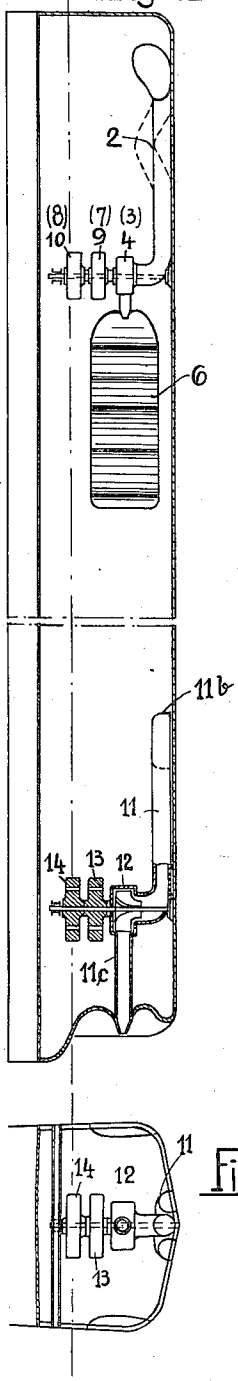
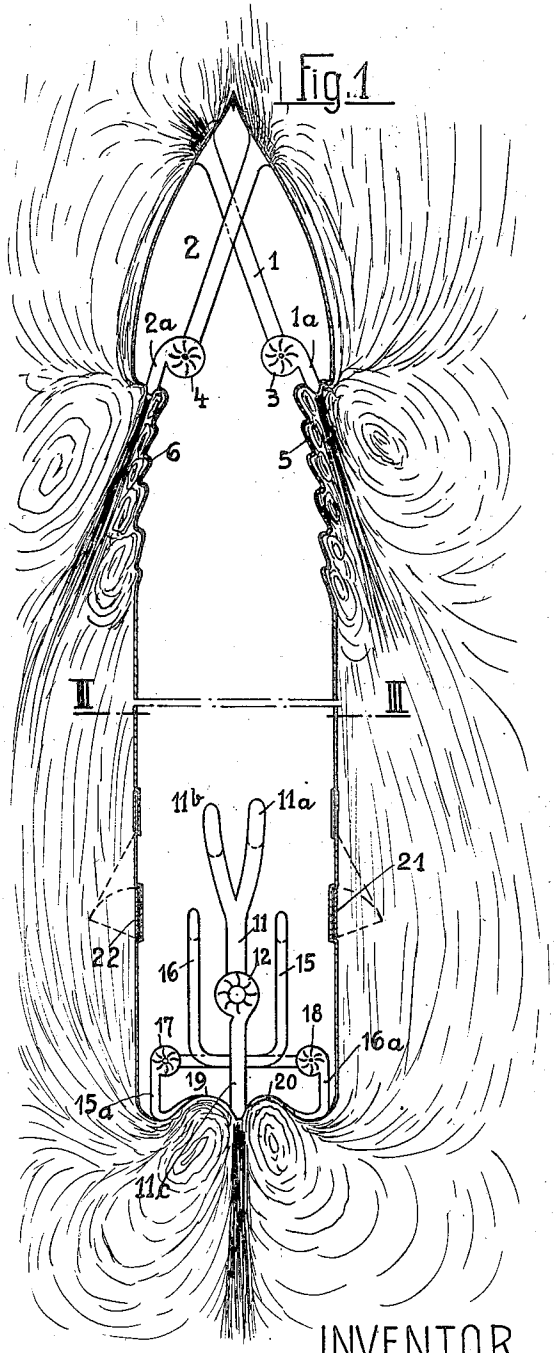


Fig.3

Fig.1



INVENTOR

FRITZ RANK

BY Richards & Geier

ATTORNEYS

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APPARATUS FOR DRIVING AND STEERING SHIPS

Fritz Rank, Sarkoy, Turkey

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8 Claims. (Cl. 115—12)

This invention relates to a device for driving and steering ships in which potential eddy flows of the water are utilized, these eddies being produced and utilized in this way that the water is sucked into a suitably designed device below the water line of the ship by means of tubes or other passages and is conducted through the body of the ship and re-conducted into the outer water behind the place or places of suction into niche-like cavities provided in the sides of the ship and having each a particularly designed surface suited for the formation of eddies, as is more fully described hereinafter.

I am aware of the fact that the idea per se to drive ships in this manner is no more new and I do not intend to claim that idea generally, but it is also a fact that the only proposal made up to now for the purpose in view has not proved useful, especially as regards the driving and steering of large vessels. In that known device the water is sucked in at the head or beak of the vessel by means of a conveying plant and is reintroduced into the outer water through a forked delivery pipe or, more precisely, through two delivery pipes, of which one terminates at one side of the vessel and the other at the other side of the same, said conveying plant being the only one provided. At the ends of the delivery pipes are closures designed in the manner of Venetian blinds. The entire plant is intended to constitute an artificial equivalent for the natural driving means which fishes have in the form of gills and scales, but said plant is, in fact, by no means such an equivalent, in that the exit openings are simply located in the normally extending wall of the ship, in consequence whereof the angle formed between the pressure jet and said wall is too large. The direction in which the pressure jets leave the delivery tubes extends too far outwardly and the flow eddies cannot exert their full effect. The driving power is, therefore, only slight, the more, as it must be produced by that one conveying device mentioned. There is no substitute for those other driving means which fishes have in the forms of fins and tails. Especially for steering purposes, for which fishes employ their fins and tails as further assistance, that known device is entirely useless. It is, it is true, possible to obtain a certain lateral movement solely at the head of the ship in that the above-mentioned closures at the exit openings of the delivery tubes are more or less closed, but there is no steering power available at the stern of the ship as is indispensably necessary to effect quick lateral movements or turnings. Thus, even with small vessels lateral movements or turnings can be effected only slowly, the more, as on that side to which the vessel is to be turned the entire resistance which the water presents at the head counteracts the turning, the water being sucked into the plant only at the foremost portion of the head. Besides, the conveying device must, on one side, work against the closed Venetian blinds whereby great loss of power and reduction of the efficiency of the plant is caused.

All those actually existing disadvantages of the known device of the type in question are completely obviated in my present improved device which, moreover, presents a complete artificial substitute for all driving and steering means of fishes. The gist of the invention consists in the utilization of the potential flow eddies so that adjustable steering members can be dispensed with. The invention consists, in the first place, in the provision of a plurality of conveying devices comprising each a powerful centrifugal pump which runs continually, and a driving engine of a suitable design which is regulable and can quickly be brought to its full output, and the individual driving and steering aggregates are so distributed along the entire length of the ship, between the head and the stern, that short delivery pipes terminate at the sides, as well as at the head of the vessel, the lateral pipes terminating in the range of particularly undulated walls which the currents of water issuing forth from said pipes engage and which are shaped somewhat like scales whereby the potential flow eddies are produced.

In order to enable these eddies to exert their full action or effect the individual delivery pipes terminate into the lateral niches provided with said undulated, scale-like walls in such a direction that the jets issuing forth from said pipes and the active portions of said undulations form between them very acute angles.

Niche-forming recesses or cavities are provided also at the stern of the vessel, and there terminate into them two delivery pipes, the ends of which are directed towards one another so that eddies arise, and a third delivery pipe terminates between said ends just in rearward direction whereby the eddies are fortified and rendered still more active.

In order to accelerate lateral movements or turnings of the ship during steering the suction pipes and the delivery pipes of the individual aggregates are so arranged that their ends are located on different sides of the ship.

The invention is illustrated diagrammatically and by way of example on the accompanying drawing on which Figure 1 is a horizontal section through the body of the ship and through the driving and steering means. Figure 2 is a longitudinal vertical section showing the left-hand half of the ship seen from the right to the left, and Figure 3 is a transverse section in the plane 3—3 of Fig. 1.

On the drawing, 1 and 2 (Fig. 1) denote two suction pipes which are crossing one another, as shown, and 1^a and 2^a are the appertaining delivery pipes, and between said suction and said delivery pipes are centrifugal pumps 3 and 4. The suction pipes extend forth rearwardly from the foremost portion of the body of the vessel, and the delivery pipes terminate into a kind of niches 5 and 6 provided in the sides of the vessel, the vertical main walls of said niches and the delivery pipes forming very acute angles with one another. Said vertical main walls are shaped as shown in Fig. 1, there being peculiarly shaped undulations constituting a sort of scales which are engaged by flow eddies formed by the jets of water escaping from the pipes 1^a and 2^a.

The centrifugal pumps 3 and 4 have vertical shafts and each is coupled with two electromotors 7 and 8, and 9 and 10 respectively. These motors can be driven singly or together and are regulable; they are preferably operated by Diesel-dynamos which present the advantage of having automatic regulation according to the load. As these engines and their connection with electromotors are known I have abstained from showing them in the drawing.

The suction pipes and the delivery pipes are provided with shutting-off devices that can be electrically controlled. Between these devices and the centrifugal pumps parallel pipes are connected with the suction pipes and the delivery pipes, also those parallel pipes being provided with shutting-off devices and the arrangement being such that the direction of the currents of water can be reversed. It is, however, also possible to make the pumps and their engines reversible. Also these features are known and I have therefore again abstained from showing such an arrangement and combination of parts in the drawing.

In the rear of the vessel is a conveying pipe 11, the suction portion of which is forked, as indicated by 11^a and 11^b (Fig. 1). The ends of the pipes 11^a and 11^b are located in the bottom of the vessel, as shown in Fig. 2. The delivery pipe 11^c extends counter to the suction pipes and terminates just at the rearmost portion of the ship's body (Fig. 1), and between it and the suction pipes is also a centrifugal pump 12 which is also coupled with two electromotors 13 and 14 also combined with Diesel-dynamos or the like (not shown), as has been described with respect to the pumps 3 and 4. Also with the pump 12 it is suited to the purpose to provide means for reversing the direction of the water streaming through this conveying device.

There are in the rear of the ship also two centrifugal pumps 17 and 18 which are also provided with motors etc., just as the other pumps. 15 is the suction pipe of the pump 17, and 15^a is the delivery pipe of the same; 16 is the suction pipe of the pump 18, and 16^a is the delivery pipe thereof. As appears from Fig. 1, the pipe 15 lies in front of the pump 18, and the pipe 16 lies in front of the pump 17, so that the pipes 15 and 15^a lie on opposite sides of the pump 12, as do also the pipes 16 and 16^a with respect to this pump. The delivery pipes or, more precisely, their ends, are bent towards one another (Fig. 1) and they terminate into niches 19 and 20 located just at the rear of the ship's body. The streams of water escaping from these pipes form eddies in these niches, and the current of water issuing forth from the pipe 11^c penetrates the eddies and strengthens them and renders them still more effectual.

Laterally from the pipes 15 and 16 flat niches are provided in the sides of the ship, and turnable flaps or fins 21 and 22 are located in these niches. These movable members may be moved and controlled mechanically, preferably electrically, and they assist in steering and stopping manoeuvres.

The manner of action at forward drive can be seen at the stream lines in Fig. 1. If steered to one of the sides, this can be done in several ways, according as the turning is to be effected more or less quickly. For instance, those aggregates conveying water to those sides to which the head and the stern are to be turned may be stopped and only the other aggregates may be operated by one of the appertaining electromotors. Or all aggregates are running and those that are to produce an increased pressure are operated also with the aid of the second motor that had been at a standstill up to then. Or the one set of the aggregates is left at rest and the other is operated with a greater supply of power. In every case the resistance presented by the water on those sides to which the head and the stern of the ship is to be turned is reduced by reason of the sucking away of the water. This action can be rendered still more effective by turning outwardly the one or the other of the flaps or fins 21, 22, as the case may be.

Stopping manoeuvres and driving rearwardly can be effected by reversing the direction of running of all aggregates or certain thereof, as the case may be, and quite slow stopping may be effected also solely by means of said fins, the driving aggregates being then at a standstill.

It is suited to the purpose to employ electromotors of short axial length, but large diameter, so that their armatures can be used as fly mass for rendering the operation of the sets more stable, also when running without load.

I wish it to be understood that such aggregates as in the front portion of the ship may be provided also in the middle portion of the same, also with crossing suction pipes, but these pipes will then commence at the bottom of the ship's body.

It is a matter of course that for the mechanical and electrical steering and controlling of the individual conveying aggregates all auxiliary means may be used that are known in naval and general engineering so that the ship can be conducted from the bridge-deck without the assistance of mediators.

I claim:

1. A device for driving and steering ships by the utilization of potential eddy flows, comprising a plurality of driving and steering aggregates, said aggregates being independent of each other and being distributed along the length of a ship, each of said aggregates comprising a continually operating conveying device and a driving device; suction pipes beginning in front of said driving and steering aggregates and situated below the water line of said ship, delivery pipes extending rearwardly from said aggregates, the

beginning of the suction pipe and the end of the delivery pipe of each aggregate in the front and rear portions of the ship being located on different sides of the ship's body, and scale-like surface portions formed in the walls of the ship and situated adjacent to said delivery pipes, whereby said portions are engaged by the eddies formed by water currents issuing from said delivery pipes.

2. A device for driving and steering ships by the utilization of potential eddy flows, comprising a plurality of driving and steering aggregates, said aggregates being independent of each other and being distributed along the length of a ship, each of said aggregates comprising a continually operating conveying device and a driving device; suction pipes beginning in front of said driving and steering aggregates and situated below the water line of said ship, delivery pipes extending rearwardly from said aggregates, the beginning of the suction pipe and the end of the delivery pipe of each aggregate in the front and rear portions of the ship being located on different sides of the ship's body, niches formed in the walls of the ship, and scale-like surface portions formed in said niches behind said delivery pipes, whereby said portions are engaged by the eddies formed by water currents issuing from said delivery pipes.

3. A device for driving and steering ships by the utilization of potential eddy flows, comprising a plurality of driving and steering aggregates which are independent from one another and of which three are located in the rear portion of the ship and each of which comprises a continually operating conveying device and a regulable driving device adapted to be brought quickly to full performance, said aggregates being distributed along the entire length of the ship; suction pipes commencing in front of said driving and steering aggregates; delivery pipes extending rearwardly from said driving and steering aggregates, the delivery pipes of two oppositely located aggregates of the rear aggregates extending with their ends towards one another and the delivery pipe of the third rear aggregate terminating between said two aggregates, and niches located at the rearmost portion of the ship's body and receiving the first-mentioned delivery pipe ends; and scale-like surface portions provided at the wall of the ship and being so located relatively to the delivery pipes of the driving and steering aggregates in the front of the ship as to be adapted to be engaged by the eddies formed by the jets of water streaming forth from these delivery pipes.

4. A driving and steering device for ships with utilization of potential eddy flows, comprising a plurality of driving and steering aggregates which are independent from one another and each of which comprises a continually operating conveying device and a regulable driving device adapted to be brought quickly to full performance, said aggregates being distributed along the entire length of the ship; suction pipes commencing in front of said driving and steering device and being located below the water line; delivery pipes extending rearwardly from the said aggregates, the commencement of the suction pipe and the end of the delivery pipe of every aggregate being located on different sides of the ship's body; and scale-like surface portions provided at the wall of the ship and being so located relatively to said delivery pipes as to be able to be engaged by the eddies formed by the currents of water issuing forth from these pipes, substantially as set forth.

5. A device for driving and steering ships with the aid of potential eddy flows, comprising a plurality of driving and steering aggregates which are independent from one another and each of which comprises a continually operating centrifugal pump with vertical shaft and electromotors coupled with the respective shaft and Diesel-dynamos coupled with said electromotors, every aggregate being regulable independent from the other ones; suction pipes commencing in front of said pumps and being located below the water line; delivery pipes extending rearwardly from the said pumps; and scale-like surface portions provided at the wall of the ship and being so located relatively to said delivery pipes as to be able to be engaged by the eddies produced by the jets of water issuing forth from the said delivery pipes, substantially as set forth.

6. A device for driving and steering ships by the utilization of potential eddy flows, comprising a plurality of driving and steering aggregates which are independent from one another and each of which comprises a continually operating centrifugal pump with vertical shaft and two electromotors arranged one above the other and being coupled with said shaft and being adapted to be switched on and off independent from one another; means for driving said electromotors; suction pipes commencing in front of said pumps, and being located below the water line; delivery pipes extending rearward from the said pumps, and scale-like surface portions provided at the wall of the ship and being so located relatively to said delivery pipes as to be able to be engaged by the eddies produced by the jets of water issuing forth from the said delivery pipes.

7. A device for driving and steering ships by the utilization of potential eddy flows, comprising a plurality of driving and steering aggregates which are independent from one another and each of which comprises a continually operating centrifugal pump with vertical shaft and electromotors coupled with said shaft and means for driving said motors, the armatures of said motors being so designed as to be adapted to be used also as fly mass; suction pipes commencing in front of said pumps and being located below the water line; delivery pipes extending rearwardly from the said aggregates; and scale like surface portions provided at the wall of the ship and being so located relatively to said delivery pipes as to be able to be engaged by the eddies produced by the water currents issuing forth from the said delivery pipes.

8. In combination, a ship body, a driving aggregate carried by said body, a suction pipe connected with said aggregate, and a delivery pipe connected with said aggregate, said delivery pipe ending in a niche formed in a wall of said ship body behind said delivery pipe and having undulated walls shaped similarly to fish scales and forming a very acute angle with said delivery pipe, the walls of said niche being adapted to be engaged by the eddies formed by the water streaming from said delivery pipe.

FRITZ RANK.