May 17, 1927. 1,628,837

F. GEBERS

PROPELLING MECHANISM FOR SHIPS

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Fig. 1.

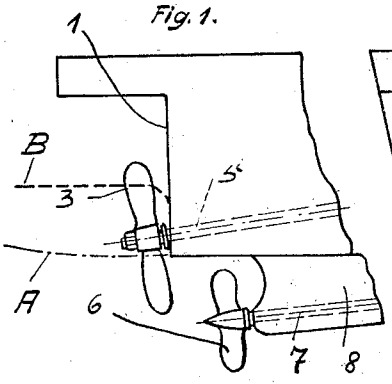


Fig. 2.

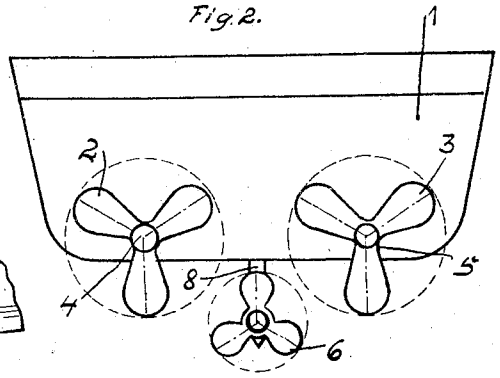


Fig. 3.

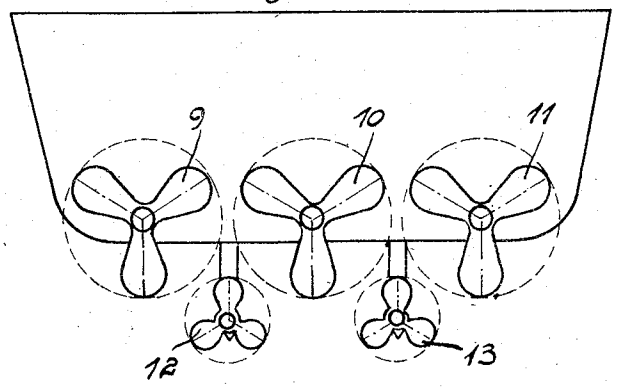
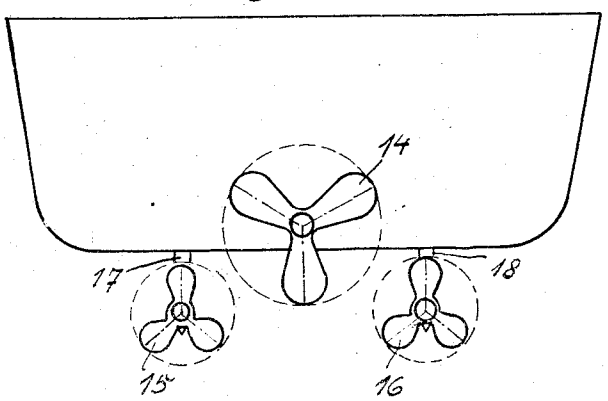


Fig. 4.



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Fig. 5.

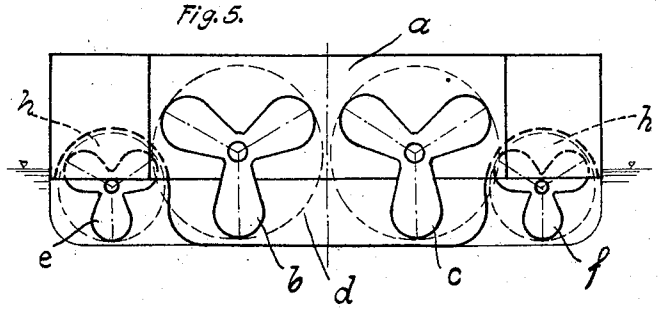


Fig. 6.

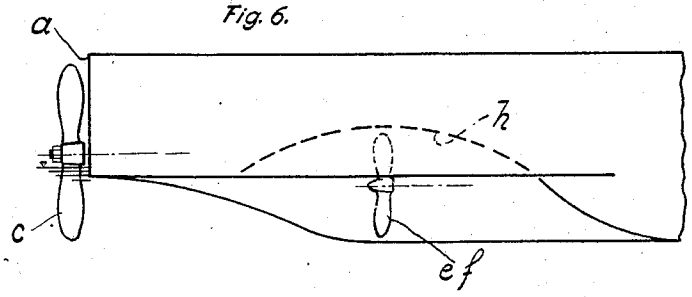
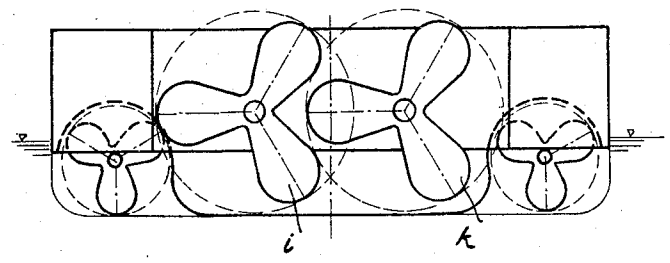


Fig. 7.



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UNITED STATES PATENT OFFICE.

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PROPELLING MECHANISM FOR SHIPS.

Application filed July 3, 1924, Serial No. 724,143, and in Germany July 6, 1923.

This invention has for its object to arrange the propelling surface for ships in such a manner that temporarily, for maximum effect, it is as great as possible and that on the other hand, temporarily, when the economy makes it desirable to utilize a smaller useful propelling surface, this smaller surface is at disposal. A further object of the invention is to mount the propeller shafts so that the resistance of the bare ship's hull is increased as little as possible.

The invention relates to—

(1) Ships which have to run temporarily at extraordinarily high speed, maximum speed, and temporarily at low speeds, further:

(2) Ships which temporarily tug heavily and temporarily with lesser or without appendix and which perhaps sail even down stream.

For high-speed ships an arrangement of the propellers, called the Hickmann propeller arrangement, has become known, directly behind the stern of rapid motor boats, according to which the shafts are located entirely in the ship's hull, not in extensions of the same, the propellers immersing, especially when the ship is running, only with a part of the lower half of the circular surface. Propellers of this type might be called "out of water propellers". The lines of the ship are in this case shaped accordingly.

A propeller arrangement of this type has its maximum efficiency only at a determined number of revolutions and at a determined speed of the ship, e. g. when the speed has become so high that the water running after does not reach any more the stern of the ship, and the propeller hub, and consequently the largest portion of the circular surface of the propeller, is working above water. If a ship of this type has to run, instead of at the maximum speed, at a considerably slower speed, the marching speed, for instance instead of at full speed of 45 nautical miles only at the marching speed of 10 nautical miles, this becomes possible only by changing the number of revolutions of the propeller. By the slower speed the position of the ship with regard to the water is however altered, and the immersion conditions are thereby considerably changed for the worse, as the propeller works now also with the hub and with the inner parts of their blades in the water behind the stern. Their efficiency becomes consequently very unfavorable as the power spent is no longer in proportion with the speed.

For the running at full speed it will, in those cases where the stern must have only a determined width, when the requirements as regards speed are extraordinarily high, no longer be possible to use for the above mentioned arrangement economical propeller diameters.

These inconveniences are avoided by the present invention and a propelling arrangement is created which is equally economical for full speed and for marching speed and permits of obtaining an especially high speed.

The improved arrangement is illustrated by way of example diagrammatically in the accompanying drawing in which:—

Fig. 1 shows the stern of a ship in side elevation.

Fig. 2 shows this stern viewed from behind.

Fig. 3 is a similar view as Fig. 2, the arrangement being however somewhat modified.

Fig. 4 shows a further modification in a similar view as Fig. 2.

Fig. 5 shows a third form of construction in elevation, the stern of the ship being viewed from behind.

Fig. 6 is a side elevation of Fig. 5.

Fig. 7 is a similar view as Fig. 5, the arrangement being slightly modified.

According to the invention the propelling arrangement consists of a combination of a kind of out of water propellers with ordinary submerged propellers, the shafts of the latter being preferably arranged in or on a central fin projecting from the ship's bottom, in order to increase in this manner at the same time the steadiness of course of the ship.

As shown in Figs. 1 and 2 two out of water propellers 2 and 3 are arranged behind an even stern 1 so that their shafts 4 and 5 are completely located in the hull, the circular surface of the same protruding over the lower edge of the ship's bottom only for a small portion (less than the half). At the side of these propellers an under water propeller 6 is further arranged so that it is completely submerged at every position of

the ship. The shaft 7 of this propeller is accommodated, according to the embodiment of the invention shown, in a longitudinal fin 8. This propeller will generally be of much smaller diameter than the two out of water propellers.

At high speeds all propellers work together and line A (Fig. 1) indicates the approximate course of the full water in the central plane of the ship and at the sides of this central plane where the out of water propellers work.

For marching or slow speeds the propeller 6 works preferably alone at considerably lower number of revolutions than at full speed and the motor drive is regulated at the same time for such a ratio of transmission and the motor capacity is regulated so that at a determined marching speed a sufficiently high efficiency is obtained, or a reversible propeller is used so that the pitch of the blades may be varied. The two out of water propellers are either disengaged as usual, or when they have to rotate also and when they have three blades, turned so that one blade stands perpendicularly downward in which position the propeller is secured, or when reversible screws are used as out of water propellers the blades will have to be adjusted in the running direction. Line B (Fig. 1) indicates the approximate course of the full water.

As the out of water propeller possesses for high speeds a very great pitch (on the drawing the blades are only diagrammatically shown) the resistance of the propeller surface, which at the marching speed is immersed, is not very considerable even when the blades are fixed. The seaworthiness is however considerably improved by the under water propeller arranged at a low level.

Great importance is attached in this arrangement that the propeller currents from the several propellers do not intersect one another or only as little as possible, this arrangement presenting the further advantage that the propeller currents from the out of water propellers do interfere comparatively little with the propeller currents from the submerged propellers so that it is possible to arrange the propellers closely together.

It is evident that the arrangement described can always be modified by addition of another out of water propeller and of one propeller arranged as usual so that the driving capacity is subdivided five times, seven times, nine times and so on. Fig. 3 shows the combination of three out of water propellers 9, 10, 11 and of two ordinary propellers 12 and 13. The combination may be such that only one out of water propeller 14 and two ordinary propellers 15 and 16, the latter in fins 17 and 18, are arranged together and this arrangement would be further improved in a similar manner as the other combination shown in Fig. 3. Even numbers of out of water propellers might further be combined with odd numbers of submerged propellers.

When the out of water propellers are in odd number one of these propellers is preferably constructed as a propeller rotating in opposite directions, viz, composed of two propellers which, as in torpedoes, are mounted the one directly behind the other on two telescoped shafts and rotating the one in right hand direction and the other in left hand direction, or guide blades in front or behind are provided, or the rudder is used as compensating means to ensure the steadiness of course.

If necessary, all the propellers might evidently be constructed as propellers rotating in opposite directions or fitted with guide blades.

For tugging ships, especially ships sailing on waters of limited depth, a similar combination of out of water propellers and submerged propellers is advantageously used.

The limitation of the immersion which for ships of this kind is generally a condition to be fulfilled makes it necessary to subdivide the propeller surface as much as possible even if tunnel screws are used. If more than two propellers are necessary the admission of the water to the inner propellers is very unfavorable as the proximity of the sole to the ship's bottom impedes the admission from below.

These inconveniences are avoided by the forms of construction shown diagrammatically in Figs. 5 to 7. A combination of ordinary submerged propellers with out of water propellers is used also in this case. The submerged propellers may work in tunnels, generally as outer propellers, one or several out of water propellers being preferably used as inner propellers. The lines of the stern part of the ship are arranged so that a good water admission is obtained and the out of water propellers are made to rotate in such a direction that the water is agitated from the outer side to inwards where the water is wanted most.

In the form of construction shown in Figs. 5, 6 and 7 two out of water propellers *b* and *c* are arranged directly behind the even stern, the shafts of these propellers being mounted entirely in the interior of the ship, the screw circle *d* of said propellers immersing only for less than the lower half. The stern of the ship may, as shown in the drawings, slightly immerse in the water with its lower edge, at the position of rest, as later on, when the propellers are working, the surface of the water is lowered, and the resistance is not unfavorably influenced by the fact that the ship ends in a low vertical plane. The lower edge of the stern might however be situated higher above the water

if the mounting of the propellers permits it or if it should be necessary. Two submerged propellers *e* and *f* are arranged besides the two out of water propellers, said two submerged propellers working in lateral tunnels *h* so that the largest possible propellers might be used. If the depth of the water is sufficient the tunnels may evidently be omitted. Instead of two out of water propellers only one out of water propeller or any other convenient number of them may be arranged. If difficulties of steering should be caused by odd number propellers, propellers rotating in opposite directions or guide blades may be used as described above.

Although the arrangement will be made so that a mutual disturbing of the screw currents is avoided as much as possible it might happen that this cannot be avoided especially if the width of the arrangement is limited. In this case the shafts of the out of water propellers will be coupled with one another as shown in Fig. 7 at *i* and *k* so that the propellers intersect the one in the range of the other in case it should be impossible to arrange the same the one behind the other. This will evidently be necessary also for the out of water propellers when there are no submerged propellers.

I claim:—

1. In a drive mechanism for ships, the combination of propellers, immersing during travel with only a portion of the propeller circuit, and propellers completely submerged, each type of propeller being driven by separate machines, the submerged propeller cooperating with the semi-submerged propellers for high speed but operating alone at low speeds, the semi-submerged propellers at low speeds remaining stationary.

2. In ships, a hull, a shaft in the hull having its rear end contiguous to the water level in the rest position of the hull, a propeller mounted at the rear end of said shaft and during the period of speeding raising said hull and dipping only the working areas of its blades, a submerged propeller rotatably mounted beneath the hull and adapted to remain completely submerged at all speeds of the hull, said propellers being independently operative, whereby both propellers and their driving means may be utilized at high speeds while the submerged propeller and its driving means only may be used at lower speeds.

In testimony whereof I affix my signature.

FRIEDRICH GEBERS.