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A. GAMBIN.

PROPELLING SHIPS.

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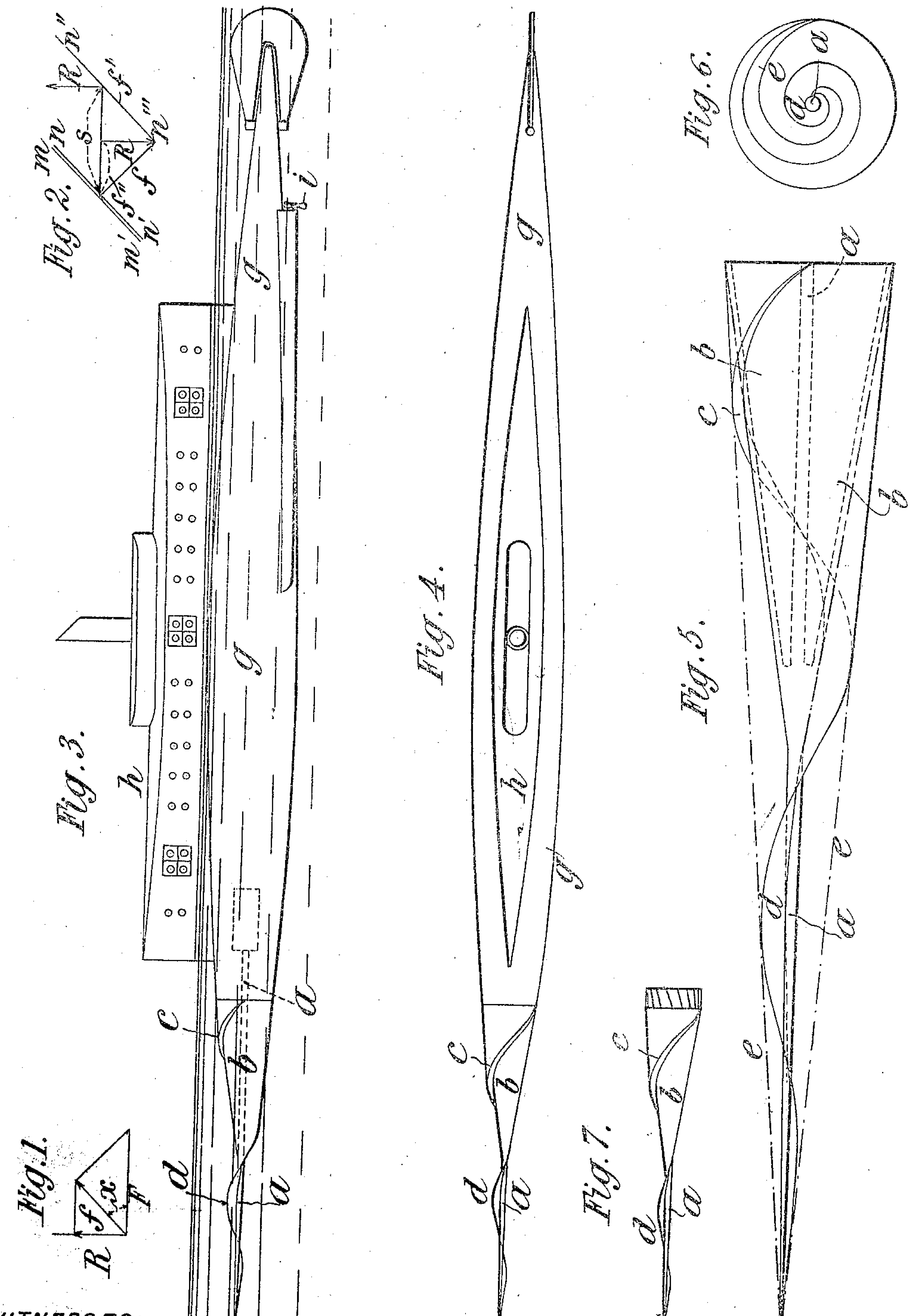

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PROPELLING SHIPS.

No. 822,732. Specification of Letters Patent. Patented June 5, 1906.

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To all whom it may concern:

Be it known that I, ANDRÉ GAMBIN, a citizen of the Republic of France, residing in Paris, France, have invented certain new and useful Improvements in Propelling Ships, of which the following is a specification.

The screw placed astern of a ship is generally recognized as the most advantageous propeller hitherto invented. Now the effects of this propeller are several, and while under the best conditions less than a fourth part of the work done is translated into a movement of the ship in the direction of her axis, the remainder produces movements in the surrounding fluid which are at variance with the movement sought.

In the accompanying drawings, Figures 1 and 2 are diagrams showing the composition and resolution of the force operating. Fig. 3 is a longitudinal vertical section, and Fig. 4 a plan of a ship provided with a propeller embodying the present invention. Figs. 5 and 6 are respectively a side elevation and an end view of the same on an enlarged scale. Fig. 7 is a plan of another propeller embodying the invention.

The maximum axial progression for a given power expended is obtained with a blade inclined at forty-five degrees, since if F be the generating force we have, as a fact, (see Fig. 1,) $f = F \cos x$, $R = f \sin x$, and by substitution $R = F \sin x \cos x$. R is consequently a maximum for forty-five degrees, in which case $f = \frac{F}{\sqrt{2}}$ and $R = \frac{f}{\sqrt{2}}$, and by substitution $R = \frac{F}{2}$; but as this force acts upon two masses each of which is movable it may be taken that the force available for propelling each mass is only $\frac{F}{4}$, so that this is the force causing the ship to move, provided that she, and therefore the screw, does not suffer any displacement. As this displacement is inevitable, the force producing the movement sought is really less than $\frac{F}{4}$. This force has to overcome the resistances corresponding with, first, the pressure on the ship's bow in displacing the surrounding fluid; second, the skin friction of the hull; third, the increased friction due to the phenomenon known as "citation;" fourth, the back suction due to the displacement of the fluid in rear of the propeller, which has caused certain constructors to make an ovoid form follow in the wake of the screw to fill up the void, (these last two phenomena evidently limiting the effective maximum revolutions of the propeller,) and, fifth, the total back suction of the whole mass of the ship. To obviate these inconveniences, I propose a special propeller placed in front of the ship and drawing the latter in its wake. This propeller is carried by a horizontal shaft, which may be driven by any motor, preferably a turbine.

The propeller comprises an extension of the horizontal shaft *a* passing axially through a cone *b* whose base covers the front of the ship and whose height is equal to the perimeter of the base. This cone carries a helicoid surface *c* at an angle of forty-five degrees with the axis of the cone and therefore of a pitch equal to the height of the cone. This helicoid surface is prolonged to make a spire beyond the summit of the cone, and the contour of the prolongation is contained by a second cone *e* having the same base as the first, but of double the height. Thus the helicoid surface, which is formed with a concave face turned toward the apex of the longer cone, comprises exactly two spires.

The surface of the outer cone only exists in rear of the first spire of the helicoid surface, being cut away in advance thereof to expose the surface of the inner cone. The second spire of the helicoid surface is a continuation of the first and is fixed to the extension of the shaft *a*. Thus while the first spire consists solely of a concave surface turned toward the apex of the cone the second has a concave front surface and a convex rear surface for action on the fluid.

The propeller is rotated in the direction which tends to produce a vacuum in front of the screw, upon which, in conjunction with the boring action of the screw, the propulsion of the ship depends. The latter is preferably completely submerged.

Representing Fig. 2 by $m\ m'$ the surface of the fluid and by $n\ n'$ the helicoid surface at rest, when the latter has rotated to a position $n''\ n'''$ a force s, due to suction, is produced, which may be resolved into components—viz., f' parallel to the blade and therefore of no effect, and f perpendicular to the blade. The latter may be resolved in its turn into two other components—viz., f'', directly opposed in action to the generating force—that is to say, to the rotating force of the apparatus, and therefore directly suppressed, and R, the sole force able to exert its action freely and capable of producing the axial displacement of the apparatus equal to the circular direction of the disk of the helicoid, since the blade is inclined at forty-five degrees and for all lower displacements a point of the pitch of the helicoid will depart from the trajectory traced by the turns inscribed and will occasion a void and therefore a suction tending to reëstablish the normal progress.

By this construction of the propeller cavitation and displacement in the rear of the propeller are no longer drawbacks, but are the actual means of propelling the ship, and the pressure on the bow may be entirely eliminated by constructing the hull so that its outline is, as it were, an extension of the conical propeller. Moreover, the bow may be caused to enter the cone, thus aiding to support the latter. There remain then only the skin friction and the back suction due to the whole mass, and to obviate these last-named inconveniences, if it is desired to have a perfect ship, where speed shall be the essential point, an outline for the ship should be chosen approximately following the graphical representation of the centripetal reaction under the influence of the pressure of the superincumbent fluid after the passage of the propeller, for it can be readily imagined that there will be back suction if the ship is displaced by the whole of her length in less time than is necessary for the centripetal reaction to fill up the void produced after the passage of the propeller, while there will be skin friction in the contrary case. If, then, the fluid requires a time to pass from the periphery of its maximum displacement to the center under the centripetal reaction, the ship *g* must have the form of a cone, (or of a cone surmounting an ovoid to allow for the centrifugal action prolonged beyond the base of the propeller,) having a base equal to the said displacement and of height equal to the pitch of the helicoid multiplied by the number of revolutions in the given time. This cone as well as the propeller are completely submerged, but the cone *g* may be surmounted by an elongated upper deck *h* emerging from the water and containing the crew and the passengers. In this case the surface of the propeller may be increased to set off against the resistance of this upper deck *h*—for example, by bounding it by the director cylinder or cylindrical envelop instead of the exterior cone or by giving it an intermediary extension. The whole constitutes a semisubmarine type with which one can certainly obtain the best nautical speed.

This propeller is evidently as well suited for aerial traction as for nautical traction and may receive other applications. It may constitute a very advantageous propeller for a torpedo. The propeller may be ballasted or contain suitable spaces to give it buoyancy in the surrounding fluid, so as to relieve the strain on the propeller-shaft. The space between the propeller and the bow of the ship may serve as an exhaust-chamber for the engines, there being here a diminished pressure as a result of the rotation of the propeller. The propeller thus produces all the useful effects and no other, and beyond the work necessary for the centrifugal displacement the resistances to be overcome are practically reduced to the internal friction of the engine.

To increase the steering power and to facilitate manoeuvering, ships provided with this propeller may have twin screws *i* in the usual manner of pitch forty-five degrees, which in full way really act as screws, which cannot be said of the screws similarly used at present.

To simplify the construction of this propeller, the two surfaces of the helicoid may be constituted by a single blade constructed as an Archimedean screw of a single spire or an angular or logarithmic screw of Pascal or a similar spiral. The concave side of this curve will trace the pneumatic surface, while the convex side will trace the centrifugal surface. This blade will be suitably cut away to assure its greater stability, while keeping it sufficiently extended to provide a suction-surface proportional to the resistance created by the upper deck and other superstructures outside the essential coni-ovoid form of the ship. On the other hand, the screw propulsion may be combined with the suction propulsion by fitting to the external outline of this new propeller another helicoid blade, making a salient angle (greater than two right angles) with the concave face and a reëntrant angle (less than two right angles) with the convex face, or by terminating the base of the propeller by a circular ring surmounted by helicoidal wings, like a worm gear-wheel, having helicoid teeth. (See Fig. 7.)

Having thus described the nature of my said invention and the best means I know of carrying the same into practical effect, I claim—

1. A propeller for nautical and aerial locomotion comprising a shaft, a cone on the said shaft, a helicoid surface mounted on the said cone and continued on the said shaft.

2. A propeller for nautical and aerial locomotion, comprising a shaft *a*, a cone *b* on said shaft, and a helicoid *d* passing around the cone *b* and around the shaft *a* beyond the apex of the cone.

3. A propeller for nautical and aerial locomotion comprising a shaft, a cone on the said shaft, a helicoid surface on the said cone, a continuation of the said helical surface on the said shaft, the said continuation being of such form that its outline touches the outline of an imaginary cone having the same base as the first-named cone.

4. A propeller for nautical and aerial loco-

motion comprising a cone of height equal to the perimeter of its base, a shaft extending horizontally from the bow of the ship and carrying the said cone, a helicoid surface on the said cone at an angle of forty-five degrees to the axis thereof, a second helicoid surface extending as a continuation of the first and carried by the said shaft, the outline of said second helicoid surface being contained within the outline of a second cone having the same base as and double the height of the first-named cone, the said second cone being cut away except to the rear of the first-named helicoid surface, and both the said helicoid surfaces being concave on the side turned toward the apex of the said second cone and convex on the opposite side.

In witness whereof I have hereunto signed my name, this 13th day of January, 1905, in the presence of two subscribing witnesses.

ANDRÉ GAMBIN.

Witnesses:

MARCEL ARMENGAUD, Jeune,

C. G. BURBEZAT.