May 24, 1927. 1,629,767

S. VALDÉS

JET PROPULSION APPARATUS FOR THE DRIVING OF VEHICLES, SHIPS, BOATS, FLYING MACHINES, AND THE LIKE

Filed Dec. 15, 1924 2 Sheets-Sheet 1

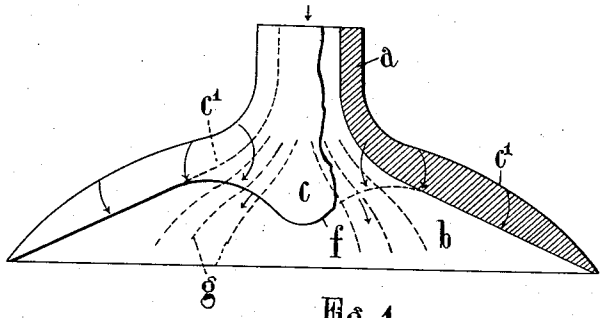


Fig. 1.

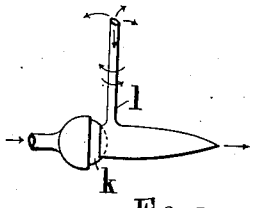


Fig. 5.

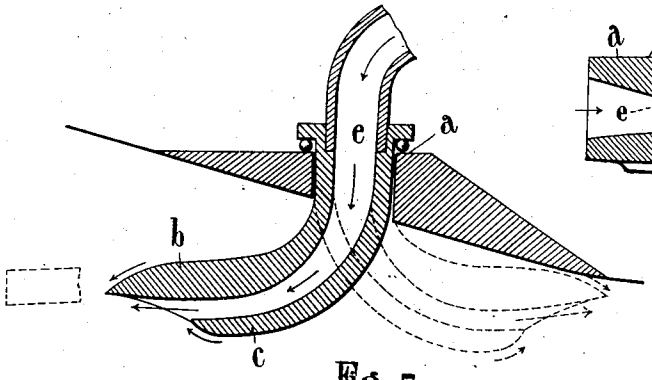


Fig. 7.

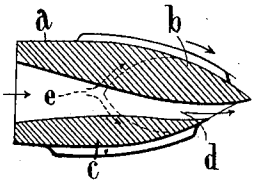


Fig. 2.

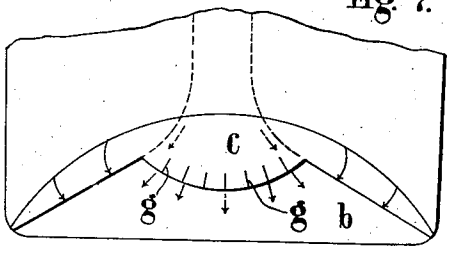


Fig. 3.

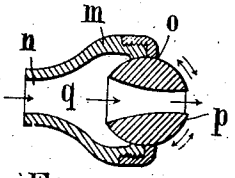


Fig. 6.

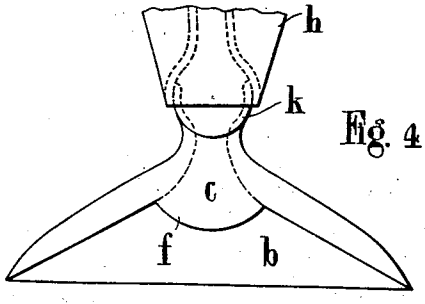


Fig. 4.

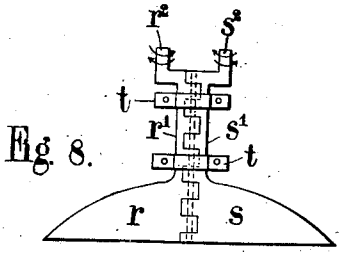


Fig. 8.

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Filed Dec. 15, 1924 2 Sheets-Sheet 2

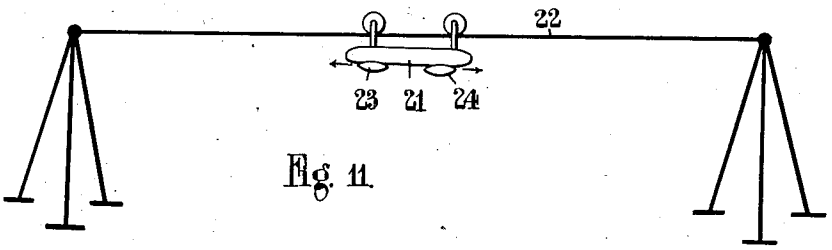


Fig. 11.

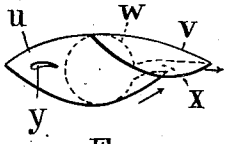


Fig. 9.

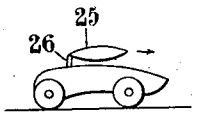


Fig. 12.

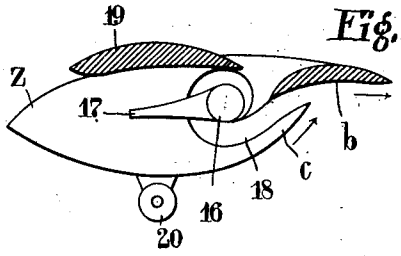


Fig. 10.

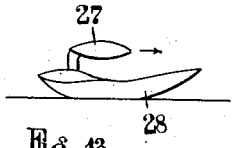


Fig. 13.

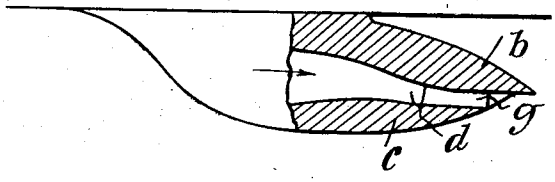


Fig. 17.



Fig. 16.

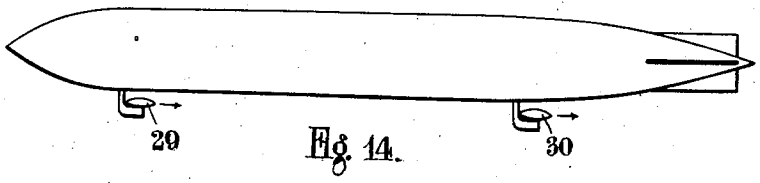


Fig. 14.

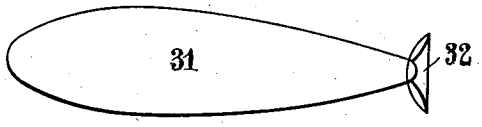


Fig. 15.

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UNITED STATES PATENT OFFICE.

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JET-PROPULSION APPARATUS FOR THE DRIVING OF VEHICLES, SHIPS, BOATS, FLYING MACHINES, AND THE LIKE.

Application filed December 15, 1924, Serial No. 756,131, and in Great Britain March 18, 1924.

My invention relates to propulsion mechanism of the reaction type and consists in a reaction apparatus; a new and useful improved mechanism for the discharge of fluid.

Hitherto the mechanism for discharging fluid has comprised deflecting vanes in order to give to the jet of fluid the desired direction, but, even with such an improvement, the efficiency of the system of propulsion by reaction is still lower than that of the screw propeller, owing principally, to the slip of the jet of fluid in the medium into which the said jet discharges—slip which increases with the speed of the discharging fluid.

The reaction apparatus of my invention is for obtaining the maximum reaction of the discharging fluid by means of reducing to the minimum the said slip of discharge.

To this end the invention consists essentially in an improved reaction propelling device for a vehicle comprising in combination a hollow hub, a hollow extension connected to and flaring outwardly from such hub, a pair of broad shallow lips terminating such extension, pressure fluid adapted to issue from between such lips, and convergent stream line external surfaces to the lips and extension member, whereby the medium in which the propeller is immersed flows towards and across the lips so that the issuing pressure fluid obtains full impact upon the external medium.

The reaction apparatus can be attached to the discharging mechanism in a fixed position, or can be adjusted into any desired position by means of a spherical universal connection or by coupling, or any other suitable mechanism, in order that the reaction apparatus may receive a universal movement for the control of the direction of the discharging fluid for manœuvering and steering the boat or vehicle in all directions, as required.

The reaction apparatus can be made or constructed of one blade only, as above described, or the said blade may be composed of two or more leaves joined together by means of hinges or any other suitable mechanism in order that the degree of concavity of the surface of the reaction apparatus can be varied as required.

Various embodiments of the invention are illustrated in the accompanying drawings in which—

Figure 1 is a reverse plan view partly in section of one form of reaction apparatus according to the invention;

Figure 2 is a central transverse sectional view of Figure 1;

Figure 3 is a diagrammatic view of a part of the after portion of a flat bottomed boat fitted with a fixed reaction apparatus;

Figure 4 is a view similar to Figure 3 of a part of the after portion of a submarine fitted with an adjustable reaction apparatus;

Figure 5 is a side elevation of movable reaction apparatus, such as is shown in Figure 4;

Figure 6 is an enlarged sectional elevation of the universal connection shown in Figure 5;

Figure 7 is a sectional elevation of a form of reaction apparatus which is reversible;

Figure 8 is a diagrammatic plan view of reaction apparatus in which the blade is composed of two hinged or movable leaves;

Figure 9 is a diagrammatic side view of a rocket device fitted with a reaction apparatus;

Figure 10 is a side sectional view in diagram of an air vehicle propelled with a reaction apparatus according to the invention;

Figure 11 is a side view of a suspended jet propelled air vehicle fitted with two reaction apparatus;

Figure 12 is a side view of a light swift jet propelled vehicle for use on sandy or soft roads, fitted with a reaction apparatus;

Figure 13 is a side view of a light swift air jet propelled boat fitted with a reaction apparatus for use in a rapid current;

Figure 14 is a side view of a jet propelled airship fitted with two reaction apparatus;

Figure 15 is a side view of a jet propelled torpedo fitted with a double turbine blade surface reaction apparatus;

Figure 16 is an enlarged side sectional view of the double turbine blade surface apparatus of Figure 15.

Fig. 17 is a longitudinal sectional view of Fig. 3, showing the radial ribs.

Referring to Figures 1 and 2, the reaction apparatus comprises a shell or casting of metal or other suitable material provided with a central tubular hub portion *a* which is fixedly or movably connected to the after end of a ship in convenient proximity to the keel or elsewhere as required. Such hub

is extended rearwardly of the ship and laterally on each side in relatively shallow form so as to constitute a pair of flat horizontal lips *b*, *c*, in cross section, of which the upper lip *b* projects beyond or overhangs the lower lip *c* except at the extreme tip at each side. Both lips are connected together by a web *c'* along the back edge and by means of the central hub *a*, whilst the circular tubular space within the hub merges into the somewhat flat horizontal space *d* which separates the lips.

It is to be noted that as shown in Figure 2, the external surface of the lips is of convex or smooth stream-line profile, and that the centre line of space *d* is somewhat lower relatively to that of the hub. The width of the space *d* is also considerably narrower than the internal diameter of the hub *a* so as to spread the pressure fluid across the whole width of the blade, such fluid being admitted at the required velocity by suitable means from within the ship or vehicle to the hub. The internal surfaces of the lips are made as smooth as possible so as to offer the least possible resistance or friction to the flow of the pressure fluid. The outer ends of both lips are reduced to a sharp or thin edge and their internal surfaces are such that as the jet of water passes between them as shown by the straight arrows, it has a slightly upward direction.

It is to be observed, when such a reaction device is in operation, that as it moves through the water or other medium in which it is immersed, the medium will flow upward as shown by the curved arrow along the exterior surface of the lower lip and across the path of the pressure fluid issuing from between the lips, and impinges upon or just clears the tip of the overhanging upper lip. At the same time there is a flow of the medium down over the external surface of the upper lip, see the curved arrows, that converges towards the underflow and beyond the tip. The convergence of these two flowing masses ensures that there will always be a full supply of the medium directly opposed to the pressure fluid flowing out between the lips, so that maximum reaction is obtained and no slip can occur.

As will be seen in Figure 2 by the dotted line at *e*, the external surface of the lateral parts of the lips are smooth and well rounded so as to present as little resistance as possible to the medium through which the reaction apparatus is travelling, the medium flowing as shown by the curved arrows.

In the manner described above, the device constitutes as it were a reaction surface, in which the greatest amount of reaction is attained and the momentum of the fluid utilized to the uttermost, and in which there is no cavitation or slip.

As will be seen in Figure 1 the lower lip *c* is not altogether regularly set back relatively to the upper lip *b*, but it is at about its centre part *f* again extended rearwardly, so as to better utilize at the centre the outflowing pressure fluid.

Referring to Figure 3, a modified form of the reaction apparatus is shown which is more or less built into the bottom of a flat bottomed boat. The operation is substantially the same as above described, but in this case in order to assist the spreading of the pressure fluid, the central part of the space between the upper and lower lips is provided with a series of radial vanes *g* so that the pressure fluid is distributed as shown by the straight arrows. The external surfaces of both of the lips may be also radially vaned as shown at *g'* Figure 1 to guide the flow of the medium over the lips.

In the two modifications above described, the reaction apparatus is a fixture so that the propelling effort is always in a constant direction, but in Figures 4 and 5 there is illustrated a system in which the reaction apparatus is adjustable by connecting it with the stern *h* of a submarine for example by means of a universal joint *k*. The construction of the apparatus is substantially the same as that already described, the pressure fluid being admitted to the blades by a hollow arrangement of the universal joint, so that the reactionary effort may be exerted either straight astern or at a desired angle thereto, up or down or sidewise.

Any convenient means may be used for adjusting the angular disposition of the reaction apparatus and Figure 5 shows one such device, in which there is secured to the upper lip a vertical rod or stem *l* by means of which the lips as a unit may be swung up or down in a vertical plane or at any angle in a horizontal plane sidewise around the universal joint as a centre.

One convenient form of universal joint is shown in Figure 6 in which *m* is a fixed hollow shell of bulbous form, one end *n* of which is relatively narrow and admits the pressure fluid. At the other end the shell is enlarged and fitted with a screwed cap formed with an internal spherical bearing surface *o* to receive a hollow spherical member *p* which constitutes the moving part of the joint. The area of the fluid passage *q* through the sphere *p* is progressively reduced to guide the fluid even when moved into an extreme position, and it will be understood that the reaction apparatus with its upper and lower lips is suitably attached to, or integrally formed with the sphere.

Referring to Figure 7, a form of reaction apparatus is shown in which the hub *a* forms an upright stem with the lips arranged horizontally as before. The hub is rotatably supported by a part of the boat or ship framing as shown, whereby

the lips may be adjusted from their normal driving ahead position as shown in full lines, to the dotted position for reversing or driving astern.

Although preferably the reaction apparatus will be used with the lips in a horizontal position they may, if desired, be arranged vertically. When horizontal they may be of curved form in cross section either upward or downward but it is preferred to make them with a downward curve, that is with the concavity on the lower side.

In Figure 8 a modification is shown in which the lips are formed in two parts r, s which centrally fit together and have rearward stem-like extensions r' s' cranked at their ends r^2 s^2. The two parts r s and r' s' are hinged or otherwise pivotally connected together, so that by suitable actuating mechanism applied to the cranked ends r^2, s^2 the two parts r, s may be adjusted relatively to one another, so that they shall be either horizontal or turned downward to narrow the field of reaction. Suitable clips or other holding devices t are applied to the stems r', s' to assist in supporting the apparatus.

Besides being used for the propulsion of ships and boats, the device may be used for driving any other vehicle or device and Figure 9 shows the invention adapted to a rocket for carrying a life line or other purpose. This comprises a torpedo-shaped body u carrying at its rear end a reaction apparatus v such as that already described. Within the body u is provided an ignition chamber or gas generator w having a discharge x for the pressure fluid generated in chamber w. The reacting pressure fluid passes out in the direction of the straight arrow and acts to propel the rocket in the manner already described. To impart stability the body u may be fitted with a pair of stabilizing wings y of which one is shown.

In Figure 10 the reaction apparatus is shown as adapted to an aeroplane. The body z contains a turbine at 16 having an air inlet 17 and a compressed air discharge 18 which causes a flow of air between the lips b, c as before. The turbine may be driven in any suitable way such as by an electric motor, or by hand for starting and afterwards by the movement of the machine in which the rush of air would act upon a vane wheel. 19 is a supporting plane and 20 is one of a pair of landing wheels

Figure 11 shows the reaction apparatus applied to an overhead cable vehicle or a telfer suspension. 21 is a car suspended by a pair of wheels from a fixed overhead cable 22, the car having two reaction apparatus 23, 24 each carried upon a stem after the manner shown in Figure 7, so that both may drive the car in one or the other direction as shown by the arrows or each may be fixed so that when 23 is in operation the car moves from left to right, and in the reverse direction when 24 is in action, or a single apparatus may be used which is rotatably adjustable through 180° to obtain the desired drive.

In Figure 12 the invention is represented as applied to a light car, in which the reaction apparatus 25 is carried above the car upon a stem 26 serving as a duct for supplying pressure fluid and by which the direction of the reaction effort shown by the arrow may be adjusted so as to steer the car only or to both steer the car as well as propel it, or the device may be a fixture. Such a system would be useful where the road is such that it is difficult for the wheels to obtain a driving grip.

Figure 13 shows a similar arrangement in which the reaction apparatus 27 is fitted above a light boat or hydroplane 28 where high speed and but little draft are required, whilst Figure 14 shows two reaction apparatus 29, 30 suspended from beneath an airship of lighter than air type. The arrows show the direction of the discharging pressure fluid.

Figure 15 illustrates in plan view the application of the invention to a torpedo 31 fitted with a double turbine blade surface 32 upon which the fluid pressure discharges and reacts, and Figure 16 is an enlarged sectional elevation of the reaction apparatus shown in Figure 14 with the double-turbine blade surface sides 33 and 34. The straight arrows indicate the direction of the discharging fluid from the common outlet edge of the turbine blade surfaces 33 and 34 of the reaction apparatus.

It will be understood from the foregoing that the described reaction apparatus is such that no slip will occur and the full amount of reactive effort will be secured. It may be used for propulsion alone or for steering alone whatever means are used for propulsion, or for both purposes combined. Moreover the reaction apparatus although it may be made with more than one blade surface, comprises preferably a single blade member. Instead of arranging the apparatus on the longitudinal centre of the boat or vehicle it is to drive, one or more of such apparatus may be used on each side of such centre line.

Having now described my invention, what I claim as new and desire to secure by Letters Patent is:

1. Improved reaction propelling device for a vehicle comprising in combination a hollow hub, a hollow extension connected to and flaring outwardly from such hub, a pair of broad shallow lips terminating such extension from between which pressure fluid is adapted to issue, and convergent

stream line external surfaces to the lips and extension member, whereby the medium in which the propeller is immersed flows towards and across the lips so that the issuing pressure fluid obtains full impact upon the external medium.

2. Improved reaction propelling device for a vehicle comprising in combination a hollow hub supported by the vehicle to be propelled, an extension to such hub of shallow outwardly flaring form and merging from the hub and into and through which hub is adapted to be passed a pressure fluid to reach the interior of the extension, a pair of broad shallow lips at the front of the extension and from between which is adapted to issue the pressure fluid, and curved external surfaces on the said hub and extension converging towards said lips so that the medium in which the propeller is immersed flows towards and across the lips whereby the pressure fluid coming from between the lips and discharging directly from the edges thereof, obtains full impact upon the external medium.

3. A reaction propelling device as claimed in claim 2 in which the upper member of the pair of broad shallow lips extends beyond the lower lip and forms a surface against which may impinge a current flowing up from beneath the lower lip.

4. In a reaction propelling device as claimed in claim 2, the combination of means whereby the position of the propelling device may be so adjusted that its centre line is at an angle with the longitudinal axis of the vehicle.

5. In a reaction propelling device as claimed in claim 1, the combination in which the lower member of the pair of horizontal lips has an irregular shaped edge or profile relatively to that of the upper.

6. In a reaction propelling device as claimed in claim 1, the combination of a series of radial vanes between the broad shallow lips to assist in laterally spreading the issuing pressure fluid.

7. In a reaction propelling device as claimed in claim 1, the combination of a series of guiding ribs upon the external surfaces of the turbine member and lips to guide the flow of the medium in which the lips are immersed.

8. A reaction propelling device for ships and vessels, comprising in combination a hollow hub, carried by the stern of the vessel, a horizontal hollow extension merging therefrom of shallow outwardly flaring form, a supply of pressure fluid within the vessel, adapted to be passed through the hub and into the hollow extension, a pair of broad horizontal shallow lips at the front of the member and from between which the pressure fluid issues, curved external surfaces on the said hollow member converging towards said lips so that the medium in which the propeller is immersed flows towards and across the lips whereby the pressure fluid coming from between the lips and discharging directly from the edges thereof obtains full impact upon the external medium, and means whereby the position of the propelling device relatively to the vessel may be so adjusted that its centre line is changed relatively to the longitudinal axis of the vehicle.

In testimony whereof I have signed my name to this specification.

SALUSTIO VALDÉS.