May 13 , 1924. 1,493,753

B. T. KOLEROFF

PROPULSION DEVICE

Filed Oct. 25, 1923 2 Sheets-Sheet 1

Fig. 1.

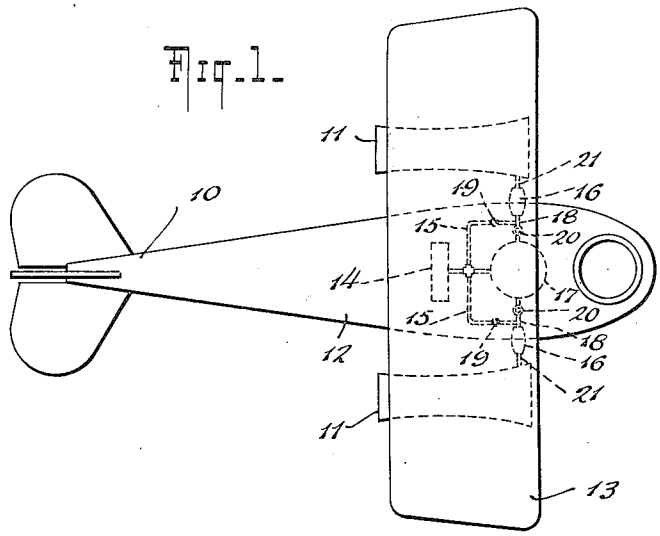
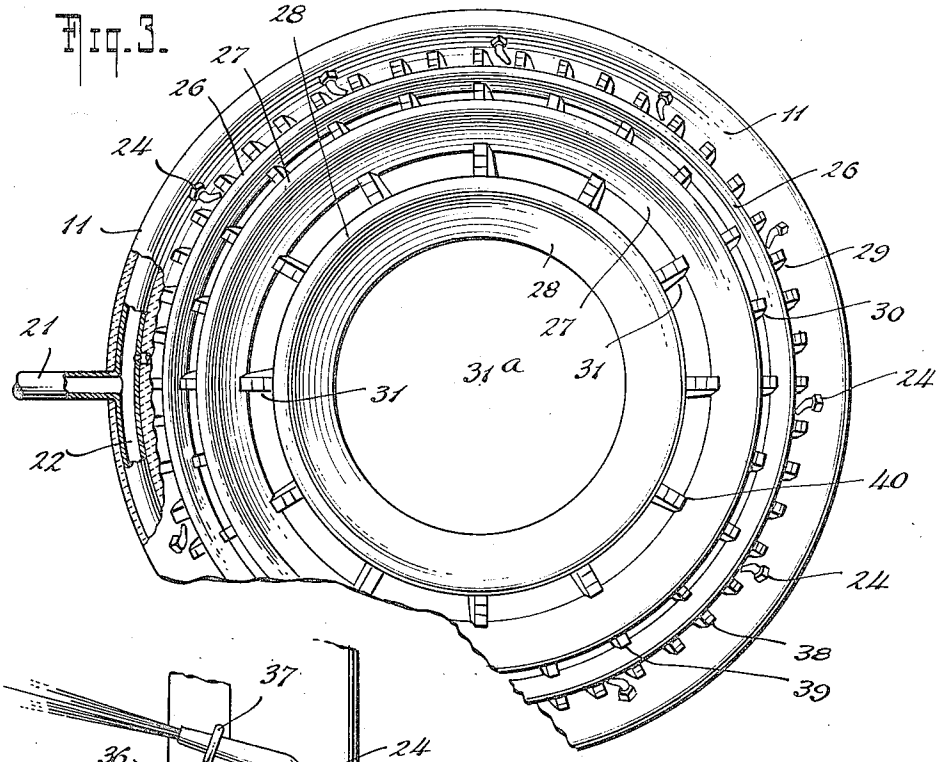


Fig. 3.



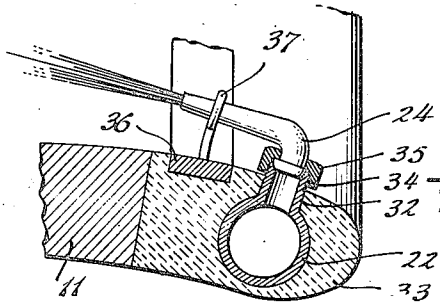


Fig. 6.

INVENTOR

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BY Richards & Geier

ATTORNEYS

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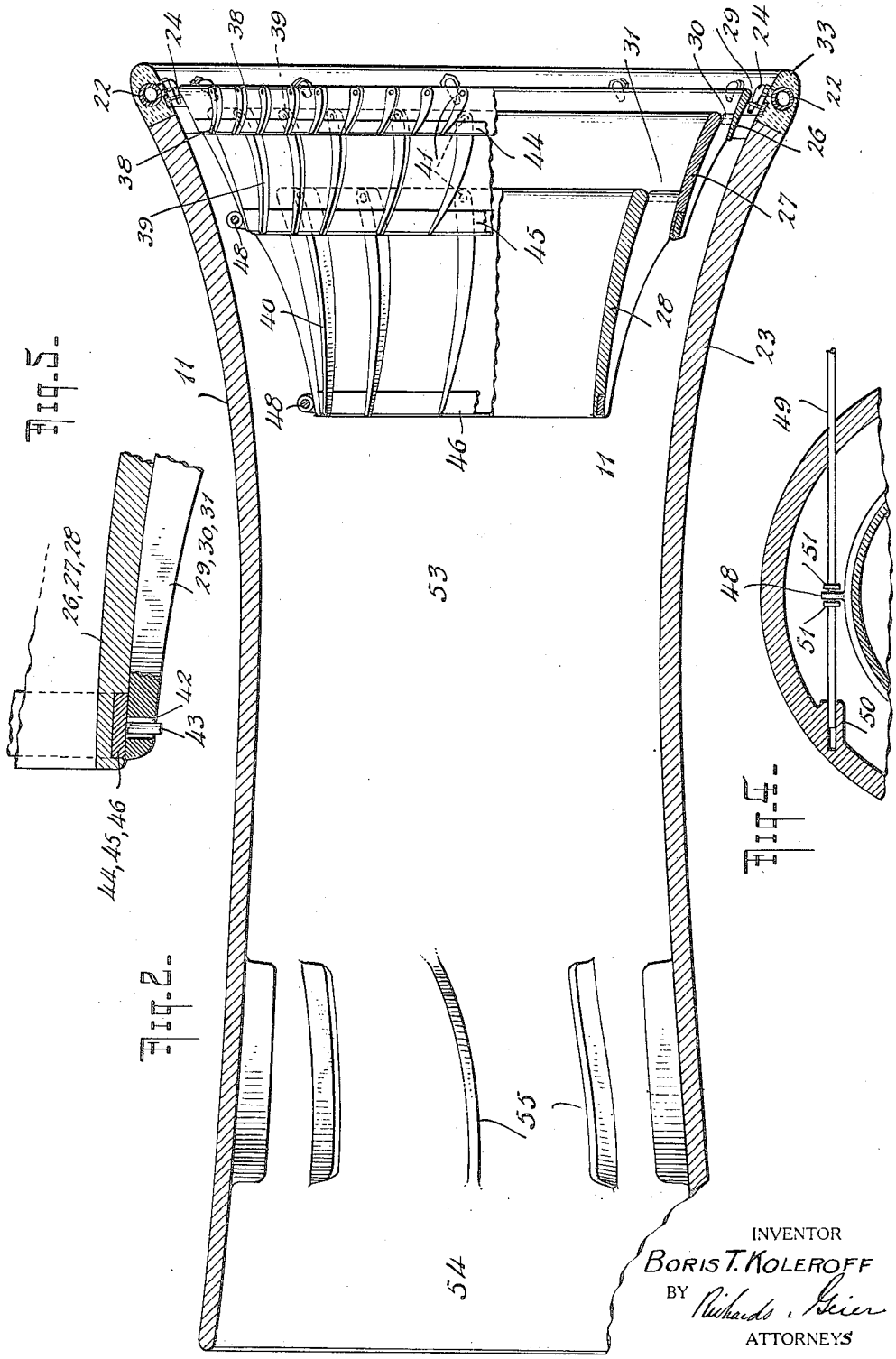


Fig. 2.

Fig. 3.

Fig. 4.

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Patented May 13, 1924. 1,493,753

UNITED STATES PATENT OFFICE.

BORIS T. KOLEROFF, OF NEW YORK, N. Y.

PROPULSION DEVICE.

Application filed October 25, 1923. Serial No. 670,642.

To all whom it may concern:

Be it known that I, BORIS T. KOLEROFF, formerly a citizen of Russia, now a citizen of United States, residing at New York, county of New York, and State of New York, have invented certain new and useful Improvements in Propulsion Devices, of which the following is a specification.

This invention relates to the application of a new principle in jet propulsion of flying machines, vehicles or boats in a medium or the propulsion of the medium itself and has for its principal object to improve upon the construction of a propelling apparatus of the type disclosed in my prior United States Patent No. 1,362,997, granted December 21, 1920.

Considered more specifically, my invention consists in the provision of means in a propelling apparatus such as disclosed in said patent for including a vortex motion in the fluid passing through the device, by means of which vortex motion the fluid passing through the region adjacent the centre of the device is in a condition of reduced pressure or density than in those regions adjacent the outer circumference, thereby producing a considerable increase in the normal vacuum effect towards the central section or axis of the device.

By producing a vortex motion in the fluid which passes through the device, the momentum of the stream is considerably increased, because the total amount of vacuum induced within an apparatus such as disclosed in my prior patent is considerably augmented by the increase of vacuum towards the center of the production of the vortex motion of the fluid, thus considerably increasing the volume and consequently the momentum of fluid passing through the device and thereby increasing proportionately the reactive force.

In the embodiment of the invention hereinafter more specifically described, the vortex action is produced by the provision of a plurality of inclined jet propulsion nozzles, the vortex effect of which is supplemented by a plurality of inclined guiding surfaces or vanes whose inclination is decreased towards the axis of the device to prevent disturbance of the swirling or vortex motion of the fluid. A further object of this invention is to provide means for varying the angle of inclination of the vanes so that by varying the vortex effect the propelling force of the device may be varied independently of the amount of active fluid fed to the device; this object being of particular applicability to the use of the device for the propulsion of flying machines, vehicles, or boats so as to ensure the attainment of maximum propelling force for every condition of speed.

For the accomplishment of these and such further objects as will be apparent to those skilled in the art to which this appertains, the invention consists in the construction, combination and arrangement of parts, an embodiment of which is hereinafter more specifically described and is illustrated in the accompanying drawings, forming a part hereof, but it will be understood that changes, variations and modifications may be resorted to without departing from the spirit of my invention.

Fig. 1 is a plan view of an aeroplane showing a propelling device embodying my invention attached thereto.

Fig. 2 is a central longitudinal section through the propelling device.

Fig. 3 is an end elevation of the device shown in Fig. 2 as seen from the right hand end thereof.

Fig. 4 is a sectional detail of the vane ring actuating rod.

Fig. 5 is a sectional detail of the means for connecting the vanes to the ring for actuating them, and

Fig. 6 is a sectional detail of a jet nozzle.

An installation of a propelling device of the character herein described preferably will consist of three parts, first, of a device for feeding the active fluid into a pressure chamber; second, of an arrangement for the combustion of this active fluid and finally of the jet propulsion apparatus proper; it will be understood, however, that the invention is not limited to the use of the products of combustion as the active fluid, but any kind of gaseous fluid, such as steam, may be employed. Referring to Fig. 1 of the drawing, wherein a conventional type of an aeroplane is indicated generally by the numeral 10, and is provided with a pair of jet propulsion devices 11, located upon opposite sides of the fuselage 12, beneath the wings 13. Air from a high pressure compressed air apparatus 14 is supplied through pipes

15 to the combustion chambers 16, to mingle with the fuel supplied from the fuel container 17 to said chambers by the pipes 18, suitable valves as indicated at 19 and 20 being interposed in the pipes 15 and 18 respectively.

The gaseous products of combustion from the combustion chambers 16 flow through the pipes 21 to the hollow annular distributer 22, suitably secured to one end of the outer shell 23 of each of the propelling devices (see Fig. 2).

A plurality of jet propulsion nozzles 24 receive the gaseous products from the distributer 22 and discharge same longitudinally, but spirally into the interior of the shell 23 adjacent the inner circumference thereof. The spiral discharge of the nozzles 24 is effected by inclining the nozzles at an angle to the longitudinal axis of the shell 23, as shown in Figs. 2 and 3 of the drawings. A plurality of rings 26, 27 and 28 are arranged within the shell 23 in overlapping spaced concentric relationship to form a plurality of spaced annular air admission openings 29, 30 and 31 and central opening 31ª which is defined by the ring 31, and through which the outside air is entrained into the shell 23 in a plurality of streams, to mix with the gaseous mass discharged from the nozzles 24 and thereby increase the volume of the mass passing through the device.

The nozzles 24 are preferably arranged in such a manner that the angle of inclination thereof may be changed to vary the vortex effect of the active mass of fluid within the shell and for this purpose the annular distributer 22 is provided with a plurality of nipples 32 which project beyond the heat insulating material 33 employed for incasing said distributer. Each of the nipples 32 are provided with a suitable ground joint surface to contact with a cooperating surface upon the inner end of the nozzles 24 (see Fig. 6) and are externally screw threaded as at 34 to permit a nut 35 to be engaged therewith for pivotally securing the nozzles 24 to the distributer. A flat collar 36 slidably mounted within a suitably cut out groove in the insulating material 33 is provided with a plurality of eyes 37, one for each nozzle 24, which engage about the nozzles adjacent the ends thereof, whereby rotation of the ring 36 will cause the nozzles 24 to be swung upon their pivotal connections to change the angular inclination thereof.

Each of the rings 26, 27 and 28 is provided with a plurality of vanes or deflecting surfaces, the outer ring 26, having the vanes 38 secured thereto, the intermediate ring 27, the vanes 39 and the inner ring the vanes 40. Each vane has its upper end pivotally mounted upon a pivot pin 41, which pins are secured to and project outwardly from each respective ring and also serve to secure the rings in concentric relation to each other and to the outer shell 23, the pivot pins 41 of the ring 26 having their outer ends secured to the shell 23, the pins of ring 27 being secured to ring 26 and the pins of ring 28 being secured to ring 27. The lower end of each vane is provided with a slightly elongated slot 42 in which is received a pin 43 (see Fig. 5) there being a pin 43 for each of the vanes 38, 39 and 40, projecting outwardly from the collars 44, 45 and 46 respectively, said collars being slidably mounted within a suitably cut out groove 47 in each respective ring.

Each collar is provided with an apertured lug 48 (see Figs. 2 and 4) through which a rod 49 passes for rotating said collars. The inner end of each rod is slidably supported within an apertured boss 50 in the shell 23 and its outer end passes through the shell to enable the rods to be connected to any suitable actuating means which will cause simultaneous operation of all of the rods. A pair of collars 51 are secured to each rod 49 adjacent the lugs 48 to cause the collars 44, 45 and 46 to be rotated when the rod is moved longitudinally. A similar longitudinally movable rod is also provided for rotating the collar 36 for the nozzles 24.

It will be noted (Fig. 2) that the angle of deflection of the guiding surfaces decreases from the outer circumference towards the center of the device, the vanes 40 being inclined less than vanes 39 and these in turn having an inclination less than those of vanes 38. The number of vanes is also preferably progressively decreased from the outer circumference towards the center, there being in the modification shown twice as many vanes 39 as vanes 40, and twice as many vanes 38 as vanes 39, but it will be understood that any number of vanes may be employed. The diameter of the shell 23 is gradually reduced from the entrance end thereof to a point beyond the inner end of the ring 28 to form a mixing chamber 53 from which point the shell flares outwardly to form the divergent cone or bell shaped delivery end 54 and a short distance inwardly from the mouth of said delivery end 54 a plurality of blades 55 are mounted which are reversed in angular direction to the vanes or guiding surfaces 38, 39 and 40, the purpose of these blades being to neutralize the torque which would be produced upon the device tending to cause its rotation upon its own axis, by the force of the air acting upon said inclined guiding surfaces and the reactive force of the inclined jet propulsion nozzles 24.

All of the parts comprising the device, rings, vanes or guiding surfaces, etc., should be of stream line configuration in the lon-

gitudinal direction of the device so as to reduce to a minimum the resistance to the incoming air.

The operation of the device is as follows, the jets from the nozzles 24 will exert a propulsion effect in accordance with the well known properties of simple jets. The velocity of the fluid passing from the nozzles 24 through the annular space 29 will cause a considerable quantity of air to be entrained from outside of the shell, which entrainment of air is produced in part by the viscosity of the fluid and also by the vacuum induced in said space. The inclination of the nozzles 24 will cause the mass of fluid within said space to be rotated spirally, which spiral rotation is further assisted by the inclination of the guiding surfaces 38, which will insure the spiral rotation of the entrained air, the angles of inclination of the nozzles 24 and guiding surfaces 38 being so arranged that the spiral rotation of the entrained air will coincide with the rotation of the fluid from the nozzles 24.

The longitudinally moving and spirally rotating gaseous layer passing through the annular space between the inner surface of the outer shell 23 and the outer ring 26 will entrain a volume of air through the annular space 30, which in turn will entrain a further volume through the annular space 31.

As the air and fluid passing through the device is rotated spirally, as it passes longitudinally through the shell 23, a vortex effect is produced and in order to insure a regular and even vortex motion the inclination of the guiding surfaces 38, 39 and 40 is progressively decreased towards the longitudinal axis an amount corresponding to the different velocities of the vortex, due to the different circumferential dimensions of the mass of fluid rotating in each of the annular spaces 29, 30 and 31 respectively.

Due to the vortex motion, a successive reduction of pressure is produced towards the longitudinal axis of the machine so that not only will the normal effect of the air entrainment through the annular spaces 29, 30 and 31 be considerably augmented, but a further entrainment of air will occur in the region of the axis through the central portion of the inner ring 28 and as a result of the successive vacuums and successive building up of additional volumes, a powerful spirally rotating gaseous mass will enter continuously into the chamber 53 to be delivered by the divergent delivery end 54.

Due to the vacuum created within the apparatus, the air acquires considerable momentum before its actual entry into the shell 23, so that the total momentum of the vortex stream and consequently the reactive force of the axial component thereof is considerably increased. As a torque would be produced by the impingment of the stream upon the guiding surfaces 38, 39 and 40, the effect of such torque may be neutralized by introducing the blades 55 inclined oppositively to said guiding surfaces and so proportioned and arranged to create a torque equal and opposite in direction to the first torque. In addition to this torque balancing effect due to the blades 55, the axial component of the total momentum of the stream is increased and therefore correspondingly increases the reactive force.

By the pivotal mounting of the guiding surfaces and nozzles and the provision of means to vary their angular inclination, the vortex effect and consequently the propulsive effect may be varied without varying the volume of fluid delivered by the nozzles. While this variation of the angular inclination of the guiding surfaces would cause the line of contact thereof with their respective rings to be disturbed, such disturbance will not materially effect the efficiency of the device as the amount of movement of the guiding surfaces would only be comparatively slight. However, if necessary, the outer surface of the rings which as shown are surfaces of revolution, may be of an irregular contour adjacent the guiding surfaces so as to insure contact of the rings and guiding surfaces for all positions of the latter.

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

1. A propelling device comprising an outer shell having a plurality of tubular members arranged in spaced concentric relationship within said shell and means to cause a spirally rotating and longitudinally moving mass of fluid to be passed through said outer shell, to produce successive entrainments of air through the spaces between said tubular members.

2. A propelling device comprising an outer shell having a plurality of tubular members arranged in spaced overlapping concentric relationship within said shell and means to cause a spirally rotating and longitudinally moving mass of fluid to be passed through said shell to produce successive entrainments of air through the spaces between said tubular members.

3. A propelling device comprising an outer shell having a plurality of tubular members arranged in spaced overlapping concentric relationship within said shell, a plurality of jet nozzles arranged within said shell, means for causing a fluid under pressure to be discharged from said nozzles and means including said nozzles to produce a vortex movement of the fluid within said shell to cause successive volumes of air to be entrained within said shell through the spaces between said tubular members.

4. A propelling device comprising an outer shell, a plurality of tubular members arranged in spaced concentric relationship to each other and to said shell, a plurality of jet nozzles angularly inclined to the longitudinal axis of said shell, arranged within said shell, means for causing a fluid under pressure to be discharged from said nozzles, and a plurality of inclined guiding surfaces mounted upon said members.

5. A propelling device comprising an outer shell having diverging entrance and delivery ends, a plurality of tubular members mounted in concentrically spaced relationship to each other and to said shell adjacent the entrance end thereof, a plurality of jet nozzles mounted within said shell adjacent the entrance end and directed towards the delivery end thereof, means to cause a fluid under pressure to be discharged from said nozzles and means to cause a vortex motion within the fluid passing through said shell.

6. A propelling device comprising an outer shell having diverging entrance and delivery ends, a plurality of nozzles mounted within said shell adjacent the entrance end and directed towards the delivery end thereof, means for discharging a fluid under pressure from said nozzles, a plurality of tubular members arranged in spaced overlapping concentric relationship within said shell to cause successive volumes of air to be entrained within said shell by the fluid discharged from said nozzles, and means to produce a vortex motion within said entrained air.

7. A propelling device comprising an outer shell having diverging entrance and delivery ends, a plurality of nozzles mounted within said shell adjacent the entrance end and directed towards the delivery end thereof, means for discharging a fluid under pressure from said nozzles, a plurality of tubular members arranged in spaced overlapping concentric relationship within said shell to cause successive volumes of air to be entrained within said shell by the fluid discharged from said nozzles, and means to produce a vortex motion within said entrained air, comprising a plurality of guiding surfaces inclined to the longitudinal axis of said shell.

8. A propelling device comprising an outer shell having diverging entrance and delivery ends, a plurality of nozzles mounted within said shell adjacent the entrance end and directed towards the delivery end thereof, means for discharging a fluid under pressure from said nozzles, a plurality of tubular members arranged in spaced overlapping concentric relationship within said shell to cause successive volumes of air to be entrained within said shell by the fluid discharged from said nozzles, and means to produce a vortex motion within said entrained air comprising a plurality of guiding surfaces mounted upon said tubular members and inclined to the longitudinal axis of said shell.

9. A propelling device comprising an outer shell having diverging entrance and delivery ends, a plurality of nozzles mounted within said shell adjacent the entrance end and directed towards the delivery end thereof, means for discharging a fluid under pressure from said nozzle, means to cause successive volumes of air to be entrained within said shell by said fluid comprising a plurality of tubular members arranged in spaced concentric overlapping relationship within said shell, said nozzles being inclined to the longitudinal axis of said shell to cause said fluid to pass through said shell with a spirally rotating movement and a plurality of inclined guiding surfaces to impart a similar movement of rotation to the entrained air.

10. A propelling device comprising an outer shell having diverging entrance and delivery ends, means for discharging a fluid under pressure into said shell adjacent the entrance end and towards the delivery end thereof and a plurality of inclined guiding surfaces within said shell and extending partially across the interior thereof, the inclination of said guiding surfaces to the longitudinal axis of said shell decreasing progressively toward said axis.

11. A propelling device comprising an outer shell having diverging entrance and delivery ends, a plurality of nozzles mounted within said shell adjacent the entrance and directed towards the delivery end thereof, means for discharging a fluid under pressure from said nozzles, a plurality of tubular members arranged in spaced overlapping concentric relationship within said shell to cause successive volumes of air to be entrained within said shell by the fluid discharged from said nozzles, and means to produce a vortex motion within said entrained air, comprising a plurality of inclined guiding surfaces mounted on said tubular members, the angle of inclination of said surfaces decreasing progressively from the outermost to the innermost of said tubular members.

12. A propelling device comprising an outer shell having diverging entrance and delivery ends, a plurality of nozzles mounted within said shell adjacent the entrance end and directed towards the delivery end thereof, means for discharging a fluid under pressure from said nozzles, a plurality of tubular members arranged in spaced overlapping concentric relationship within said shell to cause successive volumes of air to be entrained within said shell by the fluid discharged from said nozzles, and means to

produce a vortex motion within said entrained air, comprising a plurality of guiding surfaces inclined to the longitudinal axis of said shell, and a plurality of inclined reaction blades adjacent the delivery end, the inclination of said blades being opposite in direction to the inclination of said guiding surfaces.

13. A propelling device comprising an outer shell having diverging entrance and delivery ends, a plurality of nozzles mounted within said shell adjacent the entrance end and directed towards the delivery end thereof, means for discharging a fluid under pressure from said nozzles, a plurality of tubular members arranged in spaced overlapping concentric relationship within said shell to cause successive volumes of air to be entrained within said shell by the fluid discharged from said nozzles, means to produce a vortex motion within said entrained air, comprising a plurality of guiding surfaces movably mounted within said shell and inclined to the longitudinal axis thereof and means to vary the inclination of said guiding surfaces.

14. A propelling device comprising an outer shell having diverging entrance and delivery ends, a plurality of nozzles mounted within said shell adjacent the entrance end and directed towards the delivery end thereof, means for discharging a fluid under pressure from said nozzles, a plurality of tubular members arranged in spaced overlapping concentric relationship within said shell to cause successive volumes of air to be entrained within said shell by the fluid discharged from said nozzles, means to produce a vortex motion within said entrained air comprising a plurality of guiding surfaces pivotally mounted on said tubular members and inclined to the longitudinal axis of said shell and means to vary the inclination of said guiding surfaces.

15. A propelling device comprising an outer shell having diverging entrance and delivery ends, a plurality of nozzles mounted within said shell adjacent the entrance end and directed towards the delivery end thereof, means for discharging a fluid under pressure from said nozzles, a plurality of tubular members arranged in spaced overlapping concentric relationship within said shell to cause successive volumes of air to be entrained within said shell by the fluid discharged from said nozzles, means to produce a vortex motion within said entrained air; and means to cause a torque to be exerted substantially equal to and opposite in direction to that produced by the action against said guiding surfaces of the fluid mass passing through said device.

16. A propelling device comprising an outer shell having an entrance and a delivery end, a plurality of jet nozzles mounted adjacent the entrance end and directed towards the delivery end of said shell, means to discharge a fluid under pressure through said nozzles, tubular members constructed and arranged to cause successive volumes of outside air to be entrained through said shell by the passage of said fluid, and means to cause the pressure within the moving mass of fluid within said shell to be progressively decreased from the outer circumference towards the axis thereof to produce a region of low pressure adjacent said axis.

In testimony whereof I have affixed my signature.

BORIS T. KOLEROFF.