June 18, 1935. A. G. SANDEN 2,005,473

AIR JET PROPELLED CONVEYANCE

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Fig. 1

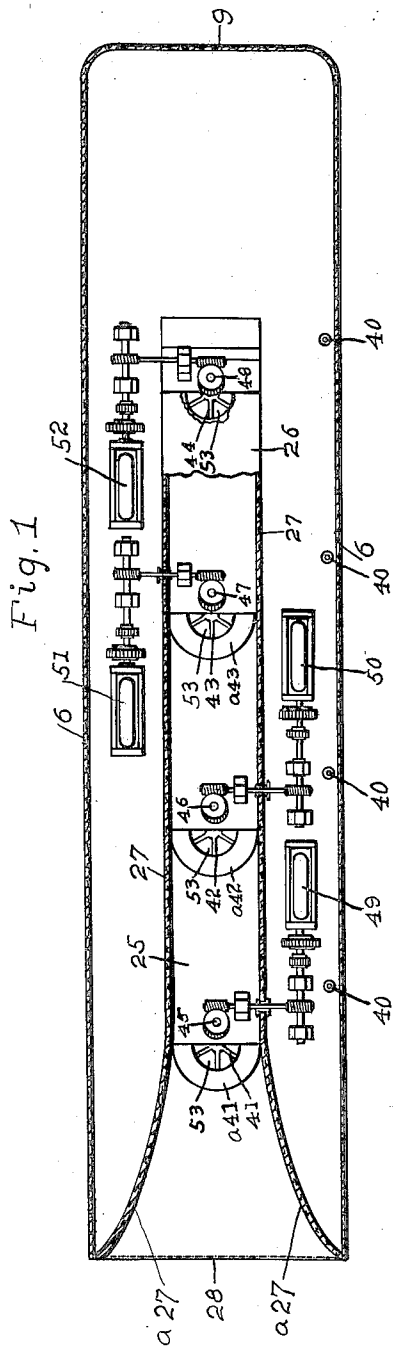

Fig. 2

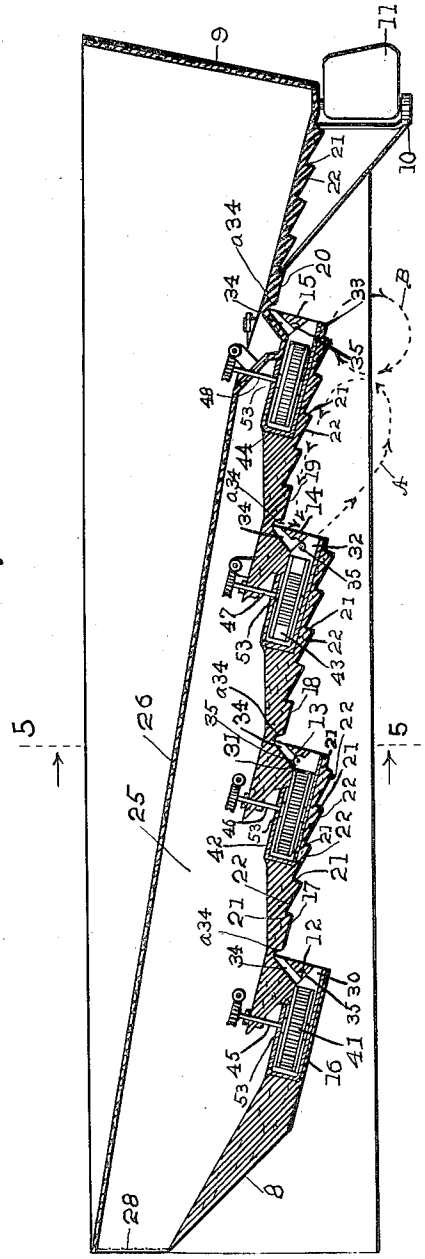

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Fig. 3

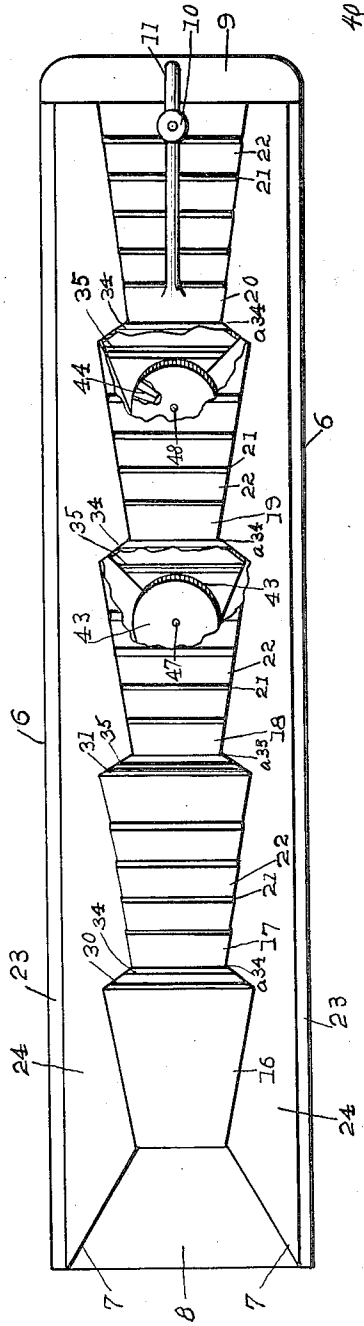


Fig. 6

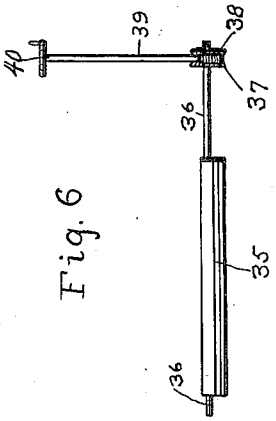


Fig. 7

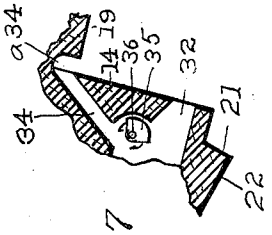


Fig. 5

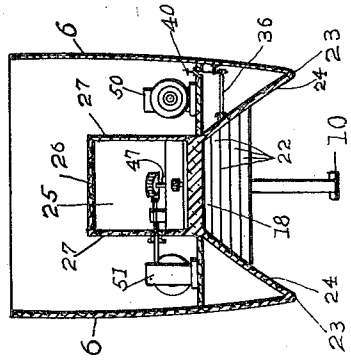
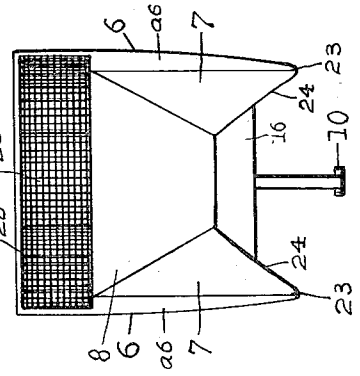


Fig. 4



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AIR-JET PROPELLED CONVEYANCE

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Application March 13, 1933, Serial No. 660,498

6 Claims. (Cl. 115—15)

My invention relates to improvements in air-jet propelled conveyances, and has for an object to provide a plurality of main air nozzles in the bottom of the conveyance from which jets of air may be ejected wherewith the conveyance is propelled.

Another object of my improvement is to provide a particular shape of conveyance bottom adapted to retain the ejected air maintaining a compressed-air cushion on which the conveyance may float.

Another object of my improvement is to provide a particular shape of conveyance bottom adapted for propulsion by impulses from whirls in the said compressed-air cushion or in the medium in which the conveyance travels.

Another object of my improvement is to provide a shape of conveyance bottom suited to force the conveyance upward by the forward motion thereof.

Another object of my improvement is to provide bypass conduit nozzles in fluid connection with the said main air nozzles discharging above the same.

Another object of my improvement is to provide a valve adapted for closing the entrance to each of the bypass nozzles, for opening the same and for deflecting more air therethrough.

Another object of my improvement is to provide an air blower discharging into each pair of main and bypass nozzles ejecting air therethrough.

Another object of my impovement is to provide an air trunk or trunnel leading to the intakes of the several air blowers from a flaring inlet in the bow of the conveyance adding a propelling effort when air is being drawn into the same.

Another object of my improvement is to provide a separately-controlled prime mover for each of the said air blowers.

Other objects of my improvement will appear as the description proceeds.

I attain these and other objects of my improvement with the structure and mechanism illustrated in the accompanying two sheets of drawings, forming a part of this specification, in which Figure 1 is a plan view of the hull of a boat which is shaped to suit my improvement, and in which my mechanism is mounted, from which the deck has been broken away, Fig. 2 is an elevation view of a section of Fig. 1 on a medial longitudinal vertical plane, Fig. 3 is a bottom plan view of Fig. 1, Fig. 4 is an elevational view of the bow of the hull, Fig. 5 is a cross-section of the hull on the line 5—5 of Fig. 2, Fig. 6 is a side elevation of the valve for controlling the opening into the bypass nozzle and the operating mechanism thereof segregated and drawn on a larger scale, and Fig. 7 is an end elevation of the bypass valve.

Certain parts are broken away to show other parts hidden thereby. Similar characters refer to similar parts throughout.

With more particular reference to the designated parts: The sides 6, 6 of the hull are preferably shaped like the sides of a scow. The hull bottom is longitudinally concave with the flaring sides 24, 24 providing the side keels 23, 23. The bow slants backward and downward below the entrance of the air tunnel 25 as shown at 8. From the side stem posts a6, a6 the bow also slants rearward toward the center of the hull as shown at 7, 7 intersecting the part 8 and also the concave bottom 24. The stern 9 is substantially square.

The concave bottom has the sides 24, 24 slanting upward and toward the center of the hull from the side keels 23, 23. The said slanting sides 24, 24 are intersected by a series of bottom planes shown at 16, 17, 18, 19 and 20 with the intervening steps 12, 13, 14 and 15. Each of the bottom planes 17, 18, 19 and 20 is subdivided into the shorter and steeper bottom planes 22, 22, 22, 22 and the intervening steps 21.

The rudder bearing 10 is secured to the bottom of the hull and mounts the rudder 11.

The main air nozzles 30, 31, 32 and 33 are narrow openings in the steps 12, 13, 14 and 15 respectively athwart the bottom and enlarging inwardly. Each of the main air nozzles has a smaller bypass nozzle 34 branching therefrom in an upward and rearward direction discharging in a groove a34 in the angle made by one of the said planes 17, 18, 19 and 20 with one of the steps 12, 13, 14 and 15 respectively.

At the entrance end of each of the bypass nozzles 34 is a recess in which is disposed a sectoral valve 35 fastened on a shaft 36. The shaft 36 is mounted in bearings for oscillation whereby the valves may be placed in different operative positions, as shown in the nozzle 30 where the valve 35 is entirely within the said valve recess and the bypass nozzle is entirely open, in the nozzle 31 where the said valve entirely closes the bypass nozzle and in the nozzle 32 where the said valve is disposed within the main nozzle deflecting more air into the bypass nozzle. On one end of the nozzle valve shaft 36 is fastened the worm wheel 37. A hand wheel 40 is fastened on one end of the drive shaft 39 on the lower end

of which is fastened the worm 38 operatively engaged with the said worm wheel 37. Suitable bearings are provided to mount the drive shaft 39 for revolution and the valve shaft 36 for oscillation as shown in Fig. 5. One of the valves 35 is disposed in each of the said valve recesses in the main nozzles, as stated, and the shafts 36 and 39 are suitably mounted for operating each of the valves independently by the hand wheels 40 disposed as shown in Figs. 1 and 5.

There are four air paddle wheels 41, 42, 43 and 44, fully shown in Fig. 2, having shafts 45, 46, 47 and 48, respectively, fastened thereto. These air wheels are each suitably mounted in air-blower housings and the shafts thereof are mounted in bearings for revolution. The housing *a*41 for the air wheel 41 is disposed to discharge air, drawn through the opening 53 therein by the operation of the wheel therein, through the nozzle 30 beneath the plane 17. The housing *a*42 for the air wheel 42 is disposed to discharge air, drawn through the opening 53 therein by the operation of the said wheel, through the nozzle 31 beneath the plane 18. The housing *a*43 for the air wheel 43 is disposed to discharge the air, drawn through the opening 53 therein by the operation of the said wheel, through the nozzle 32 beneath the plane 19. The housing *a*44 for the air wheel 44 is disposed to discharge air, drawn through the opening 53 therein by the operation of the said wheel, through the nozzle 33 beneath the plane 20. It being understood that the air forced through the main nozzles will subdivide and part thereof will pass through the bypass nozzles if the openings thereinto are not closed by the valves 35.

It is desired that the several air wheels be separately driven. For this purpose the prime mover 49 is connected through suitable gears and control devices to the air-wheel shaft 45 for revolving the air wheel 41, the prime mover 50 is connected through suitable gears and control devices to the air-wheel shaft 46 to revolve the air wheel 42, the prime mover 51 is connected through suitable gears and control devices to the air-wheel shaft 47 for revolving the air-wheel 43, and the prime mover 52 is connected through suitable gears and control devices to the air-wheel shaft 48 for revolving the air wheel 44. By this arrangement the several air blowers may be caused to deliver equal volumes of air at equal pressures through the several nozzles, these volumes and pressures may vary relatively, or one or more of the blowers may be not revolved while the others are being driven. When the boat is driven at high speed with light draft nozzles 30 and even nozzle 31 also may be above the water level, in which cases it is not helpful to force air out of the same.

The air trunk 25 is provided by the top wall 26, the side walls 27, 27 and the hull bottom. The side walls of the air trunk flare outwardly at the inlet thereof as shown at *a*27, *a*27. The inlet of the air trunk preferably occupies the full width of the bow and about one third of its depth and is covered by the screen 28. The air trunk delivers air from the bow to each of the blower inlets 53.

As illustrated, the conveyance used for the purposes of this specification is a boat built of metal and painted wood.

In operation, the four air blowers draw air in at the flaring opening at the bow of the boat and eject it through the nozzle-shape openings in the main steps in the concave bottom thereof. The suction produced in the air trunk by the operation of the air blowers tends to maintain a vacuum at the bow resulting in a force operating to propel the boat forward. The ejection of the compressed air through the said nozzle openings results in producing forces operating to propel the boat forward.

The general shape of the whirls produced in the mixed air and water beneath the concave bottom by the said ejected air is indicated by arrow-marked dotted lines in Fig. 2 as having been caused by air from the pair of nozzles 32, 34 where the lower part of the larger whirl A provides forces for moving the boat forward by impinging on the water and the upper part of the larger whirl also operates to propel the boat forward by impinging on the secondary steps 21 in the principal plane 19. The air ejected from the smaller nozzle 34 is reversed in direction in the groove *a*34 and moves downward to prevent the formation of adverse whirls in the angle between the step 14 and the plane 19. The downward direction of this air current also provides a force operating to lift the boat in the water. The smaller whirl set up at B by the air from the nozzle 32 is not helpful in propelling the boat forward.

A separate prime mover is shown to drive each of the air blowers. This is a simple arrangement to make them entirely independent in operation. This is desirable since the rapid movement of the boat through the water may lift the bow and make the relatively slower operation of the forward blowers, or even their stopping, preferable.

For boats with considerable depth of draft it is preferred to use a reciprocative air compressor, rather than the rotary form illustrated.

The particular shapes of bottom and bow illustrated and described, and their equivalents, as useful for a water conveyance of light draft are also applicable to boats of deeper draft, both in the speed-boat class and in the heavier carriers and also for submarines.

These shapes also are applicable to snow and ice sleds, to lighter-than-air dirigibles and to the fuselage of aeroplanes.

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

1. A conveyance body including side keels and side stem posts providing a concave bottom longitudinally and a concave bow, a plurality of inclined planes on the said bottom slanting downwardly rearwardly, and intervening steps connecting the said incline planes each having a main and a bypass air nozzle therethrough.

2. A conveyance body including side keels and side stem posts providing a concave bottom of the said body and a concave bow thereof, a plurality of inclined planes on the said body slanting rearwardly downwardly, intervening steps connecting the said inclined planes each having a main and a bypass air nozzle therethrough, and a controllable valve disposed at the entrance of the said bypass nozzles regulating the passage of air therethrough.

3. A conveyance including a body having side keels and side stem posts providing a concave bottom and a concave bow to the said body, a plurality of inclined planes on the said concave bottom slanting rearwardly downwardly, intervening steps connecting the said bottom planes each having a main and a bypass nozzle opening therethrough, and an air compressor having

fluid outlet connections with the said nozzles ejecting air therethrough beneath the said planes.

4. A conveyance including a body having side keels and side stem posts providing a concave bottom and a concave bow to the said body, a plurality of inclined planes on the said concave bottom slanting rearwardly downwardly, transverse steps between the said planes each having a main and a bypass nozzle therethrough, a controllable valve disposed at the entrance to each of the said bypass nozzles regulating the passage of fluid therethrough, and an air compressor having fluid outlet air conduit connections with all of the said nozzles ejecting air therethrough beneath the said bottom planes.

5. A conveyance including a body having side keels and side stem posts providing a concave bottom and a concave bow to the said body, a plurality of principal inclined planes slanting rearwardly downwardly disposed on the said concave bottom, transverse steps between the said principal planes each having a main nozzle opening therethrough directed substantially parallel with the said principal planes and a secondary nozzle therethrough directed upward substantially at right angles with the said planes, a plurality of inclined planes and intervening steps in each of the said principal planes rearward of the said nozzles, a controllable valve disposed at the inlet of each of the said secondary nozzles regulating the passage of fluid therethrough, an air compressor having outlet air conduit connections with each of the said pairs of main and secondary nozzles, and means to actuate each of the said air compressors independently.

6. A conveyance including a body having side keels and side stem posts providing a concave bottom and bow to the said body the said bow having an air-inlet opening therein, a plurality of principal inclined planes slanting rearwardly downwardly disposed on the said concave bottom, transverse steps between the said principal planes each having a main and secondary nozzle therethrough the main nozzle being directed parallel with the said principal planes and the secondary nozzle being directed toward and at right angles with the said planes into a groove therein reversing the direction of fluid expelled through the said secondary nozzle, each of the said principal planes having the said groove therein adjacent the said step thereon, a plurality of inclined planes and intervening steps in each of the said principal planes rearward of the said nozzles, a controllable valve disposed at the inlet of each of the said secondary nozzles regulating the passage of fluid therethrough, an air blower disposed forward of each of the said main and secondary nozzles ejecting compressed air from the outlet thereof through the same, an air trunk connecting all of the inlets to the said air blowers with the said air-inlet opening in the said bow, and separately controllable means to actuate each of the said air blowers.

ARTHUR G. SANDEN.