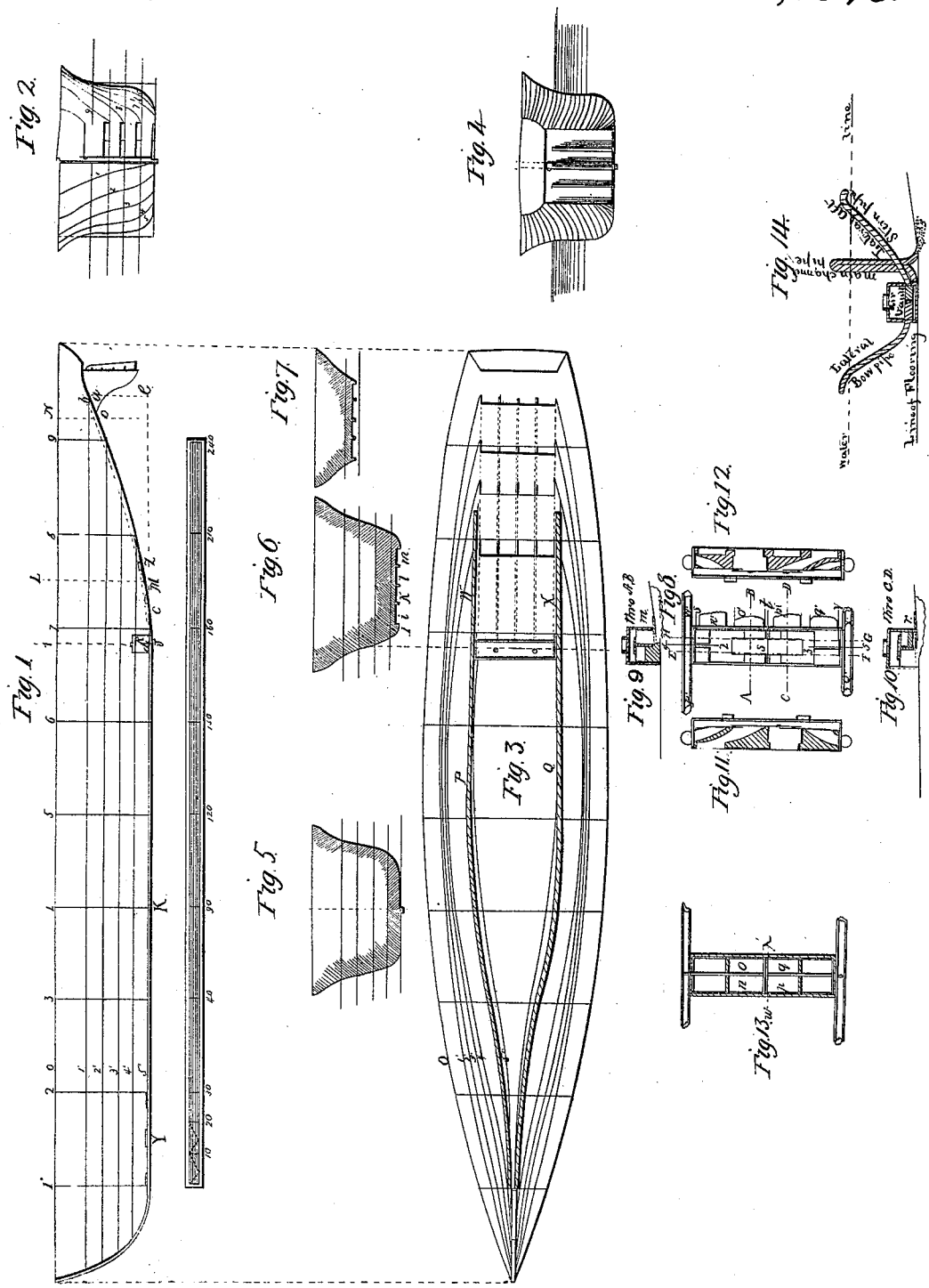
S. W. Hall.

Pneumatic Propeller.

No. 3,332. Patented Nov. 6, 1843.



UNITED STATES PATENT OFFICE.

SYLVESTER W. HALL, OF TROY, NEW YORK.

METHOD OF PROPELLING VESSELS BY THE BUOYANCY OF AIR IN WATER ACTING AGAINST INCLINED SURFACES.

Specification of Letters Patent No. 3,332, dated November 6, 1843.

To all whom it may concern:

Be it known that I, SYLVESTER W. HALL, of the city of Troy, in the county of Rensselaer and State of New York, have invented a new, useful, and Improved Mode of Propelling Vessels; and I do hereby declare that the following is a full, clear, and exact description of the same, reference being had to the annexed drawings, making part of this specification.

The nature of my invention consists in making use of the buoyant force of atmospheric air discharged in channels or grooves under the vessel to propel it by causing the air to act in its ascent against an inclined surface of the vessel, by which the buoyant force of the air is transmitted according to the known laws which govern the action of forces of this nature on inclined surfaces, and tends to give motion to the vessel in a direction contrary to that in which the surface rises and the air tends to escape.

To enable others skilled in the art to make and use my invention I will proceed to describe the principles of its construction and operation.

Figure No. 1, of the annexed drawings is a side view or elevation of a vessel or boat. Fig. No. 2, is the body plan. Fig. No. 3, is a horizontal plan. Fig. No. 4, is a view astern. Fig. No. 5, is a cross section of the boat through K. Fig. No. 6, is a cross section of ditto through L M. Fig. No. 7, is a cross section of ditto through N O.

R in Fig. No. 1 is an air vault or chamber in which the air is received from the blowing engines and from which it issues to the under side of the boat.

Fig. No. 8 is the horizontal plan of the air vault showing the slides. Figs. Nos. 9, 10, 11, and 12 are sections of the same as explained in the drawings. Fig. 13 is a horizontal plan of the air vault with the slides removed.

The air may be furnished by blowing engines of the usual form adapted to the purpose, or by bellows or in any manner most convenient. The air thus furnished may be conducted by the use of pipes of wrought or cast iron or other suitable material of sufficient size and strength for the quantity of air used and the degree of pressure they will be required to sustain into the air vault R, Fig. 1. From this vault or chamber it is conducted by one or more pipes or passages through the bottom to the under and outer sides of the boat into the water as seen in Figs. 9 and 10. Here it is received into one or more channels or grooves as seen in cross section in Figs. 6 and 7 and inclining upward toward the stern as seen in longitudinal section Fig. 1. The air thus discharged being specifically lighter than water has a buoyant force or upward tendency against the inclined surface (*a b*) which according to the known laws which govern the transmission of forces on inclined surfaces tends to give a progressive motion to the boat, and by the same effect tends to give a retrograde motion (toward the stern) to the water within the channels which opposes its escape in that direction. The surface of the air or the end of the bubble thus opposed to the water I denominate the resisting surface in this description.

As the power, with which a given quantity of air acting upward against the surface *a b* tends to propel the boat is varied (according to the above mentioned laws of the transmission of forces on inclined surfaces) by the greater or less inclination of this surface, by which inclination I mean that which would be generally expressed by the angle *b a e*, Fig. 1, and as the velocity with which the said power would tend to propel the boat would vary in an inverse ratio with that power. It is evident that the said inclination of the surface should be determined for any boat, with reference to the propelling force, which on that boat would be required, and this will depend upon the size and figure of the boat, her draft of water, the resistance which would oppose her motion through the water, the speed for which she is intended, the power of her engine and whatever other conditions are required in the construction of the vessels.

It would appear generally that in a vessel so constructed as to meet comparatively little resistance to motion and intended for high velocities the said inclination of surface should be less than in a vessel of an opposite character. In general for boats of ordinary construction an inclination should be given to the surface *a b* (see Fig. 1) of from 1 vertical in 4 horizontal to 1 vertical in 6 horizontal feet. In other words the length of the surface measured horizontally

(a e) should be from 4 to 6 times its vertical height (b e). It must be also borne in mind in determining the inclination of the said surface that the degree of its inclination has other influences on the efficient action of the air to propel the vessel. 1st. It is evident that diminishing the inclination would increase the length of surface and that increasing the inclination would shorten the same. 2nd. It is evident that diminishing or increasing this inclination would have an influence on the figure which the air would assume in the channels, which would diminish or increase the resisting surface opposed by the air to a retrograde motion and consequently influence the efficiency of the air in propelling the boat. For instance: If the angle b a e, Fig. 1, be increased the length of the bubble would be diminished and its depth increased, thereby increasing the resisting surface and diminishing the loss of power in the slip or retrograde motion of the air. If the said angle be diminished the corresponding opposite effects would be produced.

As a means of increasing the effective resisting surface in the same quantity of air, in this respect rendering the same more effectual in propelling the vessel, which will be found most practical and expedient on the larger class of boats. The escape of the air should be so regulated as to be emitted in distinct quantities or blasts instead of continuously. The magnitude and frequency of these emissions or blasts will of course depend upon the character of the boat and the amount of air furnished by the blowing apparatus. As a general rule they should be as frequent as may be and act distinctly and independently of each other. As a means of thus effecting and regulating the escape of the air in distinct masses, puffs or blasts, the inclined surface a h Fig. 1, against which the air is intended to act, may be divided into several channels or grooves as seen in cross section Figs. 6 and 7. The entrance from the air vault R, Fig. 1, to each of these said channels may be through and by means of a separate and distinct compartment as seen in horizontal plan Fig. 13, where n o p q are the said compartments each of which connects by an open passage to the aforesaid channels or move under the vessel represented in Fig. 8 by n' o' p' q'.

To enable the reader more easily to trace the passage of the air it is represented in different passages by different colors.

S in Fig. 8 is a plate or slide of cast iron or other suitable material supported at its ends, by cross bars as seen in the sections Figs. 11 and 12, and in the middle by a guide rod or bar x w Fig. 13 extending from one side of the air vault to the other at angles to its sides. A groove is made in the under side of the slide S to fit upon the said guide rod and secure a regular motion. When the weight of the slide may be insufficient to keep it in its place it may be done by cross bars similar to those which support it. The requisite motion may be given to the slide by connecting the rod (t) with the engine or motive power, by any of the known forms so as to alternately thrust the slide forward closing the passages or compartments n p and opening o q and draw it back closing o q and opening n p.

For the purpose of turning the boat, changing its course, or moving it sidewise, more effectually than can be done by the use of the rudder, air may be discharged at one or more points under the fore or after part or under the fore and after part of the vessel so as, by its buoyant force acting upward against the inclined surface or convex sides of the vessel to move it in a horizontal direction contrary to that in which the air escapes. This may be done by conveying the air from the lateral compartments as shown in the ends of the air vault by a passage into the lateral pipes as shown in Fig. 8, P′ Q′ W′ X′. By the said pipes shown also P, Q, W, X, Fig. 3, it is conveyed to the points of discharge shown at Y Z Fig. No. 1.

Here the air is discharged through one or more tubes pipes or orifices of the requisite strength and dimensions for the quantity and density of the air used, into the water and acts as before described to move the boat. The emission of the air into these pipes is regulated by slide valves situated in the air vault, so as to close or open either of the passages leading from the said lateral compartments into the lateral pipes P′ Q′ W′ X′ as represented in Figs. 8, 11 and 12. The said slides may be moved by means of hand or other power attached to the rods S, V, passing through the sides of the air vault or by a lever, crank or other convenient instrument attached to said rods.

As a means, of directing the air into the compartments, communicating with the main channels under the boat or those lateral compartments communicating with the lateral pipes P′ Q′ W′ X′. The slides 2 and 3 Fig. 8 of cast iron or other suitable material, as seen in Figs. 8, 11 and 12 are made to move backward and forward by the rods 4—5 so as to close or open the main or lateral channels as well. These slides pass under the slide S and the cross bars which support it. They rest upon bars or in guides secured to the sides of the air vault and work sufficiently close on their bearings as to effectually exclude the passage of the air.

The slide rods all of which pass through an orifice in the sides of the air vault should be made to fit so closely in the same by means of stuffing boxes and packing or otherwise as may be necessary to prevent the escape of the air. These rods may be of

iron steel or other suitable material and of sufficient size to resist the strain to which they will be subjected.

In order to secure the air vault against water rising into it through the passages in case of a leakage of air from the same and in case of repairing or inspecting the machinery, slides may be constructed of cast iron or other suitable material at seen in cross section *m r* Figs. 9 and 10 snugly fitted to grooves in which they work so as to effectually prevent the rise of water through any of the channels.

In vessels where it may not be an object to keep all the machinery below the surface of the water, the rising of the water in the pipes and passages may be effectually prevented by locating the air vault on deck or above the water line. When this may not be conveniently done the air may be conveyed from the air vault or the blowing engine or whatever may be employed to furnish it, in pipes, upward sufficiently above the water line as to be secure against the highest rise of the water and thence proceeding in the most convenient course to a point whence they incline downward to the point of discharge as seen in Fig. 14.

The air vault, connecting pipes, &c., used for the confinement and conveyance of the air may be constructed of cast or wrought iron, wood or such other material as may be proper for the purpose. Their size and strength must be determined by the quantity of air used and the degree to which it is condensed.

The air vault should be firmly secured to its place by wrought iron bolts passing through the timbers of the vessel or by any other convenient method.

The main channels under the boat may be formed by recesses in the body of the vessel which may be divided by flanges or projecting divisions of wrought iron wood or other suitable material as seen in Figs. 6 and 7 or they may be formed by securing the flanges to any boat the form of which may admit of the proper upward inclination of surface.

For the purpose of sharpening the stern of the boat the channels may converge as they approach the stern or some of them may terminate before reaching the stern as may be found most convenient and proper for the boat to which they are applied.

The depth of the flanges and channels used will vary not only with the quantity of air used but with the velocity with which it moves. For instance the passages through which the air is discharged through the bottom of the vessel may be so shaped as to direct the air toward the stern. The velocity of the air from these passages will increase with the density of the air or the degree to which it is condensed the depth of the flanges therefore at this point may be less in the same proportion and the inclination of the surface may also be reduced to near or quite a level according to the expansion of the condensed air.

For the purpose of letting off the air not required in moving the vessel, one or more escape valves may be constructed in the pipes or passages leading to the air vault or in the air vault itself so that with the engine in motion the air may be wasted and produce no effect on the boat.

What I claim as my invention and desire to secure by Letters Patent is,

1. The application of the buoyant force of air immersed in water to the lower surface, or bottom, of the boat inclined upward as herein described, in combination with such a channel, channels, grooves, or form of contrivance, as may admit the water to flow freely from the bow to supply the place of the air as it escapes toward the stern and prevent its rising up at the sides of the vessel. The peculiar feature of the improvement herein claimed is that the air passes in channels or spaces open downward and from the bow instead of in trunks or recesses closed below, which would prevent the water rising upward into the channels as the air escapes, as has been before known.

2. For the purpose of causing the air to issue in distinct jets or blasts, and directing it into a channel, or into different channels, I claim the use of the slide valves and compartments herein described or other analogous means, in combination with the channels or grooves on a surface inclined upward as herein described.

3. For the purpose of moving sidewise and turning the boat I claim the employment of air conveyed through suitable tubes or passages from the blowing or other machinery by which it is furnished to the points of discharge under the fore or after part or under the fore and after part of the boat so as to operate on the inclined surface on the sides of the boat, as herein described.

SYLVESTER W. HALL.

Witnesses:
D. R. MORSELL,
THOS. P. JONES.