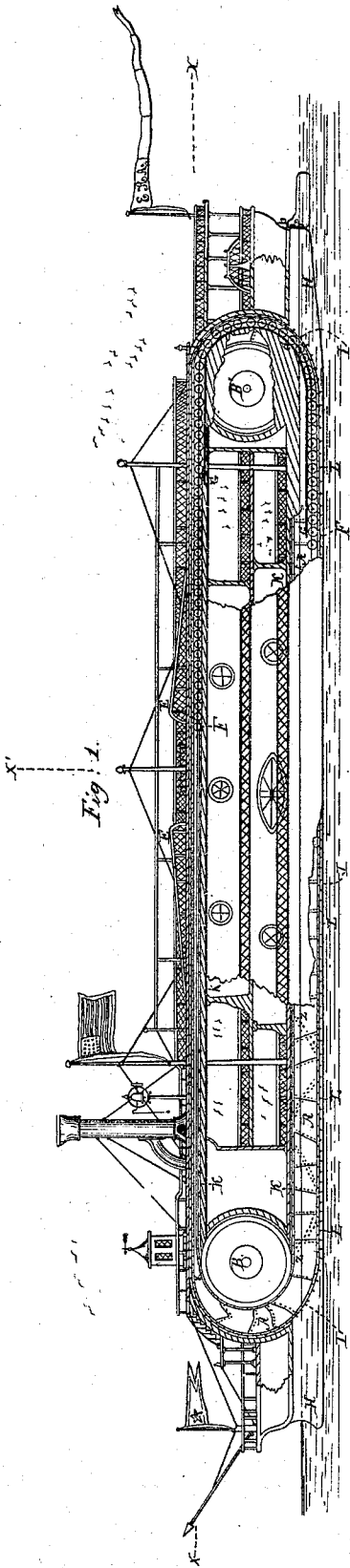
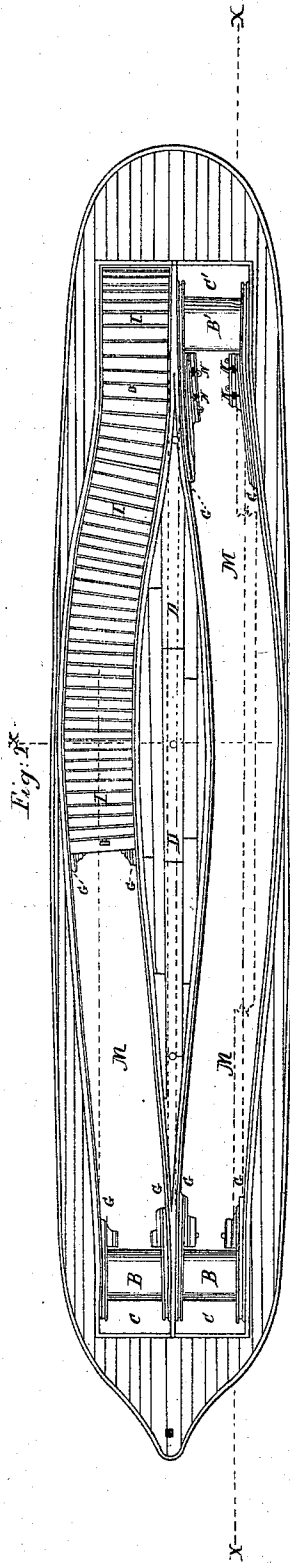
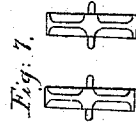
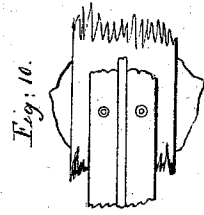
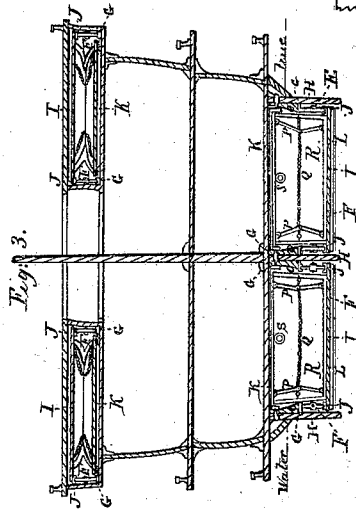
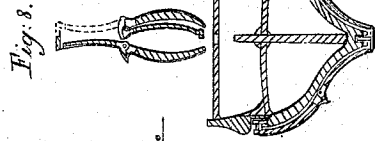
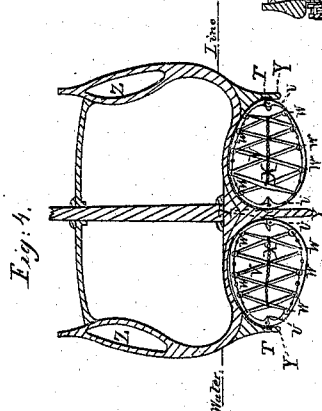
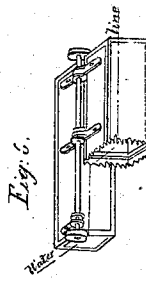
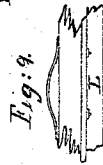


W. M. Storm.
Chain Propeller.

N^o 8,070.

Patented Apr. 29, 1851.



Inventor.
Jm M. Storms

UNITED STATES PATENT OFFICE.

WILLIAM M. STORM, OF TROY, NEW YORK.

FLEXIBLE HOSE OR FLOAT FOR SUPPORTING VESSELS.

Specification forming part of Letters Patent No. 8,070, dated April 29, 1851.

To all whom it may concern:

Be it known that I, WILLIAM M. STORM, of New York, (at present residing at Troy, New York,) have invented a new and Improved Mode of Buoying and Propelling Vessels by means of what I term "Air-Float" Propellers; and I declare the following specification to embrace a full and exact description of the same.

The main feature of my invention consists in supporting and propelling a vessel upon an endless flexible buoy or hose "air-float," so that little or no portion of the vessel proper need be immersed, but only or mainly depend for its buoyancy on the "displacement" effected by the air-float, which has a motion nearly or quite horizontal under and opposite to the vessel.

Some twenty years since, or more, a plan was originated of adding to the still older and well-known device of an endless chain of paddles passing around drums at the forward and after part of a boat, hollow metallic or other buoying vessels, the paddles being fixed to these, and these to the chain or connecting-band of the series. In this mode the principle, although intrinsically good, (for it appears to have been the "germ" of air-floats,) was so far counteracted by a construction radically bad and entirely wanting in many indispensable conditions and provisions that the whole was rendered valueless and I believe never attempted in practice. Drums or cylinders in that case intended to be used in any way cannot be immersed so as to give a continuous or evenly-buoying surface, and even with buoying vessels of a different form it would be difficult to do so at all with the above plan, and as no provision appears to have been made to maintain them in a rigid horizontal plane while under the boat, they would be subject to great lateral vibration or strain sidewise, rise upward while passing from the forward to the after drum, endangering the breaking of the chain, increasing friction, losing buoyant force, and diminishing in various ways the intended effect.

My invention admits of being applied under various different forms, the principal and most important of which are represented at Figures 1 and 4 of the drawings annexed, those being the forms I design for practical appli-

cation, the others being merely to show possible forms of this buoying principle.

Similar letters of reference indicate similar parts in all the figures.

Fig. 1 is a view of a river or bay steamer with certain portions removed as through line *xx* of Fig. 2, so as to disclose parts more particularly to be described. Fig. 2 is a sectional plan through line *xx* of Fig. 1. Fig. 3 is a vertical cross-section through line *x'x'* of Figs. 1 and 2. Fig. 4 is a cross-section of a vessel for marine navigation and having a different form of air-floats applied to her, such form being more applicable for sea use. Fig. 5 shows a mode by which a vessel may in a measure overcome the friction of the water by transferring it to wheels by means of a buoyant and false bottom formed by a jointed frame-work or ribs covered with a flexible water-proof material. Fig. 8 shows a cross-section of this false buoyant bottom inverted and collapsed, also one of the ribs folded. This form, however, I consider of little, if any, practical value. Fig. 6 shows a form, &c., of air-tight boxes, of which a buoyant endless chain may be formed for buoying, and, if desired, propelling a vessel to which they may be applied. This plan is similar in principle to that hereinbefore referred to, but different in other respects, their novelty and their advantage over the plan mentioned consisting in the following points: They are not attached to an endless chain or band, but constitute the band themselves. They are not intended to be totally immersed. (See sketch.) They are provided with wheels and axles that they may be confined to a rail or track, and thus be maintained in an even plane and proper position while passing under the boat. They are so formed as to have the whole area of their sides parallel and so nearly or quite in contact each with the other preceding or succeeding it while moving horizontally in the water, thus giving a comparatively even and (in effect) almost unbroken and equally buoying surface. They may be used with or without main driving-drums, &c. The fault of this plan also for practice is that if constructed of metal they are too heavy; if of wood they are too liable to breakage. They are perversive to worms. The multiplicity of joints in either case is attended with many

disadvantages, &c., all of which are obviated by employing a proper flexible material in the construction of the buoys, which in addition insures the greatest practicable degree of lightness, cheapness of construction, ease of repair, precision of action, &c. Fig. 7 shows two kinds of semi-buoyant wheels suited for use with the air-floats. These wheels could also be made like those of land carriages, excepting an extra breadth of rim, and having spokes of wood or metallic piping, as I have recently seen them, and having a thin water-tight side casing, as those shown, they would be quite buoyant. Figs. 9 and 10 show broken segments of the "track-boards" hereinafter to be described.

A, Fig. 1, is an endless hose, buoy, or float constructed of india-rubber, canvas, gutta-percha, sole-leather, or other fit flexible material, (shown in side view.) It would also be well in some cases for the material to be slightly elastic. Two of these floats are most advantageous in one vessel placed side by side or parallel and in the same plane, but separate. These hose or air-floats are made collapsible, so as to be less bulky when out of the water, and so not occupy great space in the vessel proper and where it can be least afforded. They are by this means rendered less unwieldy, and top-heaviness of the vessel is also thereby avoided. The floats are stretched over two driving drum-wheels B B' at or near each end of the boat, and when in motion pass horizontally under the boat, which should be nearly or quite flat-bottomed, parallel to each other and to the line of her length, which, after traversing, they rise through "throats" or cases C' over the drum or driving-wheels B', and being collapsed, as shown in Fig. 1, while so rising, a portion of the air they contain passing out at valves fixed at two, three, or more places equidistant in the length of the float for that purpose. They pass back so collapsed between casings (which may be formed on the upper side by the hurricane-deck and below by the upper cabin ceiling, each adapted to the double purpose they would then fulfill) toward the bow, where the portion now collapsed in passing over the driving-wheels B and down into the water through throats C is re-inflated.

There are air-valves in the outer band of track-boards, which are held closed by the pressure of the water when immersed, and which are opened outward by the pressure of the air within the float when that is forced to make its exit by the float being pressed together or collapsed in passing over the drum or wheel B'. There are also air-valves opening inward in the inner band of track-boards, which may be held closed by a spring and forced open by the pressure of the air in its effort to enter the float when this is expanded or inflated in passing over drum B. In lieu of any valves in any part of the float large open holes in the inner band of track-boards may be

substituted, or valves held in position by a spring, yet capable of opening in either direction by pressure on either side. It will be observed that the floats, being confined at all times to the tracks and the peripheries of the drums, which alternately diverge and converge opposite the throats C and C', they (or portions of them) are constantly being successively inflated and collapsed per force. The course of the two floats in passing back toward the bow may be seen at Fig. 2, where it is shown they do not move parallel, as beneath the boat, but gradually separate toward midship and again come to their original position at the throats C, thus leaving a space or opening D, approximating an ellipse, the object of this being to give place for sky-lights E and central stairways from below to the upper or hurricane-deck.

There is operating in conjunction with the air-floats an endless traveling band of wheels F, Figs. 1 and 3. These extend on an endless fixed track, a portion of which is indicated at G, Figs. 1, 2, and 3. These bands of wheels, of which there are four in all, two to each float, (although one band might be made to answer between the floats, particularly if these move parallel during their entire revolution,) as the inflated float tends to rise by its buoyancy, receive the pressure, transferring it to the aforesaid endless track, which is fixed above to the vessel inside of the casings, through which the floats move when out of the water, and below to the parallel reels H, Figs. 1 and 3, between which the floats move when or where immersed.

Each hose A has track boards or plank I, Figs. 1, 2, and 3, of proper thickness, fastened to it outside (as also inside) of the endless band which it forms, with their edges a little separated and at right angles to the length of the float, thus forming, as it were, a species of flexible bellows. Their principal purpose is to thus render the float quite flexible in the line of its length perpendicularly, slightly so horizontally, and not at all in the line of the track-boards or the line of its width. The track-boards I are also sufficiently long to project beyond the flexible side of the float, that thus on the ends so projecting may be fastened tracks J, which receive the peripheries of the wheels F, bearing the buoyant pressure, as before mentioned, of the float while under the boat, and also the gravitating pressure of the outer band of track-boards I and the upper portion of the hose A while passing back over or through the boat. The track J, taken as a whole, must of course be flexible, as is evident, and thus each segment of these tracks can be little or no greater in length than the width of the track-board to which it is fastened. It is well, however, and almost necessary, to connect the ends of each segment by a joint to each other preceding and succeeding it, that will turn or act in one direction only out of a horizontal plane common to all the segments. Various other and auxiliary

means may be employed to the same end, which is the maintenance of the moving track-boards and track while under the boat, &c., in a rigid horizontal plane as regards the traveling bands of bearing-wheels, which immediately support the boat and over which in one sense she travels. The inner band K of track-boards (see Figs. 1 and 3) being stretched taut over the driving wheels or drums B B', the outer band of track-boards I should be stretched over the endless band of bearing-wheels F, and that this may be done, leaving the upper portion of the air-float collapsed and the lower portion inflated, as shown in Figs. 1 and 3, the two bands of track-boards being thus eccentric to each other, it is necessary that the floats be so constructed that if the two bands of track-boards were drawn taut and at the same time concentric the hose or flexible portion between said band should throughout its length be found partially collapsed, or the whole, as it were, like a "tub" bellows, half-closed. By observing this direction the float, when placed in its position, as represented in Fig. 1, will work more smoothly and not be liable to improper corrugation in the line of its length.

Of the outer band of track-boards each may have fastened on it a metallic rib running nearly its length, the rib forming in its cross-section a T. This rib is shown in end view at L, Fig. 1, and in side view at L, Figs. 3 and 9. A bottom view is also given at Fig. 10, these two last figures representing enlarged fractions. These ribs strengthen the track-boards, and their vertical flanges form also the paddle and propelling or, more properly, reacting surface of the vessel. The vessel might be propelled by a distinct apparatus, however, as the common paddle-wheel, for instance; but this would generally be less convenient.

In Fig. 3 the track-boards are shown divested of the ribs L.

The weight of the inner band of track-boards K is supported while the float is passing collapsed over the ways M on the stationary friction-wheels N. That portion of each track-board coming in contact with them may be faced with a metallic plate to prevent abrasion.

It were best that the metal employed in the construction of the wheels, tracks, joints, &c., of air-floats should not be seriously oxidizable by alternate exposure to water and air. Galvanized iron, bronze, or brass would probably be best, although cast-iron would answer tolerably well, being less oxidizable than the same metal wrought. It would also be well to cover such of the rubbing-surfaces as may be convenient with some substance that would diminish the noise, which might otherwise attend their motion in an inconvenient degree for passenger-boats. The casings through which the floats pass might also be constructed with a view to this. It would

also be well to place a rack or other proper guard between the parallel reels and in front of the floats to prevent the collision with them of any heavy body that might in such case tear off the metallic ribs, split the track-boards, or become wedged between the sides of the floats and the reels.

The track-boards, to render them less liable to warping, checking, &c., instead of being of simple plank, may be each constituted of wooden cross-bars dovetailed or mortised into each other and forming a grating, in which case the rib L, so necessary in the other case, might be omitted, the "grate" form of track-boards being sufficiently strong without it and the sides of the transverse or longer bars of the grating forming sufficient propelling-surface.

The float being held from rising at the bottom by the wheels F, the pressure of the water still coming on the flexible side O (see Fig. 3) has a tendency to thrust them in. This may be counteracted by allowing the ends of the inner band of track-boards to bear on a row of stationary friction-wheels, (see Fig. 3,) which may extend fore and aft far enough to receive them, while that part of the float opposite to which they are attached is in the water.

The track-boards I and K are connected at intervals by light toggle links or levers P, which relieve in part the strain on O, and the cross-chains connecting the middle joints of each pair being of such a length as to prevent the toggle-links from becoming entirely distended or straightened out, and the side O being attached opposite and to the middle joint of the toggles when the float is collapsed, they in doubling together draw in the sides of the float, causing it to fold smoothly and properly.

The inner and outer bands of track-boards may also be connected by light chains in the interior of the float, running diagonally in the line of its length, as indicated by the double dotted lines between Z and Z, Fig. 1. These by their tension will support the strain that would otherwise come in an undue degree upon the flexible and slightly-elastic sides of the float in the conveyance of motion or force from the inner to the outer band of track-boards. This will be better understood by inspecting the drawings.

At intervals through and across the interior of the floats may be flexible partitions R, (see Fig. 3,) each having holes, as S, through them, so located as to admit (if considered best) air to pass freely from one part of the float to another; but should the floats leak the water at every revolution of them would by means of partitions R, which "bag" in rising over drum B', be carried over the drum and emptied through water-valves (or holes, their substitutes) opening outward in some of the inner track-boards K out upon the water-tight ways M, Fig. 2, and run off and down through throats C, to whence it came,

the ways M having a slight incline to facilitate this. Thus leakage, unless very great, would be of no material consequence.

The valves just mentioned may be formed by simple holes with a disk of pliable or elastic substance, as leather or india-rubber, of greater area tacked fast at two or more points and covering the holes.

Fig. 4 shows a cross-section of a sea-vessel having a pair of endless-hose air-floats, collapsible horizontally, running on bearing-wheels T, attached to the curved and jointed braces U in the interior of the float, the extremities of the braces being connected to the extremes of "lazy-tong" frames V, which have friction-rolls W and connecting-links at their outer knuckles or joints, and also cross-chains X, connecting their middle joints to prevent the frame being spread too far laterally, and the frame itself being to prevent the float from being collapsed vertically by the pressure of the water. These floats pass between parallel reels Y, (which might be metallic and act as ballast,) and being operated in most respects substantially as those previously described, with the exception that they need not, being applied to a sailing-vessel, be extended over driving-wheels, they may rise out of the water and, collapsing horizontally, pass through appropriate openings or cases, as Z, formed in the sides of the vessel, toward the bow for reimmersion.

The main object and grand advantage in the application of the flexible endless-hose air-floats is the giving a firm, equal, continuous, and extended surface of support to a vessel, as before set forth, without the immersion of any body of great magnitude or cross-section, (as is the hull of a vessel,) that would necessarily be forced through the water in her progress, (air-floats acting, as will be observed, as a body separate and distinct from the vessel, or as the water surrounding her, the portion of the float immersed being in a view stationary while the vessel moves onward,) and this double purpose and object has never been attainable by any plan ever heretofore proposed; but by the application of the air-floats, as described, the first great obstacle—the resistance of the water—is not only almost wholly and entirely removed, but at the same time the heretofore-existing practi-

cal impediments hereinbefore remarked to the practicability of the principle of buoyant propellers are obviated, as before shown, and many important contingencies heretofore undiscovered or unnoticed as necessarily connected with that principle are hereby easily and perfectly provided for, as has been fully set forth.

Theoretically, at least, the advantages possessed by a vessel fitted with these air-floats for reaching a high speed, particularly on rivers and other comparatively smooth waters, are even greater than possessed by a locomotive on a railway, as the track, so to speak, is more generally level and unconfined, the supporting-surface more unbroken and even, both driving and bearing wheels are larger, and the latter receive their load on their peripheries. Thus there is no such vibration of axles. The wheels, float, &c., act as one great fly-wheel, the speed of which is accelerating. The whole is comparatively light and compact, the float therefore quite wieldy, and a river-boat two or three hundred feet long and of broad beam, with an engine of a fraction of the power usually employed in such boats, might attain a speed of forty or fifty miles per hour.

These air-floats are applicable to sailing-vessels, vessels propelled by artificial power, row-boats, &c.

Having thus fully described my invention, that which I claim, and desire to secure by Letters Patent of the United States, is as follows:

1. The plan of supporting a vessel in whole or part upon or by means of a flexible movable endless hose or air-float, or on an endless movable chain of flexible buoyant compartments, for the purposes set forth.

2. Making said flexible hose, air-float, or its equivalent collapsible, for the purposes hereinbefore mentioned.

Not limiting myself in or by these claims to any particular forms or arrangement of the buoys or floats, &c., so long as the peculiar features of my invention, as described and claimed, are substantially fulfilled.

WM. M. STORM.

Witnesses:

P. McMANUS,
CORA MT. STORM.