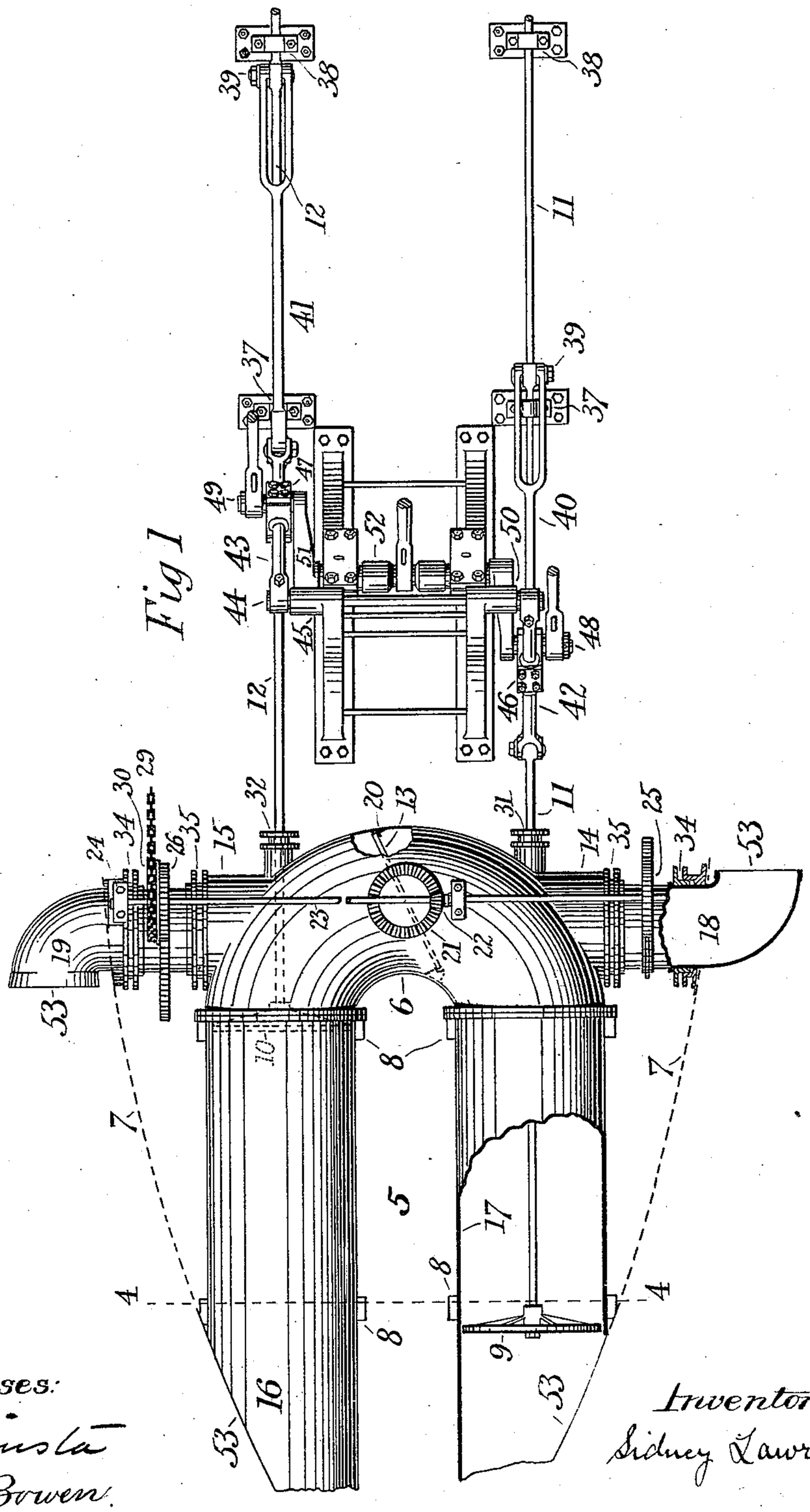
(No Model.) 2 Sheets—Sheet 1.

S. LAWRENCE.

MECHANISM FOR AND MODE OF MARINE PROPULSION.

No. 565,359. Patented Aug. 4, 1896.

Fig 1



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Inventor:
Sidney Lawrence

(No Model.) 2 Sheets—Sheet 2.

S. LAWRENCE.

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Fig 2

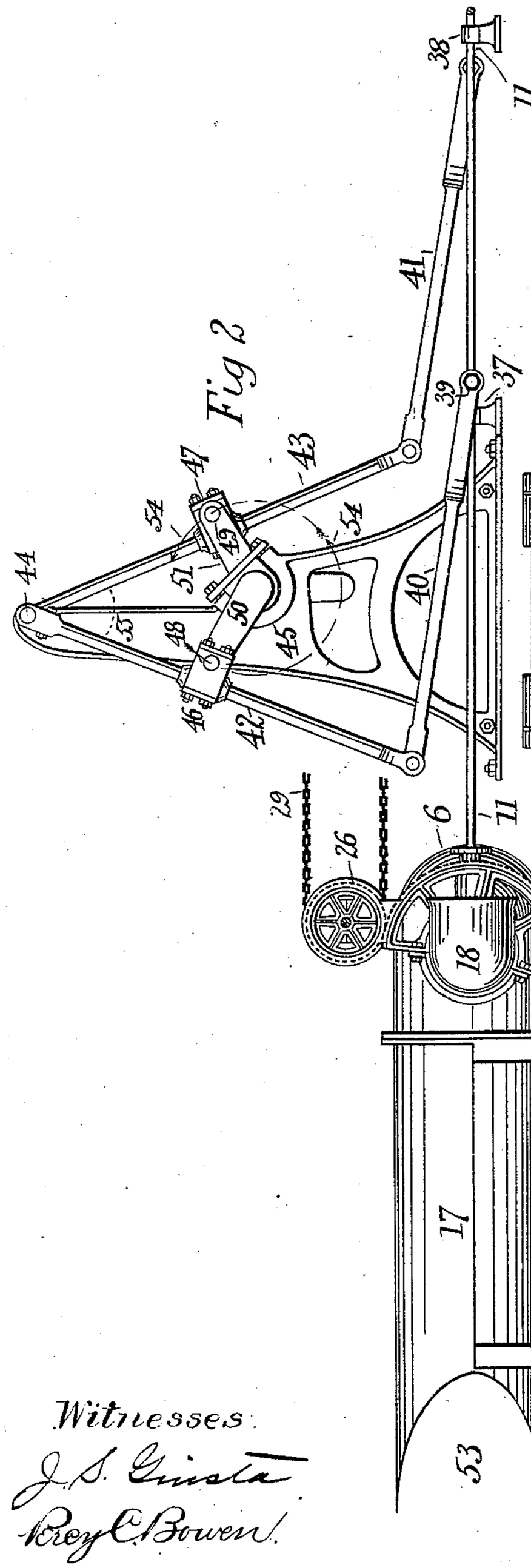
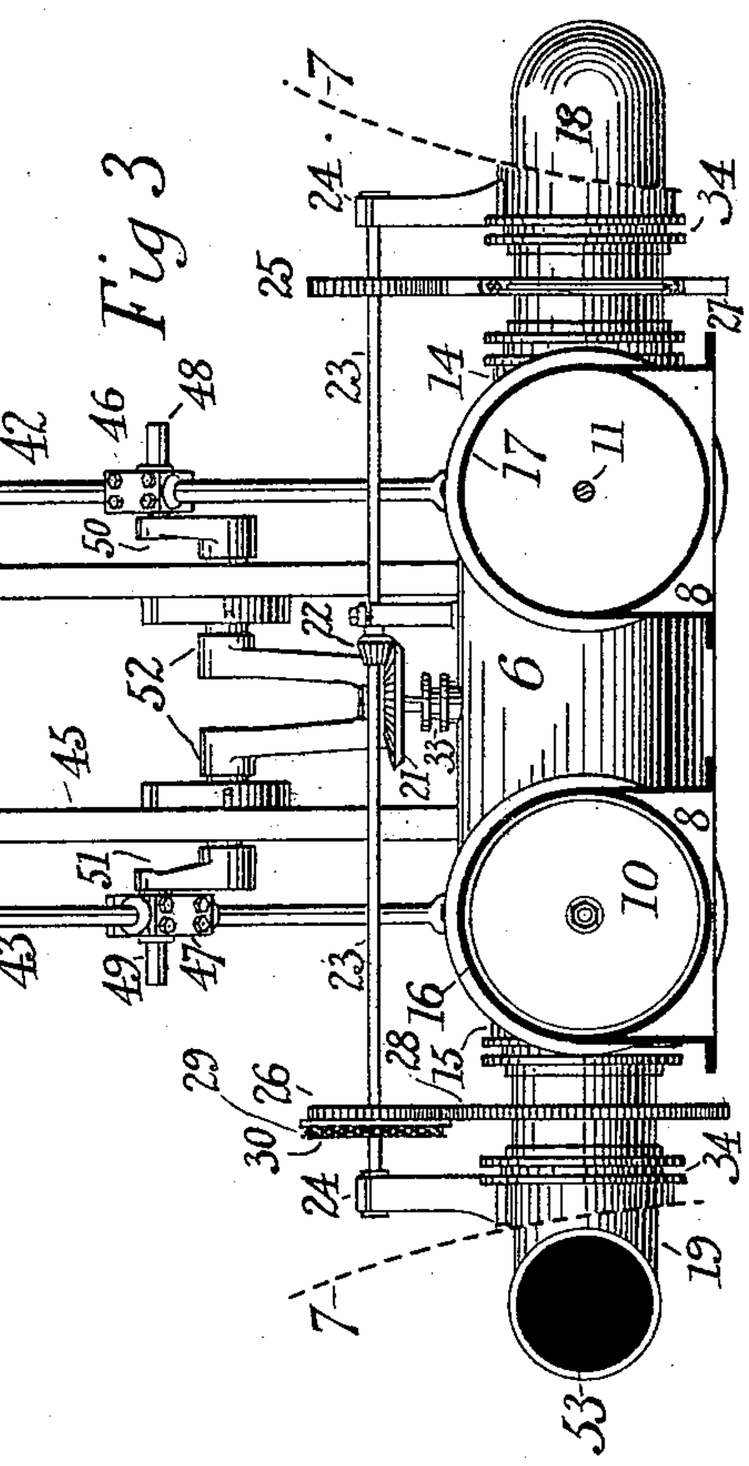


Fig 3



Witnesses:
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Inventor:
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UNITED STATES PATENT OFFICE.

SIDNEY LAWRENCE, OF MELBOURNE, VICTORIA.

MECHANISM FOR AND MODE OF MARINE PROPULSION.

SPECIFICATION forming part of Letters Patent No. 565,359, dated August 4, 1896.

Application filed May 11, 1896. Serial No. 591,135. (No model.)

To all whom it may concern:

Be it known that I, SIDNEY LAWRENCE, engineer, a subject of the Queen of the United Kingdom of Great Britain and Ireland, and a resident of 159 Queen Street, Melbourne, in the Colony of Victoria, have invented certain new and useful Improvements in Mechanism for and Mode of Marine Populsion, of which the following is a specification.

My invention relates to improvements in mechanism for propelling marine vessels and in the mode of using said mechanism, and the object of the invention is to produce an apparatus to which steam or other motive power may be applied, and which will enable vessels to be propelled at greater speed than can be obtained by any of the ordinary well-known means, or to propel such vessels at the same speed but with a less expenditure of steam or other motive power. Furthermore, the object of the invention is to employ apparatus which is not so liable to injury as the exposed blades of screw-propellers, all the essential parts of said apparatus being wholly within the vessel's skin and therefore fully protected. This protection in the case of war vessels is of particular importance.

The improved mechanism comprises the construction and arrangement of parts which is illustrated in the accompanying drawings, in the different figures of which like numerals of reference indicate similar parts, and in which—

Figure 1 shows a plan of the mechanism I use in carrying out my invention, parts being shown broken away to exhibit other parts more clearly. Fig. 2 is a side elevation of parts of the same mechanism, but with the sides of the vessel not shown. Fig. 3 is an end elevation, partly in section, on the line 4 4 in Fig. 1, as seen looking from stern to bow.

Referring to the drawings, 5 represents part of the stern end of a vessel of any suitable size or construction, taken on a horizontal section as deep beneath the water-line as it is convenient to locate that part of the mechanism.

6 is a U-shaped metal tube having wings or openings at each side of the head.

16 and 17 represent the members or legs of the tube 6, and are of equal dimensions and parallel, one member being on each side of and equidistant from the longitudinal middle line of the ship. The members 16 and 17 are open at the rear and preferably terminate at the skin 7 of the vessel, within which the tube is fitted, as shown in the drawings. A protecting or strengthening ring (not shown) may be attached to the skin 7 around the rear end of each tube. The pillows or supports 8 serve to keep the tube fixed horizontally. 9 and 10 are two pistons or plungers fitting within 16 and 17, respectively, (but not tightly,) and reciprocated therein by piston-rods 11 and 12, respectively. Any suitable antifriction-surfaces may be employed for the interior of members 16 17 and for the rims of the pistons 9 10, but in actual working the piston-rims will be surrounded by a film of water, so that friction will thus be largely eliminated.

The tube 6 has a central valve 13, by which it can be divided into two independent portions, and has also two wings 14 15, one on each side, which communicate with the vessel's exterior by means of reversible open-mouthed curved jet-directors 18 19, which form the outer ends of such wings.

For the purposes of illustration one jet-director 18 is shown in the drawings with its opening turned toward the bow, the other being shown with its opening toward the stern, but in practice both jet-directors are always turned in the same direction as one another. When the vessel is going ahead, they both open to the stern, while when the vessel is required to go astern they are both turned so as to open toward the bow. The turning to point forward or sternward, as the case may be, is accomplished simultaneously with the closing or opening, respectively, of valve 13, which is shown in its closed position in the drawings, but which is open when the jet-directors are pointed to the stern—that is, under normal conditions.

Water-tight gates to close (when required) the open ends of members 16 17 and to close the waterways within the wings 14 15 may be provided, to enable repairs to be effected from within, or for other purposes. These gates are not shown in the drawings, as their construction will be well understood, and they form no part of this invention. The mouths 53 of the members 16 17 and of the directors

18 19 may be protected by netting when desired.

20 represents stops for valve 13; 21, bevel gear-wheel affixed to the valve-spindle and engaging bevel gear-wheel 22, which is secured to spindle 23, which is suitably journaled, as at 24, and extends transversely nearly the whole width of the vessel.

25 and 26 are two spur-wheels keyed to spindle 23 and engaging the sector-wheels 27 28, which are strapped or fixedly secured to the inner ends of jet-directors 18 19, respectively.

29 is a chain engaging a sprocket-wheel 30, which may be integral with wheel 26, but of any suitable size.

31 32 are stuffing-boxes through which piston-rods 11 and 12 work, and 34 and 35 are stuffing-boxes which prevent the water having access to the interior of the ship through the joints of the directors.

33 is a stuffing-box through which the spindle of the valve 13 is extended above the tube 6.

Suitable guides or bearings, as 37 38, are provided for the long piston-rods 11 12, to which are pivotally linked by pins 39 connecting-rods 40 and 41, which are linked to ends of vibrating arms 42 and 43, respectively, the other ends of said arms being journaled or pivoted on the same axis 44 (as on a shaft) at the head of a strong rigid frame 45. The arms 42 and 43 are bushed in sliding blocks 46 and 47, in which the crank-pins 48 and 49 are journaled, the respective cranks being shown by 50 and 51. These cranks are actuated by the main shaft 52, which is parallel to the axis 44 and is journaled in the frame 45. Rotary motion is given to the main shaft in any suitable manner, the drawings showing portions of connecting-rods as usable to actuate the shaft in conjunction with main or propelling engines of the triple-expansion type.

My mode of operating the pistons 9 10 is to propel the same very rapidly in the opposite direction to that in which the vessel is required to travel, whether it be ahead or astern, while the return stroke is made much more slowly. Any suitable ratio between these speeds may be secured by various means, the jet-directors being arranged to point as already explained. If the vessel is propelled ahead by this mode of working the pistons, great speed may be secured. The pistons are preferably placed and operated so they work alternately as nearly as possible, although their relative positions will constantly vary (in a cycle) in consequence of their variations of speed. The result of these varying positions is that the amount of fluid between the backs of or connecting the two pistons will likewise vary, and when being diminished will issue as jets from the directors 18 19, and so help to propel the vessel. When being increased, additional fluid will be drawn in through the said directors, the mouths of which should be as small as is compatible with this purpose. The smaller they are the more rapid, and consequently useful, will be the outward intermittent jets from them. If the two pistons work as alternately as their varying speed will admit of, then several advantages are secured, as the power of the main engines can be better utilized, and the amount of water representing the maximum difference in the quantity of fluid which is between the pistons at different times will be at its minimum. This minimum quantity is dependent on the relative speed of the fast and slow strokes, other conditions being the same.

It will be clear that when traveling the vessel is propelled by the combination of thrusts by solid pistons and of intermittent jets of water. As, when going astern, valve 13 is dividing the tube 6 into two independent parts, the water which is in advance of each piston during its rapid stroke bowward will have only one outlet, and therefore will have greater force than if the valve 13 were open.

By connecting the piston-rods 11 and 12 to the connecting-rods 40 and 41, and connecting the said connecting-rods to the vibrating arms 42 and 43, and pivoting the said vibrating arms on a common axis, all as shown and described, and then connecting the vibrating arms to the crank-arms 47 and 48 through sliding blocks mounted on the said vibrating arms, the required difference of velocity of the piston is secured. As the distance from the centers of the blocks 46 and 47 to the center of the axis of the cranks 49 and 50 is continually varying when the said cranks are in motion, the velocity, therefore, of a point located at the center of those blocks will be a variable quantity, hence the variable velocity imparted to the vibrating arms and thence through intermediate mechanism to the pistons.

The angle between the cranks 50 and 51 should preferably be one hundred and eighty degrees, *i. e.*, they should be exactly opposite one another, because when in the latter position the maximum difference in the quantity of fluid which is between the pistons at different times will be at its minimum.

Taking cranks 50 and 51 as moving in the direction shown by arrow 54, then each time a vibrating arm reaches a line tangential to the circle described by the pin of the crank moving it (or parallel to such tangent) the piston corresponding to such arm will be at one end of a stroke. Therefore in fitting the pistons in place they should be fixed accordingly. This is illustrated in the drawings, both arms being at or parallel to such a tangent, and both pistons being at the end of a stroke. It will be evident that the shorter the short arc joining the tangents is (in other words, the wider is the angle 55) the quicker will be the stroke of the piston in one direction in proportion to the time occupied by the return stroke of the piston, and that by using longer vibrating arms or longer cranks 50 51 the distance traveled in one piston-stroke

may be increased. In the drawings the ratio of the short arc to the long is 1:2. Therefore each piston will make a stroke in one direction in half the time it will take to make the reverse stroke. It is preferable to use arms as short as convenient.

When it is desired that the vessel should go astern, the main crank-shaft 52 must be rotated in the reverse direction to that required for going ahead. This can be accomplished by reversing-gear as ordinarily used in marine engines. The chain 29 may be connected to such gearing in order that the said chain may operate the valve 13 and jet-directors 18 19, as already explained, as soon as the reversing-lever is actuated.

It will be obvious that the pistons shown in the drawings might be employed to pump water out of the hull of the vessel into the sea, or vice versa, by connecting to tube 6 suitable pipes provided with appropriate valves, but I make no claim to cover any such device.

Having now particularly described and ascertained the nature of my said invention and in what manner the same is to be performed, I declare that what I claim is—

1. In a mechanism for the propulsion of marine vessels, the combination with a U-shaped tube having rearwardly-extending members, wing-tubes at the sides of the tube-head, revoluble jet-directors mounted on said wing-tubes, means for varying the direction of said jet-directors, pistons carried within the said members of the U-shaped tube, means for imparting a reciprocating motion to the said pistons in such a manner that the forward stroke will be more rapid than the return stroke, a valve mounted in the head of the said U-shaped tube and means for operating the said valve, substantially as described.

2. In a mechanism for the propulsion of marine vessels, the combination, with a U-shaped tube having rearwardly-extending members, of wing-tubes at the sides of the tube-head, jet-directors revolubly mounted on the said wing-tubes, a valve in the aforesaid tube-head, means for simultaneously opening and closing said valve and revolving the said jet-directors, pistons carried within the members of the U-shaped tube, and means for imparting reciprocating motion to the said pistons against the pressure of the water in front of one piston and behind the other, substantially as described.

3. In a propelling mechanism for marine vessels, the combination with a U-shaped tube having rearwardly-extending members, of wing-tubes at the sides of the tube-head, a valve in said tube-head, a spindle connected to said valve and a gear-wheel mounted on said spindle, jet-directors carried by the aforesaid wing-tubes, means for simultaneously changing the direction of the said jet-directors and operating the said valve, pistons carried within the said rearwardly-extending tubes, and means for imparting a variable reciprocating motion to the said pistons against a column of water in front of one piston and in the rear of the other piston, substantially as described.

4. In a propelling mechanism for marine vessels, the combination with a U-shaped tube having rearwardly-extending members, of wing-tubes communicating with the interior of the tube-head and carried on each side thereof, a valve in the said tube-head adapted to open and close the water-passage through the said head, a spindle connected to the said valve, a gear-wheel carried by said spindle, revoluble jet-directors carried by the said wing-tubes and provided with stuffing-boxes, sector-wheels mounted on said directors, a spindle carrying gear-wheels engaging said sector-wheels and the gear carried by the valve-spindle, means for rotating said spindles so as to simultaneously operate the valve and jet-directors, pistons carried within the said members of the U-shaped tube, and means for imparting reciprocating motion to the said pistons, substantially as described.

5. In mechanism for the propulsion of marine vessels, the combination with a U-shaped tube having rearwardly-projecting members, of wing-tubes at the sides of and communicating with the interior of the tube-head, jet-directors revolubly mounted on the said wing-tubes, a valve in the aforesaid tube-head, means for simultaneously opening and closing the said valve and changing the direction of the said jet-directors, pistons carried within the members of the U-shaped tube, piston-rods connected to the said pistons and passing through the said tube-head, guides for said piston-rods, connecting-rods connected to said piston-rods with their other ends extending toward the said tube, vibrating arms connected to the said connecting-rods, a shaft journaled in the upper ends of the said vibrating arms, a supporting-stand carrying said shaft, a crank-shaft mounted on said stand and sliding blocks mounted on the said vibrating arms and journaled to the crank-pin of the crank-arms, substantially as described.

6. In a mechanism for propelling marine vessels, the combination with a U-shaped tube having rearwardly-extending members, of wing-tubes, communicating with the interior of the tube-head and carried on each side thereof, a valve in said tube-head adapted to open and close the water-passage through the said head, a spindle connected to the said valve, a stuffing-box carried by the said tube-head, and engaging the said spindle a gear-wheel carried by said spindle, revoluble jet-directors carried by said wing-tubes and provided with stuffing-boxes, sector-wheels mounted on said directors, a spindle carrying gear-wheels engaging said sector-wheels and the gear carried by the valve-spindle, means for rotating said spindle to operate said di-

rectors and valve, pistons carried in the said members of the tube, piston-rods connected to said pistons and passing through said tube-head, connecting-rods connected to said piston-rods, vibrating arms connected to the said connecting-rods, a shaft journaled in the upper ends of the said vibrating arms, a supporting-stand carrying said shaft, a crank-shaft mounted on said stand, and sliding blocks mounted on the said vibrating arms and journaled on the crank-pins of the crank-arms, substantially as described.

7. In a mechanism for the propulsion of marine vessels, the combination with two passages opening rearwardly through the stern of the vessel, a wing-passage from each of said passages through the side of the vessel; jet-directors revolubly mounted on the said wing-passages; a valve in the passage connecting the two rearwardly-opening passages; means for simultaneously operating said valve and revolving the said jet-directors; pistons carried within the said rearwardly-opening passages; and means for imparting reciprocating motion to the said pistons against the pressure of the water in front of one piston and behind the other, substantially as described.

8. In a propelling mechanism for marine vessels, the combination with a U-shaped tube having rearwardly-extending members; of wing-tubes at the sides of the tube-head; a valve in said tube-head; jet-directors carried by the wing-tubes; means for simultaneously changing the direction of the said jet-directors and operating the said valve; pistons carried within the said rearwardly-extending tubes; and means for imparting a reciprocating motion to the said pistons, substantially as described.

9. In a mechanism for propelling marine vessels, the combination with a U-shaped tube having rearwardly-extending members, of wing-tubes communicating with the interior of the tube-head and carried on each side thereof, a valve in said tube-head adapted to open and close the water-passage through the said head, revoluble jet-directors carried by said wing-tubes, and adapted to be directed to the rear when the motion of the vessel is forward, and forward when the motion of the vessel is to the rear, means for simultaneously changing the direction of the jet-directors and operating the said valve, pistons carried within said rearward-extending members, and means for imparting a reciprocating motion to the said pistons in such a way that one stroke will be quicker than the next, substantially as described.

In witness whereof I have hereunto set my hand in the presence of two subscribing witnesses.

SIDNEY LAWRENCE.

Witnesses:
G. G. TURRI,
E. S. NICHOLLS.