June 8, 1943. N. A. THOMPSON 2,321,531

PROPELLING APPARATUS FOR WATERCRAFT

Filed Nov. 21, 1942 2 Sheets-Sheet 1

FIG. 1.

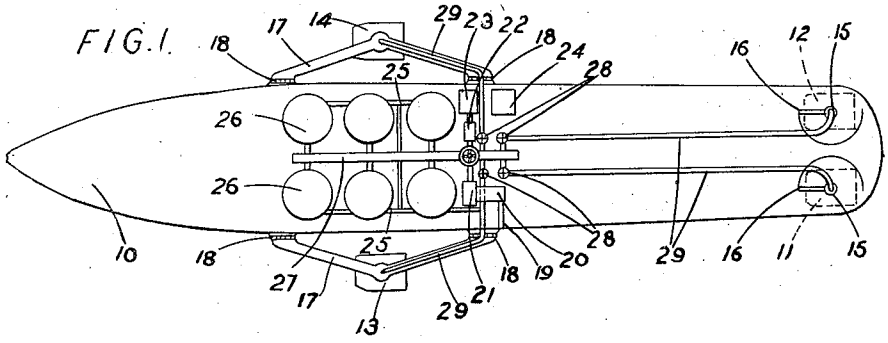


FIG. 2.

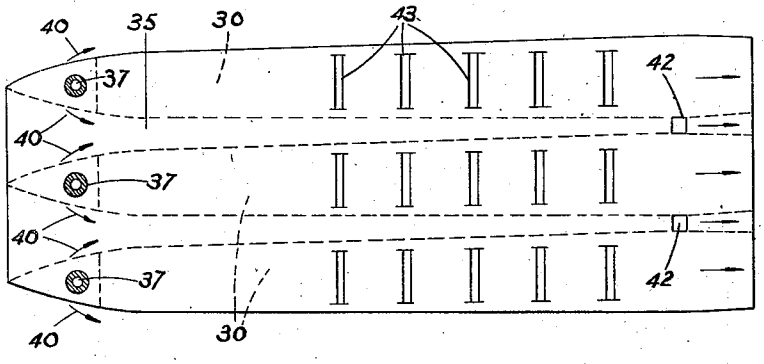
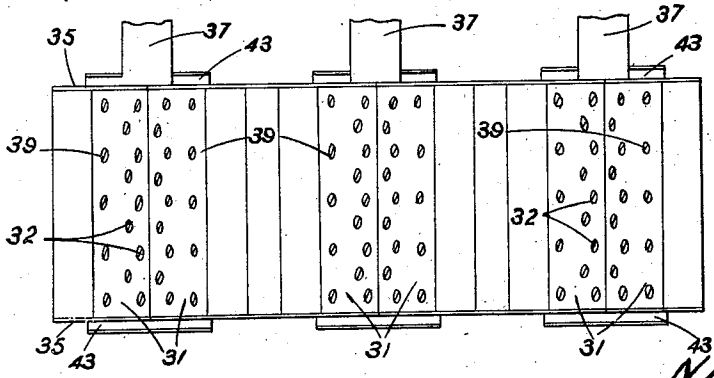


FIG. 3.



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PROPELLING APPARATUS FOR WATERCRAFT

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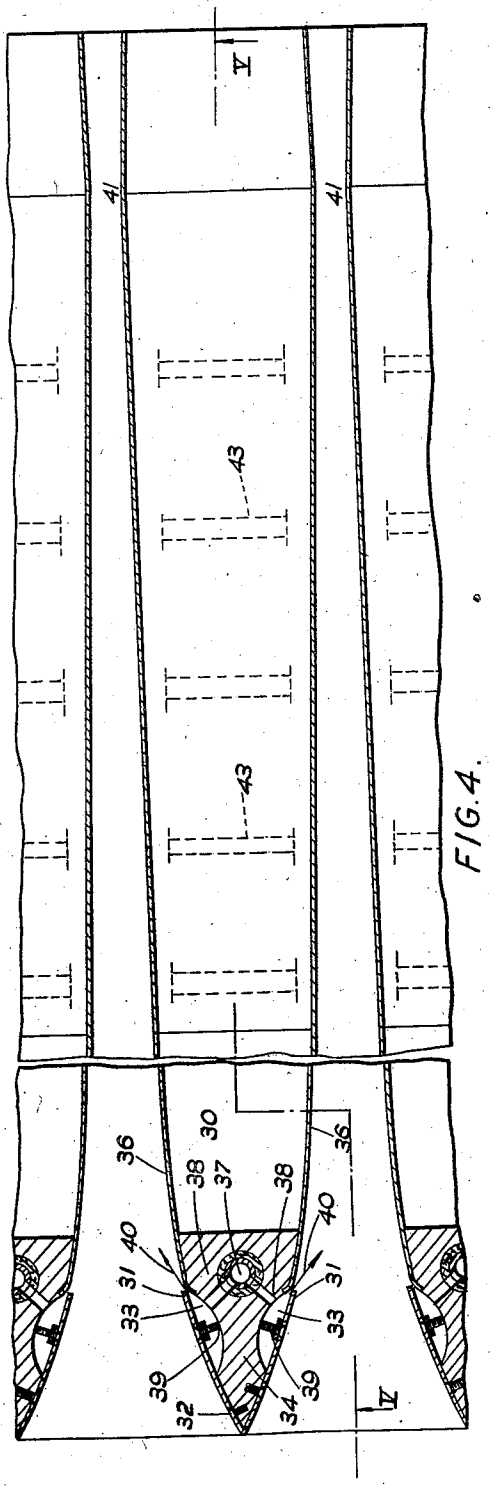


FIG. 4.

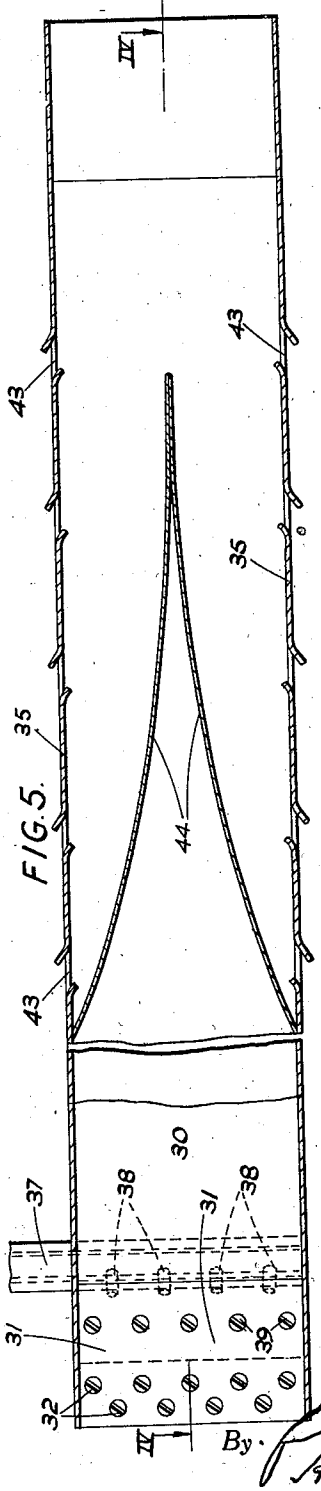


FIG. 5.

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2,321,531

PROPELLING APPARATUS FOR WATERCRAFT

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Application November 21, 1942, Serial No. 466,444
In Great Britain November 22, 1941

12 Claims. (Cl. 115—11)

This invention relates to the propulsion of watercraft and it is concerned with a method of propulsion in which sheet-jets of steam or other fluid under pressure from a suitable source are injected into conduits submerged in the water, causing the flow of water through the conduits to produce the propulsive effect. It is generally convenient to form the conduits in pontoon elements to which fluid under pressure is delivered, each conduit consisting of a passage which may be of uniform height but of diminishing width from the front toward the rear, while the fluid pressure medium is emitted as a sheet-jet at each side of the conduit near the front. Additional sheet-jets may be provided along the length of the conduit if required.

Each pontoon may be made up of a number of boat-shaped elements disposed side by side between top and bottom cover plates, and spaced apart so as to leave conduits of the proper shape between them through which the water can flow under the impelling action of the sheet-jets. If steam is used as the pressure medium it will preferably be superheated, and if the vessel to which the pontoon is applied is to travel in salt water the boilers providing the superheated steam will be associated with suitable de-salting equipment.

The narrow slits through which the pressure medium issues in sheet-jets may be formed at the sides of the conduits near the nose ends of the boat-shaped elements. The conduits gradually become narrower toward the rear, but preferably expand again a little before the delivery point is reached. Water is preferably taken in through entries arranged in the upper and lower cover plates of the boat-shaped elements and delivered through the rear of these elements so as to prevent cavitation and eddying in the spaces between the ends of the conduits through which the thrust streams of water are issuing. The cover plates may also be provided with apertures preferably covered with gauze at the narrowest part of each conduit to stabilise the pressure conditions between the outside water and the inside water at these points.

The pontoons or some of them may be mounted to turn for steering purposes and to turn through 180° for reversing purposes, and they may be mounted in various positions, under the stern of the vessel, in the shell of the vessel, or on outriggers at the sides and so forth, according to requirement. The pontoons should always be completely submerged to a sufficient depth to prevent disturbance of the propulsive effect by surface water conditions.

The invention is illustrated by way of example in the accompanying drawings, in which:

Figure 1 is a diagrammatic plan of a vessel such as a speed boat or launch to which the invention is applied;

Figure 2 is a plan view of a small width pontoon on a larger scale;

Figure 3 is a front view thereof;

Figure 4 is an enlarged plan view, partly in section on the line IV—IV of Figure 5, showing one of the boat-shaped elements of a pontoon with parts of adjacent elements; and

Figure 5 is a side elevation partly in section on the line V—V of Figure 4, showing one such element.

Referring first to Figure 1, the vessel 10 there shown may be assumed to be a speed boat or launch. It has two of the pontoons 11 and 12 disposed under the stern and two others 13 and 14, mounted on outriggers approximately amidships or a little in front of the mid-point longitudinally. Each of the pontoons 11 and 12 is mounted in swivel bearings 15 through which steam can be conveyed to headers on the pontoons while allowing the pontoons to be directed as desired for steering or turning through 180° for reversing the boat. For this purpose tillers 16 are indicated by which each pontoon can be turned separately but of course they could be connected for simultaneous movement if preferred. The pontoons 11 and 12 are submerged under the stern of the vessel. The pontoons 13 and 14 are carried by outrigger frames which are preferably mounted by hinges at 18 on the hull of the vessel so that they may be raised together with the pontoons which they carry to facilitate docking and so forth. The pontoons 13 and 14 may also be mounted to be turned about a vertical axis if desired, through suitable connections but this is not illustrated.

Water is taken in at a suitable intake, such as 19 leading to a pump 20 which may be driven through a reduction gear 21 from a steam turbine or other prime mover 22. In order to facilitate starting, an electric motor-dynamo unit 23 is provided fed with current from a battery 24, and capable of recharging this battery when required when driven by the turbine 22. The pump 20 delivers the water through pipes 25 to a set of flash boilers 26 which will include desalting equipment in case the vessel is to operate upon salt water. The flash boilers deliver steam at a few atmospheres pressure to

a header 27 which delivers it through control valves 28, preferably all at one control station, to lagged pipes 29 leading to the respective pontoons. The pipes 29 leading to the outrigger pontoons may be flexible or should have swivel joints in them if the outriggers are to be hinged as indicated. Pontoons placed in the positions 13 and 14 are well situated to reduce the resistance of the vessel in travelling through the water by the suction they create at the front, which tends to decrease the pressure on the sides of the vessel along its entrance, and by the pressure from the thrust streams at the rear, which tends to decrease the suction along the sides toward the stern.

Figures 2 and 3 illustrate a small pontoon element with only two conduits through it, to show the principle of construction. For most purposes the pontoons will have a larger number of conduits side by side, say six or more. The conduits are formed between boat-shaped elements 30 spaced apart and connected by cover plates 35 at the top and bottom. The forward end of each boat-shaped element is occupied by a casting or frame 34, Figures 4 and 5, which supports the side plating 31 held in place by screws 32 or otherwise. At each side of the casting or frame 34 are D-shaped pipes or channels 33 whose outer walls are formed by the plates 31. These plates are held at their rear ends by adjusting screws 39 in positions such that they leave narrow slits at their rear edges through which the sheet-jets of steam may issue as indicated by the arrows 40. The slits are very narrow, of the order of five-hundredths of a millimeter for example, and the gaps through which the jets issue are between the rear edges of plates 31, and the surface of plating 36 which extends from the channels 33 toward the rear of the boat-shaped elements. The plating 36 may be continuous along each side of the element to its rear end unless it is desired to introduce further sheet-jets, in which case similar channels 33 are provided wherever required along the length of the conduits, extending from top to bottom of the boat-shaped elements at each side of a conduit, and the plates 36 are arranged to form gaps at the rear edges of these channels, exactly as illustrated by the plates 31.

Each conduit between a pair of boat-shaped elements narrows rapidly at first in the neighbourhood of the sheet-jets and then contracts gradually toward the rear up to the point indicated at 41 in Figure 4, where the narrowest cross section or throat in the conduit is reached beyond which it expands slightly toward the rear. The water flowing through each conduit forms a thrust stream at the rear by which the propulsive effect on the pontoon, and hence on the vessel, is produced by thrust against the water through which the pontoon is passing. It is desirable to stabilise the pressure conditions in the thrust stream at the throat in relation to the water above and below, and for this purpose apertures which may be covered by wire gauze are provided at the top and bottom of each conduit, as indicated at 42 in Figure 2, the apertures being formed in the cover plates 35. The cover plates are also provided with a series of water entries at 43 arranged at intervals, preferably both above and below each boat-shaped element, as shown in Figures 2, 4 and 5 for taking in water and allowing it to escape at the rear of each boat-shaped element. The sum of the effective areas of the openings of the water entries 43 should be about the same as the area at the rear of each boat-shaped element so that the amount of water discharged at the rear may correspond with that displaced by the boat-shaped element as it travels through the water. This avoids cavitation at the rear of the boat-shaped elements between the thrust streams and enables these streams to act effectively to produce a propulsive effect on the water around each stream. Although it is not essential, the interior of each boat-shaped element may be provided with partitions as indicated at 44, Figure 5, which meet toward the rear for the purpose of assisting in bringing together the water streams collected by the upper and lower water entries 43, causing them to merge and to issue as a single stream at the rear.

At each side of the pontoon shown in Figure 2 there are sheet-jets near the front as indicated by the arrows 40 on the outer surfaces of the outermost boat-shaped elements. These assist in the propulsive effect and reduce the resistance of the water against the sides of the pontoons. If preferred, however, additional channels may be formed by walls at the outside enclosing these outer sheet-jets. Each sheet-jet acts upon the water with an injector action, the jets in the conduits imparting their momentum to the water as the width of the conduits narrows until the water is flowing at its highest velocity at about the throats 41, Figure 4.

The pontoons made up as above described may be built into, attached to, or mounted on any part of the vessel where they can exert their propulsive effect on the water, and the particular arrangement illustrated in Figure 1 has been given by way of example only. It is possible to steer the vessel by control of the steam pressure alone through the valves 28 to the pontoons on either side of the vessel, but the turning of some at least of the pontoons is desirable for steering purposes as illustrated in Figure 1.

Although it is possible to use the pontoons with suitable controls, either of the steam pressure supplied to them or of their angular positions, for steering purposes, a rudder may be provided as well for steering.

Where flashboilers are used the steam can be superheated to any required extent, but if other types of boilers are provided they may need additional superheaters for this purpose according to standard practice in steam boiler plants.

The invention is not limited to the particular method of forming the sheet-jets by extensions of the plating at the sides of the boat-shaped elements, as a similar result can be attained by causing the jets of steam to escape from slits at the rear ends of D-shaped pipes embedded in recesses in the side faces of the elements. In every case the superheated steam must issue at high velocity in a backwardly directed jet in sheet form in order to produce the desired result.

The conduits have been shown as being of uniform depth throughout and only contracting in width, but this is not essential as the depth may be varied if preferred as well as the width. It will be evident that the propulsive effect is independent of the position of the pontoons in the water, but as they have to be submerged it is preferable to arrange the pontoons with the upper and lower cover plates horizontal as shown in order that each pontoon may contain a number of parallel conduits without extending to any inconvenient depth below the surface.

Although the invention has been described

throughout as applied to the propulsion of watercraft by means of sheet-jets of superheated steam, it will be understood that the steam may be replaced by any gas under pressure which it is convenient to provide. For example, air might be provided by a compressor, or gas under pressure might be generated by the combustion of a liquid fuel or the like. The propelling effect of the pontoons would be the same with any gas issuing in sheet-jets under sufficient pressure. For the purpose of marine propulsion, however, the use of steam as the propelling medium may be considered preferable, and the invention has therefore been described with reference to a supply of superheated steam to the jets.

The invention provides a convenient method of installing additional power plant in vessels whose speed it is desired to increase, for example cargo boats which are to be attached to a convoy. The invention can also be applied for the auxiliary propulsion of vessels which are not normally propelled by power but which may need to use a power unit at times.

I claim:

1. Apparatus for the propulsion of watercraft comprising a body formed with a plurality of conduits which contract from the front toward the rear, means for causing sheet-jets of fluid to issue under pressure in the walls of said conduits, near to the front end thereof and rearwardly directed over said walls, said sheet-jets of fluid being under such pressure as to propel thrust streams of water through said conduits, means for supporting said body on any craft to be propelled, and means for supplying pressure fluid thereto.

2. A propelling apparatus for watercraft consisting of a plurality of boat-shaped elements spaced apart between cover plates so as to form between them conduits broad at the front and contracting toward the rear, and means for forming rearwardly directed sheet-jets of pressure fluid near to the forward ends of the respective conduits, under such conditions that they can impart their energy to streams of water passing through said conduits toward the rear.

3. A propelling apparatus for watercraft consisting of a pontoon built up of a plurality of boat-shaped elements disposed side by side between cover plates above and below the same, said boat-shaped elements being spaced apart laterally so as to provide between them conduits broad at the front and contracting toward the rear, means for providing a narrow slit in the side wall of each such conduit near to its nose end adapted to permit a backwardly directed sheet-jet of pressure fluid to issue therefrom over the side wall of said conduit, and means for conveying a fluid under pressure to said pontoon.

4. Propelling apparatus for watercraft as claimed in claim 3, in which each boat-shaped element comprises a stiff supporting body formed with a channel at each side, plating attached to said supporting body forming the nose of said boat-shaped element, and means for adjusting said plating over said supporting body in such manner as to provide narrow backwardly directed slits through which sheet-jets of pressure fluid may issue from said channels.

5. Propelling apparatus for watercraft as claimed in claim 3, in which said boat-shaped elements are so shaped that the conduits between them contract rapidly from the nose end for a short distance, and then contract more gradually toward the rear up to a position at which the narrowest throat is formed, beyond which said conduits expand again slightly to the discharge end.

6. Propelling apparatus for watercraft as claimed in claim 3, in which the cover plates above and below the conduits between said boat-shaped elements, have apertures in them near to their rear ends adapted to enable the pressure conditions between the water in the interior of said conduits and the water surrounding the same to be stabilized before the water issues from the rear end of each such conduit.

7. A propelling apparatus for watercraft consisting of a pontoon built up of a plurality of boat-shaped elements disposed side by side between cover plates above and below the same, said boat-shaped elements being spaced apart laterally so as to provide between them conduits broad at the front and contracting toward the rear, means for providing a narrow slit in the side wall of each such conduit near to its nose end adapted to permit a backwardly directed sheet-jet of pressure fluid to issue therefrom over the side wall of said conduit, and means for conveying a fluid under pressure to said pontoon, in which the cover plates above and below the conduits between said boat-shaped elements, have apertures in them near to their rear ends adapted to enable the pressure conditions between the water in the interior of said conduits and the water surrounding the same to be stabilized before the water issues from the rear end of each such conduit, and wherein the apertures in the cover plates of the conduits are situated at the narrowest part of each conduit, beyond which such conduit expands slightly toward its discharge end.

8. Propelling apparatus for watercraft as claimed in claim 3, in which the cover plates above and below said boat-shaped elements are formed with a plurality of water inlets spaced apart along the length of said boat-shaped elements, adapted to permit water to pass from the outside into the interior of said boat-shaped elements, and out at the rear ends thereof, the effective areas of said water inlets being such as to permit a flow of water into and through each said boat-shaped element substantially corresponding to the water displaced by such element in its movement through the water.

9. A vessel adapted to travel on water, a pontoon built up of a plurality of boat-shaped elements disposed side by side between cover plates above and below the same, said boat-shaped elements being spaced apart so as to provide a plurality of conduits between them contracting from the front of said pontoon toward the rear thereof, narrow slits in the side walls of said boat-shaped elements adapted to permit the issue of sheet-jets of pressure fluid rearwardly directed over the side walls of said conduits, means for supporting said pontoon from said vessel in a position such that it is submerged in water on which said vessel floats, means for turning said pontoon relatively to its support for steering and reversing purposes, said supporting means being such as to convey a pressure fluid from said vessel to the said slits in the side walls of said conduits while permitting of the turning movements of said pontoon in its support, and a source of pressure fluid on said vessel.

10. A vessel and a pontoon therefor as claimed in claim 9, said pontoon having apertures in the cover plates thereof adapted to permit water to enter said boat-elements and to pass through

them toward the rear in amount substantially corresponding to the volume of water displaced by said boat-shaped elements as the vessel with said pontoon supported therefrom travels through the water.

11. A vessel and a pontoon therefor as claimed in claim 9, said vessel carrying a boiler adapted to provide a supply of superheated steam under pressure, and means for conveying said superheated steam to said pontoon in all positions thereof relatively to said vessel.

12. A vessel adapted to travel on water, a source of pressure fluid carried by said vessel, and a plurality of pontoons as claimed in claim 3 with means for supporting some of said pontoons at the sides of said vessel, means for supporting at least one such pontoon under the stern of such vessel in such manner that it can be turned with respect to said vessel for steering and reversing purposes, said supporting means including conduits for conveying the pressure fluid from said vessel to each of said pontoons.

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