May 6, 1969 N. V. LASKEY ET AL 3,442,242

STOPPING AND MANOEUVERING MEANS FOR LARGE VESSELS

Filed June 5, 1967 Sheet 1 of 3

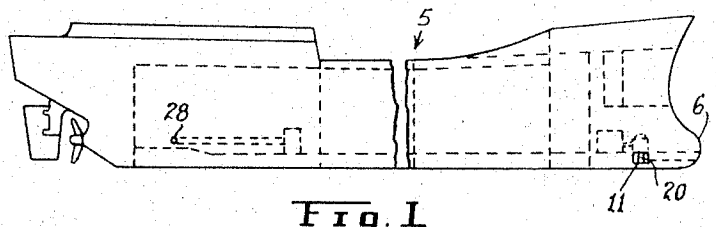

Fig. 1

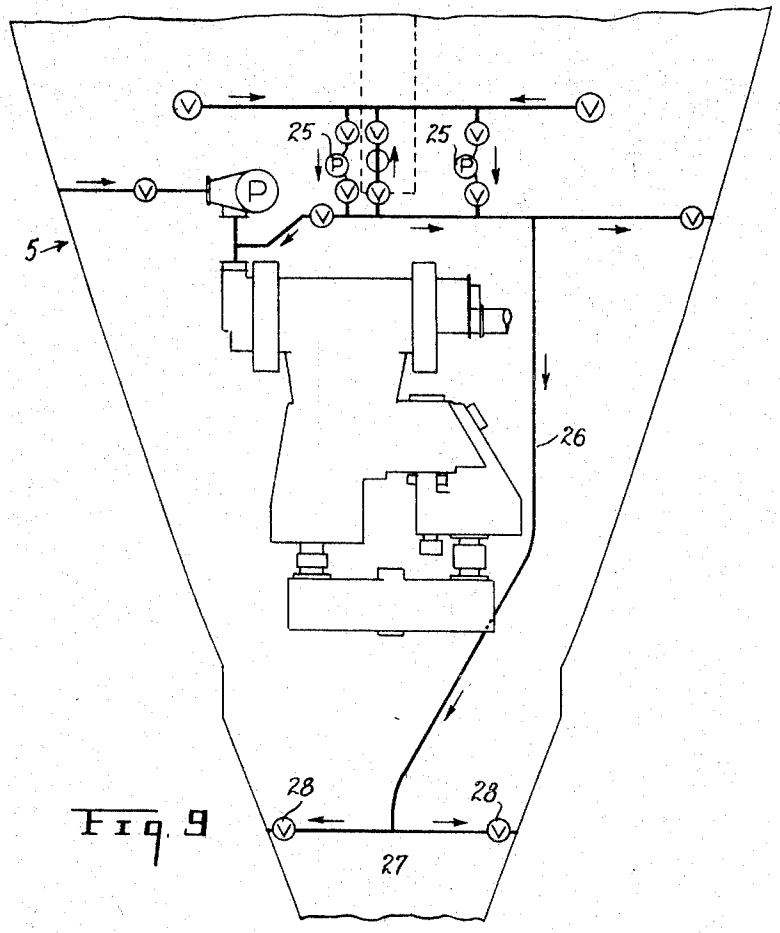

Fig. 9

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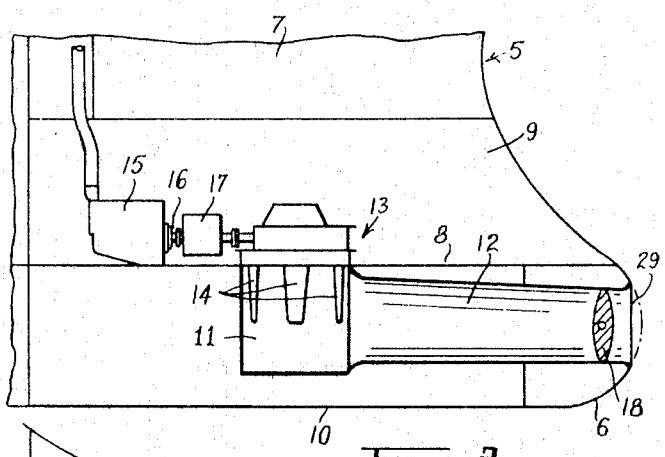

Fig. 2

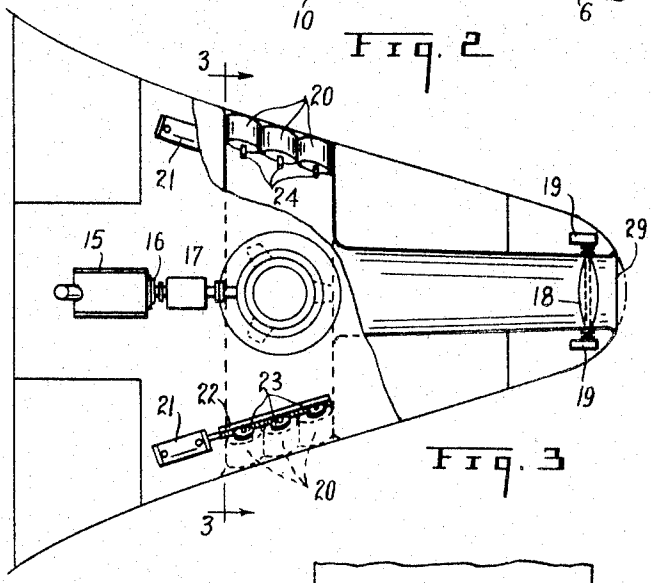

Fig. 3

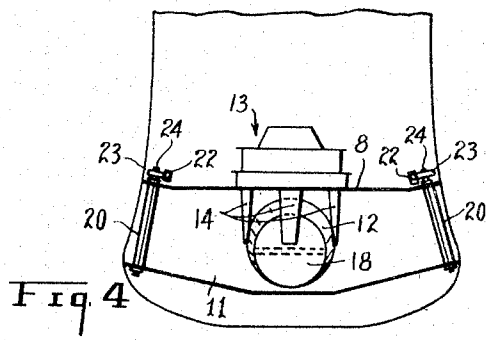

Fig. 4

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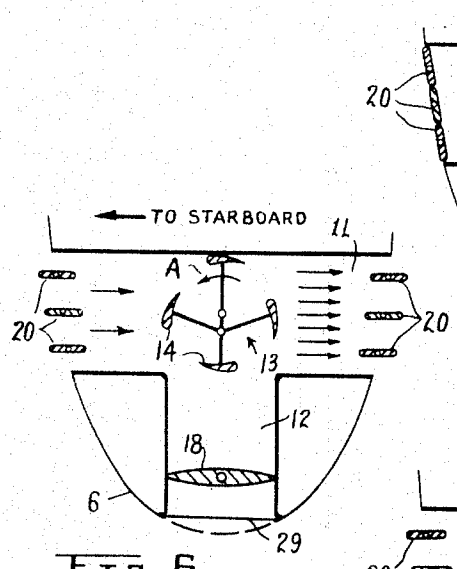

Fig 6

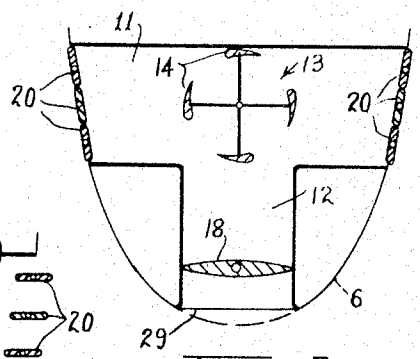

Fig. 5

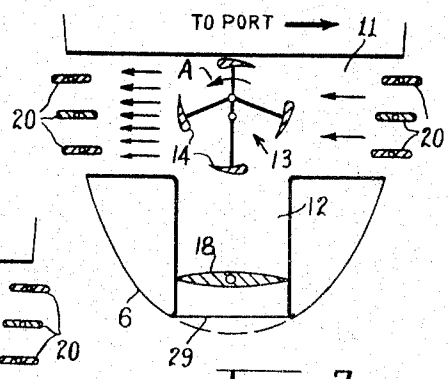

Fig. 7

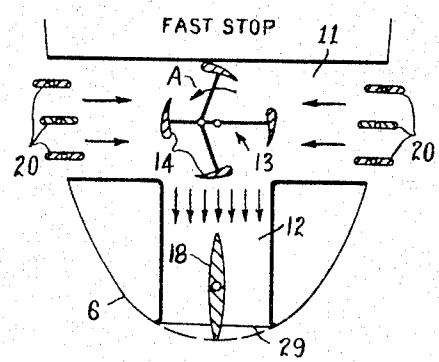

Fig. 8

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3,442,242

STOPPING AND MANOEUVERING MEANS FOR LARGE VESSELS

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U.S. Cl. 114—148 5 Claims

ABSTRACT OF THE DISCLOSURE

Stopping and manoeuvering means for large vessels having a cycloidal or vertical axis propeller located on the longitudinal centreline of the vessel in a transverse compartment open to both port and starboard sides of the vessel. A longitudinal passageway projects forward from the transverse compartment and is open at the bow of the vessel. Valves serve to open and close the seaward ends of the transverse compartment and longitudinal passage whereby a flow of water can be directed from the bow of the vessel to the propeller and be diverted from the propeller to either port or starboard or can be directed from either port or starboard to the propeller and from the propeller to the opposite side of the vessel. The valves on the port and starboard ends of the transverse compartment can be set at a predetermined angle to discharge water at an angle to the longitudinal centreline of the vessel.

This invention relates to stopping and manoeuvering means for large vessels, particularly for large vessels traversing confined waterways such as rivers, canals etc.

With the steady growth which has taken place in the size of tankers and bulk carriers in recent years, ship operators have become extremely concerned with regard to the inability to manoeuver and stop these large vessels rapidly owing to the exceedingly high momentum which has to be destroyed before the vessel can be brought to a stop. In addition, very often the vessel has to be stopped in a winding channel and, at the same time be manoeuvered to negotiate the channel or avoid oncoming vessels.

At present, reversal of the vessel's propeller is the only available means to stop the vessel and, whereas the practice has been satisfactory in relatively small vessels, it is totally inadequate for large tankers and bulk carriers, as a consequence, the 'ahead reach' or distance travelled after the propeller is reversed until the vessel comes to a stop is considerable and constitutes an operational hazard, particularly in confined waters. In addition, the problem of manoeuvering large vessels in confined waters, particularly during the operation of bringing the vessel to a stop, is of particular importance. At present, a degree of manoeuvering is possible by the use of side thrust jets assisting the control provided by the rudder of the vessel.

In vessels employed in the Great Lakes, these problems are more acute, as the vessels are continuously entering and leaving locks. The main problem is to slow down the advance of the vessel and to arrest all motion rapidly, whenever the need arises. To use the propeller in reverse for this purpose while the vessel is entering a lock is undesirable, as the bow yaws and causes the hull to strike the wall of the lock. To overcome this, the practice on the Great Lakes and St. Lawrence Seaway is is to disembark able-bodied seamen via specially designed landing booms, so that they can tow and affix mooring wires on the bitts provided along the top of the lock walls. The mooring lines are then heaved tight by special mooring winches, which are designed to provide a light-line speed of 600 feet per minute, so as to enable all slackness

in the mooring wires to be taken up rapidly in order to stop the vessel.

The problem of manoeuvering and stopping a large vessel of the type used in the Great Lakes and St. Lawrence Seaway is further aggravated by the fact that such vessels generally have a block coefficient above 0.80.

The present invention overcomes the above disadvantages and makes use of a device which produces a reverse water-jet thrust at the fore end of the vessel which is quite independent of the propeller at the stern. This device also enables lateral thrust to be developed at the bow, either to port or starboard, in order to correct any misalignment of the vessel in the lock when it is entering or leaving. The device can be used in conjunction with the rudder of the vessel and with lateral thrust water-jets located at the stern.

The device for producing a reverse water-jets thrust at the bow makes use of a Voith Schneider cycloidal or vertical axis propeller and, whereas this is a propelling device which has been in vogue for many years and has been used for providing lateral thrust either to port or starboard at the fore end of the vessel and for this purpose has been used immersed in the open water surrounding the vessel, it has never been used to produce a reverse water-jet thrust to arrest forward motion in a large vessel. One of the important and unique features of the vertical axis propeller is that the direction of thrust from it can be diverted to any angle through 360 degrees and the jet takes the form of a flat stream unlike that produced by a conventional propeller, which has a rotational swirl.

The Voith Schneider propeller in the present invention is located in a rectangular, transversely oriented, tunnel at the fore end of the vessel and the propeller is located on the longitudinal centreline of the vessel and in line with a longitudinally disposed circular and slightly tapered tube which extends forwardly from the transverse tunnel through a bulb appendage at the fore foot of the vessel. A series of flaps are located at the port and starboard ends of the transverse tunnel and are operated to open and close the tunnel to the surrounding water. The flaps can be set to any desired angle of opening. A butterfly valve is located at the forward end of the longitudinally disposed tube.

The Voith Schneider propeller is driven by a suitable prime mover via a reduction gear-box and clutch and the value of reverse thrust or lateral thrust is controlled by the speed of rotation of the propeller.

The primary object of the invention is to provide a reverse water-jet thrust at the fore end of large vessels to stop forward movement and to provide lateral water-jet thrust for manoeuvering of the vessel in confined waters.

A further object of the invention is to provide means whereby complete control of a vessel in confined waters such as canal locks etc. is obtained without the use of flow lines and special winches.

A further object of the invention is to provide means whereby a single vertical axis propeller located within a transverse tunnel combines the functions of providing reverse water-jet thrust and lateral thrust.

A further object of the invention is to provide means whereby the flow of water to the vertical axis propeller is controlled by flaps at the port and starboard ends of the transverse tunnel.

A further object of the invention is to provide lateral water-jet thrust at both the bow and stern of the vessel for control of manoeuverability in conjunction with reverse water-jet thrust.

These and other objects of the invention will be apparent from the following detailed specification and the accompanying drawings in which:

FIG. 1 is a partial longitudinal elevation of a vessel

of the type described showing the disposition of the reverse water-jet thrust means and lateral thrust means according to the present invention.

FIG. 2 is a partial vertical section of the fore-foot of the vessel shown in FIG. 1, showing a Voith Schneider vertical axis propeller installed for operations in a transverse tunnel which is connected to a longitudinal tube directed forwardly from the transverse tunnel.

FIG. 3 is a partial plan view of the installation shown in FIG. 2, partly in section and showing the transverse tunnel and longitudinal tube closed to the surrounding water.

FIG. 4 is a partial transverse section taken on the line 4—4 of FIG. 3.

FIG. 5 is a diagram of the installation shown in FIG. 3 with the propeller at rest.

FIG. 6 is a diagram similar to FIG. 5 but showing the butterfly valve closed and the propeller set to cause a flow of water through the transverse tunnel to effect a water-jet thrust moving the vessel to starboard.

FIG. 7 is a diagram similar to FIG. 6 but showing the propeller set to effect movement of the vessel to port.

FIG. 8 is a diagram similar to FIGS. 5, 6 and 7 but showing the butterfly valve open and the propeller set to produce a reverse water-jet thrust forward to effect quick stopping of the vessel.

FIG. 9 is a partial plan view showing the installation of a water-jet system for lateral movement of the stern of the vessel shown in FIG. 1.

Referring to the drawings the vessel **5** shown in FIG. 1 is illustrative of a large tanker or bulk cargo vessel having a block coefficient of 0.80 or over and having a forwardly projecting bulb appendage **6** at its fore-foot.

Between the forepeak tank **7** and the tank top **8** there is provided an engine room **9** and between the tank top and the bottom shell **10** of the vessel there is provided a transverse tunnel **11** and a longitudinal circular tube **12** whose forward open end is at the surface of the bulb appendage **6**, and its rearward end is in open connection with the transverse tunnel **11**. The transverse tunnel **11** is preferably of rectangular cross section while the tube is slightly tapered towards its forward end.

A Voith Schneider vertical axis propeller **13** is mounted on the tank top **8** on the longitudinal centreline of the vessel and has its blades **14** projecting downwards into the transverse tunnel **11**. The propeller **13** is driven by the prime mover **15** through the clutch **16** and reduction gear **17**.

A butterfly valve **18** is located in the forward end of the longitudinal tube **12** and is remotely controlled by means of the actuators **19**.

The outboard port and starboard ends of the transverse tunnel **11** are provided with a series of gates of flaps **20** located in line fore and aft as shown in FIG. 3. In the drawings, three flaps are shown at each end of the tunnel however, the number of flaps provide will depend on the size of the tunnel and the degree of control of flow of water into the tunnel desired. The flaps **20** are rotatable about vertical axes by means of cylinder and piston devices **21** operating the toothed racks **22** and the pinions **23** mounted on the spindles **24** of the flaps.

The flaps **20** on the port and starboard ends of the tunnel **11** are operated independently of each other by their respective cylinder and piston devices **21** for fine control of the water into the tunnel both for reverse water-jet thrust and lateral thrust.

In FIG. 9 of the drawings there is shown a system for obtaining lateral water-jet thrust at the stern of the vessel which can be operated to complement the lateral water-jet system at the forward end of the vessel. In this arrangement the stern water-jet thrust are fed with water from the ballast pumps **25** through the pipe line **26** and port and starboard branch lines **27**. The water-jet to the sides of the vessel is controlled by the valves **28** which are operated by remote controlled actuators in well known

manner. The valves **28** and the flaps **20** can be operated to complement each other either for turning or steering the vessel or moving it bodily to port or starboard, or to control the vessel during a fast stop.

Referring now to FIGS. 5 to 8 inclusive which show in diagrammatic form the operation of controlling port and starboard thrust and fast stopping of the vessel.

It is not deemed necessary to describe the design and the manner in which the Voith Schneider vertical axis propeller **13** is controlled as the manner in which the propeller blades are set to achieve various results is well known.

In FIG. 5 the propeller **13** is shown with its blades in a position of rest and the butterfly valve **18** and the flaps **20** are in the closed position. This is the position these various elements take when the vessel is at rest or is proceeding normally in a forward direction and no fast stop or lateral manoeuvering of the vessel is required other than can be accomplished by normal rudder control.

In FIG. 6, with the butterfly valve **18** remaining closed and the flaps **20** opened, the propeller is driven to rotate in the direction of the arrow A and the setting of the blades **14** is adjusted to cause a flow of water through the tunnel **11** from starboard to port. The reaction to this flow of water is to cause the bow of the vessel to move to starboard. A complementary control of the vessel can be achieved by operation of the valves **28** at the stern of the vessel to either amplify or retard the movement of the bow to starboard. The intensity of the thrust of the water-jet through the tunnel **11** is governed by the speed of rotation of the propeller **13**.

In FIG. 7 the action is similar to that described in connection with FIG. 6 except that the bow of the vessel is moved to port. The butterfly valve **18** remains closed and the setting of the propeller blades **14** is adjusted to cause a flow of water through the tunnel **11** from port to starboard. The reaction of the flow of water is to cause the bow of the vessel to move to port. Similarly a complementary control of the vessel can be achieved by the operation of the valves **28** at the stern of the vessel.

In FIG. 8 the butterfly valve is moved to the open position. With the flaps **20** remaining open, the setting of the propeller blades **14** is adjusted to cause a flow of water into the transverse tunnel **11** from both port and starboard and the water is directed by the propeller into the longitudinal tube **12** and out through the opening in the bulb appendage **6**. The effect of the forwardly directed water-jet is to cause a reverse thrust which will quickly slow down the forward movement of the vessel and bring it to a stop in a relatively short distance. The flaps **20** in their transverse position as shown in FIG. 8 will induce a drag which will assist in bringing the vessel to a fast stop.

It should be noted that the outlet of the tube **12** is centred in the bulb appendage **6** of the vessel therefore the peripheral edge **29** of the forward and of the tube **12** is located on the spherical surface of the hub considerably forward of the stem of the vessel so that the water-jet projected forwardly will be most effective in bringing the vessel to a fast stop.

By means of the above described invention the operation of large vessels in restricted waters is considerably improved, taking into consideration that, in restricted waters there is a tendency for the stern of the vessel to drift towards the nearest bank while the bow tends to move away towards the centre of the channel. Control of the vessel to keep it central in the ship channel is therefore greatly facilitated by using the fore and aft water-jets so that the bow and stern of the vessel move laterally in unison, or independently of each other, this is particularly important in lining-up the vessed in entering or leaving canal locks. Coupled with the lateral control of the vessel is the ability to slow down or stop quickly, this is accomplished by the above described invention where partial reverse thrust or full reverse thrust is obtained by the setting of the flaps **20** and the speed of rotation of the propeller blades **14**, together with the

operation of the stern water-jets in order to maintain complete manoeuverability of the vessel.

While the means to stop the vessel quickly and the means to provide lateral control can be operated independently of each other as the need arises, the master of the vessel can make use of all these means to obtain a degree of control of the vessel in confined water which has not, hitherto, been available.

What we claim is:

1. A fast stopping and manoeuvering system for large vessels comprising tunnel means located transversely of the vessel and open to the surrounding water at port and starboard sides of the vessel, a tubular passage located on the longitudinal centreline of the vessel having one end thereof communicating with the said tunnel and its other end open to the surrounding water at the bow of the vessel, a vertical axis cycloidal propeller the blades of which project downwardly into the said tunnel at the longitudinal centreline of the vessel, port and starboard gate controlling the flow of water into and out of the tunnel, and a valve in the said tubular passage, the said port and starboard gate means and the said valve being independently operated to control the flow of water to port or starboard through the said tunnel or from the said tunnel through the said tubular passage, the setting of the blades of the cycloidal propeller being adjustable to provide a water-jet thrust to port, starboard through the tunnel, or forward through the tubular passage.

2. A fast stopping and manoeuvering system for large vessels as set forth in claim 1 in which the vessel is provided with a bulb appendage at its fore-foot and the forward end of the said tubular passage extends through the bulb appendage.

3. A fast stopping and manoeuvering system for large vessels as set forth in claim 1 in which the said gate means includes a series of flaps rotatable about a vertical axis, the said flaps in their open position projecting partially outside the surface of the vessel to provide a drag on the forward progress of the vessel.

4. A fast stopping and manoeuvering system for large vessels as set forth in claim 3 in which each series of flaps at port and starboard are operable by a common operating means.

5. A fast stopping and manoeuvering system for large vessels as set forth in claim 1 in which the said transverse tunnel is of rectangular cross section and the said tubular passage is slightly tapered in the forward direction.

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ANDREW H. FARRELL, *Primary Examiner.*