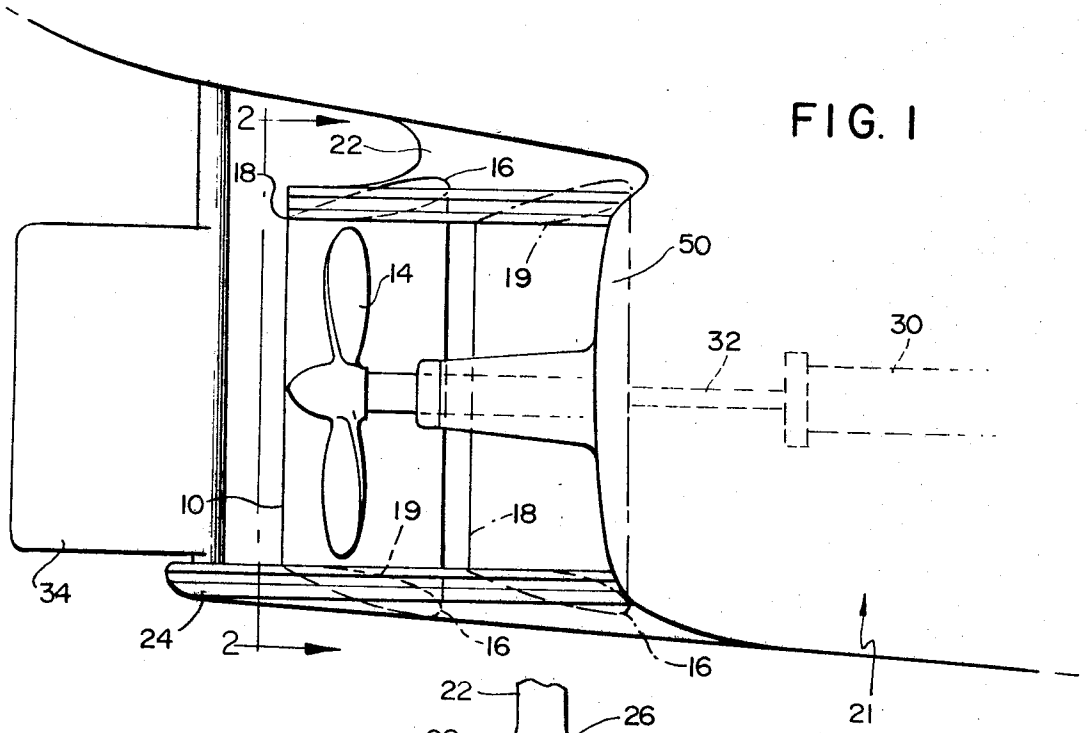
May 26, 1970 E. A. DOW 3,513,798

STEERING DEVICE FOR VESSELS

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FIG. 1



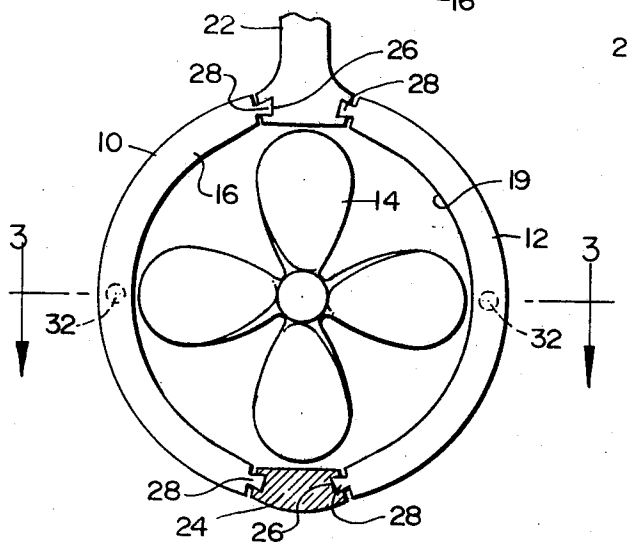


FIG. 2

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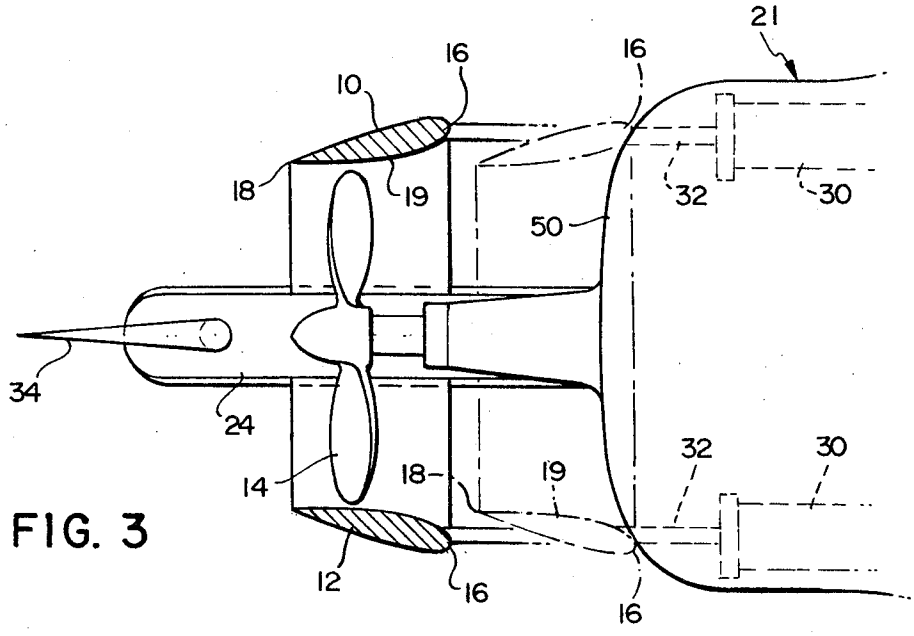


FIG. 3

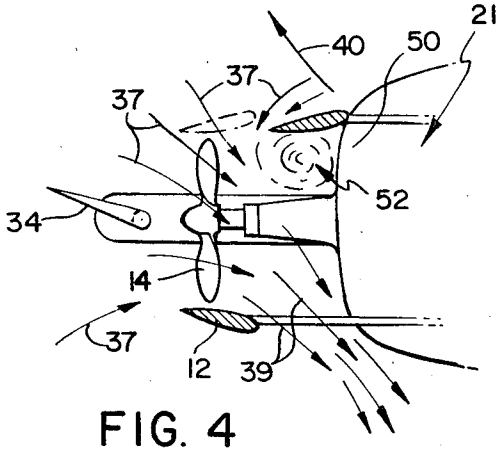


FIG. 4

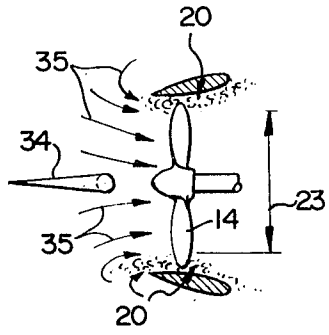


FIG. 5

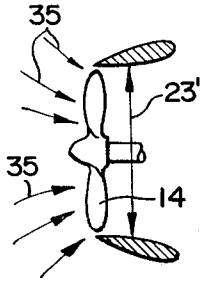


FIG. 6

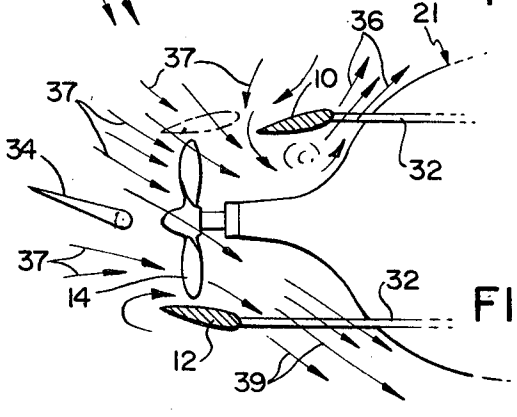


FIG. 7

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3,513,798

STEERING DEVICE FOR VESSELS

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Int. Cl. B63h 25/06
U.S. Cl. 114—166 8 Claims

ABSTRACT OF THE DISCLOSURE

My disclosure includes a segmented Kort-type nozzle which is separable into two arcuate halves, each of which defines one side of the nozzle. The nozzle sements are moveable forwardly in unison or independently of each other from a normal, propeller embracing position to a forward, remote position which, depending on the position of the segments, increases appreciably the efficiency of the propeller while backing and particularly when backing and turning.

SUMMARY OF THE INVENTION

My invention is directed to an improved device for steering a ship while backing and more particularly to an improved variation of the Kort nozzle. The Kort nozzle as described in U.S. Pat. No. 2,030,375 is a bell-mouthed device supported from the stern of a ship and which surrounds the propeller. It is highly effective to increase the efficiency and thrust of the propeller and is particularly useful in relatively slow speed craft, such as tug boats, where propeller efficiency is a paramount consideration. Although it is effective in increasing the efficiency of the propeller when driving the ship forward, the Kort nozzle tends to hinder the directional control of the ship particularly when backing. For this reason a ship having a Kort nozzle about its propeller is frequently found to have an auxiliary rudder or flanking rudders disposed forwardly and on each side of the nozzle which aid in steering effectively the ship while backing. One of the primary objects of my invention is to provide a nozzle arrangement which is effective both to steer a backing ship without the use of auxiliary rudders.

The forward, circular mouth of the conventional Kort nozzle is enlarged and has a flared smoothly rounded forward edge to facilitate the entrance of water to the propeller as the boat moves ahead. The aft edge of the nozzle has little, if any, flare and is relatively sharp to permit the jet from the propeller to merge smoothly with the surrounding water when the boat is moving ahead thus minimizing the generation of eddies or other drag-producing turbulent flow. Because of the sharp aft edge of the nozzle and the constricted area defined by the aft edge of the nozzle a considerable restriction is presented to flow of water forwardly through the nozzle when the propeller is reversed to back the ship. This results in a loss of propeller thrust and efficiency when backing. Because the water jet developed by the propeller is of a reduced intensity when backing, the rudder becomes ineffective in controlling the direction of backing and for this reason the aforementioned auxiliary rudders are required.

Another object of my invention is to provide a novel method and apparatus which retains the advantages of the Kort nozzle when driving the ship ahead but which eliminates appreciably the disadvantages displayed by the Kort nozzle when backing the ship.

Accordingly I provide a nozzle segmented vertically to define a pair of separable arcuate segments on each side of the propeller, each of the segments defining virtually one-half of the nozzle. When functioning as a Kort nozzle both segments are disposed in their rearward position to enshroud the propeller. By drawing one of the nozzle segments to a forward position while backing the ship, the propeller draws water from its unshrouded side in large volume because of the removal of the restriction presented by the aft edge of the forwardly drawn nozzle segment. The water is ingested at a quartering angle and is discharged at substantially the same angle forwardly past the stern of the hull on the opposite, shrouded side of the nozzle. This arrangement causes the boat to back vigorously with the stern swinging toward the unshrouded side of the propeller.

Another aspect of my invention is directed to the provision of a bulbous member formed on the hull which cooperates with the forwardly withdrawn nozzle segment to preclude water from passing between the hull and the forwardly drawn nozzle segment while backing the ship. I have found this bulbous reacting surface to enhance greatly the turning efficiency when backing.

Other advantages and object of my invention will become apparent from the following detailed description and accompanying drawings wherein:

FIG. 1 is a side elevation of the stern of a propeller driven ship equipped with my nozzle and illustrating the fore and aft positions of the nozzle segments;

FIG. 2 is an end view of my nozzle as viewed from the line 2—2 of FIG. 1;

FIG. 3 is a top view of my nozzle, in section, as viewed from the line 3—3 of FIG. 2;

FIG. 4 is a diagrammatical view similar to that of FIG. 3 illustrating one of the nozzle segments in its forward position;

FIG. 5 is a view similar to that of FIG. 4 illustrating the nozzle sections in an aft, conventional Kort-type arrangement;

FIG. 6 is a view similar to that of FIG. 5 with the nozzle sections moved forwardly in unison; and

FIG. 7 is a view similar to that of FIG. 4 illustrating the effect of a conventional hull without the bulbous reacting surface.

FIGS. 1, 2 and 3 show a preferred embodiment of my invention in which a pair of nozzle segments **10** and **12** are supported at the stern of the ship and are positioned in normally embracing relation to the propeller **14** to form a Kort-like nozzle about the propeller **14**. The nozzle segments **10**, **12** taper rearwardly from an enlarged mouth defined by a smoothly rounded forward edge **16** to a narrowed aft opening defined by the relatively sharp aft edge **18**. When the nozzle segments **10**, **12** are in their rearward position illustrated by the solid lines in FIGS. 1 and 3 they embrace the propeller and function in much the same manner as a conventional Kort nozzle to increase the efficiency and thrust of the propeller **14**, particularly when driving the ship ahead. In the conventional Kort nozzle arrangement the dimensions of the propeller **14** and nozzle are such that the propeller tips will rotate in close proximity to the most narrow portion of the interior wall **19** of the nozzle which, as shown in FIGS. 1, 3 and 5, generally is located forwardly of the aft edge **18**. When the propeller **14** drives the boat ahead the enlarged mouth at forward edge **16** of the nozzle and the tapered sharp edge **18** of the nozzle permit water to be drawn smoothly through the nozzle. By contrast, when the propeller **14** is reversed to back the ship the relatively sharp aft edge **18** of the nozzle interferes with smooth flow to cause eddies and turbulence to be generated as indicated by the reference character **20** in FIG. 5. The tips of the propeller **14** which rotate through the region **20** are impaired by the turbulence and become relatively inefficient, i.e. the propeller tips are starved and cannot generates their maximum thrust. The effective diameter of the propeller **14** is thus reduced as indicated by the reference character **23**. Propeller efficiency when backing is reduced also by reason of the fact that the narrow aft opening of the nozzle defined

by the aft edge **18** restricts the rate of flow of water in a forward direction. The combined effect of the restricted flow and the turbulent region **20** detract greatly from the maximum efficiency of which the propeller is capable.

As shown in the substantially schematic FIG. 6, my invention provides a means for moving the nozzle segments **10** and **12** forwardly, in unison, so that the aft edge **18** of the nozzle is disposed about or just forward of the tips of the propeller **14**. Forward shifting of the nozzle in this manner removes the flow restriction presented by the aft edge **18** of the nozzle so that the propeller no longer will be starved and may generate its maximum thrust.

FIGS. 1, 2 and 3 illustrate one manner by which my nozzles may be mounted. Each of the nozzle segments **10** and **12** is mounted to the hull **21** of the ship for independent movement in a fore and aft direction so that they may be disposed between the forward and rearward positions illustrated in FIGS. 1 and 3 and any intermediate positions such as shown somewhat diagrammatically in FIG. 5. Upper and lower supporting brackets **22** and **24** are provided and are mounted to or formed integrally with the hull **21**. Fore and aft extending tracks **26** formed in the brackets **22, 24** slidably receive the slides **28** which in turn are secured to or formed integrally with the nozzle segments **10** and **12** as shown in FIG. 2. The fore and aft position of each of the nozzle elements **10, 12** along its associated tracks **26**, may be controlled by an activating cylinder **30** which drives a control rod **32** in a fore and aft direction. The aft end of each control rod is secured to its associated nozzle element **10, 12**. Thus, when it is intended to back the ship in a straight direction, the cylinders **30** are actuated to withdraw the control rods **32** to a position wherein the nozzle segments are drawn forwardly in unison to the position as shown in FIG. 6. Other mounting arrangements for moving the nozzle sections in a fore and aft direction will be apparent to those skilled in the art.

One of the primary objects of my invention is to overcome the relatively poor turning characteristics which a ship equipped with a Kort nozzle exhibits while backing. The primary reasons for such poor turning characteristics while backing will be more clearly understood by referring to FIG. 5. It will be noted that when the ship is driven forward and the nozzles are in their conventional rearward position as shown in FIG. 5 the rearwardly directed water jet exits from the aft end nozzle at an increased velocity due to the rearwardly tapered configuration of the nozzle. The rudder **34**, which is disposed aft of the nozzle and propeller **14**, receives the full rearward thrust of the relatively intense water jet and is thus quite responsive to steer the boat. In contrast when the propeller **14** is reversed to back the ship the water is drawn through the aft end of the nozzle along directions shown by the arrows **35** in FIG. 5 from which it will be apparent that the forward flow of water past the rudder **34** is of a lesser intensity than when the boat is being driven ahead. This is also true when the nozzles are shifted forwardly to the position shown in FIG. 6, in that the quantity and velocity of water flowing past the rudder **34** while backing is not as intense as when the boat is being driven forward. It should be noted again here that auxiliary flanking rudders are frequently located forwardly of the nozzle and propeller to partake of the forwardly directed water jet that exits forwardly from the nozzle while backing. Although such auxiliary rudders are helpful they, too, are relatively inefficient because the forwardly directed water jet is frequently turbulent and generally flows at a reduced velocity due to the flared, enlarged forward mouth of the nozzle.

I have found that when a ship is equipped with a nozzle in accordance with my invention it displays highly efficient backing characteristics and has particularly responsive and efficient turning characteristics while backing without the use of auxiliary rudders. For example, FIG. 4 is a somewhat schematic illustration of a ship equipped with a segmented nozzle and in which the left nozzle segment **10** has been withdrawn to a remote position that is forward of the propeller **14** while the right nozzle **12** remains in its normal propeller embracing position. With the left nozzle segment **10** so withdrawn the aft opening between the nozzle segments is enlarged greatly which substantially eliminates the restriction to forward flow between the nozzle segments that had been presented when both nozzle segments **10, 12** were in their rearward, enshrouding position. When one of the nozzle segments is withdrawn as shown in FIGS. 4 and 7 the propeller, in backing, draws water from its unshrouded side in large volume, shown by the arrows **37**. The water approaches and passes between the nozzle segments **10, 12** at a quatering angle and is discharged forwardly at more or less the same angle (shown by the arrows **39**) past the stern on the opposite side of the hull (the right side as sen in FIG. 4). Because of the quatering angle at which the propeller draws the water through the nozzle the ship backs vigorously with the stern swinging toward the unshrouded side of the propeller (as indicated by the arrow **40** in FIG. 4). Although the rudder **34** may be used to aid directional control while backing, the primary turning moment imparted to the stern of the hull is a result of the aforementioned nozzle configuration. Of course, if the nozzle segments **10, 12** were reversed so that the right segment **12** were forward and the left segment were aft the ship would back to the right.

I have found also that the turning efficiency of my segmented nozzle may be enhanced further by preventing any water from flowing forwardly between the forwardly withdrawn nozzle segment and the hull as indicated by the arrows **36** in FIG. 7. This aspect of my invention, shown in FIG. 4, includes the addition of a deflecting pod **50** which may be secured to or formed integrally with the hull **21** and which is disposed forwardly of the propeller **14** and nozzle. The pod **50** is contoured to engage the forward edge **16** of the nozzle segments **10, 12** in a substantially complementary manner so that the forwardly directed water jet is precluded from passing between the forwardly drawn nozzle segment and the pod **50**, and a region of turbulence **52** is generated. For example, when the left nozzle segment **10** is drawn forwardly to cause the stern to swing to the left while backing the ship as shown in FIG. 4, all of the water drawn by the propeller **14** through the nozzle segments **10** and **12** will exit at a quartering angle between the right side of the hull and the normally positioned nozzle segment **12**. In this matter the full force of the water jet is utilized in turning and backing the ship.

Having thus described my invention, I claim:

1. In a propeller driven ship having a Kort-type nozzle surrounding said propeller for increasing the efficiency of said propeller in driving said ship ahead, the improvement comprising:

means constructing said nozzle of a pair of separable arcuate nozzle segments, each of which defines one side of said Kort-type nozzle; and

means mounting each of said nozzle segments to said ship for movement independently of each other and in a fore and aft direction between said propeller surrounding position and a remote position that is forward of said propeller whereby when said ship is backing one of said segments may be in said remote position and the other of said nozzle segments may be in said propeller embracing position thereby providing an enlarged passage between said nozzle segments through which water may be discharged forwardly and at a quartering angle to cause the stern of said ship to swing toward the remotely disposed nozzle segment.

2. An apparatus as claimed in claim **1** further comprising:

driving means connected to said nozzle segments for effecting said fore and aft movement thereof.

3. An apparatus as claimed in claim **1** wherein said means mounting said nozzle segments for said fore and aft movement comprises:

fore and aft extending track means supported by said hull; and

means mounting said nozzle segments to said track means for movement along said track means in said fore and aft direction.

4. An apparatus as claimed in claim 1 further comprising:

a bulbous member supported at the stem of said ship forwardly of said propeller and nozzle, said bulbous member being disposed in fore and aft alignment with said nozzle segment so as to be engageable by said nozzle segments when said segments are in said forward, remote position,

said bulbous member being contoured to engage each of said nozzle segments in a snug, complementary fit to preclude the flow of water between said bulbous member and a remotely positioned nozzle segment,

whereby when backing said ship with one of said nozzle segments in its forward position and the other of said nozzle segments in its aft position substantially all of the water drawn through said propeller will exit at a quartering angle between said bulbous member and said aft positioned nozzle segment.

5. An apparatus as claimed in claim 4 wherein said bulbous member is of complementary contour to the forward edge of said nozzle segments and wherein said snug, complementary engagement of said nozzle segments and said bulbous member is effected at said forward edge of said nozzle segments.

6. An apparatus as claimed in claim 4 wherein said bulbous member is formed integrally with the hull of said ship and defines, at least part of the stern of said hull.

7. A method of steering a propeller driven ship equipped with a Kort nozzle surrounding said propeller while said ship is backing comprising:

removing one side of said nozzle from its propeller surrounding position to a remote position forward of said propeller wherein a substantial portion of the water jet generated by said propeller will pass between said sides of said nozzle at a quatering angle wherein the stern of said ship will swing toward said removed side of said nozzle.

8. A method of steering a ship as claimed in claim 7 further comprising:

precluding the flow of water between said removed side of said nozzle and the hull of said ship so that substantially all of the water jet generated by said propeller may exit between said hull and the remaining, unremoved side of said nozzle.

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ANDREW H. FARRELL, Primary Examiner