June 2, 1964 J. H. POOL 3,135,091

JET PROPELLED BOATS

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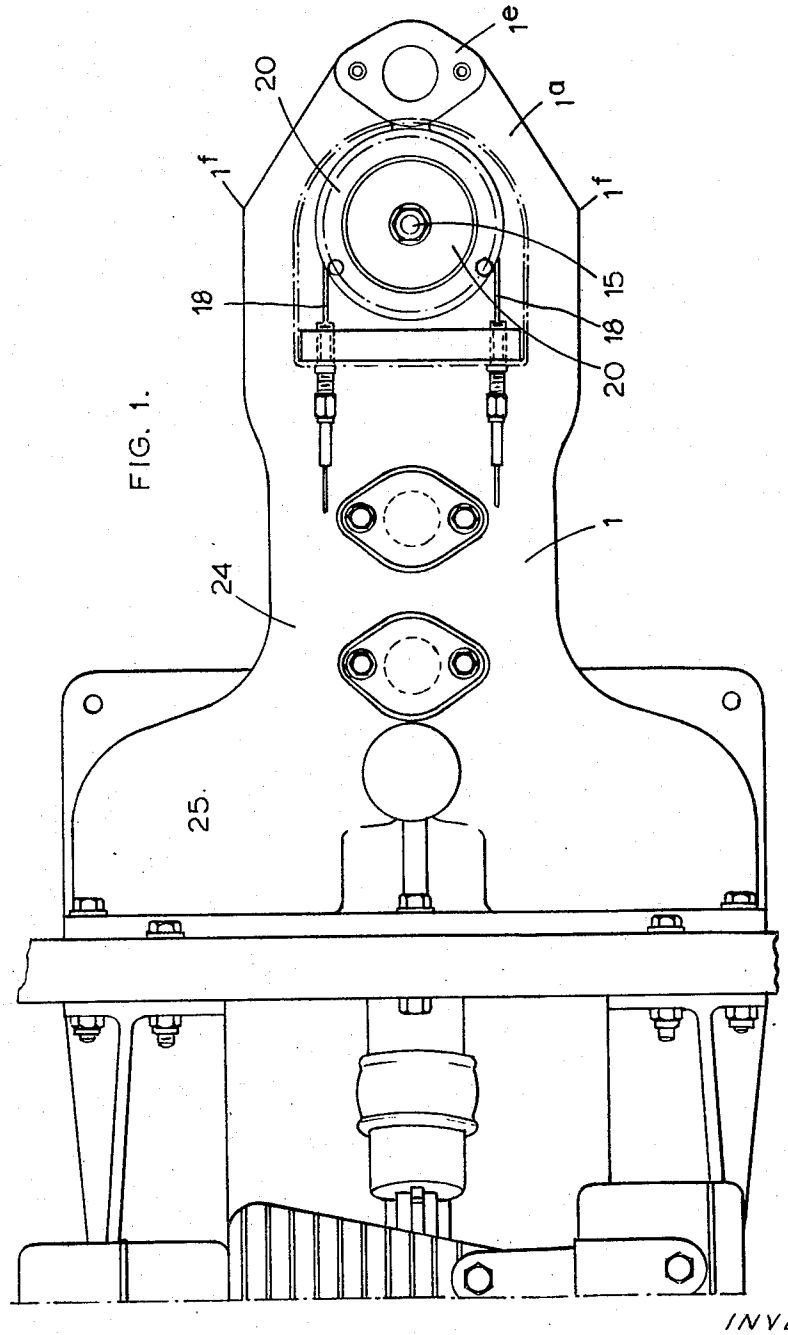


FIG. 1.

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FIG. 2.

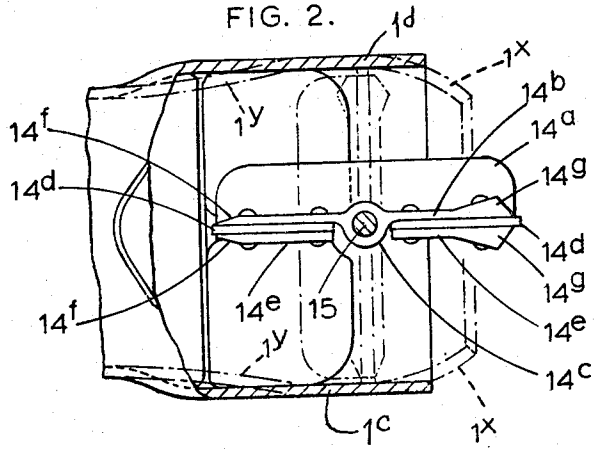
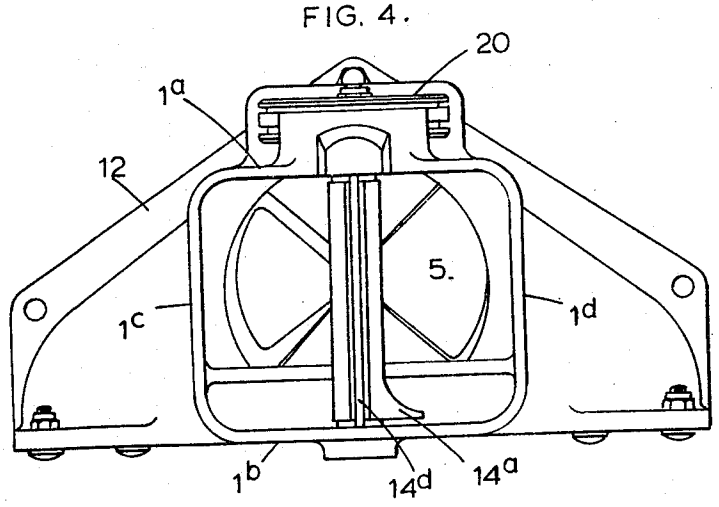


FIG. 4.



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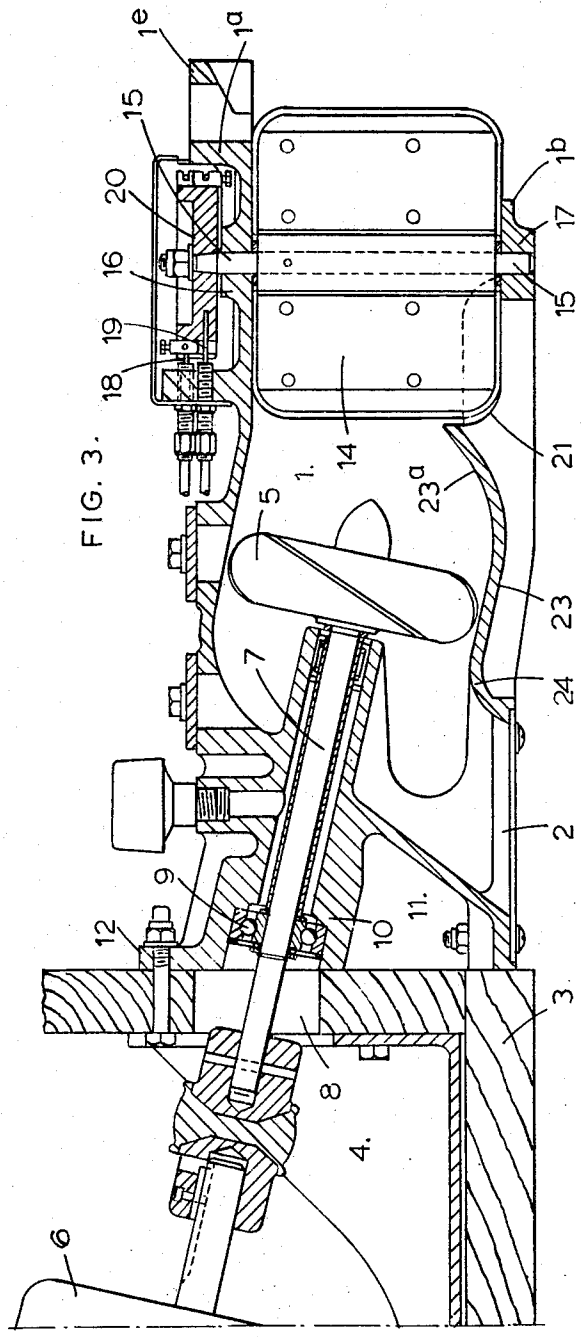


FIG. 3.

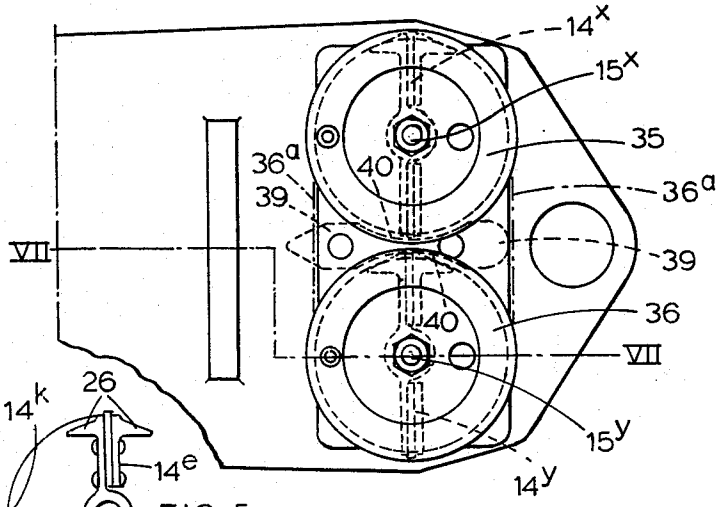
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JET PROPELLED BOATS

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FIG. 6.



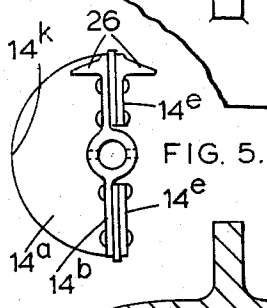


FIG. 5.

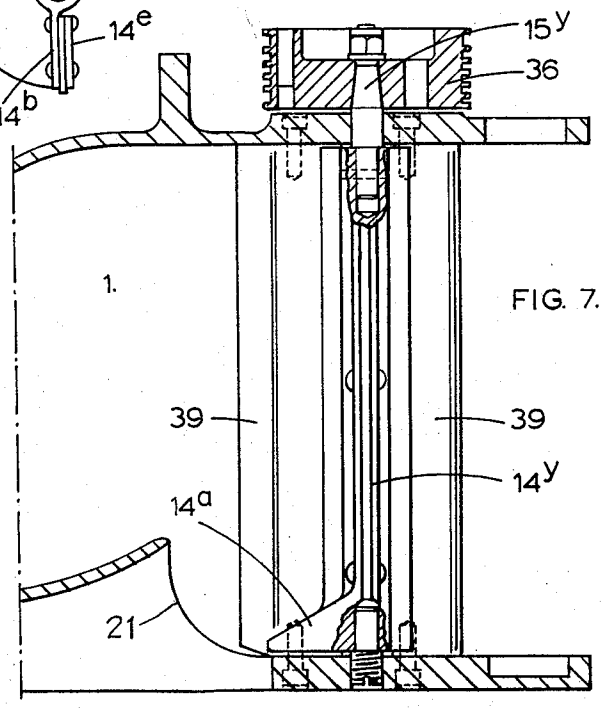


FIG. 7.

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United States Patent Office

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3,135,091

JET PROPELLED BOATS

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Claims priority, application Great Britain Sept. 21, 1960
10 Claims. (Cl. 60—35.54)

This invention relates to propulsion units and to steering means therefor for jet propelled boats in which a power unit drives an impeller so associated with a conduit having an intake and a rearwardly directed discharge outlet for the water that it ejects a jet of water rearwardly for propelling the boat, steering being effected by means which is controllable for deflecting the jet of water in the required direction.

Further, in accordance with the present invention, there is provided a jet propulsion unit for a boat, the unit comprising a power driven impeller mounted within a conduit having an induction opening located forwardly of the impeller and a discharge outlet directed rearwardly thereof for propelling the boat, the conduit having to the rear of the impeller a deflector member adapted to be actuated as a rudder for changing the direction of the emerging stream of water for steering purposes, and which may be set to a "neutral" position and which may also be set so as to deflect the stream of water forwardly in relation to the boat to effect a reverse drive to the boat.

Still further in accordance with the present invention, there is provided for use with a jet propelled boat propulsion and steering means in the form of an impeller accommodated within a housing adapted to be supported in outboard relationship to the stern of the boat and adapted to be connected to a power unit which may be mounted in the boat adjacent to the stern, the said housing having an intake through which a stream of water is induced by the operation of the impeller and a rearwardly directed outlet to provide a jet of water for propelling the boat, the said outlet having in association therewith a deflector plate adapted to function as a rudder and having connected thereto remote control means by which it can be set from a neutral position to various steering positions and also to a position wherein it will deflect the jet of water forwardly to propel the boat in reverse.

Desirably the propeller means of the present invention is so designed that it may be adapted readily to a conventional boat with a minimum structural alteration to the boat and, with this in mind, when so adapted the power unit may be located within the boat adjacent to the stern, and the means for inducing a stream of water and projecting the water rearwardly as a jet may be secured readily outboard of the stern of other convenient part of the boat, and has associated with it the steering and reversing means.

In carrying one form of the present invention into practice there is provided a conduit having an intake end with a mouth adapted to be positioned just in rear of and close to the keel of the boat near the rear end of the boat, the said conduit containing an impeller adapted to be driven from a power unit supported in the boat, e.g. by carrying a shaft from the power unit through a wall of the conduit to the impeller which may take the form of a screw or other suitable impelling means. The conduit has an outlet end projecting beyond the stern of the boat and, supported for pivoting on a vertical axis in the conduit close to its outlet, is a deflector plate adapted to function as a rudder and for this purpose may be supported by a vertical pintle journalled in bearings in the conduit and extended above the conduit for connection to any suitable remote control means for rotating it to change the direction of the deflector member relative to the conduit.

The deflector member may comprise a substantially flat plate of sheet metal or other suitable durable material and its width is such that in one position thereof it substantially covers the cross-sectional area of the rear part of the conduit and may depend below the conduit, but normally occupies a vertical plane containing the longitudinal axis of the conduit, i.e. for straight propulsion of the boat, from which it will be apparent that by displacing the deflector member through an angle less than 90° in either direction it can be used for steering the boat.

A feature of the aforesaid deflector member is that its lower edge, which is below the conduit, is radiused or bent at a suitable angle and consequently if this radius or bend extends with the deflector member in the normal or any normal steering direction it has little effect on the propulsion and steering of the boat but, if the deflector member is turned through 90° from its normal or straight ahead drive position so that the radiused or bent lower edge projects forwardly, then the jet or stream of water ejected from the conduit will be deflected downwardly and forwardly by the radiused or bent lower edge, but if such radiused or bent lower edge projects rearwardly then the deflector member may be regarded as being in a "neutral" position to function to keep the boat substantially stationary or considerably reduce the propulsion action of the jet whether or not the impeller is being driven.

To enable the deflector member to function satisfactorily as aforesaid the base of the outlet end of the conduit has from its rear nozzle or mouth a part removed to afford an opening just in front of the deflector to enable the stream of water to be deflected downwardly through the opening. Thus, for example, the conduit may at its rear end be of square cross-section with its lower wall having at its rear end part a semi-circular portion removed therefrom to provide a mouth through which the stream of water may be deflected by a deflector member when going in reverse and during the "neutral" stage, it being understood that the deflector member will be in the form of a plate with a radiused or angularly bent lower edge, the vertical dimension of which plate is greater than that of the outlet end of the conduit, its upper end being close to the upper wall of the conduit.

Instead of the deflector comprising a substantially flat plate it may comprise a substantially half cylindrical plate rotatable on a vertical axis and with its inner surface normally directed forwardly, an outlet opening for the jet stream being provided in the plate midway between its end vertical edges, the deflector mating in a tail of the conduit radiused to accommodate the deflector and having an opening contained in a greater angle than the opening in the deflector so that angular adjustments of the deflector about its vertical axis will direct the jet stream in all normal steering directions through the opening in said tail, the relative widths (in the horizontal plane) of the two openings being such that the deflector member may be moved to a position in which its opening is blanked off by the tail to effect a reverse action on the jet stream for reversing the boat.

In order that the invention may be clearly understood and readily carried into effect, drawings are appended herewith illustrating the embodiments thereof and wherein:

FIGURE 1 is a plan view of one embodiment showing the stern end of the boat carrying the power unit and a jet stream conduit accommodating a plate type of control member for steering and driving the boat astern;

FIGURE 2 is a broken detailed sectional plan view of the rear end of the conduit;

FIGURE 3 is a sectional elevation of FIGURE 1;

FIGURE 4 is a rear elevation view of the conduit;

FIGURE 5 is a plan view showing a modified form of control member at the rear end of the conduit;

FIGURE 6 is a plan view showing the use of duplicated deflector members; and

FIGURE 7 is a section on the line VII—VII of FIGURE 6.

Referring to FIGURES 1 to 4 of the drawings, there is provided a conduit indicated generally by the reference numeral **1** having an intake opening **2** at the base of its front end adapted to be positioned approximately in line with the keel **3** of the boat **4** desirably near the stern of the boat, the said conduit containing an impeller **5** actuated by a power unit **6** supported in the boat, e.g. by carrying a shaft **7** from the power unit through an opening **8** in the stern and through a journal bearing **9** located within a boss **10** integral with the front end of the conduit, which front end is recessed as at **11** to minimise weight and is spread laterally and flanged as at **12** for attachment by bolts **13** to the stern of the boat. The rear end of the conduit **1** is open for the discharge of the jet stream of water displaced by the impeller **5**, and supported in such rear end for pivoting on a vertical axis in the conduit close to its outlet, is a deflector plate **14** adapted to function both as a rudder and to afford a reaction control surface for driving the boat astern. For this the plate **14** is supported by a vertical pintle **15** journalled in upper and lower bosses **16** and **17** respectively integral with the conduit and extended above the conduit for connection to any suitable remote control means for rotating it to change the direction of the rudder and deflector member **14** relative to the conduit. The controller for the member **14** may comprise a steering wheel or a pulley or transverse arm on a rudder bar spindle, not shown, to which are connected two sheathed cables **18** and **19** also connected to a disc or other suitable member **20** affixed to the top of the pintle **15**. By reference to FIGURE 3 it will be seen that the conduit **1** has a rear upper wall part **1***a* extended above the plate **14** whereas its lower rear end part has a relatively narrow transverse wall part **1***b* to receive the lower end of the pintle **15**. A second opening **21** extends forwardly from part **1***b*, across the full width of the rear end of the conduit between side walls **1***c* and **1***d* of the conduit. The opening **21** terminates at the rear edge of the upwardly and rearwardly converging streamlined rear part **23***a* of a circular cross-section part **23** of the conduit accommodating the impeller **5**. This circular cross-section part merges as a forward flaring **24** into the laterally spread front end **25** of the conduit. The opening **21** thus is positioned below the upwardly deflected lower part of the jet stream so that on setting the member **14** to drive the boat astern the step **14***a* will direct the jet stream downwardly and forwardly below the streamlined rear part **23***a* of the conduit.

The deflector member **14** may comprise a plate of sheet metal or other suitable durable material and its width is such that in one position thereof it effectively closes the cross-sectional area of the rear part of the conduit, but normally occupies a vertical plane containing the longitudinal axis of the conduit, i.e. straight propulsion of the boat, from which it will be apparent that by displacing the deflector member through an angle less than 90° in either direction it can be used for steering the boat.

The rear top wall part **1***a* of the conduit **1** extends rearwardly beyond the side walls and converges into a stern nose piece **1***e* which is apertured to receive an engine exhaust pipe, and side walls **1***c* and **1***d* terminate approximately in line with the rear edge of the narrow transverse base part **1***b* to minimise obstruction to the jet stream of water from the conduit. The side walls may however converge for a short distance in rear of the part **1***b*.

The rudder or deflector member **14** is formed along its base with a uni-lateral step **14***a* which as shown in FIGURE 4 has a radiused upper face the function of which is to assist the stream of water from the impeller forwardly through the opening **21** when the member **14** is set transversely in the conduit for the purpose of driving astern, it being understood that the step **14***a* will face forwardly. If the step **14***a* is set to face rearwardly the member **14** will assist in holding the boat stationary or to retard its forward movement.

The member **14** may be composed of a vertical plate **14***b* with the step **14***a* integral therewith and having a biased or asymmetrical vertical centre tube **14***c* to receive the pintle **15** as shown in FIGURE 2. Two sheets of rubber **14***d* are secured between the plate **14***b* and two plates **14***e* and project slightly beyond the outer vertical and upper edges of the plates to bear lightly against the side walls **1***c* and **1***d* and the top **1***a* and base **1***b* of the conduit, to ensure easy close mating of the deflector member with the conduit, the plates **14***b* and **14***e* at their normally front ends being tapered with marginal parts **14***f* to minimise resistance to the flow of water past them. The rear of the member **14** is somewhat flared as at **14***g* by appropriately progressively thickening the normally rear part of the plate **14***b* and the like parts of the rear plate **14***e*. This progressive thickening rearwards of the normally rear part of the steering member **14** is found to hydrostatically balance the member **14** and gives ease of control in all directions of its movement. However, as shown in FIGURE 5, the rudder member **14** may comprise the plates **14***b* and **14***e* with the rubber sheets **14***d* as foresaid, the normally rear ends of the plate **14***b* and rear plate **14***e* being formed with laterally disposed substantially triangular section vertical webs **26**. These webs **26** present front faces which are normal to the plate **14** and the apices or free edges of the webs are so located that they lie close to and just inside the downstream of the water deflected from the member **14** in rear of the pintle **15** to act as balancing vanes to the member **14**.

It is preferred to radius or streamline the side walls **1***c* and **1***d* so that the side walls are radiused concentrically as indicated in FIGURE 2 by the broken lines **1***x* relative to the arc generated by each vertical edge of the member **14** when moving rearwardly and in advance of this the side walls merge as at **1***y* into the part of the conduit containing the impeller **5**. By this means the part of the deflector member **14** moving rearwardly keeps the passage closed to the jet stream and the part moving forwardly progressively increases its clearance from the walls **1***c* and **1***d* giving steering control. The rearwardly radiused parts **1***x* extend for about 45° measured about the axis of pintle **15** from their junctions to the parts **1***y* to the rear of the conduit **1**.

In the embodiment illustrated in FIGURES 6 and 7 there is shown diagrammatically the use of two coupled deflector plates **14***x*, **14***y*, each similar to that shown in FIGURE 5 and mounted on individual pintles **15***x*, **15***y* and constantly maintained parallel, e.g. by pulleys or sprocket wheels **35**, **36** fixed to the upper ends of the pintles and a cable or chain **36***a* passed thereover and another cable or chain passed over them to a common control wheel (not shown) and actuated from the remote control means, e.g. a steering wheel or a rudder bar. In this arrangement a streamline section partition **39** separates the two plates **14***x*, **14***y* and radiused concentrically as at **40** with the arcs generated by the vertical edges of the plates opposed to the partition when in the reverse drive position shown in FIGURE 6. Likewise the side walls **1***c*, **1***d* of the conduit are correspondingly radiused with respect to the other vertical edges of the two deflector plates. Each of the said plates may carry at its lower edge the laterally directed step **14***a* to assist in driving the boat astern, and in FIGURE 5 it will be seen that this step has a radiused free edge **14***k* which moves close to and is concentric with the appropriate radiused surface of the partition **39** and walls of the conduit **1**.

I claim:

1. A jet propulsion unit for boats comprising a power

unit driven impeller mounted within a conduit having an induction opening in advance of the impeller and a discharge outlet directed rearwardly for propelling the boat, the conduit having in rear of the impeller a deflector member adapted to be actuated as a controller for changing the direction of the effective stream of water for steering purposes, set to a "neutral" position so as to deflect the stream of water generally downwardly, and also adapted to be set so as to deflect the stream of water forwardly in relation of the boat to effect a reverse drive to the boat.

2. A jet propulsion unit for boats comprising a conduit mounted in a position extending fore and aft of the boat, an impeller mounted for rotation in and between the ends of said conduit, an induction opening in the base of the conduit in advance of the impeller, a first outlet located at the rear of the conduit for the jet stream when driving the boat ahead, a second outlet between said induction opening and said first outlet for the discharge of the jet stream forwardly when driving the boat astern and generally downwardly when in a neutral position, a substantially vertical deflector member pivoted about a substantially vertical axis and adapted to function as a controller for changing the direction of the effective jet stream for steering purposes and adapted to substantially close the said rear outlet in one position to reject the jet stream forwardly through said second outlet and in another position to reject the jet stream generally downwardly through said second outlet, and to be set from said closing positions to various steering positions, said deflector member having at its lower part a step-like lateral projection shaped to assist the forward rejection of the jet stream through said second outlet, and means to connect said deflector member to remote control means.

3. A jet propulsion unit according to claim 2, wherein said deflector member is a substantially vertical plate supported between its ends for rotation on a vertical axis and along its lower edge provided with a uni-lateral step-like projection merged into one face of the plate to function in assisting the rejection of the jet stream forwardly from the impeller into the forward direction when driving the boat astern, the lower edge region of the other face of the plate being generally flat.

4. A jet propulsion unit according to claim 3, wherein said plate has at its normally trailing end a rearwardly flared effective thickening of the plate.

5. A jet propulsion unit according to claim 2, wherein said deflector plate is duplicated, the two plates being actuated in unison each about its respective vertical axis, a partition separating the two plates and radiused to substantially concentric relationship with the arcs generated by side edges of the plates which are opposed to such partition when the two plates are set to astern drive position, the conduit being correspondingly radiused in opposition to other side edges of the two plates.

6. A jet propulsion unit according to claim 2, wherein said conduit is a tubular member at its front end open and secured to the boat, an induction opening in its base at its front end, the rear part of the conduit at its upper part being provided with means to connect the said deflector member to remote control means and beneath the deflector member being open in advance of the axis of rotation of said member to afford the second discharge outlet for the jet stream.

7. A jet propulsion unit according to claim 2, wherein said deflector member has spaced parallel lateral edges, and in which said conduit is radiused at the rear end parts of its side walls concentrically with the arc generated by the lateral edges of the deflector when moving from the reverse position to the forward drive position, and such radiused parts of the conduit merge forwardly away from the arc generated by said lateral edges of the deflector member.

8. A jet propulsion unit according to claim 5, wherein the base of the conduit in advance of the deflector plates is merged from the part immediately surrounding the impeller upwardly and rearwardly and at its rear edges forms the front edge of the opening in the base of the conduit through which the jet stream is deflected when driving the boat astern, the deflector plates depending beneath the said rear edge of the base of the conduit.

9. In a jet propulsion unit for boats, a deflector member mounted in a discharge conduit and comprising a substantially flat vertical plate supported mid-way between its ends for rotation in a vertical axis, and a projection along the lower edge of one face to assist forward rejection of the jet stream, the lower edge of the other face being flat.

10. A jet propulsion unit according to claim 1, in which said deflector member is duplicated, said unit further comprising means for actuating the two deflector members in unison.

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