United States Patent [19]

Hurst

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[54] **INBOARD-OUTBOARD MARINE DRIVE**

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[73] Assignee: **Chrysler Corporation**, Highland Park, Mich.

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[52] **U.S. Cl.** ..... **115/41 R**

[51] **Int. Cl.** **B63h 5/12**

[58] **Field of Search** ..... 115/41 R, 41 HT, 35

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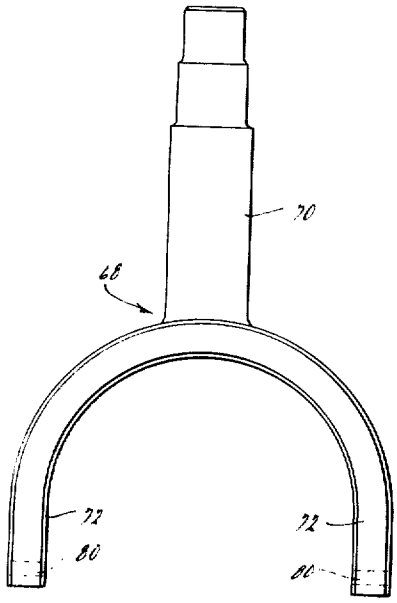
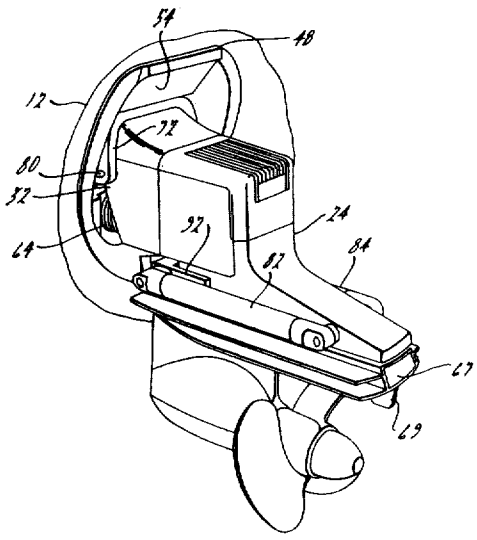
[57] **ABSTRACT**

An inboard-outboard marine drive unit for boats wherein an outboard power leg is carried by an inverted yoke having a pair of downwardly extending, laterally spaced yoke arms receiving the power leg therebetween and a generally upwardly extending center post, the post being connected to the boat inboard of the stern transom. The inverted yoke is "steerable" in that steering of the power leg is accompanied by rotation of the yoke on its upwardly extending center post. Raising and lowering of the outboard power leg for trimming, tilting and kick-up is by rotation of the power leg about a generally horizontal axis extending between the spaced yoke arms.

11 Claims, 7 Drawing Figures





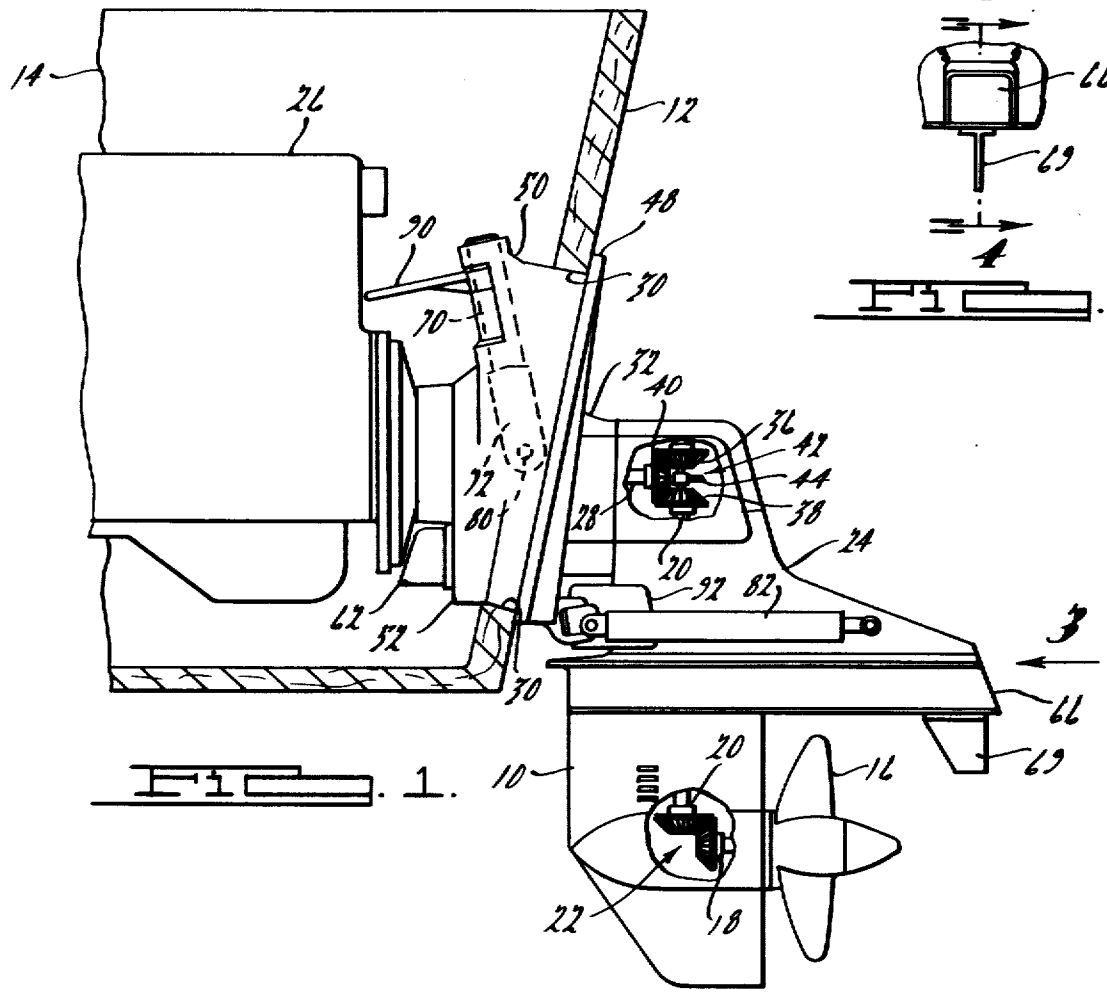


FIG. 1.

FIG. 3.

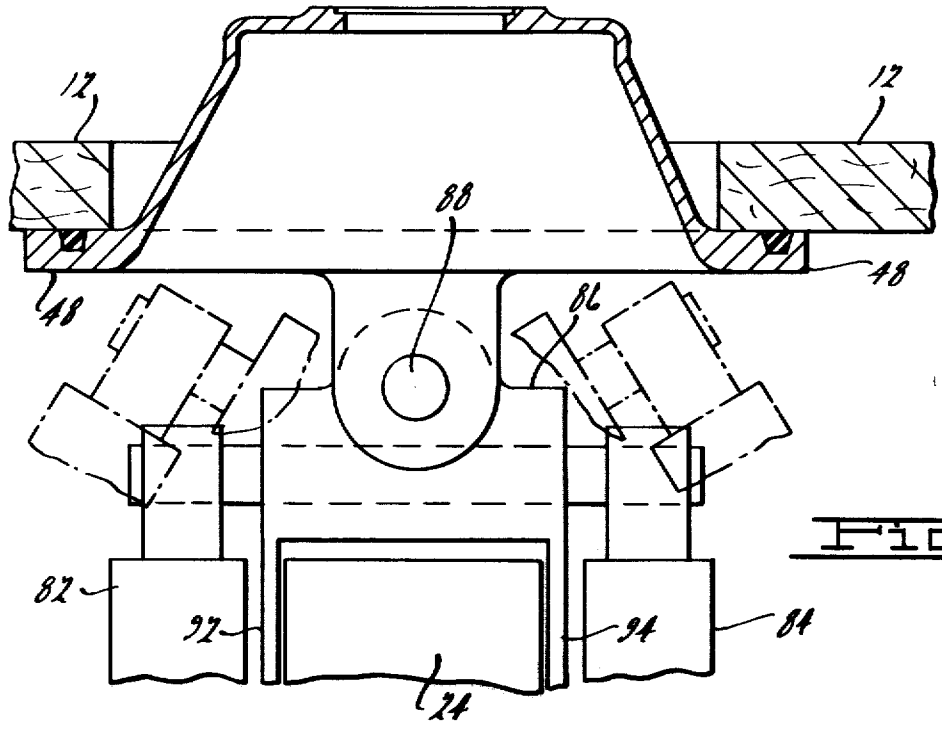
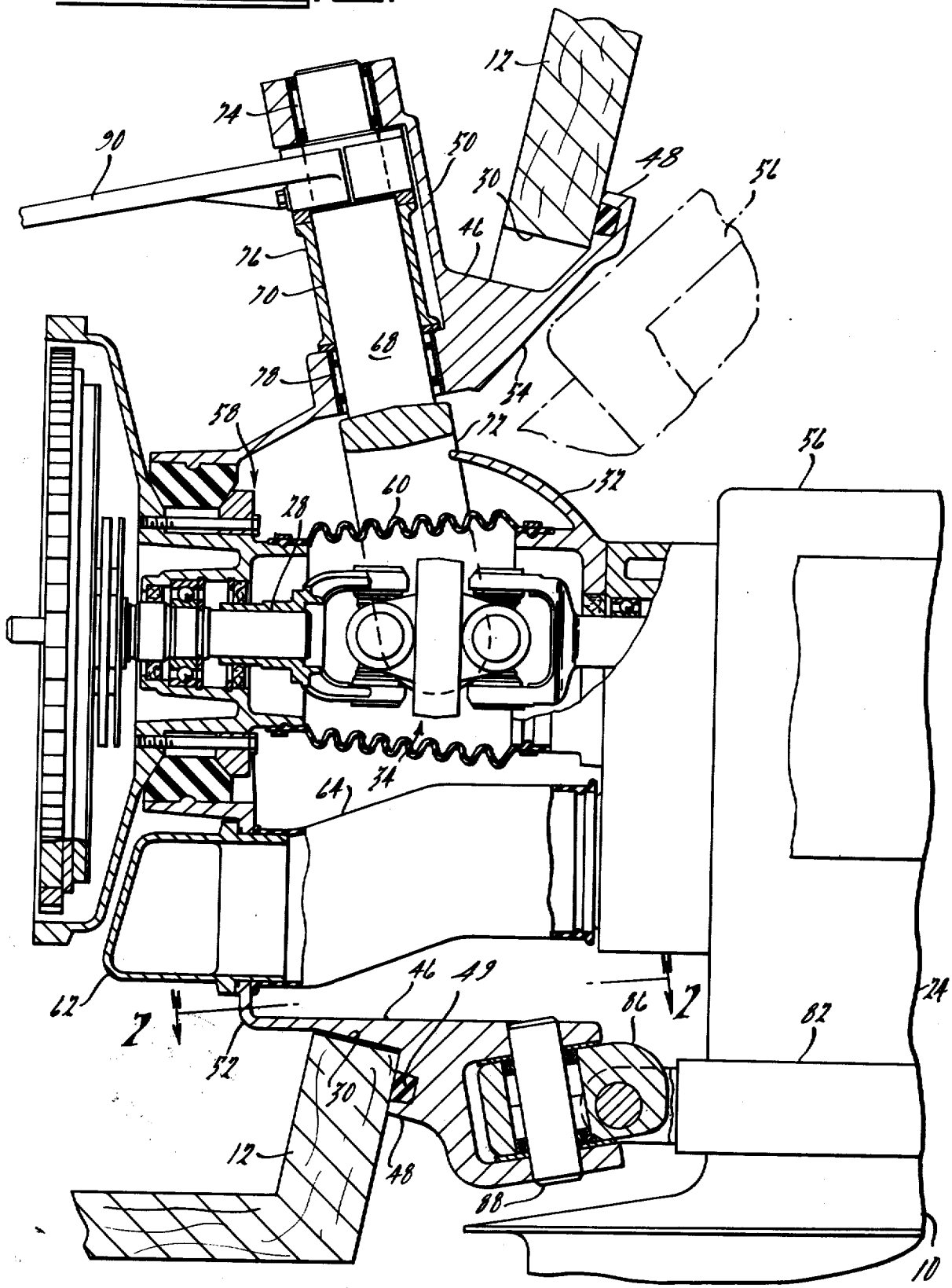


FIG. 2.

FIG. 2.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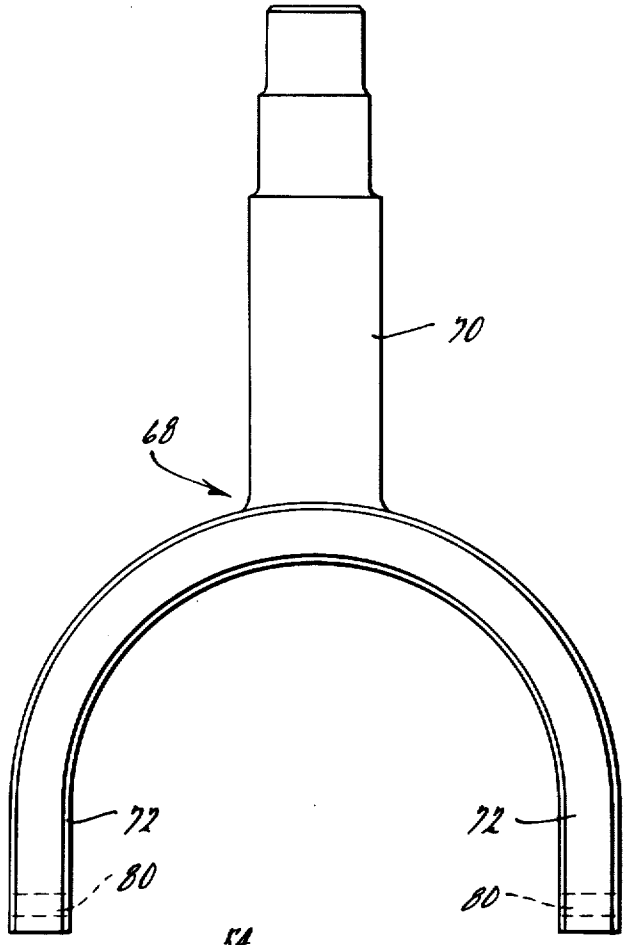

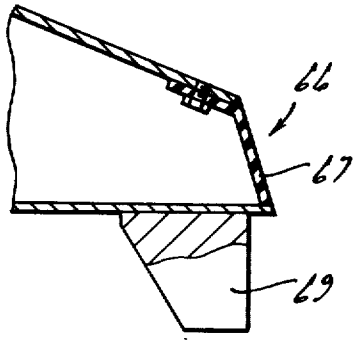

FIG. 4.

FIG. 5.

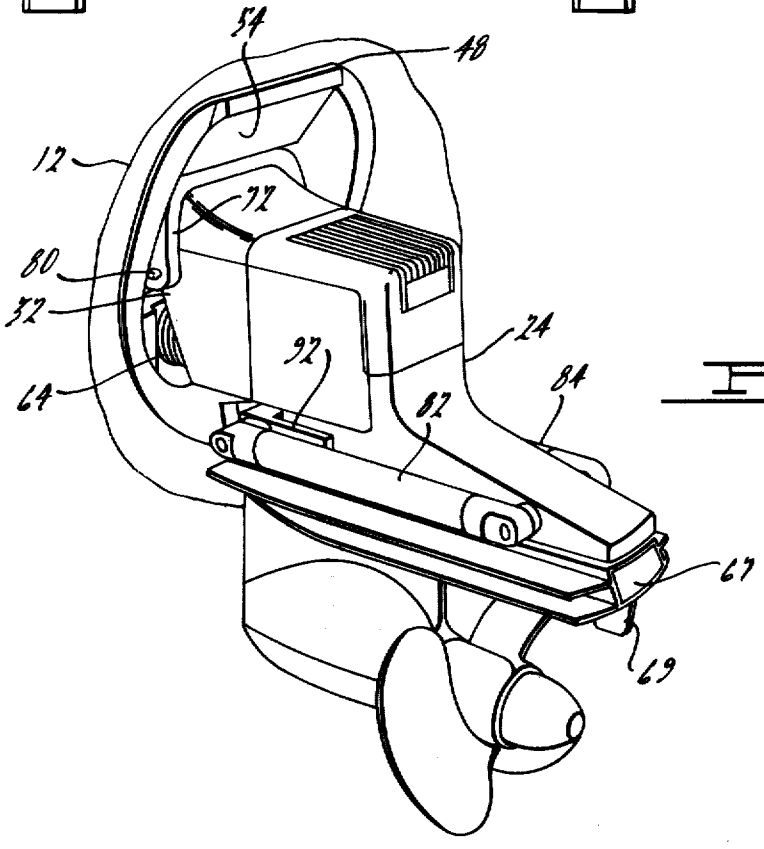

FIG. 6.

INBOARD-OUTBOARD MARINE DRIVE

BACKGROUND OF THE INVENTION

This invention relates to inboard-outboard marine drive units for watercraft, particularly boats, wherein an inboard engine has a rearwardly extending drive shaft coupled through universal joints to power transmission means in an outboard power leg to thereby drive a propeller carried at the lower end of the leg. The outboard power leg is aft of the stern and is mounted for pivoting on two mutually generally perpendicular axes. It is therefore free to swing laterally for steering the boat while also being free to swing vertically such that the lower end thereof may move rearwardly and upwardly in a tilting, trimming and/or kick-up motion relative to the steering of the boat in order to adjust the position of the power leg relative to the boat.

A main feature of the invention comprises the use of an inverted or downwardly disposed yoke member having an upwardly extending center post and downwardly extending laterally spaced yoke arms. The outboard power leg is carried on a generally horizontal axis by the yoke arms whereas the yoke and outboard power leg together are connected to the boat by the upwardly extending center post. The post provides a generally vertical axis for steering and is inside the boat where it is not exposed to water. Other features of the invention will become apparent below.

BRIEF DESCRIPTION OF THE DRAWING

FIG. **1** is a partially broken away and partially sectioned port elevation of a boat with an inboard-outboard drive unit embodying the invention;

FIG. **2** is an enlarged view of part of the port elevation of FIG. **1** primarily in section shown, among other features, the steerable inverted yoke and the double universal joints interconnecting the drive means between the engine and the outboard power leg; the upper portion of the outboard power leg is shown in a raised position in phantom lines.

FIG. **3** is a fragmentary view of the exhaust outlet for the unit taken in the direction of arrow **3** in FIG. **1.**

FIG. **4** is a fragmentary sectional view along lines **4—4** of FIG. **3.**

FIG. **5** is an elevation showing the inverted yoke member by which the outboard power leg is supported and connected to the boat;

FIG. **6** is a perspective stern view showing the boat and outboard power leg of FIGS. **1** and **2,** and

FIG. **7** is an enlarged view partially in cross section, taken generally along line **7—7** of FIG. **2,** showing the pivoted connector attaching the forward ends of the hydraulic cylinders to the boat and showing in phantom the variable positions of the hydraulic cylinders when the outboard power leg is turned laterally to port and starboard for steering the boat.

DESCRIPTION OF THE PREFERRED EMBODIMENT

Referring to the drawing Figures, the inboard-outboard unit includes outboard power leg **10** carried aft of stern transom **12** on a partially shown boat or other watercraft **14.** Outboard power leg **10** includes a propeller **16** carried by a horizontal propeller shaft **18** which is driven by power transmission means including

vertical drive shaft **20** through a pair of bevel gears generally indicated at **22** to propel the boat.

Vertical drive shaft **20** is supported within outboard power leg housing **24** and is in turn driven by engine **26** mounted inboard of boat **14** through a horizontal drive shaft means **28** which extends rearwardly from the engine through a transom opening **30** and into a forwardly extending bell-shaped portion **32** of housing **24.** Intermediate its length horizontal drive shaft means **28** is provided with a double universal joint genenerally indicated at **34** in FIG. **2.** Double universal joint **34** has its center substantially at the intersection of a steering axis and a tilt axis of outboard power leg **10.** These axes are described further hereinbelow.

The drive connection between the horizontal drive shaft means **28** and vertical drive shaft **20** includes a pair of horizontal spaced beveled gears **36** and **38,** one of which is a forward gear, the other being a reverse gear. Both are supported for rotation within suitable bearings on the upper end of shaft **20.** A drive gear **40** carried on horizontal drive shaft means **28** drivingly engages gears **36** and **38** and causes the latter to rotate in opposed directions in the well-known manner. A clutch element, generally indicated at **42,** is disposed between beveled gears **36** and **38** and is carried by shaft **20** and slidable axially thereon to selectively engage gears **36** and **38** to complete the drive connection between horizontal drive shaft means **28** and vertical drive shaft **20** to thereby drive propeller **16** in the desired direction. Clutch element **42** also has an intermediate "neutral" position between gears **36** and **38** in which position propeller **16** is rendered inoperative. Axial movement of clutch element **42** relative to shaft **20** is effected by projecting member **44** which may be actuated by means not shown, but typically a remote control arrangement in boat **14** as is known in this art. The particular drive connection and clutch arrangement described may be varied as its specific design is not critical to the invention.

The mounting means for outboard power leg **10,** associated with the boat between the engine and outboard power leg comprises a one-piece casting **46** although it may comprise inner and outer separate pieces positioned on each side of transom **12** and bolted or otherwise fastened together. Mounting means **46** includes an outer peripheral flange portion **48** which fits sealingly (seal **49**) around transom opening **30** and may be fastened to transom **12** by a series of bolts as shown in FIG. **6.** Mounting means **46** extends through transom opening **30** and terminates interiorly of boat **14** and transom **12** in an upper rigid mounting portion **50.** The lower inner portion of mounting means **46** may include a lower mounting portion **52** for exhaust connection purposes. Mounting means **46** will preferably be shaped to include a hollow or indented area **54** (best shown in FIGS. **2** and **6**) in the upper portion **56** of house **24** when the outboard power leg **10** is raised. Such an arrangement also provides clearance for steering in the raised position. Mounting means **46** may also carry a shaft support structure and seal arrangement generally indicated at **58** for supporting horizontal drive shaft means **28** in opening **30** of transom **12.** An annular flexible bellows **60** is disposed about double universal joints **34** and has its ends secured forwardly to support structure **58** and rearwardly to housing portion **32** as shown in FIG. **2.** Exhaust receiving means **62** is fitted to lower mounting portion **52** for receiving ex-

haust gases from engine **26**, the interconnection therebetween not being shown for the sake of simplicity. Such arrangements are well known. A flexible conduit member **64** interconnects fittings **62** and housing **24** of outboard power leg **10** for conducting engine exhaust interiorly of housing **24** and out exhaust outlet **66**, which is substantially at the water line when the outboard power leg is in its normal operating position and the boat is "on plane." The exhaust arrangement for the unit is shown in detail in FIGS. **3** and **4** of the drawing. Exhaust outlet **66** is closed by a flexible flapper member **67** which is normally closed to prevent the entrance of water into the unit. Due to its flexibility, it opens with exhaust pulses to allow the escape of exhaust gases to the water. The unit may also include a trim tab **69** for off setting torque reaction and reducing steering effort.

The upper rigid mounting portion **50** of mounting means **46** pivotally supports an inverted yoke member **68** on a generally vertical axis to provide for steering movement of the outboard power leg in a lateral side to side movement. Yoke member **68**, best shown in FIG. **5**, is inverted or downwardly extending laterally spaced yoke arms **72**. Yoke member **68** is generally disposed inboard of transom **12** being mounted for rotation in upper rigid mounting position **50** by connection with upwardly extending center leg **70** and suitable bearing means and fastening means indicated at **74, 76** and **78** of FIG. **2**. The inboard pivotal support of yoke member **68** in upper mounting portion **50** provides the reguisite steering axis and steering movement of outboard power leg **10** which is carried by yoke arms **72** through its connection with housing portion **32** as best shown in FIG. **6**. This connection provides a generally horizontal axis extending through yoke arms **72** at **80**. Any suitable pivotal connection means may be utilized to establish the connection between housing portion **32** and yoke arms **72**. Carried as described above, it can be seen that there is provided a steerable yoke member fitted inboard the boat in a compact manner.

Steering is provided for by means of tiller arm **90** which is connected to the upwardly extending center post **70** of yoke member **68** such that lateral movement of tiller arm **90** causes yoke member **68** to pivot in mounting portion **50** thus turning yoke **68** and moving outboard power leg **10** in a rotary steering movement, i.e., a lateral side to side movement. Remote control mechanisms and/or power steering mechanism may be attached to tiller arm **90** to allow steering to be accomplished from other locations in the boat remote from the tiller arm. Such arrangements are well known in the art and need not be described herein.

To control and limit the tilt, trim and/or kick-up movements of the outboard power leg **10**, a pair of extendable/collapsible hydraulic cylinders **82** and **84** are attached to each side respectively of power leg **10** and to boat **14**. In its preferred form, cylinders **82** and **84** are pivotally connected to support **86** which is itself pivoted for turning at **88** on substantially the same axis as post **70** of yoke member **68**. Such an arrangement provides for the maintenance of the same relative position of the hydraulic cylinders **82** and **84** as outboard power leg **10** is turned through its various steering movements. As shown in FIG. **7**, the hydraulic cylinders can assume varied positions shown in phantom depending on the extent of the steering movement. Thus there is provided an additional connection between the outboard power leg and the boat. Such cylinders can be readily designed to provide for trimming, tilting and/or kick-up and such design details do not provide any part of this invention and need not be described herein since such matters are well known in the art.

Additionally, support **86** may include a pair of spaced lateral side members **92** and **94** (best seen in FIGS. **1** and **7**) for slidably receiving outboard power leg housing **24** therebetween to provide lateral support therefor due to side loading of the unit. The extent of the engagement provided by the side members may be varied by changing their size both overall and length.

What is claimed is:

1. In an inboard-outboard marine drive unit for boats having an inboard engine connected to an outboard power leg through drive shaft means and universal joint means, the improvement comprising a yoke member having a generally upwardly extending center post directed oppositely from generally downwardly extending laterally spaced yoke arms, means pivotally mounting the power leg to the yoke arms about an axis to allow the power leg to be rotated upwardly and rearwardly for trimming, tilting and kick-up, and means pivotally connecting the upwardly extending center post of the yoke to the boat about an axis to allow the yoke and power leg to rotate laterally for steering the boat.

2. The inboard-outboard drive unit according to claim **1** wherein the yoke member is carried by the boat so as to position the axis of the post at the horizontal drive center line inboard of the aft side of the boat stern transom.

3. The unit according to claim **2** wherein the yoke member is carried such that the axis through the yoke arms is also inboard of aft side of the stern transom.

4. The inboard-outboard drive unit according to claim **1** including means in addition to the yoke member for connecting the power leg to the boat below the universal joint means.

5. The unit according to claim **4** wherein the means connecting the power leg to the boat includes a lower support means pivotally attached to the boat for turning on a steering axis corresponding to that for the outboard power leg and hydraulic cylinder means extending between the lower support means and the power leg for raising and lowering the power leg about the axis provided at the yoke arm.

6. The unit according to claim **5** wherein the lower support means further includes a pair of spaced lateral side members for receiving at least a portion of the power leg therebetween and providing lateral support thereto.

7. In an article of manufacture for use with an inboard engine and rearwardly extending flexible drive means in a boat, an outboard power leg including propeller means adapted for connection to the flexible drive means, a downwardly disposed yoke member positioned forward of the power leg and comprising an upwardly extending center post and a pair of laterally spaced yoke arms extending downwardly from the center leg for carrying the drive means thereon, first pivot means mounting the power leg to the yoke arms for movement of the power leg about a generally horizontal axis, and second pivot means adapted for mounting the post of the yoke to the boat for lateral steering movement of the yoke and power leg.

8. In an inboard-outboard drive in combination with a boat having a transom and an inboard engine with a drive means extending rearwardly from the engine through the transom, an outboard power leg including power transmission means connected to the drive means including a double universal joint interconnecting the engine drive shaft and the power transmission means of the power leg, a propeller at the lower end of the power leg driven by the power transmission means, a mounting member fixedly associated with the boat between the engine and the power leg, an inverted yoke comprising an upwardly extending center post and a pair of downwardly extending laterally spaced arms, means pivotally connecting the center post of the yoke to the mounting member above the working center of the double universal joint, and means pivotally connecting the power leg to the yoke arms for fore and aft swinging of the leg.

9. The combination according to claim 8 including means in addition to the yoke member, for connecting the power leg to the boat.

10. The combination according to claim 8 wherein the center post of the yoke member is received by the mounting member inboard the aft side of the boat transom.

11. The combination according to claim 10 wherein the entire yoke member is positioned inboard of the aft side of the boat transom.

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