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[54] **STERN DRIVE HYDRAULIC TRIM CONTROL SYSTEM INCLUDING A TILT POSITION INDICATOR**

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[52] **U.S. Cl.** ..... **115/41 HT;** 115/35

[51] **Int. Cl.²** **B63H 5/12**

[58] **Field of Search** ..... 115/41 HT, 41 R, 34 R, 115/35, 34 A, 12 R, 12 A; 338/118, 196; 116/124 D

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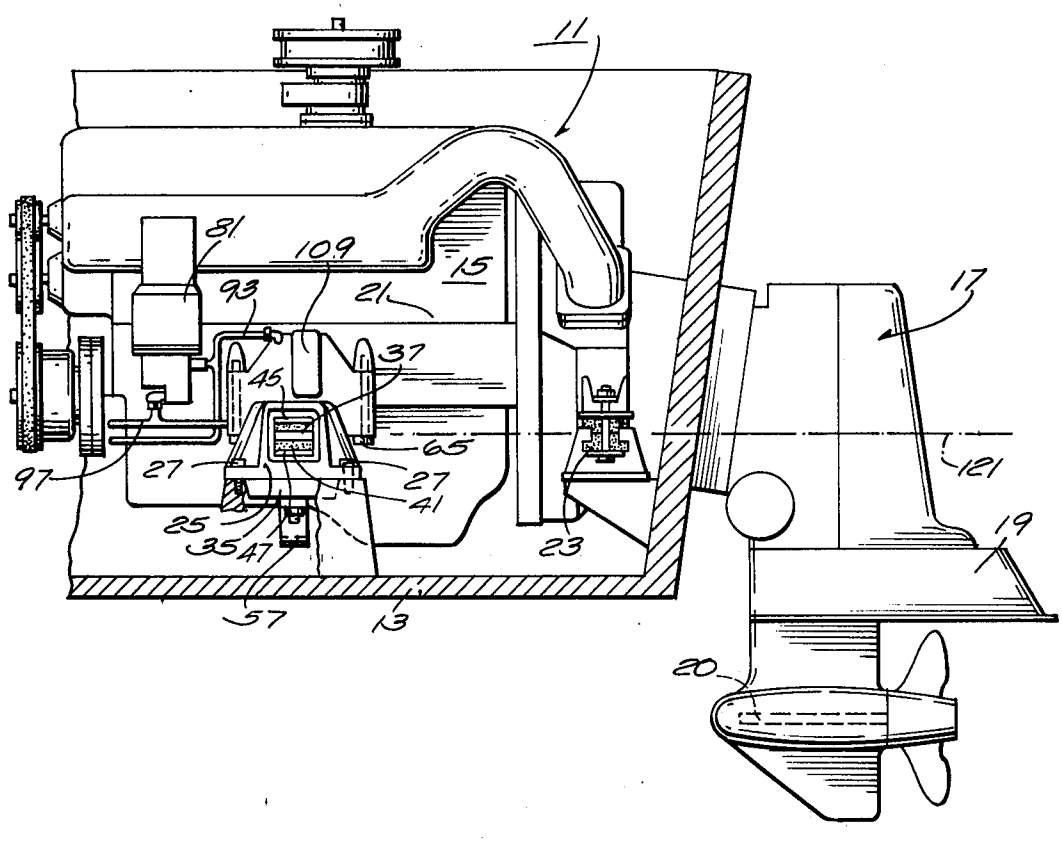
[57] **ABSTRACT**

A stern drive unit including a stern drive leg fixed to the rear of an engine and including a part which is tiltable vertically and swingable horizontally independently of the engine, together with a rearwardly located elastomeric mount connected to the stern drive unit and adapted for connection to a boat hull for vibrationally isolating and supporting the stern drive unit from the boat hull,and for providing a pivotal axis relative to which the stern drive unit is tiltable relative to the boat hull, an elastomeric part, a bracket fixed to the elastomeric part and adapted to be fixed to the boat hull, an arm fixed to the elastomeric part remotely from the bracket, and a jacking mechanism connected between the engine and the arm for tilting the stern drive unit relative to the boat hull while also supporting and vibrationally isolating the engine from the boat hull.

7 Claims, 4 Drawing Figures



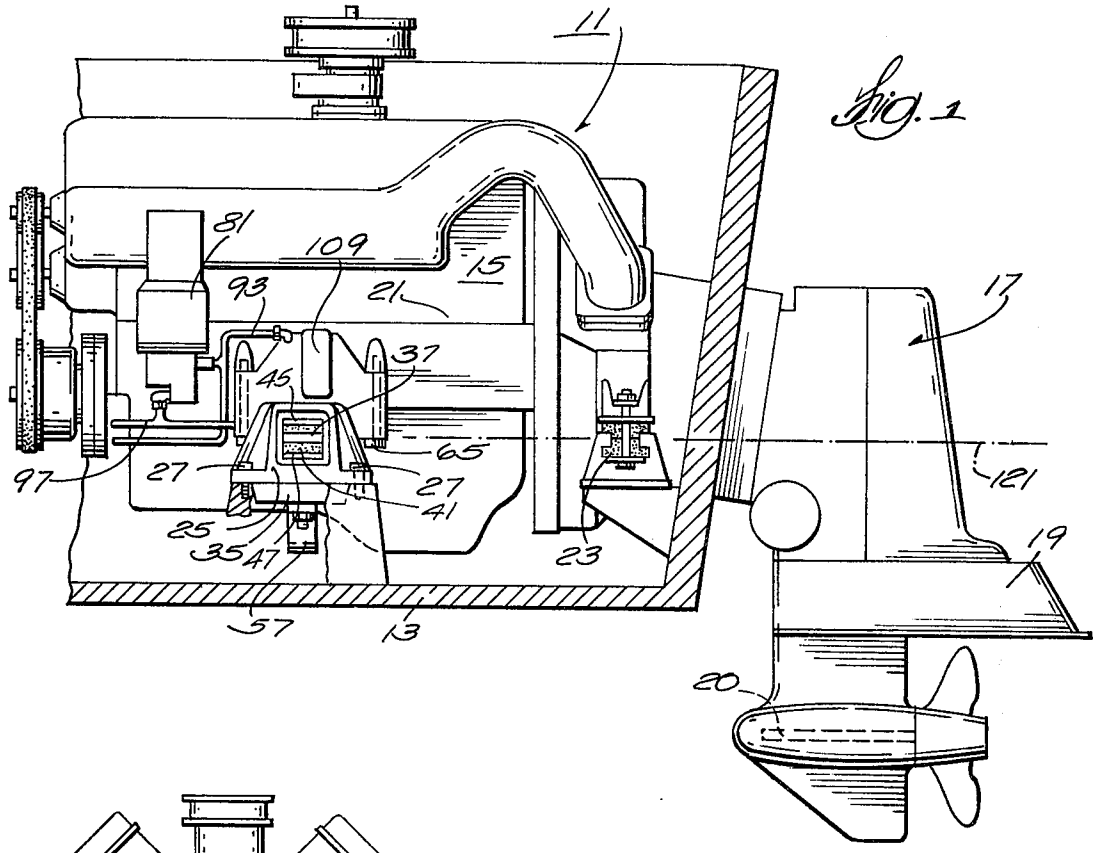

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Fig. 1

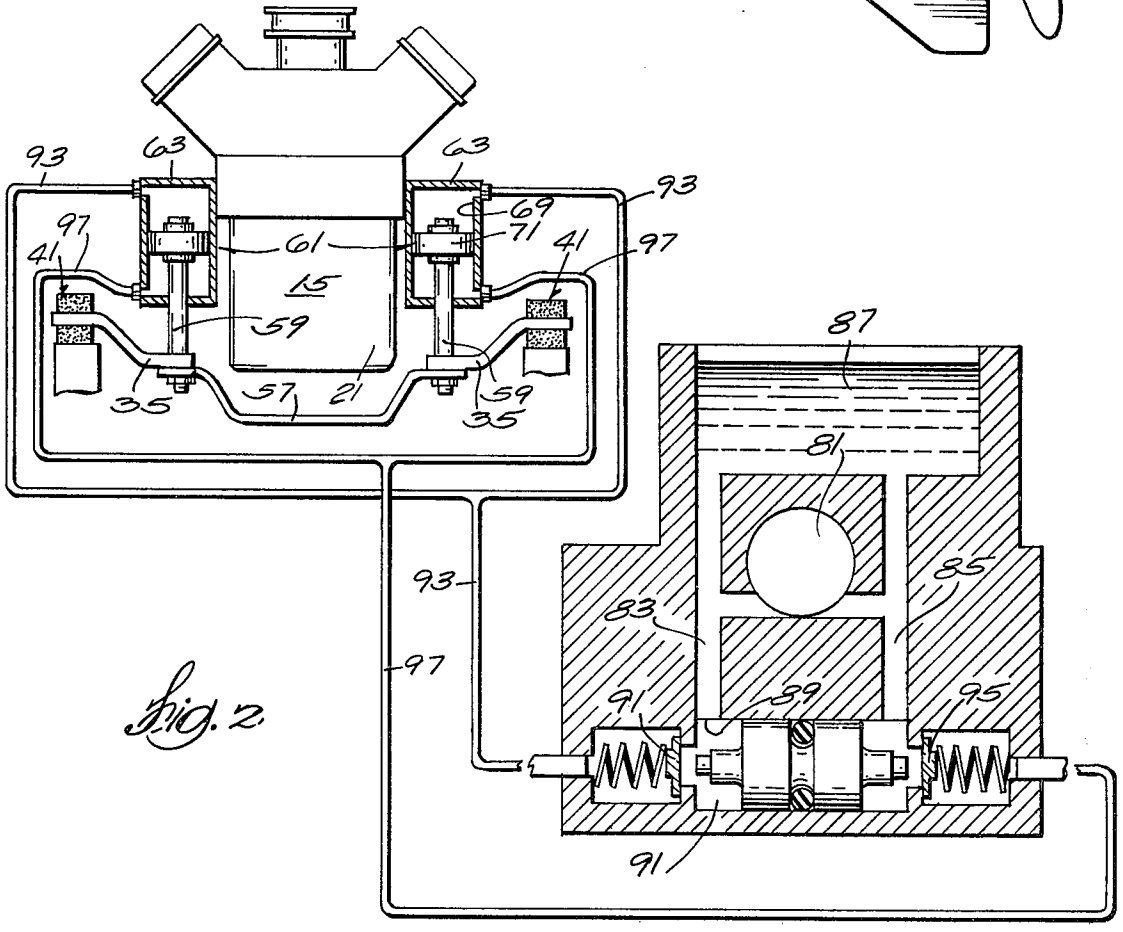
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Fig. 2

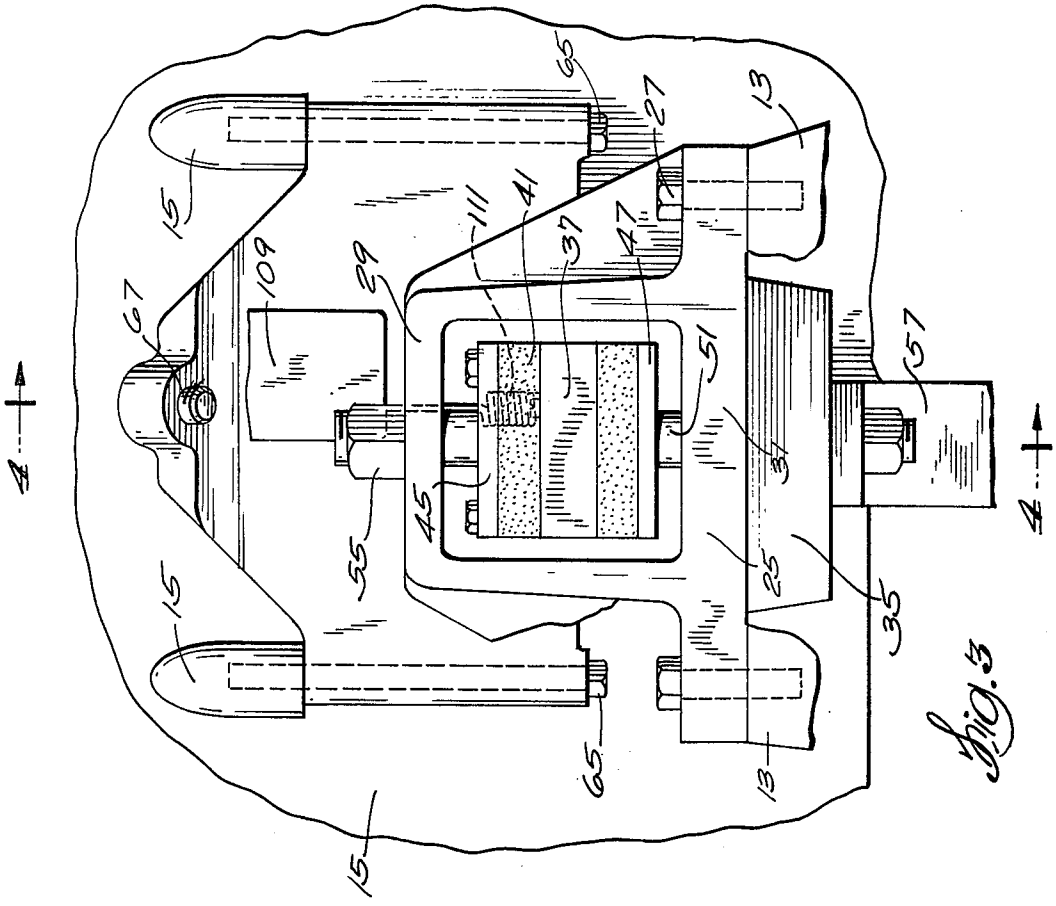
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Fig. 3

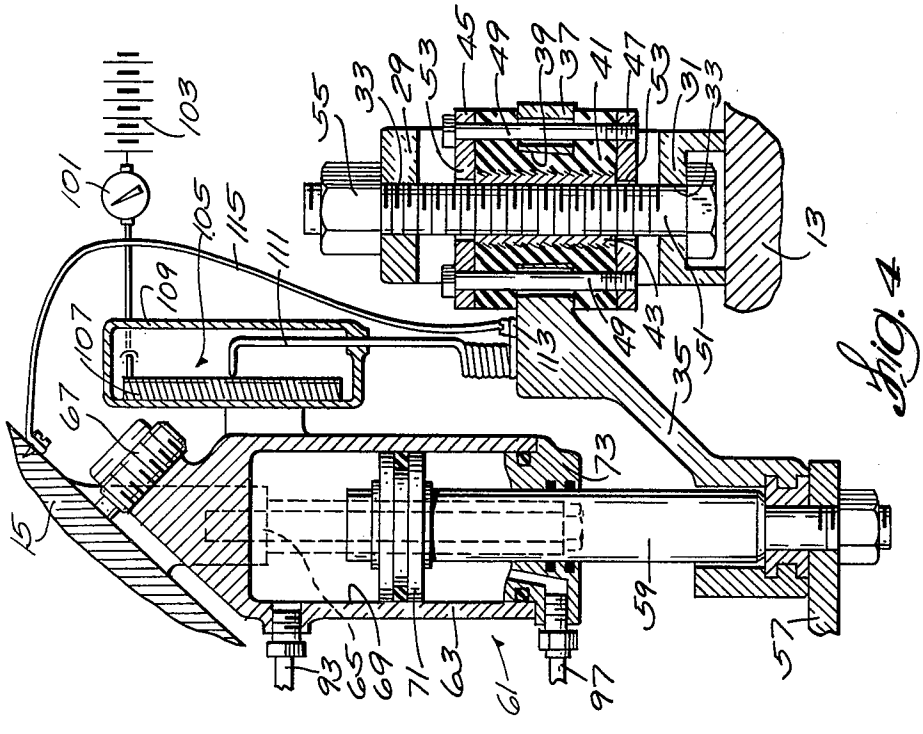
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Fig. 4

STERN DRIVE HYDRAULIC TRIM CONTROL SYSTEM INCLUDING A TILT POSITION INDICATOR

BACKGROUND OF THE INVENTION

The invention relates generally to stern drive units and to arrangements for vibrationally isolating and supporting and variably tilting such stern drive units. The invention also relates to arrangements for indicating the "trim" position of a stern drive unit relative to a supporting boat.

Attention is directed to the U.S. Pat. No. 3,722,456 issued Mar. 27, 1973 which discloses a screw-type arrangement for variably trimming a stern drive unit. It is noted that in U.S Pat. No. 3,722,456, the forward vibration isolating mount is located between the screw jack and the engine.

Attention is also directed to the U.S. Collis Application Ser. No. 321,049 filed Jan. 4, 1973, which application discloses a tilt position indicating arrangement.

SUMMARY OF THE INVENTION

The invention provides a stern drive unit comprising a stern leg fixed to the rear of an engine and including a part which is tiltable vertically and horizontally swingable, together with elastomeric mounting means connected to the stern drive unit rearwardly of the front of the engine and adapted for connection to a boat hull for vibrationally isolating and supporting the stern drive unit from the boat hull and for providing a pivotal axis relative to which the stern drive unit is tiltable relative to the boat hull, and means located forwardly of the elastomeric mounting means for tilting the stern drive unit about the elastomeric mounting means and for vibrationally isolating and supporting the stern drive unit from the boat hull. The isolating, supporting, and tilting means comprises a mount including an elastomeric part, a bracket fixed to the elastomeric part and adapted to be fixed to the boat hull, an arm fixed to the elastomeric part in spaced relation from the bracket, and a jacking mechanism connected between the engine and the arm for tilting the stern drive unit relative to the boat hull.

In accordance with one preferred embodiment of the invention, the jacking mechanism comprises a hydraulic cylinder-piston means including a piston fixed to the arm and a hydraulic cylinder which receives the piston and which is fixed to the engine, together with means for selectively supplying hydraulic fluid to the cylinder to relatively displace the cylinder and the piston.

In further accordance with one embodiment of the invention, the stern drive unit further includes means for indicating the trim position of the stern drive unit relative to the boat and including a variable resistor fixed to the cylinder and a slide member guided for movement in engagement with the resistor and fixed to the arm, whereby the slide member moves relative to the resistor in response to relative movement between the cylinder and the piston so as thereby to vary the resistance of the resistor.

In still further accordance with one embodiment of the invention, the engine includes a V-shaped block with the apex thereof pointing downwardly, the rearwardly located elastormeric mounting means includes an elastormeric part on each side of the engine, and the isolating, supporting and tilting means comprises means for selectively supplying hydraulic fluid, a tie bar

extending transversely beneath the engine, and, on each side of the engine, a mount including an elastormeric part fixed to the tie bar, a bracket fixed to the elastormeric part in spaced relation from the tie bar and adapted to be fixed to the boat hull, a hydraulic cylinder fixed to the engine and connected to the hydraulic fluid supply means, and a piston received in the cylinder and fixed to the tie bar. Preferably, all of the elastormeric parts are approximately located in a generally horizontally common plan so as to optimize vibration isolation of the V-block engine.

One of the principal features of the invention is the provision of a stern drive unit in which a jacking mechanism is interposed between a forward engine vibration isolating support mount and the engine.

Another of the principal features of the invention is the provision of a jacking mechanism for tilting of a stern drive unit about a horizontal axis, which jacking mechanism is located between the engine and a forwardly located vibration isolating and stern drive supporting mount.

Another of the principal features of the invention is the provision of a stern drive unit in which a jacking mechanism is interposed between a forward engine vibration isolating and supporting mount and the engine and wherein the engine includes a V-block supported on each side by fore and aft mounts located in a common plane.

Another of the principal features of the invention is the provision of a hydraulicly actuated mechanism for tilting a stern drive unit.

Still another of the principal features of the invention is the provision of a stern drive unit including a tilting mechanism comprising a hydraulic cylinder which is fixed to the engine and a piston which is movable relative to the cylinder in response to the application to the cylinder of pressure fluid, and which is connected to a vibration isolating mount which supports the engine.

Still another of the principal features of the invention is the provision of a stern drive unit tilting mechanism which is economical to construct and which will provide long and reliable service over a long and useful life.

Other features and advantages of the invention will become known by reference to the following drawings, general description, and claims.

THE DRAWINGS

FIG. 1 is a fragmentary, side elevational view, partially in section, of a boat including a stern drive unit incorporating various of the features of the invention.

FIG. 2 is a schematic view of the tilting or jacking arrangement incorporated in the stern drive unit shown in FIG. 1.

FIG. 3 is an enlarged view of a portion of the stern drive unit shown in FIG. 1.

FIG. 4 is a partially schematic fragmentary sectional view taken generally along line 4—4 of FIG. 3.

Before explaining the invention in detail, it is to be understood that the invention is not limited in its application to the details of construction and the arrangements of the components set forth in the following description or illustrated in the drawings. The invention is capable of other embodiments and of being practiced and carried out in various ways. Also, it is to be understood that the phraseology and terminology employed herein is for the purposes of description and should not be regarded as limiting.

GENERAL DESCRIPTION

Shown in the drawings is a stern drive unit **11** mounted at the rear of a boat hull **13** and including an engine **15** and connected propulsion unit **17** comprising a leg, part, or lower unit **19** which includes a shaft **20** carrying a propeller and which is vertically tiltable and horizontally steerable relative to the engine **15.** Any suitable stern drive unit construction can be employed. However, in the illustrated construction, the engine includes a V-shaped block member which is arranged with the apex thereof pointing downwardly.

At the rear, the engine **15** is mounted, on each side of the boat hull **13,** through elastormeric mounts **23** of rubber or other resilient material, which mounts **23** are described in greater detail in U.S. Pat. No. 3,722,456 issued Mar. 27, 1973. As in U.S. Pat. No. 3,722,456, the rearward rubber mounts **23** vibrationally isolate and support the stern drive unit **11** as well as afford tilting of the stern drive unit **11** about a generally horizontal axis and relative to the boat hull **13** so as to provide a "trim" adjustment, i.e., to provide a fine tilting adjustment of the stern drive unit **11** to facilitate horizontally locating the propeller shaft **20.**

In accordance with the invention, there is also provided, forwardly of the rearward resilient mounts **23,** a forward resilient means for mounting the stern drive unit **11** from the boat hull **13** and hydraulically operated means connected between the forward resilient mounting and the engine **15** for displacing the engine **15** relative to the forward resilient mounting means and thereby tilting the stern drive unit **11** about the rearward mounts **23** to obtain fine "trim" adjustment.

More specifically with respect to the forward mounting means, in the illustrated construction, such means is located adjacent to the mid section of the engine **15** and comprises, on each side of the engine, a bracket **25** which is fixed to the boat hull **13** and in any suitable manner such as by one or more bolts **27** and which includes, as shown best in FIGS. **3** and **4,** spaced upper and lower portions **29** and **31,** respectively, which include aligned bores **33.**

Extending into the space between the upper and lower portions **27** and **31,** respectively, of each of the brackets **25** are respective arms **35** which include a mount portion **37** having an aperture **39** into which extends an elastomeric part or mount **41** in the form of a mass of rubber or other resilient mounting material, which rubber mass continuously engages the aperture **39** and the margins of the aperture **39** on the upper and lower surfaces of the arm portion **37.** The rubber mass **41** is bonded to a sleeve **43** including an internal thread and is fixed to the arm portion **37** by upper and lower clamping plates **45** and **47,** respectively, which plates are joined together by a plurality of bolts which extends through the arm portion **37,** and are threaded into the lower plate **47.** If desired the mount **41** and sleeve **43** can be formed in two parts for insertion into the aperture **39** from the top and bottom.

Each arm **35** and the attached elastomeric mount **41** is fixed to the adjacent bracket **25** by a bolt **51** which passes through the bores in the bracket portions **29** and **31,** which extends through enlarged holes **53** in the clamping plates **45** and **47** in spaced relation thereto, and which is threaded into the sleeve **43,** and into a nut **55** so as to rigidfy the bracket **25,** bolt **51,** and sleeve **43,** while permitting free movement of the arm **35** relative to the bracket **25** subject to the resilience of the elastomeric mount **41.**

The transversely spaced arms **35** are fixedly connected together by a transverse tie bar **57.** If desired, the arms **35** and tie bar **57** could be fabricated unitarily. In turn, the arms **35** (or tie bar **57**) are respectively connected to the respective piston rods **59** of a pair of transversely spaced hydraulic cylinder-piston assemblies **61** which are respectively mounted on the opposite sides of the engine **15.** More specifically, on each side of the engine **15,** a cylinder housing **63** is fixed to the engine **15** by means including a pair of vertically extending bolts **65** which are spaced fore and aft and by means of a set screw **67** which is located approximately midway between the bolts **65** and which extends upwardly and toward the center plane of the engine **15** at an angle of about **45** degrees. Each of the cylinder housings includes a vertically orientated and downwardly open cylinder **69** which contains a piston **71** connected to one of the piston rods **59** and which is closed, at the bottom thereof, by an apertured end cap **73** through which the connected piston rod **59** extends.

Accordingly, application of fluid pressure within the cylinders **69** above or below the pistons **71** will cause the cylinder housings **63** to rise or fall relative to the pistons **71** and thereby elevate or depress the engine **15** so as thereby to tilt the stern drive unit about the rearward elastormeric mounts **23.**

Any suitable means can be provided for selectively supplying hydraulic fluid to be opposed ends of the cylinder **69.** In the illustrated construction, such means comprises, as shown schematically in FIG. **2,** an electrically driven reversable pump **81** which communicates through parallel conduits or ducts **83** and **85** to a reservoir or sump **87** and to the opposite ends of a spool valve cavity **89.** In turn, the left end of the spool valve cavity **83** is connected through a spring biased check valve **91,** and through a conduit **93** to the upper ends of the cylinders **69.** The other end of the spool valve cavity **89** is connected through a spring biased check valve **95** and through a conduit **97** to the lower ends of the cylinders **69.**

Also in accordance with the invention, there is provided means for indicating the "trim" position of the stern drive unit **11.** While various other constructions could be employed, in the illustrated construction, such means comprises (See FIG. **4**) a gauge or meter **101** which is connected to a suitable source of constant voltage such as, for instance, a battery **103,** which is sensitive to the applied voltage, and which is also connected to a variable resistor **105** arranged so that tilting movement of the engine **15** causes variation in the resistance of the resistor **105.** More particularly, in the preferred construction, the variable resistor **105** comprises a vertically extending coil **107** which is fixed in a housing **109** attached to the cylinder housing **63,** together with a wiper or slide member **111** which is fixed at its lower end to one of the arms **35** by suitable means, such as a screw **113,** and which extends upwardly and into the resistor housing **109** for guided movement therein and for variable engagement with the coil **107** depending upon the position of the engine **15** relative to the arms **35.**

Preferably, the slide member **111** is electrically connected by a wire **115** or by other suitable means to the engine block member **21** so as to complete an electrical circuit.

While it is preferred to employ the illustrated dual hydraulic cylinder-piston assemblies **61** which are connected to a tie bar **57** supported at its ends by the elastormeric mounts **41**, the invention is also applicable to a single hydraulic cylinder-piston assembly or other jacking mechanism connected between an engine **15** and one or more elastormeric mounts **41** supported by the boat hull **13**.

In the illustrated construction, in which the engine **15** includes a V-shaped block member **21** having its apex pointed downwardly, it is preferred, in order to achieve maximum vibration isolation, that all of the elastormeric mounts **23** and **41** be approximately located in a generally horizontal common plane **121**. (See FIG. **1**).

In operation, supply of pressure fluid to the top of the cylinders **69** (and drainage of pressure fluid from the bottom of the cylinder **69**) effects lifting of the forward end of the engine **15** so as thereby to tilt the stern drive unit **11** in the clockwise direction about the rearward elastormeric mounts **23**. Supply of pressure fluid to the bottom of the cylinders **69** (and drainage of pressure fluid from the top of the cylinder **69**) effects lowering of the forward part of the engine **15** and consequent tilting of the stern drive unit **11** in a counter clockwise direction about the rearward elastormeric mounts **23**. At the same time, the forward and rearward mounts **23** and **41** serve to isolate the boat hull **13** from engine vibration.

Various of the features of the invention are set forth in the following claims.

What is claimed is:

1. A stern drive unit comprising an engine, a stern drive leg fixed to the rear of said engine and including a part which is tiltable vertically and swingable horizontally independently of said engine, elastomeric mounting means connected to said stern drive unit rearwardly of the front of said engine and adapted for connection to a boat hull for vibrationally isolating and supporting said stern drive unit from the boat hull and for providing a pivotal axis relative to which said stern drive unit is tiltable relative to the boat hull, and means located forwardly of said elastomeric mounting means for tilting said stern drive unit about said elastomeric mounting means and for vibrationally isolating and supporting said stern drive unit from the boat hull, said isolating, supporting and tilting means comprising a mount including an elastomeric part, a bracket fixed to said elastomeric part and adapted to be fixed to the boat hull, an arm fixed to said elastomeric part remotely from said bracket, and a jacking mechanism connected between said engine and said arm for tilting said stern drive unit relative to the boat hull.

2. A stern drive unit in accordance with claim **1** wherein said jacking mechanism comprises a hydraulic cylinder piston means including a piston fixed to one of said arm and said engine, and a hydraulic cylinder which receives said piston and which is fixed to the other of said engine and said arm, and means for selectively supplying hydraulic fluid to said cylinder to relatively displace said cylinder and said piston.

3. A stern drive unit in accordance with claim **2** wherein said piston is fixed to said arm and said cylinder is fixed to said engine.

4. A stern drive unit in accordance with claim **3** and further including means for indicating the tilt position of said stern drive unit relative to the boat and including a variable resistor fixed to said cylinder and a slide member guided for movement in engagement with said resistor and fixed to said arm, whereby said slide member moves relative to said resistor in response to relative movement between said cylinder and said piston so as thereby to vary the resistance of said resistor.

5. A stern drive unit comprising an engine, a stern drive leg fixed to the rear of said engine and including a part which is tiltable vertically and swingable horizontally independently of said engine, elastomeric mounting means connected to said stern drive unit on each side thereof and rearwardly of the front of said engine and adapted for connection to a boat hull for vibrationally isolating and supporting said stern drive unit from the boat hull and for providing a pivotal axis relative to which said stern drive unit is tiltable relative to the boat hull, and means located forwardly of said elastomeric mounting means for tilting said stern drive unit about said elastomeric mounting means and for vibrationally isolating and supporting said stern drive unit from the boat hull, said isolating, supporting and tilting means comprising means for selectively supplying hydraulic fluid, a tie bar extending transversely beneath said engine, and, on each side of said engine, a mount including an elastomeric part fixed to said tie bar, a bracket fixed to said elastomeric part remotely from said tie bar and adapted to be fixed to the boat hull, a hydraulic cylinder fixed to said engine and connected to said hydraulic fluid supply means, and a piston received in said cylinder and fixed to said tie bar.

6. A stern drive unit in accordance with claim **5** and further including means for indicating the tilt position of said stern drive unit relative to the boat and including a variable resistor fixed to one of said cylinders and a slide member guided for movement in engagement with said resistor and fixed to said tie bar, whereby said slide member moves relative to said resistor in response to tilting movement of said stern drive unit so as thereby to vary the resistance of said resistor.

7. A stern drive unit in accordance with claim **5** wherein said engine includes a V-shaped block with the apex thereof pointed downwardly, wherein said elastomeric mounting means each includes an elastomeric part, and wherein said elastomeric parts are approximately located in a common generally horizontal plane.

* * * * *