Sept. 1, 1970 R. K. FARRINGTON ET AL 3,526,152

DUAL STATION STEERING MECHANISM

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FIG. 1

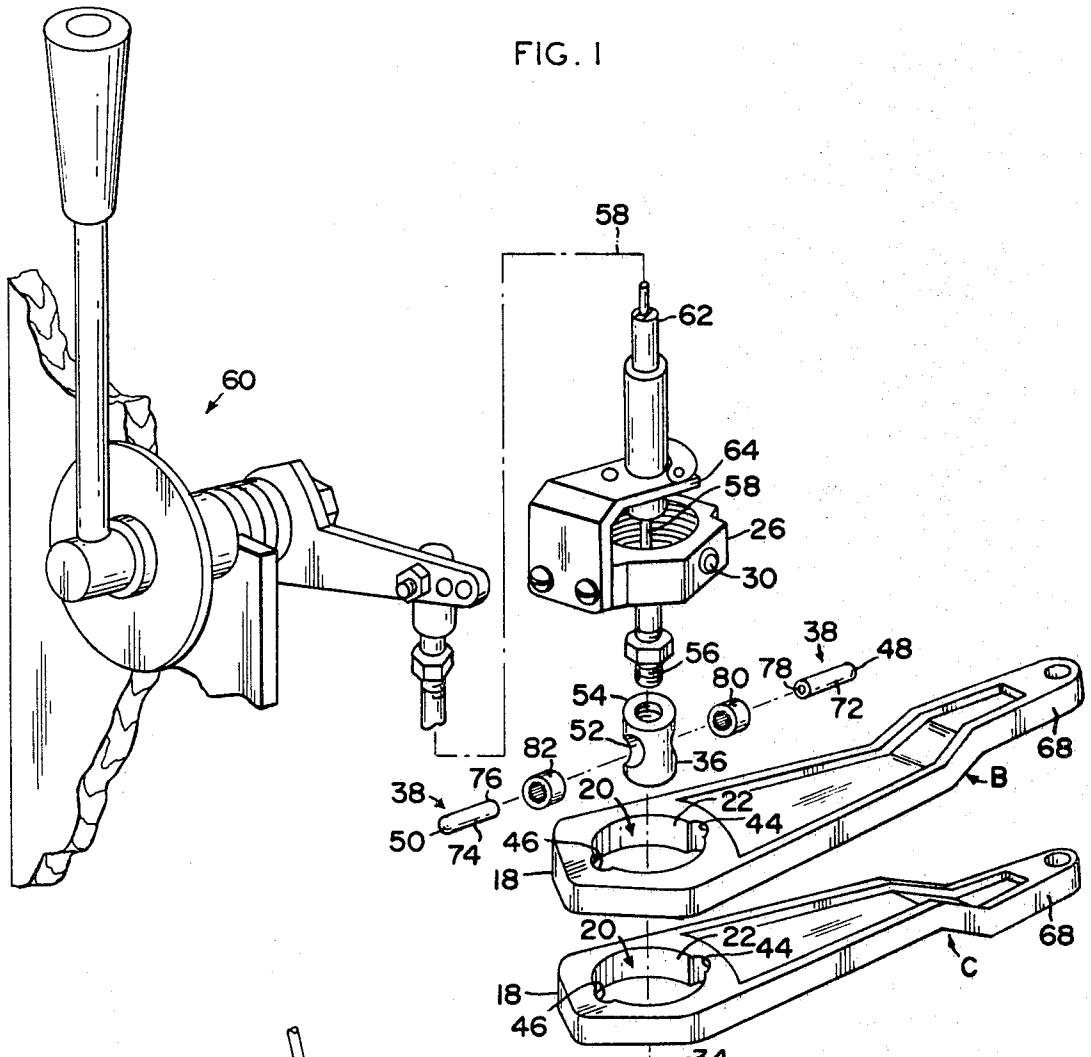
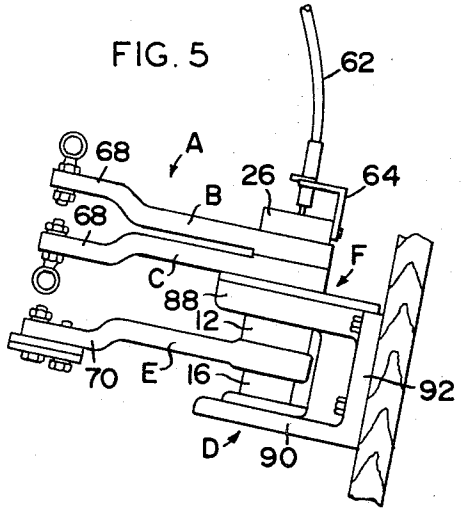


FIG. 5



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DUAL STATION STEERING MECHANISM

Filed March 24, 1969 3 Sheets-Sheet 2

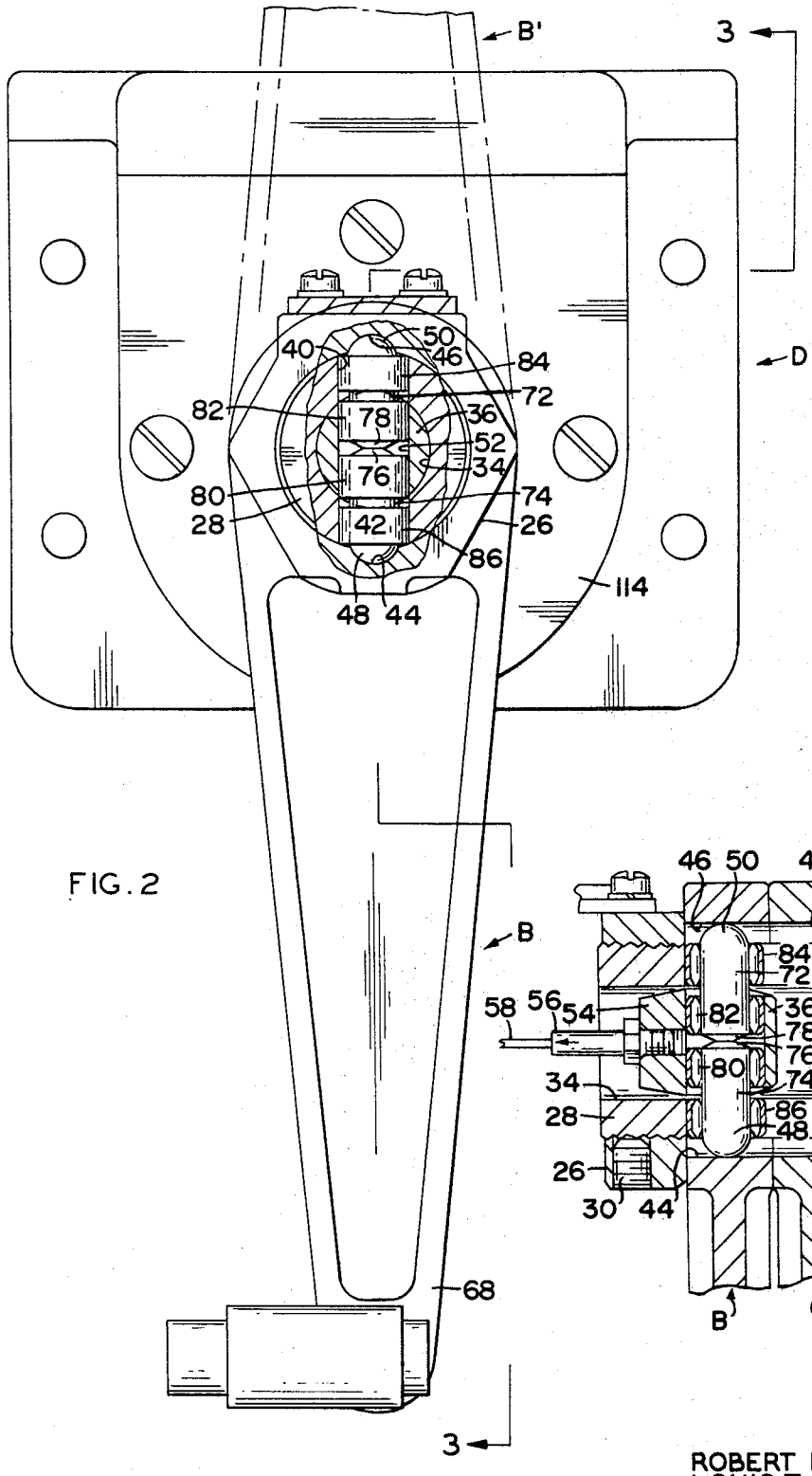


FIG. 2

FIG. 4

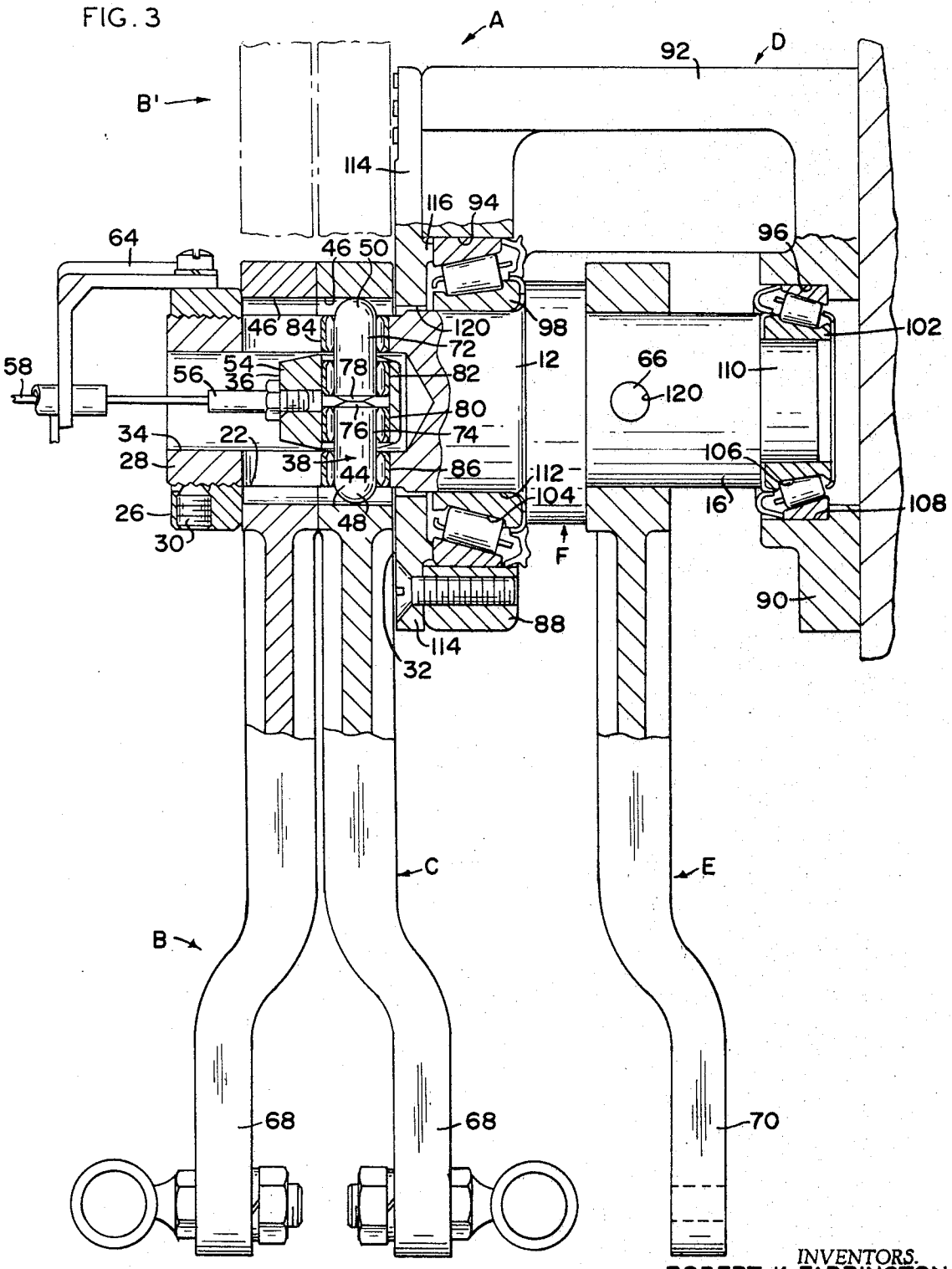
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DUAL STATION STEERING MECHANISM

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FIG. 3



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3,526,152

DUAL STATION STEERING MECHANISM

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Int. Cl. G05g 11/00
U.S. Cl. 74—479 9 Claims

ABSTRACT OF THE DISCLOSURE

A steering interchanger by which the steering mechanism of a boat can be controlled from one or the other of two steering stations on a boat. The interchanger comprises a pair of arms oscillatably supported on a rotatable body wherein the arms are connected separately to the two steering stations and the body is connected to the boat steering mechanism. A pair of axially aligned pin halves are movable in said body between the arms engaging opposed torque transmitting surfaces of one or the other of the arms, the pin halves being housed in cylindrical anti-friction sleeve members which permit the pin halves to roll relative to said surfaces rather than slide. These and other features provide an interchanger which is adaptable to different makes of boats and boat drives.

The present invention relates to steering mechanisms, and more particularly to an improved steering interchanger which can be controlled from one of two control stations on a boat.

The invention is particularly applicable to boats having single or twin inboard-outboard drives, and will be described with particular reference thereto, although it will be appreciated that the invention has broader application.

In the art of medium-sized engine propelled boats, it is conventional practice to have two stations from which the boat may be steered, for instance, one on the main deck, and another on what is normally termed a "flying bridge." From each station, a push-pull cable leads from the steering wheel assembly to the rudder mechanim. It has been found that if both of the steering assemblies are always engaged, the drag created by the steering assembly which is not in use makes the amount of effort required to steer from the other station unduly large.

Pat. No. 3,128,738, assigned to assignee of the present application, describes a mechanism positionable adjacent the stern of a boat, which can selectively engage one of the steering stations with the rudder, while disengaging the other. Such a mechanism, termed an interchanger, was designed primarily for use with inboard engine craft having a conventional rudder where, except when the boat is in a tight turning circle, forces on the interchanger are low.

As described in said prior patent, the steering interchanger comprised a cylindrical rotatable body operatively connected to the boat rudder post, and a pair of steering arms movable in spaced planes at right angles to the axis of the interchanger body, connected via cables to the boat steering stations. An engaging pin was adapted to ride up-and-down within the interchanger body to engage the body with one or the other of the steering arms, through opposed torque transmitting recesses of the latter, the pin being carried by a piston axially movable within the body. Control cables leading to either of the two steering stations provided the means for moving the piston.

Although the above arrangement proved to be excellent for conventional rudder turning, the advent of the inboard-outboard drive resulted in certain difficulties. In such a drive, steering is accomplished by turning the entire motor transmission which supports the drive propeller, so that not only are conventional turning forces experienced against the steering mechanism, but in addition, the rotation of the propeller creates forces which are transmitted to the steering mechanism. This combined torque on the interchanger body binds the engaging pin against the body and the arm recesses developing friction forces which make it very difficult to disengage the pin from one steering arm and engage it with the other.

The above is particularly true in the case of dual or twin inboard-outboard units wherein a single steering interchanger is used to turn both of the inboard-outboard transmissions. The combined forces developed by the two drives makes it virtually impossible to shift from one steering station to the other when the boat is underway; particularly when the boat is in a turn; or even when the boat is proceeding straight ahead, if the engines are not exactly aligned or parallel.

Another problem experienced with conventional steering interchangers is one of space limitation depending upon the make of boat and drive involved. Before the advent of the inboard-outboard unit, the area near the transom of a boat and rudder post usually was relatively open placing little limitation upon the design or mounting of the interchanger. However, the inboard-outboard engine is positioned close to the boat transom, and the engine components, such as the exhaust riser or risers, and other objects, severely restrict the position and use of the interchanger. Even the design of the boat itself can seriously restrict the location and orientation of the interchanger, and in particular, movement of the interchanger steering arms.

Also it is possible, because of the location and orientation of the interchanger in some boats, for a relatively large eccentric loading to be imposed on the rotatable body, creating forces which tend to bind the interchanger body in the housing in which it rotates reducing the effectiveness of the interchanger.

In accordance with the present invention, there is provided in an interchanger device of the general character described including a rotatable body, a pair of steering arms oscillatably supported on the body, pin means shiftable in the body for engaging opposed torque transmitting surfaces of one or the other of the arms, the improvement comprising the pin means being in the form of axially aligned pin halves, including cylindrical anti-friction sleeve members encompassing the pin halves to permit rolling movement of the halves, rather than sliding engagement, when the halves are shifted from the torque transmitting surfaces of one of the arms to those of the other, so that shifting can be readily accomplished even though high torque forces are being transmitted through the interchanger body.

Preferably, the pin halves are in abutting relationship guided by apertures in the interchanger body and movable from one arm to the other by a piston member, the anti-friction members comprising a pair of cylindrical needle bearings contained by said piston member and body apertures for each of the pin halves.

In accordance with a further preferred aspect of the invention, there is provided a mounting bracket including mounting surfaces at right angles to each other, support means supporting the rotatable body in a plane substantially parallel with one of the surfaces, further comprising upper and lower tapered roller bearing sets angled with respect to the axis of rotation of the body intermediate the body and the support means; and steering lever means mounted on the body rotatable therewith between the tapered roller bearing sets.

Accordingly, it is an object of the present invention

to provide a steering interchanger which is capable of being used with different types of boats and drives, including an inboard-outboard drive, and in particular, an interchanger which is capable of being shifted between steering arms even when subjected to high and/or eccentric loads.

The invention, objects and advantages thereof will become apparent upon consideration of the following specification, with reference to the accompanying drawings, in which:

FIG. 1 is an exploded view of a steering interchanger in accordance with the present invention;

FIG. 2 is an enlarged, detailed partial section, plan view of the interchanger of FIG. 1;

FIG. 3 is a section view taken along the line 3—3 of FIG. 2;

FIG. 4 is a partial section view similar to FIG. 3; and

FIG. 5 is an elevation view of the interchanger of FIG. 1 illustrating an aspect of the invention.

Referring now to the drawings, wherein the showings are for the purpose of illustrating the preferred embodiment of the invention only and not for the purpose of limiting the same, the figures show a steering interchanger A which includes steering arms B and C adapted to be connected to control stations remote from the interchanger, and a mounting bracket D (FIG. 3) by which the steering interchanger is mounted on the transom or hull floor of a boat. Also part of the interchanger is a steering lever E adapted to be connected to the steering means for a boat (such as a tiller arm) the steering arms and lever being mounted upon a rotatable body F rotatable within the mounting bracket D.

United States Pat. No. 3,128,738 describes a steering interchanger of which the present invention constitutes an improvement. As with the interchanger of said prior patent, the body F is an elongated generally cylindrical member comprising a center portion **12** between axially aligned cylindrical extensions **14** and **16** of reduced diameter. The extensions **14**, which for purposes of this description, will be termed the upper extension, supports the steering arms B and C (termed upper and lower arms), the latter being elongated members (generally similar in shape) provided with bulbous end portions **18** which are hollowed out to define openings **20**. The openings are dimensioned to provide inner surfaces **22** which are cylindrical in part to encompass and ride upon the outer cylindrical surface **24** of the extension **14**.

The steering arms are adjacent to each other and aligned in generally the same direction, but are rotatable in separate upper and lower planes. They are held onto the cylindrical extension **14** by means of a collar **26** threaded onto the upper end **28** of the extension **14**, the collar being held onto the extension by means of a set screw **30**, or other means. Spaced from the end **28**, an annular surface **32** (FIG. 3) of the mounting bracket assembly D contacts the lower arm cooperating with the collar **26** to locate the arms axially on the extension **14**.

Within the extension **14**, an axially drilled bore **34** is provided dimensioned to accommodate a piston member **36** movable up-and-down axially within the bore, the piston member carrying and moving with it an engaging pin means generally indicated as item **38**. In addition to riding with the piston member **36**, the pin means extends through and is guided by opposed elongated slots **40** and **42** (FIG. 2), in the wall of the rotatable body upper end **14**, the slots being parallel with the axis of the end **14** and movement of the piston member.

In the inner surfaces **22** of the encompassing arm portion **18**, of arms B and C, are opposed elongated recesses **44** and **46**, extending from the bottom to top sides of each of the arms, the recesses being engaged by the opposite ends **48** and **50** of the pin means **38** (FIG. 2). In this respect, the longitudinal length of each of the slots **40** and **42** is sufficient to permit shifting the engaging pin means from the recesses of one arm to those of the other. This can be seen in FIGS. 3 and 4, where in FIG. 3 the pin means **38** engages the recesses of the lower arm C, and in FIG. 4, the recesses of the upper arm B. It is apparent, referring to these figures, that the arms B and C are freely rotatable on the body extensions **14**, except when engaged by the pin means, and can be so engaged when the slots **40** and **42** of the extension **14** are aligned with the opposed arm recesses **44** and **46**.

To accommodate the pin means **38**, the piston member **36** is provided with a cylindrical, straight bore **52** which is at right angles to the direction of movement of the piston member, and through which the pin means extends. Connected to the piston member, to the upper end **54** thereof, is a cable pin **56** threaded into the piston. The cable pin is aligned with the direction of movement of the piston, and connected to a cable **58**, this cable leading to one or more control members **60** positioned at one or both of the steering stations. The control members are provided with lever arms adapted for translational movement of the control cable **58**, the latter being slidable within a sheath **62** connected to bracket **64** mounted on the interchanger collar **26**.

By means of the control members **60**, the piston member **36** of the interchanger is axially moved within the bore **34** of the interchanger body, thereby engaging one or the other of the arms B and C with the rotatable body F.

The interchanger body lower extension **16** comprises a cylindrical external surface on which steering lever E is keyed by a locking pin **66**, FIG. 3. It is clear that when one or the other of the arms B and C is rotatably actuated, the steering lever E will also turn or rotate. Following the teachings of prior Pat. No. 3,128,738, both the steering arms, at the ends **68** remote from the interchanger, are connected with steering cables leading to control stations of the boat, for instance, two control stations, one on the main deck, and the other on a flying bridge of the boat. The end **70** of the steering lever E in turn is connected by a suitable linkage to one or more rudder posts or to the steering arms of one or more inboard-outboard drives, or other units.

It is apparent that the forces exerted on the steering lever E can be very high, which forces are transmitted through the interchanger body **12** to the steering arms B and C. In the interchanger illustrated in Pat. No. 3,128,738, the pin means, connecting one or the other of the interchanger arms with the interchanger rotatable body, was comprised of a single long cylindrical pin which engaged at its opposite ends the opposed recesses of the steering arms. The influence of a clockwise or counter-clockwise force exerted by the lever arm E (and resulting forces exerted by the arms B and C) would cause the pin to engage one recess along one of its sides and the other recess along its opposite side, this engagement during movement of the pin axially from one arm to the other tending to rotate the pin in opposite clockwise and counter-clockwise directions. The result was that the pin simply slid along the arm recesses during such axial movement, and also slidingly engaged the guide slots of the interchanger body. In the face of the high torque forces experienced with modern high powered inboard-outboard and other drives, the resulting friction often made it impossible to shift the interchanger from one of the control stations to the other.

In accordance with the present invention, the pin means **38** comprises axially aligned abutting cylindrical halves **72** and **74** each of which extends from about the axis or center of the piston member **36** to the base of an opposed arm recess. The end portions **48** and **50** of the pin halves are rounded as shown to seat in the half-round arm recesses, and the opposite inner abutting ends **76** and **78**, located adjacent the axis of the piston **36**, are tapered or

conical. In this way, the two pin halves abut each other with a minimum amount of surface in contact.

Also in accordance with the invention, the pin halves are encompassed adjacent their inner ends **76** and **78**, each by a pair of cylindrical anti-friction sleeve members **80–84**, of the type including cylindrical roller bearing members, ball bearing members, and metallic bushings; although preferably the members are cylindrical needle bearings as shown. Two of the cylindrical needle bearings **80** and **82** are seated in the cylindrical bore **52** of the piston member, the opposed slots **40** and **42** in the body extension **14** being dimensioned to accommodate the other needle bearings **84** and **86**, encompassing the pin halves in the space between the inner and outer surfaces of the extension. This arrangement permits the pin halves to roll along the recesses as they are shifted from engagement with one steering arm to engagement with the other steering arm. The two pin halves are maintained in engagement with the recesses of the steering arms by being abutted together, the minimal surfaces of contact between the pin halves permitting one pin half to rotate in one direction, and the other to rotate in the opposite direction, the direction of rotation depending upon the directions of force applied by the steering arms and lever to the interchanger body.

During shifting of the pin halves between arms, the outer set of needle bearings **84** and **86** move along the guide slots **40** and **42** of the interchanger body with the pin halves. Preferably, the guide slots are dimensioned so that the needle bearings simply roll along a surface of the guide slots for minimum resistance to movement.

As illustrated in FIG. 3, the mounting bracket D for the interchanger body F is substantially U-shaped, comprising upper and lower flanges **88** and **90** extending at right angles with respect to a rear wall **92**. The bracket is substantially open between the flanges, except for the rear wall, to accommodate pivotal movement of the steering lever E in a plane intermediate the flanges. To retain the interchanger body within the bracket, the two flanges **88** and **90** define aligned openings **94** and **96** provided with tapered roller bearing sets **98** and **102**, the two tapered bearing sets defining opposed bearing races **104** and **106** which are angled inwardly towards each other and towards the pivot axis of the steering lever. The lower race **106** is seated in an annular seat **108** of the lower flange **90**, and engages a narrow neck **110** of the interchanger body, bearing generally inwardly and upwardly against the neck. The upper race **104** bears downwardly and inwardly against a shoulder **112** of the body, and is held in position within the opening **94** by means of a cover plate **114** via an annular lip **116** of the plate bearing against the upper roller bearing housing. The cover plate is secured to the interchanger bracket upper flange **88** by means of a plurality of annularly spaced screws. By tightening the screws, and the use of shims, or other means, the lip **116** of the cover plate can be made to press against the upper bearing housing whatever degree is necessary, to take-up play in the bearing sets.

FIGS. 3 and 5 illustrate the versatility of the interchanger. The mounting bracket D can be mounted to the floor of the boat hull, by placing the lower flange **90** of the bracket against the floor, or can be mounted on the transom of the boat by placing the rear wall **92** of the bracket against the transom. In the former case, the steering arms B and C may be oriented with respect to the interchanger bracket and body in the positions shown in FIG. 3, in the same direction with respect to the steering lever E, or can be reversed in direction to extend at 180° with respect to orientation of the steering lever. Various other orientations of the steering arms and steering lever can be obtained by drilling the hole **120** (in the rotatable body) for the locking pin **66** of the steering lever E at different angles with respect to the orientation of the steering arms B and C.

The above clearly creates a very flexible and universal interchanger which can be used in different makes of boats, with different types of drives. Particularly with respect to the latter, in that rotation in the interchanger is virtually friction free, use of the interchanger is not limited to smaller horsepowers, or restricted from use with certain high torque drives. With respect to both, the various positions and orientations for the interchanger can be achieved without the need for auxiliary mounting brackets.

Further the roller bearing mountings for the interchanger body, in the mounting bracket, make it possible to apply eccentric loads on the steering lever E at angles with respect to the plane of movement of the steering lever, i.e., up or down with respect to said plane of movement, to further increase the versatility and universal applicability of the interchanger.

The tapered bearings also permit take-up of wear in the interchanger reducing back-lash which may occur after substantial use.

Although the invention has been described with reference to specific embodiments, variations within the scope of the following claims will be apparent to those skilled in the art.

What is claimed is:

1. A steering interchanger comprising:
- a rotatable body;
- a pair of adjacent steering arms rotatably supported on said body;
- a pin movable in said body between said steering arms adapted to engage torque transmitting cooperating surfaces of one or the other of said arms;
- means for moving said pin; and
- cylindrical anti-friction means housing said pin permitting rolling movement of the pin relative to said cooperating surfaces.

2. The interchanger of claim **1** wherein said pin comprises axially aligned cylindrical halves, said steering arms being oscillatable in separate planes about said body axis, said cooperating surfaces defining opposed recesses in each arm in which said cylindrical halves roll.

3. A steering interchanger comprising:
- a rotatable body;
- a pair of adjacent steering arms oscillatably supported on said body in separate parallel planes;
- piston means axially movable in a path defined by said body between the planes of said arms;
- cooperating oppositely facing recesses in said steering arms;
- axially aligned abutting cylindrical pin halves adapted to extend between said recesses, said body defining opposed longitudinally extending slots and said piston means defining a laterally extending bore, said slots and bore being alignable with said recesses to accommodate said pin halves;
- rolling bearing means housing said pin halves and encompassed by said piston means and rotatable body.

4. A steering interchanger comprising:
- a rotatable body including an outer cylindrical surface and an inner axially aligned bore;
- a pair of adjacent steering arms oscillatable in parallel planes at right angles to said body axis, said arms comprising end portions encompassing and in sliding engagement with said body outer surface;
- opposed elongated, longitudinally extending apertures defined by said body, said arm cooperating surfaces defining opposed recesses positionable opposite said apertures;
- piston means movable in said bore, said piston means defining a transversely extending bore positionable in alignment with said apertures;
- means to move said piston means;
- a pair of abutting, cylindrical, pin halves in said piston means bore extending through said apertures and engaging said opposed recesses;
- cylindrical needle bearings housing said pin halves, said

bearings being contained within said opposed apertures and said piston means bore.

5. The interchanger of claim 4 wherein said pin halves abutting ends are tapered inwardly so that the surface area of contact between said pin halves is minimal.

6. A steering interchanger including:

a rotatable body;

a pair of adjacent steering arms rotatably supported on said body;

a key movable between said steering arms adapted to engage one or the other of said arms;

piston means movable in said body to move said key;

said key comprising a cylindrical surface rollingly engaging said arms; and

rolling bearing means between said key and said body and piston means to permit said key to roll relative thereto.

7. A steering interchanger according to claim 6 including a mounting bracket comprising at least two surfaces at right angles to each other adapted for mounting said rotatable body, said arms being oscillatable about said body in separate parallel planes.

8. A steering interchanger according to claim 7 wherein said mounting bracket is U-shaped including parallel upper and lower flanges, a portion of said rotatable body extending between said upper and lower flanges; annular bearing means contained by said flanges engaging said portion whereby the axis of rotation of said body is perpendicular to the plane of said flanges; said bearing means being in parallel planes at right angles to said axis of rotation and including bearing races which are angled with respect to said axis each lying in a conical area which diverges in the direction of the other race; further including a steering lever connected to said portion oscillatable in a plane parallel with but between the planes of said upper and lower flanges.

9. A steering interchanger comprising:

a rotatable body;

a pair of adjacent steering arms rotatably supported on said body;

a pair of axially aligned cylindrical pin halves movable in said body between said steering arms adapted to engage opposed torque transmitting cooperating surfaces of one or the other of said arms; and

means for moving said pin halves between said arms.

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MILTON KAUFMAN, Primary Examiner

U.S. Cl. X.R.

74—471; 114—146; 192—48.9