Aug. 11, 1964 J. F. MORSE 3,143,994

STEERING CONNECTION FOR OUTBOARD MOTORS

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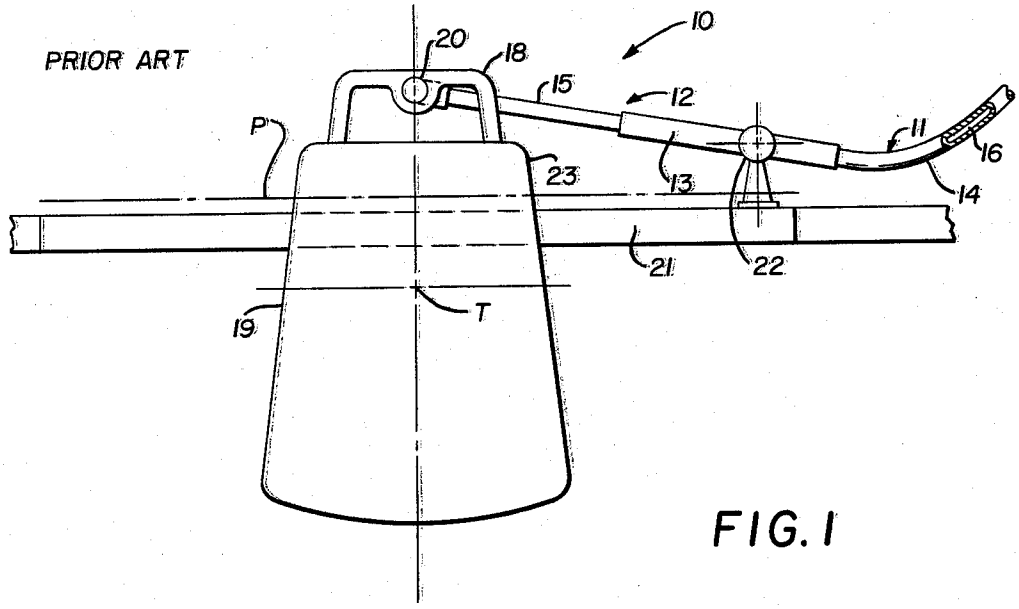


FIG. 1

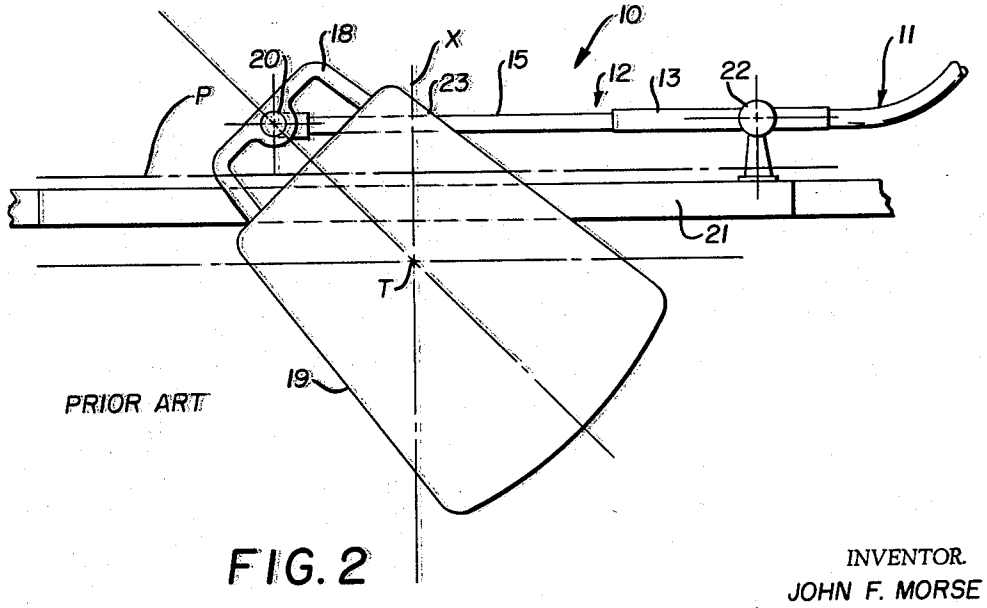


FIG. 2

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STEERING CONNECTION FOR OUTBOARD MOTORS

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PRIOR ART

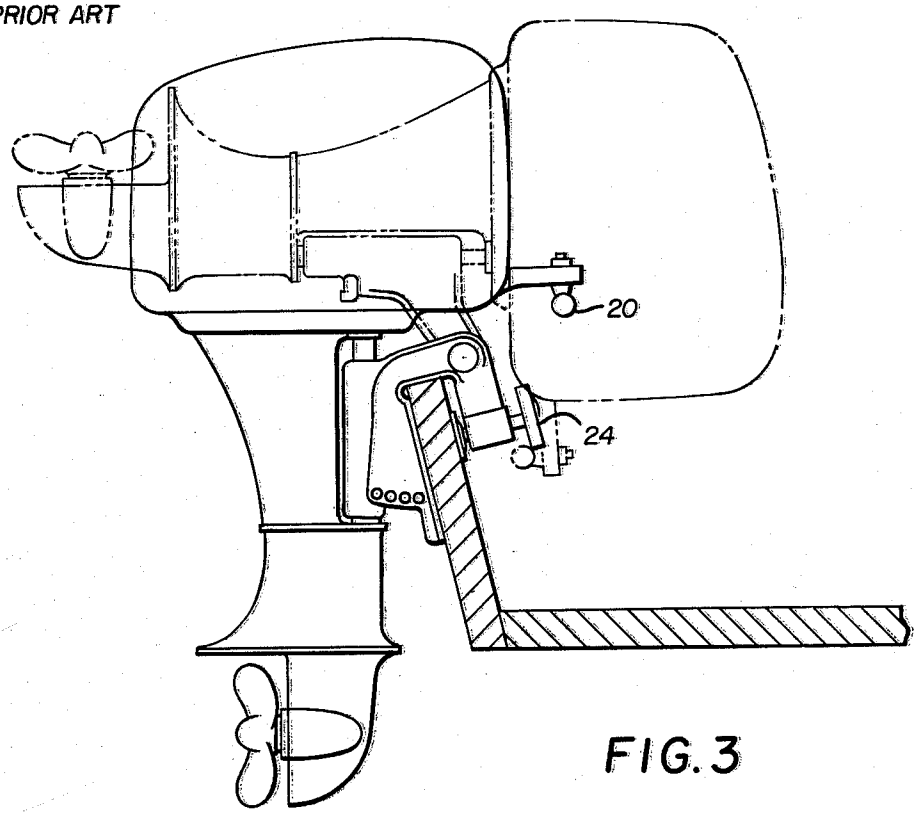


FIG. 3

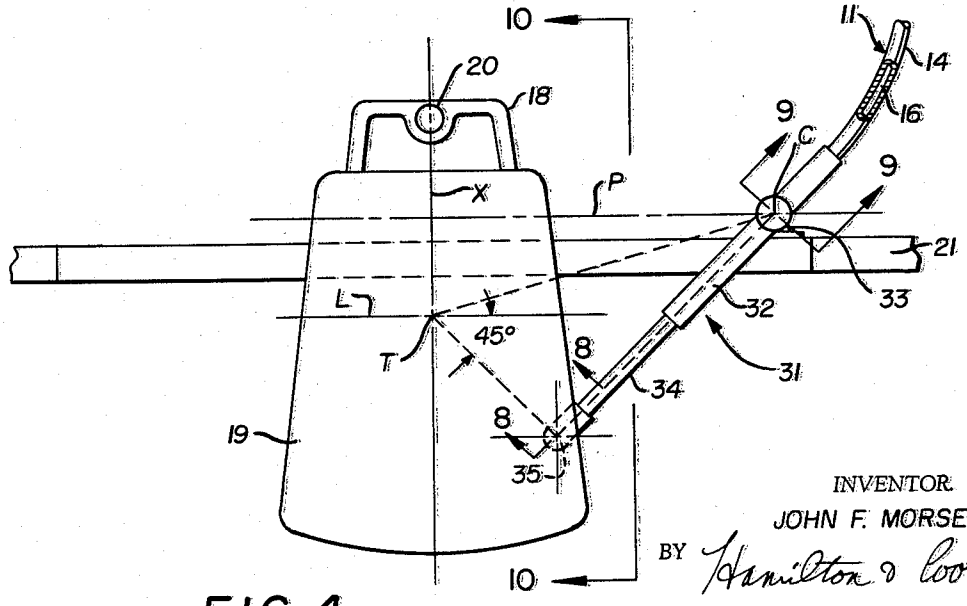


FIG. 4

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STEERING CONNECTION FOR OUTBOARD MOTORS

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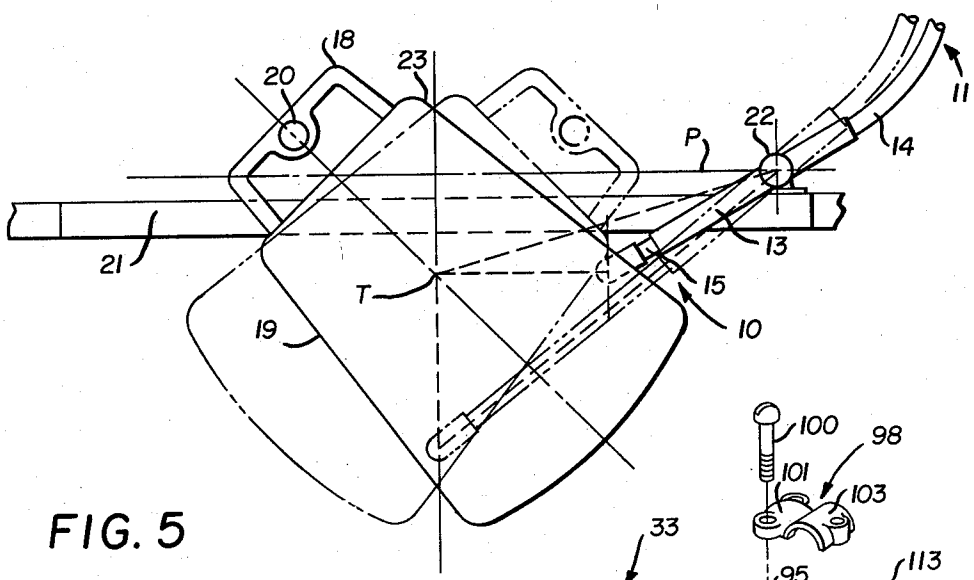


FIG. 5

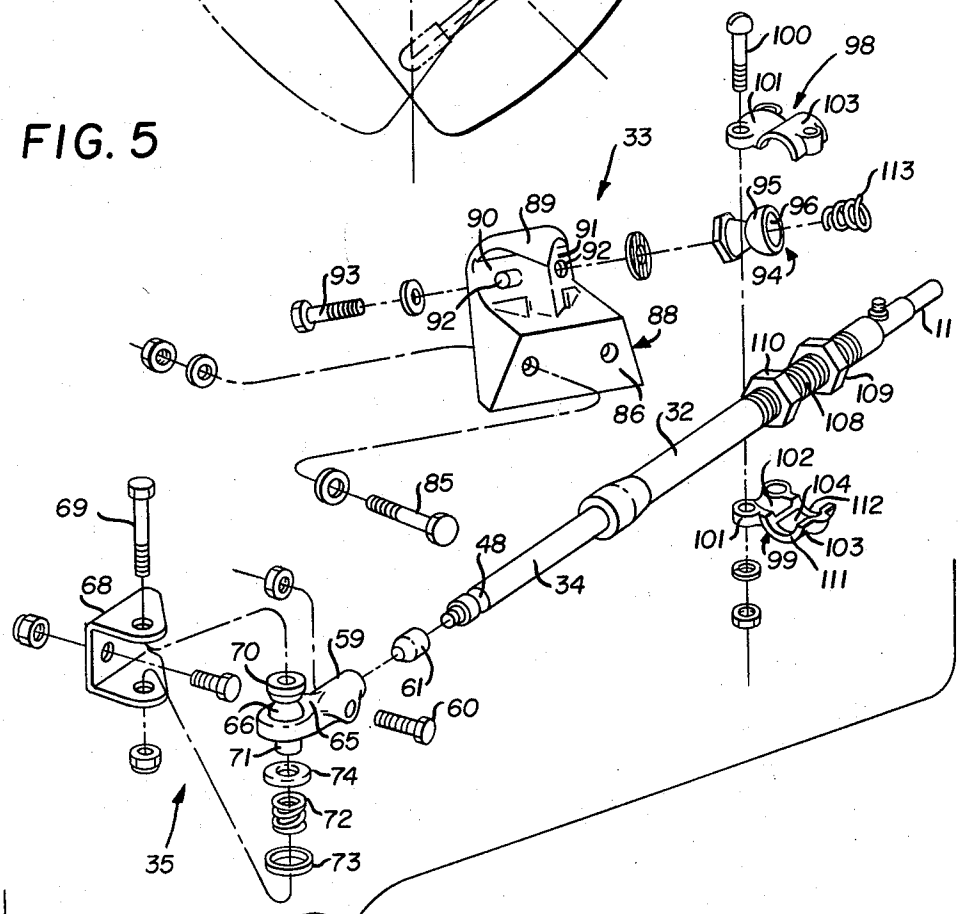


FIG. 6

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STEERING CONNECTION FOR OUTBOARD MOTORS

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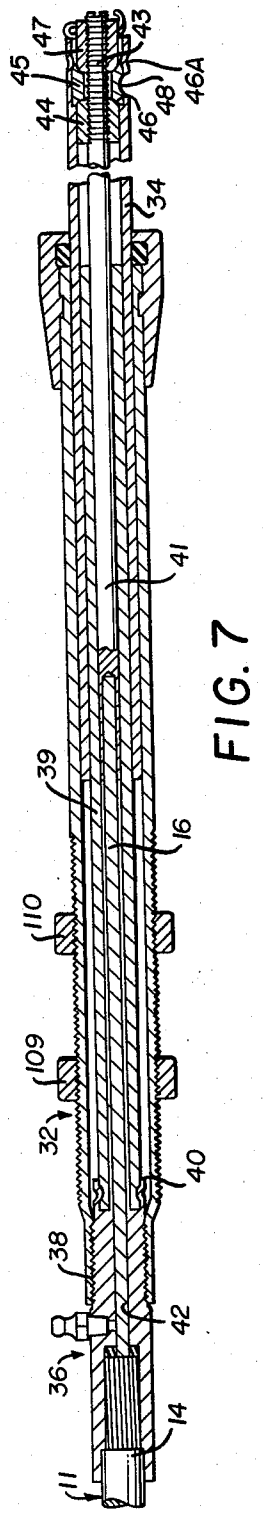


FIG. 7

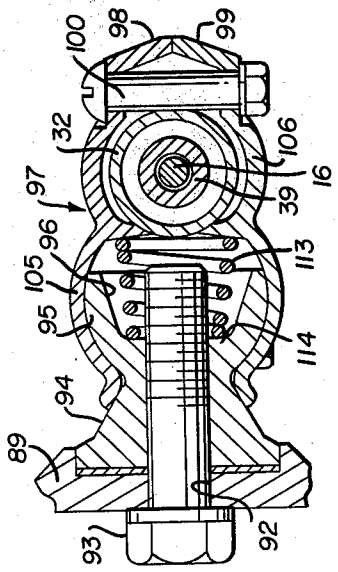


FIG. 9

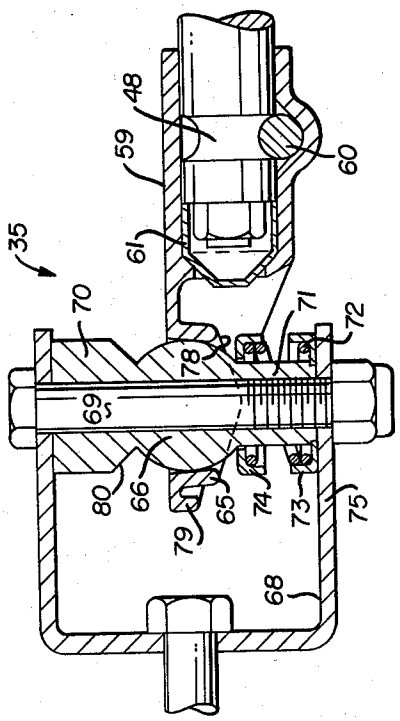


FIG. 8

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STEERING CONNECTION FOR OUTBOARD MOTORS

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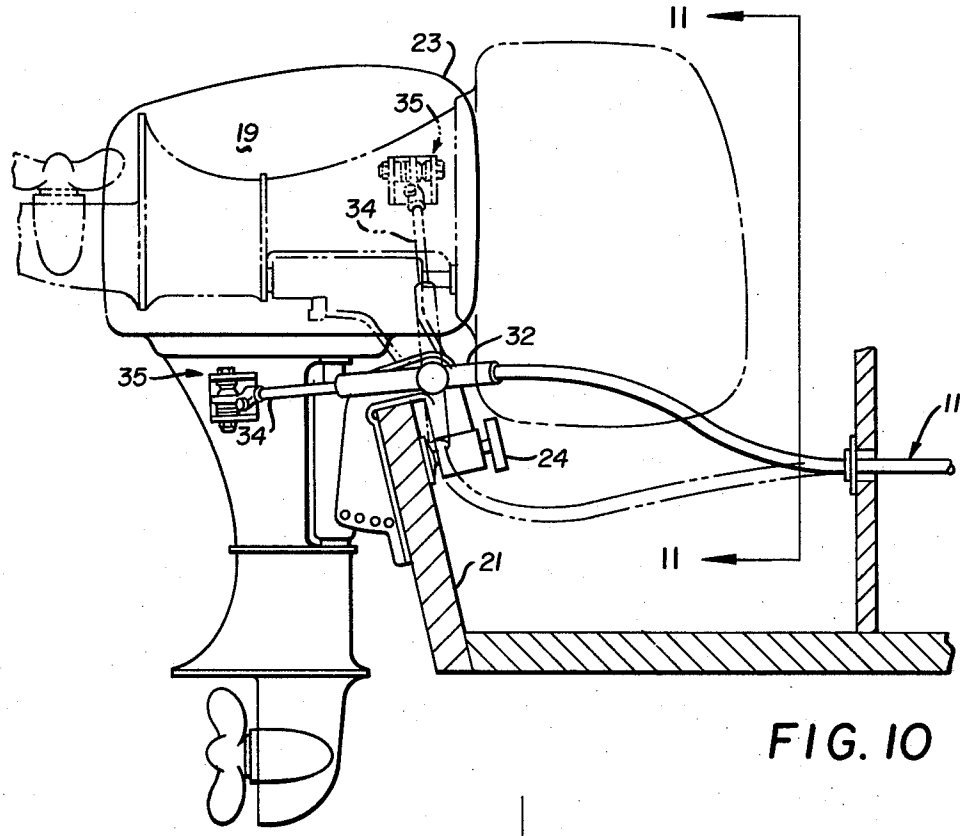


FIG. 10

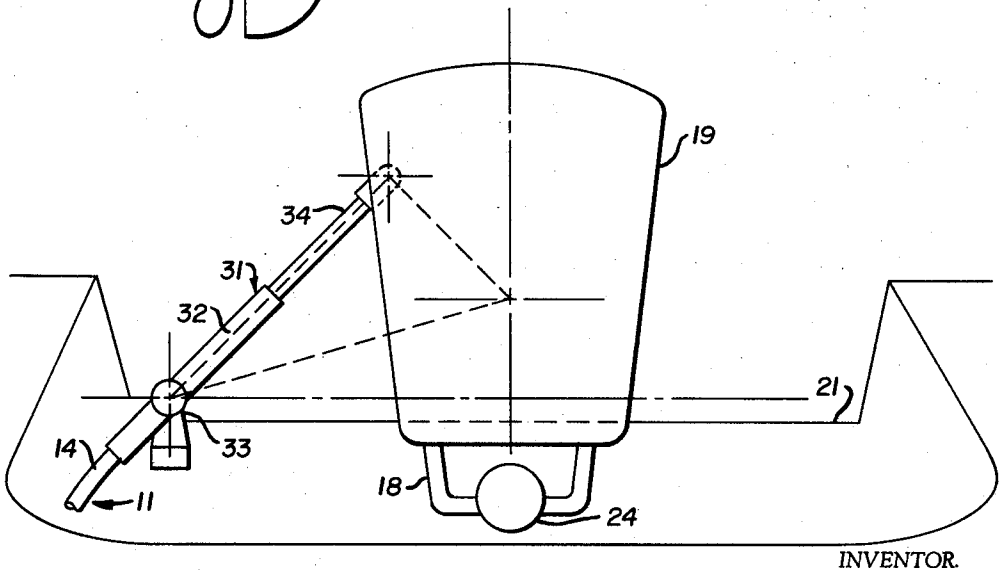


FIG. 11

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3,143,994

STEERING CONNECTION FOR OUTBOARD MOTORS

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Filed Jan. 9, 1963, Ser. No. 250,260
2 Claims. (Cl. 115—18)

The present invention relates generally to steering mechanisms. More particularly, the present invention relates to an apparatus and system for steering an outboard motor. Specifically, the present invention relates to an apparatus and system for efficiently connecting a mechanical motion transmitting device of the push-pull cable variety to an outboard motor.

Marine steering assemblies for years have conventionally utilized rope and pulley or other "balanced" remote control systems. "Balanced" remote control systems are almost as old as ships themselves and, when used as steering mechanisms, have traditionally comprised a wheel and shaft with a rope drum at the steering station to provide the required movement of the two ropes leading from the drum to the driven component and connected thereto in opposition. The opposition of the connection to the driven component and the appellation "balanced system" appear quite appropriate when it is realized that the mechanical motion transmitting ropes, or cables, must form a closed system because of their inability to relay mechanical motion by other than tensile stresses.

These balanced systems have been widely used to steer outboard motors. The early, small horsepower outboard motors were equipped with a carrying handle for the purpose of providing a suitable means by which the motor could be grasped for carrying while not attached to the boat. For motors up to about ten horsepower the carrying handle is very satisfactory, but with the higher horsepower-higher weight motors of today, the handle is impracticel for carrying the motor. These larger motors are now supplied with lifting rings or other forms of top connectors to facilitate handling of the motors by cranes or other mechanical lifting devices. Nevertheless, the physical structure of the carrying handle is retained even in the largest of these motors. Now, however, the carrying handle is retained because it provides a convenient point for connecting the opposed cables, i.e., the tiller ropes, of a balanced steering system. The flexibility of the tiller ropes allows them to be easily displaced should they physically conflict with any portion of the motor as it moves through its turning and tilt-up ranges.

However, a balanced steering system is quite bulky, cumbersome, expensive to install, readily subject to interference by exterior objects. Moreover, any misalignment between the guiding pulleys, rope drum, carrying handle and any of the other components can cause excessive binding and wear to the system.

The advent of the push-pull control cable, an example of which can be found in the applicant's prior U.S. Patent No. 3,013,443, provided in a single cable the necessary structure for effecting remote control by the application of either tensile or compressive forces. The push-pull cable thus provides a transfer device which overcomes the difficulties incident to balanced systems, and is particularly easy to install in a conventional boat, either during or after construction of the boat, without requiring specialized engineering or mechanical ability.

Actuation of the core of the push-pull cable, however, requires something more than the prior rope drum of the balanced system at the steering station. The applicant's copending application, Serial No. 225,088, filed September 20, 1962, discloses an improved steering and motion transmitting mechanism employing a rack and cable assembly together with a steering head assembly for actuating the core of a push-pull cable to transmit mechanical motion.

When a push-pull cable is connected to the carrying handle of a motor in lieu of the flexible tiller ropes of the balanced system, several serious problems arise. Both loss in efficient steering control and, in many cases, physical damage either to the steering system or the outboard motor is incident to such a system.

Because the core of the push-pull cable transmits both tensile and compressive stresses, the connector assembly between the end of the core and the motor must include a telescopically guided rigid member for transmitting both tensile and compressive forces exteriorly of the push-pull cable casing. If this rigid member is connected to the carrying handle, as it has heretofore been, the rigid member may frequently conflict with the structure of the motor both as the motor is attempted to be moved through its turning and tilting ranges. Such conflict can cause severe damage to both the motor and steering mechanism. Damage to the motor generally occurs by way of breaking the carrying handle, damaging or breaking the fuel connections, and/or damage to the motor base plate or shroud. Damage to the steering mechanism generally involves a bending of the telescopically guided rigid member. Because of the relatively close tolerances necessary for an efficient connector assembly, such bending results in binding or a complete jamming of the steering assembly.

Moreover, if the push-pull system is connected to the carrying handle of the motor, as was the balanced system, there is a serious loss in the steerable range of the motor. There is a long radius between the turning axis of the motor and the carrying handle. This long radius was advantageous to the balanced system, because it provided a mechanical advantage for the turning of the motor, thus lessening the necessary tensile stress on the tiller ropes of the balanced system to turn the motor. Proportionate to this increased mechanical advantage there is also an increase in the length of the arc through which the carrying handle must move to effect a rotation of the motor about its turning axis. Push-pull cable steering systems, because of installation and space limitations on most boats adapted for outboard motors, are limited in the available effective displacement of the telescopically guided rigid member. For the telescopic rigid member to operate most effectively the overall length of the rigid member required, when the rigid member is fully extended, is approximately two and one half times the length of the displacement travel. The installation and space requirements thus limits displacement of the rigid member to approximately eight or nine inches of travel in most boats accommodating outboard motors. This restricted travel range, in conjunction with the long radius from the turning axis of the motor to the connection point on the carrying handle, results in an undesirable reduction of the turning range of the motor.

Another spacing difficulty is encountered when a push-pull system is to operate twin outboards via the carrying handle connection. Generally, the push-pull system is connected to one of the twin outboard motors, and a tie rod is fastened between the two motors to steer the second contemporaneously with steerage of the first. Because of the spacing requirements between two large outboard motors, most boats will not have sufficient room between the one motor and the inside of the hull to allow for the relatively long rigid end element of the push-pull cable and the required radius of bend of the flexible portion of the cable as it is directed forward to the steering wheel.

A further difficulty has been the fact that the telescoping end elements of the push-pull cable must slope upwardly from the cable casing connection point at the

transom to the connection on the carrying handle of the engine. This places the cable in a position that encourages the entrance of water and prevents its natural drainage from the internal parts of the cable assembly. The retention of water within the end fittings and cable casing is intolerable because of the resulting corrosion, especially in salt water environments.

Further difficulties have been that with the use of other known push-pull systems the turning ratio of the motor with respect to wheel rotation has been unequal with respect to right and left turns and that, if the outboard motor struck an object under the water which suddenly tilted the motor, the wheel would spin violently out of the helmsman's grasp.

It is therefore an object of the present invention to provide a steering system employing a push-pull cable whereby the full turning range of the motor can be assured.

It is another object of the present invention to provide a steering system employing a push-pull cable in which the steering system provides a substantially constant ratio between turning of the motor and rotation of the wheel in either direction from the dead ahead position.

It is a further object of the present invention to provide a steering system employing a push-pull cable in which there is no physical interference between the motor and the control cable through the full turn and tilt ranges of the motor.

It is a further object of the present invention to provide a steering system employing a push-pull cable which is so balanced that any titling of the motor, irrespective of the degree at which the motor is turned, will not displace the core of the push-pull cable, and therefore not impart any motion to the steering wheel as a result of tilting of the motor.

It is a still further object of the present invention to provide a steering system employing a push-pull cable which will permit a wider spacing of twin motors within a given hull width or a narrower hull width for a given motor spacing.

It is a still further object of the present invention to provide a steering system employing a push-pull cable in which the connection of the motor is such that the end of the cable can be downwardly inclined to allow self draining and thereby prevent retention of water within the end fittings.

These and other objects which will become apparent from the following specification are accomplished by means hereinafter described and claimed.

One preferred embodiment is shown by way of example in the accompanying drawings band hereinafter described in detail without attempting to show all of the various forms and modifications in which the invention might be embodied; the invention being measured by the appended claims and not by the details of the specification.

In the drawings:

FIG. 1 is a schematic top plan view depicting a prior art steering system with a push-pull cable attached to the carrying handle of an outboard motor which is represented in the dead ahead position;

FIG. 2 is a view similar to FIG. 1 with the motor depicted as being turned to its full right turn position;

FIG. 3 is a side elevation taken substantially on line 3—3 of FIG. 1 and showing the full tilted position of the motor, in phantom;

FIG. 4 is a schematic top plan similar to FIG. 1 showing the improved steering system of the present invention with the motor in dead ahead position;

FIG. 5 is a view similar to view 4 with the motor represented in full right turn position and, in phantom, in full left turn position;

FIG. 6 is an exploded perspective of the connector assembly for attaching the core of a push-pull cable to the motor according to the concept of the present invention;

FIG. 7 is a longitudinal section through the connector assembly depicted in the exploded perspective of FIG. 6;

FIG. 8 is an enlarged cross section taken substantially on line 8—8 of FIG. 4;

FIG. 9 is an enlarged cross section taken substantially on line 9—9 of FIG. 4;

FIG. 10 is a side elevation taken substantially on line 10—10 of FIG. 4 and showing the full tilted position of the motor, in phantom; and,

FIG. 11 is a view looking horizontally aft depicting the motor in full tilted position as taken substantially on line 11—11 of FIG. 10.

In general, an improved steering connection for outboard motors according to the present invention comprises a telescopically extensible connector assembly which mechanically links the core of the push-pull cable to the motor. This connector assembly is connected to the casing of a push-pull cable by a guiding member which is also anchored to the boat. Within the guiding member is a telescopically reciprocable rigid cable ram member, one end of which is connected to the core of the push-pull cable and the other end of which is attached to the motor.

The connection of the guide member to the boat and the ram member to the motor are both ball-socket type connections which are required to be particularly placed with relationship to the turning and tilting axes of the motor, as will be hereinafter described in detail.

As shown in FIGS. 1–3 of the drawings, the prior art steering assembly, indicated generally by the numeral 10, comprised a push-pull cable 11 terminating in an extensibly controllable connector means 12. One portion of this connector means 12 is a guide 13 which is attached to the casing 14 of push-pull cable 11 and pivotally mounted on the boat. The second portion of the connector means 12 is extensor rod, or ram, 15 connected at one end to the core of the push-pull cable and at the other end to the carrying handle 18 of the motor 19, as by the ball 20 dependingly attached to the handle 18.

The motor 19 is mounted on the transom 21 of the boat in the usual fashion and has a turning axis, indicated by the letter T and a pivotal tilt-up axis, indicated by the letter P.

When utilizing this representative prior art mounting system the motor 19 can not be turned completely through its turning range. When the pivotal mounting 22 of the guide is placed on the side of the motor, as shown in FIGS. 1 and 2, an attempt to turn the motor to the hard right position may create a conflict between the ram 15 and the shroud 23 of the motor. The ram 15 is prevented from assuming the position shown in dotted lines in FIG. 2 because of the interference of the ram 15 with the shroud 23. This reduction in steering range is not only annoying, but can be extremely hazardous to the operation of the boat. Moreover, severe damage to the motor and/or steering system can be occasioned by this interference. Because of the considerable weight of many present day outboard motors, the motor can develop considerable pressure as it rolls to one side or the other during highway trailering, and thereby bend or break, the shroud or connector assembly.

Similarly, the pivotal connecting ball 20 and ram 15 conflictingly engage the transom clamps 24 when the motor is in its tilted position. Here too, serious damage can occur. The length of the outboard motor below the tilt-up axis P allows considerable amount of leverage to develop when the motor strikes an object beneath the surface of the water. When the motor is thus forced to the maximum tilt-up position, as represented in FIG. 3, severe structural damage can occur to conflicting parts.

Moreover, coincident with this unintentional tilt-up, the distance between the pivotal mounting 22 and the ball connection 20 in some prior art systems will also suddenly change. This results in an induced rotation of the steering wheel which can be sufficiently violent to spin the wheel out of the grasp of the operator, or even physically injure the operator.

The construction of the improved steering system disclosed herein obviates the prior art steering system deficiences.

The schematic representation of the improved steering system is depicted in FIG. 4. The improved system comprises an improved connector assembly, indicated generally by the numeral **31**, which mechanically links the push-pull cable **11** to the motor **19** also mounted on the transom **21** of the boat in customary fashion.

The improved connector assembly **31** utilizes a guide member **32** which connects the casing **14** of push-pull cable **11** to the transom **21** by a pivotal transom, or base, connector assembly **33**. A ram **34** is telescopically guided for reciprocal movement in guide **32**. One end of the ram **34** is connected to the core **16** of the push-pull cable and the other end is connected to the motor **19** by the terminal assembly **35**. However, it is important to notice that the improved system does not employ the ball **20** on the carrying handle **18**. Instead, the terminal assembly **35** is attached either to the motor housing or the shroud at a point approximately 45° to the rear of the turning axis T of the motor. As can be readily observed in FIG. 4, the rearward angle is measured from a reference line L oriented transversely of the dead ahead reference line X.

The transom connector assembly **33** is mounted on the transom **21** such that the pivot point C of the connector assembly falls in close proximity to the tilt-up axis P. The exact position of the pivot point C is determined such that the angle between a line through the turning axis T of the motor and the terminal assembly **35** and the center line of the connector assembly **31** is approximately 90° when the motor is in the dead ahead position, represented in FIG. 4. The angular relationship of the center line of the connector assembly **31** to the center line of the boat, in this case and most single motor installations also the center, or dead ahead, line of the motor (both represented by line X), when the motor is in dead ahead position, is also 45°. This unique connection of the steering assembly to provide for particular triangulation of the terminal assembly **35** and the transom or base connector assembly **33** with respect to the turning and tilting axes, permits the telescopic elements of the push-pull cable to be positioned such that the steering assembly, or any part thereof, avoids any conflict with the motor through its entire turning and tilting ranges. The avoidance of conflict through the entire turning range is graphically depicted in FIGS. 5, 10 and 11. FIG. 5 represents a turning of the motor through its complete turning range without conflict between the steering mechanism and motor. FIGS. 10 and 11 similarly depict the tilting of the motor through its complete tilting range without conflict.

Moreover, the particularly defined construction permits the steering assembly to remain dynamically stable through the complete tilt-up range at any given point of the turning range. Hence, if the motor is unintentionally tilted, the steering wheel will not rotate regardless of the position of the motor with respect to the turning axis. Note that in the construction of the present invention the components maintain their relationship throughout the tilting range. This is evident by comparing FIGS. 4 and 11.

Furthermore, the construction of the improved steering assembly allows the terminal assembly **35** to be placed on a relatively short radius about the motor turning axis in order to achieve the full turning range of the motor with the relatively small displacement range of the push-pull cable core available with the telescopic connector assembly **31**.

To the particular construction is also attributable a constant ratio between the turning of the motor and rotation of the steering wheel on either side of the dead ahead position.

The preferred structural embodiment of the concept of the present invention is shown in FIGS. 6–9.

As best shown in FIG. 7, the push-pull cable **11** is supplied with an end fitting **36**. One end of fitting **36** is swaged onto the end of the cable casing **14**, and the other end is provided with threads **38** on the outer surface thereof. The guiding member **32** is secured to the cable, as being threaded onto the threads **38** on end fitting **36**.

An extension tube **39** is swivelly mounted into fitting **36**, as by the socket arrangement **40**. An end rod **41** is slidably received within extension tube **39** and is connected to the end of the core element **16** which extends through a longitudinal bore **42** provided through end fitting **36**. Extension tube **39** fits closely around the end rod **41** to guide the rod and prevent excessive deflection of that portion of the core **16** sliding therein when subjected to compressive forces. The ram **34** is connected to the end of rod **41**. To connect the ram **34** to the rod the outermost end of rod **41** has a threaded portion **43** on which is retained a hub **44**. The threaded portion **43** extends through the hub **44** and a bushing **45**. Bushing **45** is secured to the interior of ram **34** by a shoulder **46** and a crimp **46A** on the inner surface of ram **34**. A lock nut **47** on the threaded portion **43** completes the connection.

An annular, or at least partially annular, groove **48** is provided near the end of ram **34** and preferably radially of bushing **45**. The terminal assembly **35** is attached to the ram **34** by the annular groove **48**.

The terminal assembly **35**, as best shown in FIGS. 6 and 8, has a clevis **59** which engages the annular end of ram **34** and a pin, or bolt, **60** which extends through the clevis transversely of the ram **34** and engages the annular groove **48** to join the terminal assembly to the core **16** of the push-pull cable **11**.

An end seal, such as the plastic cup **41**, is fitted over the end of ram **34** and enclosed within clevis **59**. The seal cup **61** is lockingly retained between the ram **34** and the clevis **59**.

Extending outwardly of, and attached to, clevis **59** is a half socket **65**. The ball **66** is received in half socket **65** and is firmly attached to the motor bracket **68**, as by the bolt **69** extending through the ball **66** and the two mounting extensions **70** and **71**. The ball and socket are constantly biased into engagement by a helical compression spring **72** which encircles the mounting extension **71** of the ball **66** and seats opposed bearing cups **73** and **74**. These cups **73** and **74** are floatingly positioned about extension **71** and frictionally engage the socket **65** and one of the legs **75** of the mounting bracket **68**.

Extension **71** extends through a slot **78** in the half socket which limits the movement of the socket **65** with respect to the ball **66** to be transversely of the plane of the slot **78**. Moreover, this unidirictional relative motion of the socket with respect to the ball together with the rotatable mounting of ball **66** within the socket **65** provides a complee and unbinding connection between the ram **34** of the steering mechanism and the motor through the complete turning and tilting ranges.

A lip flange **79** on the periphery of the half socket **65** strengthens the socket and also limits the rotation thereof on ball **66** by contact with the limit shoulder **80** on extension **70**.

A transom, or base, connector assembly **33**, as best shown in FIGS. 6 and 9, is secured to the transom **21** by bolts **85** extending through the base flange **86** of the base bracket **88**.

The base bracket **88** also has a support flange **89** with angularly disposed, opposed faces **90** and **91**. Each face **90** and **91** has a bore **92** transversely therethrough whereby a bolt **93** can mount a ball swivel **94**. The ball portion **95** of swivel **94** is a hollow, semispherical structure which presents a cup-like interior **96**.

A swivel housing **97** comprises opposed identical segments **98** and **99** which are joined by a plurality of clamping bolts **100**. Each segment **98** and **99** has one portion **101** with a spherical inner surface **102** and a second portion **103** with a cylindrical inner surface **104**. These spherical surfaces **102** are of such dimension that when the two segments **98** and **99** are bolted together, a socket **105** is formed for engaging the ball portion **95** of swivel **94**. The cylindrical surfaces **104** are of such dimension that when the segments **98** and **99** are bolted together a sleeve **106** is formed which engages the outer surface of the guide **32**.

A portion of the outer surface of guide **32** is provided with threads **108** on which turn two lock nuts **109** and **110**. These two lock nuts engage the opposite ends **111** and **112** on the sleeve **106** to maintain the axially adjustable position of the guide **32** with respect to the transom, or base, connector assembly **33**.

The sleeve thus engages the guide **32** at some point along its axial length, a volute compression spring **113** extends between the guide **32** and the base **114** of the cup-like interior **96** of ball **95**. This spring **113** biases the ball **95** into constant engagement with the socket **105** to permit a closer and stronger connection between the guide **32** and bracket **88**.

To install the improved steering connection of the present invention, the terminal assembly **35** is attached 45° rearwardly of the turning axis T of the motor **19** and the base bracket **88** is secured to the transom **21** of the boat such that the pivot point C formed by the swivel **94** and socket **105** lies in close proximity to the tilting axis P of the motor. The preferred position is that where a line extending through the turning axis T and the terminal assembly **35** will intersect a line through the pivot point C of the guide **32** to the base connector assembly **33** and the terminal assembly **35** is approximately 90° when the motor **19** is in the dead ahead position as shown in FIG. 4. The difference in the dimension between the pivot point of the guide **32** to the base connector assembly **33** and the terminal assembly **35** for various installations is accommodated by selective positioning of the lock nuts **109** and **110**.

When the steering connection for outboard motors is mounted in the above disclosed manner, the objects of the invention are accomplished.

What is claimed is:

1. An outboard motor steering connection for a steering system employing a push-pull cable to transmit steering forces to an outboard motor having a tilting axis and a turning axis about which said motor turns to either side of a dead ahead position for steering comprising, a connector assembly, said connector assembly having a guiding member and a rigid ram member telescopically reciprocable in said guiding member, said ram operatively connected to be telescopically reciprocated by said push-pull cable, a terminal assembly on said ram, said terminal assembly attached to said motor rearwardly of said turning axis, a mounting assembly pivotally attached to said guiding member, said mounting assembly constructed and arranged to fixedly position the pivot point of said guiding member in close proximity to the tilting axis of said motor and such that a line through said turning axis and said terminal assembly intersects a line through the pivotal attachment of said guiding member to said mounting assembly and said terminal assembly at approximately 90° when the motor is in dead ahead position.

2. An outboard motor steering connection for a steering system employing a push-pull cable to transmit steering forces to an outboard motor having a tilting axis and a turning axis about which said motor turns to either side of a dead ahead position for steering comprising, a connector assembly, said connector assembly having a guiding member and a rigid ram member telescopically reciprocable in said guiding member, said ram operatively connected to be telescopically reciprocated by said push-pull cable, a terminal assembly on said ram, said terminal assembly attached to said motor approximately 45° rearwardly of said turning axis, a mounting assembly pivotally attached to said guiding member, said mounting assembly constructed and arranged to fixedly position the pivot point of said sleeve in close proximity to the tilting axis of said motor and such that a line through said turning axis and said terminal assembly intersects a line through the pivotal attachment of said guiding member to said mounting assembly and said terminal assembly at approximately 90° when the motor is in dead ahead position.

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