Oct. 27, 1964 E. R. CASALE 3,154,047

TRANSMISSION

Filed Oct. 1, 1962 2 Sheets-Sheet 1

Fig. 1.

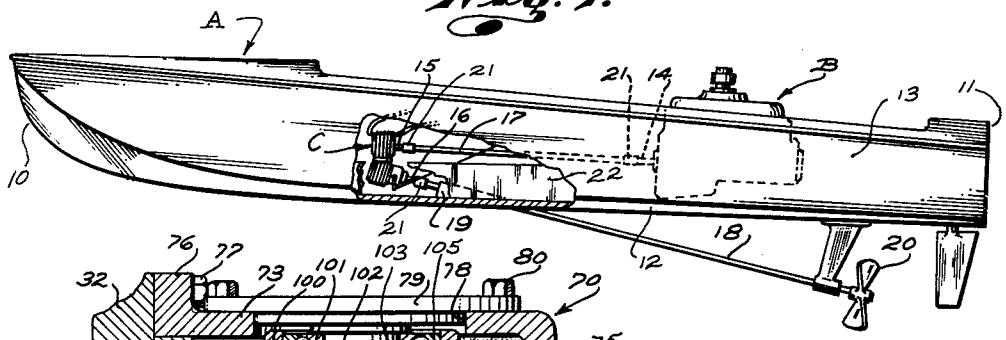


Fig. 3.

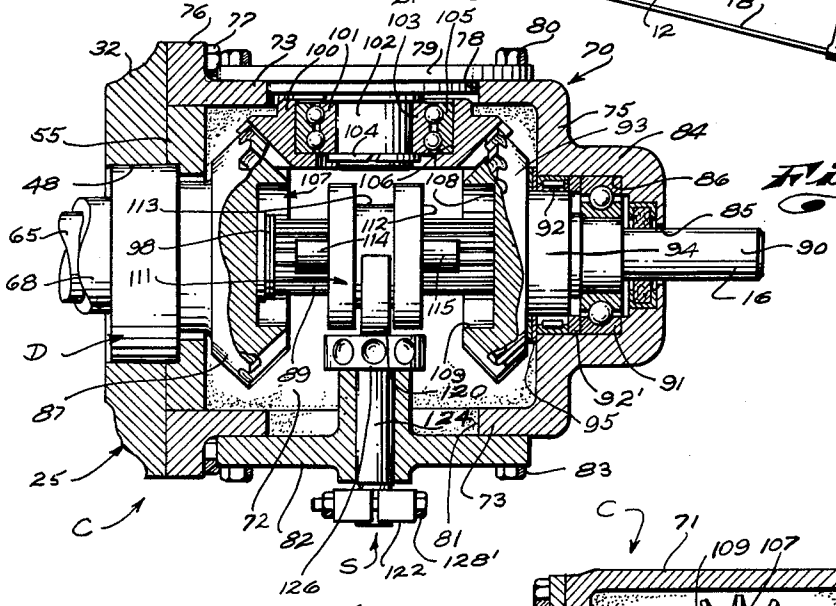


Fig. 5.

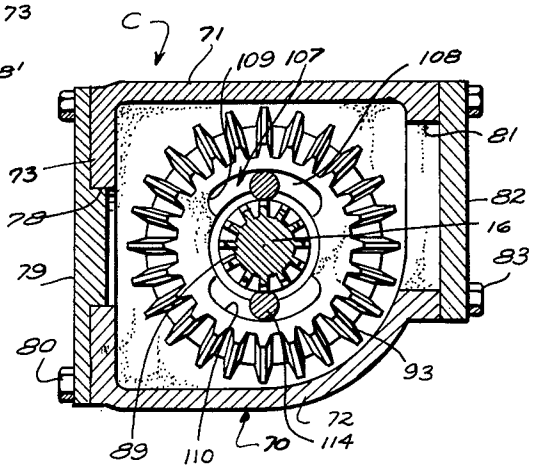
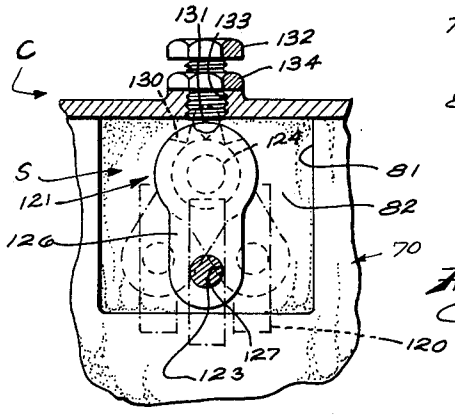


Fig. 6.



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TRANSMISSION

Filed Oct. 1, 1962 2 Sheets-Sheet 2

Fig. 2.

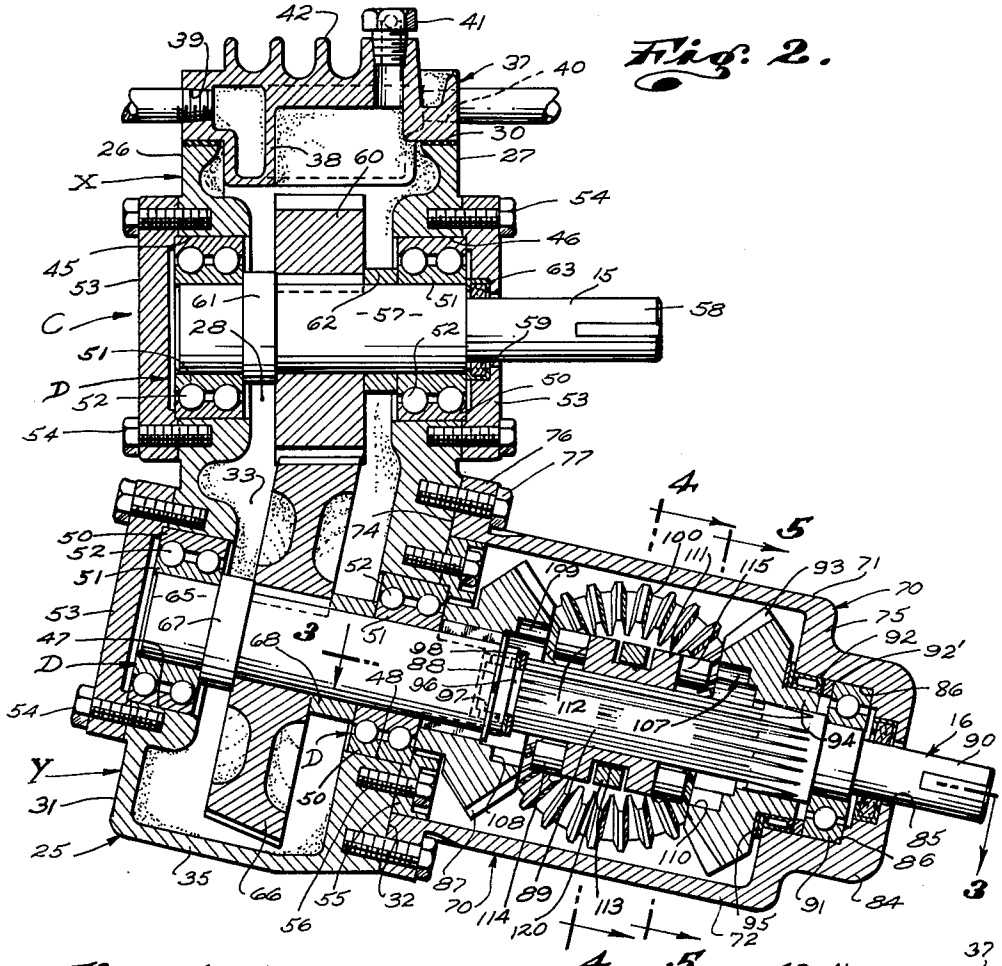


Fig. 4.

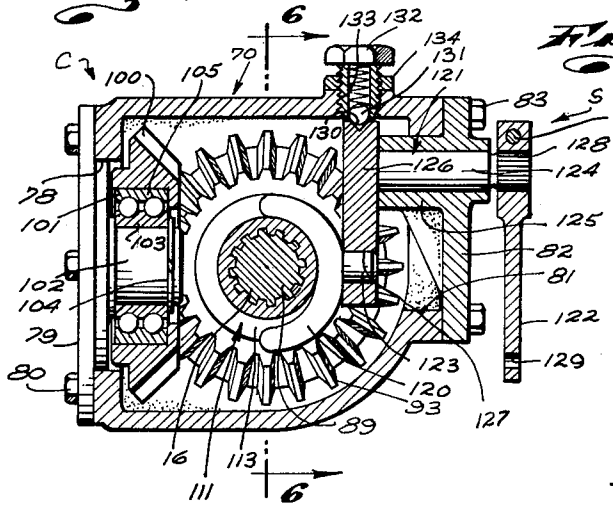
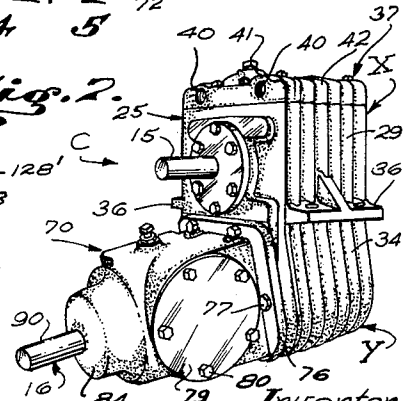


Fig. 2.



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United States Patent Office 3,154,047 Patented Oct. 27, 1964

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3,154,047

TRANSMISSION

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Filed Oct. 1, 1962, Ser. No. 227,418
6 Claims. (Cl. 115—34)

This invention relates to a transmission and is more particularly concerned with an improved V-type transmission for use in power boats.

In the past, it has been common practice, in power boats, to place the prime mover or engine substantially amidship with its central axis inclined downwardly and toward the stern of the boat, or rearwardly, at a suitable angle, for example, 10–15° and in axial alignment with the propeller shaft which extends downwardly and rearwardly from a point near the rear end of the engine, within the hull of the boat, through a suitable stuffing box in the bottom of the boat, and terminating below the stern or rear portion of the boat.

A suitable screw or propeller is fixed to the rear end of the propeller shaft. The ordinary marine drive such as set forth above further includes a transmission fixed to the rear end of the engine to form an integral part thereof and coupled with the propeller shaft. The transmission in such installations is a jaw or friction clutch type transmission having forward, neutral and reverse positions.

In recent years, the trend in power or motor boat design has been toward the establishment of high speed planing hulls as distinguished from slow, displacement hull designs. It has been found that in high speed planing hull designs, it is desirable and highly beneficial to place the mass of the engine in the rear of the hull, above the planing surface. So arranging the engine requires that a suitable drive means be provided between the engine at the rear of the boat to the forward, inboard end of the propeller shaft, which must remain in substantially the same relationship with the hull as before and as set forth above. To facilitate arranging the engine in the rear, the art has developed what have become known as marine V-drives. The ordinary marine V-drive is a simple gear box adapted to be mounted to or in the hull of a motor boat adjacent the forward end of the propeller shaft and has an upper, rearwardly-projecting input shaft connected with a torque shaft extending forwardly from the transmission of the engine, which engine is arranged so that its drive shaft and transmission projects forwardly in the boat, and an output shaft projecting rearwardly and downwardly, in axial alignment with and connected to the forward end of the propeller shaft. The input shaft is normally horizontal and carries a helical gear, while the output shaft is inclined, as indicated above, and carries a helical bevel gear.

The principal resistance in marine drives is afforded by the screw or propeller. In a rear engine V-drive setupt, such as set forth above, additional resistance is afforded by the V-drive.

In the ordinary or conventional rear engine, V-drive set up, wherein the transmission is fixed to and forms a part of the power plant at the rear of the boat, the forces and resistance encountered when operating the transmission, that is, shifting it into and out of forward, neutral and reverse, are transmitted through the V-drive unit. Accordingly, such units must be made extremely stout and heavy.

Further, since the entire mass and resistance offered by the torque shaft, V-drive, propeller shaft and propeller are at the output end of the transmission, the transmission in the ordinary V-drive set up, is subjected to a maximum of strains and stresses and must be stout and heavy.

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An object of the present invention is to provide a novel rear engine V-drive for motor boats.

It is an object of my invention to provide a novel drive of the character referred to including a prime mover, a V-drive spaced forwardly of the prime mover and connected therewith by a torque shaft, a three position transmission at the output end of the V-drive, a propeller shaft connected with and extending rearwardly and downwardly from the transmission and a propeller on the propeller shaft.

It is another object of my invention to provide a novel, unitary, combination marine drive and transmission.

A further object of the present invention is to provide a novel marine transmission that is neat and compact and which is highly effective, rugged and durable.

The various objects and features of my invention will be fully understood from the following detailed description of a typical form and application of my invention, throughout which description reference is made to the accompanying drawings, in which:

FIG. 1 is a side elevational view of a motor boat with my new drive related thereto;

FIG. 2 is a detail sectional view of my new V-drive transmission;

FIG. 3 is a sectional view taken as indicated by line 3—3 on FIG. 2;

FIG. 4 is a sectional view taken as indicated by line 4—4 on FIG. 1;

FIG. 5 is a sectional view taken as indicated by line 5—5 on FIG. 1;

FIG. 6 is a sectional view taken as indicated by line 6—6 on FIG. 1; and

FIG. 7 is a perspective view of my new construction.

The present invention has to do with a novel drive for power boats and includes a novel V-drive transmission.

In FIGURE 1 of the drawings, I have shown a boat A with my new drive related thereto.

The boat A is a typical hydroplaning hull having a bow 10, stern 11, bottom 12 and sides 13.

The drive for the boat A includes an internal combustion engine or prime mover B arranged in the stern or rear quarter of the boat with its drive shaft 14 projecting forwardly, a combination V-drive and transmission C arranged in the forward portion of the boat and having an upper, rearwardly-projecting input shaft 15 and a lower, downwardly and rearwardly-projecting output shaft 16, a torque shaft 17 between the drive shaft 14 and the input shaft 15, a propeller shaft 18 connected with the output shaft 16 and extending downwardly and rearwardly through a stuffing box 19 in the bottom 12 of the boat and a propeller 20 on the rear end of the propeller shaft 18. The several shafts are connected one to the other by suitable universal joints 21.

The engine B and the transmission C are suitably mounted and supported on longitudinal stringers 22 in the hull.

The transmission C includes a primary housing 25 having upper and lower portions X and Y. The upper portion X of the housing 25 has flat, vertically-disposed front and rear walls 26 and 27, vertical side walls 28, which side walls are preferably provided with outwardly-projecting vertical radiating fins 29, and an open top 30.

The lower portion Y of the housing 25 includes flat, upwardly and rearwardly-inclined front and rear walls 31 and 32, vertical side walls 33, which are provided with outwardly-projecting radiating fins 34 and a rounded bottom wall 35.

In the preferred carrying out of the invention, the housing 25 is provided with laterally outwardly-projecting, horizontally disposed mounting flanges 36 at its sides,

at the point of joiner between the upper and lower portions X and Y thereof.

The open top 30 of the upper portion X of the housing 25 is closed by a suitable cover 37, which cover is provided with a suitable water jacket 38 which projects into the upper portion of the housing a limited extent and is supplied with water coolant through suitable inlet and outlet ports 39 and 40. The cover 37 is also provided with a suitable vent valve 41 which communicates with the interior of the housing.

The inlet port 39 is connected with the discharge side of the water pump of the engine B and the outlet port 40 is connected with the engine blades. In the preferred carrying out of the invention when the engine is a V-type engine, I provide two outlet ports 40, each of which is connected with one bank of the engine. With this combination and relationship of parts, the jacket 38 of the cover serves as a flow equalizing manifold for the water delivered to the engine.

The cover 37, like the side walls of the housing, is provided with outwardly-projecting radiating fins 42 and is secured to the top of the housing by suitable screw fasteners. In practice, the cover 37, being water jacketed can be formed of bronze so as to resist corrosion.

The front and rear walls 26 and 27 of the upper portion X and 31 and 32 of the lower portion Y of the housing have axially aligned bearing receiving openings 45 and 46, and 47 and 48, respectively.

The housing 25 is preferably formed by casting and is provided with suitable bosses and/or enlargements where required to reinforce it and to adapt it to accommodate the bearings, fasteners and other parts and/or features of the construction.

Each of the several bearing openings referred to above is provided with a suitable anti-friction bearing D, having an outer race ring 50 engaged with the wall of the opening, an inner annular race ring 51 adapted to cooperatively receive a portion of a shaft and a pair of annular rows of ball bearings 52 between the races. The bearing openings 45, 46 and 47 are closed by suitable keeper plates 53 fixed to the walls of the housing related thereto, by means of suitable bolt-type fasteners 54. The plates 53 serve to maintain the bearings in their related openings and against axially outward displacement.

The bearing D in the opening 48 in the rear wall of the lower portion Y of the housing is held against axial rearward displacement by a suitable keeper ring 55 secured to the rear surface of the rear wall by fasteners 56.

The input shaft 15 of the transmission C has a forward portion 57 engaged in and extending between the bearings D in the openings 45 and 46 in the housing and a rear portion 58 projecting rearwardly from the forward tion X of the housing, between the front and rear walls thereof and is suitably keyed thereto.

A suitable helical input gear 60 is engaged on the inner portion 57 of the shaft 15 to occur within the upper portion X of the housing, between the front and rear walls thereof and is suitably keyed thereto.

The shaft 15 is provided with a spacer enlargement 61 to occur between the gear 60 and the bearing D in the opening 45 and carries an annular spacer ring 62 to occur between the gear 60 and the bearing D in the opening 46.

A suitable oil seal 63 is provided in the opening 59 to seal between the rear portion 58 of the shaft 15 where it projects from within the housing.

A driven shaft 65 having a forward portion and a rear portion is arranged in the lower portion Y of the housing 25 with its forward portion engaged in and extending between the bearings D in the openings 47 and 48.

The shaft 65 carries a helical bevel gear 66, which gear cooperatively engages the gear 60 in the upper portion of the housing and which is suitably keyed to the shaft 65.

The shaft 65 like the shaft 15 has a spacer enlargement 67 which occurs between the bearing D in the opening

47 and the gear 66 and a spacer ring 68 which occurs between the bearing D in the opening 48 and the gear.

The rear portion of the shaft 66 projects freely from the rear wall 32 of the lower portion Y of the primary housing 25.

The transmission C further includes a secondary housing 70 which housing is fixed to and projects rearwardly from the rear wall 32 of the lower portion Y of the primary housing 25.

The secondary housing 70 supports and carries the reverse gear mechanism as will hereinafter be described.

The housing 70 has substantially flat top, bottom and side walls 71, 72 and 73, an open front end 74 and a rear wall 75.

The front end of the housing is provided with an outwardly-projecting mounting flange 76 about its perimeter which flange abuts and is secured to the rear wall 32 of the housing 25 by suitable bolt-type fasteners 77.

One side wall 73 is provided with a round access opening 78 closed by a plate 79, fixed to said side wall by means of fasteners 80.

The other side wall 73 has an opening 81 closed by a plate 82, which plate is fixed to the said side wall by fasteners 83.

The rear wall 75 is provided with a rearwardly-projecting, forwardly-opening cup-like projection 84 having a central shaft-receiving opening 85 and defining a forwardly-opening bearing receiving socket 86.

The rear portion of the drive shaft 65 projects freely into the secondary housing 70 and carries a primary or forward drive helical bevel gear 87. The bevel gear 87 is keyed to the shaft 65 and is retained thereon, in engagement with the bearing D in the opening 48 of the primary housing, by means of a snap ring 88.

The output shaft 16 is in axial alignment with the shaft 65 and has an inner, splined forward portion 89 extending longitudinally in the secondary housing 70 and a straight, rear portion 90 of reduced diameter extending through the opening 85 in the projection 84 on the rear wall 75. The rear portion 90 of the shaft is rotatably supported in the housing 70 by means of an anti-friction ball bearing 91 engaged in the bearing socket 86 and seated on the bottom thereof. The rear end of the forward splined portion 89 of the shaft 16 establishes a shoulder which butts and stops against the bearing 91.

Arranged within the bearing socket 86, forward of the bearing 91 is an anti-friction needle bearing 92. A spacer 92' is arranged between the bearings 91 and 92.

Arranged in the rear portion of the housing 70 is an annular forwardly-disposed secondary or reverse helical bevel gear 93. The reverse bevel gear 93 is engaged about the shaft 16 with running clearance and has a rearwardly-projecting tubular extension 94 engaged in and rotatably supported by the bearing 92, in the socket 86.

A suitable thrust bearing 95 is arranged between the gear 93 and the rear wall 75.

The forward end of the forward portion 89 of the shaft 16 is provided with a spindle 96 of reduced diameter which spindle projects into a socket in the rear end of the drive shaft 65 and is rotatably supported therein by a suitable anti-friction pilot bearing 97.

A thrust bearing 98 is engaged about the spindle 96 to occur between the opposing ends of the shaft 65 and 16.

Arranged within the housing 70 is an idler bevel gear 100, which gear is on a horizontal axis intersecting the axis of the shaft 16 and is in driven and driving engagement with the forward and reverse bevel gears 87 and 93. The gear 100 is rotatably supported by an anti-friction ball bearing 101 engaged on an inwardly-projecting spindle 102 on the plate 79, closing the access opening 78 at one side of the housing 70.

The bearing 101 has an inner race 103 retained on the spindle 102 by means of a snap ring 104 and an outer race 105 seated in a central, laterally, outwardly-opening socket 106 in the gear.

The rear end or face of the forward bevel gear 87 and the front end or face of the rear bevel gear 93 are provided with axially outwardly-opening arcuate recesses 107 having flat bottom walls 108 and rounded end walls 109. In the case illustrated, the recesses 107 have arcuate outer walls 110 and are open, radially inwardly.

Each gear 87 and 93 have two recesses 107, each extending about 90° about the axis of their respective gears and at diametrically opposite sides of the axes of said gears.

Slidably engaged on the splined forward portion 89 of the output shaft 16, between the gears 87 and 93, is a carriage 111 with flat forwardly and rearwardly-disposed ends 112 and a central radially-outwardly-opening annular groove 113.

The forwardly-disposed end of the carriage is provided with a pair of axially-outwardly-projecting cylindrical dogs 114 which dogs occur at diametrically opposite sides of the central axis of the carriage, are equal in longitudinal extent with the depth of the recesses 107 in the gear 87 and equal in radial extent with the radii of the end walls 109 of the recesses 107.

The rearwardly-disposed end of the carriage is provided with a pair of axially outwardly-projecting cylindrical dogs 115 which dogs occur at diametrically opposite sides of the central axis of the carriage, are equal in longitudinal extent with the depth of the recesses 107 in the gear 93 and equal in radial extent with the radii of the end walls 109 in the recesses 107.

The carriage normally occurs in a neutral position midway between the gears 87 and 93 where the dogs 114 and 115 are disengaged from and clear of the recesses 107 in their related gears and is shiftable forwardly and rearwardly to positions where the ends of the carriage butt against the opposing end faces of the gears related thereto and where the dogs enter the recesses in said related gears and stop and seat against the end walls 109 of the recesses to establish driving engagement between the shaft 16 and the gears.

When the carriage is shifted forwardly into engagement with the forward bevel gear and the dogs 14 enter and seat in the grooves 107 therein, direct drive is established between the driven shaft 65 and the output shaft 16.

When the carriage is shifted rearwardly into engagement with the reverse bevel gear 93, and the dogs 15 enter and seat in the recesses 107 therein, driving engagement is established between the reverse gear 93 and the shaft 16, driving or rotating the shaft 16 in a reverse direction from the driven shaft 65.

A suitable manually operable shifting means S is provided to selectively shift the carriage from its normal or neutral position, forwardly and rearwardly into and out of driving engagement with the gears 87 and 93.

The means S includes a substantially semicircular yoke 120 engaged in and about the annular groove 113 in the carriage, a shift crank 121 carried by the plate 82 closing the lateral opening 81 in the housing 70 and an operating lever 122 carried by the crank at the exterior of the construction.

The yoke 120 has a laterally-outwardly-projecting pin 123. The shift crank 121 has a horizontally disposed shaft 124 rotatably engaged in and projecting through a tubular boss 125 at the upper portion of the plate 82 and a normally vertically-disposed arm 126 depending from the inner end of the shaft 124 and provided with an opening 127 at its lower end in which the pin 123 on the yoke is slidably engaged.

The lever 122 is a simple elongate arm having an opening 128 at one end to receive the outer end of the shaft 124 and an opening 129 at its other end to facilitate connecting the lever with suitable operating linkage, as circumstances require.

The end of the lever in which the opening 28 occurs is split and a suitable clamp screw 128' is provided to facilitate clamping the lever into tight engagement on the shaft 124.

The means S further includes suitable orienting means, which means includes three circumferentially spaced detents 130 in the upper end of the arm 126, which is cylindrical or rounded, and a spring-loaded ball 131 carried by the top wall of the housing 70 and engageable in the detents. The ball 131 is shown carried by a suitable bolt-type cup 132 threadedly engaged in an opening 133 in the housing and maintained in fixed vertical position therein by a suitable lock nut 134.

The yoke is adapted to establish bearing engagement with the sides of the annular groove 113 in the carriage and is so-shaped as to allow for limited vertical shifting relative to the yoke, as it is shifted through or with the loci of travel of the lower end of the crank arm.

With the means S set forth above, it will be apparent that the construction can be easily and conveniently shifted from one position to another and that it is suitably retained in any selected position by the detent means.

From the foregoing, it will be apparent that with the transmission at the output end of the V-drive and connected directly to the propeller shaft, the resistance afforded by the propeller shaft is transmitted directly into and through the transmission.

Further, the V-drive is driven constantly in one direction and is not started, stopped and reversed upon operation of the transmission as in the case of other drives of the general character referred to. This makes possible the employment of superior, quieter and smoother gear design.

Still further, the transmission, upon being operated is not required to stop and start the running parts of the V-drive and the torque shaft.

With the construction provided, the transmission, being at the lower end of the V-drive, the center of gravity of the construction is lower than in other similar drives and results in a more stable installation.

Since the transmission only has to handle the weight and resistance of the propeller shaft and propeller, less shock, vibration and noise is generated and transmitted into and through the boat.

Having described a typical preferred form and application of my invention, I do not wish to be limited or restricted to the specific details herein set forth, but wish to reserve to myself any modifications or variations that may appear to those skilled in the art and fall within the scope of the following claims:

Having described my invention, I claim:

1. For use in a boat with a forwardly and upwardly inclined propeller shaft and an engine above the propeller shaft with its drive shaft extending horizontally and projecting rearwardly, a marine V drive transmission including a primary housing, an upper horizontal input shaft rotatably carried by the housing and projecting rearwardly therefrom to connect with the drive shaft, a lower, downwardly and rerawardly inclined driven shaft rotatably carried by the primary housing and having a rear portion with a central rearwardly opening pilot-bearing receiving socket projecting rearwardly from the primary housing, and meshed gears on the input and drive shafts within the primary housing and establishing driving engagement therebetween, a secondary housing fixed to and projecting rearwardly and downwardly from the lower portion of the primary housing to receive the rear portion of a driven shaft and having an output shaft receiving opening in its rear end concentric with the driven shaft and a bearing receiving socket in its rear end, an anti-friction pilot bearing in the socket in the rear end of the driven shaft, an anti-friction shaft bearing in the socket in the secondary housing, an elongate output shaft extending axially through and projecting rearwardly from the secondary housing to connect with the propeller shaft and rotatably supported by said pilot and shaft bearings, a forward bevel gear with rearwardly opening dog receiving re-

cesses fixed to the rear portion of the driven shaft within the secondary housing, a second anti-friction bearing in said socket in the rear end of the secondary housing, a rear bevel gear rotatably supported by said second bearing and having a central opening freely receiving the output shaft, an idler gear rotatably supported in fixed position within the secondary housing at one side thereof on an axis normal to the axis of the output shaft and engaged with the bevel gears, a carriage with forwardly and rearwardly projecting dogs in splined engagement on the output shaft between the forward and rear bevel gears and shiftable axially thereon to selectively shift the dogs into and out of engagement in the recesses in the bevel gear, and manually operable shifting means to shift the carriage.

2. For use in a boat with a forwardly and upwardly inclined propeller shaft and an engine above the propeller shaft with its drive shaft extending horizontally and projecting rearwardly, a marine V drive transmission including a primary housing, an upper horizontal input shaft rotatably carried by the housing and projecting rearwardly therefrom to connect with the drive shaft, a lower, downwardly and rearwardly inclined driven shaft rotatably carried by the primary housing and having a rear portion with a central rearwardly opening pilot-bearing receiving socket projecting rearwardly from the primary housing, and meshed gears on the input and drive shafts within the primary housing and establishing driving engagement therebetween, a secondary housing fixed to and projecting rearwardly and downwardly from the lower portion of the primary housing to receive the rear portion of a driven shaft and having an output shaft receiving opening in its rear end concentric with the driven shaft and a bearing receiving socket in its rear end, an anti-friction pilot bearing in the socket in the rear end of the driven shaft, an anti-friction shaft bearing the socket in the secondary housing, an elongate output shaft extending axially through and projecting rearwardly from the secondary housing to connect with the propeller shaft and rotatably supported by said pilot and shaft bearings, a forward bevel gear with rearwardly opening dog receiving recesses fixed to the rear portion of the driven shaft within the secondary housing, a second anti-friction bearing in said socket in the rear end of the secondary housing, a rear bevel gear rotatably supported by said second bearing and having a central opening freely receiving the output shaft, an idler gear rotatably supported in fixed position within the secondary housing at one side thereof on an axis normal to the axis of the output shaft and engaged with the bevel gears, a carriage with forwardly and rearwardly projecting dogs in splined engagement on the output shaft between the forward and rear bevel gears and shiftable axially thereon to selectively shift the dogs into and out of engagement in the recesses in the bevel gear, and manually operable shifting means to shift the carriage, including a semicircular yoke slidably engaged in an annular radially outwardly opening groove in the carriage, a crank having a shaft rotatably supported by and projecting through a wall of the secondary housing, and a laterally projecting arm at one end thereof to occur within the housing and pivotally connected with the yoke, an operating lever fixed to the other end of the shaft and accessible at the exterior of the housing.

3. For use in a boat with a forwardly and upwardly inclined propeller shaft and an engine above the propeller shaft with its drive shaft extending horizontally and projecting rearwardly, a marine V drive transmission including a primary housing, an upper horizontal input shaft rotatably carried by the housing and projecting rearwardly therefrom to connect with the drive shaft, a lower, downwardly and rearwardly inclined driven shaft rotatably carried by the primary housing and having a rear portion with a central rearwardly opening pilot-bearing receiving socket projecting rearwardly from the primary housing, and meshed gears on the input and drive shafts within the primary housing and establishing driving engagement therebetween, a secondary housing fixed to and projecting rearwardly and downwardly from the lower portion of the primary housing to receive the rear portion of a driven shaft and having an output shaft receiving opening in its rear end concentric with the driven shaft and a bearing receiving socket in its rear end, an anti-friction pilot bearing in the socket in the rear end of the driven shaft, an anti-friction shaft bearing the socket in the secondary housing, an elongate output shaft extending axially through and projecting rearwardly from the secondary housing to connect with the propeller shaft and rotatably supported by said pilot and shaft bearings, a forward bevel gear with rearwardly opening dog receiving recesses fixed to the rear portion of the driven shaft within the secondary housing, a second anti-friction bearing in said socket in the rear end of the secondary housing, a rear bevel gear rotatably supported by said second bearing and having a central opening freely receiving the output shaft, an idler gear rotatably supported in fixed position within the secondary housing at one side thereof on an axis normal to the axis of the output shaft and engaged with the bevel gears, a carriage with forwardly and rearwardly projecting dogs in splined engagement on the output shaft between the forward and rear bevel gears and shiftable axially thereon to selectively shift the dogs into and out of engagement in the recesses in the bevel gear, and manually operable shifting means to shift the carriage, including a semi-circular yoke slidably engaged in an annular radially outwardly opening groove in the carriage, a crank having a shaft rotatably supported by and projecting through a wall of the secondary housing, and a laterally projecting arm at one end thereof to occur within the housing and pivotally connected with the yoke, an operating lever fixed to the other end of the shaft and accessible at the exterior of the housing, an orienting means related to the crank and adapted to releasably hold said crank in forward, neutral and reverse positions, said orienting means including a radially outwardly disposed semi-circular surface on the crank arm concentric with the shaft, three circumferentially spaced radially outwardly opening detents in said semi-circular surface, and a spring loaded ball stop carried by the secondary housing and engageable in said detents.

4. For use in a boat with a forwardly and outwardly inclined propeller shaft and an engine above the propeller shaft with its drive shaft extending horizontally and projecting forwardly, a marine V drive transmission including, an elongate primary housing with a vertically disposed upwardly opening upper portion with axially aligned front and rear bearing openings, a forwardly and downwardly inclined lower portion with front and rear axially aligned bearing openings, a cover engaged on and closing the top of the upper portion, an anti-friction bearing in each of said bearing openings, an input shaft with a drive gear arranged in the upper portion of the primary housing and rotatably supported in the bearings in the upper portion of the primary housing and projecting rearwardly therefrom, means on the rear end of the input shaft to connect said shaft with the engine drive shaft, a downwardly and rearwardly inclined driven shaft with a bevel gear thereon arranged in the lower portion of the primary housing and rotatably supported in the bearings in the lower portion of the primary housing, said driven shaft having a rear end portion with a rearwardly opening pilot bearing socket projecting rearwardly from the primary housing, said bevel gear being engaged with the drive gear, a secondary housing fixed to and projecting rearwardly from the lower portion of the primary housing to receive the rear portion of the driven shaft and having an output shaft receiving opening in its rear end concentric with the driven shaft and a bearing-receiving socket in its rear end, an anti-friction pilot bearing in the rear end of the driven shaft,

an anti-friction shaft bearing in the socket in the rear of the secondary housing, an elongate output shaft extending axially through and projecting rearwardly from the secondary housing to connect with the propeller shaft and rotatably supported by said shaft bearing and having a forwardly projecting spindle engaged in and rotatably supported by said pilot bearing, a thrust bearing engaged about said spindle and between the adjacent ends of the driven and output shafts, a forward bevel gear with rearwardly opening arcuate dog receiving recesses having axially extending side walls fixed to the rear end portion of the driven shaft within the secondary housing, a second anti-friction bearing in the said socket in the rear end of the secondary housing, a rear bevel gear rotatably supported by said second bearing and having a central opening freely receiving the output shaft, an idler gear rotatably supported in fixed position within the secondary housing at one side thereof on an axis normal to the axis of the output shaft and engaged with the bevel gears, an elongate carriage with circumferentially spaced forwardly and rearwardly projecting dogs in splined engagement on the output shaft between the forward and rear bevel gears and shiftable axially to selectively shift the dogs into and out of engagement in the recesses in the bevel gears, and manually operable shifting means to selectively shift the carriage into and out of engagement with the bevel gears.

5. For use in a boat with a forwardly and outwardly inclined propeller shaft and an engine above the propeller shaft with its drive shaft extending horizontally and projecting forwardly, a marine V drive transmission including, an elongate primary housing with a vertically disposed upwardly opening upper portion with axially aligned front and rear bearing openings, a forwardly and downwardly inclined lower portion with front and rear axially aligned bearing openings, a cover engaged on and closing the top of the upper portion, an antifriction bearing in each of said bearing openings, an input shaft with a drive gear arranged in the upper portion of the primary housing and rotatably supported in the bearings in the upper portion of the primary housing and projecting rearwardly therefrom, means on the rear end of the input shaft to connect said shaft with the engine drive shaft, a downwardly and rearwardly inclined driven shaft with a bevel gear thereon arranged in the lower portion of the primary housing and rotatably supported in the bearings in the lower portion of the primary housing, said driven shaft having a rear end portion with a rearwardly opening pilot bearing socket projecting rearwardly from the primary housing, a secondary housing fixed to and projecting rearwardly from the lower portion of the primary housing to receive the rear portion of the driven shaft and having an output shaft receiving opening in its rear end concentric with the driven shaft and a bearing-receiving socket in its rear end, an anti-friction pilot bearing in the rear end of the driven shaft, an antifriction shaft bearing in the socket in the rear of the secondary housing, an elongate output shaft extending axially through and projecting rearwardly from the secondary housing to connect with the propeller shaft and rotatably supported by said shaft bearing and having a forwardly projecting spindle engaged in and rotatably supported by said pilot bearing, a thrust bearing engaged about said spindle and between the adjacent ends of the driven and output shafts, a forward bevel gear with rearwardly opening arcuate dog receiving recesses having axially extending side walls fixed to the rear end portion of the driven shaft within the secondary housing, a second anti-friction bearing in the said socket in the rear end of the secondary housing, a rear bevel gear rotatably supported by said second bearing and having a central opening freely receiving the output shaft, an idler gear rotatably supported in fixed position within the secondary housing at one side thereof on an axis normal to the axis of the output shaft and engaged with the bevel gears, an elongate carriage with circumferentially spaced forwardly and rearwardly projecting dogs in splined engagement on the output shaft between the forward and rear bevel gears and shiftable axially to selectively shift the dogs into and out of engagement in the recesses in the bevel gears, and manually operable shifting means to selectively shift the carriage into and out of engagement with the bevel gears, said shifting means including a semi-circular yoke slidably engaged in and about an annular radially outwardly opening groove in the carriage and having a radially outwardly projecting pivot pin, a crank having a shaft rotatably supported by and projecting through the secondary housing, and a laterally projecting arm at one end thereof to occur within the secondary housing and pivotally engaged on the outwardly projecting pin on the yoke, an operating lever fixed to the other end of the shaft and accessible at the exterior of the housing, and an orienting means relating to the crank and adapted to releasably hold said crank in forward, neutral and reverse positions.

6. For use in a boat with a forwardly and outwardly inclined propeller shaft and an engine above the propeller shaft wtih its drive shaft extending horizontally and projecting forwardly, a marine V drive transmission including, an elongate primary housing with a vertically disposed upwardly opening upper portion with axially aligned front and rear bearing openings, a rearwardly and downwardly inclined lower portion with front and rear axially aligned bearing openings, a cover engaged on and closing the top of the upper portion, an antifriction bearing in each of said bearing openings, an input shaft with a drive gear arranged in the upper portion of the primary housing and rotatably supported in the bearings in the upper portion of the primary housing and projecting rearwardly therefrom, means on the rear end of the input shaft to connect said shaft with the engine drive shaft, a downwardly and rearwardly inclined driven shaft with a bevel gear thereon arranged in the lower portion of the primary housing and rotatably supported in the bearings in the lower portion of the primary housing, said driven shaft having a rear end portion with a rearwardly opening pilot bearing socket projecting rearwardly from the primary housing, a secondary housing fixed to and projecting rearwardly from the lower portion of the primary housing to receive the rear portion of the driven shaft and having an output shaft receiving opening in its rear end concentric with the driven shaft and a bearing-receiving socket in its rear end, an antifriction pilot bearing in the rear end of the driven shaft, an antifriction shaft bearing in the socket in the rear of the secondary housing, an elongate output shaft extending axially through and projecting rearwardly from the secondary housing to connect with the propeller shaft and rotatably supported by said shaft bearing and having a forwardly projecting spindle engaged in and rotatably supported by said pilot bearing, a thrust bearing engaged about said spindle and between the adjacent ends of the driven and output shafts, a forward bevel gear with rearwardly opening arcuate dog receiving recesses having axially extending side walls fixed to the rear end portion of the driven shaft within the secondary housing, a second anti-friction bearing in the said socket in the rear end of the secondary housing, a rear bevel gear rotatably supported by said second bearing and having a central opening freely receiving the output shaft, an idler gear rotatably supported in fixed position within the secondary housing at one side thereof on an axis normal to the axis of the output shaft and engaged with the bevel gears, an elongate carriage with circumferentially spaced forwardly and rearwardly projecting dogs in splined engagement on the output shaft between the forward and rear bevel gears and shiftable axially to selectively shift the dogs into and out of engagement in the recesses in the bevel gears, and manually operable shifting means to selectively shift the carriage into and out of engagement with the

bevel gears, said shifting means including a semi-circular yoke slidably engaged in and about an annular radially outwardly opening groove in the carriage and having a radially outwardly projecting pivot pin, a crank having a shaft rotatably supported by and projecting through the secondary housing, and a laterally projecting arm at one end thereof to occur within the secondary housing and pivotally engaged on the outwardly projecting pin on the yoke, an operating lever fixed to the other end of the shaft and accessible at the exterior of the housing, and orienting means relating to the crank and adapted to releasably hold said crank in forward, neutral and reverse positions, said orienting means including a radially outwardly disposed semi-circular surface on the crank arm

concentric with the crank shaft, three circumferentially spaced radially outwardly opening detents in said semi-circular surface, and a spring loaded ball stop carried by the secondary housing and engageable in said detents.

References Cited in the file of this patent

UNITED STATES PATENTS

1,548,917	Vincent	Aug. 11, 1925
2,130,125	Fromm	Sept. 13, 1938
2,538,933	Coan	Jan. 23, 1951
2,751,799	Long	June 26, 1956
2,859,634	Walter	Nov. 11, 1958