Oct. 31, 1950

E. M. WILSON ET AL

2,528,480

OUTBOARD MOTOR

Filed June 11, 1946

5 Sheets-Sheet 1

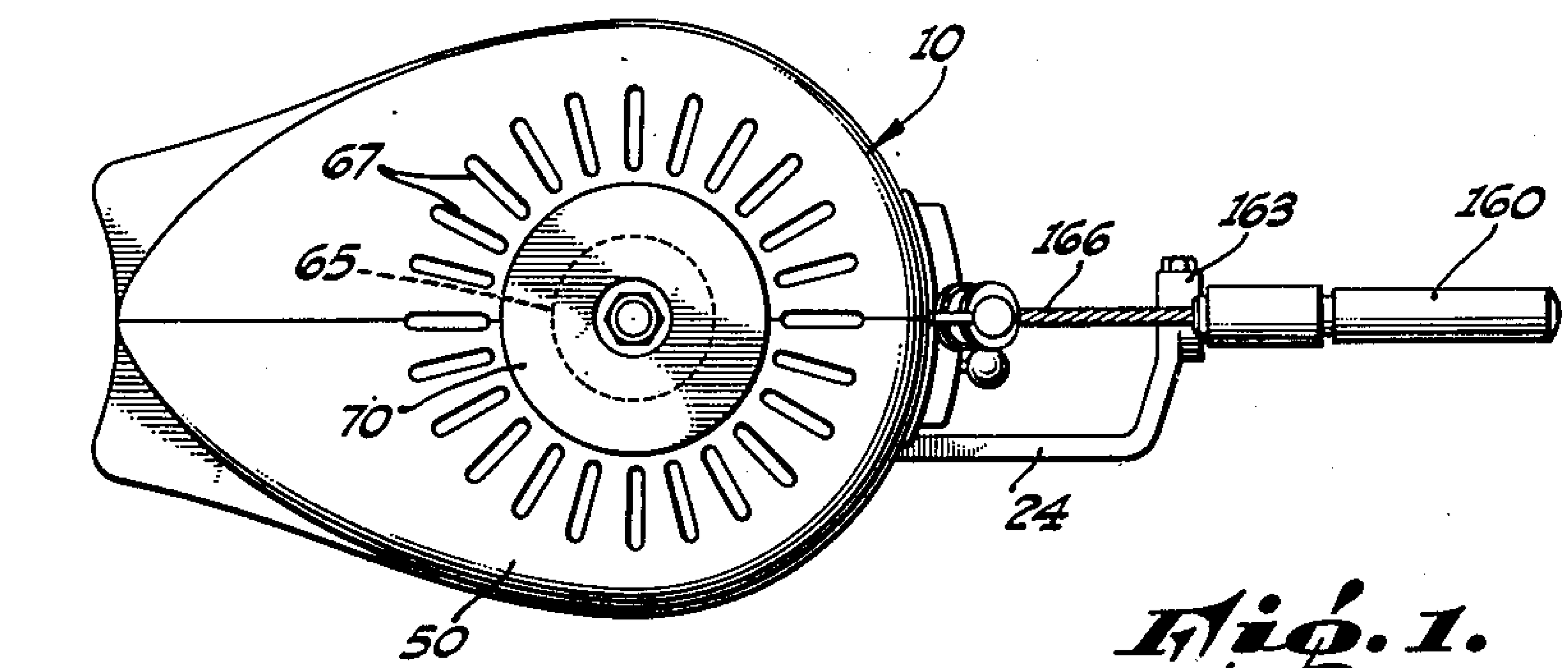

Fig. 1.

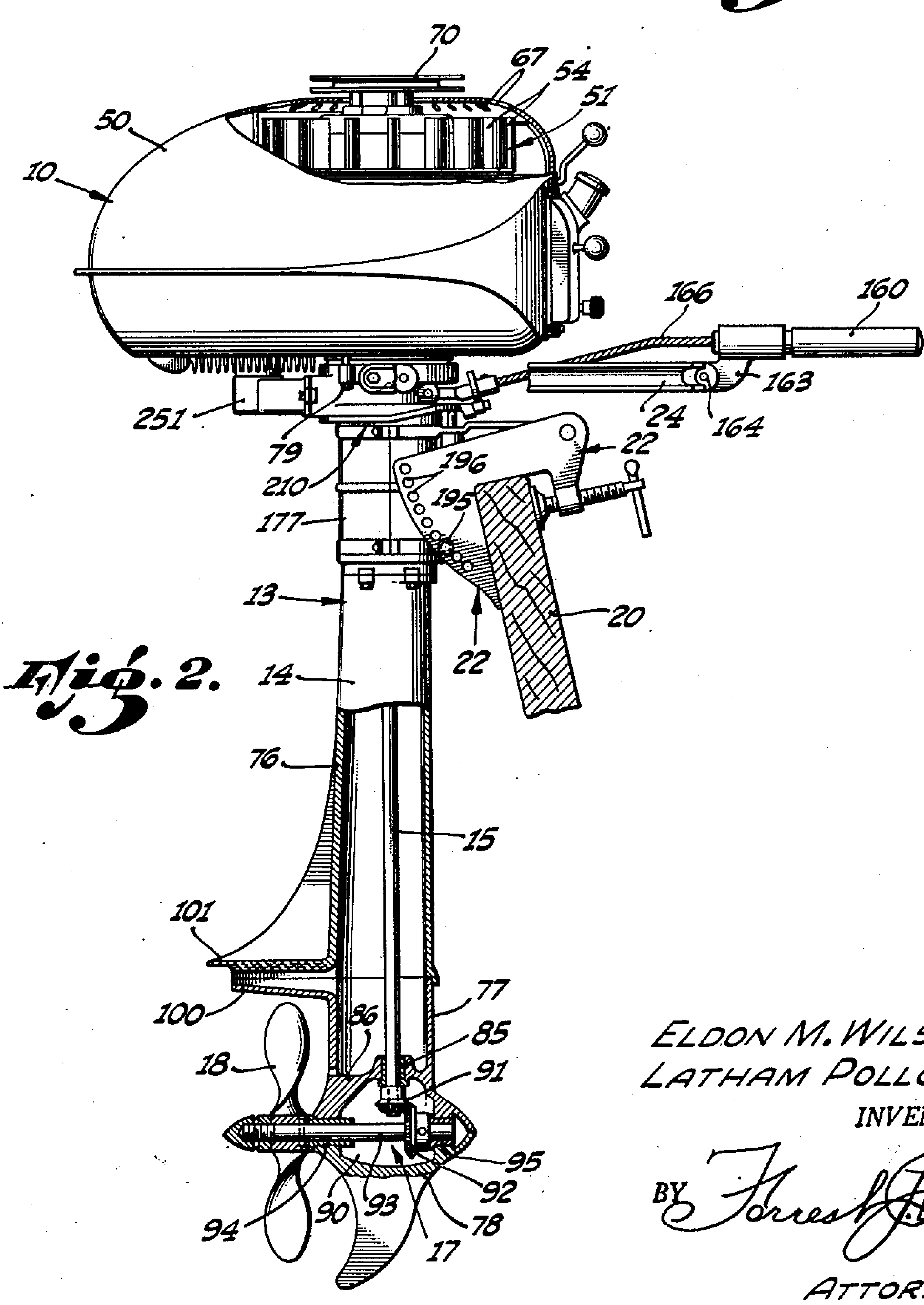

Fig. 2.

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OUTBOARD MOTOR

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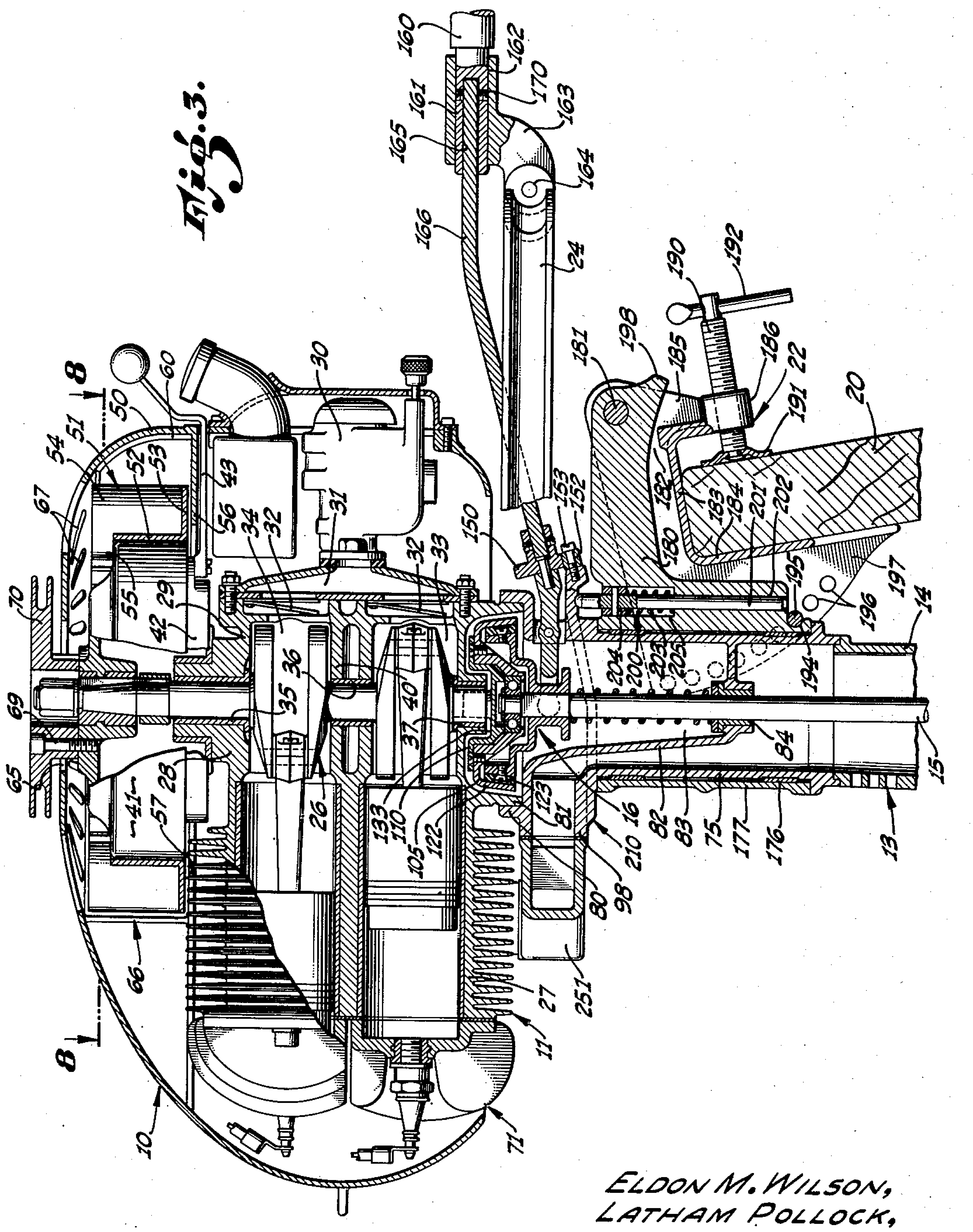

Fig. 3.

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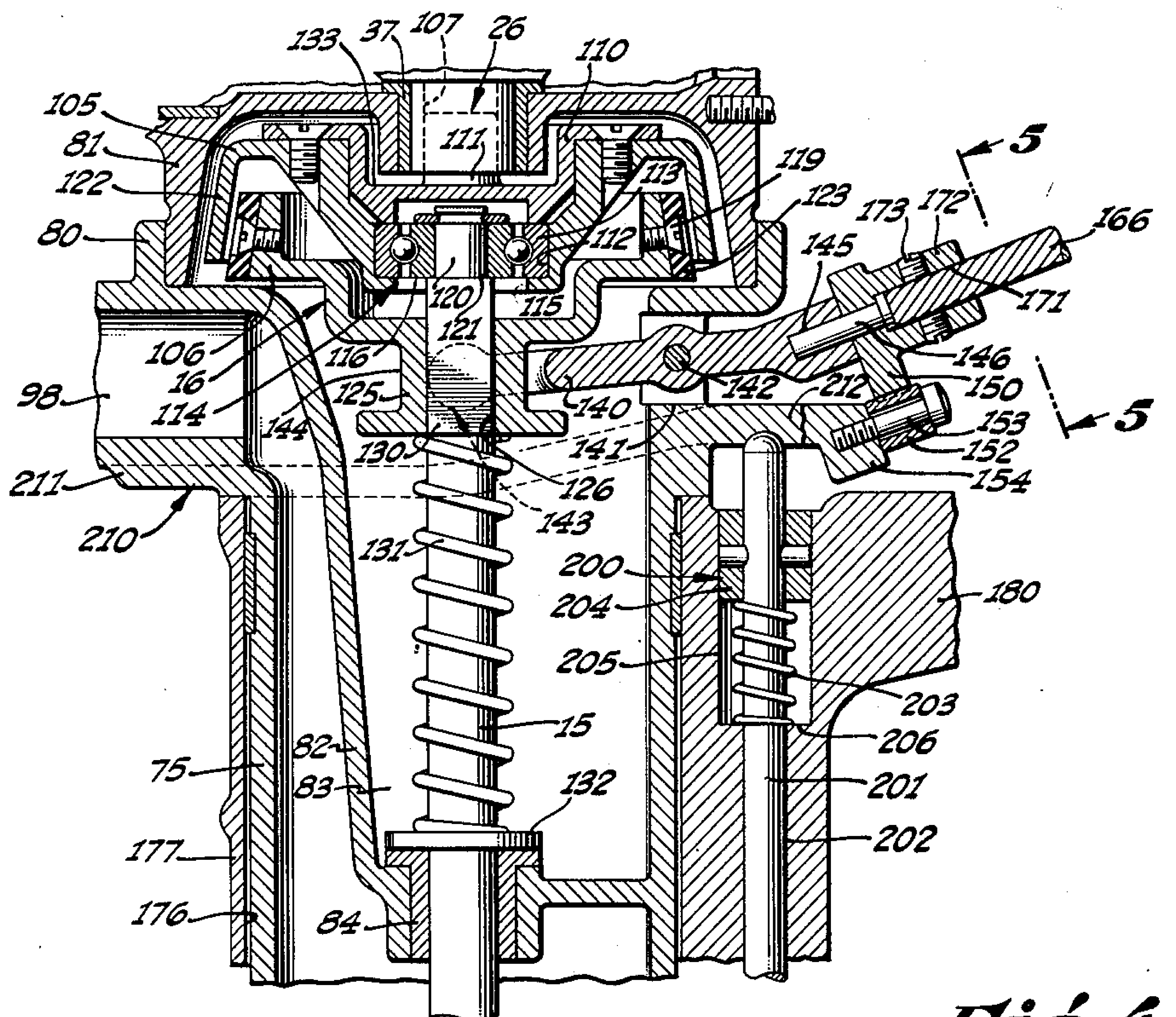

Fig. 4.

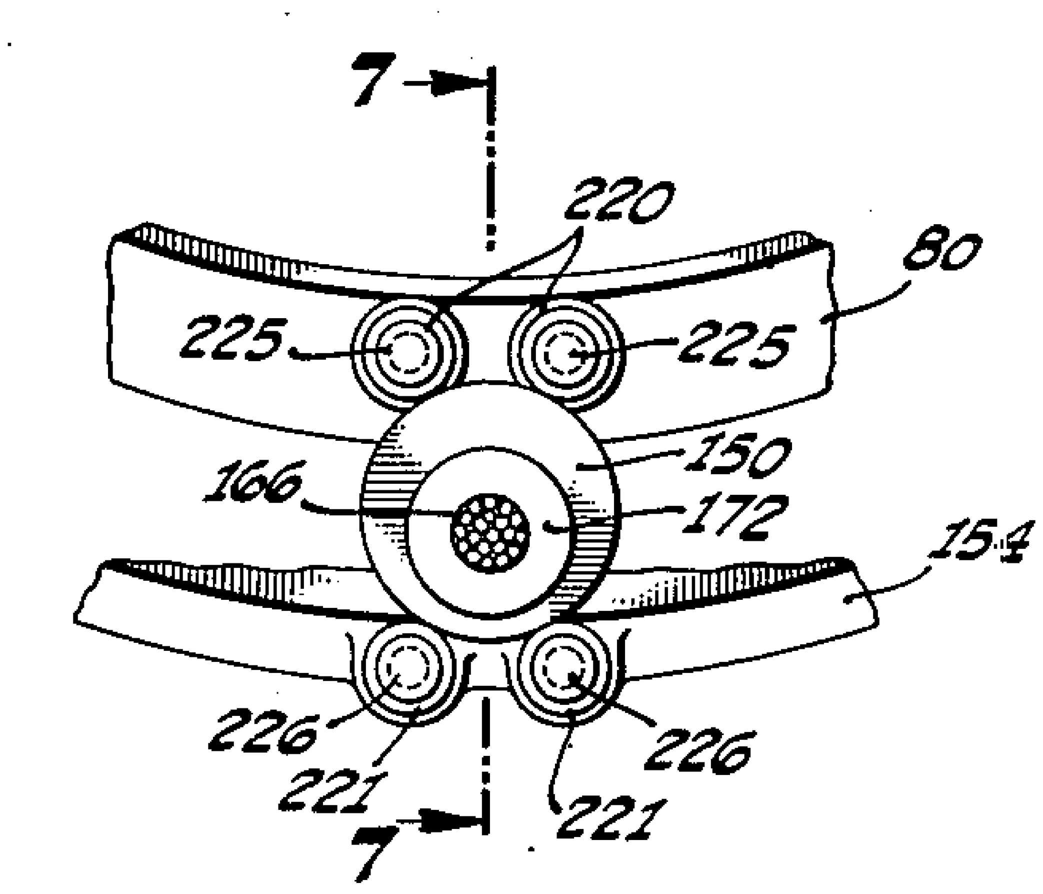

Fig. 6.

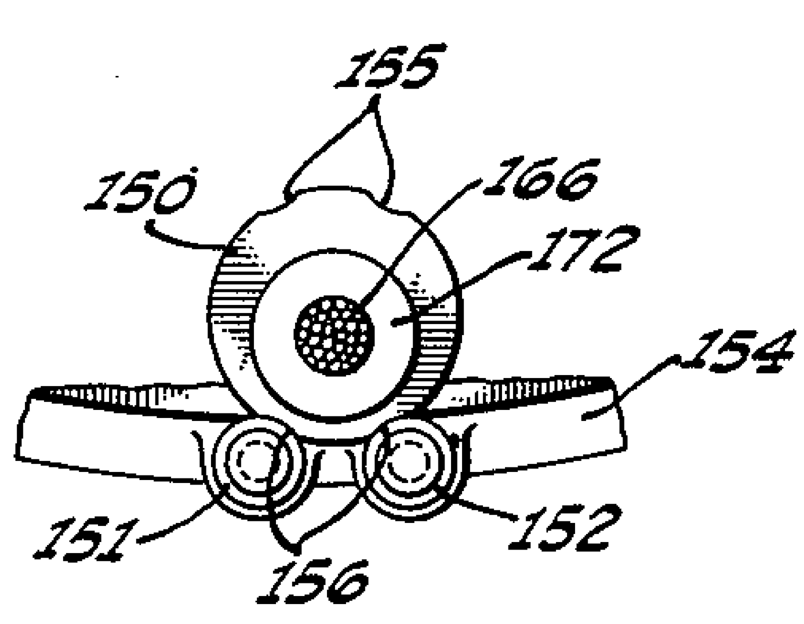

Fig. 5.

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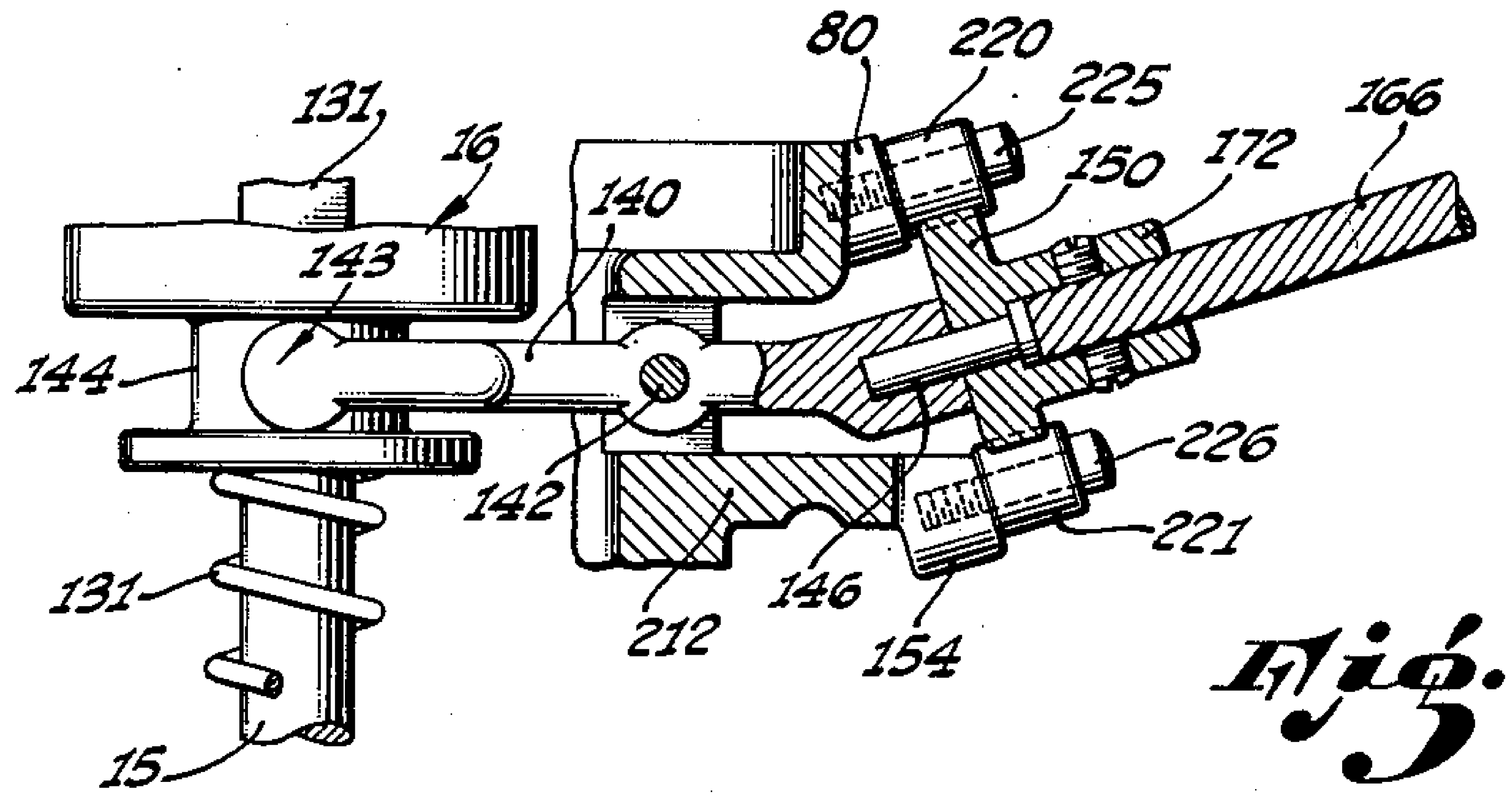

Fig. 7.

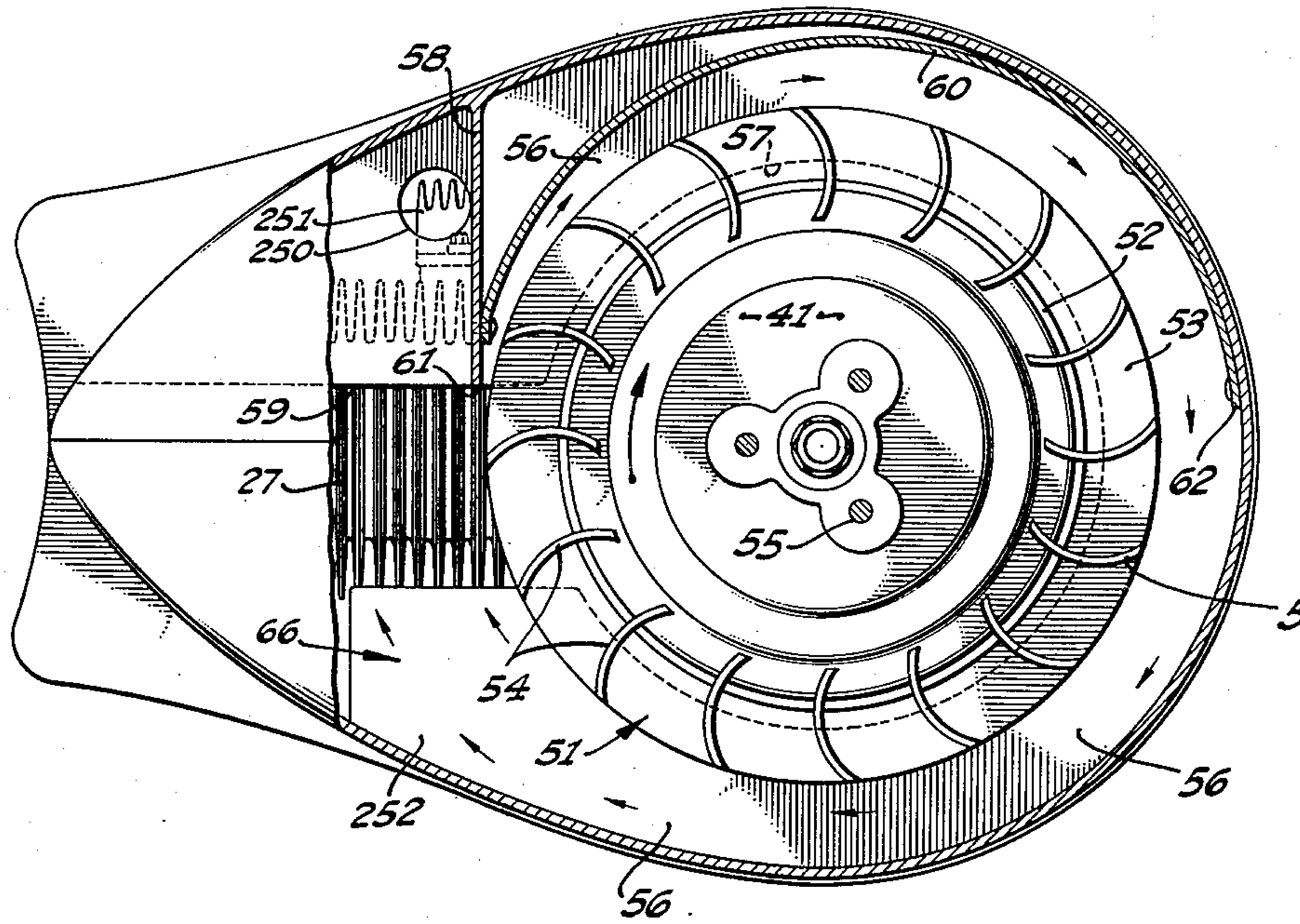

Fig. 8.

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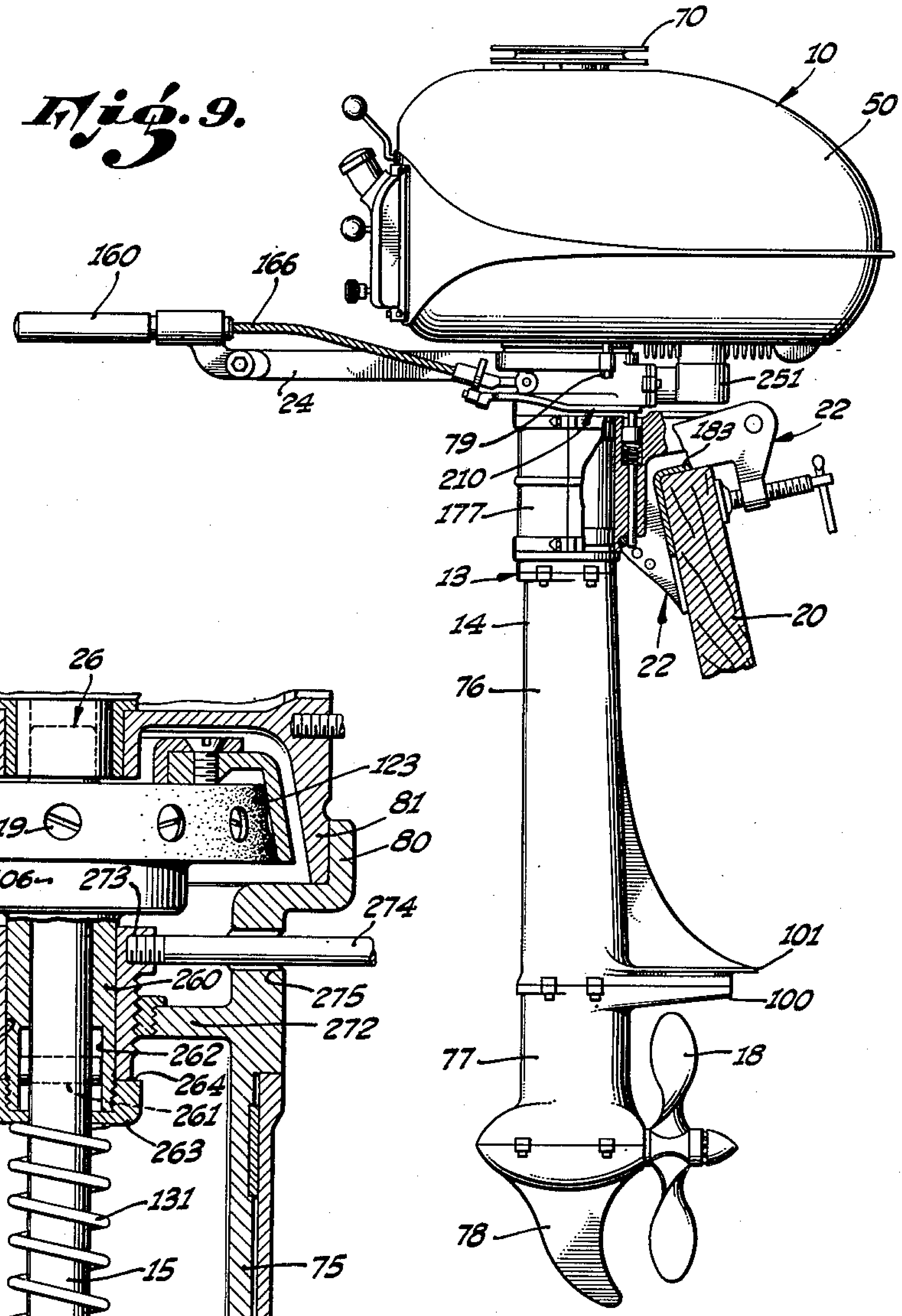
Fig. 9.



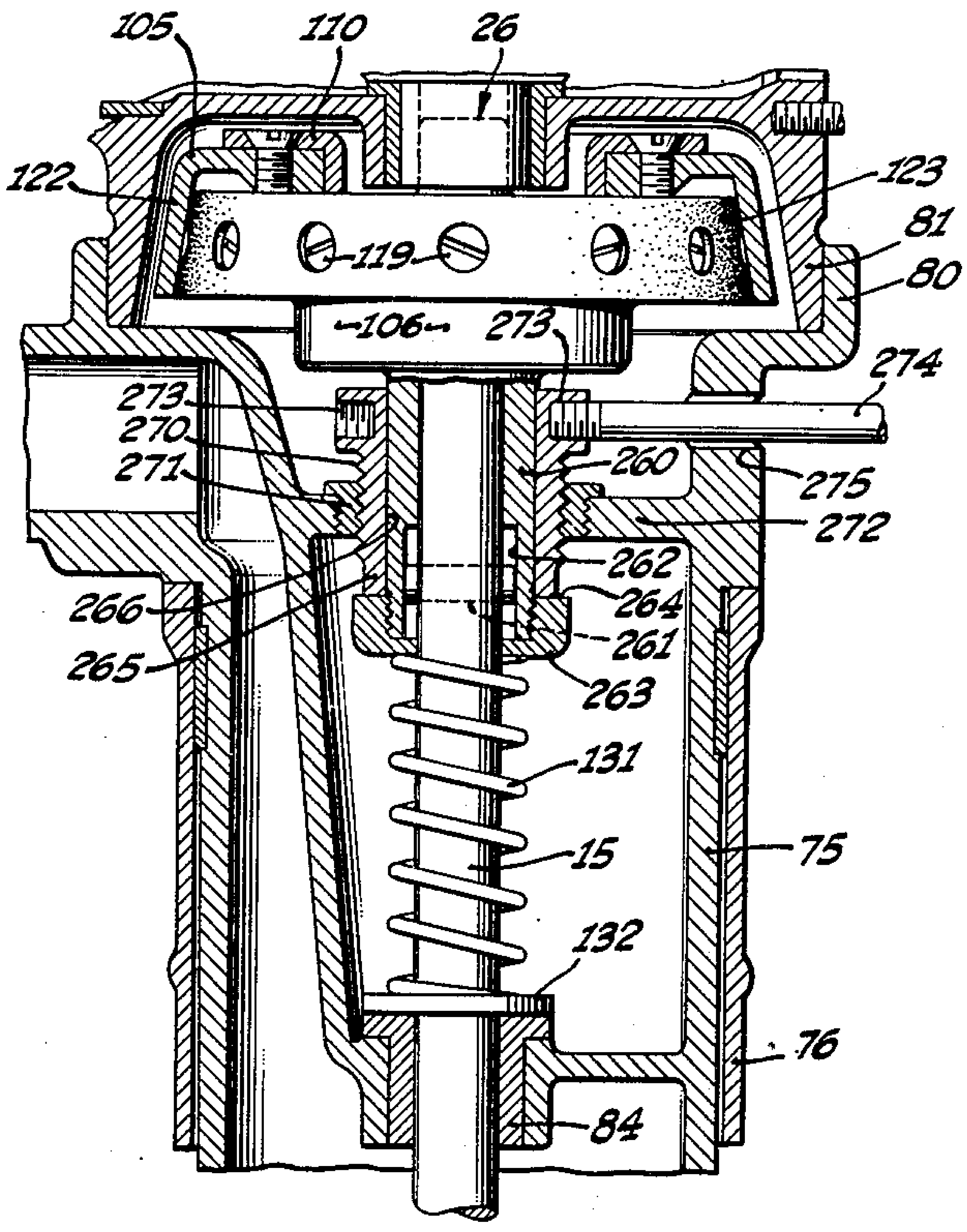


Fig. 10.

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Patented Oct. 31, 1950

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UNITED STATES PATENT OFFICE

2,528,480

OUTBOARD MOTOR

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Application June 11, 1946, Serial No. 675,920

7 Claims. (Cl. 115—18)

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The present invention relates to outboard motors, and is directed to the provision of a new and improved outboard motor embodying many advantageous features not found on any prior machine to our knowledge.

One of the principal shortcomings of outboard motors heretofore known has been the lack of a manually controllable clutch in the propeller transmission mechanism which could be disengaged at will to permit the propeller to stop while the engine idles. Thus, when it has been desired in the past to bring the boat to a standstill, the only course open has been to kill the engine and then to restart it when ready to move on. Two-cycle engines, which power the great majority of all outboard motors, are sometimes difficult to start even when hot, and frequent restarting necessitated by the absence of a clutch is a serious inconvenience and annoyance.

The omission of a clutch has not been due solely to lack of foresight on the part of outboard motor designers, nor to a desire to reduce the size, weight, and cost of the unit, but has been dictated primarily by the difficulties experienced in obtaining adequate cooling of the engine when the clutch is disengaged. This is due to the fact that all outboard motors have heretofore been water-cooled, and the cooling water has been circulated through the cylinder jackets by a pump submerged beneath the water level and driven from the propeller shaft or the vertical drive shaft. Thus, when the drive shaft or propeller shaft were stopped by disengaging the clutch, the pump stopped also and the circulation of cooling water ceased, with resultant heating of the engine. Attempts to overcome this difficulty by driving the pump directly from the engine crankshaft resulted in other complications and were generally unsatisfactory.

The present invention, however, eliminates the problem entirely by utilizing an air-cooled engine with a blower fan mounted on the engine crankshaft which maintains a flow of cooling air over the cylinders as long as the engine is running, regardless of whether the propeller shaft or drive shaft are rotating or stationary.

One of the primary objects of the present invention, therefore, is the provision of a new and improved outboard motor embodying a manually controllable clutch permitting the propeller to be disconnected from the engine at will, and designed in other respects to meet the cooling requirements of such a unit when operating with the clutch disengaged.

Another object of the invention is to provide

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a novel clutch construction combining simplicity, compactness, light weight, absolute reliability, and low cost of manufacture. In this connection, one of the features of our novel clutch construction resides in the shape and arrangement of the driver and driven member whereby any oil seeping down into the clutch compartment from the engine crankcase is thrown outward by centrifugal force from the driver and is prevented from coming in contact with the clutch facings.

A further object of our invention is the provision of a novel shell or outside casing for the engine which constitutes a volute housing for the blower fan. In this way, the outside casing of the engine serves the several functions of providing an ornamental and protective covering for the entire power unit; providing a volute housing of high efficiency for the centrifugal blower; and providing a shroud for directing the cooling air from the blower down over the cylinders. By thus eliminating a separate blower housing and cylinder shroud in addition to the usual protective casing, the bulk of the outboard motor is reduced to a minimum, resulting in a compact unit of pleasing appearance and light weight.

These and other objects and advantages of the present invention will become apparent to those skilled in the art upon consideration of the following detailed description of the preferred embodiment thereof, reference being had to the appended drawings wherein

Figure 1 is a top plan view of an outboard motor embodying the principles of our invention;

Figure 2 is a partially sectioned side-elevational view of the same;

Figure 3 is an enlarged sectional view of the power head and clutch mechanism;

Figure 4 is a still further enlarged fragmentary view of Figure 3, showing the clutch in disengaged condition;

Figure 5 is a sectional view, taken along the line **5—5** in Figure 4, showing the preferred arrangement of the eccentric wheel, which actuates the clutch;

Figure 6 is a similar view of an alternative arrangement of the eccentric wheel and rollers, which provides positive engagement of the clutch and eliminates the need for a clutch spring;

Figure 7 is a partially sectioned side elevational view of the construction shown in Figure 6;

Figure 8 is a sectional view, drawn to enlarged scale and taken along the line **8—8** in Figure 3, showing the construction of the cooling-air fan chamber;

Figure 9 is a partially sectioned side elevational view of the outboard motor turned 180° around to drive the boat in reverse, illustrating the manner in which the anti-tilt lock plunger is cammed down behind a pin bolt on the transom bracket to prevent the motor from being tilted; and

Figure 10 is a vertical section taken through an alternative embodiment of the clutch mechanism.

Reference is had now to the drawings, wherein the reference numeral 10 designates the power head of the outboard motor in its entirety, said power head including the motor 11 with its related accessories such as the carburetor, magneto, fuel tanks, and starter. The lower unit is indicated at 13, and comprises a shaft housing 14 enclosing the drive shaft 15, clutch 16, gears 17, and propeller 18. The outboard motor is adapted to be mounted on the transom of a boat by means of a transom bracket 22, and is steered by a tiller bar 24 which is fixed to the top end of the shaft housing 14 and extends forwardly therefrom.

In the preferred embodiment of our invention, the motor 11 takes the form of a two-cylinder, two-cycle, air-cooled engine, having a crankshaft 26 disposed vertically and the cylinders 27 arranged in line, to the rear of the crankshaft. The two cylinders and the top half 28 of the crank case (or rear half as it appears in the drawings) are preferably cast en bloc, and a separate pan or bottom crankcase portion 29 is bolted to the top half 28. A carburetor 30 is mounted on the front end of the bottom crankcase portion 29 as shown, and the fuel-air mixture from the carburetor is drawn into a manifold chamber 31 and thence through reed valves 32 into separate crankcase compartments 33 and 34 by the pumping action of the pistons, as is well understood in the art. The crankshaft 26 is journaled in top, center, and bottom bearings 35, 36 and 37, respectively, said center bearing being supported in a solid partition 40 which divides the crankcase into the two pressure-tight compartments 33, 34.

The top end of the crankshaft 26 projects above the end of the crankcase and has a magneto rotor 41 mounted thereon in the usual manner. The stator 42 of the magneto is mounted on the top end of the crankcase in any suitable fashion, and has an operating lever 43 extending forwardly from the bottom side thereof, said lever preferably being also connected to the carburetor throttle valve by suitable linkage (not shown) so that the throttle is closed simultaneously with retarding of the spark.

The power head 10 is enclosed by a streamlined cast metal shell 50 which has the dual function of protecting the operator from contact with the hot engine, while at the same time providing a housing for the cooling air blower 51 and a shroud for directing the air down over the cylinders. The shell 50 is preferably made in two halves to facilitate coring the casting, said halves being joined together in a longitudinal vertical plane by a plurality of bolts, not shown. The blower 51 is of the centrifugal type and comprises an annular rim 52 having a radial flange 53 extending outwardly from the bottom edge thereof, with a plurality of angularly spaced, radially extending blades 54 fixed to both said rim and said flange. The blades 54 are preferably curved, as shown in Figure 8, which has the effect of improving the efficiency of the blower. An overhanging portion 55 of each blade projects radially inward over the top of the rim 52, and the rim 52 is pressed over the outer shell of the magneto rotor 41 to bring the bottom edge of said overhanging blade portions into contact with the top of the rotor shell.

The housing for the blower 51 is in the form of a volute, and is defined in part by the shell 50 and in part by a horizontal partition 56 cast integrally with the two halves of the shell and disposed in closely spaced relation beneath the flange 53. The partition 56 is formed with a circular opening 57 concentric with the crankshaft 26, through which the latter projects. Also cast integrally with the left hand half of the shell 50 (the top half, as seen in Figure 8) is a vertical partition 58 which is joined with the side and top of the shell and projects laterally inward to the inner edge of the horizontal partition 56. The left hand portion of the horizontal partition 56 terminates in an edge 59 which extends rearwardly from the opening 57 to the back end of the shell 50, parallel to the axis of the cylinder 27 and offset slightly to one side thereof, as shown in Figure 8. The edge 59 of the partition 56 serves to confine the cooling air to the finned cylinders 27, closing off the open spaces alongside the cylinders through which the air would otherwise be wasted. A circular opening 250 in the partition 56 directs a portion of the air down over the finned exhaust pipe 251 to cool the latter. The right hand half of the partition 56 terminates rearwardly in a shelf 252, the edge of which extends rearwardly from the opening 57 parallel to the opposite edge 59 to a point approximately even with the head end of the cylinders, where it is cut off to provide an enlarged opening through which a substantial portion of the air is directed down over the finned cylinder heads.

Cooperating with the shell 50 and partition 56 is a curved vertical wall 60 which may be made of sheet metal and which is attached by screws at one end 61 to the inner edge of the partition 58 and at the other end 62 to the shell 50. The wall 60 extends from the horizontal partition 56 up to the bottom surface of the top wall of the shell 50, and is shaped to conform closely to the curvature of the shell. The end 61 of the wall 60 lies closely adjacent to the outer periphery of the blower 51, while the opposite end 62 of the wall, diametrically across the blower, is tangent to the shell 50. The chamber thus formed between the blower wheel and the wall 60 is substantially a volute, increasing uniformly in cross sectional area from end 61 to end 62.

Air is drawn into the blower housing through a circular intake opening 65 in the top of the shell 50 concentric with the axis of the blower, and through a plurality of radially extending slots 67 arranged in a circle around the opening 65, as shown in Figure 1. These slots 67 provide the requisite cross sectional area for the intake opening, and at the same time afford a protective grill for preventing entrance of any foreign object into the blower which might damage the same or obstruct the free passage of air. The opening 65 is further protected by a rope-starter wheel 70 which is bolted at 69 to the top of the magneto rotor housing 41 and which is disposed slightly above the opening, said wheel having a somewhat larger outside diameter than the intake opening so that the latter is completely sheltered under the starting wheel. Air from the blower 51 is discharged through the opening 66 defined by the vertical edge 61 and the opposite wall of the shell 50, and is directed down over the finned cylinders and confined thereto by the downwardly curved rear end portion of the shell 50, being discharged to the atmosphere through an opening 71 in the bottom of the shell.

The blower housing construction described in the paragraphs above, utilizing the outer shell 50 of the power head for the greater part of its wall area, provides a unit of the very minimum bulk, which is an important consideration in outboard motors. Such motors are usually transported in automobile trunks and, at best, are unwieldy to handle. Furthermore, since they are usually attached to relatively small boats, a motor of excessive size presents an incongruous appearance. In addition to the consideration of size, the volute chamber construction, with its uniformly increasing cross-sectional area between points 61 and 62 contributes appreciably to the overall efficiency of the centrifugal blower, reducing the power required for cooling the engine.

The lower unit 13, as brought out previously, comprises a shaft housing 14 which encloses the drive shaft 15 and, at its upper end, contains a clutch 16. The shaft housing 14 is preferably die cast in four longitudinal sections 75, 76, 77 and 78, which are joined together as shown in Figure 2.

The top section 75 of the housing is cylindrical in shape and is provided at its upper end with a cup-shaped portion 80 of enlarged diameter which receives an annular mounting flange portion 81 projecting axially downward from the bottom end of the crankcase. The power head 10 is secured to the top section 75 of the lower unit 13 by means of two bolts 79 on opposite sides of the motor which extend through aligned bolt holes in the cup-shaped portion 80 and in the crankcase. The hollow interior of the housing section 75 is divided by a partition 82 to form an upper compartment 83 which is separate from the balance of the interior of the shaft housing. In the bottom portion of the partition 82 is a sleeve bearing 84 within which the drive shaft 15 is journaled. The shaft 15 is also journaled adjacent its bottom end in a second sleeve bearing 85 (see Figure 2) which is supported by a horizontal partition 86. The gears 17 are contained within a compartment 90 formed by companionate cavities in sections 77 and 78, and comprise a beveled pinion 91 fixed to the bottom end of shaft 15 which meshes with a beveled gear 92 mounted on and pinned to the horizontally disposed propeller shaft 93. The shaft 93 is journaled in bearings 94 and 95 and projects rearwardly from its housing, the propeller 18 being mounted thereon in the usual manner.

The shaft housing 14 also serves as an exhaust pipe through which the exhaust gases from the engine are carried for under-water discharge, and to this end, the top section 75 is provided on its back side with a port 98 which communicates with the open interior of the housing. The exhaust pipe 251 of the engine is bolted to said port, and the exhaust gases are carried down through the hollow shaft housing and discharged beneath the water through a flattened tail pipe 100 projecting rearwardly from the housing below the anti-cavitation plate 101 and in closely spaced relation thereto.

The drive shaft 15 is arranged coaxial with the crankshaft 26 of the engine and is adapted to be connected thereto by the clutch mechanism 16 which will now be described.

In its preferred form, illustrated in Figures 3 and 4, the clutch 16 comprises a driver 105 and driven member 106, the driver 105 being in the form of an inverted cup having a sunken center, and the driven member 106 being disposed beneath the driver and within the confines of the outer wall thereof. The driver 105 is bolted to the bottom side of a coupling member 110 having an upwardly extending flat tongue 111 which is slidably and non-rotatably disposed within a correspondingly shaped hole 107 in the end of the crankshaft. This construction provides a driving connection between the crankshaft and clutch driver which prevents the transmission of end thrust forces from either member to the other, and also provides a quickly separable coupling permitting the power head 10 to be lifted off of the lower unit when the two mounting bolts 79 are removed. The hub of the clutch driver 105 has a central bore 112 into which the outer race 113 of a ball bearing 114 is pressed. The top edge of the outer race 113 abuts against the bottom surface of member 110, while the bottom edge of the race is engaged by an inwardly turned flange 115 on the driver hub. The inner race, designated at 116, is pressed onto a stub portion 120 of reduced diameter at the end of the shaft 15, the bottom end of said race abutting against a shoulder 121 on the shaft, while the top end is engaged by a retainer ring.

The downwardly turned outer flange 122 of the driver 105 is conical in shape and is engaged on its inner face by a clutch facing 123 of corresponding conical shape which is secured by countersunk screws 119 to the outer periphery of the driven member 106. The driven member 106 is formed with a hub 125 having a square hole 126 broached through the center thereof which receives a portion 130 of square cross section on the shaft 15. By virtue of this construction, the driven member 106 is slidable axially along the shaft but is held against rotation with respect thereto. The driven member is yieldingly urged into engagement with the driver by means of a spring 131 which embraces the shaft 15 and bears against the bottom end of the hub 125. The bottom end of the spring 131 bears against a thrust washer 132 which is welded to the shaft 15 just above the bearing 24.

The advantages of the clutch construction described are many. Probably the most important of these advantages is the way in which the clutch facing is protected from oil which unavoidably seeps down through the bottom bearing 37 of the engine from the crankcase. Such oil drops into the cavity 133 in the top of the member 110 and is thrown outwardly by centrifugal force to the inside surface of the mounting flange 81 where it runs down into the compartment 83 and collects in the bottom thereof. The clutch driven member 106, being enclosed on the top and sides by the driver 105, is completely sheltered from any oil and enjoys complete protection therefrom. The oil then seeps through the clearances of the shaft bearing 84 to lubricate the latter and is expelled through the tailpipe 100 with the exhaust. The partition 82 prevents the entrance of exhaust gas into the compartment 83 where it would foul the clutch facings and escape through the opening 141.

Another advantage of our improved clutch lies in the arrangement of the clutch spring 131, thrust washer 132, driven member 106, driver 105, and ball bearing 114, whereby the thrust of the spring is taken in both directions by the drive shaft 15. By reason of this construction, the thrust of the spring 131 is isolated from the engine crankshaft, preventing undue wear on the thrust faces of the crankshaft main bearings.

Another advantageous feature of the clutch described resides in the fact that disengagement of the clutch is accomplished by pulling the driven member 106 down out of contact with the driver, and this is done by a shift lever 140 (to be described in more detail presently) which engages the driven member. Since the driven member comes to a stop as soon as the clutch is disengaged, it will be seen that there is no running friction between the shift lever 140 and the driven member 106 while the clutch is disengaged, which is a distinct advantage inasmuch as it eliminates the need for a special throw-out bearing which is necessary in the more widely used multiple disk clutch, or in other clutch constructions wherein the shifting lever acts on the constantly rotating driver.

The clutch 16 is disengaged by means of the shift lever 140 which extends through an opening 141 in the front wall of the shaft housing top section 75, and is pivotally mounted on a pin 142 for swinging movement in a vertical plane. The inner end of the lever 140 is bifurcated to form a fork 143, the fingers of which are disposed within a groove 144 in the hub 125 on opposite sides thereof. Pressed into a longitudinally extending hole 145, drilled in the outer end of lever arm 140, is a pin 146 upon which is journalled an eccentric 150. The outer rim of the eccentric 150 rides on a pair of laterally spaced rollers 151 and 152 disposed below the eccentric and positioned equidistantly on opposite sides of the axis thereof, said rollers being journalled on pin bolts 153 which are screwed into tapped holes formed in the outer face of a flange 154. The eccentric 150 and rollers 151, 152 are arranged so that when the low point of the eccentric is bearing on the rollers, as in Figure 5, the clutch driven member 106 is held in full engagement with the driver 105 by the spring 131. When the high point of the eccentric 150 is resting on the rollers, however, the outer end of the lever arm 140 is raised, causing the fork 143 to be depressed and the driven member 106 to be pulled down out of engagement with the driver. Two pairs of angularly spaced notches 155 and 156 (see Figure 5) are formed in the rim of the eccentric 150, on the high and low sides respectively, and these notches are adapted to receive the rollers 151, 152 when the eccentric is in either of its operative positions, providing a detent action which prevents the eccentric from rolling out of either operative position when the controlling means is released.

Operation of the clutch is effected by means of a twist-grip handle 160 having a cylindrical shank 161 which is journaled within a bore 162 in a member 163 pivoted at 164 on the outer end of the tiller bar 24. The purpose of the pivotal connection 164 is to permit the handle 160 to swing upwardly in the event the motor is tilted, as will be pointed out more fully hereinafter. The shank 161 of the handle is drilled centrally from the rear end thereof to provide a hole 165 which receives the front end of a flexible cable 166, said cable being secured in the hole by set screws 170. The rear end of the cable 166 is likewise received within a central, longitudinally extending hole 171 in the hub 172 of the eccentric 150 and is secured by set screws 173. The cable 166 is preferably comprised of several layers of oppositely wound strands of stainless steel wire and is capable of transmitting a considerable torque in either direction of rotation. Thus, it is seen that engagement or disengagement of the clutch 16 can be effected by merely turning the twist-grip handle 160 through 180°, the torque thus applied being transmitted by the cable 166 to the eccentric 150 to rotate the latter and thereby swing the operating arm 140 up or down, as the case may be.

Steering of the outboard motor is also accomplished by swinging the tiller bar 24 in the desired direction, the lower unit 13 being pivotally supported on the transom bracket 22 for swinging movement about the axis of the drive shaft 15 to permit such steering movement. To this end, the cylindrical top section 75 of the shaft housing is journalled within a vertical bore 176 in a tubular barrel portion 177 which is integral with a bracket member 180. The bracket member 180 extends forwardly from barrel portion 177 and is pivotally connected by a pin 181 to the vertical flange 182 of a clamp member 183, said clamp member 183 being formed with a downwardly extending backing plate 184 which bears against the back side of the transom 20. At its front end, the clamp 183 has a downwardly extending arm 185 terminating in a boss 186 having a threaded aperture therein which receives a clamping screw 190. At its rear end, the screw 190 has a bearing plate 191 pivotally connected thereto which is engageable with the front surface of the transom 20 to secure the transom bracket thereto, while the front end of the screw has a handle 192 by which the screw can be turned.

During normal operation of the outboard motor, when the boat is being driven straight ahead, the thrust of the propeller acting in a forward direction on the bottom of the lower unit produces a counterclockwise moment on the outboard motor which is resisted by engagement of a notch 194 on the lower front end of the barrel portion 177 with a transversely extending thrust pin 195, which extends through alined holes 196 in a pair of laterally spaced flanges 197 extending rearwardly from the backing plate 184 on opposite sides of the barrel member 177.

In order to accommodate variations in the inclination of the transom 20 encountered in different makes and models of boats, the flanges 197 are provided with a plurality of pairs of holes 196 which are arranged in an arc described about the pin 181 as a center. Thus, if a particular transom is inclined upwardly and rearwardly from the bottom of the boat and it is found that the outboard motor is tilted at an undesirable angle, the pin 195 can be withdrawn and reinserted through any other pair of holes 196 to bring the unit to a vertical position or to any desired degree of angularity.

The notch 194 engages the pin 195 on the back side only thereof to take the thrust of the propeller when the latter is driving the boat forwardly and, being open on the front side, allows the unit to tilt upwardly about the pin 181 if the propeller or skeg strikes an obstruction. Damage to the propeller and other parts of the outboard motor is thus avoided by allowing the unit to yield and ride over the obstruction, the normal driving position being resumed as soon as the lower unit has cleared the obstacle. A limit stop arm 198 projects downwardly and forwardly from the front end of the bracket member 180, and is engageable with the clamp member 183 to limit the angular movement of the outboard motor and prevent the propeller from being thrown out of the water if an obstruction is hit at high speed. The pivotal connection of the twist-grip handle 160 with the tiller bar 24, described earlier, allows the handle to fold upwardly when the unit tilts and thus prevents the handle from being torn out of the operator's hand by the sudden violent angular deflection of the handle. This arrangement also affords protection to the operator's hand against injury which might otherwise result if a rigid tiller bar handle were to strike the bottom of the boat or the transom. The flexible cable 166 merely bends when the tiller bar handle folds up, without disturbing the eccentric 150 or the clutch 16.

One of the features of the present outboard motor is that it can be turned 180° to drive the boat in reverse, and in this condition, with the direction of propeller thrust reversed, the unit must be restrained against tilting, as the propeller would otherwise push the bottom end of the lower unit up out of the water. Accordingly, we have provided an anti-tilt lock device, designated generally by the reference numeral 200, which is operated automatically when the outboard motor is turned more than 90° in either direction from straight ahead, to lock the unit to the transom bracket.

The anti-tilt lock 200 comprises a plunger 201 which is slidably disposed within a vertical bore 202 provided in the body of the bracket member 180 immediately ahead of and parallel to the barrel portion 177. The plunger 201 is yieldingly urged upwardly by a spring 203 embracing the plunger and bearing against the bottom of a bushing 204 which is pinned or otherwise secured to the plunger. The spring 203 and bushing 204 are contained within a counterbore 205 at the top end of the bore 202, said spring bearing at its bottom end against the shoulder 206 formed by the junction of the counterbore with the bore. The bore 202 opens through the bottom of the bracket member 180, and the bottom end of the plunger 201 is normally retracted into the bore so that it clears the thrust pin 195.

The plunger 201 is adapted to be cammed down to a position behind the pin 195, thereby locking the unit against tilting movement, and this is accomplished by an annular cam 210 which engages and acts upon the top end of the plunger. The cam 210 is formed integral with the top section 75 of the shaft housing and comprises a radially outward extending flange, the bottom surface of which bears on the plunger 201. The rear half 211 of the circular flange is the low side of the cam and lies in a horizontal plane, while the front half of the flange rises from each side of the shaft housing in the manner of a spiral ramp to a flat high point 212 at the front end of the housing. The cam 210 is so arranged and proportioned that when the outboard motor is in the straight-ahead position shown in Figure 1, with the top end of the plunger 201 in engagement therewith, the bottom end of the plunger is fully retracted into the bore 202, and the unit is free to tilt. When the outboard motor is turned more than 90°, however, the cam 210 depresses the plunger 201 down behind the thrust pin 195, locking the unit to the bracket member 180.

The arrangement illustrated in Figures 6 and 7 shows an alternative construction for the clutch actuating mechanism, featuring positive engagement of the clutch 16 instead of the spring-loaded engagement of the previously described construction. In this embodiment, the eccentric 150 is disposed between and turns on two pairs of rollers 220 and 221 which are located at the top and bottom of the eccentric. The two top rollers 220 are journalled on pin bolts 225 which are screwed into suitable tapped holes provided in the cup-shaped element 80, while the two bottom rollers 221 are journalled on pin bolts 226 which are screwed into the flange 154, as in the preceding embodiment. The throw-out mechanism is initially set up so that when the eccentric 150 is turned to bring its high point down to the bottom position, the clutch driven member will be just disengaged from the driver. Engagement of the clutch is then effected by turning the eccentric as far as it will turn in either direction, at which point the driven member will be solidly against the driver and further rotation of the eccentric prevented.

With this arrangement of the eccentric 150 between oppositely disposed pairs of rollers 220 and 221, the shift lever 140 is positively swung downwardly to engage the clutch, as well as upwardly to disengage the same, enabling the clutch spring 131 to be dispensed with. The operation of this clutch actuating mechanism is not affected by wear of the clutch facing 123, inasmuch as the eccentric is turned until full engagement is obtained, and a worn clutch merely requires slightly more of a turn on the eccentric 150 to take up the extra clearance.

Still another embodiment of our improved clutch is illustrated in Figure 10, wherein the clutch driver 105 and driven member 106 are substantially the same as in the preceding constructions, but with an alternative clutch actuating mechanism. In this instance, the hub of the driven member 106 comprises a downwardly extending cylindrical sleeve 260 which slidably receives the cylindrical top end of the drive shaft 15. The hub 260 is connected to the shaft 15 to drive the latter by a pin 261 which extends diametrically through the shaft 15, and the ends of said pin being slidably disposed within longitudinally extending slots 262 formed in the inner surface of the hub. The slots 262 thus permit the hub 260 of the driven member to slide up and down on the shaft 15, while the pin 261 transmits the drive from the clutch member 106 to the shaft 15. Screwed onto the bottom end of the hub 260 is a thrust ring 263 having a shoulder 264 which bears against the bottom end of a throw-out member 265 and which is also engaged by the spring 131. The member 265 has a smooth bore 266 which serves as a journal for the hub 260, and external threads 270 of coarse pitch formed on the outside surface thereof which are engaged in companionate internal threads in a stationary bushing member 271. The member 271 is screwed into a horizontal partition 272 formed integrally with the shaft housing top section 75. The top end of the throw-out member 265 is enlarged in diameter and has a plurality of radially extending tapped holes 273 formed therein, and screwed into one of said holes is the clutch lever 274 which extends forwardly through a transversely elongated opening 275 in the front wall of the housing element 75 to a point conveniently within reach of the operator.

The clutch is actuated by swinging the lever 274 horizontally from one side to the other, which rotates the throw-out member 265 and causes the latter to move up or down by reason of its threaded engagement with the stationary member 271. When the throw-out member moves down, the clutch driven member 106 is carried down with it by the ring 263 which is screwed onto the end of the hub 260 and which is engaged by the bottom end of the throw-out member. When the throw-out member moves up, the clutch driven member is pushed up by the spring 131 and follows the throw out member up until the clutch becomes fully engaged.

While we have shown and described in considerable detail what we consider to be the preferred embodiment of our invention, it will be understood that the aforesaid description is merely illustrative of the principles of the invention and not, in any sense restrictive on the same. To those skilled in the art, there will occur many changes in the shape and arrangement of the several parts going to make up the machine in its entirety, but such changes do not depart from the broad concept of the invention defined in the appended claims.

We claim:

1. In an outboard motor having a crankshaft, and a propeller drive shaft, a clutch serially arranged between said crankshaft and said drive shaft, the combination of a lever arm operatively connected to said clutch and pivotally supported for swinging movement between clutch-engaged position and clutch-disengaged position, an eccentric wheel journalled on said lever arm and engageable with a stationary element whereby rotation of the wheel causes said lever arm to move from one of said positions to the other, and a control handle operatively connected to said eccentric wheel to turn the same.

2. In an outboard motor having a crankshaft, a propeller drive shaft, and a clutch serially arranged between said crankshaft and said drive shaft, the combination of a lever arm operatively connected to said clutch and pivotally supported for swinging movement between clutch-engaged position and clutch-disengaged position, an eccentric wheel journalled on said lever arm and rolling on a pair of angularly spaced rollers disposed on one side of the center of the eccentric wheel whereby rotation of the wheel causes said lever arm to move from one of said positions to the other, and a control handle operatively connected to said eccentric wheel to turn the same.

3. In an outboard motor having a crankshaft, a propeller drive shaft, and means for securing said outboard motor to a boat and providing for pivotal movement of the outboard motor about a substantially vertical axis, the combination of a clutch serially arranged between said crankshaft and said drive shaft, a tiller bar connected to said outboard motor for turning the same to steer the boat, a lever arm operatively connected to said clutch and pivotally supported for swinging movement between clutch-engaged position and clutch-disengaged position, an eccentric wheel journalled on said lever arm, said wheel having rolling engagement on its periphery with at least one roller journalled on said outboard motor whereby rotation of the wheel causes said lever arm to move from one of its positions to the other, a handle movably mounted on said tiller bar, and means connecting said handle with said eccentric wheel for rotating the latter when the handle is moved.

4. In an outboard motor having a crankshaft, a propeller drive shaft, and means for securing said outboard motor to a boat and providing for pivotal movement of the outboard motor about a substantially vertical axis, the combination of a clutch serially arranged between said crankshaft and said drive shaft, a tiller bar connected to said outboard motor for turning the same to steer the boat, a lever arm operatively connected to said clutch and pivotally supported for swinging movement between clutch-engaged position and clutch-disengaged position, an eccentric wheel journalled on said lever arm, the peripheral edge of said wheel rolling on a pair of angularly spaced rollers journalled on said outboard motor on one side of the center of the eccentric wheel whereby rotation of the latter causes said arm to move from one of its positions to the other, the periphery of said wheel being notched to receive said rollers when the wheel is in either of its operative positions to prevent the wheel from turning by itself, a handle journalled on said tiller bar, and a flexible torque-transmitting cable connecting said handle to said eccentric wheel whereby the latter is turned when the handle is turned.

5. In an outboard motor having a crankshaft, a propeller drive shaft, and means for securing said outboard motor to a boat and providing for pivotal movement of the outboard motor about a substantially vertical axis, the combination of a clutch serially arranged between said crankshaft and said drive shaft, a tiller bar connected to said outboard motor for turning the same to steer the boat, a lever arm operatively connected to said clutch and pivotally supported for swinging movement between clutch-engaged position and clutch-disengaged position, an eccentric wheel journalled on said lever arm, two pairs of angularly spaced rollers journalled on said outboard motor on opposite sides of the axis of said eccentric wheel, the periphery of said wheel having constant rolling engagement with both pairs of rollers, whereby rotation of said wheel causes positive displacement of said lever arm from one of its positions to the other when the wheel is turned, and means on said tiller bar for turning said wheel.

6. In an outboard motor having a crankshaft, a propeller drive shaft, and a clutch serially arranged between said crankshaft and said drive shaft, the combination of a lever arm operatively connected to said clutch and pivotally supported for swinging movement between clutch-engaged position and clutch-disengaged position, an eccentric wheel journalled on said lever arm, two pairs of angularly spaced rollers journalled on said outboard motor on opposite sides of the axis of said eccentric wheel, the periphery of said wheel having constant rolling engagement with both pairs of rollers, whereby rotation of said wheel causes positive displacement of said lever arm from one of its positions to the other when the wheel is turned, and a control handle operatively connected to said eccentric wheel for turning the same.

7. In an outboard motor having a crankshaft, a propeller drive shaft coaxial with the crankshaft, and a clutch serially arranged between said crankshaft and said drive shaft, said clutch comprising an inverted cup-shaped driver having a non-rotatable sliding connection with said crankshaft, a companionate driven member slidably and non-rotatably connected with said drive shaft, said driven member being disposed within and engaging the inner surface of said driver, an anti-friction radial and thrust bearing having one race thereof fixedly mounted on said drive shaft, said driver being fixedly mounted on the other race of said bearing, a spring bearing at one end on said driven member and urging the latter into engagement with said driver, said spring bearing at its other against a shoulder on said drive shaft to transmit its thrust thereto, and means engageable with said driven member to

move the latter out of engagement with said driver against the thrust of said spring.

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