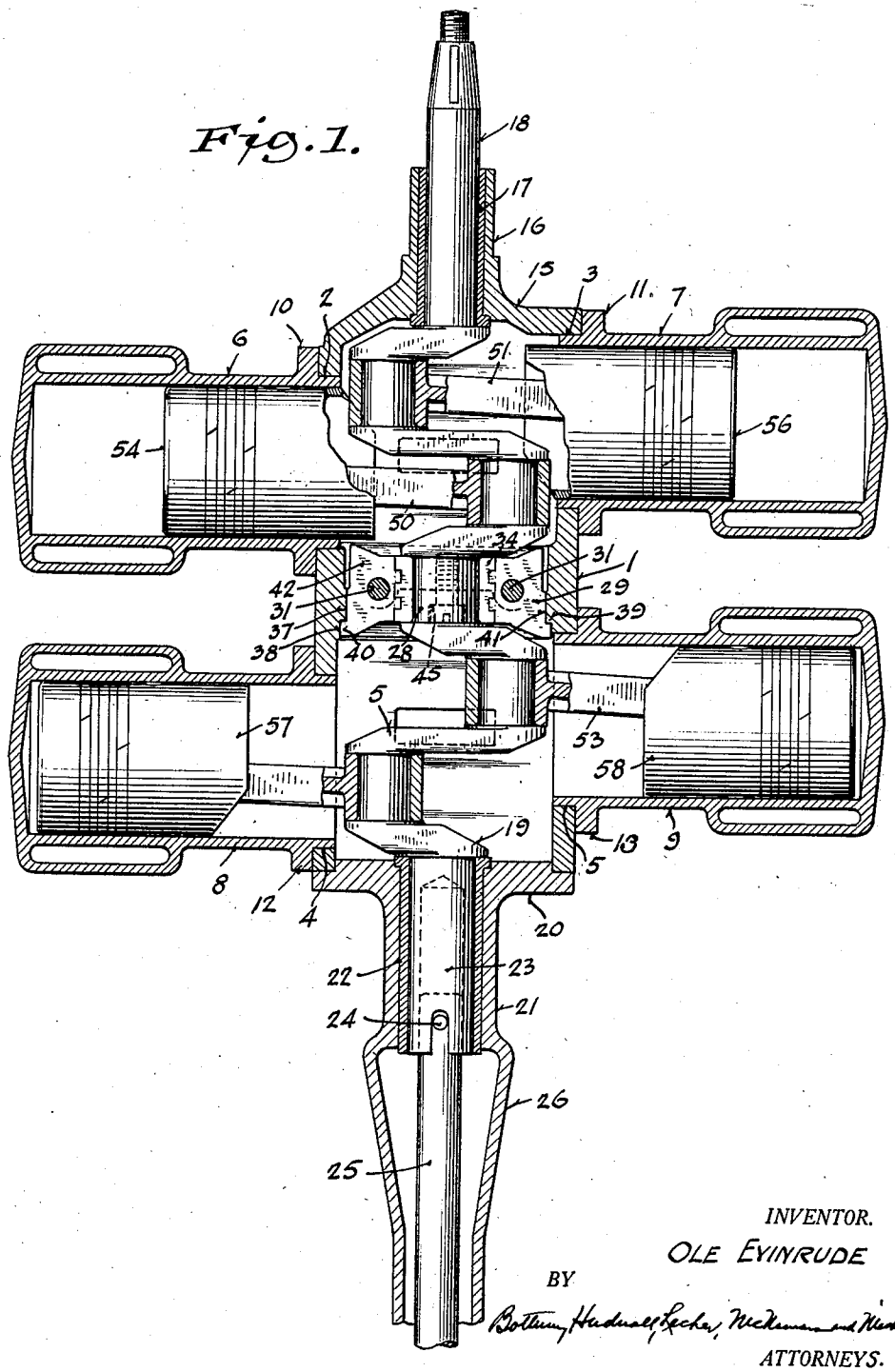
Aug. 18, 1931. O. EVINRUDE 1,819,323

FOUR-CYLINDER OUTBOARD MOTOR

Filed Feb. 27, 1928 2 Sheets-Sheet 1

Fig. 1.



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Fig. 2.

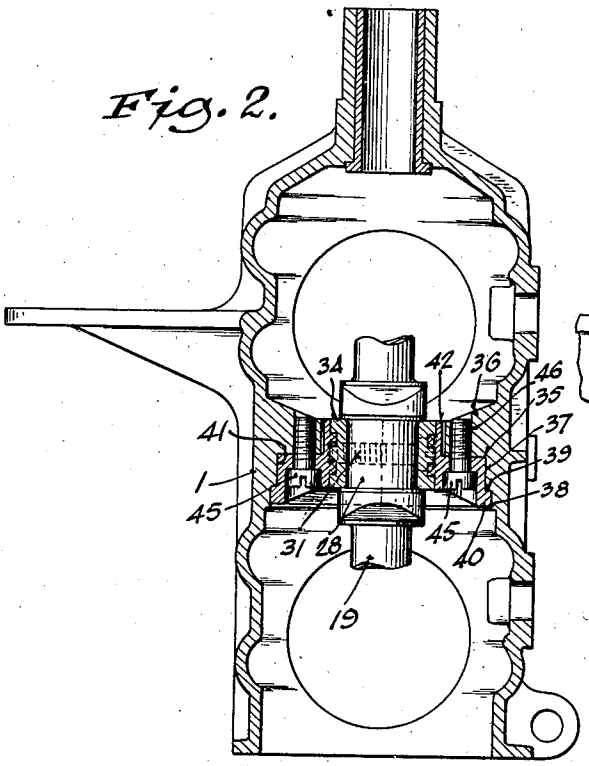


Fig. 3.

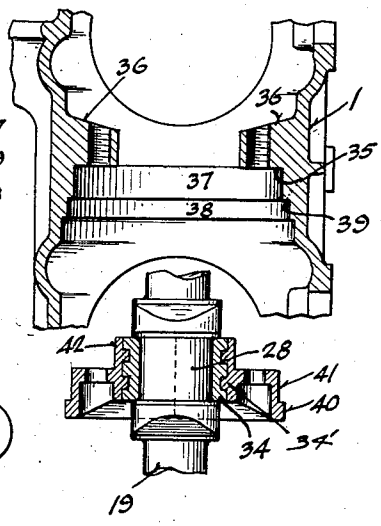
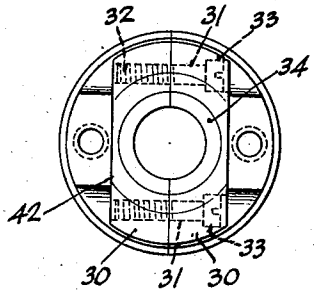


Fig. 4.



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UNITED STATES PATENT OFFICE

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FOUR CYLINDER OUTBOARD MOTOR

Application filed February 27, 1928. Serial No. 257,501.

This invention relates in general to outboard motors and more particularly to a high speed four cylinder outboard motor.

In general the object of the present invention is to simplify the construction and assembly of a high speed outboard motor of this type while enhancing such essential features as strength, rigidity and durability and retaining a comparatively light weight motor. The outboard motor embodying the present invention may have an average crankshaft speed of 3800 r. p. m. and develops a maximum of speed, power and flexibility with a marked smoothness in operation and without vibration at even high speeds.

In carrying out the present invention, an outboard motor is provided which has a one piece crank casing and a novel bearing arrangement for the crank shaft, so constructed and so organized with the crank casing as to facilitate the assembly of the motor and yet the crank shaft is so supported as to minimize vibration even at the high speeds developed. A crank shaft with three bearing portions is provided, one bearing portion being located at one end of the crank shaft and being fitted in a bearing member cast integral with the crank casing. At the other end of the casing, a separable bearing and cap or closure is provided and is placed in position after the crank shaft has been assembled with the crank casing. Intermediate its ends the crank casing is provided with a seat for a novel bearing member of sectional construction which is assembled with the crank shaft prior to the assembly of the crank shaft with the crank casing. Co-operating means is provided between the bearing and the seat and between the bearing and the crank casing for securing the bearing in position and for sealing the crank case into two chambers, one chamber communicating with one pair of cylinders and the other chamber communicating with the other pair of cylinders.

Other objects and advantages of the invention reside in certain novel features of the construction, arrangement and combination of parts which will be hereinafter more fully described and particularly pointed out in the appended claims, reference being had to the accompanying drawings forming a part of this specification, and in which:

Figure 1 is a fragmentary view partly in transverse central vertical section and partly in side elevation showing a four cylinder outboard motor constructed in accordance with the present invention;

Figure 2 is a sectional view of the crank case, the plane of the section being at right angles to the section shown in Figure 1, the center bearing for the crank shaft being shown partly in section and partly in elevation;

Figure 3 is a fragmentary view partly in section and partly in elevation illustrating how the center bearing is assembled with the crank shaft prior to the introduction of the crank shaft into the crank casing; and

Figure 4 is a detail view in elevation of the center bearing.

Referring to the drawings, wherein for the sake of illustration is shown an outboard motor embodying the present invention, the numeral 1 designates generally a one piece crank casing. The crank casing is provided with openings 2, 3, 4 and 5 receiving the inner ends of the cylinders 6, 7, 8 and 9, these cylinders having flanges 10, 11, 12 and 13 snugly abutting machined surfaces provided therefor on the crank casing and being rigidly fastened to the crank casing by any suitable fastening means. At one end, the crank casing has an integral end wall 15 formed with a tubular bearing 16 lined with a bushing 17 engageable with a bearing portion 18 of a crank shaft designated generally at 19. The opposite end of the crank casing is closed by an end piece 20 rabbeted around its periphery to interfit with the end of the crank casing. Suitable means is provided for securing the end piece to the crank casing. The end piece 20 also has a tubular bearing 21 lined with a bushing 22 with which a bearing portion 23 of the crank shaft is engaged. This portion 23 may be coupled as at 24 with the drive shaft 25 and a section of a housing for the drive shaft designated at 26 may be integrally formed with the tubular bearing 21.

The crank shaft 19 also has an intermediate bearing portion 28 and for this intermediate bearing portion a novel bearing designated at 29 is provided. The bearing 29 is split and consists of two half sections 30 which are held in position around the bearing portion 28 of the crank shaft by means of screws 31 threadedly engaged as at 32 with one of the sections 30 and having their heads countersunk as at 33 in the other section. Each section 30 includes a body portion 34' and a bushing 34 (see Fig. 3), the bushing being cast into permanent interfitting relation with ribs and grooves provided on the inner periphery of the body portion.

The crank casing 1 is provided with a seat designated generally at 35 for the bearing 29 and with inwardly directed webs or lugs 36 provided on opposite sides of the crank casing adjacent the seat 35. The seat 35 is of stepped formation and consists of accurately machined cylindrical surfaces 37 and 38 of slightly different diameter and a machined shoulder 39 at the juncture of the surfaces 37 and 38. The bearing 29 is formed at one end with a flange 40 machined to have gas tight fit with the surfaces 38 and 39 of the seat and also has a peripheral surface 41 machined to fit snugly the surface 37 of the seat. One side of the bearing 29 bears against the webs or lugs 36 and this same side has a reduced extension 42 of non-circular form which extends in between the webs or lugs 36. Screws 45 are fitted in countersunk openings provided in the bearing member 29 and are threadedly connected as at 46 with openings provided therefor in the webs 36.

With this construction the bearing 29 is first assembled with the bearing portion 28 of the crank shaft prior to the assembly of the crank shaft with the crank casing, this being accomplished by fitting the sections 30 of the bearing about the portion 28 of the crank shaft and securing these assembled sections by inserting and taking up on the screws 31. With the bearing 29, thus assembled on the crank shaft, the crank shaft and bearing 29 are introduced into the open end of the crank casing and the bearing portion 18 of the crank shaft is inserted into the tubular bearing 16. The bearing 29 may then be secured in place by inserting and tightening up the screws 45, the openings 4 and 5 and the open end of the crank case permitting of access to the bearing 29 for tightening up or removing the screws 45. With the bearing 29 secured in position, the end piece 20 may be assembled and then after connecting rods 50, 51, 52 and 53 and pistons 54, 55, 56, 57 and 58 are placed in position, the cylinders may be assembled with the pistons and with the crank casing to complete the assembly of the major elements of the motor.

This construction not only simplifies the problem of assembly and makes it possible to use a rigid one piece crank case, but also so supports the crank shaft as to minimize vibration and make possible a smooth running motor operable at extremely high crank shaft speeds to develop a maximum of speed, power and flexibility.

The motor illustrated operates on the conventional two stroke cycle wherein the charge is drawn into the crank casing on the outstroke of the pistons, compressed therein on the instroke of the piston and then by-passed into the combustion chamber through piston controlled ports for compression and firing. This is a well known and widely used cycle and the details for accomplishing it are well known but it becomes essential when using a four cylinder outboard motor to isolate or provide a gas tight seal or partition between the space in the crank casing serving one pair of cylinders and the space in the crank casing serving the other pair of cylinders. This is accomplished in this invention by the same means which affords an intermediate bearing for the crank shaft. In other words, the bearing 29 so interfits with the crank casing as to provide a gas tight partition. The machined engaging surfaces of the bearing 29 and its seat 35 are usually sufficient to accomplish this seal but shellac or gaskets may be provided between the engaging surfaces if desired. The sections 30 of the bearing 29 may have their engaging faces shellaced if desired.

I claim:

1. An outboard motor engine of the two cycle type comprising two pair of cylinders, a single piece crank casing having openings around which the cylinders are secured, pistons operating in the cylinders, a crank shaft, connecting rods between the crank shaft and the pistons, said crank shaft having three bearing portions, said crank casing having end bearing members engageable with two of the bearing portions of the crank shaft, at least one of said end bearing members being removable, a sectional bearing member comprising parts joined on an axial plane engaged with the intermediate bearing portion of the crank shaft, a seat formed on an intermediate portion of the crank casing and with which the sectional bearing member has a gas tight fit and means for securing the sectional bearing member to the crank casing, the cranks of said shaft and the cylinders on said crank casing being so arranged as to provide differing cycles of operation at the opposite sides of said sectional bearing member, and said member being adapted to prevent leakage from one side to the other when one side of the crank case is under compression and the other is not.

2. An outboard motor comprising a crank casing having end bearing members co-operable with end bearing portions of the crank

shaft, at least one of the end bearing members being removable, the crank shaft being insertable endwise into the other bearing member, a stepped bearing seat provided directly in an intermediate portion of the crank casing, inwardly extending opposed webs adjacent said seat, a sectional intermediate bearing member encircling an intermediate bearing portion of the crank shaft and having its periphery adapted to snugly engage said seat and means co-acting with the intermediate bearing member and the webs for securing the intermediate bearing member to its seat.

3. An outboard motor engine including a crank casing, a crank shaft, and means for rotatably supporting the crank shaft on the crank casing and including a separate intermediate bearing member made up of sections with faces abutting in an axial plane assembled about an intermediate bearing portion of the crank shaft, means for holding the sections together, said crank casing having a seat with which the intermediate bearing member is engaged, webs on the crank casing and fastening means cooperable with the webs and with the bearing member for securing it to its seat.

4. An outboard motor including a crank casing, a crank shaft, and means for supporting the crank shaft on the crank casing and for providing a gas tight partition in the crank casing and comprising a separate bearing member engageable with a bearing portion of the crank shaft, said crank casing having a recessed seat directly receiving said separate bearing member, and means for holding the bearing member in gas tight relation to its seat.

5. An internal combustion engine having crank case compression, said engine comprising a one piece crank case provided with cylinder openings, cylinders secured to said crank case about said openings, a crank shaft of one piece provided with cranks spaced in said case and end and intermediate bearing portions, bearing means supporting the end bearing portions of said shaft from said case and constituting closures for the ends of the case, and a central bearing partition constituting a multi-part disk assembled about the central bearing portion of said shaft and anchored in gas tight relation to said case, the cranks on said shaft being so disposed as to actuate pistons oppositely with respect to the heads of the respective cylinders, whereby to create in the opposite ends of the crank case a relatively high pressure differential alternately favoring the respective ends.

6. An internal combustion engine comprising a tubular crank case divided intermediate its ends with a shouldered seat including cylindrical bores of differing internal diameters, a crank shaft provided with bearings in ends of said case and having an intermediate bearing portion, and a partition member having differing external diameters corresponding to the diameters of said seat, and a shoulder complementary to the shoulder of said seat, said partition member including a bearing for the central bearing portion of said shaft and adapted therewith to constitute a gas tight closure between the ends of said case.

7. An internal combustion engine comprising a tubular crank case divided intermediate its ends with a shouldered seat including cylindrical bores of differing internal diameters, a crank shaft provided with bearings in ends of said case and having an intermediate bearing portion, and a partition member having differing external diameters corresponding to the diameters of said seat, and a shoulder complementary to the shoulder of said seat, said partition member including a bearing for the central bearing portion of said shaft and adapted therewith to constitute a gas tight closure between the ends of said case, said partition member comprising parts joined upon an axial plane and operatively connected together about said shaft.

8. An internal combustion engine comprising a crank case provided intermediate its ends with an annular seat and spaced centrally projecting boss immediately adjacent thereto, a bearing member complementary to said seat and closely fitted therein, and screw threaded means connecting said bearing member with said boss for tightening said bearing member upon said seat.

9. An internal combustion engine comprising a crank case provided intermediate its ends with an annular seat and spaced centrally projecting boss immediately adjacent thereto, a bearing member complementary to said seat and closely fitted therein, and screw threaded means connecting said bearing member with said boss for tightening said bearing member upon said seat, said bearing member being recessed to receive said boss.

10. An internal combustion engine comprising a crank case provided with an annular seat, and integral bosses spaced about said case adjacent said seat, and a crank shaft bearing adapted to constitute a gas tight partition across said case, said bearing comprising semi-cylindrical parts joined in an axial plane having portions projecting axially between said bosses, and connecting means extending through said axially projecting portions to connect said parts, and supplemental connecting means attaching the respective parts to said bosses.

In witness whereof, I hereto affix my signature.

OLE EVINRUDE.