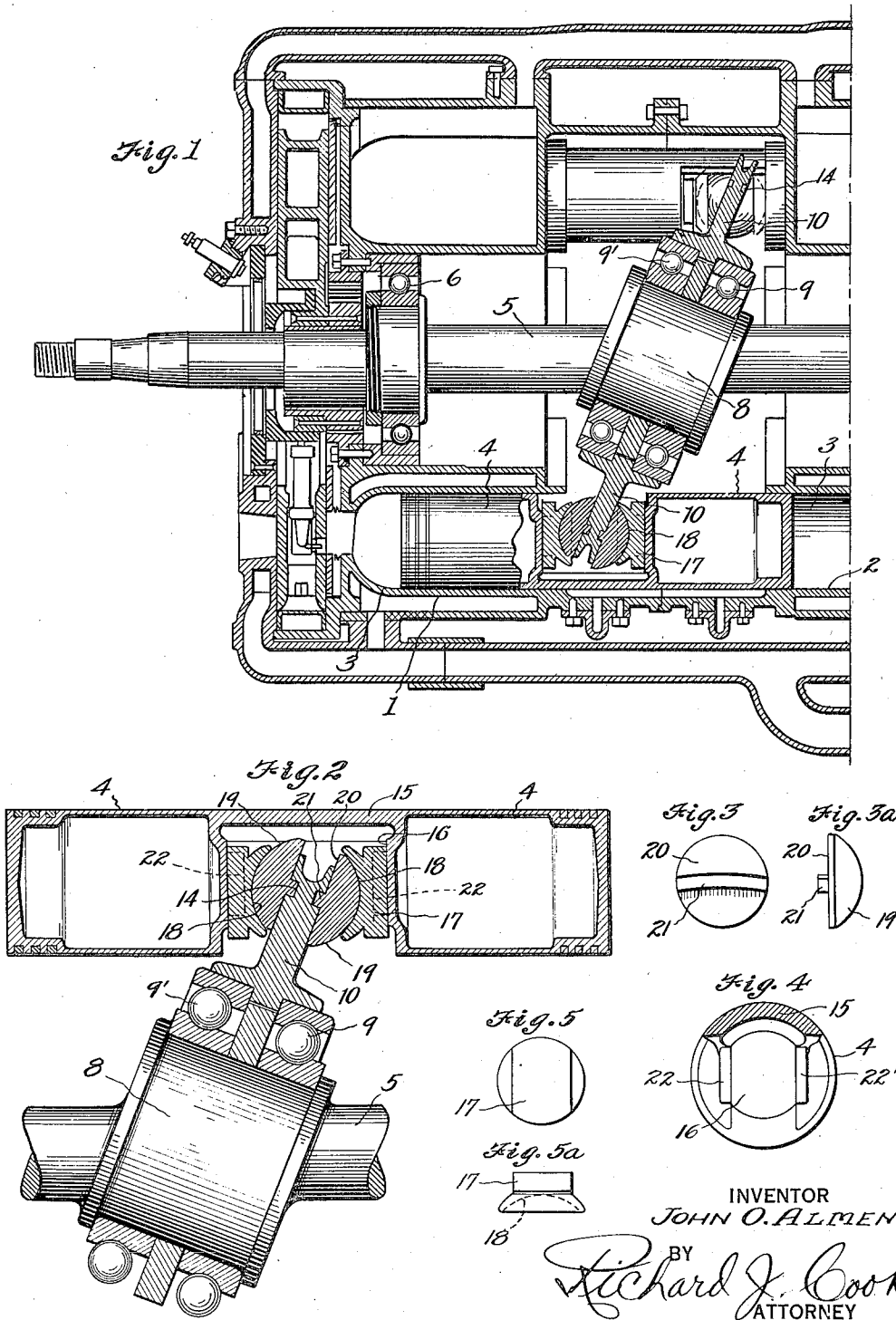


J. O. ALMEN.  
INTERNAL COMBUSTION ENGINE.  
APPLICATION FILED SEPT. 27, 1920.

1,430,275.

Patented Sept. 26, 1922.



# UNITED STATES PATENT OFFICE.

JOHN O. ALMEN, OF SEATTLE, WASHINGTON, ASSIGNOR TO ALMEN-CROSBY MOTORS COMPANY, INC.

## INTERNAL-COMBUSTION ENGINE.

Application filed September 27, 1920. Serial No. 413,092.

*To all whom it may concern:*

Be it known that I, JOHN O. ALMEN, a citizen of the United States, and resident of the city of Seattle, county of King, State of Washington, have invented certain new and useful Improvements in Internal-Combustion Engines, of which the following is a specification.

This invention relates to improvements in internal combustion engines, and more particularly to improvements in engines comprising a plurality of cylinders that are arranged circularly about and parallel with a central power shaft and equipped with pistons that are so connected with the shaft that their reciprocation in proper sequence will impart rotary motion to the shaft.

The type and construction of engines for which the present improvement is intended will be better understood by referring to my co-pending application for improvements in valve mechanism for internal combustion engines, filed August 10, 1920, and serially numbered 402,565.

The object of the present invention is to improve upon the means whereby the several pistons are connected with the power shaft, in order to provide a less expensive construction, one that is more easily assembled and which eliminates certain gearing heretofore used without lessening the efficiency of the engine in operation.

In accomplishing this and other objects of the invention, I have provided the improved details of construction, the preferred forms of which are illustrated in the accompanying drawings, wherein—

Figure 1 is a longitudinal, sectional view of an engine embodying improved features of construction according to the present invention.

Figure 2 is an enlarged, detail, sectional view of a piston and a part of the engine crank shaft connected by means of a disk and bearings constructed and assembled according to my invention.

Figure 3 is an under side view of one of the bearing members used, showing the accurate guide rib thereon adapted to the guide slot in the connecting disk.

Figure 3<sup>A</sup> is a side view of the same.

Figure 4 is a transverse sectional view of the piston, substantially on the line 4—4 in Figure 2.

Figure 5 is an under side view of one of the socketed bearing members.

Figure 5<sup>A</sup> is a side view of the same.

Referring more in detail to the several views of the drawings, wherein like reference numerals designate like parts—

1 and 2 designate complemental housings or cylinder casings, each of which embodies a plurality of circularly arranged cylinders 3 wherein pistons 4 are operatively mounted for reciprocation.

Extending longitudinally and centrally through the engine casing, in parallel alignment with the cylinders, is a power shaft 5 supported adjacent its opposite ends within anti-friction bearings 6 which retain it rigidly in functional alignment with respect to the several pistons.

Formed on the drive shaft between the inner ends of the cylinders, is a journal 8, the axial line of which bisects the axial line of the shaft at an acute angle, and mounted revolubly on this journal through the intermediacy of two spaced apart sets of anti-friction ball bearings 9—9 is a rocker plate 10 through which driving energy is transmitted from the pistons to the power shaft.

The plate 10 comprises a ring-like disk having oppositely extending peripheral flanges 12—12' adjacent its inner periphery that are adapted to overlies and support the same functionally upon the bearings 9—9', and about its outer periphery, in its opposite faces, are concentrically formed grooves 14.

The pistons of corresponding cylinders of the two casing sections, are joined by neck elements 15 and are spaced apart so as to receive the periphery of the plate 10 between their inner end walls.

Connection between the member 10 and the several pistons is effected in the following manner:

The inner ends of each set of pistons are provided with flat bearing surfaces 16, and seated thereagainst, at opposite sides of the plate 10 are bearing blocks 17, each having a smooth base portion fitting the surfaces 16 and provided on their opposite sides with inwardly opening, spherically formed sockets 18 adapted to co-operatively receive the spherically formed surfaces of bearings 19; the latter comprising flat inner faces 20 which seat against opposite faces of the

plate 10 and which have radially curved ribs 21 thereon which extend slidably into the grooves 14 in the opposite sides of the plate.

5 The inner end walls of the pistons are provided with guide flanges 22—22' between which the bases of the blocks 17 are adapted to slide in a radial direction toward or from the shaft 5.

10 By reason of mounting the rocker head on an inclined journal, reciprocation of the power driven pistons will impart a wobbling motion to the rocker plate which in turn effects the rotation of the shaft 5.

15 Owing to this manner of connecting the several pistons with the rocker plate, it is required that there be no fixed relation between the members but that the bearing members be permitted, as the pistons reciprocate, to move radially toward and from the shaft 5 and also that the plate 10 be permitted to move in opposite circumferential directions relative to the bearings 19. Both of these movements are provided for in the present construction, the first in the slidable mounting of the blocks 17 between the guide flanges 22—22' on the piston ends, and the latter in the sliding connection of the ribbed bearings 19 on the opposite faces of the plate 10.

30 Blocks 17 are made slidable radially in the pistons, in order that the pressure which would otherwise be set up between the piston and cylinder wall, due to the inclined plate, may be eliminated in the position shown in the drawings. There is a pressure against the cylinder at other positions which, as in the ordinary motor, acts in both directions and the algebraic sum of these pressures is equal to the torque of the motor. Another reason for this construction is that it will prevent any slight tendency of rotation on the part of the piston due to friction in the connecting bearings to the wobbler.

45 Since it is only necessary that the rocker plate have a limited movement circumferentially with respect to the pistons, it would be possible to provide short slots, which could be straight or radially curved, instead of providing the continuous grooves 14, and mount the ribs of the bearing members 19 within these slots. It is apparent also that the plate could be ribbed and the bearing members grooved to receive the ribs, instead of the reverse construction illustrated.

In operation, the admitting and exhausting of fuel charges in proper sequence into and from the cylinders causes reciprocation of the pistons to impart a wobbling motion to the plates 10 and this imparts rotary motion to the shaft 5; the bearing members 17 moving radially toward and from the shaft 5, and the plate 10 moving revolvably on its mounting members as is necessary during the reciprocation of the pistons.

By this manner of connection I have provided a less expensive construction than was formerly used, one that is more easily, and which requires less time and expense in assembling, and by which certain gearing heretofore used has been eliminated without lessening the efficiency of the engine in operation.

Having thus described my invention, what I claim as new therein and desire to secure by Letters-Patent, is:

1. In an engine of the class described, the combination with a revolvable power shaft and a piston operating in a line parallel with the shaft, of a rocker plate mounted on the shaft and coacting bearing members mounted between a face of the plate and the piston end having a sliding connection with the piston to permit movement toward and from the power shaft, and a sliding connection with the plate to prevent lateral pressure on the piston.

2. In an engine of the class described, the combination with a revolvable power shaft having a journal thereon with its axial line intersecting the axial line of the shaft at an angle, and a piston operating in a line parallel with the shaft, of a rocker plate mounted revolvably on the journal, complementary bearing members disposed between a face of said plate and an end of said piston, one of said bearing members having a fixed sliding connection with the piston to move only in a direction toward and from the power shaft, and the other of said bearing members having a slidable connection with said plate which permits the plate to move circumferentially with respect to the bearing.

3. The combination in an engine comprising a casing having a plurality of cylinders arranged circularly therein, pistons mounted for reciprocation in said cylinders and a power shaft mounted to revolve centrally of the cylinders having an inclined journal thereon, of an annular rocker plate mounted revolvably on said journal, and co-acting ball and socket bearing members mounted between the piston ends and face of said plate; one of said members having radial slidable connection with the piston end toward and from the power shaft and the other member having arcuate connection with the rocker plate, for the purpose set forth.

4. The combination in an engine comprising a casing having a plurality of cylinders arranged circularly therein, pistons mounted for reciprocation in said cylinders and a power shaft mounted parallel with and centrally of the cylinders and having a journal thereon with its axial line intersecting the axial line of the shaft at an acute angle, of an annular rocker plate having annular grooves concentrically therein mounted to revolve on said journal and co-

acting ball and socket bearing members mounted between the piston ends and plate; the outer of said members having radially slidable movement on the inner piston ends toward and from the power shaft and the other members having arcuate guide ribs thereon seating in said annular grooves and slidable on said plate.

5. The combination in an engine comprising complementary casing sections each having a plurality of cylinders arranged circularly therein and in axial alinement with those of the other section, rigidly joined pistons mounted for reciprocation in corresponding cylinders and having spaced apart walls at their inner ends, a power shaft mounted to revolve centrally of the cylinders having a journal formed thereon at an incline to the axial line of the shaft, an annular rocker plate mounted to revolve on said journal with its peripheral edge extending between the inner end walls of joined pistons, co-acting ball and socket members disposed between the end walls of joined pistons, and opposite faces of said rocker plate; the outer of said members having sliding connection with the piston walls in a direction toward and from the power shaft, and the inner members having pivotal movement on said outer members and ar-

cuate, slidable movement on the rocker plate about the journal axis.

6. The combination with complementary casing sections each having a plurality of cylinders arranged circularly therein and in axial alinement with those of the other section, rigidly joined pistons mounted for reciprocation in corresponding cylinders and having spaced apart walls at their adjacent ends provided with bearing guide flanges, a power shaft mounted centrally of the cylinders having a journal thereon at an incline to the axial line of the shaft, of an annular rocker plate, having annular grooves in its opposite faces and concentric therewith, co-acting ball and socket bearing members mounted between the inner piston end walls and said plate, the outer of said members being slidably mounted between said piston guide flanges to move radially toward and from the power shaft and the inner members having spherical surfaces adapted to move pivotally within said outer socketed members and provided on their inner surfaces with arcuate guide ribs slidable in said plate grooves for the purpose set forth.

Signed at Seattle, Washington this 21st day of September 1920.

JOHN O. ALMEN.