Nov. 27, 1945. T. L. CHARD 2,389,764

OSCILLATORY ENGINE

Filed June 20, 1942 3 Sheets-Sheet 1

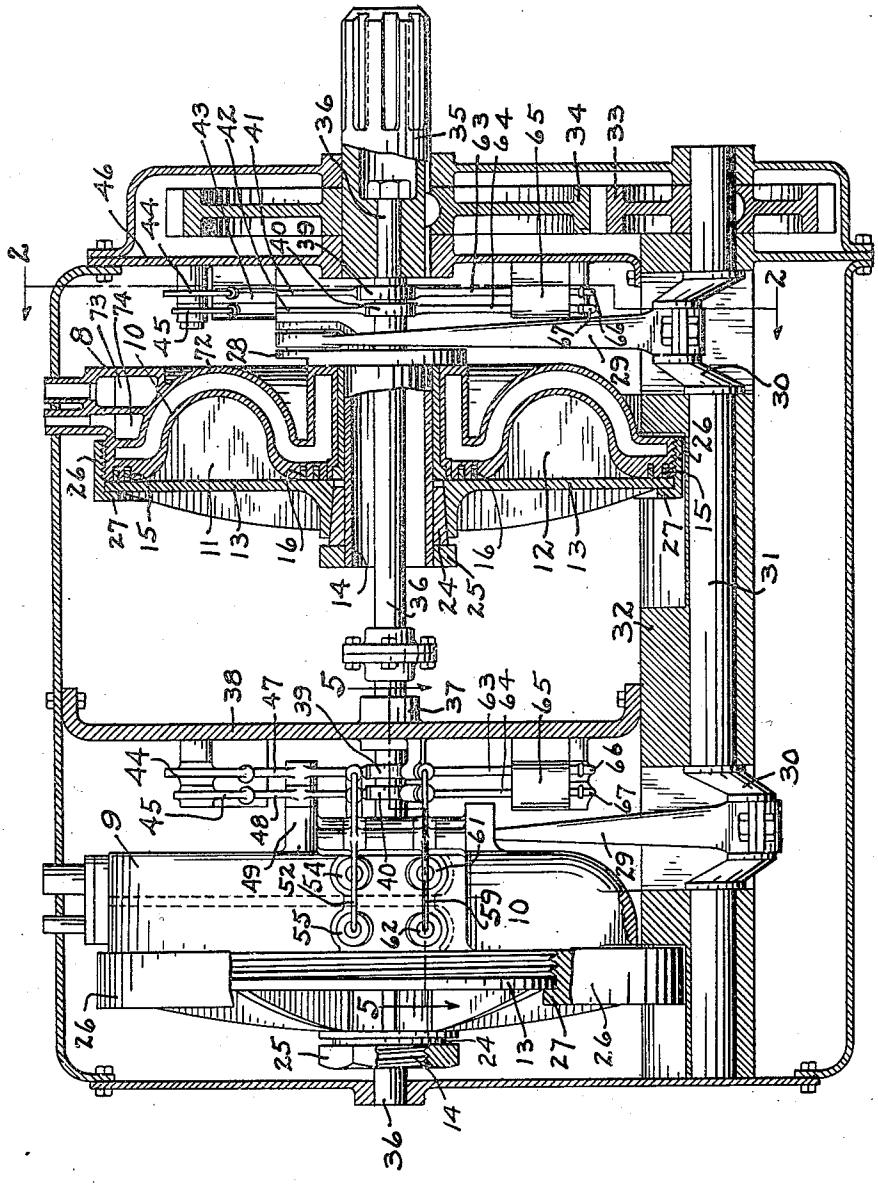

Fig. 1.

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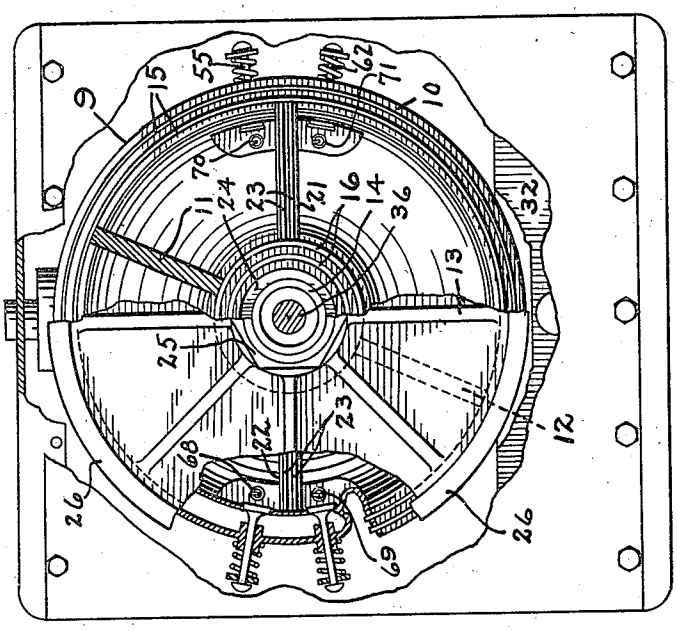

Fig. 3.

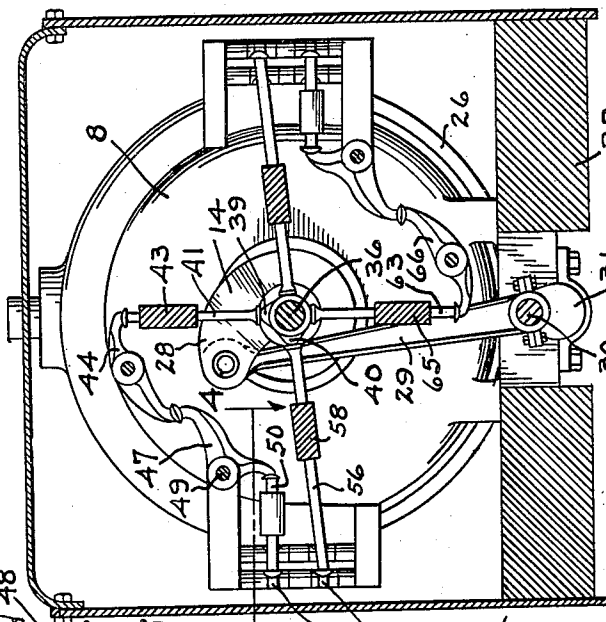

Fig. 2.

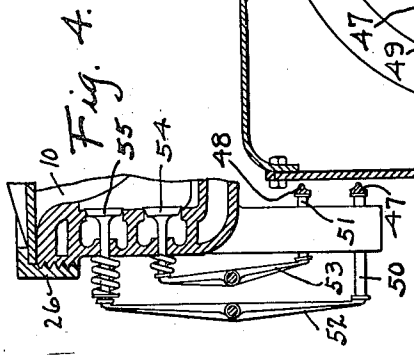

Fig. 4.

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OSCILLATORY ENGINE

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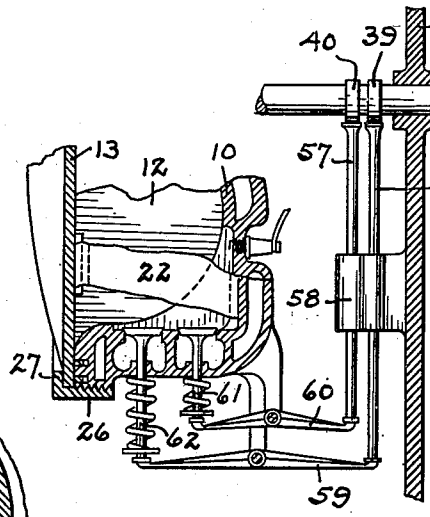

Fig. 5.

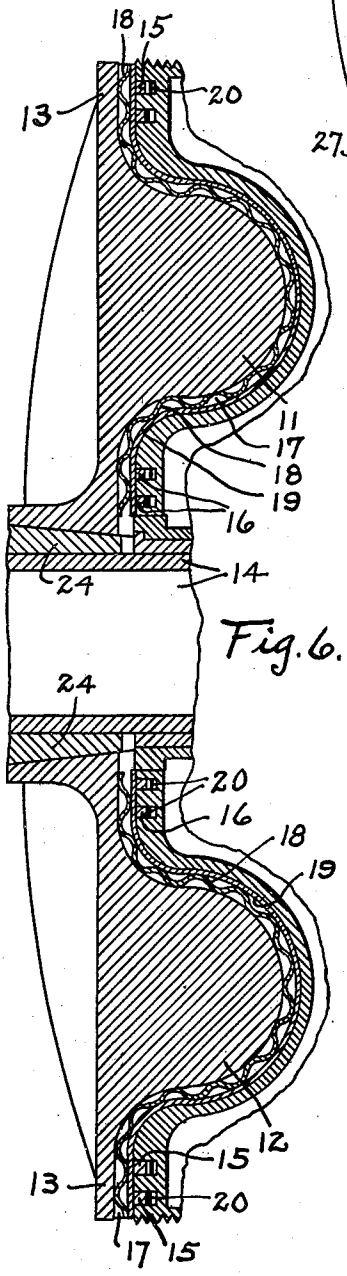

Fig. 6.

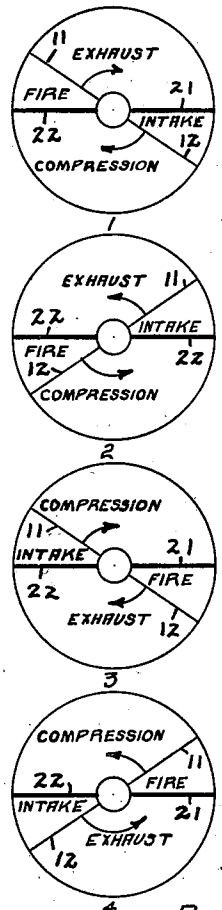

Fig. 7.

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Patented Nov. 27, 1945

2,389,764

UNITED STATES PATENT OFFICE

2,389,764

OSCILLATORY ENGINE

Telford L. Chard, Indianapolis, Ind., assignor of one-half to Lodge Y. Chard, New Castle, Ind.

Application June 20, 1942, Serial No. 447,829

4 Claims. (Cl. 123—18)

This invention relates to an internal combustion oscillating type engine and has for a primary object the provision of a structure whereby a pair of pistons are carried by a plate serving as a cover over a raceway within which the pistons oscillate between a pair of abutments extending across the raceway.

An advantage of the invention resides in the fact that the piston carrying plate may oscillate over the raceway with a minimum amount of friction arising by sealing means, and at the same time the plate may be readily removed from the raceway.

Heretofore the structure of oscillating engines as known to me embodied that construction wherein the pistons were substantially circular in section as opposed to the substantially semicircular section of the pistons employed in my structure. The circular or cylindrical pistons of those prior engines required a split housing with the necessary accompanying complications of effecting seals. In the structure embodying my invention, the sealing is very simply accomplished and may be maintained by suitable adjusting of the plate in relation to the raceway in order to compensate for wear.

These and other objects and advantages of the invention will become apparent to those versed in the art in the following description of one particular form of the invention illustrated diagrammatically in the accompanying drawings, in which

Fig. 1 is a view in central, vertical, longitudinal section through a structure embodying the invention;

Fig. 2, a view in vertical transverse section on the line 2—2 in Fig. 1;

Fig. 3, a view in rear elevation and partial section;

Fig. 4, a detail in section on the line 4—4 in Fig. 2;

Fig. 5, a detail view on an enlarged scale in section on the line 5—5 in Fig. 1;

Fig. 6, a view in diametrical section on a further enlarged scale through the cover plate and raceway; and

Fig. 7, a diagram of the cycles of operation.

Like characters of reference indicate like parts throughout the several views in the drawings.

In the present example, a two-unit type of engine is illustrated, it being understood that the engine may be constructed in a single unit or any multiple number of units. Referring to the drawings, each unit, generally designated by the numerals 8 and 9, includes a casing 10 having an annular raceway opening from one side; a pair of substantially semicircular pistons 11 and 12 sealably fitted to slide around the raceway; a plate 13 from which the pistons 11 and 12 extend (in the present showing, integrally therefrom); and a rocker shaft 14 to which the plate 13 is removably secured. The pistons 11 and 12 extend from the inner face of the plate 13 in a common diametrical plane normal to the inner face of the plate 13. This inner face of the plate 13 is planar.

The casing 10 is provided with one or more sealing rings 15, herein shown as two in number, carried in spaced apart slots around a peripheral portion on that side of the casing directed toward the inner face of the plate 13. The casing 10 is provided with a central portion surrounding the rocker shaft 14, in which central portion is carried one or more sealing rings 16, herein shown as two in number, to be in contact with the central zone of the inner face of the plate 13. In other words, these two sets of rings 15 and 16 serve as the sealing means between the plate 13 and the outer and inner marginal portions of the raceway within the casing 10.

The pistons 11 and 12 are each provided with a slot 17, Fig. 6, entering from the outer faces of the pistons 11 and 12, these slots 17 being carried on around from the respective pistons and across the plate 13 to extend at least across the sets of rings 15 and 16. Within each slot 17 is positioned a spring member 18 and then over that spring member 18 is positioned a sealing band 19 in the nature of a piston ring whereby the band 19 is yieldingly urged against the surface of the raceway and also against the rings 15 and 16, the band 19 having ends extending from each side of the piston to carry on across the rings 15 and 16. The rings 15 and 16 are yieldingly pressed outwardly from their respective slots by spring members 20 similar in nature to the spring members 18.

The raceway is divided diametrically into two chambers behind the plate 13 by means of a pair of abutments 21 and 22, both abutments having sealing bars 23, two in number in the present showing, to extend slightly from their respective abutments into yielding contact with the inner face of the plate 13. Referring to Fig. 3, the piston 11 may oscillate between the top sides of the abutments 21 and 22 whereas the piston 12 is limited to oscillation within the raceway below the abutments 21 and 22.

The plate 13 is secured to the shaft 14 by any suitable means wherein a rigid driving connection therewith is had and which connection may

be adjustable longitudinally of the shaft 14. One particular means herein shown is that of a conical collar 24 engaging over the outside of the shaft 14 with a sliding fit and entering a tapered bore in the hub of the plate 13 to have a nut 25 screw-threadedly engage the shaft 14 and abut the outer end of the collar 24 to force that collar into the tapered bore provided in the plate 13. The plate 13 may be held in any position desired in relation to the degree of pressure to be exerted against the sealing rings while the collar 24 is being forced into the plate hub for the driving connection. As a matter of safety, and also as further sealing means, a collar 26 is screw-threadedly engaged about the outer peripheral portion of the casing 10 to have an inturned flange 27 extend radially inwardly on the outer side of the plate 13 for a slight distance. Where the engine is made in a large size, the presence of this collar 26 serves to prevent the plate 13 from warping or expanding out of sealing contact with the outer rings 15.

The shaft 14, in the design illustrated herein, is made to be hollow and carries a crank arm 28 on one end, to which crank arm is rockably connected by its upper end a connecting rod 29. The lower end of this connecting rod 29 engages about a bearing on a crank throw 30 of a shaft 31 mounted in the lower bed plate 32 to have its axis parallel to the axis of the shaft 14.

On an end of the shaft 31 is fixed a spur gear 33 which is in constant mesh with another spur gear 34 that is fixed to the final drive shaft 35. Using a four-cycle system of operation, the gear 34 will be twice as large in diameter as that of the gear 33. Fixed to the shaft 35 is a cam shaft 36 extending axially into the shaft 14 and on through into the next unit, preferably supported by a bearing 37 carried by a member 38 extending upwardly from the bed plate 32. This cam shaft 36 carries for each unit 8 and 9 a pair of cams 39 and 40 to operate the valve mechanism required for each unit. In contact with the cams 39 and 40 are the upper push rods 41 and 42 respectively, Figs. 1 and 2. These push rods are slidingly guided through a bearing 43 to extend by their upper ends against the respective rockers 44 and 45 which are supported from the housing members 46 and 38 respectively, the member 46 also carrying a bearing to support the drive shaft 35. A second pair of rocker arms 47 and 48 bear by their respective ends under the ends of the rockers 44, 45, Fig. 2. The other ends of these rocker arms 47, 48 on the other side of their bearing 49, Fig. 4, press against push rods 50, 51 that are guided against respective ends of a third set of rocker arms 52, 53 that in turn have their opposite arm ends bear against intake and exhaust valves 55, 54. This takes care of the intake and exhaust valve operating mechanism on the upper left-hand side of the units 8 and 9 in each instance.

Now to operate the intake and exhaust valves on the same side of the units below the abutment 22, a pair of push rods 56, 57, having their inner ends bearing respectively against the cams 39, 40, Fig. 5, are slidingly guided through a bearing 58 carried for the one unit 8 by the housing member 46 and for the other unit 9 by the member 38. The outer ends of these push rods bear respectively against the inner and outer rockers 59 and 60 which are rockably mounted to have opposite ends bear respectively against the intake and exhaust valves 62 and 61.

In like manner, a pair of push rods 63, 64 bearing against the cams 39, 40 extend downwardly therefrom to be supported through a bearing 65 to have their ends in abutment with arms of rockers 66, 67 in turn having arms bearing against a second set of rockers to operate the intake and exhaust valves on the right-hand side of the casing below the abutment 21. Push rods having their inner ends abutting the cams 39, 40 extend directly outwardly to rocker arms to operate the intake and exhaust valves above the abutment 21, duplicating the mechanism above described in relation to the operation of the valves 61 and 62. In any event, the design of the valve operating mechanism does not per se constitute the gist of the invention. The mechanism described is merely for the purpose of illustration of one particular possible form.

Spark plugs 68, 69, 70 and 71, Fig. 3, are provided respectively above and below the abutment 22 and the abutment 21 preferably adjacent the intake valves in each instance. Any suitable ignition system (not shown) may be employed to furnish current to these plugs in the proper sequence in accordance with the sequence of operations as indicated in Fig. 7, the ignition system being omitted in order to prevent confusion in the drawings. Likewise the oiling system has been omitted for the sake of clarity in respect to the showing of the invention itself.

In the form of engine design shown, the casing 10 is provided with means for cooling, comprising a water jacket 72 extending around the raceway. Intake and exhaust manifolds 73 and 74 are provided as integral parts of the casing leading from top ports down around the casing to the respective valves.

Referring now to Fig. 7, the sequence of operations takes place as follows, the diagram having reference to one single unit. In operation number one, the spark plug has ignited the charge under the piston 11 to force that piston on around to exhaust gases from the other side of that piston 11 and above the abutment 21. At the same time the piston 12 is being carried around to pull in an intake charge under the abutment 21 and to compress a charge between it and the under side of the abutment 22. Following the completion of the limit of travel of the pistons 11 and 12 (this limit being determined by the throws of the cranks 28 and 30), the crank throw 30 having revolved substantially 180 degrees, operation number two occurs wherein the spark plug fires immediately under the abutment 22 to reverse the direction of travel of the pistons 11 and 12 as indicated by the arrows whereby continued travel of those pistons causes the crank throw 30 on the shaft 31 to continue to turn in the same direction to complete 360 degrees of travel by the time the pistons 11 and 12 have again reached their limits of travel in this operation. As indicated in operation number two, Fig. 7, the piston 12 is being driven around to compress the charge previously taken in, this compression being exerted against the abutment 21, while the piston 11 is exhausting the raceway between it and the abutment 22.

This operation number three occurs whereby the spark plug fires immediately under the abutment 21 to drive the piston 12 back again to the left, Fig. 7, to exhaust that space between it and the abutment 22 while the piston 11 is pulling in a charge behind it and above the abutment 22 and compressing the previously taken in charge between it and the abutment 21. The shaft 31 in the meantime is traveling another 180 degrees,

always in the same direction of rotation, while the shaft 14 is oscillating under the impulses set up by the pistons in reversing their travel. Finally, operation number four completes the cycles wherein piston 11 is pushed away from the abutment 21 upon the firing of the plug thereadjacent to cause the charge to be compressed between the forward side of the piston 11 and the abutment 22, all while the piston 12 simultaneously pulls in a new charge behind it and exhausts the raceway between it and the under side of the abutment 21.

While I have herein shown and described my invention in the one particular form as now best known to me, it is obvious that structural variations may be employed, particularly in the valve operating mechanism, the particular structure for supporting the various members and driving shafts, all without departing from the spirit of the invention and I therefore do not desire to be limited to that precise form beyond the limitations as may be imposed by the following claims.

I claim:

1. In an oscillatory engine, the combination of a casing having an annular raceway opening on a side thereof; a cover plate revoluble over said raceway; pistons fixed to and extending from said plate into said raceway; a fixed abutment across said raceway between said pistons; a rocker shaft mounted axially of said raceway and drivingly engaged with said plate; a crankshaft; and a connecting rod interconnecting with said rocker shaft and said crankshaft; and a collar encircling said plate about its peripheral margin and detachably engaging said plate, said collar being formed to limit movement of the plate away from said casing.

2. In an oscillatory engine, a relatively fixed casing having an annular raceway opening from a casing side; a plate covering said raceway; means mounting the plate to permit oscillation about said casing axially of said raceway; a piston fixed to said plate and slidingly fitting within said raceway; and spaced apart abutments carried by said casing, between which abutments said piston may travel.

3. In an oscillatory engine, a relatively fixed casing having an annular raceway opening from a casing side; a plate covering said raceway; means mounting the plate to permit oscillation thereof about said casing axially of said raceway; a piston fixed to said plate and slidingly fitting within said raceway; spaced apart abutments carried by said casing, between which abutments said piston may travel; and means carried by said casing limiting axial travel of said plate from said casing.

4. In an oscillatory engine, a relatively fixed casing having an annular raceway opening from a casing side; a plate covering said raceway; means mounting the plate to permit oscillation thereof about said casing axially of said raceway; a piston fixed to said plate and slidingly fitting within said raceway; spaced apart abutments across said raceway carried by said casing, between which abutments said piston may travel; and means carried by said casing limiting axial travel of said plate from said casing; said means comprising a ring adjustably engaging said casing and extending in part radially inwardly over the outer face of the peripheral portion of said plate.

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