Jan. 3, 1933. E. W. WEIDNER 1,893,045

INTERNAL COMBUSTION ENGINE

Filed Dec. 11, 1930 4 Sheets-Sheet 1

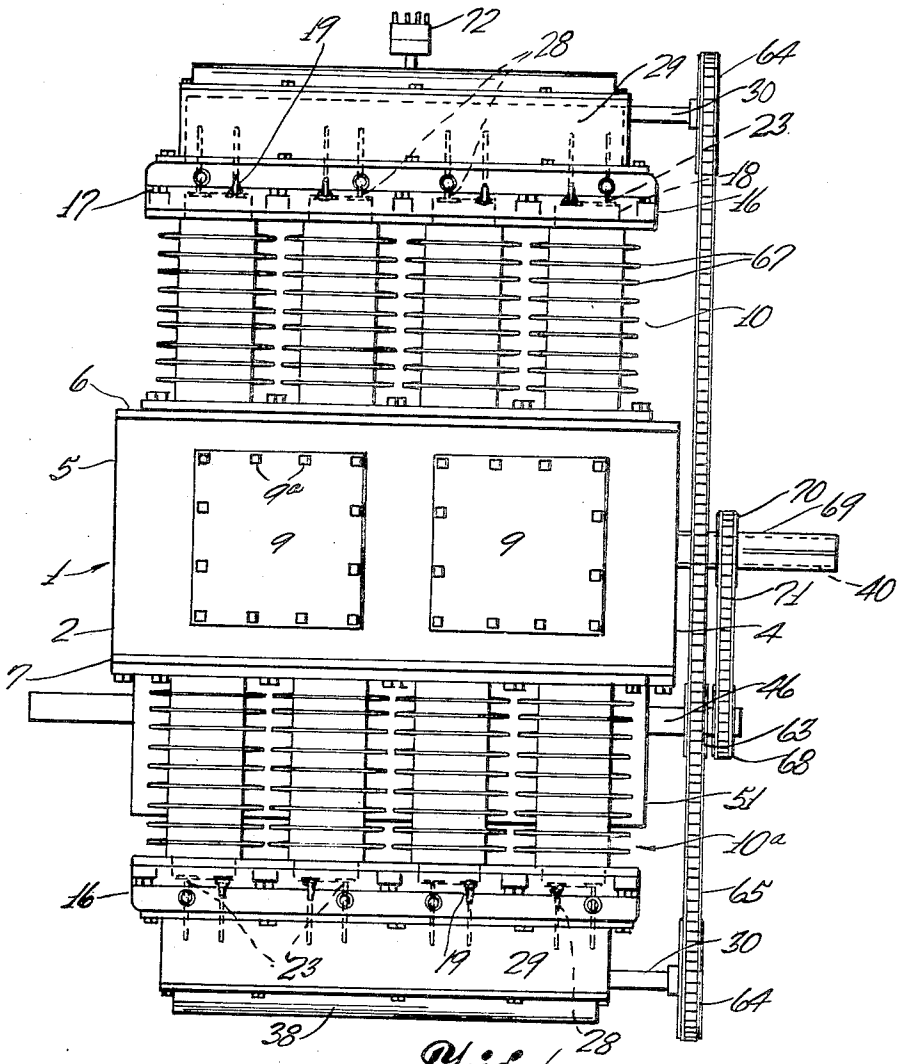


Fig. 1.

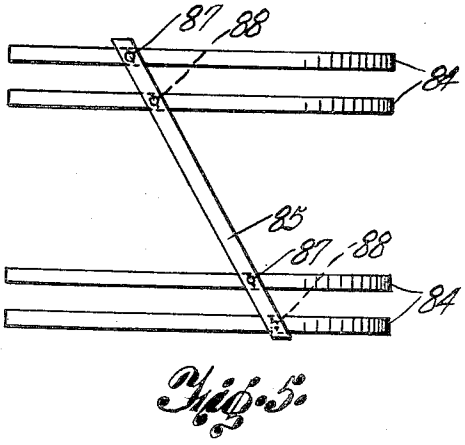


Fig. 5.

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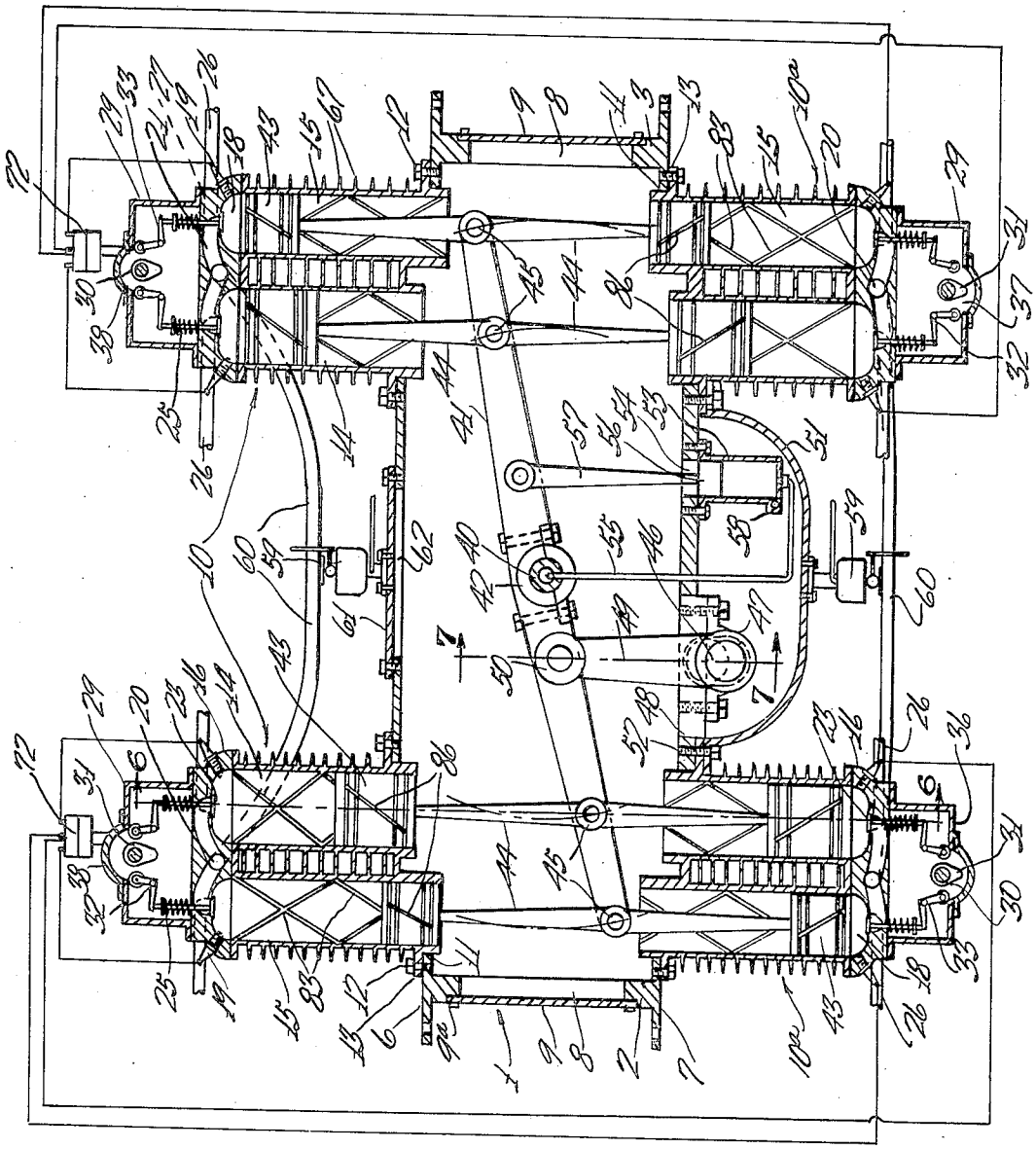
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INTERNAL COMBUSTION ENGINE

Filed Dec. 11, 1930 4 Sheets-Sheet 2



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INTERNAL COMBUSTION ENGINE

Filed Dec. 11, 1930 4 Sheets-Sheet 3

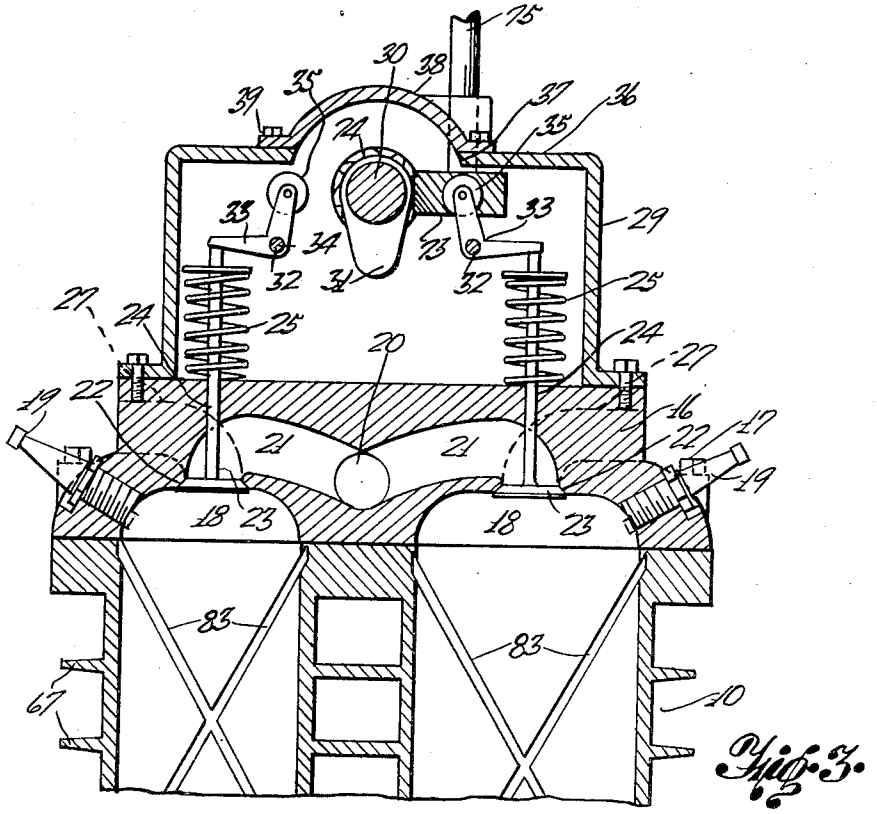


Fig. 3.

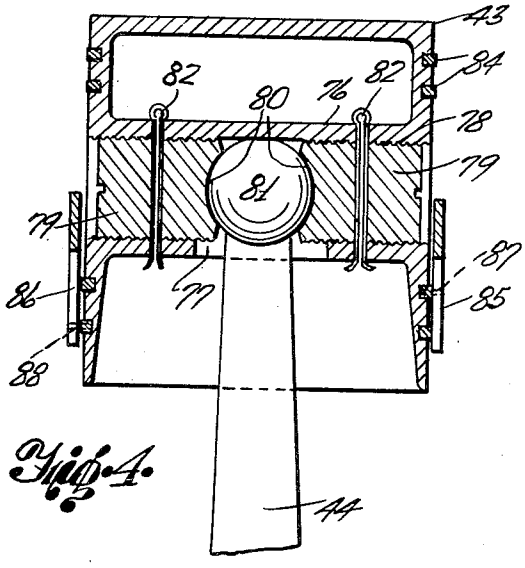


Fig. 4.

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INTERNAL COMBUSTION ENGINE

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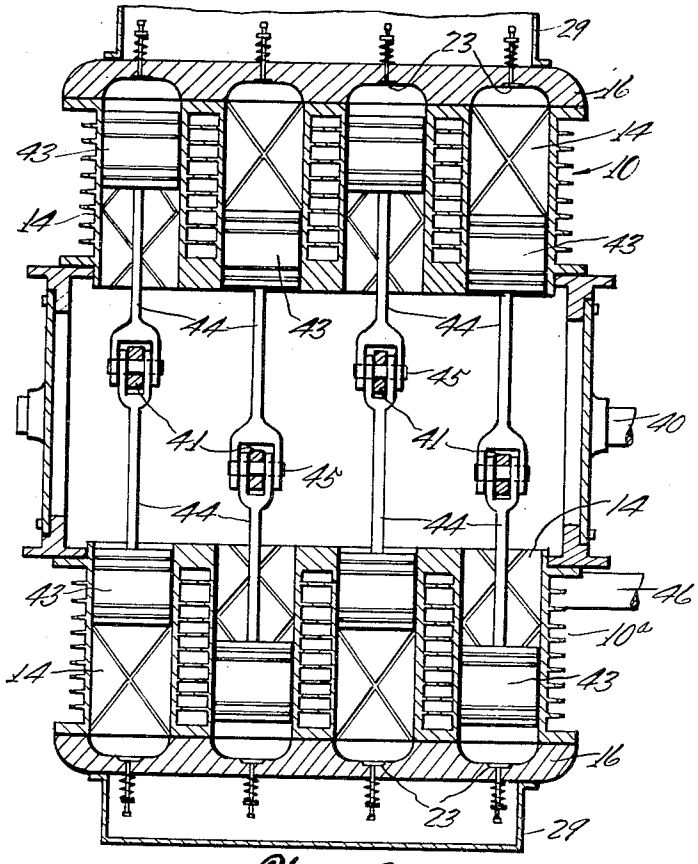


Fig. 6.

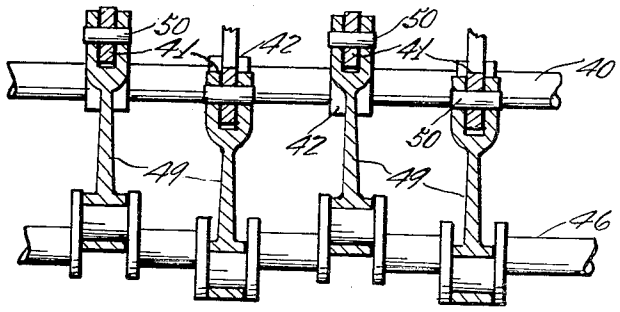


Fig. 7.

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Patented Jan. 3, 1933 1,893,045

UNITED STATES PATENT OFFICE

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INTERNAL COMBUSTION ENGINE

Application filed December 11, 1930. Serial No. 501,606.

This invention relates to internal combustion engines and the main object is to provide an engine which will deliver a greater amount of power for a given weight and which will be relatively small in size.

Another object is to provide an engine in which the pistons rotate on their axes as they reciprocate in the cylinder thus preventing uneven wear on the pistons and cylinder walls.

Another object is to provide an engine in which the piston rings are connected by slides disposed at an angle to the axes of the pistons and adapted to slide in spiral grooves provided in the cylinder walls, thus causing the pistons to rotate as above described.

A further object is to provide an engine including a plurality of cylinder assemblies each of which are operatably connected to a common crankshaft and provided with independent carburetion and ignition systems thus allowing the remaining cylinder assemblies to continue their normal operation should one assembly become accidentally inoperative. The safety factor of the engine is thus greatly increased and the engine for this reason as well as its great power for a given weight is well adapted for use in aircraft of all kinds.

The foregoing and other objects together with means whereby the same may be carried into effect will best be understood from the following description of a preferred embodiment of my invention taken in connection with the accompanying drawings wherein:

Figure 1 is a side view of my improved engine, the same being shown as including 32 cylinders.

Figure 2 is a vertical cross section of the engine as shown in Figure 1.

Figure 3 is an enlarged vertical cross section through one of the cylinder heads and the upper portion of a cylinder assemblies.

Figure 4 is an enlarged cross section through one of the pistons and its mounting on the connecting rod.

Figure 5 is a detail in elevation of the piston ring assembly for one piston.

Figure 6 is a vertical section along the line 6—6 in Figure 2.

Figure 7 is a vertical section along the line 7—7 in Figure 2.

Referring now more particularly to the drawings the reference character 1 designates a substantially rectangular center or crank housing including the sides 2 and 3, front and rear ends 4 and 5 and the top and bottom 6 and 7. The sides 2 and 3 have openings 8 covered by plates 9 held in place by bolts 9*a*, access being had to the interior of the housing 1 by removing said plates 9. Upper cylinder assemblies or blocks designated generally at 10 and lower cylinder assemblies or blocks 10*a* are mounted on the top and bottom 6 and 7 respectively and along the sides thereof, the said assemblies or blocks extending inward at one end into the housing 1 through apertures 11 in the said top and bottom and being secured in place thereon by bolts 12 passed through the flanges 13 as shown. The cylinder assemblies 10 and 10*a* each have a plurality of inner cylinders 14 arranged one behind the other and similarly arranged outer cylinders 15, the inner and outer cylinders being also disposed in spaced laterally aligned pairs. The engine as here shown comprises 32 cylinders with 8 in each cylinder assembly 10 and 10*a* though any desired number may be used. The cylinder assemblies are so mounted on the housing 1 that both the inner and outer cylinders on each side of the top 6 are in axial alignment with the corresponding cylinders on the bottom 7 and are opposed thereto. Cylinder heads 16 are bolted as at 17 to the tops of the upper cylinder assemblies 10 and to the lower faces or bottoms of the lower cylinder assemblies 10*a*, and these cylinder heads have combustion chambers 18 registering with the cylinders 14 and 15 and spark plugs 19 communicating with each combustion chamber. Intake passages 20 are extended longitudinally through the cylinder heads 16 and are connected by laterally extended branches or ports 21 with the combustion chambers 18, the said branches terminating or entering the combustion chambers at the center thereof and in axial alignment with the cylinders. These ends of the branches or ports 21 are angularly faced or beveled as at 22 to provide valve

seats for the intake poppet valves 23 which have their stems 24 extended through the heads 16 and are spring set to normally close the ends of the branches 21 by the springs 25 in the usual manner. Exhaust manifolds 26 are arranged longitudinally along both the inner and outer sides of the cylinder heads 16 and are connected to exhaust passages 27 extending inwardly from the sides of the cylinder heads to the combustion chambers 18. These passages 27 terminate at the centers of the combustion chambers 18 alternately behind and in front of the ends of the branches 21 of the intake passages 20 and are similarly beveled at their ends to receive the exhaust poppet valves 28 which are arranged in exactly the manner described for the intake valves 23. The exhaust manifolds 26 are connected in any suitable manner at their rear ends to carry away the burnt gases in the usual manner. Cam housings 29 are mounted on the cylinder heads 16 and enclose the stems and springs of the intake and exhaust valves 23 and 28, and cam shafts 30 are journaled from end to end through these housings, the said shafts projecting forwardly through the housings at their forward ends as shown in Figure 1. The said cam shafts 30 are arranged midway between the valve stems and springs and carry intake and exhaust cams as shown at 31 which are arranged in alignment with the proper valves and which are mounted on the shaft in the required relative angular positions according to the firing order of the cylinders. Rocker arm rods 32 are secured from end to end through the housings 29 at each side of the cam shafts 30 and on a plane nearer the cylinder heads 16 as shown. Valve rocker arms 33 are fulcrumed at 34 on these rocker arm rods 32 and engage the valve stems of the intake and exhaust valves at one end while at their other ends they are provided with rollers 35 to engage the cams 31 as they are rotated by a means to be described. The arrangement is such that the ends of the rocker arms 33 carrying the rollers 35 are forced outward as the lobe or nose of the cams 31 pass thus swinging the rocker arms on the rods 32 and opening the intake and exhaust valves as will be understood. The cam housings 29 have their horizontally disposed walls 36 cut away or longitudinally slotted as at 37 and hoods or covers 38 are bolted at 39 over these slots to allow access to the interior of the housings.

A fulcrum shaft 40 is longitudinally extended through the center of the housing 1 and is fixed therein, the forward end of the said shaft extending forwardly from the front of the housing as shown. Four beams or levers 41 are centrally fulcrumed in spaced relationship at 42 on the fulcrum shaft 40, the said levers being of such length that when in their horizontal position their ends project slightly outward of the axes of the outer cylinders 15 of the upper cylinder assemblies 10. Pistons 43 are mounted in the cylinders 14 and 15 and the piston or connecting rods 44 thereof are extended inward into the housing 1: The inner ends of these connecting rods 44 are pivotally connected together and to the beams 41 at 45, the connecting rods of the outer cylinders 15 being pivoted at the ends of the beams and the connecting rods of the inner cylinders 14 being pivoted to the beams at a point inward from the ends thereof a distance equal to the center to center distance between the inner and outer cylinders as shown. A crankshaft 46 is journaled longitudinally along the bottom 7 of the crank housing 1 in bearings 47, the said bottom being cut away or longitudinally slotted as shown at 48 to receive the crankshaft and to allow it to turn. The said crankshaft 46 is offset laterally to one side of the longitudinal center or axes of the housing 1 and has four cranks or throws disposed beneath the beams 41 which are of course disposed directly under the inner and outer cylinders 14 and 15 of the cylinder assemblies 10. Four crank links 49 are pivoted to the cranks of the crankshaft 46 and are eccentrically pivoted at 50 to the beams 41 at a point directly above the crankshaft and to one side of the fulcrum points of the beams. An oil pan 51 is removably secured by bolts 52 to the bottom 7 of the housing 1 between the cylinder assemblies 10*a* and an oil pump is provided within this pan, the same comprising a cylinder 53 secured to the bottom 7 beneath an opening 54 therein and connected by a tube 55 to the fulcrum shaft 40 which is of tubular construction so that the oil will flow therein, the oil being then fed to the various moving parts through tubing (not shown) in the usual manner. A piston 56 is mounted in the cylinder 53 and is connected to one of the beams 41 by a connecting rod 57 to be reciprocated as the beam rocks on its fulcrum shaft 40. A check valve 58 is provided on the cylinder 53 through which oil from the pan 51 which contains the lubricating oil enters on the upstroke of the piston as will be understood. Carburetors 59 of conventional form are provided and the same are connected by manifolds 60 to the rear ends of the intake passages 20 in the cylinder heads 16. A carburetor is provided for the cylinders above the housing 1 and another is provided for the cylinders below the housing 1, the former being mounted on the removable top plate 61 covering an opening 62 in the top 6 and the latter being depended from the oil pan 51.

It will now be understood that the explosive mixture fed to the cylinders when fired will force the pistons inward in the cylinders toward the interior of the housing 1 and will alternately raise and lower each end of the

beams 41. These beams 41 will in turn rotate the crankshaft 46 through the crank links 49. A sprocket 63 is mounted on the forward end of the crankshaft 46 and relatively larger sprockets 64 are mounted on the forward ends of the cam shafts 30 and a sprocket chain 65 is trained over these sprockets in such manner that the cam shafts will be rotated as the crankshaft rotates. The cams 31 thus open and close the intake and exhaust valves in proper sequence for four stroke cycle operation of the cylinders. It will be noted that the intake valves of each laterally aligned pair of inner and outer cylinders 14 and 15 are operated by the same cam which opens them at intervals of 180 degrees apart and the exhaust valves are similarly arranged. The cam shafts are arranged to rotate at one half the speed of the crankshaft. Each time either of the ends of the beams 41 move downward they are moving under the impulse of a downwardly directed power strike from one of the pistons of the upper assemblies 10 and each time either of the ends move upward they are moving under the impulse of an upwardly directed power strike delivered by one of the pistons of the lower assemblies 10*a*. The other ends of the beams 41 are of course also forced upward or downward by a corresponding power stroke of the piston in the cylinder assemblies 10 and 10*a* of the other side of the engine. In other words each time one end of one of the beams is forced downward by a power stroke of a piston in the upper cylinder assembly the opposite end of the beam is forced upward by a power stroke of a piston in the lower cylinder assembly thus doubling the power exerted on the beam over that which would be obtained were only the upper or lower cylinders used alone. In order to equalize the power exerted upon the beams by the inner and outer cylinders, the outer cylinders are of smaller bore but longer stroke than the inner cylinders as shown, the reasons for this variation in length of stroke being obvious. Thus the power exerted on each beam 41 to cause it to rock is continuous and equal resulting in a great decrease in vibration and making the engine run smoothly. Furthermore this action together with the leverage exerted on the crankshaft by the beams 41 makes the engine very powerful as will be understood and makes for greater ease of operation under sudden loads. The engine is thus particularly adaptable for use in aircraft and the cylinders 14 and 15 are for this reason shown in the drawings as provided with air cooling fins 67 though they may be water jacketed for other installations if desired. A sprocket 68 is mounted on the crankshaft 46 and a sleeve 69 is journaled on the forwardly extended end of the fulcrum shaft 40, a sprocket 70 being mounted on this sleeve and connected to the sprocket 68 by a sprocket chain 71. A propeller or power take off device, of any kind (not shown) may be mounted on this sleeve 69 or any other suitable arrangement made to make use of the power of the engine. The spark plugs 19 are energized or fired by suitable high tension coils or magnetos (not shown), distributors 72 mounted on the upper cylinder heads 16 regulating the firing of the spark plugs in the usual manner. The distributors are driven by the cam shafts 30 through spiral or worm gears 73 and 74, the former mounted on the distributor shafts 75 and the latter on the cam shafts 30.

It will be noted in Figure 2 that due to the use of the beams 41 and the axial alignment of the upper and lower cylinders the connecting rods 44 remain in substantially axial alignment with the cylinders 14 and 15 during the entire movement of the beams 41 thus preventing the usual angular pull and side stress on the pistons which occur where the connecting rods are connected directly to the crankshaft. This arrangement reduces the tendency of the piston and cylinder to wear unevenly and to further carry out this advantageous feature I provide the novel mounting of the pistons now to be described. Referring to Figure 4 each piston 43 has a diametrically extended sleeve or tube 76 having an opening 77 through its wall nearest the open end of the piston as shown and through which opening the end of the connecting rod 44 may freely pass. This sleeve 76 is interiorly threaded as at 78 and plugs 79 may be screwed in the same, the inner ends of the said plugs being concaved or cupped as shown at 80. The end of the connecting rod is spherical or enlarged and provided with a ball 81 against which the inner concaved ends of the plugs 79 are brought into contact. This construction allows the piston to rotate freely on its own axis on the connecting rod but holds the piston in place against axial displacement relative to the connecting rod. The plugs 79 may be secured in an adjusted position by the cotter keys 82 or by any other suitable means. In order to rotate the pistons on their own axes as they are reciprocated in the cylinders, the latter are provided with spirally cut grooves 83, as shown. The piston rings 84 on each of the pistons 43 are four in number and are connected by slides 85 and 86, one slide 85 being secured at 87 to the first and third rings and the other being secured at 88 to the second and fourth rings. The slides 85 and 86 are set at the same angle relative to the axes of the pistons, the angle corresponding to the pitch of the grooves 83. The arrangement is such that the slides 85 and 86 may be screwed into the grooves 83 as the pistons are placed in the cylinders and will then cause the cylinders to rotate or oscillate as they are reciprocated in the cylinders as will be understood. This rotation or oscillation of the pistons prevents uneven

wear on the cylinder walls as hereinbefore pointed out and due to the fact that the pistons are screwed into the cylinders it is possible to leave less clearance between the piston rings and cylinders thus increasing the compression with consequent greater efficiency of the engine.

While I have herein set forth a certain preferred embodiment of my invention it is understood that I may vary from the same in minor structural details so as best to construct a practical device for the purposes intended, not departing from the spirit of the invention and within the scope of the appended claims.

I claim:

1. In a device of the kind described, a fulcrum shaft, beams fulcrumed intermediate their ends on the fulcrum shaft, a crankshaft operatably connected to the beams and adapted to be rotated by the upward and downward movement of the ends thereof, cylinders mounted above and below the beams, pistons in the cylinders, and a pair of connecting rods connected to the pistons in each pair of vertically aligned cylinders and extended therefrom in axial alignment and connected together at their inner ends to the ends of the beams.

2. In a device of the kind described, a fulcrum shaft, a beam fulcrumed intermediate its ends on the fulcrum shaft, aligned pairs of cylinders disposed side by side above and below each end of the beam, pistons in the cylinders, and connecting rods connected to the pistons and extended axially outward from the cylinders and pivotally connected to the beam adjacent its ends.

3. In a device of the kind described, a horizontally disposed fulcrum shaft, a beam fulcrumed intermediate its ends on the fulcrum shaft, a pair of cylinders mounted both above and below each end of the beam, pistons mounted in the cylinders, connecting rods connected to the pistons at one end and connected together and to the ends of the beam at their opposite ends.

4. In a device of the kind described, a fulcrumed beam, laterally aligned pairs of cylinders mounted in vertically aligned positions above and below the end portions of the beam, pistons and connecting rods operatively mounted in the cylinders, the outer cylinders of each pair being longer than the inner cylinders, and the connecting rods in the outer cylinders being connected to the extreme ends of the beam and the connecting rods in the inner cylinders being connected to the beam inwardly of its ends.

5. In a device of the kind described, a fulcrumed beam, a pair of laterally aligned cylinders set above and below each end of the beam, the outer cylinder of each pair being of smaller bore and longer length than the inner cylinders, pistons mounted in the cylinders, connecting rods extended from the pistons in the outer cylinders and pivoted to the ends of the beam, and connecting rods extended from the pistons in the inner cylinders and pivoted to the beam inwardly of the ends thereof.

In testimony whereof I affix my signature.

EARL W. WEIDNER.