June 10, 1930. J. A. BOUGHTON 1,762,650

INTERNAL COMBUSTION ENGINE

Filed Oct. 11, 1928 5 Sheets-Sheet 1

FIG. 5

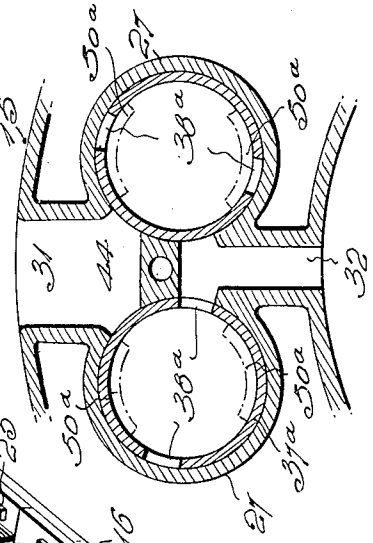


FIG. 1

Witness
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Filed Oct. 11, 1928 5 Sheets-Sheet 2

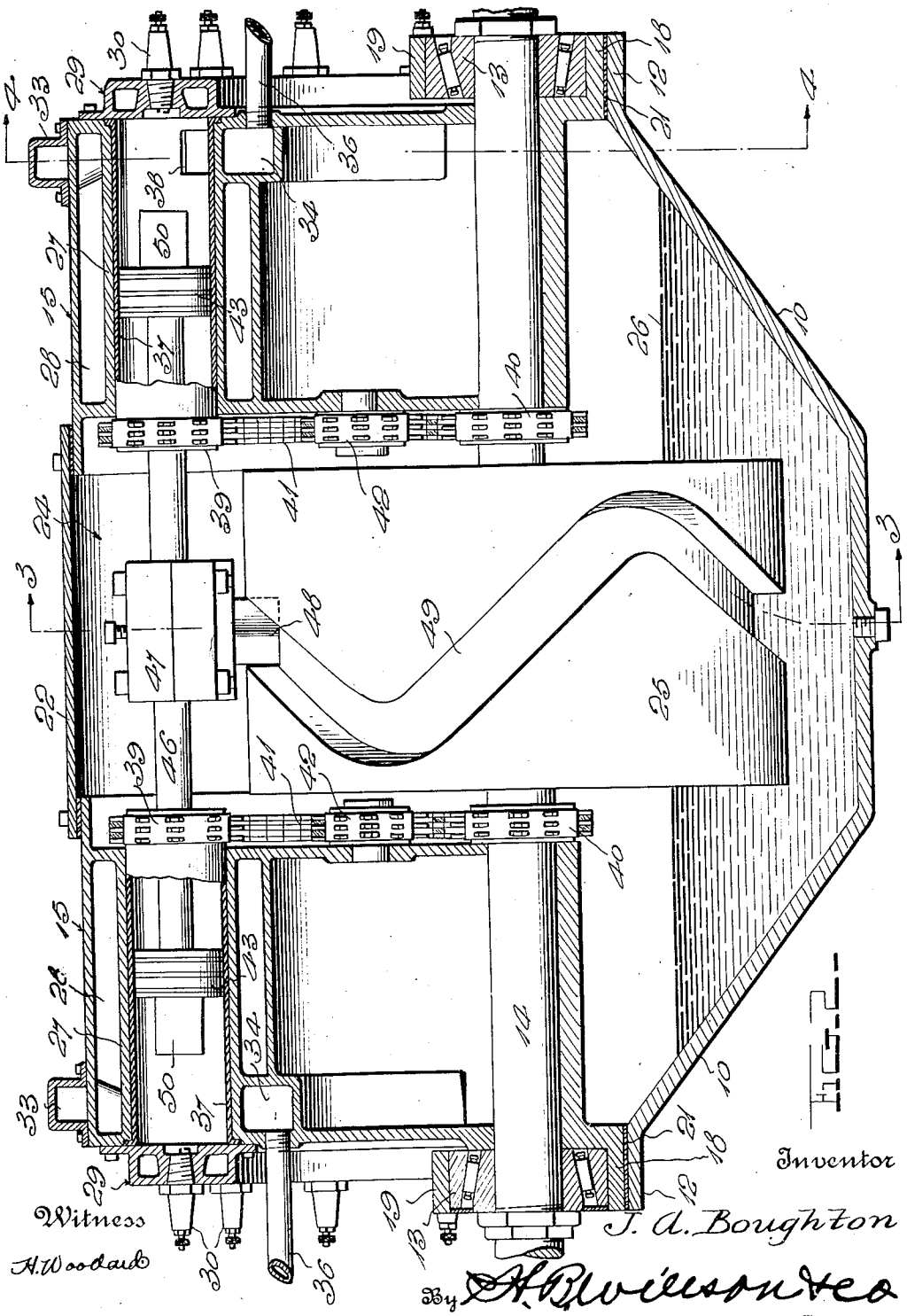


Fig. 2.

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INTERNAL COMBUSTION ENGINE

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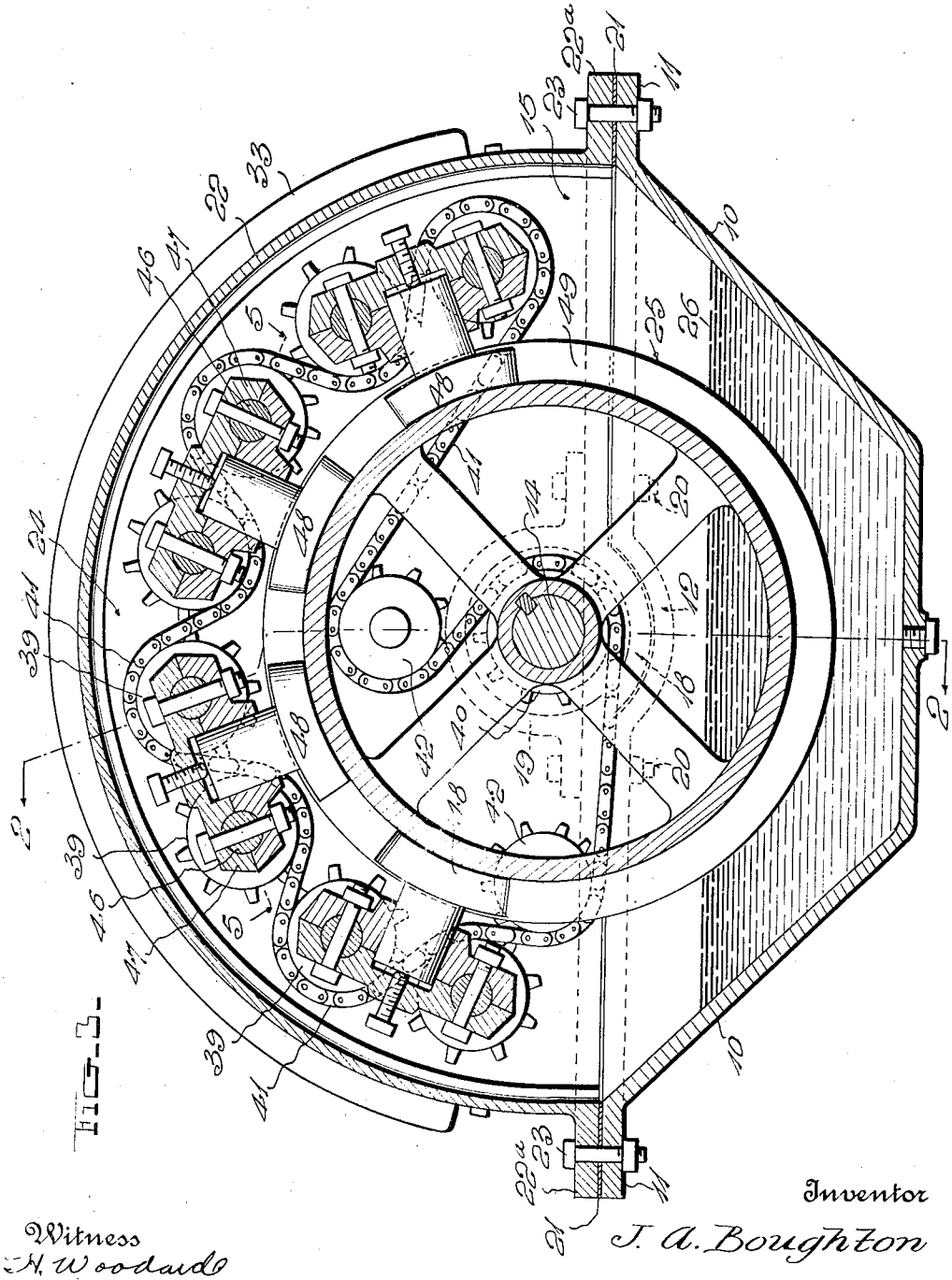


Fig. 3.

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INTERNAL COMBUSTION ENGINE

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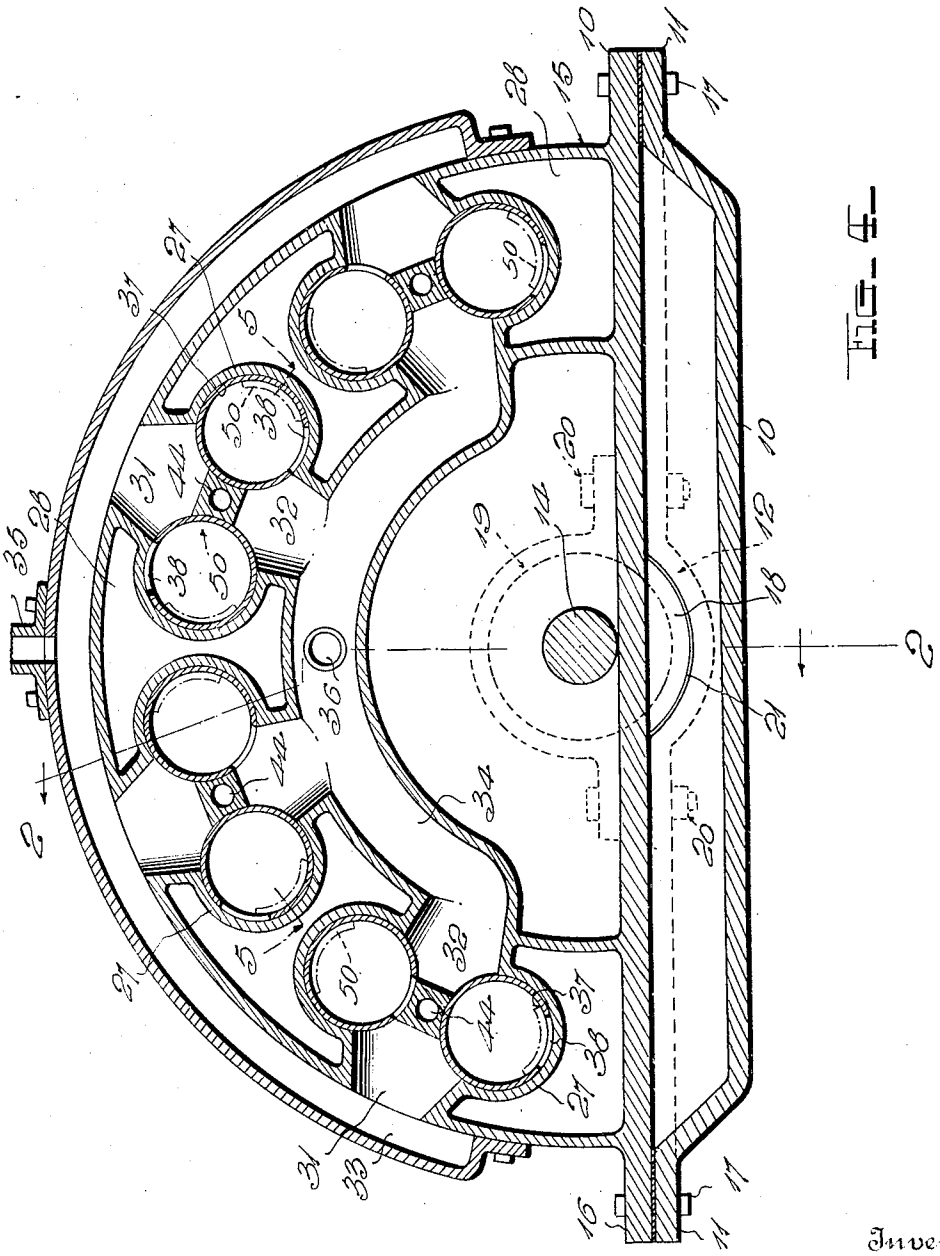


Fig. 4.

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INTERNAL COMBUSTION ENGINE

Filed Oct. 11, 1928 5 Sheets-Sheet 5

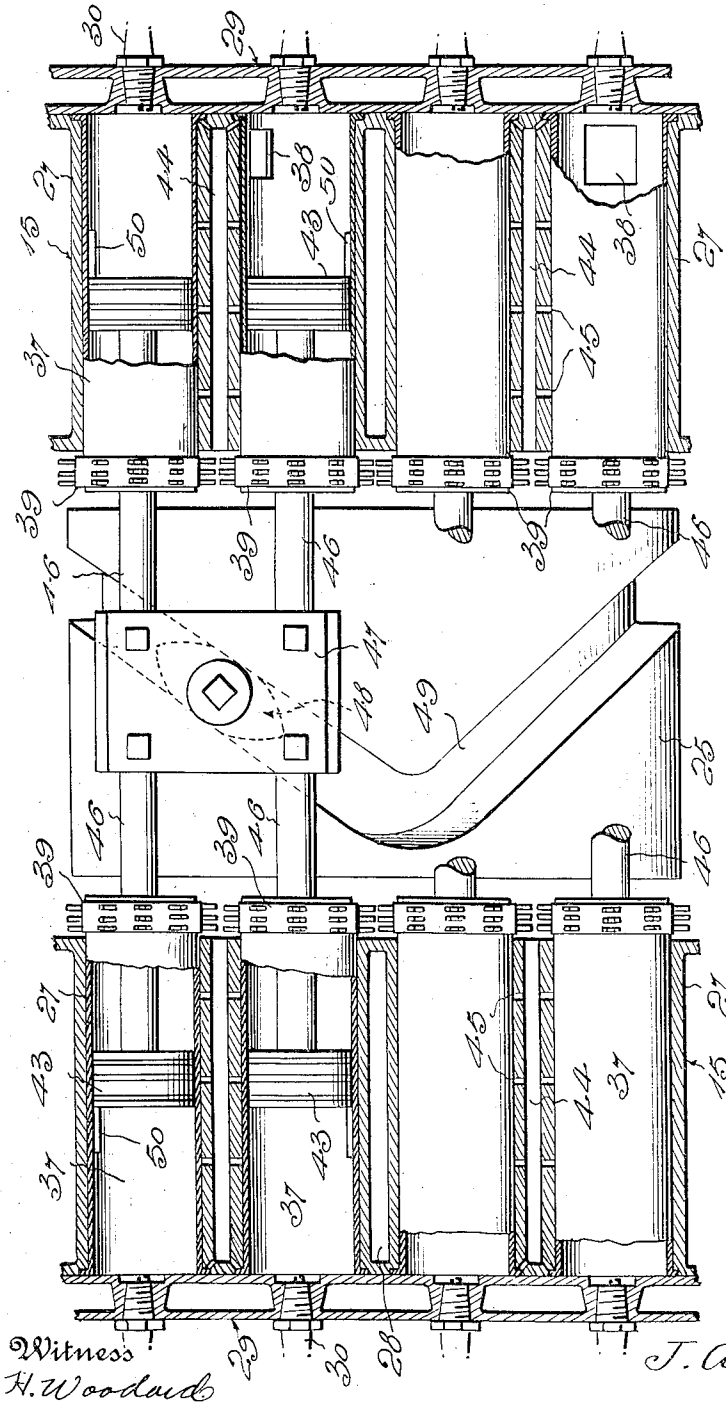


Fig. 5.

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UNITED STATES PATENT OFFICE

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INTERNAL-COMBUSTION ENGINE

Application filed October 11, 1928. Serial No. 311,812.

The invention relates to internal combustion engines of the type embodying two opposed sets of cylinders, rods rigidly connecting opposed pistons in said cylinders, cross heads secured to said rods, and a rotatable cam drum between said sets of cylinders engaging shoes on the cross heads to convert reciprocatory into rotary motion.

One aim of the invention is to provide a construction in which each cross head is secured to a pair of the rods, necessitating that the pairs of pistons connected to these rods, shall move only as a single unit. Thus, in the cylinders of one pair of pistons, exhaust and compression may be effected simultaneously with expansion and intake in the cylinders of the other pair of pistons and vice versa, and hence there are no strokes of the cross head which are not power strokes.

A further aim is to provide an improved construction in which explosions occur simultaneously in the two opposed cylinder blocks, thereby overcoming vibrations and excessive end thrusts on the shaft of the cam drum.

A still further aim is to provide a construction in which new and improved valve means are provided for the cylinders.

A still further object is the provision of a construction in which novel provision is made for effective lubrication of moving parts.

Yet another aim is the provision of an engine which is of comparative simplicity, yet will be highly efficient and in every way desirable.

With the foregoing in view, the invention resides in the novel subject matter hereinafter described and claimed, description being accomplished by reference to the accompanying drawings.

Fig. 1 is a perspective view.

Fig. 2 is a vertical longitudinal sectional view on line 2—2 of Fig. 3 and Fig. 4.

Figs. 3 and 4 are vertical transverse sections on lines 3—3 and 4—4 of Fig. 2.

Fig. 5 is a horizontal sectional view on line 5—5 of Figs. 3 and 4.

Fig. 6 is a detail vertical sectional view similar to a portion of Fig. 4 but showing a different form of construction.

The features of construction disclosed in the drawings will be rather specifically described, with the understanding that within the scope of the invention as claimed, variations may be made.

10 on the drawings denotes a horizontally elongated oil pan having an outstanding flange 11 at its upper edge provided with depressed portions 12 at the ends of the pan to assist in accommodating bearings 13 for the engine shaft 14. Two substantially semi-cylindrical cylinder blocks 15 rest upon the end portions of the pan 10 and are provided with outstanding flanges 16 secured by bolts or the like 17 to the flange 11. At the outer ends of the cylinder blocks, the flange 16 is depressed at 18, these portions fitting into the depressed portions 12 and receiving the bearings 13. Caps 19 are shown extending over the bearings and holding them in the depressions 18, these caps being fastened to the flanges 16 by cap screws or the like 20. Appropriate gaskets 21 are of course provided between the flanges 11—16 to prevent leakage of oil.

An arched hood-forming plate 22 extends across the space between the peripheral portions of the cylinder blocks 15 and is provided with outstanding flanges 22^a secured to the flange 11 by bolts or the like 23. This hood and the inner ends of the cylinder blocks 15 cooperate in forming an oil splash chamber 24 in which a cam drum 25 is disposed, said drum being secured to the shaft 14 and arranged to dip into the oil 26 in the pan 10, so that numerous internal parts will be effectively lubricated.

The cylinder blocks 15 are provided with opposed cylinders 27 and with water jackets 28 around said cylinders. The inner ends of these cylinders are open while their outer ends are closed by appropriate water cooled heads 29 carrying the usual spark plugs 30 to which current may be supplied by any desired ignition system (not shown). Intake and exhaust ports 31—32 are provided for the cylinders 27 and they communicate with intake and exhaust manifolds 33—34. The intake manifolds 33 preferably extend around the peripheries of the cylinder blocks 15 and fuel

may be led to these manifolds from an appropriate carbureter (not shown) through a pipe such as 35. The exhaust manifolds 34 are shown at the inner sides of the arcuate series of cylinders 27 and exhaust pipes 36 are illustrated in communication with these exhaust manifolds.

Rotary sleeve valves 37 are mounted in the cylinders 27 and each valve is provided with only one port 38 for successive registration with the ports 31—32. Sprocket wheels 39 are secured to the inner ends of these sleeve valves and are disposed at the inner ends of the cylinder blocks 15, within the oil splash chamber 24. Other sprockets 40 are secured upon the shaft 14, and endless chains 41 are trained around all of these sprockets and appropriately located idlers 42, for the purpose of driving the sleeve valves 37. As shown in Fig. 3, the chains 41 pass alternately in opposite directions around the sprocket wheels 39 so that the sleeve valves are driven in the proper directions and the chains are prevented from jumping the sprockets. Oil is supplied to all of these sprockets and the chains by the splash from the drum 25 and this splashing also lubricates the inner sides of the valves 37 in which pistons 43 operate. For lubricating the outer sides of the valves 37, longitudinal oil ports 44 are provided between adjacent cylinders. The outer ends of these ports open into the chamber 24 to receive oil splashed upwardly in the latter, and from these ports, branch ports 45 lead through the cylinder walls as shown in Fig. 5, and also in Fig. 4.

The pistons 43 are secured to the ends of rods 46, and these rods are tied together in pairs by appropriate cross heads 47, so that the rods of each pair and the pistons 43 secured to these rods can have no movement with respect to each other. Each cross head 47 is provided with an appropriate shoe 48 engaging the cam groove 49 of the drum 25, so that reciprocation of the pistons, rods and cross heads will effect rotation of the cam drum 25 and the shaft 14. While expansion and intake are occuring in one pair of cylinders in one of the heads 15, the opposed cylinders in the other head are exhausting and compressing, and vice versa. There is thus no stroke of any cross head which is not a power stroke. Moreover, while explosion is taking place in one cylinder block, driving pistons and associated cross head in one direction, a similar explosion is taking place in the other cylinder block, driving other pistons and cross head in the other direction. Thus, the effects of the explosions are counterbalanced and vibration is reduced to the minimum. This also overcomes excessive end thrusts upon the bearings of the shafts 14. In this connection, it may be explained that in addition to the bearings 13 shown for this shaft, it may be provided with others near the cam drum 25, if desired.

Preferably, each piston 43 is provided at its periphery with a guard 50 extending toward the cylinder head. This guard covers the port 38 when ignition takes place and prevents carbon from blowing outwardly through said port and having a tendency to cut the wall of the cylinder against which the sleeve valve operates.

If desired, sleeve valves 37^a may be substituted for the valves 37 and driven at half the speed. Each valve 37^a is provided with two ports 38^a instead of with only one and when this type of valve is used, each piston will be provided with two guards 50^a having the same function as the guard 50 and adapted to cover the ports 38^a when the cylinder fires, as indicated at the right-hand portion of Fig. 6.

Excellent results are obtainable from the general construction shown and described, but it is to be understood that within the scope of the invention as claimed, variations may be made.

I claim:—

1. In an internal combustion engine, a rotatably mounted shaft, two opposed sets of piston-containing cylinders mounted on arcs concentric with said shaft, rotary valves for said cylinders having driving sprockets at the inner ends of the latter and disposed in two common planes, rods connected with the pistons and having shoes, a cam drum on the shaft co-acting with said shoes for converting reciprocatory into rotary motion, said drum being spaced inwardly from the inner ends of the cylinders, sprockets on said shaft between said drum and said inner ends of the cylinders and disposed in the same planes with the sprockets of said valves, and endless chains engaged with the shaft-carried sprockets and passed also around the valve-driving sprockets.

2. In an internal combustion engine, a rotatably mounted shaft, two opposed sets of piston-containing cylinders mounted on arcs concentric with said shaft, rotary valves for said cylinders having driving sprockets at the inner ends of the latter and disposed in two common planes, rods connected with the pistons and having shoes, a cam drum on the shaft co-acting with said shoes for converting reciprocatory into rotary motion, said drum being spaced from the inner ends of the cylinders, sprockets on said shaft between said drum and said inner ends of the cylinders and disposed in the same planes with the sprockets of said valves, and endless chains engaged with the shaft-carried sprockets and passed alternately in opposite directions around the valve-driving sprockets.

3. In an internal combustion engine, a horizontally elongated oil pan extending substantially throughout the length of the

engine, two substantially semi-cylindrical cylinder blocks secured upon the upper edges of the end portions of said pan and having longitudinal opposed piston-containing cylinders which are open at the inner ends of said blocks, an arched plate across the space between the peripheral portions of the cylinder blocks and secured to said blocks and to the longitudinal edges of the oil pan, providing an oil splash chamber, a cam drum in said chamber extending into said pan to splash oil from the latter, a shaft carrying said drum, bearings for said shaft supported by the ends of said oil pan and disposed under said cylinder blocks, rods rigidly connecting opposed pistons and having shoes co-acting with said cam drum, valves for the cylinders, and driving connections between said shaft and said valves disposed in said chamber.

4. In an internal combustion engine, a horizontally elongated oil pan extending substantially throughout the length of the engine, two substantially semi-cylindrical cylinder blocks secured upon the upper edges of the end portions of said pan, said blocks having longitudinal opposed piston-containing cylinders which are open at the inner ends of said blocks, an arched plate across the space between the peripheral portions of the cylinder blocks and secured to said blocks and to longitudinal edges of said oil pan, providing an oil splash chamber, a cam drum in said chamber extending into said pan to splash oil from the latter, a shaft carrying said drum, bearings for said shaft supported by the ends of said oil pan and disposed under said cylinder blocks, rotary valves for said cylinders, rods rigidly connecting opposed pistons and having shoes co-acting with said cam drum, sprockets on the inner ends of said valves disposed in two common planes, additional sprockets on said shaft between said drum and the inner ends of said cylinder blocks, and endless chains engaged with the shaft-carried sprockets and passing also around the valve-carried sprockets.

5. In an internal combustion engine, a plurality of rotary valves all parallel with the engine shaft and having sprockets at one end, a sprocket on said engine shaft, and a driving chain passed around the sprockets of said valves and engaged also with the sprocket of said shaft.

6. In an internal combustion engine, a plurality of rotary valves all parallel with the engine shaft and having sprockets, a sprocket on said engine shaft, and a driving chain passed alternately in opposite directions around the sprockets of said valves and engaged also with the sprocket of said shaft.

In testimony whereof I have hereunto affixed my signature.

JOHN A. BOUGHTON.