

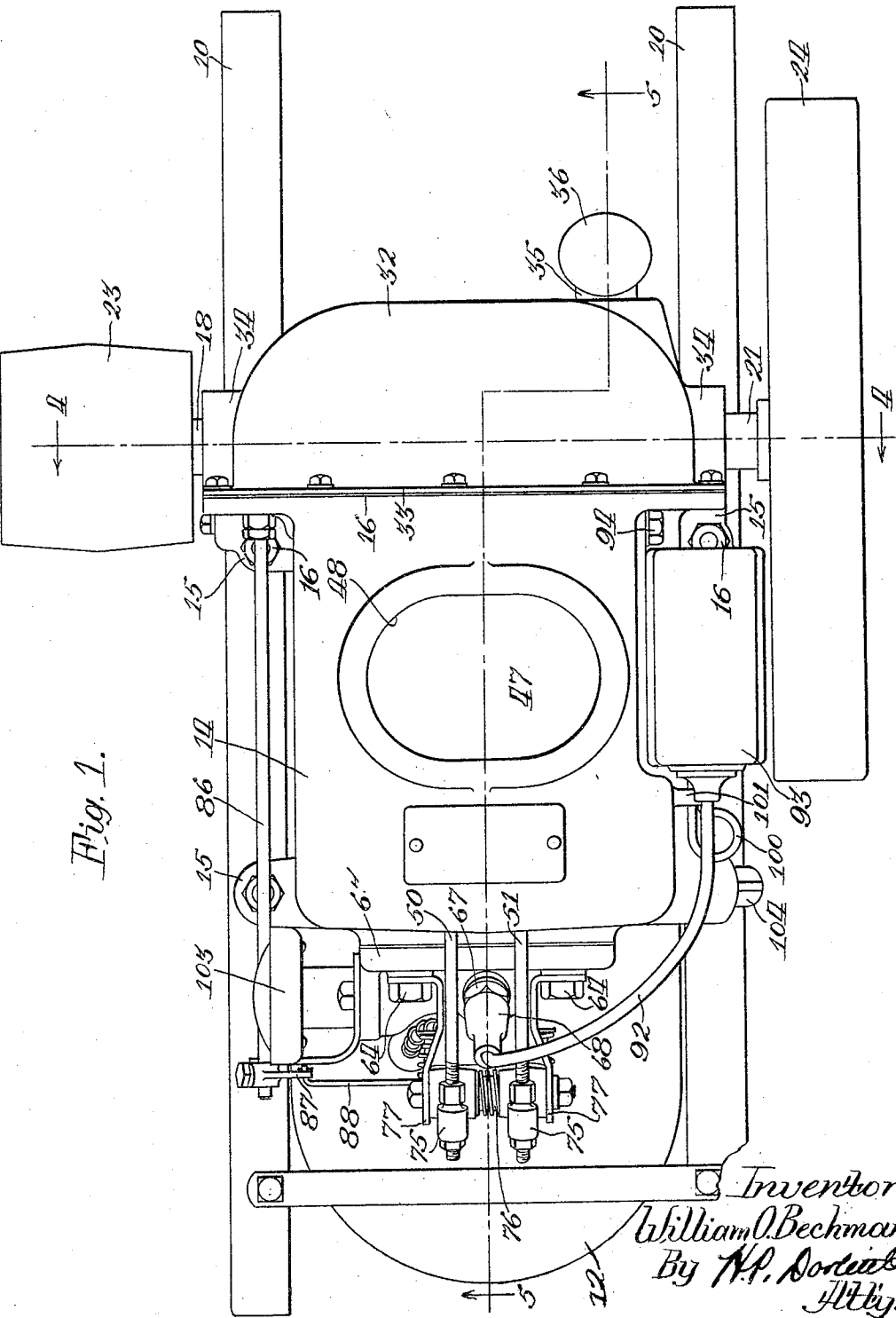
June 27, 1933.

W. O. BECHMAN
INTERNAL COMBUSTION ENGINE

1,915,283

Filed April 30, 1931

6 Sheets-Sheet 1



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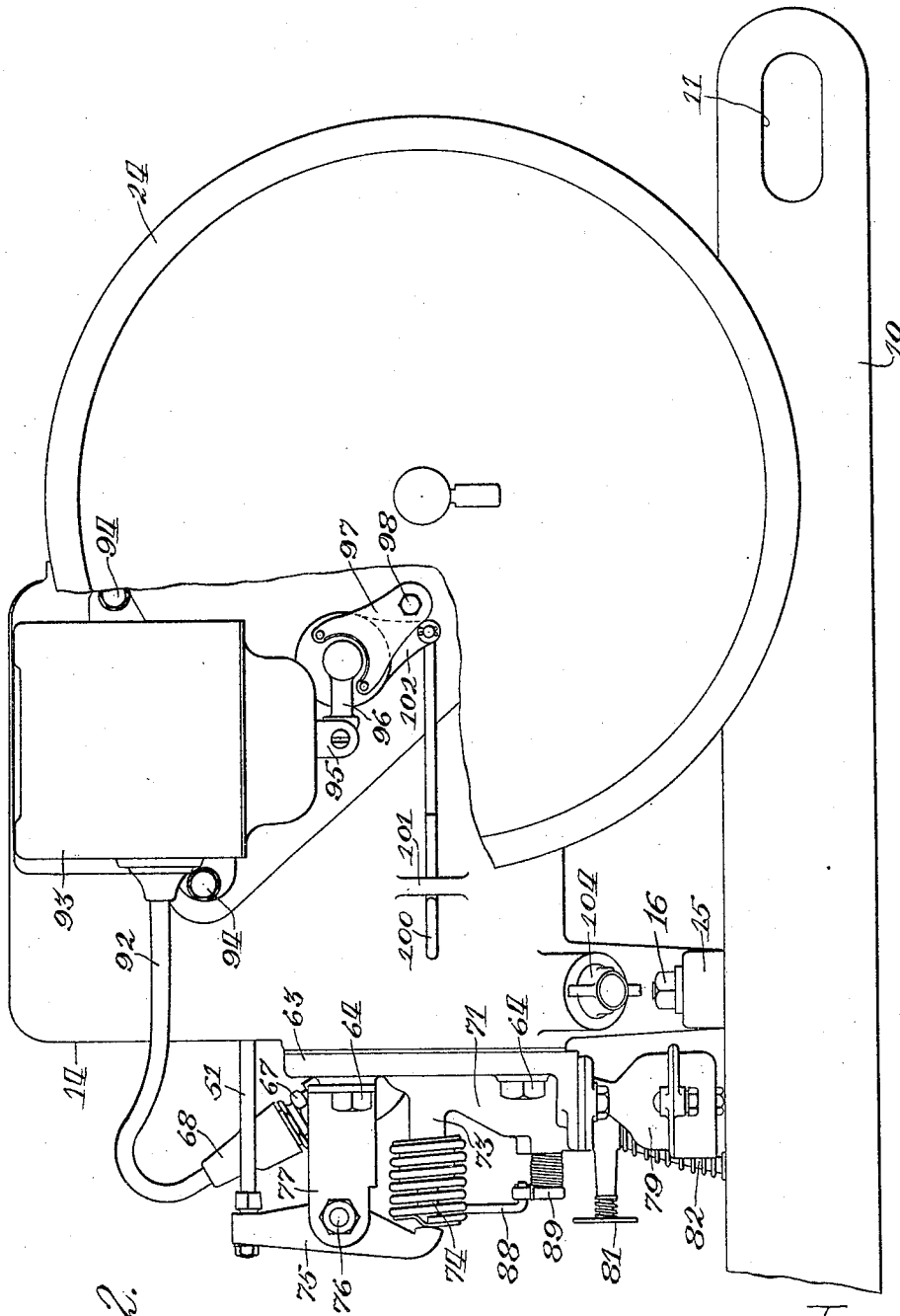
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6 Sheets-Sheet 2



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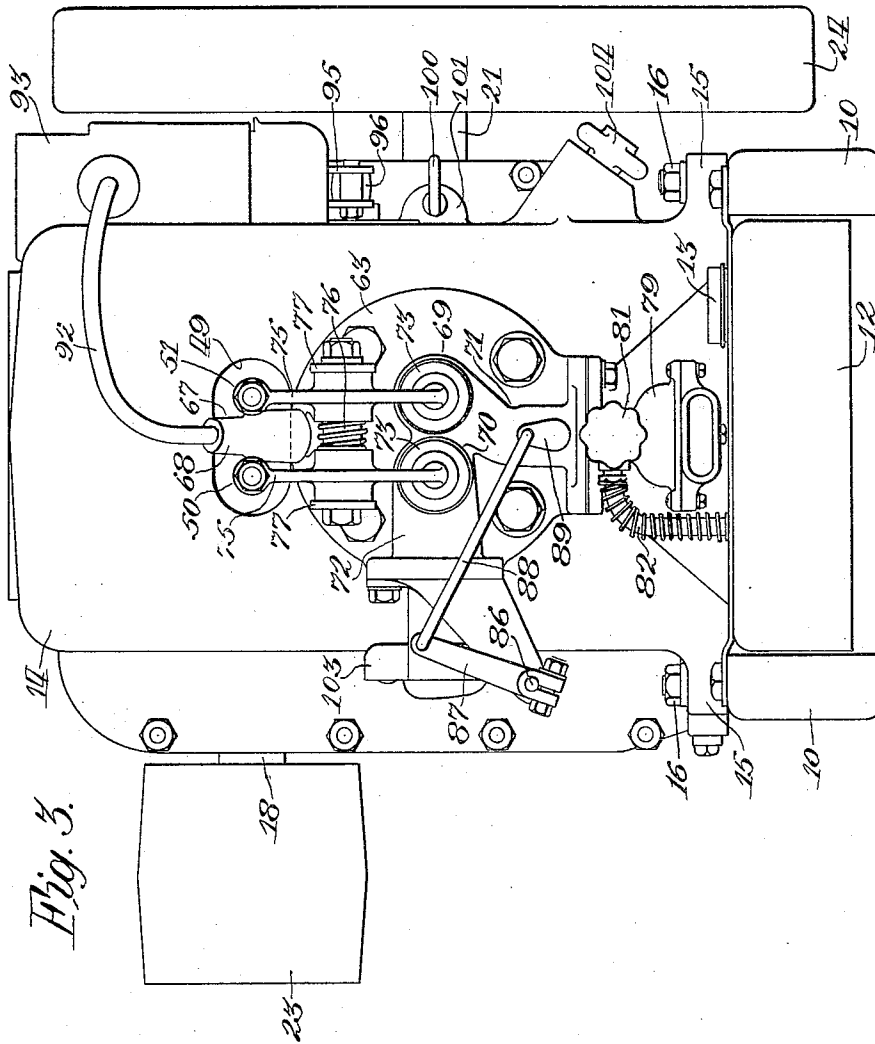
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INTERNAL COMBUSTION ENGINE

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6 Sheets-Sheet 3



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INTERNAL COMBUSTION ENGINE

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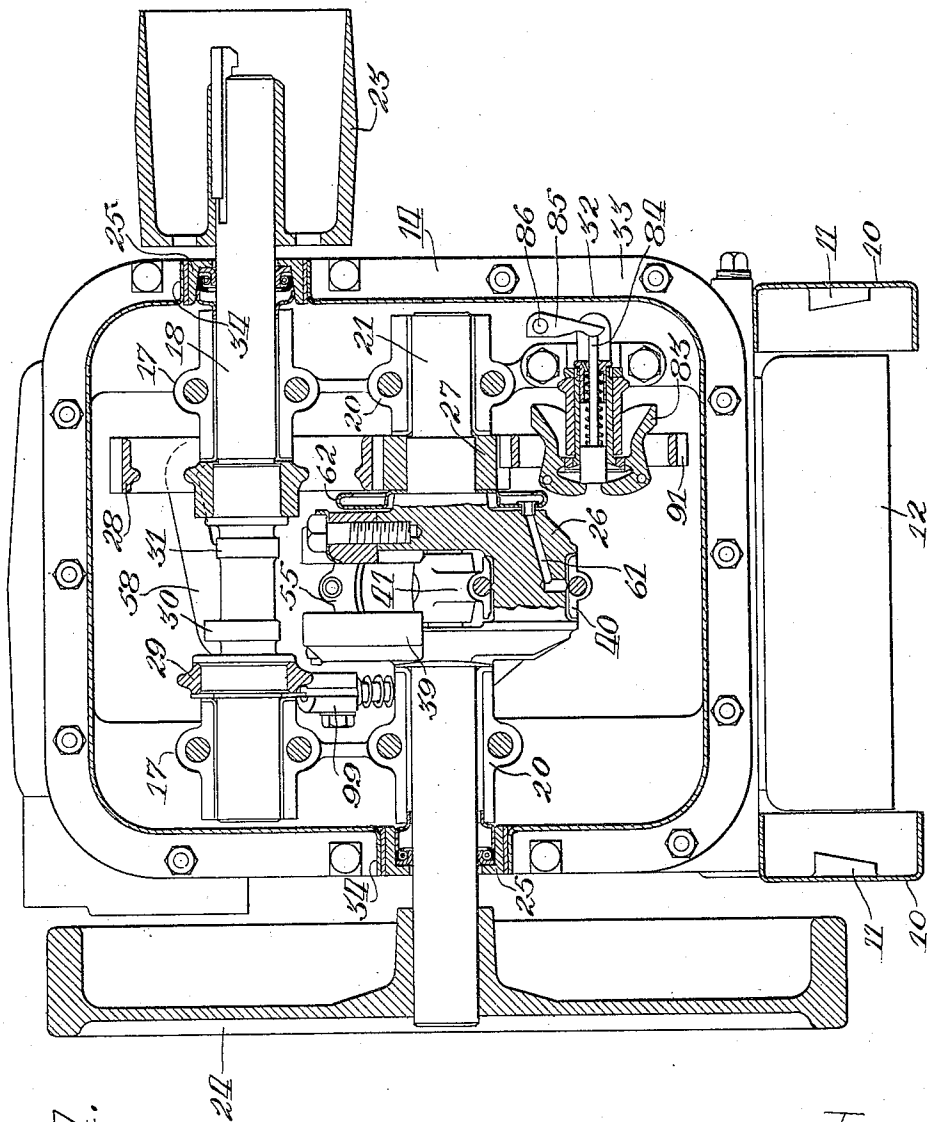


Fig. 4.

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INTERNAL COMBUSTION ENGINE

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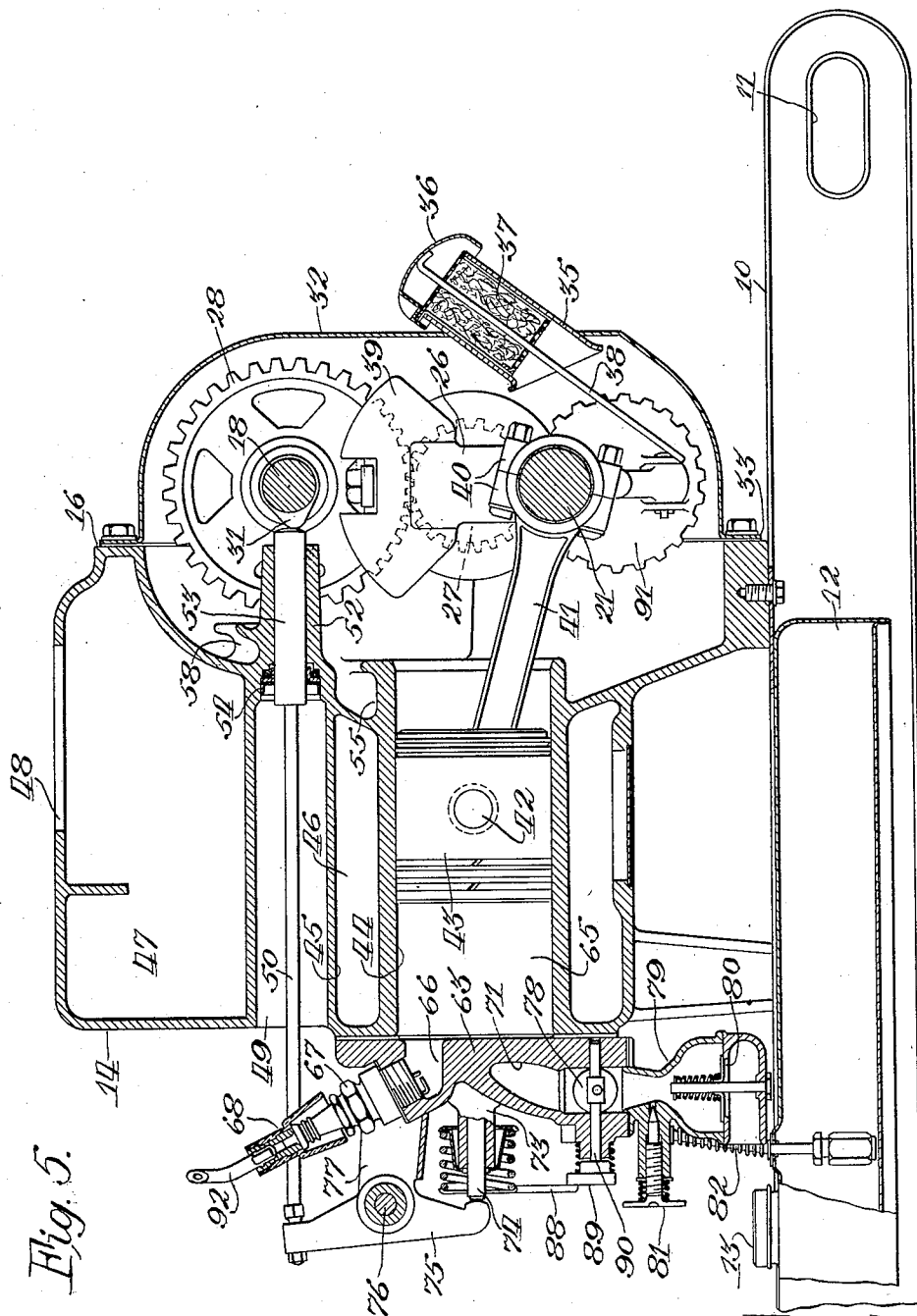


Fig. 5.

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INTERNAL COMBUSTION ENGINE

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Fig. 6.

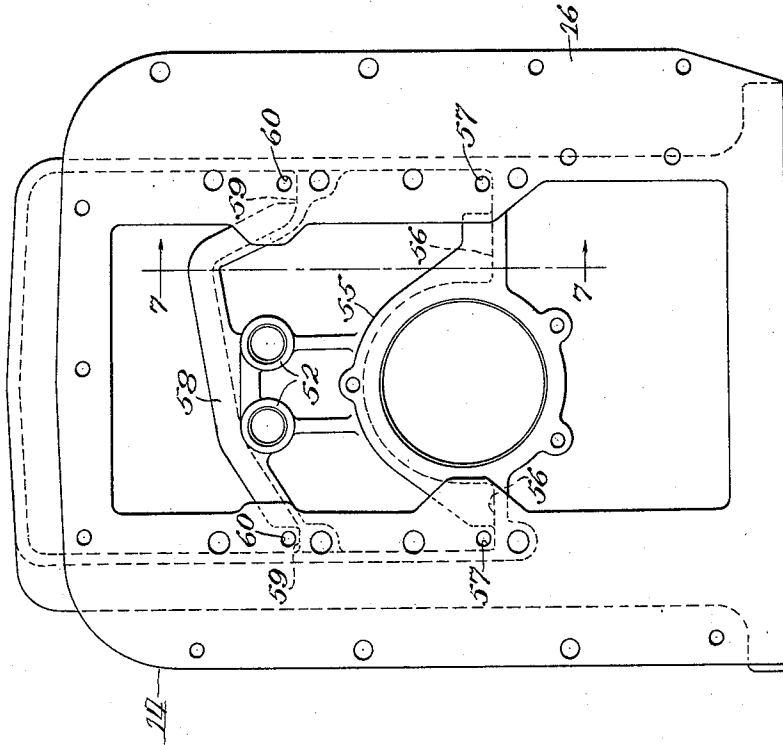
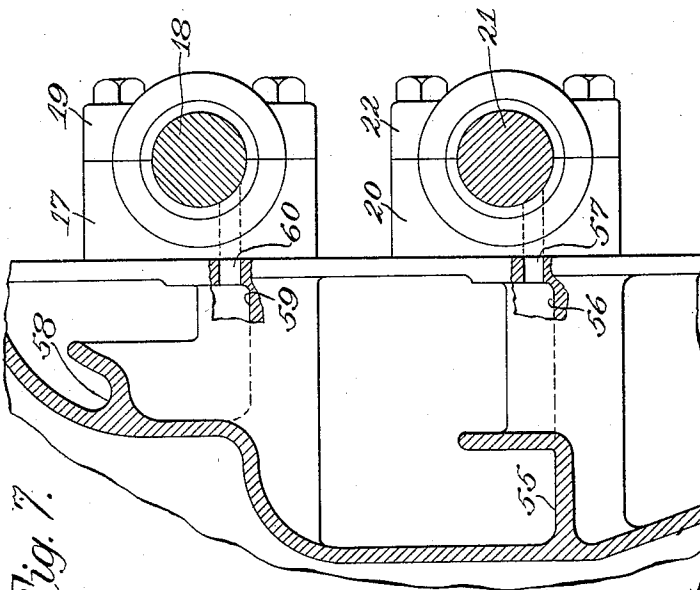


Fig. 7.

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UNITED STATES PATENT OFFICE

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INTERNAL COMBUSTION ENGINE

Application filed April 30, 1931. Serial No. 534,014.

The invention relates to improvements in an internal combustion engine of the four cycle type having a single cylinder.

The objects of the invention are to provide
5 a simplified and generally improved engine of the kind specified with the main thoughts being to achieve compactness, minimum weight, neatness of design and appearance, and, lastly, enclosure of the maximum number
10 of moving parts, to exclude dirt therefrom. More specific objects relate to features of design of the engine block with provision for mounting crank and cam shafts with efficient facilities for lubricating bearings for
15 these shafts; to provide a quickly removable cover for the open end of the block to facilitate inspection and repairs, if necessary; to provide an integral sleeve in the block passed through the water cooling hopper to enclose
20 and locate the valve operating push rods; and, in conclusion, generally to provide other important features of construction, and relative positioning of parts, as will later more fully appear.

25 These objects are briefly attained by the form of the invention herein chosen in the drawings for purposes of illustration, and by way of example. In these drawings:

30 Figure 1 is a top plan view of the internal combustion engine;

Figure 2 is a side elevational view of the structure shown in Figure 1 with a portion of the fly-wheel broken away, better to illustrate certain parts of the engine;

35 Figure 3 is an elevational view of the head end of the engine, which would be looking from the left to the right in Figures 1 and 2;

40 Figure 4 is a transverse sectional view through the engine, as seen along the line 4—4 appearing in Figure 1 when viewed in the direction of the arrows;

45 Figure 5 is a longitudinal sectional view through the engine, as seen along the broken section line 5—5 appearing in Figure 1 when viewed in the indicated direction;

Figure 6 is an end view of the casting comprising the block of the engine when looking at the same from the end shown in Figure 4; and,

50 Figure 7 is an enlarged detail view through

part of this block casting, as seen along the line 7—7 appearing in Figure 6 when looking in the direction indicated by the arrows.

The engine may be mounted on any appropriate form of support such for example
55 as the two spaced runners 10 having hand holes 11 to facilitate handling and transport of the engine when desired. These side members 10 are of channel steel, for lightness and strength, and in any convenient manner carry
60 a fuel tank 12 at one end, as best shown in Figures 4 and 5. This tank has a filler opening closed by a cap 13.

The engine block is generally numbered 14, the same being cast as an integral piece
65 having suitable ears 15 to serve as means to receive bolts 16 for anchoring the engine to the runners, or side members, 10. At its right hand end, as seen in Figure 5, the block 14 has a flat, vertically machined face 16'
70 which is open, as shown in Figure 6. This end of the casting carries two spaced bearing blocks 17, as shown in Figures 4 and 7, properly bushed to journal for rotation a
75 transversely disposed, horizontal cam shaft 18 held in place by bolted parts 19. Below the cam shaft, this same end of the block carries two similar bearing blocks 20 for
80 journaling the transversely disposed, horizontal crank shaft 21 held in place by bolted cover blocks 22. The cam shaft 18, as shown in Figure 4, projects laterally out of the
85 right hand side of the block 14, where it carries a pulley wheel 23 for taking off power in the well known manner. Conversely, the
90 crank shaft 21 is passed out laterally of the block 14 toward the left, said projected end of the crank shaft having secured thereto a flywheel 24. Where each of these shafts
95 extends from the block 14, said block carries in any approved way an oil and dirt seal 25 for the purpose of excluding dirt and preventing oil leakage.

The crank shaft 21 is formed with a crank 26 disposed centrally off the open end of the
100 block 14, and, to one side of the crank 26, has fastened thereto a crank shaft pinion 27 in mesh with a gear 28 secured to the cam shaft 18. The gear reduction here is two to one, so that the cam shaft makes two revolu-

tions to one for the crank shaft. The cam shaft 18 also carries and operates an eccentric 29 and two cams 30 and 31 for a purpose presently to appear.

Closing the open end 16 of the block 14 and the mechanism just above described is a pressed sheet metal cover 32 having a flange 33 which is appropriately bolted to the periphery of the same open end face 16. The sides of this cover 32 are notched, as at 34, (see Figure 4), to fit as snugly as possible around the shafts 18 and 21 and the respective seals 25. As shown in Figures 1 and 5, this cover carries a sleeve 35 in which is detachably mounted a breather unit 36 including air cleaner wire wool 37 and an oil gauge 38 that extends downwardly into the crank case.

The crank shaft 21 carries the usual counterbalancing weight 39, while the crank 26 thereof is provided with a bushed bearing 40 that connects a connecting rod 41 thereto in the usual way. This rod or pitman 41 is pivotally connected at its other end with a wrist pin 42 mounted in a piston 43 which is reciprocally carried in a cylinder 44 disposed horizontally and formed as an integral sleeve part of the block casting 14. Surrounding the cylinder 44 is a spaced circular sleeve 45 providing a water jacket 46 which is in communication with a water hopper 47 open at its top, as at 48, said hopper also being an integral part of the block and being arranged at the top thereof, as best shown in Figure 5.

Between the cylinder 45 and the hopper 47, the block 14 is formed with an integrally cast, longitudinally extending tunnel or passage 49, open at its left hand end, as seen in Figure 5, said tunnel providing a substantially enclosed space for a pair of valve push rods 50 and 51, which are reciprocally mounted in bearings 52 formed as a part of the block 14. The valve push rods are at the cam shaft side, respectively, formed with thickened portions 53 engageable by the cams 30 and 31 heretofore described. In this manner the rods 50 and 51 are alternately reciprocated. A seal 54 is provided around each portion 53, where it projects into the tunnel 49 to exclude dirt from the crank case and to prevent leakage of oil therefrom. Effective lubrication is contemplated as a major factor in this construction, and the mechanism for achieving such desirable result will now be described.

As appears best in Figures 5 and 6, the cylinder sleeve 44 projects slightly into the crank case. The upper portion of this projected portion, as at 55, is formed as a trough which is generally shaped in a half-circle, so that oil picked up by said trough will drain to reservoirs 56 that feed to openings 57 in the block 14, said openings or bores directing the lubricant to the bearings 20, 22

for the crank shaft 21. (See Figure 7). In a quite similar manner, as shown in Figures 5, 6 and 7, the block 14 is integrally formed with a trough 58 that receives splashed oil which then drains to the opposite ends thereof from whence it feeds to reservoirs 59 that lead the oil to passages 60 in the block 14, said passages 60 leading the lubricant to the two bearing 17, 19 for the cam shaft 18. The connecting rod bearing is oiled from a bore 61 in the crank 26, said bore receiving its supply of oil from an oil catching disk 62, (see Figure 4).

It will be understood that the crank case is filled with oil up to a suitable level and that, as the crank 26 and gear 27 play therein, the oil is carried or splashed up to the troughs 55 and 58 for oiling the crank and cam shaft bearings in the manner described. The splashed oil also comes into direct contact with the cams 30 and 31 and eccentric 29 to lubricate these parts. The bearing 40 is oiled through the feed passage 61, and the piston 43 and wrist pin 42 are oiled by direct splash.

Continuing now with the structure, it will be seen in Figure 5 that the cylinder 44 is closed by a head 63 connected by bolts 64 to the block 14, as appears from Figure 2. Between this head and the piston 43 is the usual combustion chamber 65 of the engine. The head 63 has an opening 66 that receives a spark plug 67 having a weather-proof covering 68. The head is also provided with an inlet port 69 and an exhaust port 70 from which, respectively, extend leads 71 and 72. The head includes two of the usual valve stem guides 73, each reciprocally carrying valve stems 74, operable alternately by two rocker arms 75 mounted on a shaft 76, which in turn is carried by a pair of spaced brackets 77 secured to the head 63. The upper ends of these two rocker arms 75 are adjustably connected to the ends of the push rods 50, 51 heretofore described.

The intake lead 71 carries a butterfly valve 78 and connects with a carbureter 79. This carbureter has a valve controlled air inlet 80 and a needle valve 81 for controlling the quantity of fuel fed to the carbureter from a fuel feed pipe 82, which communicates with the fuel reservoir 12, (see Figure 5). The butterfly valve 18 is automatically controlled by a governor 83 (see Figure 4) embodying the usual centrifugally operated weights acting to move a rod 84 engageable with a crank lever 85 on a shaft 86, which protrudes outwardly from the block 14, as shown also in Figures 1 and 3. The free end of the rock-shaft 86 in turn carries a crank 87 pivotally connected to a link 88 in turn pivotally connected to a small crank 89 which turns the stem 90 that carries the butterfly valve 78. This governor 83, as appears in Figure 4, includes in the conventional way a gear 91 in mesh with the crank shaft pinion 27 hereto-

fore described. In this fashion, the governor is driven directly from the crank shaft 21.

The spark plug 67 is connected with an electrical conductor cable 92, the other end of which connects to an enclosed, weather-proof magneto 93 of the well known reciprocatory armature type. This magneto is appropriately bolted to the engine block by bolts 94 on the flywheel side. Protruding from the bottom of the magneto is a push-pull member 95 connected with an arm 96 (see Figure 2), that is moved up and down to reciprocate the armature of the magneto by means of a crank 97 connected to a rockshaft 98, which, in a conventional manner, is operated by a tripper mechanism 99 (see Figure 4) inside the engine case, which tripper, in turn, is driven by the eccentric 29 heretofore described. The stroke of the push-pull link 95 may be varied in the usual way by means of a hand operated link 100 carried in an eye 101 at the side of the block 14, said link 100 having connection with a setting mechanism 102.

The exhaust outlet 72 carries a suitable form of muffler 103 shown in Figures 1 and 3.

The lubricant may be drained from the crank case by means of a drain plug 104 provided at the bottom of the crank case on the flywheel side of the engine, as shown best in Figure 2.

In using the engine the case will be filled with oil to a level indicated by an appropriate mark on the gauge stem 38. Fuel, of course, is contained in the tank 12, and cooling water is in the hopper 47 and jacket 46. To start the engine, the spark control rod 100 and needle valve 81 are properly set to regulate ignition and fuel supply to make starting as easy as possible. Thereupon, the flywheel 24 is manually turned to create combustion in the chamber 65. All parts are now in motion and in the conventional four-cycle manner the first out stroke of the piston 43 occurs with the exhaust valve open and the inlet valve closed, thereby accomplishing scavenging of the combustion chamber. On the return or in-stroke of the piston, the exhaust valve closes and the inlet valve opens to charge the combustion chamber. The piston then returns on its outstroke to compress the charge and, during such stroke, both inlet and exhaust valves are held closed. Near the termination of this compression stroke of the piston, the spark plug 67 is ignited to fire the compressed charge and thus, in the conventional manner, the piston is quickly returned on its power stroke to turn the crank shaft and connected parts.

The mode of lubrication of the various bearings and parts has already been described, with one exception, and that is in the case of the gearing 27, 28, which are lubricated by splash and from oil picked up by the governor drive gear 91 which plays down in the oil bath.

Access to the engine interior is readily had upon removal of the cover plate 32, which seals and encloses the crank and cam shaft assemblies.

From this detailed disclosure, it must now be appreciated that an improved internal combustion engine is provided, which achieves all of the desirable objects heretofore recited therefor.

It is the intention to cover herein all such changes and modifications as do not depart from the spirit and scope of the invention as indicated by the appended claims.

What is claimed is:

1. In an internal combustion engine of the horizontal type, an integrally cast block embodying a cylinder sleeve surrounded by a water jacket, a head for the sleeve, a cooling hopper above the cylinder sleeve and in communication with the jacket, and a tunnel formed in the block independent of the head to provide a space for valve operating push rods.

2. In an internal combustion engine, an integrally cast block embodying a cylinder sleeve surrounded by a water jacket, a cooling hopper above the cylinder sleeve and in communication with the jacket, and a tunnel formed in the block between the water jacket and hopper to provide a space for valve operating push rods.

3. In an internal combustion engine, an integrally cast block embodying a horizontally disposed cylinder sleeve surrounded by a water jacket, a cooling hopper formed at the top of the block in communication with said jacket, and a horizontally disposed tunnel formed in the block between the cylinder sleeve and the hopper.

4. In an internal combustion engine, a block embodying a horizontal cylinder sleeve, cooling jacket and cooling hopper, one end of said block being finished as a flat open end, a crank shaft, bearings on the flat end for carrying the same on the block, a cam shaft, bearings on the flat end for carrying the same on the block, a piston operable in the sleeve from the crank shaft to which it is connected, means to drive the cam shaft from the crank shaft, and a cover removably connected to said flat end to enclose said parts and the open end of the block.

5. In an internal combustion engine, a block embodying a horizontal cylinder sleeve, cooling jacket and cooling hopper, one end of said block being finished as a flat open end, a crank shaft, bearings on the flat end for carrying the same on the block, a cam shaft, bearings on the flat end for carrying the same on the block, the crank shaft projecting at one end laterally of the block, a flywheel carried on said crank shaft end, the cam shaft projecting at one end laterally of the block in an opposite direction, a pulley carried on said cam shaft end, a piston operable in the

sleeve from the crank shaft to which it is connected, means to drive the cam shaft from the crank shaft, and a cover removably connected to said flat end to enclose said parts and the open end of the block.

6. In an internal combustion engine, a block embodying a horizontal cylinder sleeve, cooling jacket and cooling hopper, one end of said block being finished as a flat open end, a crank shaft, bearings on the flat end for carrying the same on the block, a cam shaft, bearings on the flat end for carrying the same on the block, an oil receiving trough formed in the block, means for passing oil from the trough to the crank shaft bearings, a piston operable in the sleeve from the crank shaft to which it is connected, means to drive the cam shaft from the crank shaft, and a cover to enclose said parts and the open end of the block.

7. In an internal combustion engine, a block embodying a horizontal cylinder sleeve, cooling jacket, and cooling hopper, one end of said block being finished as a flat open end, a crank shaft, bearings on the flat end for carrying the same on the block, a cam shaft, bearings on the flat end for carrying the same on the block, an oil receiving trough formed in the block as a half-circle over the end of the cylinder sleeve, a reservoir at each end of the half-circle trough, a passage from each reservoir to each crank shaft bearing to lubricate the same, a piston operable in the sleeve from the crank shaft to which it is connected, means to drive the cam shaft from the crank shaft, and a cover to enclose said parts and the open end of the block.

8. In an internal combustion engine, a block embodying a horizontal cylinder sleeve, cooling jacket, and cooling hopper, one end of said block being finished as a flat open end, a crank shaft, bearings on the flat end for carrying the same on the block, a cam shaft, bearings on the flat end for carrying the same on the block, an oil receiving trough formed in the block, means for directing oil from said trough to the cam shaft bearings, a piston operable in the sleeve from the crank shaft to which it is connected, means to drive the cam shaft from the crank shaft, and a cover removably connected to said flat end to enclose said parts and the open end of the block.

9. In an internal combustion engine, a block embodying a horizontal cylinder sleeve, cooling jacket, and cooling hopper, one end of said block being finished as a flat open end, a crank shaft, bearings on the flat end for carrying the same on the block, a cam shaft, bearings on the flat end for carrying the same on the block, an oil receiving trough on the block, said trough having a high portion draining to two lower ends, a reservoir at each end, passages in the block for leading the oil from said reservoirs to the cam shaft

bearings, a piston operable in the sleeve from the crank shaft to which it is connected, means to drive the cam shaft from the crank shaft, and a cover enclosing said parts and the open end of the block.

10. In an internal combustion engine, a block embodying a horizontal cylinder sleeve, cooling jacket, and cooling hopper, one end of said block being finished as a flat open end, a crank shaft, bearings on the flat end for carrying the same on the block, a cam shaft, bearings on the flat end for carrying the same on the block, a pair of oil receiving troughs on the block, means for passing the oil from one trough to the cam shaft bearings, means for passing the oil from the other trough to the crank shaft bearings, a piston operable in the sleeve from the crank shaft to which it is connected, means to drive the cam shaft from the crank shaft, and a cover enclosing said parts and the open end of said block.

11. In an internal combustion engine, a block embodying a horizontal cylinder sleeve, cooling jacket, and cooling hopper, one end of said block being finished as a flat open end, a crank shaft, bearings on the flat end carrying the same on the block, a cam shaft, bearings on the flat end for carrying the same on the block, a pair of oil receiving troughs integrally formed on the block, said troughs each having a high portion and two lower ends, reservoirs at said low ends of the troughs, passages in the block for leading oil from the reservoirs of one trough to the cam shaft bearings, similar passages in the block for leading oil from the reservoirs of the other trough to the crank shaft bearings, a piston operable in the sleeve from the crank shaft to which it is connected, means to drive the cam shaft from the crank shaft, and a cover enclosing said parts and the open end of said block.

12. An internal combustion engine comprising, in combination, a block having a horizontally disposed cylinder sleeve, a water jacket surrounding the sleeve, a cooling hopper above the sleeve and jacket, said block having an open end, a crank shaft journaled on the block at said open end, a piston in the sleeve driven from said crank shaft, a head closing the cylinder sleeve, a cover detachably mounted on the open end of the block to close the same, a breather sleeve in said cover for the crank case of the engine, and an oil gauge in the breather sleeve.

13. An internal combustion engine comprising, in combination, an integrally cast block having a horizontally disposed cylinder sleeve, a water jacket and a cooling hopper, said block having an open end, a crank shaft journaled on the block at said open end, a piston in the sleeve driven from said crank shaft, a head closing the cylinder

sleeve, a cover detachably mounted on the open end of the block to close the same, said cover including a breather opening for the crank case of the engine, a cap for the
5 breather opening, and an oil gauge carried by said cap.

14. An internal combustion engine comprising, in combination, a block having a cylinder sleeve surrounded by a water jacket,
10 the block including a cooling hopper and a sleeve between the hopper and cylinder sleeve, said block having an open end including a crank case, a tunnel in the block open at the head end of the block, geared
15 together crank and cam shafts arranged transversely at the open end of the block in bearings mounted on the block, a piston slidable in the cylinder sleeve and driven from the crank shaft, valve push rods oper-
20 able from the cam shaft and located in said tunnel, a cover closing the open end of the block, a head closing the head end of the cylinder sleeve, a spark plug in the head, inlet and exhaust leads including valves carried
25 by said head, rocker arms for operating the valves and carried by the head and connected to said push rods, and a carbureter communicating with said inlet lead.

15. An internal combustion engine comprising, in combination, an integrally cast
30 block having a horizontally disposed cylinder sleeve surrounded by a water jacket, the block including a cooling hopper at its top and a sleeve forming a horizontal tunnel between the hopper and cylinder sleeve, said
35 block having an open end including a crank case and the said tunnel being open at the head end of the block, geared together crank and cam shafts arranged transversely at the open end of the block in bearings mounted
40 on the block, the crank shaft extending from one side of the block and carrying a flywheel, the cam shaft extending laterally from the opposite side of the block and carrying a pulley wheel, a piston slidable in the cylinder sleeve and driven from the crank shaft,
45 valve push rods operable from the cam shaft and located in said tunnel, a cover closing the open end of the block, a head closing the head end of the cylinder sleeve, a spark plug, and inlet and exhaust leads including valves
50 carried by said head, rocker arms connected to the valves and carried by the head and connected to said push rods, and a carbureter communicating with the inlet lead.
55

In testimony whereof I affix my signature.

WILLIAM OTTO BECHMAN.