Nov. 18, 1924. 1,515,765

S. ASSER

INTERNAL COMBUSTION ENGINE

Filed Feb. 10 1923 2 Sheets-Sheet 1

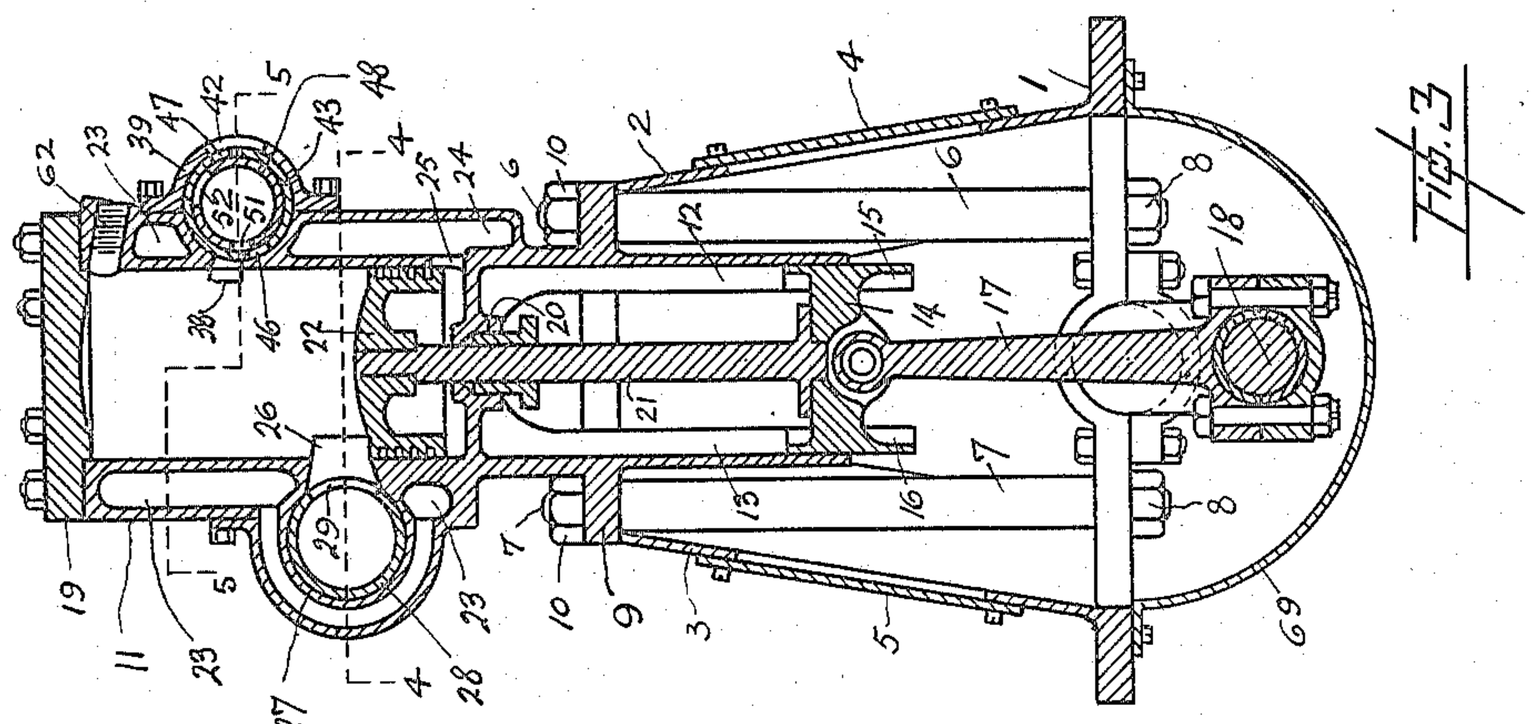

Fig. 3

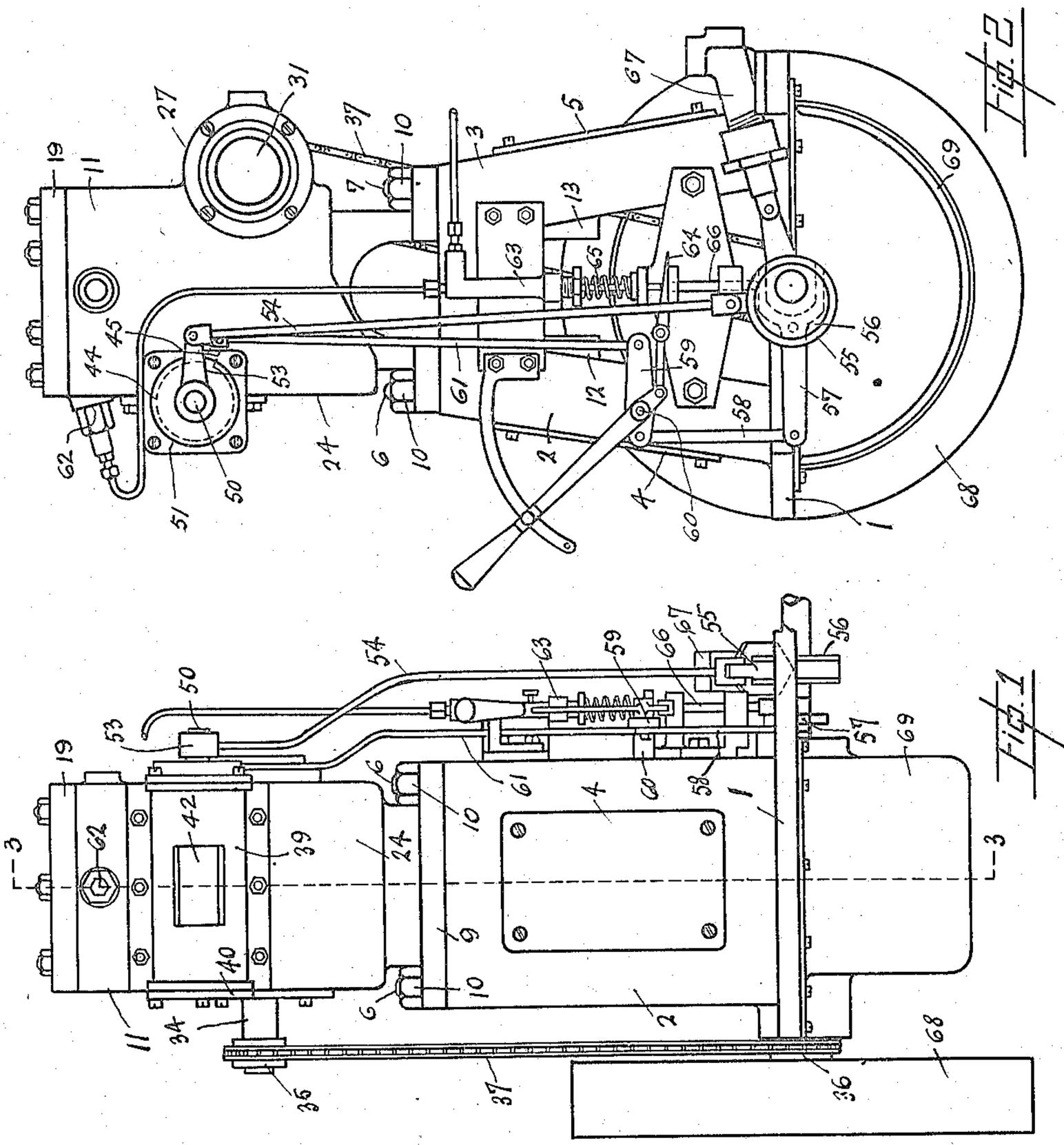

Fig. 2

Fig. 1

INVENTOR

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By Marks & Clerk

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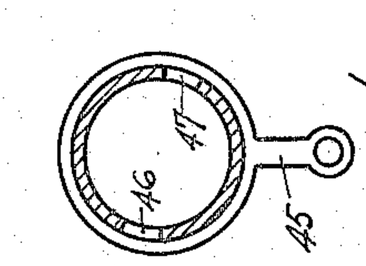

Fig. 13

Fig. 15

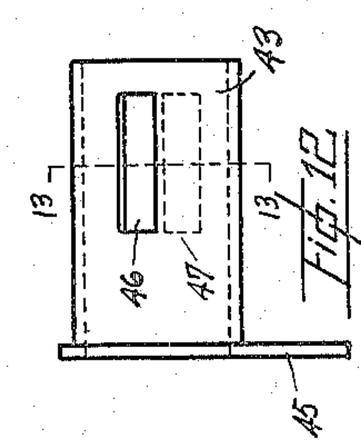

Fig. 12

Fig. 14

Fig. 9

Fig. 11

Fig. 8

Fig. 10

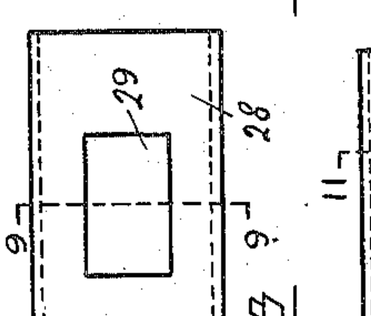

Fig. 4

Fig. 5

Fig. 6

Fig. 7

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UNITED STATES PATENT OFFICE.

SYDNEY ASSER, OF VICTORIA, BRITISH COLUMBIA, CANADA.

INTERNAL-COMBUSTION ENGINE.

Application filed February 10, 1923. Serial No. 618,285.

To all whom it may concern:

Be it known that I, SYDNEY ASSER, a subject of the King of Great Britain, residing at the city of Victoria, in the Province of British Columbia, Canada, have invented certain new and useful Improvements in Internal-Combustion Engines, of which the following is a specification.

My invention relates to improvements in internal combustion engines, and the object of my invention is to devise a directly reversible engine of the simplest construction capable of efficiently using low grade and heavy oils which can be manufactured cheaply and sold at a low cost while at the same time retaining the efficiency as far as horse power, maintainance and endurance are concerned of the most expensive engines, thus enabling heavy oil engines to be obtained at a very low price approximating closely that of the lowest priced gasoline engines in use at the present time. A further object is to provide an engine of this character in which the ports are so arranged that very complete scavenging of the exhaust gases is effected and in which the valves controlling the ports are at no time subject to the high pressure of ultimate compression nor the high temperature of initial combustion, thus reducing friction and enabling proper cooling of the parts to be readily and effectively maintained.

I attain these objects by the construction illustrated in the accompanying drawings in which—

Fig. 1 is a front view of the engine.

Fig. 2 is an end view.

Fig. 3 is a sectional elevation taken through the line 3—3 of Fig. 1.

Fig. 4 is a sectional plan view taken through the line 4—4 of Fig. 3.

Fig. 5 is a sectional plan view taken through the line 5—5 of Fig. 3, certain of the ports being shown in registration.

Fig. 6 is an outside view of the air inlet valve chamber outer half.

Fig. 7 is a cross sectional view taken through the line 7—7 of Fig. 6.

Fig. 8 is a side elevation of the exhaust valve.

Fig. 9 is a cross sectional view taken through the line 9—9 of Fig. 8.

Fig. 10 is a side elevation of the inner air inlet valve sleeve.

Fig. 11 is a cross section taken through the line 11—11 of Fig. 10.

Fig. 12 is a side elevation of the outer air inlet valve sleeve.

Fig. 13 is a cross section taken through the line 13—13 of Fig. 12.

Fig. 14 is a view showing positions of the exhaust valve at designated positions of the stroke.

Fig. 15 is a view showing positions of the air inlet valve sleeves at designated positions of the stroke.

Similar figures of reference indicate similar parts throughout the several views.

1 indicates the engine bedplate from which extend upwardly front and back columns 2 and 3 provided with handholes and handhole plates 4 and 5 covering the same, and within these front and back columns 2 and 3 are front and back pairs of vertical columns, the respective pairs being indicated by the numerals 6 and 7 and each column being secured at its lower end to the bedplate by a nut 8 while at its upper end it extends above the columns 2 and 3 so that the cylinder flange 9 may be seated on these columns and rigidly secured thereto by nuts 10 threaded on to the upper ends of the vertical columns 6 and 7. The cylinder 11 is thus secured centrally in position and it is provided with downwardly extending guides 12 and 13 between which is mounted a crosshead 14 having shoes 15 and 16 slidably engaging the guides, to which crosshead is connected the top end of the connecting rod 17 the bottom end of which is connected to the crank shaft 18 rotatably mounted in the usual manner on the bedplate.

The cylinder 11 is provided at its upper end with a removable cover 19 and at its lower end it is closed, the closed end being centrally apertured and provided with a stuffing box 20 through which extends the piston rod 21 the lower end of which is secured to the crosshead 14 while its upper end is secured to the piston 22 within the cylinder. On its front side the cylinder, which is water jacketed, as at 23, is provided with a chamber 24, which chamber is in communication with the bore of the cylinder through a port 25 formed in the cylinder wall towards its lower end and below the piston. At a suitable height in its wall, that is, the cylinder wall, preferably where it will be fully uncovered by the piston when at the bottom of its stroke, an exhaust port 26 is formed which port opens into an offset

cylindrical chamber 27 formed on the cylinder transversely of the same on the opposite side to the chamber 24 and rotatably mounted in the bore of the chamber 27 is a cylindrical sleeve valve 28 having a port 29 adapted to register with the cylinder exhaust port at predetermined intervals during the operation of the engine, as will be hereinafter described. The transverse chamber 27 is closed at one end, as at 30, and open at its opposite end, as at 31, for the connection of an exhaust pipe thereto, and the sleeve 28 is also closed at one end, as at 32, and open at its opposite end, as at 33, its closed end being provided with an integral shaft 34 which extends centrally and rotatably through the closed end 30 of the chamber while its open end 33 is open to the chamber end opening 31, from which it will be seen that when the sleeve port 29 is in registration with the cylinder exhaust port 26 the bore of the cylinder will be in communication with the interior of the sleeve. A sprocket 35 is secured to the shaft 34 in alignment with a sprocket 36 on the engine shaft and these sprockets are chain-connected by a link-belt chain 37 so that the rotation of the engine shaft correspondingly rotates the sleeve 28.

38 indicates and air inlet port formed in the cylinder wall at a designed point intermediate the height of the cylinder and diametrically opposite the exhaust port 26. This port 38 is positioned above the top end of the chamber 24 and opens into an offset cylindrical chamber 39 formed on the cylinder transversely of the same which chamber is closed at one end by a cover 40 and with the interior or bore of which towards the closed end the chamber 24 communicates through a port 41 in the chamber wall. In its outer wall the chamber 39 is provided with an air inlet port 42. Mounted in the bore of the chamber 39 for oscillating movement therein is a sleeve 43 open at both ends, which sleeve is flanged at one end as at 44, Fig. 2, to bear on the outer end of the chamber 39 its opposite end extending to a point in alignment with the innermost edge of the port 41, its flanged end being provided with an arm 45. This sleeve will be termed hereinafter the "outer air inlet valve sleeve" and it is provided with a pair of diametrically opposite ports 46 and 47 which register at predetermined intervals in the operation of the engine with the ports 38 and 42 respectively. Mounted in the bore of the outer air inlet valve sleeve 43 for oscillating movement therein is what is termed an "inner air inlet valve sleeve" 48, this sleeve being open at its inner end and closed at its outer end as at 49 and being provided on the closed end with an integral shaft 50 which extends freely and centrally through a cover plate 70 secured to the end of the chamber 39. This sleeve 48 is provided with a pair of ports 51 and 52, as shown in Figs. 3 and 15, and to its shaft 50 is secured an arm 53, Fig. 2, to the outer end of which is connected the upper end of an eccentric rod 54 the lower end of which is connected to and operated by an eccentric strap 55 and eccentric 56 mounted on the engine shaft, as shown in Fig. 2, and on the engine shaft is also mounted a cam-operated rocker arm 57 the free end of which is connected by a rod 58 to one end of a rocking lever 59 fulcrumed on the pin 60 the opposite end of which lever is connected by a rod 61 to the arm 45 of the outer air inlet valve sleeve 43 Fig. 12.

62 indicates the fuel inlet orifice, the fuel being injected therethrough by means of a fuel pump 63 operated by any suitable cam-operated tappet means from the engine shaft, the stroke of the pump being controlled by means of a handle-operated wedge 64 interposed between the pump plunger rod 65 and the tappet rod 66. The engine is provided with the usual water circulating pump 67, flywheel 68, and crankcase 69.

The operation of the engine will be readily understood on reference being had to the drawings, the one illustrated therein being of the two cycle type, in which, after being initially started by means of an electric coil or any other well-known device (not shown) for starting purposes, ignition is continued due to the heat of the cylinder. The piston has no baffle so that the cylinder end clearance is reduced to the minimum and a high compression is attainable. Assuming, therefore, that the piston 22 is on the top centre with a charge of ignitible gas between it and the cylinder cover and a charge of air between it and the bottom of the cylinder the cycle of operation may be described as follows, having particular reference at the same time to Figs. 3, 14 and 15, from which it will be noted that the air ports 38 and 42 are closed due to the position of the sleeves 43 and 48, and that the exhaust port 26 is also closed. The gas being fired the piston is driven downwardly actuating throughout the downstroke the engine shaft, the eccentric 56 and rocker 57 so that the sleeves 43 and 48 are partially rotated in the direction indicated by the arrow in Fig. 15 through the successive positions from the top centre of the engine to 180° or the bottom centre, the sleeve 43 being stationary, however, until the crank reaches 120°. On following these movements it will be seen that as soon as the piston starts from the top centre the inner sleeve 48, which is controlled by the eccentric 56, starts moving towards the cylinder intake port 38 until when half stroke, or 90°, is

reached, the inner sleeve port 51 is just on the point of opening the cylinder port 38 but is still covered by the outer sleeve 43. Passing 90° the outer sleeve 43, which is controlled by the rocker 57, begins to move quickly and at 135°, or three-quarters stroke, the outer sleeve port 46 and the inner sleeve port 51 are partially open to each other and to the cylinder port 38 so that the interior of the chamber 39 is now in communication with the bore of the cylinder and thus the air which has been forced into this chamber through the port 25 and air chamber 24 by the downwardly moving piston enters the cylinder restrictedly; between 135° and 180°, however, the ports 46 and 51 are in full registration both with each other and with the cylinder port 38 so that the full air charge then enters the cylinder. Referring now to Fig. 14 it will be seen that the exhaust valve sleeve 28, which rotates through complete revolutions concurrently with the engine revolutions, is open to the cylinder exhaust port 26 between 130° and 180° and this port is uncovered by the piston between these positions, so that between the 135° and 180° positions of the piston the air intake port 38 of the cylinder is open to the air chamber 24 and concurrently the exhaust port 26 of the cylinder is open to the interior of the chamber 27 and thus the exhaust gases are blown out of the cylinder into the chamber 27 and out through its open end 31 by the air which is compressed in the chamber 24 by the piston on the downstroke. On the upstroke of the piston the eccentric 56 and rocker 57 operate through their respective return strokes so that the sleeves 43 and 48 are partially rotated in the opposite direction towards their normal, or starting positions, assuming during their return movements, the successive positions shown in Fig. 15 from 180°, or bottom centre, through 225°, 270°, 315° to 360°, or top centre. On again following these movements it will be seen that the cylinder intake port 38 is closed throughout the upstroke of the piston by the sleeves 43 and 48, which while partially rotating do not open this port on the return movement. It will be noted, however, that from 180° to 270° the port 47 of the outer valve sleeve 43 is open to the air inlet port 42 in the outer wall of the chamber 39, the sleeve remaining in this position during the piston movement from 180° to 270° because the rocker 57 is operated by cam only at a predetermined moment, but that on the commencement of the upstroke the inner valve 48 actuated by the eccentric commences its partial return movement until at 225° the port 52 is in partial registration with the ports 47 and 42 and at 270° in full registration therewith while from 270° to the end of the upstroke the ports are in partial registration so that the interior of the chamber 39 is in communication both with the atmosphere through ports 52, 47 and 42 and with the chamber 24 through port 41 and with the cylinder through port 25 so that from 180° to 360° on the upstroke a charge of air is drawn into the cylinder below the piston as it moves upwardly. When the piston reaches 360° or the top centre the respective air intake valve sleeves are in their normal positions, as shown in Fig. 15, the exhaust valve sleeve also being in its normal position closing the exhaut port 26. A charge of fuel is injected through the injection port 62 at the proper moment, that is, approximately 6° before dead centre and is then ignited so that the cycle of operations just described is repeated as long as the engine is kept in operation.

It should be here stated that by applying the intake valve sleeves 43 and 48 to a four cycle engine the same is made directly reversible without change of operation, by timing gear or otherwise.

From the foregoing it will be seen that I have devised a heavy oil engine of the simplest construction which is highly practical and economical and capable of being manufactured and sold at a low cost without detracting in any degree from its efficiency and serviceability.

What I claim as my invention is:—

1. In an internal combustion engine, an explosion cylinder and a piston therein, said cylinder being closed at both ends and having intermediate its height an intake port and on the opposite side to and on a lower plane than the intake port an exhaust port, a transverse cylindrical chamber carried by said cylinder into which the said intake port opens, said chamber having a port in its wall open to the atmosphere and being extended to form a lower chamber communicating at its lower end with the lower end of the cylinder, an outer valve sleeve mounted for partial rotation in the transverse chamber open at one end to the lower chamber having ports designed for registration at predetermined intervals with the said intake and atmosphere ports, an inner valve sleeve mounted for partial rotation in the bore of the outer one also open at one end to the lower chamber having ports designed for registration at predetermined intervals with the outer sleeve ports and the intake and atmosphere ports, mechanism for operating the outer valve sleeve, and mechanism for operating the inner sleeve independently of the outer one.

2. In an internal combustion engine, an explosion cylinder and a piston therein, said cylinder being closed at both ends and having intermediate its height an intake port and on the opposite side to and on a lower plane than the intake port an exhaust port, a

transverse cylindrical chamber carried by said cylinder into which the said intake port opens, said chamber having a port in its wall open to the atmosphere and being extended to form a lower chamber communicating at its lower end with the lower end of the cylinder, an outer valve sleeve mounted for partial rotation in the transverse chamber open at one end to the lower chamber having ports designed for registration at predetermined intervals with the said intake and atmosphere ports, an inner valve sleeve mounted for partial rotation in the bore of the outer one also open at one end to the lower chamber having ports designed for registration at predetermined intervals with the outer sleeve ports and the intake and atmosphere ports, cam-operated mechanism for operating the outer valve sleeve and eccentric-operated mechanism for operating the inner sleeve independently of the outer one.

3. In an internal combustion engine, an explosion cylinder and a piston therein, said cylinder being closed at both ends and having intermediate its height an intake port and on the opposite side to and on a lower plane than the intake port an exhaust port, a transverse cylindrical chamber carried by the said cylinder into which the said intake port opens, said cylinder having a port in its wall open to the atmosphere and being extended to form a lower chamber communicating at its lower end with the lower end of the cylinder, an outer valve sleeve mounted for partial rotation in the transverse chamber open at one end to the lower chamber having ports designed for registration at predetermined intervals with the said intake and atmosphere ports, an inner valve sleeve mounted for partial rotation in the bore of the outer one also open at one end to the lower chamber having ports designed for registration at predetermined intervals with the outer sleeve ports and the intake and atmosphere ports, cam-operated mechanism for operating the outer valve sleeve, eccentric-operated mechanism for operating the inner sleeve independently of the outer one, a transverse cylindrical chamber open at one end carried by the cylinder into which the exhaust port opens, a valve sleeve rotatably mounted in said chamber having one end open to the open end of the chamber and being provided with a port adapted to register at predetermined intervals with the exhaust port, and means for rotating said valve.

In testimony whereof I hereunto affix my signature, at the city of Victoria, this 26th day of January, 1923.

SYDNEY ASSER.