

May 23, 1939.

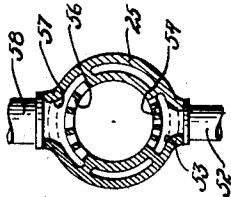
L. M. BEALL ET AL

2,159,072

ENGINE

Filed April 15, 1937

2 Sheets-Sheet 1



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2 Sheets-Sheet 2

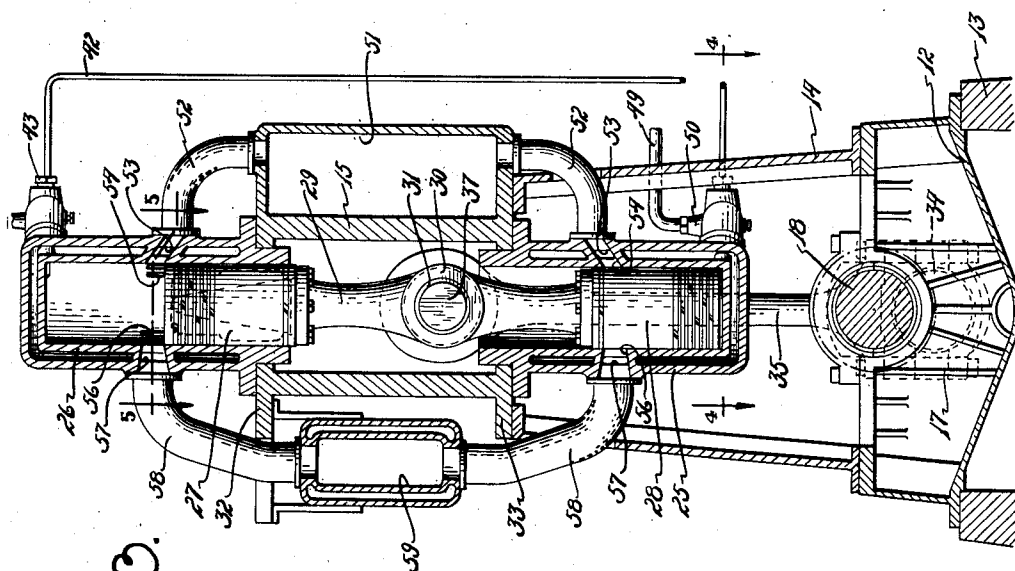


Fig. 3.

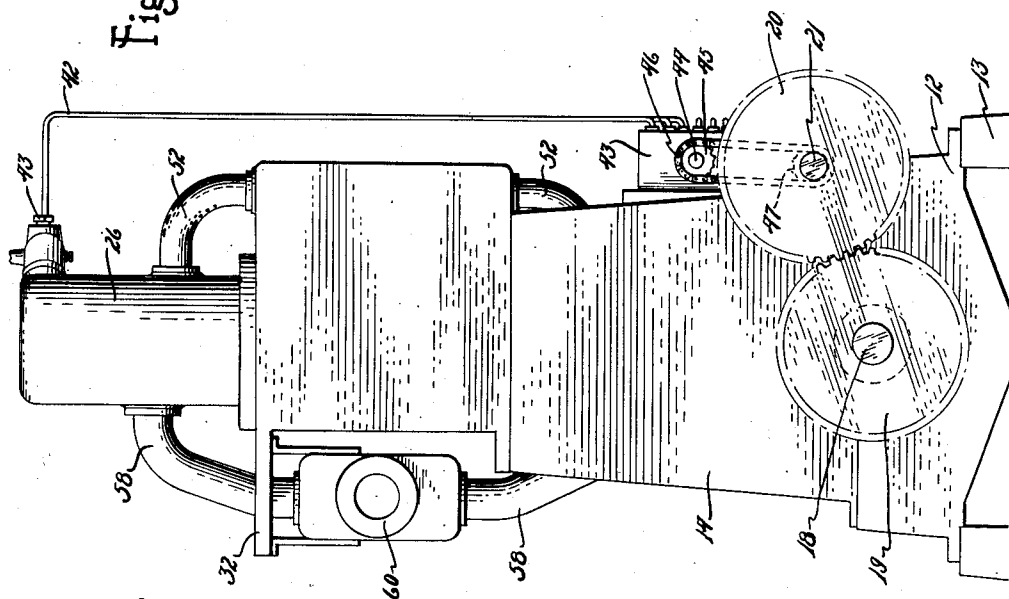


Fig. 2.

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2,159,072

ENGINE

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6 Claims. (Cl. 123—53)

Our invention relates to a new and useful improvement in an engine and particularly an engine of the Diesel type.

It is an object of the present invention to provide in an engine of this type and primarily in one of the double-acting two or four cycle type, a construction whereby the efficiency of engine may be raised so as to lessen the cost per horsepower.

Another object of the invention is the provision of an engine of this type, so constructed and arranged, as to increase its thermal and mechanical efficiency and to eliminate various parts so as to minimize the likelihood of disarrangement of the parts.

Another object of the invention in the projection in an engine of this class is a construction whereby the reciprocating pistons of adjacent cylinders may be connected together in order to provide a construction in which power may be delivered equally at the top and the bottom of the movement of the crank shaft.

Another object of the invention is the provision of a novel type of combustion chamber whereby two cylinders are connected together and fuel delivered simultaneously to the cylinders thru the combustion chamber.

Another object of the invention is the provision of means for scavenging the cylinder and also scavenging the combustion chamber.

Another object of the invention is the provision of a construction whereby the connecting rod is fixedly connected to the wrist pin or bar which serves as part of a means of connection to the pistons.

The invention consists in the various parts and method of operation herein described and more particularly embodied in the claims forming a part hereof.

The invention will be best understood by a reference to the accompanying drawings which form a part of this specification and in which:

Fig. 1 is a fragmentary side elevational view of an engine embodying the invention with parts broken away and parts shown in section.

Fig. 2 is an end elevational view of the engine illustrated in Fig. 1.

Fig. 3 is a sectional view taken on line 3—3 of Fig. 1.

Fig. 4 is a sectional view taken on line 4—4 of Fig. 3.

Fig. 5 is a sectional view taken on the line 5—5 of Fig. 3.

In the drawings we have illustrated the invention applied to an engine of the Diesel type and

in the illustration we have shown the engine equipped with a pair of units. From a description of the invention it is believed obvious that the number of units may be increased to such number as desired. In the illustrations the engine embodies a bed plate 12, mounted on a suitable support 13. Resting on and projecting upwardly from the bed plate 12 is a supporting frame 14 which serves as a support for the box housing 15. At spaced intervals, there are provided bearings 16, supported by the standards 17 which extend upwardly from the bed plate 12. Journalled in these bearings 16 is a crank shaft 18 which carries the wheel 19, having teeth on its periphery meshing on its gear 20 which is fixedly mounted on shaft 21. This shaft 21 is journalled in the bearing 22 and also in the bearing 23, which is mounted on the side wall of the air starting distributor 24.

If desired, a fly wheel may be fixedly mounted on the shaft 18.

Mounted on the box-housing and projecting upwardly therefrom, is a cylinder 26, the cylinders 25 and 26 being axially aligned with each other so that the piston 27, which slides in the cylinder 26, is in alignment with the piston 28 which slides in the cylinder 25. These cylinders may be termed upper and lower cylinders and the pistons corresponding thereto likewise so termed.

The pistons 27 and 28 are connected together by a thrust bar 29 which is provided intermediate its ends with an enlarged portion 30, in which is fitted a bushing 31. Positioned adjacent the cylinder 26, is an upper cylinder 26', in alignment with a lower cylinder 25'. Slideable in the cylinder 26' is a piston 27' in alignment with a piston 28', slideable in the cylinder 25'. These pistons are connected by the thrust bar 29' constructed in the same manner as is the thrust bar 29 with an enlarged portion in which is fitted a bushing 31'.

The cylinders 26 and 26' are mounted on the top plate 32 of the box housing and the cylinders 25 and 25' are mounted on the lower plate 33. The construction is such that these cylinders are always mounted in units such as illustrated, as there is a cooperative relation between each pair of upper cylinders and each pair of lower cylinders.

Each unit is mounted with a crank 34 on the crank shaft and this crank is connected to one end of a connecting rod 35, the opposite end of which is fixedly mounted on the enlarged portion 36 of the cross bar or wrist pin 37, which projects

through the bushings 31 and 31' and rocks therein. Consequently the pair of upper pistons and the pair of lower pistons move in unison with each other, the pair of upper pistons moving on the power stroke when the lower pistons are compressing and vice versa, in a two cycle engine. In a four cycle engine the movements would be alternate but not as referred to for a two cycle engine.

The plate 32 is recessed as at 38 to accommodate the end of the connecting rod 35 and the plate 33 is slotted at 39 to accommodate the connecting rod 35.

At each pair of cylinders we provide a combustion chamber 40, which is connected, through the passages 41, with the interior of the cylinders. A fuel delivery pipe 42 communicates with the spray nozzle 43, which serves to deliver fuel under pressure to the combustion chamber 40. This delivery pipe 42 leads from the fuel pump 43', which is operated by the shaft 44, on which is fixedly mounted the sprocket gear 45, rotated by the sprocket chain 46, which also engages the sprocket wheel 47 fixedly mounted on the shaft 21.

Compressed air is driven into the air starting distributor 24 through the fitting 48 and this distributor 24 is in communication through conduits 49 and a suitable control valve 50, with each combustion chamber 40. This compressed air, from the distributor 24 is used for starting purposes and also for scavenging at periodic times. When the engine is running the control valves controlling the flow of air from the distributor 24 into the combustion chamber 40 are opened to deliver a puff or jet of air into the combustion chamber 35 for effecting the scavenging therefrom, of the burned gases therein.

An air chamber or compartment 51 is mounted on the box housing and air under pressure may be delivered thereinto through the fitting 52. This compartment 51, communicates with each of the cylinders through a conduit 52, so that air may be delivered into the space 53 and therefrom through the openings 54 into the interior of the cylinder 26 or 25, as the case may be. This air is used for scavenging purposes and the openings 54, which are of slot-like nature, are uncovered by the piston in its movements on the power stroke, after the slot-like openings 56 are uncovered. These openings 56 communicate with the pocket 57 in communication with the conduit 58. This conduit 58, communicates with the compartment 59, from which the exhaust gases may be led by a suitable conduit, connected to the fitting 60.

The control valves referred to are not illustrated and the fuel injection system is not detailed because these parts, in themselves, form no part of the invention and are of a construction well-known in the art.

Thus, it is seen that as the fuel is delivered into the cylinders it is delivered simultaneously into a pair of cylinders and the pistons in these cylinders serve to deliver the thrust to a single crank. It is also seen that cooperating with this pair of cylinders, is another pair to deliver the thrust to the crank simultaneously through their pistons in the opposite directions. In this way, we have provided a construction of Diesel engine, whereby, the horsepower may be considerably increased without increasing, to any great extent, the size of the engine and without increasing at all, the size of the piston or cylinder or the revolutions per minute. It is also believed that the efficient scavenging of the combustion chamber has been clearly illustrated. The combustion chamber

scavenging system will provide a supercharging effect and will insure the proper working of the air starting check valve on long runs. It will not be necessary to provide combustion chamber scavenging at reduced loads or while maneuvering, so it will not interfere in any way with the air starting periods.

The supply of air for scavenging the combustion chamber may be taken from the first-stage of the starting air compressor or from an independent single stage compressor.

As will be noted, the combustion chamber is formed in the shape of the letter V and it contains the clearance volume for a pair of cylinders instead of one and by projecting outwardly, the necessary clearance for the connecting rod is provided. The working pistons, being arranged four to each crank, work in pairs and will have a minimum of clearance at their head ends. Practically the entire volume of each pair of cylinders will be displaced or compressed into the combustion chamber. This combustion chamber will not only equalize compression pressures between each pair of adjacent cylinders, but will also equalize pressure caused by combustion and in fact over the whole cycle of operations.

The combustion chamber will be water jacketed and the temperature may be varied independent of the cylinder water jackets. By circulating hot water from an external source through the combustion chamber jacket, especially in cold weather, facility of starting may be obtained. This eliminates the necessity of maintaining the water in the cylinder jackets at a higher temperature with a constant economy of operation. Also by maintaining the water temperature of the combustion chamber at a higher point than the water jackets of the cylinders, economy in the operation of the engine will be obtained.

It is also possible to detach a combustion chamber in its entirety by uncoupling its fastenings and thus a combustion chamber may be removed and replaced easily and quickly in a minimum amount of time. Thus the engineer may repair the combustion chamber removed at his leisure.

It will also be noted that this invention makes it possible to simplify the construction of a double acting engine and particularly at the lower and the bottom cylinders in comparison with the usual crank and head of a double acting cylinder. This construction eliminates the need of one of the two spray valves usually found in an engine of this type and renders the parts more easily accessible for inspection and repair.

What we claim as new is:

1. In an engine of the class described, a rotatable crankshaft; a pair of cylinders positioned in proximity and parallel to each other; a second pair of cylinders positioned in proximity and parallel to each other and spaced from and in axial alignment with said first-mentioned pair; a piston slideably mounted in each of said cylinders; means for connecting the pistons in each aligned pair of cylinders with each other; a connecting rod connecting to a crank on said crankshaft; means for connecting said connecting means with said connecting rod for effecting a movement of said pistons in unison with each other; a pair of combustion chambers, each projecting outwardly from said cylinders and each communicating with a pair of cylinders, each of said combustion chambers effecting a delivery of fuel simultaneously into each of the cylinders with which it communicates; and means for de-

livering fuel centrally into each of said combustion chambers.

2. In an engine of the class described, a rotatable crankshaft; a pair of cylinders positioned in proximity and parallel to each other; a second pair of cylinders positioned in proximity and parallel to each other and spaced from and in axial alignment with said first-mentioned pair; a piston slideably mounted in each of said cylinders; means for connecting the pistons in each aligned pair of cylinders with each other; a connecting rod connecting to a crank on said crankshaft; means for connecting said connecting means with said connecting rod for effecting a movement of said pistons in unison with each other; a pair of combustion chambers, each projecting outwardly from said cylinders and each communicating with a pair of cylinders, each of said combustion chambers effecting a delivery of fuel simultaneously into each of the cylinders with which it communicates; and means for delivering fuel centrally into each of said combustion chambers, the projection of said combustion chambers outwardly from the cylinders providing necessary clearance for the throw of the connecting rod.

3. In an engine of the class described, a rotatable crankshaft; a pair of cylinders positioned in proximity and parallel to each other; a second pair of cylinders positioned in proximity and parallel to each other and spaced from and in axial alignment with said first-mentioned pair; a piston slideably mounted in each of said cylinders; means for connecting the pistons in each aligned pair of cylinders with each other; a connecting rod connected at one end to a crank of said crank shaft; means for connecting the opposite end of said connecting rod to said connecting means; and a pair of substantially V-shaped combustion chambers, each communicating with a pair of cylinders, each combustion chamber effecting a delivery of fuel in each of the combustion chambers with which it communicates, said combustion chambers projecting outwardly from said cylinders sufficiently to provide clearance for the connecting rod in its movements.

4. In an engine of the class described, a pair of cylinders positioned in proximity and parallel to each other and in axial alignment; a piston slideably mounted in each of said cylinders; means for connecting said pistons together; means for effecting a reciprocation in said pistons in unison with each other; a combustion chamber exterior of each of said cylinders and communicating therewith adjacent its end; an air chamber for reception of air under pressure, each of said cylinders having a plurality of axially directed elongated slots; means for establishing communication of said air chamber with said slots, the pistons in said cylinders being adapted

for covering said slots when moved on the compression stroke a predetermined distance and adapted for uncovering said slots upon the completion of the power stroke, each of said cylinders having a plurality of elongated axially directed exhaust slots formed therein; an exhaust chamber exterior of said cylinders; means for establishing communication of said exhaust chamber with the exhaust slots in each of said cylinders, said exhaust slots being axially offset relatively to said first-mentioned slots, said pistons being adapted for uncovering said exhaust slots when traveling on the power stroke prior to the uncovering of said first-mentioned slots.

5. In an engine of the class described, a rotatable crankshaft; a pair of cylinders positioned in proximity and parallel to each other; a second pair of cylinders positioned in proximity and parallel to each other and spaced from and in axial alignment with said first-mentioned pair; a piston slideably mounted in each of said cylinders; means for connecting the pistons in each aligned pair of cylinders with each other; a connecting rod connected at one end to a crank on said crankshaft; a cross bar projecting through the opposite end of said connecting rod and fixed thereto and projecting at its opposite ends into bearings formed in said connecting means; and a pair of combustion chambers exterior of said cylinders each communicating with a pair of cylinders adjacent its end and adapted for delivering fuel simultaneously into each of the cylinders with which it communicates, said combustion chambers being outwardly offset from said cylinders sufficiently to provide clearance for the connecting rod in its movements.

6. In an engine of the class described, a rotatable crankshaft; a pair of cylinders positioned in proximity and parallel to each other; a second pair of cylinders positioned in proximity and parallel to each other and spaced from and in axial alignment with said first-mentioned pair; a piston slideably mounted in each of said cylinders; means for connecting the pistons in each aligned pair of cylinders with each other; a connecting rod connected at one end to a crank of said crankshaft; means for connecting the opposite end of said connecting rod to said connecting means for effecting a movement of said pistons in unison with each other; a pair of combustion chambers exterior of said cylinders, each communicating with a pair of said cylinders adjacent one end, each combustion chamber effecting simultaneous delivery of fuel into each of the cylinders with which it communicates; a source of air under pressure; and means for conducting air from said source into a combustion chamber.

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