July 31, 1951 J. B. PLATNER 2,562,639

ENGINE

Filed March 24, 1948 5 Sheets-Sheet 1

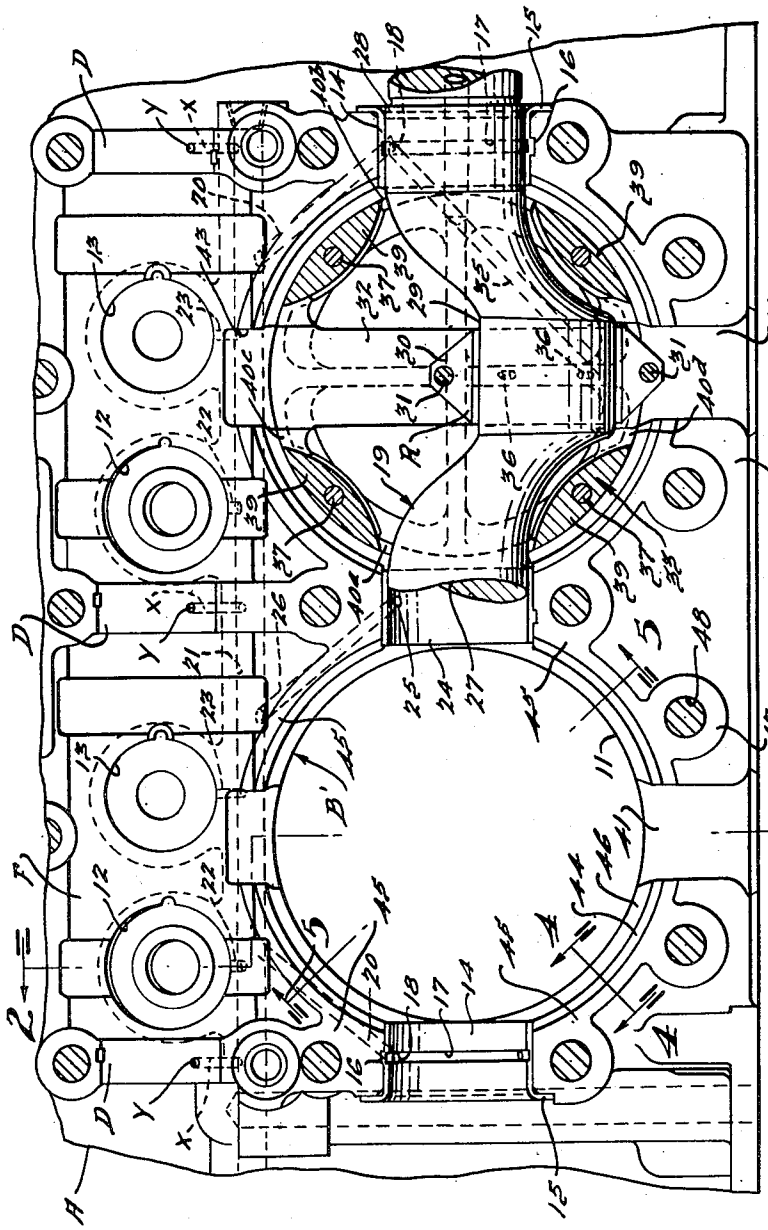


FIG. 1.

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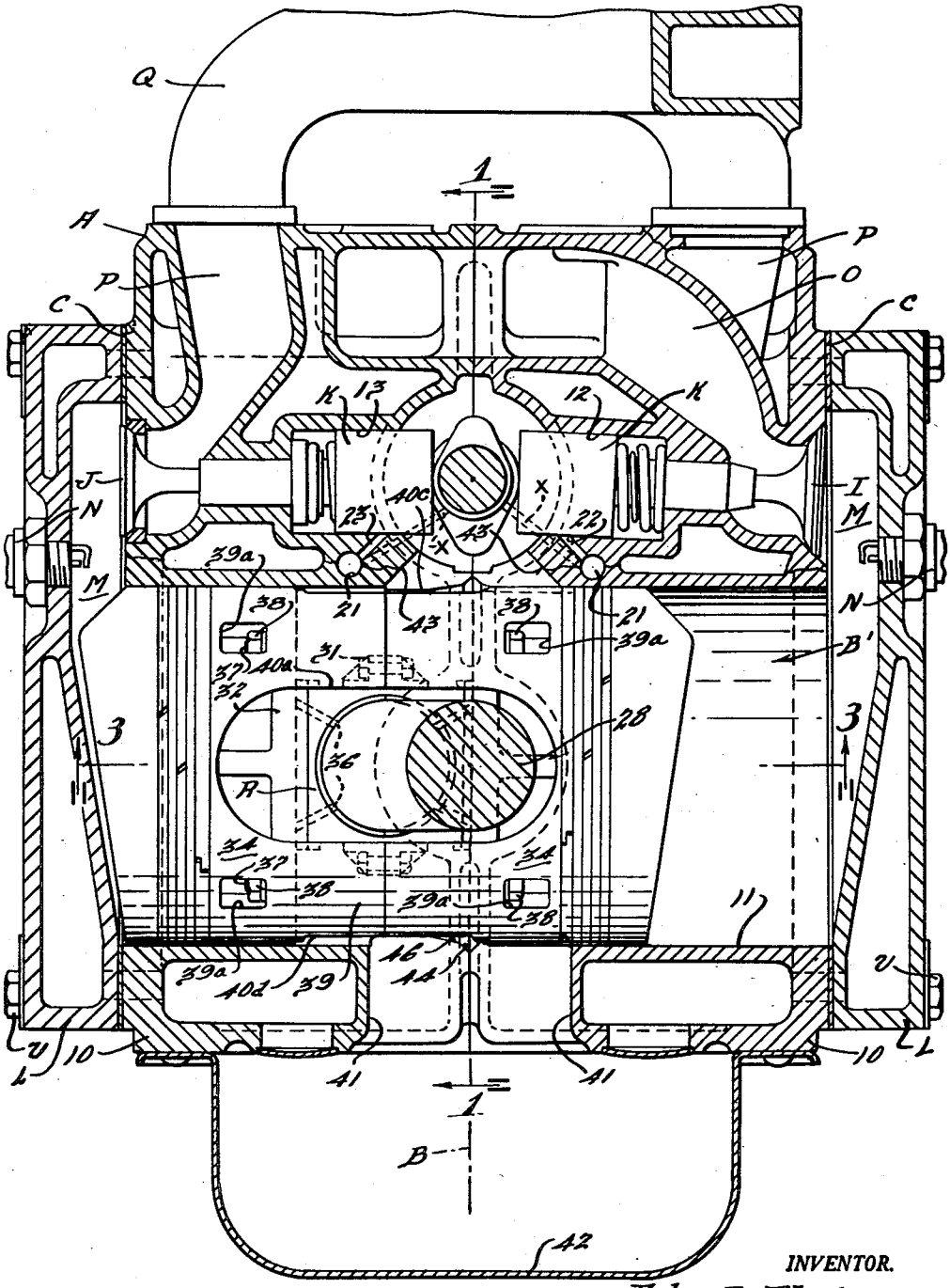


Fig. 2.

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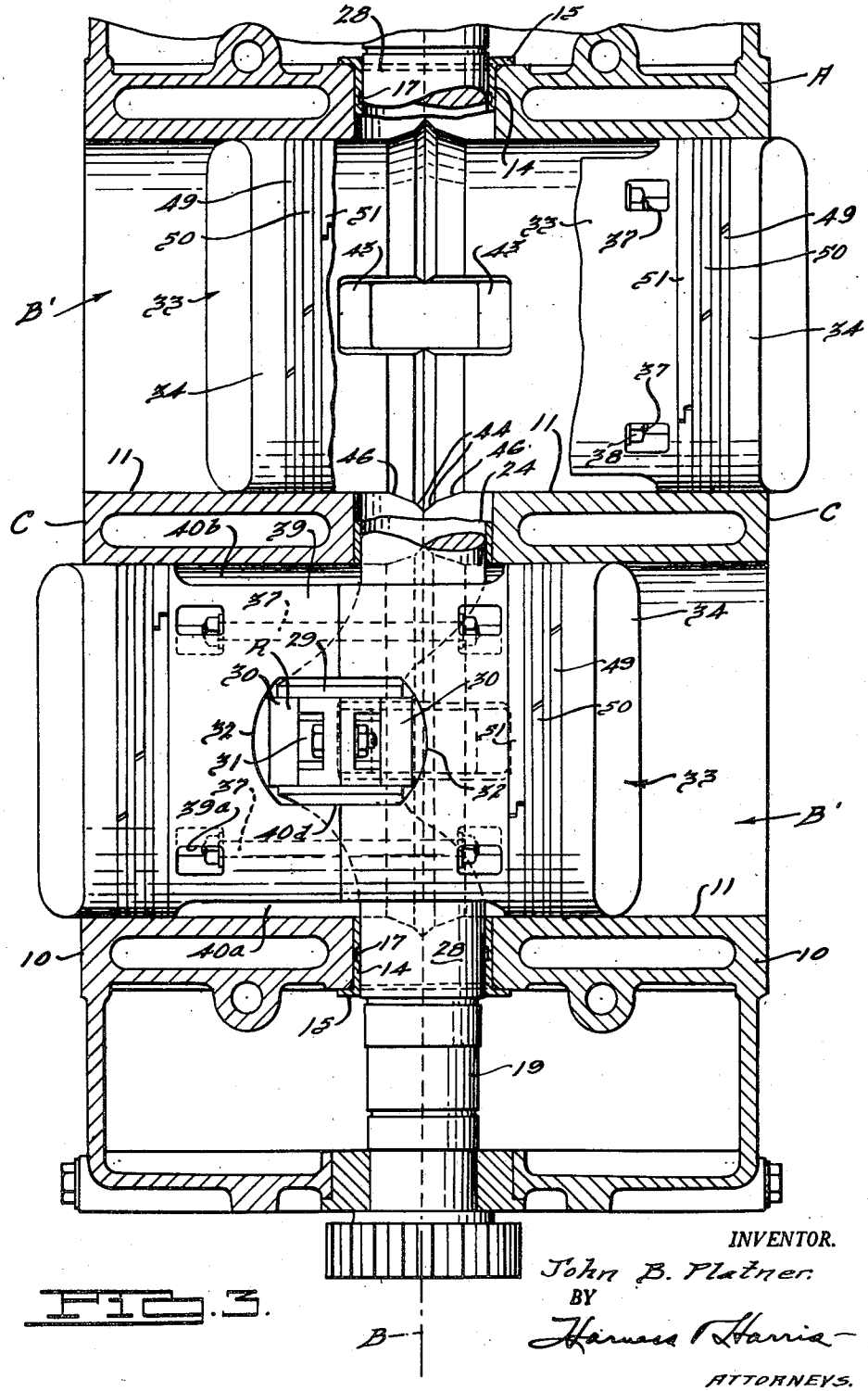


Fig. 3.

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ENGINE

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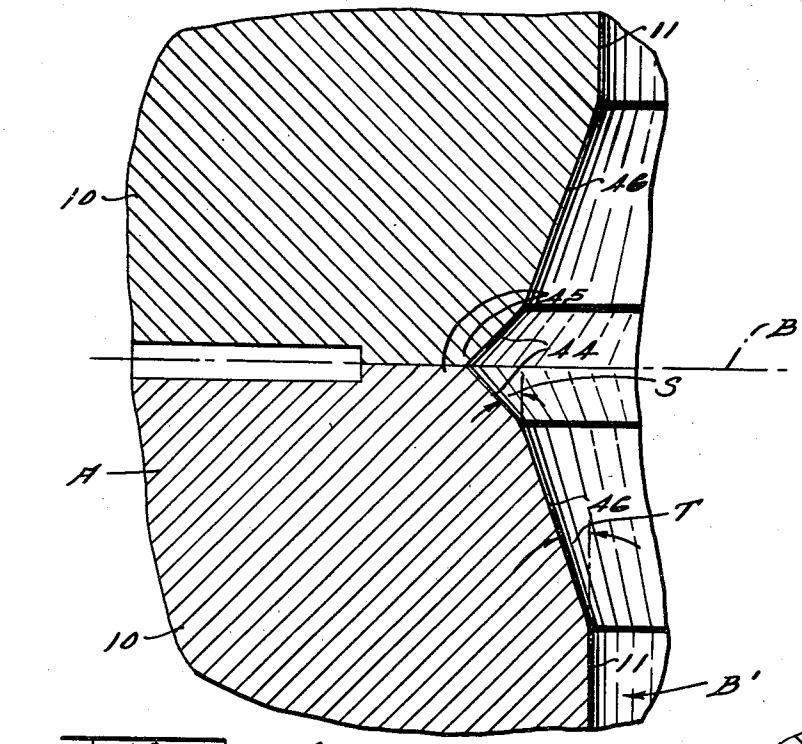


Fig. 4.

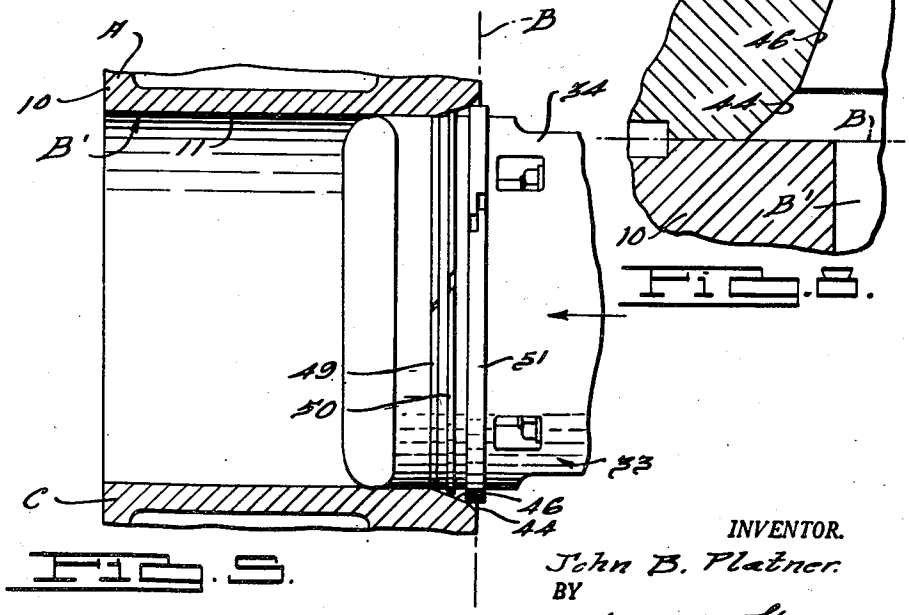


Fig. 5.

Fig. 6.

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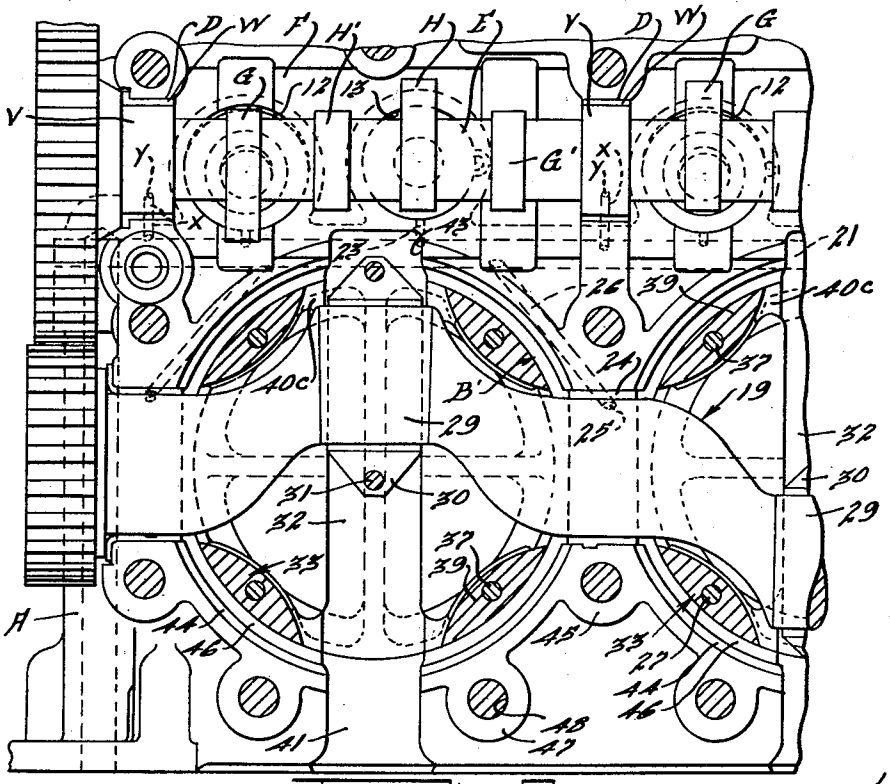


FIG. 7.

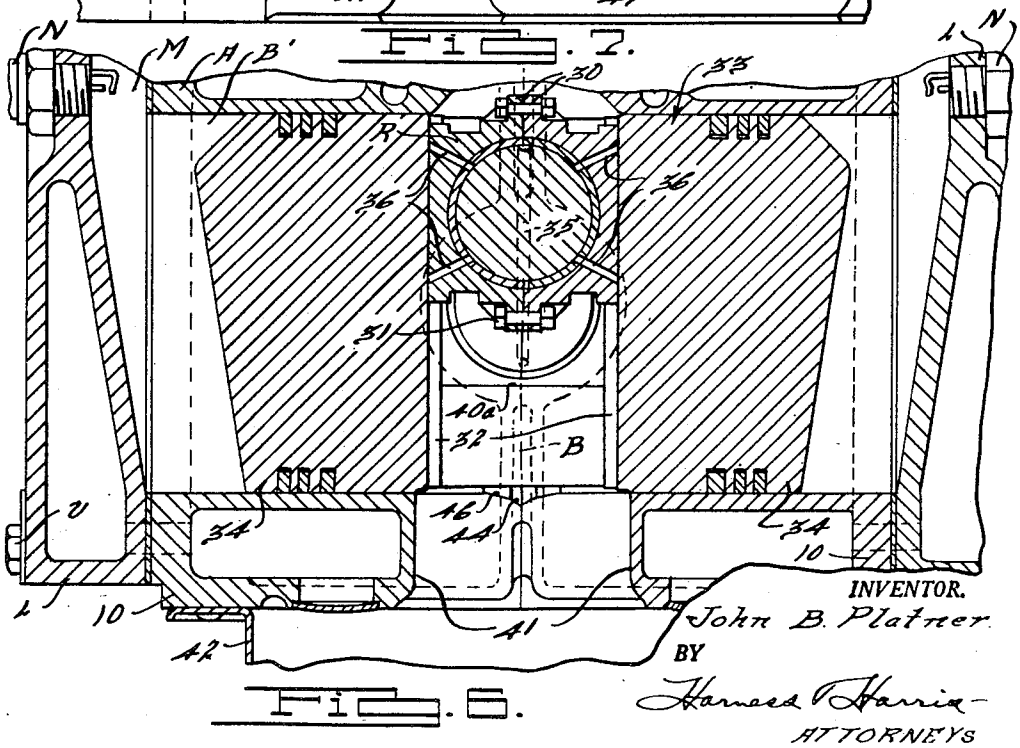


FIG. 6.

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Patented July 31, 1951 2,562,639

UNITED STATES PATENT OFFICE

2,562,639

ENGINE

John B. Platner, Detroit, Mich., assignor to Chrysler Corporation, Highland Park, Mich., a corporation of Delaware

Application March 24, 1948, Serial No. 16,688

4 Claims. (Cl. 121—194)

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This invention relates to a construction in which pistons reciprocate in cylinders for the transmission of power. More specifically, it relates to a machine in which reciprocating double-ended pistons have opposed pressure faces at their opposite ends and crankshafts are directly connected to the pistons without the aid of connecting rods by passing the crankshaft through the body portion of the pistons.

In a machine of the above type the insertion of the pistons and their rings in cylinders presents difficulties, because the requirement for the crankshaft to pass directly through the pistons prevents the pistons from being inserted into the cylinder block by way of the head end, where the insertion might be facilitated by the use of piston ring compressors. Thus it is necessary to make the cylinder block in two parts that are clamped together to journal the crankshaft between them, and each of which block parts receives each piston in a cylinder. It is possible to insert the pistons and rings at one end into one block part by the use of a ring compressor, but it is not possible to follow this conventional practice with the other block part because the block parts must be clamped together.

I have solved the problem of inserting the pistons in the block parts by providing beveled or chamfered edges around the cylinder bores which edges compress the piston rings suitably as they are inserted in the block parts. When the block parts are clamped together, the chamfered edges provide grooves that aid escape of lubricant delivered to crankshaft bearings in the pistons and thereby prevent the lubricant from being pumped along the cylinders into the combustion chambers.

An object of the present invention is to provide in a construction employing cylinders and reciprocal pistons therein, an improved arrangement whereby lubricant is appropriately conducted away so as not to be pumped along the cylinders into the combustion chambers. This arrangement is advantageously applied to a construction in which the pistons have a pressure face at each end and a crankshaft passes through the pistons.

Another object is so to shape cylinder blocks adapted to receive reciprocal pistons that the insertion of the pistons and their associated rings in the blocks is facilitated. This is of special advantage in a construction wherein the crankshaft passes through the pistons and the use of a special ring compressor is impossible.

A further object is to so shape a multi-part engine block that in disassembled condition certain portions thereof facilitate insertion of pistons and their associated rings in the block and in assembled condition these certain portions serve as lubricant-conducting grooves.

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Additional objects are to provide an improved lubricating system for a double acting engine, particularly with respect to the escape of excess lubricant from various operating parts.

Another object is to provide a double acting engine having a plurality of escape paths for excess lubricant, one being through a hollow piston chamber and others by escape grooves which guide and conduct the excess lubricant back to the supply source.

A further object is to utilize the engine cylinder openings which accommodate swinging movement of the bearing block structure to eject lubricant guided and conducted thereto by a novel system of channels or grooves in the cylinder bore.

An additional object is to provide a novel and improved lubricating ejecting system for the valve gear of a double acting type of engine, preferably in conjunction with the aforesaid grooves and cylinder bore openings.

Other objects will appear from the disclosure.

In the drawings:

Fig. 1 is a longitudinal sectional elevational view through a portion of the cylinder block structure of the engine, the crankshaft being broken away and one piston and other parts being removed, the view being taken as indicated by line 1—1 of Fig. 2;

Fig. 2 is a transverse sectional elevational view through the engine showing a piston installed therein, the view being taken as indicated by line 2—2 of Fig. 1;

Fig. 3 is a sectional view taken on the line 3—3 of Fig. 2;

Fig. 4 is an enlarged sectional view on the line 4—4 of Fig. 1;

Fig. 5 is a sectional view on the line 5—5 of Fig. 1, showing a piston being applied to the cylinder block;

Fig. 6 is a fragmentary view, generally similar to Fig. 2, the section being taken through the piston which is shown in its mid-stroke position;

Fig. 7 is a longitudinal sectional elevational view through a portion of the engine, the view being generally similar to Fig. 1, but showing the camshaft and other parts omitted from Fig. 1;

Fig. 8 is a view like Fig. 4, but illustrating a modified form of my invention.

In the drawings, reference character A represents the engine cylinder block structure which is formed of a pair of complementary or companion block portions 10 adapted to be bolted

together in face contact represented by the plane B. The block structure A is provided with any desired number of working cylinders or cylinder bores B' each of which is formed of a half-portion 11 so that when block portions 10 are brought together each cylinder B' extends with uniform diameter laterally through the block structure A opening at the outer end face C of each block portion 10.

Each block portion 10 is provided with recesses in its face at plane B such that companion pairs of the recesses provide openings D for rotatably journalling a camshaft E on an axis in plane B above a similarly located axis of the engine crankshaft 19, the camshaft being driven from the crankshaft at half speed as is customary for a four stroke cycle engine. Between adjacent openings D the companion recesses of the block portions provide a camshaft chamber F within which are located two pairs of intake and exhaust cams G, H, and G', H', one pair controlling an intake valve I and an exhaust valve J adjacent one outer end of a cylinder B' and the other pair controlling an intake and an exhaust valve adjacent the other outer end of the same cylinder as more particularly disclosed and claimed in the copending application of John P. Butterfield, Serial No. 16,650, filed March 24, 1948. The valves are operated by the respective cams through suitable spring biased tappets or cam followers K slidably guided in openings 12 for the intake valve tappets and 13 for the exhaust valve tappets. The openings 12, 13 in each block portion 10 are recessed laterally outwardly from the chambers F as best shown in Figs. 1 and 2.

Attached to each end face C is a cylinder head L having combustion chambers M for the respective ends of the cylinders B' at such face and for overlying the pair of intake and exhaust valves associated with such cylinder end. Each combustion chamber has the usual spark plug N. Each cylinder block portion 10 is cored to provide intake passages O and exhaust passages P, suitable manifolds communicating with the openings of passages O and P at the top face of the cylinder block structure, only the exhaust manifold Q being shown in Fig. 2.

At the sides of the cylinder bore portions 11 each block portion 10 is formed with companion semi-cylindrical journal depressions that are located in the meeting block faces at plane B, said depressions receiving semi-cylindrical bearing members 14. Each bearing member 14 has a flange 15 engaging a face of its associated block portion adjacent the semi-cylindrical depression. Each bearing member 14 has a projection 16 fitting in a suitable recess in the block portion 10 to lock the bearing member against movement. Each bearing member has an inner groove 17 and a hole 18 leading from the groove 17 to the outer side of the bearing 14. The groove 17 and hole 18 are adapted to provide lubricant to the crankshaft 19 journalled in the bearings 14. Lubricant reaches each bearing 14 through a passage 20 in the block 10 leading from a lubricant supply gallery or passage 21 extending the length of each block portion to which lubricant may be supplied by a suitable pump, not shown.

Lubricant reaches the tappet guide openings 12 and 13 by way of passages 22 and 23 leading from the passages 21 as shown in Fig. 2. Between adjacent cylinders is a semi-cylindrical depression in the face of each block portion 10 at plane B receiving a semi-cylindrical bearing 24 having an opening 25 through which lubricant is supplied to a journal portion of the crankshaft 19 mounted in the bearing 24. Lubricant is supplied from the passage 21 to the bearing 24 and its opening 25 by way of a passage 26 in the block. In Fig. 1 the crankshaft 19 is broken away so that it is shown to extend only across the right hand cylinder. The portion of the crankshaft shown is seen to comprise two axial portions 27 and 28 journalled in the bearings 24 and 14, respectively, and an offset crank portion 29. The offset portion within each cylinder B' is journalled in a pair of cooperating members 30 secured to each other by bolts 31 forming a slide head or bearing block R slidably bearing on the portions 32 forming a slideway in a double-ended piston 33 formed of complementary halves 34 in each of which a slideway portion 32 is formed. A lubricant conducting passage 35 extends through the crankshaft 19 from the part of the axial portion 28 at the bearing groove 17 to a mid region of the offset crank portion 29 of the crankshaft.

Passages 36 lead through the slide head portions 30 from the offset crankshaft portion 29 to the slideway portions 32. The passages 36 are so located in the slide head portions that as the crankshaft 19 rotates the delivery end of the opening of the passage 35 at the offset crankshaft portion 29 passes over the inner ends of the passages 36. Lubricant for the bearing surfaces of the slideway 32 and the slidehead R comes from the gallery 21 to the passage 20, the opening 18 and the groove 17 in the bearing member 14, the crankshaft passage 35, and the slide head openings 36. It will be understood that each crank pin and slideway is lubricated by a pressure feed from a crankshaft passage 35 extending from a main bearing 14.

The piston 33 is composed of the complementary parts 34 secured together by bolts 37 and nuts 38 at both ends of each bolt. Bolts 37 pass through four skirt projections 39 in each piston part 34, the projections of one piston part abutting those of the other. The nuts 38 are applied to the bolts 37 through openings 39*a* formed in the skirts of the piston parts. The skirt projections 39 on the piston parts 34 provide the piston 33 with four openings; two at the left and right sides of the piston, as viewed in Fig. 1, designated 40*a* and 40*b*, respectively, through which the crankshaft 19 extends, and two openings at top and bottom of the piston, designated 40*c* and 40*d*, respectively, the lower end of the bearing block R being shown as extending into the bottom opening 40*d* with the crankshaft positioned as in Fig. 1.

The block portions 10 are provided, at the bottom of each cylinder B' as viewed in Fig. 2, with companion recesses 41 located in their end faces at plane B. Each pair of companion recesses 41 provides an opening or escape passage through the cylinder block structure A leading from the hollow interior of a piston 33 and its associated cylinder B' downwardly to an oil pan 42 which provides a lubricant reservoir. When any crank 29 is moving in the immediate vicinity of its Fig. 1 position then the associated bearing block R sweeps downwardly through the piston opening 40*d* and outwardly of the cylinder wall, such movement being accommodated by opening 40*d* which is at such time registered with opening 41. In similar manner the block portions 10 are recessed at 43 diametrically opposite openings 41 to accommodate swing of the bearing block C when it is moving 180° from the illustrated Fig. 1 position, piston opening 40*c* being then registered with opening 43. Each lubricant admission

passage or opening 43 places a cam chamber F in communication downwardly through the cylinder block structure A to the hollow interior of a piston 33. It will be apparent that each pair of openings 41 and 43 are in constant communication with each other through a piston 33 as the piston reciprocates in its cylinder. However, the openings 41 and 43 are prevented from communicating with either of the combustion chambers M at the opposite ends of the cylinder B' by reason of the opposite headed portions of the piston.

The inner end of each cylinder portion 11 at the portions circumferentially between the depressions 41 and 43 and the crankshaft bearings 14 and 24 and adjacent the plane B is formed with a circumferentially extending compound groove or chamfer or with a series of chamfers or grooves illustrated in detail in Fig. 4. A chamfer portion 44 leads from a raised boss portion 45 on each block 10, this raised portion having its face machined to define the face engagement of the block portions 10 in plane B. Chamfer 44 leads at a relatively large angle S to the cylinder 11, for example, about 45°, and a chamfer portion 46 leads from the chamfer portion 44 to the cylinder 11 at a relatively small angle T to the cylinder, for example, about 20°. Preferably the juncture or intersection between chamfers 44 and 46 is slightly rounded to avoid a sharp corner to facilitate ring assembly. There are four raised portions 45 extending about each cylinder portion 11 between the depressions 41 and 43 and the bearings 14 and 24. Each portion 45 is finish-machined and engages a corresponding portion 45 on the other block portion 10 so as to provide engagement of the block portions at regions extending about the inner end of each cylinder portion 11 which, as will presently be more apparent, constitutes an opening for receiving a piston 33. The raised portions 45 are extendetd to provide circular raised portions 47 formed about holes 48 in the block portions 10 through which bolts U extend for securing the block portions to one another. Bolts U also extend through the cylinder heads L as shown in Fig. 6. The chamfer portions 44 and 46 in the two block portions 10 form grooves about the pistons 33, such grooves extending between the depressions 43 and the crankshaft bearings 14 and 24 and between these bearings and the depressions 41 for the conveyance of lubricant to the pan 42.

The camshaft E has its journal portions V running in bearings W which are split and anchored in the mating recesses D of the block portions 10 similar to the crank shaft bearings 14 and 24. Lubricant is supplied to the journals V by oil passages X extending in one or both of the block portions 10 from the oil header 21 thereof through the bearing insert W to the outlet Y.

As previously stated, lubricant is supplied to the bearing surfaces between the slideway 32 and the slide head R through a crankshaft passage 35. Excess lubricant from the slide head and the slideway goes into the hollow interior of piston 33 and escapes therefrom by draining through the piston opening 40*d*, and thence down through the block depressions 41 and into the pan 42. Excess lubricant also escapes axially of the crankshaft from crankshaft bearings 14 and 24 by way of the piston openings 40*a* and 40*b*, the annular portions of the grooves formed by the chamfers 44, 46 extending below the crankshaft bearings 14 and 24, and then through the head depressions 41 and into the pan 42. Lubricant supplied from galleries 21 to the intake and exhaust valve tappet guides 12 and 13 by way of the passages 22 and 23, and excess lubricant from camshaft bearing W and the cams drains into the camshaft chambers F. This lubricant then drains in several paths leading to opening 41 and pan 42. Each path leads from the cam chamber outlet at opening 43, thence in one path into the hollow piston through the opening 40*c* or in paths along grooves formed by chamfers 44, 46 between the head depressions 43 and the crankshaft bearings 14 and 24. The portion of the lubricant entering the piston may escape therefrom by way of the piston opening 40*d* or by way of the piston openings 40 and 40*b* at the crankshaft bearings 14 and 24 and along the grooves formed by the chamfer portions 44, 46 below the crankshaft bearings. Lubricant supplied to the crankshaft bearings 14 and 24 by way of the passages 20 and 21 escapes either into the piston at openings 40*a* and 40*b* and out by way of the piston opening 40*d* at the head depressions 41 or by way of the grooves formed by the chamfers 44, 46 below the bearings 14 and 24.

The chamfer portions 44, 46 serve another purpose, which is illustrated in Fig. 5, namely, that of facilitating insertion of the pistons 33 in the cylinder portions or piston openings 11 of the block portions 10. The portion 44 of relatively large angle to the cylinder opening 11 serves to center each of piston rings 49, 50, and 51 as the piston 33 and its rings are applied to the opening 11. The portion 46 of relatively small angle to the opening 11 serves to compress the rings for insertion in the opening. Fig. 5 illustrates by the various stages of the rings 49, 50 and 51 the way in which the chamfer 44, 46 facilitates insertion of the rings in the piston and the piston and rings in the cylinder. The use of an ordinary piston ring compressor is impracticable as the crankshaft 19 extends through the pistons 33, thereby making insertion of the pistons from the head end of the block impossible, and a piston ring compressor could conveniently be used, if at all, only for the insertion of the pistons in one block portion because the blocks must be brought together and adequate room is not available for use of a conventional ring compressor.

In the assembly of the illustrated engine parts the bearing blocks R are assembled on the crank pins 29 and the piston halves are then brought together in assembled relationship with the bearing blocks. The piston rings are loosely assembled in the ring grooves at each end of each of the pistons. The valve gear is assembled in the two blocks portions 10 and the camshaft laid into one block portion which is supported on its face C. Then the sub-assembly of crankshaft with the bearing blocks and pistons is moved down into position such that one end of each piston enters a chamfered end of a cylinder portion 11 and the crankshaft is lowered into its half bearings 14 and 24. The camshaft timing and drive is then adjusted and then the other cylinder block portion 10 is lowered into position with the chamfered ends of its cylinder portions 11 approaching the ends of the pistons which are projecting from the first cylinder block portion 10. The cylinder heads L and bolts U are then installed or one head L with the bolts U may be initially assembled with the first block prior to receiving the aforesaid crankshaft and piston sub-assembly.

While I prefer to form each of the block portions 10 with the compound chamfer 44, 46 it is, of course, of greatest importance that the second

block portion assembled shall have such chamfer as such block portion presents the greater difficulty in using a conventional ring compressor. Therefore, if desired only one block portion may be chamfered in the broader aspects of my invention as shown in Fig. 8. However, in order to best realize the advantages of my invention in the assembly of the pistons as well as in the distribution of lubricant, I prefer to chamfer both block portions. This dispenses with the requirement for the use of a ring compressor for one block portion and also provides the desired degree of efficiency in the flow of lubricant back to the oil pan.

In Fig. 8 only one of the block portions is chamfered at 44, 46 just as in Fig. 4. The other block portion is not chamfered. Such arrangement still provides an oil groove for the flow of lubricant back to the oil pan 42 but the unchamfered bore portion will not function to guide the lubricant to the groove and, therefore, the efficiency of the return lubricant flow will not be as good as the preferred embodiment employing the Fig. 4 arrangement.

When the block portions 10 are assembled as shown in Figs. 2 and 3, the depressions 41 combine to form an opening leading from the lower side of an aligned set of cylinder portions 11 to the pan 42. The depressions 43 form an opening leading to the upper side of an aligned set of cylinder portions 11.

The escape of lubricant from only the piston 34 in the right-hand piston opening 11 of Fig. 1 has been described, but it is to be understood that lubricant will escape in similar fashion from and around the piston in left-hand opening 11, which piston is omitted from Fig. 1 for the sake of clarity in illustration.

The structure described above may be used either as a pump or an engine depending on whether power is supplied by the crankshaft to the pistons or whether power is supplied by the pistons to crankshaft.

Features of novelty disclosed in the subject application but not claimed herein are more particularly described and claimed in the copending application of Alexander G. Herreshoff, Serial No. 16,801, filed March 24, 1948, and in the copending applications of John P. Butterfield, Serial Nos. 16,645, 16,646, 16,647, 16,648, 16,649, and 16,650, filed March 24, 1948.

I claim:

1. In combination, a pair of cylinder blocks each having a pair of opposed end faces, said blocks being secured together along a pair of meeting end faces, each block having a cylinder bore extending between the end faces and aligned with that of the other block, a piston mounted in the aligned cylinder bores and having opposed pressure faces and an intermediate crankshaft-receiving portion, sets of rings mounted on the piston on both sides of the crankshaft-receiving portion, each block having at its end face meeting the other block a chamfered portion surrounding its cylinder bore, the chamfered portions facilitating the insertion of the piston and the rings in the blocks and combining to form a groove facilitating escape of lubricant from the crankshaft-receiving portion of the piston, each chamfered portion comprising an initial portion leading from the meeting face at a relatively large angle to the associated cylinder bore and a final portion leading from the initial portion to the cylinder bore at a smaller angle to the cylinder bore.

2. A structure comprising a pair of cylinder block portions with each portion having opposed end faces, said block portions being adapted to be secured together with a pair of opposed end faces in meeting engagement, each block portion having a cylinder bore portion extending between the end faces thereof and respectively aligned with a cylinder bore portion in the other block portion, aligned, cooperating, semi-cylindrical depressions extending transversely to the cylinder bores along the meeting face of each block portion adapted to rotatably support a crankshaft, other depressions located in the meeting face of one block portion and extending from opposite sides of the cylinder bore portions and generally transverse to said semi-cylindrical depressions, said other depressions cooperating with similar depressions in the other block portion to form passages through said bores, and mating chamfered edges formed about the ends of the bore portions of each of said block portions adjacent said meeting end faces, each chamfered portion comprising an initial portion leading from the meeting face at a relatively large angle to the associated cylinder bore and a final portion leading from the initial portion to the cylinder bore at a smaller angle to the cylinder bore, said chamfered edges extending in a direction circumferentially between the depressions of each of said block portions, the chamfered edges of one block portion cooperating with the chamfered edges of the other block portion to form portions of an annular groove in each of said cylinder bores adjacent said meeting faces.

3. In combination, a crankshaft having axial portions and an offset portion, a double-ended piston embracing the offset portion of the crankshaft, a pair of cylinder blocks each having a pair of opposed end faces, said blocks being secured to one another with a pair of end faces in meeting engagement, each block having a bore extending between the end faces and aligned with a bore in the other block to provide a continuous cylinder bore through said blocks, said piston being slidably received in the cylinder bore in said blocks, each block further having a chamfered edge formed at the intersection of its bore with the meeting face and cooperating with the chamfered edge in the other block to form a substantially V-shaped groove that extends circumferentially about the cylinder bore adjacent the meeting faces of the blocks, said substantially V-shaped groove, comprising an initial portion leading from the meeting face at a relatively large angle to the associated cylinder bore and a final portion leading from the initial portion to the cylinder bore at a smaller angle to the cylinder bore.

4. An engine cylinder block structure comprising, a pair of cylinder block portions each having a pair of opposed end faces, said blocks being adapted to be secured together with a pair of end faces in meeting engagement, each block structure having a bore extending therethrough transversely of said meeting faces such that a portion of a cylinder bore extending through each of said block portions from an opening at said meeting faces, one of said block portion having a pair of depressions in its meeting face cooperable with a cooperating pair of depressions in the meeting face of the other block portion and so constructed and arranged as to be capable of rotatably mounting a crankshaft, the ends of the bore portions in said block portions adjacent said meeting faces being provided with outwardly con-

verging, stepped, chamfers at said opening so arranged that when said block portions are in engagement with each other as aforesaid said stepped chamfers cooperate with each other to form portions of an annular groove opening toward the interior of said cylinder bore intermediate the length thereof and extending in a direction circumferentially between said mating pairs of depressions.

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The following references are of record in the file of this patent:

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Certificate of Correction

Patent No. 2,562,639 July 31, 1951

JOHN B. PLATNER

It is hereby certified that error appears in the printed specification of the above numbered patent requiring correction as follows:

Column 5, line 41, for "extendetd" read *extended*; column 6, line 15, for "openings 40" read *openings 40a*; column 8, line 66, for "extending" read *extends*; line 68, for "portion" read *portions*;

and that the said Letters Patent should be read as corrected above, so that the same may conform to the record of the case in the Patent Office.

Signed and sealed this 16th day of October, A. D. 1951.

[SEAL]

THOMAS F. MURPHY,
Assistant Commissioner of Patents.