March 7, 1933. E. H. FAHRNEY 1,899,949

LUBRICATING MEANS FOR HIGH PRESSURE PUMP PISTONS

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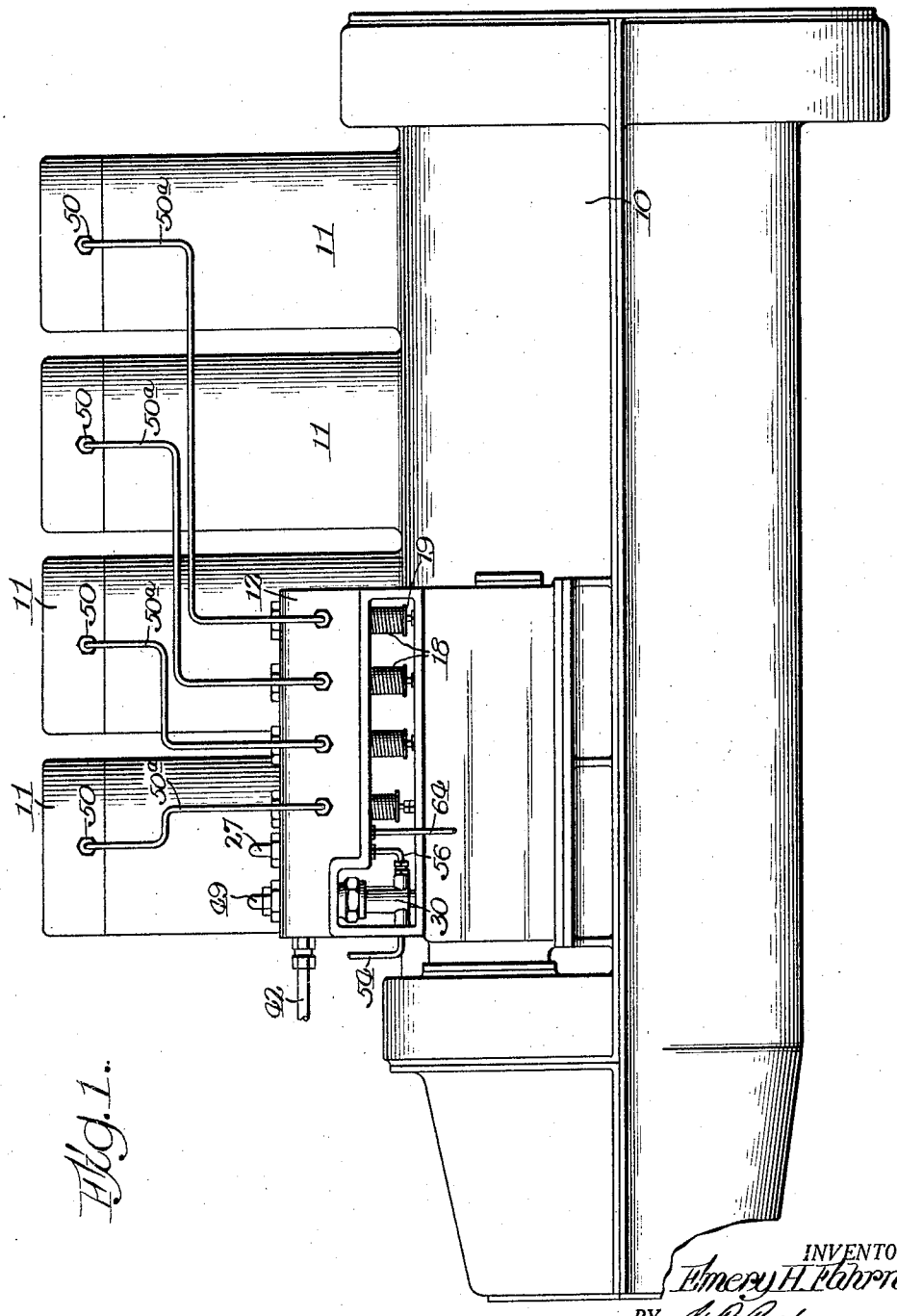

Fig. 1.

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Fig. 2.

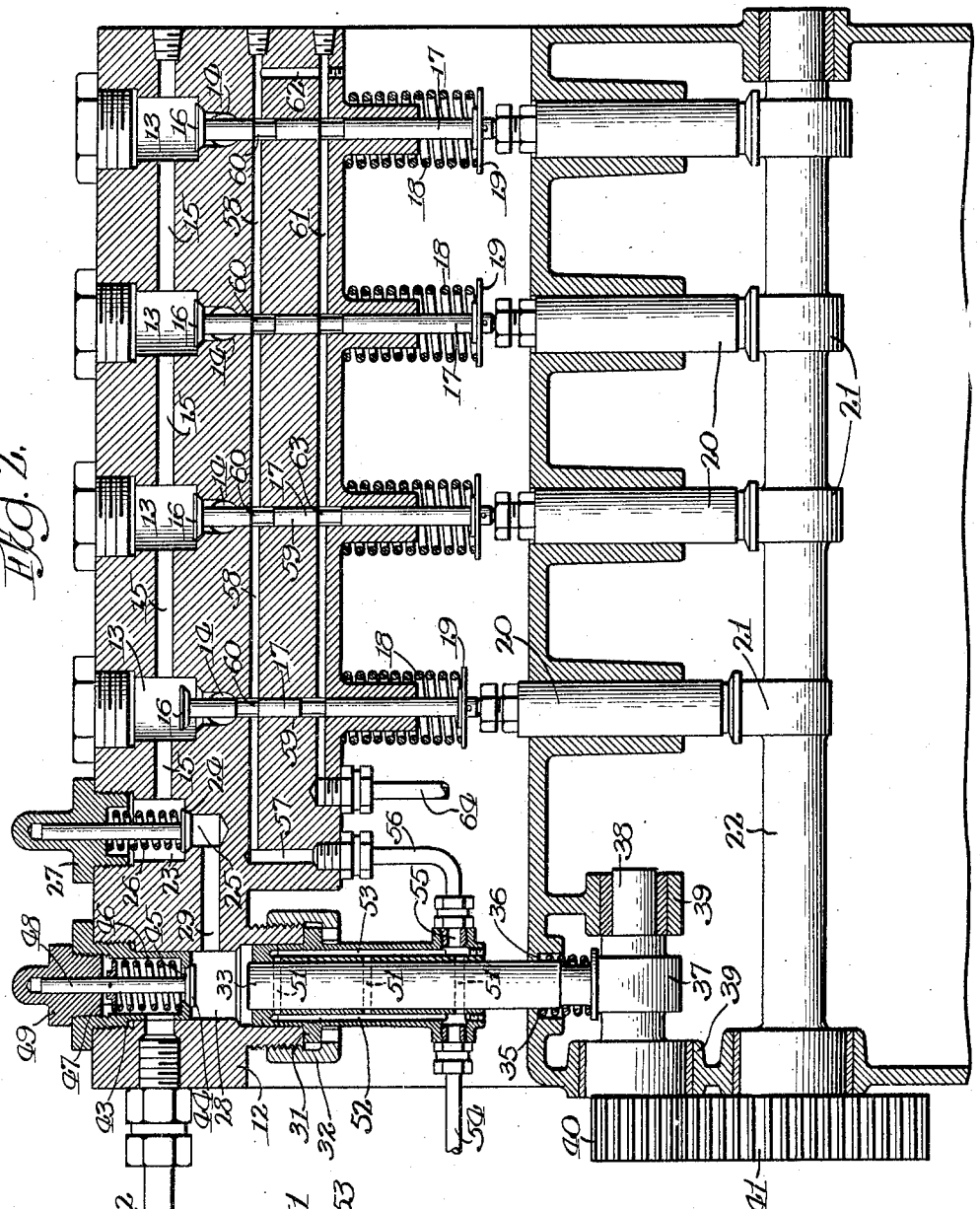
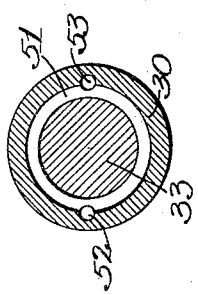


Fig. 3.



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UNITED STATES PATENT OFFICE

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LUBRICATING MEANS FOR HIGH PRESSURE PUMP PISTONS

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In apparatus in which pumps are provided for producing a high pressure or compression, such for instance as in engines of the Diesel type, when the liquid fuel is subjected to a very high pressure before being injected or discharged from the nozzle into the engine cylinders, it has been found that with some fuels the pistons will be lubricated by such fuel, but all fuels do not possess such lubricating qualities or characteristics.

Therefore, when the latter class of fuels are employed, or even in some forms of compressors for other kinds of fluid, the piston will not be lubricated, which is objectionable as the efficiency and operation of the pump will be impaired.

It is one of the objects of the present invention to overcome these difficulties and objections by providing improved means whereby the piston may be lubricated regardless of the nature of the fluid which is being compressed or operated upon by the piston.

To the attainment of these ends and the accomplishment of other new and useful objects as will appear, the invention consists in the features of novelty in substantially the construction, combination and arrangement of the several parts hereinafter more fully described and claimed and shown in the accompanying drawings illustrating this invention, and in which

Figure 1 is a diagrammatic view in side elevation with parts omitted and parts broken away, of an engine of the Diesel type having a lubricating means for pump piston thereof applied thereto and constructed in accordance with the principles of this invention.

Figure 2 is an enlarged detail vertical sectional view of a portion of the engine and of the lubricating means applied thereto, constructed in accordance with the principles of this invention.

Figure 3 is an enlarged detail sectional view taken on line 3—3, Figure 2.

While this invention will be described in connection with an engine of the Diesel type it is to be understood that the invention is not to be so limited as it may be applied with equal efficiency to any other high pressure or compression apparatus which embodies a piston subject to such lubrication.

Referring more particularly to the drawings the numeral 10 designates generally the head of the crank casing and 11 the engine cylinders.

Mounted upon the head or the supporting structure of the engine is a head 12 in which is arranged a plurality of distributing chambers 13 for the fuel which is to be injected into the respective cylinders through nozzles communicating with the openings 14. The distributing chambers 13 are connected by means of a passage 15 and in each of the chambers is arranged a valve 16 having a stem 17. These stems extend below the head 12 and springs 18 are provided which tend normally to hold the valves 16 closed. The springs encompass the valve stems, one end thereof engaging a fixed abutment and the other end of the spring engages a collar or shoulder 19 on the respective valve stems 17.

The valves 16 are opened in the ordinary manner by means of the usual tappets 20, which in turn are actuated by cams 21 on a shaft 22 which is rotated in the usual manner.

Arranged in the head 10 is an outlet chamber 23 which has communication with the passage 15 and arranged in the chamber 23 is a valve 24 which controls an inlet opening 25. A spring 26 tends normally to seat the valve 24 and an adjustable closure 27 is provided for the outlet chamber 23.

A compression chamber 28 is also provided in the head 12 and this chamber has communication by means of a passage 29 with the opening 25 that discharges into the outlet chamber 23.

Arranged in the compression chamber 28 is a bushing 30, which is provided with a flange 31 adapted to engage the end of the chamber 28 and the bushing is held in position by means of a nut or collar 32 which engages the flange 31 and holds the same against the end of the chamber 28.

Reciprocable within the bushing 30 is a piston 33 which extends beyond the bushing and is provided with a shoulder or collar 34 against which one end of a spring 35 that

encompasses the piston 33 rests, the other end of the spring 35 engaging an abutment 36, so that the normal tendency of the spring 35 is to hold the end of the piston 33 against a cam 37, which latter is connected with a shaft 38 that rotates in suitable bearings 39, motion being imparted to the shaft 38 in any suitable manner such as by means of a gear wheel 40 which meshes with a gear 41, the latter being secured to the shaft 22.

The portion of the chamber 28 upon which the nut or collar 32 is threaded, and the nut or collar itself, as well as the abutment 36, are so constructed and arranged with respect to each other to provide sufficient space so that when the nut or collar is detached the bushing may be readily removed by withdrawing from the chamber 28, the portion of the bushing which is seated within the chamber.

Fuel is supplied to the chamber 28 to be compressed therein from any suitable source through a pipe 42 which has communication with a valve chamber 43, the latter being secured in the end of the chamber 28. A valve 44 is provided for controlling an opening 45 in the valve chamber 43 and a spring 46 tends normally to seat the valve 44. One end of the spring 46 engages a wall of the valve casing and the other end abuts a shoulder or collar 47 secured to the valve stem 48. The valve stem projects into a cap or closure 49 for the valve chamber.

With this construction it will be manifest that when the fuel oil which is to be supplied to the engine is admitted through the pipe 42 into the chamber 28 the valve 44 will be opened and when the piston 33 operates to compress the fuel the valve 44 will be closed and the fuel under pressure will flow through the passage 29 to unseat the valve 24 and into the outlet chamber 23 from where it is distributed by means of the passages 15 to and through the respective distributing chambers 13. When the valves 16 are opened the fuel under pressure will be delivered through the outlets 14 to the respective nozzles 50 through suitable pipes 50^a to be injected into the cylinders 11.

This is the general mode of operation of the ordinary Diesel type engine.

It has been found that some of the fuel oils will serve as a lubricating means for the piston 33 and it has also been found that other fuel oils will not lubricate the piston. Therefore in order to provide a means whereby the piston may be lubricated at all times regardless of the nature of the fuel or fluid to be compressed, means are provided whereby a supplemental or independent circulation of lubricating oil may be directed to and against the piston.

To that end the bushing 30 is provided with a plurality of annular grooves or recesses 51 opening through the face of the bushing that contacts with the periphery of the piston and these grooves 51 are spaced in directions lengthwise of the piston.

Passages 52—53 are also provided in the bushing to extend lengthwise thereof and to form communication between the grooves 51.

An inlet pipe 54 has communication with one of the passages 52—53 and to this pipe 54 lubricating oil is supplied from any suitable source and under any desired or predetermined pressure.

Leading from the other of the passages 52—53 is an outlet 55 to which is connected a pipe 56 that has communication with a passage 57 in the head 12 and leading from this passage 57 is another passage 58 which has communication with openings 59 in which the stems 17 of the valves 16 reciprocate. Portions of the stems 17 of the valves 16 are cut away as at 60 so as not to interrupt the flow of the lubricant through the passage 58 and from one of the valve stems to the other. The passage 58 has communication with a return passage 61 by means of a communicating passage 62 and this passage 61 also has communication with and extends across another portion of the openings in which the stems 17 of the valves 16 reciprocate. The valve stems 17 are also provided with peripheral grooves 63 spaced from the grooves 60 and so disposed that the flow of lubricant through the return pipe 61 will not be obstructed. Communicating with the passage 61 is a discharge pipe 64 which preferably leads to the sump of the engine.

Thus it will be seen that no matter what kind of fluid is being compressed in the chamber 28 by the piston, a lubricant will be supplied to the piston 33 as well as the valve stems 17 and the course of flow of the lubricant will be from the pipe 54, through the passage 52, a portion thereof being discharged through the grooves 51 against the piston 33, while the remaining portion of the lubricant flows through the passage 53, out of the outlet 55, through the passages 56—57, into the passage 58, past and in contact with each of the valve stems 17, thence through the passage 62, passage 61 on the return and also again past and in contact with the valve stems 17 and out of the discharge pipe 64.

It will be manifest that with this system of lubrication it is not necessary to depend upon any lubricating qualities of the fluid being compressed and it is obvious that the lubricant may be supplied at any desired pressure according to the pressure of the fuel oil.

While the preferred form of the invention has been herein shown and described, it is to be understood that various changes may be made in the details of construction and in the combination and arrangement of the several parts, within the scope of the claims,

without departing from the spirit of this invention.

What is claimed as new is:—

1. In combination, a chamber, means for supplying the chamber with a fluid to be compressed, a piston, means for reciprocating the piston to compress said fluid in said chamber, a hollow casing extending across and forming a portion of a wall of said chamber, and through which casing the piston moves, means for supplying a lubricant to the said casing under a pressure greater than the fuel oil pressure, and means for discharging the lubricant from the casing against the piston at points spaced in directions lengthwise of the piston as the latter reciprocates through the casing.

2. In combination, a chamber, means for supplying the chamber with a fluid to be compressed, a piston, means for reciprocating the piston to compress said fluid in said chamber, a hollow casing extending across and forming a portion of a wall of said chamber and through which casing, the piston moves, and means for circulating a lubricant through the casing at a pressure above the fuel pressure in the chamber, there being openings in the wall of the casing through which some of the lubricant will be delivered against the lateral face of the piston.

3. In an engine of the Diesel type, a chamber for receiving the fuel oil, a reciprocable piston for compressing the fuel in said chamber, a bushing in which the piston is reciprocable, said bushing forming a wall of the said chamber, means for reciprocating the piston, there being a passage through the bushing opening against the lateral face of the piston at points spaced lengthwise of the piston, and means for circulating a lubricating fluid through said passage at a pressure greater than the fuel pressure in said chamber, a portion of the lubricating fluid being discharged from said passage against the lateral face of the piston.

4. In combination, a chamber, means for supplying to the chamber a fluid to be compressed, a reciprocable piston for compressing the fluid in the chamber, means for reciprocating the piston, a bushing freely movable and accessible from the outside of the chamber and through which the piston moves, grooves in the inner face of the bushing, said grooves being closed by the piston, there being passages in the bushing communicating with said grooves, and means for discharging a lubricating fluid into said passages to be delivered from said grooves against the piston.

5. In combination, a chamber, means for supplying to the chamber a fluid to be compressed, a reciprocable piston for compressing the fluid in the chamber, means for reciprocating the piston, a bushing through which the piston moves, said bushing forming a portion of a wall of said chamber, grooves in the inner face of the bushing, said grooves being closed by the piston, there being passages in the bushing communicating with said grooves, there being a supply inlet and a discharge outlet for said passages other than said grooves, and means for circulating a lubricating fluid into said inlet, through the bushing and out of the last said outlet at a pressure greater than the fuel pressure in the said chamber.

6. In an engine of the Diesel type, a chamber, means for supplying to the chamber a fluid to be compressed, a reciprocable piston for compressing the fluid in the chamber, means for reciprocating the piston, a plurality of distributing valves, stems connected with the valves, means for reciprocating said valves and stems, and means for circulating a lubricating fluid around and in contact with the said piston and said valve stems for lubricating them.

7. In an engine of the Diesel type, a chamber, means for supplying to the chamber a fluid to be compressed, a reciprocable piston for compressing the fluid in the chamber, means for reciprocating the piston, a plurality of distributing valves, stems connected with the valves, means for reciprocating said valves and stems, and means for circulating a lubricating fluid successively around and in contact with the said piston and said valve stems for lubricating them.

8. In an engine of the Diesel type, a chamber, means for supplying to the chamber a fluid to be compressed, a reciprocable piston for compressing the fluid in the chamber, means for reciprocating the piston, a plurality of distributing valves, stems connected with the valves, means for reciprocating said valves and stems, and means for circulating a lubricating fluid around and in contact with the said piston and valve stems, at points spaced longitudinally of each for lubricating them.

In testimony whereof, I have signed my name to this specification, on this 5th day of February, 1930.

EMERY H. FAHRNEY.