Feb. 9, 1937. P. A. FRANK 2,069,826

ENGINE

Filed Sept. 2, 1932

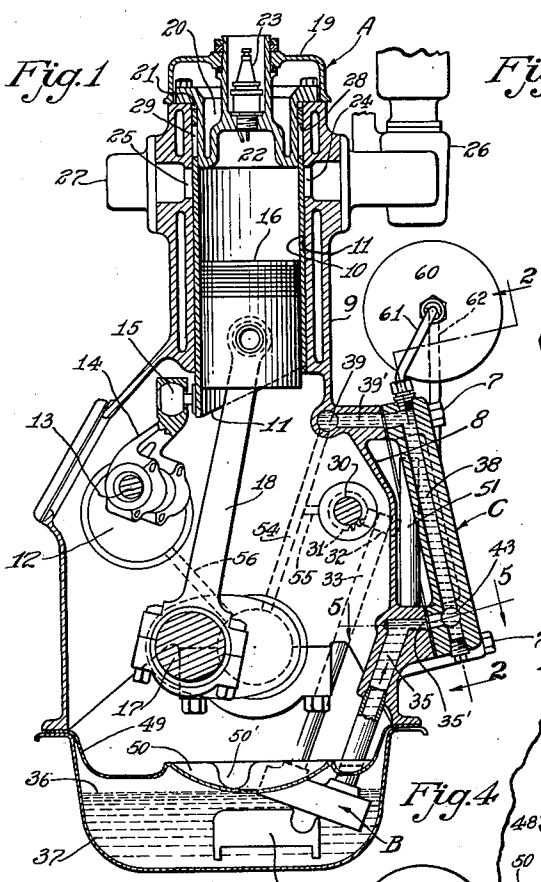

Fig. 1

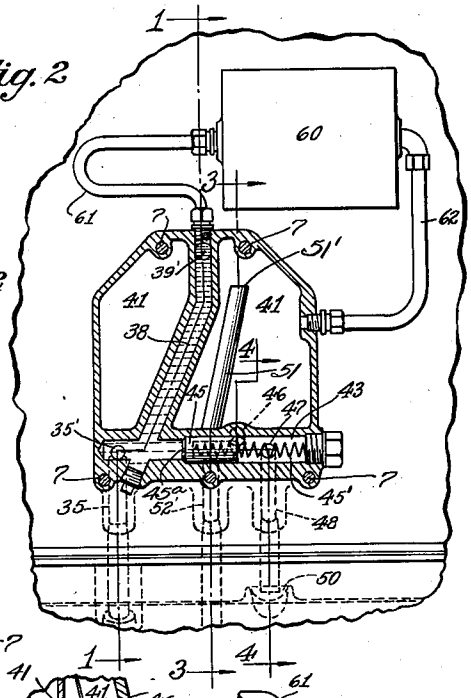

Fig. 2

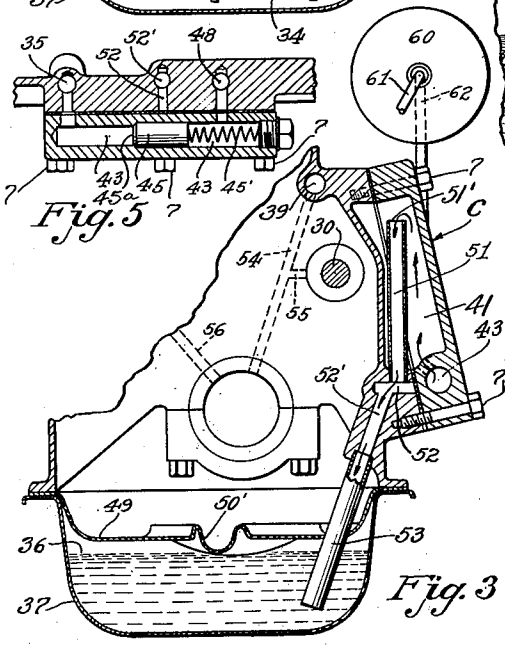

Fig. 3

Fig. 4

Fig. 5

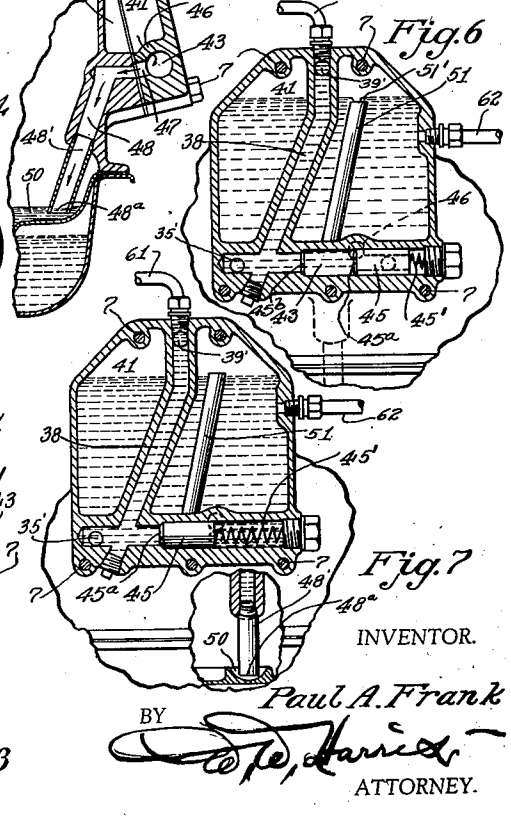

Fig. 6

Fig. 7

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2,069,826

ENGINE

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8 Claims. (Cl. 184—6)

My invention relates to engines and more particularly to an engine lubricating system of particular application to an engine of the sleeve valve type in which the associated sleeve valve means having a reciprocating movement are required to be initially lubricated on starting the engine.

The principles of my invention may be advantageously incorporated in engines other than those of the type shown in the illustrated embodiment of my invention, especially when it is desired to provide a supplemental splash system of lubrication operable solely during the initial engine operation. I have found my invention as herein illustrated and described especially useful in connection with a single sleeve valve engine of the combined movement type.

An object of my present invention is to generally improve the operating performance of an engine by constructing an improved lubricating system therefor which provides for more efficient lubrication of the engine during the initial engine operation.

Another object of my present invention is to more efficiently lubricate an engine by providing a supplemental splash lubrication operatively responsive to engine operation.

A further object of my invention is to construct an engine with an improved lubricating system in which a portion of the lubricant is stored during engine operation and deposited on a splash pan on stopping the engine in readiness to be splashed on parts to be lubricated on again starting the engine without interference with the regular engine lubrication.

Still further objects of my invention are to provide a generally improved engine construction embodying various novel structural arrangements and other particular novel features hereinafter described in more detail.

For a further understanding of my invention, reference may be had to the accompanying drawing which illustrates one form which my invention may assume, and in which:

Fig. 1 is a vertical transverse sectional view of a typical engine cylinder illustrating the principles of my invention and taken on the line 1—1 of Fig. 2,

Fig. 2 is a detail sectional view taken substantialy on the line 2—2 of Fig. 1 and illustrating the lubricant reservoir and associated valve structure controlling the reservoir drain,

Fig. 3 is a fragmentary sectional view taken on the line 3—3 of Fig. 2 and illustrating the reservoir overflow,

Fig. 4 is a fragmentary sectional view taken substantially on the line 4—4 of Fig. 2 and illustrating more particularly the means for connecting the reservoir with the splash pan,

Fig. 5 is a fragmentary horizontal sectional view of the valve structure taken substantially on the line 5—5 of Fig. 1,

Fig. 6 is a fragmentary sectional view similar to Fig. 2 showing the relative position of parts during engine operation, and

Fig. 7 is a similar fragmentary sectional view illustrating the reservoir starting to drain into the splash pan on stopping the engine.

In carrying out my invention I preferably have illustrated an engine A including a cylinder block 9 having a plurality of cylinders 10, a single sleeve valve 11 being operable in each of said cylinders and having a combined oscillating and reciprocating movement for controlling the cyclical events of the engine. It will be understood that my invention is not limited to any particular type of engine or sleeve valve means in its broader aspect.

The sleeve valve means illustrated herein are preferably operated by a wobble shaft 12 having wobble cranks 13 each adapted for connection by means of a connecting yoke 14 and a sleeve lug 15. The piston 16 operable within each cylinder is adapted to be connected with the crankshaft 17 by means of the connecting rod 18. A cylinder head 19 having a re-entrant portion 20 depending within and spaced from the cylinder walls provides for a sleeve pocket 21 and combustion chamber 22, the ignition means such as a spark plug 23 functions in the usual manner.

The cylinder intake and exhaust ports 24 and 25 communicate respectively with the intake and exhaust manifolds 26 and 27 in a usual manner, the sleeve valve means having intake and exhaust ports 28 and 29 respectively cooperating with the cylinder intake and exhaust ports 24 and 25.

I preferably provide a counterbalance shaft 30, which may be provided with a gear 31 adapted for cooperative engagement with a gear 32 carried by the lubrication pump shaft 33 cooperatively associated with a lubricant pump B.

The lubrication pump B is provided with an intake means 34 preferably immersed in lubricant stored in the crankcase and delivers lubricant to a passage or conduit carried by the crankcase structure. The screen 34 lies substantially below the lubricant level 36 contained in the oil pan 37 and is preferably in communication with the lubricant at all times. In its broad aspects, the

lubricant in the crankcase may be referred to as a source of lubricant supply.

The conduit 35 preferably terminates at the outer side face of the crankcase structure as at 35'. Said crankcase structure is also preferably provided with a header or gallery 39 for conducting lubricant, various passages or conduits 54, 55 and 56 being provided for conducting the lubricant from the header or gallery 39 to various engine parts to be lubricated such as bearings for respectively supporting the crankshaft 17, counterbalance shaft 30 and wobble shaft 13. The header or gallery 39 communicates with a passage or conduit 39' which terminates at the outer surface of the crankcase similarly to the conduit or passage 35. The crankcase structure is recessed as at 8 preferably intermediate the passage 35' and 39' and a closure member or cover C is secured to the crankcase structure by bolts 7 or other suitable fastening devices, said cover cooperating with the recess to provide a lubricant reservoir 41.

The cover is provided with a passage 38 adapted for connecting passages or conduits 35' and 39' thereby providing a continuous lubricant conducting passage connecting the lubricant pump with the gallery 39 and associated passages 54, 55 and 56 leading to the engine parts to be lubricated.

A valve chamber 43 preferably extending longitudinally of the cover, communicates with the passage 38. An opening 46 connects the chamber 43 with the reservoir 41 and an opening 47 connects the chamber with a crankcase passage 48, the outlet of said passage 48 terminating above a splash pan 49, the relatively short pipe section 48' being preferably associated with the passage 48 and terminating in an outlet 48^a within a recess or trough 50 carried by said splash pan. The splash pan is preferably constructed with a plurality of said troughs 50, one for each cylinder, connected by intermediate troughs 50' preferably extending longitudinally of the engine.

A valve means preferably consisting of a plunger 45 is movably supported within the valve chamber 43, said plunger being adapted for movement axially of the chamber and spring loaded as by the spring 45', said spring 45' exerting a pressure tending to maintain the plunger 45 in a position as shown in Figs. 2 and 7 and seating the beveled or chamfered end 45^a of the plunger against the beveled seat 45^b incorporated in the valve chamber 43, to close communication of the reservoir and opening 46 with the lubricant conducting or supply means 38. The length of the plunger is such and the relative spacing of opening 46 and seat 45^b is such as to uncover the opening 46 when the valve is seated as shown in Fig. 2, the openings 46 and 47 being thereby placed in communication. The contents of said lubricant reservoir 41 are thus free to drain into the splash pan 49 by reason of the connecting openings 46, 47, the passage 48 and open end pipe section 48'. The character and strength of the spring 45' is such as to exert only a relatively slight force on the valve to seat same and this pressure is insufficient to overcome the lubricant pressure developed at engine idling speeds. In the device constructed by assignee company under the supervision of applicant, a spring was used which could be overcome by a lubricant pressure of approximately four pounds. Engine idling speeds usually develop a lubricant pressure of approximately fifteen pounds so it will be evident that the valve will not be seated until the engine speed has been relatively reduced considerably below that found necessary for idling.

Thus the contents of the reservoir are drained into the splash pan when the engine is inoperative and due to the fact that opening 46 is only partially uncovered thereby providing a rather small orifice through which the lubricant can drain, it will take somewhere in the neighborhood of about five minutes to drain the reservoir, so therefore, a momentary stopping of the engine due to the engine dying will drain only a very small amount of lubricant into the splash pan.

Immediately on starting the engine, the lubricant pressure is increased from zero to an amount sufficient to move the plunger valve 45 off its seat and place the opening 46 in communication with the lubricant supply means (see Fig. 6). Lubricant is pumped into the reservoir but this will not interfere with the regular lubricating system as a column of lubricant remains in passage 38 and the pump pressure is immediately transmitted to the lubricant in the header or gallery 39 for force feeding to the respective conduits or passages connecting the header with the engine parts to be lubricated.

An overflow pipe 51 is associated with the reservoir 41 and the upper open end 51' of this pipe terminates adjacent the upper part of the reservoir in order to maintain a predetermined lubricant level in the reservoir. This overflow pipe is connected by means of passages or conduits 52, 52' in the crankcase structure with a pipe 53 terminating within the engine crankcase. Thus overflow from the reservoir is returned to the crankcase or other suitable source of supply and it may be noted that this overflow places the reservoir in communication with the crankcase, substantially at atmospheric pressure. This overflow pipe serves to vent the reservoir.

The reservoir is soon filled after starting the engine and on next stopping the engine, the lubricant in said reservoir tends to drain onto the splash pan 49 where the same is distributed to the troughs, the lower extremity of said connecting rods 18 being arranged to sweep through the troughs 50 and to thereby splash the lubricant contained therein onto certain engine parts to be lubricated. In the present embodiment of my invention, the lubricant is splashed on the sleeve valve means. On again stopping the engine, the contents of the reservoir is dumped onto the splash pan for refilling said troughs to thereby prepare for another lubrication of engine parts during the next subsequent starting of the engine.

If desired, a filter 60 may be operatively connected with the lubricating system, said filter being preferably connected in shunt with the lubricating system (see Fig. 2) by means of conduits 61 and 62 connected with the filter and to the passage 38 and reservoir 41 respectively.

It may be noted that the pump delivery to gallery 39 is started against a column of lubricant and thereby there is no appreciable delay in the functioning of said system, and no air pockets are present in the lubricant conducting means to interfere with the operation thereof.

Thus, it will be observed from the illustrations and description that my invention offers a novel means for constructing a lubricating system which has in general many improved features. It offers a structure providing a positive means for lubricating the engine moving parts immediately at the start of each performance thereof. Further, my invention as embodied in this structure provides for a lubricant delivery unobstruct-

ed by air pockets as is sometimes found in other structures of this type. These features in general offer improved means for engine lubrication and provide for an improved and efficient engine performance.

It will be apparent that various modifications may be made in my invention without deviating from the principles of my invention and it is not my intention to limit my invention to the particular construction and method described and shown for purpose of illustration.

What I claim as my invention is:

1. A lubricating system for an engine having a crankcase, a splash pan, means including a conducting portion for circulating lubricant under pressure to engine parts to be lubricated during engine operation, a lubricant reservoir vented to the crankcase and having an inlet and outlet respectively communicating with the lubricant conducting portion and said splash pan, and valve means responsive to pressure of the lubricant in said conducting portion for controlling said reservoir inlet and outlet.

2. In an engine lubricating system, a splash pan, a lubricant supply means through which a lubricant may be conducted under pressure to engine parts to be lubricated, a lubricant reservoir separate from said lubricant supply means and having an inlet and outlet, and valve means actuated in response to the pressure within said lubricant supply means for controlling said reservoir inlet and outlet.

3. In an engine lubricating system, a splash pan, a lubricant supply means through which a lubricant may be conducted under pressure to engine parts to be lubricated, a lubricant reservoir separate from said lubricant supply means and having an inlet and outlet, valve means controlling said reservoir inlet and outlet, said valve means actuated in response to the lubricant pressure in said lubricant supply means whereby to open said reservoir inlet and close the reservoir outlet during engine operation and to close the inlet and open the reservoir outlet when the engine stops whereby to drain the contents of the reservoir into said splash pan.

4. In an engine lubricating system, a splash pan, a lubricant supply means through which a lubricant may be conducted under pressure to engine parts to be lubricated, a vented lubricant reservoir separate from said lubricant supply means, a valve chamber communicating with said lubricant and having openings respectively communicating with the reservoir and splash pan, and valve means operable within said valve chamber and actuated in response to pressure variations in said lubricant supply means to open and close said openings whereby to control the filling and draining of said reservoir.

5. In an engine lubricating system, a splash pan, a lubricant supply means through which a lubricant may be conducted under pressure to engine parts to be lubricated, a lubricant reservoir separate from said lubricant supply means, a valve chamber communicating with said lubricant supply means and having openings spaced axially of the valve chamber and respectively communicating with the reservoir and splash pan, and valve means movable axially of the valve chamber in response to pressure variations in such lubricant supply means, said valve means being moved to place said openings in communication in response to a predetermined drop in pressure in the lubricant supply means whereby to drain the reservoir into the splash pan.

6. A lubricating system for an internal combustion engine including a crankcase structure, a lubricant pump, lubricant conducting means connected with the pressure side of said pump and carried by the crankcase structure, a splash pan, a reservoir separate from said lubricant conducting means and having an opening, and means operable in response to pressure produced in the lubricant conducting means during engine operation whereby to place the reservoir in communication with said conducting means, and spring loading means for said pressure operable means whereby to close the communication between the reservoir and lubricant conducting means when the engine stops, said pressure operable means constructed to open the communication between the reservoir and splash pan when the engine stops whereby to drain the contents of said reservoir into the splash pan on stopping the engine.

7. In an internal combustion engine, a crankcase structure having lubricant conduits, a lubricant pump, said crankcase structure having a recess opening outwardly thereof, a cover for closing said recess and cooperating therewith to provide a lubricant reservoir, said cover having a lubricant passage cooperating with the lubricant conduits in the crankcase to provide a lubricant conducting system, and means carried by said cover for controlling said lubricant passage, said means being actuated to dump the contents of said reservoir.

8. In an internal combustion engine, a crankcase structure having lubricant conduits, a lubricant pump, said crankcase structure having a recess opening outwardly thereof, a cover for closing said recess and cooperating therewith to provide a lubricant reservoir, said cover having a lubricant passage cooperating with the lubricant conduits in the crankcase to provide a lubricant conducting system, and lubricant distributing means carried by said cover and including a pressure actuated valve for selectively controlling the introduction and discharge of lubricant to and from said reservoir respectively.

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