Dec. 30, 1947. R. J. FURSTOSS ET AL 2,433,447

AUTOMATIC CYLINDER DRAINAGE SYSTEM FOR INTERNAL-COMBUSTION ENGINES

Filed Oct. 5, 1945 3 Sheets-Sheet 1

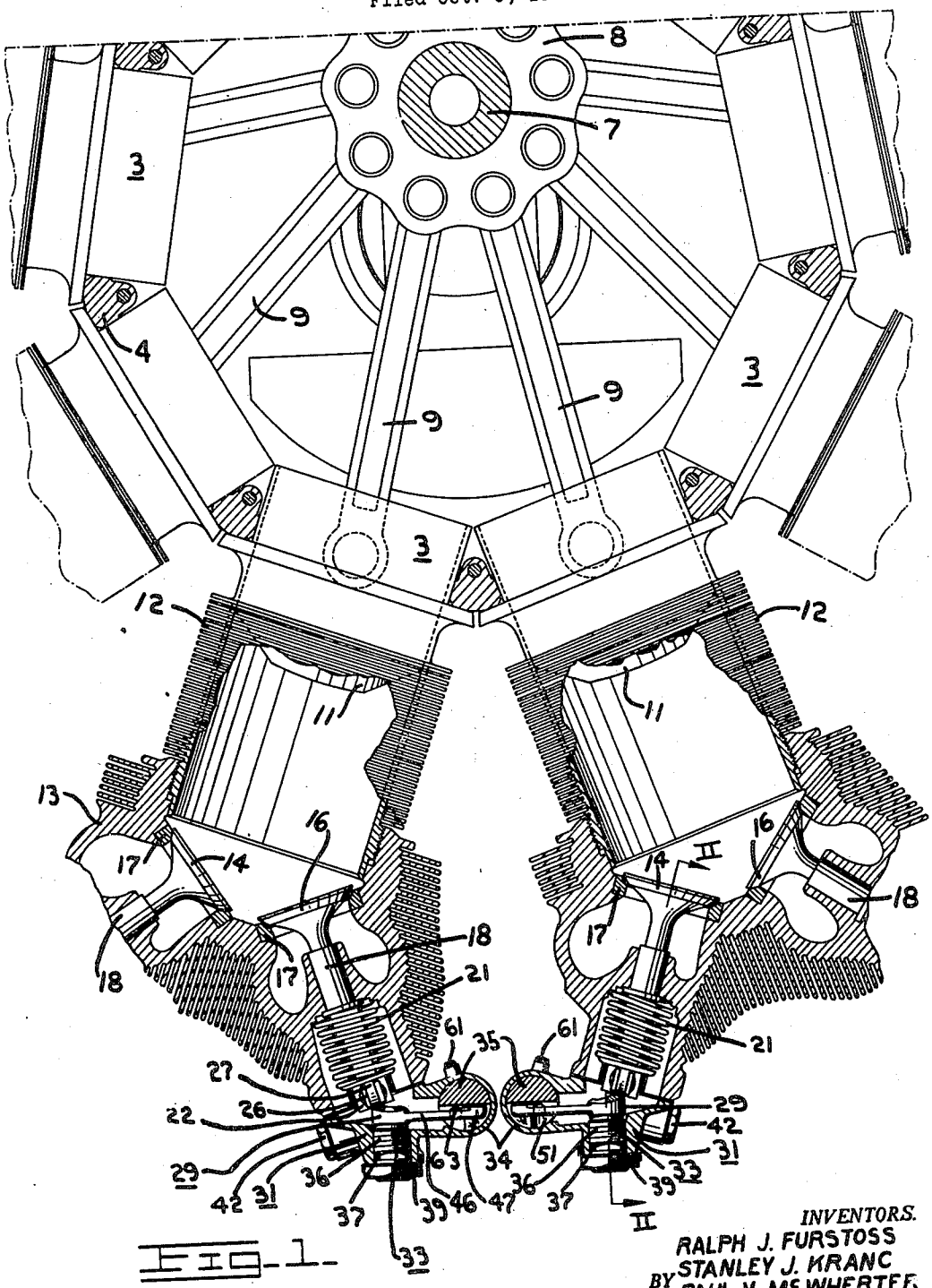


Fig. 1.

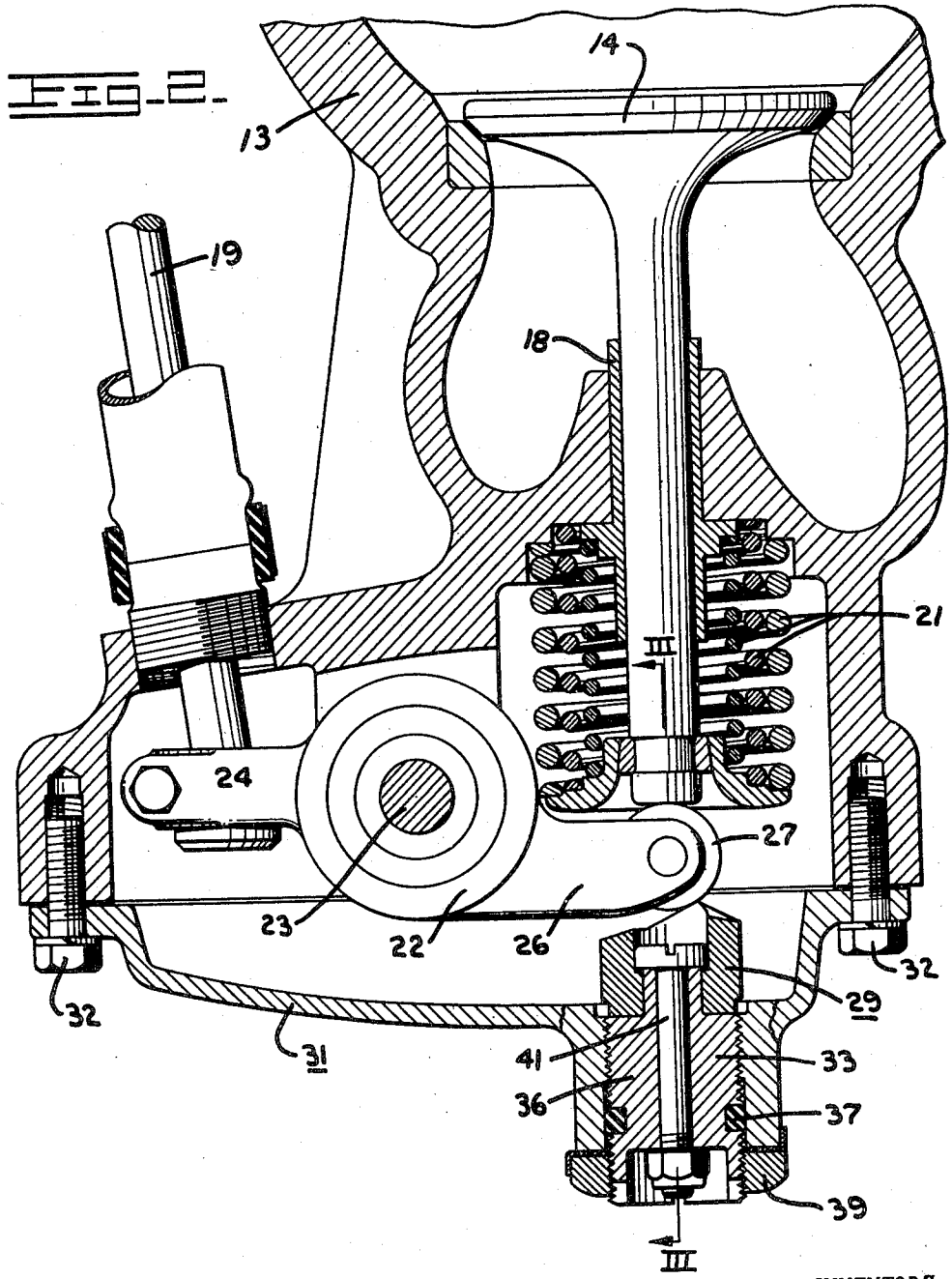
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FIG. 2.



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FIG. 4

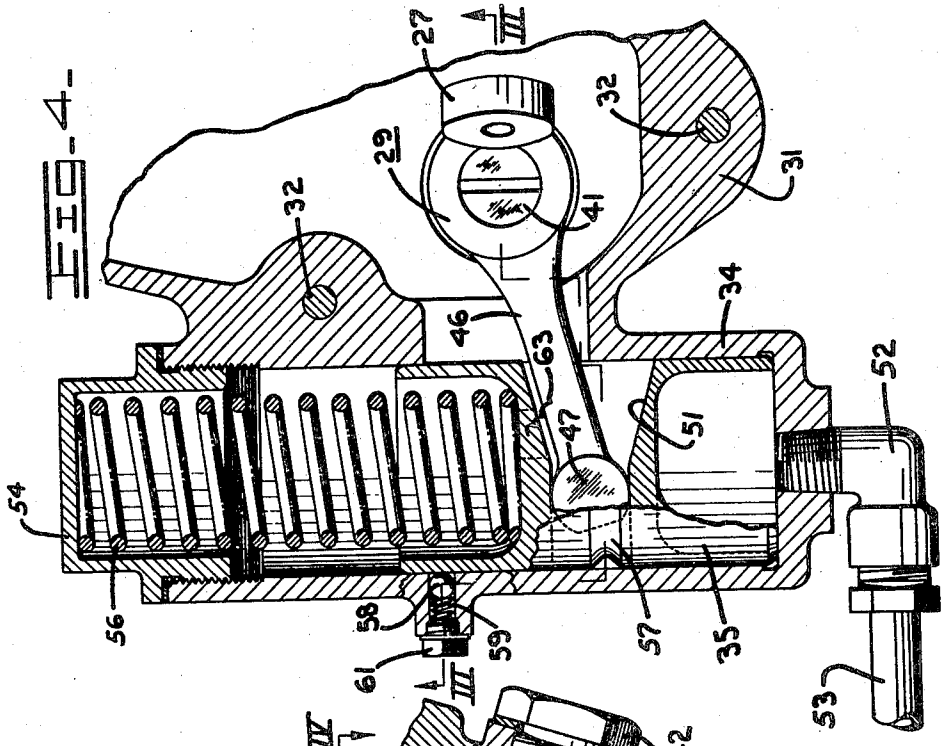
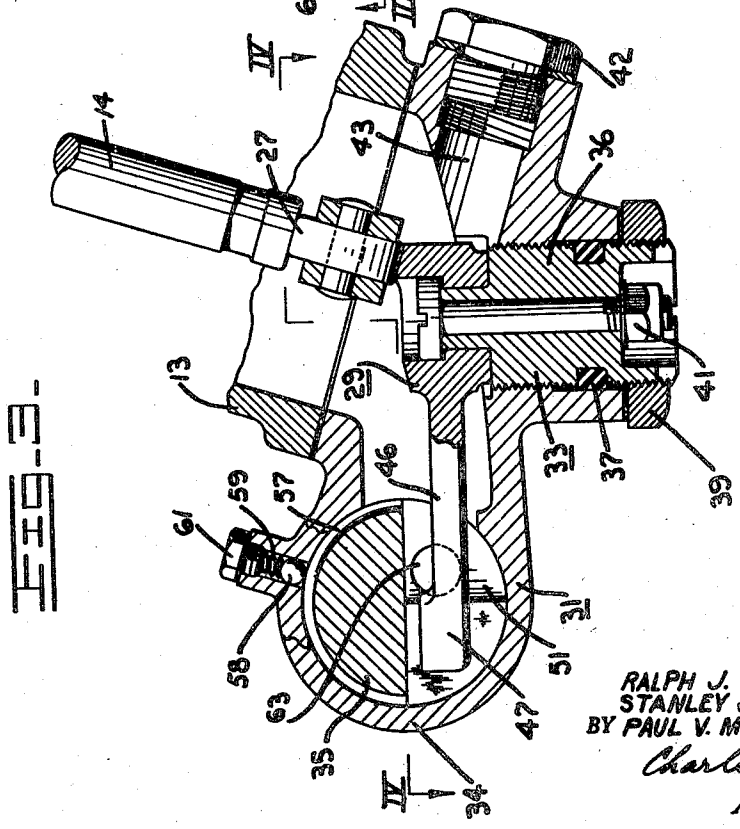


FIG. 3



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Patented Dec. 30, 1947

2,433,447

UNITED STATES PATENT OFFICE

2,433,447

AUTOMATIC CYLINDER DRAINAGE SYSTEM FOR INTERNAL-COMBUSTION ENGINES

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Application October 5, 1945, Serial No. 620,436

5 Claims. (Cl. 123—198)

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The present invention relates to a system for draining cylinders of internal combustion engines and particularly to mechanism automatically establishing drainage in the lowermost cylinders of a radial internal combustion engine or the like wherein the accumulation of oil when the engine is not in operation presents a hazard.

It is well known that in internal combustion engines wherein some of the cylinders are inverted such, for example, as the radial engine, lubricating oil from the crank case often seeps past the pistons in the inverted cylinders and accumulates in the combustion chamber. In doing so the leakage oil occupies space which is required for combustion and sometimes causes breakage of the engine when it is placed in operation because of excessive pressure resulting from the reduced combustion area.

Various attempts have been made to correct this difficulty, one, for example, being that disclosed in the application of C. G. Rosen, No. 521,327, filed on February 7, 1944, wherein mechanism is disclosed for opening inlet or exhaust valves of the inverted cylinders when the engine is at rest. In said application, the mechanism disclosed comprises an engine shutoff control lever and mechanical linkage between such lever and the cylinder valves which is so arranged that shutting off of the engine is accomplished by opening of either an intake or exhaust valve in the inverted cylinders to provide for drainage from such cylinders of any crank case oil or the like which might otherwise accumulate therein. The mechanical linkage so employed for accomplishing this purpose is relatively complicated and consequently is subject to breakage or failure. Furthermore, while the linkage disclosed in the application hereinabove referred to is satisfactory for draining two cylinders, there are many engines in which more than two cylinders should be drained and the duplication of such mechanical linkage for each additional cylinder would result in additional complication and expense.

The present invention is concerned with the same general problem as that referred to in the application hereinabove mentioned but has for one of its objects the solution of such problem by hydraulic means as distinguished from mechanical means, the hydraulic means being controlled

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by lubricating oil pressure rather than by mechanically controlled linkage.

It is an object of the present invention to provide simple, effective means for automatically insuring drainage of lubricating oil or other liquids from the inverted cylinders of a radial combustion engine or the like while the engine is out of operation and for automatically disabling such drainage means while the engine is operating and also for effecting such automatic control by fluid pressure and particularly by pressure of the lubricating oil system of the engine. Further and more specific objects and advantages of the invention are made apparent in the following specification wherein reference is made to the accompanying drawings which illustrate the invention in a preferred form.

In the drawings:

Fig. 1 is a fragmentary transverse sectional view of a radial combustion engine illustrating the cylinder drainage system of the present invention applied to the two lowermost cylinders thereof;

Fig. 2 is an enlarged sectional view taken along the line II—II of Fig. 1;

Fig. 3 is a fragmentary sectional view taken along the line III—III of Figs. 2 and 4; and

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

Referring first to Fig. 1 of the drawings, a radial internal combustion engine is shown as comprising a plurality of cylinders 3 suitably secured to and radially disposed with relation to a crank case 4. The usual crank shaft 7 is shown as carrying a master connecting rod 8 to which are pivotally connected link rods 9 connected in turn to pistons 11 which are disposed for reciprocation, one in each of the cylinders 3. Each of the cylinders 3 is provided with the usual cooling fins 12.

Each cylinder 3 has, as indicated on the two lowermost cylinders disclosed in Fig. 1, a cylinder head 13 which provides mountings for an intake valve 14 and an exhaust valve 16. As is conventional practice, valve seat inserts 17 are included in the cylinder head for each of the valves 14 and 16 and valve guide bushings 18 are provided to permit reciprocal operation of each of the valves. Push rods 19, most clearly shown in Fig. 2, effect opening of the valves in the manner presently to be explained, and each of the valves is

urged toward its closed position by springs shown at 21. The push rods 19 are suitably connected with valve rockers 22 which are mounted for oscillation on shafts 23 and which have arms 24 engageable by the push rods in a conventional manner. Arms 26, which also extend from the valve rockers 22, carry rollers 27 engageable with the ends of the valve stems so that as viewed in Fig. 2 depression of the push rods 19 effects opening of the valves 14, all in properly timed sequence.

According to the present invention, a valve opening cam 29 is disposed beneath and engageable with the roller 27 for one or the other of the valves in each of the lowermost cylinders of the engine. Upon rotation of the cam 29, a rise on its cam surface engages the roller 27 to open the valve 14 and therefore permits drainage from its associated cylinder of any oil which would otherwise collect therein.

The mounting and operation of the cam 29 is best illustrated in Figs. 2, 3 and 4 wherein a valve cover 31 is shown as secured to cylinder head 13 by cap screws 32. This valve cover provides a mounting for an adjustable support assembly 33 for the cam 29 and also includes, as shown in Figs. 3 and 4, a cylinder 34 for a piston 35 which is adapted to be reciprocated in the cylinder by lubricating oil pressure. The position of the piston 35 in the cylinder 34 controls the position of the cam 29 by rotation thereof so that during operation of the engine the cam does not interfere with the normal opening and closing of the intake or exhaust valve 14. However, when the engine is at rest and the lubricating oil pressure drops, the cam 29 will be rotated to a position in which it engages its associated roller 27 and through such roller holds the corresponding intake or exhaust valve in an open position to permit drainage from the cylinder.

The adjustable support for the cam 29 includes a threaded member 36 upon which the cam is mounted and through which the cam may be advanced or retracted toward the roller 27 for adjustment. The seal 37 preferably surrounds the member 36 and a lock nut 39 is employed to lock the adjustable member in its adjusted position. A nut and bolt shown at 41 retains the cam 29 in position on its adjustable support 36. Preferably a removable cap 42 provides access through an aperture 43 to enable the use of a feeler gauge between the roller 27 and the cam 29 during adjustment of the cam.

The cam 29 is provided with a lever arm 46 which has an end 47 extending into a slot 51 in the piston 35 so that upon reciprocation of the piston in its cylinder 34 the lever arm 46 will be oscillated to rotate the cam 29. A fitting 52, Fig. 4, forms a communication between one end of the cylinder 34 and an engine oil pressure line 53. The line 53 may be in communication with any conventional oil pressure system, not shown, which according to common practice contains oil under pressure when the engine is in operation and in which the pressure is reduced immediately upon cessation of such operation. It is not intended that this invention be limited to the use of any particular fluid pressure as the structure shown can be operated with lubricating oil pressure or with any source of fluid pressure wherein the pressure is materially greater only during the operation of the engine. The end of the cylinder 34 opposite to that which is in communication with the source of pressure is closed by a cap such as that shown at 54 and a spring such as shown at 56 is interposed between the cap 54 and the piston 35. When the engine is not in operation the spring 56 normally holds the piston 35 in the position illustrated in Fig. 4 in which position the cam 29 is turned to engage the roller 27 and raise the valve stem with which it is associated.

When the engine is operating and maintaining a pressure in the oil line 53, this pressure is communicated to the side of the piston 35 which opposes the action of the spring 56 and the piston is moved upwardly until the cam 29 is rotated to a position where it does not interfere with normal opening or closing of the valve which it effects.

Some form of detent mechanism is preferably employed to prevent oscillatory movement of the piston in response to slight variations in oil pressure and such mechanism may comprise a groove 57 formed in the side of the piston 35 and adapted to receive a ball 58 urged inwardly by a spring 59 which reacts against a cap screw 61 as illustrated in Figs. 3 and 4. An aperture 63 is also preferably provided in the piston and extends between the chamber which contains the spring 56 and the slot 51 so that any lubricant or other fluid which is entrapped in the spring chamber will be free to flow out of such chamber as the piston is moved under the influence of oil pressure.

The apparatus herein disclosed operates automatically to retain the valve in open position when the engine is at rest and to permit normal operation of the valve when the engine is started and all of the time while it is in operation. The present disclosure illustrates the apparatus as applied to one valve in each of two cylinders. Because of the fact that the actuating means which overcomes the action of the valve opening spring is controlled entirely by fluid pressure the apparatus is readily adaptable for use with any number of cylinders and can therefore be applied to engines where it is desired to provide for bleeding liquids from more than two cylinders without the provision of complicated and undesirable mechanical connections.

We claim:

1. In an engine having a lubricating oil pressure system and having a cylinder in which liquid is apt to accumulate, a valve positioned to afford drainage for such liquid, resilient means for retaining the valve open, and means responsive to fluid pressure for opposing said resilient means to permit the valve to close and a connection between the lubricating oil pressure system and said means responsive to fluid pressure whereby the valve will be permitted to close only during operation of the engine.

2. In an engine which has a system for fluid which is under pressure only during operation of the engine, valves associated with engine cylinders for draining liquid therefrom, means for holding said valves open when the engine is at rest, and means responsive to pressure in said system for permitting said valves to close.

3. In an engine having a lubricating oil pressure system and having a cylinder in which liquid is apt to accumulate and having the usual intake and exhaust valves one of which is positioned to effect drainage from said cylinder, a cam for holding said one valve open, fluid pressure means for moving said cam to permit said valve to close, and a connection for communicating pressure to said fluid pressure means from the oil pressure system which is under pressure only during operation of the engine.

4. In an engine having a cylinder in which liquid is apt to accumulate and having the usual intake and exhaust valves one of which is positioned to effect drainage from said cylinder, a cam engageable with said one valve to hold it open and moveable to a position to permit it to close, a lever arm on said cam, a piston engaging said lever arm, spring means urging the piston in one direction to effect opening of the valve and fluid pressure means operable against said piston to oppose said spring means to permit the valve to close, and a source of fluid for said fluid pressure means which is under pressure only during operation of the engine.

5. In an engine having cylinders with the usual intake and exhaust valves and having an oil system wherein the oil is under pressure only during operation of the engine, and wherein some of the cylinders are apt to accumulate liquid while the engine is at rest, means for holding open one of said valves in each cylinder which might accumulate liquid to effect drainage of such liquid while the engine is at rest, and means actuated by pressure of oil in said system to disable the means which holds the valves open.

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