May 21, 1940. A. H. R. FEDDEN ET AL 2,201,525

LUBRICATION OF INTERNAL COMBUSTION ENGINES

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Fig.1.

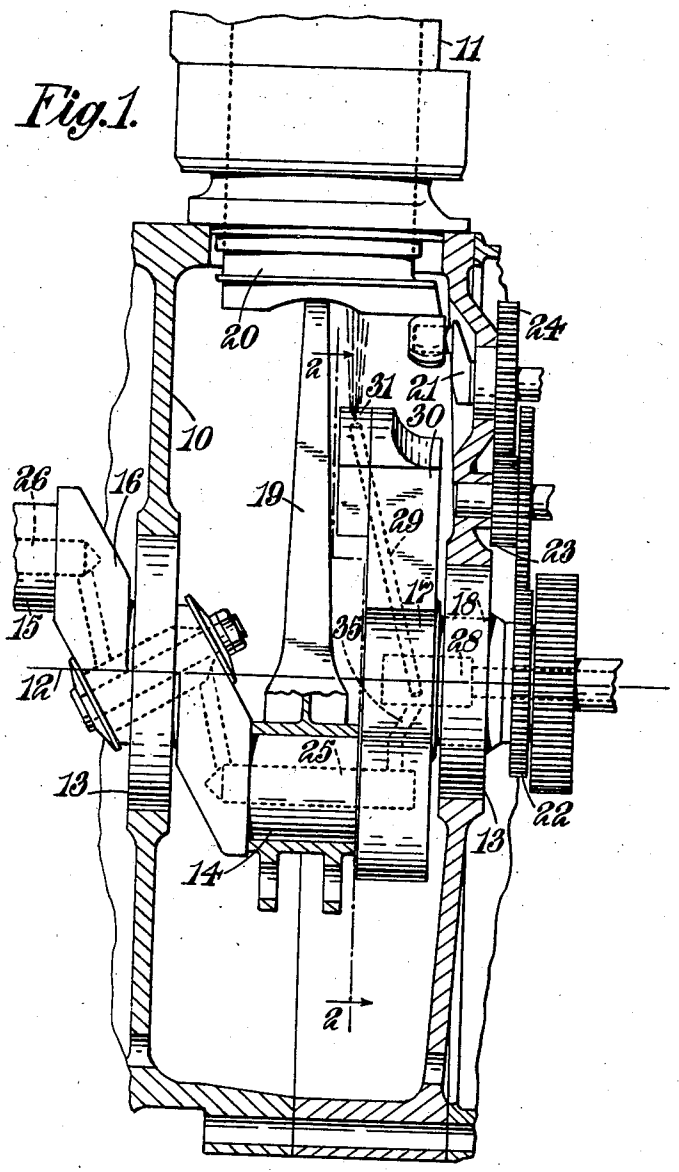

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Fig. 2.

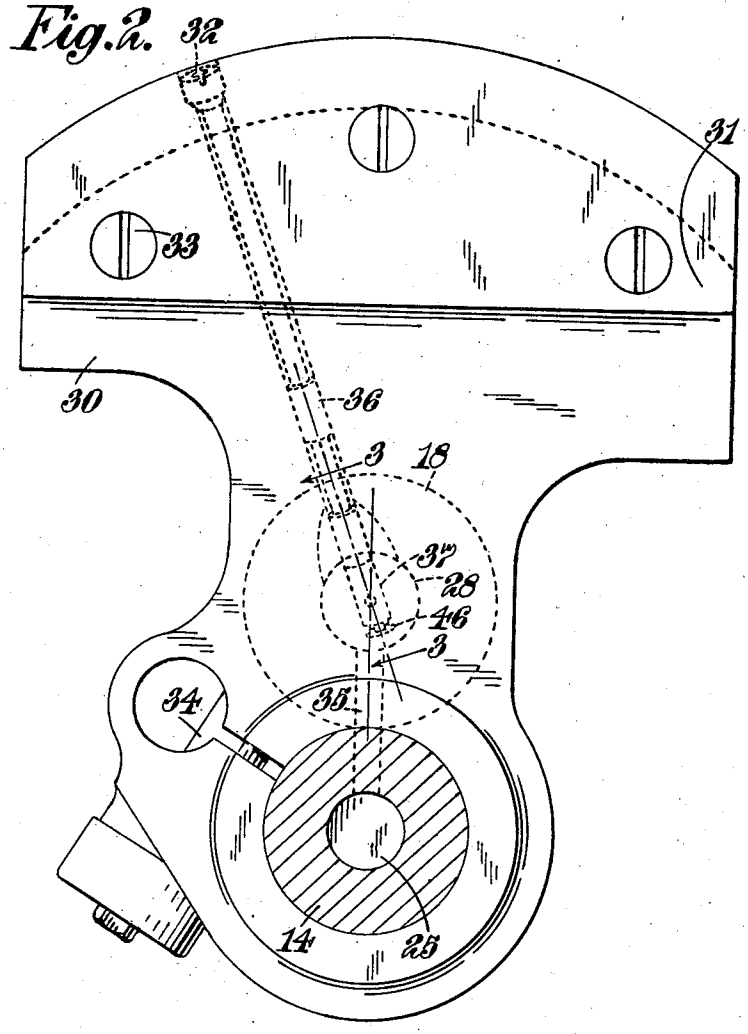

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Fig.3.

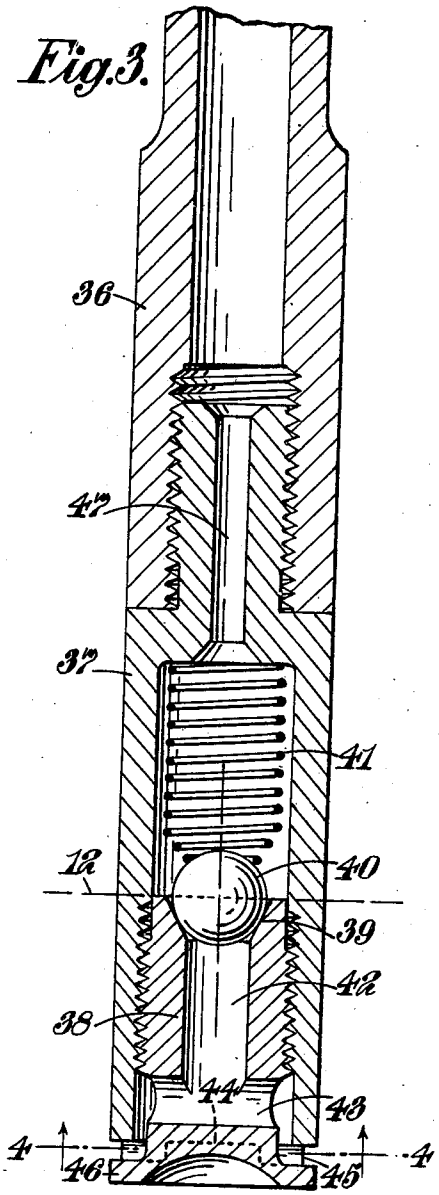
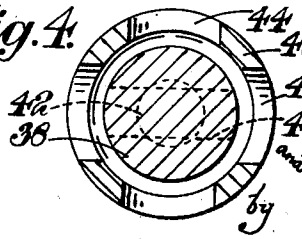


Fig.4.



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Patented May 21, 1940 2,201,525

UNITED STATES PATENT OFFICE

2,201,525

LUBRICATION OF INTERNAL-COMBUSTION ENGINES

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Application April 7, 1939, Serial No. 266,592
In Great Britain May 5, 1938

2 Claims. (Cl. 184—6)

This invention relates to the lubrication of internal-combustion engines and has for its object to provide a copious and accurately predetermined supply of lubricating oil to the pistons and associated parts. The invention is therefore of particular value as applied to an engine of the sleeve-valve type.

According to the invention, an internal-combustion engine, of the kind in which the crank-shaft is formed with a crank-web having a balance-weight on the side of the crank-shaft axis opposite the crank-pin, comprises a conduit leading from the hollow interior of the crank-shaft to a discharge orifice at or near the outer end of the balance-weight and means for supplying lubricant to the interior of the crank-shaft. The said orifice is preferably disposed near to the inside of the balance-weight, i. e., near to the transverse plane containing the adjacent connecting-rod or rods.

A specific embodiment of the invention will now be described by way of example with reference to the accompanying drawings of which—

Figure 1 shows, in sectional elevation, part of a two-bank sleeve-valve internal-combustion engine of the radial cylinder type,

Figure 2 is an end elevation on the line 2—2 of Figure 1 to an enlarged scale, showing one crank-web and balance-weight,

Figure 3 is a section, to a greatly enlarged scale, on the line 3—3 of Figure 2, and

Figure 4 is a section on the line 4—4 of Figure 3.

As shown first in Figure 1, the crank-case 10 of the engine supports cylinders 11 of which one, only, is shown, there being seven or nine such cylinders radially arranged with respect to the crank-shaft axis 12. A similar bank of cylinders (not shown) is arranged to the left of the plane containing the cylinders 11.

The crank-case carries bearings 13 for a fabricated two-throw crank-shaft comprising crank-pins 14, 15, an intermediate crank-web 16, an end crank-web 17, and a shaft portion 18. It will be understood that, at the left-hand end of the engine, an end web similar to 17 and a shaft portion similar to 18 are provided. The crank-web 17 is clamped to the crank-pin 14 by means of a bolt 34, an arrangement which, however, forms no part of the present invention. The chamber 25 within the crank-pin 14 communicates by an oil-way 35 with an oil chamber 28 within the crank-web 17.

The crank-pin 14 is engaged by a connecting-rod 19 pivoted at the top, in the usual way, to a piston which reciprocates inside a sleeve 20 slidable in the cylinder 11. The sleeve 20 is driven with a combined reciprocating and rotary motion by means of a sleeve-driving crank 21 which is driven from the shaft portion 18 by a gear train 22, 23, 24. It will be understood that connecting-rods for the other cylinders 11 in the bank are articulated to the big-end of the connecting-rod 19.

The fabricated crank-shaft is hollow throughout and oil is supplied to it by means of an engine-driven pump. Oil from the chambers 25 and 26 passes through suitable parts of the crank-pins 14 and 15 respectively to lubricate the big-ends in the respective banks of cylinders.

A conduit 29 leads from the oil chamber 28 obliquely through the balance-weight portion 30. To the inside face of the crank-web 17 the usual block 31 is fitted, by means of screws 33, to increase the mass of the balance-weight and according to the invention the said conduit 29 leads from the balance-weight portion 30 through the block 31 and opens in an orifice 32 at or near the curved periphery of the block, as shown in Figure 2.

The conduit 29 is lined with a tube 36 (see Figures 3 and 4) to the inner end of which a tubular valve chest 37 is screw-threaded as shown. The valve chest 37 is engaged at its inner end by a bush 38 the outer end of which is formed as a conical valve seat 39 to engage a steel ball 40 pressed on to its seat by a compression-spring 41. The bush 38 is formed longitudinally with a bore 42 which opens at the inner end into a diametral passage 43 the external orifices of which are spaced away in a radial direction with respect to the end of the tubular member 37. The end of the member 37 is cut across with four wide notches 44 so as to leave four intervening tongues 45 to engage the flanged head 46 of the bush 38. Thus, when the bush is screwed home, the four notches 44 constitute inlet orifices immersed in the oil chamber 28 and leading by way of the passage 43, the bore 42, and a bore 47 in the stem portion of the member 37, to the interior of the tube 36.

It is found that, unless a valve is provided in the oil-spray conduit, the resistance to the flow of oil offered by the conduit at very low engine speeds is proportionately so small as to reduce unduly the pressure of the oil in the circuit. The spring 41 is so designed that, at very low engine speeds, the valve 40 closes the tube 36 and pre-

vents oil from being discharged through it. At higher speeds, however, the increased pressure of the oil lifts the ball off its seat and oil is discharged along the tube **36** and escapes through the orifice **32**. As the crank-web **17** rotates the oil so discharged forms a curtain of spray which lubricates the internal and external surfaces of the sleeves **20** and therefore also lubricates the pistons and cylinder walls.

It is desirable that the operation of the ball valve shall not be modified by centrifugal force acting on the ball **40**. For this purpose, as shown in Figure 3, the ball is arranged so that its centre coincides with the axis **12** about which the crank-shaft rotates. Alternatively, the ball might be so arranged that the combined effects of the spring and centrifugal force maintains its operation constant despite variations in the speed of the engine.

It will be seen that, by arranging the discharge orifice **32** near the inside face of the crank-web **17**, that is to say as near as possible to the plane of the connecting-rods, the curtain of oil-spray above referred to strikes the sleeves and other parts as nearly as possible along the plane containing the cylinder axes. The advantage of arranging the discharge orifice **32** at the periphery of the balance-weight block **31** is that, since this point is at a greater radius from the axis **12** than any other rotating part within the crank-case, the oil is discharged with maximum velocity.

The orifices formed by the notches **44** at the inner end of the tubular member **37** and the narrow annular space between the bush **38** and the member **37** through which the oil has to flow on its way to the passage **43** act to regulate the rate of flow of oil into the tube **36**. Moreover, sludge or other foreign matter in the oil is excluded by these narrow passages, whereby the arrangement also constitutes a filter.

We claim:

1. A hollow crank-shaft having a crank-pin, a balance-weight on the side of the crank-shaft axis opposite the crank-pin, a conduit leading from the interior of the crank-shaft to a discharge orifice near the outer end of the balance-weight, an automatic valve so disposed in said conduit as to be substantially unaffected by centrifugal force, and means for closing said conduit except for one or more narrow orifices.

2. A hollow crank-shaft having a crank-pin, a balance-weight on the side of the crank-shaft axis opposite the crank-pin, a conduit leading from the interior of the crank-shaft to a discharge orifice near the outer end of the balance-weight, a valve seating in said conduit, a ball disposed with its centre lying substantially on the axis of rotation of the crank-shaft, a spring tending to close the ball on to the valve seating, and means for closing said conduit except for one or more narrow orifices.

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