C. B. KIRKHAM.

LUBRICATING PUMP.

APPLICATION FILED SEPT. 5, 1918.

1,363,793.

Patented Dec. 28, 1920.

2 SHEETS—SHEET 1.

FIG. 1

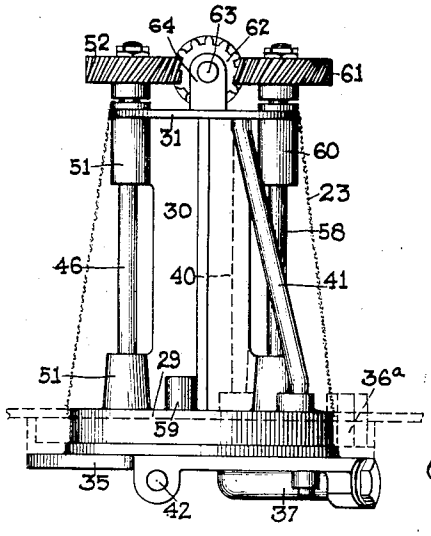


FIG. 3

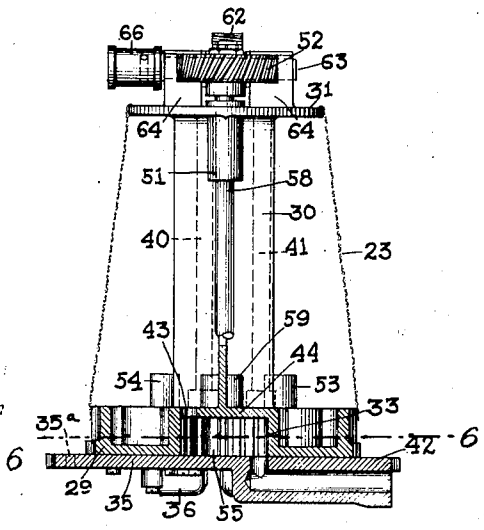


FIG. 2

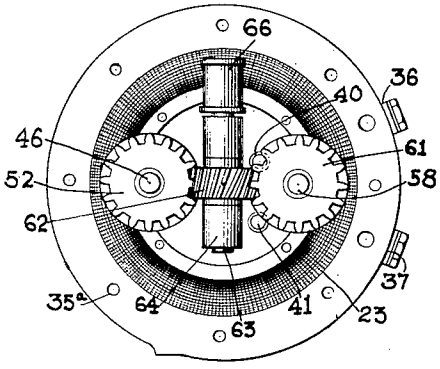


FIG. 4

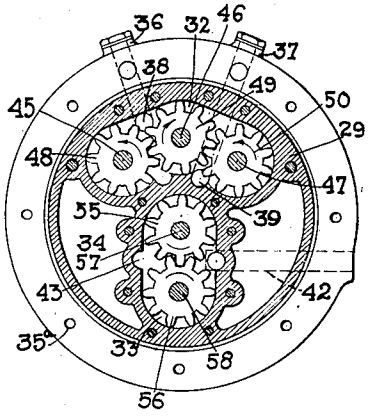
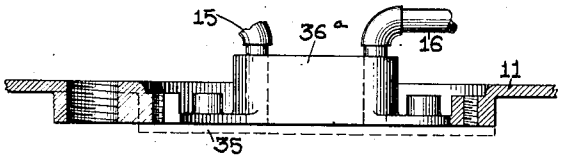


FIG. 5



Inventor

CHARLES B. KIRKHAM

By Attorney

C. B. KIRKHAM.

LUBRICATING PUMP.

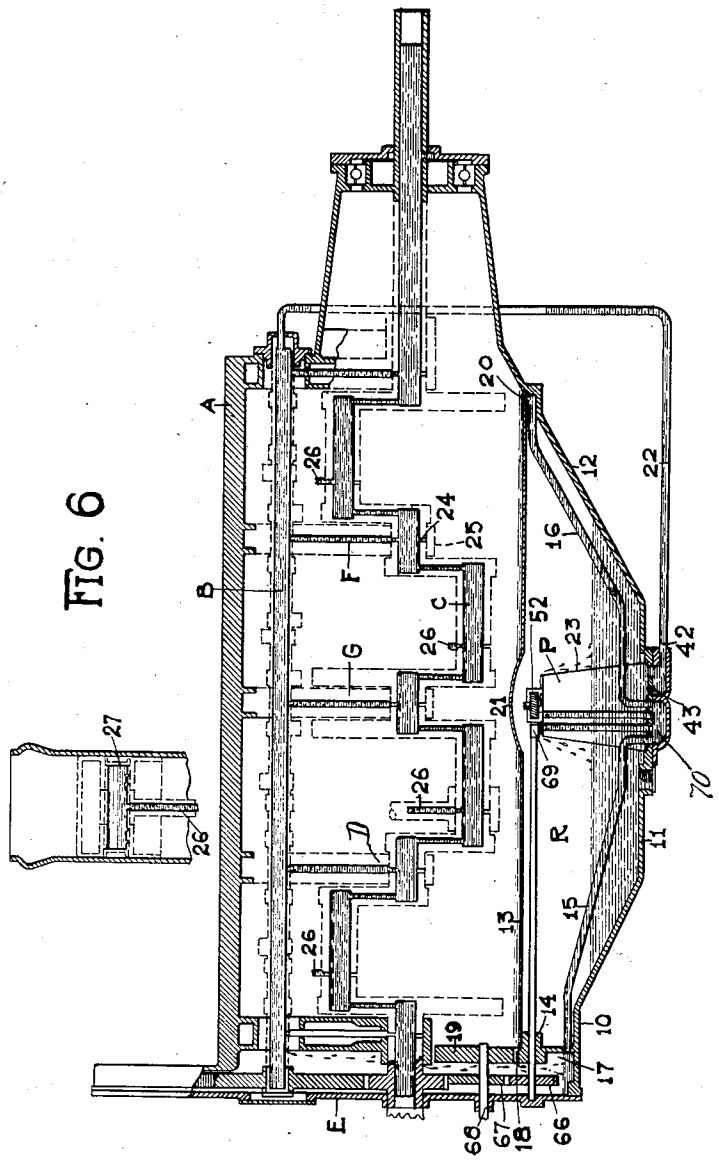
APPLICATION FILED SEPT. 5, 1918.

1,363,793.

Patented Dec. 28, 1920.

2 SHEETS—SHEET 2.

FIG. 6



Inventor

CHARLES B. KIRKHAM

By Attorney

UNITED STATES PATENT OFFICE.

CHARLES B. KIRKHAM, OF GARDEN CITY, NEW YORK, ASSIGNOR, BY MESNE ASSIGNMENTS, TO CURTISS AEROPLANE AND MOTOR CORPORATION, A CORPORATION OF NEW YORK.

LUBRICATING-PUMP.

1,363,793. Specification of Letters Patent. Patented Dec. 28, 1920.

Original application filed September 18, 1915, Serial No. 51,481. Divided and this application filed September 5, 1918. Serial No. 252,717.

To all whom it may concern:

Be it known that I, CHARLES B. KIRKHAM, a citizen of the United States, residing at Nassau Boulevard, Garden City, in the county of Nassau and State of New York, have invented certain new and useful Improvements in Lubricating-Pumps, of which the following is a specification.

This application is a division of my original application Serial Number 51,481, filed September 18th, 1915.

The original application covers an improved lubricating system for internal combustion engines, and particularly engines used on aircraft. The present application is directed more particularly to the lubricating pump illustrated in this application.

An important feature of the invention is to provide a feed pump which is relatively simple in construction and may therefore be manufactured cheaply, and is so designed that it may be quickly mounted in the crank casing or removed therefrom as a unit and without requiring that any portion of the crank casing itself or associated parts of the engine be removed.

A still further object is to so design the pump that the lubricant after passing the circuit of the lubricated parts will be discharged directly into the main reservoir and then drawn from the reservoir after having been first filtered by a screening element and returned along the feed line to the starting point of the lubricated circuit.

The above and other incidental objects of a similar nature which will be hereinafter more specifically treated, are accomplished by such means as are illustrated in the accompanying drawings, described in the following specification and then more particularly pointed out in the claims which are appended hereto and form a part of this application.

With reference to the drawings wherein there has been illustrated the preferred embodiment of the invention as it is reduced to practice, and throughout the several views of which similar reference numerals designate corresponding parts;

Figure 1 is a side view of the preferred form of pump employed,

Fig. 2 is a top plan view of the pump,

Fig. 3 is a composite view partly in elevation in the plane at right angles to the plane of Fig. 1, and partly in vertical section.

Fig. 4 is a section on the line 6—6, Fig. 3,

Fig. 5 is a detail section of the crank case bottom, and

Fig. 6 is a diagrammatic view illustrating the general system of lubrication embodied in the present invention.

Before taking up the detail description of my invention I desire to explain that while the system and apparatus associated therewith has been illustrated in the accompanying drawings in connection with an eight cylinder four cycle engine, it may, nevertheless, be as readily and as efficiently applied to any other type of internal combustion engine without departing in any way from the spirit or scope of the invention, and without requiring that any consequential modification be made.

In describing the invention as embodied in the accompanying drawings reference is now had particularly to Fig. 6 wherein is diagrammatically illustrated the path of the lubricant through the lubricated parts of the engine; the main supply reservoir for the lubricant; the pump whereby the lubricant is fed from the supply reservoir to the lubricated parts; the drip pan upon which falls the lubricant escaping from the bearings; and the conduits which connect each terminal of the drip pan with the pump.

The engine generally designated as an entirety by the letter A is provided with the usual cam shaft B and crank shaft C which members are journaled in suitable bearings designated D and are housed in the crank case indicated at E. The cam and crank shafts B and C are provided throughout their entire length with oil ducts or bores, as best illustrated in Fig. 6, the lubricant being supplied to the ducts of the crank shaft by means of ducts or conduits F which extend through the stationary bearings D of the cam shaft. The lubricant is

fed from the main supply reservoir, indicated at R, through the cam and crank shafts and ducts associated therewith by the pump P in a manner and along a path which will be hereinafter fully explained.

The lubricant reservoir previously designated R is defined by the bottom wall 10 of the crank case E. This bottom wall is provided with a flat horizontal central portion 11 which is disposed a considerable distance below the plane of the perimeter of the wall 10 and is connected therewith by means of the sloping portions 12. These sloping walls 12 converge as shown in Fig. 6, toward the center of the bottom wall so that the lubricant normally tends to collect in the center of the reservoir at which point the pump P is mounted.

Mounted above the bottom of the wall 10 of the crank case and in approximate parallel relation to the flat central portion 11 thereof is a drip pan 13 which member is preferably formed of sheet metal and is suitably supported at its terminals or marginal portions by shoulders 14 or equivalent elements as will be more readily noted upon reference to Fig. 6. The pan 13 is disposed to receive the lubricant as it escapes from the cam and crank shafts. It is necessary that this lubricant falling upon the pan be returned to the main reservoir and for this reason the pump P is connected to each terminal of the pan by means of independent conduits indicated at 15 and 16. The conduit 15 leads into a small collecting chamber 17 into which the lubricant flows from the terminal bearings of the cam and crank shafts and from the adjacent ends of the pan through the bores or ducts 18 formed in the partition 19. The conduit 16 however leads directly to the pan 13 and opens through the upper face thereof as indicated at 20.

From the description thus far given it now becomes apparent that the pump may act to continuously return the lubricant which has been caught by the pan 13, to the main reservoir R regardless of the inclination of the engine bed to the horizontal, since the pump is operatively connected to both terminals of the pan by means of independent conduits.

In order to equally distribute the lubricant between the ends of the drip pan when the engine is in a normal horizontal position, I have provided a draining shed 21 which is formed by stamping up the central portion of the drip pan as in Fig. 6.

The lubricant in being returned to the reservoir R from the drip pan is drawn through the conduits 15 and 16 and is discharged over the upper end of the pump and into the reservoir as indicated in Fig. 6. The feed side of the pump P is connected to the cam shaft by means of a conduit indicated at 22. The lubricant which is forced through this conduit by the feeding gears of the pump is drawn from the main reservoir, but it is first cleaned of all foreign matter by a screen 23. This screen 23 completely houses the pump and it is therefore apparent that the lubricant entering the feed side of the pump must first pass through the screen. The lubricant which is returned to the reservoir from the drip pan does not pass through the screen before entering the reservoir, however, since it is discharged over the top of the pump and over the outside of the screen. The general features of my improved lubricating system will now be fully appreciated. Obviously the lubricant contained in the reservoir R will, after having been cleaned of foreign matter by the screen 23, be started on its path through the conduit 22 by means of the feeding side of the pump. The lubricant passes from the conduit 22 into the cam shaft B from which it passes through the ducts F into the crank shaft C. The lubricant escapes from the crank shaft C through ducts 24 into the connecting rod caps 25 whence it passes up through the connecting rods by means of ducts 26 and into the pistons as at 27. The circulation of the lubricant is effected by virtue of the constant pressure maintained in the lubricated circuit by means of the pump.

The lubricant of course constantly escapes from the several bearings and falls upon the drip pan. From the drip pan the lubricant is returned to the main reservoir R by the pump through the medium of conduits 15 and 16, as previously explained.

The principal features of the lubricating system itself being thus disclosed, reference will now be had particularly to Figs. 1, 2, 3. and 4 in describing the details of construction of the preferred form of pump employed.

The body structure of the pump includes a base casting 29; a vertically disposed web 30 which is cross shaped in cross section, and a circular head plate 31 which is carried on the upper end of the web 30 and preferably formed as an integral part thereof. The base casting 29 constitutes a housing for two sets of meshing gears, one of which operates to draw the lubricant through the conduits 15 and 16 and to discharge it into the main reservoir, and the other of which serves to draw the lubricant from the reservoir and force it through the feed pipe 22.

The first mentioned set of gears are mounted in what will hereinafter be termed a return chamber 32, and the second mentioned set of gears is mounted in a chamber 33 which will hereinafter be referred to as the feed chamber of the pump. The base

casting 29 is cored out as indicated at 34 in order that the pump may be as light as possible. The bottoms of the chambers 32 and 33 are open so that the gears may be inserted or removed during the assembling of the pump or when repairs are to be made. The base plate indicated at 35 is provided, however, to normally seal the bottoms of the chambers 32 and 33. This base plate also serves as a means for attaching the pump to the bottom wall 11 of the crank case, and is provided with screw or bolt receiving apertures indicated at 35ª, for reception of fastening elements to secure the pump to the crank case. Thus, as will be hereinafter more fully explained, the pump may be quickly removed from the crank case or applied thereto as a unit by the mere removal or insertion of the bolts or screws of the base plate 35.

The conduits indicated at 36 and 37 lead into the return chamber 32 at diagonally opposite points as indicated at 38 and 39. The conduits 15 and 16 respectively lead into these two conduits 36 and 37 by way of the boss 36ª (illustrated in Fig. 5) formed integrally with the rim of the opening provided in the crank casing bottom 11 to inclose the pump. This boss receives the ends of the conduits 15 and 16, and serves to establish communication therebetween and the conduits 36 and 37 in such manner as to interfere in no way with the detachability of the pump. Conduits indicated at 40 and 41 lead from the return chamber 32 to the head plate 31 as in Figs. 3 and 4. It is through these two last mentioned conduits that the lubricant is discharged over the top of the head plate and down the outside of the screen 23 and into the reservoir R. The conduit indicated at 42 leads from the feed chamber 33 to the conduit 22, and the intake opening indicated at 43 is formed in the top 44 of the intake chamber 33 to admit the lubricant which is filtered through the screen 23 into the feed chamber.

Within the return chamber 32 are mounted on shafts 45, 46 and 47 three spur gears 48, 49 and 50. These three shafts are arranged at the corners of an imaginary isosceles triangle, the shaft 46 being located at the apex of such triangle. These spur gears mesh with the close fit that is requisite in spur gear lubricating pumps. The shaft 46 extends upwardly through bearings 51 formed on the cross web 30 as in Fig. 3. The upper end of this shaft carries a worm gear 52. It will be seen upon reference to Fig. 6 that rotation of the shaft 46 will be transmitted through the gear 49 to the idler gears 50 and 48. The shafts of gears 50 and 48 are journaled in bearings 53 and 54 respectively, which are formed as integral parts of the base casting.

Within the feed chamber 32 is disposed the meshing spur gears 55 and 56 which are keyed upon shafts 57 and 58 respectively. The shaft 57 is journaled in a bearing 59 which is formed as an integral part of the base casting, while the shaft 58 extends upwardly through bearings 60 and through the head plate 31. Upon the upper terminal of this shaft 58 is keyed a worm gear 61.

Attention is now directed to the fact that the gears 52 and 61 are both meshed with a common actuating worm 62 which member is keyed upon an axle 63 journaled in bearings 64 formed upon the head plate. The rotation of the shaft 63 will of course be transmitted by means of the worm 62 to the worms 52 and 61. Thus the two shafts 46 and 58 are actuated from a common driving element. In actuating the shaft 63 I provide the jack shaft 65 which extends longitudinally through the crank casing and below the drip pan, as fully disclosed in Fig. 2, and is journaled in the partition wall 19 and the end wall of the crank casing. A gear 66 keyed upon the shaft 65 and a gear 67 keyed upon an axle 68 are employed in transmitting the rotation of the crank shaft to the shaft 63.

A coupling 69 which may be of any suitable type is employed in connecting the shafts 65 and 63. This coupling is preferably carried by the shaft 63 so that it may be removed with the pump in case repairs are necessary.

The actual construction and arrangement of the several parts of the pump being thus disclosed, it now remains to describe the manner in which these several parts co-act to draw the lubricant from the drip pan through the conduits 15 and 16 and to discharge it into the reservoir R, and to further explain the manner in which the lubricant is drawn from the reservoir and is fed under pressure through the conduit 22, to the lubricated circuit. In this connection reference will now be had primarily to Fig. 6.

The shaft 46 will, upon rotation, through the medium of gear 49, cause the gears 48 and 50 to rotate in the opposite direction as indicated by arrows in Fig. 4.

Thus, as will be seen upon reference to Fig. 6 the lubricant from one end of the drip pan will be sucked through the conduits 15 and 36 by means of the gears 48 and 49, while the lubricant from the other end of the drip pan will be sucked through the conduits 16 and 37 and into the chamber 32 by the gears 49 and 50. The lubricant drawn into the return chamber through these independent conduits will be forced out through the conduits 40 and 41 by the gears 48 and 49, and 49 and 50. Thus the

return side of the pump is so designed that one set of gears is arranged in a novel manner to cause a simultaneous flow of lubricant from both ends of the drip pan into the return chamber of the pump and to force this supply of lubricant back into the main reservoir R through the conduits 40 and 41.

As indicated at 70 an annular trough or chamber is formed in the bottom wall of the crank case around the base casting of the pump. The trough is provided so that the sediment filtered by the screen 23 will collect upon the base casting 29. Thus when the pump is removed from the reservoir the sediment which has been collected in the reservoir will be simultaneously removed.

At the same time the shaft 58 will be rotating in response to the rotation of the worm 62 which member drives both the worms 61 and 52 as has been previously explained. The rotation of the shaft 58 causes the rotation of the meshing gears 55 and 56 which (assuming they are rotating in the direction indicated by arrows in Fig. 4) will draw the lubricant from the main reservoir into the chamber 33 by way of the opening 43. The lubricant drawn into the chamber 33 will be forced by the gears 55 and 56 through the conduit 42, from which it will pass into the conduit 22 and thereby returned to the lubricated circuit of parts hereinbefore described.

In concluding the description of my present invention I desire now to briefly direct attention as to what are some of its particularly novel features. The crank case is so shaped that the lubricant reservoir, which its bottom wall defines, induces a collection of the lubricant around the pump at all times, thus insuring a constant supply of lubricant to the feed side of the pump without regard to inclination of the engine bed.

The pump contains a duplex set of gears for simultaneously drawing the lubricant from both ends of the drip pan and discharging it back into the main reservoir, and a single set of gears for supplying the lubricant from the reservoir and feeding it under pressure to the lubricating circuit.

The pump is, while made in detachable sections for convenience in assembling or disassembling, designed as a unitary structure which may be readily applied to or removed from the crank case without requiring the disassemblage of this portion of the engine or of any associated parts.

The lubricant falling upon the drip pan from the lubricated parts of the engine may be drawn back into the return side of the pump by both or either one of two independent but complemental return conduits which communicate with the drip pan at opposite ends or portions thereof.

The pump is so designed that but a single set of gears is required to maintain forced flow of the lubricant through the conduits which connect the pump with the drip pan. The lubricant is, after being passed through the lubricated circuit of parts and returned to the main reservoir, filtered by a screening element prior to being again fed into the lubricated circuit.

By inclosing the lubricant reservoir in the manner stated, it is quite evident that the lubricant contained therein cannot, under any circumstances, drain wholly without the reach of the pump to render operation thereof ineffectual in feeding oil to the machine parts.

What I claim is;

1. A lubricating pump comprising a base, a cross shaped vertically disposed web, a circular head plate carried by the upper end of the web, said base having an intake chamber for the reception of a double gear pump and another chamber for the reception of a single gear pump, said web having vertical passages leading downwardly therethrough and communicating with said double pump chamber.

2. A lubricating pump comprising a base casting, an upright member carried thereby, said casting having two chambers therein for the reception of rotary pumps and having inlets and outlets leading to and from said chambers, the outlet from one of the chambers consisting of a vertical passage through said upright, a pair of gear pumps disposed in one of said chambers, a single gear pump disposed in the other of said chambers and means for driving said gear pumps.

3. A lubricating pump comprising a base, a vertically disposed web, a head plate mounted on the upper end of the web, said base, web and head plate being cast in one piece, said base having a pair of gear pump chambers disposed therein, said web having a vertical passage therethrough which serves as an outlet from one of said chambers, gear pumps disposed in said chambers, vertically disposed drive shafts journaled in said casting and actuating said pumps, and a countershaft disposed on said head plate and driving said vertically disposed shafts.

4. A lubricating pump structure having a pair of separate and distinct chambers formed therein, a duplex gear pump disposed in one of said chambers and a single gear pump disposed in the other of said chambers, a screen housing inclosing said chamber structure, the duplex pump chamber comprising an inlet and an outlet which are independent of the screen, the outlets leading to points exteriorly of the screen, and said single pump chamber comprising an inlet leading through said screen and an outlet independent thereof and means for driving said gear pumps.

5. A lubricating pump comprising a sup-

porting base adapted for attachment to a support, a vertically disposed member formed integrally with said base, said base having a pair of gear pump chambers formed therein and inlets and outlets communicating therewith, the outlet for one of said chambers leading upwardly through said vertically disposed member, and the inlet of the other chamber leading from points exteriorly of the pump, a gear pump disposed in each of said chambers, means for driving said gear pump and a filtering screen surrounding said pump for the purpose set forth.

In testimony whereof I hereunto affix my signature.

CHARLES B. KIRKHAM.