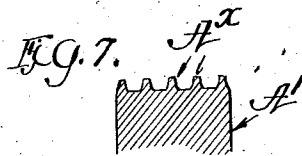
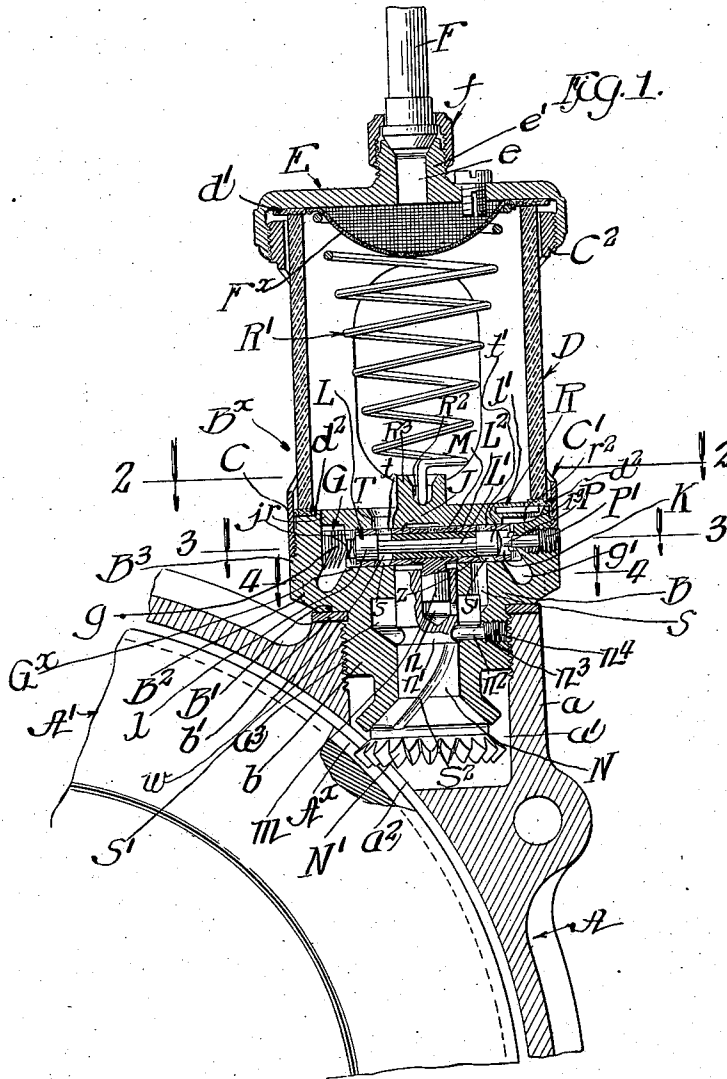


A. LEVEDAHL.
FORCE FEED OILER.
APPLICATION FILED NOV. 7, 1910.

Patented June 4, 1912.
3 SHEETS-SHEET 1.

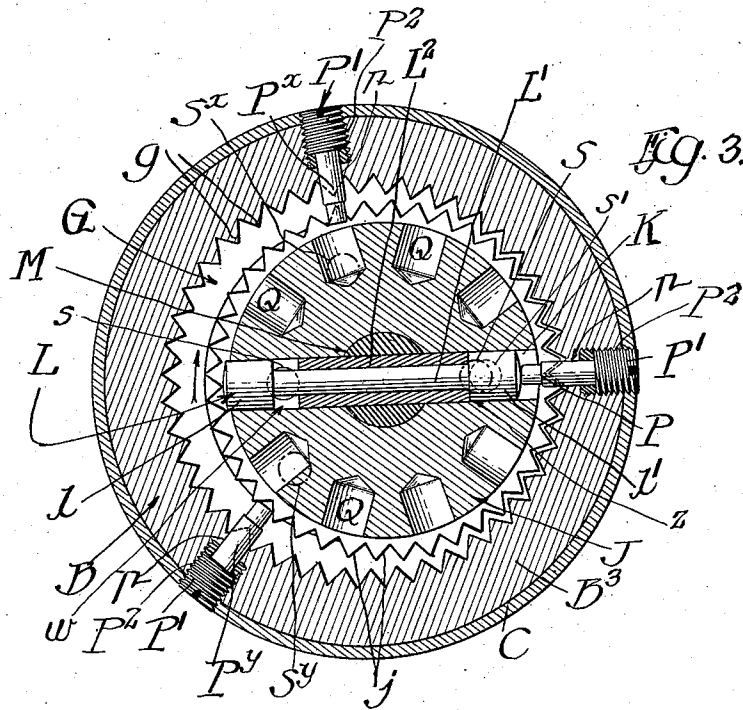
1,028,471.



Witnesses:
J. H. Alfude
L. R. Wilkins

Inventor
Axel Levedahl
by Park & Brown Attys

1,028,471.



Inventor
Axel Levedahl
by Pool & Birren
Attys

A. LEVEDAHL.
 FORCE FEED OILER.
 APPLICATION FILED NOV. 7, 1910.

Patented June 4, 1912.
 3 SHEETS—SHEET 3.

1,028,471.

Fig. 4.

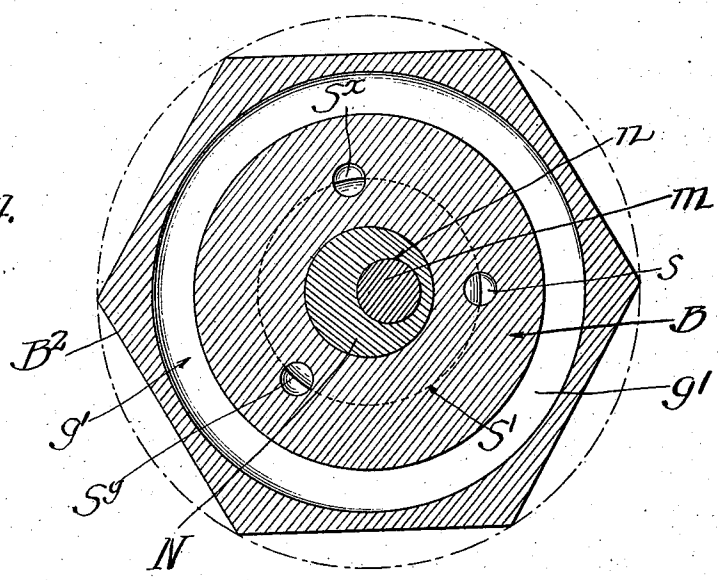
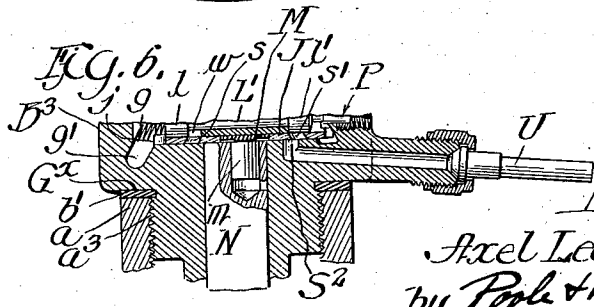
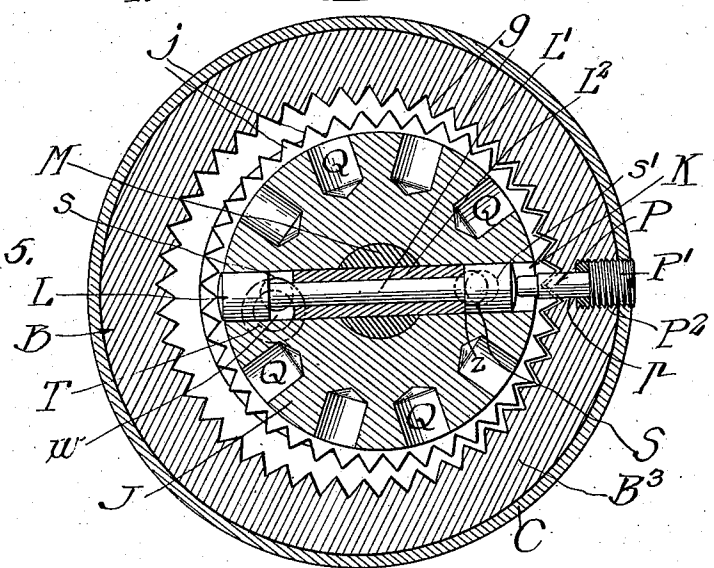


Fig. 5.



Witnesses:
J. H. Alfrede
A. R. Wilkins

Inventor
Axel Levedahl
 by *Park & Brown* Attys

UNITED STATES PATENT OFFICE.

AXEL LEVEDAHL, OF AURORA, ILLINOIS, ASSIGNOR TO AURORA AUTOMATIC MACHINERY COMPANY, OF AURORA, ILLINOIS, A CORPORATION OF ILLINOIS.

FORCE-FEED OILER.

1,028,471.

Specification of Letters Patent.

Patented June 4, 1912.

Application filed November 7, 1910. Serial No. 591,011.

To all whom it may concern:

Be it known that I, AXEL LEVEDAHL, a citizen of the United States, and a resident of Aurora, in the county of Kane and State of Illinois, have invented certain new and useful Improvements in Force-Feed Oilers; and I do hereby declare that the following is a full, clear, and exact description thereof, reference being had to the accompanying drawings, and to the letters of reference marked thereon, which form a part of this specification.

This invention relates to a force feed oiler and consists of the matters hereinafter described and more particularly pointed out in the appended claims.

In the drawings: Figure 1 is a vertical section through the oiler, which is shown herein as attached to the crank-case of a motor. Fig. 2 is a cross-section through the oiler on the line 2—2 of Fig. 1. Fig. 3 is a cross-section on the line 3—3 of Fig. 1. Fig. 4 is a cross-section on the line 4—4 of Fig. 1. Fig. 5 is a cross-section similar to that of Fig. 3 showing a modified form of the device. Fig. 6 is a partial vertical section showing a modified form for delivering the oil fed by the oiler. Fig. 7 is a cross-section through the fly-wheel of the motor to which the oiler is attached.

The improved force feed oiler is shown herein as applied to a motor in which the fly-wheel is provided with means for driving the oiler while the oiler itself is supported upon the crank-casing.

A is the crank-casing, to which, in this instance, the oil is to be fed, containing the fly-wheel A¹ by means of which the oiler is driven.

B^x indicates the oiler as a whole. It embraces a body B, containing the working parts of the oiler and a reservoir D supported on said body and containing a supply of oil.

The crank-casing is provided with an upright boss *a* within which is formed a vertical annular recess *a*¹ which communicates through an opening *a*² with the interior of the crank-casing. Said recessed boss has an internal screw-thread *a*³ at its upper end to receive the lower threaded end *b* of the body B of the oiler. Said body has an annular shoulder B¹ which bears against a washer *b*¹ resting upon the upper end of the boss *a*. Immediately above the shoulder B¹

said body is made of hexagonal or other polygonal section, as indicated at B² (Figs. 1 and 4), so that a wrench may be used in applying the oiler to the boss *a*. Above the part B², the body is preferably cylindric in section as indicated at B³. Said part B³ is provided with an external screw-thread to receive an internally threaded ring C forming the lower end of a skeleton frame C¹ surrounding the reservoir D, which is preferably made of glass.

C² is a ring forming the upper end of the skeleton frame C¹. It is provided with an external screw-thread for the attachment of a cap E which has an annular, depending, internally threaded flange having threaded engagement with said ring C².

The reservoir D is tubular in form and is confined between the upper face of the body B and the lower face of the cap E, cork washers *d*¹, *d*², being interposed between the ends of said reservoir and the said confining members.

F is a pipe connected to a source of oil supply (not shown). Said pipe leads to a central opening *e* in the cap E and is connected to a threaded nipple *e*¹ formed on said cap by means of a coupling *f*, or in any other convenient manner.

In the upper end of the oiler body B is formed a cylindric recess or chamber G which contains the mechanism by means of which a predetermined quantity of oil is taken from the reservoir D and discharged periodically into the crank casing, as in the present instance, or other part to be oiled. The vertical, cylindric wall of said chamber G is provided near its base with a set of internal, radially projecting teeth *g*. Below said teeth there is formed in the bottom wall G^x of said chamber G an annular depression or groove *g*¹ which forms a supplemental reservoir to supply oil for the working parts of the oiler contained in said chamber. Within the inner boundary of said groove, the bottom wall G^x of the chamber G is flat and forms a bearing for a flat disk J (see Figs. 1 and 3), which is of less diameter than that of the chamber G. Said disk is eccentrically placed in said chamber and is provided on its periphery with upper and lower rows of radial teeth *j*, *j* which are adapted to engage the teeth *g* as said disk is rolled edgewise about the walls of said chamber with its un-

der face sliding on the bottom wall G^x thereof.

The disk J is drilled diametrically to form an aperture K parallel to its faces and opening at each end between the planes of the disk teeth j, j . In the aperture K is located a bushing L^2 which is shorter than the diameter of the disk J, said bushing filling said aperture K except at its ends where there are formed piston chambers w and z . l, l^1 indicate piston heads working respectively in said piston chambers w and z and connected by a piston-rod L^1 which has bearing in the bushing L^2 .

t, t^1 are admission ports opening through the top of the disk J into the piston chambers w and z , respectively. s, s^1 are discharge ports opening through the bottom of said disk into the chambers w and z , respectively.

The disk J has a central vertical bore to receive an annular plug M which is bored horizontally to receive the bushing L^2 . On the lower end of said plug M is located a centrally disposed stud m which engages within a recess n eccentrically placed in the upper end of a short vertical shaft N. Said shaft has bearing in the body B of the oiler and its central vertical axis is coincident with the central vertical axis of the chamber G. The central axis of the stud m is positioned from the central vertical axis of the shaft N, a distance equal to one-half of the difference between the pitch diameters of the toothed disk J and of the internally toothed chamber G. From this description it is apparent that the rotation of the shaft N will cause the stud m to revolve about the central vertical axis of said shaft, that is to say, about the central vertical axis of the chamber G, and this will in turn cause the toothed disk J to roll edgewise around the chamber G, the teeth j, j of the disk engaging the teeth g on the vertical walls of the chamber, and the bottom of the disk sliding on the bottom G^x of said chamber. In the present instance the shaft N is driven by the fly-wheel A^1 in the crank-casing A, said shaft being provided at its lower end with a beveled gear N^1 which engages with a worm A^x formed on the periphery of the fly-wheel.

The shaft N may be supported within its bearing in any convenient manner. In the drawings, said shaft is shown as provided on its surface with an annular groove n^1 within which engages the end of a radially disposed pin n^2 . Said pin has a screw-threaded head n^3 which engages within an internally threaded recess n^4 in the body B of the oiler.

Above and resting upon the disk J is a plate R which forms the bottom wall of the reservoir D, and which serves to confine the disk J within the chamber G (see Figs. 1

and 2). Said plate has radial projections r which engage against the cylindric walls of the chamber above the teeth g . Between said projections are formed openings r^1 located above the annular groove g^1 in the lower wall of the chamber G. Said openings permit the oil from the reservoir to freely enter said groove g^1 and fill the space between the teeth g in the vertical wall of said chamber and the teeth j, j of the disk J so that said teeth thus run in oil. One of the parts r of the plate R is provided with a pin r^2 which engages a notch r^3 cut in the upper end of the body B and prevents said plate from rotating with the disk J. The plate R is held in place against the disk J by means of a spiral spring R^1 which bears at its lower smaller end in a socket R^2 formed in a boss R^3 on the upper surface of the plate R and at its upper end bears against the under surface of the cap E. A wire gauze F^x is preferably located below the opening e in the cap E in order to filter the oil, said gauze being shown in the drawings as supported by the spring R^1 , the upper end of which holds the peripheral edges of said gauze in contact with the under face of the cap E.

The plate R is provided with a series of openings or ports in this case three, T, T^x , T^y , which are arranged at equal radial distances from the center of said plate and with which the admission ports t, t^1 , in the top of the disk J, are adapted to be brought to register in the movement of said disk. Below the disk J are located a series of vertical discharge passages S, S^x , S^y , corresponding in number to the ports T, T^x , T^y , and each located at points substantially opposite, in a direction diametric of the chamber G, to one of the ports T, T^x , T^y . Said discharge passages are formed in the body of the oiler and open at their upper ends through the bottom wall G^x of the chamber G at points located at equal radial distances from the center of said bottom wall and such that the discharge ports s, s^1 of the disk J will come to register with the upper ends of said passages in the operation of the disk. Said discharge passages S, S^x , S^y are connected with an annular chamber S^1 in the body of the oiler surrounding the shaft N with its bottom on a level with the groove n^1 on the surface of the shaft. A spiral groove S^2 is formed in the outer surface of the hub of the gear N^1 , with its upper end opening into the annular groove n^1 and its lower end opening into the recess a^1 of the boss a . Thus oil discharged through the passages S, S^x , S^y into the chamber S^1 , will flow by gravity through the groove S^2 into the recess a^1 and thence into the crank casing A.

P, P^x , P^y (see Figs. 1 and 3), indicate pins

projecting radially inward from the walls of the chamber G and located in the plane of the common central axis of the pistons l , l^1 . Said pins are positioned respectively in radial line with the discharge passages S , S^x , S^y and are adapted as the disk J is rolled edgewise about the chamber G to be engaged by the outer ends of the pistons l , l^1 , so as to produce periodic reciprocation of said pistons, first in one direction and then in the opposite direction. Each pin P, P^x , P^y is located in a radial aperture p in the vertical wall of the chamber G. Said aperture is provided at its outer end with an internally screw-threaded enlargement P^2 to receive a screw-threaded enlarged head P^1 formed on the outer end of the pin. By means of this construction the pins may be adjusted radially inward or outward for a purpose which will presently appear. In the operation of the disk, the piston l^1 engages against the pin P which causes said piston l^1 to reciprocate inwardly and the piston l to reciprocate outwardly, the parts then being in the position shown in the drawings. The piston l next engages against the pin P^y which causes said piston to move inwardly and the piston l^1 to move outwardly. The piston l^1 next engages against the pin P^x and is thereby pushed inwardly, causing the piston l to move outwardly and so on, the pistons being alternately engaged by the pins so that each piston is alternately and periodically reciprocated inward and then outward. The relative angular positions of the pins P, P^x , P^y in the wall of the chamber G which correspond with and are radially in line with the discharge passages S , S^x , S^y , respectively, will be more specifically described later.

It is apparent from the above description that when the disk J moves into position where either piston, l^1 , for example, is engaged by one of the pins P, P^x , P^y , so as to be reciprocated inward that the chamber z in which that piston works will be above a discharge passage S , S^x or S^y , and that said chamber will then be open to said discharge passage through its discharge port s^1 . As the admission port t^1 of said chamber is at this time closed against the lower face of the plate R, the inward movement of the piston will force any oil that is in the chamber through the discharge port into the associated discharge passage. At the same time the opposite chamber w in which the piston l has moved outward, is passing under one of the ports T, T^x , T^y of the plate R and said chamber w is open to said port through its admission port t . Oil from the reservoir thus flows into said piston chamber and fills it. Since there is no outlet for this oil, the discharge port s , being closed against the bottom wall G^x of the chamber G, this charge of oil is carried with the

chamber w until its plunger l is engaged by one of the pins P, P^x , P^y when said oil is discharged through its discharge port s into one of the discharge passages S , S^x , S^y , as described in the case of the chamber z , which is at the same time opened to receive another charge of oil. It will be thus apparent that in the operation of the parts above referred to, the piston chambers w and z will be alternately charged and discharged, and that while one piston chamber is being charged the other piston chamber will be discharging the supply previously received. The discharges will be made through the discharge passages S , S^x , S^y in succession. The openings T, T^x , T^y are shown in the drawings (Fig. 2) as slightly in advance of a position in a line passing through the pins P, P^x , P^y , respectively, diametric of the chamber G, considering the disk J as rotating in the direction of the arrow, so that when the admission ports t or t^1 pass under said ports T, T^x or T^y , the piston chambers may be open to the fullest extent by reason of the fact that the piston working in the chamber has moved to the outward limit of its movement before the admission ports t or t^1 come to register under a port T, T^x or T^y .

In the movement of the disk J caused by the rotation of the shaft N and the engagement of the teeth j , j^1 of said disk with the teeth g of the chamber G, each of the admission ports t , t^1 of the piston chambers w and z is brought to register below the port T in the plate R once during each complete rotation of said disk. In the same way each of the discharge ports s , s^1 is brought to register above the vertical discharge passage S once during each complete rotation of the disk.

The number of complete rotations of the disk, as compared to the number of rotations of the shaft N, depends on the difference between the number of teeth j and the number of teeth g . In the example illustrated there are forty-four teeth g and forty teeth j , both multiples of four, the number representing the difference in number between the two sets of teeth. Each time the shaft N makes a complete rotation, the disk J is caused to be rolled edgewise once about the inner periphery of the chamber G, but on account of the difference between the length of the circumference of the disk and the length of the circumference of the chamber, said difference being represented by the four teeth that the latter has in excess of the former, a tooth of the disk which engages a certain tooth of the chamber at the beginning of a rotation of the shaft N, will be four teeth back of the disk tooth which engages the said certain tooth of the chamber at the end of one rotation of the shaft; at the end of the next rotation of the shaft, it will be

four additional teeth or eight teeth back of the tooth engaging with said certain tooth of the chamber and so on, said disk rotating upon its own axis through an angle subtended by four of its teeth for each rotation of the shaft N and in a direction the reverse of the direction in which said shaft is rotating. Thus, as the disk has forty teeth or ten times four teeth, it will be rotated upon its own axis through an angle of 360° at the end of ten rotations of said shaft, and through an angle of 180° at the end of five rotations of the shaft. Starting with the disk J in the angular position shown in Fig. 3, with the piston chamber z on the right and the piston chamber w on the left, it is apparent that at the end of five rotations of the shaft N, the disk will have been rotated so as to bring the piston chamber w into the right hand position and the piston chamber z into the left hand position, and at the end of another five rotations of said shaft, or at the end of ten rotations from the beginning, the piston chamber z will be brought back to its initial position.

Twice in each complete rotation of the disk J and in ten rotations of the shaft N, an end of the bore K will be presented to the pin P and the piston l or l' , being at the outer limit of its movement, will be struck by said pin and pushed to its inner limit of movement, producing a reverse movement in the other piston l or l' . It is apparent that in the operation of the disk J, points in the periphery of the disk separated from the central axis of the bore K by angles subtended by four of the teeth j and by multiples of said angles, will be successively presented to the pin P, and I therefore provide in the periphery of the disk J a series of radial recesses Q, the central axes of which are separated by angles equal to the angle subtended by four teeth of the disk. Thus, when the teeth j at a recess Q come into engagement with the teeth g at the pin P, said pin enters said recess without interfering with the operation of the disk.

In order to provide for a greater number of movements of the pistons l , l' , that is to say, movements intermediate the periodical movements caused by the pin P, which occur respectively at the end of five and of ten rotations of the shaft N, the additional pins P^x and P^y are provided. In the example illustrated, the pin P^x is separated from the pin P by an angle subtended by twelve teeth g of the chamber G, while the pin P^y is separated from the pin P by an angle subtended by sixteen of said teeth, said angle being measured in a counter direction, and said pins P^x and P^y being separated by an angle subtended by sixteen teeth. The numbers of teeth in each case are multiples of four. It is apparent that in the operation of the disk these pins P^x and P^y will engage

within the ends of the bore K and effect each two movements of the pistons l and l' in the same way as the pin P, so that said pistons will be operated four additional times during one rotation of the disk J or during ten rotations of the shaft N. The pins P^x and P^y are located as nearly as may be at equal angular distances from the pin P, but may not be located at exactly equal angular distances in the present instance, because said angles must each be subtended by a number of teeth corresponding to a multiple of four, which would not be true in this case if the angular distances were exactly equal. When they do not engage within the ends of the bore K so as to effect movement of the pistons l , l' , the pins P^x , P^y will engage within one of the recesses Q, as in the case of the pin P, without obstructing the operation of said disk.

The operation of the improved oiler is as follows:—Oil flows in through the pipe F so as to fill the reservoir D. From thence it flows through the openings r^1 in the plate R into the groove g^1 in the bottom of the chamber G whence it works between the bearing surfaces of the working parts contained in said chamber. Oil flows into and fills the apertures T, T^x , T^y in the plate R from which it flows through the admission ports t , t^1 into the disk J when said ports pass under said apertures in the movement of the disk. From said apertures the oil flows into and fills the piston chambers w or z when the position of the plungers l or l' in said chambers leaves them open for the reception of oil. From the piston chambers w and z the oil is alternately discharged through the discharge ports s , s^1 when said ports come above the discharge passages S, S^x , S^y .

In Fig. 1 the parts are shown in position just after the pin P has effected movement of the plunger l' to its inner limit of movement and of the plunger l to its outer limit, thus closing the piston chamber z and opening the piston chamber w , which is filled with oil from the aperture T. In the movement of the disk as it rolls edgewise about the walls of the chamber G and slides on the bottom wall G^x of said chamber, said disk is next brought into position where the pin P^y engages against the plunger l and effects an inward movement of said plunger and an outward movement of the plunger l' . At this time the discharge port s of the chamber w is above the passage S^y which communicates with the chamber about the shaft N and the admission port t is closed by the under face of the plate R. The movement of the piston l forces the oil out of the chamber w through the discharge port s into the discharge passage S^y . At the same time, the piston l' , moving to the outer limit of its movement, has opened up the chamber z , thereby producing a partial vacuum

(since the discharge port s^1 is closed against the bottom wall of the chamber G) which causes the oil which has filled the admission port t^1 from the aperture T^v in the plate R to be sucked into and fill the chamber z . The further movement of the disk brings the piston l^1 into engagement with the pin P^x which effects an inward movement of the piston l^1 and an outward movement of the piston l . The admission port t has now passed under the aperture T^x of the plate R, the discharge port s being closed against the bottom wall G^x of the chamber G, while the admission port t^1 of the chamber z has been closed against the under side of the plate R and the discharge port s^1 brought into position above the passage S^x . Thus, the inward movement of the piston l^1 discharges the oil from the chamber z into the passage S^x , while the outward movement of the piston l has caused oil to be sucked in through the admission port t to again fill the chamber w . The movement of the disk next brings the plunger l into engagement with the pin P which effects movements of said pistons to discharge the chamber w and fill the chamber z in like manner, as in the case of the other pins, and the operation continues, the chambers in the disk being alternately filled from one of the apertures T , T^x , T^v and discharged into one of the passages S , S^x , S^v . Oil is thus forced at succeeding intervals into the chamber about the shaft N whence it passes through the groove therein into the recess a^1 and from there is supplied to the gear casing.

If the use of three pins above described produces a larger feed of oil than is necessary to supply the particular parts to be supplied with a lubricant, the pins P^x and P^v may be omitted as illustrated in Fig. 5, where only the one pin P is used. In such case the apertures T^x and T^v in the plate R are likewise omitted as are also the discharge passages S^x and S^v . In this case the chambers w and z in the disk are each filled and discharged once during each complete revolution of the disk J and during 10 revolutions of the shaft N. The oil may be discharged in other ways as for example in Fig. 6, where S^2 represents an oil passage opening through the bottom wall G^x of the chamber G, which passage is connected with a pipe U leading to any part of the machine requiring an oil feed.

The pins P , P^x , P^v may be adjusted inwardly or outwardly in order to determine the length of the reciprocation of the pistons l , l^1 an equal adjustment being made with reference to all the pins. In this way the amount of oil withdrawn from the reservoir and discharged through the discharge passages S , S^x , S^v at each reciprocation of said pistons may be adjusted.

The spring R^1 which holds the plate R

yieldingly in engagement with the disk J, takes up the wear between the disk and the parts against which it slidably engages and thus always insures a tight joint.

It will be noted that in the action of the oiler, when oil is being taken from the reservoir into one of the piston chambers, the discharge port of said chamber is closed against the bottom G^x of the chamber G and that when oil is being discharged from said piston chamber through its exhaust port, its admission port is closed against the plate R, there being at no time any connection between the reservoir and a discharge passage. Thus, there will at no time be any action to cause a vacuum, air bubbles or compression in the discharge passages or in the oil receptacle to which said discharge passages lead, and the reservoir can be left with a proper air opening to compensate the oil used without any deleterious result.

The use of the oil filter F^x prevents the passage of any extraneous matter with the oil into the parts supplied by the oil feed.

While in illustrating one embodiment of my invention, I have shown and described certain details of mechanical construction and arrangement, it is apparent that these may be modified in various ways without departing from the spirit of my invention and I do not wish to be limited thereby except as pointed out in the appended claims.

I claim as my invention:—

1. In combination with a reservoir, a closure for said reservoir embracing bearing members and an interposed, relatively movable sliding member engaged between said bearing members, and having both a sliding and a rotative movement, said relatively movable member having a piston chamber provided with an admission port and an exhaust port, each closed against one of said bearing members, a reciprocable piston in said piston chamber, a supply port in one bearing member opening into the reservoir, a discharge passage in the other bearing member offset from said supply port, automatic means for producing relative movement of the members to alternately bring said admission port of said piston chamber to register with said supply port and its exhaust port to register with said discharge passage, and automatic means for intermittently reciprocating said piston.

2. In combination with a reservoir, a closure for said reservoir embracing inner and outer flat bearing members and an interposed plate slidably engaged between said bearing members, and having both a sliding and a rotative movement, said plate having a piston chamber provided with an admission port closed against said inner bearing member and an exhaust port closed against said outer bearing member, a reciprocable piston in said piston chamber, a supply port

in said inner bearing member, a discharge passage in said outer bearing member offset from said supply port, automatic means for moving said plate to alternately bring said admission and exhaust ports of said piston chamber to register respectively with said supply port and discharge passage, and automatic means for intermittently reciprocating said piston.

3. In combination with a reservoir, a closure for said reservoir embracing inner and outer flat bearing members and an interposed plate slidably engaged between said bearing members, said plate having a piston chamber provided with an admission port closed against said inner bearing member and an exhaust port closed against said outer bearing member, a reciprocable piston in said piston chamber, a supply port in said inner bearing member, a discharge passage in said outer bearing member offset from said supply port, automatic means for moving said plate to alternately bring said admission and exhaust ports of said piston chamber to register respectively with said supply port and discharge passage, and automatic means for intermittently reciprocating said piston, said last named means being adjustable to determine the length of the reciprocation of said piston.

4. In combination with a reservoir, a chamber adjacent said reservoir having a flat wall and a surrounding cylindric wall provided with internal radial teeth, a flat disk bearing against the flat wall of said chamber and provided with peripheral teeth adapted to engage the teeth of said chamber, said disk being of less diameter than said chamber and being eccentrically placed therein, a flat plate intermediate said flat chamber wall and said reservoir bearing against said flat disk and confining the same within said chamber, a piston chamber in said disk having oppositely disposed admission and exhaust ports, said exhaust port being closed against the wall of said chamber and said admission port being closed against said flat plate, a piston reciprocable in said piston chamber, a supply port in said flat plate, a discharge passage opening through the flat wall of said chamber at a point offset from said supply port, means for causing said disk to roll edgewise about the cylindric walls of said chamber with its opposite faces in sliding engagement with said plate and the flat wall of said chamber adapted to alternately bring said admission and exhaust ports of said piston chamber to register with said supply port and discharge passage, and means projecting from the wall of said chamber adapted to reciprocate said piston.

5. In combination with a reservoir, a chamber adjacent said reservoir having a flat wall and a surrounding cylindric wall

provided with internal radial teeth, a flat disk bearing against the flat wall of said chamber and provided with peripheral teeth adapted to engage the teeth of said chamber, said disk being of less diameter than said chamber and being eccentrically placed therein, a flat plate intermediate said flat chamber wall and said reservoir bearing against said flat disk and confining the same within said chamber, a piston chamber in said disk having an admission and an exhaust port oppositely disposed, said exhaust port being closed against the flat wall of said chamber and said admission port being closed against said plate, a piston reciprocable in said piston chamber, means for causing said disk to roll edgewise about the cylindric walls of said chamber with its opposite faces in sliding engagement respectively with said plate and the flat wall of said chamber, said plate and flat chamber wall being provided respectively with a supply port and a discharge passage offset from each other and positioned to alternately register with the associated ports of said piston chamber in the movement of said disk, and a pin located in said chamber wall adapted to reciprocate said piston.

6. In combination with a reservoir, a chamber adjacent said reservoir having a flat wall and a surrounding cylindric wall provided with internal radial teeth, a flat disk bearing against the flat wall of said chamber and provided with peripheral teeth adapted to engage the teeth of said chamber, said disk being of less diameter than said chamber and being eccentrically placed therein, a flat plate intermediate said flat chamber wall and said reservoir bearing against said flat disk and confining the same within said chamber, a piston chamber in said disk having an admission and an exhaust port oppositely disposed, said exhaust port being closed against the wall of said chamber and said admission port being closed against said plate, a piston reciprocable in said piston chamber, means for causing said disk to roll edgewise about the cylindric walls of said chamber with its opposite faces in sliding engagement respectively with said plate and the flat wall of said chamber, said plate and flat chamber wall being provided respectively with a supply port and a discharge passage offset from each other and positioned to alternately register with the associated ports of said piston chamber in the movement of said disk, a pin located in said chamber wall adapted to reciprocate said piston, and means for adjusting the position of said pin to determine the length of the reciprocation of said piston.

7. In combination with a reservoir, a chamber adjacent said reservoir having a flat wall and a surrounding cylindric wall

provided with internal radial teeth, a flat disk bearing against the flat wall of said chamber and provided with peripheral teeth adapted to engage the teeth of said chamber, said disk being of less diameter than said chamber and being eccentrically placed therein a distance equal to one-half the difference between the pitch diameters of said disk and chamber teeth, a flat plate intermediate said flat chamber wall and said reservoir bearing against said flat disk and confining the same within said chamber, diametric and oppositely placed piston chambers located in said disk and opening through the peripheral edges thereof, each piston chamber having an admission port and an exhaust port oppositely disposed, said exhaust ports being closed against the flat wall of said chamber and said admission ports being closed against said plate, pistons reciprocable in said piston chambers, means connecting said pistons whereby the movement of one is communicated to the other, a rotative shaft journaled in said flat chamber wall co-axial with said chamber, a stud rigid with said disk and co-axial therewith, said stud engaging within a recess in said shaft, a pin projecting from the circumferential wall of said disk adapted to engage the outer ends of said pistons, and a supply port in said plate and a discharge passage in the flat wall of said chamber substantially in a line diametric of said chamber with said pin.

8. In combination with a reservoir, a chamber adjacent said reservoir having a flat wall and a surrounding cylindric wall provided with internal radial teeth, a flat disk bearing against the flat wall of said chamber and provided with peripheral teeth which are adapted to engage the teeth of said chamber, said disk being of less diameter than said chamber and being eccentrically placed therein a distance equal to one-half the difference between the pitch diameters of the teeth of said disk and chamber, a flat plate intermediate said flat chamber wall and said reservoir, bearing against said flat disk and confining the same within said chamber, diametric and oppositely placed piston chambers located in said disk and opening through the peripheral edges thereof, each piston chamber having an admission port and an exhaust port oppositely disposed, said exhaust ports being closed against the flat wall of said chamber and said admission ports being closed against said plate, pistons reciprocable in said piston chambers, a rod connecting said pistons, a rotative shaft journaled in said flat chamber wall and co-axial with said chamber, a stud rigid with said disk and co-axial therewith, said stud engaging within a recess in the end of said shaft, a supply port in said plate and a discharge passage in

the flat wall of said chamber arranged substantially in a line diametric of the chamber, a pin projecting inwardly from the wall of said chamber in line with the supply port in said plate and the discharge passage in said flat chamber wall, said pin being adapted to be engaged by the ends of said pistons in the movement of said disk, and apertures located in the periphery of said disk, spaced at angular distances from the axes of said piston chambers corresponding to angles subtended by the difference between the number of teeth in said disk and the number of teeth in said chamber wall and multiples thereof.

9. In combination with a reservoir, a chamber adjacent said reservoir having a flat wall and a surrounding cylindric wall provided with internal radial teeth, a flat disk bearing against the flat wall of said chamber and provided with peripheral teeth which are adapted to engage the teeth of said chamber, said disk being of less diameter than said chamber and being eccentrically placed therein a distance equal to one-half the difference between the pitch diameters of the teeth of said disk and chamber, a flat plate intermediate said flat chamber wall and said reservoir, yieldingly held against said flat disk and confining the same within said chamber, diametric and oppositely placed piston chambers located in said disk and opening through the peripheral edges thereof, said piston chamber having an admission port and an exhaust port oppositely disposed, said exhaust ports being closed against the flat wall of said chamber and said admission ports being closed against said plate, pistons reciprocable in said piston chambers, a rod connecting said pistons, a rotative shaft journaled in said flat chamber wall co-axial with said chamber, a stud rigid with said disk and co-axial therewith, said stud engaging within a recess in the end of said shaft, a supply port in said plate and a discharge passage in the flat wall of said chamber arranged substantially in a line diametric of the chamber, a pin projecting inwardly from the wall of said chamber in line with the supply port in said plate and the discharge passage in said flat chamber wall, said pin being adapted to be engaged by the ends of said pistons in the movement of said disk, and apertures located in the periphery of said disk, spaced at angular distances from the axes of said piston chambers corresponding to angles subtended by the difference between the number of teeth in said disk and the number of teeth in said chamber wall and multiples thereof.

10. In combination with a reservoir, a chamber adjacent said reservoir having a flat wall and a surrounding cylindric wall provided with internal radial teeth, a flat

disk bearing against the flat wall of said chamber and provided with peripheral teeth which are adapted to engage the teeth of said chamber, said disk being of less diameter than said chamber and being eccentrically placed therein a distance equal to one-half the difference between the pitch diameters of the teeth of said disk and chamber, a flat plate intermediate said flat chamber wall and said reservoir, bearing against said flat disk and confining the same within said chamber, diametric and oppositely placed piston chambers located in said disk and opening through the peripheral edges thereof, each piston chamber having an admission port and an exhaust port oppositely disposed, said exhaust ports being closed against the flat wall of said chamber and said admission ports being closed against said plate, pistons reciprocable in said piston chamber, a rod connecting said pistons, a rotative shaft journaled in said flat chamber wall, co-axial with said chamber, a stud rigid with said disk and co-axial therewith, said stud engaging within a recess in the end of said shaft, a plurality of supply ports in said plate and an equal number of discharge passages in the flat wall of said chamber, each discharge passage being arranged substantially in a line diametric of the chamber with a supply port in said plate, a like number of pins projecting inwardly from the wall of said chamber, each in line with a supply port in said plate and a discharge passage in said flat chamber wall, said pins being adapted to be engaged by the ends of said pistons, said pins being spaced at angular distances from each other corresponding to multiples of angles subtended by the difference between the number of teeth in said disk and the number of teeth in said chamber wall, and apertures in the periphery of said disk adapted to be entered by said pins in the operation of said disk.

11. In combination with a reservoir, a chamber adjacent said reservoir having a flat wall and a surrounding cylindric wall provided with internal radial teeth, a flat disk bearing against the flat wall of said chamber and provided with peripheral teeth which are adapted to engage the teeth of said chamber, said disk being of less diameter than said chamber and being eccentrically placed therein a distance equal to one-half the difference between the pitch diameters of the teeth of said disk and chamber, a flat plate intermediate said flat chamber wall and said reservoir, bearing against said flat disk and confining the same within said chamber, diametric and oppositely placed piston chambers located in said disk and opening through the peripheral edges thereof, each piston chamber having an admission port and an exhaust port oppositely

disposed, said exhaust ports being closed against the flat wall of said chamber and said admission ports being closed against said plate, pistons reciprocable in said piston chamber, a rod connecting said pistons, a rotative shaft journaled in said flat chamber wall co-axial with said chamber, a stud rigid with said disk and co-axial therewith, said stud engaging within a recess in the end of said shaft, a plurality of supply ports in said plate and an equal number of discharge passages in the flat wall of said chamber, each discharge passage being arranged substantially in a line diametric of the chamber with a supply port in said plate, a like number of pins projecting inwardly from the wall of said chamber each in line with a supply port in said plate and a discharge passage in said flat chamber wall, said pins being adapted to be engaged by the ends of said pistons, said pins being spaced at angular distances from each other corresponding to multiples of angles subtended by the difference between the number of teeth in said disk and the number of teeth in said chamber wall, said pins being longitudinally adjustable, and apertures in the periphery of said disk adapted to be entered by said pins in the operation of said disk.

12. In combination with a reservoir, a chamber adjacent said reservoir having a flat wall and a surrounding cylindric wall provided with internal radial teeth, a flat disk bearing against the flat wall of said chamber and provided with peripheral teeth which are adapted to engage the teeth of said chamber, said disk being of less diameter than said chamber and being eccentrically placed therein a distance equal to one-half the difference between the pitch diameters of the teeth of said disk and chamber, a flat plate intermediate said flat chamber wall and said reservoir, bearing against said flat disk and confining the same within said chamber, diametric and oppositely placed piston chambers located in said disk and opening through the peripheral edges thereof, each piston chamber having an admission port and an exhaust port oppositely disposed, said exhaust ports being closed against the flat wall of said chamber and said admission ports being closed against said plate, pistons reciprocable in said piston chamber, a rod connecting said pistons, means acting to roll said disk edgewise about the cylindric wall of said chamber, in sliding engagement with said flat chamber wall and said plate, a plurality of supply ports in said plate and an equal number of discharge passages in the flat wall of said chamber, each discharge passage being arranged substantially in a line diametric of the chamber with a supply port in said plate, a like number of pins projecting inwardly from the wall of said chamber,

each in line with a supply port in said plate and with a discharge passage in said flat chamber wall, said pins being adapted to be engaged by the ends of said pistons, said 5 pins being spaced at angular distances from each other corresponding to multiples of angles subtended by the difference between the number of teeth in said disk and the number of teeth in said chamber wall, and 10 apertures in the periphery of said disk adapted to be entered by said pins in the operation of said disk.

13. In combination with a reservoir, a chamber adjacent said reservoir having a 15 flat wall and a surrounding cylindric wall provided with internal radial teeth, a flat disk bearing against the flat wall of said chamber and provided with peripheral teeth adapted to engage the teeth of said chamber, 20 said disk being of less diameter than said chamber and being eccentrically placed therein a distance equal to one-half the difference between the pitch diameters of the teeth of said disk and chamber, a non-rotative 25 plate closing said chamber and yieldingly held against said flat disk to confine the same within said chamber, said plate being provided with peripheral apertures opening into said chamber, a peripheral 30 groove in the flat wall of said chamber, diametrically and oppositely spaced piston chambers located in said disk and opening through the peripheral edges thereof, each piston chamber having an admission port 35 and an exhaust port oppositely disposed, said exhaust port being closed against the flat wall of said chamber and said admission port being closed against said plate, pistons reciprocable in said piston chamber, 40 a rod connecting said pistons, means acting to roll said disk edgewise about the cylindric wall of said chamber and in sliding engagement with said plate and said flat chamber wall, a supply port in said plate 45 and a discharge passage in the flat wall of said chamber arranged substantially in a line diametric to the chamber, and a pin projecting inwardly from the wall of said chamber in line with the supply port in said 50 plate and the discharge passage in said flat chamber wall, said pin being adapted to be engaged by the ends of said pistons.

14. In combination with a reservoir, an oiler body having a chamber adjacent said 55 reservoir, said chamber having a flat wall and a surrounding cylindric wall provided with internal radial teeth, a flat disk bearing against the flat wall of said chamber

and provided with peripheral teeth adapted to engage the teeth of said chamber, said 60 disk being of less diameter than said chamber and being eccentrically placed therein a distance equal to one-half the difference between the pitch diameters of the teeth of said disk and chamber, a non-rotative plate 65 closing said chamber and yieldingly held against said flat disk to confine the same within said chamber, diametrically and oppositely placed piston chambers located in said disk and opening through the periph- 70 eral edges thereof, each piston chamber having an admission port and an exhaust port oppositely disposed, said exhaust ports being closed against the flat wall of said chamber and said admission ports being closed 75 against said plate, pistons reciprocable in said piston chamber, a rod connecting said pistons, a rotative shaft journaled in said oiler body co-axial with said chamber, a stud rigid with said disk and co-axial there- 80 with, said stud engaging within a recess in said shaft, a supply port in said plate and a discharge passage in said oiler body opening through the flat wall of said chamber substantially in a line diametric of the cham- 85 ber, a pin projecting inwardly from the wall of said chamber in line with said supply port and discharge passage, said pin being adapted to be engaged by the ends of said pistons, a channel formed in said oiler 90 body about said shaft, said discharge passage being connected to said channel, and an open groove formed in said shaft leading from said channel.

15. In a device of the character described, 95 a disk provided with a diametric bore, a bushing located in said bore, said bushing terminating short of the end of said bore forming piston chambers opening through the periphery of said disk, pistons working 100 in said piston chambers, a rod connecting said pistons and having bearing in said bushing, said rod being longer than said bushing, said plate having a central aperture, and a plug located in said aperture, 105 said plug being bored diametrically to receive said bushing.

In testimony that I claim the foregoing as my invention I affix my signature in the presence of two witnesses, this 2nd day of 110 November A. D. 1910.

AXEL LEVEDAHL.

Witnesses:

FRANK S. RHOADS,
R. A. NORLING.