No. 822,238. PATENTED JUNE 5, 1906.

E. A. BARNES.

ANTILUBRICANT THROWING DEVICE.

APPLICATION FILED NOV. 3, 1904.

2 SHEETS—SHEET 1.

Fig. 1.

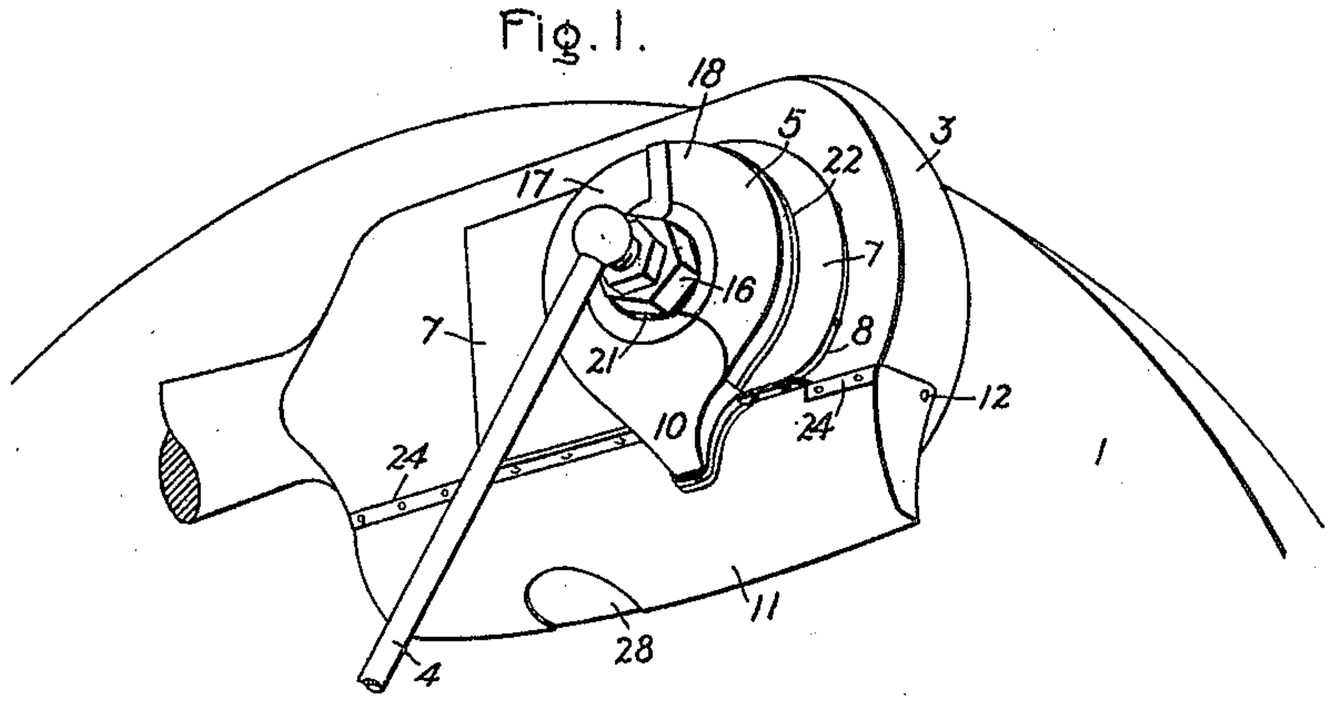


Fig. 2.

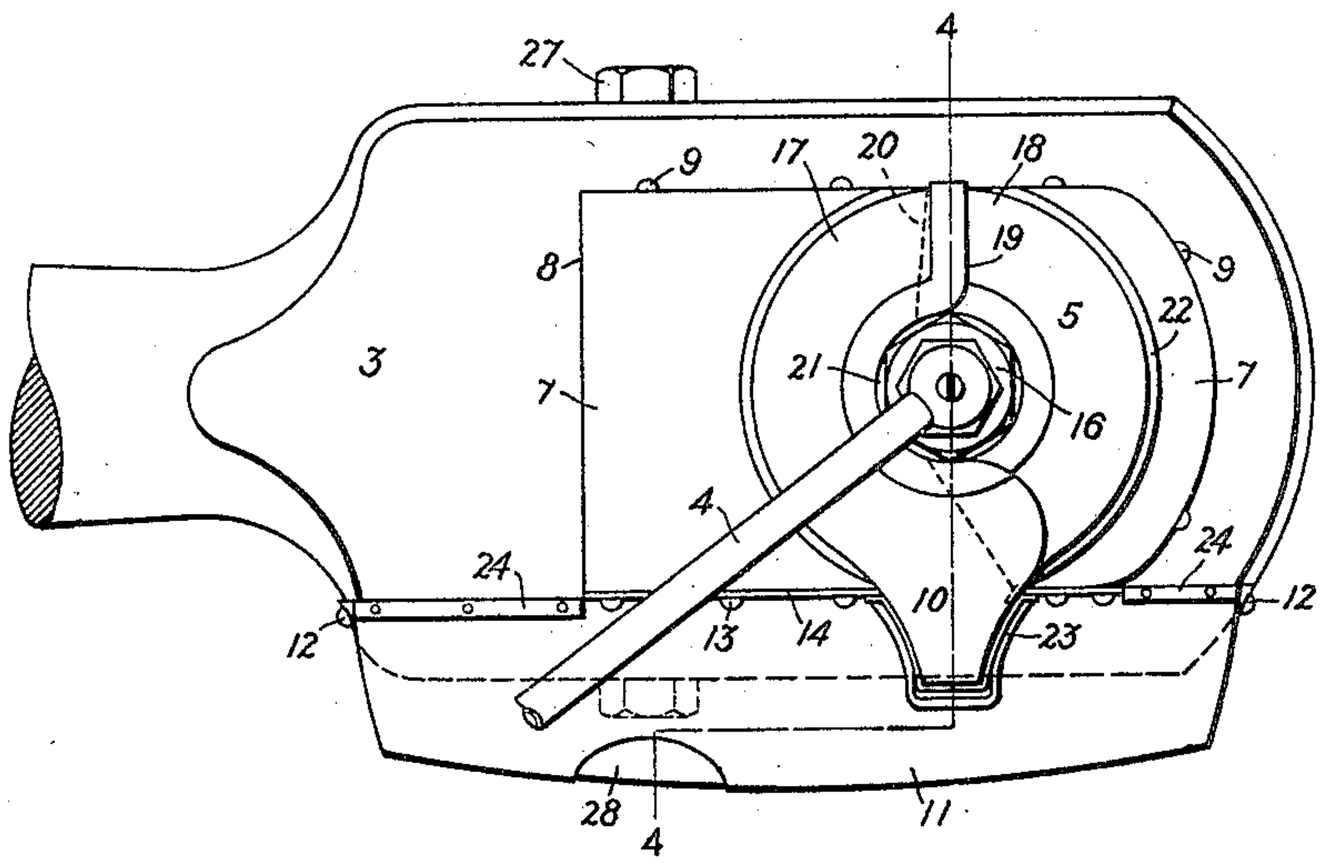
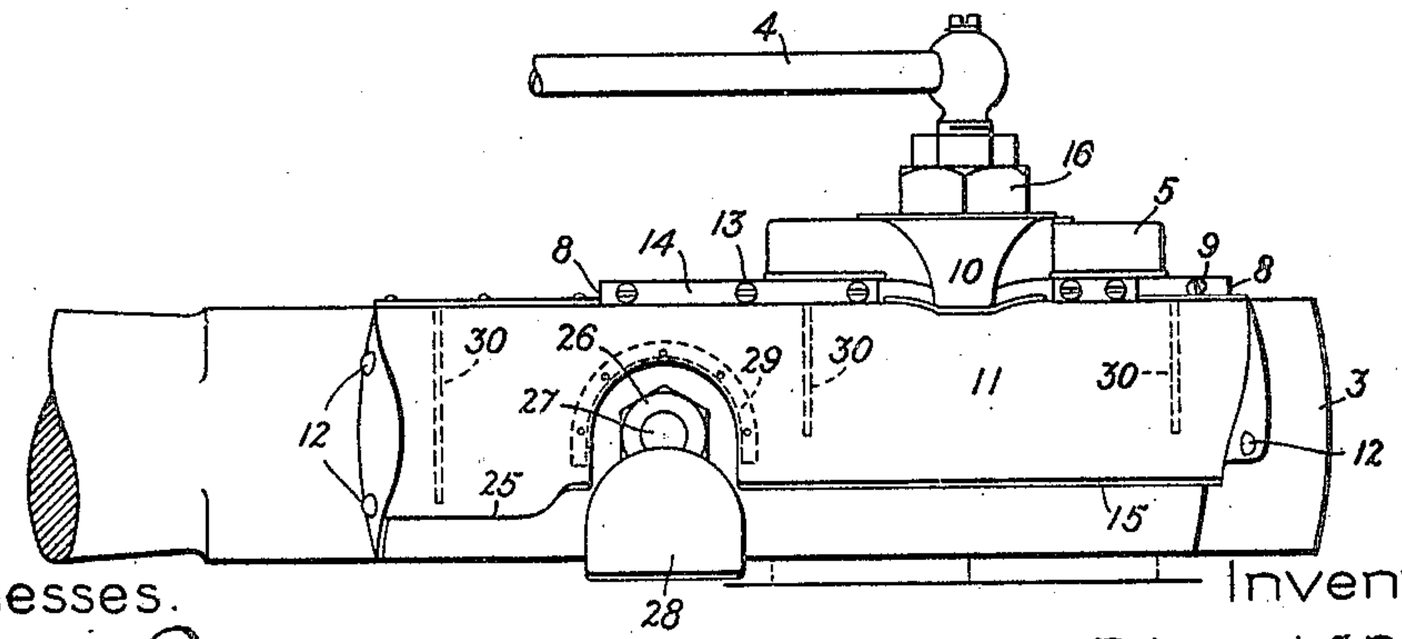


Fig. 3.



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2 SHEETS—SHEET 2.

Fig. 4.

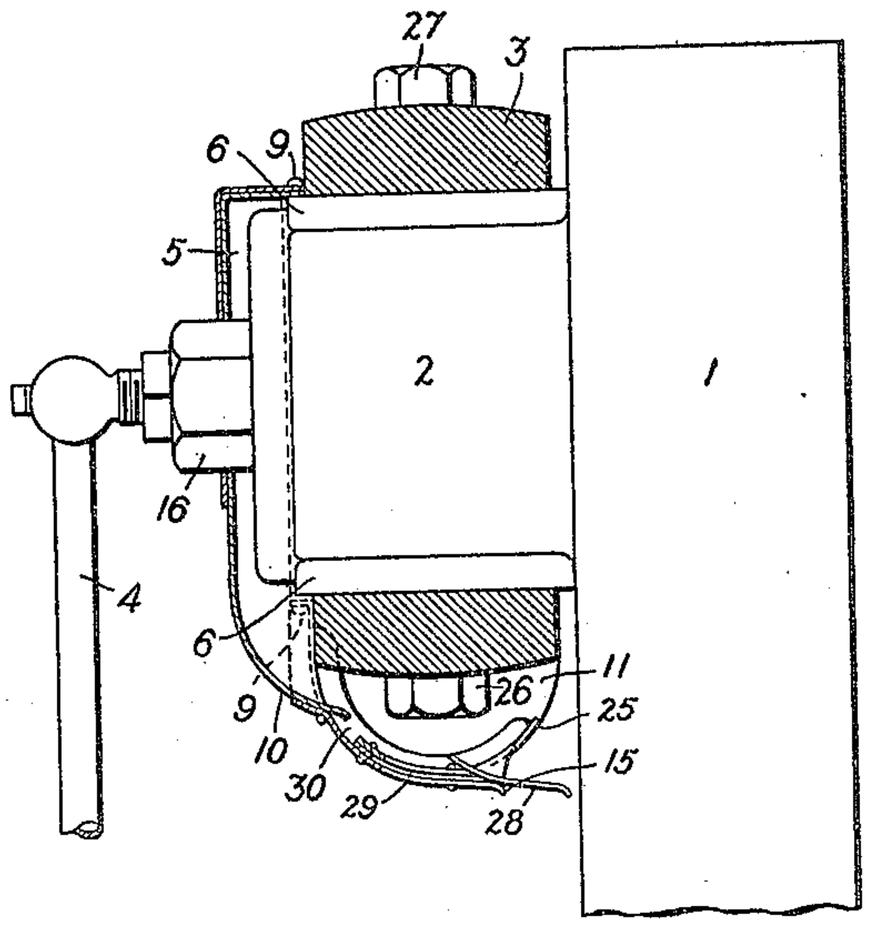
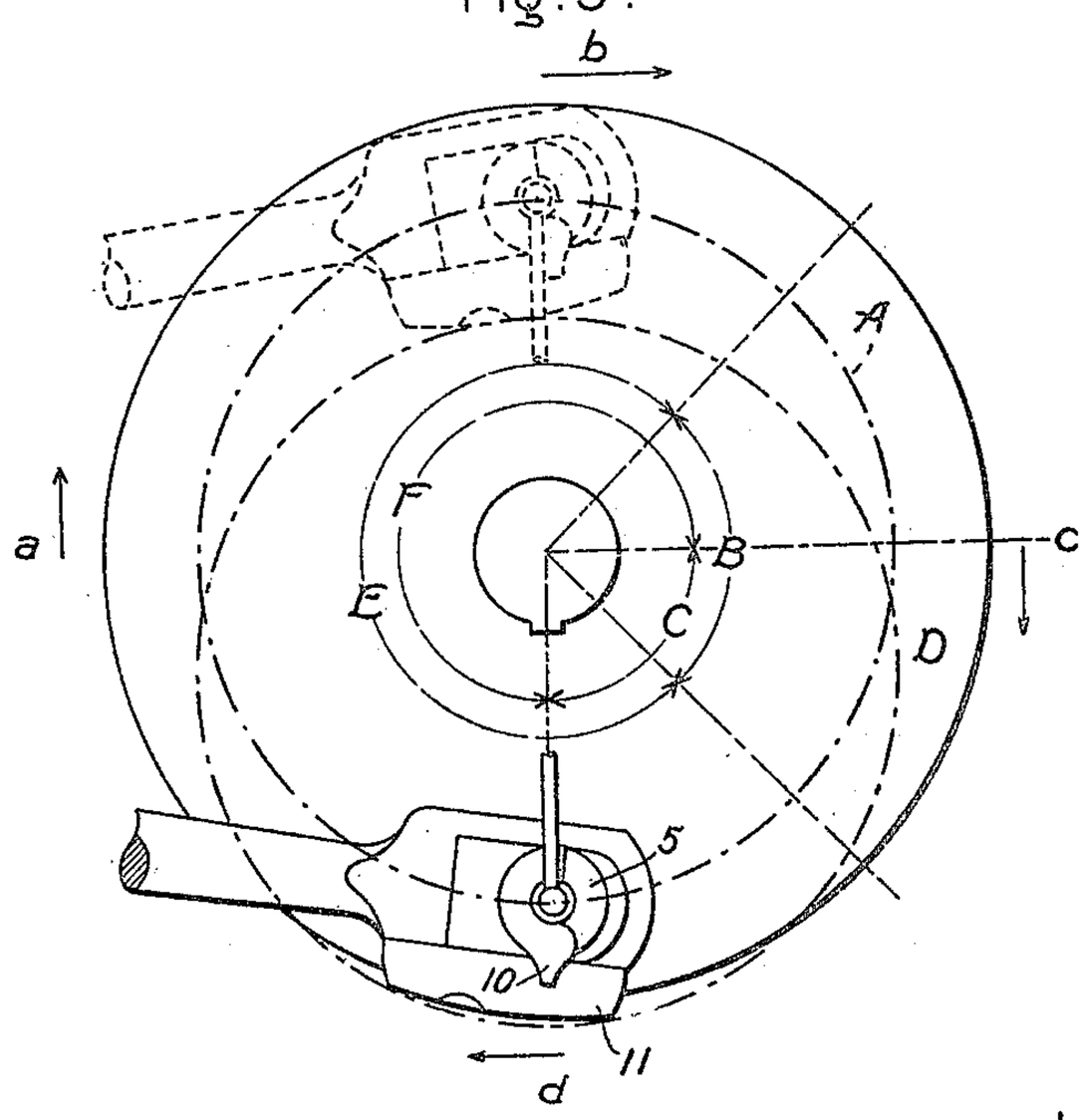


Fig. 5.



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UNITED STATES PATENT OFFICE.

EDWARD A. BARNES, OF FORT WAYNE, INDIANA, ASSIGNOR TO GENERAL ELECTRIC COMPANY, A CORPORATION OF NEW YORK.

ANTILUBRICANT-THROWING DEVICE.

No. 822,238. Specification of Letters Patent. Patented June 5, 1906.

Application filed November 3, 1904. Serial No. 231,200.

To all whom it may concern:

Be it known that I, EDWARD A. BARNES, a citizen of the United States, residing at Fort Wayne, county of Allen, State of Indiana, have invented certain new and useful Improvements in Antilubricant-Throwing Devices, of which the following is a specification.

My invention relates to lubricating devices; and its object is to provide means for preventing the wasteful throwing of lubricating-oil from moving parts of mechanisms—such, for instance, as the crank-pins of engines. The waste of lubricant from this cause forms an important item in the operating expenses of power plants. This is due not only to the loss of lubricant itself flying off into the engine-room from the moving parts, which is, of course, considerable, but on account of a constant service which it necessitates on the part of the attendant to wipe up the oil, thus taking much time and consuming large quantities of waste. Furthermore, the throwing of oil is objectionable, as it renders the plant more inflammable and subject to fire where wood forms a part of the structure.

Various devices have been proposed to obviate these objections, and those which have come into use are of a type which generally comprises a shield or guard that entirely or partially surrounds the periphery of the crank-disk and which in some instances extends toward the cross-head to a certain distance above and below the connecting-rod. The function of the guard is to catch the flying particles of lubricating-oil. These collect on the inner surface of the guard and thence gravitate to the receiving-basin of the filtering and lubricating system generally employed in this connection. A device of this character is objectionable mainly because of its high cost and its size, which latter renders the inclosed parts more inaccessible, detracts from the otherwise pleasing appearance of the engine structure, and conceals from view the movement of the parts.

My invention is designed to attain the desirable results aimed at by such oil-collecting guards and at the same time to provide a device which is simple, inexpensive, and of such diminutive size as to be relatively unnoticeable when applied to an engine.

Broadly, the invention comprises means revolving with the crank-pin or similar part which collects the lubricant thrown therefrom and discharges it during a predetermined portion of the revolution.

In carrying the invention into practice I provide a chamber around the outer end of the crank, which is closed at every point except the bottom, where it opens into a downwardly-discharging mouth. This mouth is permanently open, and the ejection of the lubricant therefrom is mainly due to centrifugal force. The centrifugal force causes the particles of lubricant to be thrown off tangentially from the crank-pin and its brasses at every point in the revolution thereof. These particles collect on the inner wall of the chamber, and they can be discharged only during that part of the revolution when the centrifugal force acts in a general downward direction. Hence the ejection of the lubricant through the mouth occurs during a limited portion of the revolution. The force of gravity also assists to eject the lubricant at the time the centrifugal force is most effective, so that the maximum discharge effect is due to the combined action of centrifugal force and gravity. Obviously the force of gravity exerts attraction on the lubricant collected in the chamber at all points and tends to cause it to flow out through the mouth at every point in the revolution. This tendency, however, is effectually overcome by the centrifugal force, which acts in opposition to the force of gravity during a major portion of the revolution, the first force being of a magnitude much greater than that of gravity, due to the angular velocity and the moment through which it acts.

Instead of discharging the lubricant directly from the mouth to the receiving-basin of the filtering and lubricating system located on the girder of the engine, it is advantageous to empty it into a shallow elongated chamber moving with the crank and arranged in fixed relation to the collecting-chamber and extending horizontally below the same. This lower or discharge chamber is open at one side approximately its entire length, and the bottom curves downwardly toward the lower edge of the opening, where it terminates in a lip. The lubricant is discharged from the upper chamber upon the curved bottom of a lower chamber. Here it flows toward the lip, where it concentrates and is thrown off by the coöperating centrifugal force and

gravity in a manner similar to the lubricant discharging through the mouth. In practice I have found that the device discharges lubricant into the receiving-basin of the filtering and lubricating system approximately during the time the crank-pin passes through the last half of the down portion of the revolution and takes place over an angle of about ninety degrees. Hence during the other two hundred and seventy degrees of the revolution the centrifugal force acts in a direction to prevent the lubricant from discharging, and its magnitude exceeds that of gravity, so that substantially no lubricant is discharged from the device.

It has been my experience while operating high-speed reciprocating engines that as much as a quart of lubricating-oil has been thrown off from the crank-pin and adjacent parts in the course of a day's run. This takes place in the form of spray, of which the minute particles are deposited on the floor and other parts on objects in the room. By applying my device as above described to the same engine operating under the same conditions the lubricant flying off from the moving parts has been effectually prevented and the lubricant returned to the filtering and lubricating system with substantially no loss.

In the accompanying drawings, which illustrate one embodiment of the invention, Figure 1 is a perspective view of my improved device applied to a crank-pin on an engine. Figs. 2 and 3 are respectively an elevation of the same and a bottom plan view drawn on an enlarged scale. Fig. 4 is a vertical section taken on line 4 4, Fig. 2; and Fig. 5 is a diagram of the crank-pin movement for illustrating the operation of the device.

My invention is in the nature of an attachment, and while I have illustrated it as applied to a side crank or disk form of engine it is adaptable to center-crank engines and can be made in various sizes and forms to meet different requirements.

Referring to the drawings, 1 indicates the crank-pin disk of an engine; 2, the crank-pin; 3, the connecting-rod, and 4 the feed-pipe of a centrifugal lubricator, which comprises an annular casing or chamber 5, which extends around the outside end of the crank-pin and in fixed relation thereto. The casing may be fixed to the yoke of a connecting-rod in any approved manner. It is preferable, however, to attach it to the crank-pin brasses 6, as shown more clearly in Fig. 4. For this purpose the casing is provided with lateral extensions 7, which are flanged at their edges to fit snugly over the edges of the brasses that protrude from the connecting-rod yoke. These flanges 8 are provided with apertures through which extend screws 9, that enter tapped holes in the brasses, whereby the flanges are held in tight contact with the brasses to prevent lubricant from working out.

From the lower portion of the casing 5 depends the spout or mouth 10, which curves inwardly toward the crank-disk. This mouth communicates with the elongated discharge-chamber 11, located below the connecting-rod yoke, and extends approximately the full length thereof. It is fitted around the lower portion of the yoke and is removably secured in place by screws 12 at its ends, which engage in tapped holes in the yoke, and also by screws 13, which extend through apertures in the flange 14 at the upper edge of its side wall and screw into tapped openings in the crank-pin brasses. The apertures in the flange 14 are preferably slotted, so as to provide for adjusting the crank-pin brasses without necessitating the removal of the chamber 11. The side of the discharge-chamber adjacent to the crank-disk is open, and the opposite side and the bottom form a rounded or convex wall which terminates in a slightly downwardly curved lip 15. This lip extends along the bottom between the ends, and the lubricant that is discharged from the annular collecting-chamber 5 through the mouth is deposited on the curved bottom of the discharge-chamber and flows down the bottom to the lip 15, from which it is thrown off.

The annular conducting-chamber 5 and the lateral extensions 7 may be of sheet metal pressed into the desired form and provided with an opening to enable it to be assembled around the crank-pin nut 16. I find it more convenient to make the chamber of two parts 17 and 18, divisible on approximately a vertical line, Figs. 1 and 2. Adjacent edges 19 and 20 of the parts unite in a carefully-fitted lap-joint, and each edge is cut away to form together a circular opening 21 to accommodate the crank-pin nut 16. Having the chamber in two parts permits it to be removed or assembled without interfering with the feed-pipe of the centrifugal lubricator. Also it permits each part to be secured to different crank-pin brasses, so that the adjustable one may be adjusted without necessitating the removal of the parts by reason of the lap-joint. The extensions may be formed integral with the semi-annular portions and are preferably reinforced by wires 22, set in solder around the base of the semi-annular portions at a point adjacent the extensions, or the extensions may be separate and secured to the semi-annular portions in any desired manner.

The mouth 10 is formed on the part 17 of the chamber 5 and extends beyond the periphery of the semi-annular portion thereof. The discharge-chamber is cut away at 23 and flanged or otherwise reinforced, so as to fit the walls of the mouth. The latter chamber is also made of sheet metal and is strength-

ened by strips 24, riveted thereto at opposite sides of the flange 14, at which points they are not secured to the connecting-rod yoke. It is to be noted that the rear end of the discharge-chamber extends a much greater distance to one side of the crank-pin than does the forward end extend to the opposite side, and also the rear end of the lip 15 is turned upwardly, as at 25, Figs. 3 and 4. The purpose of this is to overcome any tendency of the lubricant to be thrown out toward the rear on the connecting-rod, due to windage, as the crank-pin moves through the initial part of the upward stroke—that is, in case the engine is "running over." In case the engine is "running under" the prolongation of the discharge-chamber would necessarily be toward the front.

In order to adjust the adjustable crank-pin brass, access to the nut 26 of the bolt 27 for setting the usual adjusting-wedge is provided through a removable slide 28 in the bottom of the discharge-chamber. This slide is arranged axially in line with the bolt and is removable in a direction toward the crank-disk, as shown partly removed in Figs. 3 and 4. It fits in a slideway 29, provided on the interior surface of the bottom of the chamber, and is frictionally held in the slideway to form therewith a practically oil-tight joint. The edge of the slide adjacent the crank-disk is so shaped as to preserve the continuity of the lip 15. The discharge-chamber is provided with a plurality of baffle-plates 30, Figs. 3 and 4, which serve as braces to stiffen the structure and as baffle-plates to prevent the lubricant from agitating back and forth between the ends of the chamber.

The operation of the apparatus may be explained in a general way as follows: Lubricating-oil is fed in the usual manner to the crank-pin by the centrifugal lubricator and lubricates the crank-pin and the bearing-surfaces of the brasses. From these it works out and accumulates upon the wall of the annular collecting-chamber. During a certain portion of the downstroke the lubricant is ejected into the discharge-chamber, whence finally it is ejected into the receiving-basin of the filtering and lubricating system.

The operation may be explained more in detail in connection with Fig. 5, which represents diagrammatically the movement of a crank of an overrunning-engine. The crank-pin and the adjacent end of the connecting-rod revolves in the crank-pin circle A, and at every position therein the mouth 10 of the chamber 5 points approximately in the same direction—that is to say, downwardly, as indicated in the two positions shown. The lubricant that collects on the wall of the chamber surrounding the crank-pin is acted upon by centrifugal force, which is constantly changing its direction at every point in the revolution. This force is of substantially constant magnitude. When the crank is in mid-position of its upstroke, the centrifugal force is acting upwardly, as indicated by the arrow *a;* when it is in the position shown in dotted lines the force is acting toward the right, as indicated by arrow *b;* when in mid-position of its downstroke, the force is acting downwardly, as indicated by arrow *c,* and when in the position shown in full lines the force is acting toward the left, as indicated by arrow *d.* From this it will be seen that when the crank-pin is in the middle of its downstroke the centrifugal force is acting in a direction parallel to that toward which the mouth of the collecting-chamber opens, and in the other positions mentioned it is acting away from that direction. Also when the centrifugal force is acting downwardly the force of gravity acts in parallelism thereto or in the same direction, so that these two forces coöperate to eject the lubricant accumulated in the collecting-chamber during the major part of the revolution. Obviously the downwardly-acting centrifugal force does not abruptly begin and end at the point indicated by the arrow *c,* but begins and ends some distance in advance and behind such point—say approximately forty-five degrees—and continues through the arc B. Hence gravity and centrifugal force act during about one-quarter of the revolution to cause the lubricant to be ejected through the mouth, and while the crank-pin is moving through the arc E or the other three-quarters of the revolution the centrifugal force acts away from the direction of the opening of the mouth and also in opposition to gravity.

After lubricant begins to discharge upon the bottom of the lower chamber a short period elapses before the lubricant begins to discharge from the lip, as it requires a short interval of time for the lubricant to flow down the bottom to the lip. Hence the discharge from the lip begins near a point indicated approximately at *c* and continues through a greater or less part of the downstroke or through arc C. It is to be noted that the centrifugal force acting at the lip when the discharge of lubricant therefrom occurs increases from the beginning to the end of the operation. This is due to the eccentricity of the path of rotation of the lip, as indicated by the circle D. The centrifugal force acting at the lip when the crank is at *d* is twice that acting at the lip when the crank is at *b,* as the respective moments of the forces at these points or the radial distance from each point to the center of the crank is a ratio of two to one. Passing from *b* to *d* the centrifugal force at the lip increases from a minimum to a maximum. The rate of increase in magnitude of the force is greatest when the crank-pin is moving through the arc C, which coincides with the period when lubricant is discharging from the lip.

This increase of centrifugal force insures a complete ejection of all the lubricant from the discharge-chamber that is received from the collecting-chamber. Hence no lubricant is ejected from the discharge-chamber while the crank-pin moves through the arc F.

I do not wish to be understood by the foregoing explanation of the operation to be stating exactly at what point in the revolution the collecting-chamber begins and stops delivering lubricant into the lower chamber or when the latter chamber begins and stops ejecting lubricant therefrom, as these various steps are difficult of verification. Therefore Fig. 5 and the description thereof is to be taken as illustrative in a general manner of the operation and the general principles involved. From actual practice, however, I have found that the lubricant is thrown off tangentially from the lip over a zone which includes an angle of about ninety degrees normal to the vertical center line through the crank-shaft as measured at the basin of the filtering and lubricating system.

In accordance with the provisions of the patent statutes I have described the principle of operation of my invention, together with the apparatus which I now consider to represent the best embodiment thereof; but I desire to have it understood that the apparatus shown is only illustrative and that the invention can be carried out by equivalent means.

What I claim as new, and desire to secure by Letters Patent of the United States, is—

1. The combination with an element moving in an orbital path and means for lubricating the same, of a device arranged in coöperative relation to said element and moving therewith which collects lubricant therefrom and throws it off in a definite direction during a predetermined portion of the revolution.

2. The combination with an element moving in an orbital path and means for lubricating the same, of a device revolving with said element which collects lubricant therefrom and throws it off during a predetermined portion of the revolution.

3. The combination with a crank-pin, a connecting-rod, and a means for lubricating the crank-pin, of a device arranged around the crank-pin which collects lubricant therefrom at a certain portion of the revolution and discharges it at another portion.

4. The combination with a crank-pin, a connecting-rod and a lubricator for the crank-pin, of a casing extending around the pin which is provided with a discharge-opening in its bottom.

5. The combination with a crank-pin, a connecting-rod, crank-pin brasses, and a lubricating device, of means for preventing lubricant from being thrown from the said parts, said means comprising a collecting-chamber surrounding the end of the crank-pin, and a discharge-chamber communicating therewith which receives lubricant from the collecting-chamber and discharges it at a predetermined portion of the revolution.

6. The combination with a revolving crank-pin, a connecting-rod, crank-pin brasses and a lubricating device, of means for preventing lubricant from being thrown from said parts, said means comprising a collecting-chamber carried by the connecting-rod and surrounding the end of the crank-pin, and a discharge-chamber carried by the connecting-rod which receives lubricant from the collecting-chamber and delivers it at a predetermined portion of the revolution.

7. The combination with a revolving crank-pin, a connecting-rod, crank-pin brasses, and a lubricating device, of means for preventing lubricant from being thrown from said parts, said means comprising a casing secured around the other end of the crank-pin, and a discharge-casing removably secured to the connecting-rod below and communicating with the upper casing for receiving lubricant from and discharging it downwardly during a limited portion of the revolution.

8. The combination with a revolving crank-pin, a connecting-rod, crank-pin brasses, and a lubricating device, of means for preventing lubricant from being thrown from said parts, said means comprising a collecting-chamber secured to the crank-pin brasses and surrounding the outer end of the crank-pin, a downwardly-extending mouth at the bottom of said chamber, and an elongated chamber carried by the connecting-rod which communicates with said mouth to receive lubricant therefrom and discharges it downwardly as the crank moves through the lower portion of its revolution.

9. The combination with a revolving crank-pin, a connecting-rod, crank-pin brasses carried thereby, means for adjusting the brasses, and a lubricating device, of means for preventing lubricant from being thrown from the said parts, said means comprising a collecting-chamber surrounding the outer end of the crank-pin and secured in fixed relation thereto, an elongated discharge-chamber below the collecting-chamber, a connection between the chambers, and a removable slide in the discharge-chamber for permitting access to the means for adjusting said brasses.

10. The combination with a revolving crank-pin, a connecting-rod, crank-pin brasses carried thereby, means for adjusting the brasses, and a lubricating device, of means for preventing lubricant from being thrown from the said parts, said means comprising a two-part collecting chamber surrounding the crank-pin and having its parts secured to the crank-pin brasses and relatively movable therewith, an elongated chamber communi-

cating with the collecting-chamber and extending at one end to a greater distance on one side of the crank-pin than at the other, and means at the end more remote from the crank-pin for counteracting the effect of windage in the discharge-chamber.

11. The combination with a revolving crank-pin, a connecting-rod, crank-pin brasses carried thereby, means for adjusting the brasses, and a lubricating device, of means for preventing lubricant from being thrown from the said parts, said means comprising a collecting-chamber surrounding the outer end of the crank-pin and secured in fixed relation thereto, an elongated discharge-chamber below the collecting-chamber which is open at one side and provided with a discharge-lip along its bottom edge, a downwardly-extending mouth connecting the two chambers, a removable slide provided in said discharge-chamber which is arranged to permit access to the means for adjusting the brasses and which is shaped at one edge to conform to the said lip.

12. A device for preventing lubricant from being thrown from crank-pins, comprising an annular collecting-chamber adapted to be placed around the crank-pin, an elongated chamber below the same which is open at one side, a discharge-lip formed at the bottom thereof adjacent to the open side, and a connection between the two chambers.

13. A device for preventing crank-pins from throwing lubricant, comprising a collecting-chamber for surrounding the crank-pin, extensions provided thereon which are adapted to be secured to the crank-pin brasses, and a separate chamber adapted to be secured in fixed relation to the collecting-chamber and is open at one side to discharge lubricant received from said latter chamber.

14. A device for preventing crank-pins from throwing lubricant, comprising a two-part collecting-chamber for surrounding the crank-pin, an extension provided on each part for securing the chamber in place, and a separate chamber adapted to be secured in fixed relation to the collecting-chamber and is open at one side to discharge lubricant received from said latter chamber.

In witness whereof I have hereunto set my hand this 29th day of October, 1904.

EDWARD A. BARNES.

Witnesses:

N. N. KING,

W. F. MELCHING.