April 28, 1931. H. E. McCRAY 1,803,120

INTERNAL COMBUSTION ENGINE

Original Filed Feb. 15, 1923 2 Sheets-Sheet 1

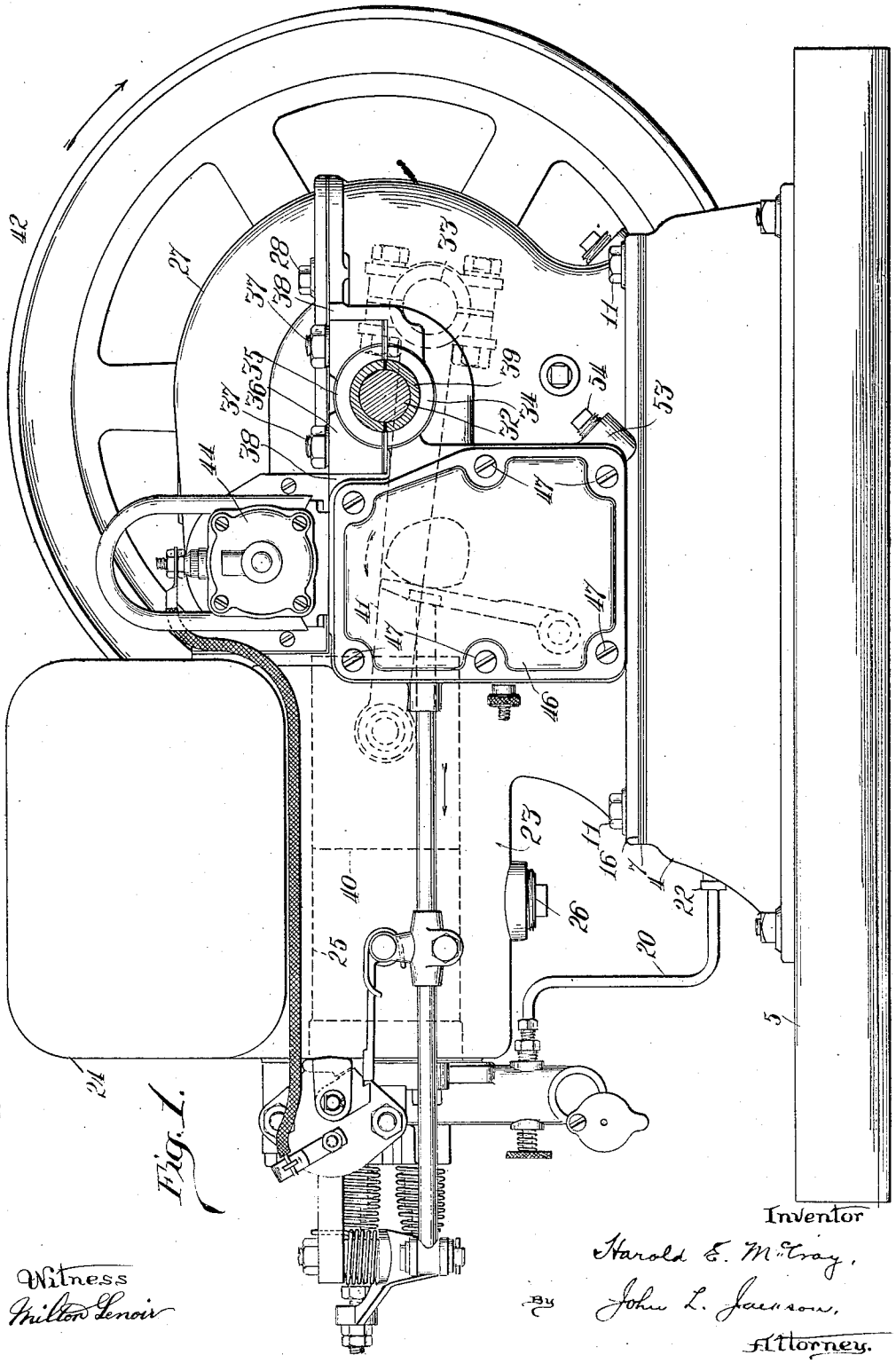

Fig. 1.

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Fig. 2.

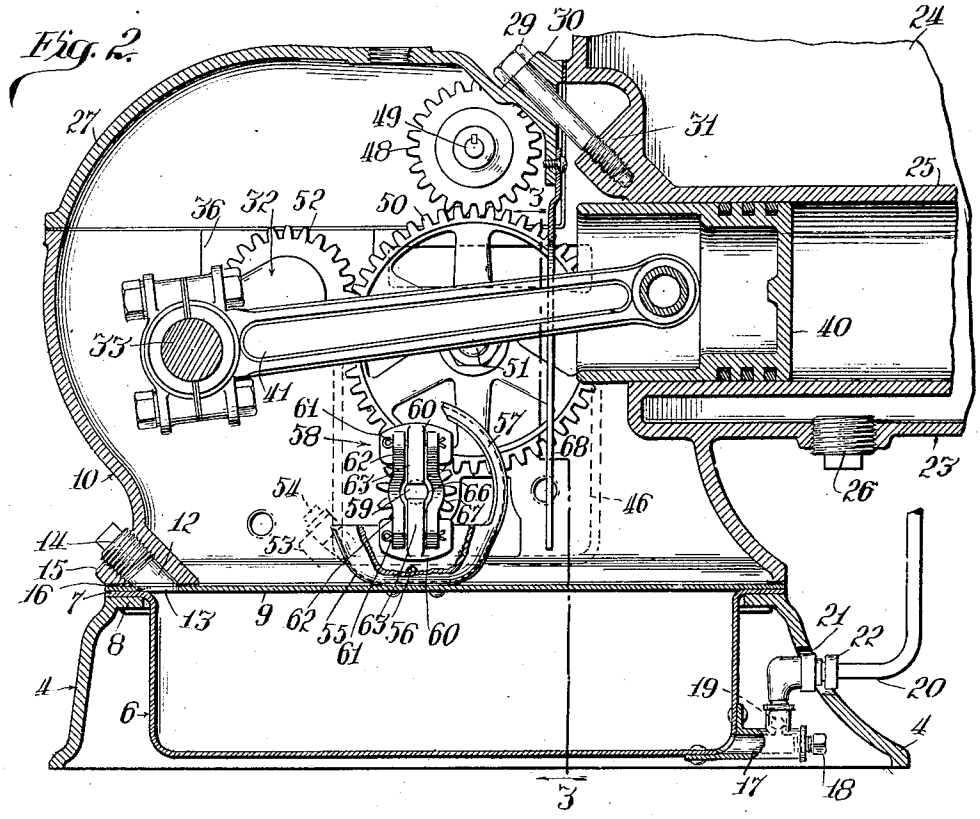
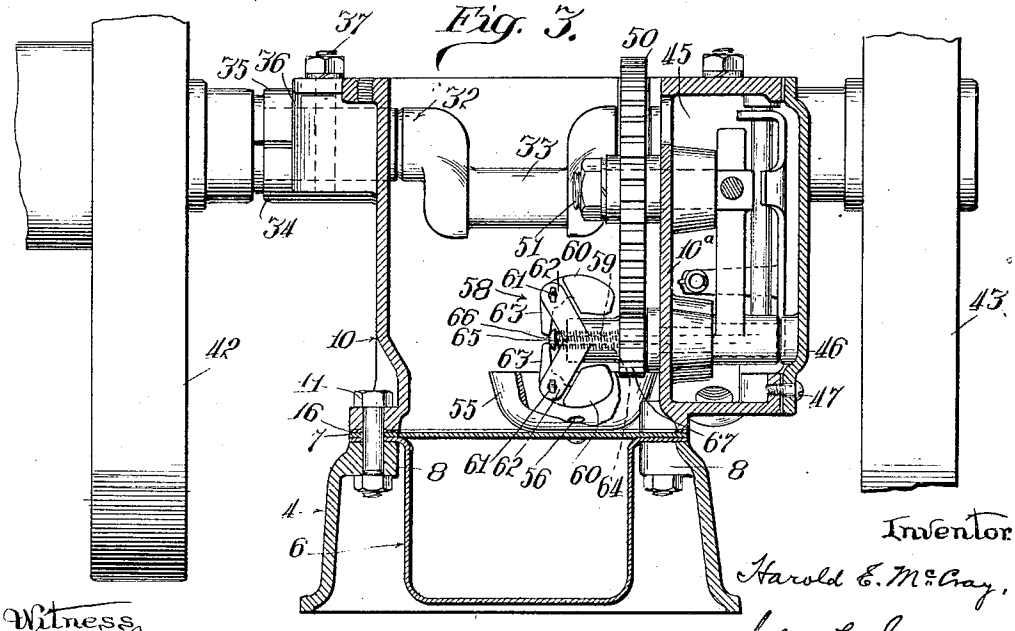


Fig. 3.



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INTERNAL-COMBUSTION ENGINE

Original application filed February 15, 1923, Serial No. 619,081. Divided and this application filed April 27, 1925. Serial No. 26,153.

My invention relates to internal combustion engines of the horizontal type such as are commonly used for operating farm machinery, and it has particularly to do with means for lubricating the operating parts of the machine that are contained within or are accessible from the crank case of the engine. It has for its object to provide improved means actuated by the crank shaft for distributing throughout the crank case a lubricant, such as oil, contained therein, and for controlling the distribution of the oil so that all the parts requiring lubrication will be amply supplied, but will not receive more than is required to keep them properly lubricated. I accomplish this object as illustrated in the drawings and as hereinafter described. What I regard as new is set forth in the claims.

In the accompanying drawings,

Fig. 1 is a side elevation of the form of internal combustion engine that I have chosen for the purpose of illustrating the practical application of my invention;

Fig. 2 is a partial longitudinal vertical section of the crank case and the cylinder block; and

Fig. 3 is a transverse vertical section on line 3—3 of Fig. 2, the crank case cover being omitted.

The engine illustrated in the drawings comprises a hollow base 4 in the form of a casting adapted to be bolted or otherwise secured to a supporting plate 5, of wood or other suitable material, and to contain within it a fuel tank 6 which, as best shown in Figs. 2 and 3, occupies the greater portion of said base. The fuel tank is in the form of a pan or box of suitable dimensions to fit into the base 4, and is provided at its upper margins with an outwardly extending flange 7 which overlies an inwardly projecting flange 8 on the upper margin of the base, the arrangement being such that the fuel tank is supported so that its bottom is slightly above the plate 5. A cover plate 9 fits over the fuel tank 6, its marginal portions resting on the flange 7, as shown in Fig. 3, and upon the margins of this cover plate rest the marginal portions of a crank case 10 which is securely bolted to the base 4 by bolts 11. By this construction the cover plate 9 serves not only as the top of the fuel tank 6, but also as the bottom of the crank case, and, as hereinafter pointed out, the crank case and cover plate are tightly fitted together so that the crank case is adapted to contain a quantity of lubricant, such as oil, without leakage. To provide for filling the fuel tank 6, the crank case 10 is provided at some convenient point, preferably at its outer end, with a passage 12 which leads to a filling opening 13 in the cover plate 9, as best shown in Fig. 2. Said passage is adapted to be closed by a plug 14, or other suitable means. In order to prevent the escape of oil from the crank case into the passage 12 and opening 13, and also to prevent leakage from the crank case, the passage 12 is formed in a boss 15 provided at the lower portion of the crank case and having portions that overlie the marginal portion of the cover plate 9 around the opening 13 therein, and a gasket 16 is placed around the lower margin of the crank case between it and the cover plate, said gasket extending also around the opening 13, as best shown in Fig. 2. By this means when the bolts 11 are drawn up tightly the escape of oil from the crank case into the fuel tank is prevented. Fuel is delivered from the fuel tank through a pipe 17 connected with the inner end of said tank at the bottom thereof, and having at its outer end a plug 18 by the removal of which the tank may be emptied when desired. Leading from the pipe 17 is a check valve 19, preferably of the ball type, with which connects a supply pipe 20 through which fuel is conducted to the engine cylinder. As shown in Fig. 2, the pipe 17 and check valve 19 are both located within the base 4, said check valve being preferably in the form of an elbow casting, one end of which extends through an opening 21 in the base so that the pipe 20 may be conveniently connected therewith by a coupling 22. By this construction the check valve is protected and is not apt to be damaged in transporting the engine, as when the pipe 20 is uncoupled none of the parts connected with the fuel tank project beyond the base. The arrangement of the

fuel tank within the base is advantageous, not only because said tank is well protected, but also because space is economized. Furthermore, by mounting the crank case on a separable base, the base can easily be removed and changed for one of a different size, as might be necessary if it were desired to use fly-wheels of larger diameter than usual, and, moreover, a crank case of standard design can be used with bases of different heights. It may here be explained that this construction is not herein claimed, as it is not essential to the subject matter to which the present application is directed, and is included in the subject matter of a separate application, Serial No. 26,151 for patent filed of even date herewith, now Patent 1,727,016.

The crank case 10 constitutes also the main engine frame, since cast integral with it is a cylinder block 23 and water hopper 24, as best shown in Fig. 2. As shown in said figure, the engine cylinder 25 extends horizontally through the lower portion of the water hopper 24, but is separated therefrom laterally so that the water in the hopper surrounds said cylinder. In the bottom of the cylinder block is an opening having a plug 26 through which the water in the hopper may be drawn off.

The crank case portion of the engine frame is provided with a removable cover 27 which is held in place preferably by bolts 28 at opposite sides thereof near the crank case end of the engine, and by an intermediate bolt 29 which extends diagonally through a boss 30 in the cover 27 into a boss 31 in the portion of the engine frame that forms the inner wall of the water hopper 24, as shown in Fig. 2. Gaskets placed between the cover 27 and the parts of the engine frame against which its margins abut make the closure between said parts oil tight. By removing the cover access may be had conveniently to the operating parts in the crank case, all of which are thereby fully exposed.

Extending transversely of the crank case is a crank shaft 32, the crank portion of which is indicated at 33 and is best shown in Fig. 3. The end portions of said crank shaft are mounted in suitable bearings in the side walls of the crank case 10, the lower bearing being shown at 34 and the upper bearing at 35 in Fig. 1. As therein shown, the side walls of the crank case adjacent to these bearings are cut away and the lower bearings are formed in depressed portions or recesses in said side walls. The upper bearings 35 are formed in removable blocks 36 which slide vertically into these recesses, with the side margins of which they engage closely enough to prevent the escape of oil from the crank case. Said blocks are secured in place by bolts 37, and as the walls of the crank case hold them against endwise movement, there is no lateral strain on said bolts. Adjacent to said recesses the side walls of the crank case are strengthened and widened by lateral flanges or extensions 38, as shown in Fig. 1, so that wide bearing surfaces are provided for the ends of the blocks 36 and they are strongly supported. The bearings 34, 35 are provided with the usual anti-friction linings 39, as shown in Fig. 1. By removing the cover 27 and blocks 36, the crank shaft may readily be removed when necessary.

As best shown in Fig. 2, 40 indicates the piston which operates in the cylinder 25, said piston being connected by a pitman 41 with the crank portion 33 of the crank shaft, which, as best shown in Fig. 3, is preferably provided with two flywheels 42, 43, one at each side of the engine. A magneto 44 is mounted on the crank case at one side thereof between the crank shaft and the water hopper, as shown in Fig. 1, and below the position of the magneto is a chamber 45 having a laterally disposed cover plate 46 which contains certain controlling mechanism by means of which the operation of the valve mechanism and the ignition devices is controlled. As such controlling mechanism is not within the scope of the subject matter of the present application, it need not be described. The cover plate 46 is removable so that access may be had to said chamber, and it is held in place by screws 47, best shown in Fig. 3.

The magneto 44 is driven from the crank shaft 32 by means of a train of gears inside the crank case and subject to lubrication by the lubricating means hereinafter described, said train of gears comprising a pinion 48 mounted on the armature shaft 49 of the magneto, a gear 50 mounted on a transverse shaft 51 journalled in one of the side walls 10^a of the crank case, as shown in Fig. 3, and a pinion 52 mounted on the crank shaft 32, as shown in Fig. 2. It will be seen from the foregoing description that all the operating parts above described are located in, or are accessible from, the interior of the crank case, so that oil contained in the crank case may be distributed to them for their lubrication.

As indicated in Fig. 2, the lower portion of the crank case serves as an oil reservoir, oil being supplied thereto through a passage formed in a boss 53 that projects from the lower portion of the crank case at one side thereof and is normally closed by a plug 54. Said boss is best located so that it opens into the crank case at a point approximately midway of the length thereof and adjacent to the oil hole through which oil is supplied to the pan hereinafter described. The advantage of this arrangement is that said passage forms a safe gauge as to the level of the oil in the crank case, even though the engine may have been set slightly out of a level

position. In other words, owing to the location of said passage a fair average indication of the oil in the crank case may be obtained, whereas if it were located either in the front or the back portion of the crank case it might indicate an abundance of oil or an absence of oil, depending upon which end of the engine happened to be lower.

Located within the crank case, and secured to the bottom thereof, is a pan 55, shown in Figs. 2 and 3, which has a hole or perforation 56 in it a short distance above the bottom thereof for admitting oil from the crank case to said pan, and at that side of said pan adjacent to the engine cylinder 25 it is provided with an upwardly projecting curved deflector 57, the purpose of which will be hereinafter explained. Arranged over and dipping into the pan 55 is a centrifugal governor 58 mounted on a transverse shaft 59 journaled in the side wall 10^a of the crank case. The governor 58 comprises weighted levers 60 pivoted at 61 to diverging arms 62 that project from the inner end of the shaft 59, the levers 60 being provided with inwardly projecting arms 63 which project toward the axis of the shaft 59, as shown in Fig. 3. Obviously, as the governor rotates the weighted portions of the levers 60 tend to swing out, or away from the shaft 59, and the outer ends of the rams 63 tend to move inwardly in substantial alinement with the axis of said shaft. This inward movement of the arms 63 is resisted by a spring 64 mounted on a rod 65 which extends axially through the shaft 59 and is provided with a head 66 which underlies the inner ends of the arms 63, as best shown in Fig. 3. The spring 64 is fitted in a recess in the inner end portion of the shaft 59, and the inner end of said spring bears against an abutment formed at the inner end of said recess. By this construction said spring tends to hold the governor levers 60 in their normal or retracted position, but yields to permit them to swing outward under centrifugal action. The governor is so arranged with reference to the pan 55 that when it is rotated by the operation of the engine, as hereinafter described, thereby causing the levers 60 to swing outward, said levers dip into the oil in said pan and consequently take up oil therefrom and distribute it throughout the crank case, thereby lubricating the operating parts therein, or accessible therefrom. The governor 58 is rotated from the crank shaft 33 by means of the gear 50 which meshes with a pinion 67 mounted upon and rotating with the governor shaft 59, as shown in Figs. 2 and 3. Consequently whenever the engine is in operation the governor is rotated and distribution of the oil occurs, the quantity of oil so distributed depending upon the speed of the engine. Obviously when the engine operates at high speed the governor shaft 59 rotates more rapidly, and the levers 60 are thrown out further, and dip further into the oil as the speed increases, and accordingly take up more oil from the pan 55 than they would if the engine were running at slower speed. The governor therefore constitutes a centrifugally variable rotary element which is capable of throwing more oil under increased speeds, due to the fact that the throwing elements are caused to dip further into the oil under conditions of increased speed. By driving the rotary element from the crank shaft through speed multiplying gearing as described, it rotates at much higher speed than the crank shaft, so that even though the crank shaft be rotating at a comparatively slow speed the oil throwing element rotates at a speed high enough to beat the oil into a fog or mist and distribute it to the parts requiring lubrication, so that the engine is always properly lubricated regardless of the speed of the crank shaft. By making the oil throwing element in the form of a governor that regulates the speed of the engine, manifestly the distribution of the oil is coordinated with the speed of the engine so that proper lubrication is automatically provided for. The connections by which the governor regulates the speed of the engine are more fully shown and described in my pending application, Serial No. 619,081, but I wish it to be understood that while I prefer to use the arrangement for that purpose shown in said application, any other suitable construction may be employed.

The improved arrangement described by which the oil to be distributed is taken from the pan 55 instead of directly from the main body of oil in the crank case, also contributes to the regulation of the distribution of the oil, since the amount of oil accessible to the governor is limited to that supplied to the pan through the hole 56, and therefore if the governor takes away the oil faster than the flow through said hole, the supply in the pan will be depleted, thereby reducing the amount that is taken up by the governor levers. By this means the distribution of an excessive quantity of oil at high engine speeds is prevented. The pan 55 serves the further purpose of keeping out sediment which may accumulate in the bottom of the crank case, and the sides of the pan also serve as deflectors to direct the oil throughout the interior of the crank case. The deflector 57 is provided to prevent an excessive amount of oil from being thrown against the piston and into the cylinder, and to direct the oil toward and against the bearing of the pitman on the crank shaft. In addition to such deflector I prefer also to provide a shield 68 in the form of a plate which extends transversely of the crank case adjacent to the inner end of the cylinder 25 and between it and the pan 55, as shown in Fig. 2. Said shield is secured at its upper margin to a flange 69 that pro-

jects downwardly from the cover 27, as shown in Fig. 2, and it is provided with a vertical slot through which the pitman 41 extends and in which it operates, as illustrated in said figure. Although the deflector 57 and shield 68 prevent oil from being thrown directly against the piston and into the cylinder, they are amply lubricated by the oil globules disseminated throughout the crank case by the action of the rotating oil distributing means described.

My present application is a division of my said application, Serial No. 619,081, filed Feb. 15, 1923, and it should be understood that any patentable subject-matter shown and described but not claimed in this application is included in said application, Serial No. 619,081, or in other divisional applications based thereon.

What I claim as my invention and desire to secure by Letters Patent, is:—

1. In a splash lubricating system, the combination of a crank case adapted to contain lubricating oil, an oil receptacle in said crank case, and a rotary oil throwing element adapted to dip into said receptacle, comprising an oil throwing member responsive to changes in centrifugal force.

2. In a splash lubricating system, the combination of a crank case adapted to contain lubricating oil, a receptacle therein adapted to contain said oil, and a rotary oil throwing element adapted to dip into said receptacle, comprising an oil throwing member responsive to changes in centrifugal force disposed over said receptacle and operating under conditions of increased speed to dip further into said receptacle.

3. In a splash lubricating system, the combination of a crank case adapted to contain lubricating oil, a receptacle in said crank case having a restricted oil supplying connection therewith for limiting the amount of oil supplied to said receptacle, and a rotary oil throwing element adapted to dip into said receptacle comprising means caused to dip further into said receptacle under conditions of increased speed.

4. In an internal combustion engine, the combination of a crank shaft, a receptacle adapted to contain lubricating oil, and means for controlling the speed of the crank shaft and distributing the lubricating oil comprising a rotary oil throwing element adapted to dip into said receptacle, and means caused to dip further into said receptacle under conditions of increased speed.

5. In an internal combustion engine, the combination of a crank case adapted to contain lubricating oil, a crank shaft supported by said crank case, a rotary governor in the lower portion of said crank case and adapted to dip into the oil therein, and means operated by the rotation of said crank shaft for rotating said governor.

6. In a splash lubricating system, the combination of a crank shaft, a receptacle adapted to contain lubricating oil, means for distributing the oil comprising a rotary oil throwing element adapted to dip into said receptacle and operating under conditions of increased speed to dip further into said receptacle, and means rotating said element from the crank shaft at a higher speed than that of the crank shaft.

7. In a splash lubricating system, the combination of a crank shaft, a receptacle adapted to contain lubricating oil, a rotary oil throwing element adapted to distribute oil from said receptacle, said element responding centrifugally to changes in speed for varying the amount of oil thrown, and means for driving said rotary element from the crank shaft at a higher rate of speed than that of the crank shaft.

8. In a splash lubricating system, the combination of a crank shaft, a receptacle adapted to contain lubricating oil, a rotary oil throwing element adapted to distribute oil from said receptacle, said rotary element responding centrifugally to changes in speed for varying the amount of oil thrown, means for driving said rotary element from the crank shaft, and means operated by the rotation of said rotary element for controlling the speed of the crank shaft.

9. In a splash lubricating system, the combination of a crank case adapted to contain lubricating oil, an oil receptacle in said crank case having an opening in the lower portion thereof for the admission of oil thereto from said crank case, and a rotary oil throwing element adapted to dip into said receptacle comprising means caused to dip further into said receptacle under conditions of increased speed.

10. In a splash lubricating system, the combination of a crank case adapted to contain lubricating oil, an oil receptacle in said crank case having an opening in the lower portion thereof for the admission of oil thereto from said crank case a rotary oil throwing element driven by the crank shaft and arranged to dip into the oil in said receptacle to distribute the same, said rotary element responding to changes in centrifugal force for varying the amount of oil distributed and means for directing the oil thrown by said oil throwing element toward the crank shaft.

11. In a splash lubricating system, the combination of a crank case adapted to contain lubricating oil, an oil receptacle in said crank case having an opening in the lower portion thereof for the admission of oil thereto from said crank case, a rotary oil throwing element driven by the crank shaft and arranged to dip into the oil in said receptacle to distribute the same, said oil throwing element comprising means responding to changes in cen-

trifugal force for varying the amount of oil thrown thereby and a deflector carried by said receptacle and arranged to direct the oil thrown by said oil throwing element toward the crank shaft.

12. In a splash lubricating system, the combination of a crank case adapted to contain lubricating oil, an oil receptacle in said crank case having an opening in the lower portion thereof for the admission of oil thereto from said crank case, a rotary oil distributing element adapted to dip into the oil in said receptacle and by its rotation to distribute the same, means for driving said oil distributing element at a higher rate of speed than that of the crank shaft, and means for directing the oil thrown by said oil throwing element toward the crank shaft.

13. In an internal combustion engine, the combination of a crank case adapted to contain lubricating oil, a cylinder block communicating with the interior of said crank case, a piston operating in said cylinder block, a crank shaft supported by said crank case and connected with said piston, a rotating oil distributing element located between the crank shaft and the cylinder block, means for driving said oil distributing element from the crank shaft, a deflector for directing the oil thrown by said oil distributing element toward the crank shaft, and a shield interposed between said oil distributing element and the cylinder block for limiting the amount of oil supplied to said piston and the cylinder block.

14. In an internal combustion engine, the combination of a crank case adapted to contain lubricating oil, a rotary oil throwing element adapted to dip into said oil, and an inlet in the crankcase for introducing oil thereinto located at approximately the desired oil level in close proximity to said rotary oil throwing element, for predetermining the amount of oil in said crank case.

15. An internal combustion engine comprising a crank case adapted to contain lubricating oil, a receptacle therein adapted to receive the oil, a rotary oil throwing element adapted to dip into said receptacle, and an inlet for introducing oil into the crank case located therein at approximately the desired oil level for predetermining the amount of lubricant in said crank case, said inlet being disposed in close proximity to the transverse plane of said receptacle.

16. An internal combustion engine comprising a crank case adapted to contain lubricating oil, an oil receptacle in said crank case having an opening in the lower portion thereof for the admission of oil thereto from said crank case, a centrifugally operating rotary oil throwing element adapted to dip into said receptacle, and an inlet for introducing oil into said crank case located in close proximity to the transverse plane of the opening in said oil receptacle.

17. In a splash lubricating system, the combination of a crank case adapted to contain lubricating oil, an oil receptacle in said crank case having an opening in the lower portion thereof for the admission of oil thereto from said crank case, a rotary oil distributing element adapted to dip into the oil in said receptacle and by its rotation to distribute the same, and means for driving said oil distributing element at a higher rate of speed than that of the crank shaft.

18. In a splash lubricating system, the combination of a crank case adapted to contain lubricating oil, an oil receptacle in said crank case, means for conducting oil from the crank case into said receptacle at a limited rate, a rotary oil distributing element adapted to dip into the oil in said receptacle and by its rotation to distribute the same, and means for driving said oil distributing element at a higher rate of speed than that of the crank shaft.

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