Feb. 28, 1939. F. F. KISHLINE 2,148,821

LUBRICATION SYSTEM FOR SUPERCHARGERS

Original Filed Aug. 7, 1935 4 Sheets-Sheet 1

Fig. 1.

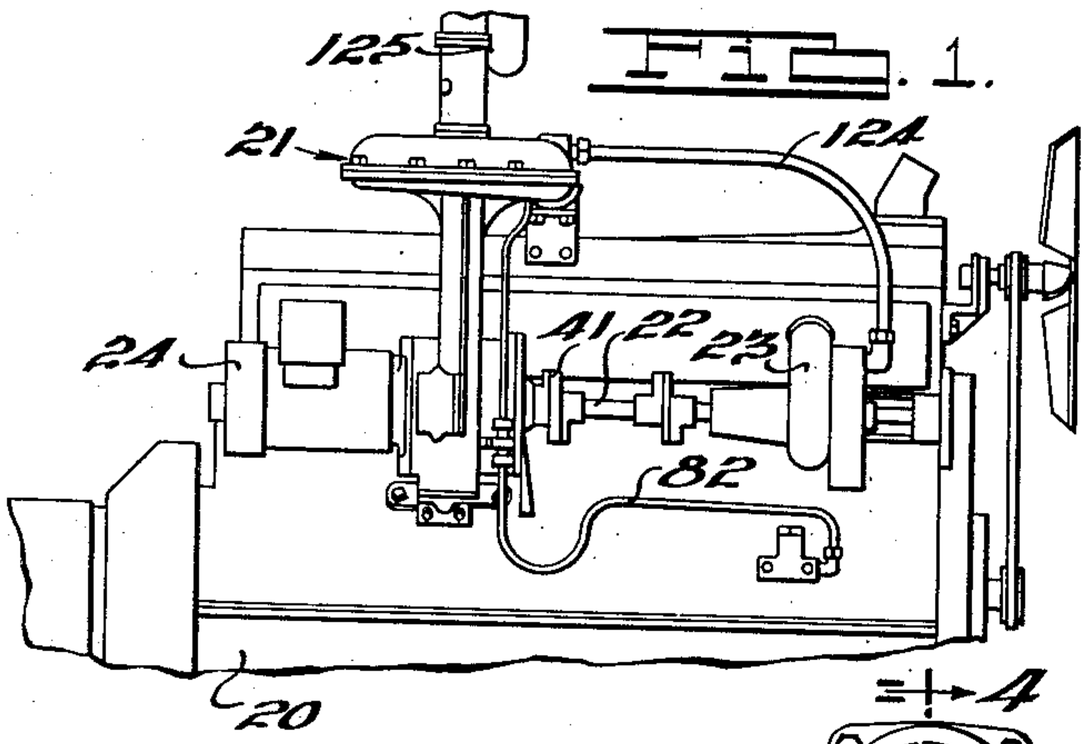
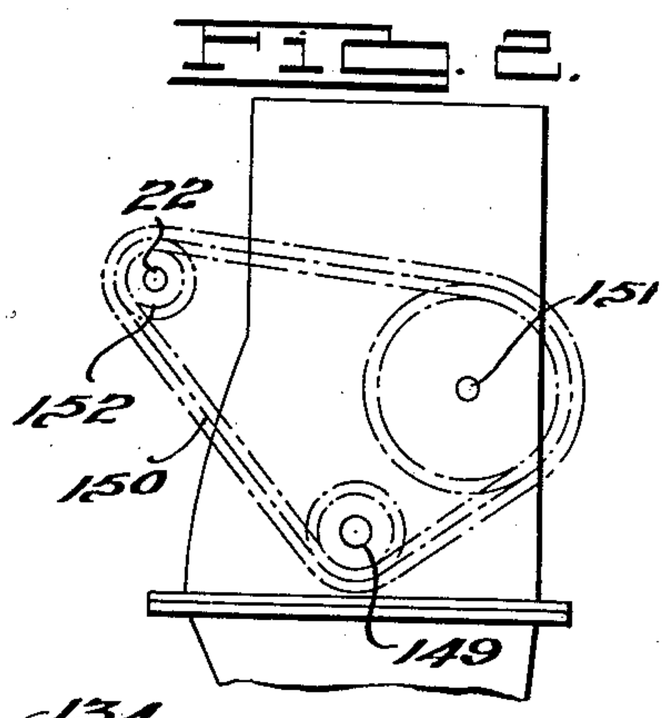


Fig. 2.



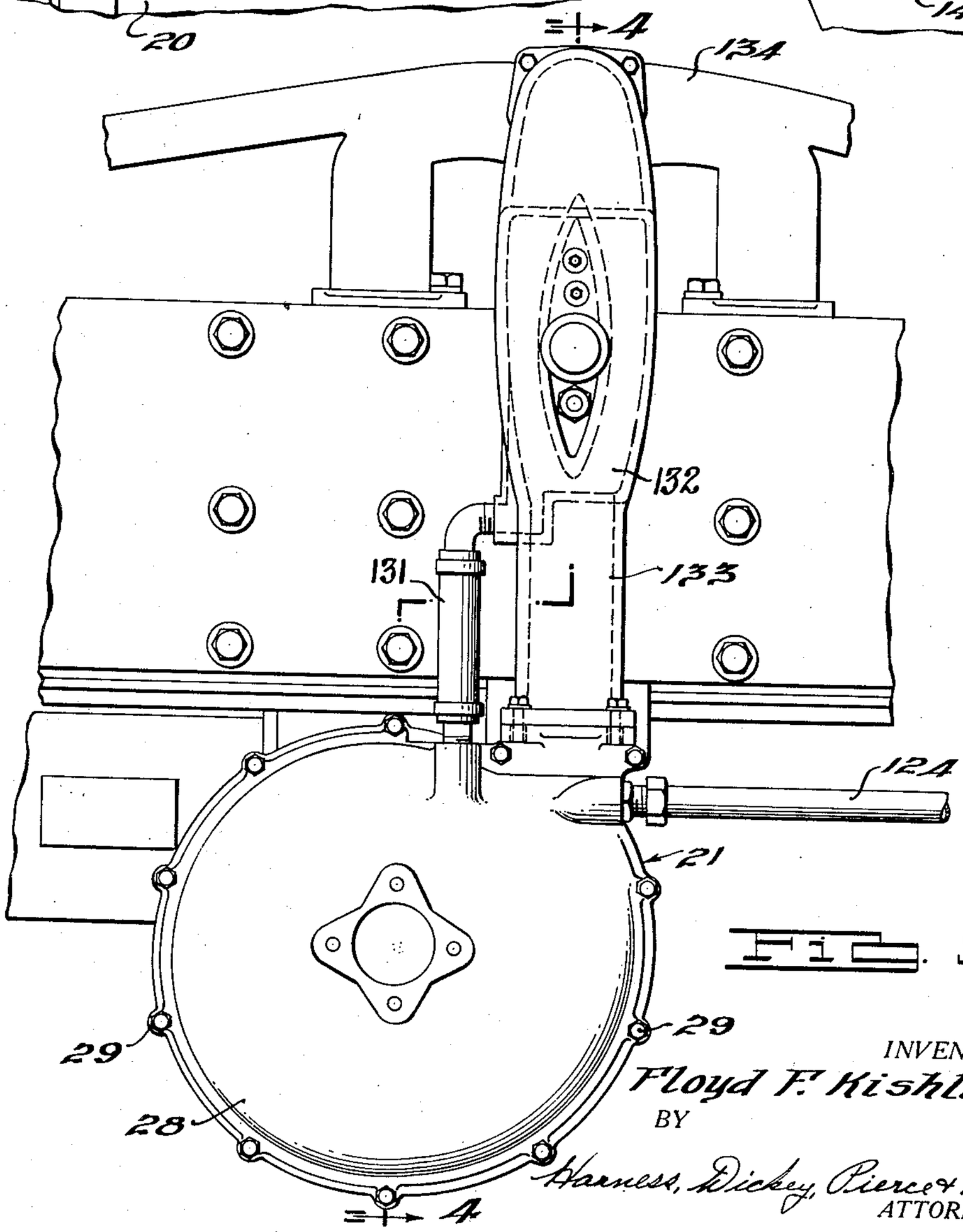


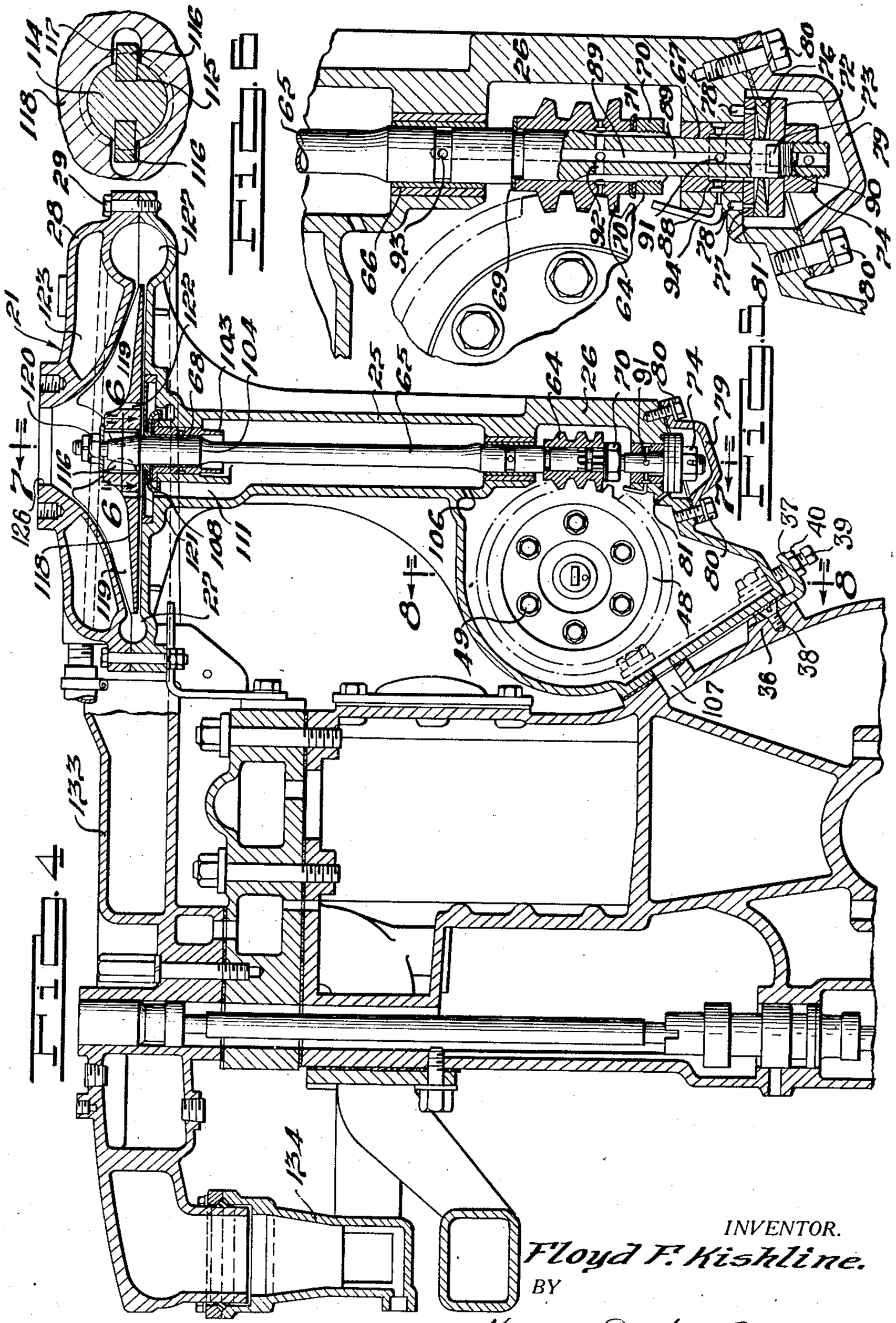
Fig. 3.

INVENTOR.
Floyd F. Kishline.
BY
Harness, Dickey, Pierce & Mann.
ATTORNEYS.

Feb. 28, 1939. F. F. KISHLINE 2,148,821

LUBRICATION SYSTEM FOR SUPERCHARGERS

Original Filed Aug. 7, 1935 4 Sheets-Sheet 2



INVENTOR.
Floyd F. Kishline.
BY
Harness, Dickey, Pierce & Mann.
ATTORNEYS.

Feb. 28, 1939. F. F. KISHLINE 2,148,821

LUBRICATION SYSTEM FOR SUPERCHARGERS

Original Filed Aug. 7, 1935 4 Sheets-Sheet 3

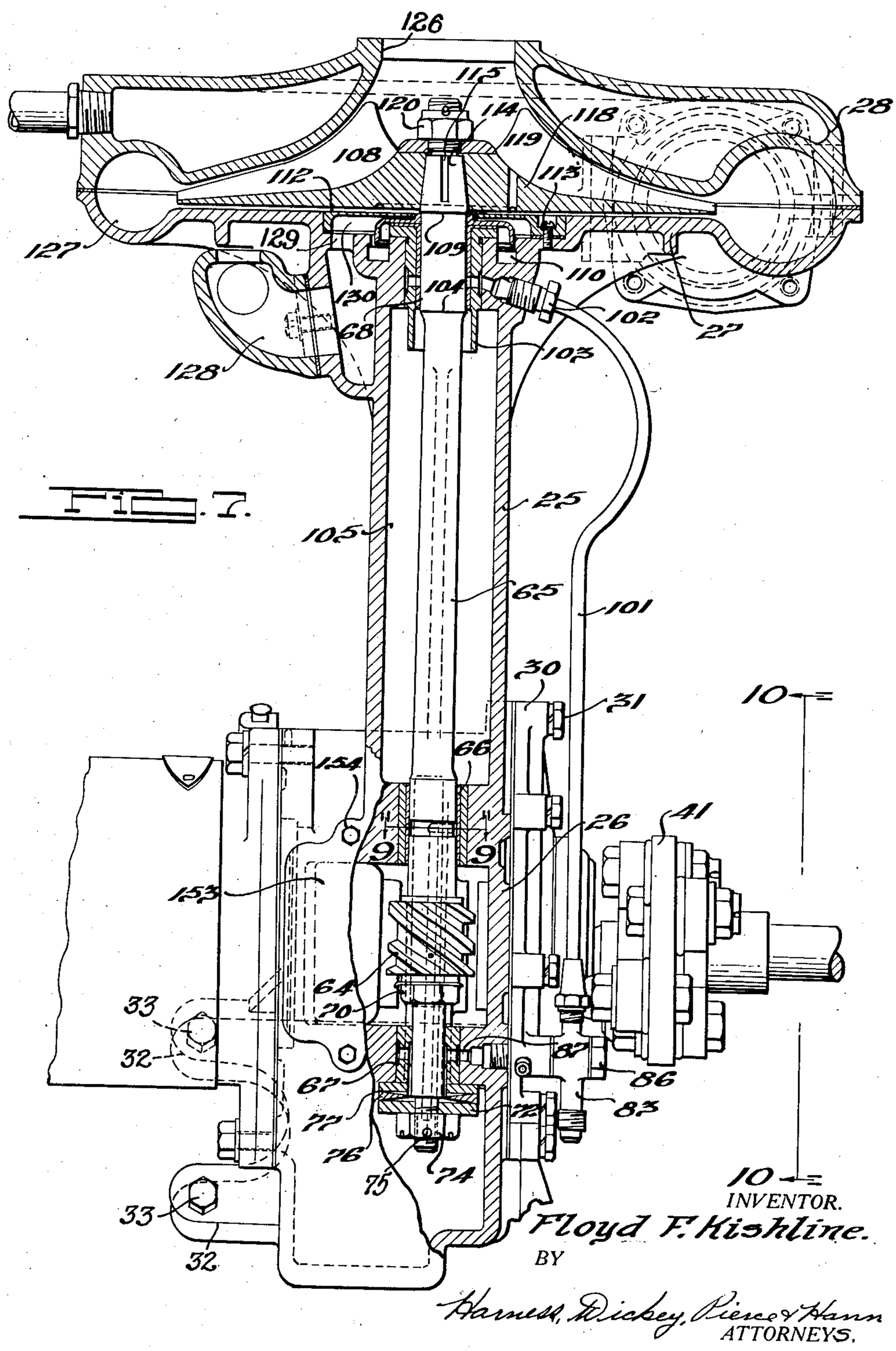


FIG. 1.

INVENTOR.
Floyd F. Kishline.
BY
Harness, Dickey, Pierce & Mann
ATTORNEYS.

Feb. 28, 1939. F. F. KISHLINE 2,148,821

LUBRICATION SYSTEM FOR SUPERCHARGERS

Original Filed Aug. 7, 1935 4 Sheets-Sheet 4

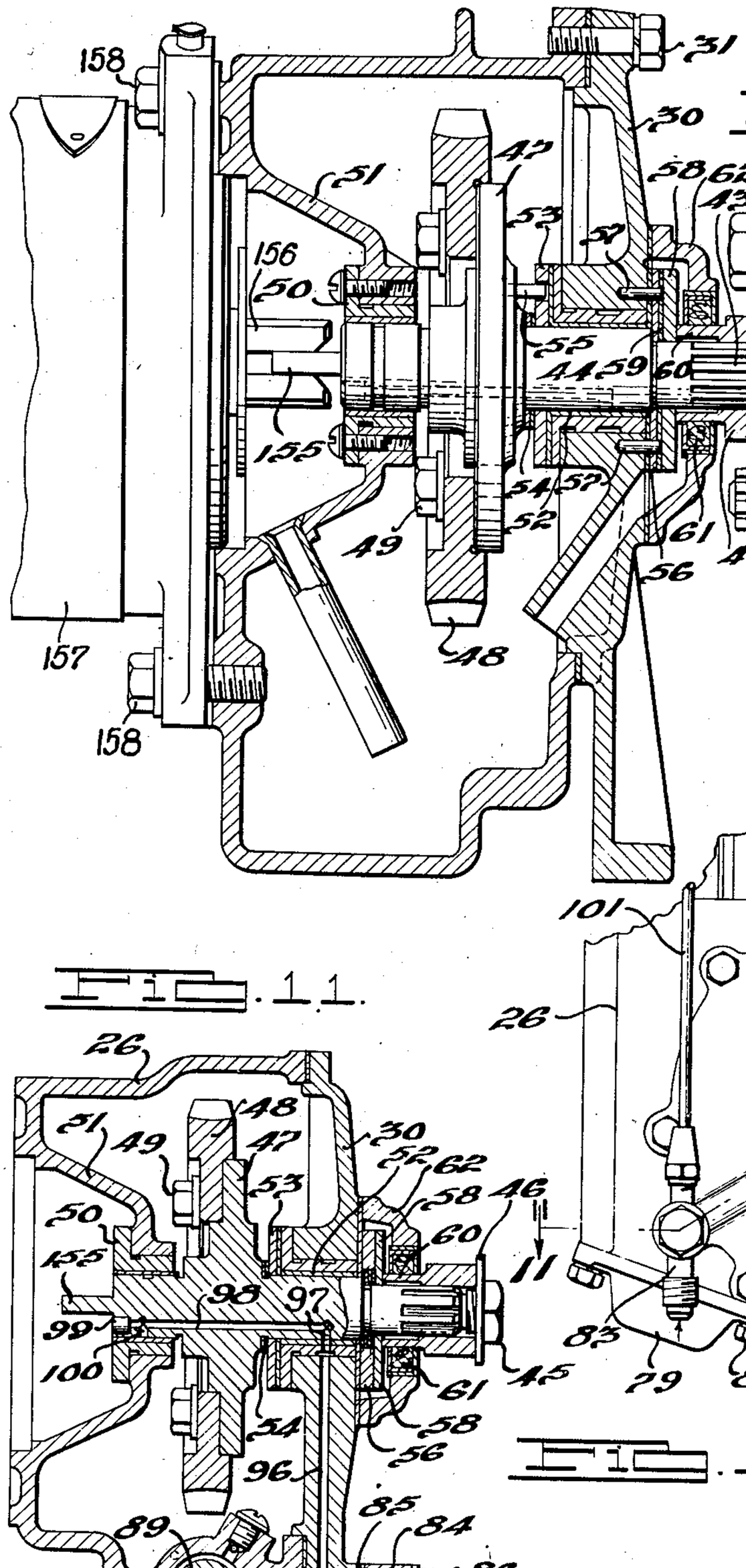


FIG. 8.

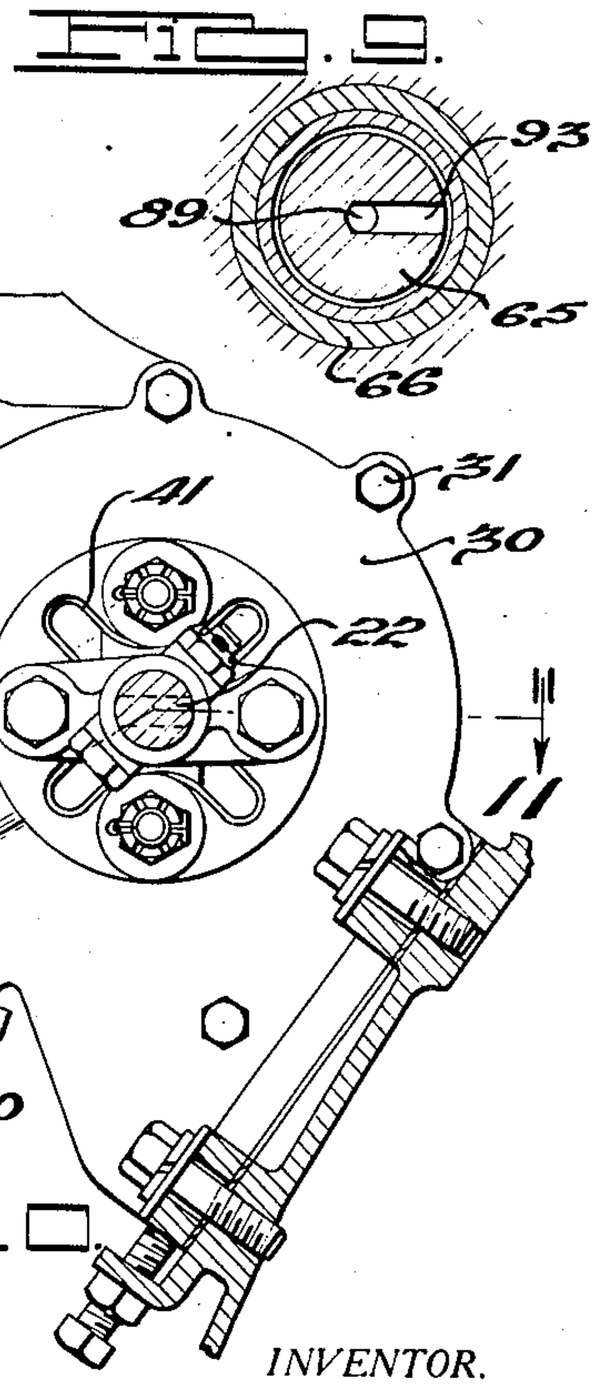


FIG. 11.

FIG. 10.

INVENTOR.

Floyd F. Kishline.

BY

Harness, Dickey, Pierce & Mann.

ATTORNEYS.

Patented Feb. 28, 1939 2,148,821

UNITED STATES PATENT OFFICE

2,148,821

LUBRICATION SYSTEM FOR SUPERCHARGERS

Floyd F. Kishline, Detroit, Mich., assignor to Graham-Paige Motors Corporation, a corporation of Michigan

Original application August 7, 1935, Serial No. 35,022. Divided and this application January 15, 1936, Serial No. 59,201

4 Claims. (Cl. 184—6)

This invention relates to internal combustion motors and particularly to the fuel induction systems thereof and has particular relation to a supercharger construction employed in connection with such induction systems, the principal object being the provision of a new and novel construction which particularly lends itself to quantity production and continued and efficient service without requiring especial attention; which has no parts that are subject to unusual wear so as to require frequent replacement to maintain its efficiency, and which is of such simple and rugged character as to permit its assembly and/or disassembly by the usual types of garage mechanics with but little possibility of interfering with its proper operation.

This application is a division of applicant's prior co-pending application for Supercharger for internal combustion motors, filed August 7, 1935, Serial No. 35,022.

While the above mentioned prior co-pending application is primarily directed to the mounting of a supercharger on an internal combustion motor, the present case is primarily directed to a novel and unique lubrication system for superchargers.

Other objects include the provision of a supercharger construction including a vertically arranged drive shaft to the upper end of which a supercharger impeller is secured and to the lower end of which a driven worm is secured, the shaft extending in unbroken relationship between these parts and being provided with means adjacent the bottom of the shaft for controlling the axial position of the shaft and the parts carried thereby; the provision of a special form of connection between the impeller of the supercharger construction and its driving shaft so constructed and arranged as to reduce the stresses in the hub of the impeller in service; the provision of a supercharger construction for an internal combustion motor including a housing enclosing the driving elements for the supercharger and which housing is in open communication with the interior of the motor crank case, together with a novel form of means for sealing the space between the supercharger impeller casing and the casing for the driving mechanism therefor without the necessity of employing rubbing surfaces; the provision of means in combination with a supercharger impeller having a vertically arranged downwardly projecting drive shaft of means for preventing the passage of liquid fuel from the impeller housing downwardly along the said shaft; and the provision of means in combination with a hollow supercharger housing in open communication with the interior of the crank case of an internal combustion motor, permitting the casing to breathe without danger of losing oil particles therefrom.

Other objects include the provision of a novel oiling system for a motor supercharger; the provision of a motor supercharger so constructed and arranged as to provide a lubricant well for those bearing surfaces subjected to greatest pressures in service so that a readily available supply of oil is provided for such services in starting up the engine and before the oiling system becomes operative to provide a flow of oil through the supercharger; and the provision of a supercharger having a worm and wheel for driving the same and so constructed and arranged as to constantly bathe the contacting teeth of the worm and wheel with a stream of lubricant.

The above being among the objects of the present invention, the same consists in certain novel features of construction and combinations of parts to be hereinafter described with reference to the accompanying drawings and then claimed, having the above and other objects in view.

An illustrative embodiment of this invention is shown in the accompanying drawings, in which:

Fig. 1 is a view in side elevation of a conventional in-line type of internal combustion motor equipped with my improved supercharger, the lower portion of the motor being broken away.

Fig. 2 is a diagrammatic view in front elevation of the same illustrating the manner in which the accessory shaft is driven in conjunction with the cam shaft from the crank shaft of the motor.

Fig. 3 is an enlarged fragmentary top plan view of the supercharger mounted on the motor but with the carburetor removed from the top of the supercharger.

Fig. 4 is a transverse vertical sectional view taken on the line 4—4 of Fig. 3, showing the motor, intake manifold and supercharger.

Fig. 5 is an enlarged vertical sectional view showing in detail the mounting of the lower end of the impeller shaft and the manner in which it is lubricated.

Fig. 6 is an enlarged fragmentary sectional view taken on the line 6—6 of Fig. 4 showing the manner in which the impeller is keyed to the top end of the impeller shaft.

Fig. 7 is an enlarged sectional view taken on the line 7—7 of Fig. 4 with a portion of the gear case housing broken away to show the interior thereof.

Fig. 8 is an enlarged vertical sectional view

taken on the line 8—8 of Fig. 4, showing the driving gear shaft journaled in the driving gear housing and cover plate therefor, and the thrust bearings which hold the driving gear positioned axially within its housing.

Fig. 9 is an enlarged fragmentary sectional view taken on the line 9—9 of Fig. 7, showing the details of construction of the intermediate journal bearing for the impeller shaft and the manner of distributing lubricant therearound.

Fig. 10 is an enlarged fragmentary view, partly in elevation and partly in section, taken substantially on the line 10—10 of Fig. 7, showing the lubricant connections on the driving gear housing cover plate.

Fig. 11 is a sectional view taken on the line 11—11 of Fig. 10, showing the lubricant supply ducts for the driving gear shaft bearings, and the lower impeller shaft bearings.

In the construction shown in the drawings, a conventional type of cylinder in-line internal combustion motor 20 is shown provided with the improved supercharger generally designated at 21 mounted on the crank case thereof and driven by an accessory shaft 22 which also drives water pump 23 and generator 24. The generator 24 is attached to that side of the supercharger driving gear housing opposite to the supercharger's attachment to the accessory shaft 22 so that the generator is in reality driven by the drive shaft of the supercharger which in turn is actuated by the accessory shaft as shown more clearly in Fig. 8.

The supercharger, per se, comprises a generally vertically disposed housing, the middle portion 25 of which will be hereafter designated as the impeller shaft housing; the lower portion 26, which will be hereafter referred to as the driving gear housing, and the upper part 27, which will be hereafter referred to as the lower half of the impeller housing. A complementary cover plate or housing 28 is secured to the housing 27 by bolts and cap screws so as to form a suitable enclosure for the impeller of the supercharger. The driving gear housing 26 is provided with a cover plate 30 rigidly secured thereto by cap screws 31.

The boss 36 is recessed to receive one leg of an angle bracket 37 so that the top surface thereof is substantially flush with or slightly below the surface of the boss 36, said bracket being attached to the boss 36 by countersunk flat head screws 38. The other leg of the bracket 37 is drilled and tapped to receive set screws 39 which are threaded therethrough in position to have their inner protruding ends abut against the driving gear housing 26 for adjustably positioning the supercharger with respect to the accessory shaft and other connection to which the supercharger is attached. Lock nuts 40 are provided on the set screws 39 for securing said screws in adjusted position so that the supercharger may be replaced in such adjusted position in the event of removal for service or the like. The slightly enlarged holes through the lugs 32 permit limited adjustment by the set screws 39 before the cap screws 33 are fully set up.

Means are provided for driving the supercharger and comprise a flexible coupling 41, one end of which is attached to the accessory shaft 22, and the other end of which is provided with an interiorly splined hub 42 which telescopes on the complementary splined end 43 of a driving gear shaft 44. A nut 45 is threaded on the reduced threaded end of the shaft and bears against a washer 46 and which in turn abuts against the splined hub 42. The driving gear shaft 44 is provided with an integrally formed radially extending hub 47 medially of its ends to which is secured a drive gear 48 of the cone type by means of a series of cap screws 49.

The end of the shaft 44 opposite to that connected to the accessory shaft is journaled in a removable bushing 50 which is mounted in the depressed end wall 51 of the driving gear housing 26, and the other end of the shaft at the opposite side of the hub 47 is journaled in a bearing 52 mounted in the cover plate 30. A thrust bearing 53 is provided between the inner radially flanged end of the bearing 52 and the hub 47, its location on the shaft being accurately positioned by a series of shims 54, the shims being supplied in variable thicknesses. Pins 55 are fixed in the thrust bearing 53 and extend axially of the shaft with their ends fitting in apertures provided in the hub 47 so that the thrust bearing is constrained to rotate with the hub. A bearing washer 56 is secured by pins 57 to the outside of the cover plate 30 and forms one-half of a second thrust bearing, the other half of which comprises a ring or washer 58 which is clamped against a series of variable thickness shims 59 by a reduced inner end 60 of the hub 42.

The outer surface of the hub portion 60 is accurately turned and smoothed so as to be adaptable for having an oil seal 61 bear thereon, the oil seal being carried by a supplementary cover plate 62. With this arrangement opposite sides of the cover plate are impressed by the thrust bearings and the driving gear 48 is accurately positioned within the housing 26 by the location of the driving gear shaft 44 in its cover plate bearing.

The worm 64 is splined on the lower end of a vertically disposed impeller shaft 65 which is journaled immediately above and below the worm in the bearings 66 and 67 respectively, and closely adjacent its upper end in a bearing 68. The lower end of the shaft 65 is provided with a shoulder 69 against which the worm 64 abuts and is held against said shoulder by a nut 70 threaded on the shaft 65 and secured in position by lock washers 71. The lower end of the shaft 65 extends below the lower bearing 67 and is provided with a thrust bearing comprising a washer or apertured disc 72 which is slotted to fit the flattened sides 73 of the shaft so that said washer is rotated with the shaft and is held thereon by a castellated nut 74 secured by a cotter key 75. The upper surface of the washer 72 bears against a floating washer 76 which is slightly tapered in cross section toward the middle thereof, as shown clearly in Fig. 5, this construction aiding in the lubrication of the bearing by permitting lubricant to be fed outwardly by centrifugal force. The floating washer 76 in turn bears on its upper side against a washer or apertured disc 77 which is secured to the housing by pins 78 so as to be constrained against rotation.

A cup shaped cover 79 is secured to the housing by cap screws 80 so as to provide a well or reservoir for lubricant in such manner that the shaft thrust bearing is substantially submerged in lubricant at all times. An overflow opening 81 is provided so that lubricant may circulate through the bearing and overflow into the driving gear housing.

Lubricant is supplied to the drive gear shaft and impeller shaft by an oil supply pipe 82, shown in Fig. 1, which conducts lubricant to the fitting 83 shown in Figs. 7 and 10, from which point it

passes inwardly through a radially disposed opening 84 to an axially disposed bore 85 of attaching bolt 86, the inner end of which is threaded into the housing. Lubricant passes inwardly from the passage 85 through a bore 87 in the housing to the lower bearing 67.

Axially extending grooves 88 are provided in the lower half of this bearing for conducting lubricant downwardly to the thrust bearing at the lower end of the impeller shaft 65 and which comprises the discs 72, 76, and 77. The lower end of the impeller shaft 65 is provided with an axial bore 89, the lower end of which is closed by a plug 90. Radially extending bores 91 are provided at a point medially of the bearing 67 so that lubricant may pass from this bearing inwardly to the axial bore 89, thence upwardly to radial bores 92 which are provided between the lower teeth of the worm and outwardly through radial bores 93 which are provided at the medial part of the bearing 66. The lower bearing 67 is also provided with a pipe or nozzle 94 which directs a stream of lubricant directly into the teeth of the drive gear 48 as its teeth go into mesh with the worm 64.

The attaching bolt 86 is also provided with radially disposed bores 95 which permit lubricant to pass into a bore 96 formed in a cover plate housing and which leads to the bearing 52, which bearing is peripherally grooved so that the lubricant passes completely around it. The shaft 44, at a point in registry with the peripheral groove in the bearing 52, is provided with a radially extending bore 97, the inner end of which communicates with an axially extending bore 98 which is drilled eccentrically in the shaft 44 and the outer end of which is closed by plug 99. At a point adjacent the plug 99 another radially extending bore 100 is provided which permits the lubricant to pass from the bore 98 outwardly to the bearing surfaces of the removable bearing 50.

The fitting 83 is also provided with a lead pipe 101 which extends upwardly, as shown clearly in Fig. 7, and conducts lubricant through a suitable fitting 102 threaded in the upper part of the impeller shaft housing 25 to the upper bearing 68. The upper bearing 68 at its lower end is provided with a cylindrical skirt 103 which is in spaced relation to the impeller shaft 65, so that lubricant draining out of the bearing 68 and being thrown off of the shaft at its shoulder 104 is collected on the inner side of the skirt 103 and drains therefrom in relatively large drops.

It has been found in practice that due to the extremely high speed of rotation of the impeller shaft, lubricant draining out of the upper bearing is thrown off of the shoulder 104 in the form of a very fine mist having the appearance of blue smoke, which mist is readily drawn upwardly through the breather space provided around the shaft and opening in the top of the housing and is fed with the fuel into the motor. Lubricant draining from the skirt 103 drops downwardly in the space 105 which is provided in the housing 25 around the shaft 65 and passes through a drain hole 106 into the driving gear housing. All lubricant from the journaled parts thus drains into the driving gear housing 26 which serves as a reservoir for the lubricant and maintains a lubricant level therein which partially submerges the gear teeth on the lower part of the driving gear 48 so that these teeth are at all times lubricated when the motor is first started. After normal operation, lubricant is maintained in the housing 26 at the proper desired level by reason of the overflow openings 107 which are provided in registry with each other in the motor crank case housing and supercharger driving gear housing, as shown more clearly in Fig. 4.

In practice, it has been found impossible and impracticable to effect a seal around the impeller shaft at a point where it passes into the impeller housing, and therefore means have been provided for effectively excluding lubricant of the bearing 68 from passing into the impeller housing and comprises an inverted saucer shaped oil slinger 108 tightly fitted on the shaft 65 between the upper bearing 68 and a shoulder 109, formed on the shaft, the peripheral edge of the oil slinger being curved downwardly and housed within an annular groove 110 formed in the upper end of the housing. The floor of the groove 110 progressively slopes downwardly so that oil passing thereinto from the inner surface of the oil slinger is drained around the shaft and then downwardly through the breather opening 111 as shown more clearly in Fig. 4.

For convenience of manufacturing, the upper end of the housing is closed by a plate 112 which is secured to the housing by screws 113; said plate forming one wall of the impeller housing and being provided at its center with an opening through which the upper end of the impeller shaft 65 extends. The upwardly extending end 114 of the impeller shaft is frusto-conical in shape and provided at diametrically opposite sides with key ways 115 for receiving keys 116, said keys extending into rather loosely fitting slots 117 formed in the hub of an impeller 118. The impeller 118 is in the form of a disc having a lower plane side, and an upper side provided with radially disposed, axially extending fins or blades 119 which are of decreasing height from the hub of the impeller outwardly.

The tapered end 114 of the shaft and the complementary hole formed in the impeller hub are disposed at a relatively steep angle so that tightening of the nut 120, by which the impeller is secured to the impeller shaft, will not exert an undue bursting strain on the impeller. However, the angle and fit of the impeller on the tapered shaft is such that when the nut 120 is securely tightened, the impeller is driven substantially entirely from its frictional fit on the shaft rather than through the keys 116, which keys are provided more as a safety precaution than as a regular driving means for the impeller.

The under plane side of the impeller 118 is provided with an annular groove 121 which surrounds the shaft 65 in spaced relation thereto and the impeller is provided with axially extending bores 122 which provide communication with the groove 121. With this arrangement, liquid fuel, which might tend to drain inwardly toward the shaft between the underside of the impeller and its adjacent housing, is entrapped in the groove 121 and drawn upwardly through the bores 122 where it is mixed in with the fuel passing through the impeller housing.

The top or cover plate 28 of the impeller housing is provided with a water jacket opening 123 of varying cross sectional area and the point where the water jacket has the greatest cross sectional area is located adjacent to the place where the impeller suction pressure is the lowest. Water from the internal combustion motor cooling system pump 23 is supplied to the water jacket 123 by feed pipe 124.

A down draft carburetor 125, as shown in Fig. 1, is mounted on top of the impeller housing so as to discharge its fuel downwardly through

the central opening 126 provided in the impeller housing cover 28 so that the fuel is drawn downwardly on to the top surface of the impeller 118 from which it is thrown outwardly by the impeller blades 119 into the collecting ring 127 which is formed beyond the outer peripheral edge of the impeller partly in the lower housing 27 and partly in the upper housing or over plate 28.

The upper end of the impeller shaft housing 25 is provided with a breather 128 which permits air to pass inwardly into the opening 129 which partially surrounds the upper end of the housing and into the annular space 130 formed underneath the plate 112. From the annular space 130 the air passes upwardly around the shaft into the impeller housing, thence outwardly to the groove 121 and then through the bores 122. This arrangement provides a positive flow or breathing of air into the impeller housing independently of air coming in through the carburetor so that the carburetor adjustment has to be made so as to compensate for this additional amount of air.

Water passes out of the jacket 123 through a pipe and hose connection 131, as shown in Fig. 3, and into a water jacket 132 formed in the fuel duct 133 which carries the fuel from the supercharger to the motor intake manifold 134.

In the operation of this device rotation of the motor crankshaft 149 through the medium of chain belt 150 rotates the cam shaft 151 and accessory shaft gear wheel 152 which is rigidly secured to the accessory shaft 22. Rotation of the shaft 22 causes the drive gear 48 to rotate the worm 64, thus rotating the impeller 118.

Rotation of the impeller draws fuel downwardly through the carburetor 125, and supercharges it outwardly through the collecting duct 127 into the cross-over duct 133, thence to the intake manifold 134 of the internal combustion motor.

When the supercharger is first assembled on the motor, a quantity of lubricant is introduced into the casing at 26 through an inspection plate 153 which is secured to the housing 26 by cap screws 154 so that the thrust bearing at the lower end of the impeller shaft and some of the teeth on drive gear 48 are submerged in oil, thus insuring lubrication of the driving gear teeth immediately upon starting of the motor. As the motor turns over and oil is driven through the motor lubricating system, lubricant under pressure will be supplied to the supercharger through the supply pipe 82 and thence into both bearings of the driving gear shaft as well as the three bearings of the impeller shaft. In addition thereto, as soon as the motor starts, a stream of oil will be projected out of the pipe 94 directly into the face of the teeth of the driving gear and worm as they come into engagement.

The arrangement of the supercharger and cross-over duct 133 is such that the floor of the fuel conducting passageway from the supercharger to the intake manifold is on a continual decline so that liquid fuel which may condense on the walls of the cross-over duct can not form in puddles, but drains at all times and at all places from the floor of the supercharger to the intake manifold 134.

As shown in Fig. 8, the end of the driving gear shaft opposite to that connected to the accessory shaft is flattened as at 155 so as to be embraced between parallel fingers 156 of the armature shaft of a generator 157 which is secured to the housing 26 by cap screws 158.

Formal changes may be made in the specific embodiment of the invention described without departing from the spirit and substance of the broad invention, the scope of which is commensurate with the appended claims.

I claim:

1. In a supercharger construction, a housing having an impeller compartment and an impeller shaft compartment separated by a wall, a shaft journaled in said housing and extending into the impeller compartment through an opening in said wall, said shaft having substantial clearance with the edges of said opening, an impeller fixed on said shaft within the impeller compartment, an oil slinger snugly fitted to said shaft between said wall and shaft journal, and in spaced relation to said wall, means for supplying air to the space between said oil slinger and wall whereby said impeller will cause a flow of air into said impeller compartment through the opening around said shaft where it extends through said wall.

2. In a supercharger a substantially vertically disposed impeller shaft, an impeller on said shaft, a journal bearing for such shaft adjacent said impeller, an oil slinger fitted to said shaft between said bearing and impeller, said oil slinger having a downwardly inclined peripheral edge and an annular trough surrounding said shaft into which extends the peripheral edge of said oil slinger.

3. In a supercharger, a housing, an impeller shaft journaled in said housing, a worm on said shaft, a gear for driving said worm, and a thrust bearing for resisting axial thrust of said shaft, said bearing including a disc fixed to the housing, a disc fixed to rotate with the shaft, and a floating disc between said fixed discs.

4. In a supercharger, a housing, a substantially vertically disposed impeller shaft journaled in said housing, a worm on said shaft, a gear for driving said worm, a journaled bearing for said shaft below said worm, means for supplying lubricant under pressure to the medial part of said bearing, said bearing having an axially disposed groove in its bearing face extending from the medial part thereof downwardly to the lower end thereof, and a thrust bearing for said shaft located below said journaled bearing whereby lubricant passing down said journaled bearing groove is supplied to said thrust bearing.

FLOYD F. KISHLINE.