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PUMP

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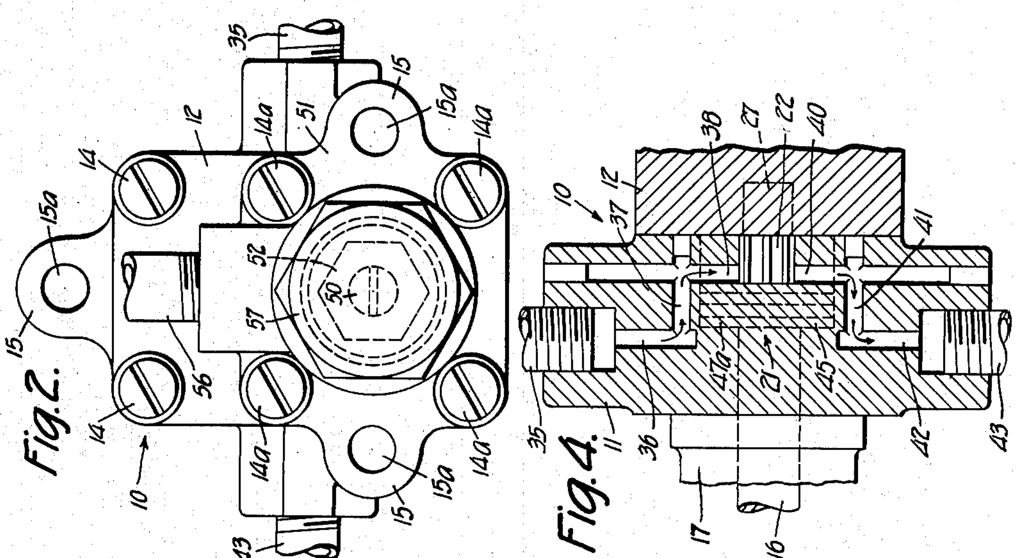

Fig. 2. Fig. 4.

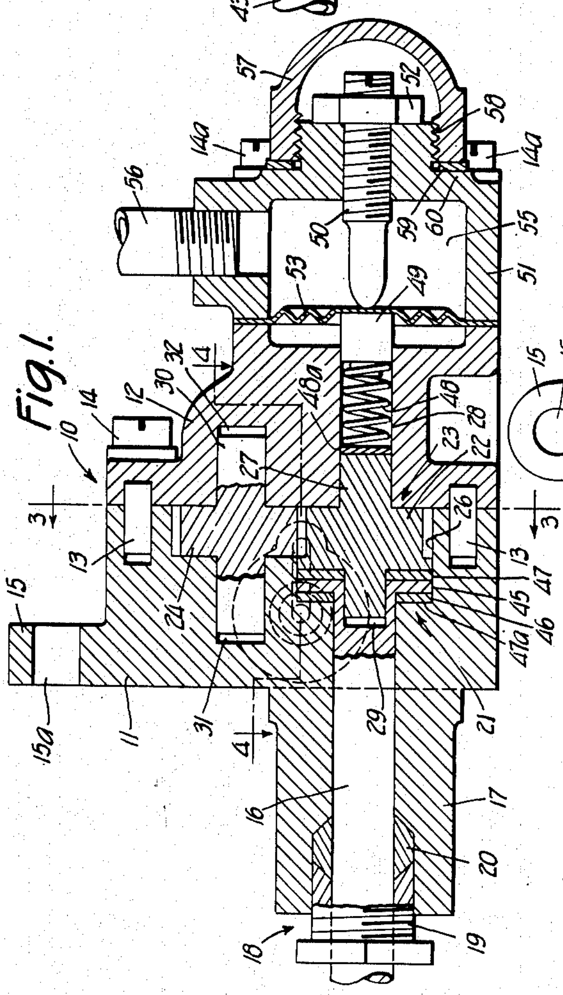

Fig. 1.

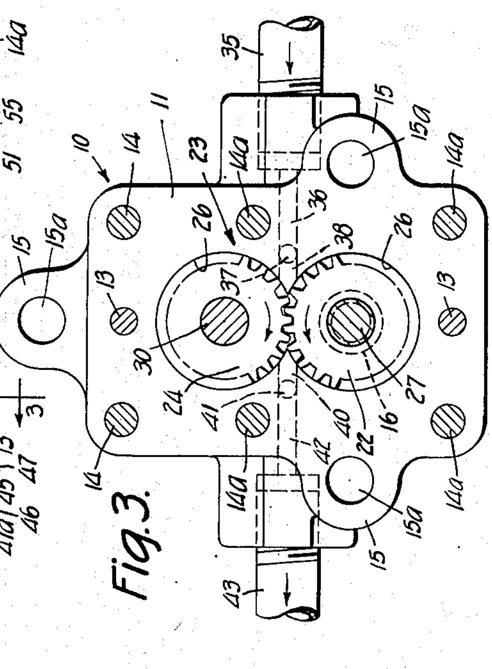

Fig. 3.

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6 Claims. (Cl. 103—23)

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This invention relates to improvements in pumps and is herein illustrated as applied to fuel pumps for internal combustion engines.

Heretofore provision has been made in fuel pumps for by-passing the fuel to return it to the fuel tank when the pump reaches its maximum load or resisting pressure of the carbureter. This by-passing of the fuel has been found objectional since it produces churning of the fuel which results in the formation of air bubbles and vapor locks.

An object of the present invention is to provide a fuel pump whereby the by-passing of the fuel and resulting objections are avoided.

To this end the present invention provides means whereby a solid stream of liquid, free from the air bubbles, may be delivered to the carbureter, the flow of this stream being retarded and in some instances stopped whenever the pump pressure approaches the maximum load or pressure of the carbureter. As soon as the pressure in the carburetor drops the stream of the fuel from the pump tends to resume its normal flow.

In carrying out this feature of the invention there is provided suitable means through the medium of which the drive shaft actuates the impeller and permits the rotation of the drive shaft when the impeller is arrested by the pressure of the carbureter.. This means includes a spring which produces sufficient pressure to cause the rotation of the impeller until a predetermined pump pressure is reached.

Another object of the invention is to automatically vary the pump pressure in accordance with various atmospheric pressure, for example when the pump is used in an airplane flying at various altitudes.

To this end provision is made of pressure responsive means which cooperates with the spring means to increase or decrease the effect of suitable friction means so that the pump pressure is increased automatically as the pump is carried to higher altitudes. The pressure responsive means is associated with the usual supercharger to be acted upon by its varying pressures which change with the height of altitude.

Other features and advantages will hereinafter appear.

In the drawings which form part of the specification:

Fig. 1 is a vertical section taken lengthwise of the pump;

Fig. 2 is an elevation looking at the right hand end of the pump in Fig. 1;

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Fig. 3 is a vertical section taken on the line 3—3 of Fig. 1, looking in the direction of the arrows at said line; and

Fig. 4 is a sectional top plan view of a portion of the pump taken on the line 4—4 of Fig. 1, looking in the direction of the arrows.

Similar reference characters represent similar parts throughout the specification.

The pump includes a casing 10 composed of two sections 11 and 12 which are located with respect to each other by dowel pins 13 and are secured to each other by screws 14 and 14a. The casing 10 is provided with lugs 15 having holes 15a through which suitable screws or bolts may be passed to secure the pump to an engine, not shown, or any other suitable object.

A drive shaft 16 extends through a bearing 17 and into the engine or any other suitable prime mover, to be rotated thereby. A stuffing box 18 comprising a gland 19 and packing 20 is provided at the outer end of bearing 17 to prevent leakage therefrom. At the inner end of the shaft 16 there is located a suitable friction means including a clutch 21 through the medium of which there is driven a gear 22 of impelling means 23, the gear 22 meshing with a gear 24 to drive the latter. The gears 22 and 24 are located in communicating chambers 26 to rotate freely therein. The impeller gear 22 is supported by a shaft 27 one end of which runs in a hole 28 of the casing section 12, the other end engaging in a hole 29 in the end of drive shaft 16. The driven gear 24 is supported by a shaft 30 one end of which engages in a hole 31 in casing section 11, the other end engaging in a hole 32 in the other casing section 12.

Thus it will be understood that while the impelling means 23 is in operation, gear 22 rotating in a counter-clockwise direction, Fig. 3, liquid is drawn thereby from a reservoir or tank (not shown) through pipe 35, Figs. 3 and 4, passages 36, 37 and 38 into chamber 26. The liquid is then forced by the impelling means 23 from the chamber 26 through passages 40, 41, 42 and pipe 43 to deliver the liquid to the engine or any other suitable means.

When the pump pressure approaches the maximum carbureter pressure the impelling means 23 slows down or is gradually stopped while the drive shaft 16 continues to rotate because of slippage of the clutch 21. As soon as the carbureter pressure drops the impelling means tends to resume its normal operating speed. Since the drive shaft continues to run at the speed of the prime mover the clutch 21 slips during the temporary slowing down or stopping of the impelling means 23.

The clutch 23 includes a flange 45 rigid on drive shaft 16 and located between two discs 46 and 47. The disc 46 is freely supported on drive shaft 16 and disc 47 is freely supported on gear shaft 27. These discs and the flange 45 are located in an extension 47*a* of the lower part of chamber 26 or in that part in which the gear 22 is located. A spring 48 provided in the hole 28 bears against the end of shaft 27 through the medium of a washer 48*a* to press the gear 22 axially against the carbon disc 47 which in turn presses against the flange 45, the latter pressing against the carbon disc 46 and the latter pressing against the end wall of extension 47*a* of chamber 27. This clutch construction produces sufficient friction to drive the impeller 23 to pump to a pressure depending upon the strength of spring 48. The discs 46 and 47 may be composed entirely of carbon or they may be of other suitable material with their surfaces carbonized to reduce to a minimum the wear of the clutch and associated parts. It will be noted that the left side of gear 22 extends to the outer edge of the teeth to thus provide a bearing surface as large as possible and also prevent the ends of the gear teeth from scraping the face of disc 47.

The right hand end of spring 48 bears against a plug like element 49 also located in the hole 28. The spring is constructed as nearly as possible to produce a predetermined pump pressure before the slipping of the clutch occurs. It should be understood that various springs 48 may be designed to produce various predetermined pump pressures within certain limits. Thus if the spring 48 produces seven pounds pressure and it is desired to increase the pump pressure to ten pounds this spring is removed and substituted by a stronger one to produce ten pounds pump pressure.

In case the springs do not produce exactly the required pressure, for example a little less than seven pounds or ten pounds, they may be adjusted slightly to increase their pressure to bring the pump pressure up to the exact pressure required. To this end the plug like element 49 may be pushed inwardly by a set screw 50 to adjust the spring and consequently the effectiveness of the clutch so that the pump delivers exactly the predetermined pressure before the clutch slips. The set screw 50 is threaded into a member 51 and is held in its adjusted position by lock nut 52. The member 51 is held on the outer side of the casing section 12 and is secured by the screws 14*a*.

To prevent leakage of liquid out of the end of the right hand end of the pump which may find its way past the plug 49 there is provided a cover in the form of a diaphragm 53 which is located between the plug 49 and set screw 50. This diaphragm is circular and is clamped tightly at its edge between the end of casing section 12 and the member 51.

In order that the pump may efficiently deliver fuel to the engine when used in various high altitudes as for example engines in airplanes, the member 51 may be provided with a chamber 55 into which extends a branch 56 from the usual super-charger so that the increasing pressures produced by the super-charger, as the airplane ascends, may act on the diaphragm to accordingly increase the pressure of spring 48 through the medium of the plug 49 and thus increase the pressure on the friction device with a result that the pump pressure is increased, as required, in higher altitudes.

To prevent leakage of air from the chamber 55, which may otherwise occur by passing out around the threads of set screw 50, there is provided a cap 57 which is threaded onto a reduced portion 58 of member 51. This cap presses a washer 59 of soft copper tightly against a shoulder 60 of the member 51 to form a seal.

From the foregoing it will be understood that if the pump is to be used only at sea level certain parts necessary for use in high altitude may be omitted.

Thus it will be understood that the pump of the present invention is simple in construction, efficient in operation and capable of pumping to a predetermined pressure; that when the pump approaches and meets resistance equal to its maximum pressure it is slowed down and may finally stop while the drive shaft continues to rotate; that as soon as the resistance diminishes the pump tends to resume its normal operation to produce a steady flow of liquid; and that the pump pressure is automatically varied in accordance with the altitude in which it is performing.

It should also be understood that although the pump has been described as a fuel pump it may also be used to pump other liquids or fluids.

While certain preferred embodiments of the invention have been described, it will be understood that certain parts may be used with others and that changes in the form, arrangement, proportions, sizes and details thereof may be made without departing from the scope of the invention as defined in the appended claims.

I claim:

1. In a pump, the combination of a casing, a drive shaft extending into one end of the casing, a clutch associated with the inner end of said shaft, an impeller element to be driven by said shaft through the medium of said clutch, a shaft to support said impeller element, the inner end of said drive shaft having a hole therein in which one end of the impeller shaft is supported, said casing having a hole extending in from the other end thereof in which the other end of the impeller shaft is supported, a spring in the last mentioned hole to press said impeller element against said clutch, a plug like element in the last mentioned hole to act against said spring, a diaphragm to engage the outer end of said plug like element, means to secure said diaphragm at its edge to the end of said casing to prevent leakage from the last mentioned end of said casing, and means to prevent leakage from the end of the casing into which the drive shaft extends.

2. In a pump, the combination of a casing, a drive shaft extending into one end of the casing, a clutch associated with the inner end of said shaft, an impeller element to be driven by said shaft through the medium of said clutch, a shaft to support said impeller element, the inner end of said drive shaft having a hole therein in which one end of the impeller shaft is supported, said casing having a hole extending in from the other end thereof in which the other end of the impeller shaft is supported, a spring in the last mentioned hole to press said impeller element against said clutch, and means to hold said spring in the hole.

3. In a gear pump, the combination of a casing, a drive shaft extending into one end of the casing, a driving impeller gear, a driven impeller gear operable thereby, a clutch adjacent to one side of the driving gear to be actuated by the drive shaft to rotate said driving gear, said casing

having a hole in the other end thereof, a spring in said hole to act against the other side of the driving gear to press it against said clutch, a diaphragm to close the last mentioned end of said casing, and means acting on the exterior of said diaphragm to adjust the pressure of said spring.

4. In a pump, the combination of a casing, a drive shaft extending into one end of the casing, a clutch associated with the inner end of said shaft, an impeller element to be driven by said shaft through the medium of said clutch, a shaft to support said impeller element, the inner end of said drive shaft having a hole therein in which one end of the impeller shaft is supported, said casing having a hole extending in from the other end thereof in which the other end of the impeller shaft is supported, a spring in the last mentioned hole to press said impeller element against said clutch, means to hold said spring in the hole, and means to vary the pressure of said spring.

5. In a gear pump, the combination of a casing, a drive shaft extending into one end of the casing, a driving impeller gear, a driven impeller gear operable thereby, a clutch adjacent to one side of the driving gear to be actuated by the drive shaft to rotate said driving gear, said casing having a hole in the other end thereof, a spring in said hole to act against the other side of the driving gear to press it against said clutch, a diaphragm to close the last mentioned end of said casing, means acting on the exterior of said diaphragm to adjust the pressure of said spring, means forming a fluid pressure chamber associated with said diaphragm, and means to conduct fluid into said chamber to act through the medium of said diaphragm on said spring independently of the pressure adjusting means.

6. In a gear pump, the combination of a casing, a drive shaft extending into one end of the casing, a driving impeller gear, a driven impeller gear operable thereby, a clutch adjacent to one side of the driving gear to be actuated by the drive shaft to rotate said driving gear, said casing having a hole in the other end thereof, a spring in said hole to act against the other side of the driving gear to press it against said clutch, a diaphragm to close the last mentioned end of said casing, means acting on the exterior of said diaphragm to adjust the pressure of said spring, means forming a fluid pressure chamber associated with said diaphragm, means to conduct fluid into said chamber to act through the medium of said diaphragm on said spring independently of the pressure adjusting means, means to adjust the pressure of said spring, the pressure adjusting means comprising a screw extending through the fluid chamber to the exterior thereof for manipulation.

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