

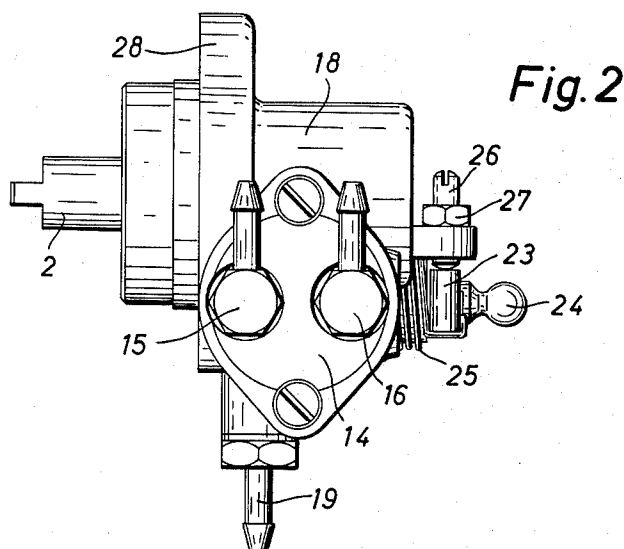
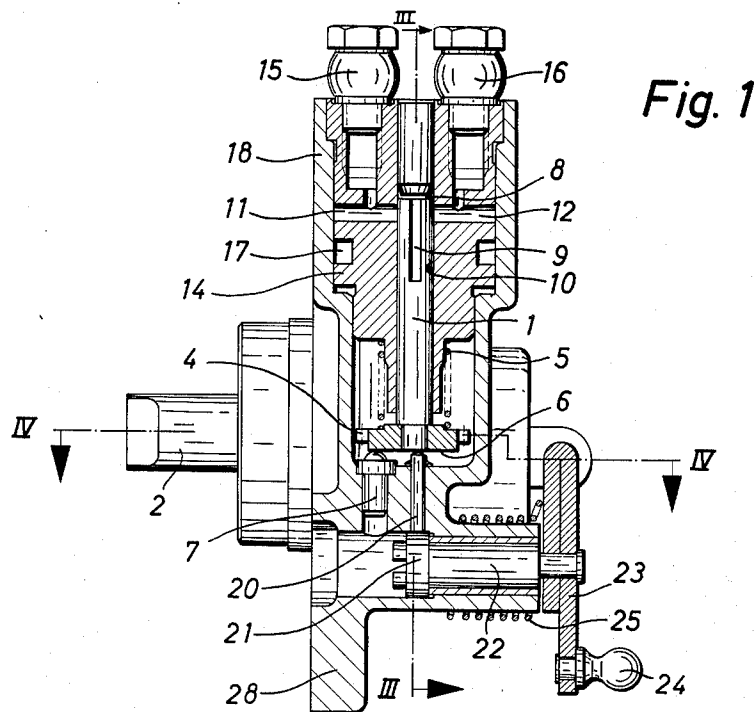
Aug. 24, 1965 W. STAEGE ETAL 3,202,102
 DEVICE FOR LUBRICATING TWO-STROKE CYCLE INTERNAL
 COMBUSTION ENGINES USING LIGHT FUEL
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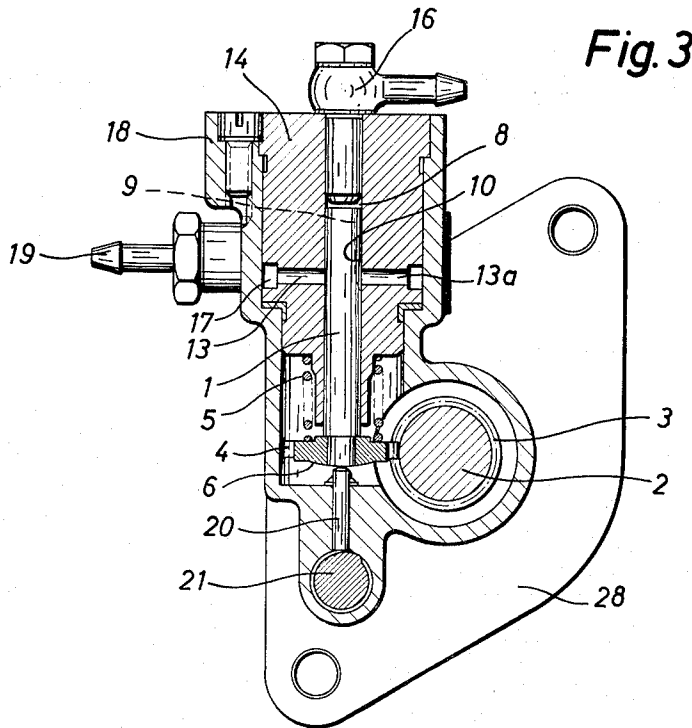


Fig. 3

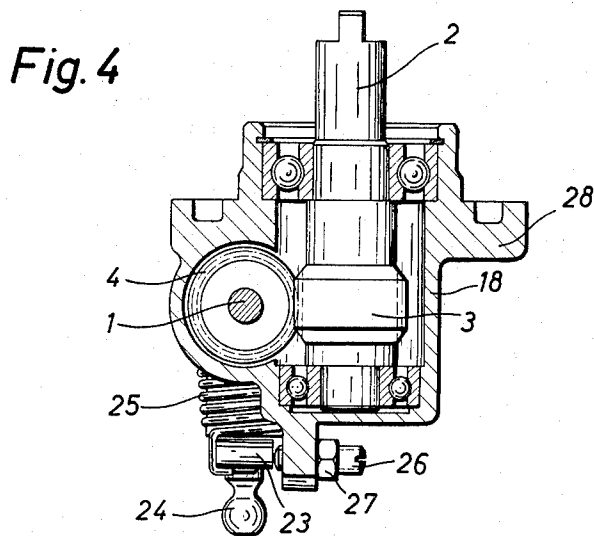


Fig. 4

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DEVICE FOR LUBRICATING TWO-STROKE CYCLE INTERNAL COMBUSTION ENGINES USING LIGHT FUEL

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K 42,143

9 Claims. (Cl. 103—7)

This invention relates to a method of lubricating an internal combustion engine operating on the two-stroke cycle system and using light fuel whereby a pressurized lubricant is supplied to the engine by means of a separate lubricating oil pump which is independent of the fuel supply system. The invention also concerns a lubricating oil pump adapted to carry the method of the invention into practice. The said method which has been known as "fresh oil lubrication" affords an important advantage over the so-called mixture lubricating system in which a predetermined proportion of lubricating oil is admixed with the light fuel. This lubricating oil forms a constituent of the fuel/air mixture prepared in the carburettor and is carried, by the fuel/air mixture, to the various points to be lubricated. The advantage resides in the fact that the internal combustion engine may be fitted with two separate tanks, namely a fuel tank and an oil tank. Moreover, it is possible to control the supply of lubricating oil to the engine by means of the rate-of-delivery control member of the oil pump so as to match the oil supply with the operating conditions of the internal combustion engine independently of the fuel supply. On the other hand, however, it is an inherent drawback of the fresh oil lubricating system that in cases in which the internal combustion engine is operated under conditions of low ambient temperatures the lubricating oil is no longer effectively distributed because the oil tends to become less free-flowing at lower temperatures, it being even possible that the temperature of the oil drops below the point of congelation, this in turn causing undesirable wear and, under certain conditions, serious damage to the engine.

In order to provide for the afore-described advantageous fresh oil lubricating method to be rendered usable even under conditions of very low ambient temperatures, the present invention provides for lubricating oil and light fuel serving to dilute the oil to be brought into contact in the lubricating oil pump which then serves to supply the engine with a mixture of lubricating oil and light fuel. Thus, according to the invention, a mixture of lubricating oil and light fuel is prepared, the formation of this mixture, in contrast to the known mixture lubricating system, occurring independently of the formation of the fuel/air mixture with which the engine is supplied, with the oil/fuel mixture being exclusively prepared in the lubricating oil supply means.

According to another aspect of the invention, the lubricating oil pump may be adapted alternately to deliver lubricating oil and light fuel, the formation of the oil/fuel mixture being effected by the delivery pressure in the delivery line leading from the pressure chamber of the oil pump to the internal combustion engine. During operation of the engine, this arrangement ensures the supply of a constant oil/fuel mixture, the mixture ratio being a function of the adjustment of the lubricating oil pump.

For the purpose of carrying the method of the invention into effect there is provided a lubricating oil pump in the form of a valveless plunger type pump having a pump plunger adapted to be reciprocated and simultaneously rotated. The pump plunger having at least one control means provided therein which control means serve, before

each pressure stroke, to connect, according to the selected mixture ratio, the pressure chamber of the pump with suitable supply ports for lubricating oil and for light fuel. The arrangement is such that during the pressure stroke of the plunger the media acted upon by the plunger are transferred into a mixing chamber disposed upstream of the delivery connection of the pump. According to still another aspect of the invention, the supply pump is provided with a delivery-rate adjusting device in which the rate of delivery is adjusted by suitably limiting the length of the suction stroke of the pump plunger.

Other objects and features of the invention will become apparent as the description proceeds, especially when taken in conjunction with the accompanying drawing, illustrating a preferred embodiment of the invention, wherein:

FIG. 1 is a vertical cross section of a lubricating oil pump according to the invention;

FIG. 2 is a plan view of the pump of FIG. 1;

FIG. 3 is a vertical cross section along the line III—III of FIG. 1; and

FIG. 4 is a transverse cross section along the line IV—IV of FIG. 1.

The embodiment of a pump shown in the drawings includes a pump plunger 1 which is adapted to be simultaneously reciprocated and rotated, with the plunger being driven in rotation by a pump drive shaft 2 extending perpendicularly to the plunger axis, and having formed therein a drive worm 3 meshing with a worm gear 4 rigidly connected to the plunger. The upward stroke motion of plunger 1 is effected against the action of a return spring 5 in the form of a compression spring by a cam face 6 provided on the under side of worm gear 4 and co-operating with a stop or abutment 7 mounted in the pump body. The cam face 6, in the case of the embodiment shown, is designed in such a manner that the plunger performs two delivery strokes per revolution. The upper end of the plunger 1 is provided with an axial groove 9 opening towards the pressure chamber 8 of the pump during the two suction strokes occurring in the course of one full revolution of the plunger, the groove 9 alternately connects the supply port 11 for the lubricating oil and the supply port 12 for the light fuel leading into the working chamber 10 of the plunger with the pressure chamber 8 of the pump, whereas during the delivery strokes following the suction strokes the groove 9 connects the pressure chambers 8 with one of the radial delivery galleries 13 and 13a leading from the working chamber 10 of the plunger and extending at right angles to the ports 11 and 12. The supply of the lubricating oil and the light fuel to the ports 11 and 12 formed in the pump body is effected through connectors 15 and 16, respectively, threaded into the pump body. The delivery galleries 13, 13a in the form of drilled holes lead to an annular mixing chamber 17 in pump body 14. The mixing chamber in turn is connected to a delivery union 19 screwed to the pump casing 18 which serves to connect the delivery line to an internal combustion engine.

An adjustable suction stroke limiting member cooperating with pump plunger 1 is provided for the purpose of controlling the amounts of lubricating oil and light fuel to be delivered during each delivery stroke of the pump plunger. This suction stroke limiting member is constituted by a stop pin 20 disposed coaxially with the plunger 1 and slidably mounted in pump casing 18; the axial position of the stop pin is controlled by an adjustable eccentric 21 mounted for rotation within the pump casing. Mounted on a shaft 22 carrying the eccentric and extending out of the pump casing 18 is an adjusting arm 23 carrying a ball-headed pin 24 to which a suitable operating linkage may be connected. A torsion spring 25 biases the adjusting arm 23 towards a stop screw 26 carried by a

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lug projecting from the pump casing 18. With the adjusting arm 23 abutting the stop screw 26, the pump is adjusted for minimum delivery. The minimum delivery of the pump can be adjusted by means of stop screw 26 which may be locked in position by means of a lock nut 27.

The pump of the invention is driven at a speed which bears a constant ratio to the speed of the internal combustion engine. For this purpose the end of pump drive shaft 2 projecting from pump casing 18 is formed in such a manner that it may be connected by means of a positively acting coupling either to the crankshaft of the internal combustion engine or to an auxiliary drive connected to the latter. A mounting flange 28 formed on the pump casing 18 serves to secure the pump to the casing of the internal combustion engine.

What is claimed is:

1. A valveless plunger type oil pump for lubricating internal combustion engines comprising a pump housing and a cylinder, a pump plunger with slot means disposed in said cylinder for simultaneous reciprocating and rotary movement, said cylinder and plunger forming a pressure chamber, a fuel-oil mixing chamber in said cylinder having inlet passages disposed approximately 180° apart and adapted to communicate with said slot means, oil inlet passage means disposed approximately 90° from said chamber inlet passages, fuel inlet passage means disposed approximately 90° from said mixing chamber inlet passages and approximately 180° from said oil passage means, said oil and fuel means adapted to communicate with said slot means, means for simultaneously reciprocating and rotating said plunger to communicate said pressure chamber and slot means first with said oil means, then with one of said inlet passages to deliver oil to said mixing chamber, then with said fuel passage means, and then with the other inlet passage to deliver fuel thereto, and outlet means for discharging fuel and oil from said mixing chamber, whereby said pump provides successive suction and successive delivery strokes.

2. The oil pump according to claim 1, wherein said mixing chamber is a ring-shaped channel coaxially ar-

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anged around said plunger and connected to said pressure chamber by said inlet passages in said cylinder.

3. The oil pump according to claim 1, wherein said plunger slot means is an axially directed slot which opens toward said pressure chamber.

4. The oil pump according to claim 1, wherein said means for reciprocating and rotating said plunger comprises a gear wheel being engaged with a worm gear attached to a drive shaft.

5. The oil pump according to claim 4, wherein said means for reciprocating and rotating said plunger includes a return spring and a cam means arranged at the lower surface of said gear wheel, said cam means cooperating with a pin fixedly secured to said pump housing, and said cam means.

6. The oil pump according to claim 5, including means limiting reciprocating movement of said plunger for controlling the quantity of said fuel and said oil to be delivered at each delivery stroke.

7. The oil pump according to claim 6, wherein said limiting means comprises a pin arranged coaxially with said plunger and axially slidable in said pump housing, the axial position being adjusted by the angular position of an eccentric means.

8. The oil pump according to claim 6, wherein said eccentric means is fixedly secured to a shaft rotary movable in said pump housing, said shaft including an adjusting arm and a torsion spring biasing said arm towards an abutment arranged on said pump housing for causing said oil pump to deliver a minimum quantity.

9. The oil pump according to claim 8, with said arm further including an adjustable screw controlling the position of said abutment.

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