July 14, 1964 F. K. H. NALLINGER 3,140,700

PROCESS AND APPARATUS FOR LUBRICATING INTERNAL COMBUSTION ENGINES

Filed April 27, 1961 4 Sheets-Sheet 1

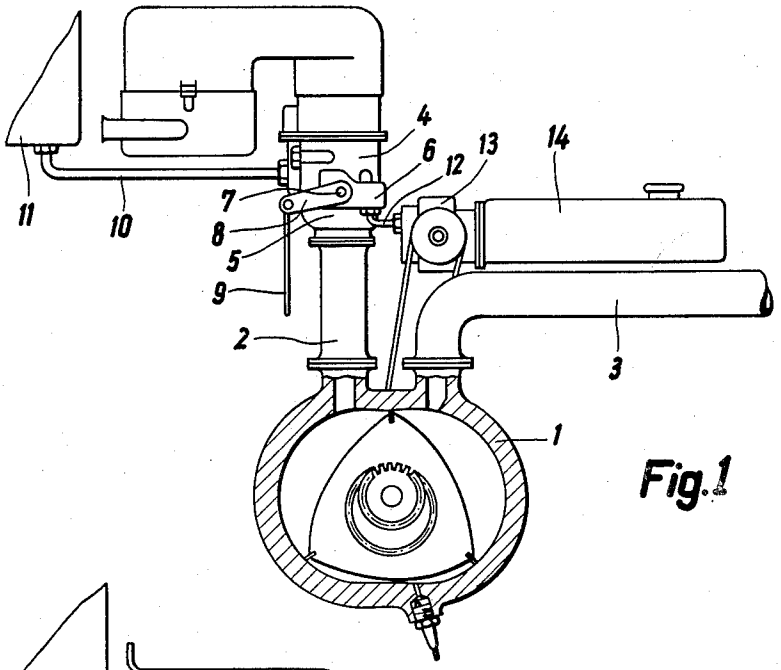

Fig.1

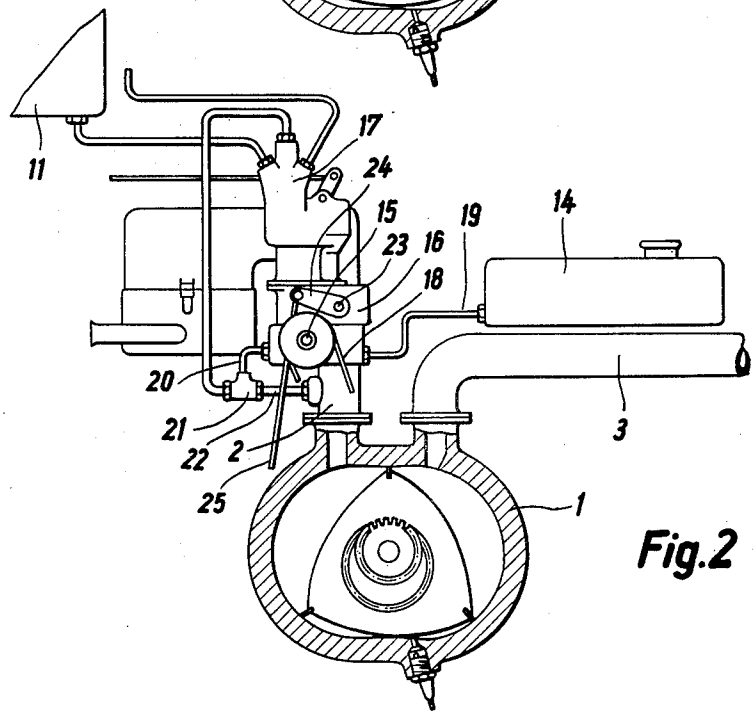

Fig.2

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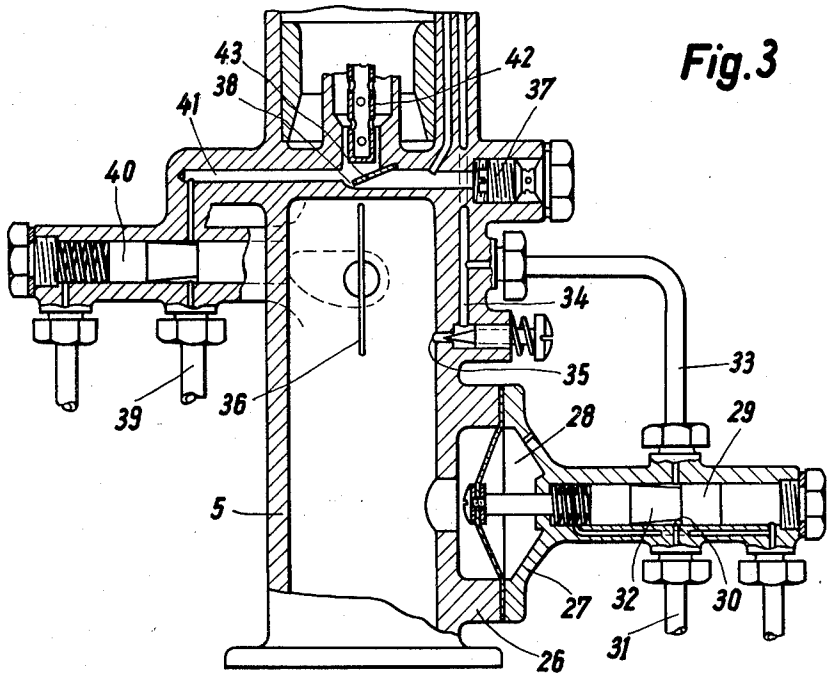

Fig.3

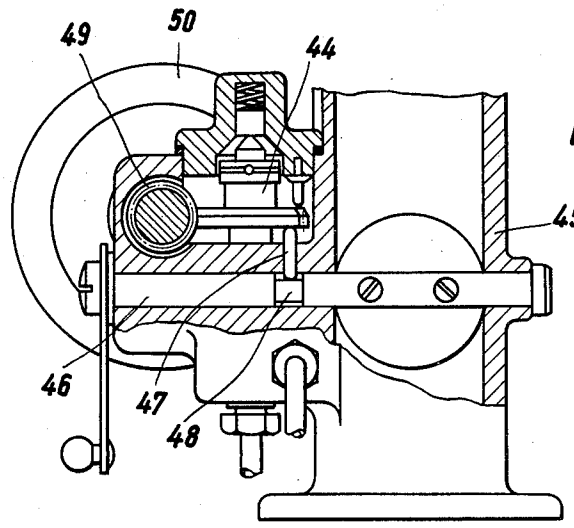

Fig.4

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PROCESS AND APPARATUS FOR LUBRICATING INTERNAL COMBUSTION ENGINES

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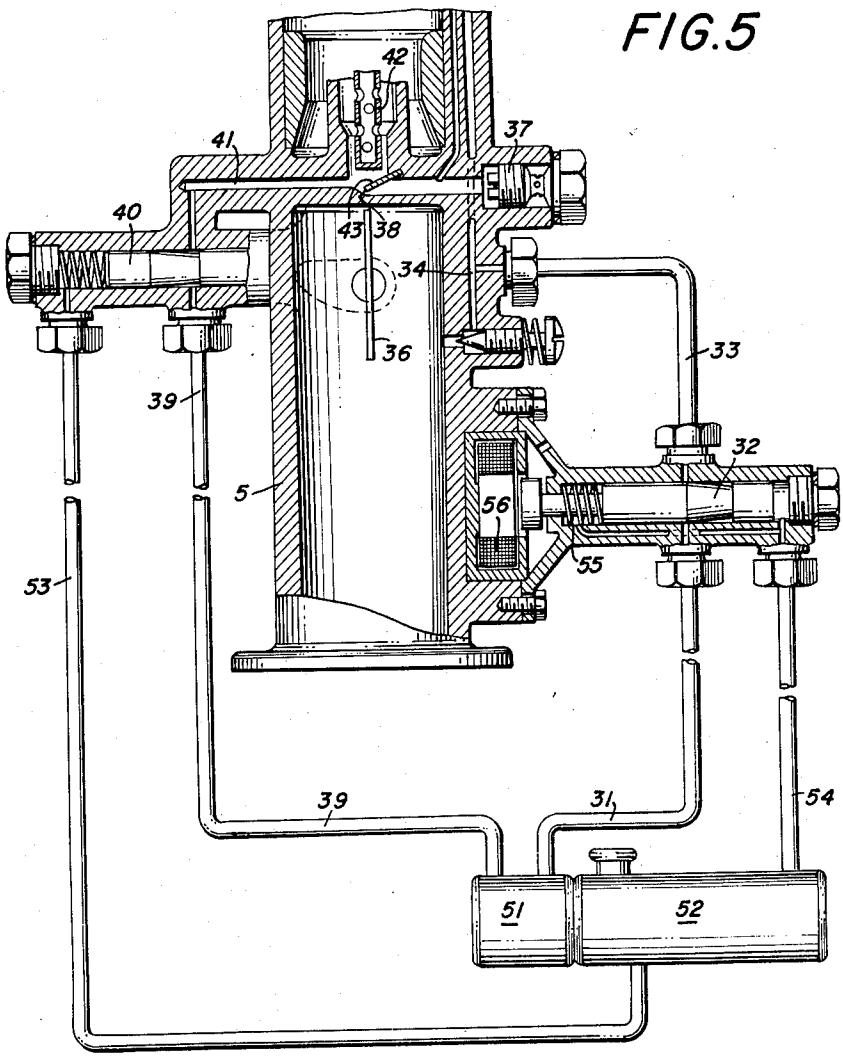
FIG.5



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PROCESS AND APPARATUS FOR LUBRICATING INTERNAL COMBUSTION ENGINES

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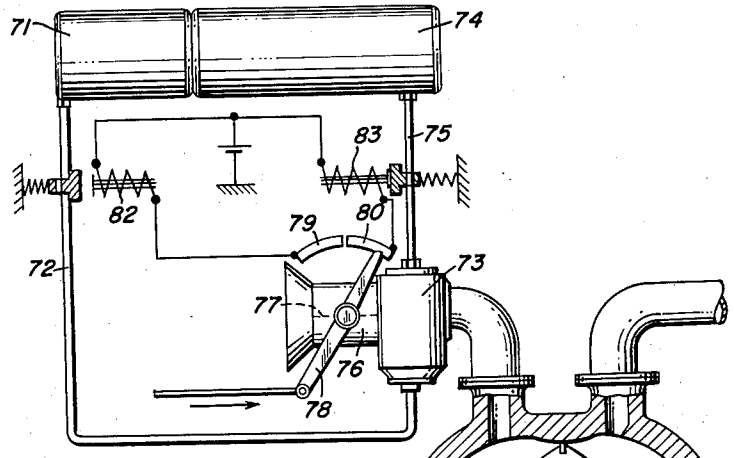
FIG. 7



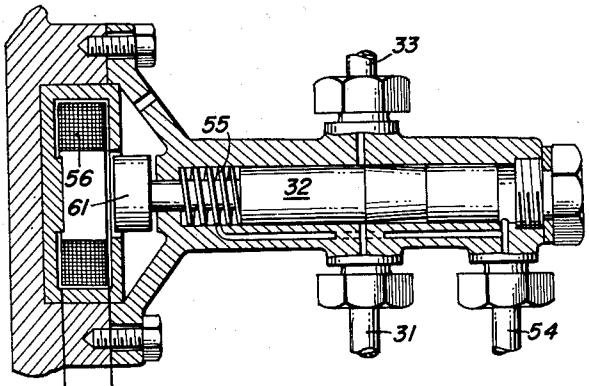
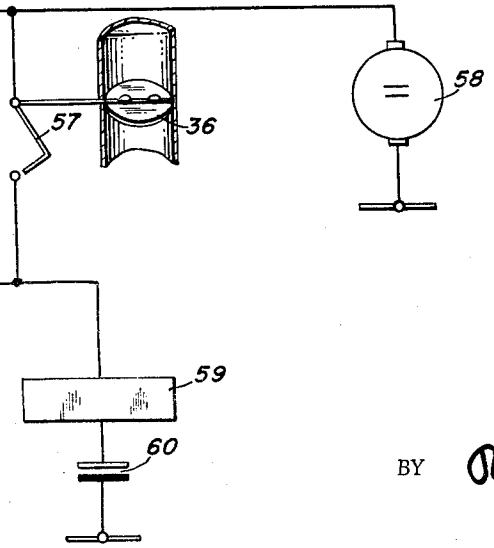


FIG. 6



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PROCESS AND APPARATUS FOR LUBRICATING INTERNAL COMBUSTION ENGINES

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8 Claims. (Cl. 123—119)

This invention relates to a process and apparatus for lubricating internal combustion engines and refers more particularly to a lubrication process and apparatus wherein lubricating oil is mixed to the fuel used for the engine.

An object of the present invention is the provision of a process of the described type, wherein the mixing ratio of lubricating oil to the engine fuel gradually varies from 1:∞ at no load to the usual ratio at full load.

Another object of the present invention is to apply such lubricating process and apparatus not only to two-stroke internal combustion engine but to combustion engines in general, preferably rotary piston motors as well as rotary compressors.

A further object is to provide an apparatus whereby internal combustion engines or pumps as well can be lubricated with comparatively simple drives which are accessible to the fuel-air-oil mixture, whereby the lubrication takes place in a very simple manner, can be precisely measured and is most effective, since oil is very finely divided by the pulverized fuel.

Other objects of the present invention will become apparent in the course of the following specification.

In accordance with one of the features of the present invention, the measuring or the addition of the correct amount of oil to the fuel is effected through the regulation of the amount of lubricating oil which is actuated directly or indirectly by the shaft or spindle of the throttle valve. In the case of internal combustion engines using fuel injection, particularly with injection into the inlet pipe, it is advantageous to provide a regulation of the amount of lubricating oil which is operated directly or otherwise by the injection pump regulation. This procedure avoids the possibility that the factor of safety for the oil measuring device must be selected as being too high due to the lack of uniformity in the construction of transmission rods, with the result that accordingly, the machine sometimes would receive more oil than is necessary. Furthermore, it is advantageous, for example, for vehicles which are driven for a comparatively long time downhill under brakes with a closed throttle valve, to increase the added amount of oil with increasing vacuum in the suction pipe by means of a control diaphragm which is actuated by vacuum in the suction pipe. A device of this type is also particularly advantageous when due to the regulation of the gasifier or the injection pump, it is not possible to completely stop the flow of the supply fuel during the push. In that case, a large amount of oil is added to the fuel which is not being combusted. The fuel evaporates and is pumped out through the exhaust ports or valves and the oil lubricates the bearing surfaces.

A substantial structural simplification can be attained in accordance with the present invention by constructing the regulatable oil pump of one piece with the support for the throttle valve of the gasifier. It is also advantageous, according to the present invention, if the case of injection engine to combine the regulatable oil pump with the injection pump into a single aggregate so that, for example, the two pumps will have a common driving shaft or cam shaft. The drive of the pumps is then simplified and there is a saving in connecting parts required for regulation purposes. As far as internal combustion engines provided with a gasifier are concerned, it is furthermore advantageous to provide a conduit to the gasifier from a fuel container as well as a conduit from a container for the fuel-oil mixture and to combine the throttle device with means which open a valve for pure fuel when the throttle has a small opening and open a valve for supplying the fuel-oil mixture when the throttle is opened more widely. For that purpose, it is advantageous to provide at the throttle device contact operated means which actuate electrically operated valves. In order to provide a particularly good and intensive distribution of a small amount of oil upon a surface which should be as large as possible, it is advisable to add oil to the fuel prior to the mixture with the sucked in air. A place located behind the main nozzle is particularly suitable for the supply of oil to the fuel. To provide a regulation which should be as free from inertia as possible, according to a further feature of the invention, the oil is conducted through a special conduit into the fuel supply shortly before the mixing pipe. A further improvement of this feature of the invention consists in the provision of a guide plate or a guide sieve in the carrier of the mixing tube which guides the flow of fuel at the inlet of the oil conduit and may also serve to facilitate the mixing of oil and fuel. In order to provide the same amount of oil under all operational conditions in summer as well as in winter, according to a further feature of the invention, the oil pump and an oil container are located adjacent to or directly above the exhaust conduit. Due to this arrangement, oil is always provided with a correct temperature at the start and has the correct viscosity when the machine is running. Fnally, it is advantageous to influence the supply of oil additionally by means of a speed regulating device which may be an electrical device or a mechanical device.

The invention will appear more clearly from the following detailed description when taken in connection with the accompanying drawings showing by way of example, preferred embodiments of the inventive idea.

In the drawings:

FIGURE 1 is partly a side view and partly a section through an apparatus constructed in accordance with the principles of the present invention.

FIGURE 2 is partly a section through and partly a side view of a somewhat differently constructed apparatus.

FIGURE 3 is a section through a device according to the present invention, used for varying the amount of oil supplied to the suction pipe, some parts being shown in side elevation.

FIGURE 4 is a section through a construction wherein the oil pump is made of one piece with the throttle valve support, some parts being shown in side elevation.

FIGURE 5 is a section through a construction wherein an electrically actuated valve is used.

FIGURE 6 illustrates diagrammatically and in section the electrical connections of the valve.

FIGURE 7 is a side view, partly in section of yet another construction.

FIGURE 1 shows a rotary piston motor 1 which is lubricated by lubricating oil mixed with the fuel. The mixing ratio of oil to the fuel is regulated by varying the ratio of oil to fuel in the mixture gradually from 1:∞ at no load to the usual ratio at full load.

The rotary piston motor 1 is connected with a suction or inlet pipe 2 and with an exhaust pipe 3 for the combusted gas. The inlet pipe 2 is connected with a gasifier 4 which carries a support 5 for the throttle valve. The member 5 is integral with the casing 6 for the regulating slide valve. The throttle valve has a shaft 7 used for operating the regulating slide which is not shown in the drawing. For that purpose, the throttle valve shaft 7 is connected with a lever 8 of the throttle valve. The lever 8 is connected with a transmission rod 9.

The pipe 10 connects the gasifier 4 with a tank 11 for the fuel. The casing 6 of the regulating slide is connected

with a pipe 12 which is also connected to the pump 13 for the lubricating oil. The pump 13 is connected with an oil tank 14 which is mounted above the exhaust pipe 3, with the result that oil having a uniform temperature is always supplied from the tank 14 to the pump 13. Due to this arrangement, oil is quickly heated in the oil tank 14 particularly in the vicinity of the lubrication pump 13 even in case of a cold start, so that the amount of transmitted oil is for all practical purposes independent from the temperature of the outer air.

The advantage of providing this arrangement of the regulating slide casing 6 consists in that the throttle valve 7 also actuates the slide valve (not shown) in the casing 6. Due to this arrangement, lack of precision caused by air or play in the gas transmission devices or other transmissions will have no effect.

In operation, the rotary piston motor 1 is supplied with a fuel-oil mixture through the inlet pipe 2 while the combusted gas escapes through the exhaust pipe 3. The regulating slide is actuated by the throttle valve shaft 7 by means of the throttle valve lever 8 and the transmission rod 9, so that the regulation of the amount of lubricating oil takes place depending upon the position of the throttle valve. Fuel is supplied to the gasifier 4 out of the fuel tank 11 through the conduit 10. Oil is transmitted into the slide valve casing 6 through the conduit 12 by means of the pump 13 which pumps the oil from the tank 14.

As already stated, this construction has the advantage of most effective lubrication.

FIGURE 2 shows a rotary piston motor 1 which is also supplied through the inlet pipe 2 with the mixture of fuel, air and oil. The shaft of the motor 1 drives the shaft 15 which operates jointly the oil pump 16 and the injection pump 17.

Preferably, this drive of the motor shaft is effected by means of a worm drive. However, for the purpose of facility of illustration, FIGURE 2 shows a cone belt 18 used for that purpose.

In this construction, the oil tank 14 located above the exhaust pipe 3, is connected with a conduit or pipe 19 leading to the oil pump 16. A pipe 20 connects the pump 16 with the mixing chamber 21 which is connected with a pipe 22 supplying the fuel for injection purposes.

The oil pump 16 has a driving shaft 23 which is also common to the injection pump 17. The pump 17 is actuated by a lever 24 connected with a transmission rod 25. The regulatable oil pump 16 and the injection pump 17 are combined into a single aggregate.

In operation, the shaft of the motor 1 drives the shaft 15 which is used for driving the oil pump 16 and the injection pump 17. Lubricating oil is transmitted from the oil tank 14 through the pipe 19 to the oil pump 16 and the pump 16 drives the oil through the conduit 20 to the mixing chamber 21 and thence through the pipe 22 to the injection device for the fuel.

Due to this arrangement, the injection pump 17 supplies to the inlet pipe 2 a mixture of fuel and oil which is always adapted to the actual operation of the engine and the regulation of the amount of oil is dependent upon the regulation of the mixture.

FIGURE 3 illustrates an inlet pipe provided with the portion 5. The member 5 has a flange 26 which is connected with a slide casing 27. The slide is combined with a driving diaphragm 28. For that purpose, the diaphragm 28 is connected with a slide 29 having a conical portion 32. A pipe 31 for the supply of oil is connected with the casing 27 and has an inlet 30 located close to the conical portion 32 of the slide. Another pipe 33 connects the casing 27 with a conduit 34 provided in the member 5 and communicating with the outlet 35 of a throttle valve. A main jet 37 is connected with a passage 38 which communicates with a passage 41. A pipe 39 is connected with a regulating slide 40 which is also connected with the passage 41. A mixing tube 42 is in communication with the passages 41 and 38. A guide plate 43 is located in the passage 38 close to the passage 41 and is carried by the support for the mixing tube 42. A throttle valve 36 is located within the member 5.

The operation of the device is as follows:

The amount of oil which is supplied depends upon the diaphragm 28 which in turn is dependent upon pressure in the suction inlet, whereby the amount of oil is increased with increasing vacuum. Then the slide 29 will be moved by the diaphragm 28 to the left (looking in the direction of FIGURE 3), with the result that there will be a larger passage provided in the inlet 30 through which oil is supplied from the pipe 31 toward the conical portion 32 of the slide 29, by comparison with the size of the inlet when the slide 29 is in its extreme right hand position. Then the oil pump (not shown) transmits oil through the pipe 31, the inlet 30 regulated by the slide 29 and the pipe 33 to the passage 34; when the throttle valve 36 is closed, fuel is transmitted through the inlet 35 into the inlet pipe, provided there is a substantial uniform vacuum therein. In case of different operational conditions, oil is also transmitted to the fuel before the fuel is mixed with the sucked-in air. The fuel is conducted through the main jet 37 into the passage 38. Oil is transmitted through the pipe 39 and the regulating slide 40 into the passage 41 and is introduced into the flow of fuel at a location shortly in front of the mixing tube 42. Due to this arrangement, the mixing of oil with the fuel takes place to the greatest possible extent without inertia and without delays, and is always dependent upon changes in the position of the throttle valve 36. The mixture of fuel and oil is facilitated by the guiding plate 43 connected with the support for the mixing tube.

FIGURE 4 shows a lubricating oil pump 44 which is constructed of one piece with the support 45 for the throttle valve. The lubricating oil pump 44 is operated with an adjustable stroke in the known manner. The throttle valve has a shaft 46 provided with a cam 48 which operates a pin 47. The lubricating pump 44 is driven by a shaft 49 connected with a cone belt pulley 50.

In case of machines operating with high speed, it is advisable to use a suitable worm gear drive.

When the throttle valve is closed, the oil supplied by the pump 44 can be also regulated by an electrical speed indicator.

The operation of the device is as follows:

The stroke of the lubricating oil pump 44 is adjusted by the pin 47 through the cam 48 dependent upon the position of the shaft 46. The pump 44 is driven by the shaft 49.

It is also possible to provide a separate conduit leading from a container with fuel-oil mixture to the gasifier and a conduit to the throttle valve, means being provided which open a valve for pure fuel when the throttle valve has a small opening and which open a valve supplying a fuel-oil mixture when the throttle valve is opened to a larger extent. It is also advantageous for that purpose to provide the throttle valve with a device actuated by contact operated means which operate electrically steered valves.

In the construction shown in FIG. 5, parts which are the same as those of FIG. 3, are designated by the same numerals. In this construction, an oil pump 51 is connected directly to an oil container 52. The pipe 31 connects the oil pump 51 with the conical slide 32, while the pipe 39 connects the pump 51 with the regulating slide 40 Superfluous oil, which is not transmitted by the pipe 33 and the conduit 41 to the fuel and then to the engine, is guided back to the oil container 52 through the conduits 53 and 54. The conical slide 32 is held by a spring 55 in the position shown in FIG. 5, in which the oil transmitted by the pump 51, does not reach the pipe 33 but flows through the conduit 54 back into the oil container 52. The electrical valve connections shown in FIG. 5 include a winding 56 which is inoperative

in the illustrated position. As shown in FIG. 6, an electrical circuit is formed through a switch 57 which, in the example illustrated, is connected with the shaft of the throttle valve 36. The throttle valve 36 is shown as being somewhat open. Current produced by a light dynamo 58 then flows directly through a regulator or switching device 59 to a battery 60.

In operation, the switch is opened when the throttle valve 36 is completely closed, i.e. when the throttle valve is in the no load position. Then the current produced by the device 58, will flow through the valve winding 56. When the engine runs at no load, the device 58 produces so little current, that the force of attraction exerted by the winding 56 upon the core 61 connected with the slide 32, is less than the force of the spring 55. Therefore, in this position, the slide 32 also closes the supply of oil to the conduit 33, so that the oil transmitted by the pump 51, will flow through the conduit 54 back into the oil container 52.

When, for example, the car begins to roll down hill and thus will drive the engine while the throttle valve 36 remains in the no load position, the speed of the device 58 will increase, so that it will produce more current which will develop enough attractive force in the winding 56 to move the core 61 along with the slide 32 to the left (looking in the direction of FIG. 6). Then the slide 32 will free the passage of oil pumped by the pump 51 through the pipe 31 and into the pipe 33, so that the oil will flow to the fuel and to the engine.

The described construction makes it possible to lubricate the engine at high speeds in thrust operations, when brakes are applied or during down hill driving, despite the fact that the throttle valve 36 is located at the no load position, while no additional oil is supplied to the engine at no load when its speed is low.

FIGURE 7 illustrates a construction applicable to all types of engines, which is similar to that disclosed in the co-pending patent application Ser. No. 23,809, filed in the names of W. Werner et al. on April 21, 1960 and belonging to the same assignee. The drawing shows a fuel reservoir 71 connected by a conduit 72 with a carburetor float chamber 73. A reservoir 74 contains a fuel-oil mixture and is connected with the float chamber 73 by a conduit 75. A throttle valve 77 is located in the induction pipe 76 and carries a two-armed lever 78. The lever 78 carries a contact which may slide upon segments 79 and 80. The segment 79 controls an electromagnetically operable valve 82, while the segment 80 is connected with an electromagnetically operable valve 83. As the contact of the lever 78 slides first over the segment 79 and then over the segment 80, the valves 82 and 83 will be consectively actuated, thereby varying the supply of fuel and/or fuel-oil mixture to the float chamber.

It is apparent that the examples shown above have been given solely by way of illustration and not by way of limitation and that they are subject to many variations and modifications within the scope of the present invention. All such variations and modifications are to be included with the scope of the present invention.

What is claimed is:

1. In an internal combustion engine having fuel supplying means, a fuel charging passage and means supplying oil to the engine through said fuel charging passage, said fuel supplying means comprising a throttle valve having a shaft, and means connected with said shaft and said oil supplying means for regulating the amount of the supplied oil depending upon the positions of said shaft, said engine further comprising a speed regulating device connected with said oil supplying device for additionally regulating the supply of oil.

2. In an internal combustion engine having fuel supplying means, a fuel charging passage and means supplying oil to the engine through said fuel charging passage, said fuel supplying means comprising a throttle valve having a shaft, and means connected with said shaft and said oil supplying means for regulating the amount of the supplied oil depending upon the positions of said shaft, said engine further comprising contact-operated means connected with said throttle valve and an electrically actuated valve actuating the last-mentioned means.

3. In an internal combustion engine having fuel supplying means, a fuel charging passage and means supplying oil to the engine through said fuel charging passage, said fuel supplying means comprising a regulating slide valve and a throttle valve having a shaft, a single member constituting a casing for said slide valve as well as a support for said throttle valve, and means connected with said shaft and said oil supplying means for regulating the amount of the supplied oil depending upon the positions of said shaft.

4. In an internal combustion enging having an exhaust conduit, fuel supplying means, a fuel charging passage and means supplying oil to the engine through said fuel charging passage, said oil supplying means comprising an oil container and an oil pump connected with said oil container, said container and said pump being located adjacent said exhaust conduit, said fuel supplying means comprising a throttle valve having a shaft, and means connected with said shaft and said oil supplying means for regulating the amount of the supplied oil depending upon the positions of said shaft.

5. In an internal combustion engine having an inlet pipe, means supplying fuel to said inlet pipe, means supplying oil to said inlet pipe, and a diaphragm actuated by pressure in said inlet pipe, said oil supplying means having means connected with said diaphragm for increasing the amount of supplied oil with an increase in vacuum in said inlet pipe, said fuel supplying means comprising a throttle valve having a shaft, and means connected with said shaft and said oil supplying means for regulating the amount of the supplied oil depending upon the positions of said shaft.

6. In an internal combustion engine having a pipe for mixing fuel and oil, fuel supplying means having a pipe connected with the first-mentioned pipe, oil supplying means having a pipe connected with the second-mentioned pipe shortly before the connection of the second-mentioned pipe with the first-mentioned pipe, said fuel supplying means further comprising a throttle valve having a shaft, and means connected with said shaft and said oil supplying means for regulating the amount of the supplied oil depending upon the positions of said shaft.

7. An engine in accordance with claim 6, comprising a support carrying the first-mentioned pipe and a guide plate connected with said support and located in the second-mentioned pipe adjacent its connection with the third-mentioned pipe.

8. In an internal combustion engine having fuel supplying means, a fuel charging passage and means supplying oil to the engine through said fuel charging passage, said fuel supplying means comprising a throttle valve having a support and a shaft, said oil supplying means comprising an oil pump, said oil pump being integral with said throttle valve support, and means connected with said shaft and said oil supplying means for regulating the amount of the supplied oil depending upon the positions of said shaft.

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