L. WYGODSKY.

LIQUID FUEL INTERNAL COMBUSTION ENGINE.

APPLICATION FILED JULY 28, 1909.

971,954. Patented Oct. 4, 1910.

2 SHEETS—SHEET 1.

FIG 1

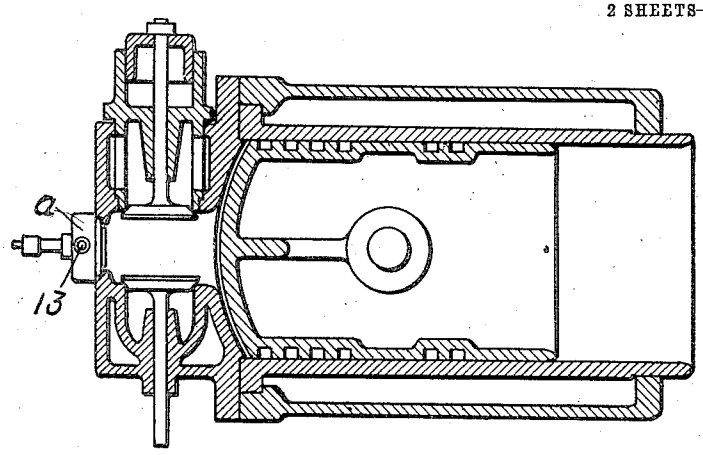

FIG 2

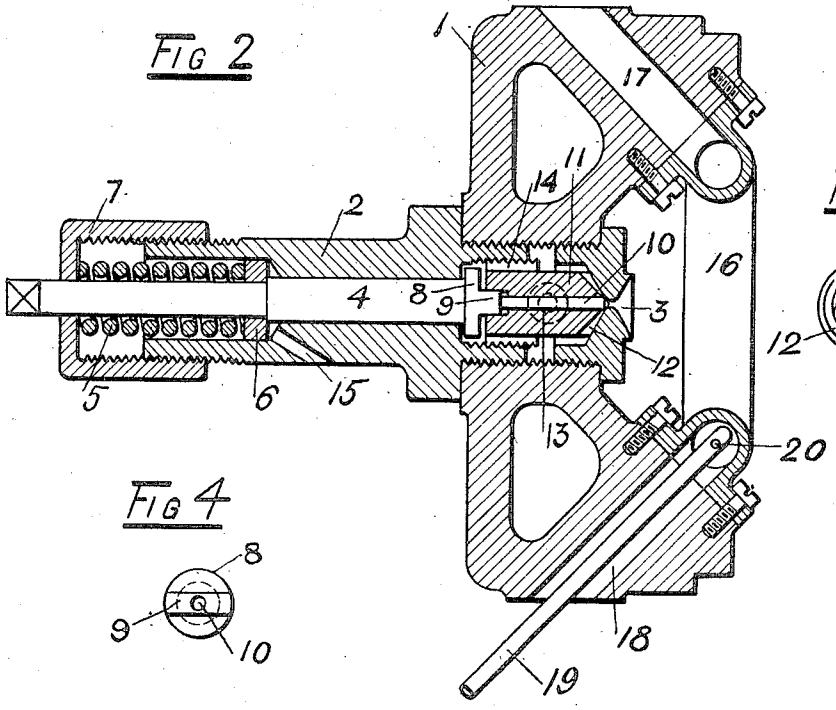

FIG 3.

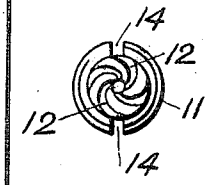

FIG 4

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2 SHEETS—SHEET 2.

FIG 5.

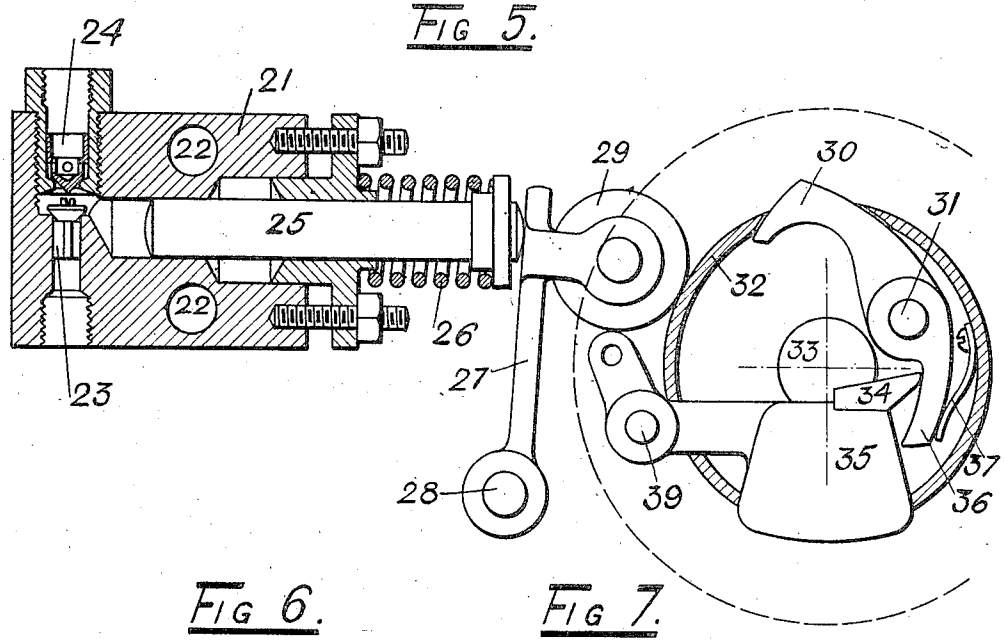


FIG 6.

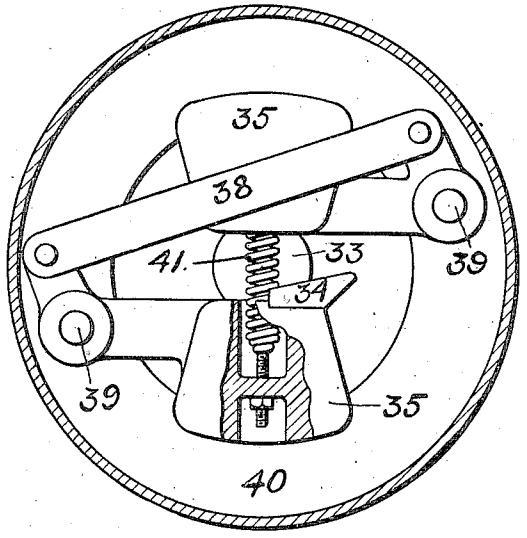
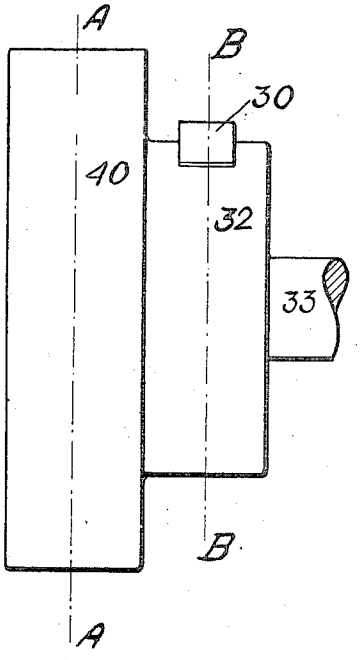


FIG 7.



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UNITED STATES PATENT OFFICE.

LEON WYGODSKY, OF NEW YORK, N. Y.

LIQUID-FUEL INTERNAL-COMBUSTION ENGINE

971,954. Specification of Letters Patent. Patented Oct. 4, 1910.

Application filed July 28, 1909. Serial No. 510,138.

To all whom it may concern:

Be it known that I, LEON WYGODSKY, a subject of Russia, and a resident of New York city, in the county of New York and State of New York, have invented certain new and useful Improvements in Liquid-Fuel Internal-Combustion Engines, of which the following is a specification.

This invention relates to a liquid fuel internal combustion engine, particularly to a crude or heavy oil engine, in which the fuel is injected without compressed air at the end of the compression stroke, thus producing a constant pressure diagram, besides that, this invention has in view to work at a lower compression pressure than has been used up to the present time in engines of the constant pressure type. To obtain this end, the following parts have been invented: a new mechanical spraying device, a new means to ignite the charge, at a low compression of about 250 pounds, also a new governing device for controlling the stroke of the fuel pump.

The accompanying drawings represent the nature of this invention, and Figure 1 represents a sectional view of the internal combustion engine, showing the position of the spraying and igniting device *a*. This device is represented in larger scale in Fig. 2. Fig. 3 represents the bottom of the spraying plug described below; Fig. 4 represents the bottom of the sprayer plunger valve. Fig. 5 represents a sectional view of the fuel pump and also the adjustable cam operating the pump lever. Fig. 6 represents the governor for adjusting the said cam. Fig. 7 represents the outer casing of the cam and the governing mechanism for operating the pump. The cam shown in Fig. 5 is a section through B B of Fig. 7. Section A A is represented in Fig. 6.

Fig. 1 represents the section of the internal combustion engine; the most vital parts of the engine are clearly shown. At the back of the combustion chamber is fixed a spraying and igniting device *a*, as represented in Fig. 2. This device (Fig. 2) consists of a water cooled casing 1, in which are screwed a guiding cylinder 2 and also a nozzle 3. In the cylinder 2 is situated a plunger 4 which by means of spring 5 and piston 6 is pressed inward. The pressure of the spring is regulated by the nut 7. This plunger at the inner end is provided with a collar 8 and a projection 9, the side elevation of which is shown in Fig. 4. This end is also supplied with a needle valve 10 closing the aperture of the nozzle 3. In the bottom of the cylinder 2 is screwed the spraying plug 11, which at the plunger end is slotted so as to fit the projection 9 of the plunger. This projection 9 works like a screw driver when turning the square end of the plunger 4,— thus giving a possibility of raising or pressing the spraying plug 11 toward the seat of the nozzle 3. The other conical end of the spraying plug 11 is provided with several spiral grooves 12; four such grooves are indicated in Fig. 3. The fuel is admitted through a nipple 13 (Fig. 1). This plug is indicated schematically in Fig. 2 by two dotted circles and is communicated with the space between plug 11 and the main casting, thus admitting the oil into the spiral grooves 12. Besides that through slots 14 the oil can press under the plunger 4.

The action of the sprayer is as follows: When the oil pump is delivering the fuel, this fuel first of all works on the plunger 4, thus raising the needle valve 10 from its seat on the nozzle. When this is effected the oil begins to flow through the spiral grooves 12, thus giving a rotary motion to the oil in the nozzle 3. The oil having a great rotary velocity, when released from the nozzle, owing to the high centrifugal force, breaks up into a fine mist. When the sprayer is acting, the collar 8 is pressed toward the bottom of the cylinder 2, thus reducing the leakage through the plunger. Any leakage passing through the plunger is stopped by the piston 6 and is directed toward the draining off hole 15. The outer end of the plunger 4 projects through the nut 7 and may be observed as it reciprocates during the operation of the sprayer and the proper action of the device partly determined thereby. The mist from the sprayer is so fine that even crude oil ignites easily when in contact with a fairly hot surface. To obtain this surface a hollow ring 16 is fixed to the sprayer. Two channels 17 and 18 communicate the inner space of the ring with the outside of the sprayer casing. In the bottom channel 18 a burning gas pipe 19 is inserted. Two jets 20 of this pipe facing in two opposite directions give two flames in the two halves of

the hollow ring 16. The air enters through channel 18 and the burned gases escape through channel 17. In such a way the ring, though inclosed in the combustion chamber, can be heated up from the outside. Certainly, after the engine has been started and worked for some time, this hollow ring 12 will keep hot without special heating from the outside. Now it can be easily seen, that an engine with such a sprayer and igniting device will work at a lower compression than that which is required in the Diesel type engine. A compression pressure of about 250 pounds per square inch has been found to be the most suitable. Ordinary gas or carbureted air may be used in the pipe 19. Two or more combined sprayers and igniters may be used in large sized engines.

Fig. 5 represents pump 21 with holes 22 for fixing to the side shaft bracket. 23 is the suction valve, 24 the delivery valve, 25 is the plunger, 26 is the spring affecting the suction stroke of the plunger, 27 is the pump lever pivoted at 28 on the side shaft bracket, 29 is the roller on which operates the adjustable cam 30. This cam 30 is pivoted at 31 in the cam casing 32 (Fig. 7), and which casing is keyed on the side shaft 33. The height of the cam is adjusted by means of a die 34 fixed to the governor weight 35 and operating upon the curved shaped tail 36 of the cam 30, and this tail is held in position by means of a spring 37. The governor weight 35 is shown in the "inside" position. The different positions of the governor weight 35 compel the cam by means of die 34 acting on tail 36, to assume different heights—thus giving different strokes for the fuel pump. The die 34 may be fixed to the cam lever 36 and the weight 35 may be supplied with a curved cam—the principle remains the same. The cam 30 representing an arc of a circle described from the center 31 will give, no matter what be the position of the cam, the same point for the beginning of the action of the oil pump, cutting off the fuel supply at the end of the pump stroke according to the position assumed by the governor weights. To increase the energy of the governor, two or more governor weights of similar design may be coupled together. Fig. 6 shows two governor weights 35 joined together by a link 38, as shown in the drawing. These weights are pivoted at 39 in casing 14 (Fig. 7), which is one casting with 32. The two weights are connected by a spring 41, which can be adjusted for different speeds as may be required.

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

1. A liquid fuel sprayer comprising a casing having a nozzle, a plug having grooves formed in one end coöperatively located with reference thereto, and means for adjusting said plug relative to said nozzle.

2. A liquid fuel sprayer comprising a casing having a nozzle, a plug abutting said nozzle, one of said elements having a groove adapted to impart a rotary movement to the fuel, said groove being disposed to form a passage between the end of said plug and said nozzle.

3. A liquid fuel sprayer comprising a casing having a nozzle, a plug abutting said nozzle, one of said elements having a groove adapted to impart a rotary movement to the fuel, and located between the end of said plug and said nozzle, and means for adjusting said plug relative to said nozzle.

4. A liquid fuel sprayer comprising a casing having a nozzle, a plug abutting said nozzle, one of said elements being provided with a plurality of curved grooves disposed to form a plurality of passages between the end of said plug and said nozzle, and adapted to impart a rotary movement to the fuel.

5. A liquid fuel sprayer comprising a casing having a nozzle, a sprayer plug having a plurality of grooves in one end which converge toward its axis, means for adjusting said plug relative to said nozzle, and a needle valve extending through said plug and controlling said nozzle.

6. A liquid fuel sprayer comprising a casing, a sprayer plug therein having a spirally grooved cone shaped end, and a nozzle having an inverted cone shaped surface in contact therewith and covering said grooves to form conduits between said plug and nozzle.

7. A liquid fuel sprayer comprising a casing, a sprayer plug therein having a tapered end provided with a curved groove, a nozzle located in operative relation thereto, a needle valve controlling said nozzle, means for forcing fuel through said nozzle and for automatically operating said needle valve.

8. A liquid fuel sprayer comprising a casing, a sprayer plug therein having a tapered end provided with a plurality of curved grooves therein adapted to impart a rotary motion to the fuel, a nozzle located in operative relation thereto, a needle valve controlling said nozzle, means for forcing fuel through said nozzle and for automatically operating said needle valve.

9. A liquid fuel sprayer comprising a casing, a sprayer plug therein provided with a grooved end, and having a needle valve extending therethrough, a nozzle controlled by said needle valve, a plunger connected to said needle valve and means for operating said needle valve through said plunger to automatically open said valve when the pressure of the fuel rises to a predetermined degree.

10. A liquid fuel sprayer comprising a

casing, a sprayer nozzle, a sprayer plug cooperatively connected therewith, a needle valve controlling said nozzle, a plunger connected to said needle valve, a plunger cylinder, and a collar serving to close the plunger cylinder when the plunger is under pressure from the fluid inside the sprayer to reduce leakage of fuel through the plunger cylinder.

11. A liquid fuel sprayer comprising a casing, a sprayer nozzle located at one end thereof, a sprayer plug coöperating therewith, a needle valve extending through said plug and controlling said nozzle, and means extending from said plug by which said plug may be adjusted relative to said nozzle.

12. A liquid fuel sprayer comprising a casing, a sprayer nozzle located at one end thereof, a sprayer plug coöperating therewith, a needle valve extending through said plug and controlling said nozzle, and means extending from said plug to the exterior of said casing by which said plug may be adjusted relative to said nozzle.

13. A liquid fuel sprayer comprising a casing, a sprayer nozzle located at one end thereof, a sprayer plug coöperative therewith, a needle valve extending through said plug and controlling said nozzle, means connected to said needle valve and extending beyond one end of said casing to indicate its operation and by means of which said plug may be rotated.

14. A liquid fuel sprayer comprising a casing, a sprayer nozzle located at one end thereof, a sprayer plug coöperative therewith, a needle valve extending through said plug and controlling said nozzle, a plunger extending from said needle valve, a piston connected to said plunger, and a spring pressing against said piston.

15. A liquid fuel sprayer comprising a casing, a sprayer nozzle located at one end thereof, a sprayer plug coöperative therewith, a needle valve extending through said plug and controlling said nozzle, a plunger extending from said needle valve, a piston connected to said plunger, a spring pressing against said piston, and ignition means comprising a hollow body located at one end of said sprayer and adapted to be heated on its inner surface and cause said fuel to be ignited at its outer surface.

16. A liquid fuel sprayer comprising a casing having a nozzle, a plug having grooves formed in one end coöperatively located with reference thereto, means for moving said plug relative to said nozzle, said casing having two channels, a tube provided with openings which register with said channels respectively, and means for heating the inner surface of said tube, said tube being connected to the end of said casing and located in coöperative relation with said nozzle.

17. A liquid fuel sprayer comprising a casing, a sprayer nozzle connected to one end of said casing, a sprayer plug having a plurality of curved grooves formed in one end thereof adapted to impart a rotary motion to the fuel, and coöperatively located relative to said nozzle, means for adjusting said plug relative to said nozzle, a needle valve extending through said plug and controlling said nozzle, means for forcing fuel through said nozzle and for actuating said needle valve automatically to govern the supply of fuel delivered from the sprayer, and an ignition device carried by said casing and located adjacent to said nozzle in coöperative relation therewith.

18. A liquid fuel sprayer comprising a casing, a sprayer nozzle located at one end thereof, a sprayer plug coöperative therewith, a needle valve extending through said plug and controlling said nozzle, a plunger extending from said needle valve, a piston connected to said plunger, and a spring pressing against said piston, said casing having an opening located adjacent to said piston to permit oil to flow to the exterior of said casing, for the purpose set forth.

19. A liquid fuel sprayer comprising a casing having a nozzle and having a chamber formed in said casing to serve as a cooling chamber for said casing, and a plug having grooves formed in one end and located opposite said nozzle.

20. A liquid fuel sprayer comprising a casing having a nozzle, a plug having a plurality of spiral grooves formed in one end thereof which are located opposite said nozzle.

21. A liquid fuel sprayer comprising a casing having a nozzle, a plug having a spiral groove formed in one end thereof which is located opposite said nozzle.

22. A liquid fuel sprayer comprising a casing having a nozzle, a plug having a spiral groove formed in one end thereof and located opposite said nozzle, and a needle valve extending through said plug and controlling said nozzle.

23. A liquid fuel sprayer comprising a casing having a nozzle, a plug having a groove formed in one end thereof, which is located opposite said nozzle.

24. A liquid fuel sprayer comprising a casing having a nozzle, a plug abutting said nozzle, one of said elements having a groove disposed to form a passage between the end of said plug and said nozzle.

Signed at New York city, in the county of New York and State of New York, this 27th day of July A. D. 1909.

LEON WYGODSKY.

Witnesses:
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CHAS. C. GILL.