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SPRAYING APPARATUS FOR INTERNAL COMBUSTION ENGINES.

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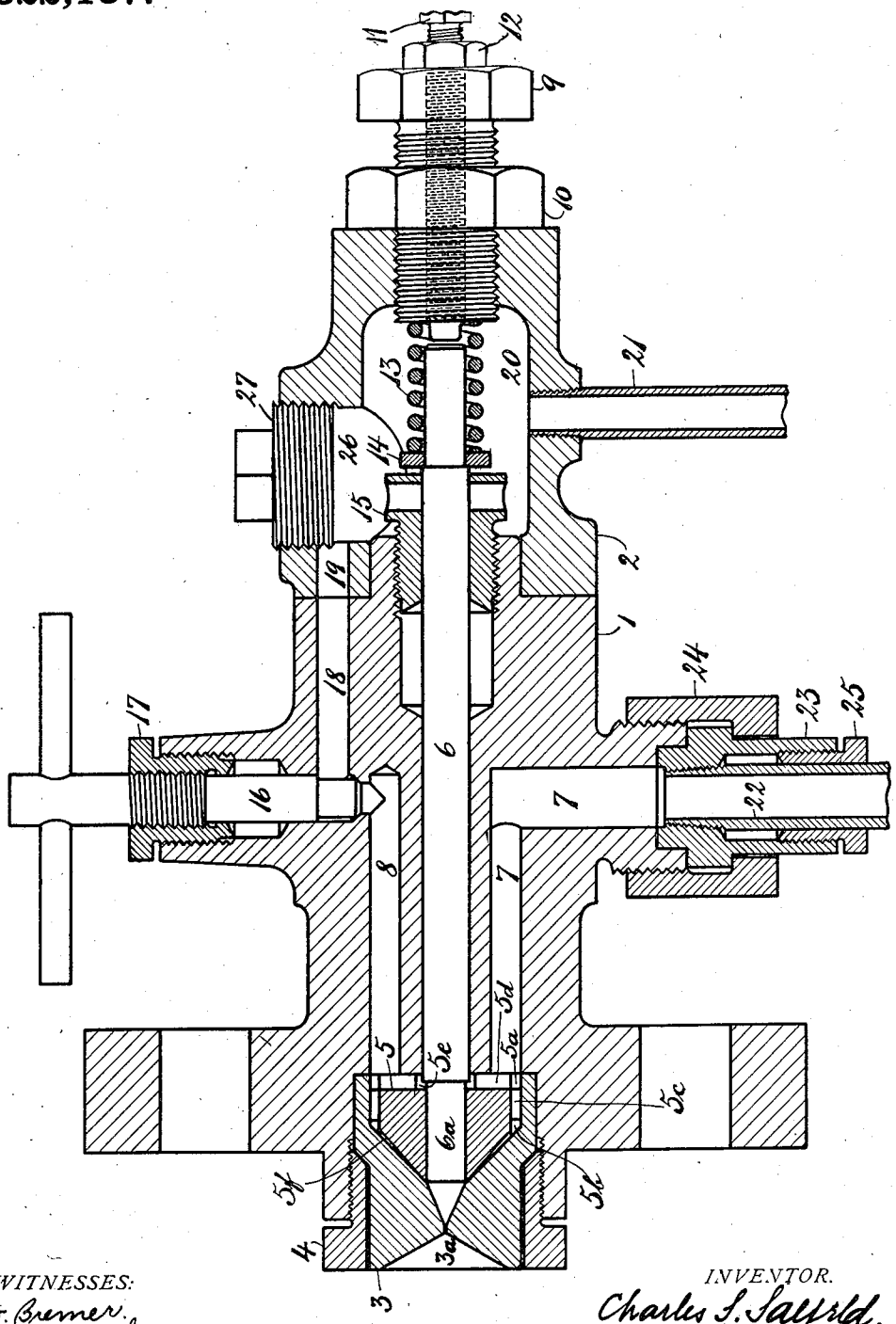
1,322,137. Patented Nov. 18, 1919.



WITNESSES:

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SPRAYING APPARATUS FOR INTERNAL-COMBUSTION ENGINES.

1,322,137. Specification of Letters Patent. Patented Nov. 18, 1919.

Application filed June 8, 1914. Serial No. 843,778.

To all whom it may concern:

Be it known that I, CHARLES S. SALFELD, a German citizen, residing at 274 Tenth street, Milwaukee, county of Milwaukee, and State of Wisconsin, have invented new and useful Improvements in Spraying Apparatus for Internal-Combustion Engines, of which the following is a specification.

My invention relates to spraying apparatus for internal combustion engines in which liquid fuel is injected into the combustion chamber.

The object of my invention is to avoid the complications usually met with in appliances of this kind and to devise an article that can be manufactured at a reasonable cost, therefore permitting of wider application than heretofore.

My invention is applicable to both systems of injecting the fuel oil, viz., either by means of compressed air or by mere hydraulic pressure.

In the drawings:

The figure is a longitudinal section through an ejector depending upon its action solely upon the operation of a high-pressure fuel injection pump and not making use of compressed air.

Like parts are identified by the same reference characters in the view.

1 is a valve box and 2 a valve box cap; 3 a valve seating, 4 a valve seating attachment screw, 5 a spraying plug and 6 an injector valve. The valve box 1 contains a passage 7 for the admission of the oil, and an overflow passage 8 for by-passing the oil when so desired. The valve box cap 2 contains a spring regulating screw 9 provided with lock nut 10 and a valve stop screw 11 provided with lock nut 12. The valve spring 13 being held in compression by a spring holder 14 at one end and the regulating screw 9 at the other end holds the valve 6 tight against its seating 3, except when the pressure of the oil admitted through passage 7 exceeds the resistance of said spring. In order to enable the oil pressure to act in this manner the valve 6 is reduced in diameter at its lower end 6^a and the differential area thus formed multiplied by the oil pressure equals the force acting against the spring 13. It will therefore be seen that in this case the valve 6 will be automatically lifted from its seating 5 as soon as the oil pressure reaches the required amount consequent upon the delivery stroke of a suitable injection pump operated in combination with the apparatus here described. The amount of such pressure is regulated by the adjustment of the screw 9, which determines the spring resistance, and the lift of valve 6 is independently regulated by the adjustment of screw 11. To effect proper admission of the oil annular grooves 5^a and 5^b are formed upon the outer circumference of the spraying plug 5 and connected by axial grooves 5^c. Radial grooves 5^d connect the annular groove 5^a with a hole 5^e formed in plug 5 and thus lead the oil from passage 7 to the differential area at the lower end of valve 6. From the annular groove 5^b tangential grooves 5^f lead to the actual seating of valve 6 thereby causing a whirling action of the oil before it issues through the hole or holes 3^a formed in seating 3. 15 is a gland to prevent excessive leakage past the stem of valve 6.

The overflow passage 8 leads to the lower side of an overflow valve 16 which is manually operated and fulfils a two-fold purpose. Before starting the engine valve 16 is opened to expel all air from the oil pipes and passages, while the pump is worked by hand, and when the engine is running valve 16 is kept slightly open to prevent an accumulation of prematurely vaporized oil in the system.

Heretofore injectors of this kind were artificially cooled by means of an external water jacket in order to prevent said premature vaporization. Contrary to such practice, I find it advantageous to arrange that the valve body 1 shall become very hot in working, and not be water-cooled. The premature vaporization which may then occur is satisfactorily taken care of by leaving valve 16 a trifle open, thus discharging through it a little oil or oil vapor at every delivery stroke of the fuel injection pump. While the number of revolutions per minute is thereby slightly affected an effect upon the regularity of running is not, as a rule, perceivable or, at any rate, so small as to be quite negligible. Moreover, the extra complication of a water jacket is thereby avoided. 17 is a gland and screwed bushing combined. Any oil passing valve 16 is taken through passages 18 and 19 to a cavity 20 formed in the valve box cap 2 which also receives any leakage from gland 15 and the oil so accumulating is led back to the main fuel tank by means of pipe 21. 22 is a high-pres-

sure admission pipe, screwed into union 23 and attached to the valve box 1 by means of a union nut 24. 25 is a pipe gland. 26 is an inspection hole formed in valve box cap 2 and may be closed by plug 27.

It is not an essential of this invention that the operation of valve 6 should be automatic. The lower end 6^a may be made of the same diameter as the valve stem 6 and the valve may then be lifted off its seat by ordinary mechanical means which need not be further described here.

The same construction may be applied when it is desired to inject the fuel oil by means of high-pressure air. The arrangement of the various parts remains substantially the same except that such parts are added as are required to meet the altered conditions of injection, but the particular arrangement of such additional parts does not form part of this invention and may be varied when so desired.

Having now particularly described and ascertained my said invention, and in what manner same is to be performed, I declare that what I claim is:—

1. In a fuel injector for internal combustion engines the combination of an injector casing, a needle valve in the casing, means for resiliently urging the valve to seat at the inner end thereof, means for admitting fluid fuel under pressure to said casing, and means for utilizing fuel pressure to lift the valve in a direction contrary to that of flow whereby fuel is momentarily ejected from said casing, said casing having a socket at its inner end, and provided with a valve stem aperture, a fuel duct and an over-flow duct, extended into the body of the casing from said socket, and a removable valve seating detachably anchored in said socket, and adapted to be withdrawn from the inner end thereof.

2. In a fuel injector for internal combustion engines the combination of an injector casing, a needle injector valve seated therein, means for automatically opening said valve, means for admitting fluid fuel under pressure to the interior of the casing and manually adjustable means for permitting the return of prematurely formed vapor to the supply tank from the inner end portion of the casing, adjacent to said valve.

3. In a fuel injector for internal combustion engines the combination of an injector casing, an injector valve seated therein, an atomizing device surrounding the stem of said valve, means for admitting fluid fuel under periodically varying pressure to the casing, means for utilizing the variation in fuel pressure to operate the valve, and adjustable means for permitting a constant separation of gaseous material from the fuel in the inner end portion of the casing, and allowing it to return to the source of fuel supply.

4. In a fuel injector for internal combustion engines, the combination with an injector casing having an injector or nozzle provided with a valve seating and an injector valve seated therein, means for opening said valve, and means for admitting fluid fuel under pressure to the interior of said casing in a predetermined quantity, of means for circulating and discharging a portion of said fuel at a predetermined rate in heat absorbing relation to the valve and its seating, and returning a portion thereof to the source of supply to prevent an accumulation of vaporized fuel about the valve and its seating.

5. In an externally uncooled injector for internal combustion engines, the combination with an injector casing having a nozzle provided with a valve seating and an injector valve seated therein, means for opening said valve, and means for admitting fluid fuel under pressure to the interior of said casing in a predetermined quantity, of means for circulating a portion of said fuel in heat absorbing relation to the valve and nozzle, said circulating means including a return duct leading to the source of supply, from a point above the valve.

6. In an externally uncooled injector for internal combustion engines, the combination with an injector casing having a nozzle and an injector valve seated therein, means for opening said valve, and means for admitting fluid fuel under pressure to the interior of said casing in a predetermined quantity, of means for circulating a portion of said fuel at a predetermined rate in heat absorbing relation to the valve and thereafter discharging said portion of the fuel through an opening above the nozzle, the size of said opening being variable during the operation of the injector.

7. In a fuel injector for internal combustion engines, the combination with an injector casing having a counterbored recess at its inner end, of a valve seat having an external shoulder fitting within said recess, a spraying plug seating within a recess in said valve seat, said valve seat and spraying plug abutting against the bottom of the recess in the injector casing, and a clamping member fitting against the external shoulder of said valve seat, and means for forcing said clamping member against said shoulder, thereby simultaneously effecting a tight joint between the ends of said valve seat and spraying plug and the bottom of the recess in said injector.

8. In a fuel injector for internal combustion engines, comprising the combination with an injector nozzle, of normally open feed and overflow ducts arranged to permit

a positive and continual circulation of fluid fuel under pressure in heat absorbing relation to the nozzle, and in a quantity exceeding that required for injection into the engine, and means for permitting a return of the lighter portions of the fuel, while permitting the heavier portions to discharge through the nozzle.

9. In a fuel injector for internal combustion engines, the method of internally controlling the temperature of the injector which consists in admitting a positive and continual flow of fluid fuel under pressure in a quantity exceeding that required for injection into the engine, circulating a portion of the fluid in the injector, and thereafter discharging it from said injector.

10. In a fuel injector for internal combustion engines, the method of carrying away excessive heat that the injector may derive from the engine, preventing the formation of vapor in the injector, and controlling its temperature, which method consists in admitting a flow of fluid fuel under pressure in a quantity exceeding that required for injection, circulating the excess fuel in the interior of the injector, and thereafter discharging said fuel from the injector.

11. In a fuel injector for internal combustion engines, the method of carrying away excessive heat that the injector may derive from the engine, preventing the formation of vapor in the injector, and controlling its temperature, which method consists in admitting a flow of fluid fuel under pressure in a quantity exceeding that required for injection, circulating the excess fuel in the interior of the injector, and thereafter discharging said fuel from the injector, and means for varying the relative flow of fluid fuel to and from the said injector in accordance with the temperature desired within the injector.

In testimony whereof I affix my signature in the presence of two witnesses.

CHARLES S. SALFELD.

Witnesses:
ALICE J. MCKERIHAN,
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