

1,003,795.

3 SHEETS--SHEET 1.

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3 SHEETS--SHEET 2.

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INTERNAL COMBUSTION ENGINE.  
APPLICATION FILED JUNE 21, 1909.

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Patented Sept. 19, 1911.

3 SHEETS—SHEET 3.

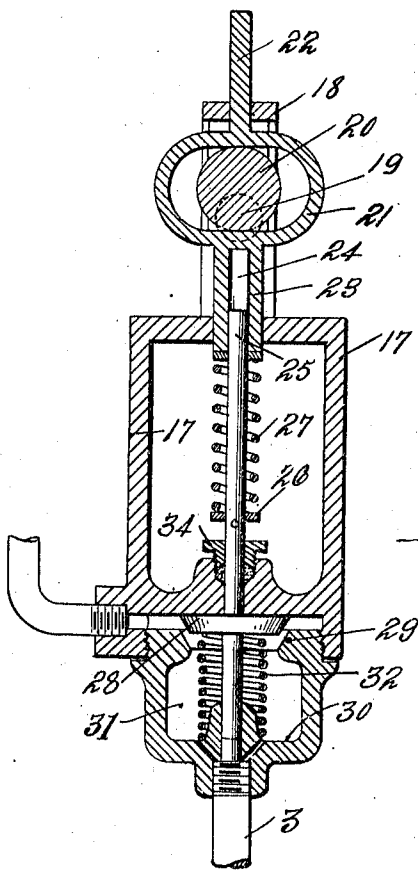


Fig. 6.

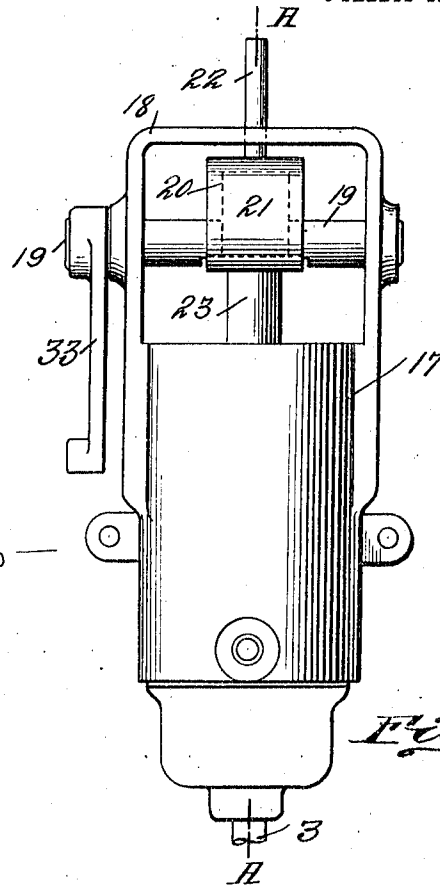


Fig. 4.

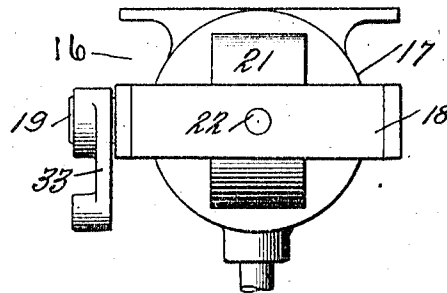


Fig. 5.

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# UNITED STATES PATENT OFFICE.

WILLIAM RABSILBER, OF BROOKLYN, NEW YORK.

INTERNAL-COMBUSTION ENGINE.

1,003,795.

Specification of Letters Patent. Patented Sept. 19, 1911.

Application filed June 21, 1909. Serial No. 503,294.

*To all whom it may concern:*

Be it known that I, WILLIAM RABSILBER, a subject of the Emperor of Germany, residing at Brooklyn, in the county of Kings and State of New York, have invented certain new and useful Improvements in Internal-Combustion Engines, of which the following is a specification, reference being had to the accompanying drawings.

10 This invention relates to internal combustion engines in which the fuel enters the working cylinder apart from and unmixed with the air necessary for its combustion and an object of my invention is to provide  
15 an internal combustion engine in which the fuel enters the working cylinder apart from and unmixed with the air necessary for its combustion and the operation of which will be free from the difficulties heretofore experienced with engines employing this system of fuel supply. The latter possesses many advantages, when compared with a system of fuel supply in which a carbureter is used; for example, there is no danger of  
25 preignition, as there is no explosive mixture compressed; and there are no "carbureter troubles". However, where liquid fuel has heretofore been supplied apart from and unmixed with the air necessary for its combustion certain difficulties of operation have been experienced which may be briefly summarized as follows: (1) Difficulty has been encountered in the handling of the minute quantities of liquid fuel fed to each working  
35 cylinder at one working stroke of the fuel-feed pump; and (2) when the cylinder and inlet pipes are heated by the combustion of the fuel in the cylinders, "gas pockets" are formed in the fuel-feed pipes with the result that the supply of fuel becomes irregular. Again, where gaseous fuel has heretofore been supplied apart from and unmixed with the air necessary for its combustion, certain other disadvantages and  
45 difficulties have arisen, which may be briefly summarized as follows: (1) Before the engine can be started, fuel in the form of gas must be produced; that is, the liquid fuel must be vaporized and this entails a loss of  
50 time before the engine can be started and requires the provision of a heating device external to the engine, such as a lamp; and (2) at starting, the cylinder-walls and valve-casing are cold and the gaseous fuel con-

denses upon coming in contact with them, thereby rendering the fuel supply irregular.

In my new engine hereinafter described, the difficulties just referred to are overcome. The engine may be started instantly with liquid fuel, which is stored and fed to the cylinder under a pressure high enough to overcome the compression of the air. As the fuel is always stored under constant pressure, the fuel can be fed to the cylinder through regular valves, instead of using the direct feeding action of a fuel-feed pump, thereby doing away with difficulties of operation due to said pump or inherent in injection systems heretofore used. After the cylinders and valves have become heated by the initial explosions, the fuel is fed in the form of gas generated by the heat from the exhaust gases discharged from the cylinders; and due to the heated condition of the latter, there will at this time be no danger of the condensation of the gaseous fuel.

In the drawings illustrating the principle of my invention and the best mode now known to me of applying that principle, Figure 1 is a plan view of my new motor, the view being somewhat diagrammatic in its nature; Fig. 2 is an end view of my new motor, this view also being somewhat diagrammatic in its nature; Fig. 3 is a diagrammatic view of the pipes by which the fuel is led from the fuel reservoir to the cylinders; Fig. 4 is an elevation and Fig. 5 is a plan of the valve which controls the admission of fuel to the pressure tank and the flow of fuel therefrom to the heating coil; and Fig. 6 is a vertical central section on the line A—A of Fig. 4.

Four cylinders *a* are shown in the drawing mounted upon the crank-case or housing *b*, in which is rotatably fitted the crank-shaft *c*. The shaft drives through gearing (not shown) the shaft *c'* which turns the bevel-gears *d*, *e*, and through them the spur-gears *f*, *g*. The spur-gear *g* is mounted upon the cam-shaft *h* upon which are mounted also the valve-controlling cams *i*. The cam levers *j* carry each at one end a cam-roller *k* and at the other end are in engagement with the valve-stem of an admission-valve *m* or exhaust-valve *n*, as the case may be.

The arrangement of parts so far described is substantially that shown and described

in my Patent No. 899,186, granted September 22, 1908; but any other suitable arrangement of valve-controlling means may be employed without departing from the spirit of my invention.

Upon one end of the crank-shaft *c* is mounted a pinion *o* which meshes with a gear *p* fast upon the stub-shaft *q* which carries also a cam-eccentric *r* upon which is pressed a cam-roller *s* by the coil-spring *t*, one end of which bears against a flange *u* on the crank-case *b* and the other end of which bears upon the collar *v*. The latter is formed upon the plunger-piston *w* which carries the cam-roller *s* and which works in a pump cylinder *x*. With the latter communicates a pipe *y* provided with a T-connection *z* from which extend the conduits 2, 3. In the conduit 2 is mounted the suction check-valve 4 and in the conduit 3 is mounted the pressure check-valve 5. The conduit 3 communicates with the pressure-tank 6 and the latter is connected by the pipe 7 with the fuel tank 8. From the pipe 3 leads a branch pipe 9 which is connected with one end of a heating coil 10 mounted in the heating drum or chamber 11. One end of the latter communicates with the exhaust-pipe 12 and its other or outlet end is connected by a pipe 13 with the muffler 38. The heating-coil 10 is connected at its other end with the fuel-inlet pipe 14 from which extend the branch fuel-inlet pipes 15. The conduit 3 is connected with the pressure-tank 6 through a valve 16 shown in Figs. 4, 5 and 6.

In the branch-pipe 9 there is mounted a pressure check-valve 35 which closes when the pressure in the heating coil 10 exceeds the pressure in the branch-pipe 9; and the pressure in the latter is, of course, the same as the pressure in the pressure-tank 6, when the valve 16 is open. The pressure in the tank 6 is due to the tension of an indifferent gas which fills its upper portion. In the pipe 7 there is mounted a safety valve 36, so adjusted that it will open when the pressure in the tank 6 becomes too great and will then allow the liquid fuel to return through the pipe 7 to the fuel-tank or reservoir 8.

The exhaust-pipe 12 is provided with the throttle-valve 37 which controls the flow of the exhaust-gases through the heating-chamber or drum 11. The outer end of the exhaust-pipe 12 communicates with the atmosphere through a muffler 38. The air-inlet pipe 39 communicates with the branch air-inlet pipes 40 and each of the latter with one of the cylinders *a*; and in the air-inlet pipe 39 is mounted a throttle-valve 39'.

The top of the valve casing 17 is provided with a yoke 18 in which are rotatably mounted the ends of a shaft 19. The latter carries an eccentric 20 which works within

the eccentric-strap 21 having at its top a guide-bar 22 which passes through a hole in the yoke 18 and being provided at its bottom with a sleeve 23 in the bore 24 of which is slidably fitted the valve-rod or valve-stem 25. The latter is provided with a collar 26 between which and the lower end of the sleeve 23 is interposed a coil-spring 27. The latter tends to hold the valve 28 upon the valve seat 29. Between the lower face or bottom of the valve 28 and the bottom wall 30 of the valve chamber 31 there is mounted a coil-spring 32 which tends to hold the valve 28 off its seat 29 and thereby to allow the fuel to pass from the pipe 3 into the pressure-tank 6. The shaft 19 carries a handle 33; and by moving the latter so as to rotate the shaft 19, the eccentric 20 is turned so as to vary the tension of the coil-spring 27; that is, by turning the handle 33 the tension of the coil-spring 27 may be adjusted. The valve-stem 25 passes through a stuffing-box 34.

During the initial portion of the run, the fuel is forced by the pressure of the indifferent gas in the top of the pressure tank 6 into the cylinders *a* through the branch fuel-inlet pipes 15. The fuel will be in liquid form and may be sprayed into the cylinders *a*. The motor having started, the exhaust-gases pass through the branch exhaust-pipes 12' into the main exhaust-pipe 12 and thence past the throttle-valve 37 into and through the heating drum or chamber 11. During this passage through the heating drum 11, the exhaust gases give up some of their heat to the liquid fuel in the heating coil 10, thereby volatilizing this fuel. A back pressure is thereby generated which closes the pressure check valve 35. The fuel is now fed to the cylinders *a* in the form of gas; and since the walls of the cylinders *a* are heated, the gaseous fuel is not condensed. When the pressure in the heating-coil 10 falls due to the consumption of the fuel therein, the pressure check-valve 35 opens and allows liquid fuel to flow from the branch pipe 9. It is obvious that by turning the handle 33 of the valve 16, the tension of the spring 27 may be varied. If the tension of this spring be increased, the liquid fuel will be fed by the pump *x* under a higher pressure to the heating coil 10 and, therefore, the gaseous fuel will be fed at a higher pressure to the cylinders *a*. Hence, the adjustable valve 16 constitutes means for controlling the pressure at which the fuel will be fed to the working cylinder.

I claim:

1. A system of fuel supply for internal combustion engines, consisting of the combination with a motor; of a reservoir for liquid fuel; a pressure-tank in which is contained liquid fuel under pressure and at

practically ordinary temperature; a heating-coil connected with said motor and tank; means for heating said coil by the exhaust gases from said motor; mechanism 5 for drawing liquid fuel from said reservoir and supplying it under pressure to said heating-coil and pressure-tank; means controlling the pressure at which the liquid fuel is supplied to said heating-coil and 10 pressure tank; and a valve-controlled conduit connecting said pressure-tank and reservoir.

liquid fuel; a pressure-tank in which is contained liquid fuel under pressure; a valve-controlled conduit which connects said reservoir and pressure-tank; a heating-coil connected with said motor and interposed in 20 the path of the exhaust gases from said motor; mechanism for drawing liquid fuel from said reservoir and supplying it under pressure to said heating-coil; and a pressure-controlling device interposed between 25 said pressure-tank and heating-coil.

WILLIAM RABSILBER.

Witnesses:

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FRANK H. SINCERBEAUX.

2. A system of fuel supply for internal combustion engines, consisting of the combination with a motor; of a reservoir for