B. C. SMITH.

GAS GENERATOR AND SEPARATOR.

APPLICATION FILED FEB. 11, 1914.

1,122,038. Patented Dec. 22, 1914.

Fig. 1.

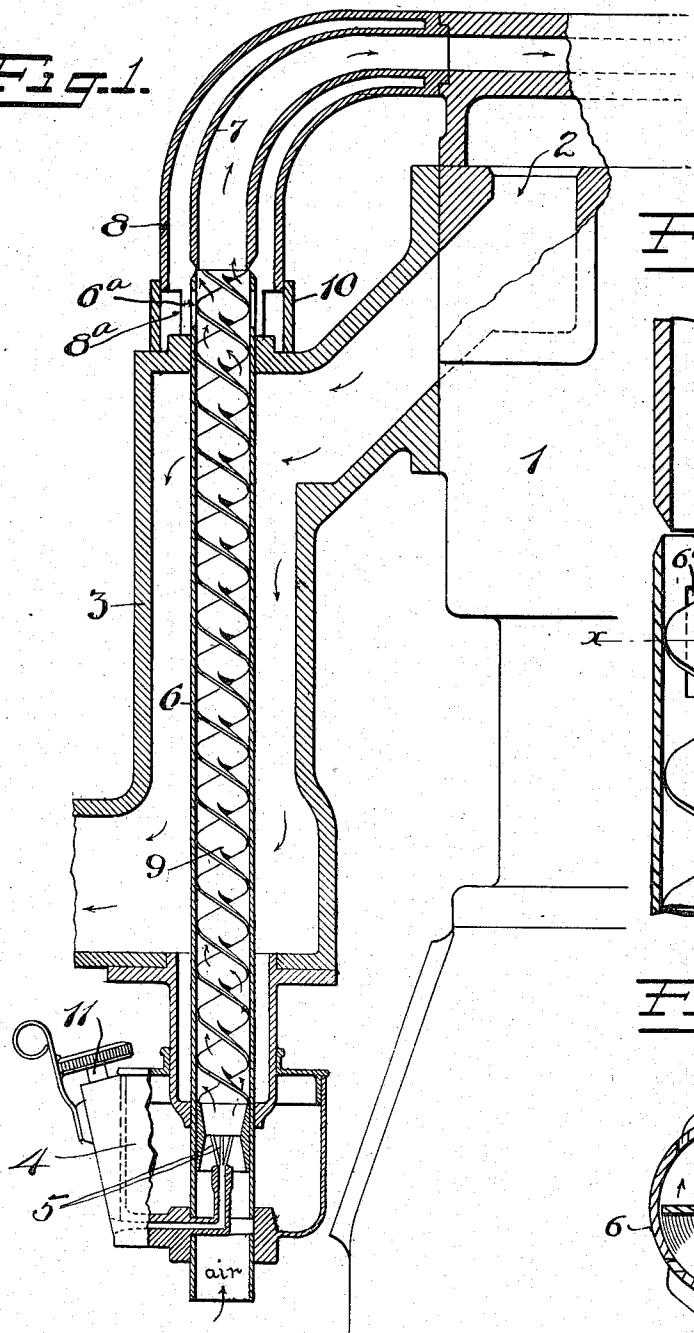


Fig. 2.

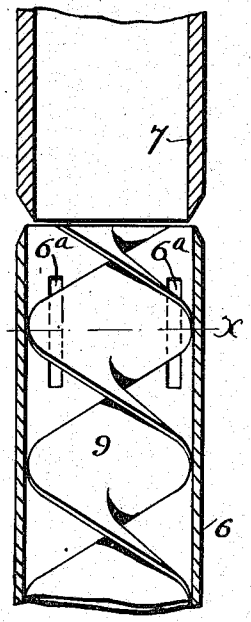
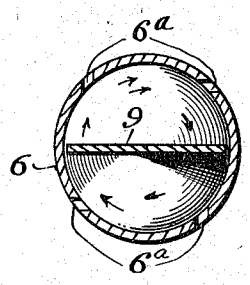


Fig. 3.



Witnesses:

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UNITED STATES PATENT OFFICE.

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GAS GENERATOR AND SEPARATOR.

1,122,038. Specification of Letters Patent. Patented Dec. 22, 1914.

Application filed February 11, 1914. Serial No. 818,017.

To all whom it may concern:

Be it known that I, BENJAMIN C. SMITH, a citizen of the United States, residing at Bayonne, Hudson county, State of New Jersey, have invented certain new and useful Improvements in Gas Generators and Separators, of which the following is a full, clear, and exact description.

My invention relates to an improved gas generator for forming and supplying gas to internal combustion engines, the object of the invention being to provide an improved construction whereby the heavier hydrocarbons may be successfully used in the above connection. Heretofore great difficulty has been experienced in the attempts that have been made to use the heavier liquid hydrocarbons in this connection because it has been impossible to successfully and completely convert the liquid hydrocarbon into a gas before it reaches the interior of the engine cylinder, with the result that some of the fuel in solid form would be drawn into the cylinder only to burn imperfectly and thereby cause the rapid accumulation of carbon on the cylinder walls and piston head, to the injury of the efficient operation of the motor. By my present improvement I have found a means for effectively overcoming the difficulties heretofore standing in the way of complete success in the use of such fuel.

In the accompanying drawings, Figure 1 is an end elevation, partly in section, of a part of an engine equipped with my improvement. Fig. 2 is a relatively enlarged detail view. Fig. 3 is a cross section on the line *x*—*x*.

1 represents conventionally a motor of the internal combustion variety.

2 represents the exhaust port.

3 represents the exhaust pipe.

4 represents conventionally an oil feed tank designed to hold liquid fuel at the proper level relatively to the atomizer tips 5, which tips are located in an air passage through which air may rush with a sufficient velocity to draw off, in the form of spray, the proper proportion of liquid fuel to make the proper gas mixture.

6 is a pipe leading from the oil feed tank 4 upwardly to a pipe 7 which represents the gas intake pipe of the motor, the same leading to the usual intake port of the motor. The pipe 6 leads up through the exhaust pipe 3 so that the hot exhaust gases will constantly maintain the pipe 6 at a high temperature while the engine is running. The inner diameter of the pipe 7 is slightly less than that of pipe 6 and the adjacent ends of these pipes are spaced apart with the ends outwardly beveled. The upper end of the pipe 6 and the pipe 7 are preferably inclosed within a tubular jacket 8 above the exhaust pipe 3 to prevent the rapid radiation of heat from the upper end of the pipe 6 and the pipe 7, where they lead from said exhaust pipe 3 to the head of the engine. The upper end of the pipe 6 is provided with longitudinal slots which preferably are arranged tangentially as shown in the section Fig. 3, this slotted upper end of said pipe performing the function of a separator as hereinafter described. Within the pipe 6 I provide means for imparting a whirling spiral movement to the ascending atomized fuel. In the preferred form, this means comprises a spiral 9 formed by symmetrically twisting a strip or plate about its longitudinal center line with its side edges engaging the inner walls of the pipe.

In operation, the engine, on its suction stroke, draws air through the pipe 6. This air enters at the lower end of the oil feed tank 4 and passes the sprayer tips 5—5 from which tips there is delivered a spray of the particular fuel used. If this fuel is one of the heavier hydrocarbons, it will not, at ordinary temperature or even under the conditions incidental to the use of an ordinary gas generator, readily volatilize and, unless some means is provided to prevent it, some of the solid fuel spray is bound to be drawn into the engine where it will burn, if at all, only slowly and imperfectly. By my improvement the spray passes through the pipe 6 where in transit a centrifugal action is set up so as to cause the heavier or solid particles of the fuel to impinge against the wall of the pipe 6 where said particles will lodge and where, by the direct heat thereof, they will be quickly turned into gas which will be taken up by and flow on with any moving gas or air adjacent thereto. If by chance, there are any solid particles of the fuel remaining in the pipe 6 when the separator is reached, these solid particles will be thrown out by centrifugal action through the slots 6ª or through the

aperture between the top of pipe 6 and bottom of pipe 7 and be thereby completely separated from the gas, which latter will flow on through the pipe 7 to the engine. I have found by actual practice that some of the heaviest hydrocarbons, hitherto regarded as unavailable for use in this connection, may be employed with entire satisfaction by the use of my improved apparatus. If desired, a clearance opening 8^a may be provided, there being a damper or movable sleeve covering 10 therefor to afford ready access to the space where the separated material accumulates to enable it to be cleaned. I have not attempted to show the inlet port or the inlet or exhaust valves, such features being too well known to require illustration or description. The exhaust pipe 3 I have shown as broken off and it is obvious that the broken off portion may comprise the usual terminal extension. 11 represents the usual fuel regulating valve by which the liquid fuel feed may be regulated. It should be understood that the particular form of vaporizer or atomizer used may be modified at will.

Where attempts have been made to use kerosene, which is a heavy hydrocarbon as compared with gasolene, it has been the practice to start the motor with gasolene until the parts were heated, whereupon the kerosene feed has to be substituted for the gasolene. Such practice may, of course, be availed of in the present case if it seems expedient.

I am aware that kerosene has been used with a moderate degree of success heretofore in an ordinary vaporizer, but so far as I am aware, such use has always resulted in the rapid deposit of carbon on the cylinder walls and upon the upper end of the piston, so that it can not be said that such efforts have been entirely successful. The failure has been due to the fact that no means has heretofore been devised to separate the solid particles of fuel from the gas before said fuel reaches the cylinder. By my improvement, which in the preferred form includes the means for causing the centrifugal action within the pipe 6 to occur, and also the use of a separating means, it is impossible for solid parts of the fuel to enter the cylinder. By applying the external jacket 8, the heat of the pipe 7 is maintained so as to prevent condensation of the gas after it leaves the separator.

It should be understood that the particular method of heating the pipe 6 shown herein—that is to say by the hot exhaust gases—is merely the preferred method, since by employing such method, the greatest economies can be attained. It should also be understood that the means for causing the current of air and fuel to whirl for the purpose of throwing any solid particles of the fuel against the hot walls of the pipe, must be a means that will maintain or continue the whirling action for a sufficient period to effectively accomplish the intended result of transforming substantially all of the fuel into a gaseous mixture as distinguished from a mixture in which solid drops, or globules, of fuel are prominent, for otherwise the separator would discard such a substantial proportion of fuel as to defeat the ends of economy and successful operation.

It will be understood that the separator is preferably located in the zone of action of the means for causing centrifugal motion to be imparted to the moving mixture so that any solid fuel therein will be discharged through the ports of said separator. Obviously, the number, shape and arrangement of these separator ports may be modified at will, although it is preferred that said ports should be in the form of slits such as described extending longitudinally of the pipe and having a relatively tangential arrangement, forming thereby one relatively sharp edge so that the solid particles may be readily whirled out of the pipe. If desired, the sharp edges aforesaid may be pressed in somewhat as indicated in Fig. 3. While any solid particles of fuel in the current will be discharged by centrifugal force through the separator ports 6^a, it is obvious that the current of gas will not be discharged therethrough by reason of the vacuum in the pipe extension 7. It is important that the space around the separator should be inclosed so that air will not leak in to such an extent as to adulterate the mixture.

What I claim is:

1. In a means for supplying gas to internal combustion engines, means for atomizing a liquid fuel, a pipe arranged to lead therefrom toward said engine, means within said pipe for positively advancing therethrough double continuously revolving spiral columns of air and atomized fuel bringing all portions of each column during travel through the pipe progressively against the walls thereof and to cause any solid portions of the fuel in said current to be impinged against the walls of the pipe, means for heating said pipe, and means for separating from the moving current any solid fuel that may remain therein as the gas mixture approaches said motor.

2. In a means for supplying gas to internal combustion engines, means for atomizing a liquid fuel, a pipe arranged to lead therefrom toward said engine, means within said pipe for positively advancing therethrough double continuously revolving spiral columns of air and atomized fuel bringing all portions of each column during travel through the pipe progressively against the

walls thereof and to cause any solid portions of the fuel in said current to be impinged against the walls of the pipe, means for heating said pipe, and means for separating from the moving current any solid fuel that may remain therein as the gas mixture approaches said motor, said separating means being located in the zone of action of the means for whirling said current for coaction therewith.

3. In a means for supplying gas to internal combustion engines, means for atomizing a liquid fuel, a pipe arranged to lead therefrom toward said engine, means within said pipe for positively advancing therethrough double continuously revolving spiral columns of air and atomized fuel bringing all portions of each column during travel through the pipe progressively against the walls thereof and to cause any solid portions of the fuel in said current to be impinged against the walls of the pipe, means for heating said pipe, and means extending longitudinally of said pipe for separating from the moving current any solid fuel that may remain therein as the gas mixture approaches said motor.

4. In a means for supplying gas to internal combustion engines, means for atomizing a liquid fuel, a pipe arranged to lead therefrom toward said engine, means within said pipe for positively advancing therethrough double continuously revolving spiral columns of air and atomized fuel bringing all portions of each column during travel through the pipe progressively against the walls thereof and to cause any solid portions of the fuel in said current to be impinged against the walls of the pipe, means for heating said pipe, and means for separating from the moving current any solid fuel that may remain therein as the gas mixture approaches said motor, said means including discharge ports in the side of said pipe.

5. In a means for supplying gas to internal combustion engines, means for atomizing a liquid fuel, a pipe arranged to lead therefrom toward said engine, means within said pipe for positively advancing therethrough double continuously revolving spiral columns of air and atomized fuel bringing all portions of each column during travel through the pipe progressively against the walls thereof and to cause any solid portions of the fuel in said current to be impinged against the walls of the pipe, means for heating said pipe, and means for separating from the moving current any solid fuel that may remain therein as the gas mixture approaches said motor, said means including discharge ports in the side of said pipe, and an inclosed space around said ports.

6. In a means for supplying gas to internal combustion engines, means for atomizing a liquid fuel, a pipe arranged to lead therefrom toward said engine, means within said pipe for positively advancing therethrough double continuously revolving spiral columns of air and atomized fuel bringing all portions of each column during travel through the pipe progressively against the walls thereof and to cause any solid portions of the fuel in said current to be impinged against the walls of the pipe, means for heating said pipe, means for separating from the moving current any solid fuel that may remain therein as the gas mixture approaches said motor, said means including discharge ports in the side of said pipe, an inclosed space around said ports, with means for permitting gas to the interior of said space.

7. In a means for supplying gas to internal combustion engines, means for atomizing a liquid fuel, a pipe arranged to lead therefrom toward said engine, means within said pipe for positively advancing therethrough double continuously revolving spiral columns of air and atomized fuel bringing all portions of each column during travel through the pipe progressively against the walls thereof and to cause any solid particles of fuel in said current to be impinged against the walls of the pipe, and means for heating said pipe.

8. In a means for supplying gas to internal combustion engines, means for atomizing a liquid fuel, a pipe arranged to lead therefrom toward said engine, means within said pipe for positively advancing therethrough double continuously revolving spiral columns of air and atomized fuel bringing all portions of each column during travel through the pipe progressively against the walls thereof and to cause any solid particles of fuel in said current to be impinged against the walls of the pipe, and means for heating said pipe, said means including an external jacket arranged to conduct the hot exhaust gases of an engine alongside the pipe to be heated.

9. In a means for supplying gas to internal combustion engines, means for atomizing a liquid fuel, a pipe arranged to lead therefrom toward said engine, means within said pipe for positively advancing therethrough double continuously revolving spiral columns of air and atomized fuel bringing all portions of each column during travel through the pipe progressively against the walls thereof and to cause any solid particles of fuel in said current to be impinged against the walls of the pipe, and means for heating said pipe, said means including an external jacket arranged to conduct the hot exhaust gases of an engine alongside the pipe to be heated, said pipe to be heated projecting above and outside of said exhaust pipe, with a separator for solid

particles of fuel adjacent that part of said pipe which projects outside of the exhaust pipe.

10. In a means for supplying gas to internal combustion engines, means for atomizing a liquid fuel, a pipe arranged to lead therefrom toward said engine, means within the pipe to cause any solid particles of fuel therein to be impinged against the walls of the pipe, a second pipe of smaller inner diameter leading to the engine having the same axis as and spaced apart from the top of the first pipe having its end outwardly beveled to form a separator for solid particles of fuel that may leave the first pipe.

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Witnesses:
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