O. B. JACOBS.

FUEL FEEDING MEANS FOR EXPLOSIVE ENGINES.

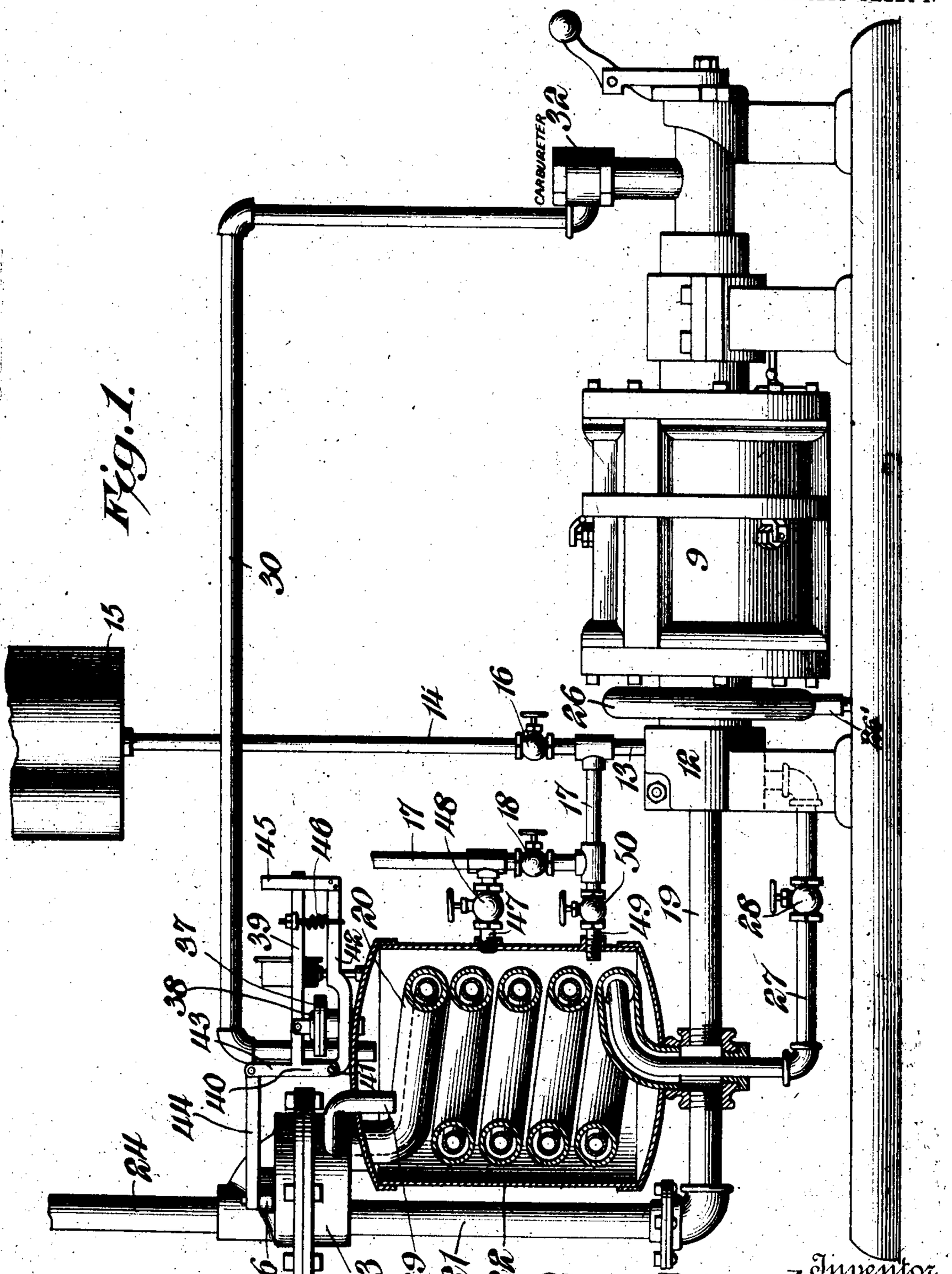
APPLICATION FILED OCT. 12, 1908.

990,741.

Patented Apr. 25, 1911.

3 SHEETS—SHEET 1.

Fig. 1.



Witnesses

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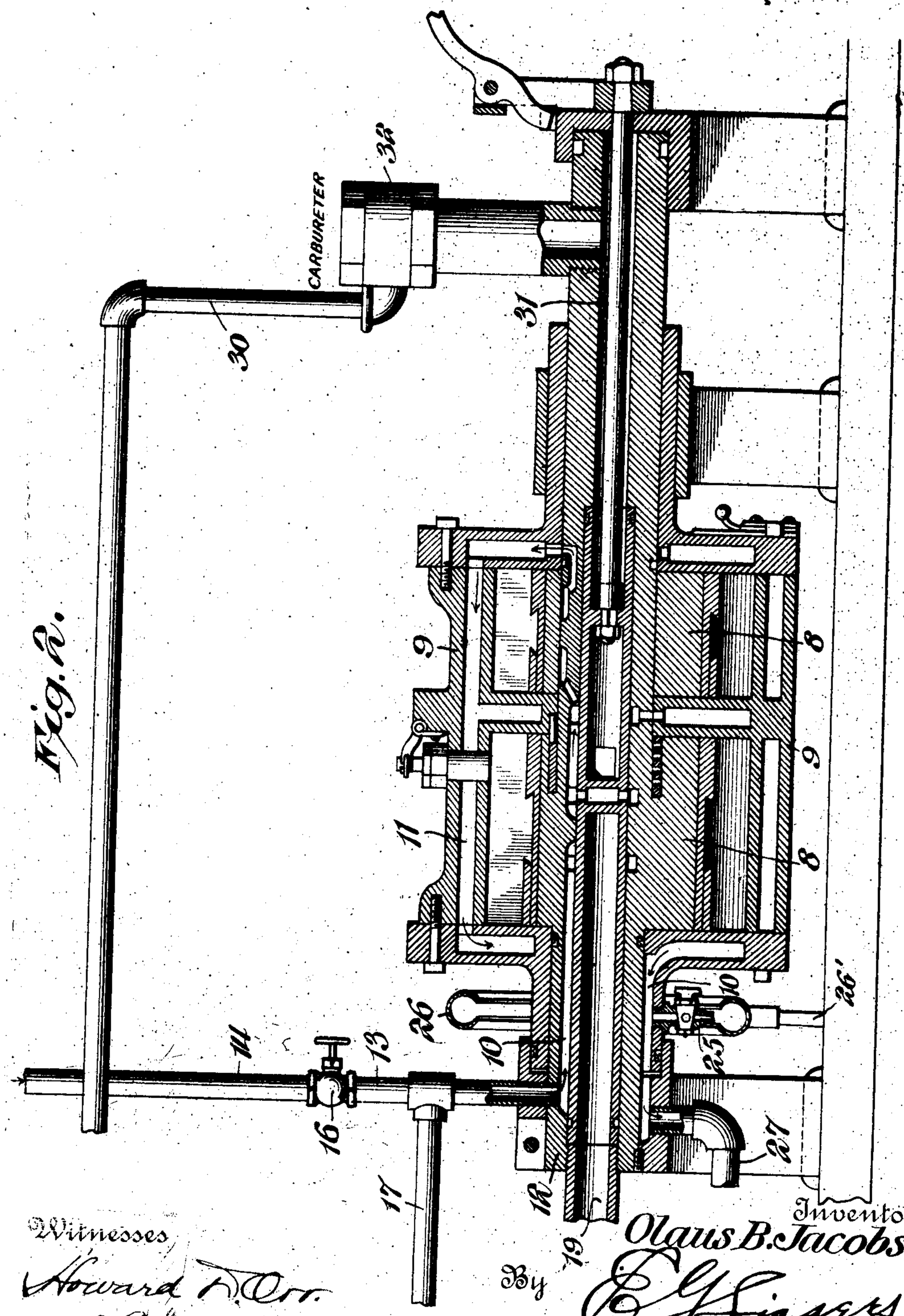

Fig. 2.

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3 SHEETS—SHEET 3.

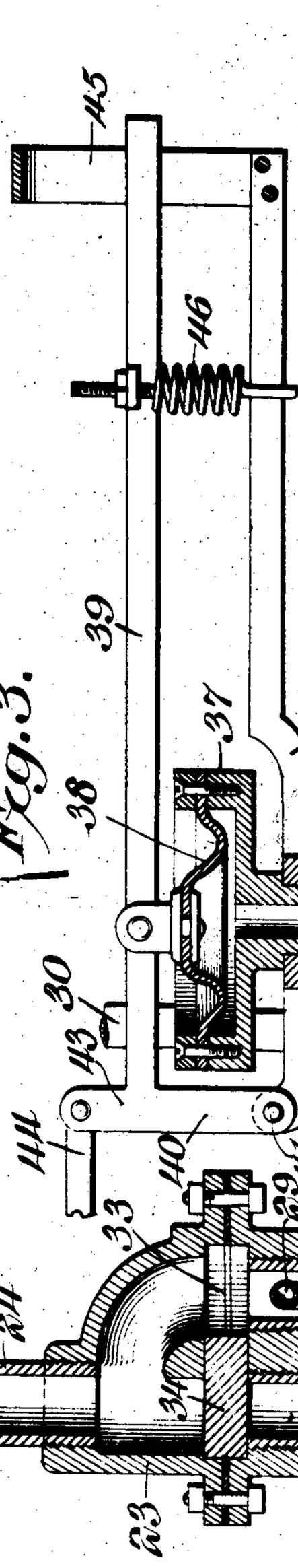

Fig. 3.

Fig. 5.

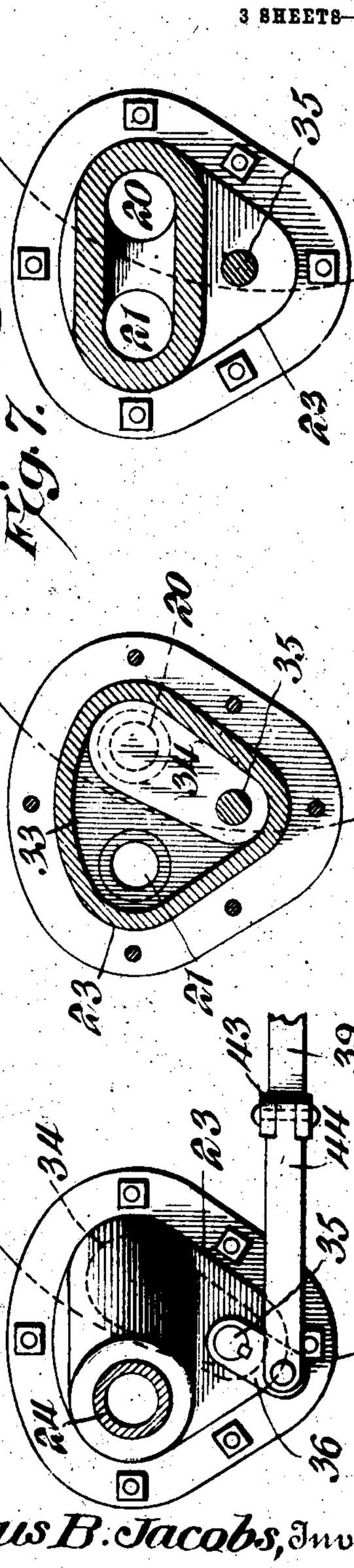

Fig. 7.

Fig. 6.

Fig. 4.

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UNITED STATES PATENT OFFICE.

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FUEL-FEEDING MEANS FOR EXPLOSIVE-ENGINES.

990,741. Specification of Letters Patent. Patented Apr. 25, 1911.

Application filed October 12, 1908. Serial No. 457,349.

To all whom it may concern:

Be it known that I, OLAUS B. JACOBS, a citizen of the United States, residing at Cleveland, in the county of Pawnee and State of Oklahoma, have invented a new and useful Fuel-Feeding Means for Explosive-Engines, of which the following is a specification.

The present invention relates more particularly to means for feeding fuel to rotary explosive engines, but is not necessarily limited to this type, as it may be successfully employed in other classes of engines.

One of the primary objects of the invention is to utilize the fuel as a cooling agent for the engine, thus lowering the temperature of the latter, while raising the temperature of the fuel, the mechanism being, however, such that water may be employed as a cooling agent if desired.

Another object of the invention is to provide novel means for highly heating the liquid hydrocarbon before carbureting and introducing the same into the engine, said means being associated with the exhaust from the engine and including mechanism by which said exhaust may be cut off from the heating means.

Still another object is to provide variable means of an automatic nature for controlling the pressure of the fuel supply.

While the invention may be embodied in a number of ways, the preferred form of construction is illustrated in the accompanying drawings, wherein:—

Figure 1 is a side elevation of an engine with the feeding means associated therewith, a portion of said feeding means being illustrated in section. Fig. 2 is a longitudinal sectional view on an enlarged scale through the engine. Fig. 3 is a detail sectional view on an enlarged scale through the upper portion of the heating means. Fig. 4 is a plan view of the controlling valve for the exhaust. Fig. 5 is a vertical sectional view therethrough. Fig. 6 is a horizontal sectional view substantially on the line 6—6 of Fig. 5. Fig. 7 is a sectional view on the line 7—7 of Fig. 5.

Similar reference numerals designate corresponding parts in all the figures of the drawings.

While the engine may be of any desired type, the mechanism is preferably employed in connection with a rotary engine of the character disclosed in my co-pending application, Serial No. 468,042, filed December 17, 1908. No claims are made to this engine in the present application as the same constitutes the subject-matter of the application above referred to. For the purposes of this case, it is believed to be sufficient to state that said engine consists of two or more stationary eccentric piston members 8, on which is journaled a rotary cylinder member 9. This engine is provided with a cooling system, which includes channels 10 and 11 formed in both the piston and cylinder members. The cooling system in itself is not claimed in this application, as it constitutes the subject-matter of another co-pending application, Serial No. 457,350, filed October 12, 1908. The inlet to the cooling system is through one of the hubs 12 of the engine, and the outlet is preferably through the same hub, though this precise arrangement is immaterial. A supply pipe 13 for the cooling medium is connected to the inlet channel 10, and connected to said supply pipe, is a water conducting pipe 14 leading from a suitable source of supply 15 and having a valve 16 therein. A liquid fuel conducting pipe 17 is also connected to the supply pipe 13, and has a controlling valve 18 therein. It will thus be seen that either water or liquid fuel can be introduced into the cooling system of the engine.

Leading from the hub 12 of the engine is an exhaust pipe 19 for the products of combustion, and this pipe is divided into branches 20 and 21. The branch 20 is in the form of a coil located within a heater casing 22, while the branch 21 is disposed exteriorly of said casing. The two branches are connected to a valve casing 23, from which leads an exhaust pipe 24, the pipes 19 and 24 thus constituting separate sections of the exhaust pipe, which are connected by the two branches 20 and 21. A discharge nipple 25 is preferably mounted on the cylinder member and communicates with the outlet channel 10′ of the cooling system. This nipple delivers into an annular trough 26 surrounding the hub 12. A pipe 27 for conducting the fuel communicates with said outlet channel 10′ of the cooling system, and is preferably provided with a controlling valve 28. This fuel conducting pipe 27 extends into and longitudinally through the coil of branch 20 in spaced

relation to the walls thereof, and has its discharge end 29 projecting from the valve casing 23 and extending into the top of the heater casing 22. A vapor fuel conducting pipe 30 leads from the top of the heater casing 22 and extends to the intake port 31 of the engine. In the pipe 30 is placed a suitable carbureter 32.

The valve casing 23, as clearly shown in Figs. 3, 5 and 6 has a valve chamber 33 common to both the exhaust pipe branches 20 and 21, and a swinging valve plate 34 operating in the chamber, is movable over either of said branches so as to close the same. The valve plate 34 is secured to a rock shaft 35, which projects from the casing, and has an exposed crank arm 36. This crank arm may constitute means for manually actuating the valve, but in the preferred form of construction, automatic means are employed for this purpose. A device responsive to the vapor pressure in the casing 22 is employed comprising a chambered body 37 mounted on the casing 22 and communicating with the interior of the upper portion thereof, which portion contains the vaporized oil or gas constituting the fuel supply for operating the engine. A flexible diaphragm 38 closes the upper end of the body and is connected to a bell crank lever 39, one arm 40 of which is fulcrumed, as shown at 41 on a supporting bracket 42. This arm 40 has an extension 43, to which is connected a link 44, said link being also attached to the crank arm 36. The long arm 39 of the bell crank lever is located above the bracket arm 42 and its free end operates in a suitable upstanding guide 45. A spring 46, adjustable along the bracket 42, is engaged with and adjustable along the arm 39 of the lever so that the amount of pressure against the diaphragm 38 necessary to operate the arm 39 can be varied, as desired. As the diaphragm responds to variations in the vapor pressure within the casing 22, the valve 34 will move for by-passing more or less of the exhaust gases around the heater casing 22 so as to maintain the temperature of the latter approximately constant. When the pressure rises the valve cuts off the supply of exhaust gases through the coiled branch 20 and opens the supply through the pipe 21. By thus by-passing the exhaust gases around the heater casing 22, the latter is permitted to cool until the normal temperature or pressure is reached. The fuel supply pipe 17, which as already stated is connected to the supply pipe 13, is also in direct communication with the heater casing 22 through the medium of a branch pipe 47 and a controlling valve 48 is located in said pipe. An outlet pipe 49 leads from the casing below the pipe 47, and is connected with and discharges heated fuel into the pipe 17 below the valve 18. A controlling valve 50 is arranged in the pipe 49. When the valves 48 and 50 are opened and the valve 18 closed, the liquid fuel will be heated in three stages. It is heated first in the casing 22, then in the engine during the cooling thereof, and finally while traversing the coil exhaust pipe. The temperature of the fuel is thus brought to a high point so that it can be readily converted into vapor.

With this structure, if it is desired to cool the engine with water, the valves 18, 48 and 50 are closed and the valve 16 is opened, whereupon the fluid will flow from the source of supply 15 through the cooling system. The valve 28 is also closed, and the nipple 25 is opened. As the cylinder member rotates, the centrifugal force will cause the water to flow through the nipple 25 into the annular trough 26, from which it discharges through a drain pipe 26′ connected with the bottom of the trough. If it is desired to use the liquid fuel as a cooling agent, the valve 16 is closed and the valve 18 is opened and the valves 48 and 50 may be left closed. Said fuel will therefore flow through the cooling system of the engine. The nipple 25 in this case is closed while the valve 28 is opened. It will therefore be evident that inasmuch as the fuel will absorb heat in its passage through the engine, its temperature will be raised and after passing through said engine, it will enter and traverse the coil 20 by way of the pipe 27, and from the upper downwardly-bent end of the latter it will be discharged into the casing 22. Leaving said casing through the pipe 30 it will be mixed with air at the carbureter, and delivered to the engine. It will be evident that in passing through the coil and heating casing, it will be raised to a high temperature by absorbing the heat from the exhaust and will thus be vaporized. When the pressure of vapor in the heating casing reaches a predetermined degree determined by the spring 46, the arm 39 of the controller will be raised. Consequently through the medium of the link 44, the valve plate 34 will be swung to a position across the discharge end of the exhaust branch pipe 20 while the other branch pipe will be opened. The exhaust will therefore pass through said other pipe until the temperature lowers to a point that will reduce the pressure in the casing 22 and permit the regulator to swing the valve across the exhaust pipe section 21. Under certain conditions, it may be desired to raise the temperature of the motive fluid before it passes through the heating system, in which case, the valves 16 and 18 are closed and the valves 48 and 50 are opened. Said motive fluid is then discharged into the heating casing first, and afterward will enter the cooling system of the engine. With this ar-

rangement the fuel can be cut out of the cooling system entirely by opening the valve 48 while the valves 18 and 50 are closed, whereupon the fuel will be introduced into the casing 22 and can flow thence through the pipe 30 to the engine for the purpose of operating said engine.

From the foregoing, it is thought that the construction, operation and many advantages of the herein described invention will be apparent to those skilled in the art, without further description, and it will be understood that various changes in the size, shape, proportion and minor details of construction may be resorted to without departing from the spirit or sacrificing any of the advantages of the invention.

Having thus fully described my invention, what I claim as new, and desire to secure by Letters Patent is:—

1. The combination with an explosive engine having a cooling system, of a fuel supply connected with the admission end of the cooling system, a refrigerant supply also connected with the admission end of the cooling system, means for permitting either the fuel or the refrigerant to enter the cooling system, an escape for the refrigerant at the discharge end of the cooling system, and a fuel-conveying connection between the discharge end of the cooling system and the working portion of the engine.

2. The combination of an explosive engine having a cooling system, a pair of fluid-conveying pipes communicating with the admission end of the cooling system, a pair of discharge ports at the discharge end of the cooling system, a heater connected with the exhaust of the engine, and a pipe leading from one of the discharge ports of the cooling system through the heater to the working chamber of the engine.

3. The combination with an explosive engine having a cooling system, of a container for liquid fuel, connections between the same and both ends of the cooling system of the engine for establishing a circulation of the liquid fuel between the container and cooling system, means for directing the exhaust from the engine through the fuel container in operative relation to the fuel connections between the outlet of the cooling system and the container, and connections between said container and the power side of the engine.

4. The combination with a rotary explosive engine having a piston and cylinder cooling system, of means for directing liquid fuel through the cooling system, an exhaust pipe arranged in proximity to the discharge end of the cooling system, a heater casing surrounding said exhaust pipe, means for carrying fuel from the discharge end of the cooling system into said heater casing, automatically actuated means controlled by the pressure of the vapor in the casing for regulating the heat within the latter, a vapor conducting pipe leading from the casing to the engine, and a carbureter located in the said vapor-conducting pipe.

5. The combination with an explosive engine, of an exhaust conduit therefor having branches, a fuel supply pipe passing through one of the branches, and means for controlling the passage of the exhaust through the branches.

6. The combination with an explosive engine, of an exhaust conduit therefor having branches, a fuel supply pipe passing through one of the branches, and automatic means for controlling the passage of the exhaust through the branches.

7. The combination with an explosive engine, of a liquid fuel heater and vaporizer closed to the admission of air, an exhaust pipe from the engine having branches, one of which passes through and is coiled within the heater, a fuel supply pipe passing through the coiled branch, and means for controlling the passage of the exhaust through the branches.

8. The combination with an explosive engine, of a heater casing, an exhaust pipe having branches, one of which extends through and the other of which is located outside the heater casing, a fuel-vaporizing pipe passing through the branch extending through the casing, and means for varying the heat in the casing by directing a variable quantity of exhaust gases through the branch therein.

9. The combination with an explosive engine, of a liquid fuel heater casing, an exhaust pipe for the engine having branches, one of which is in the form of a coil located within the casing and the other of which is located outside the said casing, a fuel-vaporizing coil disposed within the coiled branch and having its outlet discharging into the casing, and means for directing the exhaust through either branch whereby to control the temperature within the casing.

10. The combination with an explosive engine, of a fuel heater, an exhaust pipe having two branches, one of which is associated with the heater, the other being independent of the heater, a fuel supply pipe passing through the branch associated with the heater, a single valve for controlling the passage of the exhaust through the branches, and means responsive to fuel pressure in the heater for actuating the valve and thereby controlling the temperature within the heater.

11. The combination of an explosive engine, an exhaust pipe therefor comprising separated sections, a heater casing located between the sections, exhaust pipe branches connected to one of the sections, one of said branches extending through the casing and

the other branch extending exteriorly of said casing, a valve casing connecting the branches to the other exhaust pipe section, a single valve operating in the valve casing and controlling both exhaust pipe branches, and means responsive to fuel pressure in the heater for actuating the valve and thereby controlling the temperature within the heater.

12. The combination of an explosive engine, an exhaust pipe for conducting away the products of combustion, said pipe having separate branches both connected at one end with the engine and both connected at the opposite end with an outlet, means for varying the quantity of exhaust gases passing through either or both branches, a fuel conduit passing through one of the branches, a casing inclosing the branch through which the fuel conduit passes, means for discharging fuel from said conduit into the casing, a carbureter connected with the inlet of the engine, and a pipe leading out of the casing and connected with the carbureter for conveying vapor thereto.

13. The combination with an explosive engine, of a heater casing, an exhaust pipe leading from the explosive engine and having branches, one of which extends exteriorly of the casing and the other of which is in the form of a coil located in said casing, a valve casing connecting the branches, a single valve operating in the valve casing and controlling the passage of the exhaust through both branches, a pressure actuated device mounted on the heater casing and responsive to the pressure therein, a connection between the pressure-actuated device and the valve, and an adjustable spring controlling the operation of the pressure-actuated device.

14. The combination of an explosive engine, an exhaust pipe leading therefrom and having branches, a valve casing connecting said branches, a valve pivoted within the casing and arranged to move across the ends of the branches, a crank arm on the pivot of the valve, a heater surrounding one branch of the exhaust pipe, a fuel pipe passing through said branch, a pressure responsive device mounted on the heater and open to the interior thereof, an angle lever connected to said device, and a link connecting said lever with the crank arm on the pivot of the valve.

15. The combination with an explosive engine, of fuel-feeding means therefor including a heating chamber, an exhaust pipe having a coil located in the chamber, and a fuel pipe extending through the coil and having its discharge end extending out of the coil and opening into the heater.

16. The combination with an explosive engine, of an exhaust pipe leading therefrom, and fuel-feeding means for said engine including a supply pipe extending longitudinally within the exhaust pipe and having its discharge end leading out of the latter, and a casing surrounding the exhaust pipe and the discharge end of the fuel pipe for receiving fuel from the supply pipe and holding said fuel in contact with the exterior of the exhaust pipe.

17. The combination with an explosive engine, of an exhaust pipe leading therefrom and having a coiled portion, and a fuel supply pipe for the engine having a coiled portion extending longitudinally within the coiled portion of the exhaust pipe.

18. The combination with an explosive engine having an exhaust pipe, of a fuel-vaporizing device heated by the exhaust pipe, said device including a liquid fuel-conducting pipe passing through the exhaust pipe and leading out of the same, means surrounding the exhaust pipe and into which the fuel-conducting pipe discharges for further heating the fuel by contact with the exterior of the exhaust pipe, and means for conducting fuel from said surrounding means to the engine.

19. The combination with an explosive engine having an exhaust pipe, of fuel-conveying means for the engine including a heating chamber through which the exhaust pipe passes, and a fuel supply pipe delivering to the chamber and having a portion located within the portion of the exhaust pipe that is within the chamber.

20. The combination with an explosive engine, of a heater casing, an exhaust pipe leading from the engine and extending through the casing, said engine having a cooling system for the heated parts thereof, means for supplying fuel to the admission end of the cooling system, means for carrying the heated fuel from the discharge end of the cooling system through a portion of the exhaust pipe for further heating and delivering it into the heater casing, and means for directing the fuel from the said casing into the engine.

21. The combination with a rotary explosive engine including a cylinder and a piston member having communicating channels for a cooling medium, of a fuel supply pipe communicating with the channels for delivering fuel thereto, a heater casing, an exhaust pipe from the engine having branches, one of which extends exteriorly of the casing and the other of which is coiled within the casing, a valve casing connecting said branches, a valve operating in the valve casing and controlling both branches, a pressure-responsive device mounted on the casing and connected to the valve for operating the same, a pipe leading from the communicating channels and extending longitudinally within the coil, said pipe delivering into the heater casing, a pipe leading

from said casing and delivering into the engine, and a carbureter arranged in the last-mentioned pipe.

22. The combination with an explosive engine having passages in its heated parts, of means for delivering fuel or water to the admission end of said passages, means for receiving fuel from the said passages after traversing the same and directing said fuel to the engine for driving the same, and separate means for discharging water from said passages when water is used instead of fuel for cooling the heated parts.

23. The combination with an explosive engine having passages in its heated parts, of a water supply pipe and a fuel supply pipe connected with the admission end of said passages, valves for controlling said pipes, means for directing fuel from the passages to the combustion chamber of the engine, said means including a heater and a carbureter, and means for discharging water from the passages and excluding it from the heating mechanism and carbureter.

24. An explosive engine provided with a cooling system, a container for liquid fuel, means for directing the fuel from the container through the cooling system in operative quantities and back to the container, means for vaporizing the fuel subsequent to its passage through the cooling system and prior to its return to the container by the heat of the exhaust from the engine, and means for delivering the vaporized fuel from the container to the power side of the engine as demanded.

25. The combination of an explosive engine having an exhaust conduit, of a heater through which the conduit passes, a fuel-conducting pipe extending through the conduit for heating the fuel, said pipe discharging into the heater for further heating the fuel by contact with the exterior of the conduit, a pipe conducting the heated fuel from the heater to the engine, and a carbureter included within the last-mentioned pipe.

26. The combination with an explosive engine having passages in its heated parts, of a water supply pipe and a fuel supply pipe connected with the admission end of said passages, valves for controlling said pipes, means for directing fluid from the passages to the combustion chamber of the engine, said means including a heater, and means for discharging water from the passages and excluding it from the heating mechanism.

In testimony, that I claim the foregoing as my own, I have hereto affixed my signature in the presence of two witnesses.

OLAUS B. JACOBS.

Witnesses:
E. G. Todd,
Carl Mullendore.