No. 756,785. PATENTED APR. 5, 1904.

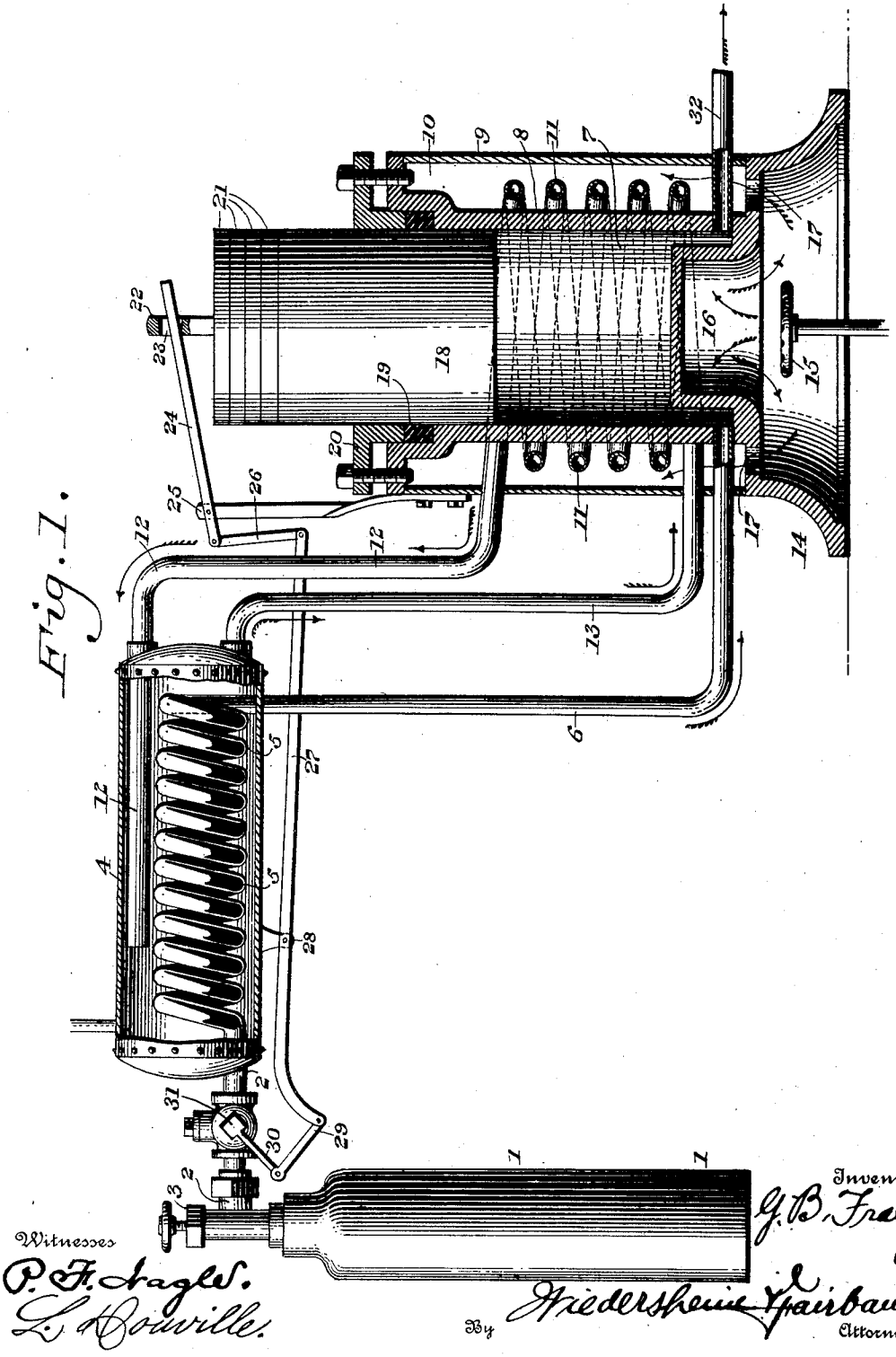
G. B. FRALEY.

APPARATUS FOR PRODUCING MOTIVE POWER FROM LIQUID GAS.

APPLICATION FILED OCT. 12, 1900.

NO MODEL. 2 SHEETS—SHEET 1.

Fig. 1.



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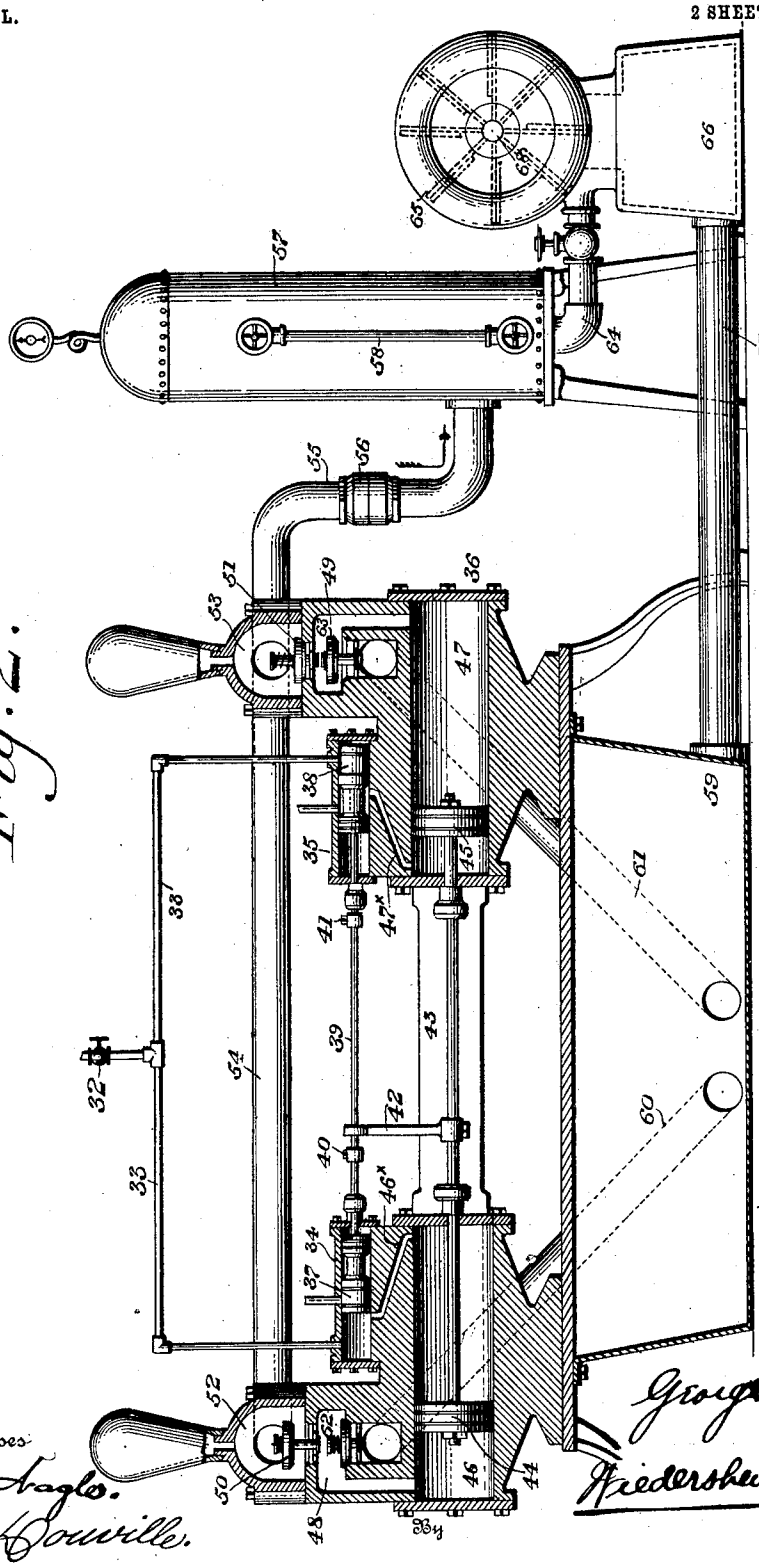
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APPLICATION FILED OCT. 12, 1900.

NO MODEL. 2 SHEETS—SHEET 2.

Fig. 2.



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No. 756,785. Patented April 5, 1904.

UNITED STATES PATENT OFFICE.

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APPARATUS FOR PRODUCING MOTIVE POWER FROM LIQUID GAS.

SPECIFICATION forming part of Letters Patent No. 756,785, dated April 5, 1904.

Application filed October 12, 1900. Serial No. 32,813. (No model.)

To all whom it may concern:

Be it known that I, GEORGE B. FRALEY, a citizen of the United States, residing in the city and county of Philadelphia, State of Pennsylvania, have invented a new and useful Improvement in Apparatus for Producing Motive Power from Liquid Gas, of which the following is a specification.

My invention consists of an improved construction of an apparatus for producing motive power from liquid gas, wherein I employ suitable means to gasify the liquid gas and raise the temperature of the same, so that the liability of freezing is prevented, the gas being transformed so that it can be safely and economically used in a suitable motor wherefrom the energy for the motive power is derived.

It further consists of novel details of construction, all as will be hereinafter fully described, and particularly pointed out in the claims.

Figure 1 represents a side elevation, partly in section, of a portion of an apparatus for producing motive power from liquid gas embodying my invention, showing especially the pressure-regulator and the means for raising the temperature of the liquid gas employed. Fig. 2 represents a longitudinal sectional view of a convenient form of a motor and its adjuncts in which the liquid gas can be utilized, showing also a side elevation of a suitable form of an accumulator-tank and motor actuated by the contents thereof.

Similar numerals of reference indicate corresponding parts in both figures.

Referring to the drawings, 1 designates a tank for the reception of the liquid gas employed, the outlet-pipe 2 therefrom being controlled by the valve 3, said pipe leading into the casing 4, which forms a hot-water tank. The pipe 2 after entering the hot-water tank takes the form of the coil 5, which I term a "gasifying-coil," which latter after leaving the tank 4 leads by the pipe 6 to the chamber 7 of the pressure-regulator 8, the latter being provided with the heat-retaining jacket 9, whereby the chamber 10 is formed, wherein is located the water-holding coil 11, the upper portion of which leads, by means of the pipe 12, into the upper portion of the hot-water tank 4, while the lower portion of the said coil 11 communicates with the lower portion of said tank by means of the pipe 13.

14 designates the base which supports the pressure-regulator, said base having located therein the heating device 15, which discharges into the combustion-chamber 16, while a portion of the heat enters the chamber 10 through the ports 17.

18 designates a plunger which is adapted to reciprocate in the pressure-regulator and is suitably packed by means of the packing 19 and the gland 20.

21 designates weights which are removably supported upon the plunger 18, the latter having the arm 22 projecting therefrom, which is provided with the slot 23, through which passes one end of the lever 24, which latter is fulcrumed at the point 25 and pivotally attached to one end of the link 26, the other end of the latter being pivoted to the lever 27, which is fulcrumed at the point 28.

29 designates a link having one end pivotally attached to the lever 27, while the other end of said link is connected to the arm 30, which actuates the valve 31, whereby it will be seen that as the pressure in the chamber 7 varies the plunger 18 will be raised and lowered, which movements will automatically control the supply of liquid gas to the gasifying-coil 5 which is in communication with the chamber 7.

By treating the liquid gas in the manner above described it will be apparent that the great difficulty heretofore experienced in the utilization of the same, which ordinarily has the tendency to freeze when released from pressure or during conversion from a liquid to a gaseous state, is obviated, since by my novel arrangement above described I am enabled to gasify the liquid gas and to raise the temperature of the same to a point which eliminates the freezing difficulty and at the same time reduces the gas into an economical and safe working pressure, as said liquid gas becomes gasified in its passage from the coil 5, its temperature being simultaneously raised,

and by passing it to the regulator, as above described, the latter will act as a superheater, and the plunger or piston 18 causes an even pressure to be maintained at all times. The gas having been reduced to proper working temperature is now withdrawn from the chamber 7 by means of the pipe 32, which leads to the branches 33, whereby the gas is introduced to the valve-chests 34 and 35 of the pump 36, which latter may be of any suitable or conventional form. I have deemed it unnecessary to show or describe the pump in detail, as any form of pump may be used; but I preferably employ the piston-valves 37 and 38, which may be constructed substantially as shown and connected by the valve-rod 39, which has thereon the tappets 40 and 41, which are actuated at the proper intervals by the tappet-arm 42, which is carried by the piston-rod 43, which is connected to the pistons 44 and 45, which are reciprocated in the cylinders 46 and 47, respectively, which communicate with their valve-chests by the ports $46^{\times}$ and $47^{\times}$, respectively.

48 and 49 designate the suction-chambers of the water-cylinders, from which water is discharged through the valves 50 and 51 into the discharge-chambers 52 and 53, which are connected by the common discharge-pipe 54, which leads to the main discharge 55, which latter is provided with the check-valve 56 and leads to the accumulator-tank 57, which may be provided with a gage 58.

59 designates a water-supply tank from which leads the suction-pipes 60 and 61 to the suction-chambers 48 and 49, respectively, the flow of water to said suction-chambers being controlled by means of the valves 62 and 63.

64 designates a discharge-pipe leading from the accumulator-tank 57 to the wheel or motor 65, which latter is shown in the present instance as being of the rotary type, the exhaust after the operation of the motor being conducted to the chamber 66 and thence by the pipe 67 to the supply-tank 59, whereby it will be seen that the operation of the apparatus is continuous.

I have shown the pump in the present instance as being double-acting and the gas-ports small in comparison to the pump, and it will further be noted that I have shown only one end of each cylinder being used for water, whereby I am enabled to bring the water into direct contact with the metal of the same, which keeps the pump always at the same temperature and acts as a lubricant and, furthermore, positively prevents any freezing.

The power can be taken by any suitable means from the shaft 68, which carries the water-wheel, the water after acting on said wheel being discharged into the tank below and returned to the pump-tank 59 and used over again and again, as is evident.

It will be apparent that various changes may be made by those skilled in the art which will come within the scope of my invention, and I do not, therefore, desire to be limited in every instance to the exact construction I have herein shown and described.

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

1. The combination with a device for raising the temperature of a liquid gas, of a water-pump comprising cylinders, valve-chests co-operative with the respective cylinders, each having a single passage communicating with its cylinder at one end of the latter, said passages serving to alternately convey the gas into the cylinders and the exhaust therefrom, a valve in each chest for alternately controlling the supply to and exhaust from its appropriate cylinder, pistons in said cylinders, a connection between the pistons, means controlled by the pistons for operating said valves, connections between the device for raising the temperature of the liquid gas and the valve-chests for supplying such gas to the latter, water-receiving conduits connected with the cylinders at points opposite those at which said passages are connected thereto, whereby the water admitted into one end of the cylinders serves to prevent the gas in the opposite end thereof from freezing, and valve mechanism for controlling the supply to and discharge of water from said cylinders.

2. The combination with a device for raising the temperature of a liquid gas, of a water-pump comprising cylinders, valve-chests co-operative with the respective cylinders, each having a single passage communicating with its cylinder at one end of the latter, said passages serving to alternately convey the gas into the cylinders and the exhaust therefrom, a valve in each chest for alternately controlling the supply to and exhaust from its appropriate cylinder, pistons in said cylinders, a connection between the pistons, means controlled by the pistons for operating said valves, connections between the device for raising the temperature of the liquid gas and the valve-chests for supplying such gas to the latter, valve-chambers in communication with said cylinders at points opposite those at which said passages are connected thereto, whereby water can flow into said cylinders at the end thereof opposite that in which the gas is admitted to thereby prevent said gas from freezing, a discharge-pipe common to said valve-chambers, suction-pipes connected with said chambers, and water supply and discharge controlling valves in said chambers.

3. The combination with a device for raising the temperature of a liquid gas, of a water-pump comprising cylinders, valve-chests co-operative with the respective cylinders, each having a single passage communicating with its cylinder at one end of the latter, said passages serving to alternately convey the gas into the cylinders and the exhaust therefrom,

a valve in each chest for alternately controlling the supply to and exhaust from its appropriate cylinder, pistons in said cylinders, a connection between the pistons, means controlled by the pistons for operating said valves, connections between the device for raising the temperature of the liquid gas and the valve-chests for supplying such gas to the latter, valve-chambers in communication with the respective cylinders at points opposite those at which said passages are connected thereto, whereby water passing from the chambers enters the cylinder in the ends thereof opposite that into which the gas is admitted to thereby prevent said gas from freezing, a discharge-pipe connected to said valve-chambers, a casing containing a motor adapted to be operated by the water passing through said discharge-pipe, a water-tank located to receive the water from the motor-casing, supply-pipes leading from said tank to the valve-chambers, and water supply and discharge controlling valves in said chambers.

4. The combination with a device for raising the temperature of a liquid gas, of a water-pump comprising cylinders, valve-chests cooperative with the respective cylinders, each having a single passage communicating with its cylinder at one end of the latter, said passages serving to alternately conduct the gas into the cylinders and the exhaust therefrom, a valve in each chest for alternately controlling the supply to and exhaust from its appropriate cylinder, pistons in said cylinder, a rod connecting the pistons, a second rod connecting said valves, having tappets, an arm upon the first rod for engaging said tappets to thereby operate said valves, connections between the device for raising the temperature of the liquid gas and the valve-chests for supplying such gas to the latter, water-receiving conduits connected with the cylinders at points opposite at which said passages are connected thereto, whereby the water admitted into one end of the cylinders serves to prevent the gas in the opposite end thereof from freezing, and valve mechanism for controlling the supply to and discharge of the water from said cylinders.

5. In an apparatus for producing motive power from liquid gas, a cylinder having a piston, means for directing a liquid gas into said cylinder at one side of the piston to operate the latter, and means for directing a fluid into the cylinder at the opposite side of the piston to prevent the liquid gas from freezing.

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