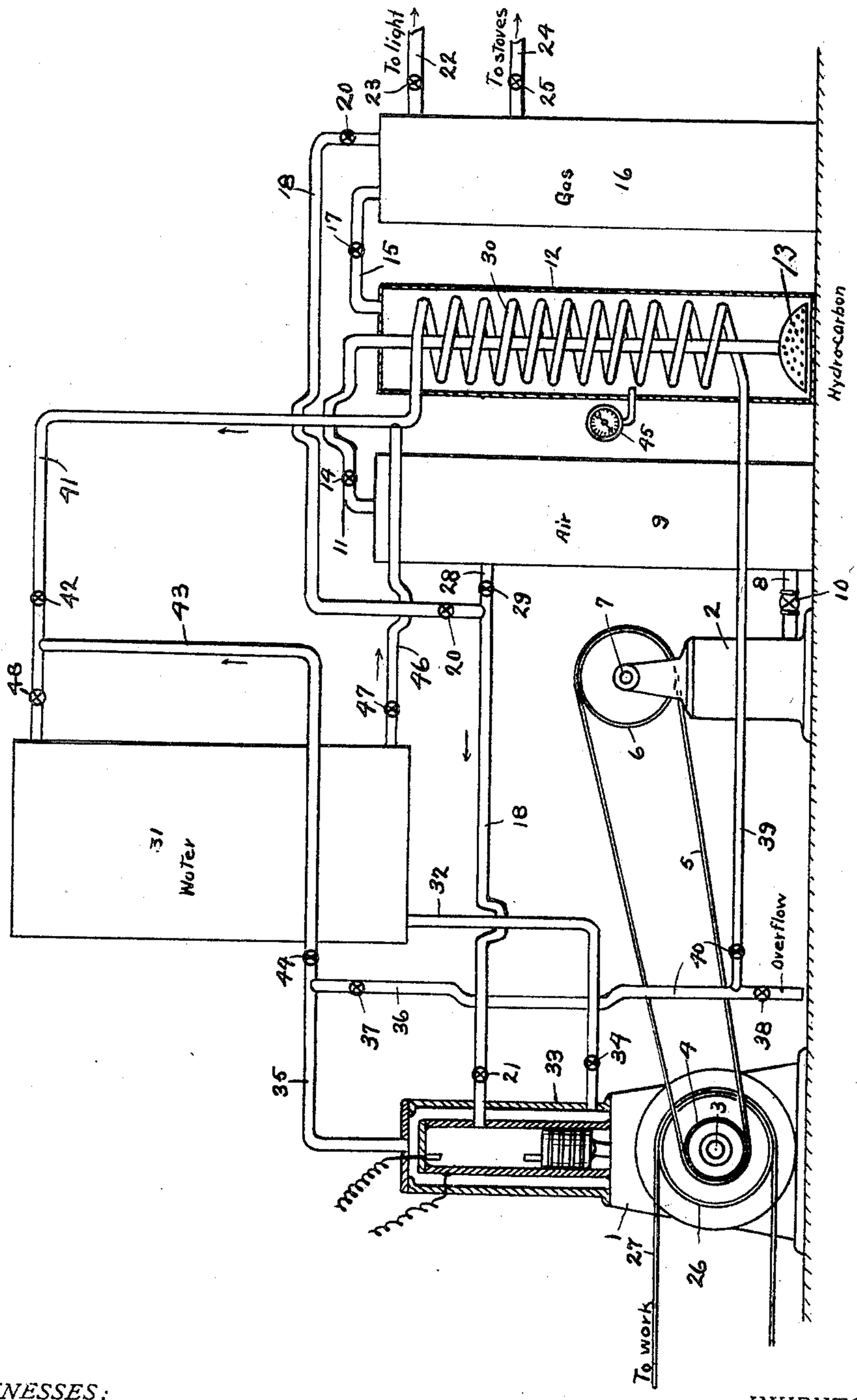
No. 649,713. Patented May 15, 1900.

# W. J. WOODWARD & D. BARCKDALL.

## EXPLOSIVE ENGINE.

(Application filed Aug. 21, 1899.)

(No Model.)




WITNESSES:

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# UNITED STATES PATENT OFFICE.

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## EXPLOSIVE-ENGINE.

SPECIFICATION forming part of Letters Patent No. 649,713, dated May 15, 1900.

Application filed August 21, 1899. Serial No. 727,918. (No model.)

*To all whom it may concern:*

Be it known that we, WILLIS J. WOODWARD and DANIEL BARCKDALL, of Indianapolis, county of Marion, and State of Indiana, have invented a certain new and useful Gas-Making Plant; and we do hereby delare that the following is a full, clear, and exact description thereof, reference being had to the accompanying drawing, in which like numerals refer to like parts.

This invention relates to a gas plant wherein the gas-engine makes the gas that drives it by forcing air through hydrocarbon fluid, a novel feature being the particular construction of tanks, pipes, and parts set out for accomplishing that end.

Another feature of this invention consists in the means employed for keeping the cylinder of the engine cool and for warming the crude oil in the carbureter or hydrocarbon-tank whenever crude oil is used. Excepting when crude oil or some similar thick heavy hydrocarbon fluid is used the warming apparatus in the hydrocarbon-tank is needless; but when a thick heavy hydrocarbon fluid is used, such as crude oil, it is liable to become so dense when cold that the passage of the air through it is difficult.

The full nature of our invention will be understood from the accompanying drawing and the description of one form of device embodying our said invention.

The drawing shows a plan or outline somewhat in diagram and with some parts in vertical central cross-section and others in side elevation in order to illustrate our invention. The location of the parts with reference to each other, as well as other forms and sizes, is left to the discretion of the maker to suit the place and work in each special case.

For illustration, let 1 represent a gas-engine of any practical form, and 2 an air-pump of any practical form that is driven by the gas-engine. In the drawing on the main shaft 3 of the engine a pulley 4 is mounted, from which a belt 5 runs to the pulley 6 on the crank-shaft 7, that drives the piston in the cylinder of the pump. Air is thus driven through the pipe 8 into the tank 9, where the air is compressed or stored. The pipe 8 is provided with a valve 10. The compressed air passes from the air-tank 9 through the pipe 11 down centrally into the hydrocarbon-tank 12 to a point near the bottom. At the lower end of said pipe 11 in the hydrocarbon-tank a conical perforated disk 13 is provided for distributing air as it escapes therefrom to pass upward through the oil. A valve 14 is placed in the pipe 11. After the air is passed through the oil and becomes charged with carbon particles the resulting vapor or gas passes out through the pipe 15 into the gas-tank 16, where it is stored. Said pipe 15 has a valve 17. From the tank 16 a pipe 18 leads to the sparking-chamber 19 of the engine. Said pipe 18 is provided with the valves 20 and 21. The gas thus entering the engine drives it.

The gas-pipe 22 extends from the gas-tank 16 to supply the lights. It has a valve 23. Another pipe 24 leads to the stoves for heating purposes, and that pipe has a valve 25. The engine shown has a pulley 26, carrying a belt 27, that runs to drive any machinery or do such other work as may be desired. Any other connection of the engine with its work may be employed instead of the belt. With this arrangement only a small fraction of the power of the engine will suffice to create all the gas or vapor that is necessary to drive the engine, so that the surplus of power, being much the larger portion generated by the engine, can be used for work.

We provide a pipe 28, leading from the compressed-air tank to the engine. It has a valve 29. This is for the purpose of using compressed air in the tank 9 for starting the engine when desired.

The device as it is shown is adapted for the use of crude oil. Hence in the hydrocarbon-tank there is placed a coil 30, through which warm water is passed for warming said crude oil. If a jacket is used instead of a coil, the supply-pipes of warm water should run to the jacket. A cold-water tank 31 is provided with a pipe 32, leading therefrom to the jacket 33 of the engine. A valve 34 is provided in said pipe. From said jacket the pipe 35 leads to the pipe 36, which is open at its lower end to provide an outlet for the water when de-

sired. In said pipe 36 two valves 37 and 38 are placed. Between them a pipe 39 leads to the coil 30 in the hydrocarbon-tank. A valve 40 is provided in said pipe 39. From the upper end of the coil 30 a pipe 41 leads back to the water-tank and has valves 42 and 48. From said pipe 41, between the valve 42 and the water-tank, or, if preferred, from said water-tank, the pipe 43 leads to the pipe 35 or back to the jacket of the engine. This pipe 43 has a valve 44.

On the hydrocarbon-tank we place a thermometer 45 for indicating the temperature of the crude oil therein. There is also a pipe 46 extending from the lower end of the water-tank to the pipe 41 and having a valve 47. With this arrangement cold water passes directly to the water-jacket surrounding the cylinder of the engine when the valve 34 is open. While passing through the water-jacket the water becomes warm, and by closing the valves 44, 38, and 47 and opening the valves 37, 40, and 48 it will pass through the pipes 35 36 39 and the coil 30, and thus warm the crude oil in the hydrocarbon-tank. From the coil 30 the warm water will pass upward through the pipe 41 back to the water-tank. This circuit may be continued until the temperature of the crude oil is satisfactory; but it cannot be continued very long, as the water would become too warm to cool the cylinder of the engine. Therefore when the temperature of the crude oil is satisfactory the passage of water to the hydrocarbon-tank can be shut off. If the water in the water-tank is not too warm for cooling the engine-cylinder, the valves 37 and 42 are closed and the valve 44 opened, whereby a short circuit is made directly from the jacket of the engine back to the water-tank and from the water-tank to the jacket of the engine. This can be continued while the water is not too hot. If the water is too hot, the valves 44 and 40 are closed and the valves 37 and 38 are opened, whereby the warm water after leaving the jacket of the engine will run out at the lower end of the pipe 36 and a fresh supply of cold water be introduced into the water-tank, or when the water has become warm, if desired, its passage to the jacket of the engine can for a time be stopped by closing the valve 34, and, if desired, it can be passed solely through the pipe 46 and be allowed to run out at the lower end of the pipe 36, (in such case the valves 47, 40, and 38 are left open,) or the water can be run through the engine-jacket and hydrocarbon-tank and out without returning it to the water-tank by closing valves 37, 47, and 48 and opening all the other valves.

In starting the device it is well to drain the cold water from the hydrocarbon-tank by opening valves 40 and 38. When the water is out, close valve 38, and then the warm water from the engine-jacket will readily flow up through the coil in the hydrocarbon-tank and warm the oil therein.

What we claim as our invention, and desire to secure by Letters Patent, is—

1. A gas-engine plant consisting of a gas-engine with a jacket about its cylinder, a pump driven by the engine, a compressed-air tank connected with the pump, a hydrocarbon-fluid tank, means for conveying air from the compressed-air tank to the lower end of the hydrocarbon-fluid tank, means for conveying gas from the hydrocarbon-tank to the engine provided with a valve for closing the same, a cold-water tank, a pipe leading from the water-tank to the jacket of the engine with a valve in it, a pipe leading from the jacket of the engine and having valved branches to the hydrocarbon-tank for warming the fluid in said tank and to the water-tank, said pipe having an outlet that can be closed and a valve on each side of said outlet, and a pipe leading from the hydrocarbon-fluid tank back to the upper end of the water-tank with a valve in it.

2. A gas-engine plant, comprising a gas-engine with a jacket about its cylinder, a pump driven by the engine, a compressed-air tank connected with said pump, a hydrocarbon-fluid tank, a pipe for conveying air from the compressed-air tank to the lower end of the hydrocarbon-fluid tank, a gas-tank connected with said hydrocarbon-tank, a pipe for conveying gas from said gas-tank to the engine, said pipe being valved for closing the same, a cold-water tank, a pipe leading from said water-tank to the jacket of the engine and provided with a valve, a pipe leading from the jacket of the engine and having valved branches to the hydrocarbon-tank for warming the fluid in said tank, and to the water-tank, said pipe having an outlet adapted to be closed, and a valve on each side of said outlet, and a pipe leading from the hydrocarbon-fluid tank back to the upper end of the water-tank, said pipe being provided with a valve.

In witness whereof we have hereunto affixed our signatures in the presence of the witnesses herein named.

WILLIS J. WOODWARD.
DANIEL BARCKDALL.

Witnesses:
V. H. LOCKWOOD,
M. C. BUCK.