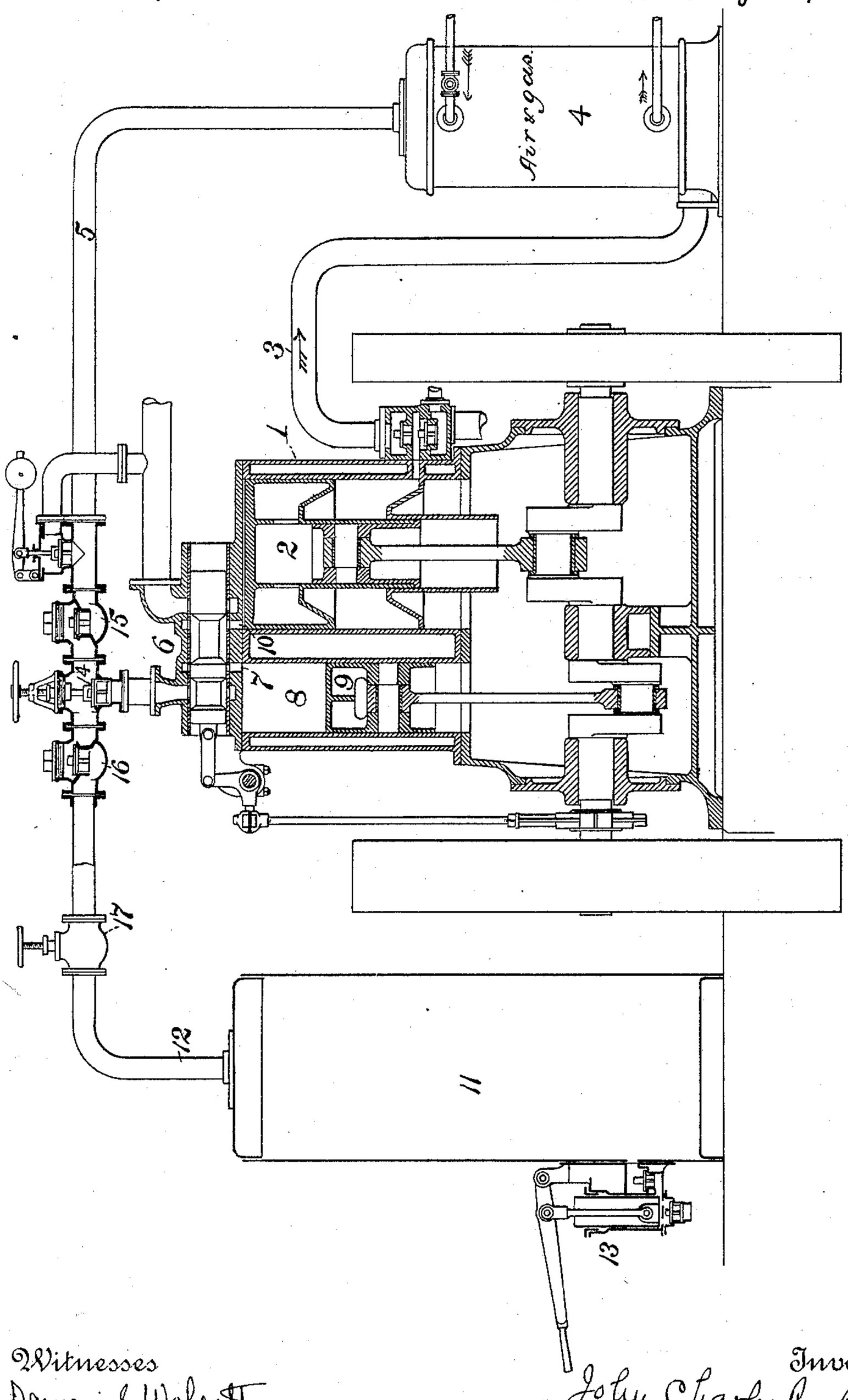
(No Model.)

J. C. BECKFELD.

GAS ENGINE.

No. 432,720. Patented July 22, 1890.



Witnesses
Dannie S. Wolcott
F. E. Gaither.

Inventor
John Charles Beckfeld
By his Attorney
George N. Christy

UNITED STATES PATENT OFFICE.

JOHN CHARLES BECKFELD, OF ALLEGHENY, PENNSYLVANIA.

GAS-ENGINE.

SPECIFICATION forming part of Letters Patent No. 432,720, dated July 22, 1890.

Application filed March 3, 1890. Serial No. 342,345. (No model.)

To all whom it may concern:

Be it known that I, JOHN CHARLES BECKFELD, a citizen of the United States, residing at Allegheny, in the county of Allegheny and State of Pennsylvania, have invented or discovered certain new and useful Improvements in Gas-Engines, of which improvements the following is a specification.

The invention described herein relates to certain improvements in gas-engines generally, but more especially of that class or kind wherein the mixture of gas and air is forced by the compression-piston into a suitable reservoir, and thence conducted to a power-cylinder, where the mixture is ignited and operates explosively on the piston therein.

The object of this invention is to provide by means of a suitable arrangement of valves and connections a previously-stored fluid-pressure in starting and operating the engine until the pressure of the explosive mixture shall slightly exceed the pressure in the starting-reservoir, and at such time and by means of such change in relative pressures, the valves are automatically shifted, cutting off connection with the starting-reservoir, and connecting the power-cylinder with the supply of explosive mixture.

The invention is hereinafter more fully described and claimed.

In the accompanying drawing, forming a part of this specification, is shown partly in section and partly in elevation a gas-engine having my invention applied thereto. The engine is constructed as described and shown in Patent No. 421,474, patented February 18, 1890, the gas and air being drawn into the cylinder 1 below the piston 2 during the upward movement of the latter, and by the downward movement of said piston is forced through the pipe 3 into the storage vessel or chamber 4. From this chamber the explosive mixture, being under a pressure of fifty pounds, (more or less,) passes by the pipe 5 into the valve-chamber 6, and thence through the port 7 into the cylinder 8, where by expansion (without explosion) it forces the piston 9 downward. When the piston 9 shall have traveled a portion or to the limit of its stroke, the admission of fluid-pressure is cut off and the gases thereafter ignited. The pressure thus generated passes by the port 7, valve-chamber 6, and port 10 into the upper end of the cylinder 1 and forces the piston 2 downward.

For starting and operating the engine until the required pressure can be produced in the chamber 4, a reservoir 11, connected by a pipe 12 with the valve-chamber 6, is provided. An air-pump 13, operated by hand or by an auxiliary engine or by the main engine, is employed for obtaining the desired fluid-pressure—*i. e.*, about one hundred pounds, (more or less,) in the reservoir 11. The pipes 3 and 12 have a common connection to the valve-chamber, and the flow of fluid from the reservoir 11 and of the explosive mixture from the chamber 4 to the valve-chamber 6 is controlled by a valve 14, as shown. In order to prevent a flow of fluid from the reservoir 11 to the chamber 4, and vice versa, check-valves of any suitable form or construction are arranged in the pipes 3 and 12, respectively.

When it is desired to start the engine, a sufficient pressure—*e. g.*, one hundred pounds—is generated in the reservoir 11 by the operation of the pump 13 or any other suitable means. The valve 14 is opened, admitting fluid-pressure to the valve-chamber 6, whence it passes by the port 7 into the cylinder 8, forcing down the piston 9. After doing its work in the cylinder 8 the fluid passes to the larger cylinder 1, where a further expansion is obtained and the piston 2 forced down. As hereinbefore described, the movement of the piston 2 forces gas and air into the chamber 4 and effects a compression thereof, the explosive mixture being held from passing to the valve-chamber by the valve 15, which is held on its seat by the greater fluid-pressure in the reservoir 11 and pipe 12. It will be readily understood that as the fluid-pressure in the reservoir is not maintained, every revolution of the engine will reduce that pressure to a certain extent, and that the pressure in the chamber 4 is proportionately increased. This reduction and increase will continue, the engine being operated by fluid-pressure from the reservoir 11, until the pressure of the explosive mixture is the greater. A certain energy will thus have been stored in the fly-wheel, which will further keep the engine in motion until it shall operate explosively. Such excess of pressure

will thereupon raise the valve 15 and close the valve 16, the explosive mixture passing through one valve-chamber and operating the pistons 9 and 2 in the manner hereinbefore described. A valve 17 is placed in the pipe 12, leading from the reservoir 11, in order that said reservoir may be charged at any time without interfering with the normal operation of the engine after it has been started. In order to prevent the generation of an excessive pressure in the chamber 4, a safety-valve 18 is placed on the pipe 5, as shown.

Although the invention is described and shown as applied to a particular construction of gas-engine, it is as readily applicable to other forms and constructions.

I claim herein as my invention—

1. The combination, with a gas-engine, of a storage-reservoir for the reception of the explosive mixture connected to the compression and power cylinders of the engine, a reservoir for the reception of fluid under pressure connected to the power-cylinder of the engine, and valves arranged in the connections to the power-cylinder and adapted one to be opened and the other closed by or under differences of fluid-pressure in the reservoir, substantially as set forth.

2. The combination, in a gas-engine wherein the explosive mixture operates first expansively and then explosively, of a storage-reservoir for the explosive mixture connected to the primary cylinder of the engine, wherein the mixture operates expansively, and to the compression-cylinder, a reservoir for the reception of fluid under pressure and connected to the primary cylinder and valves arranged in the connections to the primary cylinder and adapted the one to be opened and the other closed by differences of fluid-pressure in said connections, substantially as set forth.

3. The combination of a gas-engine, a reservoir for the reception of an explosive mixture, and a reservoir for the reception of a fluid-pressure, said reservoirs being connected to the power-cylinder of the engine, whereby the engine may be operated in turn expansively by the fluid-pressure and explosive mixture, substantially as set forth.

4. The combination of a gas-engine, a power-cylinder provided with a piston operated expansively by a fluid under pressure, reservoirs for the reception of an explosive mixture and a fluid under pressure, and connected to the power-cylinder, a valve-controlling the flow of fluid under pressure to said cylinder, and check-valves 15 and 16, suitably arranged for operation by the fluid under pressure, substantially as set forth.

In testimony whereof I have hereunto set my hand.

JOHN CHARLES BECKFELD.

Witnesses:
DARWIN S. WOLCOTT,
W. B. CORWIN.