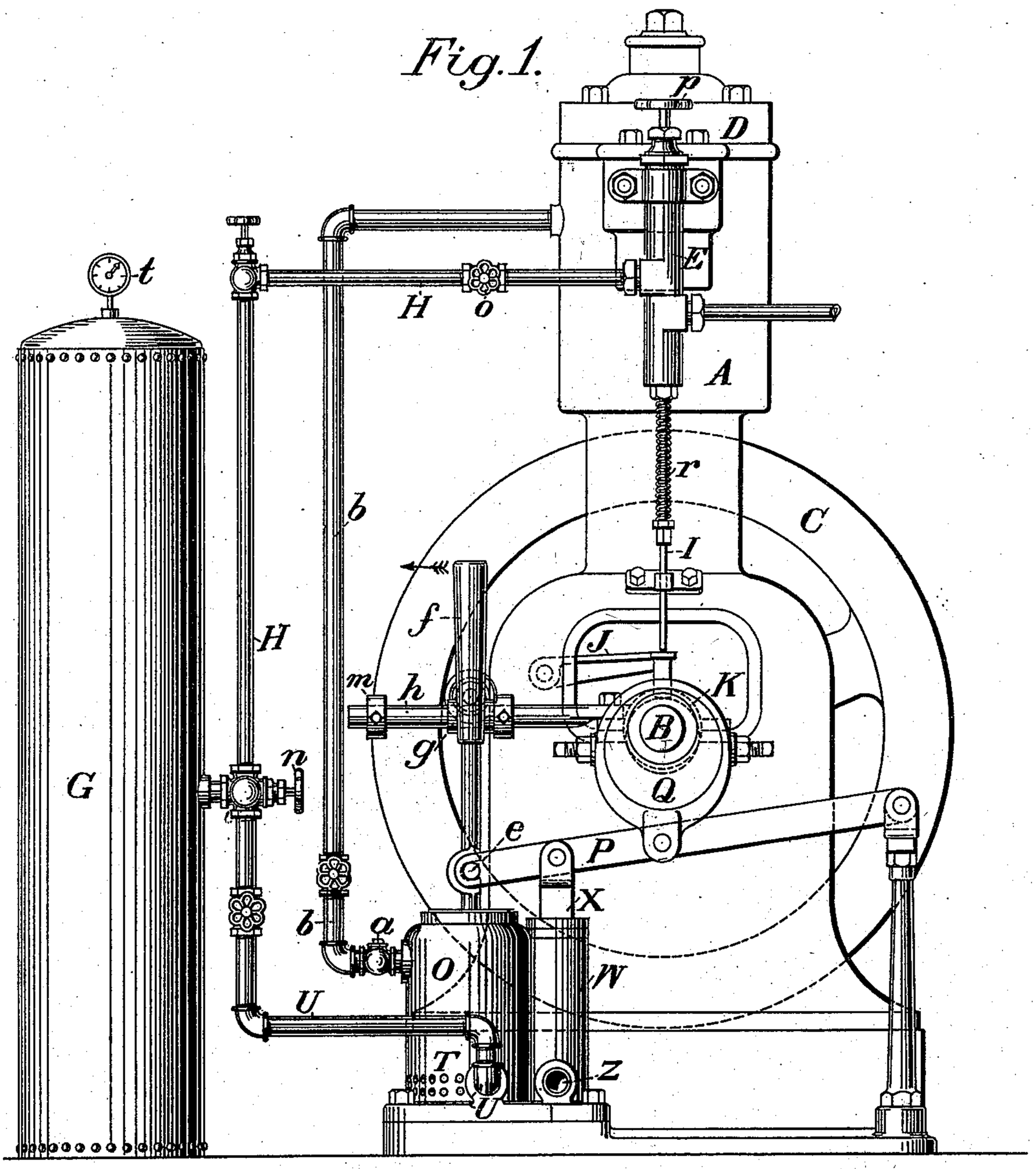
(No Model.) 2 Sheets—Sheet 1.

G. E. HOYT.

GAS ENGINE.

No. 510,140. Patented Dec. 5, 1893.

Fig. 1.



Witnesses:

C. A. Brandau.

Nelson D. Bent, Jr.

Inventor:

George E. Hoyt.

By John Richards

Atty

THE NATIONAL LITHOGRAPHING COMPANY,
WASHINGTON, D. C.

(No Model.) 2 Sheets—Sheet 2.

G. E. HOYT.

GAS ENGINE.

No. 510,140. Patented Dec. 5, 1893.

Fig. 2.

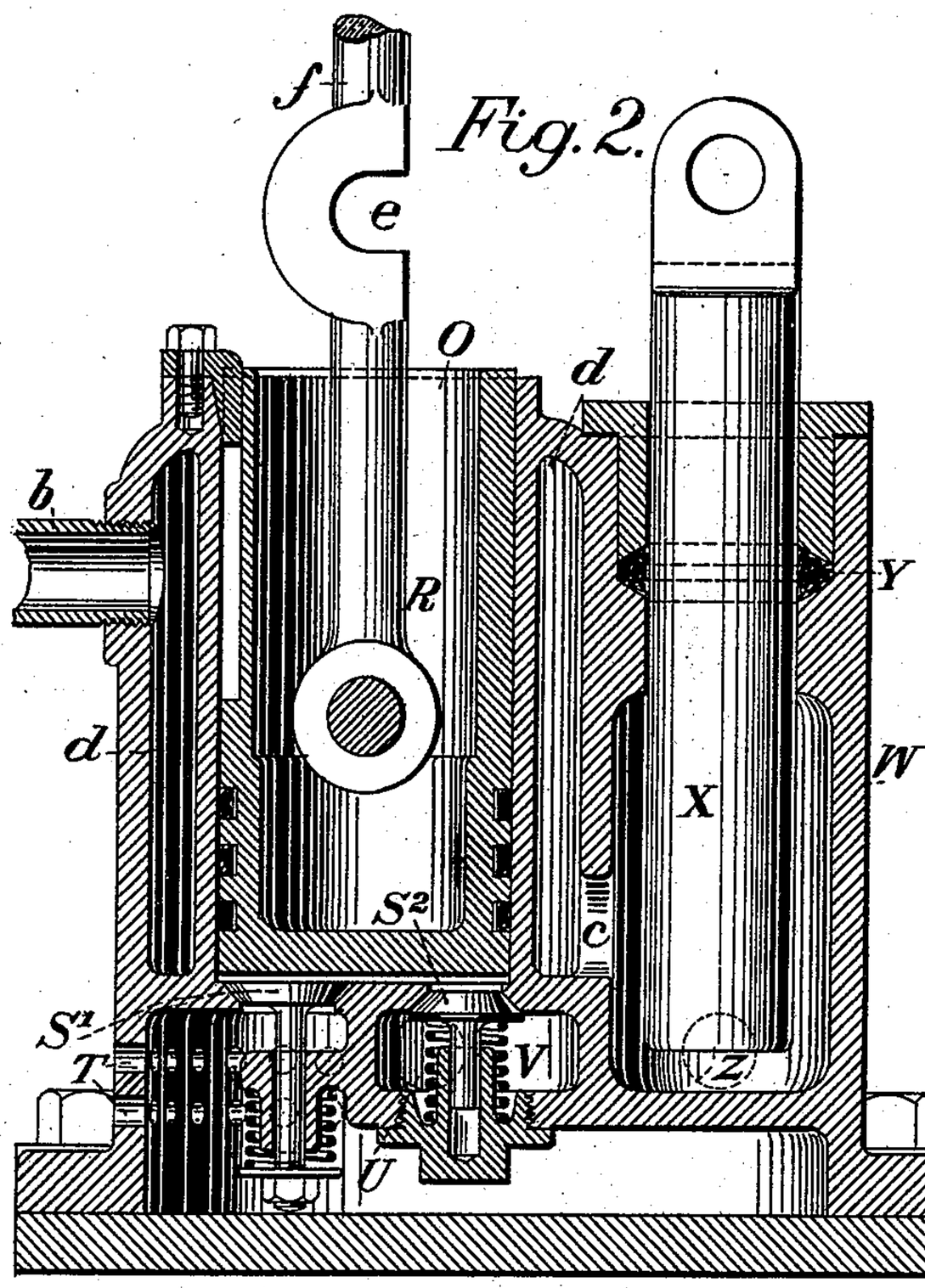


Fig. 4.

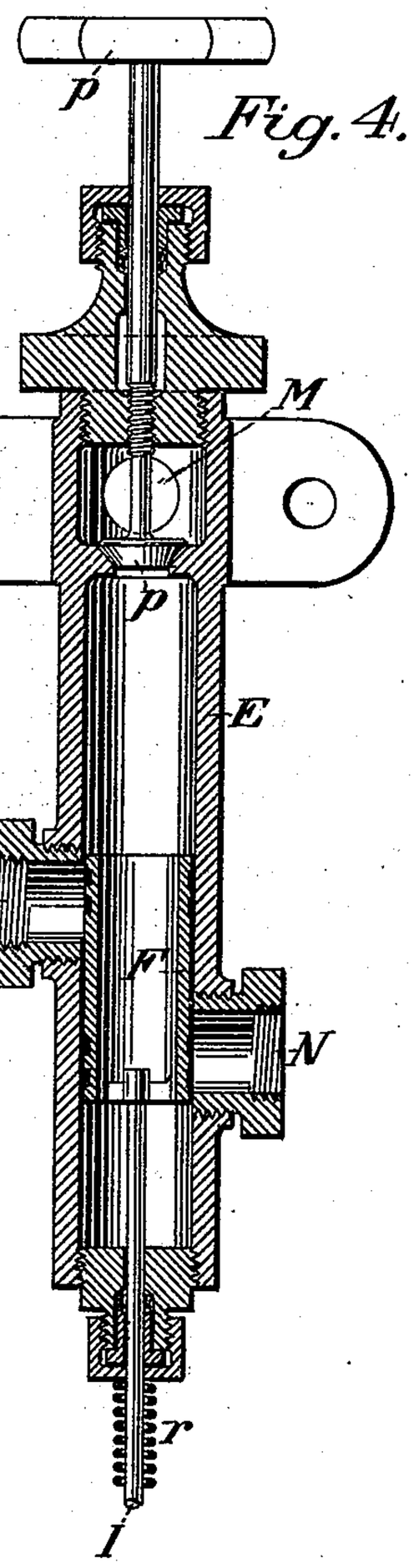
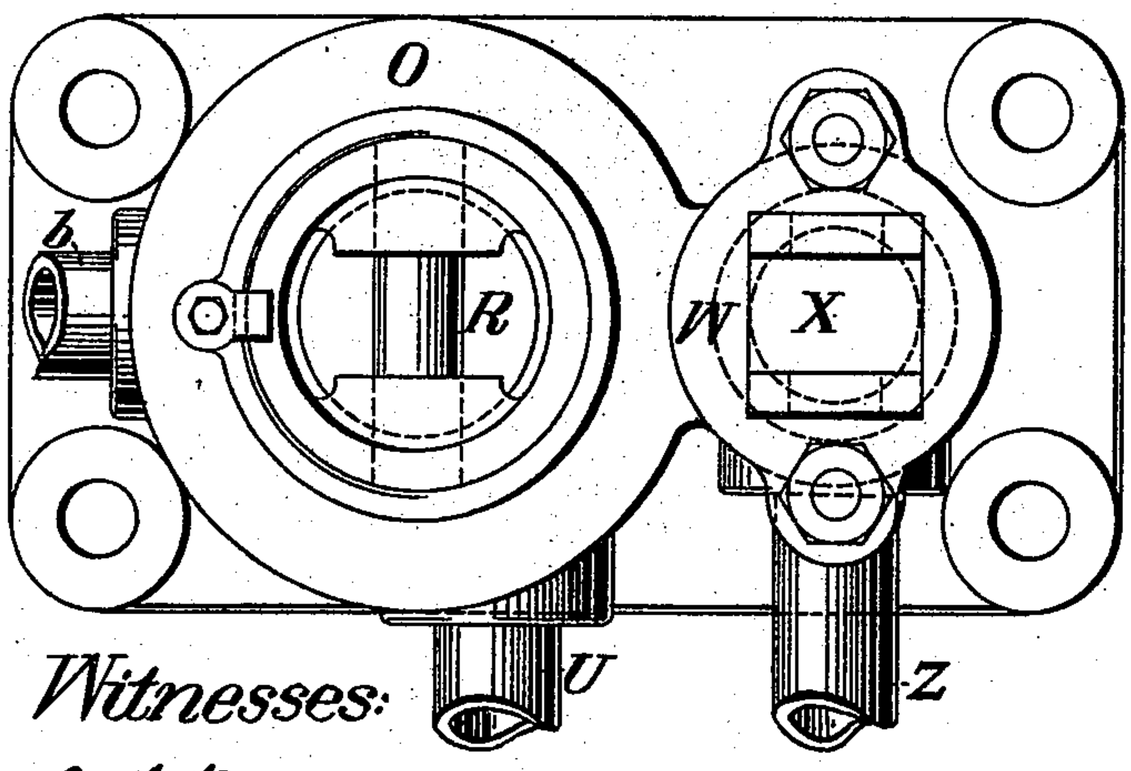


Fig. 3.



Witnesses:

E. A. Brandau

Wilson D. Bent, Jr.

Inventor:

George E. Hoyt

by

John Richards

H & G

THE NATIONAL LITHOGRAPHING COMPANY,
WASHINGTON, D. C.

UNITED STATES PATENT OFFICE.

GEORGE E. HOYT, OF SAN FRANCISCO, CALIFORNIA.

GAS-ENGINE.

SPECIFICATION forming part of Letters Patent No. 510,140, dated December 5, 1893.

Application filed March 17, 1893. Serial No. 466,513. (No model.)

To all whom it may concern:

Be it known that I, GEORGE E. HOYT, a citizen of the United States, residing in the city and county of San Francisco, State of California, have invented certain new and useful Improvements in Gas-Engines; and I hereby declare the following specification and drawings therewith to be a full, clear, and exact description of my invention.

My improvements relate to motive engines, impelled by gas or explosive vapor, ignited when under compression, and burned in the cylinders thereof, and to the means of producing such compression, or in other words, to start the engines so the cycle of operations, consisting of induction, compression, ignition, and release of the gases, can go on automatically.

My invention consists in providing an air chamber or receiver to be filled with air under pressure while the engine is working, and employing the air thus compressed as a motive power in starting the engine and until the air can be substituted by the explosive vapor or gas.

My invention consists also, of various mechanical devices to compress, cool, distribute, and apply the compressed air as a starting agent for gas engines, as set forth and shown in the drawings herewith, in which—

Figure 1 is an elevation of a gas engine provided with my improvements. Fig. 2 is a central section, through the apparatus for compressing and cooling the air. Fig. 3 is a plan view of the same apparatus. Fig. 4 is a section of the valve for controlling and distributing the compressed air when applied to the engine.

Similar letters of reference are applied to corresponding parts throughout the several figures of the drawings.

In the operation of internal combustion engines, consuming gas, petroleum vapor, or other explosive agents, it is necessary to start the engine by some auxiliary power until a charge of the explosive mixture is drawn in and compressed, so as to be ignited. This object is accomplished in the smaller class of engines by turning by hand, and for larger engines by an auxiliary one of small size, also in some cases, by injecting explosive gas that can be ignited to start the engine. All these operations are dangerous. The object of my invention is the avoidance of these methods, and to employ instead thereof, a non-explosive agent, acting by limited mechanical pressure on the piston until a charge of the explosive mixture can be drawn in and ignited in the regular way. For this purpose I employ compressed air, in the manner shown in the drawings, to which I will now refer.

The main engine A, can be of any of the well known forms, set either in a vertical or a horizontal position. It is provided with the usual piston, connecting rod, crank shaft B, and fly-wheel C, all arranged in the common manner and not requiring further explanation here. On the top or outer end of the engine cylinder is a combustion chamber D, in which explosive charges of air and gas are ignited. Communicating with this chamber is a piston valve chamber E, shown in section at Fig. 4, containing a hollow piston valve F for distributing compressed air drawn from the pipe H and receiver G. This piston valve F is given a reciprocating motion coincident with the movements of the engine, by means of a valve rod I, resting on the lever J, operated by an eccentric or cam on the engine shaft B, as indicated by the dotted lines at K Fig. 1. The downward movement of the valve and stem I, is caused by a spring *r*, so the valve when not in use can be held up by a detent. The valve F acts the same as that of a single acting steam engine. On the downward or working stroke of the engine piston, this piston valve F moves downward or outward, closing the outlet N, and opening communication between the inlet L and the port M, communicating to the engine cylinder. On the inward or compressing stroke of the engine piston, the valve F moves upward or inward, closing the inlet L, and opening communication through the interior of the valve F, between the port M and the outlet N, so the engine may be operated in this manner by compressed air, independent of explosive fuel or gas.

Referring now to the means of supplying the compressed air, the receiver G is filled by means of an air pump O, operated by a lever P, the latter actuated by an eccentric Q on

the end of the crank-shaft B. This air pump O is provided with a packed piston R and induction and eduction valves S′ S², as shown in Fig. 3. Air enters at the perforations T, and is expelled through the valve S² into the chamber V, from where it is conducted by a pipe U to the receiver G, and from thence to the engine A, by means of the pipe H, as before explained. Alongside of the air pump O, I place a water circulating pump W, having a plunger X, packing gland Y, and operated by the lever P, as seen in Fig. 1. The inlet valve of this pump is not shown in the drawings, being placed in the water inlet pipe Z. The discharge valve *a* is placed in the pipe *b*, as shown in Fig. 1. This pump W, receives water through the inlet pipe Z, and forces it through the aperture *c*, into the annular chamber *d*, around the barrel of the air pump O, absorbing thus the heat generated in compressing the air, that passes through that pump and on to the receiver G. The water is discharged from the chamber *d* through the pipe *b*, and enters a similar cooling chamber around the cylinder of the engine A, to reduce and carry off the heat therefrom in the usual manner, escaping by a waste pipe, or if there is not a constant supply, into a tank to be reconducted to the pump W, after cooling.

When the receiver G, is charged with air, to the desired pressure, as indicated by the pressure gage *t*, the hook *e* is disengaged by moving the handle *f* in the direction indicated by the arrow in Fig. 1, until the sleeve *g* comes in contact with the stop collar *m*, on the guide rod *h;* then the air pump O will stop, the water circulating pump W, alone working. By returning the lever *f* to the position shown in Fig. 1, the hook *e* is again engaged, and the air pump O started for a new supply. The air thus compressed has for its principal object, starting the engine A, so it will compress its charges of explosive fuel, but the air can also be employed for other uses, such as blowing signals on vessels impelled by gas engines, also for operating steering gearing, or any purpose requiring power independent of the main engine.

To start the engine, the valves *n*, *o*, and *p*, are opened, admitting air to the chamber E, and to the engine cylinder, starting the engine without shock, so a charge of gas can be drawn in and ignited; then the valves *p* and *o* are closed and no further air is consumed until the engine is to be again started.

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

1. In a gas engine, the combination of an independent air distributing valve therein, having a valve rod which is operated by the main engine shaft for the purpose of opening and closing the valve, the receiver containing a supply of compressed air which is delivered to the valve, and an air compressor operated by the main shaft, all arranged so that the explosive impelling gas which starts the engine may be supplemented with air, substantially in the manner and for the purpose specified.

2. In a gas engine, the combination of the valve chamber, the hollow piston, air distributing valve arranged therein, having a spring-provided valve-rod which is reciprocated by a cam or eccentric on the main engine shaft, together with a lever located between the end of the valve-rod and the eccentric, and a receiver containing a supply of compressed air which is delivered therefrom to the distributing valve, substantially as described.

3. In a gas engine, the combination of an independent air distributing valve operated by connections from the main engine shaft, a receiver containing a supply of compressed air which is delivered to the said distributing valve and an air compressor operated from the main engine shaft by mechanism which can be disengaged when desired, substantially as described.

4. In an engine, the combination of an independent distributing valve for compressed air, a receiver containing a supply of compressed air, an air compressor, a water supply pump arranged to circulate cooling water around the air pump barrel, both the air pump and water pump being operated from the engine shaft by the same connections, substantially as described.

5. In an explosive engine, the combination of an air distributing valve, a receiver containing compressed air which is delivered to the said valve, an air compressor arranged in connection with the said receiver and comprising a cylinder containing a plunger, together with suitable valves, a rod attached to said plunger and a lever detachably connected to said rod and operated by a cam on the main engine shaft, substantially as described.

6. The combination of an air distributing valve a receiver containing a supply of compressed air which is delivered to said valve, an air compressing pump, a water supply pump arranged to circulate cooling water around the air pump barrel, the main engine shaft having an eccentric thereon and a lever operated by said eccentric and permanently connected to the water pump and detachably connected to the air pump, substantially as described.

7. The combination of an air distributing valve, consisting of a cylindrical chest and a piston valve therein, having a spring-provided valve-rod which is reciprocated by a cam or eccentric on the main engine shaft so as to open or close the distributing valve, an air receiver containing a supply of compressed air which is delivered to the said valve, an air supply pump arranged to circulate cooling water around the air compressor, and the mechanism whereby the main engine shaft operates both the air pump and the water pump, substantially as described.

8. The combination of an air distributing valve, a receiver for compressed air, an air

compressor, comprising a cylinder within which is a plunger together with suitable valves, a water supply pump arranged to circulate cooling water around the air pump and mechanism whereby the main engine shaft operates both the air and water pumps, said mechanism being permanently connected to the water pump and detachably connected to the air pump, substantially as described.

9. The combination of an air distributing valve, a receiver for compressed air connected to the engine cylinder as herein described, air and water pumps in combination therewith, operated from the engine shaft by a lever permanently connected to the water pump and detachably connected to the air pump, in the manner substantially as described.

In testimony whereof I have hereunto affixed my signature in the presence of two witnesses.

GEORGE E. HOYT.

Witnesses:
ALFRED A. ENQUIST,
WILSON D. BENT, Jr.