

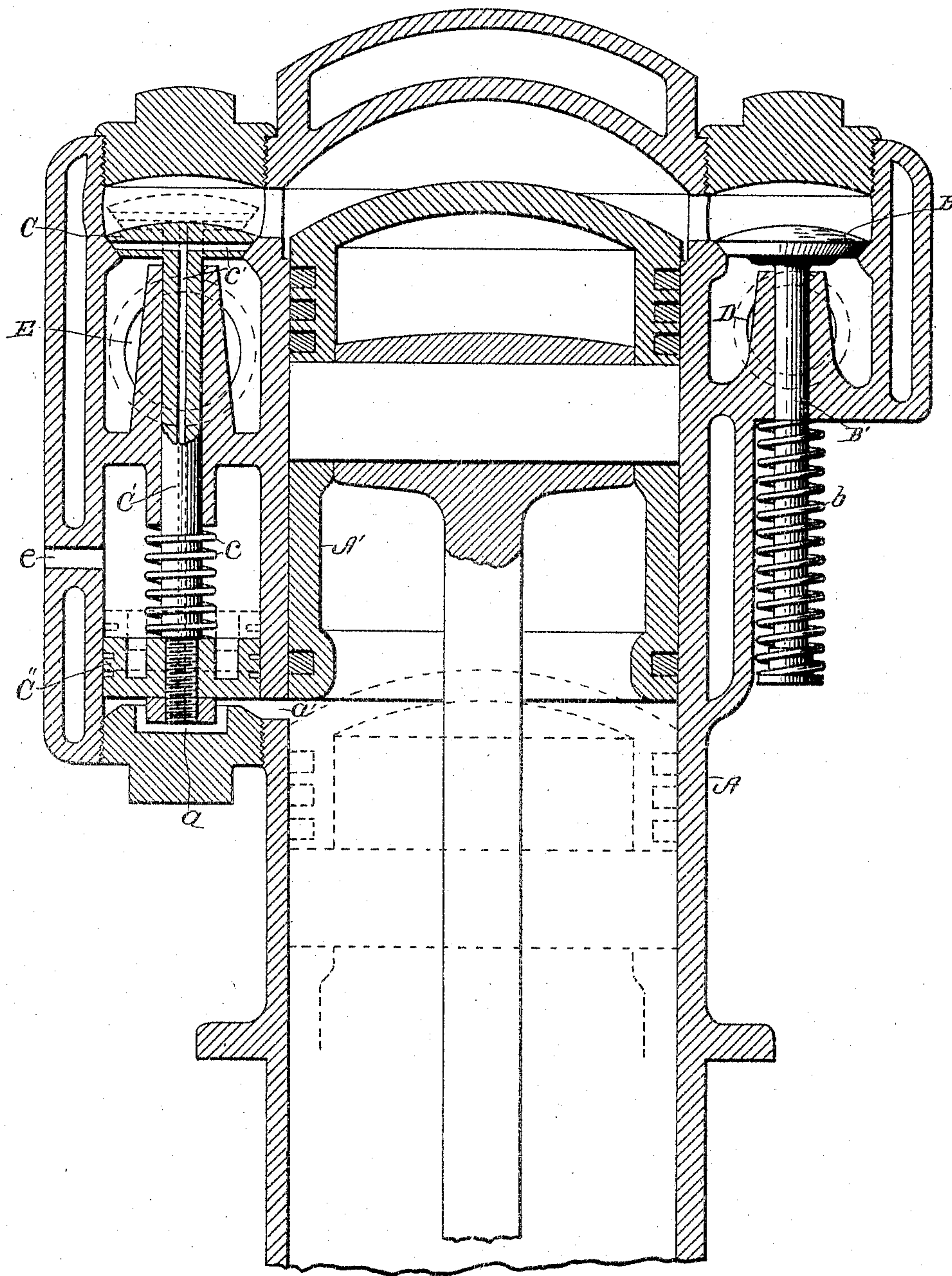
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PATENTED DEC. 6, 1904.

C. H. WAY.
VALVE GEAR FOR EXPLOSIVE ENGINES.

APPLICATION FILED DEC. 28, 1903.

NO MODEL.



Witnesses:

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Oliver A. Earl

Inventor,

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UNITED STATES PATENT OFFICE.

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VALVE-GEAR FOR EXPLOSIVE-ENGINES.

SPECIFICATION forming part of Letters Patent No. 776,708, dated December 6, 1904.

Application filed December 28, 1903. Serial No. 186,866. (No model.)

To all whom it may concern:

Be it known that I, CHARLES H. WAY, a citizen of the United States, residing at the city of Lansing, in the county of Ingham and State of Michigan, have invented certain new and useful Improvements in Valve-Gear for Explosive-Engines, of which the following is a specification.

This invention relates to improvements in valve-gear for explosive-engines. It relates particularly to the valve structure thereof.

The objects of this invention are to provide in a gas or vapor engine an improved exhaust-valve-operating means which is simple, compact, and durable and positive and effective in operation.

Further objects and objects relating to structural details will definitely appear from the detailed description to follow.

I accomplish the objects of my invention by the devices and means described in the following specification.

The invention is clearly defined, and pointed out in the claims.

A structure embodying the features of my invention is clearly illustrated in the accompanying drawing, forming a part of this specification, in which the figure is a detail longitudinal sectional view through the cylinder and the valve attachments thereof of a structure embodying the features of my invention, the position of the valves being shown in full lines.

In the drawing, A represents the main cylinder, and A' the piston, the piston being shown in its inner position, its outer position being indicated by dotted lines. Suitable inlet and exhaust ports D and E are provided.

A valve B is provided to control the inlet-port D. The valve B is arranged at one side of the cylinder in a suitable valve-chamber and is retained normally in its seat by a spring B on the stem B' thereof. The exhaust-valve C is arranged in a suitable chamber, preferably on the opposite side of the main cylinder A and is adapted to control the exhaust-port E. An auxiliary chamber *a* is provided, which is connected to the main chamber by a passage *a'*. The port or passage *a'* is so arranged that it

is connected to the main cylinder when the main piston is in its outer position and to the air when the main piston is in its inner position. An auxiliary piston C' is provided for the auxiliary chamber. The exhaust-valve C is mounted on the piston-rod C' of the auxiliary piston. The piston C' is returned to its initial position by a spring *c*, which is arranged for convenience in the auxiliary cylinder *a*. This auxiliary cylinder *a* is preferably provided with an opening or port *e*, so that the outer face of the auxiliary piston is at all times subject to atmospheric pressure.

When the exhaust-valve C is in its open position, the auxiliary chamber *a* is connected to the inner end of the main cylinder by means of the passage *c'* through the valve C and the piston-rod C', so that when the valve is open the pressure in the auxiliary chamber and in the main chamber is equalized.

In the operation of my improved valve structure the charge of explosive mixture is drawn into the main cylinder by suction in the usual manner. The second stroke compresses this charge and the explosion occurs. This is effected in the usual or any desired manner, the means not being here illustrated, as they do not form a part of this invention. The piston A' is forced outwardly by the explosion, and when the same reaches its outer position the cylinder-pressure acting upon the piston C' through the port *a'*, which is then uncovered, moves the auxiliary piston to the position indicated by the dotted lines, thereby opening the exhaust-valve. The return stroke of the piston A' seals the port *a'* and drives the exhaust from the cylinder. During this instroke the exhaust-valve C remains open as the pressure in the auxiliary chamber *a* and in the main chamber is equalized through the passage *c'* in the valve C and the piston-rod C', as has heretofore been pointed out. The diameter of the valve C is less than that of the piston C', so that there is no danger of the valve moving the piston. When the main piston A' reaches the inner end of its stroke, the port or passage *a'* is uncovered, which allows the auxiliary chamber *a* to exhaust, and the exhaust-valve is re-

turned to its seat by the spring *c*. It is assisted in this movement by the atmospheric pressure through the port or passage *e*, as the tendency of the main piston A' is to exhaust the cylinder by suction. However, the spring *c* is entirely effective for the purpose. When the valve C is returned to its seat, the passage *c'* is sealed.

The piston A' is preferably of such a length that the passage *a* is sealed practically as soon as the outstroke of the piston begins, the object being to keep the passage sealed on the exhaust-stroke. I am aware, however, that suitable valve attachments might be provided for this purpose. The form illustrated is, however, preferred by me on account of its simplicity. My improved valve structure is very simple and compact in structure and is also very economical to produce. It is also very durable, as the valves are only actuated when it is necessary to properly operate the engine. The cylinder is also very thoroughly cleaned of the exhaust, which is of course of very great advantage in the economical and effective working of the engine.

I desire to remark that I am aware that considerable variation in structural details will readily appear to those skilled in the art to which my invention relates.

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

1. In a gas or vapor engine, the combination of a main cylinder having suitable inlet and exhaust ports; a main piston; a suitable inlet-valve; an auxiliary cylinder connected to said main cylinder by a passage or port; said passage or port being so arranged that it is connected to said main cylinder when the main piston is in its outer position, and to the outer air when said piston is in its inner position; a piston in said auxiliary cylinder; a piston-rod therefor; an exhaust-valve on said piston-rod, of a diameter less than that of said auxiliary piston; a spring for returning said auxiliary piston to its initial position; a passage through said exhaust-valve and piston-rod by which said auxiliary chamber is connected to the main chamber when said exhaust-valve is open, said passage being sealed by the closing of said valve; and a port for said auxiliary cylinder whereby the outer face of said auxiliary piston is subjected to atmospheric pressure, for the purpose specified.

2. In a gas or vapor engine, the combination of a main cylinder having suitable inlet and exhaust ports; a main piston; a suitable inlet-valve; an auxiliary cylinder connected to said main cylinder by a passage or port, said passage or port being so arranged that it is connected to said main cylinder when the main piston is in its outer position, and to the outer air when said piston is in its inner position; a piston in said auxiliary cylinder; a piston-rod therefor; an exhaust-valve on said piston-rod

of a diameter less than that of said auxiliary piston; a spring for returning said auxiliary piston to its initial position; and a passage through said exhaust-valve and piston-rod by which said auxiliary chamber is connected to the main chamber when the exhaust-valve is open, said passage being sealed by the closing of said valve, for the purpose specified.

3. In a gas or vapor engine, the combination of a main cylinder having suitable inlet and exhaust ports; a main piston; a suitable inlet-valve; an auxiliary cylinder connected to said main cylinder by a passage or port, said passage or port being so arranged that it is connected to said main cylinder when the main piston is in its outer position, and to the outer air when said piston is in its inner position; a piston in said auxiliary cylinder; a piston-rod therefor; an exhaust-valve on said piston-rod of a diameter less than that of said auxiliary piston; a passage through said exhaust-valve and piston-rod by which said auxiliary chamber is connected to the main chamber when said exhaust-valve is open, said passage being sealed by the closing of said valve; and a port for said auxiliary cylinder whereby the outer face of said auxiliary piston is subjected to atmospheric pressure, for the purpose specified.

4. In a gas or vapor engine, the combination of a main cylinder having suitable inlet and exhaust ports; a main piston; a suitable inlet-valve; an auxiliary cylinder connected to said main cylinder by a passage or port, said passage or port being so arranged that it is connected to said main cylinder when the main piston is in its outer position, and to the outer air when said piston is in its inner position; a piston in said auxiliary cylinder; a piston-rod therefor; an exhaust-valve on said piston-rod of a diameter less than that of said auxiliary piston; a spring for returning said auxiliary piston to its initial position; a passage by which said auxiliary chamber is connected to the inner end of the main chamber when said exhaust-valve is open; and a port for said auxiliary cylinder whereby the outer face of said auxiliary piston is subjected to atmospheric pressure, for the purpose specified.

5. In a gas or vapor engine, the combination of a main cylinder having suitable inlet and exhaust ports; a main piston; a suitable inlet-valve; an auxiliary cylinder connected to said main cylinder by a passage or port, said passage or port being so arranged that it is connected to said main cylinder when the main piston is in its outer position, and to the outer air when said piston is in its inner position; a piston in said auxiliary cylinder; a piston-rod therefor; an exhaust-valve on said piston-rod of a diameter less than that of said auxiliary piston; a spring for returning said auxiliary piston to its initial position; a passage by which said auxiliary chamber is connected to the inner end of the main chamber when said

exhaust-valve is open, for the purpose specified.

6. In a gas or vapor engine, the combination of a main cylinder having suitable inlet and exhaust ports; a main piston; a suitable inlet-valve; an auxiliary cylinder connected to said main cylinder by a passage or port, said passage or port being so arranged that it is connected to said main cylinder when the main piston is in its outer position, and to the outer air when said piston is in its inner position; a piston in said auxiliary cylinder; a piston-rod therefor; an exhaust-valve on said piston-rod of a diameter less than that of said auxiliary piston; a passage by which said auxiliary chamber is connected to the inner end of the main chamber when said exhaust-valve is open; and a port for said auxiliary cylinder whereby the outer face of said auxiliary piston is subjected to atmospheric pressure, for the purpose specified.

7. In a gas or vapor engine, the combination of a main cylinder having suitable inlet and exhaust ports; a main piston; a suitable inlet-valve; an auxiliary cylinder connected to said main cylinder by a passage or port, said passage or port being so arranged that it is connected to said main cylinder when the main piston is in its outer position, and to the outer air when said piston is in its inner position; a piston in said auxiliary cylinder; an exhaust-valve of a diameter less than that of said auxiliary piston, adapted to be opened thereby; a spring for returning said auxiliary piston to its initial position; a passage by which said auxiliary chamber is connected to the inner end of the main chamber when said exhaust-valve is open, said passage being sealed by the closing of said valve; and a port for said auxiliary cylinder whereby the outer face of said auxiliary piston is subjected to atmospheric pressure, for the purpose specified.

8. In a gas or vapor engine, the combination of a main cylinder having suitable inlet and exhaust ports; a main piston; a suitable inlet-valve; an auxiliary chamber connected to said main cylinder by a passage or port, said passage or port being so arranged that it is connected to said main cylinder when the main piston is in its outer position, and to the outer air when said piston is in its inner position; a piston in said auxiliary cylinder; an exhaust-valve of a diameter less than that of said auxiliary piston, adapted to be opened thereby; a spring for returning said auxiliary piston to its initial position; and a passage by which said auxiliary chamber is connected to the inner end of the main chamber when said exhaust-valve is open, said passage being sealed by the closing of said valve, for the purpose specified.

9. In a gas or vapor engine, the combination of a main cylinder having suitable inlet and exhaust ports; a main piston; a suitable inlet-valve; an auxiliary cylinder connected to said

main cylinder by a passage or port, said passage or port being so arranged that it is connected to said main cylinder when the main piston is in its outer position, and to the outer air when said piston is in its inner position; a piston for said auxiliary cylinder; an exhaust-valve of a diameter less than that of said auxiliary piston, adapted to be opened thereby; a passage by which said auxiliary chamber is connected to the inner end of the main chamber when said exhaust-valve is open, said passage being sealed by the closing of said valve; and a port for said auxiliary cylinder whereby the outer face of said auxiliary piston is subjected to atmospheric pressure, for the purpose specified.

10. In a gas or vapor engine, the combination of a main cylinder having suitable inlet and exhaust ports; a main piston; a suitable inlet-valve; an auxiliary cylinder connected to said main cylinder by a passage or port, said passage or port being so arranged that it is connected to said main cylinder when the main piston is in its outer position, and to the outer air when said piston is in its inner position; a piston in said auxiliary cylinder; an exhaust-valve of a diameter less than that of said auxiliary piston, adapted to be opened thereby; a spring for returning said auxiliary piston to its initial position; a passage by which said auxiliary chamber is connected to the inner end of the main chamber when said exhaust-valve is open; and a port for said auxiliary cylinder whereby the outer face of said auxiliary piston is subjected to atmospheric pressure, for the purpose specified.

11. In a gas or vapor engine, the combination of a main cylinder having suitable inlet and exhaust ports; a main piston; a suitable inlet-valve; an auxiliary chamber connected to said main cylinder by a passage or port, said passage or port being so arranged that it is connected to said main cylinder when the main piston is in the outer position, and to the outer air when said piston is in its inner position; a piston in said auxiliary cylinder; an exhaust-valve of a diameter less than that of said auxiliary piston, adapted to be opened thereby; a spring for returning said auxiliary piston to its initial position; and a passage by which said auxiliary chamber is connected to the inner end of the main chamber when said exhaust-valve is open, for the purpose specified.

12. In a gas or vapor engine, the combination of a main cylinder having suitable inlet and exhaust ports; a main piston; a suitable inlet-valve; an auxiliary cylinder connected to said main cylinder by a passage or port, said passage or port being so arranged that it is connected to said main cylinder when the main piston is in its outer position, and to the outer air when said piston is in its inner position; a piston for said auxiliary cylinder; an exhaust-valve of a diameter less than that of said auxiliary piston, adapted to be opened thereby; a

passage by which said auxiliary chamber is
connected to the inner end of the main cham-
ber when said exhaust-valve is open; and a
port for said auxiliary cylinder whereby the
5 outer face of said auxiliary piston is subject-
ed to atmospheric pressure, for the purpose
specified.

In witness whereof I have hereunto set my
hand and seal in the presence of two witnesses.

CHARLES H. WAY. [L. s.]

Witnesses:

HARRIS E. THOMAS,
WM. H. NEWHARGT.