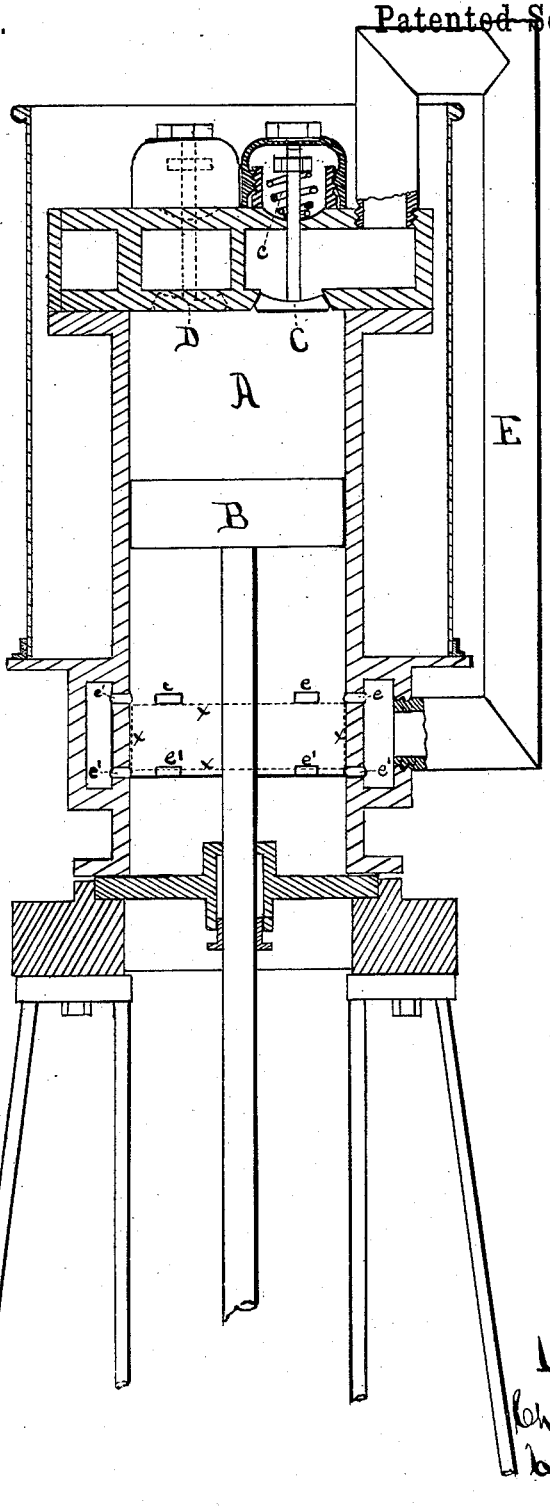
(No Model.)

C. A. MacDONALD.

GAS PUMP.

No. 304,836. Patented Sept. 9, 1884.



Witnesses
E. F. Burton.
H. Kehrel.

Inventor.
Chas. A. MacDonald
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His Attys.

UNITED STATES PATENT OFFICE.

CHARLES A. MACDONALD, OF CHICAGO, ILLINOIS.

GAS-PUMP.

SPECIFICATION forming part of Letters Patent No. 304,836, dated September 9, 1884.

Application filed August 13, 1883. (No model.)

To all whom it may concern:

Be it known that I, CHARLES A. MACDONALD, a citizen of the United States, and residing at Chicago, in the county of Cook and State of Illinois, have invented certain new and useful Improvements in Gas-Pumps, which are fully set forth in the following specification and annexed drawing, from which any person familiar with the art to which said invention pertains may make and use the same.

My invention is designed to be applied to air or gas pumps, particularly those used to exhaust from one chamber and compress in another, as in the various forms of ice-machines or refrigerator-machines. It may be regarded as an improvement on machines for such purposes, in connection with one of which it is illustrated in the accompanying drawing.

The figure is a vertical section of the pump-cylinder and the valves communicating with the exhaust and condense chambers, and a conduit communicating between the exhaust-chamber and the lower end of the pump-cylinder.

A is the pump-cylinder. B is the pump-piston. C is the valve leading from the exhaust-chamber. D is the valve leading to the condensing-chamber. *c* is a spring tending to hold the valve C on the seat. E is a conduit leading from the pump-cylinder behind the piston to the chamber F, and designed also to communicate with any chamber or cavity to be exhausted of gas by means of the pump. This conduit opens into the pump-cylinder by ports *e* and *e'*—the former at such distance above the bottom of the cylinder that the piston-head at the end of the stroke will be just below them, as shown by the dotted-line position in the figure, the port *e'* being beyond the extreme end of the course of the piston, so that they are never covered by the piston-head. As heretofore constructed, the conduit E has been made to lead from the exhaust-chamber to a point in the pump-cylinder wholly behind the piston. With such construction the exhaust-stroke of the piston must first effect a difference in pressure between the pump-cylinder or that portion of it in front of the piston and the exhaust-chamber equal to the pressure exerted by the spring *c* upon the valve C before the valve would leave the seat, and must constantly maintain that difference in order to permit gas to pass from the chamber into the cylinder. The tension of this spring is, in practice, equivalent to from four to six pounds pressure to the square inch on the valve C. The difference in tension, therefore, between the gas in the pump-cylinder and that in the exhaust-chamber will be this amount—from four to six pounds per square inch—and the amount of gas taken from the exhaust-chamber and forced into the condensing-chamber at each stroke and counter-stroke is proportionately less than if the tension in the cylinder could be made equal to that in the exhaust-chamber. To cure this defect by obtaining the same tension in the cylinder and exhaust-chamber is the purpose of my invention, and it is effected by the structure above described, for when the piston-head has passed to the position shown in the dotted outline *x x* it has uncovered the port *e* and established free communication between the exhaust-chamber and that part of the cylinder in front of the piston, and the gas will flow at once from the exhaust-chamber through the port *e* to the cylinder and establish equilibrium, so that the piston on the counter or forcing stroke will have in front of it and drive before it into the condensing-chamber a quantity of gas greater than it would otherwise have had. The result is the same in this respect as if the spring *c* or any equivalent to hold the valve on the seat were dispensed with, and at the same time the benefit of the spring as securing certainty of action is retained. The ports *e'* are necessary in order that the portion of the cylinder behind—below—the piston-head may be in free communication with the exhaust-chamber throughout the entire stroke of the piston.

I claim—

1. In an air or gas pump, the combination, with the pump-cylinder and its induction-valve, of a conduit leading from the exhaust-chamber to the cylinder, and opening thereinto by ports so situated as to communicate with the cylinder between the piston-head and the valve only near the end of the exhaust-stroke of the piston, substantially as and for the purpose set forth.

2. In a gas-pump, a pump-cylinder having

the ports *e* opening thereinto between the induction-valve and the extreme outward position of the piston-head, a passage leading from the exhaust-chamber, communicating with the cylinder through such ports, a valve opening from the exhaust-chamber to the cylinder, and mechanical means for seating the valve, all combined and operating substantially as and for the purpose set forth.

3. In a gas-pump, the combination, with the cylinder and its induction-valve, of the conduit E, communicating with the cylinder both above and below the extreme outward position of the piston-head, substantially as and for the purpose set forth.

In testimony that I claim the foregoing as my invention I have hereunto set my hand in the presence of two witnesses, at Chicago, Illinois, this 9th day of August, 1883.

CHARLES A. MACDONALD.

Attest:
WM. P. GREENHILL,
CHAS. J. BENTLEY.