No. 719,454. PATENTED FEB. 3, 1903

W. J. FRANCKE.

COMPRESSOR.

APPLICATION FILED NOV. 23, 1901.

NO MODEL. 2 SHEETS—SHEET 1.

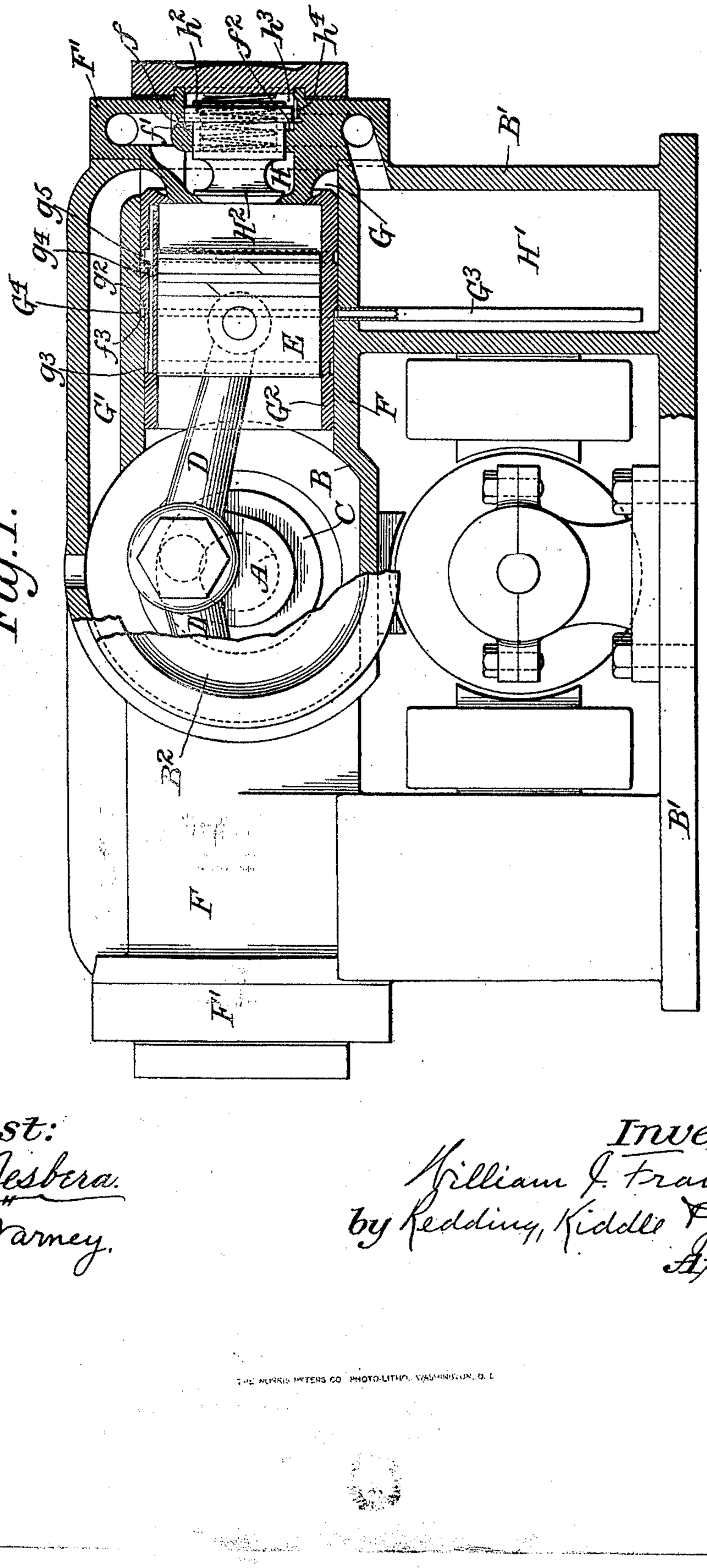


Fig. 1.

Attest:
A. N. Jesbera.
L. E. Varney.

Inventor:
William J. Francke
by Redding, Kiddle & Greeley
Attys.

No. 719,454. PATENTED FEB. 3, 1903.

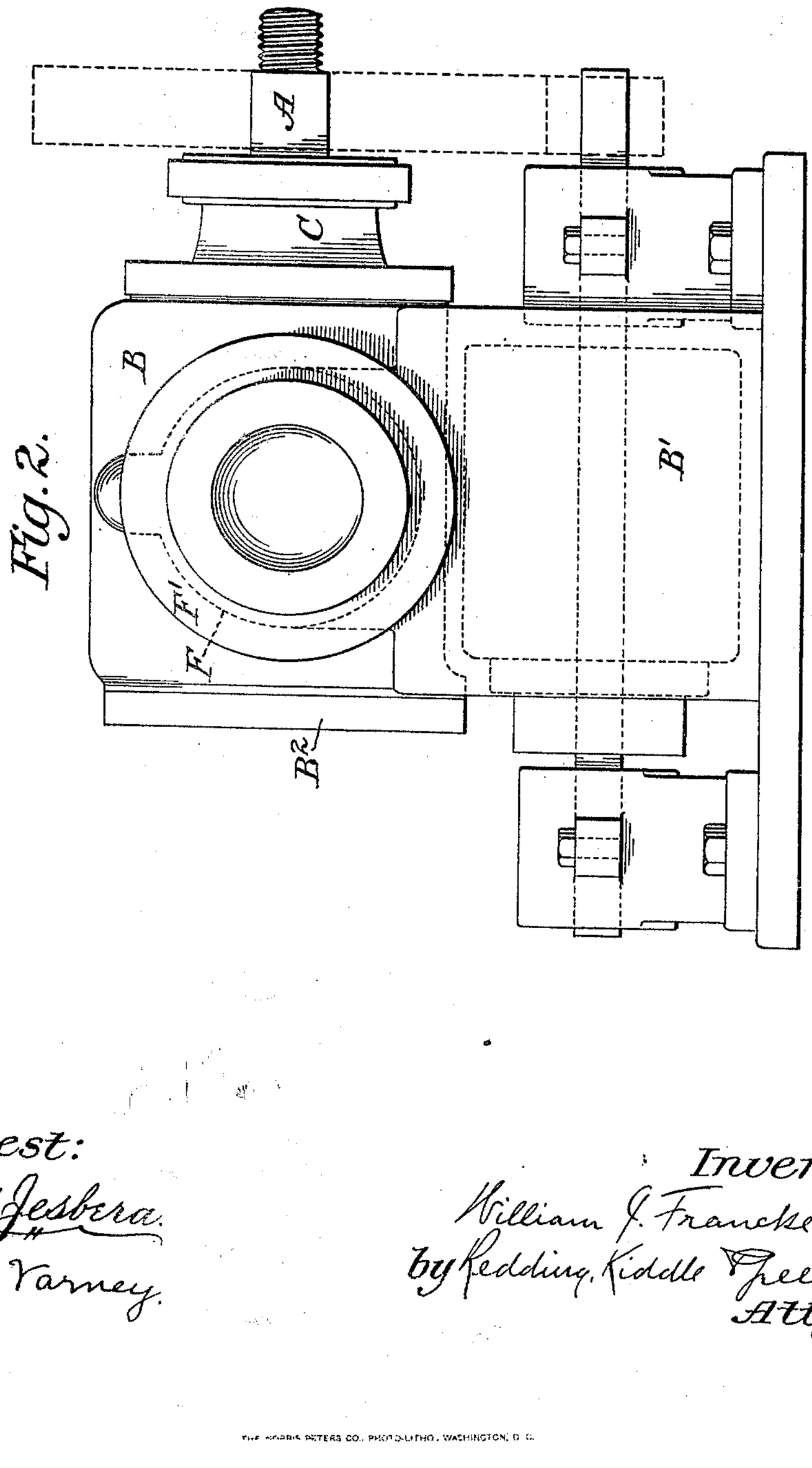
W. J. FRANCKE.

COMPRESSOR.

APPLICATION FILED NOV. 23, 1901.

NO MODEL. 2 SHEETS—SHEET 2.

Fig. 2.



Attest:
A. N. Jesbera.
L. E. Varney.

Inventor:
William J. Francke
by Redding, Kiddle & Peeler.
Attys.

UNITED STATES PATENT OFFICE.

WILLIAM J. FRANCKE, OF NEW BRUNSWICK, NEW JERSEY, ASSIGNOR TO THE BRUNSWICK REFRIGERATING COMPANY, OF NEW BRUNSWICK, NEW JERSEY, A CORPORATION OF NEW JERSEY.

COMPRESSOR.

SPECIFICATION forming part of Letters Patent No. 719,454, dated February 3, 1903.

Application filed November 23, 1901. Serial No. 83,379. (No model.)

To all whom it may concern:

Be it known that I, WILLIAM J. FRANCKE, a citizen of the United States, residing in New Brunswick, county of Middlesex, and State of New Jersey, have invented certain new and useful Improvements in Compressors, of which the following is a specification, reference being had to the accompanying drawings, forming a part hereof.

This invention relates to compressors of the general character of that shown in Letters Patent of the United States No. 677,503, dated July 2, 1901; and it has for its object to improve the construction and operation of such compressors with especial reference to the circulation and action of the oil which is used as a check or cushion for the suction and discharge valves.

One purpose incidental to the main object is to so construct the compressor as to adapt it particularly to conditions of use in which the suction-pressure remains constant and in which the discharge-pressure is also to remain constant, and particularly to make it possible to render the operation of the compressor automatic, so that when the predetermined discharge-pressure, whatever it may be, is obtained such pressure shall be maintained without attention on the part of an operator.

Another incidental purpose is to make it possible to determine the lift of the discharge-valve, so that it shall not be subject to variation during the operation of the compressor.

The invention will be more fully described hereinafter with reference to the accompanying drawings, in which the improvements are shown as embodied in a convenient and practical form, and in which—

Figure 1 is a view, partly in side elevation and partly in longitudinal section, of a compressor to which the improvements are applied. Fig. 2 is an end elevation thereof, the motor and gearing being indicated by dotted lines.

The compressor illustrated in the drawings is represented as having two cylinders on opposite sides of a common crank-shaft A and secured to the crank-casing B, which forms a part of the base or framework B′ of the compressor, the crank-shaft having a suitable bearing at C in one end of the crank-casing, while the other end of such casing is closed by a suitable head B^2. The several pistons are connected to the common crank-pin by pitmen D, and each piston E is preferably formed as an ordinary trunk-piston. The other end of each cylinder F is covered by a head F′, in which are formed the concentric suction and discharging valve ports. The annular suction-port G is connected by a passage G′ with the crank-casing, which the gas or air enters at any convenient point. The end of a sleeve G^2 within the cylinder forms a valve to close the suction-port, such sleeve forming a longitudinally-removable lining in the cylinder and within which the piston moves, said sleeve being moved to a limited extent by the friction of the piston or by the pressure of the suction-gas or by both. At the instant the piston commences its suction-stroke a partial vacuum will be formed in the cylinder and the sleeve will be moved away from the suction-port by the pressure of the atmosphere on the unbalanced area of the sleeve which is presented to the suction-port, thereby opening the suction-valve, and at the instant the piston commences its compression stroke, the cylinder being then full of air at atmospheric pressure and the two sides of the suction-valve therefore balanced, the sleeve will be moved toward the suction-port to close the same by the pressure of the oil against the shoulder g^2 on the sleeve G, as hereinafter described. The central discharge-port H is connected by suitable passages with the auxiliary air-chamber H′, from which the air under compression may be conducted to the main reservoir or place of use in any suitable manner, the discharge-port H being closed by a valve H^2. The valve H^2 is lifted by the pressure of the gas or air during the compression stroke of the piston and returns again to its seat by the action of a spring the instant that the piston commences its suction stroke. The lubricating-oil, which is introduced at any convenient point, collects in the bottom of the auxiliary chamber H′, in which it is separated from the air which carries it after it has served its intended pur-

pose. A pipe G^3, which is extended nearly to the bottom of the auxiliary chamber H', conveys the oil, under the pressure of the air or gas upon its surface, to an annular oil channel or chamber G^4, which is formed between a shoulder f^3 on the cylinder F and a shoulder g^2 on the sleeve G. A second annular channel g^3 is formed about the sleeve G nearer the crank-shaft, such annular channel g^3 being placed in communication with the interior of the sleeve G near its head by a channel g^4. A third annular channel g^5 is preferably formed about the sleeve G between the channel G^4 and the head of the sleeve, such channel g^5 also communicating with the channel g^4. In the operation of the compressor described in said Letters Patent No. 677,503 when the predetermined pressure in the reservoir is attained, the pump continuing to run, the oil would be forced in the crank-chamber, in which it would gradually accumulate, not being able to return against the discharge-pressure. By the provision of the channel g^3, which is placed far enough toward the crank to insure the proper lubrication of the sleeve, the oil which is forced or escapes from the channel G^4 toward the crank is caught, is prevented from escaping to the crank-chamber in front of the piston, and is returned through the channel g^4, together with that received from the channel g^5, into the space within the sleeve ahead of the returning piston. From this space it is discharged through the discharge-valve into the discharge-passage, whence it returns to the auxiliary air-chamber H', as already stated. The compressor can therefore run indefinitely after the predetermined pressure is attained without any attention on the part of the operator. Furthermore, as the pressure on the oil in the channel G^4, as well as in the auxiliary air-chamber H', is then the same as the predetermined air-pressure, the sleeve G will be held from movement and the suction-valve will cease to open. Since the opening of the suction-valve depends upon the relative area of the suction-valve and of the shoulder g^2, it becomes possible to determine the pressure at which the suction-valve shall open by varying the relative area of the shoulder g^2. In building the compressor it is therefore possible to fix the relative area of this shoulder g^2 so that the compressor shall become automatic in its action and shall cease to increase the pressure after the predetermined degree has been attained. As the gas or air is discharged from the cylinder past the discharge-valve H some of the oil which is carried with it is separated therefrom and accumulates in the depression or receptacle indicated at f, such receptacle communicating with the annular channel or chamber f', formed in the head F' between the enlarged upper portion h^2 of the discharge-valve H^2 and a shoulder f^2 of the head F', the location of the shoulder f^2 being such that when the valve rests on its seat a space is left between the shoulder f^2 and the shoulder formed by the enlarged part h^2 of the valve. This space is filled with oil under discharge pressure, and the small quantity of oil therein serves to cushion the valve as it returns to its seat, some of the oil escaping around the valve before the latter actually rests upon its seat. The valve thus cushioned is absolutely noiseless in operation, as set forth in said Letters Patent No. 677,503. Behind the enlarged portion h^2 of the valve H is a space or chamber h^3, which communicates with the chamber f' through a narrow channel h^4. In the movements of the valve the oil moves from one chamber f' to the other, h^3, through the channel h^4, while such channel is uncovered by the enlarged portion h^2 of the valve; but as soon as the outer end of the channel h^4 is covered by the valve then the oil is imprisoned in the chamber h^3 and resists the further lift of the valve, cushioning this lift, as will be apparent. By varying the length of the channel h^4, and therefore the point at which it is cut off by the valve in its movement, it is possible to vary the lift of the valve to suit the particular conditions under which the compressor is to be used.

The mode of operation of the present improvements will be understood from the foregoing description without further explanation herein.

It will be obvious that changes in the details of construction and arrangement may be made and that the improvements may be applied to compressors which differ in construction from that shown and described herein without departing from the spirit of the invention.

I claim as my invention—

1. In a compressor, the combination with a cylinder, a piston, a suction-valve, and a discharge-valve, of a chamber forming an oil-cushion behind the suction-valve, a chamber in front of the piston, a conduit to deliver oil from the chamber in front of the piston to the first-named chamber, and a conduit to receive the oil escaping from the first-named chamber, prevent its escape behind the piston and return it to the second-named chamber through the discharge-valve, whereby the oil in the first-named chamber is under the discharge pressure.

2. In a compressor, the combination with a cylinder, a piston, a suction-valve, and a discharge-valve, of a chamber forming an oil-cushion behind the suction-valve, a conduit to receive the oil escaping therefrom and prevent its escape behind the piston, said conduit terminating in the cylinder in front of the piston, and means to return the oil from the discharge-valve to said chamber, whereby the oil in said chamber is under the discharge pressure.

3. In a compressor, the combination with a cylinder, a piston, a sleeve suction-valve surrounding the piston and operated by the friction thereof, and a discharge-valve, of a chan-

nel between said sleeve and cylinder forming a chamber for an oil-cushion, a chamber in front of the piston, a conduit to receive the oil escaping from the first-named chamber, prevent its escape behind the piston and return it to the second-named chamber through the discharge-valve, and means to deliver the oil from the second-named chamber to the first-named chamber.

4. In a compressor, the combination with a cylinder, a piston, a sleeve suction-valve surrounding the piston and operated by the friction thereof and a discharge-valve, of a channel between said sleeve and cylinder forming a chamber for an oil-cushion, a second channel about said sleeve in rear of the first channel to receive the oil escaping therefrom and prevent its escape behind the piston, a conduit to receive the oil from said second channel and terminating within the sleeve in front of the piston, and means to return the oil from the discharge-valve to said chamber.

5. In a compressor, the combination with a cylinder, a piston, a sleeve suction-valve surrounding the piston and operated by the friction thereof and a discharge-valve of a channel between said sleeve and cylinder forming an oil-cushion, a second channel about said sleeve in rear of the first channel to receive the oil escaping from the oil-cushion and prevent its escape behind the piston, a third channel about said sleeve in front of the first channel to receive the oil escaping forwardly from the oil-cushion, a conduit to receive the oil from said channels and terminating with the sleeve in front of the piston, and means to return the oil from the discharge-valve to said chamber.

This specification signed and witnessed this 20th day of November, A. D. 1901.

WILLIAM J. FRANCKE.

In presence of—
M. A. HARKINS,
T. G. PHINNY.