(No Model.)

4 Sheets—Sheet 1.

V. E. COHEN.

COMPRESSION PUMP.

No. 599,831. Patented Mar. 1, 1898.

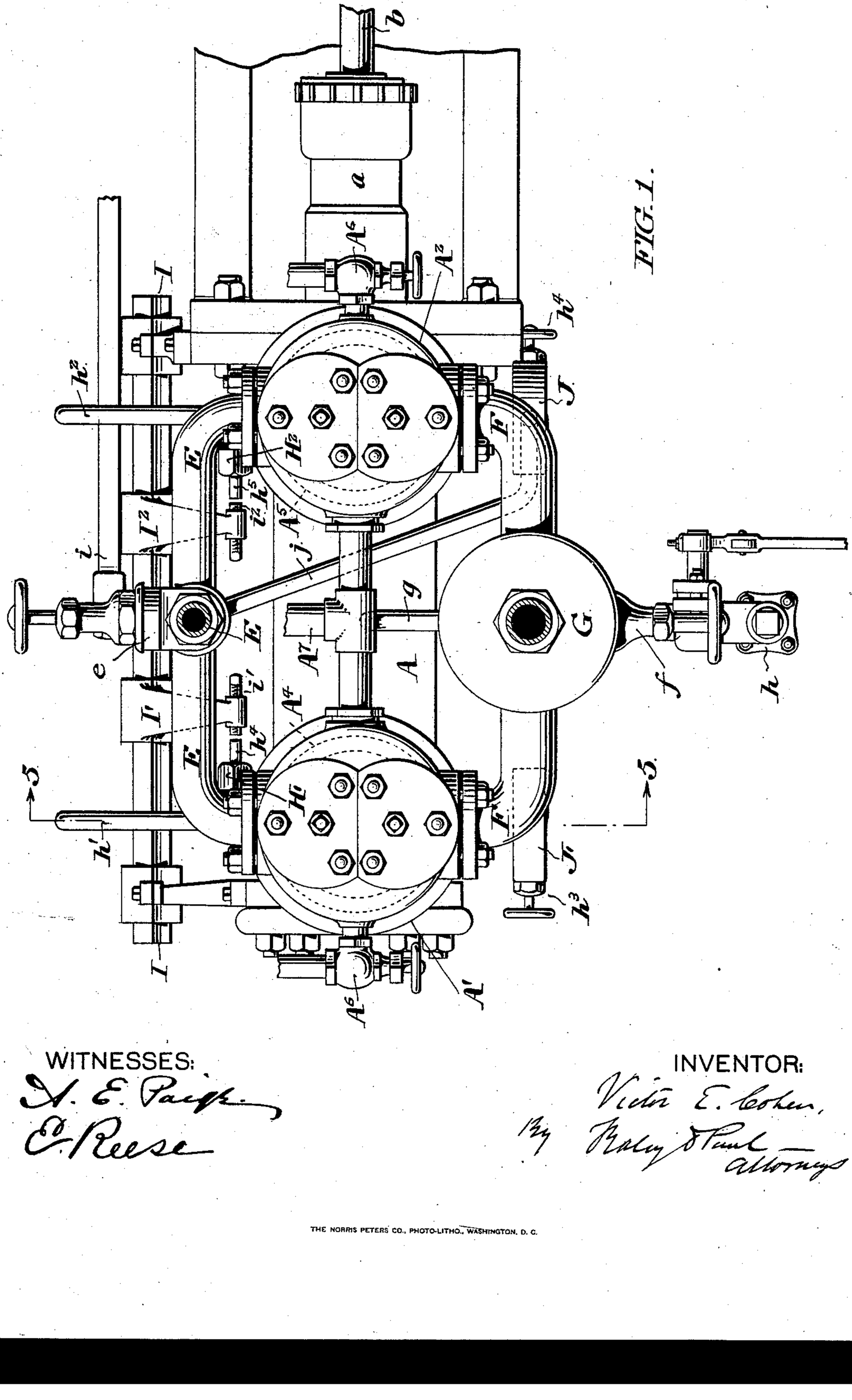

FIG. 1.

WITNESSES:

A. E. Paugh

E. Reese

INVENTOR:

Victor E. Cohen,

By Raley & Paul

Attorneys

(No Model.) 4 Sheets—Sheet 2.

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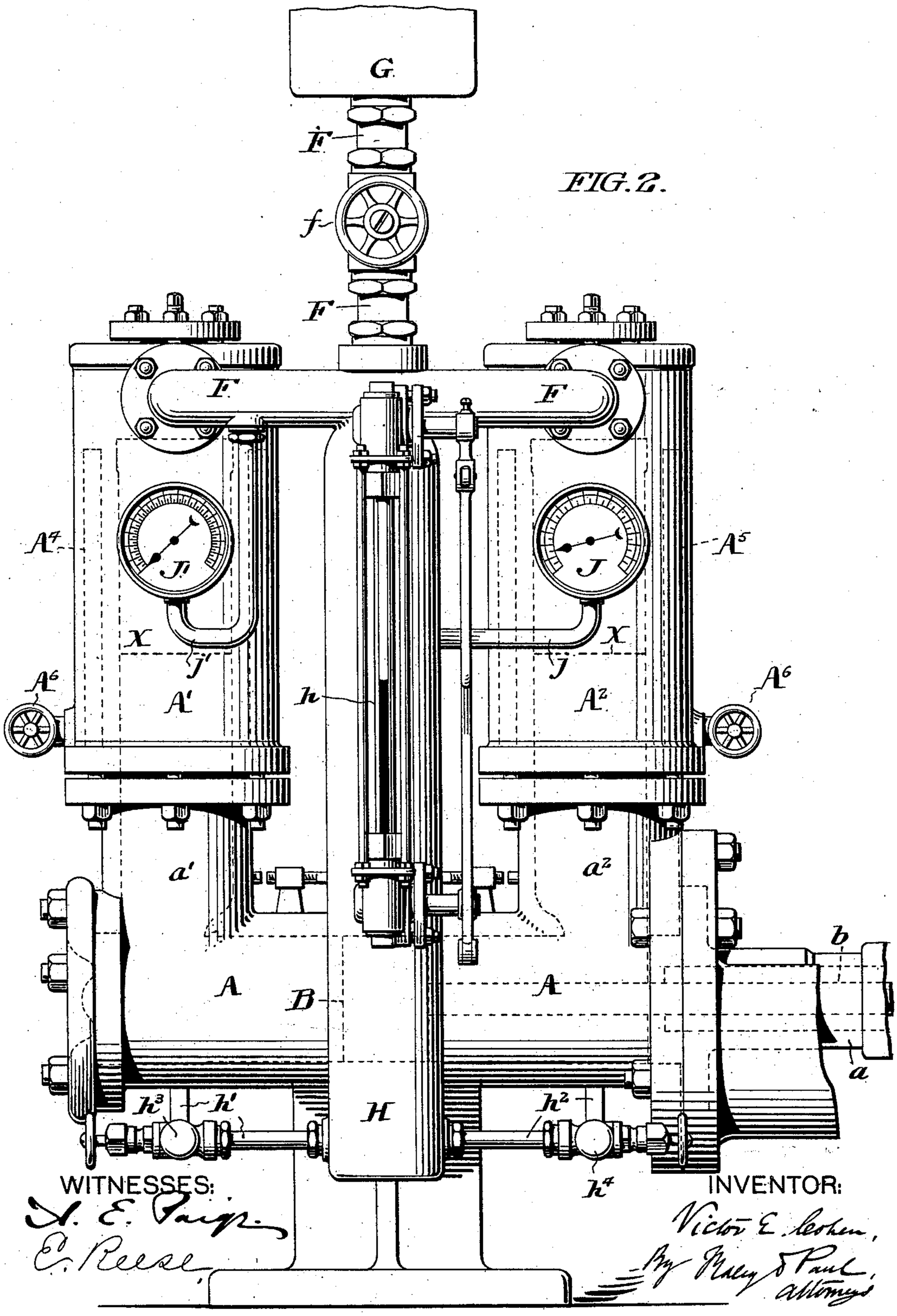
FIG. 2.



WITNESSES:
A. E. Paige
E. Reese.

INVENTOR:
Victor E. Cohen,
By Riley & Paul,
Attorneys.

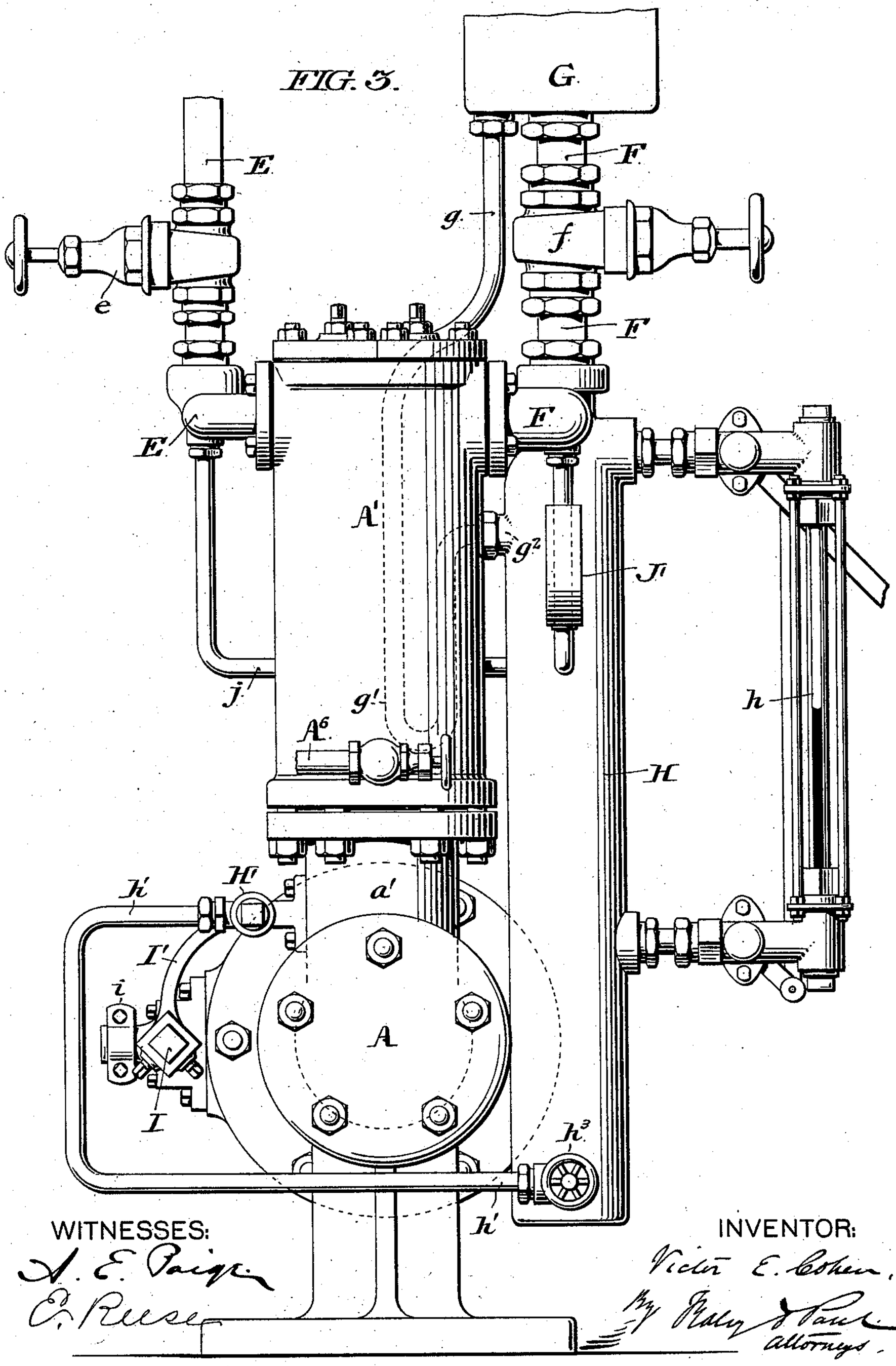
(No Model.) 4 Sheets—Sheet 3.

V. E. COHEN.

COMPRESSION PUMP.

No. 599,831. Patented Mar. 1, 1898.

FIG. 3.



WITNESSES:

A. E. Paige

C. Reuse

INVENTOR:

Victor E. Cohen,

By Ridley & Paul

Attorneys.

(No Model.) 4 Sheets—Sheet 4.

V. E. COHEN.

COMPRESSION PUMP.

No. 599,831. Patented Mar. 1, 1898.

FIG. 4.

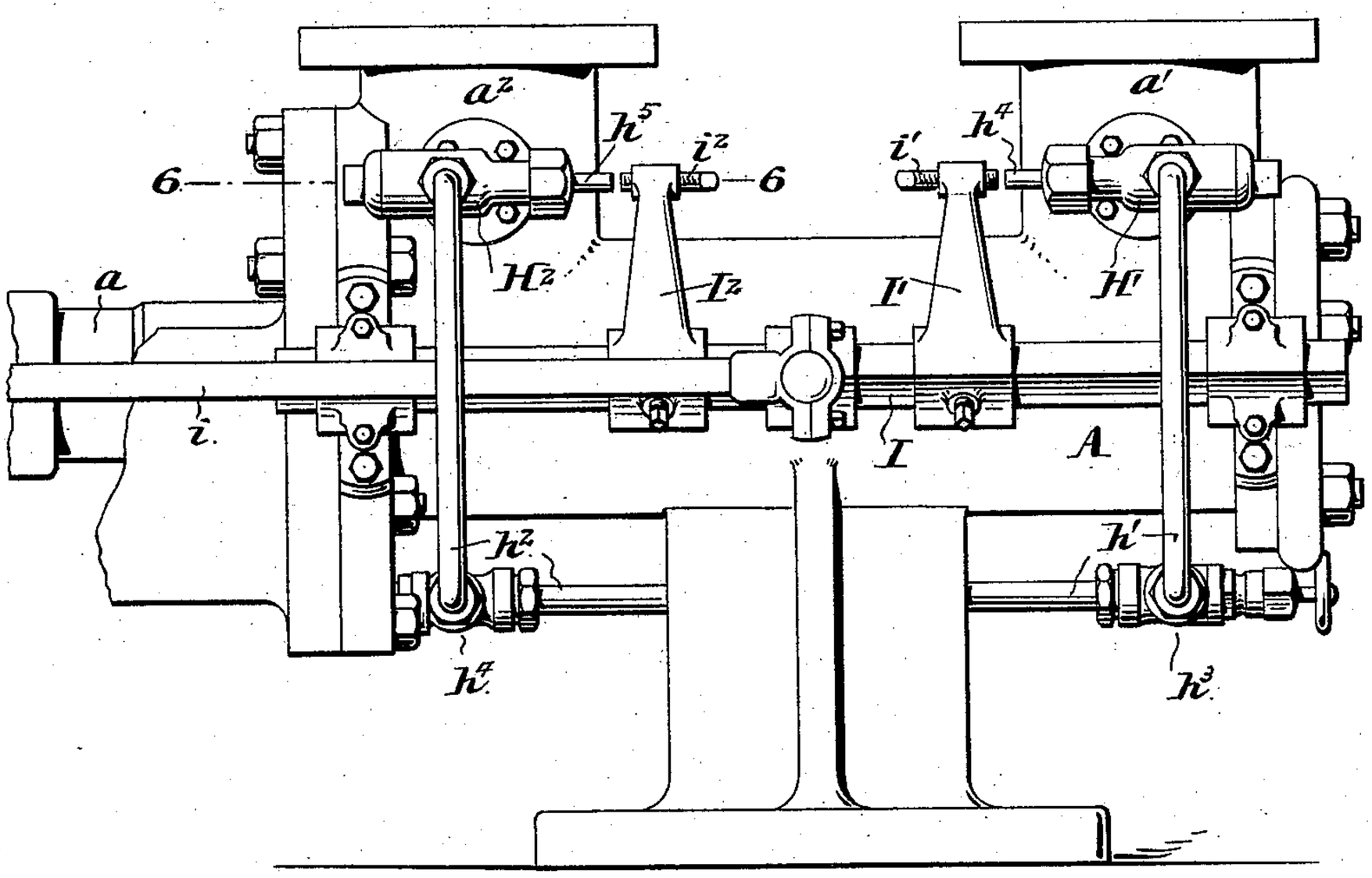


FIG. 5.

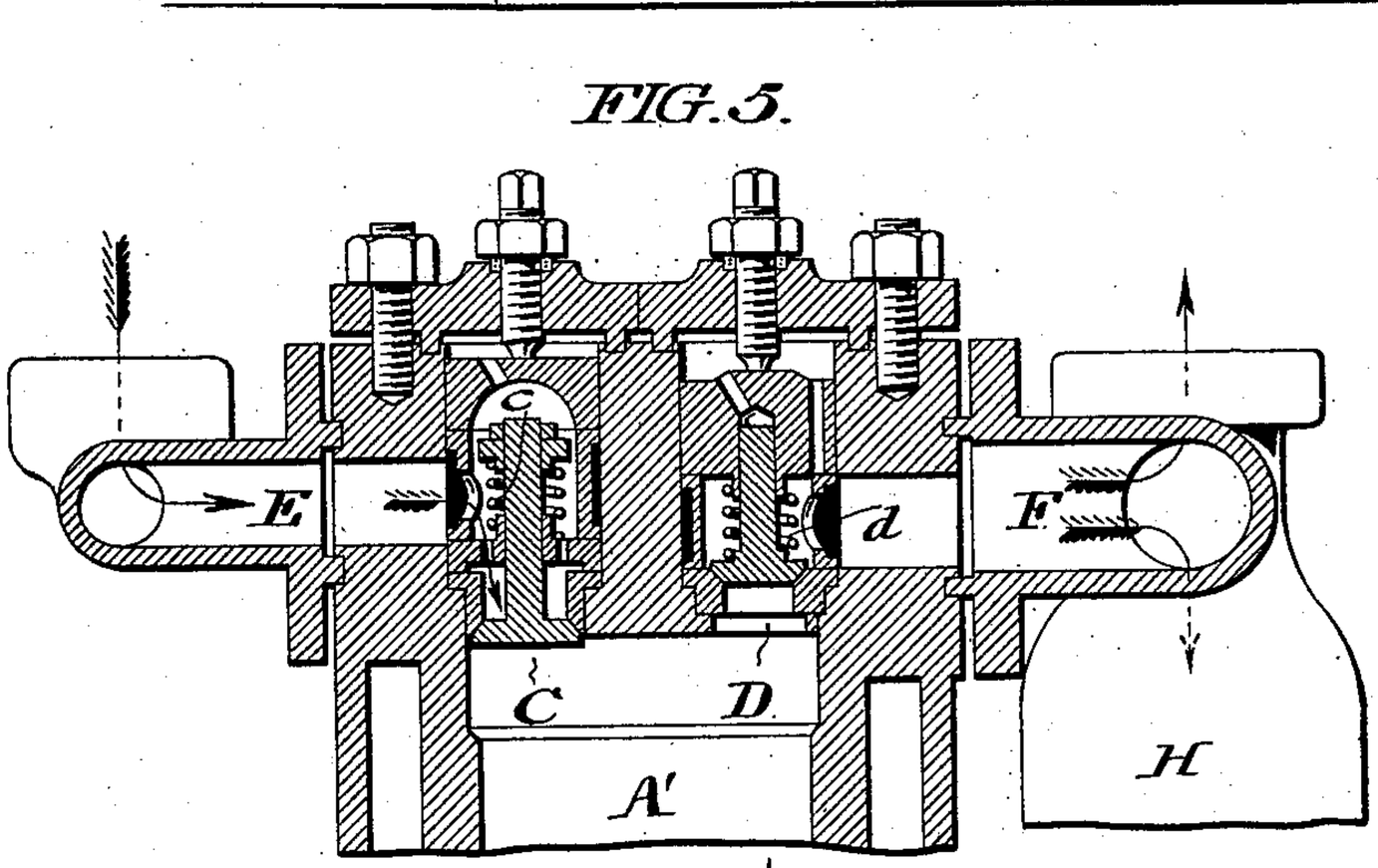
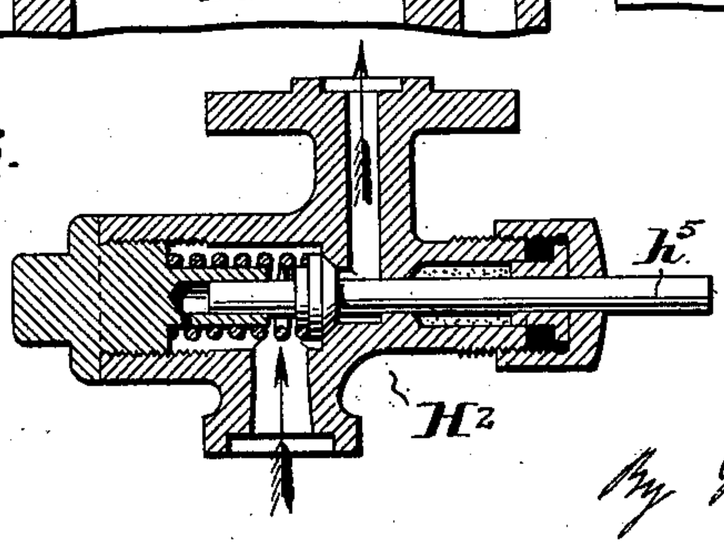


FIG. 6.



WITNESSES:
A. E. Paige
E. Reese.

INVENTOR:
Victor E. Cohen
By Briesen & Paul.
Attorneys.

UNITED STATES PATENT OFFICE.

VICTOR E. COHEN, OF PHILADELPHIA, PENNSYLVANIA, ASSIGNOR TO THE HILL MANUFACTURING COMPANY, OF SAME PLACE.

COMPRESSION-PUMP.

SPECIFICATION forming part of Letters Patent No. 599,831, dated March 1, 1898.

Application filed June 17, 1897. Serial No. 641,101. (No model.)

To all whom it may concern:

Be it known that I, VICTOR E. COHEN, of Philadelphia, in the State of Pennsylvania, have invented certain new and useful Improvements in Compression-Pumps, whereof the following is a specification, reference being had to the accompanying drawings.

The most obvious application of the device is for use in connection with refrigerating apparatus where a vapor, such as that of ammonia, is to be compressed for subsequent expansion to produce cold; but I do not limit my claims to this specific use. The pumping device is one in which the compressing action is effected through the medium of a liquid which is forced into a chamber containing the fluid to be compressed, said liquid, which for convenience of description may be termed the "piston" liquid, being of course practically a permanent body, which is utilized in successive actions of the pumping device and which is of such a character as not to commingle injuriously with the fluid to be compressed. In devices of this character mercury has been employed; but while I do not restrict my claims to any particular liquid I have found that with the device hereinafter described oil may be advantageously substituted for mercury, thus affording a cheaper and in many respects a more satisfactory medium.

The main objects of my invention are to simplify the construction of the apparatus, dispensing with cumbersome and bulky parts, and to render the compressing action efficient to the highest degree and without waste of action through the failure to completely clear the compressing-chamber. Furthermore, I am enabled to completely and efficiently return the body of piston liquid for repetition of the operation.

In the accompanying drawings, Figure 1 is a plan view of an apparatus embodying my invention. Fig. 2 is a front elevation thereof. Fig. 3 is an end elevation of the apparatus as seen from the left-hand side of Fig. 1. Fig. 4 is a rear elevation of the piston-cylinder, showing the mechanism for automatically operating the feed-valves of said cylinder. Fig. 5 is a fragmentary sectional view of parts on the line 5 5 of Fig. 1. Fig. 6 is a horizontal sectional view of one of the feed-valves of the piston-cylinder on the line 6 6 of Fig. 4.

In said figures, A is the piston-cylinder, and B the piston-head, adapted to reciprocate in said cylinder, said head being provided with the usual piston-rob b and stuffing-box a. The piston B may be reciprocated by any convenient mechanism.

The cylinder A is provided at its respective ends with upward extensions a' and a^2. The said extensions communicate, respectively, with pump-chambers A′ and A², said pump-chambers being each provided in their upper portion with an inlet-valve C and an outlet-valve D for the fluid which the apparatus is designed to compress. The said fluid is alternately admitted to said pump-chambers through the branched pipe E, which is conveniently provided with a normally open stop-valve e, said compressed fluid being alternately discharged from said chambers through the branched pipe F. The said pipe F, which is conveniently provided with a normally open stop-valve f, leads, preferably, into a separating-cylinder G, wherein said compressed fluid may be freed from particles of oil or other foreign substances which have accidentally mixed with it. Said oil, &c., gravitates through the pipe g to the trap g', which communicates at g^2 with the reservoir H.

The piston-cylinder A contains upon each side of said piston B what I term the "piston" liquid X. By means of mechanism hereinafter described said liquid is automatically supplied from a suitable reservoir H in such quantity upon the respective sides of said piston-head B that when the piston reaches the extremity of its stroke toward one or the other of said extensions of the piston-cylinder said liquid shall overflow from the top of the respective pump-chamber. In order that this may be effected, a quantity of said liquid is maintained in the reservoir H, which communicates at its top with the pipe F aforesaid. Extending from the bottom of said reservoir H are two feed-pipes h' and h^2, which lead, respectively, into the cylinder extensions a' and a^2. Said feed-pipes are conveniently provided with stop-valves h^3 and h^4;

but in the normal operation of the device said valves remain open and the flow of the surplus piston liquid from the reservoir to the respective pump-chambers A′ and A² is predetermined by the adjustment of the feed-valves H′ and H².

The valves H′ and H² are alike in construction. I have therefore shown but one of them in section in Fig. 6. Said valve comprises a spring-actuated puppet (marked h^4 and h^5) in the respective valves. Said puppets normally close the inlets from the feed-pipes to their respective cylinder extensions and pump-chambers.

Conveniently mounted upon the piston-cylinder A is a slide-rod I. Said rod is caused to reciprocate by means of a pitman *i*, which may be conveniently actuated from the motor of the piston-rod *b*, so as to make the same number of strokes as the latter, though of course with a more limited movement. Adjustably mounted upon said rod I are standards I′ and I², provided, respectively, with adjustable tappets i' and i^2. The said tappets i' and i^2 are adapted to strike and actuate the puppets h^4 and h^5 of the feed-valves H′ H², respectively.

The automatic regulation of the opening of the respective feed-valves may be predetermined with precision by the adjustment of the mechanism above described, the relation of the parts being such that shortly after the commencement of the piston's stroke one feed-valve shall open and permit the inflow of sufficient surplus piston liquid through the proper feed-pipe from the reservoir H to insure the overflow of said piston liquid from the top of that pump-chamber which is for the time being the seat of compression.

As above mentioned, the reservoir H is in communication at its top with the outlet-pipe F. Therefore when said feed-valve is opened the pressure of the fluid from said pipe F upon the surface of the reserved liquid in the reservoir H serves to inject said liquid through the said feed-pipe into the piston liquid already contained in the cylinder extension, although said liquid is of course under compression.

The reservoir H is preferably provided with an indicator *h*, whereby the quantity of reserved liquid may be determined, the said indicator being conveniently provided with the usual stop-valves, &c.

As is usual in machines of this class, the pump-chambers A′ and A² are preferably surrounded with water-jackets A⁴ and A⁵, provided with suitable inlets and outlets A⁶ and A⁷, as best shown in Fig. 1.

I also find it convenient to provide the apparatus with two gages J and J′. The said gages J and J′ being respectively connected by pipes *j* and *j*′ with the inlet E and outlet F serve to respectively indicate the pressure within said pipes.

Each of the pump-chambers A′ and A² being charged with a sufficient quantity of the piston liquid to fill said chamber when the piston B is at the end of its stroke beneath the respective chamber, and reservoir H being filled to such a height as to make said reserved liquid visible in the indicator *h*, the operation of the device is as follows: The piston B and slide-rod I are caused to reciprocate. As the piston-head shifts along its cylinder the piston liquid by gravitation follows, producing a vacuum or partial vacuum in the pump-chamber, in which said liquid sinks. As soon as the pressure in said chamber falls below the pressure of the fluid in the inlet-pipe E the valve C opens downward against the pressure of its spring *c*, allowing said fluid to flow into the space above the piston liquid, which inflow continues until the end of the stroke of the piston B, completely filling the pump-chamber. Simultaneously with the foregoing action the piston liquid in front of the piston-head B rises in its respective pump-chamber and, compressing the fluid above it, causes the valve D to open against the pressure of its spring *d* when said pressure exceeds that of the fluid in the outlet-pipe F. As said liquid rises the compressed fluid is of course discharged through said outlet-pipe F into the separating-chamber G or other suitable receptacle. The stroke of the rod I in the same direction as the piston-head B brings one of its tappets against the respective feed-valve and opens the feed-inlet to the pump-chamber, in which the fluid is under pressure. As above described, the pressure-outlet F is in communication with the reservoir H. Therefore as soon as the feed-valve is open a portion of the piston liquid from the reservoir H is injected by the fluid-pressure above it through the feed pipe and valve aforesaid into the cylinder under pressure. The quantity of the piston liquid thus delivered at the beginning of each pressure-stroke is predetermined, so that the piston liquid at the completion of its compressing stroke shall always overflow the seat of the valve D. Said surplus of course finds its way through the outlet F into the top of the reservoir H. Upon the reversal of the stroke of the piston-head B the valve D seats itself in the liquid overflowing its seat. Therefore there cannot be a waste space at the top of the compression-cylinder to contain a troublesome residue of the compressed fluid. By the reversal of the stroke of the piston-head B the valve action in the respective cylinders is of course reversed. The pump-chamber in which the fluid has just been compressed, being gradually emptied of its piston liquid, receives the inflow from the outlet E, as above described.

In the foregoing description I have referred to an ordinary reciprocating piston as the most obvious means for actuating the piston liquid; but it must be understood that I do not limit myself to the particular device shown, and in my claims I intend to compre-

hend under the term "actuating-pump" any device which is capable of producing the desired movement of the piston liquid.

Having thus described my invention, I claim—

1. The combination, of an actuating-pump; a chamber communicating therewith, said chamber being provided with inlet and outlet valves to control the admission and discharge of fluid to be compressed; a reservoir for piston liquid communicating with said pump; a body of piston liquid exceeding in quantity the capacity of said chamber; a feed-valve controlling the supply of piston liquid; and means substantially as set forth, including positive actuating mechanism for said valve, whereby at predetermined intervals a surplus of the piston liquid in the reservoir is introduced into the chamber.

2. The combination, of an actuating-pump; a pair of chambers communicating therewith, said chambers being provided with inlet and outlet valves to control the admission and discharge of the fluid to be compressed; a reservoir for piston liquid communicating with said pump in the described relation to each of said chambers respectively; a body of piston liquid exceeding in quantity the capacity of said chambers respectively; a discharge-pipe for compressed fluid, leading from each of said chambers and communicating also with said reservoir; feed-valves controlling the communication between said reservoir and said pump; and positive actuating mechanism for said valves, whereby, in the described relation to the action of the compressing-pump, a surplus of piston liquid is introduced into that one of said chambers which is for the time being the seat of the compressing action, substantially as described.

VICTOR E. COHEN.

Witnesses:
G. HERBERT JENKINS,
JAMES H. BELL.