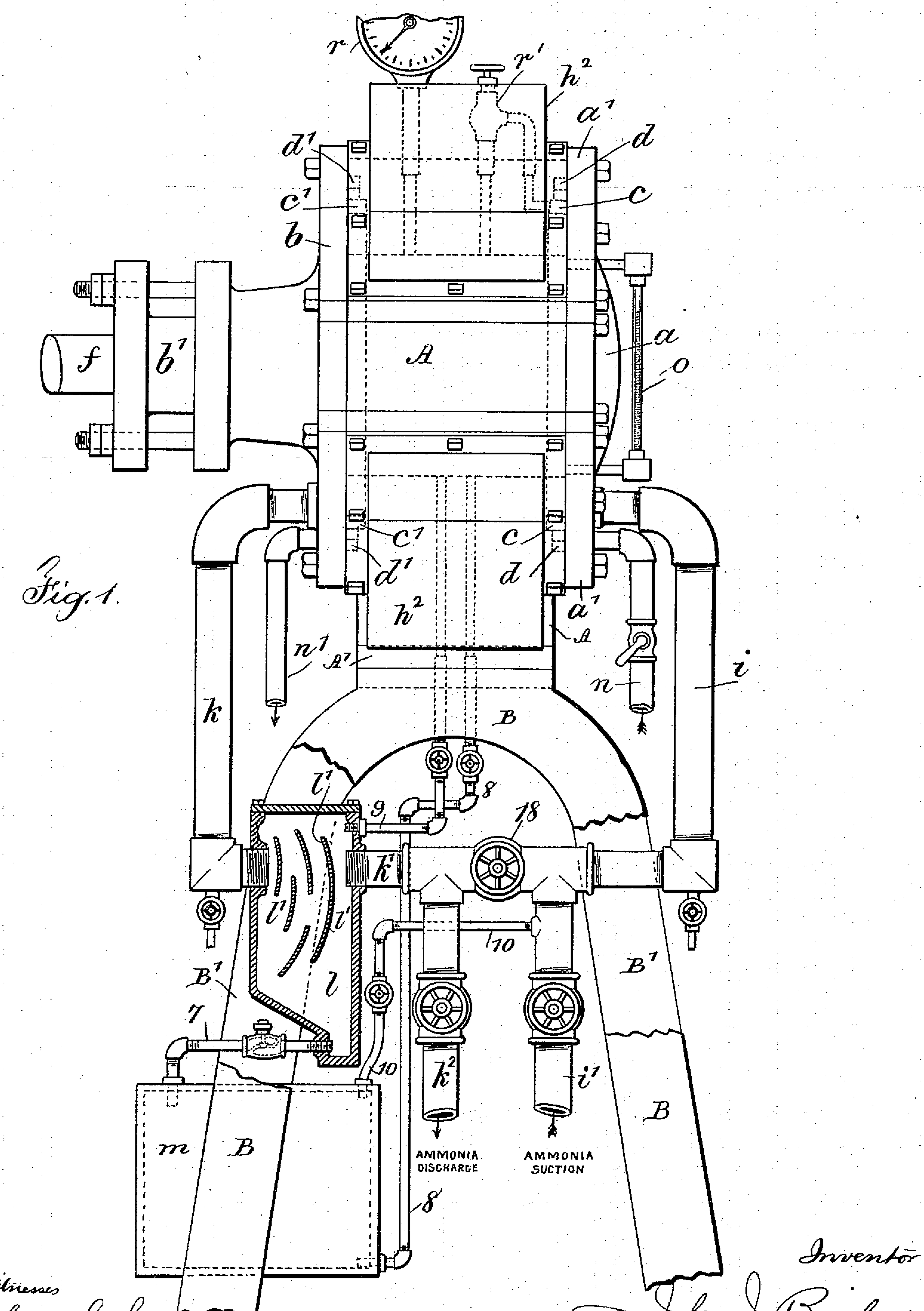
No. 612,226. Patented Oct. 11, 1898.

J. J. BAILEY.

AMMONIA GAS COMPRESSOR FOR ICE MACHINES.

(Application filed Aug. 27, 1896. Renewed Nov. 23, 1897.)

(No Model.) 3 Sheets—Sheet 1.



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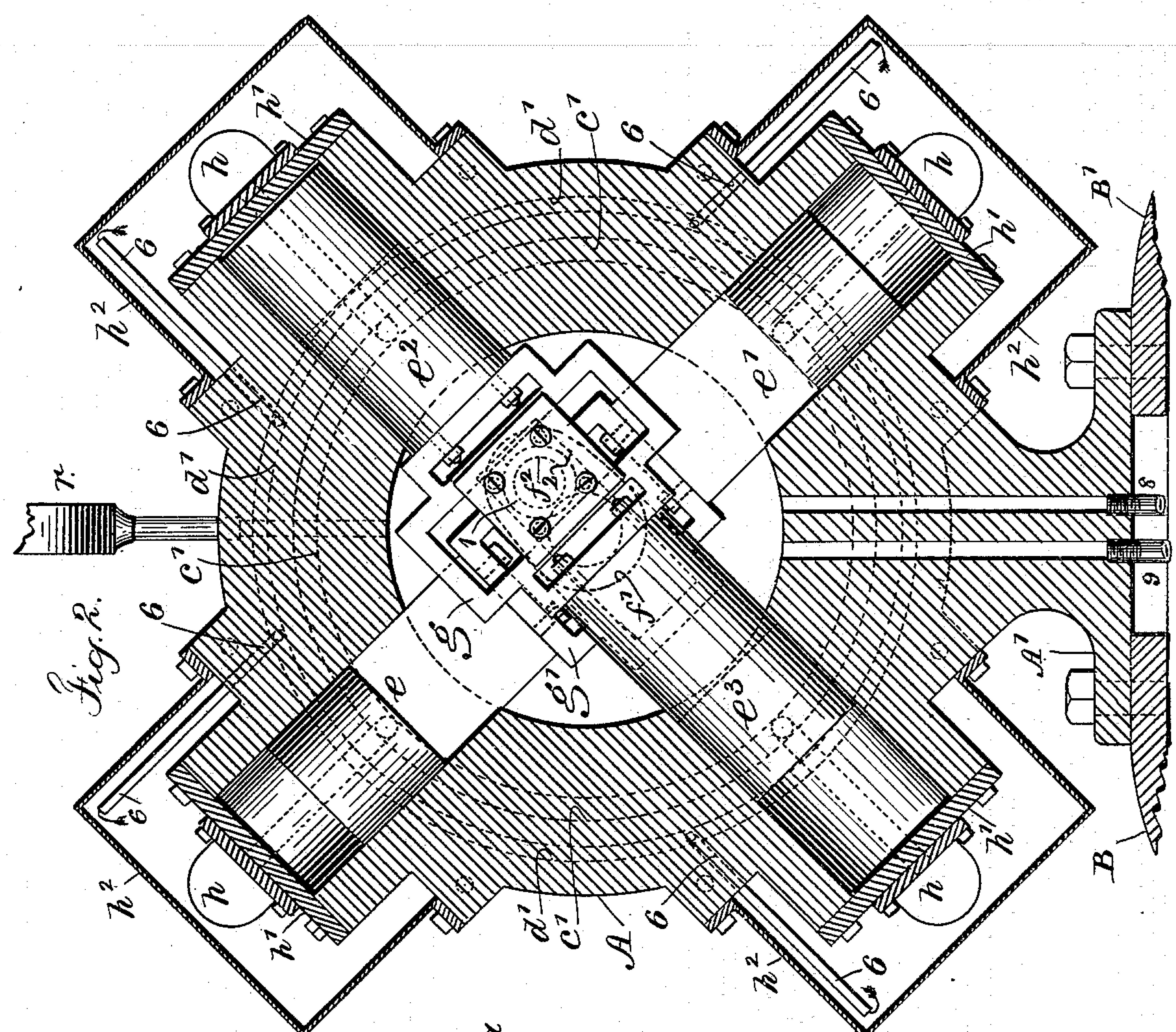

Fig. 2.

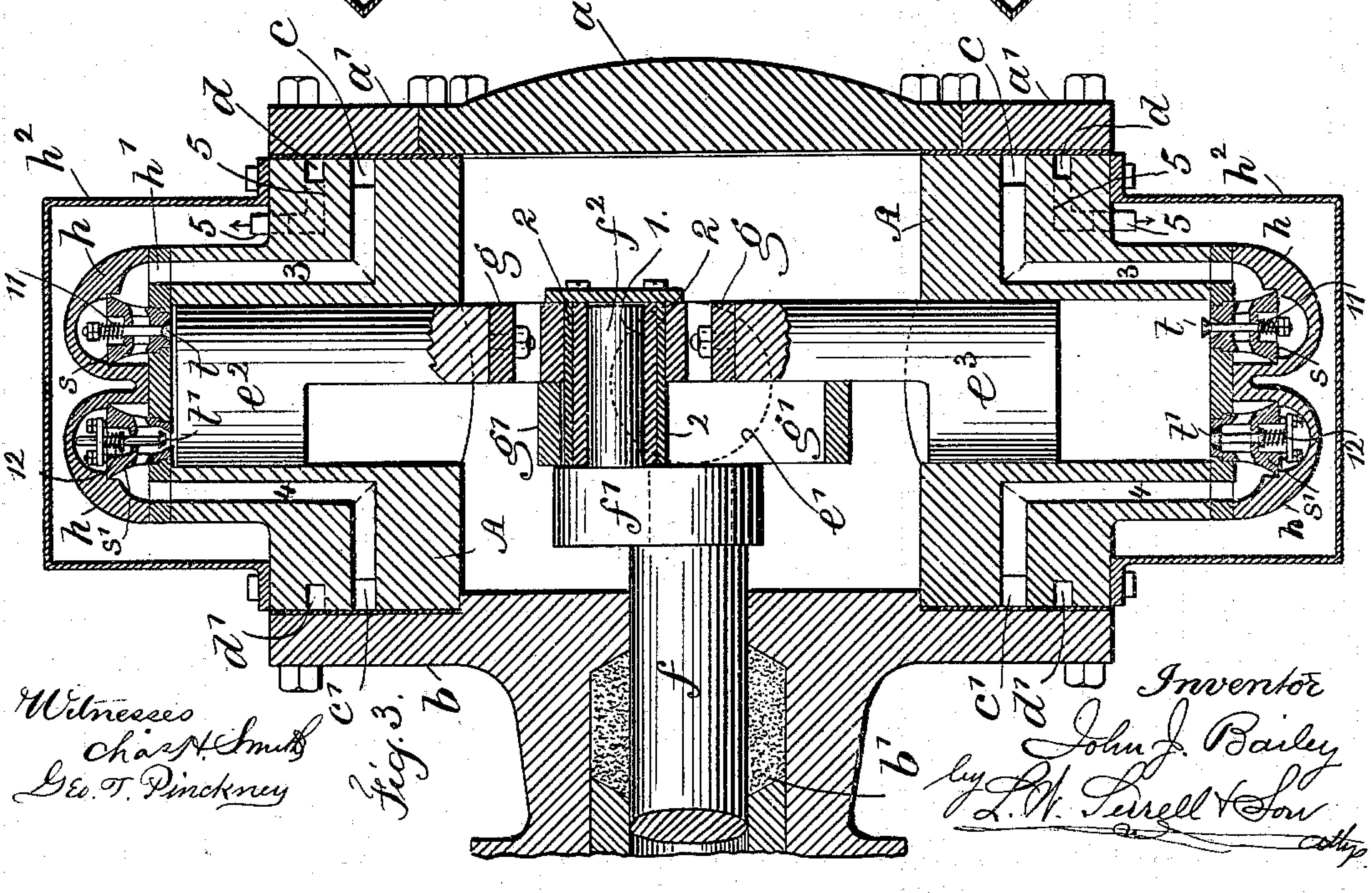

Fig. 3.

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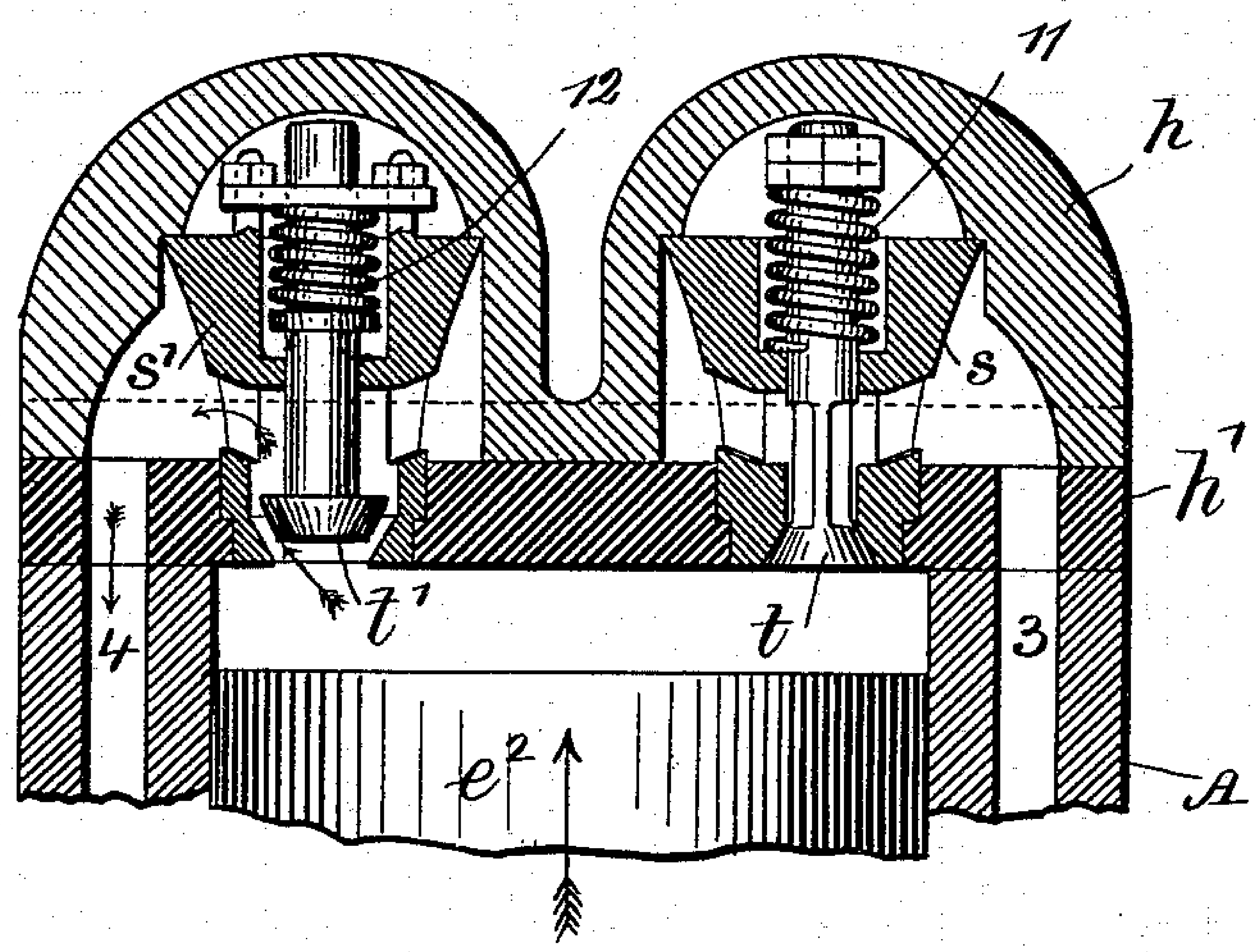
Fig. 4.



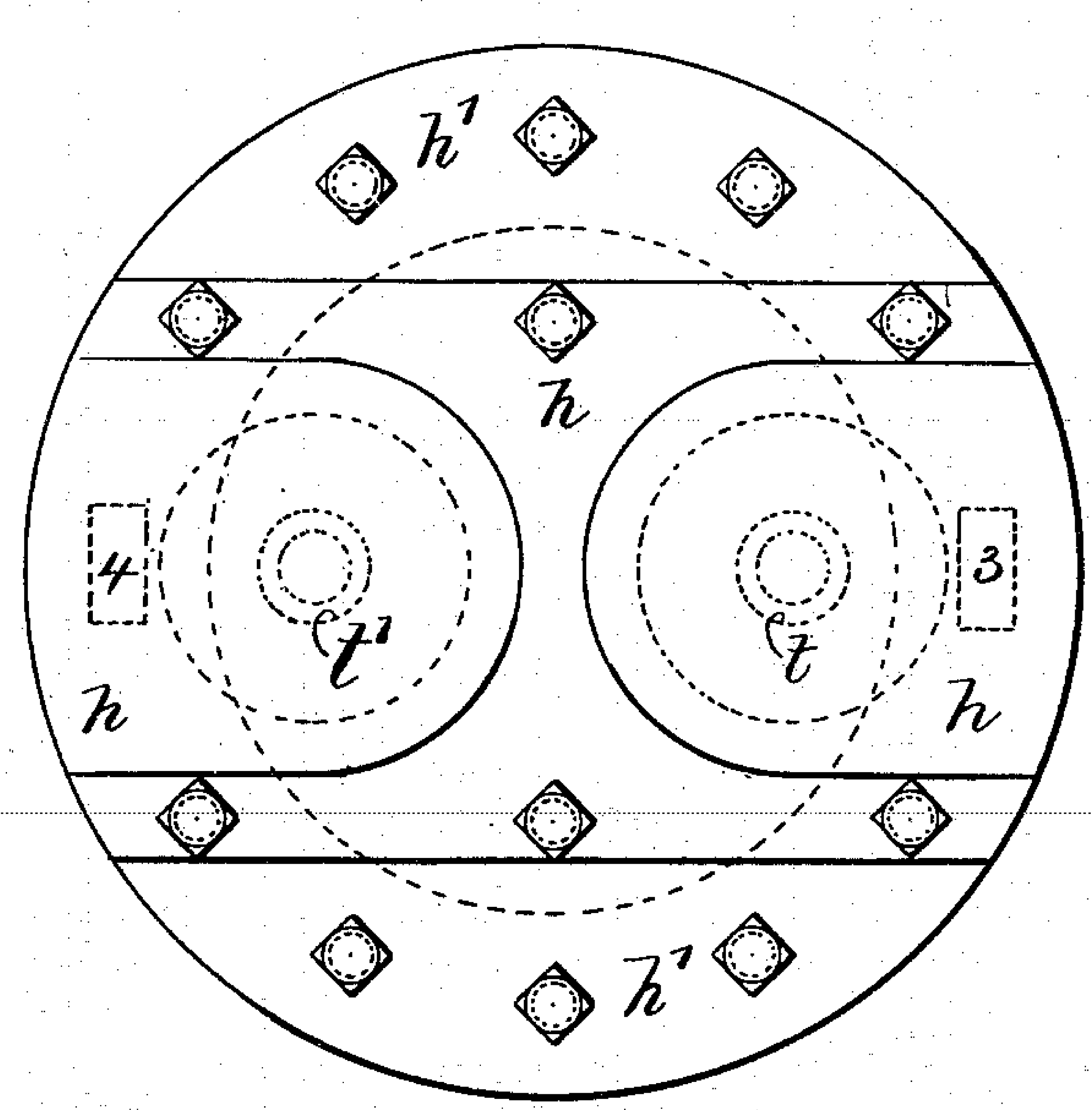


Fig. 5.

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UNITED STATES PATENT OFFICE.

JOHN J. BAILEY, OF NEW YORK, N. Y.

AMMONIA-GAS COMPRESSOR FOR ICE-MACHINES.

SPECIFICATION forming part of Letters Patent No. 612,226, dated October 11, 1898.

Application filed August 27, 1896. Renewed November 23, 1897. Serial No. 659,633. (No model.)

To all whom it may concern:

Be it known that I, JOHN J. BAILEY, a citizen of the United States, residing at New York, in the county and State of New York, have invented an Improvement in Ammonia-Gas Compressors for Ice-Machines, of which the following is a specification.

Ammonia-gas compressors for ice-machines have usually been complicated, expensive, and of considerable dimensions, so much so that the average user has difficulty in operating the devices, especially small plants, that are liable to get out of order and cause trouble for lack of proper attention.

The object of my invention is to provide a device that is simple, compact, and comparatively inexpensive and that does not require much skill to operate and keep in order.

In carrying out my invention I employ a body having four cylinders and pistons at right angles to each other and operating progressively, and there are annular passages in opposite sides of the body and by-pass connections therefrom to valve-chambers at the outer ends of the piston-cylinders, which annular passages and by-pass connections provide for the inlet and outlet of the anhydrous ammonia from the pipes of a cooling system where the ammonia has been employed or from the condenser where the anhydrous ammonia is under pressure and liquefied preparatory to its reuse. There are other annular passages and by-pass connections for the inlet and outlet of water for cooling the piston cylinders and valves during the action of compressing the ammonia-gas, and I provide for the inlet and outlet of oil to the chamber within the body, so that the pistons and the crank and other devices for operating said pistons are continually surrounded by oil. I also provide for indicating the pressure and for relieving the same, so that the machine may not be under pressure over night, and the oil is also separated from the compressed ammonia-gas before the gas passes to the condensers.

In the drawings, Figure 1 is an elevation and partial section illustrating my improved apparatus. Fig. 2 is a cross-section through the body of the machine, showing the pistons and actuating devices. Fig. 3 is a longitudinal section through two opposite cylinders and their valves. Fig. 4 is a longitudinal section in larger size of the end of one cylinder, showing the valves and the valve-case; and Fig. 5 is a plan of the valve-case shown in Fig. 4.

The body A of the machine is approximately cylindrical and provided with a foot-piece A', that is securely fastened to the supporting-legs B B'. This body A has a central chamber and is provided with four cylinders at right angles to each other. The legs of the machine are to rest on any suitable foundation. Upon one side of the body A are the heads *a a'*, composed of the disk *a* and ring *a'*. By removing the disk *a* access is given to the open center of the body A, and access is given to the annular passages by removing the ring *a'*.

Upon the other side of the body A is the head *b* and packing-gland *b'*, through which head and gland the shaft *f* passes. On the inner end of the shaft *f* is the crank *f'* and crank-pin f^2. Two double yokes *g g'* are employed, and the same are oppositely placed. To one yoke the pistons *e e'* are connected, and to the other yoke the pistons e^2 e^3 are connected. Each piston, where it passes into the cylinder, is round and fits such cylinder closely. The other portion of the piston is a half-cylinder, and, as seen in Figs. 2 and 3, the flat surfaces of the pistons are toward each other, and the two yokes are coupled to opposite pistons and occupy only the space in width of the circular pistons. This accomplishes the twofold object of economizing space and effecting a direct and even thrust upon the pistons by the crank and crank-pin as the shaft *f* is rotated, the pistons being balanced and connected in pairs. These yokes are slotted, as represented in Figs. 2 and 3, and the ends of the pistons are bolted to such yokes, and around the crank-pin is a sleeve 1, within a slide-block 2, that is in the slots of the yokes *g g'*, and this block receives motion from the crank-pin.

It will be seen that the pistons act progressively and compress and force out the gas from one cylinder and then from the next, and one piston is drawn back as its mate is projected, and the resistance to the rotation of the shaft *f* is almost uniform. Suitable power is applied to the shaft *f*.

In one side of the body A are passages c d, preferably annular, and in the other side are similar passages c' d'. From the passages c c' extend ports or by-passes 3 4, and from the passages d d' extend by-passes 5 6. The by-passes 3 and 4 are shown in Figs. 3 and 4 and extend through the seat-plates h' into the valve-cases h. These seat-plates and cases are at the outer ends of each piston-cylinder, and while there is the annular passage c on one side of the body and c' on the other side there are four by-passes 3 and four by-passes 4.

The pipe i upon one side of the machine is connected to the head a' and opens into the annular passage c, and to the pipe i is connected a pipe i', in which is a stop-valve, Fig. 1. These pipes are for the ammonia of the ice-machine.

To the head b is connected a pipe k, which opens from the annular passage c'. This pipe receives and conveys away the compressed ammonia from the piston-cylinders.

Over each valve-case h is a cover h^2, and within these covers h^2 are the ports or by-passes 5 and 6 from the passages d d', and a pipe n, connected with the head a' on one side of the machine, conveys water to the annular passage d and by-passes 5, which water flows into the space within the cover h^2 and then passes away by the ports 6, annular passages d', and the pipe n', which pipe n' leads from the passage d' and conveys the water away. The by-pass 5 is of larger area than the by-pass 6, and the by-pass 5 opens near the body of the machine, and the by-pass 6 is continued as a pipe to near the inner surface of the cover h^2, the object of this construction being to keep the covers h^2 always full of circulating water.

The ammonia-discharge pipe k opens into an oil-trap l, in which are deflectors or separators l', consisting of curved staggered plates, and from the other side of the oil-trap l is a pipe k' and a pipe k^2, having a stop-valve for leading the ammonia to the condenser. In the pipe, between the pipes i' and k^2, is a valve 18, hereinafter more particularly described.

I employ an oil-reservoir at m and a pipe 7 from the top of said reservoir, having a check-valve and entering the oil-trap l, and a pipe 8 from the bottom of said reservoir extends up and enters the bottom of the body A of the machine at a passage that extends through said body, and from a companion passage through the body of the machine an oil-pipe 9 extends to the top of the oil-trap l, and a discharge-pipe 10 extends from the top of the oil-reservoir m to the pipe i'.

The oil-gage o is employed to indicate the height of the oil in the body of the machine. The pressure-gage r and delivery-valve r' are employed upon top of the machine, with passages extending through the body A. The delivery-valve r' has a branch and an opening therefrom through the body of the machine connecting with the passage c.

The seats for the valves at the outer ends of the piston-cylinders are alike and are shown in larger size in Fig. 4. They are in the detachable valve-blocks s s' and have openings for the valve-stems and lateral openings for the anhydrous ammonia, and one valve closes outwardly and the other on its seat, so as to provide for the inlet and exit of the anhydrous ammonia, and there are springs 11 and 12 to the valves.

The operation of the machine is substantially as follows, the pistons acting progressively by the movement of the shaft, crank, and crank-pin, as aforesaid: The ammonia is drawn from the system of pipes of the ice-making machine through the suction-pipes i i' into the annular passage c and therefrom into the cylinders successively through the valve-blocks s, past the valves t, and the ammonia is compressed in the cylinders by the pistons in their movements and passes by the valves t', through the valve-block s' and by-passes 4, into the annular passage c' and away by the pipe k into the oil-trap l. In these operations a small portion of oil within the center of the body of the machine may pass along with the anhydrous ammonia and come into the oil-trap; but the deflector or separator plates l' catch the oil and the compressed anhydrous ammonia passes out of the oil-trap by the pipes k' k^2 to the condenser and is afterward employed in the usual manner in ice-making. The oil in the oil-trap l passes by the pipe 7, past the check-valve therein, into the oil-reservoir m, in which there is a pressure of anhydrous ammonia that is equal to that in the oil-trap, the check-valve preventing the return of either oil or anhydrous ammonia. The oil is forced from the reservoir m by the pipe 8 into the body of the machine, so that the mechanism is always lubricated. Oil from the body of the machine can pass or be caused to pass through the pipe 9 into the oil-trap, and so back into the reservoir. The oil is also employed as the most acceptable packing to keep all but a small part of the ammonia out of the body of the machine. Water is caused to flow through the pipe n, annular passage d, and by-passes 5 into the spaces beneath the covers h^2 and circulates around the valve-cases and the ends of the cylinders to keep the same cool, and it passes away by the by-pass pipes and passages 6 to the annular passage d' and therefrom by the pipe n' away from the machine, so that a constant current of water to cool the parts can be maintained.

In the operation of the machine there may be a pressure of anhydrous ammonia within the chamber in the body A over the oil that may approximate the pressure of the gas as compressed by the pistons, the gas escaping between the pistons and cylinders. This pressure is indicated at the gage r, and should this ammonia be left in the machine over night the same will have a tendency to drive the oil out of the machine. The delivery-valve at r' when open permits this compressed gas to escape into the annular passage c on the suction side of the apparatus where the pressure is merely nominal. The objects of the valve 18 and the valve in the discharge-pipe 10 are similar—namely, to prevent the expansion of the gas causing any damage to the machine during the night, because when the valve at 18 is open the gas that may remain in the machine in the pipe k or in the oil-tank l can expand into the suction side, and when the valve in the pipe 10 is open the compressed gas in the oil-reservoir can also expand into the suction where no harm will result. The valves r' and 18 in the pipe 10 are to be closed in the morning when starting the machine, and the ammonia is drawn into the cylinders and compressed, as hereinbefore stated, so that no gas is lost or escapes.

I claim as my invention—

1. In an ammonia-gas compressor, the combination with the body A having an open center and four cylinders and pistons at right angles to each other and in the same plane, of pistons and valves in the entrance and exit passages, a shaft and crank connected therewith, and a crank-pin, the slotted yokes g and g', the slide-block around the crank-pin and moving in said yokes, the inner ends of the pistons being half-cylinders and connected by the yokes in pairs so that the space occupied by the two yokes is equal to the width of the pistons and the pistons are in the one plane and operate progressively, substantially as set forth.

2. In an ammonia-gas compressor, the body A having an open center and cylinders and the passages c and d in one side of the body and passages c' and d' in the other side of the body, the by-passes 3 4 extending outward from the annular passages c c' the by-passes 5 6 extending outward from the annular passages d d', the annular passages c c' and their by-passes serving as inlet and exit passages for the anhydrous ammonia, and the annular passages d d' and by-passes 5 6 serving for inlet and outlet passages for cooling-water, in combination with the valves, the pistons and mechanism for actuating such pistons, substantially as set forth.

3. In an ammonia-gas compressor, the body A having an open center and cylinders and passages c and d in one side of the body and the annular passages c' and d' in the other side of the body, the by-passes 3 4 extending outward from the annular passages c c', the by-passes 5 6 extending outward from the annular passages d d', the annular passages c c' and their by-passes serving as inlet and exit passages for the anhydrous ammonia, and the annular passages d d' and by-passes 5 6 serving for inlet and outlet passages for cooling-water in combination with the valve-cases h and seat-plates h' at the respective ends of the cylinders, valve-blocks and valves within said cases closing in opposite directions, and covers h^2 over said valve-cases forming receptacles for the cooling-water, the pistons and mechanism for actuating the same, substantially as set forth.

4. In an ammonia-gas compressor the body A having an open center and cylinders and passages c and d in one side of the body and the annular passages c' and d' in the other side of the body, the by-passes 3 4 extending outward from the annular passages c c', the by-passes 5 6 extending outward from the annular passages d d', the annular passages c c' and their by-passes serving as inlet and exit passages for the anhydrous ammonia, and the annular passages d d' and by-passes 5 6 serving for inlet and outlet passages for cooling-water in combination with the valve-cases h and seat-plates h' at the respective ends of the cylinders, and covers h^2 over said valve-cases forming receptacles for the cooling-water, the ammonia suction-pipe i communicating with the annular passage c and the pipe i' for conveying ammonia into the machine, the pipe k for the delivery from the machine of the compressed ammonia, the pipe n communicating with the annular passage d for admitting cooling-water into the machine, and the pipe n' for conveying away the water, the pistons and mechanism for actuating the same, substantially as set forth.

5. In an ammonia-gas compressor, the combination with the body A having an open center and passages therethrough, of the oil-trap l and the oil-reservoir m, a pipe 7 having a check-valve connecting the oil-trap and oil-reservoir, a pipe 8 from the bottom of the oil-reservoir to one of the passages through the body of the machine, a pipe 9 from the oil-trap and a pipe 10 having a valve and extending from the top of the oil-reservoir and opening into the ammonia suction-pipe i', substantially as and for the purposes set forth.

Signed by me this 13th day of August, 1896.

JOHN J. BAILEY.

Witnesses:
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