

No. 634,335.

Patented Oct. 3. 1899.

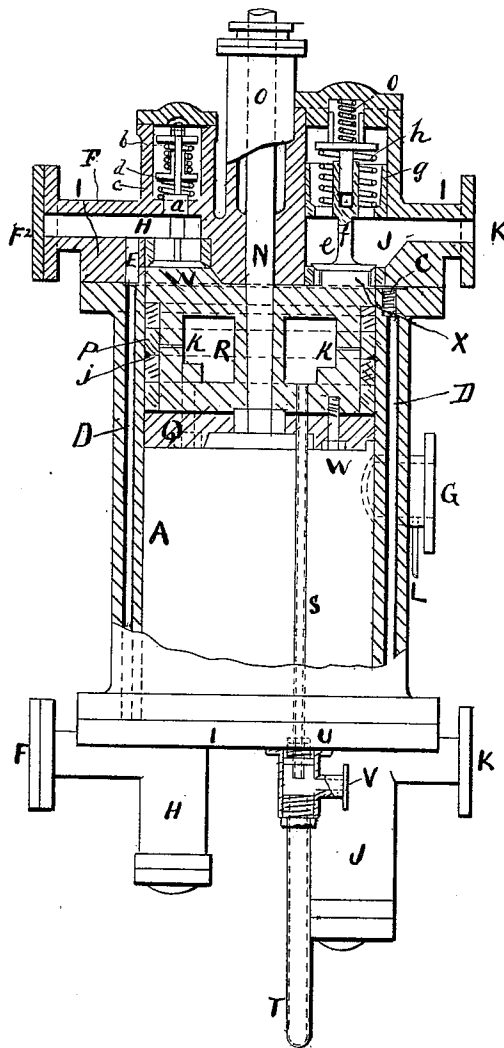
A. GLASSON.
APPARATUS FOR ICE MAKING; &c.

(Application filed Dec. 29, 1897.)

(No Model.)

2 Sheets—Sheet 1.

Fig. 1



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2 Sheets—Sheet 2.

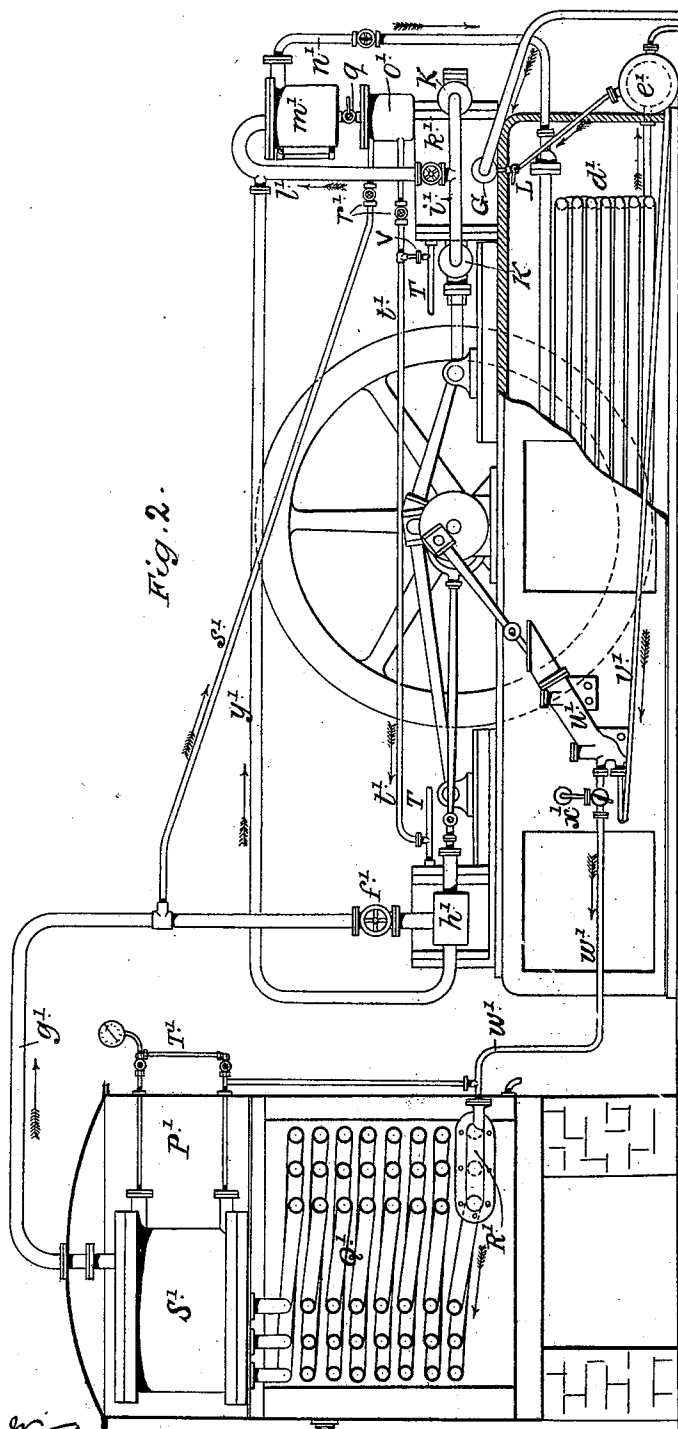


Fig. 2.

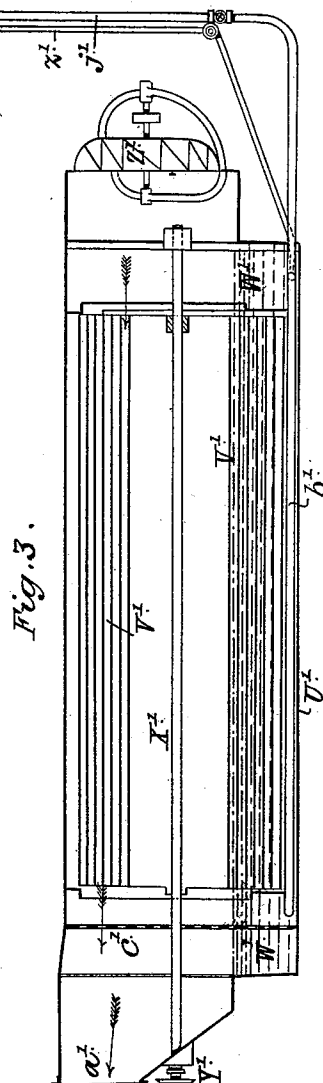


Fig. 3.

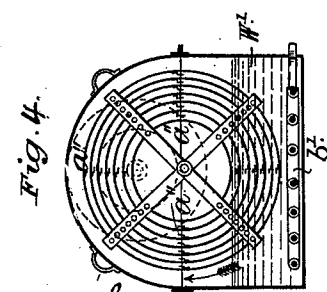


Fig. 4.

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UNITED STATES PATENT OFFICE.

ALFRED GLASSON, OF LONDON, ENGLAND, ASSIGNOR OF TWO-THIRDS TO
CHARLES EGERTON FORBES MILMAN MAINWARING, OF SAME PLACE.

APPARATUS FOR ICE-MAKING, &c.

SPECIFICATION forming part of Letters Patent No. 634,335, dated October 3, 1899.

Application filed December 29, 1897. Serial No. 664,339. (No model.)

To all whom it may concern:

Be it known that I, ALFRED GLASSON, a subject of the Queen of England, residing at Dulwich, London, in the county of Surrey, England, have invented a certain new and Improved Apparatus for Ice-Making and Refrigerating, (for which I have obtained Letters Patent in Great Britain, No. 21,509, dated November 8, 1894,) of which the following is a specification.

My apparatus is a refrigerating-machine using any high-tension condensible gas—such as sulfurous acid, anhydrous ammonia, or carbonic anhydrid.

A special feature of this apparatus is that a portion of the refrigerating agent employed in the machine is raised to a higher temperature and pressure and utilized in driving the machine without the aid of a steam-engine or a steam-boiler and by the most simple form of heat transmission of low intensity. Any substance with a temperature not lower than 150° Fahrenheit will work the apparatus.

For a particular and detailed description of my apparatus I refer to the accompanying drawings.

Figure 1 shows a longitudinal elevation, partly in section, of the gas-pump wherewith the refrigerating agent is compressed. Fig. 2 is an elevation of the complete apparatus with two parts in section. Fig. 3 shows a longitudinal section through my improved air-cooler used with the machine. Fig. 4 is a cross-section through the same.

The compression-pump I make of the form and arrangement shown in Fig. 1. This is a double-acting pump and consists of a cylindrical barrel A, made of a hard-metal liner fixed inside a cast-iron cylinder B by means of set-studs C. This arrangement forms a hollow space D, which completely surrounds the barrel, so forming a jacket to the pump, as shown. At each end of the barrel A, with its casing B, are bolted on the top and bottom covers I. These covers are each provided with a flange-neck F, having a passage-way to the suction-valve H. The ends of these branches are closed by plates, as shown at F². The opposite side of these branches are

similar flange-necks K on both top and bottom covers of the pump. They are provided with passage-ways through them to each delivery-valve J. These outlets K at the top and bottom of the pump I connect together into one main delivery-pipe by any suitable means similar to that shown at k', Fig. 2.

The suction-inlet to the pump is at G, Fig. 1, which is a flange-neck projecting from the outside casing of the pump and having a passage-way through it into the hollow space or jacket around the barrel of the pump. This jacket is connected by a clear passage at both the top and the bottom ends of the pump into the flange branches F and so to the suction-valves H. This passage is shown for the top end of the pump at E. A similar one is made into the bottom flange-neck, and in all other details the construction of the valves on both top and bottom covers is identical. This arrangement of the suction-inlets forms a complete passage-way for the cold incoming vapor to pass right around the barrel of the pump inside the jacket and then through the suction-valves into the pump. It is thus possible to keep the barrel cool by means of the spent gas passing into the pump. In starting the machine it is sometimes necessary to cool the barrel of the pump by a direct injection of a small portion of liquefied ammonia into the jacket D, which vaporizing therein effects the desired object. For this purpose a small pipe connection L is made in the suction branch G.

The suction-valves H at the top and bottom of the pump I place in boxes in the end covers I, so that they come flat up against the ends of the pump, as shown. They are made with a guide-collar a, the spindle from which runs upward in the center of two springs b and c. These springs are of different strengths. The cushion-spring c is the strongest and acts as a buffer to the recoil-spring b, thus taking up easily and quietly any violent action of the suction-valve. The springs are kept apart by means of a sliding collar-flange d, as shown. The top and bottom delivery-valves J, I make exactly as shown. The valve-face fits into the seating e. The spindle of the valve is

projected upward and terminates in a guide *g*, which is cup-shaped and contains a recoil-spring *h*. This spring bears against a collar-flange *i*, at the back of which is placed a stronger cushion-spring *o*, which acts as a buffer to the movement of the recoil-spring *h*, thus preventing shock in the action of the valve.

A novel feature of this pump is the piston *M*, having a piston-rod *N* working through an improved stuffing-box *O*. The piston has four spring piston-rings *P*. These rings are turned true and ground together on their flat edges, so that when placed against one another they are gas-tight. The division, however, between the two center rings is beveled off to half its depth, as shown at *j*. These rings are kept in position and close against one another by the piston-cover *Q*, as shown.

A hollow space *R* is formed in the center of the piston, from which a series of openings or passages *k* lead to the space at the back of the piston-rings, as shown.

A small tube *S* is screwed into the piston and forms a connection into the hollow space *R*. This tube at its opposite end passes through the bottom cover *I* of the pump and into a small closed tube-case *T* through a small stuffing-box gland *U*. This tube *S* passes backward and forward inside the case *T* as the pump-piston reciprocates when at work. The object for which this tube is provided is to secure an efficient lubrication of the piston for a portion of oil at a somewhat higher pressure than the pressure inside the pump is forced through the inlet *V* and tube *S* into the hollow space *R* inside the piston and flowing out through the small holes *k* behind the piston-rings *P* forces its way through a small hole between the center rings into the beveled slot *j*, and so fills this slot all around the piston and most efficiently lubricates it. In fact, the piston runs on a ring of high-pressure oil, which also tends to keep the piston-rings tight and renders the escape of gas past the piston impossible.

The piston is also provided with a projecting strip *W* around both top and bottom faces, and these fit into corresponding recesses made in the top and bottom covers *I* whenever the piston is at the top or the bottom of its stroke. This arrangement makes it possible to bring the suction and delivery valves at each end of the cylinder flat against the strip *W*. The strip is cut away around the delivery-valve seating *e* at *X*. The arrangement of this strip prevents any clearance around the valves wherein gas might lodge.

The cylinder of the engine which drives the compression-pump is made of the same pattern as any ordinary steam-cylinder for high steam-pressures, with this exception: The piston-rings and the lubricator of the same I make similar to those used in the compression-pump hereinbefore described and illustrated.

The part of the apparatus in which I obtain

the energy sufficient to drive the machine I call the "generator" *P'*, Fig. 2. It consists of a cylindrical iron closed tank, provided inside with a number of serpentine coils *Q'*, connected together at their lower ends into a chamber *R'*, as shown. The outlets of these coils at the top are connected into a cylindrical iron vessel *S'*, which vessel is provided with a level-glass and pressure-gage, (shown at *T'*.)

For cooling the air to very low temperatures I use with my machine a long tank *U'*, Fig. 3, in which revolve horizontally a series of thin metal cylinders *V'*, one within the other, each separated by a very narrow space and also provided with channels *a''*, Fig. 4, running the whole length of the cylinders. The lower edge of each cylinder dips down into and passes through a layer of freezing brine *W'* as it revolves on the shaft *X'* by means of the small pulley *Y'*. A fan *Z'* is fixed at one end of the tank and forces the air to be cooled through and between the metal cylinders in the direction shown by the arrows and is delivered through the outlet *a'* at a very low temperature. A coil of pipes *b'* is placed along the bottom of the tank, into which the liquefied ammonia is allowed to expand, thus cooling the brine. A perforated iron baffle-plate *C'* is fixed at the outlet end, so as to prevent any spray from the brine passing out with the air. By this arrangement of metal cylinders I am enabled to obtain a large and cold surface in a moderate space to expose to a current of air, and as the cylinders revolve through the brine and the small channels *a''* take up a small portion of the freezing-brine, thus maintaining the whole surface very cold, the air is very rapidly cooled.

The manner in which I work the machine is as follows: After withdrawing all the air from it and taking the refrigerating agent to be employed to be anhydrous ammonia a full charge of this is placed in the condenser-coils *d'*, Fig. 2, which are coils of iron pipe placed inside the tank-base of the apparatus, as shown, and surrounded by cold water. The ammonia from the coils flows into the circular iron vessel *e'*, which is a storage-tank to retain a sufficient supply of the liquefied ammonia to work the machine. A small portion of the liquefied ammonia is placed in the coils *Q'* of the generator *P'*, Fig. 2, and is then heated and raised to a pressure of about two hundred and fifty pounds per square inch. This heat may be waste heat of any description—such as exhaust-steam, hot air, or hot water. The hot substance employed passes into the generator-tank and surrounds the outside of the coils. The pressure of two hundred and fifty pounds per square inch being maintained in the generator *P'* is sufficient to drive the machine. By opening the valve *f'* this high-pressure vapor passes along the pipe *g'* into the driving-cylinder *h'*, which immediately sets the machine in motion in the same way as an ordinary steam-engine, and thus actuates

compression-pump i' , Fig. 2. The machine is now working, and as long as the pressure in the generator is maintained at a higher pressure than that in the condenser-coils will continue to work, the ammonia-gas being drawn by the pump i' from the expansion-pipe coil b' in air-cooler, Fig. 3, through the pipe j' into the pump suction branch and then inside the jacket hereinbefore described, cooling the barrel of the pump as it passes along to the suction-valves. The ammonia-gas, being compressed in the pump to about one hundred and fifty pounds per square inch, passes through the delivery branch k' to the pipe l' , then into the top of a cylindrical vessel m' , called the "oil-rectifier." The oil used in lubricating the pump i' here separates from the ammonia-gas, which gas then passes along through the pipe n' into the condenser-coils d' , where it liquefies and passes to the receiver e' . A small cylindrical vessel o' , called the "oil-storage tank," is placed immediately below the oil-rectifier m' . This vessel o' is connected to the generator main vapor-pipe g' by a small pipe s' , as shown, and also by a pipe t' to each of the oil-lubricators T on the driving-cylinder h' and the compression-pump i' . This arrangement permits the full pressure of the generator to act against the oil in the oil-receiver o' , and so forces the oil into the lubricators and thus into the pistons, as hereinbefore described and illustrated. When the oil-rectifier m' is nearly full of oil, the valves r' being closed and the valve q' opened, the oil immediately flows out into the bottom vessel o' , after which, the valves being restored to the former position, the cycle of operations proceeds as before.

To maintain the continuous working of the machine, a double-acting feed-pump u' of any approved design is fixed at the side of the tank-base and driven off the main shaft, as shown. The suction of this pump is connected by a small pipe v' to the receiver e' , from which it draws a small portion of liquid ammonia and forces it through the delivery-pipe w' into the chamber R' at the bottom of the coils Q' . This quantity is regulated to the exact amount required for the continuous working of the apparatus by means of the by-pass regulating-valve at x' . This small portion of ammonia continues evaporating at the higher pressure inside the coils Q' , thus producing a sufficient quantity of vapor to drive the cylinder h' continuously. The by-pass valve x' may be a three-way cock regulated by hand, so that, if necessary, a portion of the liquid delivered into it by the pump could be returned through a pipe leading from one of its ways to the condensing-coil and so back to the receiver, while a greater or less quantity, as desired, would pass on into the generator through the pipe w' . As shown in Fig. 2, a branch pipe from the valve x' leads through the wall of the base-tank, and this branch is connected to the coil inside the tank. The vapor passes away from the driving-cyl-

inder at the pressure of the condenser through the exhaust-pipe y' , and so into the delivery-pipe l' from the compression-pump i' , and then to the condenser in one continuous cycle. The liquefied anhydrous ammonia is allowed to pass along the pipe x' into the pipe-coil b' in the bottom of the air-cooler U' , Fig. 3, where, expanding at a lower pressure, it cools the brine W' to a very low temperature, which cooling the metal cylinders abstracts the heat from the air passing along them, as before described. A small pipe and valve L , Fig. 2, are provided for injecting a fine spray of liquefied ammonia from the receiver e' into the suction of pump, if required, for cooling the same.

The direction of the flow of vapor and liquid in the various pipes is shown by arrows marked on Fig. 2.

I claim—

1. In a refrigerating apparatus, the combination of a compressor, means for operating the same, a condenser-coil communicating with the delivery-passage of the compressor, an air-cooler, an expansion-coil within the cooler, a receiver and connections between the receiver, the condensing-coil and expansion-coil, said receiver also communicating with the compressor, substantially as described.

2. In a refrigerating apparatus, the combination of a vapor-generator, an engine communicating with the generator and adapted to be driven by vapor therefrom, a compressor connected to be operated from the engine, a condensing-coil, an air-cooler, an expansion-coil within the cooler, a receiver, connections between the condenser-coil and the delivery-passage of the compressor, connections between the expansion-coil and the inlet-passage of the compressor and communicating passages between the receiver and the generator, and the expansion and condenser coils respectively, substantially as described.

3. In a refrigerating apparatus, the combination of a vapor-generator, an engine communicating with the generator and adapted to be driven by vapor therefrom, a compressor connected to be operated from the engine, a condensing-coil, an air-cooler, an expansion-coil within the cooler, a receiver, connections between the condenser-coil and the delivery-passage of the compressor, connections between the expansion-coil and the inlet-passage of the compressor, connections between the receiver and the generator, a pump interposed in the last-named connections, and a by-pass valve in said connections between the pump and the generator, substantially as and for the purpose set forth.

4. In a refrigerating apparatus, the combination of a compressor, an engine for operating the same, a condenser-coil communicating with the delivery-passage of the compressor, an air-cooler, an expansion-coil within the cooler, a receiver, connections be-

2
tween the receiver, the condensing-coil and
the expansion-coil, said receiver also com-
municating with the compressor, and means
to lubricate the pistons of the engine and
5 compressor, substantially as and for the pur-
pose set forth.

In testimony whereof I have hereto set my

hand in the presence of the two subscribing
witnesses.

ALFRED GLASSON.

Witnesses:

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HARRY B. BRIDGE.