A. T. BALLANTINE.

ICE-MACHINE.

No. 191,638. Patented June 5, 1877.

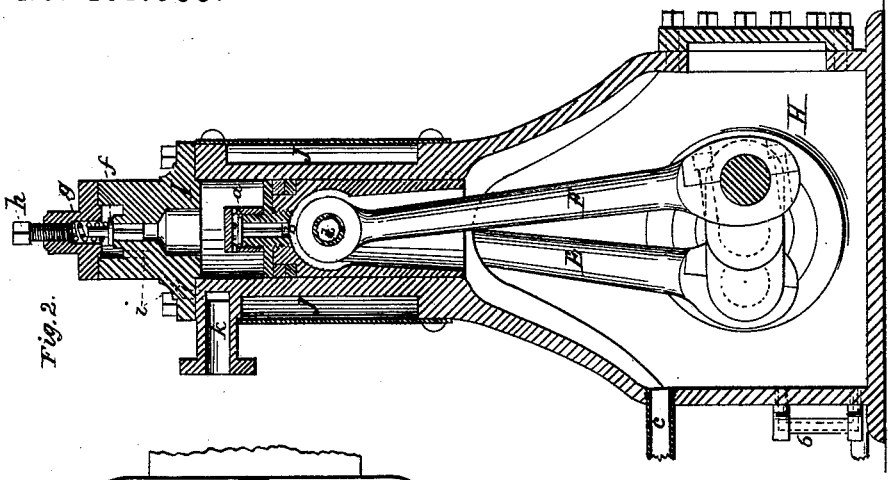

Fig. 2.

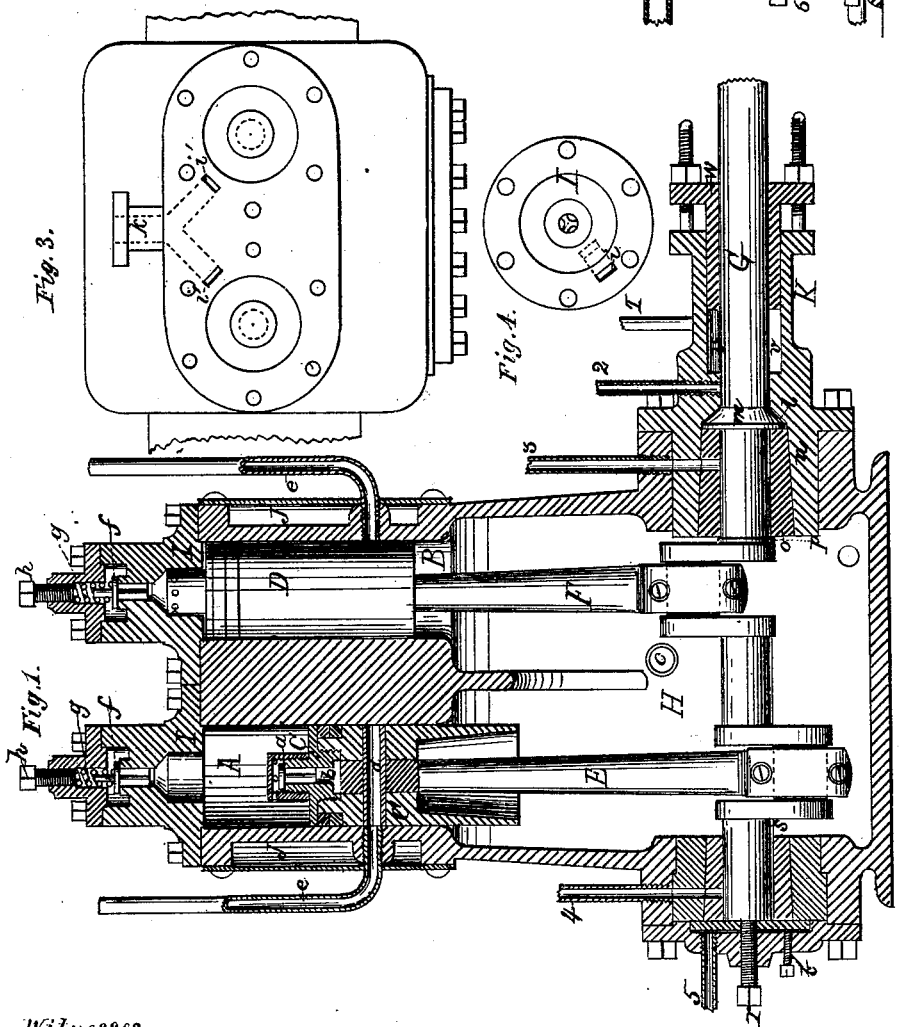

Fig. 3.

Fig. 4.

Fig. 1.

Witnesses.

E. Baldwin

A. W. Keller

Inventor.

Alexander T. Ballantine

UNITED STATES PATENT OFFICE.

ALEXANDER T. BALLANTINE, OF NEW YORK, N. Y., ASSIGNOR TO UNITED STATES ICE AND REFRIGERATING COMPANY, OF NEW YORK CITY.

IMPROVEMENT IN ICE-MACHINES.

Specification forming part of Letters Patent No. **191,638**, dated June 5, 1877; application filed May 28, 1877.

To all whom it may concern:

Be it known that I, ALEXANDER T. BALLANTINE, of the city of New York, in the county of New York and State of New York, have invented certain new and useful Improvements in Machinery for Freezing, Cooling, and Refrigerating; and I do hereby declare that the following is a full, clear, and exact description thereof, which will enable others skilled in the art to which it appertains to make and use the same, reference being had to the accompanying drawings, and to the letters of reference marked thereon, which form a part of this specification.

This invention, while designed with special reference to the needs of the system of refrigerating and freezing described in Letters Patent No. 85,719, granted January 5, 1869, to Charles Tellier, is applicable to any and all ice or refrigerating machinery in which ether, ammonia, or other refrigerant agent is forced, or caused to travel from one point to another in the machine, by means of a pump—as, for instance, in the Tellier machine, where the pump is used to force the refrigerant into a condenser.

Taking the Tellier machine as an illustration, it has been found almost, if not, indeed, quite impossible to prevent the gas from leaking from the pump at the point where the piston-rod works through the head of the pump-cylinder. The defect has been to some extent cured by packing the rod very tightly; but the leakage, although diminished, still exists, while the machine, owing to the tight packing, becomes so difficult to put in motion as to require for its operation an engine of very much greater horse-power than otherwise would be needed.

The same defect—noticed in the Tellier machine by way of example—is found in other ice-making and cooling machines in which a pump is used to force along the refrigerant agent.

Now, my invention is directed to the remedying of the defect above noted; and its object is to completely prevent leakage, without at all necessitating an increase of the power needed to run the machine.

To this end I combine the pump-cylinder, its piston and piston-rod with a chamber for the gas or refrigerating agent, in such a manner that the piston-rod works and is contained within this chamber, which is closed to the atmosphere. Under this arrangement it becomes quite immaterial whether there is any leakage or not, for if any gas leaks from the piston-rod end of the cylinder it does not pass to the open air to impregnate the atmosphere; nor is it lost, but it is received in the gas-chamber in which the piston rod works, and is there held securely.

This chamber may or may not be the source from which the pump draws the supply of gas to be forced forward. In case it is not, then the pump will take the gas from another source, while the chamber will receive and retain the leakage. The material thus gathered can, if desired, from time to time, be conducted back to the main body of the refrigerating agent.

I prefer, however, to make the chamber at the same time the source from which the pump draws its supply. I join the chamber to the piston-rod end of the pump-cylinder, and have this end of the cylinder free from any head, and opening directly into the chamber, so that the gas from the chamber will pass directly to the pump-piston, which, as usual, is provided with a valve opening when the piston moves in one direction, and closing when it moves in the opposite direction.

In order to operate the piston-rod, it, of course, becomes necessary to have some communication with the exterior of the inclosing-chamber. This I provide for by means of a driving-shaft extending inside the chamber, and there provided with crank or eccentric, connected with and adapted to give the necessary throw to the piston-rod. The shaft, at the point or points where it leaves the chamber, passes through tightly-fitting bearings, which can be made so as to effectually prevent escape of gas therethrough. The shaft having a rotary movement only, there is little liability of leakage, and the bearings can be made and fitted so as to entirely remove that liability.

The nature of my invention, and the manner in which the same is or may be carried into effect, will be understood by reference to the accompanying drawings, in which—

Figure 1 is a longitudinal vertical central sectional elevation of so much of a machine for freezing, cooling, and refrigerating as necessary to illustrate my invention. Fig. 2 is a vertical central section of the same, on the line *x y*, Fig. 1. Fig. 3 is a plan of the apparatus with the pump-cylinder heads removed. Fig. 4 is a view of the under side of one of the cylinder-heads.

In the apparatus shown in the drawing there are two pump-cylinders, A and B, each having its own piston C D and piston-rod E F. Each piston-rod has its own crank-connection with a driving-shaft, G, the cranks being so placed that the two pumps operate alternately. In each piston C D is a valve, *a*, which opens as the piston descends, and closes when the piston rises. The valve controls a passage, *b*, in the piston that is in communication through the open end of the cylinder with the chamber H, which is closed to the atmosphere, and receives, through a pipe, *c*, the gas to be forced to the condenser. To avoid joints, the chamber is preferably cast in one piece with the pump cylinder or cylinders.

Each piston-rod is, at one end, jointed to its crank, and at the other end is hung on a journal or cross-pin, *d*, in the hollow lower part of the piston, which journal or pin may be tubular, as shown in Fig. 1, with one of its open ends registering at certain times during the reciprocation of the piston with a tube or duct, *e*, through which oil or other lubricating material may be supplied under pressure, so as to lubricate the piston and cylinder. The tubular journal *d* for this purpose extends through the piston from side to side.

The valve *a* of each piston is carried in a head, C′, fixed to one end of the piston, and covered by a perforated screw-cap, which screws onto the head over the valve.

To each cylinder is applied a head, I, which contains the second valve *f* of the pump. This valve opens to allow the contents of the cylinder to pass out through it when the piston rises, and closes to prevent back-flow of the gas into the cylinder when the piston descends. It is aided in this latter action by a pressure-spring, *g*, whose pressure on the valve is regulated by a set-screw, *h*, in the cylinder-head.

The gas passing up through the valve *f* escapes through a channel, *i*, which (as indicated in dotted lines in Fig. 2) extends downwardly through the cylinder-head, and there meets a like channel, *i′*, in the wall of the cylinder leading to the pipe *k*. The two channels from the two pumps converge toward and meet in this pipe *k*, as indicated by dotted lines in Fig. 3, and the pipe *k* conveys the gas to the condenser or other receptacle into which it is to be gathered.

Under the arrangement herein described it will be noted that the piston-rods are contained and work within a chamber which is closed, and therefore receives and retains whatever fluid may leak through the piston-rod end of the pump. I am, therefore, enabled to dispense with any close packing or stuffing box arrangement for the piston-rod. Indeed, I can, as shown, dispense entirely with a head at this end of the cylinder, and joint the piston-rod directly to the crank at one end, and to the piston at the other.

The cylinders are surrounded preferably by a water-jacket, J.

In order to rotate the driving-shaft G, communication must be had with the outside of the chamber H. For this purpose the shaft, at one end, extends through the walls of the chamber, and is put in communication with any suitable source of power, by means of which rotary movement can be imparted to it.

There is considerable pressure within the chamber H when, as in the present instance, that chamber is used as the reservoir or receiver from which the pump takes its supply. It becomes therefore necessary to make and arrange the shaft-bearings so that there will be no liability to leakage through those bearings. An arrangement for this purpose is shown in the drawings. At the end where the shaft passes out from the chamber there is fitted in the walls of the chamber an elongated box, K, formed with a conical seat, *l*, to receive a conical journal, *m*, on the shaft, and also with a tapering socket, *n*, to receive a tapering longitudinally-split bearing-sleeve, *o*, that is seated in the socket, and fits the shaft, and can be set up in its socket, so as to take up wear. A shoulder, *p*, on the shaft bears against the end of the split sleeve. Thus, in case of wear, a slight endwise movement of the shaft will have the effect of pressing the shoulder *p* against the sleeve, setting the latter up into its socket, and causing it to close around and accurately fit the shaft, while at the same time the conical journal *m* is also set up against its seat *l*.

The needed movement of the shaft for this purpose can be effected by means of a set-screw, *r*, which extends from the outside through the walls of the chamber, and bears against the end of the shaft, as shown on the left in Fig. 1. The shaft at this end is also supported in a split conical or tapering bearing-sleeve, *s*, that can be set up in its conical socket by means of set-screws *t*, that bear upon a disk or plate in contact with the outer end of the sleeve. At the outer end of the box K is a space, *v*, similar to that of a stuffing-box, which, as in a stuffing-box, is closed by a follower, *w*. This space, however, is preferably packed with oil, which is supplied to it under pressure through a pipe, 1. Indeed, to all the various parts requiring lubrication the lubricant is supplied under pressure through pipes 1, 2, 3, 4, and *e*. The pressure may be produced by various means. For instance, a pump may be used to force the lubricant in; or the lubricant may be supplied by hydrostatic pressure, the degree of which pressure can be so graduated as to counterbalance the

pressure from within the apparatus to the extent needed to provide proper lubrication and neutralize the tendency of the gas to force its way out through the joints.

To lubricate the crank-connections of the piston-rods the lower part of chamber H is filled with oil to a proper height, (ascertained by means of a gage or indicator, 6,) so that the crank-pins, at each revolution, may dip into a bath of oil.

In the use of the pump thus organized with the Tellier ice-machine, the gas from the pump is conducted through the pipe to the condenser, where it is completely liquefied. I prefer to locate the condenser below the level of the pump instead of above that level, as heretofore.

The pump-piston is provided with a simple packing composed of metallic rings, as shown, it being no longer necessary, under my invention, to take great precaution against leakage through the piston, all that is needed being that there should be a reasonably tight joint, sufficient to cause the pump to act properly.

I make no claim here to the mode of forming and packing the bearings of the crank-shaft and lubricating the same, inasmuch as I contemplate making these features the subject of a separate application for Letters Patent.

Having described my invention, I would state, in conclusion, that I do not confine myself to the mechanical details herein described, as the same may be varied without departure from my invention; but

What I claim, and desire to secure by Letters Patent, is as follows:

1. In machinery for freezing, cooling, and refrigerating, the combination, substantially as set forth, of a pump for forcing the refrigerating agent, and a chamber, closed to the atmosphere, which surrounds and contains the piston-rod of the pump, and receives and holds whatever matter may escape from that end of the pump-cylinder through which the piston-rod works.

2. The pump, in combination with a chamber which surrounds and contains the piston-rod of the pump, and constitutes a gas-containing receptacle from which the pump draws its supply, substantially as set forth.

3. The combination, substantially as set forth, of these elements: the pump or pumps, the gas-receiving chamber surrounding and containing the pump piston rod or rods, and the rotary crank or driving shaft mounted in bearings in said chamber, the combination being and acting as described.

In testimony that I claim the foregoing as my own I hereunto affix my signature in presence of two witnesses.

ALEXANDER T. BALLANTINE.

Witnesses:
E. BARLOW,
F. W. KELLER.