(No Model.) 2 Sheets—Sheet 1.

E. T. WINKLER.

REFRIGERATING MACHINE.

No. 537,623. Patented Apr. 16, 1895.

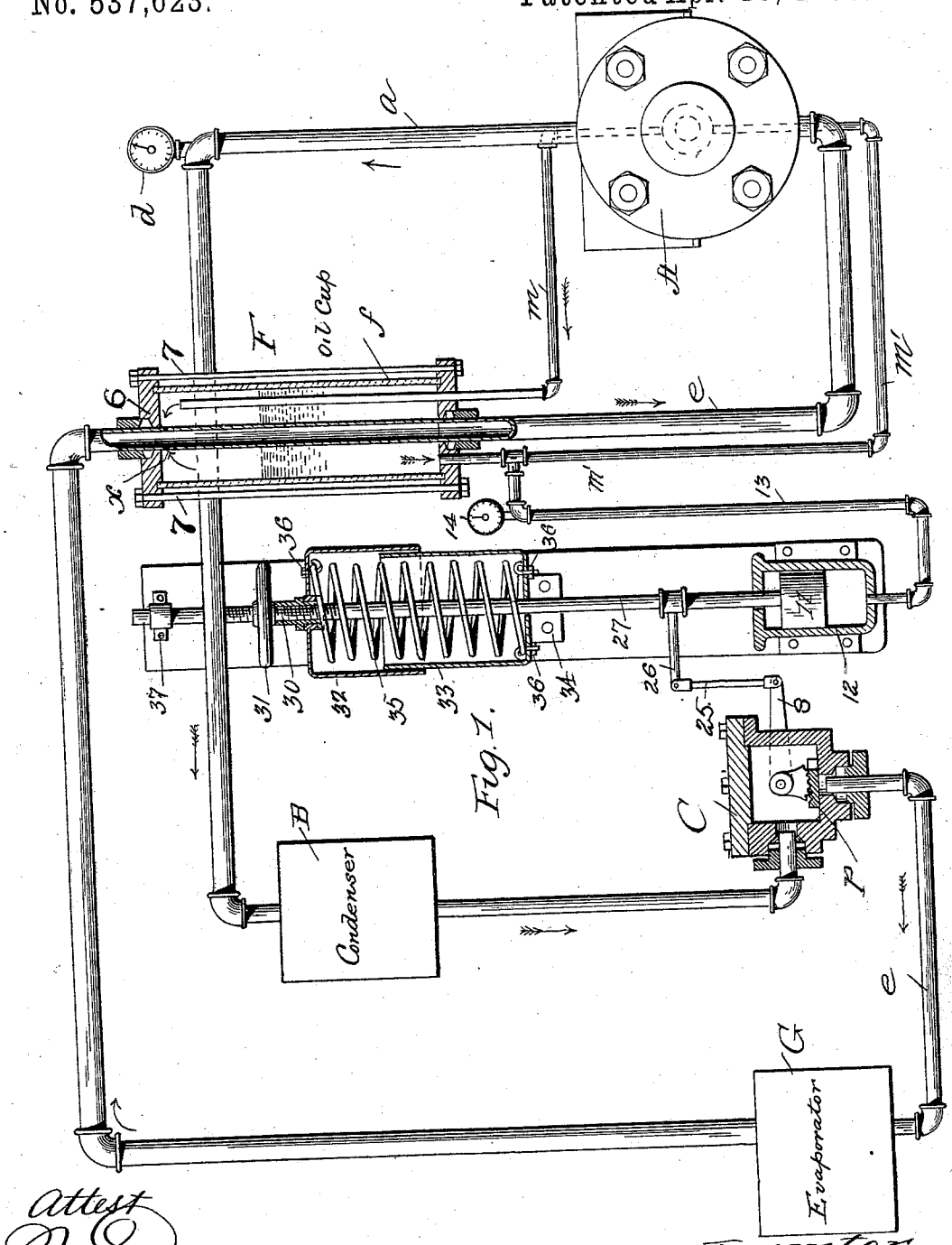


Fig. 1.

Attest
Wallace Maldrum
F. L. Middleton

Inventor
Ehregott T. Winkler
by Geo. Gear
Atty.

(No Model.) 2 Sheets—Sheet 2.

E. T. WINKLER.

REFRIGERATING MACHINE.

No. 537,623. Patented Apr. 16, 1895.

Fig. 2.

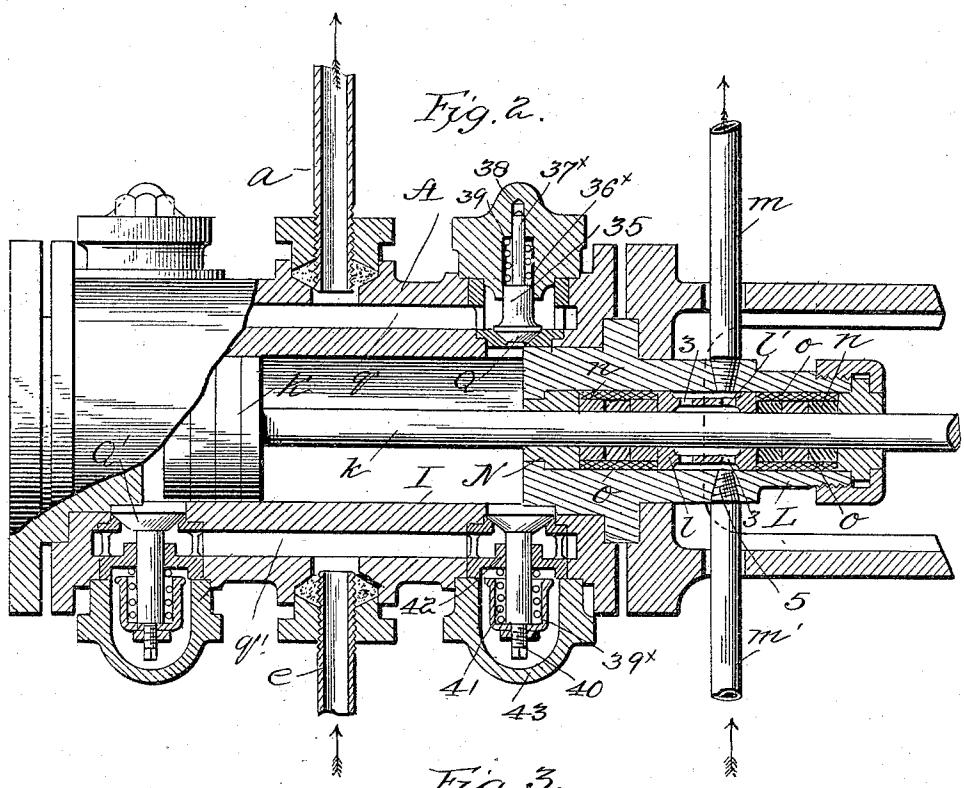
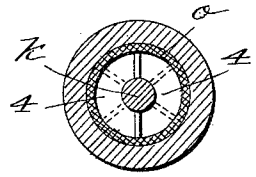


Fig. 3.



Attest
Walter Maddox
F. L. Middleton

Inventor
Ehregott T. Winkler
by Ellis Spear
Atty.

UNITED STATES PATENT OFFICE.

EHREGOTT T. WINKLER, OF KANSAS CITY, MISSOURI, ASSIGNOR, BY DIRECT AND MESNE ASSIGNMENTS, TO THE WINKLER MACHINE MANUFACTURING COMPANY, OF SAME PLACE.

REFRIGERATING-MACHINE.

SPECIFICATION forming part of Letters Patent No. 537,623, dated April 16, 1895.

Application filed February 16, 1894. Renewed March 13, 1895. Serial No. 541,624. (No model.)

To all whom it may concern:

Be it known that I, EHREGOTT T. WINKLER, a citizen of the United States of America, residing at Kansas City, in the county of Jackson and State of Missouri, have invented certain new and useful Improvements in Refrigerating-Machines, of which the following is a specification.

My invention relates to refrigerating machines of that class in which the circulation of ammonia or other volatile agent is maintained through an evaporator and condenser and system of pipes by means of exhaust and force pumps.

The machine includes the double acting pump connected in the system of pipes alternately exhausting and condensing, on each side of the piston. The machine includes also as a second part an arrangement of pipes connected with an exhaust and with an intermediate chamber between the packing rings for saving any of the vapor which may leak through the first set of packing rings. Thirdly the machine includes an improvement in an oil cup and its relation to the exhaust pipe. Fourthly the machine includes an improved form of valve regulating the flow of the circulating medium to the evaporator and adapted to be adjusted at will and thereafter to act automatically.

My said invention is illustrated in the accompanying drawings, in which—

Figure 1, presents the system of pipes conveniently arranged for illustration in side elevation with the oil cup and the regulating valve mechanism in vertical longitudinal section and the compressor or pump in end view. Fig. 2, shows a vertical longitudinal sectional view of the cylinder and its intermediate connections and appendages. Fig. 3, is a detail view of the stuffing box packing rings.

Referring now more particularly to Fig. 1, the compressor is shown at A from the pressure side thereof, a pipe *a*, leading through the condenser B to the valve chamber C. This pipe has an ordinary gage *d*, which may be set at any convenient point. From the valve chamber *c*, the exhaust pipe *e*, leads through the evaporator and through the oil cup F of the exhaust side of the pump.

The evaporator G and the condenser B may be of any construction suited to the purpose.

The details of the construction of the pump are shown more clearly in Fig. 2. The pump consists of a single cylinder and a single piston, the cylinder being indicated at I and the piston at K. The connection of the condensing pipe *a*, is shown on the upper side and on the lower the connection of the exhaust pipe *e* is represented. These connections are surrounded by suitable packing. The piston rod *k*, extends through a stuffing box L and is surrounded by two sets of packing rings one set on each side of a sleeve *l*. The sleeve *l* occupies the central part of the stuffing box chamber and is formed to leave an annular recess *l'* about the piston rod, and another similar annular chamber coterminous with the first and next to the wall of the stuffing box chamber. A thin partition in the sleeve between these two chambers has perforations 3 which allow the passage of the oil and any of the vapor which may leak through the inner packing to pass from the inner annular chamber to the outer. A pipe *m* leads from the outer chamber to the oil cup and main exhaust pipe as hereinafter more fully explained.

The packing consists of metal rings *n* which are made up of sections 4, and these are so placed that the joints between the sections of one ring are opposite the solid portions of the next contiguous ring. The diameter of these rings is less than the interior diameter of the stuffing box chamber, and the rings are surrounded by an elastic sleeve *o*, which fills the remaining space. The rings and sleeve on the inner end bear against a block N through which the piston rod works. The sleeve *l* bears against the other end and the outer rings with their rubber sleeves bear against the outer end of the sleeve *l*. The requisite pressure is applied to the packing rings by means of the plug and threaded cap in the ordinary manner. The entrance of the other pipe *m'* from the oil cup is shown at 5.

The oil cup F is formed of a glass cylinder *f* held in caps 6 by bolts 7. The pipe *m* from the chamber in the stuffing box extends through the lower cap and terminates within

the oil chamber of the cup near its upper end The other pipe m' extends through the same lower cap and terminates flush with its inner surface.

As clearly shown in Fig. 1 the exhaust pipe from the evaporator extends through the oil cup. It is provided with an opening x shown in the interior of the oil cup near its upper end. The oil is fed to the stuffing box chamber through the pipe m'. Pressure leaking through the rings from the stuffing box will escape through this pipe into the upper part of the oil chamber, whence it is turned through the orifice in the exhaust pipe e and returned to the general circulation. The oil is maintained in the cup at a proper level in relation to the pipe e and any suitable means may be used to regulate the flow of the oil from the oil cup to the stuffing box.

Difficulty has heretofore been experienced in the operation of the regulating valve controlling the flow of the liquid to the evaporator. There is a tendency in the regulator valve to stick on account of obstruction caused by the low temperature created by the exhaust. In order to avoid this and to maintain this valve in a free condition and under proper balance I have located it wholly in the chamber containing the refrigerating agent in a condensed form. The casing containing the valve is shown in Fig. 1 at C, that part of the figure illustrating it in vertical longitudinal section. The valve p consists of a slide movable over a seat in line with the pipe e, leading to the evaporator. The slide plays freely so that it may have necessary motion to open or close the port leading to the evaporator. Through the valve casing passes a rock shaft carrying a segmental gear engaging with the ratchet teeth of the slide valve. The rock shaft passes through suitable stuffing boxes on the outside and is provided with an arm 8, said arm being connected by a link 25 with the arm 26 on the piston rod 27 connected with the piston 11 moving in a cylinder 12. This cylinder is connected by a pipe 13 to the pipe m' and receives oil from the oil cup F so that the said piston 11 is under the exhaust pressure through the oil cup, the oil in which it will be seen is under the exhaust pressure through the opening x in the exhaust pipe e. This pipe 13 has a suitable pressure gage 14. This piston is placed under an adjustable resistance opposing the exhaust pressure for which purpose I extend the piston rod, screw thread the same at 30 to receive a traveling nut 31, the hub of which is grooved to receive the edge of the casing 32 which may thus be adjusted along the piston rod to telescope more or less with the companion casing 33 fixed rigidly to the frame at 34 and having an opening through which the piston rod may slide. A spring 35 is placed between the two casings being held to the rigid and adjustable casings by hooks and nuts 36. The end of the piston rod slides through a bearing 37 at the end of the frame. From this arrangement it will be seen that by turning the nut on the piston rod the spring will be adjusted and more or less resistance placed on the piston to control the operation of the regulator valve.

The spring is distended to vary its resistance and to act in opposition to the exhaust pressure. The tension of the spring acting through the connections described tends to close the valve while the exhaust pressure tends to force the piston against the pull of the spring to open the valve. The nut is used to regulate the tension of the spring at any desired point, and when this is properly seated the valve is moved by any variation in the pressure in the exhaust whereby the supply of the refrigerating agent is regulated to correspond to the pressure in the exhaust. The valve chamber is accessible only to the condensed liquid and the exhaust is wholly outside of it, so that the same temperature is maintained around the valve and its stem and no danger can arise from the freezing about the working parts. It will be seen from this arrangement that the regular valve is rendered extremely sensitive. It is relieved entirely from the exhaust pressure and changes in temperature, and the tension of the spring is not applied to this valve directly nor the rock shaft for operating it but to the piston and the pressure of the spring is directly opposed to the action of the piston and axially of the same, thus relieving the valve of all torsional strain or frictional resistance.

The valves Q regulate the passages to the condensing pipe and Q' those to the exhaust. The valves Q are connected with a condensing pipe by a common passage q and the valves Q' are connected with the exhaust by a common passage q'. This arrangement permits the piston to operate both upon the pressure and the exhaust pipe in both directions of the strokes and the loss of gas which would otherwise be occasioned by the pressure of the outstroke against the stuffing boxes is prevented by the intermediate pipes leading therefrom to the exhaust through the oil cups.

In the operation of the machine it will be understood that a pressure above one atmosphere is maintained in the exhaust there being a higher pressure of fifty or sixty pounds to the square inch on the condensing side of the pump.

It will be noticed from Fig. 2, that the valves Q Q are constructed and arranged particularly with a view to preventing straining of the parts and of the valve stems in order to insure the valves against leakage. The valves Q have very thick shanks 35 movable in bearings $36^{\times}$ and having reduced stems $37^{\times}$ moving in reduced bearing socket 38, a spring 39 being used to press on the shoulder of the thickened shank. The socket 38 is deeper than the stem and allows the valve to rise to open the port, the movement of the valve being limited by striking against the bottom of the socket. The extent of this movement is determined by

experience and remains fixed so that there can be no tampering with the valve and no danger for the parts to get out of adjustment or to work loose. The valve shank is made sufficiently heavy to avoid straining the valve or stem and prevent liability of displacement. The exhaust valves Q′ are also constructed and arranged with a view to durability and security against displacement or straining. The movement of the valve is limited by a hood 39× secured to the reduced threaded part of the valve stem 40 and having a spring 41 placed between the hood and the valve guide 42. The hood strikes against this guide and the head of the valve is relieved from all pounding against the adjacent part of the pump frame, thus preventing straining of the valve or its stem. This valve is also provided with a thickened stem. The valve is arranged in a suitable box 43.

I claim—

1. In combination, the evaporator and condenser, the oil cup F having pipe *m′* connecting with the compressor, the exhaust pipe *e* communicating with the oil cup, the regulating valve, the piston with its casing and the pipe 13 communicating with the exhaust side of the compressor through the oil cup and exhaust pipe *e*, substantially as described.

2. In combination, the compressor having a stuffing box with a vapor chamber, the evaporator and condenser, the regulating valve with piston and casing, the oil cup having pipe connections to the stuffing box and vapor chamber respectively the exhaust pipe *e* communicating with the oil cup and the pipe 13 from the piston casing also communicating with the oil cup, substantially as described.

In testimony whereof I affix my signature in presence of two witnesses.

EHREGOTT T. WINKLER.

Witnesses:

HENRY E. COOPER,

JAMES M. SPEAR.