

June 17, 1930.

C. STEENSTRUP
REFRIGERATING MACHINE
Filed Dec. 29, 1928

1,765,289

Fig. 1.

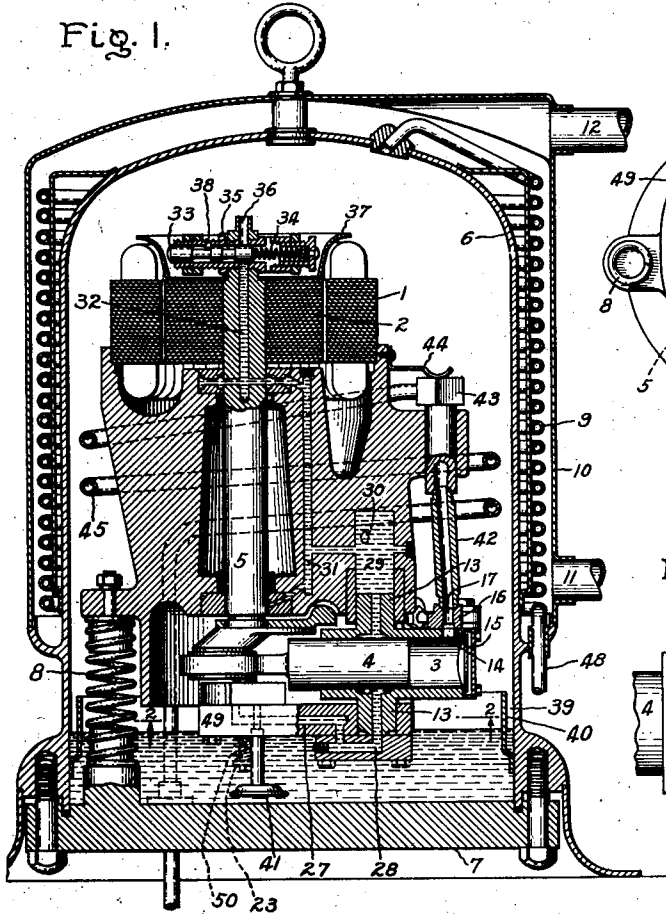


Fig. 2.

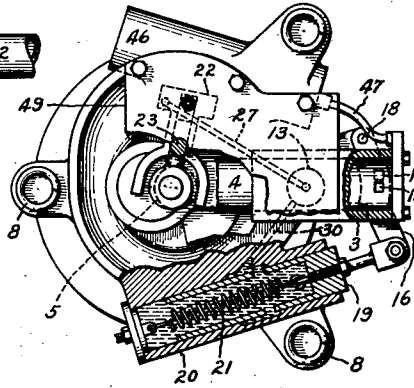


Fig. 4.

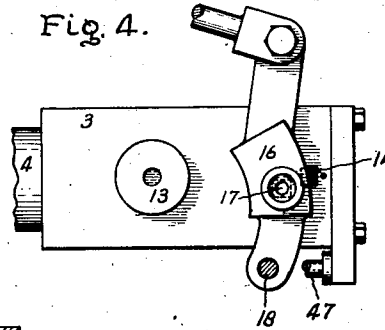
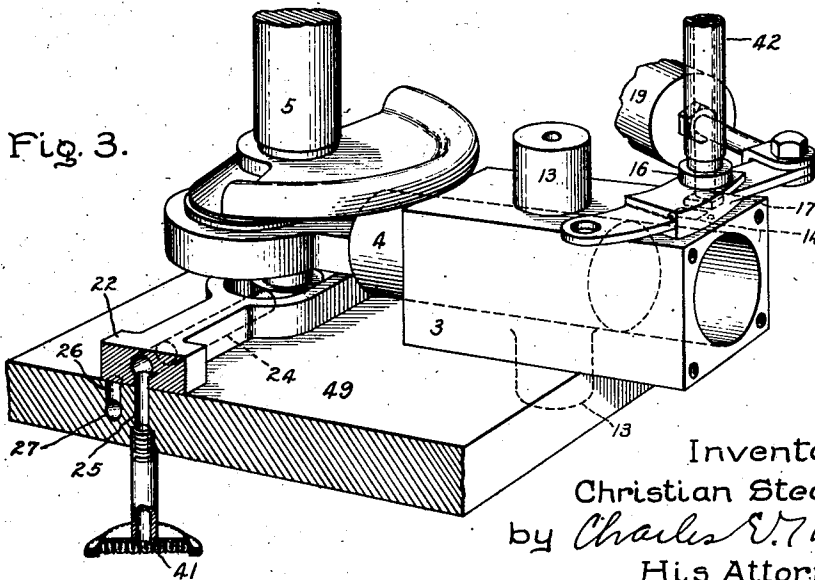


Fig. 3.



Inventor
Christian Steenstrup,
by *Charles R. Tuller*
His Attorney.

UNITED STATES PATENT OFFICE

CHRISTIAN STEENSTRUP, OF SCHENECTADY, NEW YORK, ASSIGNOR TO GENERAL ELECTRIC COMPANY, A CORPORATION OF NEW YORK

REFRIGERATING MACHINE

Application filed December 29, 1928. Serial No. 329,108.

My invention relates to refrigerating machines and particularly to such refrigerating machines as are driven by electric motors.

The machine to which my invention is applied employs a refrigerant which boils at a relatively low temperature and is caused to pass through a cycle which consists in allowing the refrigerant in the liquid form to evaporate and thus absorb heat, compressing the vaporized refrigerant, and removing the heat therefrom to cause it to condense into liquid form again, this cycle being continuously repeated during the operation of the machine.

Such refrigerating machines are arranged to maintain a substantially constant temperature in the refrigerator box, being controlled by a thermostat. When the box reaches the proper temperature, the thermostat shuts down the refrigerating machine and when the temperature in the box rises a few degrees, the thermostat operates to start the refrigerating machine again. When the machine is started under these conditions, the load on the electric motor driving the machine may be excessive and even may be so great as to prevent the machine from starting. To avoid this condition, my invention has for its object a novel arrangement for unloading the compressor of the refrigerating machine.

The various features of novelty which characterize my invention are pointed out with particularity in the claims annexed to and forming a part of this specification. For a better understanding of my invention, reference may be had to the following description taken in connection with the accompanying drawing, in which Fig. 1 is a cross-sectional view with parts broken away, of a refrigerating machine embodying my invention, Fig. 2 is a cross-sectional view in part taken on line 2—2 of Fig. 1 looking in the direction of the arrows; Fig. 3 is a perspective view of certain parts of the refrigerating machine of Fig. 1, and Fig. 4 is a view looking down upon the top of the compressor.

In the drawing, an electric motor having

a stator 1 and a rotating member 2 drives a compressor having an oscillating cylinder 3 in which a piston 4 reciprocates, the drive being through a shaft 5. The motor and compressor are mounted within the casing 6 which with the base 7 forms a chamber for compressed refrigerant. The motor and compressor are supported on the base 7 through springs 8. Surrounding the casing 6 is a coil of pipe 9 which forms the condenser of the refrigerating machine. This condenser is shown as a water-cooled one, a water jacket being formed by a casing 10 and the casing 6, water being circulated through the jacket by means of the pipes 11 and 12.

The cylinder 3 is mounted on trunnions 13 so that the same may oscillate. It has an intake port 14 on its upper surface. The end of the cylinder is covered by a flap valve 15 through which condensed refrigerant is discharged. A member 16 having a passage 17 therethrough is mounted on top of the cylinder. This member 16 is movable from the position in which the intake port opens directly into the compression chamber to a position where the intake port communicates with the passage 17 in the member 16. The member 16 is pivoted at one end about the stud 18, the other end being connected to a plunger or piston 19 moving in the cylinder 20. The plunger 19 is biased by a spring 21 to the position where the member 16 uncovers the intake port 14 and is moved to the position where the port 14 communicates with the passage 17 in the member 16 by oil pressure admitted behind the plunger 19.

In the particular arrangement shown, oil pressure is developed by an oil pump comprising an oscillating cylinder 22, which is mounted on a trunnion 23, and is held in close contact with plate 49 by a spring 50 mounted on trunnion 23. The cylinder 22 has a piston 24 therein, which is reciprocated by an eccentric pin on the end of the shaft 5. The cylinder of the oil pump communicates with the intake passage 25 and a discharge passage 26 formed in plate 49. The discharge passage communicates

by means of passages 27 and 28 with the piston 4 of the compressor, so as to lubricate the same. Oil is also forced from the passage 28 into a chamber 29. From the chamber 29 a passage 30 leads to the cylinder 20 containing the plunger 19 and to another passage 31 from which oil is supplied to the shaft 5. Oil is also forced from the passage 31 into the passage 32 in the shaft 5. When the motor is operating at normal speed, the centrifugal device 33 at the top of the motor shaft moves into the position shown in the drawing against the tension of the spring 34 to close the passage 32. When the machine gets below a predetermined speed, centrifugal force no longer keeps the member 33 in the position shown, it being retracted by the spring 34 so that oil will pass from the passage 32 around the cutout portion 35 of the member 33 and will escape out of the passage 36 into the receptacle 37 on top of the motor shaft. A stop 38 is provided for limiting the movement of the member 33 in both directions of its movement. The oil which accumulates in the receptacle 37 is thrown out, when the machine gets up to speed, against the inner wall of the casing 6 and then runs down this wall into a chamber 39 formed by a member 40 and the lower portion of the casing 16. When the chamber 39 is filled with oil, the oil overflows into the bottom of the compression chamber and any liquid sulphur dioxide carried down by the oil will be trapped in this chamber 39 and is evaporated as the machine warms up. Oil is withdrawn from the bottom of the compression chamber through an intake screen 41 which communicates with the intake passage 25 from whence it is drawn into the cylinder on the suction stroke of the oil pump, the parts being in the position shown in Fig. 3. As the oil pump reaches the end of the suction stroke the cylinder 22 is oscillated from the position in which the cylinder is in communication with the intake passage 25 to the position where it communicates with the discharge passage 26 and as the piston 24 of the oil pump makes its compression stroke, oil is forced through the discharge passage 26 and then into the passages 27 and 28 to lubricate the piston 4 and shaft 5 and supply oil pressure to the cylinder 20.

Communicating with the passage 17 in the member 16 is an intake member 42 which is movable with the member 16 and is shown as a piece of pipe having ball and socket connections with the member 16 and a member 43. The member 43 is pressed against the member 42, the member 42 against the member 16 and the member 16 against the top of the cylinder 3 by means of a spring 44. The member 43 is connected by a pipe

45 to an evaporator (not shown) located below the base 7.

In the normal operation of the refrigerating machine, evaporated gas is drawn from the evaporator through the pipe 45 into the member 43, thence into the flexible intake member 42. It then is sucked into the cylinder 3 through the passage 17 and the member 16 through the intake port 14 during the suction stroke of the piston 4. As the piston 4 reaches the end of the suction stroke the cylinder 3 oscillates so that the member 16 moves to the position shown in Fig. 3, wherein the intake port 14 is covered by the member 16 so that it no longer communicates with the passage 17. The piston 4 on its compression stroke compresses the gas in the cylinder and as the piston 4 reaches the end of its compression stroke, the flap valve 15 opens, permitting the compressed gas to escape from the cylinder into the muffler 46 through the pipe 47. From the muffler, the gas passes into the compression chamber formed by the casing 6 and enters the condenser 9 at the top of the casing 6. The compressed gas is cooled in the condenser 9 and in cooling liquefies, passing out of the condenser at the bottom thereof through pipe 48, from whence it is supplied to the evaporator in the usual manner.

When the machine stops or its speed is reduced below a predetermined amount, the centrifugal member 33 is retracted by spring 34, so that oil will pass from passage 32 around cutout portion 35 of member 33 into the receptacle 37. In this way the oil pressure in chamber 29 is reduced as well as the oil pressure upon plunger 19. The spring 21 now overcomes the oil pressure and the plunger moves back into the cylinder. The plunger moves the member 16 to the position shown in Fig. 4, uncovering intake port 14 so that it is in direct communication with the compression chamber. This results in equalizing the pressure on both sides of the piston as the machine slows down, and prevents vibration of the machine while stopping. Also when the motor starts again, the compressor will not compress any gas, at least not for a few strokes and not until the motor gets up to speed again. When the motor again gets up to speed the centrifugal device again closes passage 32, and oil pressure is built up in chamber 29, whereupon member 16 is moved into the position where the intake port 14 communicates with passage 17 in member 16 during the suction stroke of the compressor.

When the plunger 19 is retracted into the position shown in Fig. 4, the passage 17 in member 16 is sealed or closed at one end thereof by the upper wall of the cylinder. With this arrangement, low pressure gas from the evaporator cannot enter the compression chamber while the machine is

not running and thus equalize all the gas pressure in the machine.

I desire it to be understood that my unloader may be used with compressors of different construction than the one illustrated herein, and I aim in the appended claims to cover all modifications which do not depart from the spirit and scope of my invention.

What I claim as new and desire to secure by Letters Patent of the United States, is:

1. In a refrigerating machine, a compressor, a motor for driving said compressor, means forming a chamber for compressed refrigerant, said compressor having a cylinder, said cylinder having an intake port, a movable member having a passage therethrough, and means for moving said movable member from the position in which said intake port opens directly into said compression chamber to the position where said intake port communicates with the passage in said member.

2. In a refrigerating machine, a compressor, a motor for driving said compressor, means forming a chamber for compressed refrigerant, said compressor having a cylinder, said cylinder having an intake port, a movable member having a passage therethrough, an intake member communicating with the passage in said movable member, and means for moving said movable member from the position in which said intake port opens directly into said compression chamber to the position where said intake port communicates with the passage in said movable member.

3. In a refrigerating machine, a compressor, a motor for driving said compressor, means forming a chamber for compressed refrigerant, said compressor having a cylinder, said cylinder having an intake port, a movable member having a passage therethrough, means for building up an oil pressure, and means acted upon by said oil pressure for moving said movable member from the position in which said intake port opens directly into said compression chamber to the position where said intake port communicates with the passage in said member.

4. In a refrigerating machine, a compressor, a motor for driving said compressor, means forming a chamber for compressed refrigerant, said compressor having a cylinder, said cylinder having an intake port, a movable member having a passage therethrough, an intake member communicating with the passage in said movable member, means for building up an oil pressure, and means acted upon by said oil pressure for moving said movable member from the position in which said intake port opens directly into said compression chamber to the position where said intake port

communicates with the passage in said member.

5. In a refrigerating machine, a compressor, a motor for driving said compressor, means forming a chamber for compressed refrigerant, said compressor having a cylinder, said cylinder having an intake port, a pivoted movable member having a passage therethrough, means for building up an oil pressure, a plunger biased to one position by a spring and adapted to be moved against the pull of said spring by oil pressure, said plunger being connected to said pivoted movable member so as to move said movable member from the position in which said intake port opens directly into said compression chamber to the position where said intake port communicates with the passage in said member after oil pressure has been built up.

6. In a refrigerating machine, a compressor, a motor for driving said compressor, means forming a chamber for compressed refrigerant, said compressor having a cylinder, said cylinder having an intake port, a movable member having a passage therethrough, means for building up an oil pressure, means acted upon by said oil pressure for moving said movable member from the position in which said intake port opens directly into said compression chamber to the position where said intake port communicates with the passage in said member, and means dependent on the speed on said motor for relieving the oil pressure on said last mentioned means.

7. In a refrigerating machine, a compressor, a motor for driving said compressor, means forming a chamber for compressed refrigerant, said compressor having a cylinder, said cylinder having an intake port, a pivoted movable member having a passage therethrough, means for building up an oil pressure, a plunger biased to one position by a spring and adapted to be moved against the pull of said spring by oil pressure, said plunger being connected to said pivoted movable member so as to move said movable member from the position in which said intake port opens directly into said compression chamber to the position where said intake port communicates with the passage in said member after oil pressure has been built up, and means dependent on the speed of said motor for relieving the oil pressure on said plunger.

8. In a refrigerating machine, a compressor, a motor for driving said compressor, means forming a chamber for compressed refrigerant, said compressor having a cylinder, said cylinder having an intake port, a movable member having a passage therethrough, means for building up an oil pressure, means acted upon by said oil pressure for moving said movable member from the

position in which said intake port opens directly into said compression chamber to the position where said intake port communicates with the passage in said member, and means dependent upon the speed of said motor for relieving the oil pressure on said last mentioned means, said member moving to seal one end of said passage in said movable member when said oil pressure is relieved.

9. In a refrigerating machine, a compressor, a motor for driving said compressor, means forming a chamber for compressed refrigerant, said compressor having a cylinder, said cylinder having an intake port, a movable member having a passage therethrough, an intake member communicating with the passage in said movable member, means for building up an oil pressure, means acted upon by said oil pressure for moving said movable member from the position in which said intake port opens directly into said compression chamber to the position where said intake port communicates with the passage in said member, and means dependent upon the speed of said motor for relieving the oil pressure on said last mentioned means, said member moving to seal one end of said passage in said movable member when said oil pressure is relieved.

10. In a refrigerating machine, a compressor, a motor for driving said compressor, means forming a chamber for compressed refrigerant, said compressor having a cylinder, said cylinder having an intake port, a pivoted movable member having a passage therethrough, means for building up an oil pressure, a plunger biased to one position by a spring and movable against the pull of said spring by oil pressure, said plunger being connected to said pivoted movable member so as to move said movable member from the position in which said intake port opens directly into said compression chamber to the position where said intake port communicates with the passage in said member after oil pressure has been built up, and means dependent upon the speed of said motor for relieving the oil pressure on said plunger, said member moving to seal one end of said passage in said movable member when oil pressure on said plunger is relieved.

11. In a refrigerating machine, a compressor, a motor for driving said compressor, means forming a chamber for compressed refrigerant, said compressor having an oscillating cylinder, said cylinder having an intake port, a movable member having a passage therethrough, and means for moving said movable member from the position in which said intake port opens directly into said compression chamber to the position where said intake port communicates with the passage in said member on the suction stroke of said compressor.

12. In a refrigerating machine, a com-

pressor, a motor for driving said compressor, means forming a chamber for compressed refrigerant, said compressor having an oscillating cylinder, said cylinder having an intake port, a movable member having a passage therethrough, means for building up an oil pressure, and means acted upon by said oil pressure for moving said movable member from the position in which said intake port opens directly into said compression chamber to the position where said intake port communicates with the passage in said member on the suction stroke of said compressor after oil pressure has been built up.

13. In a refrigerating machine, a compressor, a motor for driving said compressor, means forming a chamber for compressed refrigerant, said compressor having an oscillating cylinder, said cylinder having an intake port, a pivoted movable member having a passage therethrough, means for building up an oil pressure, a plunger biased to one position by a spring and movable against the pull of said spring by oil pressure, said plunger being connected to said pivoted movable member so as to move said movable member from the position in which said intake port opens directly into said compression chamber to the position where said intake port communicates with the passage in said member on the suction stroke of said compressor after oil pressure has been built up.

14. In a refrigerating machine, a compressor, a motor for driving said compressor, means forming a chamber for compressed refrigerant, said compressor having an oscillating cylinder, said cylinder having an intake port, a movable member having a passage therethrough, means for building up an oil pressure, means acted upon by said oil pressure for moving said movable member from the position in which said intake port opens directly into said compression chamber to the position where said intake port communicates with the passage in said member on the suction stroke of said compressor after oil pressure has been built up, and means dependent upon the speed of said motor for relieving the oil pressure on said last mentioned means.

15. In a refrigerating machine a compressor, a motor for driving said compressor, means forming a chamber for compressed refrigerant, said compressor having an oscillating cylinder, said cylinder having an intake port, a movable member having a passage therethrough, means for building up an oil pressure, means acted upon by said oil pressure for moving said movable member from the position in which said intake port opens directly into said compression chamber to the position where said intake port communicates with the passage in said member

on the suction stroke of said compressor after oil pressure has been built up, and means dependent upon the speed of said motor for relieving the oil pressure on said last mentioned means, said member moving

5 to seal one end of said passage in said movable member when oil pressure is relieved.

16. In a refrigerating machine, a compressor, a motor for driving said compressor, means forming a chamber for compressed refrigerant, said compressor having an oscillating cylinder, said cylinder having an intake port, a pivoted movable member having a passage therethrough, means for building up an oil pressure, a plunger biased to one position by a spring and movable against the pull of said spring by oil pressure, said plunger being connected to said pivoted movable member so as to move said movable member from the position in which said intake port opens directly into said compression chamber to the position where said intake port communicates with the passage in said member on the suction stroke of said compressor after oil pressure has been built up, and means dependent upon the speed of said motor for relieving the oil pressure on said plunger.

17. In a refrigerating machine, a compressor, a motor for driving said compressor, means forming a chamber for compressed refrigerant, said compressor having an oscillating cylinder, said cylinder having an intake port, a pivoted movable member having a passage therethrough, means for building up an oil pressure, a plunger biased to one position by a spring and movable against the pull of said spring by oil pressure, said plunger being connected to said pivoted movable member so as to move said member from the position in which said intake port opens directly into said compression chamber to the position where said intake port communicates with the passage in said member on the suction stroke of said compressor after oil pressure has been built up, and means dependent upon the speed of said motor for relieving the oil pressure on said plunger, said pivoted movable member moving to seal one end of said passage in said movable member when oil pressure on said plunger is relieved.

18. In a refrigerating machine, a compressor, a motor for driving said compressor, means forming a chamber for compressed refrigerant, said compressor having an oscillating cylinder, said cylinder having an intake port, a movable member having a passage therethrough, said member being pivoted at one end thereof, means for building up an oil pressure, a plunger biased to one position by a spring and movable against the pull of said spring by oil pressure, said plunger being connected to said movable member at the other end thereof from said

pivot so as to move said movable member from the position in which said intake port opens directly into said compression chamber to the position where said intake port communicates with the passage in said member on the suction stroke of said compressor after oil pressure has been built up.

19. In a refrigerating machine, a compressor, a motor for driving said compressor, means forming a chamber for compressed refrigerant, said compressor having an oscillating cylinder, said cylinder having an intake port, a movable member having a passage therethrough, said member being pivoted at one end thereof, means for building up an oil pressure, a plunger biased to one position by a spring and movable against the pull of said spring by oil pressure, said plunger being connected to said movable member at the other end thereof from said pivot so as to move said movable member from the position in which said intake port opens directly into said compression chamber to the position where said intake port communicates with the passage in said member on the suction stroke of said compressor after oil pressure has been built up, and means dependent upon the speed of said motor for relieving the oil pressure on said plunger.

20. In a refrigerating machine, a compressor, a motor for driving said compressor, means forming a chamber for compressed refrigerant, said compressor having an oscillating cylinder, said cylinder having an intake port, a movable member having a passage therethrough, said member being pivoted at one end thereof, means for building up an oil pressure, a plunger biased to one position by a spring and movable against the pull of said spring by oil pressure, said plunger being connected to said movable member at the other end thereof from said pivot so as to move said movable member from the position in which said intake port opens directly into said compression chamber to the position where said intake port communicates with the passage in said member on the suction stroke of said compressor after oil pressure has been built up, and means dependent upon the speed of said motor for relieving the oil pressure on said plunger, said member moving to seal one end of said passage in said movable member when oil pressure on said plunger is relieved.

In witness whereof, I have hereunto set my hand this 28th day of December, 1928.

CHRISTIAN STEENSTRUP.