Sept. 13, 1932. M. DAVIS 1,877,390

MECHANICAL REFRIGERATOR

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Fig. 1.

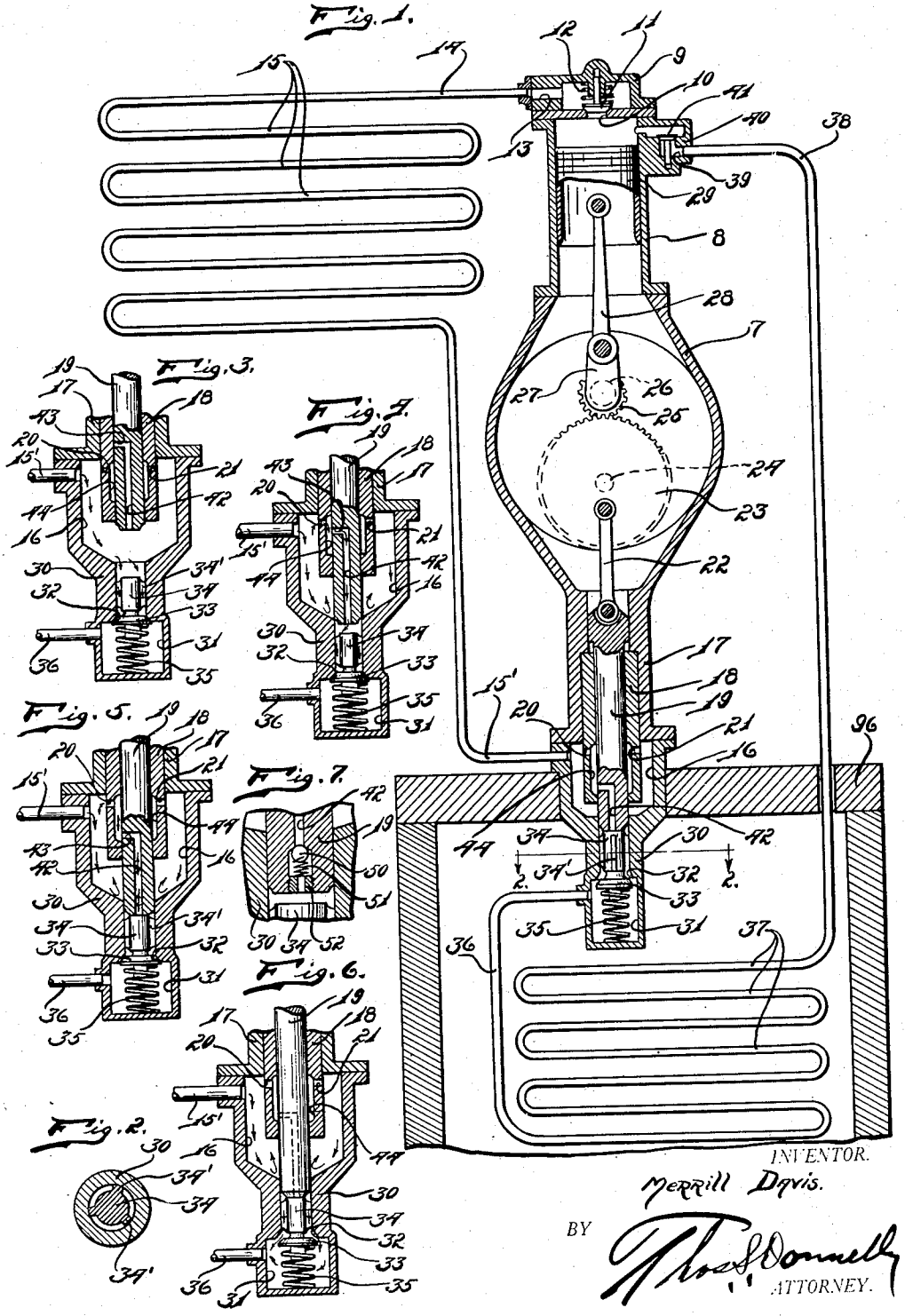


Fig. 3.

Fig. 4.

Fig. 5.

Fig. 7.

Fig. 6.

Fig. 2.

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MECHANICAL REFRIGERATOR

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My invention relates to a new and useful improvement in a mechanical refrigerator and has for its object the provision in a mechanical refrigerator of the compression type of a control mechanism for controlling communication of the high side with the low side and for controlling the delivery of cooling liquid from the high side to the low side so constructed and arranged as to be formed from a minimum number of parts to assure constant operation of the control mechanism.

Another object of the invention is the provision of an ejecting or outlet compartment or space and means for establishing communication of said compartment or space with the pressure line so as to assure efficient operation at all times.

Another object of the invention is the provision of mechanism for closing and establishing communication of the pressure side with the low side in such a manner that flashing may be eliminated.

Other objects will appear hereinafter.

The invention consists in the combination and arrangement of parts hereinafter described and claimed.

The invention will be best understood by a reference to the accompanying drawing which forms a part of this specification, and in which,

Fig. 1 is a central vertical sectional view of the invention showing it applied.

Fig. 2 is a sectional view taken on line 2—2 of Fig. 1.

Fig. 3 is a fragmentary sectional view illustrating one position of the control mechanism.

Fig. 4 is a fragmentary sectional view illustrating another position of the control mechanism.

Fig. 5 is a fragmentary sectional view illustrating another position of the control mechanism.

Fig. 6 is a fragmentary sectional view illustrating another position of the control mechanism.

Fig. 7 is a fragmentary sectional view of a modified form of the plunger.

The invention is adapted for use on mechanical refrigerators of the compression type as distinguished from the absorption type.

In the drawing I have indicated the invention applied to a compression type of mechanical refrigerator conventional in practically every way excepting that the invention has been located at its proper position in the system now at the point where the high side joins the low side. The present invention is designed to control communication of the high side with the low side and positively effect the discharge or positively operate the control so that the discharge may take place of the liquid from the high side to the low side. The invention is interposed in the system at that point where in conventional types of refrigerators the expansion valve or float valve is located.

A housing 7 is provided with the cylindrical cylinder forming extension 8 on which a head 9 is mounted. The interior of the head 9 is in communication with the cylinder 8 through the port 10 which is normally closed by the valve 11 which is retained normally in closed position by the spring 12.

The head 9 communicates through the passage 13 with the pipe 14 which is formed into coils 15 and provided with the extension 15′ communicating with the receiving compartment 16 which depends from the neck 17 projecting downwardly from the housing 7. Positioned in the neck 17 is the bushing or sleeve 18 through which is slidably projected the plunger 19. The sleeve 18 is provided with openings 20 and 21 which communicate with the receiving compartment 16.

A connecting rod 22 connects the plunger 19 eccentrically to one face of the gear 23 which is rotatably mounted on the shaft 24. The gear 23 meshes with the gear 25 which is fixedly mounted on the shaft 26 having the crank 27 which is connected by the connecting rod 28 to the piston 29 slidably mounted in the cylinder 8.

A neck 30 projects downwardly from the receiving compartment 16 and terminates in an outlet compartment or space 31. The neck 30 when in communication with the outlet compartment or space 31 forms a part of the outlet compartment or space. A valve seat 32

is formed on the neck 30 against which seats a valve head 33 having the comparatively large stem 34 which projects upwardly into the neck 30. The stem 34 is provided with a plurality of axially projecting ribs 34' which engage the inner surface of the neck 30 and serve as guides to maintain the stem 34 in spaced relation to the neck 30. A spring 35 serves normally to maintain the valve head 33 in engagement with the seat 32 so that the neck 30 is normally non-communicating with the compartment 31. This compartment 31 is in communication through the pipe 36 with the refrigerating coils 37 which are positioned in the refrigerator 96.

The coils 37 are extended and communicate by the extension pipe 38 with the passage 39 which is formed in the boss 40 on the cylinder 8. A valve 41 serves to control communication of the passage 39 with the cylinder 8.

Formed centrally in the lower end of the plunger 19 is the axially extending passage 42 which is extended to the periphery of the plunger 19 by the radial passage 43. The inner surface of the sleeve or bushing 18 is cut away at 44 to provide a space which communicates through the openings 20 and 21 with the interior of the receiving compartment 16.

In operation, a shaft 24 is rotated by suitable power means such as a motor or the like so as to rotate the gear 23. The refrigerating liquid or gas is placed in the system. When the gear 23 is rotated a rotation of the shaft 26 is effected to bring about a reciprocation of the piston 29. As the piston moves on its downward stroke it will draw into the cylinder 8 the gas which is contained in the coils 37 and the pipe 38. When the piston 29 moves upwardly, the valve 41 will be closed and the gas contained in the cylinder 8 forced under pressure through the port 10 into the cooling coils 15 where the same will liquefy and flow as a liquid into the receiving compartment 16.

When the gear 23 is rotated, the plunger 19 will be reciprocated and it will be noted that the reciprocation of the plunger 19 will not be as great a speed as the reciprocation of the piston 29 so that the gas forced into the cooling coils or the high side of the mechanism will be under pressure.

When the plunger is in the position shown in Fig. 3 the liquefied gas will be permitted to flow into the receiving compartment 16 and into the neck 30 as shown by the direction arrows. The valve head 33 will maintain the outlet compartment 31 closed from the neck 30. As the gear 23 is rotated so as to move the plunger 19 downwardly into the position shown in Fig. 4 the end of the plunger entering the neck 30 will serve to seal the neck 30 from communication with the receiving compartment 16 excepting through the passages 42 and 43, the space 44, and the openings 20 and 21. This will permit the pressure in the neck 30 to remain at the same pressure as the interior of the receiving compartment 16. There is thus provided a double seal for sealing the interior of the compartment 16 from the outlet compartment 31, the valve head 33 and the periphery of the plunger 19 serving as the double seal. As the plunger 19 moves downwardly into the position shown in Fig. 5, the end of the plunger 19 will engage the end of the valve stem 34 and thus seal the end of the passage 42. Further movement of the plunger 19 will force the valve head 33 from its seat as shown in Fig. 1 and in Fig. 6 thus permitting the liquid to flow from the high side to the low side or into the outlet or expansion chamber 31 from which it may pass into the refrigerating coils 37 and thence into the cylinder 8. As the plunger 19 moves in the opposite direction sufficiently to disengage the end thereof from the stem 34 the gas in the receiving compartment 16 will pass into the neck 30. In this way the neck 30 is filled with a high pressure gas before the plunger 19 has moved to a position of disengagement from the neck 30.

Were it not provided for filling the neck with a high pressure gas before the withdrawal of the plunger 19 therefrom, the neck 30 would be under a low pressure which suddenly being brought into contact with the liquid in the receiving compartment 16 which would be under high pressure would cause such a state to exist as to greatly interfere with the operation of the machine and lessen to a considerable degree its efficiency. The liquid under high pressure being suddenly brought into contact with the low pressure space of the neck would flash into a vapor and set up a period of spontaneous generations or explosions of the liquid which would drive practically all of the liquid out of the receiving compartment 16.

When the plunger 19 is raised so as to disengage from the neck 30, the liquid which has accumulated in the compartment 16 will then be free to pass into the neck 30 and then the operation is again repeated. In this way the condenser is at all times and regardless of pressure or temperature kept free from liquid. Maintaining the condenser or cooling coils 15 in this state lessens the pressure that the compressor or piston 29 must pump against and when the machine stops or is idle for a few minutes the condensation of the gas in the condensing coils 15 or on the condensing side of the mechanism will bring the pressure therein down to a point where there is practically no starting load. Thus the necessity of a motor with a large starting torque is eliminated.

It will also be observed that there are no delicate or sensitive parts in the control mechanism and that no adjustment of any kind is necessary while the number of parts is reduced to a minimum thus assuring a

structure which will be durable at all times with little likelihood of its becoming disarranged or out of order.

In Fig. 7 I have shown a slightly modified form of structure in which the passage 42 of the plunger 19 is provided with a ball valve 87 normally held in closed position by the spring 89 which engages the plug 90. This will prevent the formation of a vacuum at the end of the plunger or its withdrawal movement and will also permit positive ejection of fluid.

While I have illustrated and described the preferred form of my invention, I do not wish to limit myself to the precise details of structure shown but desire to avail myself of such variations and modifications as may come within the scope of the appended claims.

Having thus described my invention, what I claim as new and desire to secure by Letters Patent is:

1. In a mechanical refrigerator, a compressing mechanism; a receiving compartment; a cooling coil communicatng with said compressing mechanism and with said receiving compartment and positioned therebetween; a refrigerating coil adapted for communicating with said receving compartment and with said compressing mechanism; movable means for controlling communication of said coil with said receiving compartment; a plunger for moving said movable means to open postion, said plunger being constructed and arranged to permit the inflow of fluid under pressure between said plunger and said movable means upon withdrawal of said plunger from said movable means.

2. In a mechanical refrigerator of the class described having a high side and a low side, a valve for controlling communication of said high side with said low side; a plunger for opening said valve constructed and arranged to permit the inflow of fluid from said high side under pressure between said plunger and said valve upon withdrawal of said plunger from said valve.

3. In a mechanical refrigerator of the class described, a valve for controlling communication of the high side with the low side; a plunger for moving said valve to open position, said plunger serving upon movement for opening said valve for sealing the high side from the low side, said plunger having a passage formed therein for permitting flow of fluid from said high side to said valve upon withdrawal of said plunger therefrom.

4. A mechanical refrigerator of the class described, comprising: a pressure line; a refrigerating line; a compressing mechanism for drawing fluid from said refrigerating line and compressing the same into said pressure line; a receiving compartment for reception of compressed fluid from said pressure line; movable means for controlling communication of said refrigerating line with said receiving compartment; reciprocating means for moving said controlling means to open position; and common means for operating said moving means and said compressing mechanism.

5. A mechanical refrigerator of the class described, comprising: a pressure line; a refrigerating line; means for drawing fluid from said refrigerating line and forcing the same under pressure into said pressure line; a receiving compartment for reception of fluid under pressure from said pressure line; a valve for controlling communication of said receiving compartment with said refrigerating line; and common means for opening said valve and positively ejecting fluid from said receiving compartment into said refrigerating line.

6. A mechanical refrigerator of the class described, comprising: a pressure line; a refrigerating line; means for drawing fluid from said refrigerating line and forcing the same under pressure into said pressure line; a receiving compartment for reception of fluid under pressure from said pressure line; a valve for controlling communication of said receiving compartment with said refrigerating line; common means for opening said valve and positively ejecting fluid from said receiving compartment into said refrigerating line; and means for preventing sudden commingling of high pressure fluid and low pressure fluid with each other in communication within said receiving compartment.

7. In a mechanical refrigerator of the class described having a high and a low side, a stationary receiving compartment at the high side; a valve for controlling communication of said compartment with the low side; means for opening said valve, said means upon opening of said valve serving as a closure for closing communication of said low side with said receiving compartment.

8. In a mechanical refrigerator of the class described having a high and a low side, a receiving compartment at the high side; a valve for controlling communication of said compartment with the low side; means, movable to operative and inoperative position, for opening said valve, said means upon movement to operative position and upon opening of said valve serving as a closure for closing communication of said low side with said receiving compartment; and means co-operating with said valve opening means for preventing sudden passage of fluids from said receiving compartment into a low pressure area upon withdrawal of said valve opening means from operative position.

9. In a mechanical refrigerator having a high side and a low side a valve for controlling communication of said high side with said low side; means, independent of said

valve, for separating a quantity of fluid from the high side and opening said valve for permitting the passage of said quantity of fluid to the low side.

10. In a mechanical refrigerator having a high side and a low side means for controlling communication of said high side with said low side; mechanical means independent of said valve for separating a quantity of fluid from the high side and opening said control means for permitting the passage of said quantity of fluid to the low side.

11. In a mechanical refrigerator having a high side and a low side means for controlling communication of said high side with said low side; means for confining a quantity of fluid on said high side adjacent said control means and maintaining said quantity in communication with said high side until substantially simultaneous with the opening of said control means.

12. In a mechanical refrigerator having a high side and a low side means for controlling communication of said high side with said low side; means for confining the quantity of fluid on said high side around said control means and opening said control means for permitting said quantity to pass into said low side said means maintaining said quantity in communication with said high side until substantially simultaneous with the opening of said control means.

13. In a mechanical refrigerator having a high side and a low side means for controling communication of said high side with said low side; means for confining the quantity of fluid on said high side around said control means and opening said control means for permitting said quantity to pass into said low side said means maintaining said quantity in communication with said high side until substantially simultaneous with the opening of said control means, the space in which said quantity had been confined being maintained in communication with said high side at all times except at the time said control means are open.

14. In a mechanical refrigerator of the class described, having a high side and a low side, a receiving compartment in communication with said high side; a movable valve for controlling communication of said receiving compartment with the low side; a plunger movable into engagement at one end with said valve for moving the same to open position, said plunger having a passage formed inwardly of said end and laterally turned to open through the periphery above said end, the laterally turned portion of said passage communicating with said compartment upon movement of said plunger to valve opening position, and said passage upon movement in the opposite direction being closed at its laterally turned portion from communication with said receiving compartment, and communicating through its end with said receiving compartment.

15. In a mechanical refrigerator of the class described, having a high side and a low side, a receiving compartment permanently in communication with said high side; an outlet compartment permanently in communication with said low side; a hollow neck connecting said outlet compartment and said receiving compartment; a movable valve at one end of said neck for controlling communication of said outlet compartment with said receiving compartment; a reciprocating plunger movable into said neck and engageable at one end with said valve for moving the same to open position, said plunger upon entry into said neck, closing communication of said neck with said receiving compartment.

16. In a mechanical refrigerator of the class described, having a high side and a low side, a receiving compartment permanently in communication with said high side; an outlet compartment permanently in communication with said low side; a hollow neck connecting said outlet compartment and said receiving compartment; a movable valve at one end of said neck for controlling communication of said outlet compartment with said receiving compartment; a reciprocating plunger movable into said neck and engageable at one end with said valve for moving the same to open position, said plunger upon entry into said neck, closing communication of said neck with said receiving compartment; and an axially extending passage opening through the engaging face of said plunger and extending inwardly of said plunger and laterally turned to open through the periphery thereof, said laterally turned portion of said passage being in communication with said receiving compartment during the engagement of said plunger in said neck.

In testimony whereof I have signed the foregoing specification:

MERRILL DAVIS.