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AUTOMATIC CONTROL FOR REFRIGERATORS

Filed May 18, 1948

2 Sheets-Sheet 1

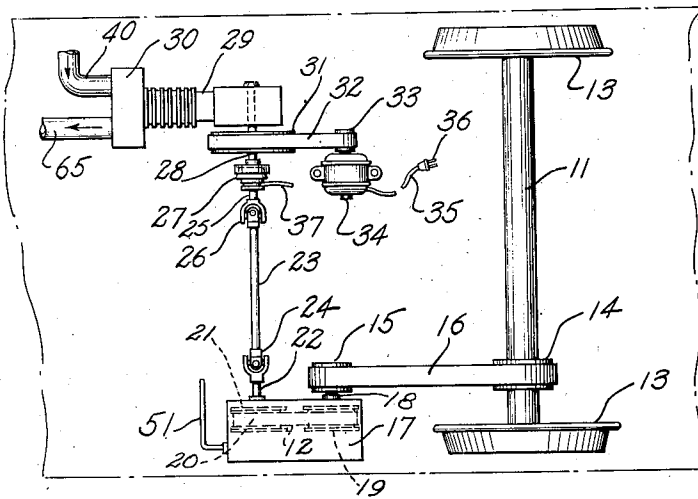
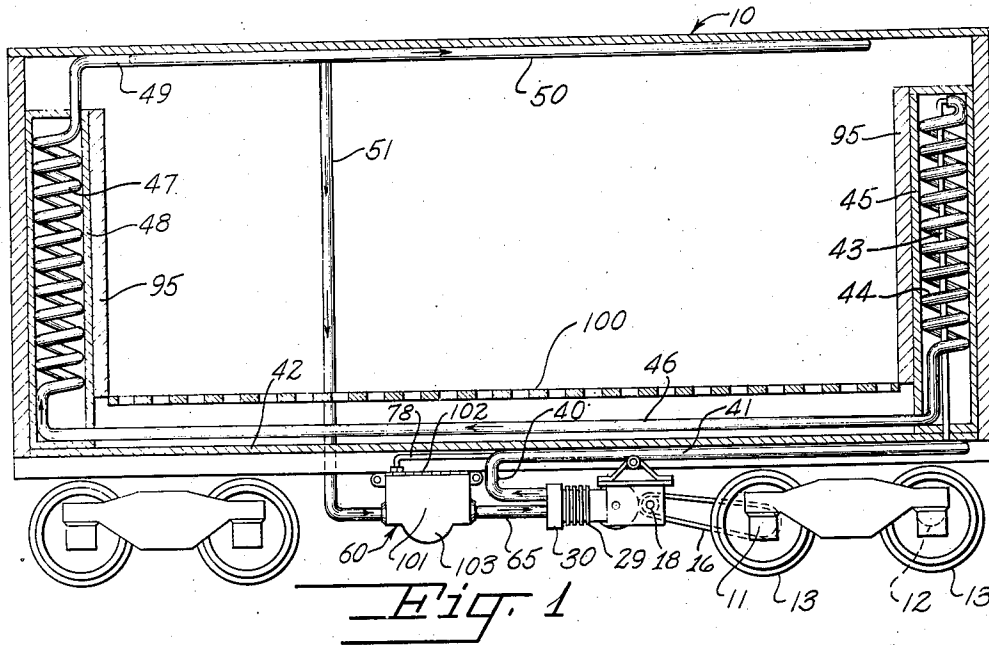


Fig. 2

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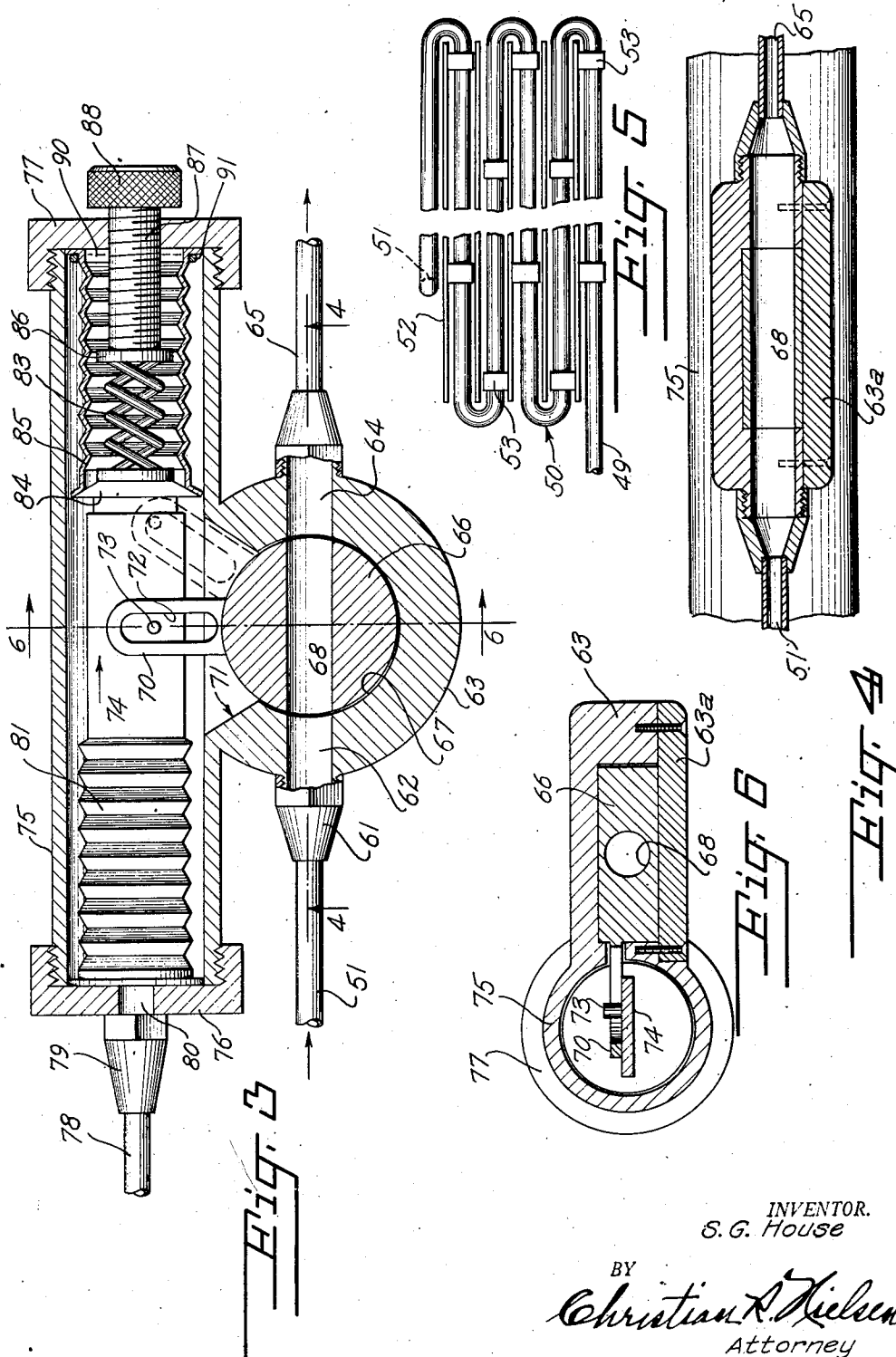
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2 Sheets-Sheet 2



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AUTOMATIC CONTROL FOR
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4 Claims. (Cl. 62-3)

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This invention relates to an automatic control for refrigerators and is more particularly adapted for use in refrigerator cars.

An object of the invention is the provision of a device for controlling the flow of a refrigerating medium to the intake of a compressor in accordance with the pressure developed at the high side of the compressor in accordance with the speed of the car.

Another object of the invention is the provision of a device for restricting the flow of a refrigerating medium in a cooling system to the suction side of a compressor by a valve which is moved toward closing position when the pressures at the output of the compressor begins to rise above a predetermined degree in order to prevent excessive cooling or possible freezing of the comestibles stored in refrigerator cars at high rolling speeds of the car.

A further object of the invention is the provision of a device for controlling the flow of a refrigerating medium in a cooling system in accordance with fluctuations in the output of a compressor which is operated by the wheels of a refrigerator car. Due to the fact, however, that the car may be standing still or may be rolling at varying speeds so that the output of the compressor will change accordingly, brine tanks are employed for housing the evaporating coils to prevent too great a rise in the temperature of the medium when the car is standing still, the output pressure of the compressor, when the car is standing still, the output pressure of the compressor, when the car is travelling at high speeds, being employed for controlling the input of said compressor.

The invention is best understood from a consideration of the following detailed description in connection with the accompanying drawings, nevertheless, it is understood that the invention is not confined to the disclosure but is susceptible of such changes and modifications as shall define no material departure from the salient features of the invention as expressed in the appended claims.

In the drawings:

Figure 1 is a longitudinal vertical section of a refrigerator car showing my invention applied thereto.

Figure 2 is a fragmentary plan view showing the connections between the axle of the refrigerator car and the compressor and the connections between an electric motor for temporarily driving the compressor.

Figure 3 is an enlarged longitudinal vertical

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section of my automatic control for the intake side of the compressor.

Figure 4 is a longitudinal horizontal section taken along the line 4-4 of Figure 3.

Figure 5 is a top plan view of the final expansion coils which are secured to the inside surface of the top of the refrigerating car, and

Figure 6 is a transverse vertical section through the controlling device disclosing a valve operated by a mechanism acted upon by the output pressure of the compressor, the section being taken along the line 6-6 of Figure 3.

Referring more particularly to the drawings, 10 designates a freight car having axles 11 and 12 secured to the usual flanged car wheels 13 which when drawn along the tracks (not shown) cause rotation of the axles and likewise a pulley 14 secured to the axle 11. This pulley drives a second pulley 15 through a belt connection 16.

For the purpose of description, however, the pulley 15 is secured to a shaft 18 which in turn drives a pulley 19 whereby a belt 20 will drive the pulley 21 and likewise a shaft 22 which projects beyond the housing of the transmission unit 17.

A shaft 23 is universally connected at 24 with the shaft 22 and is connected to a shaft 25 by a universal joint 26. A clutch 27 normally connects the shaft 25 with a shaft 28 which drives the rotor or pistons of a compressor unit 29 having a header 30.

The shaft 28 may also be driven by means of a pulley 31, the pulley being driven by a belt 32 and a pulley 33 having direct connection with the shaft of an electric motor 34. This motor is provided with the usual wires 35 and an element 36 adapted to be connected with a source of current. A lever 37 is adapted to operate the clutch 27 which disconnects the shaft 25 from the shaft 28 to permit the motor 34 to drive the shaft 28 independently of its drive from the axle 11.

An outlet pipe 40 is connected with the header 30 of the compressor 29 and also with condensing coils 41 under the floor 42 of the car 10 and whence the outside air flowing past the coils will cool them during travel. A restricted pipe 43 connects the coils 41 with the upper end of an expansion coil 44 disposed within a brine tank 45 at one end of the car. A pipe 46 connects the lower end of the coil 44 with a coil 47 also disposed in a brine tank 48 mounted at the other end of the car. The upper end of the coil 47 as shown at 49 is in communication with one end of a coil 50 secured to the underface of the roof of said car. A pipe 51 extends downwardly at one side wall of the refrigerator car and passes through the floor

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thereof for a purpose which will be explained presently.

As shown more particularly in Figure 5, the series of coils 50 are disposed in a horizontal plane and are provided with removably mounted fins 52. Clips 53 are adapted to connect the fins removably to the sections of said coil.

The condenser coils 41 lying under the floor of the car are identical in construction with that shown in Figure 5 and are adapted to cool and condense the compressed refrigerant before it enters the coil 44 in the brine tank 45. On the other hand, the coils 50 at the top of the car are in the warmer regions of the interior of said car so that the expanding refrigerant will absorb the heat of the surrounding air before said refrigerant is drawn into the suction side of the compressor for the completion of the cycle.

A housing 60 is supported exteriorly of the car and below the bottom 42 thereof. A device (Figures 3, 4, and 6) is contained in said housing for controlling the flow of the refrigerant to the suction side of the compressor in accordance with fluctuations in the output of the compressor. The pipe 51 extends through the housing 60 and is connected at 61 with an inlet passage 62 in a cylindrical valve casing 63. An outlet passage 64 is connected by a pipe 65 which extends through the housing, with the suction side of the compressor 29 through the header 30. The passages 62 and 64 in the casing are diametrically disposed. A cylindrical valve 66 is neatly fitted in a cylindrical chamber 67 in the valve casing. Said valve has a diametrical passage 68 adapted to align with the passages 62 and 64. An operating arm 70 is rigidly attached to the valve 66 and projects through an opening 71 at the upper end of the casing. The side walls of the opening are inclined and act as stops for the arm. The arm has a longitudinal slot 72 for a purpose which will be explained presently. A removable closure 63—a on the casing 63 permits the insertion of the valve 66 in the casing. The arm 70 is rocked by a pin 73 received within the slot 72 of said arm. The pin projects laterally from a reciprocating member 74 located within a cylinder 75 formed integrally with the housing 60. Closures 76 and 77 are threaded onto the opposite end of said cylinder. A pipe 78 is connected at 79 with the closure 76 and is in communication with a passage 80 which opens into the interior of a bellows 81. The outer open end of the bellows is sealed to the inner face of the closure 76 while the inner end thereof is closed and secured to the adjacent end of the reciprocating member 74. Direct pressure from the output of the compressor 29 will expand the bellows and move the member in the direction of the arrow in Figure 3 when the output pressure exceeds a predetermined speed.

Means is also included in the cylinder 75 for resisting movement of the member 74 in the direction indicated. For this purpose, I have provided a coil spring 83 having the inner end secured to a closure 84 at the inner end of the bellows 85. The closure is attached to the other end of the reciprocating member 74 so that said member connects the inner ends of the bellows 81 and 85. The outer end of the spring 83 may be attached to a disk 86 or the disk may be formed integrally with an adjusting screw having an external knurled knob 88. The outer end of the bellows 85 is secured onto an internal boss 90 at the inner face of the closure 77 by a ring 91. The screw is threaded through a central passage in said closure for providing degrees of com-

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pression on the spring 85 for counteracting the output pressure from the compressor 29.

End walls 95 (Fig. 1) are secured in any approved manner within the car 10 and spaced from the outer end walls of the car to provide vertical chambers for the brine tanks 45 and 48. A perforated false bottom 100 is supported above the bottom 42 of the car to not only provide a chamber for the pipe 46 and the coils 41 but to form an air passage to permit circulation of the cooled air in the car so that when comestibles are placed on the false bottom the air will circulate through the comestible or stored packages of foods and also beneath said false bottom and over the top edges of the end walls 95 which are spaced from the top of the refrigerator car.

One side of the housing 60 is open but is closed by a door 101 hinged at 102 in the top of the housing. The door permits ready access to the entire interior of the housing for repairs or for adjustments of the bolt 87. The bottom of the housing has an arcuately shaped portion 103 for the reception of the valve casing 63.

The operation of my device is as follows: The refrigerating medium is supplied to the cooling system in any approved manner and as long as the car is standing still, the compressor 29 will not be forcing the medium, such as methyl chloride, under pressure into the condensing coils 41 and the temperature in the refrigerating car will be at its maximum. If the car is in a freight yard and an electric outlet is convenient, the member 36 (Fig. 2) is plugged in. When the car is in motion, the compressor will be operated by the wheels of the car and will build up a pressure on the refrigerating medium in the condenser coils 41.

Under normal conditions of the operation of the compressor, the valve 66 will be in the position shown in Figure 3 and the passage 63 in said valve will be aligned with the passages 62 and 64 in the valve casing 63 so that the low side of the compressor will be fully open to the return pipe 51 of the expansion coils for the refrigerating medium. The spring 83 will retain the floating element 74 in the position shown in Figure 3 with the arm 70 vertically disposed.

When the car is rolling at a high speed, the compressor 29 will be driven also at a high speed. At this time the output of the compressor will act more positively on the bellows 81 through the pipe 78 and the floating member 74 will be moved in the direction of the arrow in Figure 3 against the tension of the spring 83, thereby rocking the arm 70 by means of the pin 73 to move the passage 68 out of alinement with the passages 62 and 64 of the valve casing 63. If the speed of the compressor continues, the expansion of the bellows 81 will also continue until the valve 66 moves the passage 68 out of alinement with the passages 62 and 64. The intake to the compressor will be closed. Since the refrigerating medium is not being forced through the coils 41, 44, 47 and 50, the temperature will rise in the refrigerating car. The pressure at the high side of the compressor will fall in time and the valve will open progressively as the arm 70 and the oscillating member 74 are returned toward the normal operative positions by the spring 83. The valve 66 will continue to control the flow of the refrigerant to the compressor until the car reaches a normal speed.

The tanks 45 and 48 which are filled with a brine aid in maintaining the coils 44 and 47 cool. These brine tanks are particularly effective when

the car is travelling slowly or when the car is standing still.

The valve 66 will be moved to closing position in accordance with speeds of the travelling car when such speeds exceed the normal rate, so that the restrictions on the intake of the compressor will be in proportion to the increased speeds of the car. Such increased speeds control the output of the compressor and the varying output is in direct ratio with the varying speeds of the car above a rate for the normal operation of the compressor.

I claim:

1. A refrigerating unit for a refrigerator car comprising a compressor, means operatively connecting wheels of the car with the compressor so that the compressor will be actuated in accordance with the speed of the car, condensing coils connected with the compressor, expansion coils having restricted communication with the condensing coils, a return pipe leading from the expansion coils to the intake side of the compressor, a valve interpolated in the return pipe, a reciprocating means connected to the valve for operating the valve, a spring acting on the reciprocating means for retaining the valve in an open position and means acted on by the output of the compressor when the car is travelling beyond a predetermined speed for shifting the reciprocating means against the tension of the spring for closing the valve.

2. A refrigerating unit for a refrigerator car comprising a compressor, means operatively connecting wheels of the car with the compressor so that the compressor will be actuated in accordance with the speed of the car, condensing coils connected with the compressor, expansion coils having restricted communication with the condensing coils, a return pipe leading from the expansion coils to the intake side of the compressor, a valve interpolated in the return pipe, a reciprocating means connected to the valve for operating the valve, a spring acting on the reciprocating means for retaining the valve in an open position, an expansible means connected with the reciprocating means, a tube connecting the expansible means with the output of the compressor, so that when the car is travelling beyond a predetermined speed, the excessive pressures at the output of the compressor will act on the expansible means for shifting the reciprocating means, against the tension of the spring and move the valve toward closing position.

3. A refrigerating unit for a refrigerator car

comprising a compressor, means operatively connecting wheels of the car with the compressor so that the compressor will be actuated in accordance with the speed of the car, condensing coils connected with the compressor, expansion coils having restricted communication with the condensing coils, a return pipe leading from the expansion coils to the intake side of the compressor, a valve interpolated in the return pipe, a reciprocating means connected to the valve for operating the valve, a spring acting on the reciprocating means for retaining the valve in an open position, an expansible means connected with the reciprocating means and in communication with the output of the compressor, means for varying the tension on the spring for retaining the valve open at a predetermined speed of the refrigerator car, an excessive speed of the car causing the compressor to develop a correspondingly increased output which acts on the expansible means to overcome the adjusted tension on the spring for moving the valve toward closing position.

4. A refrigerating unit for a refrigerator car comprising a compressor, means operatively connecting wheels of the car with the compressor so that the compressor will be actuated in accordance with the speed of the car, condensing coils connected with the compressor, a brine tank at each end of the refrigerating car, expansion coils in each tank and having restricted communication with the condensing coils, a pipe connecting the expansion coils together, a third expansion coil secured to the underface of the top of the car and in communication with the other expansion coils, a return pipe connecting the third expansion coil with the intake side of the compressor, a normally open valve interpolated in the return pipe, means for retaining the valve open at a predetermined speed of the car, and means acted on by the output of the compressor and connected to said valve for causing closing of the valve at excessive speeds of the car.

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