J. HEINRICH.

REFRIGERATING APPARATUS.

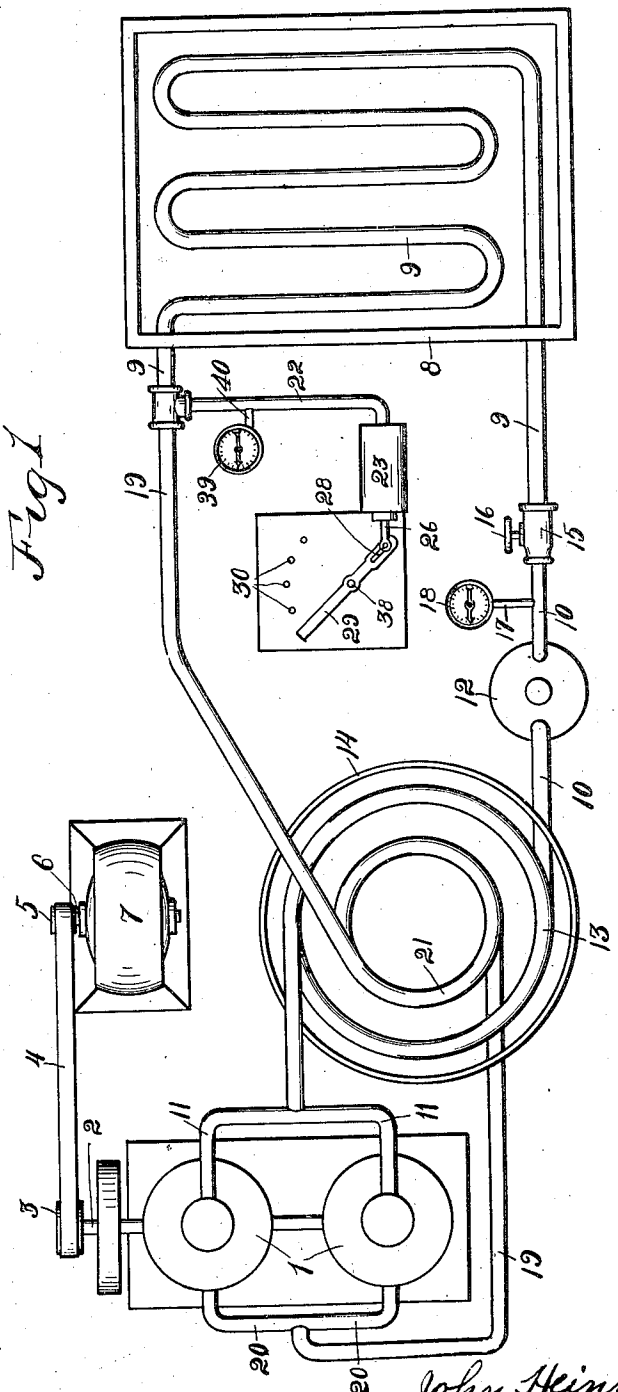
APPLICATION FILED MAY 12, 1908.

942,499.

Patented Dec. 7, 1909.

2 SHEETS—SHEET 1.

Fig 1



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2 SHEETS—SHEET 2.

Fig 2

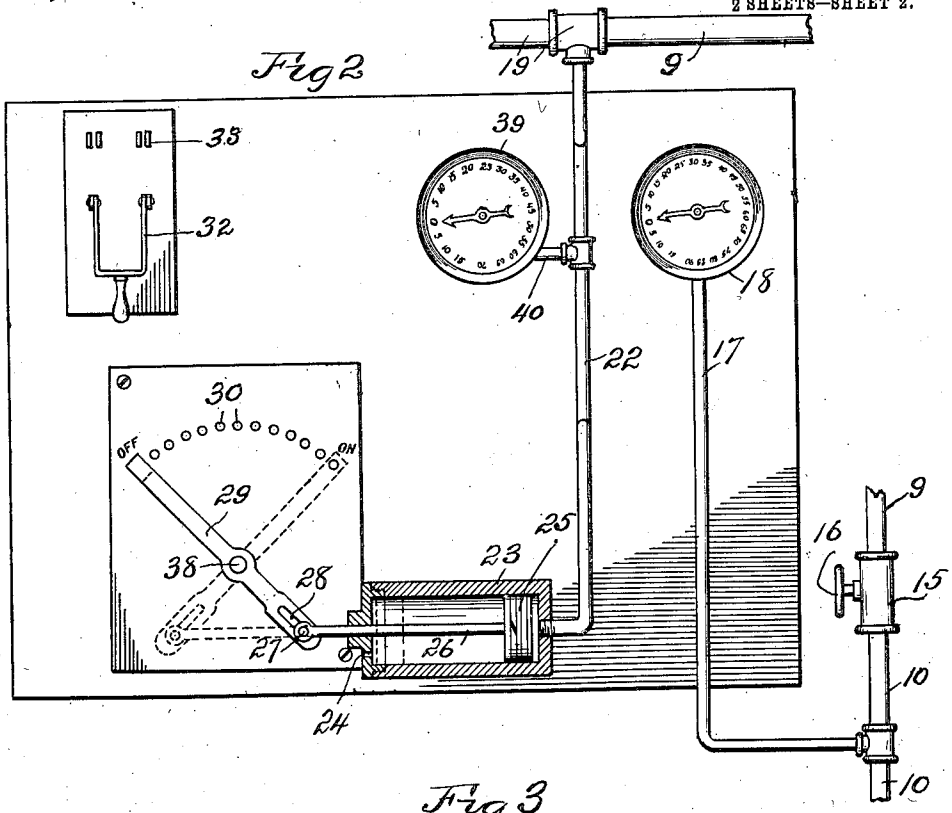


Fig 3

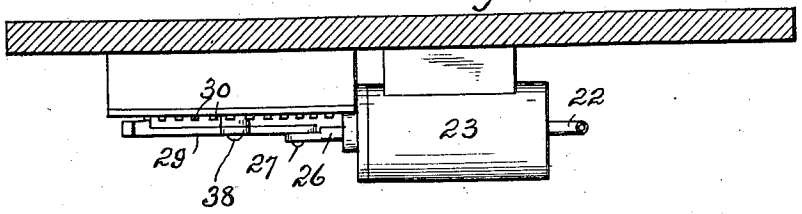
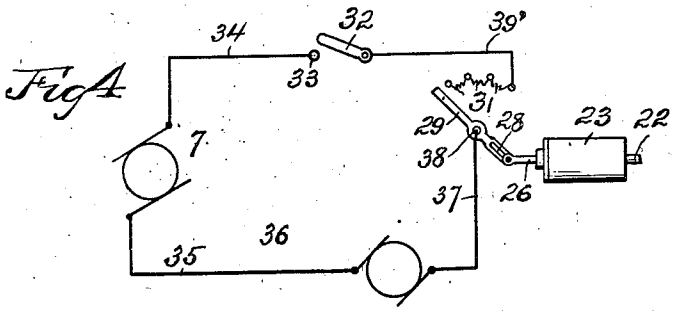


Fig 4



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UNITED STATES PATENT OFFICE.

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REFRIGERATING APPARATUS.

942,499. Specification of Letters Patent. Patented Dec. 7, 1909.

Application filed May 12, 1908. Serial No. 432,404.

To all whom it may concern:

Be it known that I, JOHN HEINRICH, a citizen of the United States, residing at Kansas City, in the county of Jackson and State of Missouri, have invented certain new and useful Improvements in Refrigerating Apparatus, of which the following is a specification.

My invention relates to improvements in refrigerating apparatus.

It relates particularly to the type of refrigerating apparatus in which refrigerating fluid is first compressed and condensed, then permitted to expand to effect the desired refrigeration, the expanded fluid being successively recompressed and reëxpanded.

The object of my invention is to provide novel means by which the pressure of the refrigerating fluid automatically controls the operation of the compressing mechanism.

In the preferred form of my invention an electric motor is employed to operate the compressing mechanism, means being provided by which the operation of the motor is controlled by pressure of the refrigerating fluid.

Other novel features of my invention are hereinafter fully described and claimed.

In the accompanying drawings illustrative of my invention—Figure 1 is a diagrammatic view of the complete apparatus. Fig. 2 is a view partly in elevation and partly in vertical section of the circuit controlling mechanism, the positions of the rheostat operating mechanism being shown in solid and dotted lines representing the positions of these parts when the circuit is respectively open and closed. Fig. 3 is a top view partly in horizontal section of what is shown in Fig. 2. Fig. 4 is a diagrammatic view of the electric circuit in which the motor is located.

Similar characters of reference denote similar parts.

Referring particularly to Fig. 1—1 denotes the two compressing cylinders or an ordinary compressor, 2 denotes the driving shaft thereof having secured thereto a pulley 3 connected by a belt 4 with a pulley 5, secured on the armature shaft 6 of an ordinary type of electric motor 7. 8 denotes the refrigerating casing inclosing a sinuously formed conductor 9, which serves as an expansion chamber. 10 denotes a conductor for conveying compressed fluid, such as ammonia, from the compressing cylinders 1 to the expansion chamber 9. One end of the conductor 10 is provided with two branch conductors 11 connected respectively with the compression cylinders 1. In the conductor 10 is located a receptacle 12 for receiving liquid ammonia. Intermediate the branches 11 and the receptacle 12 the conductor 10 is provided with a helically formed portion 13, located in a receptacle 14 adapted to contain a cooling medium, such as water. The discharge end of the conductor 10 is connected with a valve casing 15, connected to the inlet end of the expansion chamber 9 and provided with a valve 16 for controlling the flow of refrigerating liquid into the expansion chamber. 17 denotes a conductor having one end connected with the conductor 10 intermediate the valve casing 15 and the receptacle 12, the other end of the conductor 17 being connected to a pressure gage 18 of any suitable type. 19 denotes a return conductor connected at its inlet end to the expansion chamber 9 and provided at its discharge end with two branch conductors 20 discharging respectively into the cylinders 1. The conductor 19 is provided with a helically formed portion 21 located within the helical portion 13 from which it is adapted to receive heat through the intermediacy of the cooling liquid in which said helical portions are immersed. 22 denotes a conductor having one end connected to the return conductor 19, the other end being connected to one end of a cylinder 23 having at its opposite end an air inlet 24. Reciprocatively mounted in the cylinder 23, intermediate the inlet 24 and conductor 22, is a piston 25, to one end of which is secured a piston rod 26 provided at its outer end with a transverse pin 27 longitudinally movable in a longitudinal slot 28 provided in one end of a pivoted lever 29, which forms the lever of an ordinary rheostat which is provided with a series of contacts 30, consecutively connected with each other by the ordinary resistance coils 31. 32 denotes an ordinary switch lever adapted to have electrical contact with the contact 33 which is connected by a conductor 34 with one brush of a motor 7, the other brush of which is connected by a conductor 35 with one brush of a dynamo 36, the other brush of which is connected by a conductor 37 with the pivot 38 on which the lever 29

is mounted. The lever 32 is connected by a conductor 39 with one of the end contacts 30 of the rheostat. 39 denotes a pressure gage of any ordinary type which is connected by a conductor 40 with the conductor 22.

In the operation of my invention, the switch lever 32 is first swung to a position in contact with the contact 33. The lever 29 is then swung manually to the position shown in dotted lines in Fig. 2 in which position the circuit will be closed, and the motor 7 will receive current from the generator 36, and will start running. The driving shaft 2 of the compressor will thus be driven through the intermediacy of the armature shaft 6, pulley 5, belt 4 and pulley 3. The compressor in running will force compressed refrigerating fluid into the expansion chamber 9, the valve 16 first having been opened, through the branches 11, conductor 10 which includes the helical portion 13 and receptacle 12. The compressed fluid will be condensed in the helical portion 13 and will be deposited in the form of liquid in the receptacle 12. Upon entering the valve casing and passing the valve 16, the fluid will be converted into gas and passing into the expansion chamber 9 will effect refrigeration by reason of its expansion, in the ordinary manner. The expanded fluid will then be conveyed from the expansion chamber 9 into the conductor 19, through the helical portion 21, and thence by the branches 20 it will pass into the compressing cylinders 1 in which it will be compressed, and will then be subjected to cooling and expansion as above described. The conductor 22 being connected with the conductor 19 will be charged with fluid at the same pressure as that held in the conductor 19. Normally the pressure in the conductors 19 and 22 will be above the atmospheric pressure, so that the piston 25 and lever 29 will normally be held in the position denoted by dotted lines in Fig. 2. In case that the pressure in conductors 19 and 22 should fall below atmospheric, the air entering the air inlet 24 of the cylinder 23, due to the predominance of atmospheric over the gas pressure in the cylinder will force the piston 25 and lever 29 to the position shown in solid lines in Fig. 2, in which position the circuit will be broken and the motor 7 being unsupplied with current will slow down, thus causing the compressor to slow down in its operation. By turning the valve 16 so as to admit more liquid into the expansion chamber from the conductor 10, the pressure in the expansion chamber will be increased, as will the pressure in conductors 19 and 22, above the atmospheric pressure and the piston 25 and lever 29 will again be forced to the position shown in dotted lines in Fig. 2, thus again closing the circuit and thereby the motor 7 will be supplied with current and will again run at full speed, thus driving the compressor at maximum speed. When it is desired to stop the action of the compressor this may be done by closing the valve 16. The compressor will soon reduce the pressure in the expansion chamber 9 and conductors 19 and 22 below atmospheric pressure, upon which the circuit containing the motor 7 will be broken as already described, and the motor and compressor will cease operating.

From the foregoing, it will be understood that by regulating the valve 16, the compressor may be caused to supply just the required amount of fluid to retain the chamber 8 at a predetermined temperature. When the temperature of said chamber lowers below this predetermined point, by reason of coolness of the atmosphere or by reason of too much supply of refrigerant, the pressure in the chamber or conductor 9 will lower and the motor will stop. In case the temperature rises above the predetermined point by reason of the refrigerator doors being opened or fresh warm articles placed in the refrigerator, the fluid in the conductor 9 will be increased in pressure due to the increase of temperature, and the motor will be again put into operation.

My invention may be modified in different ways, within the scope of the appended claims without departing from its spirit.

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

1. In a refrigerating apparatus, the combination with means for compressing a refrigerating fluid, of a motor for operating said compressing means, an expansion chamber, a conductor for conveying compressed fluid from said compressing means to said expansion chamber, a return conductor for conveying the expanded fluid to said compressing means, and means controlled by the pressure in said return conductor for controlling the operation of said motor.

2. In a refrigerating apparatus, the combination with means for compressing a refrigerating fluid, of a motor for operating said compressing means, an expansion chamber, a conductor for conveying compressed fluid from said compressing means to said expansion chamber, a return conductor for conveying the expanded fluid from the expansion chamber to said compression means, and means by which said motor is started or stopped in operation when the pressure in said return conductor rises above or falls below respectively the atmospheric pressure.

3. In a refrigerating apparatus, the combination with a compression cylinder, of a piston mounted therein, a motor, means connected with said motor for operating said piston, an expansion chamber, a conductor for conveying compressed fluid from said

cylinder to said expansion chamber, a return conductor for conveying the expanded fluid from said chamber to said cylinder, and means by which increase and decrease in pressure in said return conductor will respectively start and stop the running of said motor.

4. In a refrigerating apparatus, the combination with a motor, of means operated by the motor for compressing a refrigerating fluid, an expansion chamber, a conductor for conveying compressed fluid from the compressing means to said expansion chamber, a valve controlling the discharge of fluid from said conductor into said expansion chamber, a return conductor for conveying expanded fluid from the expansion chamber to said compression means, and means controlled by the pressure in said return conductor for controlling the running of said motor.

5. In a refrigerating apparatus, the combination with a motor, of means operated thereby for compressing a refrigerating fluid, an expansion chamber, a conductor for conveying compressed fluid from said compressing means to said expansion chamber, a return conductor connecting the expansion chamber with said compressing means, a cylinder, a piston reciprocative in said cylinder, means by which, when said piston is reciprocated, said motor will be alternately started and stopped, and means for conveying fluid from the return conductor into said cylinder at one side of said piston.

6. In a refrigerating apparatus, the combination with a motor, of means actuated thereby for compressing a refrigerating fluid, an expansion chamber, a conductor for conveying compressed fluid from the compressing means to said expansion chamber, means for controlling the discharge from the said conductor into the expansion chamber, a cylinder, a piston reciprocative therein, a return conductor connecting said chamber with the compressing means, means actuated by said piston for controlling said motor, and a conductor connected with the return conductor and with said cylinder at one side of said piston.

7. In a refrigerating apparatus, the combination with a motor located in an electric circuit, of current generating means in said circuit, means for opening and closing said circuit, means actuated by said motor for compressing a refrigerating fluid, an expansion chamber, a conductor for conveying compressed fluid from said compressing means to said expansion chamber, a return conductor connecting said expansion chamber with said compressing means, and means controlled by the pressure in said return conductor for controlling the operation of said opening and closing means.

8. In a refrigerating apparatus, the combination with a motor located in an electric circuit, of current generating means in said circuit, means for opening and closing said circuit, means actuated by said motor for compressing a refrigerating fluid, an expansion chamber, regulatable means for controlling the discharge of compressed fluid into said expansion chamber, a conductor for conveying compressed fluid from the compressing means to said expansion chamber, a return conductor connecting said expansion chamber with said compressing means, and means by which increase and decrease in pressure in said return conductor operates said opening and closing means.

9. In a refrigerating apparatus, the combination with a motor located in an electric circuit, of current generating means in said circuit, opening and closing means in said circuit comprising a rheostat, means actuated by said motor for compressing a refrigerating fluid, an expansion chamber, a conductor for conveying compressed fluid from the compressing means to said chamber, a return conductor connecting said chamber with said compressing means, and means controlled by the pressure in said return conductor for controlling said opening and closing means.

10. In a refrigerating apparatus, the combination with a motor located in an electric circuit, of current generating means in said circuit, a rheostat in said circuit, fluid compressing means actuated by said motor, an expansion chamber, a conductor for conveying compressed fluid from said compressing means to said chamber, a valve controlling the discharge of fluid from said conductor into said chamber, a return conductor connecting said chamber with said compressing means, and means controlled by the pressure in said return conductor for controlling the operation of said rheostat.

11. In a refrigerating apparatus, the combination with a motor located in an electric circuit, of current generating means in said circuit, opening and closing means in said circuit, a piston, a cylinder in which said piston is reciprocated, means actuated by said piston for operating the opening and closing means, means actuated by said motor for compressing a refrigerating fluid, an expansion chamber, a conductor for conveying fluid from said compressing means to said chamber, a return conductor connecting said chamber with said compressing means, and a conductor connecting said return conductor with said cylinder at one side of said piston.

12. In a refrigerating apparatus, the combination with a motor located in an electric circuit, of a current generator in said circuit, a rheostat in said circuit, a cylinder, a piston reciprocative therein for controlling said rheostat, means actuated by said motor

for compressing a refrigerating fluid, an expansion chamber, two conductors for respectively conveying fluid from said compressing means to said chamber and from said chamber to said compressing means, and a conductor connecting one of said conductors with said cylinder at one side of said piston.

13. In a refrigerating apparatus, the combination with a motor, a generator, and a rheostat all located in an electric circuit, of a cylinder, a piston reciprocative in said cylinder for controlling said rheostat, means actuated by said motor for compressing a refrigerating fluid, an expansion chamber, a conductor for conveying compressed fluid from said compressing means to said chamber, a return conductor connecting said chamber with said compressing means, means for controlling the discharge of fluid from said compressing means through the first named conductor into said chamber, and a conductor connected with said return conductor and with said cylinder at one side of said piston.

In testimony whereof I have signed my name to this application in presence of two subscribing witnesses.

JOHN HEINRICH.

Witnesses:
E. B. HOUSE,
E. T. POWERS.