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CONTROLLING MECHANISM FOR REFRIGERATING APPARATUS

Filed Nov. 30, 1925

3 Sheets-Sheet 1

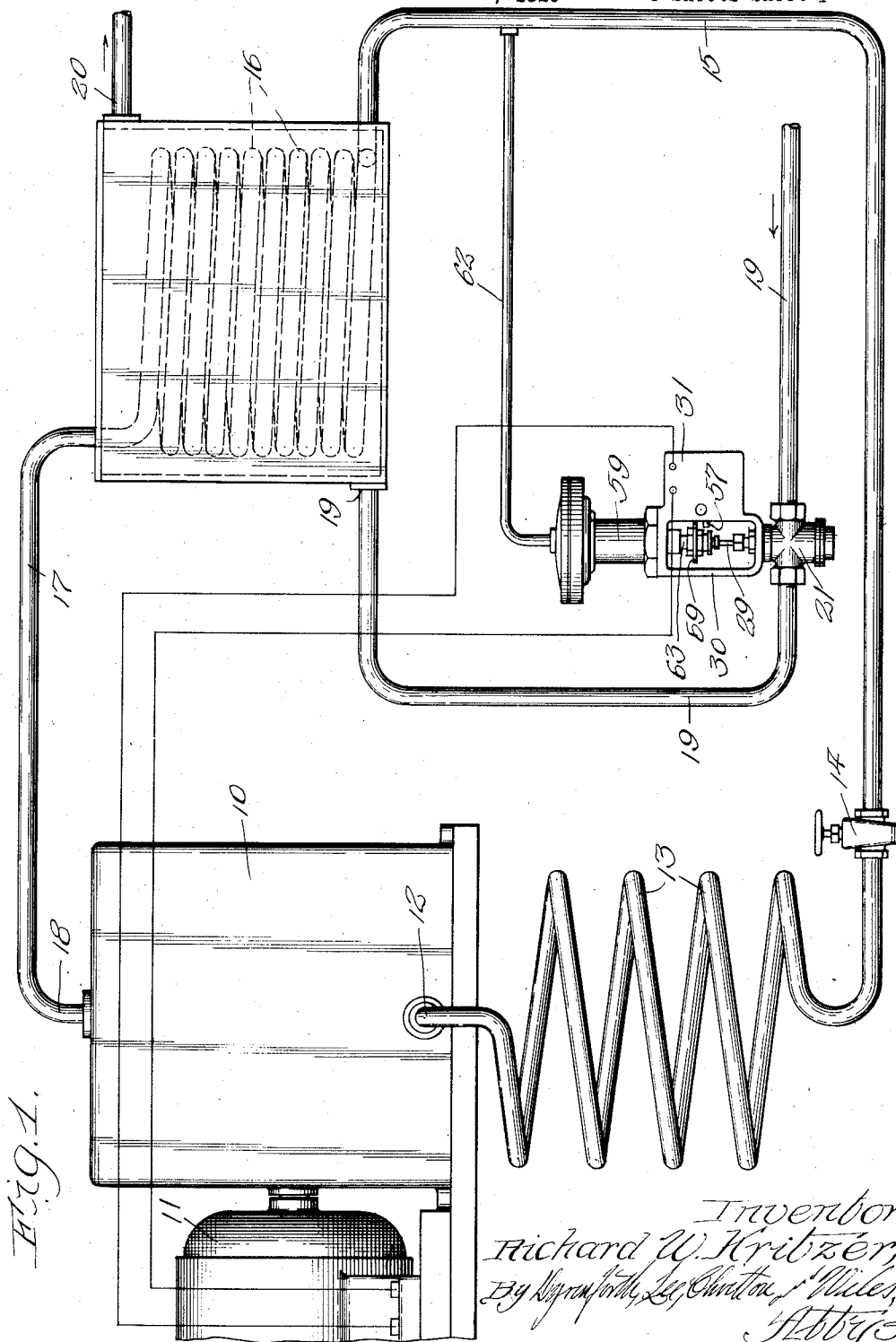


Fig. 1.

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Sept. 28 , 1926.

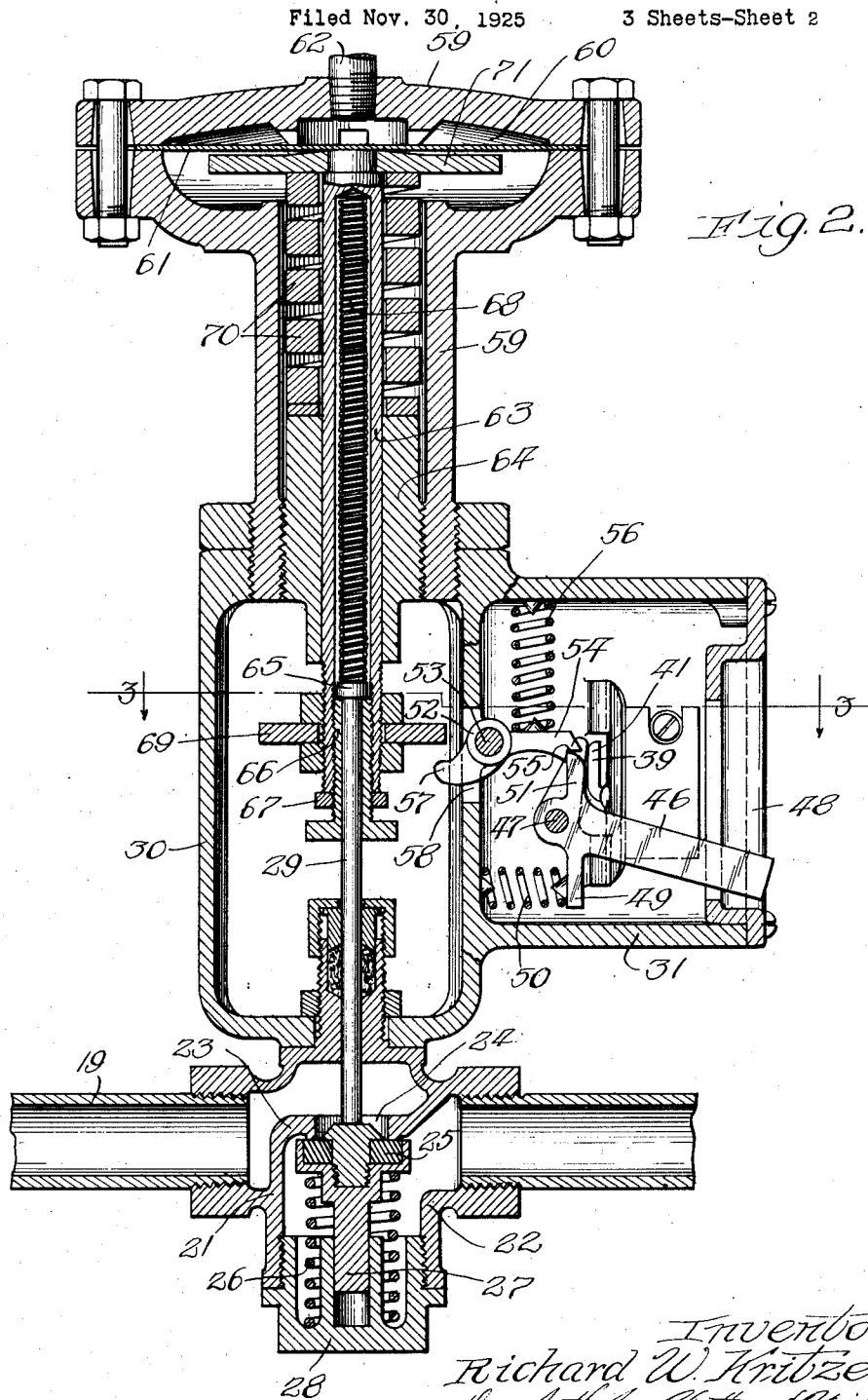
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CONTROLLING MECHANISM FOR REFRIGERATING APPARATUS

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3 Sheets-Sheet 2



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CONTROLLING MECHANISM FOR REFRIGERATING APPARATUS

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3 Sheets-Sheet 3

Fig. 3.

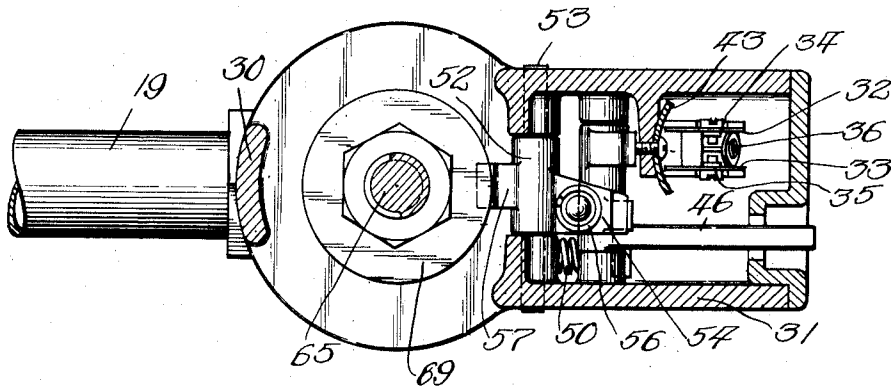


Fig. 4.

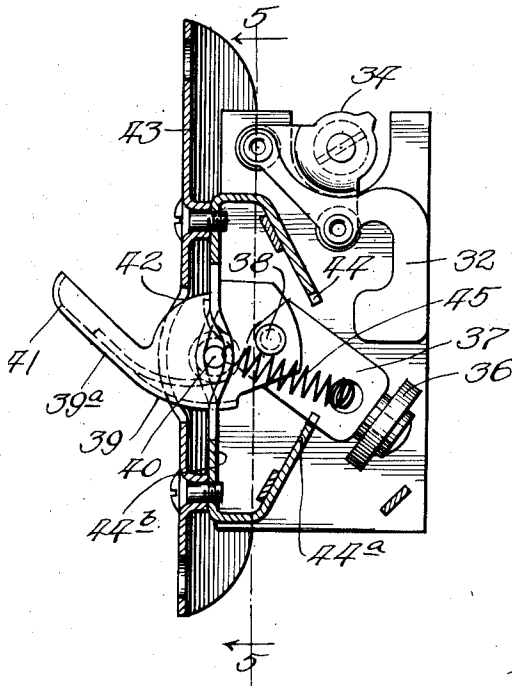
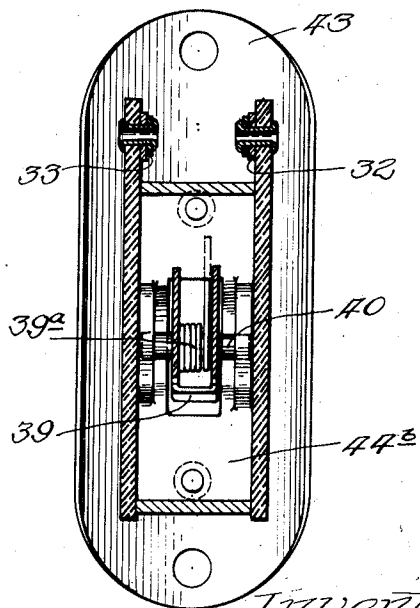


Fig. 5.



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UNITED STATES PATENT OFFICE.

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CONTROLLING MECHANISM FOR REFRIGERATING APPARATUS.

Application filed November 30, 1925. Serial No. 72,227.

My invention relates more particularly to mechanism in communication with the high pressure side of the apparatus, for automatically controlling the supplying of cooling medium to the condenser, responsive to increase of pressure of the refrigerant, and automatically discontinuing the operation of the gas compressing means in the event that the pressure on the high pressure side of the apparatus exceeds a predetermined amount; and more especially to apparatus in which the mechanism above referred to is provided as a single unit operable from the high pressure side of the apparatus, as through the medium of a single diaphragm device.

It may be stated that it is desirable in refrigerating apparatus to maintain the pressure in the high pressure side thereof within certain limits found, in practice, to be the most economical, and inasmuch as the pressure is dependent mainly upon temperature conditions, it is desirable to provide automatically operating means, to vary the amount of cooling fluid supplied to the condenser, responsive to variations in the pressure of the refrigerant. Furthermore, it is also desirable that means be provided whereby, should the pressure of the gas exceed a predetermined amount, as for example in the event of failure of supply of cooling fluid for the condenser, the operation of the compressor will be discontinued. It is furthermore desirable that the mechanism provided be so constructed that should the water valve become frozen in closed condition, it will not interfere with the discontinuing of the operation of the gas compressing means when the pressure on the high pressure side of the apparatus exceeds a predetermined amount.

My primary object is to provide a construction of the general character above stated whereby the freezing of the water valve in closed condition will not prevent the proper operation of the mechanism to discontinue the operation of the compressor in the event that the pressure on the high pressure side exceeds a predetermined amount, and to effect this result by novel, simple, inexpensive, and positively operated means.

Referring to the accompanying drawings:—

Figure 1 is a diagrammatic view of a typ-

ical form of refrigeration apparatus embodying my improvement. Figure 2 is a view in sectional elevation of my improved control mechanism forming a part of the apparatus shown in Fig. 1. Figure 3 is a section taken at the line 3—3 on Fig. 2 and viewed in the direction of the arrows. Figure 4 is an enlarged view in sectional elevation of the switch mechanism forming a part of the apparatus; and Figure 5, a section taken at the line 5—5 on Fig. 4 and viewed in the direction of the arrows.

Referring first to the apparatus diagrammatically shown in Fig. 1, which is presented merely by way of an example of a use for my improved control mechanism, 10 represents a compressor for the gasified refrigerant shown as operated by an electric motor indicated at 11. The intake for the compressor 10 is represented at 12 and is connected with the outlet end of the refrigerating coil represented at 13, the other end of which opens into an expansion-valve 14, which in turn communicates with a pipe 15 connected with, and leading from, the discharge end of a condenser-coil 16, the other, inlet, end of which communicates with a pipe 17, connected with the compressed-gas-outlet 18 of the compressor 10. The condenser-coil 16 is cooled by a liquid cooling medium, as for example water, which enters the condenser structure through the inlet 19 and discharges therefrom, after effecting the cooling function, through the outlet 20.

The apparatus shown also embodies my improved mechanism, of which the following is a description:

The mechanism comprises a valve device represented generally at 21 and interposed in the pipe 19 for controlling the flow of water to the condenser, the particular valve structure shown comprising a casing 22 formed with a partition 23, containing a port 24 controlled by the valve-proper 25 which is normally held in seated position, as shown in Fig. 2, to shut off the supply of water to the condenser structure, by a coil-spring 26 surrounding the lower, guided, stem portion 27 of this valve, and interposed between the latter and a plug 28 screwed into the casing 22, the valve-proper 25 being shown as provided with an upwardly-extending stem 29, slidable in, and projecting upwardly through, the top of the casing 22. The casing 22 is surmounted

by a frame-like member 30 provided with a laterally-extending housing 31 for enclosing mechanism through the medium of which the motor 11 is controlled, the mechanism shown being in the form of an electrical switch of a well known construction, comprising generally the following mechanism: A pair of spaced spring contact-fingers 32 and 33 connected with a stationary part of the switch structure and forming the terminals 34 and 35 of the switch, and into and out of engagement with which the bridging contact member 36 is movable. The contact member 36 is carried by a lever 37 which is pivoted at 38 to the inner end of a lever 39 pivoted on a pin 40 supported on a stationary part of the switch structure, the outer end of this lever, and represented at 41, extending through a slot 42 in a plate 43, forming a part of the switch structure, and through which portion the switch is operated. Cooperating with the lever 39 is a coil-spring 39^a which surrounds the pin 40 and engages the lever 39 and exerts a force on the latter tending to rock this lever in counter-clockwise direction to the position shown in Fig. 4. The lever 37 is located between upper and lower stop-forming portions 44 and 44^a of a yoke-clip 44^b carried by the casing of the switch and is movable into and out of engagement with these stop portions by a coil spring 45 connected at one end with the lever 37 and at its opposite end with a stationary part of the switch structure, as shown, this spring being so positioned that in the position of the lever 39 in Fig. 4 the spring 45 extends below the pivot 38 and holds the lever 37 against the stop-portion 44^a in which position the switch is open, and when the lever 39 is swung upwardly this spring extends above the pivot 38 and throws the lever 37 against the stop-portion 44 in which position the switch is closed. The arrangement of the parts just described is such, as shown, as to cause the movable parts of the switch to automatically move to the position shown in Fig. 4 after the operation of the lever 39 to move the contact 36 into engagement with the contacts 32 and 33, unless force is exerted on the lever 39, restraining its return movement under the action of the spring 39^a to the position shown in this figure. In other words, the switch remains closed only so long as pressure continues to be applied to the lever 39 after the latter has been forced to switch-closing position against the resistance of the spring 39^a.

Cooperating with the switch mechanism just described is switch-actuating and locking mechanism comprising a lever 46 pivoted on a shaft 47, carried by the casing 31, the outer end of this lever extending through a slot 48 in the casing to render it accessible for operation. The lever 46 is

provided with an arm 49, between which and the opposite side of the casing 31 a coil spring 50 is interposed, this spring tending to swing the lever 46 in counter-clockwise direction in Fig. 2. The lever 46 carries an upwardly extending arm 51 into the path of movement of which the outer end of the lever 39, extends in the swinging of the lever 46 in clockwise direction in Fig. 2, the arrangement of the parts being such that when the lever 46 is swung to the position shown in Fig. 2, the switch will be moved to closed position and remain in this condition so long as the lever 46 occupies the position as shown in this figure. The lever 46 cooperates with a latch device for holding this lever in a position in which the switch is closed, this latch device comprising a latch-lever 52 pivoted between its ends on a shaft 53 secured to the casing 31. One arm of this lever, and represented at 54, is provided with a recess 55 adapted to receive the upper end of the arm 51, and become interlocked with the latter, as shown in Fig. 2 in the operation of moving the lever 46 to the position shown in Fig. 2, the lever 52 being yieldingly held in latching position by a coil spring 56 interposed between this lever and the top of the casing 31. The other end of this lever, and represented at 57, extends through a slot 58 in the adjacent wall of the casing 31 into a position to be operated against the resistance of the spring 56 by the mechanism hereinafter described, to unlatch the lever 46 and permit the switch mechanism to return automatically to open position.

In accordance with my invention, both the valve 25, controlling the cooling fluid, and the latching device for the switch, are controlled by a single mechanism operating responsive to rise of pressure in the high pressure side of the refrigerating apparatus, the particular construction of mechanism illustrated and provided for this purpose, comprising the following elements.

A sectional diaphragm-casing 59 surmounting the member 30 and containing a chamber 60 provided with a diaphragm 61 of any suitable flexible construction held in place at its marginal edge, by a tight joint, between the sections of the casing 59, the chamber 60, above the diaphragm containing an inlet communicating with a pipe 62 connected with the high-pressure side of the refrigerating apparatus as, for example, as indicated in the drawings, whereby the diaphragm is subjected to the pressure of the condensed gas. The diaphragm 61 is connected with the upper end of a hollow stem 63 having sliding fit in a plug 64 screwed into the bottom of the diaphragm casing 59, the upper end of the valve stem 29, which is axially aligned with the stem 63 extending upwardly into the latter, at the head 65 pro-

vided on the stem 29, the stem 29 below the head 65 being surrounded by a sleeve 66 screwed into the lower threaded end of the stem 63 to form an abutment for the head 65 this sleeve being vertically adjustable in the stem 63 by the screw-threaded connection provided as above described. A lock nut 67 screwed upon the lower end of the sleeve 66 adapted to bear against the lower end of the stem 63 serves to lock the sleeve 66 in adjusted position. Located within the stem 63 and exerting downward pressure against the head 65 of the stem 29 is a coil spring 68, through the medium of which downward pressure on the valve stem 29, which is slidable in the sleeve 66, is exerted by the stem 63 to force the valve 25 open against the action of the spring 26, when this valve is in unfrozen condition. The stem 63 carries a tappet washer 69 into the path of movement of which the projecting end 57 of the lever 52 extends. The diaphragm structure comprising the diaphragm 61 and the stem 63 and the parts carried thereby, cooperates with a coil spring 70 located in the casing 59 and surrounding the stem 63 and confined between a disk 71 on the latter and the upper end of the plug 64, this spring operating to yieldingly resist downward movement of the diaphragm structure under the action of the pressure of gas in the chamber 60 above the diaphragm. The spring 70 is of such construction and proportions as to present the proper yielding resistance to the gas pressure for effecting the desired control of the valve 25 to cause the supply of cooling liquid to the condenser to be properly regulated and the tripping of the latch lever 52, by the engagement of the tappet 69 therewith, when the pressure of the refrigerant exceeds the predetermined degree at which it is desired the operation of the compressor be discontinued.

The spring 68 is provided for the purpose of permitting the stem 63 and washer 69 to lower and trip the lever 52 when the predetermined pressure has become built up in the diaphragm chamber 60, even should the valve 25 become frozen to its seat, the spring 68 to this end being so tensioned that while it operates to force the valve 25 open when the diaphragm 61 is lowered, when the valve 25 is not frozen, it will not prevent lowering of the stem 63 and the tappet 69 to actuate the locking lever 52, should this valve become frozen.

Thus provision is made for effecting the dual functions of regulating the supplying of cooling liquid to the condenser and effecting the discontinuation of the pressure-producing means in the event of excess pressure, by a single pressure-operated device, and should conditions occur presenting resistance to the opening of the valve con-

trolling the cooling liquid, the mechanism is nevertheless capable of functioning to discontinue the pressure-producing means when the predetermined excess pressure is built up.

While I have illustrated and described a particular construction embodying my invention, and have shown it as incorporated in a particular apparatus, I do not wish to be understood as intending to limit it there- to, as the same may be variously modified and altered, and the device used in other situations, without departing from the spirit of my invention.

What I claim as new, and desire to secure by Letters Patent, is:

1. In refrigerating apparatus, the combination of compressing means, a condenser, a conduit leading from said condenser and through which the compressed gas passes, means for supplying a cooling liquid to said condenser and comprising a valve, means for actuating said compressor and comprising a controlling element, and a single device operating responsive to rise of pressure in said conduit for controlling said valve and said controlling element and having a yielding portion controlling said valve only, and yieldable in the event of resistance of the valve to movement in a direction away from closed position, whereby should said valve become frozen the control of said controlling element will not be affected.

2. In refrigerating apparatus, the combination of compressing means, a condenser, a conduit leading from said condenser and through which the compressed gas passes, means for supplying a cooling liquid to said condenser and comprising a valve, means for actuating said compressor and comprising a controlling element, and a diaphragm device subject to the pressure in said conduit and operating to control said valve and said controlling element and having a yielding portion controlling said valve only, and yieldable in the event of resistance of the valve to movement in a direction away from closed position, whereby should said valve become frozen the control of said controlling element will not be affected.

3. In refrigerating apparatus the combination of compressing means, a condenser, a conduit leading from said condenser and through which the compressed gas passes, means for supplying a cooling liquid to said condenser and comprising a valve, means for actuating said compressor and comprising a controlling element, and a single device operating responsive to rise of pressure in said conduit for controlling said valve and said controlling element comprising a movable stem formed of relatively movable sections and yielding means interposed therebetween and through which one of said sections is operated, said last-referred-to section con-

trolling said valve and the other of said sections controlling said controlling element.

4. In refrigerating apparatus, the combination of compressing means, a condenser, a conduit leading from said condenser and through which the compressed gas passes, means for supplying a cooling liquid to said condenser and comprising a valve, means for actuating said compressor and comprising a controlling element, and a diaphragm device subject to the pressure in said conduit and operating to control said valve and said controlling element and comprising a movable stem operated by the diaphragm and formed of relatively movable sections and yielding means interposed therebetween and through which one of said sections is operated, said last-referred-to section controlling said valve and the other of said sections controlling said controlling element.

5. In refrigerating apparatus, the combination of compressing means, a condenser, a conduit leading from said condenser and through which the compressed gas passes, means for supplying a cooling liquid to said condenser and comprising a valve, means for actuating said compressor and comprising a switch in normally closed position and constructed and arranged to remain in open position after movement to said last-named position, and a single device operating responsive to rise of pressure in said conduit for controlling said valve and opening said switch and having a yielding portion controlling said valve only, and yieldable in the event of resistance of the valve to movement in a direction away from closed position, whereby should said valve become frozen the control of said switch will not be affected.

6. In refrigerating apparatus, the combination of compressing means, a condenser, a conduit leading from said condenser and through which the compressed gas passes, means for supplying a cooling liquid to said condenser and comprising a valve, means for actuating said compressor and comprising a self-opening switch, a latch for holding said switch in closed position, and a device operating responsive to rise in pressure in said conduit for controlling the position of said valve and releasing said latch and having a yielding portion controlling said valve only, and yieldable in the event of resistance of the valve to movement in a direction away from closed position, whereby should said valve become frozen the control of said latch will not be affected.

7. In refrigerating apparatus, the combination of compressing means, a condenser, a conduit leading from said condenser and through which the compressed gas passes, means for supplying a cooling liquid to said condenser and comprising a valve, means for actuating said compressor and

comprising a controlling element, and a single device operating responsive to rise of pressure in said conduit for controlling said valve and said controlling element and formed of relatively movable members one of which controls said valve only, the other of said members controlling said controlling element and being movable independently of said valve-controlling member in the movement of said device in a direction to force said valve open, whereby should said valve become frozen the control of said controlling element will not be affected.

8. In refrigerating apparatus, the combination of compressing means, a condenser, a conduit leading from said condenser and through which the compressed gas passes, means for supplying a cooling liquid to said condenser and comprising a valve, means for actuating said compressor and comprising a controlling element, and a single device operating responsive to rise of pressure in said conduit for controlling said valve and said controlling element and formed of relatively movable members one of which controls said valve only, the other of said members controlling said controlling element and being movable independently of said valve-controlling member in the movement of said device toward the seat with which said valve cooperates and in a direction to force said valve open, whereby should said valve become frozen the control of said controlling element will not be affected.

9. In refrigerating apparatus, the combination of compressing means, a condenser, a conduit leading from said condenser and through which the compressed gas passes, means for supplying a cooling liquid to said condenser and comprising a valve, means for actuating said compressor and comprising a controlling element, and a single device operating responsive to rise of pressure in said conduit for controlling said valve and said controlling element and formed of relatively movable members one of which controls said valve only and is movable in a direction to close said valve by the engagement therewith of the other of said members in moving in a direction away from the seat with which said valve cooperates and away from said controlling element, said last-referred-to member controlling said controlling element and being movable independently of said valve-controlling member in the movement of said device toward said controlling element.

10. In refrigerating apparatus, the combination of compressing means, a condenser, a conduit leading from said condenser and through which the condensed gas passes, means for supplying a cooling liquid to said condenser and comprising a valve which opens in the direction of the flow of water through said second-named means, means

for actuating said compressor and comprising a controlling element, and a single device operating responsive to rise of pressure in said conduit and comprising relatively 5 movable members one of which controls said valve only and is movable in a direction to close said valve by the engagement therewith of the other of said members in moving in a direction away from the seat with 10 which said valve co-operates and away from said controlling element, said last-referred-to member controlling said controlling element and being movable independently of said valve-controlling member in the movement of said device toward said controlling 15 element.

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