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METHOD OF AND MEANS FOR REMOVING FOREIGN GAS FROM CONDENSERS

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Fig. 1.

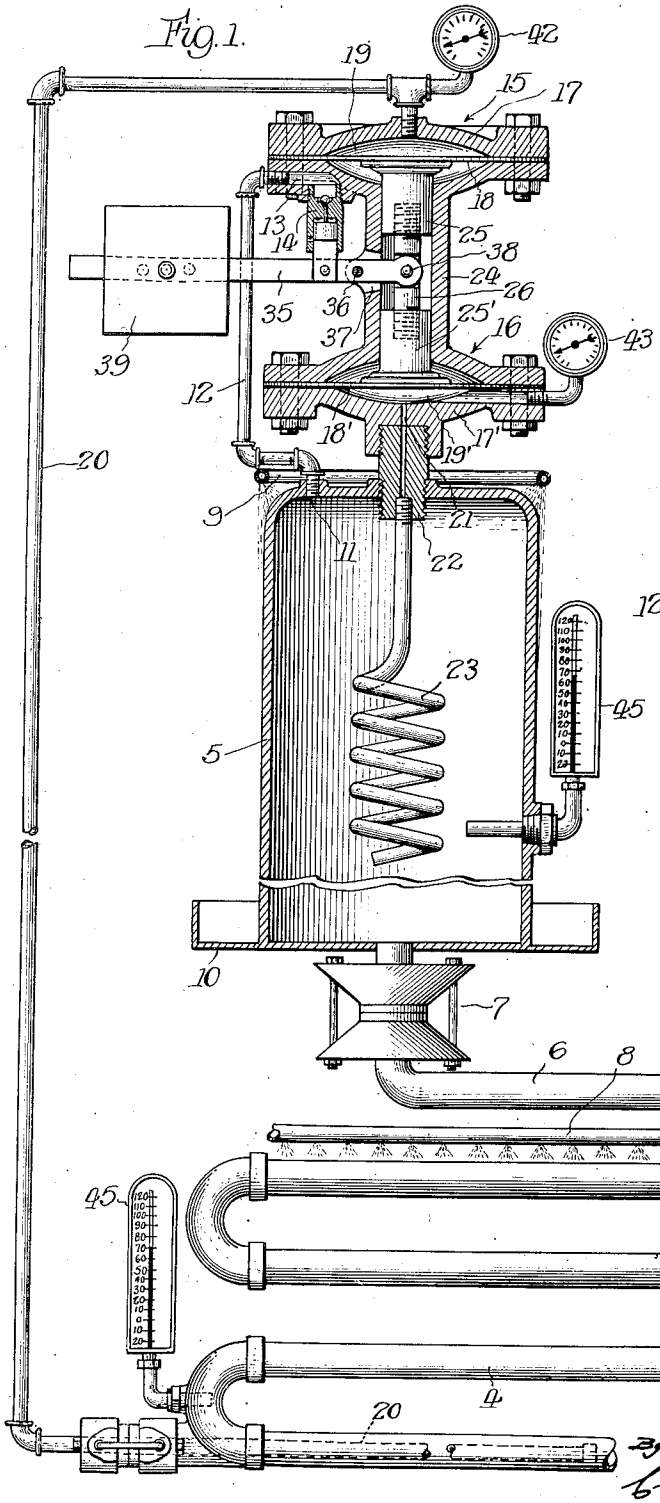
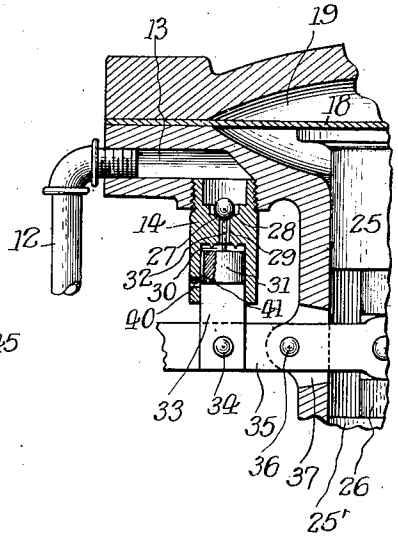


Fig. 2.



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METHOD OF AND MEANS FOR REMOVING FOREIGN GAS FROM CONDENSERS.

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The invention has general reference to the art of refrigeration and more especially to condensers such as are used in refrigeration systems. In the practical operation of such systems it is inevitable that certain foreign gases will find their way into the system through leaking stuffing boxes and through the combustion of lubricating oil in the compressor; and it becomes necessary, therefore, to relieve the system periodically of such foreign gases. The method commonly employed is to cut off the condenser from the system pressure and open a relief or blow-off valve at the upper portion of the condenser to permit the escape of such gases. This consumes, as will be apparent, a relatively large amount of time during which the system might otherwise remain in operation.

The primary object of this invention is to provide for the release of foreign or non-condensible gases from the system without necessitating any interruption in its operation, and preferably without requiring any special supervision on the part of the attendant, the operation being automatic in character.

A general object is to provide a means or apparatus of a practical character for accomplishing this result.

I have shown in the accompanying drawings one embodiment only of my invention but it is contemplated that various changes may be made by those skilled in the art without departing from the spirit and scope of the appended claims.

Figure 1 of the drawings is a fragmentary elevation section of a condenser having applied thereto an automatic gas releasing means constructed in accordance with my invention.

Fig. 2 is a vertical sectional view showing the valved venting port in detail.

I have deemed it unnecessary to illustrate a complete refrigeration system inasmuch as my invention is applicable particularly to the condenser. The latter, designated generally by the numeral 3, comprises the usual coils 4. Communicating with the uppermost coil is a chamber 5 into which such gases as do not condense in the condenser are free to pass. As herein shown, the connection between the condenser and the chamber 5 consists of a pipe 6 and connection 7. Above the upper coil of the condenser I have shown a water pipe 8 from which jets of water discharge over the condenser and constitute a cooling medium. Similarly I provide a water pipe 9 over the chamber 5 having jet openings in its under side adapted to discharge cooling water upon the top and sides of the container.

The chamber 5 is made of substantial length and at its lower end may be provided with a drip pan 10. It will be seen that this chamber constitutes a receiver for the air and other gases which are noncondensible under the conditions existing in the condenser 3, and that the pressure in the receiver is the same or approximately the same as that which exists in the condenser.

At the upper end of the chamber or receiver 5 I provide an outlet opening 11 which in the present instance is connected by means of a pipe 12 and a passage 13 with a valve casing 14 of a relief valve mechanism which is arranged to be operated by a pair of temperature responsive pressure elements or thermostats designated generally 15 and 16.

Each of said thermostatic elements comprises a two-part casing 17 or 17′ divided by means of a diaphragm 18 or 18′. The casing 17 forms upon the upper side of the diaphragm a chamber 19 which is in constant communication with one end of a pipe 20, the opposite end of which enters one of the coils of the condenser as shown in broken lines in Fig. 1 approximately in the region of liquefaction or condensation. The inserted end of the pipe 20 is sealed and into the pipe and the chamber 19 is charged a suitable temperature responsive gas, such as ammonia gas. On the other hand, the diaphragm 18′ in the casing 16 forms with the lower section of the latter a chamber 19′ which communicates by way of a port 21 and fitting 22 with the upper end of a serpentine coil 23 also sealed at its lower end and charged with ammonia gas at a suitable pressure. Both pressure elements are charged at the same pressure; but low enough to prevent condensation under normal temperature conditions.

The lower portion of the diaphragm casing 15, and the upper portion of the casing 16, are formed in the present instance integral with a tubular member 24 constituting a guide for a pair of plungers 25 and 25′ operatively connected together by a link 26. Thus pressures in the chambers 19 and 19′ are directly opposed to each other through

the diaphragms 18—18′ and the aforesaid connection therebetween through the plungers 25—25′.

The passage 13 into which the pipe 12 leading from the receiver 5 discharges, is formed in the lower part of the casing 15, and the valve casing 14 is screw-threaded into an aperture in the lower part of said casing 15 so as to communicate with said passage 13. In the casing 14 I provide a seat 27 for a valve member 28, said seat being formed at the upper end of a passage 29 communicating at its lower end with a chamber 30 in which operates a piston 31. Rising from said piston 31 is a valve stem 32 which passes loosely through the passage 29 and engages at its upper end the valve member 28; and rigid with the lower end of the piston 31 is an upstanding arm 33 pivoted at its lower end as at 24 to a lever 35 which is fulcrumed at 36 in one side of the tubular member 34. To receive the lever 35 a slot 37 is formed in said member, and the inner end of the lever is pivotally connected to the link 26 as at 38. The outer end of the lever carries an adjustable weight 39. The chamber 30 in the casing 14 has a port 40 in one wall thereof which is at all times in communication with the upper end of the chamber 30 through the medium of a small groove 41 in the periphery of the piston 31.

The operation is as follows:

The condensation of the ammonia gas passing through the condenser occurring in the region of the inserted end of the pipe 20, and the resultant giving off of latent heat of vaporization, serves to maintain the gas in this pipe at a substantially constant temperature. Accordingly a constant pressure is maintained in the upper diaphragm chamber 19. For convenience, a gauge 42 may be provided in the pipe line 20 at its upper end to indicate this pressure.

The noncondensible or foreign gases, as is usual in the operation of the condenser, pass into the upper portion thereof, and in the present instance are conducted by the pipe 6 into the receiver 5. It will be observed that these gases are subjected not only to the cooling effect of the water discharged by the pipe 8 but also to the cooling effect of the water discharged from the pipe 9 above the receiver. Consequently, the temperature of the gases collecting in the upper portion of the receiver 5 which contains the coil 23, falls to a point lower than the temperature of the gas in the pipe 20 and chamber 19. As a result the pressure of the gas acting upon the diaphragm 18′ is correspondingly lower than the pressure of the gas acting upon the diaphragm 19, the pressure in the chamber 19′ being conveniently indicated by a gauge 43. Normally the weight 39 is so proportioned and adjusted that it will, in addition to counterbalancing the weight of the pistons 25—25′ and associated parts, maintain a predetermined differential in pressure between the chambers 19 and 19′. When, however, the accumulating noncondensible gases in the receiver 5 fall below a predetermined temperature, the pressure in the chamber 19′ correspondingly falls with the result that the pressure in the chamber 19 operates the lever 35 against the force of the weight 39 and raises the piston 31, valve stem 32 and valve member 28 to permit the escape of gases from the upper end of the receiver through the pipe 12, passages 13 and 29, groove 41 and port 40 to the atmosphere. Such escape of gases, however, is made very gradual by limiting the size of the groove 41. As the cooler gases escape, relatively warmer gases which are now permitted to enter the receiver from the condenser effect an increase in pressure in the coil 23 and chamber 19′ such as to effect a closing of the valve 27. As will be seen, the arrangement is such that if any of the ammonia or other gas employed finds its way into the receiver 5 and is there condensed, it may return to the condenser.

If desired, the receiver 5 and the condenser 3 may be provided with thermometers 44 and 45 arranged to record the temperatures in the upper portion of the receiver and in the region of condensation respectively.

It will be seen that I have provided for the automatic release of foreign or noncondensible gases from a condenser in a thoroughly practical manner, avoiding the necessity of interrupting the operation of the system and thus insuring that the condenser shall at all times operate unrestricted by noncondensible gases collected in its upper end portion and hence with increased efficiency.

In the appended claims the term "noncondensible gases" is used to designate such gases which under the conditions existing in the condenser do not condense.

I claim as my invention:

1. The combination with a condenser, of a receiver for noncondensible gases communicating with the upper portion of the condenser, a pair of pressure elements arranged in opposed relation and respectively responsive to temperature changes in the region of condensation of the condenser and in the receiver, means for subjecting the condenser and receiver to a cooling medium, and valve means operatively associated with and arranged to be controlled by said pressure elements to permit the escape of gases from the receiver when the temperature of the gases therein falls below a predetermined point.

2. The combination with a condenser, of a cooling chamber communicating with the

condenser and constituting a receiver for gases passing through the condenser, a pair of pressure elements arranged in opposed relation and being respectively responsive to the temperature of the condenser at the point of liquefaction and to the temperature of the receiver in the upper portion thereof, and valve means operatively associated with and controlled by said pressure elements and means providing an outlet from said receiver arranged to be controlled by said valve means.

3. A means for releasing noncondensible gas from a condenser comprising a cooling chamber constituting a receiver into which such gases are arranged to pass from the condenser, a pair of thermostatic elements responsive respectively to the temperature of the condenser in the region of condensation and to the temperature of the gases in the receiver, said elements being arranged in opposed relation, and valve means operatively associated with and controlled by the said elements whereby when the temperature in the receiver falls to a predetermined point below said condenser temperature, gases are permitted to escape from the receiver.

4. A means for releasing noncondensible gas from a condenser comprising a cooling chamber constituting a receiver into which such gases are arranged to pass from the condenser, a pair of thermostatic elements responsive respectively to the temperature of the condenser in the region of condensation and to the temperature of the receiver, said elements being arranged in opposed relation, and valve means operatively associated with and controlled by the said elements whereby when the temperature in the receiver falls to a predetermined point below said condenser temperature, gases are permitted to escape from the receiver, said thermostatic elements each comprising a casing having a diaphragm and a tubular member communicating at one end with the casing and having its other end surrounded by the gas or fluid whose temperature is to be taken.

5. A means for permitting the escape of foreign gases from a condenser comprising, in combination, a pair of casings each having a diaphragm therein to form a pressure chamber, said diaphragms being arranged in opposed relation, a tubular member having one end inserted into the condenser in the region of condensation and its other end communicating with one of said pressure chambers, a second member having one end enclosed in the noncondensible gases of the condenser, means interposed between said diaphragms whereby the pressures in their respective chambers oppose each other, and valve means operatively associated with and arranged to be actuated in the movements of said diaphragms and means providing an outlet passage from said receiver controlled by said valve means.

6. An apparatus of the character described comprising, in combination, a receiver for gases discharged from a condenser arranged to be subjected to a cooling medium, a pair of pressure chambers, a member between said chambers whereby pressures in the respective chambers are opposed to each other, a tubular member connected with one of said chambers and having a portion thereof subject to the temperature of the gas in the condenser in the region of condensation, the second tubular member communicating with the other one of said chambers and arranged to be subject to the temperature of the gases in the receiver, each of said elements having a temperature responsive substance therein, and valve means operatively associated with the member between said chambers so as to permit the escape of gases from the receiver when the temperature thereof falls below a predetermined point reducing the pressure in its corresponding pressure chamber.

7. An apparatus of the character described comprising, in combination, a pair of thermostatic elements respectively responsive to the temperature of the condenser in the region of condensation and to the temperature of non-condensible gases, each of said elements comprising a diaphragm, means for transmitting pressure from one diaphragm to the other, a venting port through which non-condensible gases may discharge, a valve for controlling said port, a lever arranged to be operated by said diaphragms and operatively associated with said valve to actuate it, and adjustable means for opposing the operation of the diaphragm by the thermostatic element which is subject to the temperature of the condensing gases.

8. In an apparatus of the character described, a pair of casings each having a diaphragm therein, a tubular member between said casings, means slidable in said member and arranged to transmit pressure from one diaphragm to another, a lever operable by said means, a valve arranged to be actuated by said lever, and a weight on said lever for opposing pressure on one of said diaphragms.

9. A means for releasing non-condensible gas from a condenser comprising, in combination, an outlet from the condenser, a valve member controlling said outlet, and a pair of pressure responsive elements mechanically connected to said valve member and tending to move it in opposite directions.

10. A means for releasing gas from a condenser comprising, in combination, an out-

let, a valve member controlling said outlet, a pair of pressure responsive elements, a lever connecting each of said elements to said valve member, said elements tending to move said member in opposite directions.

11. A means for permitting the escape of non-condensible gases from a condenser comprising, in combination with a pair of thermostatic elements respectively subject to the temperature of the condenser in the region of condensation and to the non-condensible gases, means for varying the temperature of the non-condensible gases as they accumulate, and valve means arranged to be actuated under the control of said elements to permit the discharge of non-condensible gases to the atmosphere.

12. A means for permitting the escape of non-condensible gases from a condenser comprising, in combination with an outlet for such non-condensible gases, a valve controlling said outlet, means for varying the temperature of said gases as they accumulate, and means controlled by the difference in the temperatures of the condensible and non-condensible gases of the condenser to actuate said valve.

13. A means for releasing non-condensible gas from a condenser comprising, in combination, an outlet for the non-condensible gas, a reciprocatory valve member controlling said outlet, devices responsive respectively to the temperatures of the condensible and non-condensible gases in said condenser, and an operating lever connected to said valve member and to each of said devices.

14. The combination with a condenser, of a separate chamber for receiving the non-condensible gas accumulating in the condenser, a means for cooling the gas in said chamber, and means responsive to a predetermined temperature difference between said chamber and condenser for intermittently discharging the non-condensible gas.

15. A means for discharging non-condensible gases accumulating in a condenser comprising, in combination, a receiver for the non-condensible gas communicating with the condenser, an outlet from said receiver, a valve controlling said outlet, means for cooling the gas accumulating in said receiver, and means responsive to a predetermined difference between the receiver and condenser temperatures for opening and closing said valve.

16. A means for intermittently discharging non-condensible gas from a condenser comprising, in combination, a separate receiver for the non-condensible gas accumulating in said condenser, an outlet from said receiver, means for cooling the gas in said receiver, and means responsive to a predetermined temperature difference between said receiver and condenser for opening said outlet.

17. A means for discharging non-condensible gas from a condenser comprising, in combination, a receiver for the non-condensible gas, an outlet from said receiver, a valve adapted to permit a restricted flow of gas from said outlet, and means responsive to a predetermined difference in temperature between said condenser and receiver for opening said valve.

18. The method of intermittently discharging a non-condensible gas from a chamber supplied with a mixture of non-condensible and condensible gases which consists in cooling the mixture to a temperature at which all of the condensible component of the mixture will be condensed out, further cooling the non-condensible component, and releasing the non-condensible component when a predetermined temperature difference between the non-condensible component and the incoming mixture has been reached.

19. The method of intermittently discharging non-condensible gas from a chamber supplied with a stream containing non-condensible and condensible gases which consists in cooling the stream until all of the condensible gas has been removed, further cooling the non-condensible gas and slowly releasing the non-condensible gas when a predetermined temperature difference between it and the incoming stream has been reached.

20. The method of removing a foreign gas from condensible gas in a gaseous system which consists in separating the foreign gas from the condensible gas by cooling the mixture of condensible and foreign gas below the boiling point temperature of the condensible gas at the pressure within the system so as to condense out said condensible gas, collecting the foreign gas and effecting a further cooling thereof, and discharging the foreign gas when the difference between the temperature of the foreign gas thus collected and the temperature in the system reaches a predetermined limit.

21. A means for discharging foreign gas from a system containing a mixture of gases comprising, in combination, a separate chamber for receiving the foreign gas accumulating in the system, means for cooling the gas in said chamber below the temperature of the other gases in the system, and means responsive to a predetermined temperature difference between said chamber and said system for intermittently discharging the foreign gas.

In testimony whereof, I have hereunto affixed my signature.

GEORGE HILGER.