

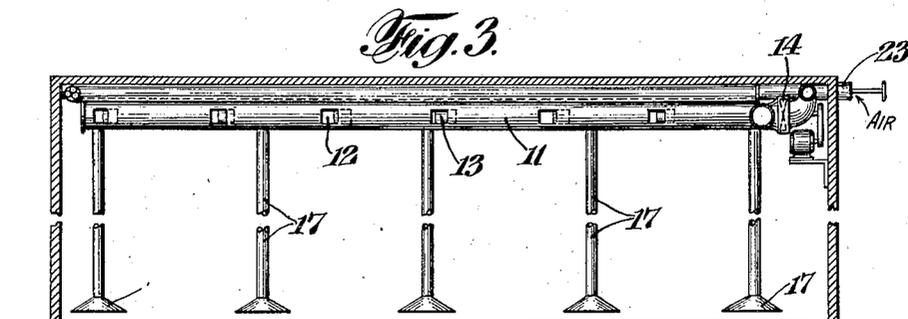
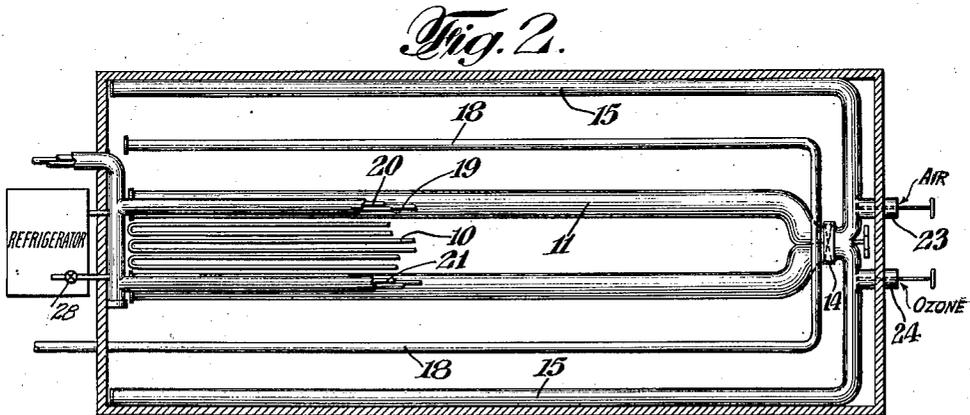
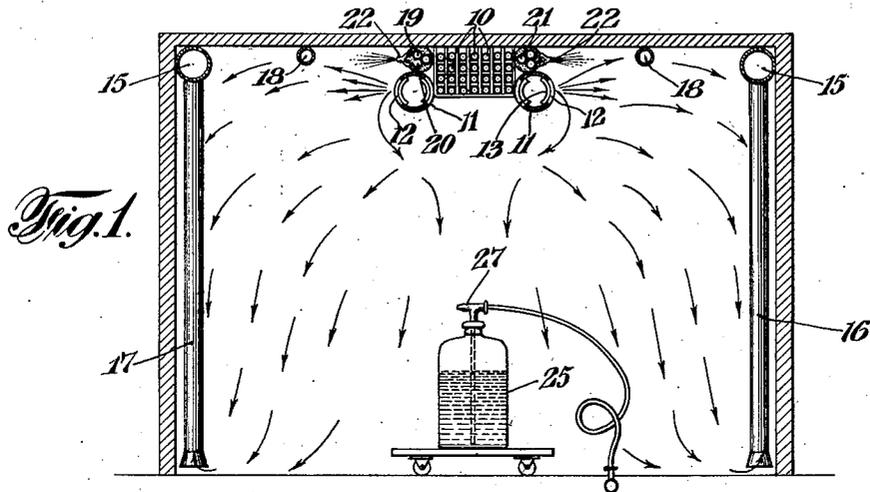
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CONDITIONING SYSTEM FOR COLD STORAGE ROOMS

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CONDITIONING SYSTEM FOR COLD STORAGE ROOMS

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This invention relates to air conditioning systems for cold storage rooms and has for an object a system for controlling the humidity of the air, regulating the flow of the air and insuring uniformity of temperature throughout the room.

According to this invention, the storage room is provided with the usual refrigeration pipes and one or more air ducts are provided in close proximity to the refrigeration pipes and vents are provided in the ducts through which air escapes into the vicinity of the refrigeration pipes. Vertical return air spouts are provided near the walls of the storage room and extend nearly to the floor. These spouts are connected with the inlet of a blower, the outlet of which discharges into the air supply duct. There is also provided at suitable location in the room one or more steam pipes and in addition one or more pipes are provided for spraying moisture into the room in the form of a very fine spray. By means of the air ducts and blower all the air in the room may be re-distributed as often as the good keeping of the commodities in the room requires. Moisture is introduced into the circulating air at such points that it is carried over the goods stored in the room. The complete and governed circulation of the air provides uniform temperature throughout the storage room thereby eliminating high temperatures in the corners or against outside walls and unifying the temperature at the top and bottom of the wall, and also brings moisture, when desired, into contact with the goods.

Excess moisture may be removed from the air in the storage room without reducing the temperature by introducing sufficient additional refrigeration in the refrigeration pipes to freeze out the moisture and introducing sufficient heat by means of steam in the steam pipes to counteract the cooling effect of the additional refrigeration. This arrangement permits the removal of moisture in rooms kept at a temperature considerably above freezing.

In addition, the humidity in a storage room maintained at temperature below freezing, may be increased by introducing water

in a very fine spray into the current of air flowing from the supply duct to the return spouts. The particles of water entering the air are so finely divided that they not only float, but almost instantly freeze. The ice thus formed is carried throughout the room and subsequently vaporizes in accordance with the physical law governing the vaporization of ice. The vapor serves to maintain the desired humidity within the storage room.

Other objects, novel features and advantages of this invention will be apparent from the following specification and accompanying drawing, wherein:

Fig. 1 is a vertical section through the storage room equipped with a refrigeration system embodying the invention.

Fig. 2 is a plan view, and

Fig. 3 is a longitudinal section.

The drawing discloses an arrangement of pipes suitable for a room approximately 75 feet by 100 feet. In rooms of different dimensions the pipes may be differently arranged and a greater or less number of pipes used, all depending upon the arrangement which will give the most efficient results for the particular room. The functioning of the apparatus will, however, be similar in all arrangements.

A bank of refrigeration pipes 10 is supported near the ceiling of the storage room in the usual manner. Air ducts 11 are arranged along the sides of the assembly of refrigeration pipes and extend substantially parallel thereto. Each duct is provided with a plurality of vents 12 which may be provided with shutters 13. At one end the ducts 11 communicate with a blower 14 by means of which air is forced into the ducts and through the vents 12. A pair of return ducts 15 are suspended from the ceiling near the walls of the room and communicate with the inlet of the blower 14. Vertical spouts 16 depend from the ducts 15 along the side walls of the room nearly to the floor and are provided at their lower ends with hoods 17. Air introduced into the storage room through the vents 12 passes through the room to the hoods 17 through which it then is re-

turned to the blower 14. The air is chilled by the refrigeration pipes 10 and is uniformly distributed throughout the room due to the circulation system, the room being maintained at substantially uniform temperature.

Within the room are provided one or more steam pipes 18 which may be located in any suitable position, for example, near and parallel to the air return ducts 15. Where desirable, these steam pipes may be located at other suitable or convenient positions. These pipes are connected to any suitable steam supply (not shown). One or more groups of pipes consisting of a water pipe 19, an air pipe 20 and a steam pipe 21 are suspended in the vicinity of the refrigeration pipes and the air ducts 11. At intervals there are provided atomizers 22 which communicate both with the water pipe 19 and air pipe 20. By means of these atomizers, a very fine spray of water may be introduced into the currents of air flowing from the air ducts 11. The steam in the pipes 21 heats the water in the pipes 19 sufficiently to prevent freezing thereof and may even keep the same slightly warm.

Fresh air for ventilation may be introduced into the storage room in any desired manner, for example, through a pipe 23 which leads either to the return air ducts 15 or air inlet ducts 11. The air introduced through this pipe preferably is cooled by first being passed over refrigeration coils provided at any suitable location in the system. Ozone may be introduced into the system through a pipe 24 for deodorizing and freshening the room. This gas may be manufactured by a suitable machine located outside the storage room and supplied to the air return ducts 15 or air inlet ducts 11. The necessary amount of ozone will be evenly distributed continuously throughout the room.

By proper location and size of the various elements of the circulation system all the air in the room may be re-distributed as often as necessary and the circulation of the air can be completed and governed. The temperature of the space in the storage room in which goods are piled may be kept within a maximum variation of 1° F. and the temperature throughout the room may be maintained uniform.

The system above described may be used to increase the humidity of the air in a cold storage room maintained at a temperature of 32° F. or below. Water is sprayed into the air from the pipes 19 through the atomizers 22, the water in the pipes being maintained slightly above freezing temperature by heat supplied from the steam in the pipes 21. The water is thus sprayed into the air at approximately freezing temperature and is immediately converted into a frozen mist which floats in the air currents and the minute ice particles are distributed throughout the entire room.

The minute ice particles thus find their way into the packages and around the commodities in the room and eventually vaporize by sublimation in accordance with the physical law governing the vaporization of ice at freezing temperatures. The water vapor thus produced supplies the necessary moisture to keep the humidity of the room at the desired degree. As the moisture introduced into the room at no time becomes liquid, the surfaces of the floor, walls, packages and commodities in the room are maintained free from liquid water and the very detrimental features of wet surfaces are avoided.

This system may also be used to reduce the humidity in a cold storage room without alternation of temperature. This is accomplished by increasing the flow of refrigerant through the pipes 10, thereby increasing condensation and freezing on the pipes of excess moisture in the air. At the same time, steam is passed through the pipe 21 to diffuse sufficient heat into the air to counteract the cooling effect of the additional refrigeration and thus prevent decrease of temperature. The temperature in the room may be retained constant by maintaining a balance between the additional refrigerant supplied to the pipes and the heat diffused into the room. This arrangement makes it possible easily to dehumidify the room while maintaining it uniformly at the temperature required for the preservation of the commodity contained therein. After the desired decrease in the degree of humidity has been effected, the flow of refrigerant may be decreased and the flow of steam through the pipes 21 cut off. Valve 28 constitutes means for controlling the rate of flow of the refrigerant in pipes 10.

The foregoing system permits uniform maintenance of temperature, humidification and de-humidification of the air at will and accurate government of the flow of air in the storage room. Also both atmospheric air and ozone can be added quantitatively and evenly distributed throughout the entire storage space.

As shown in Fig. 1, a portable humidifier may be used instead of a permanent installation. This portable humidifier preferably comprises a tank 25 mounted on a suitable truck by means of which it may be moved about the room as desired. The tank is provided with an aspirator 27 to which may be connected one end of an air hose, the other end of which is connected to any suitable source of compressed air. This arrangement may be used where, either because of the expense involved or for some other reason, it is not desirable to install a permanent humidifying system.

It is of course understood that the arrangement above disclosed is merely an illustration and that various other arrangements may be utilized, without in any way departing from

the spirit of the invention as defined in the appended claims. A greater or less number of air ducts, steam pipes and water supply pipes may be used as conditions require and the arrangement of these pipes may be varied to meet the conditions existing in any particular room. Means other than steam pipes may be used for preventing freezing of water in the pipes 20 and for supplying heat to prevent alteration of temperature during a period of dehumidification.

I claim:

1. In a system for increasing the humidity of the air in a cold storage chamber maintained at freezing temperature or lower, the combination of refrigeration pipes, means for uniformly circulating air through all parts of the chamber, a water supply pipe provided with atomizers for introducing water into the circulating air in the form of a very fine spray thereby forming minute ice particles floating in the air and effecting increase in the degree of humidity by change into vaporous condition by sublimation, and means for maintaining the water in said pipe above freezing temperature.

2. In a system for increasing the humidity of the air in a cold storage room maintained at freezing temperature or lower, the combination of a bank of refrigeration pipes located near the ceiling of the chamber, an air duct having vents for discharging air into the vicinity of said refrigeration pipes, a blower for supplying air to said duct, a return air duct communicating with the inlet of said blower, said return air duct having a plurality of vertical spouts terminating near the floor of said chamber, a water supply pipe provided with atomizers for introducing water into the circulating air in the form of a very fine spray thereby forming minute ice particles floating in the air and effecting increase in the degree of humidity by change into vaporous condition by sublimation, and means for maintaining the water in said pipe above freezing temperature.

3. In a system for reducing the degree of humidity of air in a cold storage room without effecting appreciable change in the temperature of the room, a bank of refrigeration pipes a refrigerant flowing through said pipes to maintain the air in the chamber in a chilled condition, means for increasing the flow of refrigerant through said pipes to effect increased condensation thereon of moisture from the air in the room, an air duct having vents for discharging air into the vicinity of said refrigeration pipes, a blower for supplying air to said duct, a return air duct communicating with the inlet of said blower, said ducts having a plurality of vertical spouts terminating near the floor of the room, and means for introducing heat into the circulating air during the condensation period to balance the in-

creased cooling effect of the refrigerant in said pipes.

4. A system for controlling the degree of humidity of air in a cold storage room which comprises a bank of refrigeration pipes, means for uniformly circulating air throughout all parts of the chamber, a water supply pipe provided with atomizers for introducing water into the circulating air, and heat supply means adjacent said water pipe to maintain water therein above freezing temperature.

5. A system for controlling the degree of humidity of air in a cold storage chamber which comprises a bank of refrigeration pipes arranged near the ceiling of the chamber, an air duct having vents for discharging air into the vicinity of said refrigeration pipes, a blower for supplying air to said duct, a return air duct communicating with the inlet of said blower, said duct having a plurality of spouts terminating near the floor of the room, a water pipe, an air pipe and a steam pipe supported within the room adjacent one another, and atomizers communicating both with the water pipe and the air pipe for spraying water into the air currents.

6. In a humidifying system for a cold storage chamber, the combination of refrigeration means for maintaining the air in the chamber at freezing temperature or lower, means for introducing water in the liquid state into the air in the chamber in the form of a very fine spray which will instantly freeze when released to form minute ice particles so small that they will float in the air, and means for uniformly circulating the ice laden air through all parts of the chamber as the degree of humidity is increased by change of the minute ice particles into vaporous condition by sublimation.

7. In a humidifying system for a cold storage chamber, the combination of refrigeration means for maintaining the air in the chamber at freezing temperature or lower, an atomizer located to spray water into the chamber, means for supplying water to said atomizer, and means for maintaining the water in the liquid state until it has been released by said atomizer.

8. In a humidifying system for a cold storage chamber, the combination of refrigeration means for maintaining the air in the chamber at freezing temperature or lower, an atomizer located to spray water into the chilled air, and adapted to form the water into a mist so fine that it will float in the air, means for supplying water to said atomizer, and means for maintaining the water in the liquid state until it has been released by said atomizer.

9. In a humidifying system for a cold storage chamber, the combination of refrigeration means for maintaining the air in the chamber at freezing temperature or lower

and means for introducing water in the liquid state into the air in the chamber in the form of a very fine spray, the particles of the spray being so small that they will float in the chilled air.

5 10. A method for conditioning the air in a cold storage chamber, which consists in maintaining the air in the chamber at freezing temperature or lower, introducing water
10 into the air in the form of a fine spray to produce ice particles floating in the air, and circulating the ice laden air through all parts of the chamber thereby increasing the degree of humidity of the air in the chamber by the
15 conversion of the ice particles into water vapor by sublimation.

11. In a system for reducing the degree of humidity of air in a cold storage chamber without effecting appreciable change in the
20 average temperature of the room, the combination of refrigeration pipes, a refrigerant flowing through said pipes to maintain the air in the chamber in a chilled condition, means for increasing the rate of flow of said
25 refrigerant to effect increased condensation thereon of moisture from the air, means for circulating air through all parts of the chamber and around said pipes, and means for introducing heat into the circulating air during
30 the condensation period to balance the increased cooling effect of said refrigerant.

12. The method for decreasing the degree of humidity of air in a cold storage room provided with pipes having a refrigerant running
35 therethrough without effecting appreciable change in the average temperature of the room, which comprises circulating air through all parts of the chamber and around the refrigeration pipes, increasing the rate of
40 flow of said refrigerant to effect increased condensation on the pipes of the moisture in the air, and introducing heat into the circulating air during the condensation period to balance the increased cooling effect of said
45 refrigerant.

In testimony whereof, I have signed my name to this specification.

MARY E. PENNINGTON.

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