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J. MARSHALL
AIR CONDITIONING APPARATUS
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2,500,693

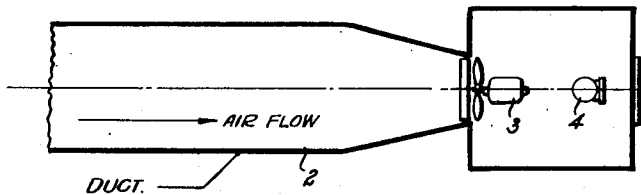


FIG. 1.

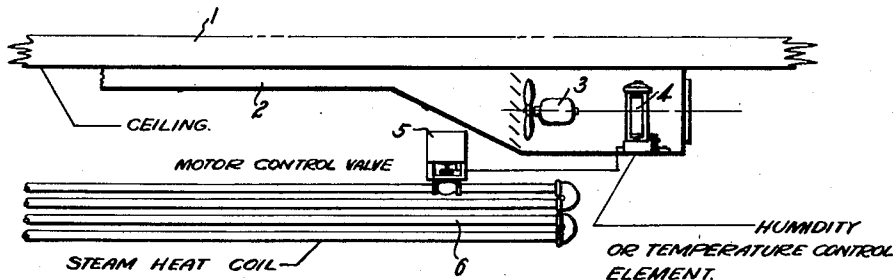


FIG. 2.

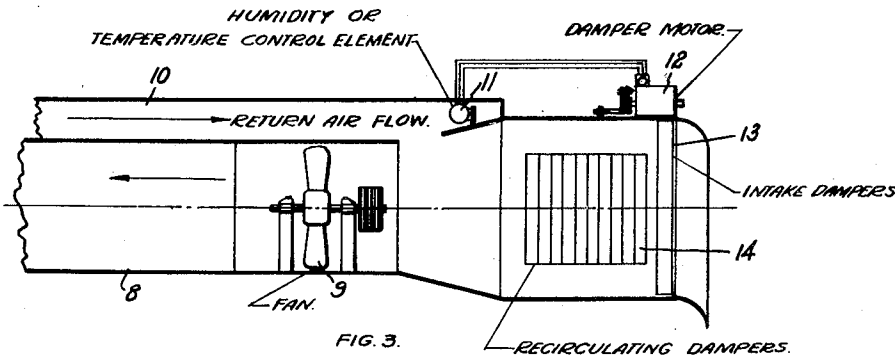


FIG. 3.

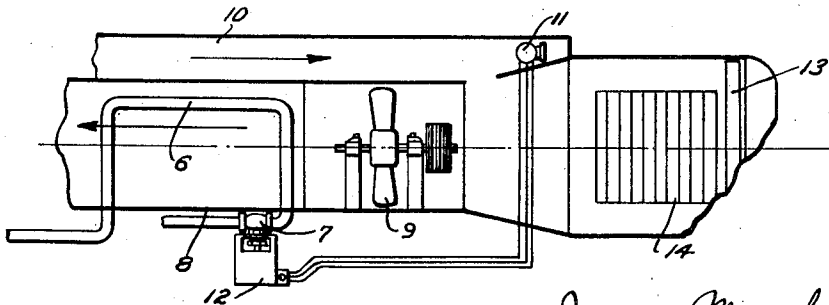


FIG. 4.

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UNITED STATES PATENT OFFICE

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AIR CONDITIONING APPARATUS

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2 Claims. (Cl. 236-44)

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This invention relates to apparatus for preventing condensation of moisture on air conditioning apparatus or other cool surfaces in a space where a high relative humidity is maintained.

In air conditioning apparatus operating at high relative humidity, condensation of moisture at some point in the apparatus is a frequent occurrence. A common expedient for taking care of such condensation is to provide means for catching the condensed moisture and disposing of it.

The present invention is designed to prevent the condensation of moisture locally without however lowering the relative humidity of the conditioned atmosphere, that is, without interfering with the normal operation of the air conditioning apparatus.

In accordance with the present invention condensation of moisture or sweating is prevented by providing automatic means responsive to the relative humidity or the temperature of the air adjacent to the surface where condensation or sweating would occur for raising the temperature or lowering the relative humidity locally at that point sufficiently to prevent condensation or sweating. Ordinarily means responsive to relative humidity is preferred but since relative humidity depends on temperature there are circumstances under which temperature responsive means may be used to detect a dangerously low temperature which may cause moisture condensation and to control a supply of heat or of air at low relative humidity to remedy the condition.

The invention consists in the combination with an air conditioning system comprising the usual means such as a fan for circulating the air with accessories such as means for heating and/or cooling the air and means for introducing moisture such as an atomizer, of means such as a fan for withdrawing a sample of air from the point or points in the system where condensation is likely to occur, means responsive to the temperature and/or humidity of the sample for detecting a dangerous condition of the sample and means controlled by the temperature and/or humidity responsive means for remedying the dangerous condition.

Several embodiments of the invention are illustrated in the accompanying drawings in which

Fig. 1 is a diagrammatic plan view;

Fig. 2 is a diagrammatic side elevational view of an arrangement for drawing a sample of air from adjacent the roof of the space being air conditioned and for supplying heat as required to prevent condensation;

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Fig. 3 is a diagrammatic elevational view of an arrangement for recirculating air from the air conditioned space to prevent condensation; and

Fig. 4 is a diagrammatic elevational view of an arrangement like that in Fig. 3 but in which the humidity or temperature control element controls a supply of heat as in the arrangement of Fig. 2.

Figs. 1 and 2 represent the situation in which cooling through the roof as in the winter time may cause condensation of moisture from the humid air coming in contact with it and Fig. 3 represents the situation when condensation may occur within an air circulating duct due to evaporation of water within the duct.

It will be appreciated that circumstances other than those illustrated may be encountered in which condensation is likely to occur and is to be avoided. For instance in the case of a central station air conditioning system designed to handle substantially saturated air and having atomizers in the air conditioned space or room to boost the humidity of the air in the room above that handled by the central station, the central station duct may sweat and the invention is applicable.

Referring to Figs. 1 and 2, 1 is the cold roof or ceiling of the air conditioned space, 2 a duct positioned to draw air from contact with the ceiling, 3 is a fan for drawing air through the duct, 4 is the humidity sensitive unit, and may be a unit such as that disclosed in U. S. Patent No. 2,261,750 to Frederic F. Bahnson, 5 a motor operated valve which is operated by the control unit 4 and in turn controls the supply of steam to the heating coil 6. In operation the fan 3 draws a sample of air through the duct 2 and blows it in contact with the humidity sensitive control device 4. When the humidity of the sample of air exceeds a predetermined value, say 90% relative humidity, at which the device 4 is set to operate, the device 4 closes an electrical circuit which operates the motor controlled valve 5 and admits steam to the coil 6, thus heating the air adjacent the ceiling and lowering its relative humidity and thereby preventing condensation.

Referring to Fig. 3, 8 is an air circulating duct, 9 the air circulating fan, 10 is a small duct for drawing a sample of air from the room into the main circulating duct, 11 is the humidity or temperature sensitive device, 12 is a motor which operates under control of the device 11 and in turn serves to operate the air intake and air recirculating dampers 13 and 14.

In operation, air is withdrawn from the room

through the duct 10 and contacts the device 11. If the humidity exceeds a predetermined value at which the device 11 is set to operate, as when cold air is brought into the room from outside and cools the duct 8 in contact with the humid air in the room and tends to cause it to sweat, the device 11 operates to start the motor 12 and to operate the dampers 13 and 14 as required e. g. to close the dampers 13 and open the dampers 14 so as to correct the condition and prevent the conduit 8 from sweating.

In the apparatus of Fig. 4 the parts 8, 9, 10, 11, 12, 13 and 14 are the same as those in Fig. 3 but in the arrangement of Fig. 4 the motor 12 controls the opening and closing of the valve 7 to control the supply of steam to the heating coil 6 to raise the temperature of the conduit 8 and thus prevent sweating.

As suggested above when the absolute humidity of the conditioned air remains fairly constant but fluctuations of temperature may give rise to sweating conditions a temperature sensitive device may be used instead of a humidity sensitive device, any fall in temperature below a safe value serving to operate the means for correcting the condition i. e. for raising the temperature as by supplying heat by means of steam heating coils, or recirculating warm air or supplying air of low humidity.

It will be appreciated that the invention may be used to prevent sweating of e. g. a cold outside wall or the cold roof or even the cold floor of an air conditioned space or it may be used to prevent sweating of the conduits which carry the conditioned air and the humidity or temperature control may serve to prevent sweating in any of a variety of ways as by supplying heat, warm air, dry air, etc. the essence of the invention be-

ing that a sample of air is drawn from the location to be protected and delivered to the humidity or temperature sensitive control device which in turn controls the operation of means for correcting the condition indicated by the sample of air e. g. the supply of heat, fresh dry air, warm air, etc.

I claim:

1. Air conditioning apparatus comprising in combination an enclosed space, means for supplying conditioned air to the closed space, means for drawing a sample of air from a selected position in said closed space at which sweating is likely to occur, a device responsive to a condition of the withdrawn sample of air indicating the approach of a sweating condition, and means operated under control of said device for locally modifying said condition by supplying heat thereto.

2. Air conditioning system comprising in combination a room, means for supplying humidified air to said room, means for drawing a sample of air from only a relatively small area in said room exposed to outside cooling, a humidity responsive device exposed to said sample of air, and means operated under control of said device for controlling a local supply of heat to said area.

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REFERENCES CITED

The following references are of record in the file of this patent:

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