[0006] However, such systems have air flow capacity limitations based on the size of the desiccant wheels used. Thus in some circumstances where additional air flow capacity is required multiple units may be needed to meet capacity requirements. In climate conditions where the air is dry, such units, depending on the surrounding climate, may provide warmer and drier air than needed. The present invention allows, in such conditions, the supply of larger volumes of conditioned air at the desired temperature and humidity.

SUMMARY

[0007] It is an object of the present disclosure to treat outside supply air and condition it to required needs in greater air flow capacity without the need for additional or larger desiccant wheels and therefore, in an efficient and economic manner.

[0008] Yet another object of the present disclosure is to provide a higher air flow capacity desiccant based dehumidification and air conditioning system which is relatively inexpensive to manufacture and to operate.

[0009] A further object of the present disclosure is to provide an air conditioning system which enables the operator to vary the proportioning of desiccant treated supply air with additional volume of cooled outside air that does not require further drying.

[0009a] According to an aspect, the present disclosure refers to an air conditioning and dehumidification system comprising: an enclosed housing having a wall dividing the housing into first and second air plenums; a refrigeration circuit including an evaporator coil in the first plenum, a condenser coil in the second plenum, and a condenser fan for drawing ambient air into the second plenum and through the condenser and discharging the air downstream from the condenser and to the outside of the housing; a dehumidification system in the housing including a desiccant wheel rotatably mounted in the housing to rotate in a plane perpendicular to the dividing wall whereby one segment of the wheel functioning as the process segment is located in the first plenum and a second segment of the wheel functioning as the regeneration segment is located

in the second plenum; an ambient air supply air fan for drawing ambient air into the first plenum through the evaporator and then through the process segment of the desiccant wheel whereby the ambient air in the first plenum is cooled and dehumidified and the regeneration segment of the wheel is regenerated by the air heated in the condenser and drawn into the second plenum by the condenser fan; means for supplying the cooled and dehumidified air from the first plenum to an enclosure and means for discharging the air stream used to regenerate the desiccant wheel from the second plenum; an ambient air bypass defining a third plenum and means for supplying ambient air through the third plenum and selectively to the enclosure as a bypass airstream; and means for selectively cooling the bypass air stream in the third plenum.

[0009b] In another aspect, the present disclosure refers to a method for conditioning ambient air for supply to an enclosure comprising the steps of: cooling a first ambient supply air stream with a cooling coil of a refrigerant system then passing the cooled ambient supply air stream through a segment of a rotating desiccant wheel to reduce the moisture content of the ambient air stream and passing the thus treated air to the enclosure; regenerating the desiccant wheel by heating a second ambient air stream with the condensing coil of the refrigerant system and passing the heated second ambient air stream through a regeneration segment of the desiccant wheel; and selectively cooling a supply of ambient air in a bypass plenum, without treatment in the first plenum, and supplying the cooled air from the bypass plenum to the enclosure.

[0010] In accordance with an example of the present disclosure an air conditioning and dehumidification system and method utilizes multiple air plenums in or with a housing that has first and second plenums separated by an intermediate wall. The first plenum is used to supply and treat an ambient air stream and then supply that treated air to an enclosure or other area to be cooled or treated. The system also includes a liquid vapor refrigeration circuit which contains an evaporator located in the first plenum to cool and dehumidify ambient air entering the first plenum and a condenser coil in the second plenum.

[0011] A supply fan is associated with the first plenum to draw ambient air into the plenum and supply the treated air from the plenum to the enclosure, area or space. A condenser fan is associated with the second plenum to draw another

ambient air stream into the second plenum which then passes through the condenser and is heated.

[0012] A desiccant dehumidification system is included in the system which utilizes a rotatably mounted desiccant wheel mounted to extend transversely to and through the intermediate wall so that a segment of the wheel is present in the first, process air, plenum and another segment is present in the second plenum, downstream of the condenser to receive air heated in the condenser as regeneration air to regenerate the desiccant wheel as it rotates during operation and after which the regeneration air is exhausted to the atmosphere.

[0013] A third ambient air plenum is also provided as an ambient air by-pass through which ambient air is selectively supplied to the enclosure or space as capacity needs are required without treatment in the first plenum by the desiccant wheel. The third plenum contains a device for cooling the ambient air drawn into the third plenum by a fan or the like before supplying that cooled third ambient airstream to the enclosure. The cooling device may be a cooler coil from a water chiller system or an evaporator coil from a DX refrigeration system that is independent from the DX system used with the first and second plenums.

[0014] In another example of the present disclosure conditioned air is supplied to an enclosure or space by cooling a first ambient supply air stream with the evaporator cooling coil of a DX refrigeration system and then passing the thus cooled and dehumidified first air stream through the process segment of a rotating desiccant wheel to further reduce moisture content in the first ambient air stream. Thereafter this treated first ambient air stream is supplied to the enclosure.

[0015] The desiccant wheel is regenerated by a second ambient air stream supplied to the second plenum which first passes through the DX condenser coil in the second plenum where its temperature is raised before passing through the desiccant wheel segment in the second plenum to regenerate the wheel. After passing through the wheel the second ambient air stream is exhausted to the atmosphere.

[0016] In addition, a third ambient air stream is selectively supplied to a third plenum preferably by a fan that is preferably independent from those fans

selectively cooling a supply of ambient air in a bypass plenum, without treatment in a first plenum, and supplying the cooled air from the bypass plenum to the enclosure.

9. The method as defined in Claim 8 wherein the ambient air in the bypass plenum is a third ambient air stream independent of the air streams in the first and second plenums.

10. The method as defined in Claim 8 wherein the ambient air in the bypass plenum is supplied from the ambient air in the first plenum upstream of the evaporator coil in the first plenum.

11. The method as defined in Claim 9 wherein the ambient air in the third plenum is supplied to the first plenum downstream of the desiccant wheel and mixed with the air leaving the process segment of the wheel before being supplied to the enclosure.

12. The method as defined in Claim 8 wherein the step of cooling ambient air in the bypass plenum includes the step of using a second evaporator coil in the bypass plenum independent of the evaporator coil in the first plenum.

13. The method as defined in Claim 8 wherein the step of cooling ambient air in the bypass plenum includes the step of using a chilled water coil to cool the ambient air therein.

14. The method as defined in Claim 8 further including the steps of pretreating ambient air supplied to the first plenum.

15. The system as defined in Claim 1 wherein the means for selectively cooling the bypass air stream is a chilled water coil.