

Gold et al.

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[54] THERMAL EFFECT RECLAIM DEVICE

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[62] Division of Ser. No. 796,839, Feb. 5, 1969, abandoned.

[52] **U.S. Cl.** 165/6, 165/66, 165/86

[51] **Int. Cl.**.....**F23I 15/02**

[58] **Field of Search**.....165/6-8, 66, 86

[56]

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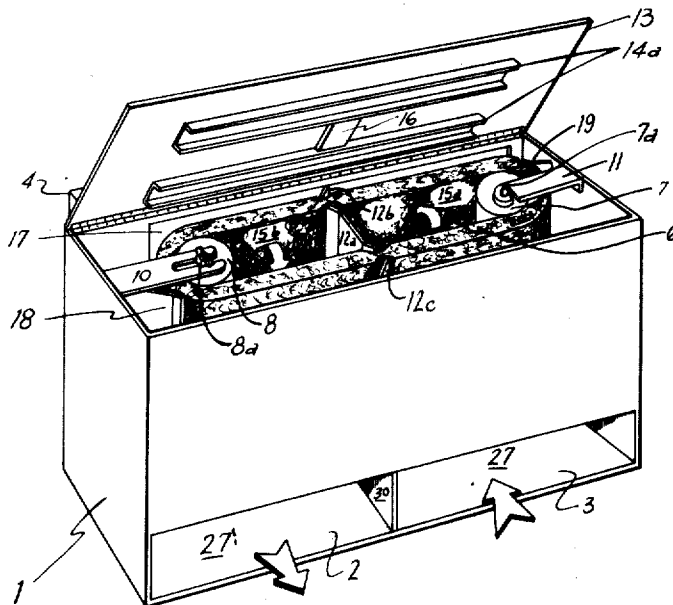
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[57]

ABSTRACT

A heat exchange apparatus to improve the thermal efficiency of a room air conditioning device which provides conditioned air to a served space and includes means to provide fresh air to the served space. The heat exchange apparatus is disposed in communicative relation with the air intake of the air conditioning device and with an air outlet from the served space.

1 Claim, 5 Drawing Figures



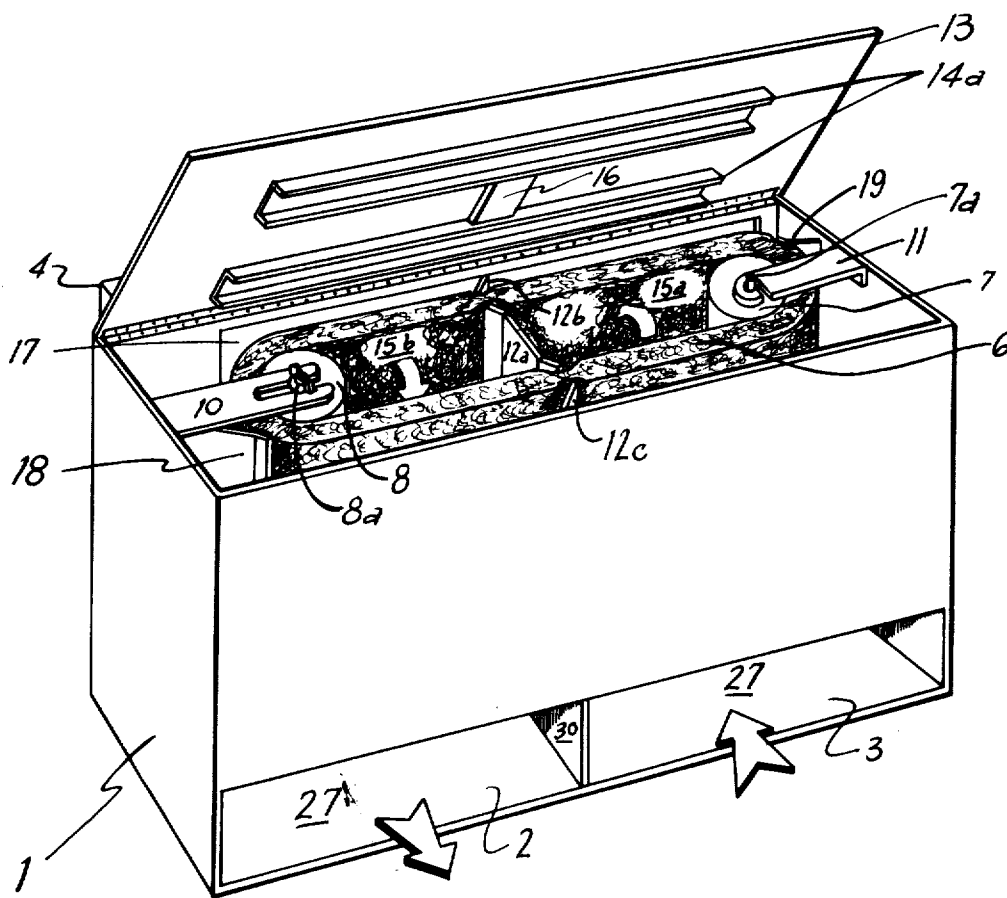


Fig. 1

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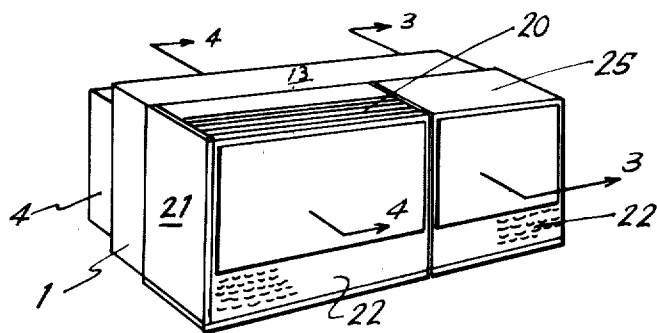


Fig. 2

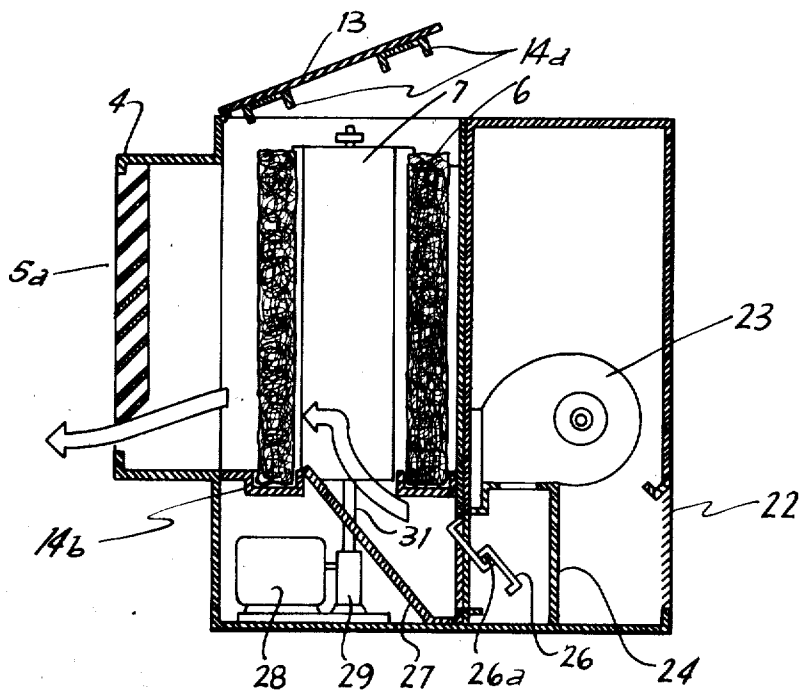


Fig. 3

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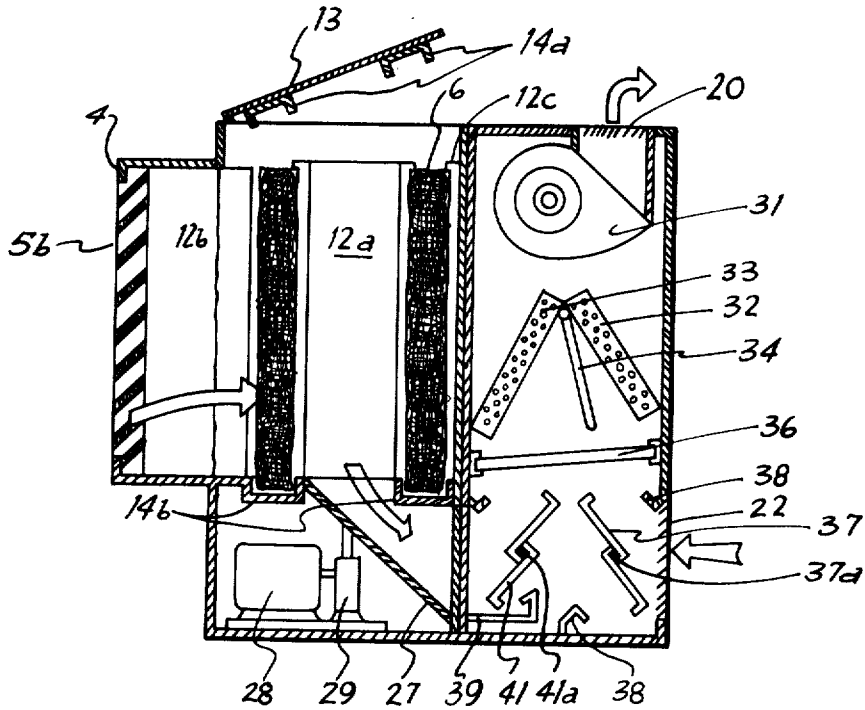


Fig. 4

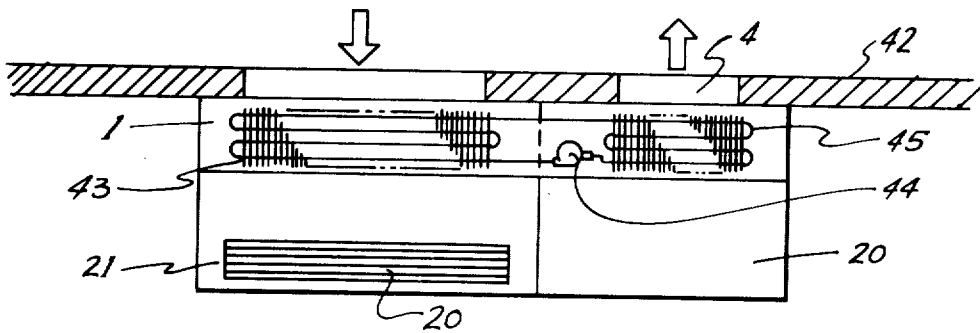


Fig. 5

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THERMAL EFFECT RECLAIM DEVICE

CROSS REFERENCE TO RELATED APPLICATIONS

The present invention is a division of co-pending application, Ser. No. 796,839, filed Feb. 5, 1969 by Harold E. Gold and Ralph B. Smith now abandoned.

BACKGROUND OF THE INVENTION

Air conditioners, as known in the art, provide means for recirculating air within a served space where the recirculated air is heated or cooled to control the temperature in the served space. Some such devices also provide means for introducing a selected quantity of outdoor air for ventilation where the fresh air is mixed with the recirculated air before the combined air stream is heated or cooled and the relative portions of outdoor air and recirculated air admitted to the unit are controlled as a function of the outside temperature and the desired temperature in the served space.

Previous unit ventilators or air conditioners do not provide a means to exhaust the recirculated air from the served space so the pressure in the served space is increased during the periods when outdoor air is admitted to the unit and a certain amount of air is then emitted through openings such as doors normally provided in the served space.

SUMMARY OF THE INVENTION

In the present invention it is recognized that in certain applications it is desirable to provide means to both admit a selected quantity of fresh air to a space served by an air conditioning device and to exhaust a controlled quantity of air from the served space to maintain a selected concentration of fresh air in the served space. The present invention further recognizes that exhausting a portion of the room air results in a loss of heating or cooling effect and that the lost thermal effect must be regained to maintain desired temperature in the served space.

The present invention advantageously provides a straightforward arrangement to be used in association with an air conditioning unit adapted to admit a selected quantity of fresh air and emit a selected quantity of recirculated room air. The present invention further provides means to efficiently recover the thermal effect which would otherwise be lost with the exhausted air and transfer the thermal effect to fresh air introduced into the air conditioning apparatus.

Various other features of the present invention will become obvious to those skilled in the art upon reading the disclosure set forth hereinafter.

More particularly, the present invention provides a heat exchange device for use in combination with an air conditioning device to condition air for a selected served space having a fresh air inlet, a recirculated air inlet communicating with the served space, and a conditioned air outlet to direct conditioned air to the served space, comprising: first air passage means communicating with a source of fresh air and the fresh air inlet of the air conditioning device, and second air passage means communicating with the served space for emission of recirculated air from the served space; first heat exchange means disposed in heat exchange relation with air flowing through the first air passage;

second heat exchange means disposed in heat exchange relation with air flowing through the second air passage; second heat exchange means disposed in heat exchange relation with air flowing through the second air passage; and, means to transfer thermal effect from the first heat exchange means to the second heat exchange means.

It is to be understood that the description of the examples of the present invention given hereinafter are not by way of limitation and that various modifications within the scope of the present invention will occur to those skilled in the art upon reading the disclosure set forth hereinafter.

Referring now to the FIGS:

FIG. 1 is a perspective view of one example of a thermal effect interchange device in accordance with the present invention;

FIG. 2 is a perspective view of one assembly including a thermal effect interchange device in accordance with the present invention and a cooperative air conditioning apparatus;

FIG. 3 is a view taken along a plane passing through line 3—3 of FIG. 2;

FIG. 4 is a view taken along a plane passing through line 4—4 of FIG. 2; and,

FIG. 5 is a schematic view of another arrangement in accordance with the present invention.

As shown in FIG. 1, a thermal effect interchange device in accordance with one example of the present invention can be enclosed in casing 1 having a fresh air outlet 2 and a recirculated air inlet 3 separated by a baffle plate 30 where the housing is adapted to receive a heat reclaiming arrangement as hereinafter described.

In the example of the Figures, a heat reclaiming means, for example a web 6 which can be made of a material with high thermal capacity, i.e., copper wire, is provided to alternately receive and give up heat to flowing air streams. Web 6 is mounted on rollers 7 and 8 disposed, respectively, at opposite ends of the casing and is moved around the rollers from one end of the casing to the other as hereinafter described. Roller 7 is provided with a cooperative spindle 7a and a bracket 11 is provided as shown with a cooperative groove to receive spindles 7a to rotatably secure roller 7 in selected position within the casing. Likewise, roller 8 is provided with spindles 8a, each adapted to be received, as shown, by a groove in a bracket 10 to rotatably secure roll 8 in casing 1. Spindle 8a is provided with threaded fastening means, as shown, to secure roll 8 relative to roll 7 to selectively adjust the tension on web 6.

Baffles 12a, 12b, 12c are provided to define an air inlet compartment 15a and an air outlet compartment 15b within casing 1. Baffle 12a is disposed within the loop formed by web 6 to contact the web in both sides of the loop and extends the entire width of the web. Baffle 12c is disposed, as hereinafter described, to extend from casing 1 to the surface of heat exchange web 6 along the width thereof while baffle 12b extends from the outer edge of louver assembly 4, as hereinafter described, to engage the surface of web 6 along the width of the web. In the arrangement shown the baffles are disposed to prevent passage of air from one compartment to the other.

Baffles 18 and 19 are provided by casing 1, as shown in FIG. 1, to cooperatively engage the surface of web 6 adjacent rollers 8 and 7 respectively to prevent air flow between the ends of belt 6 and the sides of casing 1 and restrict air flow through the selected areas of web 6.

Referring to FIGS. 3 and 4 it will be seen that one edge, for example the lower edge, of web 6 can be supported in channels 14b and that baffle means 27 can be provided within casing 1 to selectively direct air flow through compartments 15a, 15b. Referring to FIG. 3, a drive motor 28 can be provided in the unit to rotate drum 7 to move web 6 alternately through compartments 15a and 15b. Drive motor 28 is connected to a gear drive device 29 connected to drum 7 by means of a shaft 31 which extends through baffle 27.

Louver assembly 4 is provided to extend through a cooperative aperture in the wall of the space to be served by the unit and includes an air outlet 5a and air inlet 5b as shown in FIGS. 3 and 4. As illustrated in FIG. 4 and hereinbefore described, baffle 12b extends from the edge of outlet assembly 4 to contact media web 6 to prevent the flow of air from the inlet chamber and from the outlet chamber and vice versa.

A lid 13 is pivotably connected to casing 1 to permit access to the air flow compartments. Lid 13 includes seal channels 14a to receive the upper edge of each end of the loop of web 6 to prevent leakage from the inlet chamber to the outlet chamber and it will be noted that web 6 is retained between channel 14a and 14b. A sealing mat 16 is provided to engage the top of baffles 12a to prevent undesirable air leakage between compartments 15a and 15b.

An exhaustor 25 having room air inlet 22 can be cooperatively connected to casing 1, as shown in FIG. 3, to exhaust air from the served space and as shown in FIG. 2. The exhaust can be disposed alongside air conditioning apparatus 21 as hereinafter described and in the example exhaustor 25 includes a fan 23 to withdraw air from the served space to air inlet 3 of casing 1. The air stream flows to compartment 15b to pass through the heat exchange web 6 in heat exchange relation, and is ultimately emitted from the unit through outlet 5a. Air is emitted from fan 23 to a compartment formed by a baffle 24 and an adjustable damper 26 can be provided at the outlet from the compartment to selectively control the rate of air emission from the exhaustor.

An air conditioning apparatus 21 is provided to be cooperatively associated with casing 1 and, as shown in FIG. 4, the air conditioning unit includes an air inlet in communication with outlet 2 of the heat exchange apparatus so air flows through compartment 15b to the air inlet of the air conditioning apparatus. The air conditioning unit is adapted to also receive room air through louver 22 for recirculation to the served space. Room air flow through louver 22 is selectively controlled by an adjustable damper 37 mounted on a rotatable damper shaft 37a and seals 38—38a are provided to be engaged by the edges of damper 37 to restrict flow of air through inlet 22. An adjustable outdoor air damper 41 is mounted on a rotatable shaft means 41a and is provided to selectively control flow of air into the air conditioning unit. Damper 41 is adapted to engage seal members 39, 39a to prevent undesirable flow of air into the air conditioning apparatus when the damper is closed.

The air conditioner shown in the Figures includes a fan 31 to draw the combined fresh and recirculated air stream into the air conditioning unit and direct the air stream through louvered outlet 20 to the served space.

Air tempering means, for example, air heating and air cooling coils 32, 33 are disposed within the air conditioning apparatus and flow of air through the respective heat exchangers can be selectively controlled by means of an adjustable damper 34 mounted on a damper motor shaft 34a.

Tempering fluid is selectively supplied to coils 32, 33 on demand to provide desired tempering effect. Various arrangements can be provided to control flow of tempering fluid to the coils, for example in some air conditioners a selected tempering fluid can be provided to one heat exchanger device while no tempering fluid is supplied to the other device, and vice versa. In such arrangements air temperature control is maintained by directing a selected portion of the total air flow through the active heat exchanger and subsequently mixing the tempered portion with the untempered stream of air diverted through the inactive heat exchanger.

An air filter device can be provided to separate particulate matter from the air stream, for example a throwaway or renewable filter 36 can be disposed across the air flow path of the air conditioner.

Referring to FIG. 5, an alternate arrangement including a two-coil system is provided where a tempering fluid is circulated from one coil to the other. In the example shown in FIG. 5 coil 45 is provided in heat exchange relation with the air stream flowing from exhaustor 25 while a second coil 43 is disposed in heat exchange relation with the air stream admitted to air conditioning device 21. The coils are interconnected in communicative relation and the coil system contains a selected fluid, for example an ethylene glycol-water solution, which is pumped from one coil to the other, by means of a pump 44 provided in the unit, so heat is transferred from one coil to the other and from one air stream to the other.

In operation, an outdoor air stream is admitted to compartment 15b of casing 1 to pass into the center of the loop formed by web 6. The air stream passes through the web in heat transfer relation to the center of the web loop and thence along baffle 27 to the fresh air inlet of the air conditioning unit for treatment before emission to the served space.

The outdoor air stream from outlet 2 of casing 1 is combined with a selected proportion of recirculated air admitted to air conditioning device 21 through inlet 22. The combined air stream passes through filter 36, over coils 32, 33 to fan 31, and out through grill 20 to the served space.

Air which is to be exhausted from the served space is drawn into exhaustor 25 by means of fan 23 which emits the air stream into the chamber formed by baffle 24. The air stream then flows through inlet 3 of casing 1 along baffle 27 and is directed into the center of the looped web 6 in compartment 15a. The air stream passes through the web, from inside to outside, and out of the unit through outlet 5a.

The temperature of the air stream emitted from the served space through web 6 is approximately the temperature of the served space while the temperature of the web is approximately the same as the outside air so

a thermal effect is transferred between the air stream and the porous web.

In accordance with one feature of the example of the present invention shown in the figures the web is alternately moved through chambers 15a and 15b so that, for example, if the temperature in the served space is above the temperature of the outside air heat is transferred from the air stream emitted from the unit to the web so that when the web passes from chamber 15a to chamber 15b the heat gained in chamber 15a is transferred to the outside air stream admitted to the unit to preheat the air stream prior to introduction to the air conditioning unit to decrease the required heat capacity and fuel or energy consumption of the air conditioning unit. In situations where the temperature of the served space is below the temperature of the outdoor air drawn into the unit a reverse procedure occurs and in this case the air cooling requirements of the air conditioning device are correspondingly reduced.

The invention claimed is:

1. A heat exchange device for use in combination with an air conditioning device to condition air to be supplied to a selected served space, the air conditioning

device having a fresh air inlet, a recirculated air inlet and a conditioned air outlet communicating with the selected served space, said heat exchange device comprising: a first air passage means communicating with a source of fresh air and the fresh air inlet of said air conditioning device; a second air passage means communicating with served space to exhaust solely air from the served space; first heat exchange means disposed in heat exchange relation with air flowing through said first air passage; second heat exchange means disposed in heat exchange relation with air flowing through said second air passage; and, means to transfer the thermal effect from said first heat exchange means to said second heat exchange means including an endless belt of a porous web material extending from said first air passage to said second air passage and at least two rollers disposed along the inner surface of a loop formed by said endless belt to cooperatively engage said belt wherein said belt is continuously passed through said first air passage and said second air passage to transfer said thermal effect from said first air passage to said second air passage.

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