Jan. 16, 1962 R. E. LEE ETAL 3,017,160

HEAT EXCHANGE UNITS

Filed April 1, 1960 2 Sheets-Sheet 1

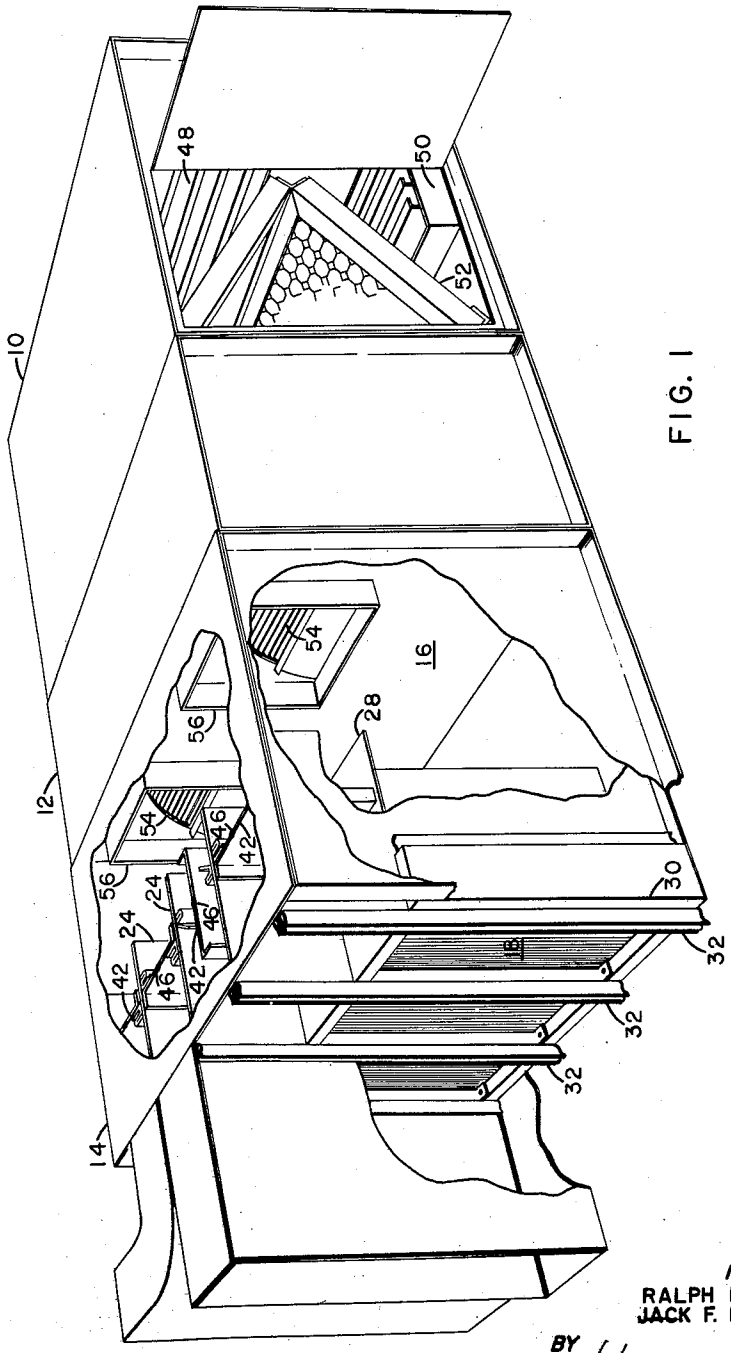


FIG. 1

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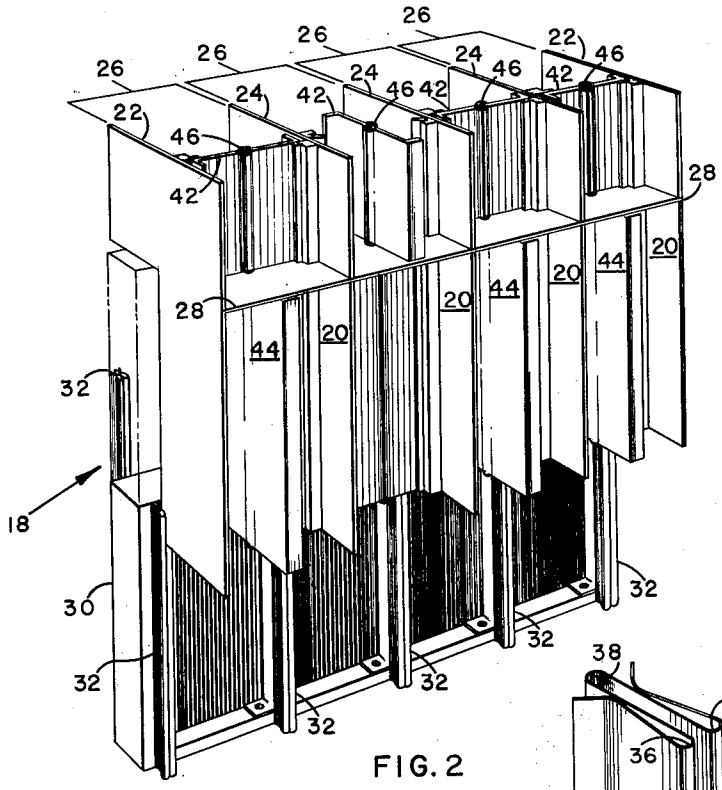


FIG. 2

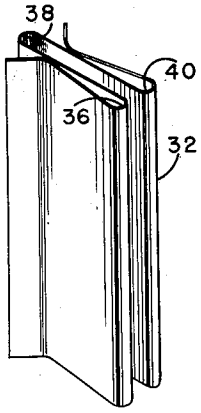


FIG. 4

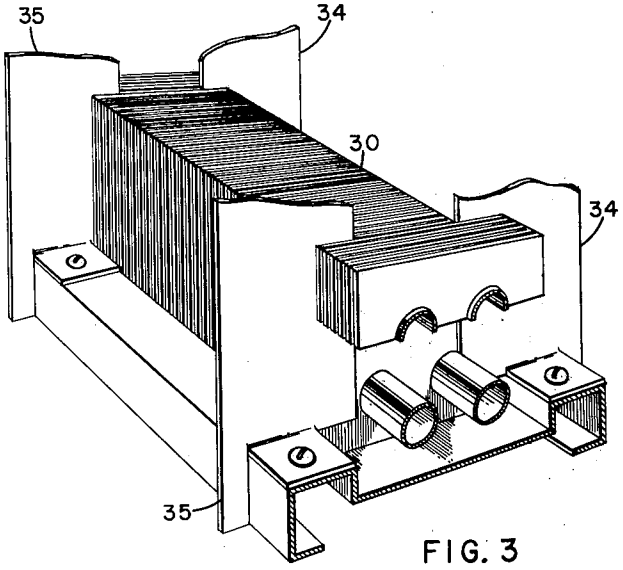


FIG. 3

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3,017,160
HEAT EXCHANGE UNITS

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6 Claims. (Cl. 257—137)

This invention relates generally to force draft type of multi-zone heat exchange units and more particularly to multi-zone heat exchangers which provide ventilation air during moderate weather.

Prior to this invention, multi-zone heat exchangers had a serious overheating problem especially during moderate weather. Since these units provide heating, cooling or ventilation air to a number of independent zones, it is not possible to shut off the hot supply because some zones may be requiring heat while other zones may be requiring cooling or ventilation. The result was that the air intended to be supplied to the zones requiring cooling or ventilation was wiping past the heating coil before introduction into the zone requiring cooling or ventilation. The end result of such wiping of the heating coil was that the temperature of the air going to the zone or zones requiring cooling and/or ventilating was too high causing overheating of the zone to which such air was introduced.

It is an object of this invention to provide a multi-zone heat exchanger which eliminates wiping of the heating heat exchanger in order to eliminate overheating of the zones that do not require heating.

A second object of the invention is to provide a multi-zone heat exchanger which is compact, inexpensive to manufactreu, readily assembled, and which eliminates wiping of the heating coil.

A third object of the invention is to provide a multi-zone heat exchanger which allows accurate control of the temperature in the zones to be conditioned.

Another object of the invention is to provide a blow thru multi-zone heat exchanger which has the zone dampers located between the fan and the heat exchanger in order to prevent coil wiping and to prevent air leakage.

A still further object of the invention is to provide a blow thru multi-zone heat exchange unit which has the zone dampers between the fan and the heat exchanger and which provides readily attachable and detachable partition members between each zone and between the zone dampers for each zone in order to eliminate coil wiping and to insure positive air flow to the zone intended.

A sixth object of the invention is to provide a compact multi-zone heat exchange unit which eliminates coil wiping and is readily attachable to the duct work which delivers air to the zones to be conditioned.

Other objects and advantages of the invention will be clearly apparent as the specification proceeds to describe the invention with reference to the accompanying drawings in which:

FIG. 1 is an isometric view of our new and improved multi-zone heat exchange unit;

FIG. 2 is an isometric view of the heat exchange coil section of FIG. 1 with the heat exchange coil being shown in a dropped position;

FIG. 3 is a partial isometric view of the heat exchange coil showing the clip attachment plates in operative position; and

FIG. 4 is a view showing the clip member used to attach the partitions to the clip attachment plates.

The preferred embodiment of our invention is shown as a heating and ventilating type of multi-zone heat exchange unit. It is within the scope of the invention to also provide a cooling heat exchanger if such is desired.

Looking now at FIG. 1, our new and improved multi-zone heat exchange unit consists basically of a combination filter mixing box **10**, a fan section **12**, and a coil and damper section **14**.

Coil and damper assembly **14** primarily encompasses a plenum chamber **16** and a heat exchanger assembly **18** sub-divided by vertical partition members **20**, **22**, and **24** into a plurality of zones **26**. Horizontal partition member **28** is provided to separate each zone **26** into a ventilating passage and a heating passage. A heat exchanger member **30** is provided to condition the air passing through each of the heating passages of the zones **26**. The heat exchange member is shown located below the horizontal partition **28** but obviously could be located above the horizontal partition **28**, if desired.

It should be noted that partitions **20**, **22**, and **24** extend into the plenum chamber **16** a substantial distance in order to provide separate and distinct air paths for each zone **26**. For purposes of assembly, disassembly, and repair, partitions **20**, **22**, and **24** are secured in position by a duct clip **32**, shown in detail in FIG. 4. Duct clip **32** is a W shaped clip of spring steel, or other suitable material and has channel passages **36**, **38**, and **40** therein adapted to engage and secure two or more sheet metal portions together.

In the preferred form of our invention, clip plates **34** and **35** (FIG. 3) are provided between the heat exchange fins of heat exchanger **30** at both the entering and leaving side of the heat exchanger. Normally clip plates **34** will be installed co-planar with clip plates **35** or could be continuous through the heat exchanger.

On the leaving side of the heat exchanger **30**, duct clips **32** are attached to clip plates **35** so that clip plates **35** nest in channel passages **38**. Channel passages **36** and **40** are then available for attachment to the sheet metal duct work for each zone to be conditioned. Also, channel passages **38** of duct clips **32** engage and secure the leaving edge of vertical partitions **22** and **24**.

On the entering side of the heat exchanger **30**, either channel passage **36** or channel passage **40** engages clip plate **34** while partitions **20** and **22** are secured in channel passage **38** to position the partitions.

Zone dampers consisting of a ventilation damper **42** and a heating damper **44** secured to a rotatably supported damper rod **46** are placed in each zone **26** to control the flow of air therethrough. Damper **42** is mounted 90° out of phase with damper **44** in order to be able to provide all ventilation air or all heated air, if desired. Damper sealing members may be provided, if desired. Obviously, intermediate positioning of the damper rod **46** will provide a mixture of ventilating air and heated air depending on the requirements of the zone to be conditioned. Positioning of the zone dampers may be controlled in any suitable manner such as using pneumatic damper motors on each zone damper with the damper motor being responsive to the temperature in the conditioned air. If desired or necessary, two or more zone damper rods **46** may be linked together to provide air conditioning for a single conditioned area.

In operation, air is drawn through fresh air damper **48** or recirculated air damper **50** or through both depending on the damper setting as determined by the damper control, not shown. This air is then drawn through filters **52** into fan inlet, not shown, of fans **54** and discharged into plenum chamber **16** through fan outlets **56**. Dependent upon the position of dampers **42** and **44**, the air is fed through the heating and ventilating passages of each zone **26** and is delivered to the area being conditioned. As set forth previously, the tem-

perature of the air delivered to the area to be conditioned is dependent upon the position of dampers 42 and 44 in each zone 26.

Assuming that some zones are calling for heat and other zones are calling for ventilation only, it is obvious that our new and improved multi-zone heat exchanger has eliminated wiping of the heating heat exchanger 30 by the air supplying the zone or zones requiring ventilation. Looking at FIGS. 1 and 2, it can be seen that the location of dampers between the fan section 14 and the heat exchanger 30 provides positive cut-off of the heat exchanger 30 when only ventilation is required. Looking at one zone 26 when damper 42 is open and damper 44 is closed, it is obvious that no air from plenum chamber 16 contacts heat exchanger 30 before passage through the ventilation passage. Partition members 20 in conjunction with partitions 28 and 24 prevent air for one zone 26 which is on heating from passing to one of the adjacent zones which may be requiring ventilation only. For these reasons, our invention provides positive passage of air from plenum chamber 16 to the zones requiring such air and eliminates overheating of the zones requiring ventilation only by positive cut-off of the heating coil in these zones requiring ventilation and by the elimination of passage of air intended for one zone 26 to one of the next adjacent zones 26.

Further, our new and improved multi-zone heat exchanger provides a structure which is readily assembled and accessible for repair. It should be noted that heat exchange 30 is connected to the duct work and the multi-zone structure only by duct clips 32. Obviously, if necessary, heat exchange coil may be readily removed for repair, cleaning, or replacement by merely disconnecting the duct clips 32 and removing the heat exchanger 30 through access panels normally provided for such use. Therefore, our new and improved structure has the obvious advantage of providing positive elimination of coil wiping and at the same time provides a structure which is readily assembled and accessible for repair and cleaning.

Although we have described in detail the preferred embodiments of our invention, we contemplate that many changes may be made without departing from the scope or spirit of our invention, and we desire to be limited only by the claims:

We claim:

1. In a single or multi-zone heat exchange unit having air moving means and a heat exchanger assembly downstream of said air moving means, said heat exchanger assembly comprising; a heat exchanger with one side longer than another, said long side being located transverse to the air stream created by said air moving means, said heat exchanger having heat exchange fins therein substantially perpendicular to said long side, a plurality of clip plates located between said heat exchange fins on the upstream side of said heat exchanger, means forming a bypass for the passage of air around said heat exchanger substantially co-extensive with said long side of said heat exchanger, a partition member between said heat exchanger and said bypass passage and extending towards said air circulating means, clip means attached to said clip plates on the upstream side of said heat exchanger, first partition means secured to said clip means and forming a multiplicity of passages through said heat exchanger, second partition means in said bypass passage substantially co-planar with said first partition means and forming a multiplicity of passages through said bypass passage corresponding with said passagse through said heat exchanger, damper mean rotatably supported in each of said bypass passages, damper means rotatably supported in each of said passages through said heat exchanger upstream of said heat exchanger, and means interconnecting said bypass damper means out of phase with the corresponding damper means in said passage through said heat exchanger to close said heat exchanger damper means when said bypass means is open whereby the air passing through said bypass passages will not be overheated due to contact with said heat exchanger before inflow to said bypass passages.

2. The structure of claim 1 when clip plates are located between said heat exchange fins on the downstream side of said heat exchanger co-planar with said clip plate on the upstream side of said heat exchanger, and clip means are attached to said clip plates on the downstream side of said heat exchanger whereby sheet metal ducts may be readily attached to said multi-zone heat exchange unit.

3. In a multi-zone heat exchange unit having air moving means and a heat exchanger assembly downstream of said air moving means, said heat exchanger assembly comprising; a heat exchanger with one side longer than another, said long side being located transverse to the air stream created by said air moving means, said heat exchanger having heat exchange fins therein substantially perpendicular to said long side, means forming a bypass for the passage of air around said heat exchanger substantially co-extensive with said long side of said heat exchanger, clip means attached to said heat exchanger on the upstream side thereof, first partition means secured to said clip means and forming a multiplicity of passages through said heat exchanger, second partition means in said bypass passage substantially co-planar with said first partition means and forming a multiplicity of passages through said bypass passage corresponding with said passages through said heat exchanger, damper means rotatably supported in each of said bypass passages, damper means rotatably supported in each of said passages through said heat exchanger upstream of said heat exchanger, and means interconnecting said bypass damper means out of phase with the corresponding damper means in said passage through said heat exchanger to close said heat exchanger damper means when said bypass means is open whereby the air passing through said bypass passages will not be overheated due to contact with said heat exchanger before inflow to said bypass passages.

4. The structure of claim 3 wherein clip means are attached to said heat exchanger on the downstream side thereof whereby sheet metal ducts may be readily attached to said multi-zone heat exchange unit.

5. In a multi-zone heat exchange unit having air moving means and a heat exchanger assembly downstream of said air moving means, said heat exchanger assembly comprising; a heat exchanger with one side longer than another, said long side being located transverse to the air stream created by said air moving means, said heat exchanger having heat exchange fins therein substantially perpendicular to said long side, means forming a bypass for the passage of air around said heat exchanger substantially co-extensive with said long side of said heat exchanger, a partition member between said heat exchanger and said bypass passage and extending towards said air circulating means, clip means attached to said heat exchanger on the upstream side thereof, first partition means secured to said clip means and forming a multiplicity of passages through said heat exchanger, second partition means in said bypass passage substantially co-planar with said first partition means and forming a multiplicity of passages through said bypass passage corresponding with said passages through said heat exchanger, damper means rotatably supported in each of said bypass passages, damper means rotatably supported in each of said passages through said heat exchanger upstream of said heat exchanger, and means interconnecting said bypass damper means out of phase with the corresponding damper means in said passage through said heat exchanger to close said heat exchanger damper means when said bypass means is open whereby the air passing through said bypass passages will not be overheated due to contact with said heat exchanger before inflow to said bypass passages.

6. In a multi-zone heat exchange unit having air moving means and a heat exchanger assembly downstream of said air moving means, said heat exchanger assembly comprising; a heat exchanger with one side longer than another, said long side being located transverse to the air stream created by said air moving means, said heat exchanger having heat exchange fins therein substantially perpendicular to said long side, a plurality of clip plates located between said heat exchange fins on the upstream side of said heat exchanger, means forming a bypass for the passage of air around said heat exchanger substantially co-extensive with said long side of said heat exchanger, clip means attached to said clip plates on the upstream side of said heat exchanger, first partition means secured to said clip means and forming a multiplicity of passages through said heat exchanger, second partition means in said bypass passage substantially co-planar with said first partition means and forming a multiplicity of

passages through said bypass passage corresponding with said passages through said heat exchanger, damper means rotatably supported in each of said bypass passages, damper means rotatably supported in each of said passages through said heat exchanger upstream of said heat exchanger, and means interconnecting said bypass damper means out of phase with the corresponding damper means in said passage through said heat exchanger to close said heat exchanger damper means when said bypass means is open whereby the air passing through said bypass passages will not be overheated due to contact with said heat exchanger before inflow to said bypass passages.

References Cited in the file of this patent

Bulletin H S–1, "Wing Featherfin Heater Section," page 5, published by T. J. Wing Mfg. Co., 154 W. 14th St., N.Y.C., copyright 1939.