Oct. 1, 1957 K. E. FOSNES 2,808,237

WALL MOUNTED AIR CIRCULATING HEAT EXCHANGERS

Filed Feb. 16, 1953

FIG. 1.

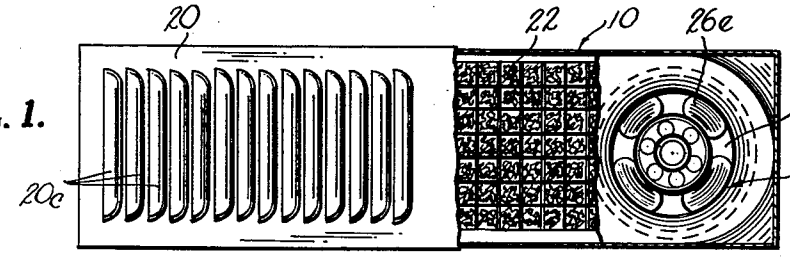


FIG. 7.

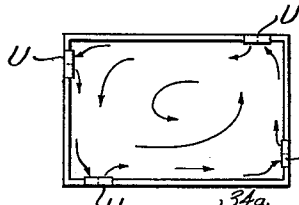
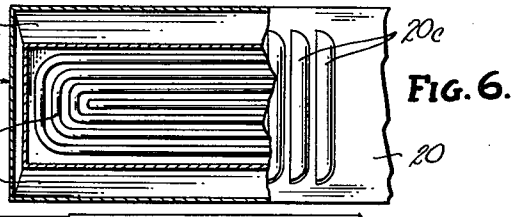


FIG. 6.



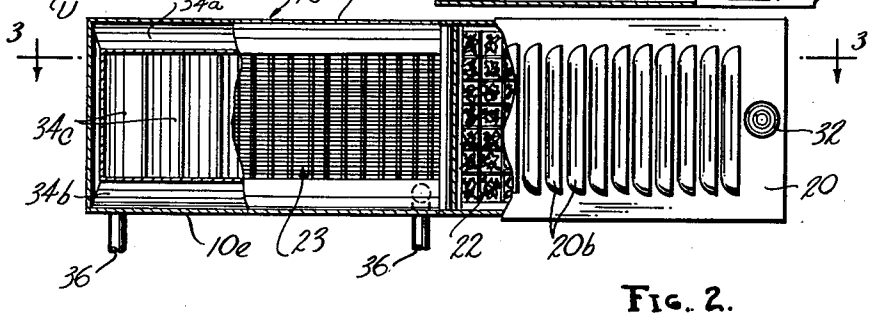


FIG. 2.

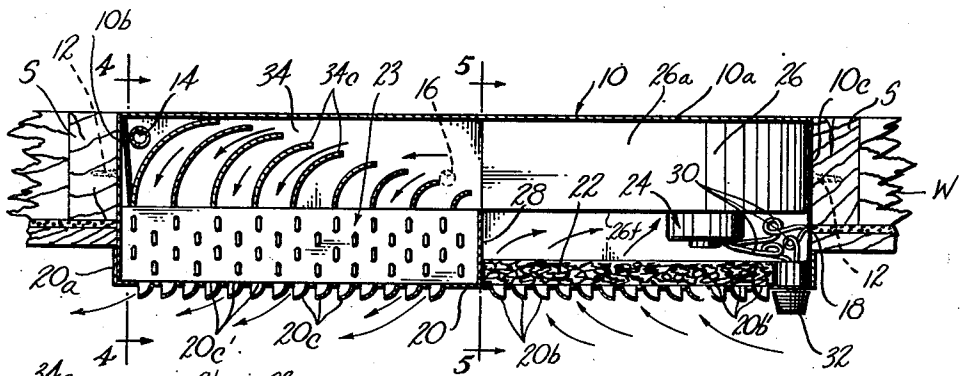


FIG. 3.

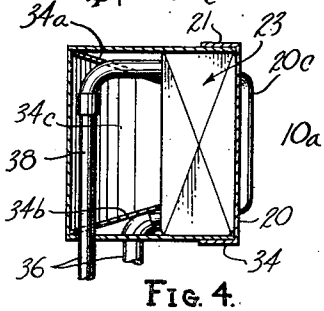


FIG. 4.

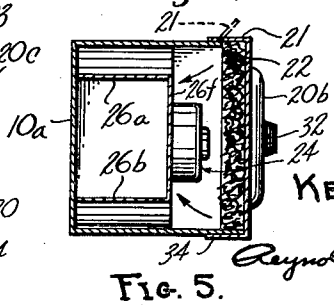


FIG. 5.

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WALL MOUNTED AIR CIRCULATING HEAT EXCHANGERS

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6 Claims. (Cl. 257—137)

This invention relates to air circulating heat exchange apparatus especially suited for home heating or cooling and similar applications, and more particularly concerns apparatus of this nature which may be constructed in such a form and compact arrangement to enable it to be mounted conveniently in the wall of a room as a conventional heat register, for instance, and when thus mounted will be capable of highly efficient operation to circulate and heat or cool the air in a manner consistent with achieving maximum comfort conditions in the room. The invention is herein illustratively described by reference to the preferred form thereof as applied to the problem of home heating, or cooling; however, it will be understood that various modifications and changes in the embodiment selected for illustrative purposes may be made without departing from the essential features of the invention.

There are in existence, of course, many different types of heating systems for homes and other buildings including, but not necessarily limited to forced air circulation furnaces, hot water convector systems, hot water or steam radiant systems, individual room stoves or other heaters supported on the floor of a room, and others. Most conventional heating systems have certain advantages and certain disadvantages, taking into consideration such factors as installation and operating costs, cleanliness of operation, conservation of building space, controllability, availability of instant heat, flexibility in respect to the matter of locating components, control of temperatures independently in the different rooms, uniformity of heating and prevention of uncomfortable drafts, etc. A general object of the present invention is to combine in a novel heat exchange device the advantages of most conventional heating systems without incurring their disadvantages, or at least to accomplish this result in a greater degree than has been possible heretofore.

More specifically an object of the invention is an improved heat exchange device capable of providing more instant heat with less loss of heat than most conventional systems, and of circulating the heat uniformly around the room at floor level to eliminate uncomfortable drafts and without producing wide fluctuations of room temperature.

Another object of the invention is the provision of heat exchange apparatus especially well suited for heating and controlling the temperature of individual rooms independently of other rooms without involving bulky or space-consuming and expensive equipment, indeed to achieve these and the other ends described while conserving useful space normally wasted by air ducts, radiators, etc.

A more specific object is apparatus of the nature described which is simple to install in existing building walls or to incorporate in new ones at optimum locations, and after installation is conveniently accessible for maintenance and repairs. Moreover the individual heat exchange units may be mounted in building walls as readily and as inconspicuously as conventional wall registers used with hot air furnaces.

With these and other objects in view as will hereinafter more fully appear, the invention resides in the provision of wall mounted heat exchange apparatus comprising an elongated housing preferably of generally rectangular proportions which encloses an interior compartmented space not appreciably thicker than a conventional building wall, such that the unit may be set into the wall without projecting into the room an objectionable amount. Particularly such a unit is low so that it may be installed conveniently beneath a window where heat application is particularly desirable. In the otherwise closed front of such housing air inlet and outlet openings, having louvers directed oppositely from each other in a horizontal sense respectively, are provided in side-by-side relationship extending in alignment horizontally across the face of the unit. Thus arranging the openings in a horizontal line causes the air to move horizontally through the unit and thereby permits such unit to be relatively narrow vertically, as mentioned, and such arrangement effects the circulation of air about the room substantially at floor level as discussed above. A heat exchange panel preferably comprising a bank of finned water coils or the like is mounted on the back side of the housing cover behind one of the openings, such as the discharge opening. Alternatively the heating element may be an electrical resistance type coil. An air filter panel is similarly mounted behind the other opening. Behind one of these panels, preferably the filter panel, which may be relatively thin, a blower is mounted to move air through the housing along a curved path extending in part lengthwise of the housing and in part perpendicularly thereto through one of the front openings. A series of curved deflector vanes mounted in the housing behind the other opening directs the moving air along a curved path extending through such latter opening and continuous with the blower-defined path. Preferably the blower is mounted behind the intake opening for drawing air through the filter first, so that the blower and other internal parts will be kept as clean as possible.

In operation as a heater, for example, with the blower motor energized and hot water supplied to the coil bank from a suitable source, a steady vortex of warm air is moved slowly around the room by the unit. When mounted near the floor, as preferred, the cool air is drawn into the unit off the floor and warm air is discharged therefrom near floor level, such that all parts of the floor are kept uniformly warm. As another advantage, additional units may be mounted at other wall locations, preferably at equal spacings, around a large room in order to minimize temperature gradients and strengthen the vortex action maintaining proper circulation of air.

These and other features, objects and advantages of the invention including certain details of the preferred type of construction thereof will become evident from the following description based upon the accompanying drawings.

Figure 1 is a front elevation view of the unit with parts broken away to show interior details. Figure 2 is a similar view with different parts broken away to show still other details of internal construction.

Figure 3 is a horizontal sectional view of the unit taken on line 3—3 in Figure 2.

Figure 4 is a vertical sectional view taken on line 4—4 in Figure 3.

Figure 5 is a vertical sectional view taken on line 5—5 in Figure 3.

Figure 6 is a front elevation view of a portion of the unit incorporating an electrical resistance heating coil, parts being broken away.

Figure 7 is a schematic plan view of a large room wherein four heat exchange units are installed in a preferred arrangement.

In its illustrated form an individual room heat exchange unit constructed in accordance with this invention comprises an open front metal housing **10** of box-like form having an elongated rectangular rear wall **10***a* which is relatively narrow vertically in order to permit mounting the unit in a room wall below a window, for example,

if desired. Preferably the housing wall **10***a* is of a length locating the end walls **10***b* and **10***c* substantially in contact with building studs S if the latter are spaced conventionally. Thus the housing is preferably about 30⅝ inches in length to be received between two studs on 16 inch centers, where the intermediate stud has been partially cut away to accommodate the unit. The end walls **10***b* and **10***c* are conveniently secured to the studs by screws **12** in order to hold the housing **10** firmly in place. The width of these end walls **10***b* and **10***c* perpendicular to the building wall W, and the width of the top and bottom walls **10***d* and **10***e* interconnecting the end walls and adjoining the rear wall **10***a*, is of the order of the building wall thickness so that the front projects only a short distance into the room, as shown in Figure 3.

This box-like housing **10** has bottom or top openings **14** and **16** to pass water pipes **36** into and from its interior and a side opening **18** for the reception of electric wires **30** for operating the blower. These may be closed initially by knockouts, and either the top or bottom knockouts, or one of each, may be opened depending on what arrangement of pipes, or wires for an electrical resistance heating unit, is most convenient. Otherwise the housing **10** is separate or detachable from other components of the unit to be contained therein.

The remaining major components of the apparatus, including blower **24** and duct **26**, deflectors **34***c*, heat exchange coil bank **23** and filter panel **22**, are fitted into the generally rectangular housing. Cover plate **20**, which may be in two parts divided vertically at the center or may be unitary, closes the open front side of the housing and is provided with a flange **20***a* extending around its edge to fit over the four walls of the housing. It may be secured in place by suitable means such as screws or bolts in each corner threaded into tabs on the box wall. While the various apparatus components may be mounted on the cover, it is not necessary that they be secured to the housing, and consequently may be merely set into the box. The filter panel **22** may be changed without the necessity of removing the cover plate **20** by providing a hinged flap **21** in the top of cover plate flange **20***a* of a width and length greater than the thickness and length of the filter, as shown in Figure 5. The flap may be opened, the old filter lifted out by grasping a tab on its upper edge, and a new filter inserted. Moreover, when access to the inside of the unit is necessary for cleaning, etc., the cover is removed from the housing and may be laid on the floor to expose the various components carried by it.

The right section or area (Figures 2 and 3) of cover **20** is largely taken up by a louvered air intake opening **20***b'* wherein the louvers **20***b* extend vertically and are shaped to draw air from the room at the right of the unit through such opening. The left section of the cover is largely occupied by a similar louvered air discharge opening **20***c'* wherein the vertically extending louvers **20***c* are directed oppositely away from the louvers **20***b* to discharge air into the room toward the left of the unit. In this manner, air in a room forced through the housing in either direction will be caused to circulate around and around the room continuously in a generally horizontal path.

Fiberglas or other suitable filter material forms the panel **22** behind the cover **20** to cover completely the louvered air intake opening for cleaning air drawn therethrough. A heat exchange panel **23** is mounted behind or on the back side of the cover **20** and covering the air discharge opening. In practice, an efficient filter panel **22** may usually be made thinner than the heat exchange element **23**, so that it is expedient to mount the relatively bulky centrifugal blower, motor and fan unit **24** in the space behind the filter **22**, instead of directly behind the heat exchanger.

The centrifugal blower rotor is received in the air duct **26** having a rounded cylindrical end portion concentric with blower **24**, a front wall **26***f*, shown in Figure 5 and at the right in Figure 3, and top and bottom walls **26***a* and **26***b* (Figure 5) merging with such cylindrical end portion. The housing wall **10***a* forms the rear wall of this blower duct, which extends approximately to the vertical transverse midplane of the housing **10**. The plate or wall **26***f* forms a funnelled axial air inlet or throat **26***d* across which the motor mounting plate **26***c* is bridged, having openings **26***e* therein through which the air passes into the blower unit. Such plate may be screwed in place by a screw in each corner threaded into tabs on the housing. A transverse vertical panel **28** extending between top and bottom housing walls **10***d* and **10***e* closes the space between the cover plate **20** and the left end of the blower duct wall **26***f* providing a sealed compartment permitting the blower to draw air efficiently through the filter **22** without side leakage. Suitable wiring leads **30** are connected to the motor or blower unit **24** and to a cover-mounted rheostat or like control element **32** for the blower motor to enable adjusting the speed of the blower, hence the rate of air circulation, and heating in the room being served. Suitable thermostatic controls may be provided to control energization and deenergization of the blower in response to predetermined changes in room temperature.

The air being moved lengthwise of the housing through the blower duct **26** reaches the transverse vertical midplane of the housing and enters a confining and directing duct **34** behind the heat exchange assembly **23**. The duct **34** is formed by forwardly convergent top and bottom walls **34***a* and **34***b* extending along the housing rear wall **10***a* and top and bottom walls **10***d* and **10***e*. A series of curved deflector plates or vanes **34***c* extending vertically between top and bottom walls **34***a* and **34***b* split and divide the air stream discharging from the blower duct **26** while gradually deflecting it from a direction parallel to the back wall **10***a* into a direction perpendicular thereto so as to discharge this air efficiently through the panel **23** and out the louvered outlet **20***c'*. The deflecting vanes **34***c* are so spaced and have their leading or air-splitting edges so located that all portions of the divided air stream pass in substantially uniform heat exchange relationship in flowing through the heat exchanger. Various airflow directing arrangements could be used for this purpose although that shown in the drawing is presently preferred.

The hot or cold water supply and return water projected into the top or bottom and pipes **36** terminate inside the housing **10**. Connecting pipes **38** are screwed into the respective inlet and outlet headers of the heat exchanger **23** and their coupling ends are faced upwardly or downwardly depending on the location of the supply pipes above or below the unit. The connecting ends of pipes **38** have internally threaded coupling elements carried rigidly by them into which the externally threaded ends of pipes **36** may be screwed.

If it should be desired to cool the room as in summer, water will be supplied to one of the pipes **36** from the usual cold domestic water supply, or from a suitable refrigeration unit, and returned to waste or to such refrigeration unit. When the device is to be used for heating, hot water will be supplied from any of various types of unit. Most convenient would be a gas heater provided especially for heating the water to be supplied to the air conditioning units but for small installations the hot water could be supplied by the usual gas or electric hot water heating units at a temperature of 130° F. to 140° F., for example. For large installations an oil fired boiler arrangement may be provided as the source of hot water.

Instead of providing a liquid heated or liquid cooled radiator unit such as **23** described above, the device may incorporate an electrically heated panel. Thus in Figure 6 an electric resistance coil **23'** carrying louvers **20***c*

is shown mounted in the left end of the air conditioning unit instead of the thin type radiator shown in Figure 2. With such an arrangement it would of course not be necessary to provide the supply and return pipes **36** but instead wires would extend through the apertures in the box to supply power to the electrical heating unit. The resistance wire preferably is embedded in a metal tube in accordance with conventional practice, but an exposed resistance wire element could be employed if desired. Suitable thermostat mechanism responsive to room temperature may be provided not only to control the operation of the blower but also to energize and deenergize such an electric heating coil or to vary the portions of the coil heated or the temperature of such portions as is conventional in the control of electric heating coils.

From the foregoing description it will be apparent that the present invention provides an extremely compact and efficiently arranged heat exchange device capable of being mounted and operated conveniently in the wall of a room where it will not interfere with the useful employment of the room space. Moreover, it is clean and provides instant heat inasmuch as the coils **23** may be kept hot at all times for adding heat slowly to the room except when the blower is turned on manually or by a thermostat to increase the rate of heat output to a relatively large value and furnish instant heat. This action tends to stabilize room temperature and reduce the amplitude of temperature fluctuations below those normally experienced. Because the cold air drawn into the unit travels a short distance along a uniform but low temperature gradient path, no objectionable drafts are produced, whereas the usual cold air returns of a central forced air circulating furnace draw cold air over large distances and from diverse areas, causing rapid movement of cold air attended by large temperature gradients. In the present invention the units are placed near the floor consistent with maximum comfort conditions. Moreover, objectionable heat ducts are dispensed with so that a very minimum of useful space is required for occupation by the heating apparatus.

The central plant for heating the hot water supplied through pipes to the individual unit or units mounted in the different rooms of the building may be located at any convenient point. The large amount of heat lost in conveyance from the central plant to the individual room register in a conventional forced air type of furnace, caused by the large size of the hot air ducts and the difficulty of insulating them, is minimized in the present system because of the absence of long ducts. Hot water pipes conveying hot water from the central water heating plant to the heat exchange unit may be small in size and easily insulated.

A similar heat exchange unit to that shown in the drawings and described hereinabove may be mounted in a wall of each room in a house, for example, and independent controls of an automatic nature may be provided for each if desired. Moreover, as shown in Figure 7, several cooperative units U of the same nature may be installed in the walls of a single large room if desired. These units are preferably spaced approximately equal distances apart around the periphery of the general vortex of moving, heated (or cooled) air which they create when operated simultaneously. With the units located at equal spacings the temperature gradients in the room will be at a minimum and the uniformity of air circulation improved thereby.

These and other advantages of the improved heating system and heat exchange units employed therein will be apparent to those skilled in the art.

I claim as my invention:

1. Wall mounted heat exchange apparatus comprising an elongated housing of a vertical width short in relation to its length horizontally and of a horizontal depth shallow in relation to its vertical width, and having an open front, cover means fitted to said housing's open front and

having air intake and discharge openings disposed in side-by-side substantially horizontal registry, vertical louvers in said discharge opening directed away from said intake opening in a horizontal sense, an air filter panel in said housing immediately behind and covering one of said openings, a heat exchange panel in said housing immediately behind the other of said openings, said air filter panel and said heat exchange panel being disposed in substantially coplanar relationship, blower means mounted inside said housing producing airflow therein, and air deflecting means in said housing cooperating with said blower means to move air from said intake opening to said discharge opening along a substantially horizontal path generally U-shaped in plan.

2. The heat exchange apparatus defined in claim 1 in which the air intake and discharge openings are disposed in substantially contiguous relationship.

3. The heat exchange apparatus defined in claim 1, wherein the air deflecting means and the two panels are mounted on the cover means and are removable from the housing therewith.

4. The heat exchange apparatus defined in claim 1, wherein the blower means includes a blower duct having a discharge end discharging parallel to the cover means but spaced inwardly therefrom and having an air intake opening facing and generally aligned with the cover means intake opening for drawing air therethrough, and the air deflecting means includes a plurality of curved generally parallel vanes interposed between the blower duct discharge end and the discharge opening of the cover means.

5. Wall mounting heat exchange apparatus comprising a shallow housing of generally rectangular shape having an open front, cover means fitted to said open front and having air intake and discharge openings disposed in side-by-side substantially contiguous horizontal registry, a heat exchange panel in said housing immediately behind and covering one of said openings, blower means mounted inside said housing producing airflow therein, and air deflecting means in said housing cooperating with said blower means to move air from said intake opening to said discharge opening along a substantially horizontal path generally U-shaped in plan, wherein the heat exchange panel and the air deflecting means are mounted on the cover means and are removable from the housing therewith.

6. Wall mounted air circulating heat exchange apparatus for heating a room comprising a plurality of heat exchange units spaced about the room, each unit being received within the wall and each unit including air intake and discharge apertures opening into the room disposed in side-by-side substantially horizontal registry, heat transfer means, air directing means guiding air moving into the intake aperture directed horizontally away from the discharge aperture, and air directing means guiding air moving out of the discharge aperture directed horizontally away from the intake aperture, and the air directing means for the intake apertures of all heat exchange units facing in corresponding directions relative to the walls in which said units are mounted and the air directing means for the discharge apertures of all of said units facing oppositely in corresponding directions relative to the walls in which the respective units are mounted.

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