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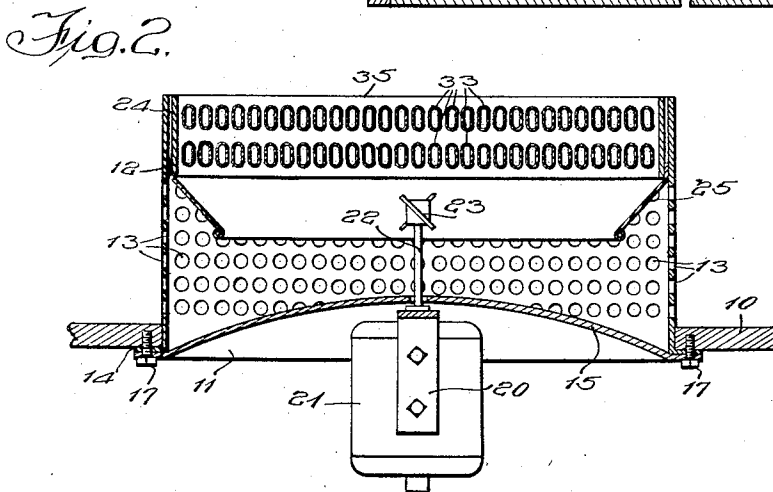
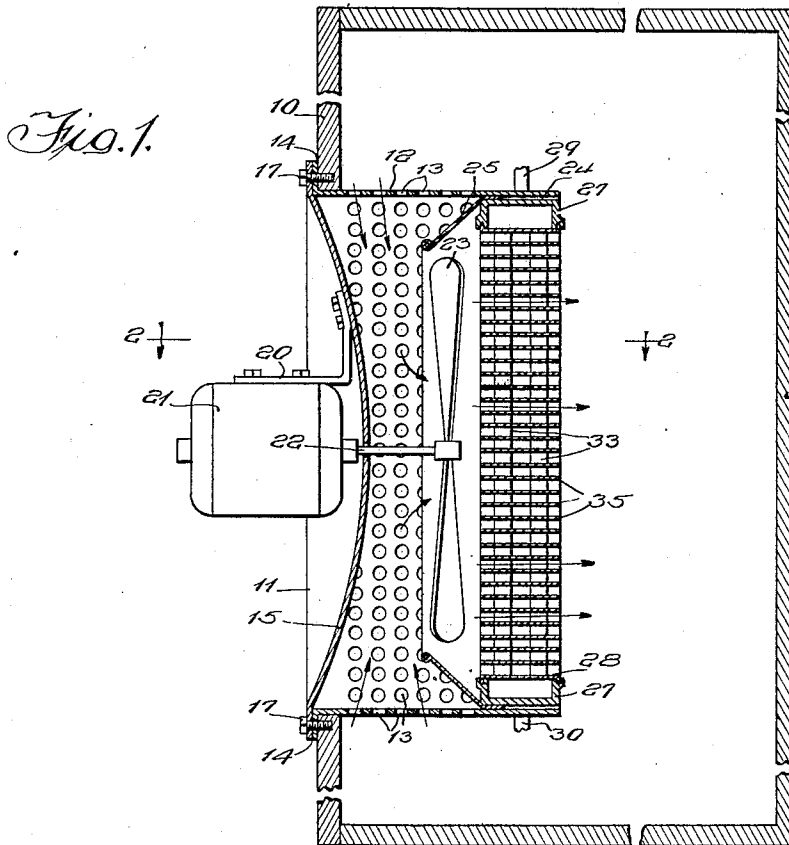
A. B. MODINE

1,884,094

HEAT EXCHANGE APPARATUS

Filed Nov. 5, 1928

3 Sheets-Sheet 1



Witness:

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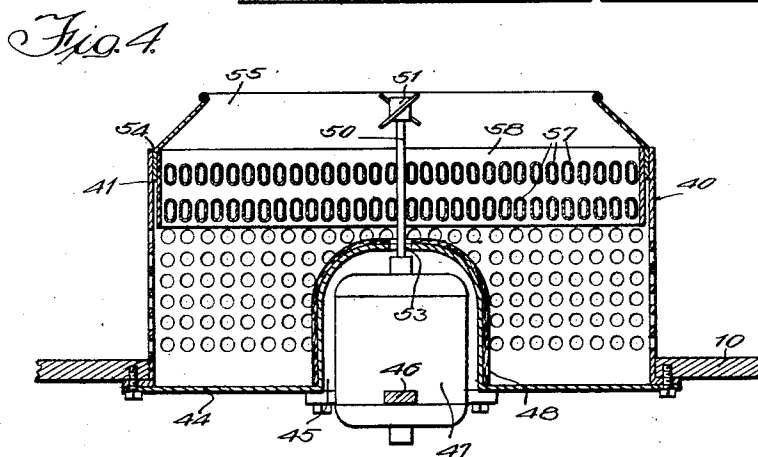
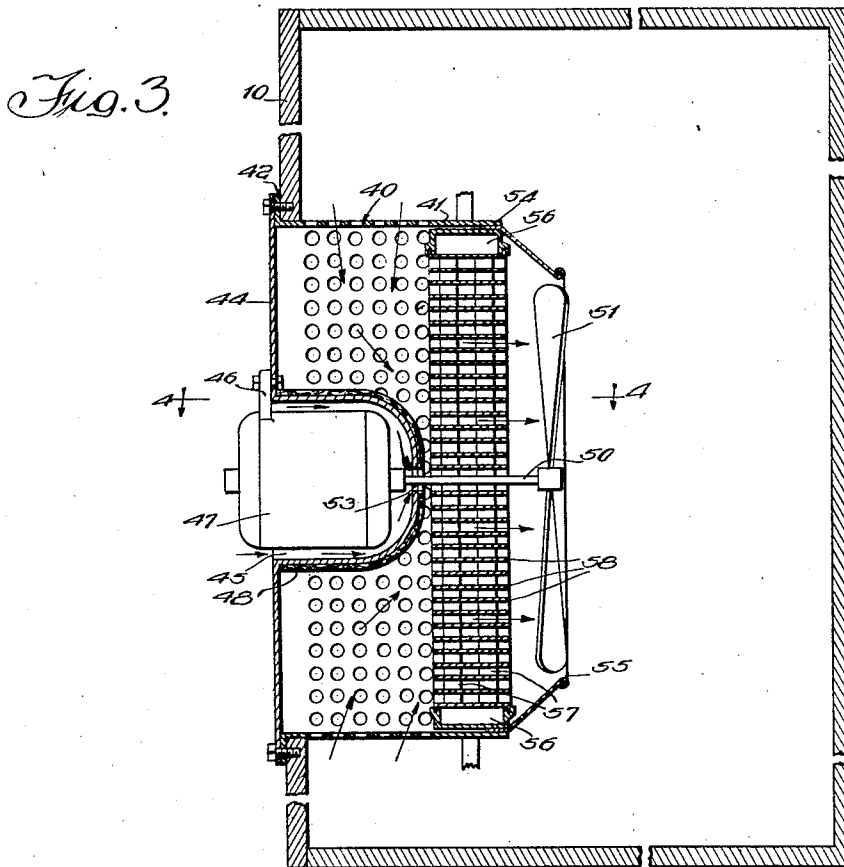
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Fig. 5.

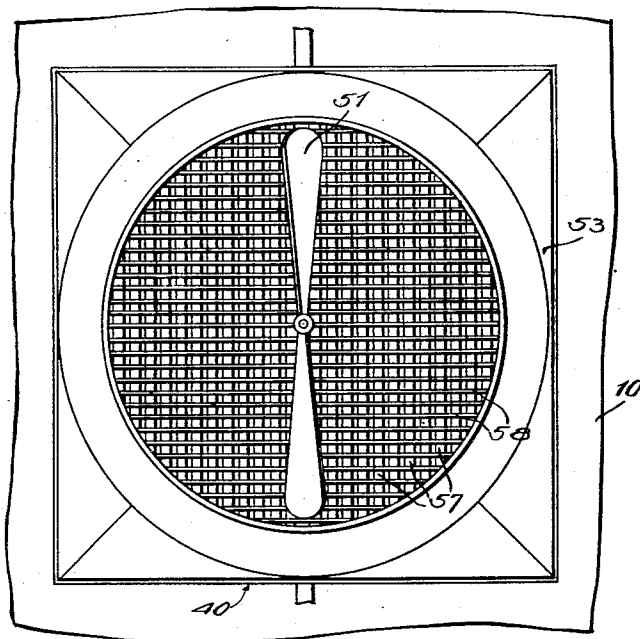
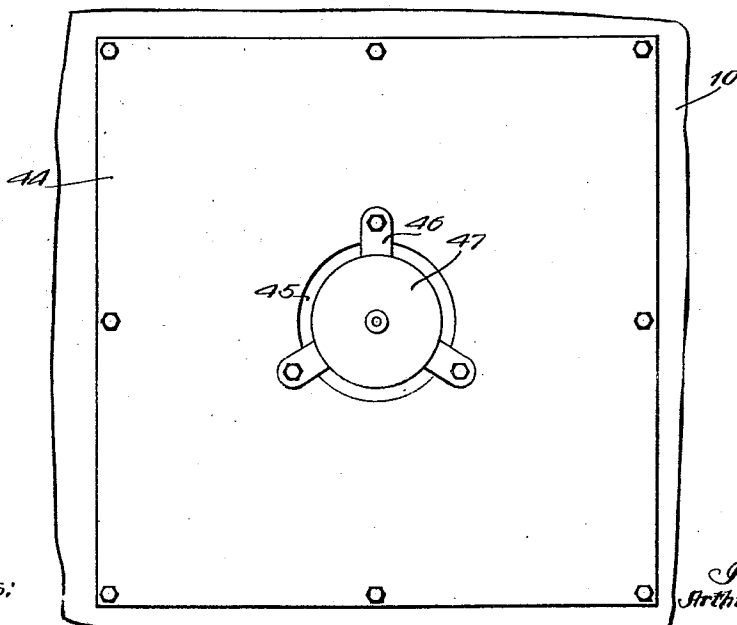


Fig. 6.



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UNITED STATES PATENT OFFICE

ARTHUR B. MODINE, OF RACINE, WISCONSIN, ASSIGNOR TO MODINE MANUFACTURING COMPANY, OF RACINE, WISCONSIN, A CORPORATION OF WISCONSIN

HEAT EXCHANGE APPARATUS

Application filed November 5, 1928. Serial No. 317,248.

My invention relates to heat exchange apparatus and has to do more particularly with such apparatus which is especially adapted to be associated with an enclosure in which heat is either imparted to or withdrawn from articles or material.

An object of my invention is to provide a device of the type described which will effect a circulation of the air within the enclosure in which the device is mounted, the air being continually either heated or cooled by the device, according to the use to which it is put, and then returned to articles or material being treated in the enclosure.

A further object of my invention is to provide such a device which is adapted to be mounted in a wall of an enclosure and so designed that the motive mechanism will be disposed outside of the enclosure, in order that it may not be affected by the temperature within the enclosure.

A still further object is to produce such a device which will be simple, convenient, efficient, compact, light in weight, comparatively inexpensive, and rugged.

Other objects and advantages, of the construction herein shown and described will be obvious to those skilled in the art from the disclosure herein given.

Referring now to the drawings forming a part of this specification which illustrate certain preferred embodiments of my invention:

Fig. 1 is a sectional view showing fragmentarily the walls of an enclosure in which is mounted a device embodying my invention;

Fig. 2 is a sectional view taken on the line 2-2 of Fig. 1;

Fig. 3 is a sectional view similar to that of Fig. 1 showing a modified form of my invention;

Fig. 4 is a sectional view taken on the line 4-4 of Fig. 3;

Fig. 5 is front elevation of the device of Figs. 3 and 4; and

Fig. 6 is a rear elevation of the device of Figs. 3, 4 and 5.

Referring first to the embodiment illustrated in Figs. 1 and 2, the numeral 10 represents an enclosure which might be either an oven for heating, drying or other purpose, or a refrigerating chamber. Disposed in an aperture of the wall 10 is a device embodying my invention represented generally at 11. The device comprises a casing having a side wall 12 which in the preferred embodiment is perforated as shown at 13. The perforated wall 12 is flanged over as indicated at 14 and joined to this flange is a plate 15 having a spherical curvature. This plate 15 is flanged and is secured to the wall by any suitable means such as bolts 17.

Attached to the outside of the casing by any suitable means such as a bracket 20 secured to the plate 15 by means of bolts or other suitable means is a motor 21, preferably of the electrical type. The shaft 22 of the motor passes through the plate 15 and carries at its end a fan 23. A plate 24 is secured to the inner front portion of the side wall 12 by any suitable means such as welding, soldering, or the like, and has an annular portion 25 integral therewith which presents an opening of substantially the same diameter as the fan and envelopes the same.

Secured within the plate 24 by welding, soldering, or other suitable means, is a pair of opposed headers comprising rectangular members 27, which may conveniently be castings closed by perforated plates 28, as shown clearly in Fig. 1. A pair of pipes 29 and 30 communicate with the respective headers and serve to transmit to and from the headers either a heating fluid or a refrigerant. A plurality of tubes 33 connect the headers by means of the apertures in the plates 28, and a plurality of plates 35 are mounted on the tubes 33 which serve to increase the effectiveness of the tubes as heat exchange elements. The tubes and plates are preferably formed of thin metal or other material which is a good heat conductor.

In operation, when the fan is rotating, air will be drawn in through the apertures 13 in the wall 12 and is forced out through the openings between the tubes 33 and the plates 35, as indicated by the arrows in Fig. 1. It will thus be seen that an effective circulation of the same air within the enclosure

is maintained. By means of this device, both the temperature and the humidity within the enclosure 10 may be maintained substantially constant. It will be readily apparent that because of the concave rear plate 15, the fan shaft 22 may be made comparatively short and thus the possibility of vibration considerably decreased.

In the device shown in Figs. 3 to 6, inclusive, a casing indicated generally at 40 is provided, having perforated side walls 41 substantially similar to the side wall 12 of the other embodiment. Attached to flanges 42 of the side walls is a rear wall 44 having a central concavity 45. Secured to the rear wall by means of a suitable bracket 46 is a motor 47 which is housed within the concavity 45. Suitable insulating material 48 covers the concave portion of the rear wall on the inside of the casing. The shaft 50 of the motor extends through the rear wall, the insulating material 48 and the radiator and carries a fan 51 at the end thereof. It will be seen that apertures 53 provided in the concave portion of the rear plate and in the insulating material 48 are slightly greater than the diameter of the fan shaft, for a purpose which will later become apparent. A plate 54 is secured by means of welding or soldering or other suitable means to the inside of the side wall 41 and is bent to form a circular frame 55 of substantially the same diameter as the fan 51. Headers 56 connected by tubes 57 on which are secured plates or vanes 58 are provided, these members being substantially similar to those disclosed in the other embodiment.

In operation, the device just described works substantially similarly to the other embodiment. When the fan is rotated by the motor, air is drawn into the casing 40 through the apertures of the side walls 41 and passes through the spaces surrounding the tubes 57 and the air in the enclosure is thus maintained in circulation. However, in this embodiment air is also drawn into the casing through the opening 53 around the fan shaft, being drawn into the concavity 45 around the motor. It will be seen that in this embodiment also the fan shaft is made substantially short as a result of the concavity in the rear plate which houses the motor. However, because of the space surrounding the motor, and because of the opening 53, air is continually circulated around the motor and it is thus kept at substantially the same temperature as that of the air outside of the enclosure. The insulation 48 also aids materially in preventing the motor from being materially heated or cooled, as the case might be, from the air within the enclosure. In both of the embodiments, of course, either a heating fluid or a refrigerant is circulated through the tubes by means of the pipes connecting with the headers, which

pipes connect a source of suitable heat exchange fluid to the device.

Having thus described my invention, it is obvious that various immaterial modifications may be made in the same without departing from the spirit of my invention; hence I do not wish to be understood as limiting myself to the exact form, construction, arrangement and combination of parts herein shown and described or uses mentioned.

What I claim as new and desire to secure by Letters Patent is:

1. In a device of the class described, an apertured casing said casing having means for mounting said casing axially of an opening provided in a wall, a heat exchange unit supported by said casing, and means carried by said casing for circulating air through said casing and in contact with said heat exchange unit, an element of which is isolated from air circulating through the casing.

2. In a device of the class described, a casing comprising continuous side walls having a plurality of apertures therein, a heat exchange unit forming a wall of said casing, a wall opposite said heat exchange unit, a motor supported upon one side of said last mentioned wall, and a fan carried by the shaft of said motor located upon the opposite side of the wall for forcing air through said heat exchange unit and expelling it from said casing.

3. In a device of the class described, a casing having a plurality of apertures therein, a heat exchange unit forming a wall of said casing, a wall opposite said heat exchange unit having a concavity therein, a motor supported by said last mentioned wall and disposed in said concavity, and a fan carried by the shaft of said motor for forcing air through said heat exchange unit and expelling it from said casing.

4. In a device of the class described, a casing having a plurality of apertures therein, a heat exchange unit forming a wall of said casing, a wall opposite said heat exchange unit having a concavity therein, a motor supported by said last-mentioned wall and having a shaft passing therethrough, said wall having an opening larger than said shaft, and a fan carried by said shaft for forcing air through the opening in said wall and through said apertures and past said heat exchange unit.

5. In a device of the class described, a casing, said casing having means provided at one end whereby said casing may be mounted in an opening provided in a wall with an end of said casing extended beyond said wall, said last mentioned end of said casing being apertured, a heat exchange unit located in said last mentioned end extending transversely of said casing, and air advancing means an element of which is located in said end of said casing.

6. In a device of the kind described, a casing, said casing having apertures and having means for supporting said casing transversely of a wall in an opening provided in said wall with the apertured portion located at one side of said wall, a heat exchange device arranged transversely of said apertured end of said casing, and an air advancing means located in said casing.

7. In a device of the kind described, a casing having apertures and means for supporting said casing transversely of a wall in an opening provided in said wall with the apertured portion arranged at one side of said wall, a member providing a closure for one end of said casing, a heat exchange device located adjacent the apertures in said casing, and air advancing means including a motor and fan, the motor being arranged on one side of said closure and the fan being arranged on the opposite side and adjacent the radiator and said apertures.

8. In a device of the kind described, a casing having apertures and means for supporting said casing transversely of a wall in an opening provided in said wall with the apertured portion arranged at one side of said wall, a member providing a closure for one end of said casing, a heat exchange device located at the apertures of said casing, air advancing means and means an element of which is located in the casing facilitating circulation of air through said casing arranged within said casing.

9. In a device of the kind described, a casing having apertures and means for supporting said casing transversely of a wall in an opening provided in said wall with the apertured portion arranged at one side of said wall, a member providing a closure for one end of said casing, a heat exchange device located at the opposite end of said casing, and air advancing means including a motor arranged within said casing, said motor being located at one side of said closure and exteriorly of said casing.

10. In a device of the kind described, a casing having apertures and means for supporting said casing transversely of a wall in an opening provided in said wall with the apertured portion arranged at one side of said wall, a member providing a closure for an end of said casing, a heat exchange device located at the opposite end of said casing, and air advancing means including a motor located within the casing, means located in said casing cooperating with the air advancing means facilitating circulation of air through said casing and said motor being located exteriorly of said casing.

In testimony whereof, I have hereunto signed my name.

ARTHUR B. MOBINE.