

May 30, 1933.

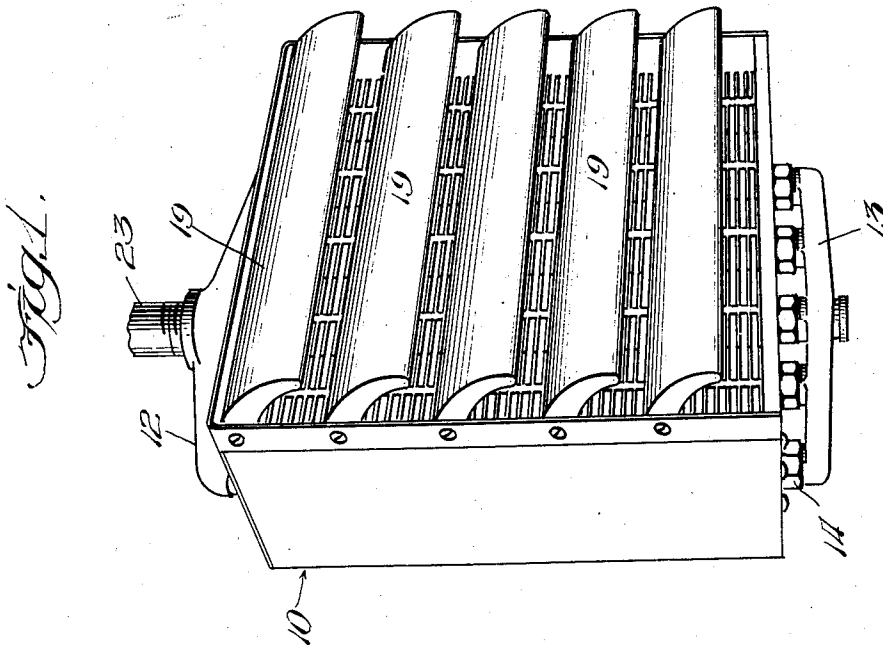
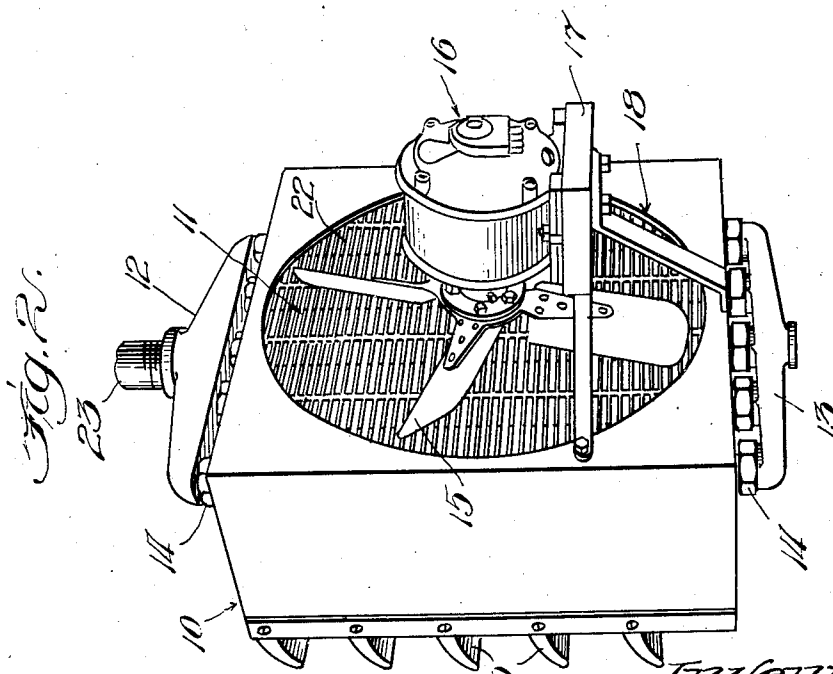
H. A. SOVERHILL

1,911,403

TEMPERATURE CONTROLLING DEVICE

Filed Nov. 21, 1927

2 Sheets-Sheet 1



Inventor:
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2 Sheets-Sheet 2

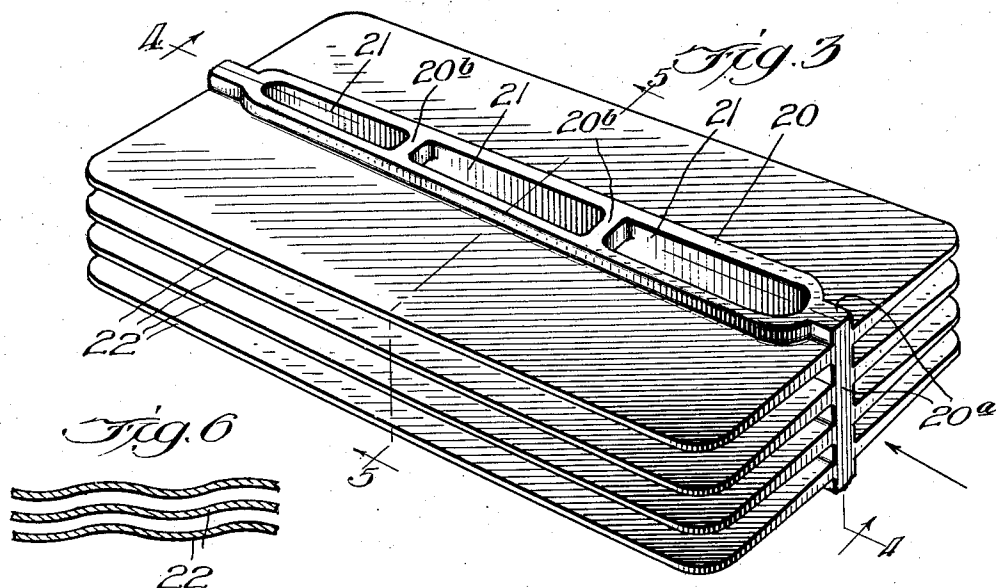


Fig. 6

Fig. 4

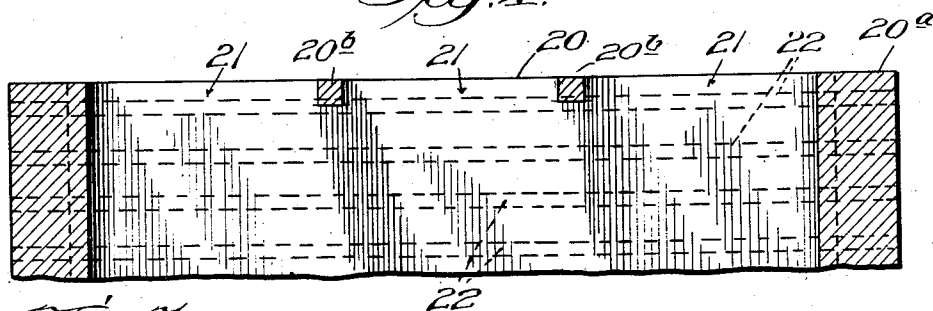


Fig. 7

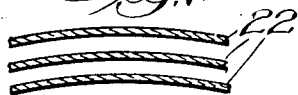


Fig. 5

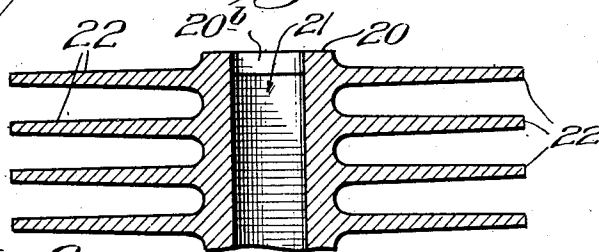


Fig. 8

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UNITED STATES PATENT OFFICE

HARVEY A. SOVERHILL, OF MOLINE, ILLINOIS, ASSIGNOR TO THERMAL UNITS COMPANY, OF CHICAGO, ILLINOIS, A CORPORATION OF ILLINOIS

TEMPERATURE CONTROLLING DEVICE

Application filed November 21, 1927. Serial No. 234,650.

My invention relates to temperature controlling devices for household, commercial, or other similar uses and has to do more especially with a novel form of heat-transfer unit.

One of the objects of my invention is to provide a heat-transfer unit which is simple in construction, easy to manufacture and which is adapted to give maximum efficiency consistently over long periods of time with a minimum of loss due to heat penetration and induction, all of which also cheapens the cost of operation to a highly appreciable extent.

Another object is to provide a heat-transfer unit which is cast as an integral piece at a single operation, such unit including a plurality of thin extended and slightly spaced heat conduction surfaces to which the air is subjected for heat transfer by convection. To this end, I employ in each transfer unit a suitable conduit having a plurality of thin, laterally projecting, parallel and closely located fins or air contact plates between and over which the air passes; and in making such integral casting I employ a ductile metal of high conductivity and thermal efficiency and which is capable of withstanding distortion without breakage and which is of such character as to flow readily and uniformly during the casting operation.

Additional objects are to provide a heat-transfer unit which is adapted not only to quick and ready cooling of the air but also to heating of the same with the same degree of efficiency; to provide an integral unit which will not be structurally affected by heat changes; to provide an exceptionally light weight unit which may not only be employed in connection with stationary installations but may be used in portable sets which, for example, may be moved from room to room in the home or from office to office to regulate the air condition as desired; to provide units which are also by the very nature of their construction very strong, durable, and capable of withstanding high pressures; and to provide for the flow of air, or fluid pressure, or whatever it may be

through and against such units in a uniform manner and at a uniform velocity to insure a full and uniform heat transfer effect.

Other objects and advantages will become apparent as this description progresses and by reference to the drawings wherein,—

Figure 1 is a perspective view showing the front of a temperature controlling device embodying my invention;

Figure 2 is a perspective view showing the rear of the device of Fig. 1;

Figure 3 is a plan perspective view of a section of one of the heat-transfer units employed in the structure of Fig. 1;

Figure 4 is a vertical section taken lengthwise of the structure of Fig. 3 substantially on the line 4—4 of that figure;

Figure 5 is a transverse vertical section taken substantially on the line 5—5 of Fig. 3;

Figures 6, 7 and 8 show different shapes which may be given the fins associated with the transfer unit.

My invention is readily adaptable to either a stationary structure which may be mounted in the wall of a room or building, or to a structure which may be mounted upon a portable support, or, in fact, to any other condition wherein similar problems are to be taken care of.

In the form shown in Figs. 1 to 5, inclusive, I employ a rectangularly-shaped frame or cabinet 10 adapted to enclose a plurality of heat-transfer units 11 which are carried by and connected one with the other at opposite ends by headers 12 and 13. These headers may be connected to the several units in any desired manner, but, preferably, by the universal couplings 14 (Figs. 1 and 2) which engage, in a manner well understood, suitable threaded extensions on the respective units 11.

To pass the air through the heat transfer units, I employ a fan or blower device 15 driven by an electric motor 16 carried by a braced support 17. This fan is located at the rear (Fig. 2) and the rear wall of the cabinet frame is provided with a suitable circular opening 18 through which the air passes from the fan. The front part of the

cabinet frame is provided with an adjustable shutter 19 which provides a directional control of the air stream. It will be understood that while I have shown the fan or blower arranged in close proximity to the transfer units, it is to be understood that such fan or blower may be located at a remote point and associated with the units 11 by means of a suitable conduit, or otherwise; and, if desired, the fan or other blower means may be driven by any desired motive means other than the electric motor 16—the main purpose being to provide some efficient means for causing the medium to be conditioned to pass to and through the heat-transfer units. In this respect, while I show and describe my invention as applied to the temperature conditioning of air, it will be readily understood that the medium to be treated may be any other fluid pressure or gas or may be a liquid, or similar substance, which may be conditioned for a purpose other than control of the air temperature.

In Figs. 3, 4 and 5 I show one form of heat-transfer unit which forms an important part of my invention. The several units used in any particular installation, for example, the arrangement shown in Fig. 1, are all preferably identical in construction and but one of them will be described. The unit comprises a central and relatively thick-walled tube 20 extending throughout its length. By reference to Fig. 3 it will be noted that this tube is flat-like, having much greater length than width and is provided with an oblong opening 21. The tube is wider at one end than the other to provide inwardly and forwardly (away from the fan as seen in Fig. 2) tapering side walls for a purpose which will be referred to more specifically hereinafter. A plurality of lateral bridge members 20^b are integrally carried by the tube to add strength and rigidity. A plurality of rectangularly shaped thin and flat fins 22 are cast integrally with and entirely around the tube 20 so that there is a heat-transfer portion on the opposite sides of the tube. These fins for the purpose of strength, have a cross-section tapering outwardly from the tube and are equally spaced in parallel relation. To aid in the heat-transfer effect (either plus or minus) to be described further, these fins are preferably located rather close together as indicated in Figs. 3, 4 and 5. The ends of the tube 20 are extended to provide a substantial thickness of the metal at such ends which serves as an integral strengthening and supporting part for the projecting ends of the fins.

The foregoing unit construction is, preferably, cast from an alloy including approximately silicon 13% and aluminum 87%. These percentages are given only by way of illustration and it will be understood that they may be varied and other elements added

as found desirable. Such an alloy is high in heat conductivity and thermal efficiency;—it is light weight and very durable;—it is subject to distortion without breakage; and it will readily flow in the formation of such a casting as shown in Fig. 3 including thin, laterally projecting and slightly spaced fins and a central tube portion. The integral arrangement of the fins and tube provides a very strong structure capable of withstanding maximum pressures. The fins with their edgewise relation to the tube strengthen the entire structure in a manner similar to strengthening bands surrounding the tube. The great number of equally spaced fins provide a considerable thermal area with which the air, or other medium, must pass in contact. The rearwardly tapered shape of the tube wall provides a laterally flaring space between the adjacent fins whereby the air which enters at the front (indicated by the arrow in Fig. 3) and tends to expand will be compensated in such a way that such expansion or other action will not affect materially the velocity of the air or medium therethrough with the result that such air is subjected to the full and complete time-contact with the fins to insure the proper thermal action. The vertical extension or rib 20^a at the rear end of the tube (adjacent the fan) not only strengthens the unit but also serves as an air directional means which tends to minimize frictional resistance in a manner which will be well understood.

The operation of the structure so far described is as follows: If the air, say in a room, is to be heated, steam, or hot water, or any other suitable heating agent, is passed from a source (not shown) through pipe 23 into the header 12 and thence through the several tubes 20 to the header 13 from which it is carried by a suitable conduit back to the source or some other desired point. As this action is taking place the fan 15 forces the air through the assembled units 11 between the fins 22 toward and past the shutter 19. The heating agent which is passed through the tubes 20 quickly heats such tubes, such heat being rapidly conducted to the extreme outer edges of the fins 22, and the continuous application of the heating agent maintains these parts in the desired heated condition. The fins 22 divide the unit into small compartments, each receiving a portion of the medium to be treated, and as the air (the medium in this instance) passes through these compartments between the fins, the heat from the fins and tube is transmitted thereto by convection, and by the time it is passed entirely therethrough it is heated to the desired extent. As above explained, the laterally flared passages between the fins provide, in effect, expansion compartments which maintain a uniform velocity flow of the air whereby the full benefit

of the heat will be obtained. Due to the fact that the tube and fins are all cast integrally, heat loss due to penetration and induction is greatly reduced over that occurring in connection with previously known devices (for example, devices wherein the tube and fins may be separate parts secured together as by soldering, or cement, or pressure contact or the like, and where, as will be readily appreciated, the heat loss must be great due to penetration and induction).

The structure shown in Figs. 1 and 2 may also be used for cooling the air in the room. In that event, any desired form of cooling or refrigerant agent is directed from a source, (not shown) to the header 13 through the tubes 20 to the header 12 and back to the source or some other desired point. In that case, the operation of the unit is identical with that above described with the exception that the result is a cooling, or heat minus effect, instead of a heating, or heat plus, effect. It will be readily appreciated that, if desired, the structure above described may be readily converted to the form of a transportable unit which may be wheeled or carried from room to room with suitable connections for plugging into electric wall sockets so that the device may be used to great advantage in regulating the room temperature under all conceivable conditions. Or, if desired, my form of heat transfer unit may take such form as to be used as an air cooling condenser section of a refrigerating system wherein the advantages to be gained, as above explained, will be readily appreciated.

In Figs. 6, 7 and 8 I show different forms which may be given the fins 22. As shown in Fig. 6, these fins may be waved or corrugated uniformly to provide an irregular passage through and between the fins to create a turbulence which causes a stirring action of the air so as to more thoroughly, evenly and quickly heat the entire volume of air throughout the entire space between the fins. For a similar purpose, the fins may be given the shape shown in Fig. 8, or they may be given the arcuate or curved form such as shown in Fig. 7. In fact, the fins may be given any desired shape without departing from the spirit and scope of my invention. The metal which I preferably employ in casting is of such character that the fins may be cast with straight sides as shown in Fig. 3 and thereafter formed to the irregular shapes of Figs. 6, 7 and 8; or they may be formed to the shapes of the latter figures during the casting operation.

My method of forming these units as an integral casting includes, in addition to the foregoing, the use of a sand mould which is formed in a well known manner to include suitable cavities and cores to give proper shape to the tube 20 and fins 22. This

mould is baked to harden before the casting to harden and prevent fracture during casting. The molten metal is fed into the mould, the metal being of a character to flow readily, and a complete unit, as shown in Figs. 3, 4 and 5 and of the desired size, is completely formed and ready for use without subsequent treatment other than cleaning of the cast surfaces and threading of joints.

While I have shown and described several forms of my invention, it will be understood that various other and further changes may be made in details and arrangement of parts without departing from the spirit and scope of my invention as defined by the claims which follow.

I claim:

1. A heat transfer unit for a device of the character described comprising a flattened tube having its opposite side walls converging from one end gradually inward, providing a similarly shaped tube passage and a plurality of separate laterally extending and parallel spaced thin plates cast integrally with and around said tube throughout its length, said plates forming with each other and said tube lateral, gradually flaring passages exteriorly of said tube through which the medium to be treated is passed, and which causes the air passing through said passages to flow at a uniform rate at all times regardless of expansion, and other effects, due to heating.

2. A thermal unit for a device of the character described which comprises an oblong tube having its exterior side walls tapering inwardly from one end, laterally projecting heat transfer fins each independent of the other and extending on all sides of said tube, the fins on opposite sides tapering in section from the tube to the outer edges of the fins, all being formed of one integral piece.

3. A heat transfer unit for a device of the character described comprising a tube having its outer side wall surfaces tapered inwardly from one end for receiving a temperature controlling agent, and means associated with said tube for forming at opposite sides thereof a plurality of open-ended compartments, each said compartment being gradually flared laterally from its inlet end to the other end.

4. In a device of the character described, the combination of a frame, an air blower device associated with said frame, means for driving said blower, means for varying the temperature of the air delivered by said blower, including passages through which the air is directed and which are shaped to compensate for air expansion to insure a substantially uniform velocity of the air, and deflecting means for directing the air which has passed through said passages.

5. In a device of the character described, the combination of means for feeding the temperature controlling medium to be treated, compartmental means through which
5 said medium is passed, said latter means having a tubular part formed by the walls of said compartmental means for receiving a heating agent, said compartmental means being arranged to compensate for expansion
10 of the temperature-controlling medium and to carry said medium therethrough at a substantially uniform velocity regardless of expansion or other similar velocity changing conditions.

15 6. In a device of the character described, the combination of a plurality of separate and independent heat-transfer units, each said unit comprising a single integral cast piece including a central hollow part serving
20 as a conduit, and thin-walled and parallel-spaced wings extending around said hollow part at equal intervals along the same; a support for said units; and means at each end of all said units for connecting said hollow parts of the several units to a common
25 source and to each other.

7. In a heat-transfer unit for a device of the character described, a vertical hollow oblong member forming a single taper-walled chamber; thin full-section plates extending around said member and projecting
30 outwardly and horizontally therefrom, said plates being located in slightly spaced and parallel relation through the length of said member and forming with said member
35 open-ended compartments flaring from one end to the other; and ribs at the opposite ends of said member serving to support and strengthen, in part, said plates and to aid
40 in directing air through between said plates on opposite sides of said member; said member, plates and ribs being cast as an integral piece.

In testimony whereof, I have subscribed
45 my name.

HARVEY A. SOVERHILL.

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