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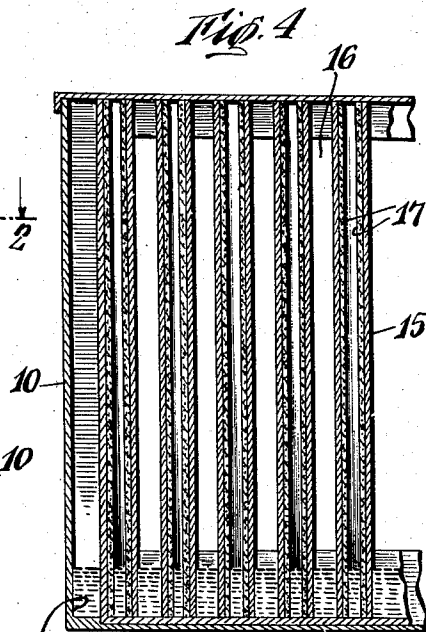
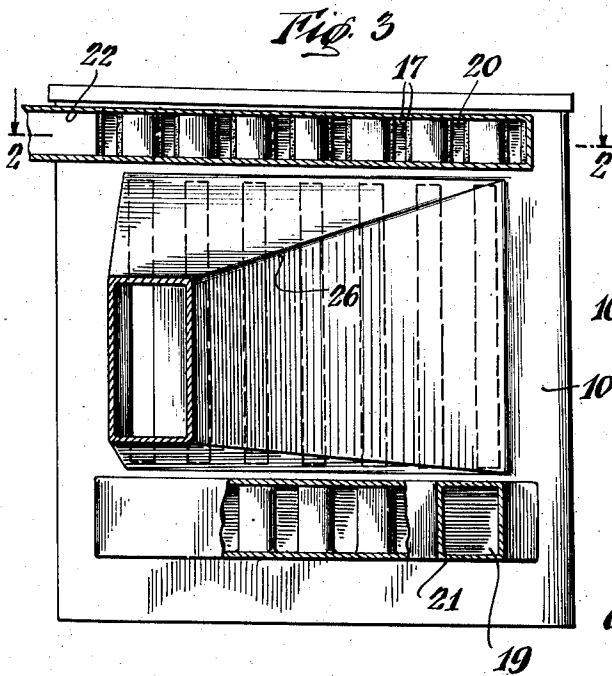
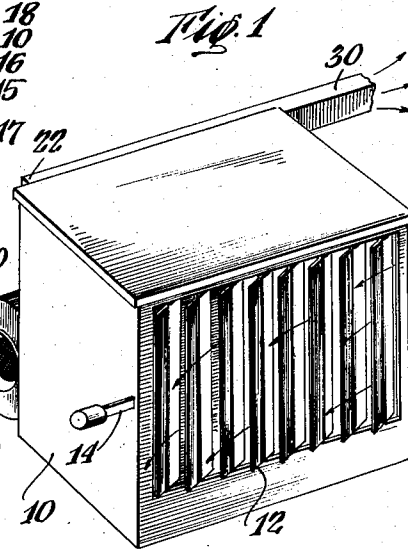
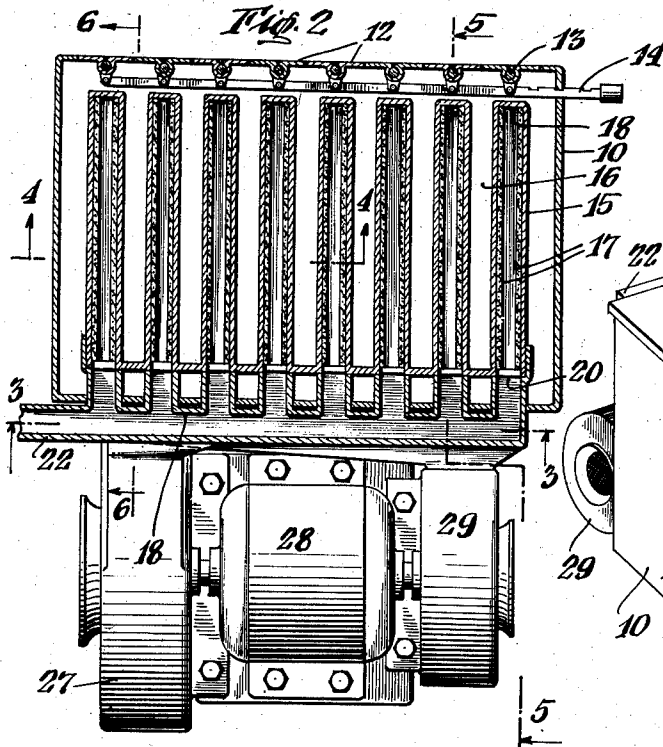
C. E. MEYERHOEFER

2,218,407

AIR CONDITIONER

Filed Aug. 25, 1937

2 Sheets-Sheet 1



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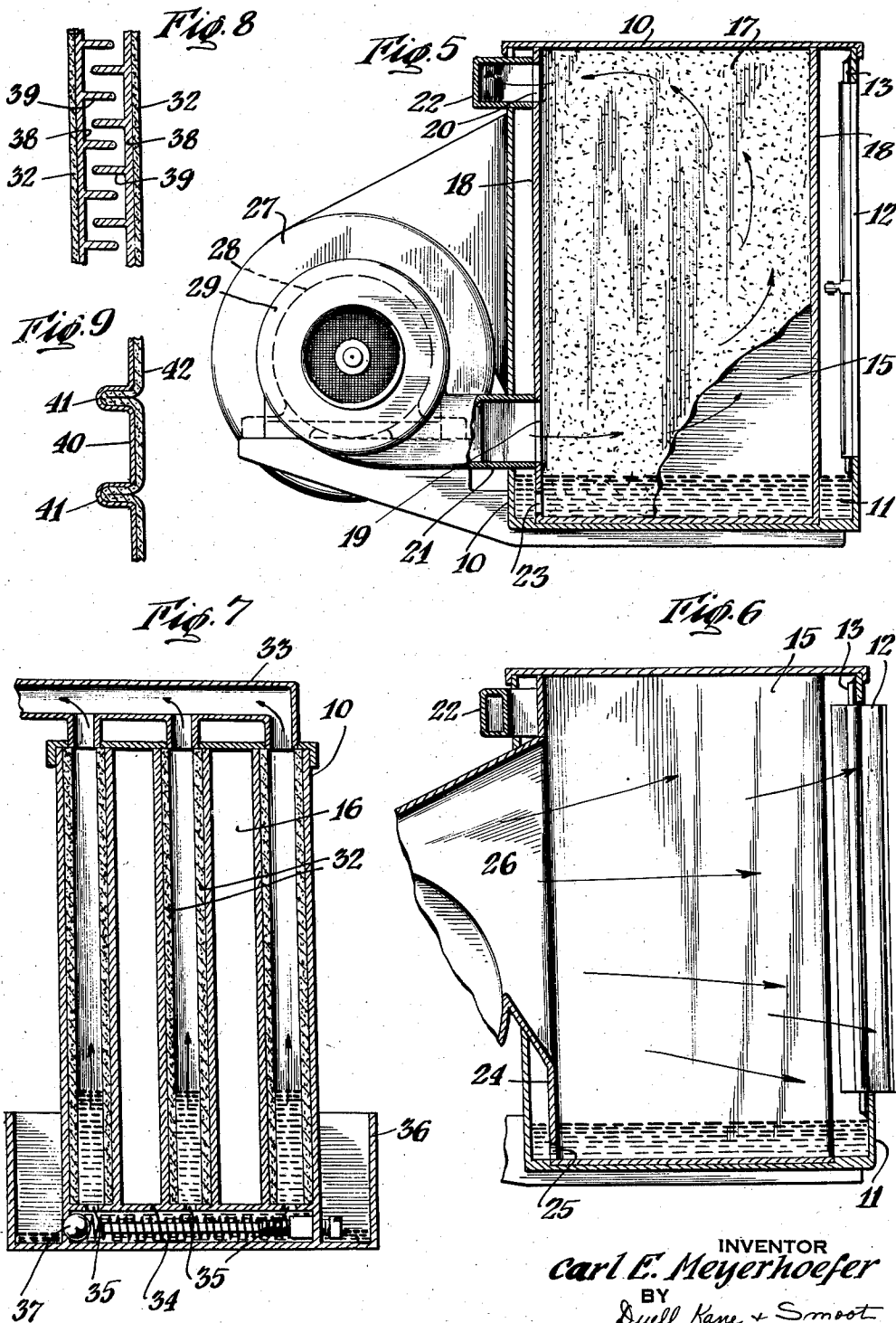
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UNITED STATES PATENT OFFICE

2,218,407

AIR CONDITIONER

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Application August 25, 1937, Serial No. 160,800

3 Claims. (Cl. 62—139)

This invention relates to a structurally and functionally improved heat exchange apparatus, and in its more specific aspects, aims to furnish a unit of this character which will be of primary utility when employed for cooling and conditioning or de-humidifying air.

It is an object of the invention to provide a structure of this nature which may be employed in association with any desired space—such as, for example, the interior of a motor vehicle—and by means of which the dry bulb temperature of the air and its moisture content, may both be lowered in an extremely satisfactory manner.

A further object of the invention is that of furnishing a conditioning apparatus which will be of an extremely compact nature so that it will occupy but minimum space. However, by means of the present unit, a maximum volume of air may be treated.

An additional object is that of furnishing an air conditioner which will operate with extreme economy, not alone with respect to the cooling fluid employed, but also with respect to the electric, or other power, which may be utilized to operate the apparatus.

Among other objects is that of furnishing a unit which may be constructed largely by automatic machinery and methods, it being feasible to employ relatively unskilled labor to achieve such assembly and adjustment operations as may not be susceptible of accomplishment by machine methods.

Moreover, the unit will include relatively few parts, each individually simple and rigid in construction, such parts operating over long periods of time with freedom from difficulties.

With these and other objects in mind, reference is had to the attached sheets of drawings illustrating practical embodiments of the invention, and in which:

Fig. 1 is a perspective view of a complete unit;
Fig. 2 is a sectional plan view thereof taken along the lines 2—2 and in the direction of the arrows as indicated in Fig. 3;

Figs. 3, 4, 5, and 6 are sectional views taken respectively along the lines 3—3, 4—4, 5—5 and 6—6 as indicated in Fig. 2, and in the directions also indicated by arrows in that figure;

Fig. 7 is a sectional fragmentary view showing a slightly different form of construction from that illustrated in the preceding figures; and

Figs. 8 and 9 are fragmentary sectional views showing details of construction which may be resorted to.

It will be understood that in the foregoing

illustrations, somewhat diagrammatic representations have been resorted to. In active commercial practice, the contours may be altered and various designs may be included, consistent with commercially accepted practice.

Thus, referring especially to Figures 1 and 5, the numeral 10 indicates a casing, the lower end of which defines a tray portion 11. This casing embraces—as shown—top and side walls, and the front or outer wall of the same may be provided by a plurality of panels or deflector members 12. These may be pivotally mounted as at 13, and be actuated by a control rod 14 to have, for example, simultaneous movement.

Of course, if in actual practice it proves desirable to dispense with the panels, or their equivalents, the outer face of the casing might be formed with an uninterrupted opening of any desired configuration. Likewise, it is apparent that if no general discharge direct to the atmosphere were desired, any convenient construction might be employed to provide a passage, or passages, confining the path of air discharged from this portion of the casing.

In any event, it is intended to furnish within the casing any desirable number of units, each preferably of similar construction, and including a pair of metal plates 15 having high heat conductivity and spaced from each other. Each of these pairs is also spaced from adjacent pairs so as to provide passages 16 for the flow of air—as hereinafter brought out. In intimate contact with the inner faces of these plates are layers of material 17. This material may be cloth, blotting paper, wicking substance, or any other suitable, absorbent layer, or layers, capable of exerting a capillary action. These layers extend preferably throughout the entire inner faces of plates 15, and the end edges of these plates are closed as indicated at 18.

Referring now primarily to Fig. 5, it will be observed that the end walls 18 may be provided with openings 19 and 20. Each of these groups of openings may be connected to manifolds 21 and 22 respectively, and in this manner it is obvious that air may be drawn, or blown, through openings 19 and be ejected, or sucked through openings 20. Under such conditions the air will, of course, flow or move over the absorbent layers 17.

Additionally, walls 18 may be formed with openings 23 within the area defined by tray portion 11. Consequently any fluid within the tray may flow into the spaces between the inner faces of the pairs of plates, and thus into contact with

the absorbent material 17. At the same time, it will be noted that the position of openings 23 is preferably such that, under normal circumstances, a water trap will be provided at this point such that air will not flow through these openings.

Referring especially to Fig. 6, it will, moreover, be observed that the spaces between the outer faces of adjacent plates may be closed as indicated at 24. Adjacent their base portions, the plates may be furnished with openings 25. It follows that any moisture upon these faces of the plates may flow downwardly and into the tray portion 11. This is especially true with respect to the outer edges of the plates which, as shown, are unobstructed. Thus a condition is presented in which moisture, deposited upon the exterior faces of the plates, flows downwardly and into the tray, such moisture flowing thence through openings 23 into contact with the material layer 17.

A further manifold 26 may connect with the forward or inner edges of the plates, and more especially those spaces defined between the outer faces thereof. This manifold might, of course, be dispensed with under certain conditions, but where—as shown—a blower 27 is employed to distribute air therethrough and, in turn, between the outer faces of the plates, it is preferred to utilize such a structure.

As is especially shown in Fig. 2, this blower may be actuated by a motor 28, which may also actuate a blower 29. The latter may be coupled to manifold 21 and, as illustrated in Fig. 1, manifold 22 may be continued in the form of an exhaust conduit 30.

Thus it is apparent that blower 29 will cause a flow of air between and over the absorbent surfaces 17. If, as illustrated, openings 20 are relatively small in comparison with openings 19, a plenum effect will be created which will be extremely desirable. In passing over these surfaces, the air will absorb moisture, and it is thus apparent that the dry bulb temperature will be reduced. Such reduction in temperature will be transmitted to plates 15 and air discharged through manifold 26 will, in moving in contact with plates 15, have its dry bulb temperature reduced. Such latter air—if relatively moist—will, of course, deposit condensate upon the faces of the plates, and, as afore brought out, this moisture will flow downwardly and collect within the tray space 11.

Consequently, while it may sometimes be necessary to fill tray 11 with water, ordinarily the supply will be maintained incident to the constant depositing of condensate. Air flowing through conduit 30 may, of course, be discharged to the outer atmosphere or—if additional humidity or moisture content is desired—it may simply discharge into the space which is to be cooled. It will be apparent to those skilled in the art that instead of utilizing separate blowers 27 and 29, one blower might be employed connecting to both manifolds 21 and 26. Also, in both instances, suction might be utilized instead of resorting to blowers. These obvious alternatives have not been illustrated because they are perfectly apparent. It is to be noted in passing, however, that in practically every conceivable instance, the air flow over the moisture absorbing layers 17, may be relatively minute compared to the air flow between the outer faces of the plates.

A construction ideally suited for use when suction is relied upon to induce the air flow between

the absorbing surfaces, has been illustrated in Fig. 7. In this view, the numeral 31 indicates metallic plates which are lined, or faced, with sheets of absorbing material 32. The spaces intervening these absorbent layers, may be coupled to an exhaust manifold 33. The latter is coupled to a suitable source of suction. The plate 34, which is preferably provided to define the base portions of these spaces, is apertured, as at 35, in line with such spaces. Accordingly, water may flow through these openings and into contact with material layers 32. A tray 36 preferably encloses the base portion of the unit and a check valve 37 normally prevents a flow of fluid from the afore mentioned spaces into the tray. It will be appreciated that only a relatively minute flow of air is necessary at this point. As shown, an adjusting screw may be provided so that the apparatus may be adjusted with nicety in the instance of any given installation. Such adjustment will, of course, contemplate preventing the check valve from unseating to too great an extent.

Similar to the construction illustrated in Fig. 6, any suitable mechanism is employed to induce an air flow through the spaces defined between the outer faces of plates 31.

It is thus apparent that with this form of construction the tray 36 is filled with water. A suitable degree of vacuum within manifold 33 will cause water to be drawn from the tray into the space between surfaces 32, and, finally, air will be drawn past check valve 37 and through apertures 35. This air will, of course, move upwardly through the columns of water defined between the absorbent surfaces, and will be drawn through manifold 33, and suitably discharged. Obviously, the pressure within the evaporating chambers will be below atmospheric, due to the suction exerted. Consequently the water will evaporate at a very low temperature, for example thirty-five to forty degrees F., depending upon degree of vacuum. The air drawn in of course speeds up evaporation. As a result, materially lower temperatures can be reached with an apparatus such as is shown in Fig. 7, than is usually practicable with a construction of the type shown for example in Figs. 1 to 6 inclusive. This is because wet bulb temperature is not depended upon, whereas when air is blown through the evaporating chambers the lowest temperature which may theoretically be reached is one equal to the wet bulb temperature of the air.

Thus, in the form of construction shown in Fig. 7, this action will cause the surfaces of plates 31 to be cooled. Consequently, air flowing between these surfaces will have its dry bulb temperature reduced. Condensate, resulting from such reduction in temperature, will flow downwardly over the faces of plates 31 and into tray portion 36.

In all, or any, of the foregoing constructions, it will be appreciated that, as shown in Fig. 8, the plates 38 may be formed with fins or ribs 39. The ribs in adjacent plates may be disposed in staggered relationship. As a consequence, a tortuous passage is provided which will assure a maximum travel of air in contact with the plate faces. Thus a maximum heat transfer will be effected.

Finally, as in Fig. 9, it will be observed that the plates 40 may be bent so that ribs or fins 41, corresponding to the elements 39, may be conveniently and economically provided. In such a construction, it is apparent that the absorb-

ing material 42 may be confined within these bent portions so as to be anchored in place. As is obvious, this construction results in great economy of manufacture, aside from the fact that danger of relative movements occurring between the absorbent linings and the plates, will be virtually precluded.

Thus, among others, the several objects of the invention as specifically afore noted are achieved. Obviously, numerous changes in construction and rearrangement of the parts might be resorted to within departing from the spirit of the invention as defined by the claims.

Having described my invention, what I claim as new and desire to secure by Letters Patent is:

1. As an article of manufacture, an air conditioner unit including a metallic plate, a layer of moisture absorbing material in intimate contact with one of the faces of said plate, and said plate being bent to provide a heat absorbing fin extending from its opposite face, said absorbing material extending into the space defined by said fin and being secured against displacement by being clamped between the adjacent inner fin faces of said plate.

2. An apparatus of the character described including a heat exchange structure presenting

passages through which air may flow, means for impelling air through said passages and in heat exchange contact with said structure, the side walls defining said passages being hollow, and being adapted to receive a liquid to cool said passages, means for exerting a suction within the spaces defined within the walls and upon the liquid disposed therein, means for admitting air through said spaces and the bodies of liquid and an absorbent material associated with the inner face of said hollow walls.

3. An apparatus of the character described including a plurality of units each comprising pairs of spaced metallic side walls, layers of absorbing material applied to the inner faces of said side walls, a tray into which said units extend and in communication with the outer and inner faces of said units, means for moving air, which is to absorb moisture, through a predetermined path and over the surfaces of said absorbent material, means for confining the air to such path, a manifold connected to said last named means to receive the moisture laden air, and means for moving air along a different path and in direct contact with the exposed outer faces of said walls.

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