

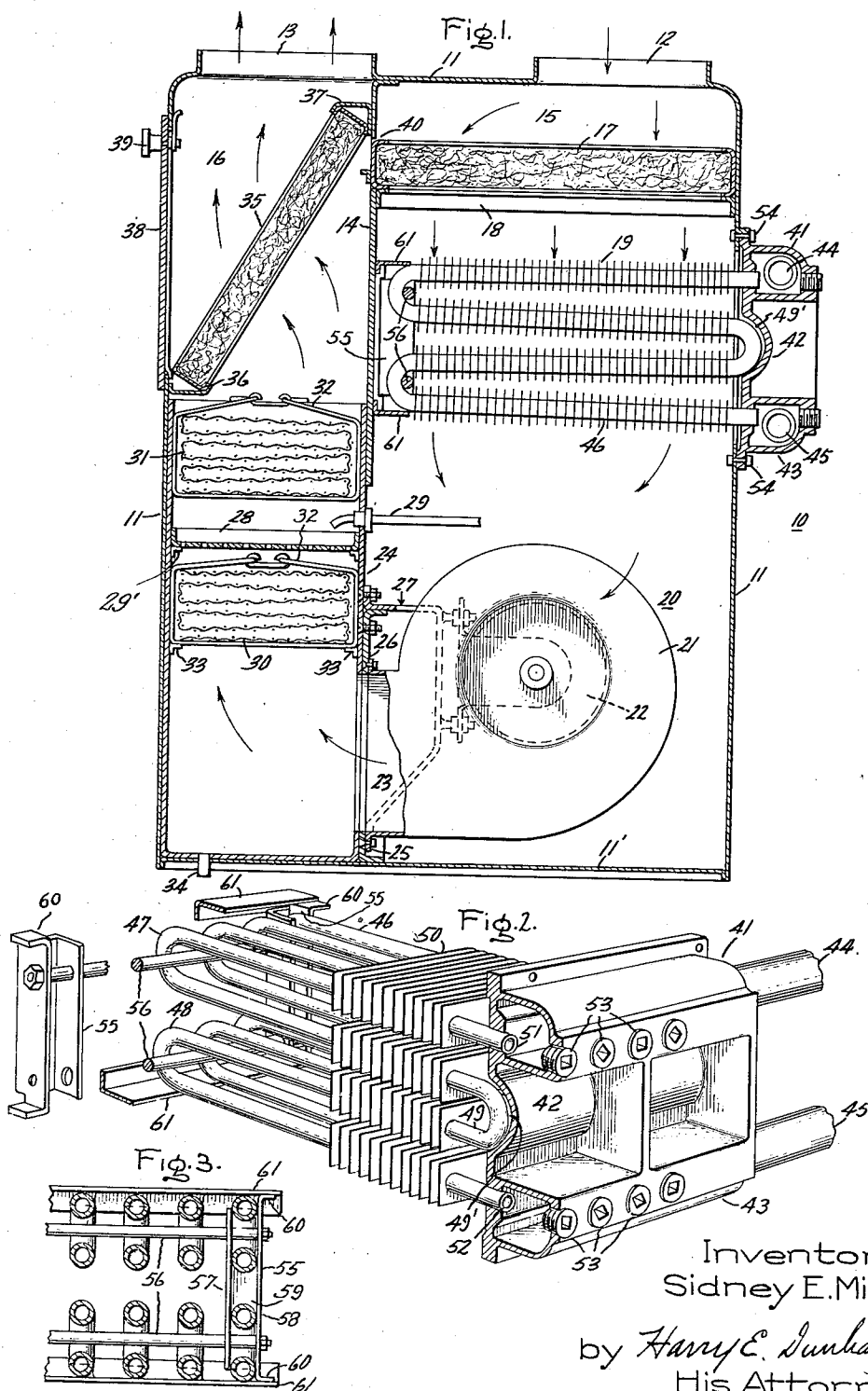
March 1, 1938.

S. E. MILLER

2,110,024

HEAT EXCHANGE UNIT

Filed Aug. 29, 1936



Inventor:
Sidney E. Miller,
by *Harry E. Dunham*
His Attorney.

UNITED STATES PATENT OFFICE

2,110,024

HEAT EXCHANGE UNIT

Sidney E. Miller, Bloomfield, N. J., assignor to
General Electric Company, a corporation of
New York

Application August 29, 1936, Serial No. 98,538

6 Claims. (Cl. 257—255)

My invention relates to heat exchangers and more particularly to exchangers adapted to be demountably supported in unit air conditioners.

A primary object of my invention is to provide a new and improved heat exchanger unit that is simple as well as substantial in construction and economical to manufacture.

Another object of my invention is to provide an improved heat exchanger constructed as an integral unit and which may be readily assembled in and removed from a conditioner of the type mentioned.

A more specific object of my invention is to provide an improved heat exchanger unit utilizing a plurality of finned tubes each constructed to form a series of U-shaped convolutions for exchanging heat between the heat exchange medium flowing therethrough and air flowing through the conditioner in which the ends of the tubes are attached to a unitary multi-header structure formed with a curved recessed portion between the headers for supporting the intermediate header and loops of the tubes.

In unit air conditioners it is desirable to obtain a maximum amount of heat transfer in a given space in order to reduce the weight and size of the unit. Space efficiency, as the heat transfer per unit volume might be expressed, has been increased not only by using finned tubing but also by restricting the air flow to the finned portion of the heat exchanger through the use of baffles and the like. A further saving in space and weight may be obtained by constructing the inlet and outlet headers through which the heat exchange medium flows to the finned tubes as an integral unit and forming a curved recess portion between and coextensive in length with the headers for supporting the header end turns of the tubes. A unit so constructed may be readily assembled at the factory and may be equally readily removed from the conditioner after installation for repairs and the like.

These and other objects of my invention will become apparent from the ensuing description taken in conjunction with the accompanying drawing in which is set forth for the purpose of illustration the details of the arrangement.

In the accompanying drawing, Fig. 1 is an elevation, partially in cross section, of a unit conditioner showing a heat exchanger unit constructed in accordance with my invention assembled therein;

Fig. 2 is a detailed perspective view, also partially in section, of the heat exchanger unit; and

Fig. 3 is a detailed view of the runner assembly supporting the return ends of the tubes.

Referring to Fig. 1, reference numeral 10 indicates an air conditioner comprising an outer unitary wall and top structure 11 forming with bottom 11' an enclosed structure. Air is supplied to the conditioner through an air inlet 12 at the top of the cabinet and led to an enclosure or the like to be supplied with conditioned air through an adjacent discharge outlet 13. The air supplied to the conditioner may be either fresh air from outdoors, recirculated air from the enclosure, or various proportions of each as determined by dampers (not shown) controlled manually or in response to temperature variations in a manner well known to those skilled in the art.

The interior of the cabinet is divided by a downwardly extending partition 14 into an air inlet passage 15 and an air outlet passage 16. The air supplied to the conditioner is first cleaned by an air filter 17, of any well known construction, slidably supported in the air inlet passage 15 by a flange 18 secured to the side walls 11. After passing through the filter, the air is heated by the novel heat exchanger unit 19, constructed in a manner to be described in greater detail hereinafter, positioned immediately below the filter.

Air is circulated through the conditioner unit and the duct system (not shown) associated therewith by an air circulating means 20, positioned near the bottom of the inlet passage. The air circulating means consists of a blower 21 driven by an electric motor 22. The blower casing is provided with a discharge passage 23, through which the air is discharged into a unitary humidifier structure 24. The blower casing is supported by the humidifier structure 24 by means of a flange 25 formed on the discharge passage and a surrounding flanged member 26 attached by bolts to the humidifier. The humidifier also mounts the blower motor 22 by means of a bracket 27 secured thereto.

The humidifier about to be described is more fully described and claimed in my contemporaneously filed application Serial No. 98,539 also assigned to the assignee of the present application. The humidifier consists of the previously mentioned unitary container 24 within which is positioned a pan-shaped perforated spray plate 28 removably supported on flanges 29' suitably secured to the container.

Water, which may be heated, is supplied to the humidifier, preferably in response to variations

in humidity within the enclosure supplied with conditioned air, through a conduit 29 extending through one of the side walls of the container 24. Associated with the spray plate are a pair of wire mesh screen stacks 30 and 31, each held in shape by the wires 32 (only one of which is shown) extending therearound. The lower screen stack is supported on flanges 33 suitably secured to the side walls of the humidifier and the upper stack is suspended from the top of the humidifier by outwardly projecting ends of the tie wires. Spent water is discharged from the humidifier through a drain opening 34 at the bottom thereof.

As described more fully in my contemporaneously filed application, the air velocity and perforations in the spray plate 28 are so chosen that the air maintains the water level on the plate at a predetermined height. The air passes through the water, breaking the water into small particles that are carried onto and suspended on the upper screen stack. The screen is made of wire having a mesh of substantially .25 inch so that globules of water may be formed at substantially uniformly spaced points within the space occupied by the stack in accordance with the principles outlined in the application of C. C. Bailey, Serial No. 733,087, filed June 29, 1934, which matured on Sept. 7, 1937 into Pat. No. 2,092,630, and also assigned to the assignee of the present application. When the water level rises above a predetermined height, water is discharged through random perforations upon the lower screen stack and there again suspended. As pointed out in my contemporaneously filed application, my improved humidifier is very efficient in operation because of the local circulation of the water between the plate and upper screen stack as well as the suspension of the water globules both above and below the spray plate. Humidification is increased by utilizing as far as possible the large evaporative surface furnished by globules suspended on the screens and the resulting transfer of heat from water to air as latent heat and the intimate contact between air and water at the spray plate and the resulting transfer of heat from air to water as sensible heat.

The humidified air is cleaned a second time by an air filter 35 similar in all respects to filter 17 in the inlet passage. Filter 35 is removably supported by supports 36 and 37 attached to the wall 11 of the cabinet and the downwardly extending partition 14, respectively. The front wall of the cabinet 11 opposite the filter 35 is provided with a removable portion 38 which may be removed from the front thereof by operation of a latching means 39. Filter 17 also may be removed similarly through the opening and a second opening 40, in partition 14.

In describing the details of the novel heat exchanger unit 19 forming my invention reference will be made in particular to Fig. 2. The unit comprises a pair of longitudinally extending headers 41 and 43 constructed as an integral unit with an intermediate curved recessed portion 42. Header 41 constitutes an inlet header to which a suitable heat exchange medium, such as water, steam or the like is supplied from a temperature changing means (not shown) through a conduit 44. Header 43 constitutes a discharge header connected by conduit 45 to the temperature changing means.

Attached to the headers are a plurality of convoluted tubes 46, each having a number of loops or bends. Three of these are illustrated and they consist of return bends or loops 47

and 48 and a single header and loop 49. The invention is however, adapted for use with tubes having a greater number of convolutions in which case the intermediate portion between the headers would be formed with a number of recessed portions 42 equaling the number of header end loops. The convoluted tubes are illustrated as constructed by bending but may be constructed equally well of straight finned portions with bends suitably secured thereto. The tubes are provided with a plurality of fins 50 in suitable heat conducting relation with the tubes. The ends 51 and 52 of the tubes are attached to the headers by any suitable means, as by expanding, which process may be carried out through the removable screw plugs 53 provided on each header.

The intermediate recessed portion 42 between the headers is made with a predetermined radius of curvature that corresponds substantially with the radius of curvature of the header end loops so that the latter fit within the recessed portion and are supported thereby. The recessed portion 42 is illustrated slightly larger than the bend 49 leaving a small space 49' therebetween. The purpose of this arrangement is to provide for the expansion of the tubes 46 when heated medium is supplied to them. The size of the space may, of course, be varied to suit varying materials and temperature conditions to which the unit is subjected.

The recessed portion 42 is illustrated as extending longitudinally substantially the entire width of the headers. This is necessary when the tubes 46 also are placed across substantially the width of the headers. In some instances, the tubes may extend only across a portion of the headers' width and in these cases the recessed portion only need be coextensive in length with the extent of the tubes. When the tubes are arranged across only an intermediate portion of the header width suitable baffles (not shown) may be arranged at either side thereof to restrict the air flow to the section provided with tubes.

The exchange unit is removably mounted within the conditioner by means of bolts or the like 54 securing the header part of the unit to the cabinet while the return end loops are suitably supported by a runner assembly consisting of a pair of flanged U-shaped channel members 55 (only one of which is shown) which support the bolts 56 engaging with the tube bends 47 and 48 to provide support therefor as more clearly shown in Figs. 2 and 3. The U-shaped channel member 55 is adapted to be fitted over the return bends on the two outermost tubes as illustrated more clearly in Fig. 3, where the legs 57 and 58 of member 55 are shown fitted over the bend so that the bottom of the U 59 is in contact with the end of the bend and the bolts 56 extend between the tubes. The leg portion 58 is also bent as indicated at its end 60 so that the return bends will be supported in between a pair of angle irons 61 fastened to the downwardly extending partition 14 within the cabinet.

In operation, the air flows through the conditioner as indicated by the arrows, entering the conditioner through inlet passage 12 and flowing past filter 17 to the heat exchanger unit 19 where it may be suitably heated or cooled. With the heat exchanger unit constructed in accordance with my invention, it will be seen that all of the air flowing through the conditioner comes in intimate contact with the finned portions of the

tubes 46, the fins extending to the outer wall 11 near the header end loops and to the flange support 61 which defines the other side of the air passage. After passing by the heat exchanger unit, the air is forced by the fan through the humidifier where it is suitably conditioned in response to the humidity variations within the space being conditioned and then is forced past the filter 35 and through outlet 13 to the space to be conditioned.

The heat exchanger unit described is very substantial and rigid in construction because of the fact that the tubes are firmly supported at their ends 51 and 52 in the headers 41 and 43, respectively, and the intermediate header end bends 49 are supported firmly by the recessed portion 42 formed between the two headers. The unit is very readily mounted in the conditioner by means of the bolts 54 and may be just as readily removed therefrom in case repairs are necessary.

What I claim as new and desire to secure by Letters Patent of the United States is:

1. In a heat exchanger unit, the combination including a pair of headers and a recessed portion therebetween formed as an integral unit, and a convoluted heat exchange medium conducting tube attached at its ends to said headers and supported intermediate said ends in said recessed portion.

2. In a heat exchanger, the combination including an integral header unit comprising a pair of headers and a recessed portion therebetween, and a tube constructed to form a series of U-shaped convolutions attached at its ends to said headers and having its header end turns supported in said recessed portion.

3. In a heat exchanger unit, the combination including a pair of headers and a recessed portion therebetween constructed as an integral unit, and a plurality of convoluted head exchange medium

conducting tubes attached at their ends to said headers and supported intermediate their respective ends in said recessed portion.

4. A demountable heat exchanger unit including in combination an integral header unit comprising a pair of spaced apart headers and a curved recessed portion therebetween, and a convoluted tube with turns having substantially the same radius of curvature as said recessed portion, the ends of said tube being supported by attachment to the headers and the header end turns by said recessed portion.

5. A demountable heat exchanger unit including in combination an integral header unit comprising a pair of longitudinally extending spaced apart headers and a curved recessed portion therebetween coextensive in length with said headers, and a plurality of convoluted tubes with header end turns having substantially the same radius of curvature as said recessed portion, said tubes being fastened at their ends to the headers and the header end turns being supported in said recessed portion.

6. A demountable heat exchanger unit for mounting in the path of air flow in a unit air conditioner, including in combination an integral header unit comprising a pair of spaced apart headers extending substantially the width of said path and a curved recessed portion of a predetermined width therebetween, a plurality of convoluted tubes extending into the path of air flow having substantially the same radius of curvature as said recessed portion and arranged over a width coextensive with said recessed portion, said tubes mounting fins on their straight portions and having their header end turns supported by said recessed portion, whereby only the finned portions of said tubes are in the path of air flow.

SIDNEY E. MILLER. 40