

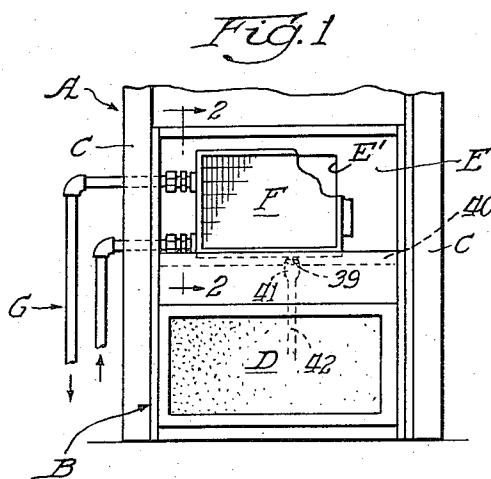
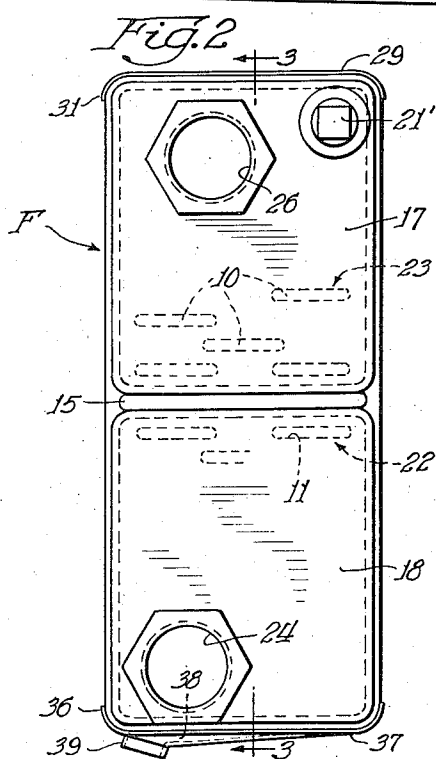
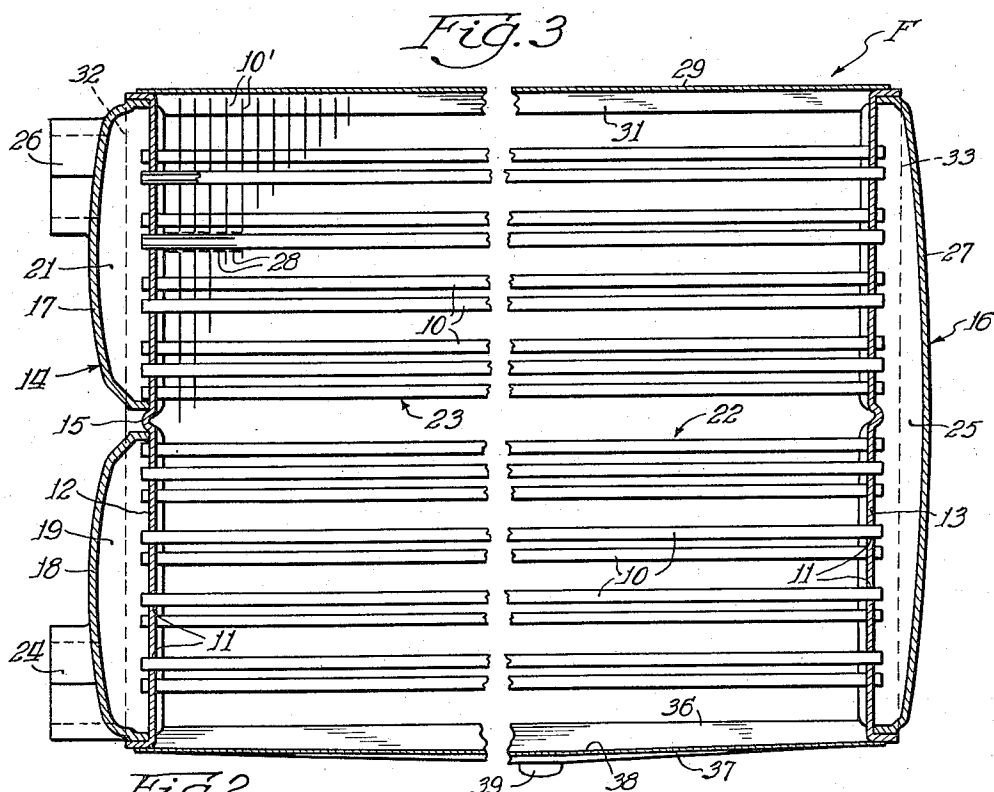
March 24, 1959

S. A. DOMAL
HEAT EXCHANGER

2,878,656

Filed Oct. 31, 1955

2 Sheets-Sheet 1



Inventor:
Stanley A. Domal
By: Joseph M. Gartner
Atty.

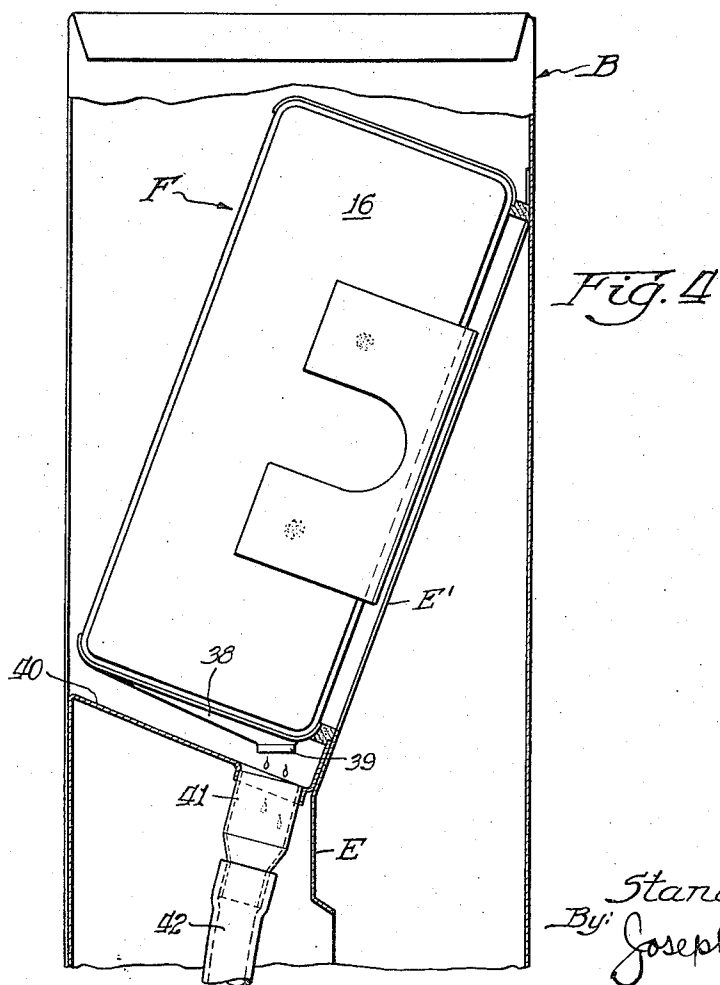
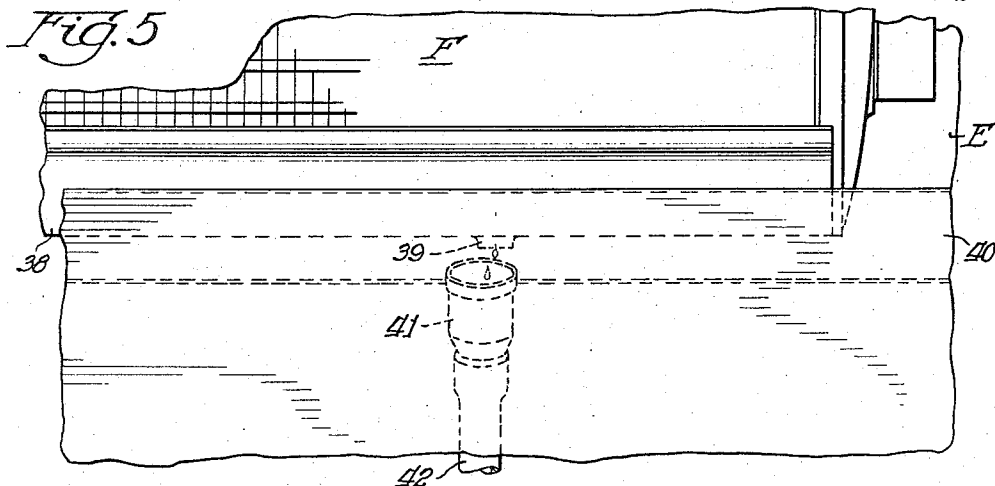
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Inventor:
Stanley A. Domal
By: Joseph M. Gartner *Att.*

1

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HEAT EXCHANGER

Stanley A. Domal, Wyandotte, Mich., assignor to Borg-Warner Corporation, Chicago, Ill., a corporation of Illinois

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1 Claim. (Cl. 62—290)

This invention relates to air conditioners and more particularly to the construction and design of heat exchangers for air conditioners.

At the outset, it is well to point out that the use of the language "air conditioner" hereinafter is intended to embrace units which condition air by heating as well as by cooling. The term "heat exchanger" is intended to include structures embracing a plurality of core tubes or conduits making up what is commonly termed a primary heat transfer element through which fluid, either hot or cold, may be forced for the purpose of encouraging the transfer of heat from the primary element to a fin or radiation structure commonly called a secondary heat transfer element.

A particular object of the present invention is the provision of a heat exchanger having a favorable ratio of primary heat transfer surface with respect to the secondary heat transfer surface.

Another object of the present invention is the provision of a heat exchanger having a parallel flow path in contra-distinction to a tortuous or serpentine flow path.

Another object of the present invention is the provision of a heat exchanger developing a minimum resistance to fluid flow through the core tubes thereof thus developing a relatively low pressure differential between the inlet and outlet sides of the core tubes for a given rate of fluid flow.

A still further object of the present invention is the provision of a small, compact yet strong heat exchanger especially suitable for use in an air conditioner of the type adapted to be recessed in the walls of a building and operable to heat the building in the winter season and cool the building during warm weather.

A further object of the present invention is the provision of a heat exchanger having closed side walls integral therewith so as to form a cowl or shroud around the core tubes and having an air inlet face and an air discharge face; the structure of the heat exchanger lending itself to flush mounting upon a wall of a casing having an opening therein of generally the same size and configuration as the inlet face of the heat exchanger.

A still further object of the present invention is the provision of a shrouded heat exchanger in which a portion of the shroud, in addition to enclosing the side surfaces of the heat exchanger, serves as a pan or tray to collect and discharge condensate which drains from the primary and secondary surfaces of the heat exchanger.

Another object of the present invention is the provision of a heat exchanger having a primary condensate drain pan and a secondary condensate drain pan spaced from the primary pan; the secondary pan having a discharge opening communicating with a discharge line and the primary pan having a discharge opening communicat-

2

ing with the discharge line directly through the opening in the secondary pan.

A heat exchanger embodying certain principles of the present invention may include a plurality of generally parallel conduits, a first header communicating with and supporting corresponding ends of said parallel conduits and a second header spaced from the first header and communicating with and supporting the other ends of said parallel conduits, said second header being divided into an inlet chamber and an outlet chamber, walls joining the ends of the headers so as to form a box-like structure therewith, a plurality of spaced fins disposed transversely of said parallel conduits so as to form a plurality of elongated air passageways through the box and transversely of said conduits, a primary condensate drain pan and a secondary condensate drain pan spaced from the primary pan, both pans having discharge openings therein, the discharge openings of the primary pan communicating with the corresponding opening of the secondary pan.

Other objects and features of the present invention will become more apparent from the following specification and drawings wherein:

Fig. 1 is an elevational view of a portion of an air conditioner with which the heat exchanger of the present invention may be associated and showing to advantage the disposition of the primary and secondary condensate drain pans;

Fig. 2 is a sectional view, somewhat enlarged, of a portion of Fig. 1 as viewed in the plane of the line 2—2, for convenience the heat exchanger is shown in the vertical position;

Fig. 3 is a section of Fig. 2 as viewed in the plane of the line 3—3 and showing to advantage the disposition of the heat exchanger core elements and the configuration and structure of the headers;

Fig. 4 is an enlarged view of the right end of the heat exchanger of Fig. 1 showing to advantage the actual disposition of the heat exchanger within the air conditioner as well as the relationship between the primary and secondary drain pans; and

Fig. 5 is a front view of a portion of Fig. 1 somewhat enlarged.

Referring now to Fig. 1 there is shown a portion of an air conditioning unit indicated generally by the reference character A with the front grill or cover removed. In general, the unit A comprises a rectangular metallic housing B suitably disposed between the studs C of a wall or partition. The housing B is compartmented such that a fan (not shown) disposed behind a suitable filter D encourages air to be drawn inwardly through the filter thence upwardly through suitable conduits in the back side of the housing to a vertical partition E. The partition E is formed with a generally rectangular opening E' whose marginal regions contact the edges of a box-like shroud which in turn supports and forms a part of a heat exchanger F. Suitable fluid connections G are provided to the core of the heat exchanger so as to provide a fluid flow path therethrough. In such an arrangement of the heat exchanger F it is apparent that room temperature air flows into the housing B through the filter D thence upwardly along the rear wall of the housing and is thereafter channeled outwardly through the heat exchanger and returned to the room.

Having described a particular environment or setting within which heat exchanger embodying the principles of the present invention may be utilized a more detailed description of the invention will now be undertaken. In Figs. 2 and 3 there is shown a plurality of con-

duits 10 having a generally rectangular configuration in cross section and disposed generally parallel to one another. The conduits 10 may be referred to hereinafter as core tubes and may be formed of any suitable metallic material such as copper or brass having a relatively high co-efficient of heat transfer.

The core tubes 10 are supported at the ends thereof by engagement with elongated slots 11 formed in a zig-zag or staggered fashion (Fig. 2) in the inner walls 12 and 13 of the header members 14 and 16 respectively. Since the headers are in effect tanks or reservoirs for fluid it necessarily follows that the joints between the periphery of the various core tubes 10 and the walls 12 and 13 be sealed and made water tight as by brazing or by a suitable tinning operation. As is apparent in Figs. 2 and 3, the wall 12 is formed with a transverse rib or protuberance 15 which serves to divide the header 14 in cooperation with shells 17 and 18 into an inlet chamber 19 and a discharge chamber 21. It is noted that the inlet chamber communicates with one group of core tubes indicated generally by the reference numeral 22 while the discharge chamber communicates with the group of core tubes indicated by the reference numeral 23. The inlet chamber 19 is provided with an opening 24 through which hot or cold water may be introduced from a remotely located hot and/or cold water supply. Correspondingly the discharge chamber 21 is similarly fitted with an opening 26 which also communicates with the remotely located chiller and/or hot water supply. The discharge chamber 21 is also fitted with a vent plug 21' which is removable to void the heat exchanger of entrapped air.

The header 16 is enclosed by the engagement of an outer wall 27 which with the inner wall 13 comprises a single compartment 25 communicating with all core tubes 10. The wall 13 is sealed and makes a water tight connection with the periphery of the core tubes and the outer wall 27 as by brazing or tinning.

It is well to point out that hereinafter, particularly in the claims to the present invention the core tubes collectively may be referred to as denoting a primary heat transfer surface. That is the portions of the core tubes 10 disposed between the headers represent a medium through which there may be thermal conductivity by virtue of the passage of hot or cold fluid through the interior of the tubes.

Disposed transversely of the core tubes and neatly encircling the outer periphery of each core tube are a plurality of generally parallel foils or fins 10' which may be collectively referred to as a secondary heat transfer surface. The fins are made of a relatively thin metallic material such as copper or bronze and may be corrugated or crimped lightly so as to form slight grooves extending along the length of the fins and interrupted by the core tubes 10. The fins are positioned on the core tubes by the engagement of a skirt portion 28 formed integral with the fins. The skirt portion 28 defines a slot through which the core tubes may be threaded prior to fastening the headers to the core tubes. Since the fins 10' are relatively pliable because of their thin construction the skirt portion 28 thereof may be crimped around the core tube thus holding the fin in position.

The top side of the heat exchanger is enclosed by a wall 29 having a depending portion 31 which is substantially coplanar with the edges 32 and 33 of the headers and the upturned portion 36 of a lower wall 37. The edges 32 and 33 and the portions 31 and 36 define a frame having coplanar edges which may bear flush upon the marginal regions of an apertured wall as shown in Fig. 1.

Stated otherwise, the edge structure defined makes it possible to mount the heat exchanger flush to an apertured wall or partition within an air conditioner housing so that air directed through the aperture must positively pass directly through the heat exchanger.

Another purpose for the coplanar edge structure is to facilitate thermally insulating the heat exchanger from the supporting, apertured wall by disposing a gasket or ring of suitable insulating material between the coplanar edge structure and the marginal regions of the apertured supporting wall. Such a gasket will, of course, further seal the edge structure to the supporting wall.

The lower wall 37 is further formed with a gradually deepening recess 38, hereinafter referred to as a primary condensate drain pan, having an opening 39 at the deepest portion thereof. The purpose for this configuration of the bottom side of the heat exchanger is to provide a receptacle for the accumulation of condensate which drains from the fins and the core tubes and to direct the condensate to an outlet.

As shown in Figs. 1, 4 and 5 the primary drain pan 38 is spaced from a secondary drain pan 40. The pan 40, extending the full width of the housing B, is formed with a discharge opening 41 in alignment with the opening 39 so that condensate discharging from the pan 38 may pass directly through the opening 41 (Figs. 4 and 5) making a minimum or substantially no contact with the secondary pan and thence to a suitable drain by means of a plastic drain line or hose 42.

By providing the spaced primary and secondary drain pans 38 and 40 respectively a serious sweating problem has been overcome. Prior to the use of the drain pan 38, relatively large quantities of condensate accumulating upon the primary and secondary heat transfer surfaces of the heat exchanger were permitted to drip downwardly directly upon the pan 40. This cold condensate chilled the pan 40 to the extent that moisture laden warm air entering the air conditioner through the filter D condensed upon the underside of the secondary pan. This condensate ultimately dripped downwardly upon the fan motor and its electrical wiring damaging these elements, if not rendering the air conditioner completely inoperative.

By forming the primary pan 38 integral with the heat exchanger the condensate originating upon the primary and secondary heat transfer surfaces is kept from spreading over the pan 40 and is directed through the aperture 41 into the plastic drain tube 42. Thus the condensate makes substantially no contact with the pan 40.

It is, of course, noteworthy to state that the air gap between the primary and secondary pans serves to insulate these members and to prevent the transfer of cold from the primary pan to the secondary pan. This construction further precludes the tendency for condensate to form upon the underside of the secondary pan.

It is to be noted (Fig. 2) that the core tubes are disposed in checkerboard fashion consistent with the requirement that a maximum amount of primary surface area be exposed to drafts of air forced through the core in the direction of the arrows.

Referring now to Fig. 3 it is apparent that upon introducing fluid into the inlet chamber 19 the fluid is free to flow from left to right through the inlet group of core tubes 22 into the header 16 thence upwardly into the outlet group of core tubes 23 into the outlet chamber 21 and back to the source.

It is anticipated that various arrangements and representations of the present invention may be undertaken without departing from the spirit and scope of the appended claim.

I claim:

An air conditioner apparatus comprising a housing, a partition in said housing, means defining an opening in said partition, a cooling unit mounted on one side of said partition and overlying said opening, said cooling unit comprising a plurality of generally parallel core tubes, a first header communicating with and supporting corresponding ends of said core tubes, a second header communicating with and supporting the other ends of said core tubes, walls joining the ends of said headers and

cooperating with the headers to form a box-like structure immediately surrounding the core tubes, one of said walls being located at the bottom of said cooling unit and formed with a gradually deepening depression and having an opening at the lowest point of said depression, said bottom wall resting immediately above a pan formed in said housing, said pan following the contour of said bottom wall and having an opening therein in alignment with the opening in said bottom wall.

5

References Cited in the file of this patent

UNITED STATES PATENTS

1,884,080	Miller	Oct. 25, 1932
2,212,710	Harper	Aug. 27, 1940
2,323,176	Ashley	June 29, 1943
2,394,402	Pennella	Feb. 5, 1946
2,614,816	Hull	Oct. 21, 1952
2,743,908	Tanner	May 1, 1956