

July 21, 1953

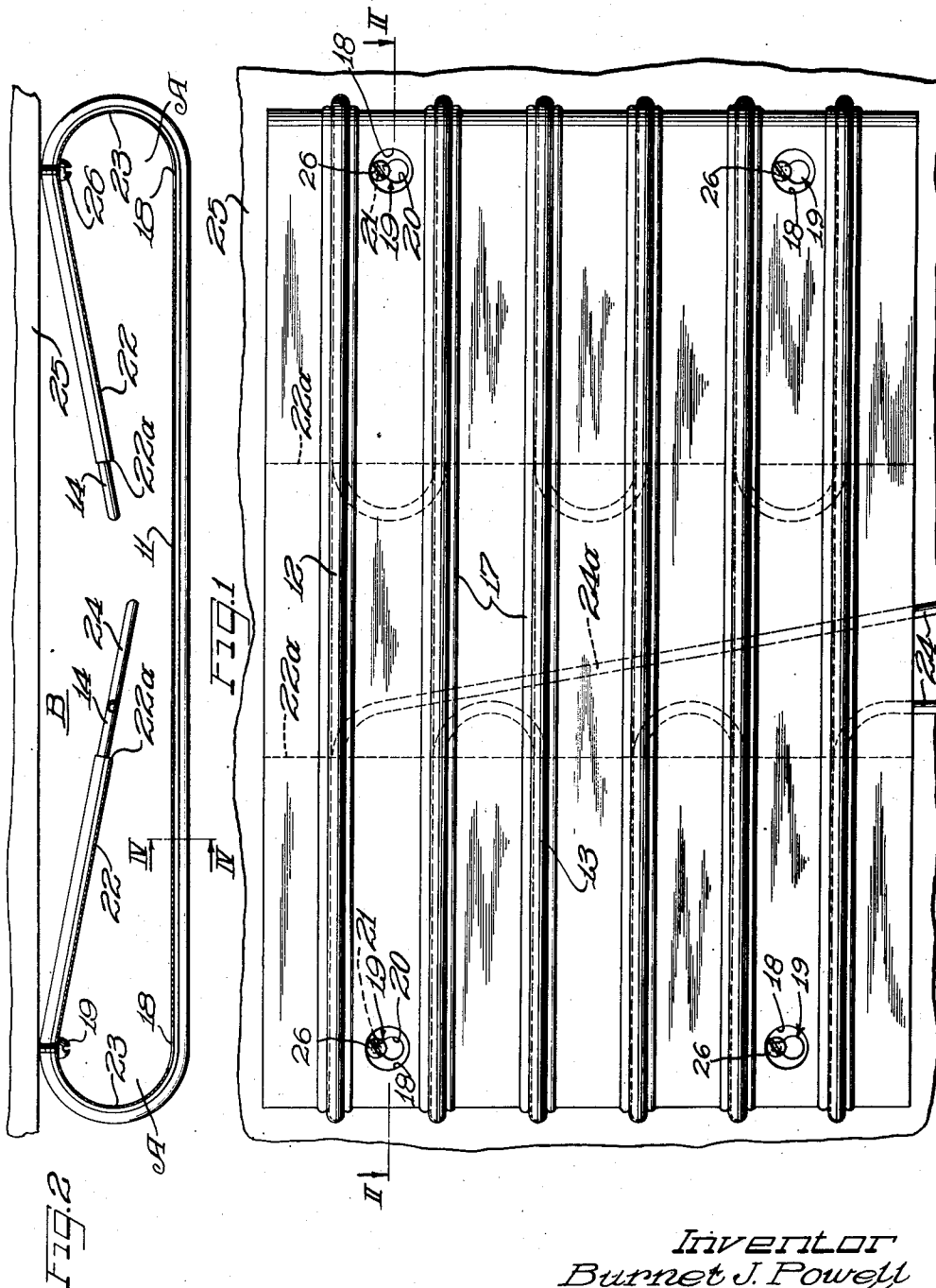
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2,646,259

CONDENSER

Filed Feb. 2, 1950

2 Sheets-Sheet 1



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FIG. 3

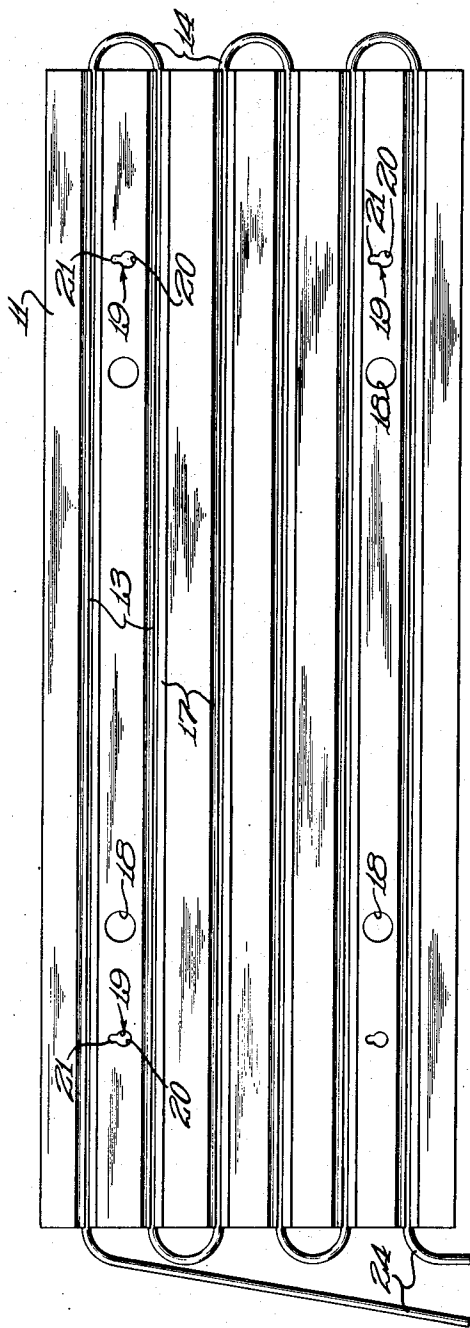
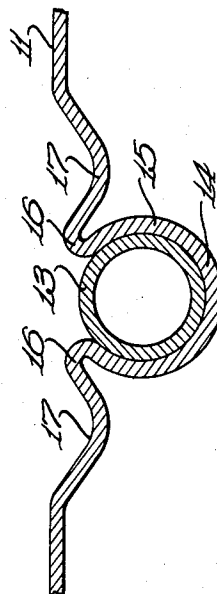


FIG. 4



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UNITED STATES PATENT OFFICE

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CONDENSER

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2 Claims. (Cl. 257—256)

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The present invention relates to a heat exchanger and the method of making the same. More particularly, the present invention relates to a heat exchanger of the tube and plate type providing a maximum heat dissipating surface area with minimum overall height.

The conventional tube and plate type heat exchangers of the prior art typically include a generally planar backing plate provided with end mounting flanges and carrying on one surface thereof a sinuous tube secured to the backing plate by suitable means, as by brazing or welding. In the case of refrigerator condensers, in order to provide a sufficient area for the dissipation of heat from the refrigerant fluid, a more or less definite overall plate dimension is required. In some applications to refrigerators the conventional tube and plate type condenser does not give adequate cooling effect in the lengths or heights of condenser permitted by the design of the refrigerator.

The present invention now provides a novel form of heat exchanger of the plate and tube type in which a greater heat dissipating effect is provided with minimum height of condenser. In addition, the heat exchanger is secured to a supporting surface, as to a domestic refrigerator, by means of the plate itself rather than through the medium of additional flanges, such as hereinbefore provided.

The condenser of the present invention more particularly includes a backing plate having a sinuous tube secured thereto by a suitable means, preferably by swaging or otherwise deforming the plate to greater than semi-peripheral contact with the tube. Opposing ends of the plates are returned to lie back of an intermediate portion of the plate and the intumed plate portions are apertured to receive means for attachment to a supporting vertical surface. When the condenser is so attached to the back of a refrigerator cabinet, the intumed flanges are in line contact with the supporting surface, while the terminal ends of the flanges are directed away from the plane of the supporting surface in spaced relation thereto to form what might be termed a double stack air passage. All of the heat dissipating surfaces of the exchanger are fully exposed to convection air currents.

The method of forming the present invention comprises generally the securing of a sinuous tube to a plane backing plate and the deformation of the plate and the tube portions carried thereby to form intumed opposing flanges, or wing portions,

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It is, therefore, an important object of the present invention to provide an improved heat exchanger, or condenser providing greater heat dissipating effect with minimum height.

Another important object of the present invention is to provide a method of making a heat exchanger by the securing of a sinuous tube to a plane backing plate and the subsequent deformation of the backing plate to form inwardly folded flanges.

It is another important object of the present invention to provide an improved condenser of the tube and plate type including a plate carrying a sinuous tube attached thereto and having intumed opposed wing portions cooperating with an intermediate portion of the plate and with a vertical supporting surface to define air stack passages for the more effective dissipation of heat with a minimum height of condenser.

Still another important object of the present invention is to provide a method for making a heat exchanger by bending a tube and plate type condenser from a generally planar form into a flattened open loop in plan, whereby a plurality of vertical passages for cooling gases are provided when the condenser is attached to a vertical supporting surface.

Other and further important objects of the present invention will be apparent from the disclosures in the specification and the accompanying drawings.

This invention (in a preferred form) is illustrated in the drawings and hereinafter more fully described.

On the drawings:

Figure 1 is a front elevational view of a heat exchanger of the present invention;

Figure 2 is a sectional view taken along the plane II—II of Fig. 1;

Figure 3 is an elevational view of the heat exchanger of the present invention prior to the formation of the terminal flanges thereon; and

Figure 4 is a sectional view taken along the plane IV—IV of Fig. 2.

As shown on the drawings:

In Fig. 1, reference numeral 10 refers generally to a heat exchanger of the present invention including a backing plate 11 formed of heat conducting sheet material, such as hot rolled or cold rolled steel, and a heat exchange conduit or tube 12 formed of copper or other heat conducting material.

As best shown in Fig. 3, the tube is of sinuous or serpentine configuration including spaced, generally parallel straight tube portions 13 se-

cured to the plate and arcuate intermediate portions 14 joining the straight portions 13 and extending beyond the confines of the backing plate 11. As particularly shown in Fig. 4, the straight tube portions 13 are confined to the plate by swaging or distortion of the plate to overlie a median diameter of the tube.

Thus, the tube straight portions 13 are bottomed against the arcuate bottom 14 of a groove 15 formed in the plate, those portions of the plate immediately contiguous to the groove 15 being deformed, as by swaging, as at 16, to overlie the tube. In the swaging step, supplementary grooves 17 are formed in the plate 11 alongside and immediately adjacent the main groove 15 receiving the tube. The particular method of swaging the plate 11 about the tube portions 13 is more particularly described and claimed in the pending application of Ray A. Sandberg, Serial No. 80,240, filed March 8, 1949, and assigned to the assignee of the instant application.

It will be seen from Fig. 3 that a plurality of parallel, spaced grooves 15 are formed in the plate 11 to traverse the entire width of the plate, the spacing of the grooves 15 corresponding to the spacing of the straight portions 13 of the tube 12 so that the plate receives the tube in its sinuous configuration.

The plate is also provided with transversely and longitudinally aligned circular apertures 18 and adjacent, similarly aligned keyhole apertures 19 defined by a lower circular aperture 20 and an upper aperture 21 communicating with the aperture 20.

The plate 11 as originally formed is generally planar, and the tube 12 is secured to the plate while it is in this configuration. Following the securing of the tube to the plate, opposite end portions of the plate are bent about relatively short radii of approximately equal length to define opposed inturned flange portions 22 and adjoining loop portions 23. The opposed flanges 22 are inturned toward the plane portion of the plate 11, so that the flanges 22 are inclined to the plane of the plate 11. When the plate is so deformed into its final form, each of the aligned apertures 18 is transversely aligned with one of the keyhole apertures 19, and the arcuate tube portions 14 lie between opposed spaced margins 22a of the inturned flange portions 22. The terminal inlet and outlet portions 24 of the tube 12 likewise lie between the flanges 22 with one of the portions 24a extending transversely of the plate 11.

The structure thus provided may be mounted on a supporting surface, such as the surface 25, by means of screws or studs 26 passing through the keyhole apertures 19 into the supporting surface. These screws 26 are first inserted through the circular portion 20 of the aperture 19 and upon downward movement of the assembly, the screw shanks enter the upper portion 21 of the apertures 19. Following this movement, a screw driver or other tool may be inserted through the apertures 18 to tighten each screw 26 upon that portion of the flange 22 surrounding the aperture 21, to secure the exchanger to the surface 25 against movement. It will be appreciated that the head of the screw or stud 26 is smaller in cross-sectional area than the area of the portion 20 of the hole 19, while being greater in diameter than the portion 21.

The reduction in overall width of the heat exchanger 10 by the formation of the inturned flanges is accomplished without any lessening of

the effective heat dissipating surface area and, in fact, with an increase in its overall efficiency. Each of the flanges 22 cooperates with the plane portion of the plate 11 to define therebetween a stack passage A for the flow of air or other cooling gas in heat transfer relation to the interior surfaces of the condenser. In addition, the flange portions 22 cooperate with the supporting surface 25 to define therewith a stack passage B for the flow of a cooling gas in heat transfer relation with the contiguous surfaces of the condenser.

In the installation of the heat exchanger 10 on a vertical surface 25, the vertical passages A and B serve as stacks for the upward flow of air induced by convection. Thus the plate, in cooperation with the surface 25, gives a double stack effect to thereby increase the efficiency of heat dissipation.

The attaching of the tube 12 to the plate 11 by means of the swaging of the plate into greater than semi-peripheral contact with the tube is particularly adapted for employment with the structure of the present invention. If the tube were attached to the plate by a conventional fastening means, as by welding or brazing, the fastening medium would be subjected to stress during the formation of the flange portions 22. However, no independent tube fastening medium is necessary for the exchanger 10, inasmuch as the metal of the plate itself is employed to attach the tube. It will also be noted that in the final flanged exchanger, the tubes 12 are upon the outer surface of the plate 11 and thus are bent about a slightly greater radius of curvature than the plate 11 itself. In this manner, collapse or buckling of the tube is prevented.

An additional advantage is obtained by the employment of the plate itself, by means of the registering apertures 18 and 19, to secure the exchanger to the backing surface without the necessity of providing additional mounting flanges, as have been employed heretofore.

It will be understood that modifications and variations may be effected without departing from the scope of the novel concepts of the present invention.

I claim as my invention:

1. A heat exchanger comprising: a backing plate having an elongated central web portion, outturned arcuate portions at opposite lateral margins of said central web portion, and elongated marginal flanges extending from the outer margins of said outturned arcuate portions obliquely inwardly toward the central web portion and together overlying a substantial portion of the extent of said central web portion; and a sinuous tube joined to said web portion, said arcuate portions, and said flanges; said arcuate portions of said backing plate being adapted to receive securing means.

2. In combination, a heat exchanger and a supporting surface therefor, said heat exchanger comprising a backing plate having an elongated central web portion, outturned arcuate portions extending from opposite lateral margins of said central web portion, and elongated marginal flanges extending from the outer margins of said arcuate portions obliquely inwardly toward said central web portion, said backing plate being secured to said supporting surface adjacent the junctures between said arcuate portions and said marginal flanges to define with the supporting surface a coolant flow passage having opposite end walls defined by said arcuate portions and having side walls defined by

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the central web portion and the supporting surface, said marginal flanges extending in spaced relation to said supporting surface and said central web portion and together traversing a substantial proportion of the extent of said coolant flow passage between the opposite end walls thereof, and a sinuous tube joined to said web portion, said flanges and said arcuate portions.

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References Cited in the file of this patent

UNITED STATES PATENTS

Number	Name	Date
1,800,150	Musgrave et al.	Apr. 7, 1931
2,029,891	Newman	Feb. 4, 1936

Number
2,091,584
2,190,288
2,279,272
2,281,299
2,289,685
2,371,215
2,441,463

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Name	Date
Brown	Aug. 31, 1937
Higham	Feb. 13, 1940
Anderson et al.	Apr. 7, 1942
Steenstrup	Apr. 28, 1942
Schoen	July 14, 1942
Benson	Mar. 13, 1945
Achs	May 11, 1948

FOREIGN PATENTS

Country	Date
Great Britain	June 4, 1931
Great Britain	May 27, 1936
France	Dec. 11, 1943
Germany	Aug. 26, 1940