

Feb. 12, 1952

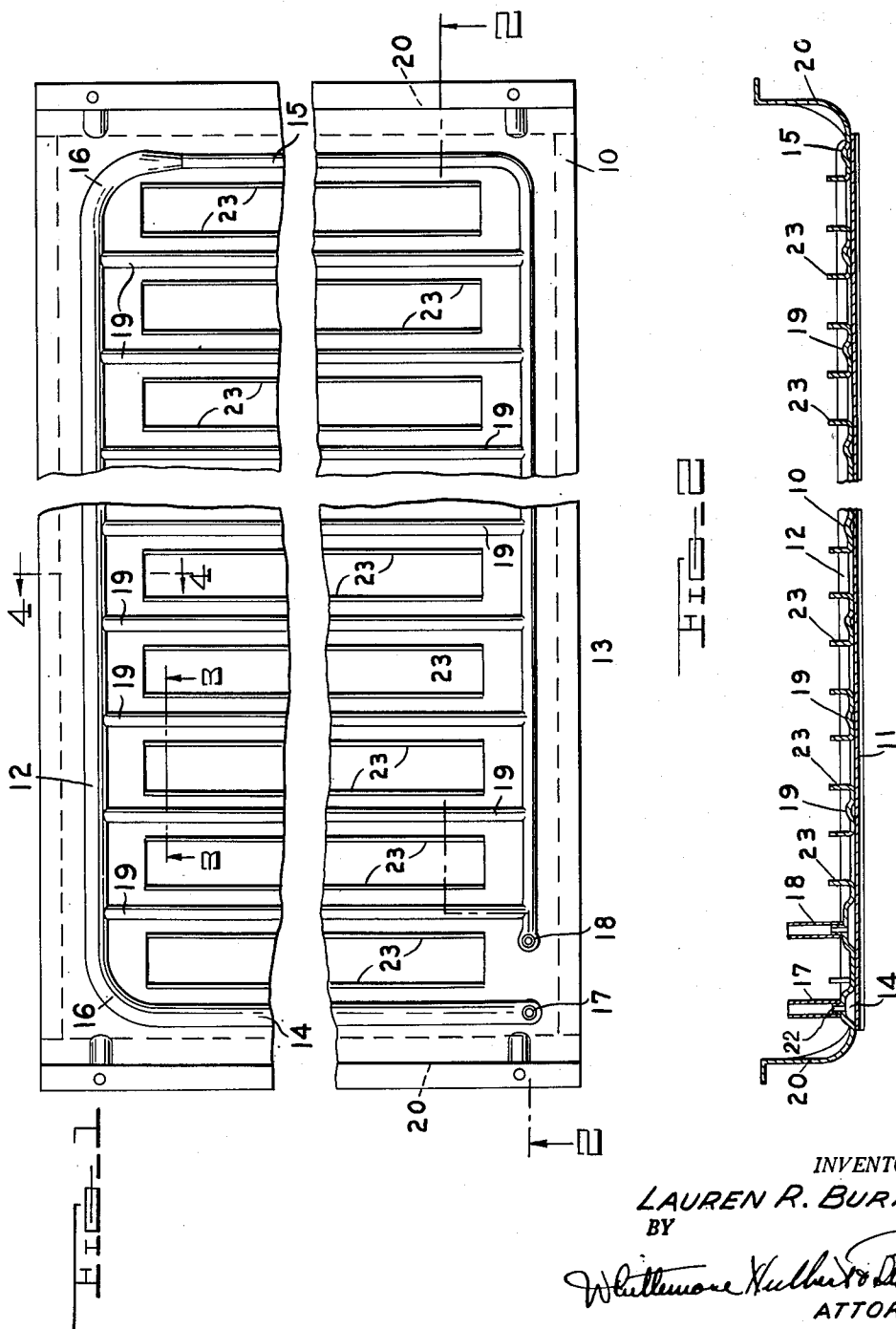
L. R. BURR

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HEAT EXCHANGE UNIT HAVING A TROUGH

Filed March 24, 1948

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FIG-3

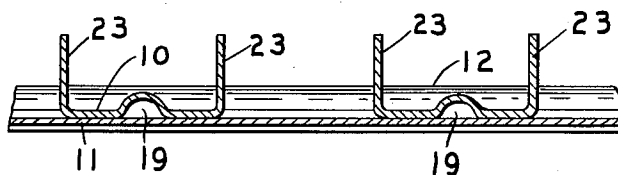


FIG-4

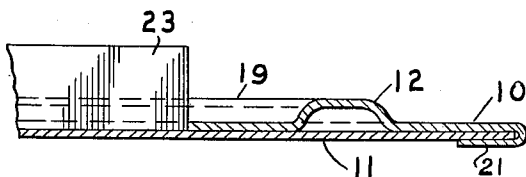
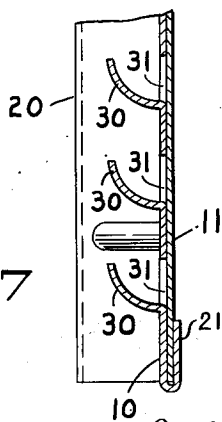


FIG-7



INVENTOR.
LAUREN R. BURR
BY

Whitmore Kullert & Belknap
ATTORNEYS

Feb. 12, 1952

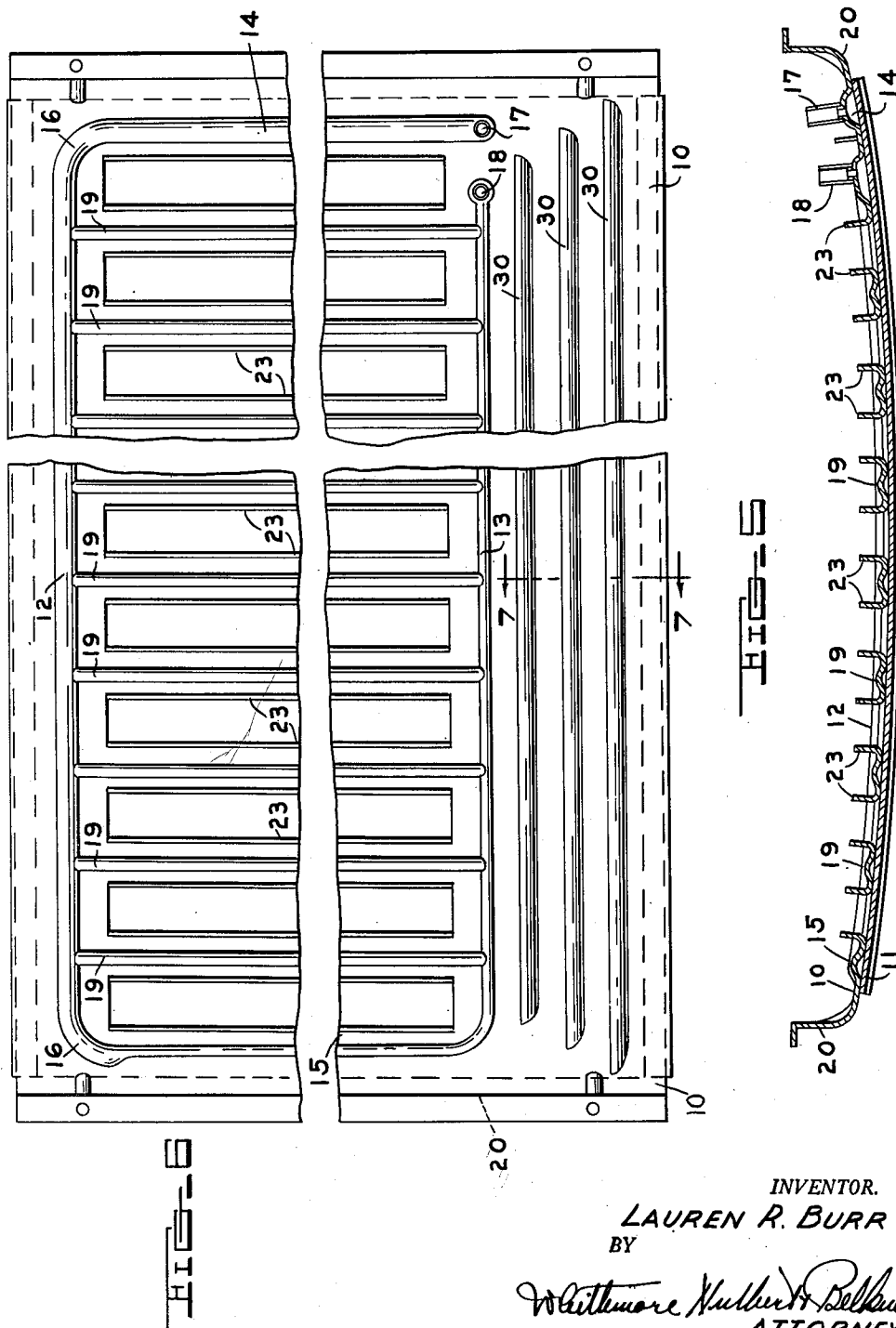
L. R. BURR

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UNITED STATES PATENT OFFICE

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HEAT EXCHANGE UNIT HAVING A TROUGH

Lauren R. Burr, Lansing, Mich., assignor to Kold-Hold Manufacturing Company, Lansing, Mich., a corporation of Michigan

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2 Claims. (Cl. 62-103)

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This invention relates generally to heat exchange units and refers more particularly to improvements in static condensers.

One of the objects of this invention is to provide a heat exchange unit composed of a relatively few simple parts capable of being inexpensively produced on a production basis and designed for effective operation by the natural circulation of air over the exposed surface area thereof.

Another object of this invention is to greatly increase the efficiency of a heat exchange unit of the above general type notwithstanding the absence of fans, blowers or equivalent instrumentalities for producing a forced circulation of air over the available surface area of the unit.

Still another feature of this invention which contributes materially to simplifying the design of the heat exchange unit is to provide a construction comprising two plates permanently secured together in face to face relationship, and having portions cooperating to form passages for a fluid such, for example, as a refrigerant.

A still further object of this invention is to emboss one of the plates in a manner such that when the two plates are secured together in face to face relationship, a plurality of laterally spaced transverse passages and a pair of header passages are formed in such relationship that the opposite ends of the transverse passages respectively communicate with the header passages.

A still further object of this invention is to provide laterally outwardly projecting fins on one of the plates between adjacent transverse passages. These fins project into the air circulating over the plates and greatly increase the heat exchange efficiency of the unit without the necessity of creating a forced draft by the use of blowers or equivalent devices.

Still another feature of this invention is to provide a static heat exchange unit of the above general construction, wherein the plates are formed of simple sheet metal stampings and wherein these plates may be intimately united to effectively seal the joints around the passages by copper hydrogen brazing.

A further object of this invention is to provide a finned heat exchange unit which is curved longitudinally to increase the rigidity and facilitate more uniform distribution of air.

Still another object of this invention is to provide a heat exchange unit having one or more troughs for collecting moisture. This feature is especially important in instances where the unit is used as a condenser in refrigerating apparatus

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of the cold wall type in that it renders it possible to drain the water resulting from condensation from the bottom of the refrigerator to the trough or troughs provided on the condenser. The trough or troughs are designed to provide adequate evaporating surface to vaporize the moisture drained from the refrigerator. This not only renders it possible to eliminate the necessity of providing a drain from the bottom of the refrigerator, but in addition, improves the cooling characteristics of the condenser.

The foregoing as well as other objects will be made more apparent as this description proceeds, especially when considered in connection with the accompanying drawing, wherein:

Figure 1 is a fragmentary elevational view of a heat exchange unit embodying the features of this invention;

Figure 2 is a sectional view taken on the line 2-2 of Figure 1;

Figure 3 is an enlarged sectional view taken on the line 3-3 of Figure 1;

Figure 4 is a sectional view taken on the line 4-4 of Figure 1;

Figure 5 is a longitudinal sectional view through a modified form of heat exchange unit;

Figure 6 is an elevational view of a further embodiment of this invention; and

Figure 7 is a sectional view taken on the line 7-7 of Figure 6.

The heat exchange unit selected for the purpose of illustrating this invention is in the form of a static condenser of the type capable of being used in refrigerating apparatus for condensing the refrigerant. When used in this manner the condenser may be mounted in a vertical position at the back of a refrigerating cabinet where air may flow by natural circulation in heat conducting relation to the exposed surface area of the condenser.

In detail the heat exchange unit or condenser shown in Figures 1 to 4 inclusive comprises two metal plates 10 and 11 secured in face to face relationship. In the interests of economy in manufacture, both plates are preferably formed of sheet metal and may be fashioned to the desired contour by simple stamping operations. The plate 10 is embossed laterally outwardly to cooperate with the plate 11 in forming elongated header passages 12 and 13 adjacent opposite sides of the plates, and to form transversely extending passages 14 and 15 adjacent opposite ends thereof. The end passage 14 is connected at one end to the passage 12 as indicated by the numeral 16, and is connected at the opposite end to an intake

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conduit 17. The end passage 15, on the other hand, has the opposite ends respectively connected to the adjacent ends of the header passages 12 and 13. The free end of the header passage 13 terminates adjacent the free end of the end passage 14 and is connected to an outlet conduit 18.

It will also be noted that the plate 10 is further embossed to cooperate with the plate 11 to form a multiplicity of transversely extending substantially parallel passages 19 intermediate the end passages 14 and 15. The passages 19 are spaced substantial equal distances laterally from each other, and are respectively connected at opposite ends with the header passages 12 and 13. The plate 10, in addition, is formed at opposite ends with laterally extending flanges 20 which are suitably apertured and serve as mounting brackets for the unit.

The opposite side edge portions of the plate 10 are formed with marginal flanges 21 which are bent under the adjacent marginal edge portions of the plate 11. The plate 11 is merely a flat sheet and in assembly, both plates are relatively positioned with a thin sheet of copper therebetween. The two conduits 17 and 18 are then telescoped on the tubular projections 22 extruded from the plate 10 at the intake and outlet openings, and the assembly is then brazed in a hydrogen atmosphere at a temperature approximately 2050° F. Thus an effective fluid tight seal is provided along the several passages and around the intake and outlet conduits.

In order to substantially increase the heat transfer efficiency of the unit, the plate 10 is formed with integral laterally outwardly extending fins 23 of substantial width between adjacent transversely extending passages 19. In the present instance two laterally spaced fins 23 are provided between adjacent transversely extending passages 14, 19 and 15. These fins extend substantially parallel to the transversely extending passages and extend for substantially the full length of the latter.

In the interests of simplicity of manufacture, the fins 23 are formed by slitting the metal of the plate 10 midway between adjacent transversely extending passages throughout a length slightly less than the passages. The metal of the plate 10 at opposite sides of the slit may then be bent laterally outwardly by a suitable stamping operation to form the fins 23. Thus the fins 23 are actually struck outwardly from the plate 10 as the latter is fashioned and the slots in the plate 10 resulting from striking the fins outwardly are closed by the plate 11. The fins 23 project a substantial distance outwardly into the circulating air and greatly increase the heat transfer capacity of a unit of given size.

When using the heat exchange unit as a condenser for refrigerating apparatus the intake conduit 17 is connected to the exhaust side of a suitable compressor (not shown) and the outlet conduit 18 is connected to intake side of the compressor. The gaseous refrigerant flows from the exhaust side of the compressor into the header passage 12 through the end passage 14, and is distributed to each of the transverse passages 19. As the refrigerant flows down through the passages 19, it is condensed and collected in the header passage 13. From the header passage 13 the liquid refrigerant is conducted in series to an expansion means and an evaporator, and is then returned to the compressor through the outlet conduit 18.

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It follows from the above that the heat exchange unit may be successfully used as a static refrigerant condenser capable of efficiently condensing the refrigerant by natural circulation of air over the available surface area of the plates and fins. The construction is simplified by the elimination of artificial air circulating equipment and is further simplified by the novel fin arrangement. This fin arrangement greatly increases the heat transfer capacity of a unit of given size and is obtained without actually adding metal or strips to the plates.

The embodiment of this invention shown in Figure 5 of the drawings is the same as the one previously described, except that the unit is curved to some extent. This construction increases the rigidity of the unit, and facilitates the distribution of air over the entire available surface of the unit. In the interests of simplicity, the same reference characters used in the description of the first form of this invention are applied to corresponding parts of the embodiment shown in Figure 5.

The modification shown in Figures 6 and 7 of the drawings differs from the first described form of the invention in that the plates 10 and 11 are extended below the bottom header passage 13, as shown in Figure 7 of the drawings. The depending portion of the plate 10 is stamped outwardly to provide vertically spaced upwardly opening troughs 30. The troughs progressively increase in length from the uppermost trough to the lowermost trough, and the openings 31 formed in the plate 10 by striking out the troughs are closed by the plate 11.

With the above construction, moisture collected at the bottom of the refrigerator cabinet may be conducted to the uppermost trough instead of being drained from the cabinet. The arrangement of troughs is such that the overflow of one trough is caught by the next adjacent lowermost trough, and the number of troughs is determined to provide adequate evaporating surface to vaporize the moisture draining from the inner surfaces of the cabinet walls. This construction not only eliminates the necessity of providing drainage means for the moisture collecting at the bottom of the cabinet, but also facilitates the cooling effect of the condenser.

What I claim as my invention is:

1. A heat exchange unit comprising sheet metal plates secured together in face to face relationship and having portions cooperating with one another to form a circuitous passage between the plates, and upwardly opening moisture retaining troughs struck outwardly from one of the plates below the passages, said troughs being spaced one above the other and progressively increasing in length from the uppermost trough to the lowermost trough whereby the overflow from one trough is collected by the next adjacent lowermost trough.

2. A heat exchange unit comprising sheet metal plates secured together in face to face contact and adapted to be supported in an upright position, one of the plates having embossed portions cooperating with the other plate to form a circuitous passage between the plates, one of said plates also having vertically spaced longitudinally extending cuts in the part thereof below the passage and the portions immediately below said cuts being bent laterally outwardly to form with the adjacent plate vertically spaced horizontally extending troughs, said troughs progressively decrease in length from the bottom trough to the

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top trough and are positioned one above the other in a manner such that the ends of the troughs below the uppermost trough project beyond the corresponding ends of the troughs immediately above the same.

LAUREN R. BURR.

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