Sept. 27, 1949. C. G. VONK 2,482,951

CONDENSER

Filed July 19, 1945 2 Sheets-Sheet 1

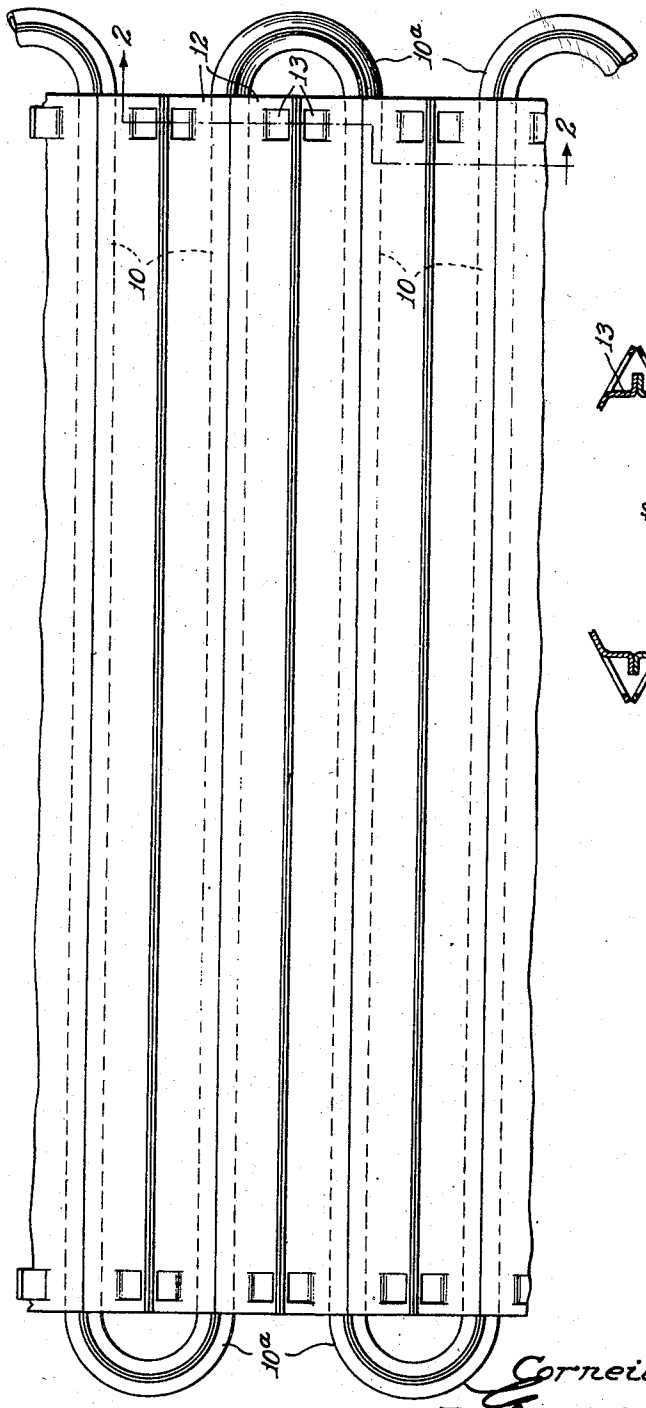


Fig. 1

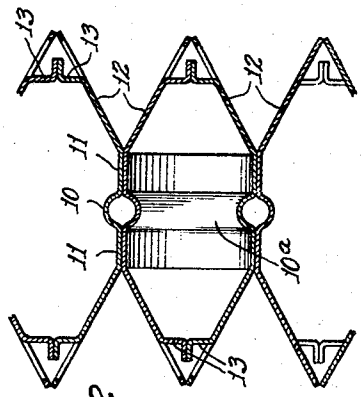


Fig. 2

Inventor:
Corneilius G. Vonk
By Edward C. Dailey & Co.
Atty.

Sept. 27, 1949. C. G. VONK 2,482,951

CONDENSER

Filed July 19, 1945 2 Sheets-Sheet 2

Fig. 4

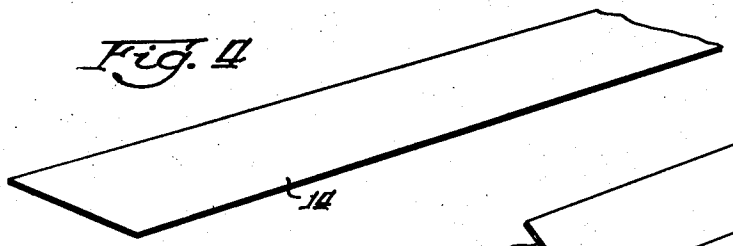


Fig. 5

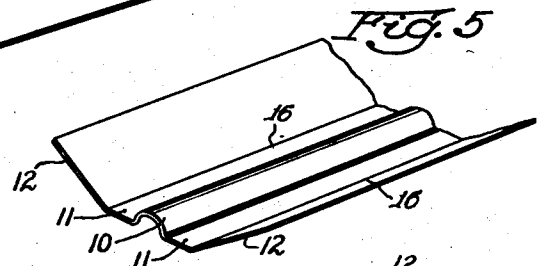


Fig. 6

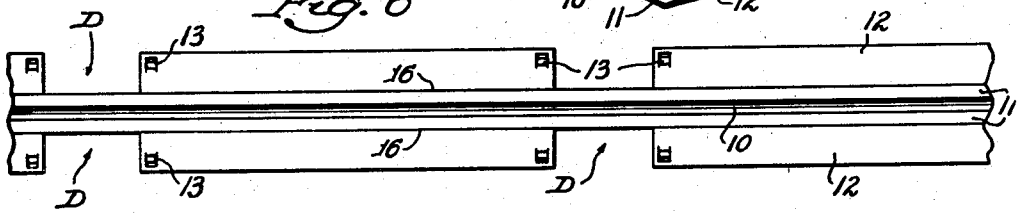


Fig. 8

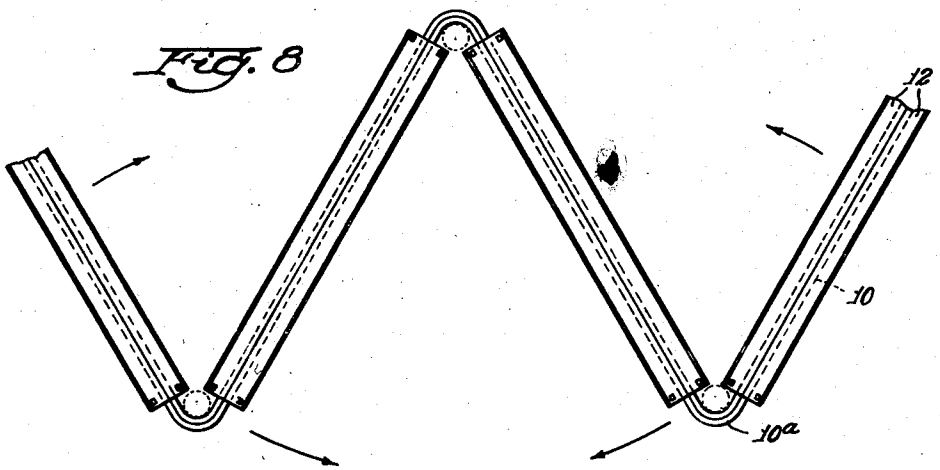


Fig. 7

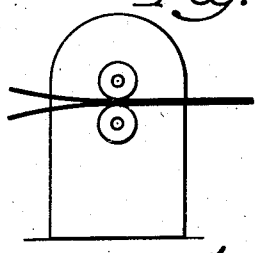
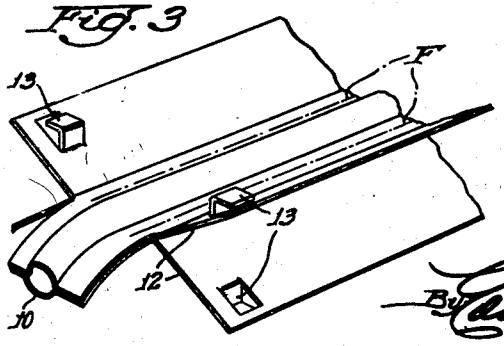


Fig. 3



Inventor:
Cornelius G. Vonk
By Clarence C. Birkhaug
Atty

Patented Sept. 27, 1949 2,482,951

UNITED STATES PATENT OFFICE

2,482,951

CONDENSER

Cornelius G. Vonk, Grand Rapids, Mich., assignor to Borg-Warner Corporation, Chicago, Ill., a corporation of Illinois

Application July 19, 1945, Serial No. 605,866

3 Claims. (Cl. 257—255)

1

The present invention relates to heat exchangers such as condensers and the like, and it has particular applicability to an assembly that is adapted for use in mechanical refrigerators.

It is one of the principal objects of this invention to simplify the construction of a heat exchanger or condenser such as contemplated herein, and to improve the efficiency, operation and dependability thereof.

Another principal object is to provide a condenser wherein the components are constructed and arranged in a novel manner so that they may be rapidly assembled to effect a material reduction in the manufacturing cost and also to produce a device of high efficiency.

A further principal object is to provide a condenser and the like which is capable of being produced by a comparatively simple method which does not involve complicated and expensive operations.

Still another object is to provide a structure such as contemplated herein which comprises an integrally finned tube which is formed by uniting two metal strips having substantially identical shape in cross section, thus dispensing with numerous special parts.

A still further object is to provide a condenser, especially adapted for mechanical refrigerators, which comprises two substantially identical metal strips united to each other to constitute an elongated member having a continuous tube or fluid passageway on which there are radial heat dissipating fins. These fins and tube are arranged so that the elongated member may be formed into a unitary assembly by imparting to the member a plurality of reverse bends at predetermined locations throughout its length so that the tubular portion defines a continuous serpentine or sinuous fluid passageway. Such assembly is characterized by the fact that certain extraneous matter, which usually impairs the efficiency of finned type condensers, will gravitate from and not accumulate on the surfaces of the fins, and also the fins of each run will tend to protect the fins of the run beneath it by shedding extraneous matter away from the other fins and runs. Furthermore, this arrangement does not detract from the heat dissipating characteristics for which the assembled unit is intended. Arrangement also is made to facilitate the attachment of the fins at each run of the sinuous passageway to portions of fins in adjacent runs.

Additional objects, aims and advantages of the improvements contemplated herein will be apparent to persons skilled in the art after understanding the construction and operation of the heat exchanger or condenser from the within description. It is preferred to accomplish the numerous objects hereof, and to practice the invention in substantially the manner hereinafter fully described and as more particularly pointed out in the appended claims. Reference is now made to the accompanying drawings that form a part of this specification, in which:

2

Fig.1 is an elevational view showing an improved heat exchanger assembly, made in accordance with this invention and especially adapted for use as a condenser for a mechanical refrigerator.

Fig. 2 is a sectional view taken along the plane of line 2—2 of Fig. 1.

Fig. 3 is a perspective of a fragmentary portion of the improved finned tube employed in this condenser.

Figs. 4 through 8 show various steps or operations performed in shaping an elongated member and assembling the same into a condenser unit or other heat exchanger device.

The drawings are to be understood as being more or less of a schematic character for the purpose of disclosing a typical or preferred form of the improvements and a method of making a condenser such as contemplated herein, and in said drawings like reference characters identify the same parts in the different views.

Referring first to Figs. 1 and 2, the improvements are shown to preferably comprise an elongated tubular member 10 formed by making reverse bends 10a in it at predetermined locations which provide, when assembled, a sinuous passageway for fluid such as the coolant media used in mechanical refrigerators. The tube 10 has side wings 11 preferably throughout its entire length, said wings projecting radially at opposite sides of the tube. At the outer margins of these wings there are outwardly diverging fins 12 which, as best shown in Fig. 2, have a V-shape cross-section. These fins 12, together with the wings 11, provide the tube with longitudinally disposed heat dissipating members projecting from opposite sides of the tube and each having a generally Y-shape cross-section.

By reversely bending the elongated member as at 10a a condenser assembly is produced wherein there are a plurality of straight longitudinal runs connected by these bends 10a as shown in Fig. 1. Throughout each of these runs the V-shaped fins 12 are in such positions that the outer margin of each fin is in close proximity to or contacting the margin of a fin on a next adjacent run, sub-

stantially in the manner illustrated in Fig. 2. The reentrant angle between a pair of fins 12 is wide enough so that the fin surfaces incline to such a degree they readily tend to shed dust, lint and other extraneous matter from them and thus prevent accumulations which are likely to seriously impair the efficiency of the unit.

The fins have L-shape clips or brackets 13 projecting away from the planes of their marginal regions. These clips perform the functions of spacers between adjacent fins in the different runs, so that by welding together the contacting portions of said clips the runs of the condenser are effectively held together as a unitary assembly.

A condenser or heat exchanger unit such as above described is fabricated from thin sheet metal, preferably in the form of two superimposed relatively narrow strips, having substantially identical cross-section and each strip being continuous throughout the runs of the condenser unit. Each flat metal strip 14 (Fig. 4) is passed between forming or shaping rollers which impart to it the cross-sectional shape shown in Fig. 5. The preferred shape comprises an arcuate or semi-circular central embossment defining half of tube 10 extending longitudinally of the blank with angular flat regions extending outwardly from each margin of the embossment. The angular flat regions which project outward from the sides of the arcuate embossment, are each of a wide flattened V-shape in cross section, with the respective portions of the V on each side of a longitudinal break 16 so that their planes intersect at the apex at an obtuse angle. The inner regions, which are next to the embossment, are in a common plane radial to said embossment and constitute the radial wings 11. The outer regions which are inclined oblique to the wings constitute the fin members 12 and incline upwardly from the plane of the blank on the same side of the blank as the semicircular embossment. The blank may then be acted on by notching dies which cut suitably shaped recesses or notches D in opposite longitudinal sides of the blank at predetermined spaced locations throughout its length as indicated in Fig. 6. Also, the corners of the blank alongside these recesses are punched out as shown to produce the L-shape clips or brackets 13. It will be noted that the notches D terminate at the inner margins of fins 12 so that they do not extend into the wing portions 11, the purpose of which will later be explained.

The succeeding steps in this method are effective to assemble two of the strips into a condenser unit. To do this two of the preformed strips of the desired length are superimposed in reversed relation one upon the other so that the wing portions 11 of one strip are in contact with the wing portions of the other strip with the fins 12 and embossments 10 extending in opposite directions away from the each other in the manner shown in Fig. 3. The two superimposed strips are fed through a suitable welding device such as schematically shown in Fig. 7 and the contacting wing surfaces 11 are united by seam welds F on each side of semicircular embossments thus providing a continuous tube 10 having extensions of Y-shape cross-section on each side thereof, the tube thus comprising the two embossments. The united strips are then given reverse bends at the regions of the notches D as shown schematically in Fig. 8. These reverse bends are such that the clips or brackets 13 are brought into contact and the tube 10 is of sinuous shape with its runs

parallel to each other and with curved ends connecting the runs. The portions of the wings 11 at the location of the reverse bends provide semicircular reinforcement webs or ribs for the tube 10 at these bends as clearly shown in Figs. 1 and 2. The arms of the L-shaped clips or brackets 13 are then united to each other by spot welding at the contacting faces. Thus, a sinuous structure is united in a unitary assembly with the outer margins of the fins 12 in close proximity to each other in the several runs of the condenser.

While the invention contemplated herein has been described in detail in its preferred form or embodiment, it will be apparent to persons skilled in the art, after understanding the improvements, that changes and modifications may be made therein without departing from the spirit or scope thereof. It is aimed in the appended claims to cover all such changes and modifications.

I claim:

1. A unitary condenser assembly having a plurality of straight runs and reverse bends joining said runs to each other, comprising two elongate members having approximately identical cross sections and arranged in a sinuous assembly, said members comprising metal strips having continuous central regions of semicircular cross section extending longitudinally of the strips for defining a cylindrical central tube; longitudinal wings at diametrically opposite sides of said semi-cylindrical regions and arranged with the wings of one strip superposed upon and attached to the corresponding wings on the other strip; said semi-circular central regions and said wings extending continuous throughout said sinuous assembly; a plurality of longitudinal fins on said strips extending obliquely outward from said wings, said fins on each strip diverging from each other and attached to the fins of an adjacent strip, said fins terminating at the ends of each run of said sinuous assembly; and means defining clips on said fins, and being arranged with the clips on one strip attached to the clips of the adjacent strip thereby to reinforce the attachment of said strips to each other for effecting the unitary assembly of said condenser.

2. A unitary condenser assembly as defined in claim 1 wherein each clip is an L-shape with one member attached to the fin and the other member is positioned flat against and attached to the corresponding member of the opposing clip.

3. A unitary condenser assembly having a plurality of straight runs and reversing bends joining said runs to each other, comprising two elongate members having approximately identical cross sections and arranged in a sinuous assembly, said members comprising metal strips having continuous central regions of semi-circular cross section extending longitudinally of the strips for defining a cylindrical central tube; longitudinal wings at diametrically opposite sides of said semi-cylindrical regions and arranged with the wings of one strip superposed upon and attached to the corresponding wings on the other strip; said semi-circular central regions and said wings extending continuous throughout said sinuous assembly; a plurality of longitudinal fins on said strips extending obliquely outward from said wings, said fins on each strip diverging from each other and the fins in adjacent runs converging outward toward each other and having their outer edges in contact thereby to define outwardly pointing V-shape sections between adjacent runs, said fins terminated at the ends of each run of said sinuous assembly; and means defining clips on said

fins, and being arranged with the clips on one strip attached to the clips of the adjacent strip thereby to reinforce the attachment of said strips to each other for effecting the unitary assembly of said condenser.

CORNELIUS G. VONK.

REFERENCES CITED

The following references are of record in the file of this patent:

UNITED STATES PATENTS

Number	Name	Date
1,708,615	Groehn	Apr. 9, 1929
2,107,031	Evans	Feb. 1, 1938
2,297,133	Burkhardt	Sept. 29, 1942
2,347,957	McCullough	May 2, 1944

FOREIGN PATENTS

Number	Country	Date
470,978	Great Britain	Aug. 25, 1937

OTHER REFERENCES

Ser. No. 300,820, Beck (A. P. C.), pub. May 25. 1943 (now abandoned).