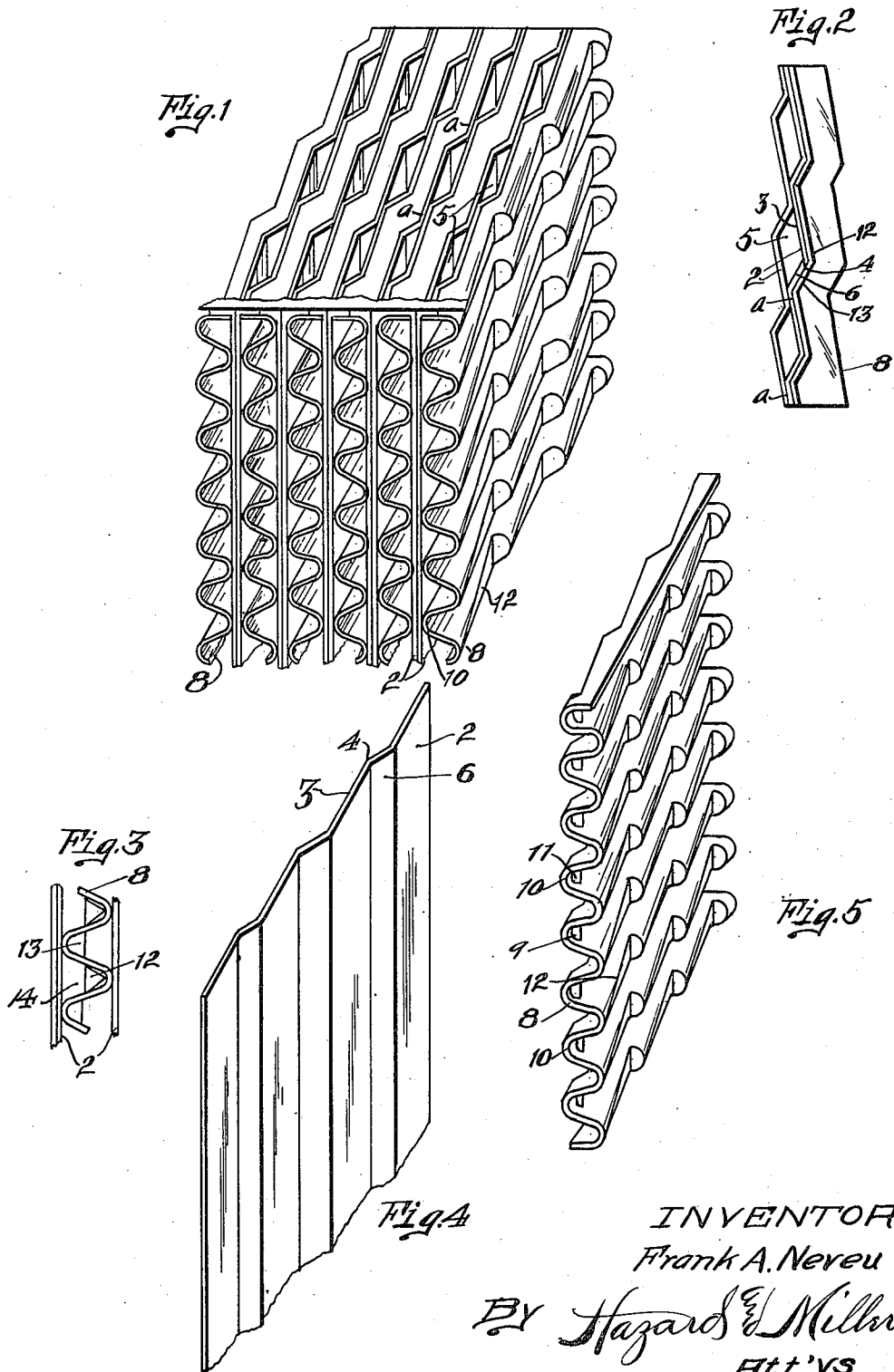


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RADIATOR.
APPLICATION FILED NOV. 7, 1919.

1,401,918.

Patented Dec. 27, 1921.



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RADIATOR.

1,401,918.

Specification of Letters Patent. Patented Dec. 27, 1921.

Application filed November 7, 1919. Serial No. 336,401.

To all whom it may concern:

Be it known that I, FRANK A. NEVEU, a citizen of the United States, residing at Los Angeles, in the county of Los Angeles and State of California, have invented new and useful Improvements in Radiators, of which the following is a specification.

This invention relates to water cooling apparatus and more particularly to the construction of radiators used for the cooling of water that circulates about, or in jackets of, internal combustion engines and has for its object to provide for a construction of this type in which the maximum cooling efficiency of water tubes is secured through a peculiar construction and arrangement of the elements which cooperate to form water tubes and air flues; and the invention consists of the features illustrated in the accompanying drawings and described and claimed hereinafter.

Figure 1 is a perspective looking toward the face of a fragment of a radiator of the improved construction.

Fig. 2 is a horizontal transverse section through the radiator construction showing but one pair of the tube forming strips and one of the flue forming strips.

Fig. 3 is an end or edge view of the structure in Fig. 2.

Fig. 4 is a perspective of a fragment of one of the vertical tube forming strips or panels.

Fig. 5 is a perspective of one of the air flue forming members.

In my application filed August 18, 1919, Serial Number 318,307, I showed one form of radiator in which the vertical water tubes were formed between oppositely disposed sheets or strips that are longitudinally corrugated, these strips being set in reversed positions in opposition to each other in a pair with the faces or lands between the corrugations in abutment or contact so that the opposite recesses or corrugations formed the passage ways or tubes through which the water may flow; each of the pairs of strips thus assembled being supported and spaced by air flue forming members that are transversely corrugated and the bases or ridges of the corrugations being bent or shaped so as to be complementary to the surface contour, transversely, of the contiguous tube forming strip on each side of the transverse air flue strip.

My present invention seeks to improve the

efficiency of the apparatus as disclosed in the above referred to application by the peculiar arrangement and construction of the parts to effect a circuitous flow of the air through the air flues, and this I accomplish as described below.

The radiator is built up of a suitable number of pairs of vertical strips or panels 2 the length and width of which may be determined according to the requirement, and these strips or panels are, preferably, made of quite thin material for the ready radiation of heat from the water.

Each of the strips or panels 2 of a pair is longitudinally fluted or corrugated from end to end, as plainly shown in Figs. 1 and 4, and these corrugations each have, preferably, one plane side or portion 3 of suitable angle with respect to the general plane of the surface of the strip, and the ridge of the corrugation which is indicated at 4 may be angular or slightly curved and thence the opposite and parallel side 6 of the corrugation is deflected again toward the general plane of the strip, so that the two sides will form substantially a space of triangular outline with respect to the general plane or surface of one side of the strip. All of the corrugations formed by the relatively angular surfaces 3—6 are symmetrical, and, preferably, the plane or surface 3 forming one longitudinal side of a corrugation is rather wider than the area of the other complementary wall or surface 6 for a purpose to be described hereinafter.

To construct the radiator a pair of the strips 2 is so placed that the ridges or hip portions 4 of each corrugation are disposed in reverse relation, as shown in Figs. 1 and 2, and having the respective flat portions 3 in juxtaposition and in longitudinally contacting relation, overlapping at the zones *a—*a** and with the hips or ridge portions 4 laterally offset to each other and thus forming between the parallel and opposite surfaces 3—3 and the similarly disposed surfaces 6—6, substantially, parallelograms. The vertical passage ways 5, thus formed, are open from top to bottom and are substantially straight and unobstructed and permit the rapid flow of the water to be cooled.

Interposed between each adjacent pair of the strips 2—2 are placed a series of spacing strips or members each of which is symmetrically corrugated, transversely, from face to face throughout the length of the

strip, and these corrugations form in combination with the outer surface of the strips 2 of each pair air passage ways or flues opening transversely from the front to the back of the radiator unit.

The construction of a spacing member or strip is clearly illustrated in Fig. 5 in which the strip is designated at 8, and in which the transverse corrugations are shown at 9, these corrugations being symmetrical with respect to the opposite faces of the strip or member 8 and are here shown as having curved ridges or hips 10 which form similarly curved valleys 11 between the walls of the successive corrugations. Obviously the spacing of the tube forming strips 2—2 in their assembled pairs will be determined by the depth of the corrugations 8.

It is an important object of the present invention to provide for the deflecting of the streams of air passing through the radiator so as to cause the same to act with maximum efficiency in absorbing the radiated heat from the water, and this I effectually secure by the present construction of the spacing member 8.

By referring to Figs. 2 and 5, it will be seen that the ridges 10 of each of the corrugations are inwardly deflected with respect to the ridge of the corrugation this deflection corresponding from end to end of each corrugation with the contour of the contiguous surface of the tube forming member 2 to which the spacing member is applied. Since a spacing member contacts along the tops of its ridges 10 with the adjacent strips 2 of contiguous pairs, it will be seen that the alternate hips or ridges 10 are designed to support the adjacent surface and contact therewith in a transverse line across the strip.

Inasmuch as the hips or crowns 4 of each pair of tube forming strips 2 are offset with respect to each other, as seen in Fig. 2, it will be obvious that the deflections above referred to in the alternate hips of the corrugations 9 will be offset with respect to each other, and this offsetting is plainly shown in Fig. 2 where the spacing strip is shown in transverse section and as having its deflected portion designated at 12 where it contacts with the adjacent plane face 3 of the contiguous vertical strip. Adjoining the deflection 12, which is relatively indented with respect to the ridge of its corrugation, the body of the corrugation is again deflected outwardly as at 13 to conform to the contour of the shorter longitudinal side or wall 6, Fig. 4.

As viewed edgewise in Fig. 3 the longer indented portion 12 of each corrugation appears as a triangular surface projecting inwardly into the air passage way or flue designated at 14 formed between the adjacent surface of a contiguous strip 2 and

a respective valley of a corrugation 9. When looking edgewise into the corrugation next above or below the passage way 14 there will appear a diaphragm or inwardly projecting portion 13 of substantially semi-circular form this being the surface presented by the outwardly deflected wall 13, Fig. 2.

When the several strips have been superposed or laid upon one another face to face in the manner above described the overlapping surfaces *a—*a** at the front and rear edges of the vertical strips, and the points of the transversely corrugated spacers are all thoroughly soldered together so as to make tight water joints to prevent leakage of the water, and the upper and lower ends of the several organized members are suitably bent or shaped over each other to form a tight closure at the upper end of the air spaces and leave open mouths, as shown in Fig. 1, for the inlet and outlet of water to the water tubes.

Various changes may be made without departing from the spirit of my invention as claimed.

I claim:

1. A water cooler or radiator for internal combustion engines, comprising corrugated, upright panels or sheets set face to face in pairs that are spaced vertically from each other, the corrugations extending vertically and forming, between the panels of each pair, continuous tubes for the flow of water; and flue forming spacers for supporting the adjacent panels of adjacent pairs, the spacers each being of a width substantially equal to the width of the panels and transversely corrugated, the ridges of the corrugations conforming to, and contacting with, the transverse sectional contour of an adjacent panel; the panels comprising each pair having their corrugations centrally offset as to the opposite panel.

2. A water cooler or radiator for internal combustion engines, comprising corrugated, upright panels or sheets set face to face in pairs that are spaced vertically from each other, the corrugations extending vertically and forming, between the panels of each pair, continuous tubes for the flow of water; and flue forming spacers for supporting the adjacent panels of adjacent pairs, the spacers each being of a width substantially equal to the width of the panels and transversely corrugated, the ridges of the corrugations conforming to, and contacting with, the transverse sectional contour of an adjacent panel; the panels comprising each pair having their corrugations centrally offset as to the opposite panel, the corrugations of each spacer being symmetrical and alternate throughout the length of the spacer.

3. A water cooler or radiator for internal combustion engines, comprising corrugated,

upright panels or sheets set face to face in pairs that are spaced vertically from each other, the corrugations extending vertically and forming, between the panels of each pair, continuous tubes for the flow of water; and flue forming spacers for supporting the adjacent panels of adjacent pairs, the spacers each being of a width substantially equal to the width of the panels and transversely corrugated, the ridges of the corrugations conforming to, and contacting with, the transverse sectional contour of an adjacent panel; the panels comprising each pair having their corrugations centrally offset as to the opposite panel, the deflections along the ridges of each corrugation forming barriers for air passing through the flues.

4. A radiator having vertical tube forming panels or strips, each constructed with a series of symmetrical longitudinal corrugations so that said corrugations form said tubes, each corrugation consisting of one flat face slightly angular to the general plane of the strip, the strips arranged in pairs and in reversed relation so that the said flat face of one corrugation is contiguous to and rests upon the similar face of the other strip.

5. In a radiator, a pair of corresponding vertically corrugated strips, abutting in nested arrangement with the ridges of the corrugations of one blank offset relative to ridges of the corrugations of the other blank to form vertical water spaces along one side

wall of each corrugation, a part of the other side wall being in contact with the corresponding side wall on the opposing strip and maintaining the first mentioned side wall in spaced relation to the corresponding side wall of the opposing strip so as to provide water passages therebetween, the other part of the last mentioned side wall constituting a wall of one of said vertical water spaces.

6. A radiator comprising, a pair of corresponding vertically corrugated strips, abutting in nested arrangement with the ridges of the corrugations of one blank offset relative to ridges of the corrugations of the other blank to form vertical water spaces along one side wall of each corrugation, a part of the other side wall being in contact with the corresponding side wall on the opposing strip and maintaining the first mentioned side wall in spaced relation to the corresponding side wall of the opposing strip so as to provide water passages therebetween, said pair of strips forming a unit adapted to be disposed parallel to a corresponding unit, the other part of the last mentioned side wall constituting a wall of one of said vertical water spaces, and a spacing fin adapted to be interposed between a pair of such corrugations.

In testimony whereof I have signed my name to this specification.

FRANK A. NEVEU.