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RADIATOR CORE STRUCTURE

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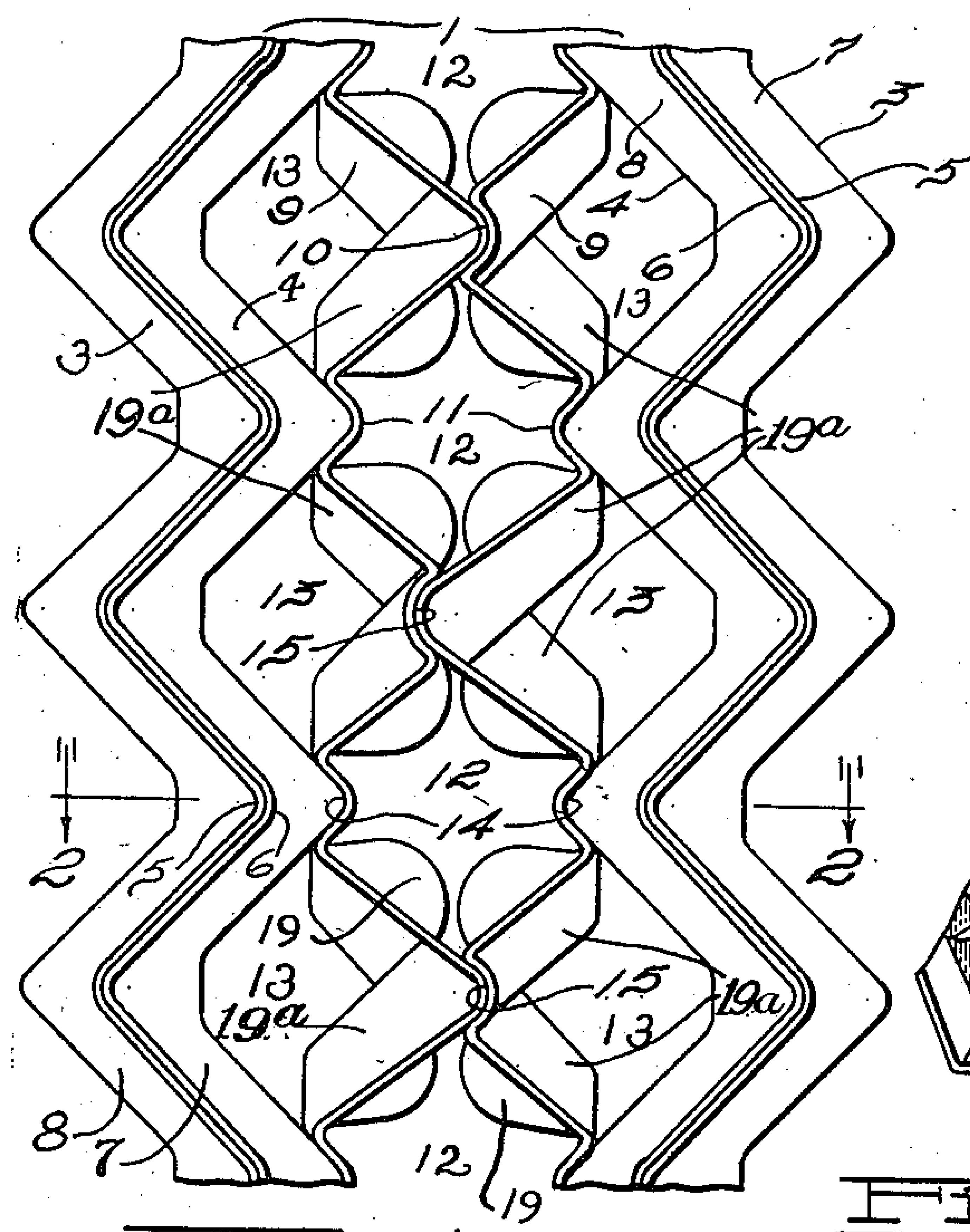

FIG. 1.

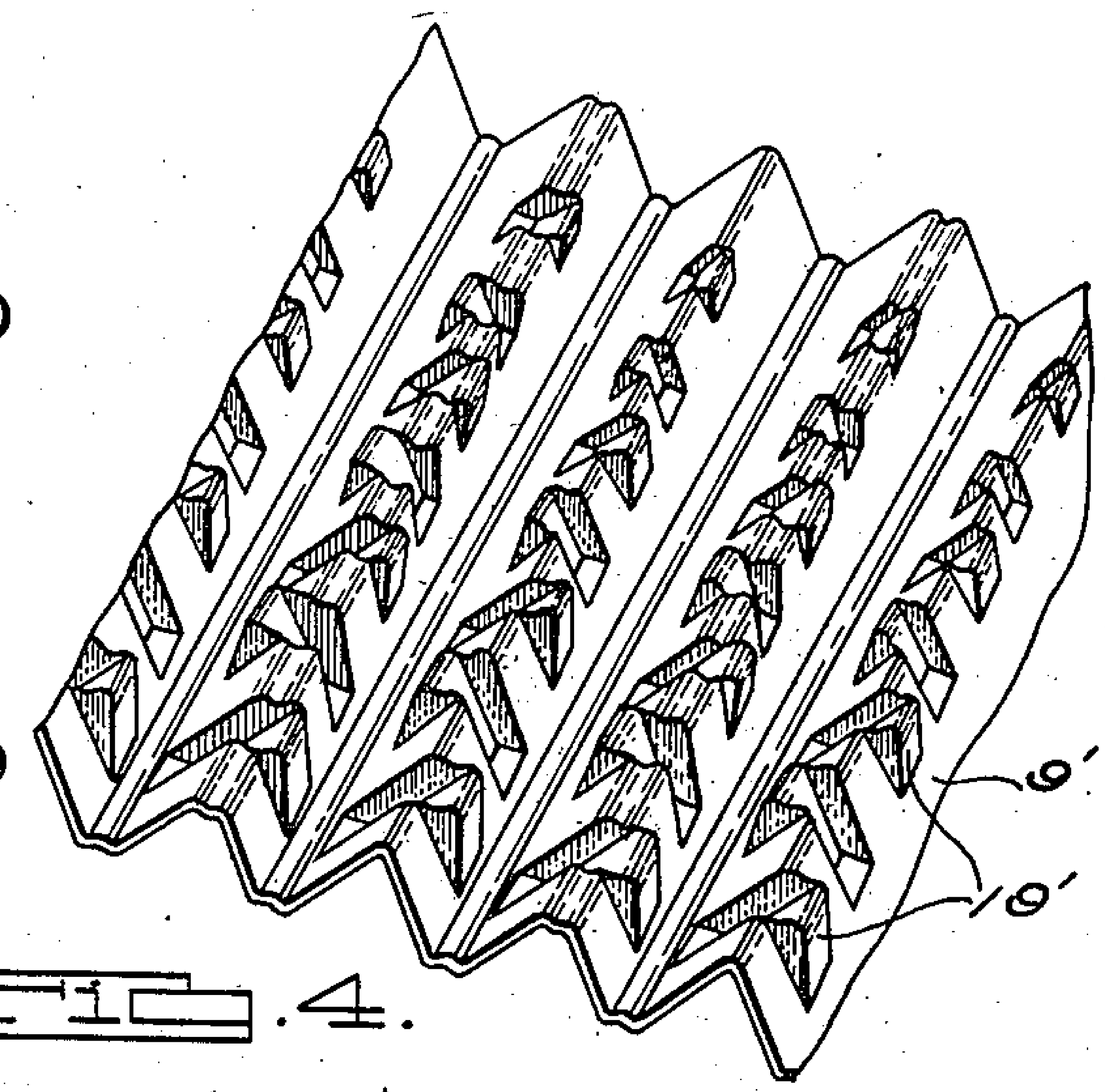

FIG. 4.

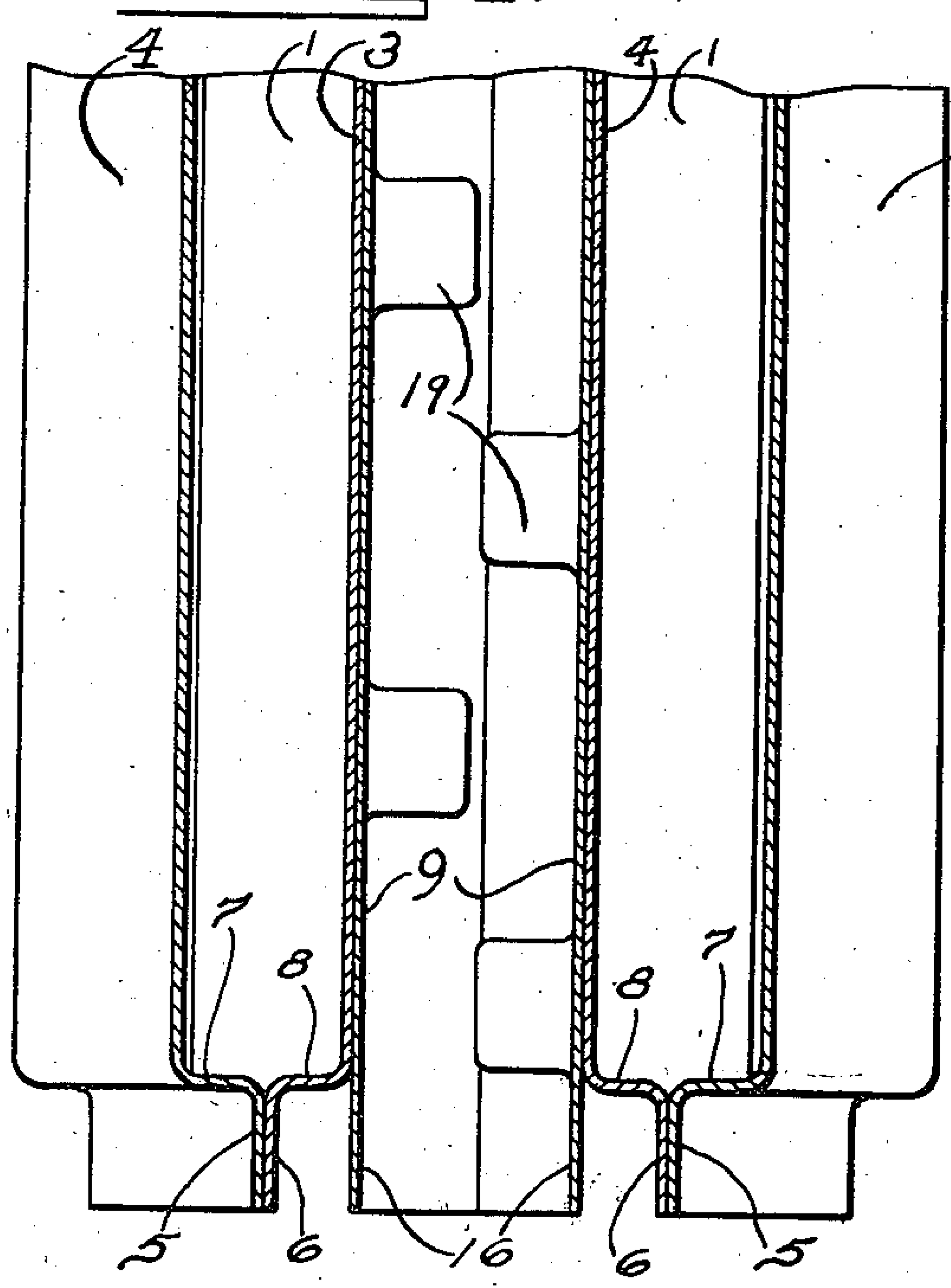

FIG. 2.

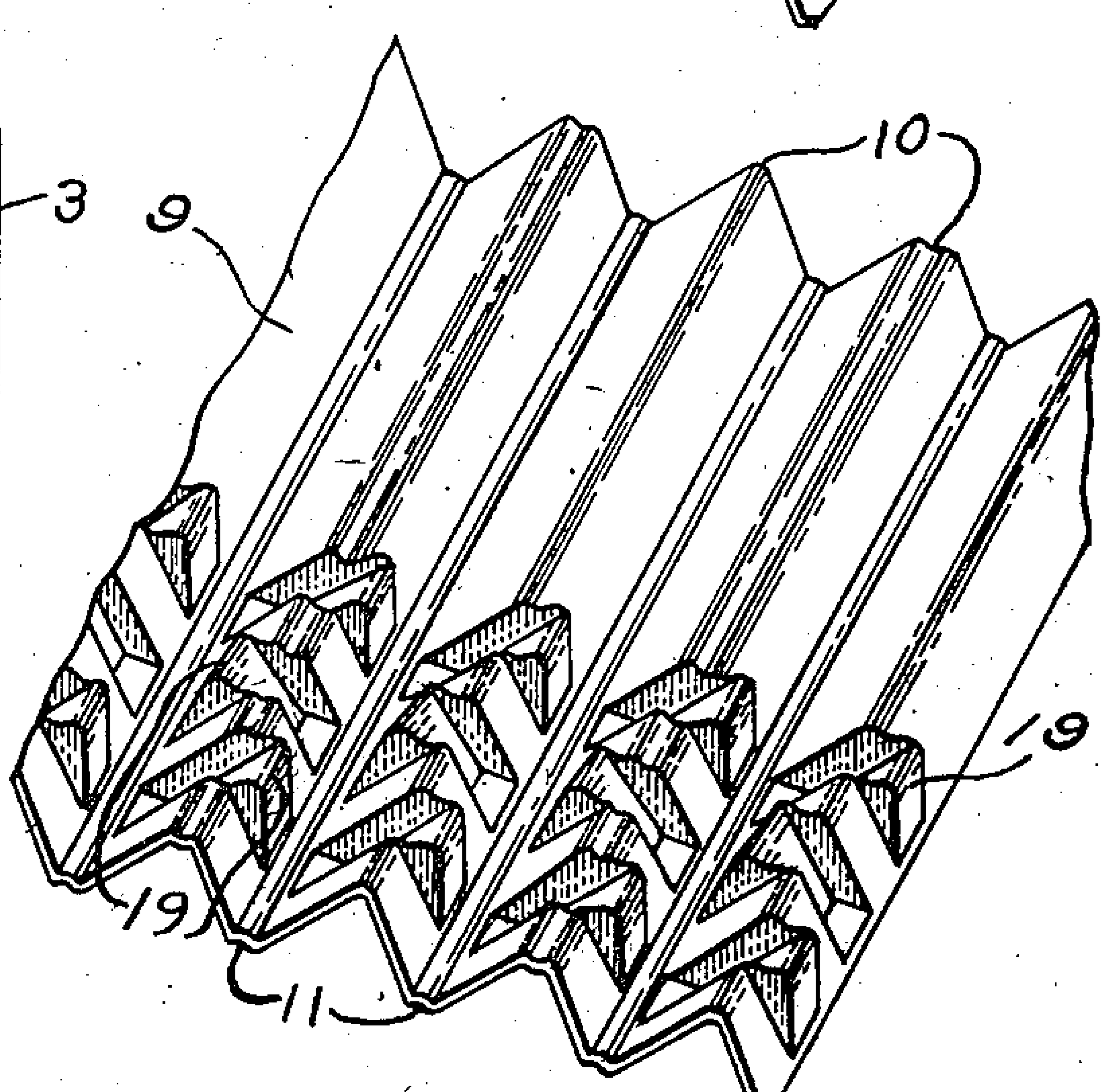

FIG. 3.

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UNITED STATES PATENT OFFICE

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RADIATOR CORE STRUCTURE

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2 Claims. (Cl. 257—130)

This invention relates to heat interchanger core structure of the type used in automobile radiators and particularly to improved spacer plates for radiator cores.

In radiator cores of the cellular type, it has become conventional practice to separate adjacent liquid passages by a pair of fluted spacer plates having adjacent convolutions contacting at alternate vertices with each other and having their intermediate spaced vertices contacting with the vertices of similar convolutions of the adjacent liquid passages. This arrangement provides three columns of cells between each pair of liquid courses, the cells of the outer and middle columns being called liquid bound and air bound cells, respectively.

The spacer plates are generally provided with protuberances which extend into the air and water bound cells for producing turbulence. Heretofore, it has been the practice to uniformly distribute protuberances of equal sizes throughout the depth of the cells and to determine the amount of turbulence by the size of the protuberances. Since the protuberances reduce the air flow through the cells, their size is necessarily limited, for increasing of the size of the protuberances beyond a certain limit causes a reduction in the air flow through the cells which reduces the cooling of the core more than the cooling is increased by the resulting increase in turbulence.

I have found that the turbulence producing means which are located at or near the entrance to the cells are tremendously more effective than the rearward protuberance, or other turbulence producing means. The effect of the rearward protuberance upon the turbulence of the air is insufficient to compensate for the loss of cooling by the obstruction which these protuberances offer to the passage of air. By employing a construction at the entrance to the cells which produce substantially violent turbulence, or by providing protuberances of substantially uniform size along only the forward portions of the spacer plates, sufficient turbulence is produced without obstructing the air flow to an extent which causes a loss in cooling effect greater than the amount that the cooling effect is augmented by the turbulence producing means of any one portion of the cells. This may also be accomplished by providing non-uniform protuberances which decrease in size from the front edges of the spacer plates to the rear edges thereof, or combining any of the above turbulence producing means in the same structure.

The main objects of the invention are to produce initial air turbulence in the cells of a radiator core; to provide turbulence producing means which extend over only that portion of the walls of the cell at which the cooling effect resulting from turbulence of the air flow is greater than the reduction or cooling effect caused by the obstruction offered to the air flow by the turbulence producing means; and to provide turbulence producing means on the walls of the cells which progressively decrease in size from the front to the rear end portions of the cells.

A further object of the invention is to provide shoulders between the entrances to adjacent water bound cells which serve as baffles and produce substantially violent initial turbulence as the air enters the cells.

An illustrative embodiment of the invention is shown in the accompanying drawing, in which:

Fig. 1 is a fragmentary front elevation of a radiator core which embodies my invention.

Fig. 2 is a horizontal section taken on the line 2—2 of Fig. 1.

Fig. 3 is a fragmentary perspective view of a spacer plate having initial turbulence producing means.

Fig. 4 is a fragmentary perspective view of a spacer plate which embodies a modified form of the invention.

In the form shown in Figs. 1 to 3, the radiator core structure includes spaced liquid courses, or conduits 1, each of which comprises a pair of convoluted sheet metal plates 3 and 4 having inwardly offset marginal portions 5 and 6 soldered together. Between the sides of the conduits and the offset marginal portions thereof are shoulders 7 and 8 which extend substantially normal to the sides of the conduits.

A pair of convoluted fins or spacer plates 9 are disposed between the conduits 1 with alternate vertices 10 and 11 of their convolutions contacting with each other and with the vertices of alternate convolutions of the conduits. This arrangement, as illustrated in Fig. 1, provides an intermediate, vertical column of air bound cells 12 and spaced vertical columns of liquid bound cells 13.

Formed in the vertices of the convolutions of the spacer plates 9 which contact with the convolutions of the water courses 1 are aligning creases 14 which extend from the front to the rear edges of the spacer plates. Alternate inner vertices of each spacer plate are provided with aligning grooves 15 in which the registering vertices of the other spacer plate are received.

The marginal edge portions 16 of the spacer plates 9 extend outwardly beyond the shoulders 8 of the water courses and they are substantially in the same planes as the corresponding intermediate portions of the sides of the convolutions of the spacer plates. With this construction, the shoulders 8 are not covered by the marginal portions of the spacer plates. Therefore, the amount of heating or cooling surface per unit cell is slightly increased, while the amount of material remains unchanged; this slight increase, however, becomes very appreciable when multiplied by the large number of cells which in an average radiator may amount to 8,000 or more. Further, these shoulders, which are located between adjacent liquid bound cells 13 of each column serve as baffles to produce a comparatively violent initial turbulence in the air flow at the entrance to the cells.

Numerous other advantages are obtained by permitting the marginal portion 16 of the spacer plates to protrude in a straight course beyond the shoulders and in spaced relation to the offset portions 5 and 6 of the plates 3 and 4 of the liquid conduits. With this construction, the vertices of each spacer plate may extend in a straight course from the front to the rear edges of the core structure and thus the spacer plates may be conveniently formed in production and shifted into proper alignment with the liquid conduits during assembly. However, with the conventional design in which the offset marginal portions on the spacer plates are present, great difficulty is experienced in production whenever the marginal portions at the front edge of the spacer plates are not equal in width to those at the rear edge. This condition occurs in production quite commonly and the marginal portions of the spacer plates, if too long at the front, project beyond the marginal portions 5 and 6 of the water course while at the rear edge the reverse condition occurs. By eliminating the offset marginal portions on the spacer plates, the dies by which these plates are formed are simplified and made less expensive to produce. Further, when the marginal portions of the spacer plates are changed and made to take a straight course, any unequal wearing of the dies which form these marginal portions, with respect to the dies which form the marginal portions 5 and 6 of the liquid conduit plates produces no trouble in production.

Further, with the spacer plates having offset marginal portions it becomes necessary to provide for a substantial clearance space between the shoulder of the plates of the liquid courses and the shoulder of the spacer plates, in order to assure continuous contact between the intermediate portions of the vertices of the spacer plates and liquid conduits. This clearance space obviously becomes filled with solder when the core structure is dipped in molten solder during its production. The presence of small recess of this type in which solder accumulates involves a waste of from two to six pounds of solder per core depending on the number of cells present at the front and rear faces. If these clearance spacers are reduced by forming the marginal portions of the spacer plates so as to substantially contact with the corresponding portions of the vertices of the spacer plates they tend to hold the intermediate portions of the vertices of the spacer plates from contacting properly with the registering vertices of the liquid conduits, and the difficulties of aligning and preventing unequal wear of the dies are increased.

The spacer plates 9 have protuberances 19 and 19^a which extend outwardly from opposite surfaces of the sides of the convolutions, respectively. These protuberances extend into the air bound and liquid bound cells and produce turbulence in the air flow therethrough. In the form shown in Fig. 3, the protuberances are provided on only the forward portions of the spacer plates so that as the air enters both the air bound and liquid bound cells, initial turbulence is produced by the exposed shoulders 8 and also by the protuberances 19. The rearward portions of the air bound and liquid bound cells are unobstructed. Thus, turbulence is produced depthwise in the cells in a manner which causes a limited reduction in the air flow through the cells and which does not reduce the cooling of the core more than the cooling is increased by the resulting increase in turbulence.

In the form shown in Fig. 4, the spacer plate 9' has convolutions substantially identical to those shown in Fig. 3, but the protuberances 19' are of non-uniform size. These protuberances are distributed throughout substantially the entire width of the spacer 9' and they decrease in size from the forward end portion of the spacer plate to the rearward end portion thereof. With this construction, turbulence is produced throughout the entire length of the cells, but the obstruction to the passage of air through the cells is decreased at the rearward portions thereof so as to prevent the obstruction offered by the protuberances from reducing the cooling effect, more than the turbulence which the protuberances create increases the cooling effect.

Although but several specified embodiments of this invention have herein been shown and described, it will be understood that various changes in the size, shape and arrangement of parts may be made without departing from the spirit of my invention and it is not my intention to limit the scope other than by the terms of the appended claims.

What I claim is:

1. A radiator core spacer plate including convoluted sheet metal, and series of protuberances extending from the wall of the convolutions of said spacer plate and decreasing in size progressively from the front to the rear edge portions thereof.

2. In a radiator core structure, a water course including a convoluted sheet metal plate having offset marginal portions and an intermediate shoulder at the front of said core structure, a spacer plate contacting with the vertices of said water course plate having marginal portions at the front of said core structure protruding beyond said shoulder and in alignment with the intermediate portions of said spacer plate, and protuberances on only the forward portions of said spacer plate for producing an initial turbulence in the air flow between said spacer plate and said water course plate.

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