O. S. BEYER.

METHOD OF MAKING SHEET METAL RADIATORS.

APPLICATION FILED MAY 28, 1910.

1,018,156.

Patented Feb. 20, 1912

3 SHEETS—SHEET 1.

Fig. 2.

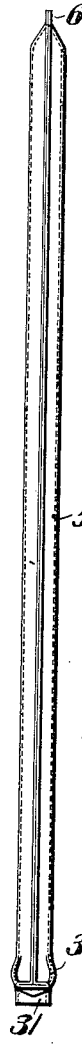


Fig. 1.

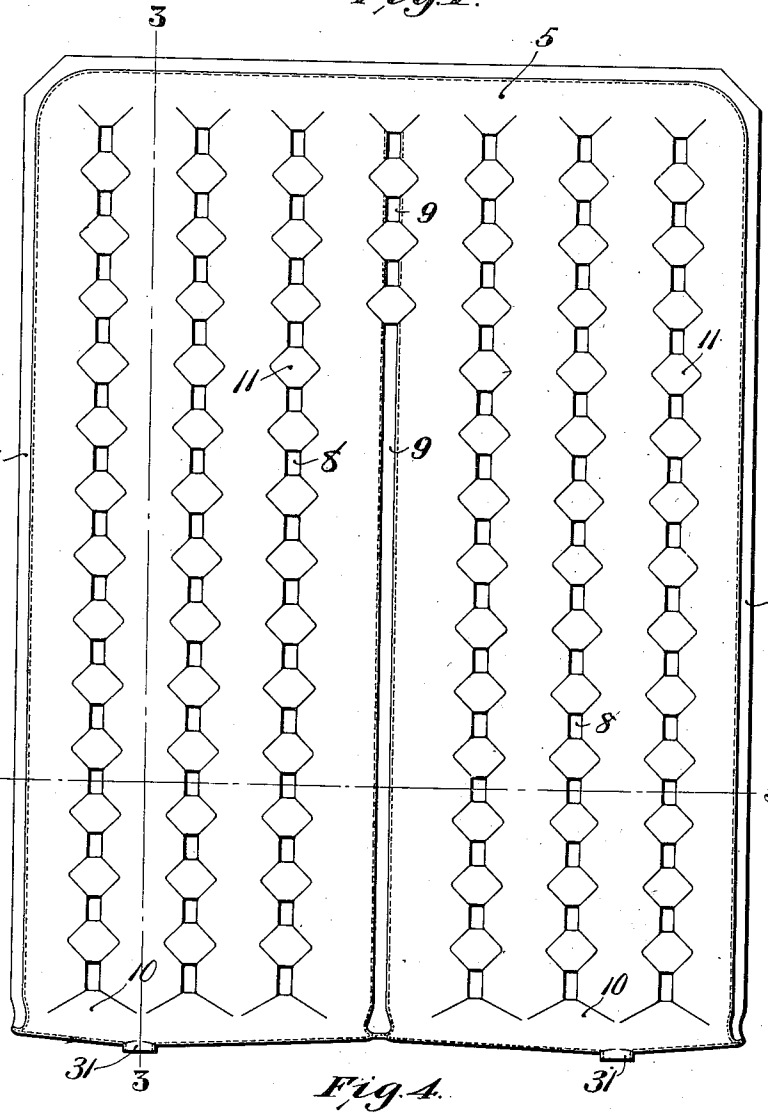


Fig. 3.

Fig. 4.

Fig. 5.

Witnesses:

E. C. Wurdeman

K. D. McPhail

Inventor:

Otto S. Beyer

by Phillips Van Everen & Fisher

Attys

O. S. BEYER.

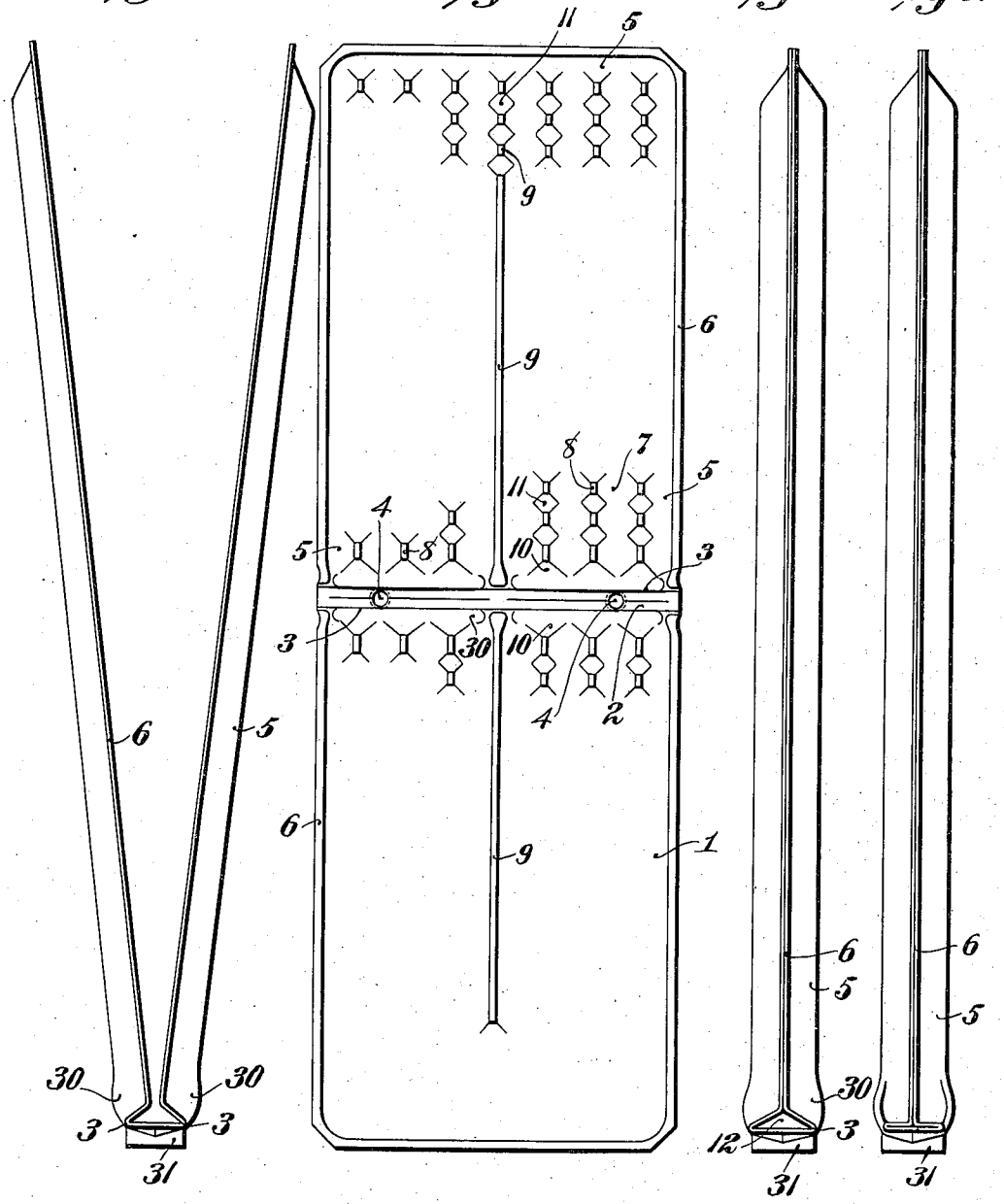
METHOD OF MAKING SHEET METAL RADIATORS.

APPLICATION FILED MAY 28, 1910.

1,018,156. Patented Feb. 20, 1912.

3 SHEETS—SHEET 2.

Fig. 7. Fig. 6. Fig. 8. Fig. 9.



Witnesses:

E. C. Curdemas

N. D. McShail

Inventor:

Otto S. Beyer

by Phillips Van Everen & Fish

Attys.

O. S. BEYER.

METHOD OF MAKING SHEET METAL RADIATORS.

APPLICATION FILED MAY 28, 1910.

1,018,156. Patented Feb. 20, 1912.

3 SHEETS—SHEET 3.

Fig. 10.

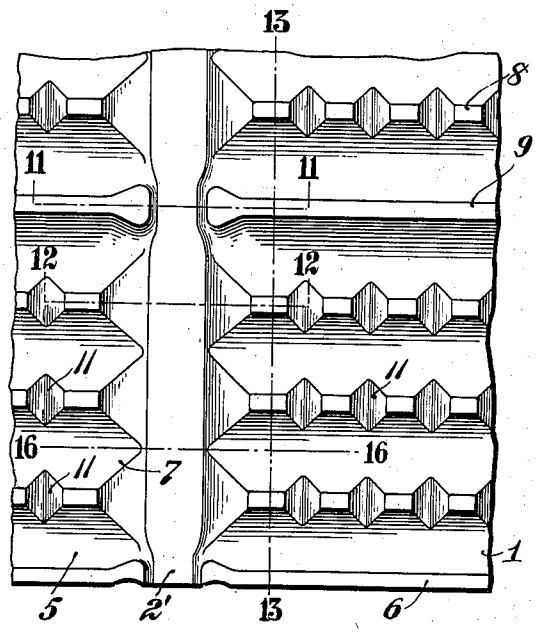


Fig. 15.

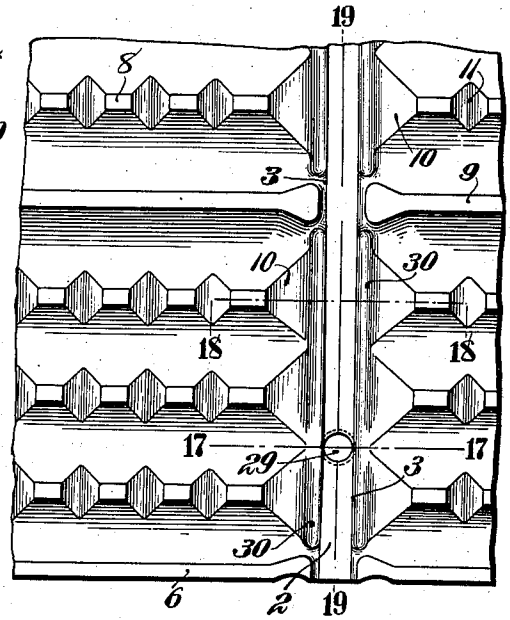


Fig. 11.

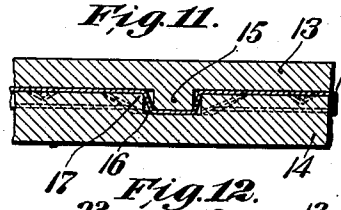


Fig. 14.

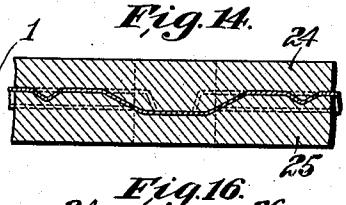


Fig. 17.

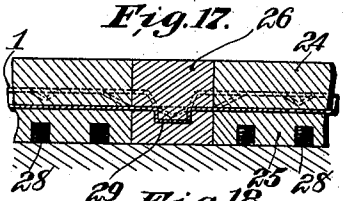


Fig. 12.

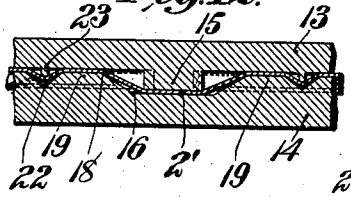


Fig. 16.

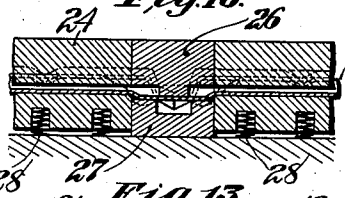


Fig. 18.

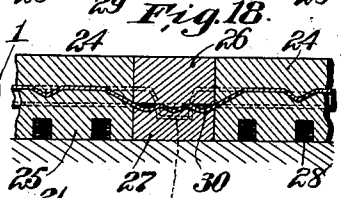
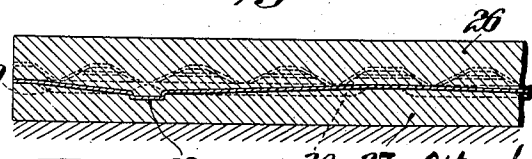


Fig. 13.

Fig. 19.



Witnesses:

E. C. Wurdemann

K. D. McPhail

Inventor:

Otto S. Beyer

by Phillips Van Everen & Fish

Attys

UNITED STATES PATENT OFFICE.

OTTO S. BEYER, OF HYDE PARK, MASSACHUSETTS, ASSIGNOR TO B. F. STURTEVANT COMPANY, OF BOSTON, MASSACHUSETTS, A CORPORATION OF MASSACHUSETTS.

METHOD OF MAKING SHEET-METAL RADIATORS.

1,018,156. Specification of Letters Patent. Patented Feb. 20, 1912.

Application filed May 28, 1910. Serial No. 563,849.

To all whom it may concern:

Be it known that I, OTTO S. BEYER, a citizen of the United States, residing at Hyde Park, in the county of Norfolk and State of Massachusetts, have invented certain new and useful Improvements in Methods of Making Sheet-Metal Radiators; and I do hereby declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same.

The invention relates to method of making sheet metal radiators or radiator sections.

The object of the invention is to provide an improved and novel radiator which may be conveniently and economically manufactured from comparatively thin sheet metal, and which will be durable and not liable to become defective or leaky under long continued use.

To these ends the invention consists in the features hereinafter described and set forth in the claims, the advantages of which will be obvious to those skilled in the art from the following detailed description.

The various features of the invention will be readily understood from an inspection of the accompanying drawings, and the following detailed description of the radiator shown therein and of the method of making the same.

In the drawings Figure 1 is a side view of a preferred form of radiator made in accordance with the present invention; Fig. 2 is a side edge view of the radiator; Fig. 3 is a vertical section on line 3—3, Fig. 1; Fig. 4 is a bottom view of the radiator; Fig. 5 is a sectional view on line 5—5, Fig. 1; Fig. 6 is a view showing one side of the sheet metal plate from which the radiator is formed after it has been bent and shaped preparatory to folding it; Fig. 7 is an edge view of the plate after the folding has been partially completed; Fig. 8 is an edge view after the folding has been completed to bring the marginal flanges together and before the marginal portions of the plate between the fold lines have been brought together; Fig. 9 is a similar view after the marginal portions of the plate between the fold lines have been closed together; Fig. 10 is an enlarged view showing a part of the central portion of the plate shown in Fig. 6 after it has been partially bent and shaped; Fig. 11 is a sectional view on line 11—11, Fig. 10, showing the plate and the dies for bending the plate in section; Fig. 12 is a similar view on line 12—12, Fig. 10; Fig. 13 is a similar view on line 13—13, Fig. 10; Fig. 14 is a sectional view on a line corresponding to line 12—12, Fig. 10, showing the manner in which the clamping plates used in reshaping the plate may be formed; Fig. 15 is a view similar to Fig. 10, showing a part of the central portion of the plate after the bending and shaping has been completed, preparatory to the folding of the plate; Fig. 16 is a sectional view on a line corresponding to 16—16, Fig. 10, showing the plate in position between the dies which rebend the central portion of the plate into the form shown in Fig. 15 before the dies have acted on the plate; Fig. 17 is a sectional view on line 17—17, Fig. 15, showing the plate and rebending dies in section; Fig. 18 is a similar view on line 18—18, Fig. 15; and Fig. 19 is a similar view on line 19—19, Fig. 15.

In accordance with the present invention the radiator is formed by bending and folding a single sheet metal plate, and securing together the contacting faces of the two end sections of the plate after it has been folded. As shown in the drawings the sheet metal plate 1 (Fig. 6) is bent and shaped by suitable dies to form a transverse depression 2 which extends across the central portion of the plate. This depression is so shaped that it is provided with two parallel fold lines 3 which extend transversely across the plate at equal distances from the center of the plate. The transverse depression is provided with one or more ports 4 between the fold lines, there being two of such ports in the specific embodiment of the invention illustrated. The bottom of the transverse depression is so shaped that it increases in depth toward the ports in either direction. In the embodiment shown the bottom of the depression is of less depth at its ends and center and gradually increases in depth until it intersects the port. The bottom of the depression is also substantially flat at its ends and center, and slopes from the fold lines toward the center. The fold lines therefore are straight and lie in the same plane as the bottom of the transverse depression at its ends and center. The plate is also bent by suitable dies to form semi-tubular depressions 5 which extend from the

transverse depression along the edges of the plate at a short distance from the extreme edge, so as to leave marginal flanges 6 about the edge of the plate. These marginal flanges also extend from the transverse depression about the edge of the plate. The plate is also bent and shaped by the dies to form semi-tubular depressions 7 which extend from the transverse depression to those parts of the marginal depressions 5 which are parallel to the transverse depression. The semi-tubular depressions 7 are so located that intermediate flat surfaces 8 and 9 are formed between the depressions extending in lines at right angles to the transverse depression 2. The surface of the plate slopes from the flat surfaces 8 toward the fold lines, as indicated at 10. The plate is also bent to form transverse semi-tubular depressions 11 connecting the tubular depressions 7 and 5, and dividing the flat surfaces 8 and the upper portion of the flat surfaces 9, into small rectangular spots. After the plate has been thus bent and shaped by the dies in a manner which will be hereinafter more fully explained, the plate is folded along the two fold lines 3, as indicated in Figs. 7 and 8, to bring the marginal flanges 6 and flat surfaces 8 and 9 into contact with each other. When the plates have been thus folded, a hollow plate or radiator section is formed which is completely closed except at the ports 4 and at the ends of the fold lines. At the ends of the fold lines there will be on each side of the radiator section a triangular opening 12, as indicated in Fig. 8. These openings are closed by forcing together the marginal portions of the plate between the fold lines, as indicated in Fig. 9. The marginal flanges and the contacting spots or surfaces 8 and 9 are then secured together as by electric welding, riveting, or in any suitable manner.

In case the inlet and outlet ports for the radiator are both formed in the transverse depression 2 which becomes the bottom of the completed radiator, it is preferred to form the continuous flat surfaces 9 about midway of the plate, and to close together the surfaces of the plate at the inner ends of the surfaces 9 after the plate has been folded. After the plate has been folded there will be a small triangular opening similar to the opening 12 at the inner ends of the surfaces 9, and this may be closed in the same manner that the openings 12 are closed. By this construction the steam or other heating fluid is compelled to flow up one side of the contacting surfaces 9 to the depressions 11 at the upper ends of the surfaces 9, and down the other side. By forming the transverse depression 2 so that its depth increases toward the ports, any water which may collect in the radiator will flow away from the joints and toward the ports. There will be no collection of moisture, therefore, in any of the joints, and no danger of corrosion and rapid wearing and eating away of the metal.

In bending and shaping the sheet metal plate to form the central transverse depression with parallel fold lines, as above described, it is preferred to first bend the plate to form a central transverse depression of substantially uniform depth and having a substantially flat bottom, and to then rebend the depressed central portion of the plate to form the fold lines and give it the shape above referred to. The preferred method of bending and shaping the plate is illustrated in Figs. 10 to 18. In accordance with the method here illustrated, the sheet metal plate is first subjected to the action of the bending dies 13 and 14 which form the transverse depression 2′ and the semi-tubular depressions 5, 7 and 11. The transverse depression 2′ is formed by a bending rib 15 on the male die 13 constructed to enter a transverse groove 16 in the female die, and to bend the plate over the shoulders 17 at the ends and center of the groove, and over the bending shoulders 18 at points intermediate the ends and center. The female die is provided with ribs 19 and intermediate depressions 20, while the male die is provided with bending ribs 21 registering with the depressions 20. The ribs 19 are provided with transverse depressions 22 which register with transverse bending ribs 23 on the male die. The ribs 19 and 21 coöperate in bending the plate to form the semi-tubular depressions 5 and 7, and the bending ribs 23 coöperate with the depressions 22 in forming the transverse tubular depressions 11. The dies are so shaped that the marginal flanges 6 and the flat surfaces 8 and 9 are in the same plane. It is also preferred to so shape the dies that the transverse depression 2′ is slightly greater in depth than the depth of the semi-tubular depressions 5 and 7, as indicated by the dotted lines in Figs. 11, 12 and 13. In forming the transverse depression 2′ in the manner described, there is practically no stretching and thinning of the metal at the central portion of the plate where the transverse depression is formed. After the transverse depression 2′ has thus been formed the central portion of the plate is subjected to the action of rebending dies which rebend the central portion to give the transverse depression the shape already described with reference to Fig. 6, and which is also shown in Fig. 15. During this reshaping of the central depressed portion of the plate the sections of the plate on the opposite sides of the central portion are preferably held by clamping plates which are shaped to fit the opposite sides of the plate. The rebending dies are so shaped that they rebend the central depressed portion of the

plate to form the straight transverse fold lines, and to give the bottom of the depression the form already described, without stretching or thinning the metal. By thus forming the transverse depression, and then rebending it to give it its final shape, the full thickness and strength of the sheet metal plate are preserved at the bottom of the finished radiator, where thickness and strength are the most desired, and a thinner plate may therefore be utilized in making the radiator than would otherwise be practicable.

The clamping plates for holding the sheet metal plate during the rebending of the central portion may be conveniently formed by using a plate after it has been bent into the shape indicated in Fig. 10 as a pattern for casting the two clamping plates 24 and 25, as indicated in Fig. 14, and then removing the central portion of the clamping plates, as indicated in dotted lines in this figure. The rebending dies 26 and 27 are arranged between the sections of the clamping plates 24 and 25, as indicated in Figs. 16 to 18. In order that the clamping plates may engage and clamp the sheet metal plate before the rebending dies act to rebend the central portion of the plate, the clamping plates 25 are supported upon springs 28. The rebending dies are so shaped that in rebending the central portion of the sheet metal plate they bring the bottom of the depression at its ends and center into the same plane as the bottoms of the semi-tubular depressions 5 and 7, form cylindrical projections 29 for the ports 4, form the straight parallel fold lines 3 which lie in the same plane as the bottoms of the depressions 5 and 7, and shape the metal between the fold lines so that the bottom of the transverse depression gradually increases in depth from the ends and center of the transverse depression toward the ports. In rebending the central depressed portion of the plate the extra metal between the fold lines and the ends of the clamping plates 24 and 25 forms the curved bulges 30 which are the most pronounced at the points where the transverse depression is of the least depth and gradually disappear toward the points where the depth of the transverse depression is the greatest. The formation of these bulges is merely incidental to providing sufficient metal in the transverse depression 2′ to enable the rebending at the point where the depression 2 is the deepest without stretching and thinning the metal at this point. After the plate has been acted upon by the rebending dies, the port projections 29 are pierced, and the metal bent outward to form the nipples 31. Sleeves or unions may be brazed or otherwise secured to these nipples, so that the supply and exhaust pipes may be conveniently connected to the radiator.

While a construction has been shown and described in which both the supply and exhaust ports are formed in the bottom of the radiator, and the radiator is divided into two sections by contacting surfaces 9 which extend from the bottom nearly to the top of the radiator, it will be understood that this construction is not essential, and that if found desirable one of the ports may be otherwise located, and the dividing contacting surfaces omitted. It will also be understood that the specific construction of the radiator, and the specific manner in which the bending is done, is not material except so far as it is set forth in the claims, and may be varied without departing from the broader features of the invention.

Having explained the nature and object of the invention, and specifically described one embodiment thereof, what I claim is:—

1. The method of making sheet metal radiators consisting in bending a sheet metal plate to form a central transverse depression provided with parallel fold lines, with one or more ports between the fold lines, and with its bottom between the fold lines increasing in depth toward the ports in either direction, and to form marginal flanges and marginal semi-tubular depressions extending from the ends of the transverse depression, and semi-tubular depressions extending from the transverse depression to the parallel marginal depressions, folding the plate on the fold lines to bring the marginal flanges together, closing together the marginal portions of the plate between the fold lines, and securing the contacting surfaces of the plate together, substantially as described.

2. The method of making sheet metal radiators consisting in bending a sheet metal plate to form a central transverse flat-bottom depression of substantially uniform depth, marginal flanges and marginal semi-tubular depressions extending from the ends of the transverse depression and semi-tubular depressions extending from the transverse depression to the parallel marginal depressions, rebending the depressed central portion of the plate to form transverse parallel fold lines, and one or more ports between the fold lines, and to gradually increase the depth of the transverse depression toward the port or ports in either direction, folding the plate on the fold lines to bring the marginal flanges together, closing together the marginal portions of the plate between the fold lines, and securing the contacting surfaces of the plate together, substantially as described.

3. The method of making sheet metal radiators consisting in bending a sheet metal plate to form a transverse depression provided with parallel fold lines with one or more ports between the fold lines and

with its bottom between the fold lines increasing in depth toward the port or ports in either direction, and to form marginal flanges and semi-tubular depressions extending at substantially right angles from the transverse depression, and to form transverse depressions between said semi-tubular depressions, folding the plate on the fold lines to bring the marginal flanges together, closing together the marginal portions of the plate between the fold lines, and securing the contacting surfaces of the plate together, substantially as described.

4. The method of making sheet metal radiators consisting in bending a sheet metal plate to form a central transverse depression of substantially uniform depth and to form marginal flanges and semi-tubular depressions extending at substantially right angles from the transverse depression and transverse depressions connecting said semi-tubular depressions, rebending the depressed central portion of the plate to form transverse parallel fold lines and one or more ports between the fold lines and to gradually increase the depth of the transverse depression toward the port or ports in either direction, folding the plate on the fold lines to bring the marginal flanges together, closing together the marginal portions of the plate between the fold lines, and securing the contacting surfaces of the plate together, substantially as described.

5. The method of making sheet metal radiators consisting in bending a sheet metal plate to form a transverse depression provided with parallel fold lines with one or more ports between the fold lines and with its bottom between the fold lines increasing in depth toward the port or ports in either direction and to form marginal flanges and semi-tubular depressions intersecting the transverse depression and separated by flat surfaces in the plane of the marginal flanges and to form transverse depressions connecting the semi-tubular depressions, folding the plate on the fold lines to bring the marginal flanges and flat surfaces together, closing together the marginal portions of the plate between the fold lines, and securing the contacting surfaces of the plate together, substantially as described.

OTTO S. BEYER.

Witnesses:
E. B PELLMAN,
F. HERLAN.