

Feb. 27, 1934.

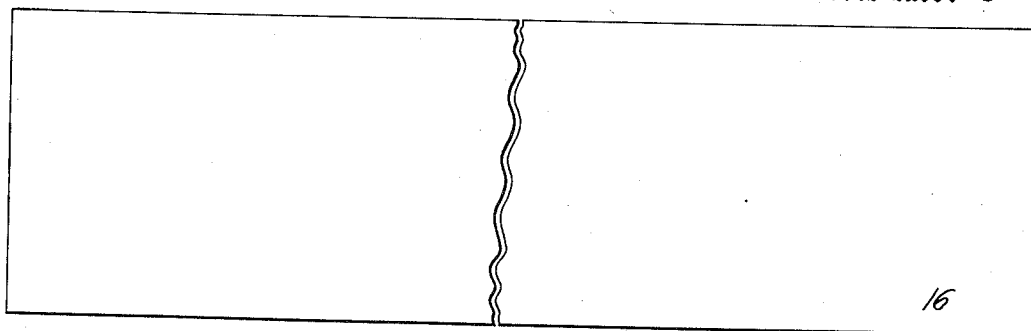
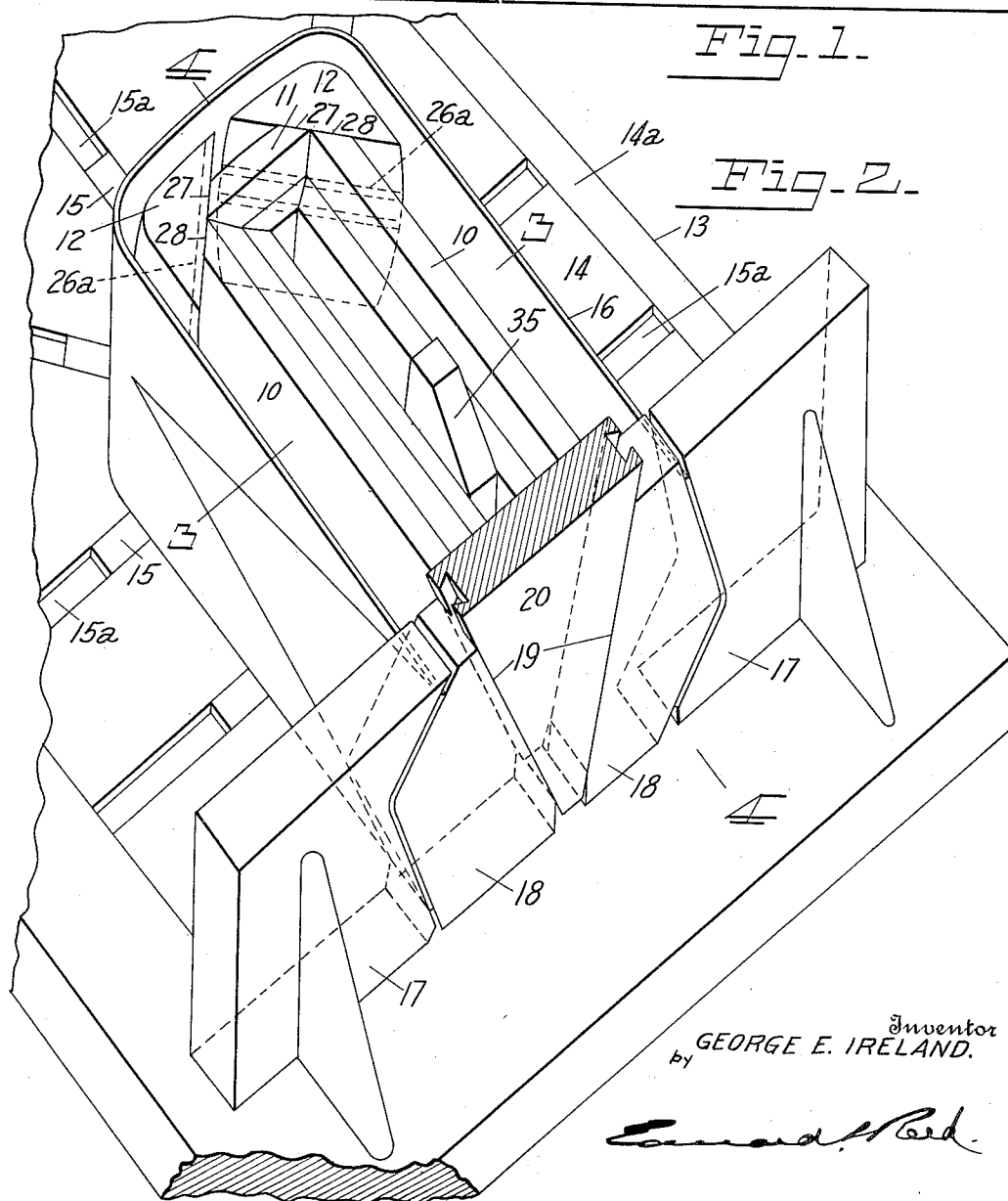
G. E. IRELAND

1,948,918

METHOD AND APPARATUS FOR PRODUCING RADIATOR SHELLS AND THE LIKE

Filed April 6, 1932

3 Sheets-Sheet 1



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Feb. 27, 1934.

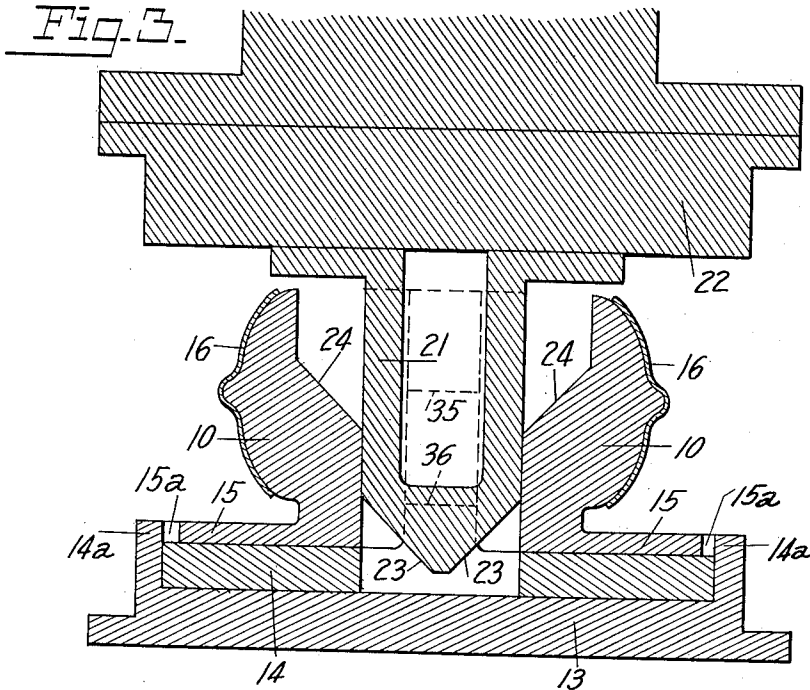
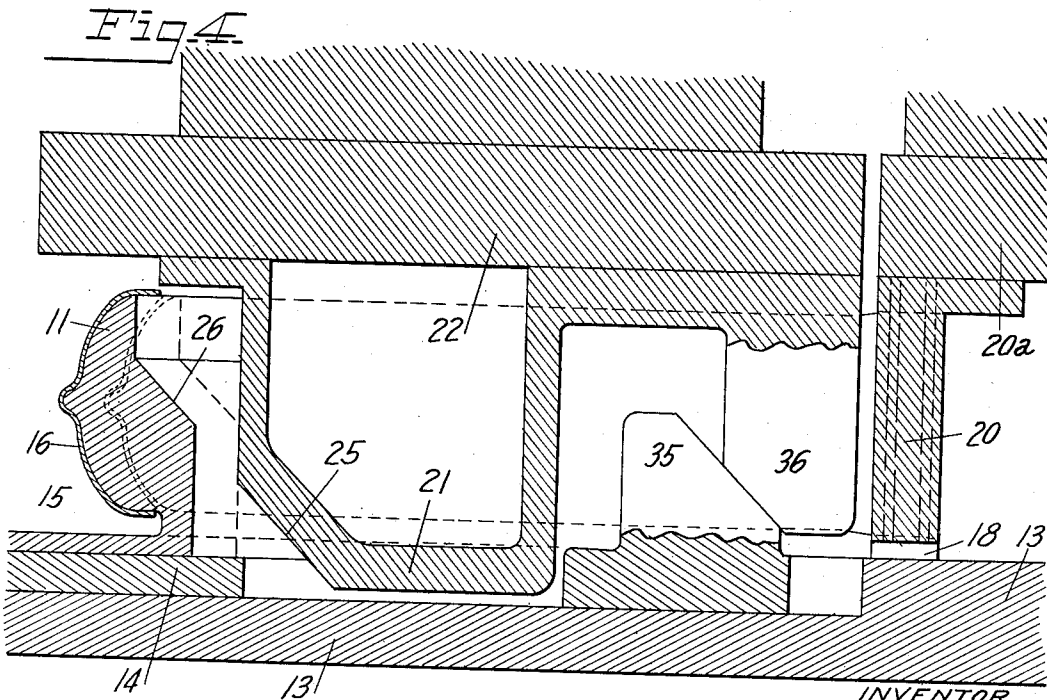
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METHOD AND APPARATUS FOR PRODUCING RADIATOR SHELLS AND THE LIKE

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3 Sheets-Sheet 3

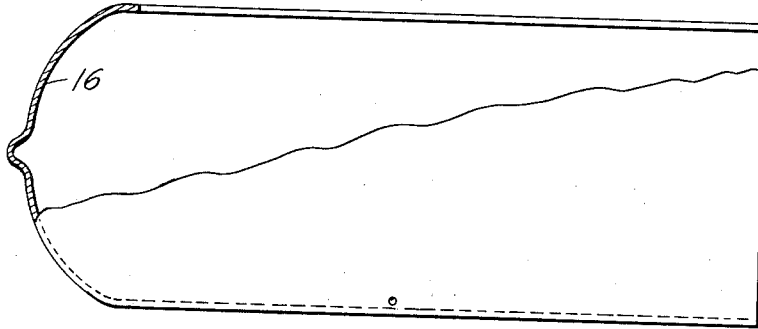


Fig. 6.

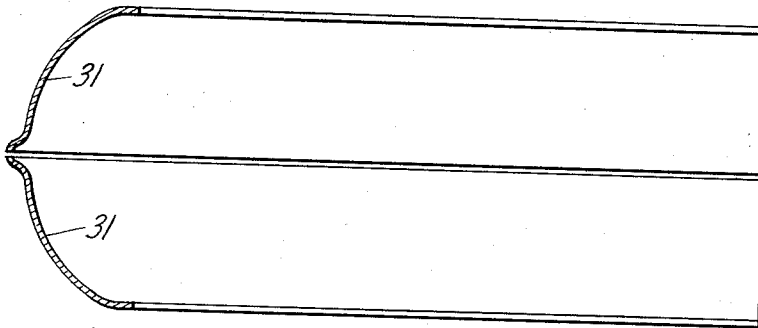
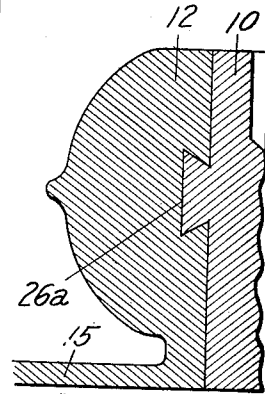


Fig. 5.

Fig. 7.

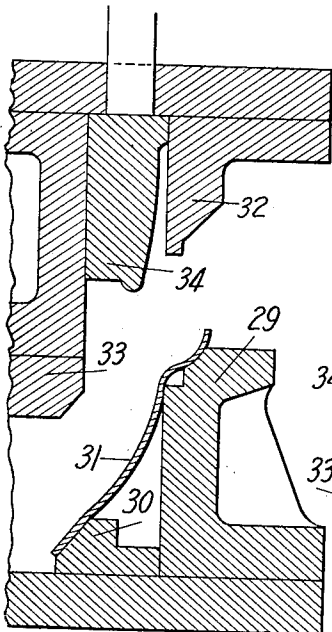


Fig. 8.

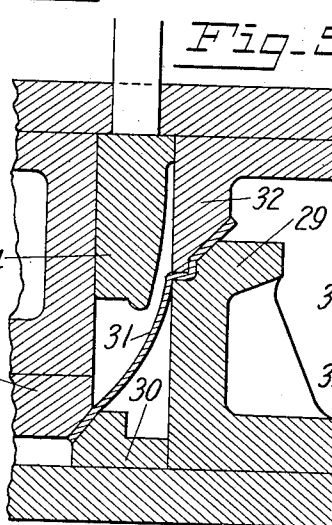


Fig. 9.

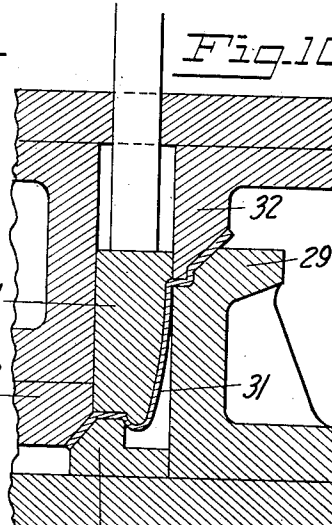


Fig. 10.

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UNITED STATES PATENT OFFICE

1,948,918

METHOD AND APPARATUS FOR PRODUCING RADIATOR SHELLS AND THE LIKE

George E. Ireland, Toledo, Ohio; Edith May Ireland and Dwight B. Ireland executors of said George E. Ireland, deceased

Application April 6, 1932. Serial No. 603,602

14 Claims. (Cl. 113—48)

This invention relates to a method and apparatus for producing radiator shells and the like and more particularly for producing sheet metal shells of a U-shape.

5 In the production of radiator shells it is customary to first provide a preliminary partially formed shell which is then given its final form by a separate operation or operations. The methods heretofore employed for producing this preliminary shell have been such as to require a number of operations and in many cases the exterior surface of the shell would be marred by die marks or wrinkles so as to prevent the same from taking the high finish desired. Further, these preliminary shells have been formed from large sheets of metal and the surface characteristics of metal which has been rolled in large sheets differs substantially from the surface characteristics of metal which is rolled in relatively narrow strips and the latter will take a much higher finish than will the former. Moreover in forming the shells from large sheets of metal there is always a considerable waste of metal.

15 One object of the present invention is to provide a method whereby a shell of this kind can be quickly and easily produced at a low cost and without waste of material.

20 A further object of the invention is to provide a method whereby U-shaped shells may be formed from a flat narrow strip of metal.

25 A further object of the invention is to provide a method whereby two preliminary shells may be formed simultaneously from a single strip of metal.

30 A further object of the invention is to provide a method whereby shells of this kind may be produced without marring the exterior surface thereof in any manner.

35 A further object of the invention is to provide a simple and efficient apparatus for carrying out the method.

40 Other objects of the invention will appear as the apparatus is described in detail.

45 In the accompanying drawings Fig. 1 is a plan view, partially broken away, of the initial blank or strip of metal from which the shells are to be formed; Fig. 2 is a perspective view of the lower portion of an apparatus for forming the shell; Fig. 3 is a section taken on the line 3—3 of Fig. 2; Fig. 4 is a section taken on the line 4—4 of Fig. 2; Fig. 5 is a sectional detail view of one of the corner die members; Fig. 6 is a side elevation, partly in section, of two preliminary shells formed in one piece; Fig. 7 is a sec-

tional view showing the two preliminary shells separated to form separate shells; and Figs. 8, 9 and 10 are sectional detail views of devices for imparting final form to the shells, showing the successive steps of the operation.

60 In forming a U-shaped shell for a radiator, or other purpose, I provide a flat strip of metal and bend the same into a U-shape conforming substantially to the general contour of the finished shell. This U-shaped strip is then placed about 65 an internal forming device and the end portions thereof firmly clamped to hold the same against movement. Preferably the clamping means is of such a character that it will also impart an initial form to the end portions of the shell. 70 While the strip is held by the clamping device the forming device is actuated to expand the body of the strip to the desired cross sectional shape. When, as in the present instance, two preliminary shells are formed simultaneously 75 from a single strip of metal the initial strip is of such a width as to permit the two shells to be formed edge to edge and the forming device will draw the intermediate longitudinal portion of the strip outwardly beyond the edges thereof 80 so as to cause the lateral portions of the strip to slope from an intermediate longitudinal line toward the respective edges thereof. When the strip has been so formed it is removed from the clamping devices and severed along a central longitudinal line to separate the same into two partially formed shells and these partially formed shells are then subjected to the action of forming devices to complete the formation thereof.

85 In the accompanying drawings I have illustrated one form of apparatus for carrying out the method to produce a radiator shell of the particular type shown. It will be understood, of course, that the shell may take various cross sectional shapes and that the apparatus may take 90 different forms without departing from the spirit of the invention.

95 As shown in the drawings the apparatus comprises an internal forming device which is in some respects similar to the forming device shown 100 in my copending application filed April 4, 1932, Serial No. 602,884, but is designed to operate on an open ended or U-shaped shell instead of a shell having both ends closed. This internal forming device comprises side die members 10, 105 an end die member 11 and corner die members 12. The several die members are supported on a base 13 for movement thereon relatively one to the other. In some cases the die members may be mounted directly on the base but when it 110

is desired to expand the end wall of the shell to a greater extent than the side walls are expanded it is preferable that a part or all of the die members shall be mounted on a supplemental support which is movable with relation to the base. In the present apparatus I have mounted the several die members on a plate 14 which is mounted on the base 13 for movement with relation thereto in the direction of the length of the shell. Each die member is movable relatively to the plate and may be mounted thereon in any suitable manner. The plate 14 is here shown as mounted in a guideway formed by flanges 14a on the base and each die member has rigidly connected therewith a gib or slide block 15 which is mounted in a groove 15a in the base. Mounted on the base 13, adjacent to that end of the forming device opposite the end die member, is a clamping device adapted to engage the end portions of a U-shaped strip 16 which has been placed about the forming device and to hold those end portions against movement. In the present construction, the clamping device comprises die members adapted to impart to the adjacent portions of the strip a shape conforming roughly to the shape imparted thereto by the die members 10. Those portions of the strip which are gripped by the clamping die members are trimmed off in the finishing of the shell. In the construction illustrated the clamping device comprises outer die members 17 rigidly secured to the base 13, beyond the end of the plate 14, and inner die members 18 movable toward and from the outer die members. The two pairs of die members 17 and 18 are so placed with relation to the forming device that the ends of the U-shaped strip extending about the forming device will extend between the die members 17 and 18 of the respective pairs. The movable die members may be actuated in any suitable manner but preferably they are provided with inclined faces 19 which diverge upwardly and which are engaged by the inclined faces of a tapered or wedge-shaped expanding member 20 which is rigidly secured to and actuated by a ram 20a, as shown in Fig. 4. The movable die members 18 may be retracted in various ways but, as here shown, they have dove-tailed connection with the expanding member 20 so that the upward movement of that expanding member will retract the die members.

The forming die members may be actuated in any suitable manner but preferably this is accomplished by an expanding member or plunger 21 rigidly secured to a ram 22 and having its lower longitudinal edges beveled to provide inclined surfaces 23 which engage the corresponding inclined surfaces 24 in the side die members 10. The expanding device 21 also has its lower transverse edge at that end adjacent to the end die member 11 beveled, as shown at 25, to engage an inclined surface 26 on the end die member. The several inclined surfaces are so arranged that the die members 10 and 11 will be simultaneously engaged and actuated by the expanding device and will thus be forced outwardly. The corner die members 12 are not directly engaged by the expanding device but have contact surfaces contacting with inclined surfaces 27 and 28 on the end and side die members, respectively, so that the outward movement of the end and side die members will force the corner die members outwardly along diagonal lines. Preferably the corner die members have dove-tailed or other suitable connection with the side and end die members, as shown at 26a, so that

they will move both outwardly and inwardly with the end and side die members.

The closed end of a radiator shell of this type is usually deeper than the sides of the shell and it is therefore necessary to impart a greater expansion to the end wall than to the side walls. To accomplish this I impart to the end and corner die members a longitudinal movement greater than the lateral movement which is imparted to the side and corner die members. With the present apparatus all the die members are moved substantially equal distances by the initial movement of the expanding device 21 and the further movement of the expanding device causes the supplemental support or plate 14 to move lengthwise on the base 13, thereby moving all the die members lengthwise of the shell. When so moved the end and corner die members will further expand the end wall of the shell but the side and corner die members will merely slide along the side walls of the shell without changing the shape thereof. For this purpose the plate 14 is provided with an upwardly extending lug or cam member 35 which is arranged to be engaged by a co-operating cam member 36 carried by the expanding device 21, this engagement taking place after the several die members have been actuated by the inclined or cam surfaces 23 and 25 of the actuating device.

In the operation of the apparatus a flat strip of metal, such as is shown in Fig. 1, is bent to U-form, by the use of any suitable bending mechanism, and is placed about the forming die members 10, 11 and 12 and its ends inserted between the combined forming and clamping die members 17 and 18. With the strip in this position the ram 20a is moved downwardly and the expanding member 20 forces the die members 18 outwardly, thus bending the end portions of the strip to the desired shape and clamping the same tightly between the die members 17 and 18. The ram 20a then remains in its lowered position and the ends of the strips are held firmly against movement while the ram 22 is lowered and the die members 10, 11 and 12 forced outwardly to expand the strip as a whole to the desired cross sectional shape and then moved lengthwise of the shell to further expand the end wall thereof. It will be noted that there are no outer forming die members or other parts in contact with the exterior surface of the body of the strip and therefore the outer surface of the finished shell will not be marred in any way, that portion of the shell which is engaged by the clamping dies being subsequently removed. After the expanding member 21 has been moved to its lowermost position and the desired shape imparted to the strip both rams are elevated, thereby releasing the strip and permitting the same to be removed.

With the particular apparatus here shown the strip now has a cross sectional shape equivalent to two partially formed shells and connected one to the other at the longitudinal center of the strip and reversed with relation one to the other. After the strip has been removed from the forming device it is severed along a central longitudinal line, by any suitable means, such as a rotary cutter, to divide the strip into two separate partially formed shells as shown in Fig. 7. Each of these partially formed preliminary shells is then separately subjected to the action of other forming devices to impart final shape thereto. These forming devices may be of any suitable character and in Figs. 8, 9 and 10 I have shown final forming devices of a well

known type. As there shown, these forming devices comprise fixed die members 29 and 30 adapted to engage and support the marginal portions of the partially formed shell, leaving the intermediate portion 31 of the shell unsupported. It will be understood that these die members conform to the general contour of the partially formed shell so that when placed thereon the shell will be supported in the position shown in Fig. 8. With the shell in this position other die members 32 and 33, are moved downwardly into engagement with the marginal portions of the shell and these portions are bent to the desired shape and are firmly clamped to the fixed die members, as shown in Fig. 9. With the shell clamped in this position a supplemental die member 34 is moved downwardly into contact with the intermediate portion 31 of the shell and draws this portion to the desired final shape, as shown in Fig. 10, thereby completing the formation of the shell.

While I have described in detail my method and one apparatus for carrying out the same I wish it to be understood that I do not desire to be limited to the details of either the method or the apparatus, as various modifications thereof may occur to a person skilled in the art.

Having now fully described my invention, what I claim as new and desire to secure by Letters Patent, is:

1. The method of producing a radiator shell or the like comprising bending a flat strip of sheet metal into a U-shape, placing said U-shaped strip about an internal forming device and inserting the free end portions thereof in a clamping device, actuating said clamping device to secure said end portions against movement, actuating said forming device to expand the intermediate longitudinal portion of said strip outwardly beyond the edges thereof, severing said strip along a central longitudinal line to provide two partially formed shells and subjecting said partially formed shells separately to the action of other expanding devices to impart final form thereto.

2. The method of producing a radiator shell or the like comprising bending a flat strip of metal into a U-shape, placing said U-shaped strip about an internal forming device and inserting the end portions thereof in a clamping device, actuating said clamping device to secure said end portions against movement, actuating said forming device to expand the walls of said strip to the desired cross sectional shape, again actuating said forming device to expand the end wall only of said strip to a different shape, removing said strip from said forming device and subjecting the same to the action of other forming devices to impart final form thereto.

3. The method of producing a radiator shell or the like comprising bending a flat strip of sheet metal into a U-shape, placing said U-shaped strip about a plurality of internal die members, clamping the ends of said strip to hold the same against movement, imparting outward movement to said die members to expand the side and end walls of said strip, moving said die members lengthwise of said U-shaped strip to further expand the end wall thereof, removing said strip from said die members and subjecting the same to the action of other forming devices to impart final form thereto.

4. An apparatus for forming U-shaped shells comprising an internal forming device, a clamping device arranged at one end of said forming

device to receive the end portions of a U-shaped strip placed about said forming device, and means for first actuating said clamping device to secure the end portions of said strip against movement and for then actuating said forming device.

5. In an apparatus for forming U-shaped shells, an internal forming device comprising side die members, an end die member and corner die members, a clamping device mounted in fixed position at that end of said forming device opposite said end die member and adapted to engage the end portions of a U-shaped strip placed about said forming device, and means for first actuating said clamping device to clamp said end portions against movement and then moving said die members outwardly.

6. In an apparatus for forming U-shaped shells, an internal forming device comprising side die members, an end die member and corner die members, fixed die members mounted at that end of said forming device opposite said end die member, movable die members cooperating with said fixed die members, said fixed and movable die members being arranged to receive between them the respective end portions of a U-shaped strip placed about said forming device, means for actuating said movable die members to form the end portions of said strip and to clamp the same against movement, and means for actuating the die members of said forming device to impart the desired cross sectional shape to said strip.

7. An apparatus for forming U-shaped shells comprising a base, a plurality of internal die members supported on said base for outward movement with relation one to the other and for movement in unison lengthwise of said base, a clamping device arranged to receive the ends of a U-shaped strip placed about said die members, and means for actuating said clamping device to secure the end portions of said strip against movement, for then imparting outward movement to the several die members, then moving said die members lengthwise of said base in unison.

8. An apparatus for forming U-shaped shells comprising a base, a supporting member mounted on said base for movement lengthwise thereof, a plurality of internal die members mounted on said supporting member for outward movement with relation thereto and for movement therewith lengthwise of said base, a clamping device arranged on said base to receive the ends of a U-shaped strip placed about said die members, means for actuating said clamping device to secure the end portions of said strip against movement, and means for first moving said die members outwardly on said supporting member and then moving said supporting member and the die members lengthwise of said base.

9. The method of producing a radiator shell or the like comprising bending a strip of sheet metal having substantially parallel edges to provide a U-shaped structure, placing said U-shaped structure about an internal forming device and inserting the free end portions thereof in a combined forming and clamping device, actuating said combined device to form said end portions of said structure and clamp the same against movement, actuating said internal forming device to expand the remaining portions of said structure to the desired cross sectional shape, removing said structure from said forming device, and subjecting the same to the action of

other forming devices to impart final form thereto.

10. The method of producing a radiator shell or the like comprising bending a strip of sheet metal having substantially parallel edges to provide a U-shaped structure, placing said U-shaped structure about a plurality of internal die members, clamping the free ends of said structure to hold the same against movement, imparting outward movement to said die members to expand the side and end walls of said structure, moving said die members lengthwise of said structure to further expand the end wall thereof, removing said structure from said die members and subjecting the same to the action of other forming devices to impart final form thereto.

11. The method of producing a radiator shell or the like comprising bending a flat strip of sheet metal into a U-shape, clamping the free ends of said U-shaped strip to hold the same against movement, subjecting the U-shaped strip to the action of forming members moving in directions substantially at right angles to the plane of the respective parts of said strip to expand the same to the desired cross sectional shape, removing said U-shaped strip from said forming members and subjecting the same to the action of other forming devices to impart final form thereto.

12. The method of producing a radiator shell or the like, comprising bending a flat strip of sheet metal into a U-shape, placing said U-shaped strip about a plurality of internal forming members, and inserting the free ends thereof in a clamping device, actuating said clamping device to secure said end portions against movement, then moving said forming members in directions substantially at right angles to the plane

of the respective parts of said strip, to expand said strip to the desired cross sectional shape, removing said strip from said forming members and subjecting the same to the action of other forming devices to impart final form thereto.

13. The method of producing a radiator shell or the like comprising bending a flat strip of sheet metal into a U-shape, placing said U-shaped strip about a plurality of forming members and inserting the free end portions thereof in a combined forming and clamping device, actuating said combined device to form the end portions of said strip and clamp the same against movement, moving said forming members in directions substantially at right angles to the planes of the respective parts of said strip to expand the remaining portions of said strip to the desired cross sectional shape, removing said strip and subjecting the same to the action of other forming devices to impart final form thereto.

14. The method of producing a radiator shell or the like comprising bending a flat strip of sheet metal into a U-shape, placing said U-shaped strip about a plurality of internal forming members and inserting the free end portions thereof in a clamping device, actuating said clamping device to secure said end portions against movement, then moving said forming members in directions substantially at right angles to the planes of the respective parts of said strip to expand said strip to the desired cross sectional shape, severing said strip along an intermediate longitudinal line to provide two partially formed shells, and subjecting said partially formed shells separately to the action of other forming devices to impart final form thereto.

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