July 17, 1934. G. E. IRELAND 1,966,723

METHOD OF PRODUCING SHEET METAL SHELLS FOR AUTOMOBILE RADIATORS

Filed April 4, 1932 4 Sheets-Sheet 1

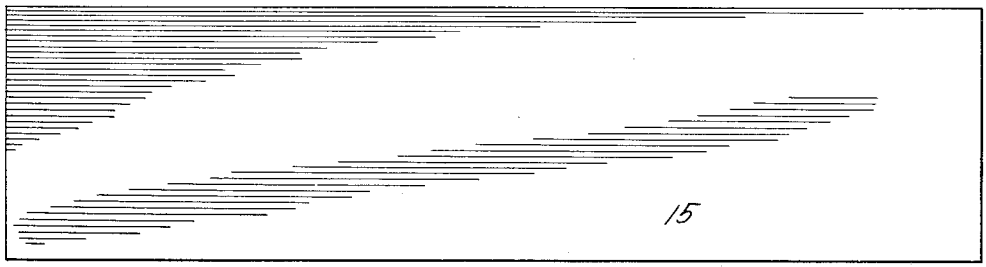


Fig. 1.

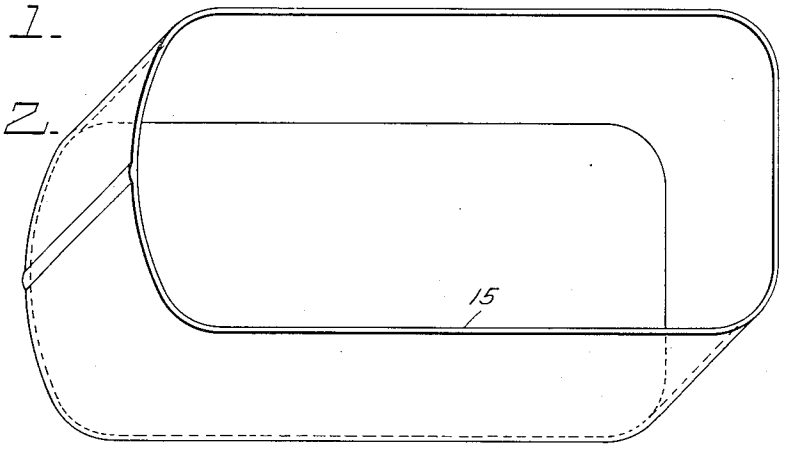


Fig. 2.

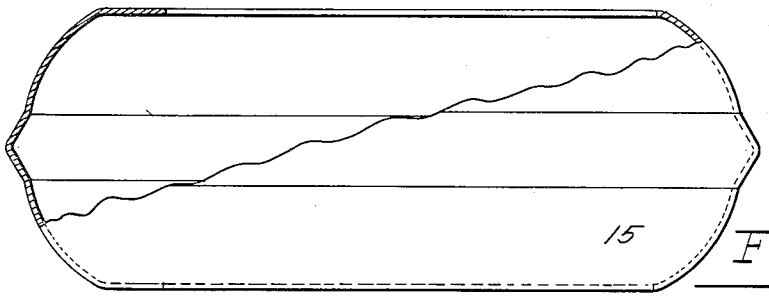


Fig. 3.

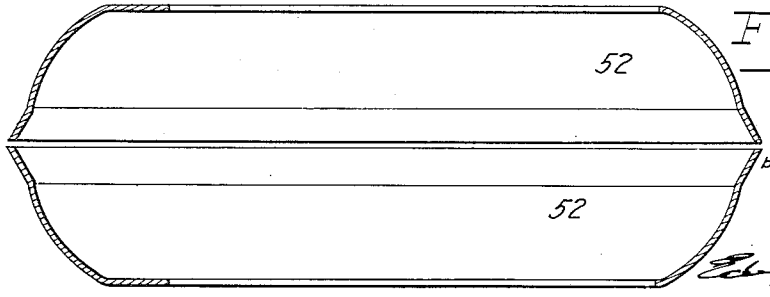


Fig. 4.

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METHOD OF PRODUCING SHEET METAL SHELLS FOR AUTOMOBILE RADIATORS

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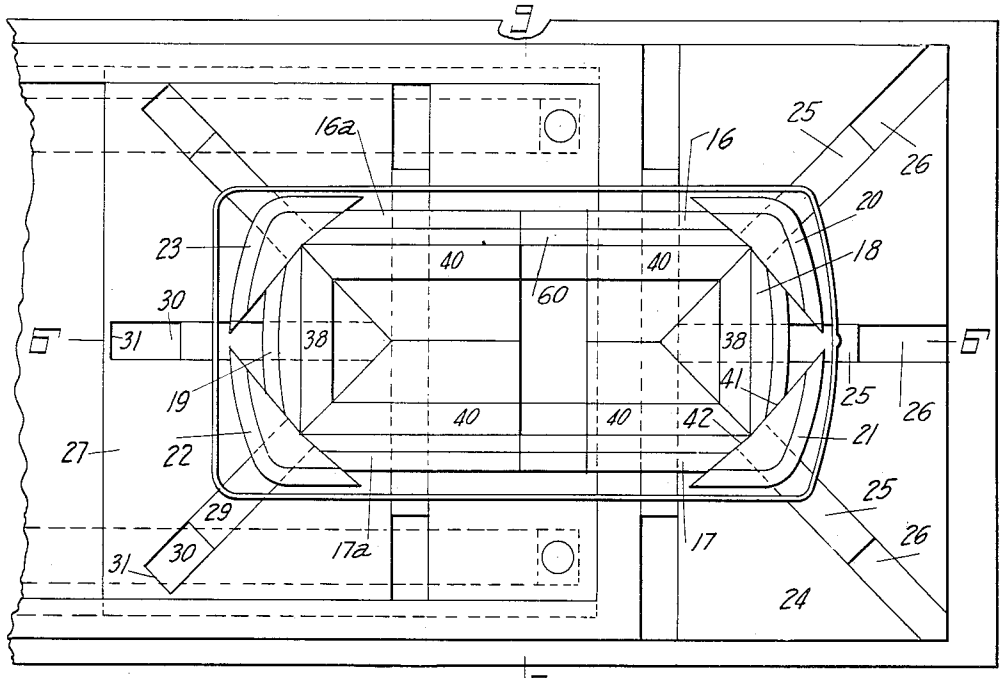


Fig. 5.

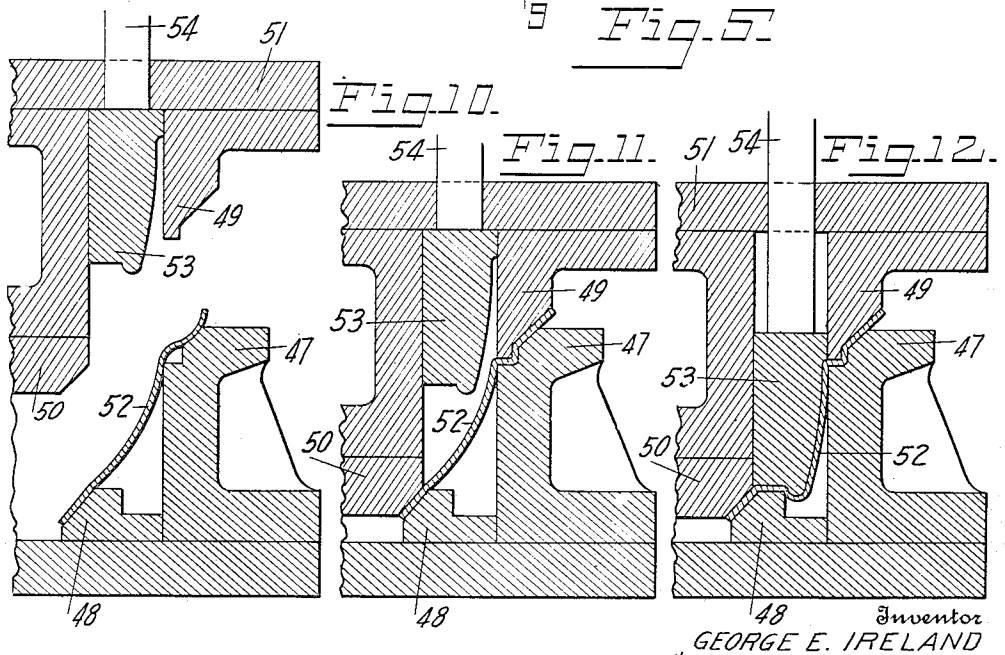


Fig. 10.

Fig. 11.

Fig. 12.

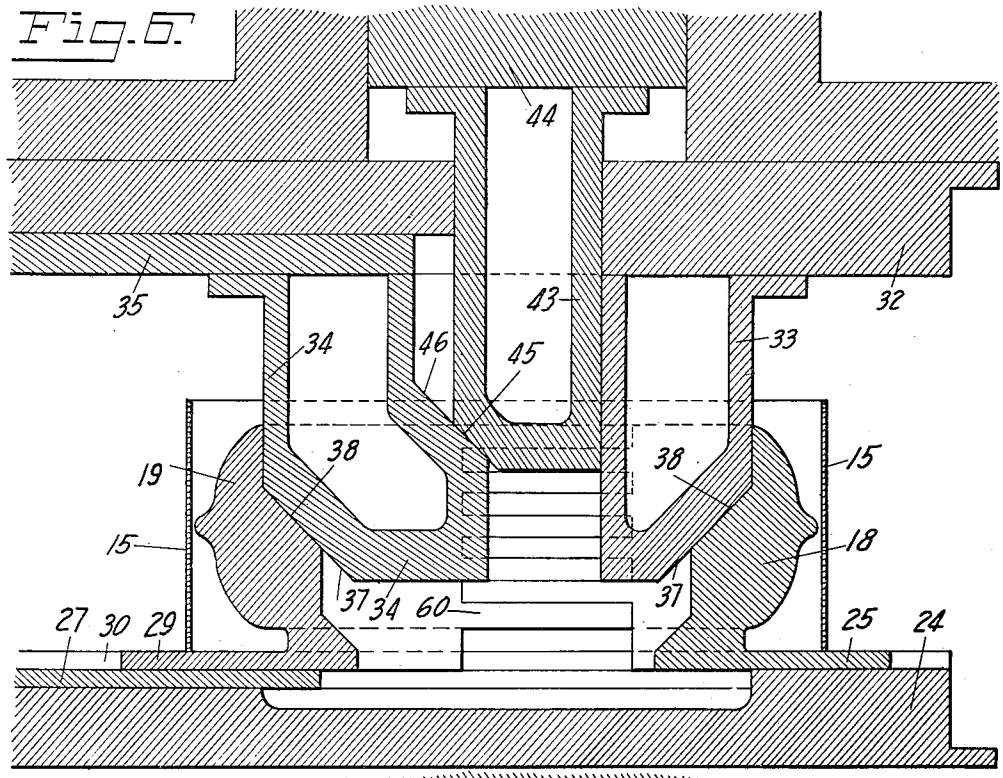
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Fig. 6.



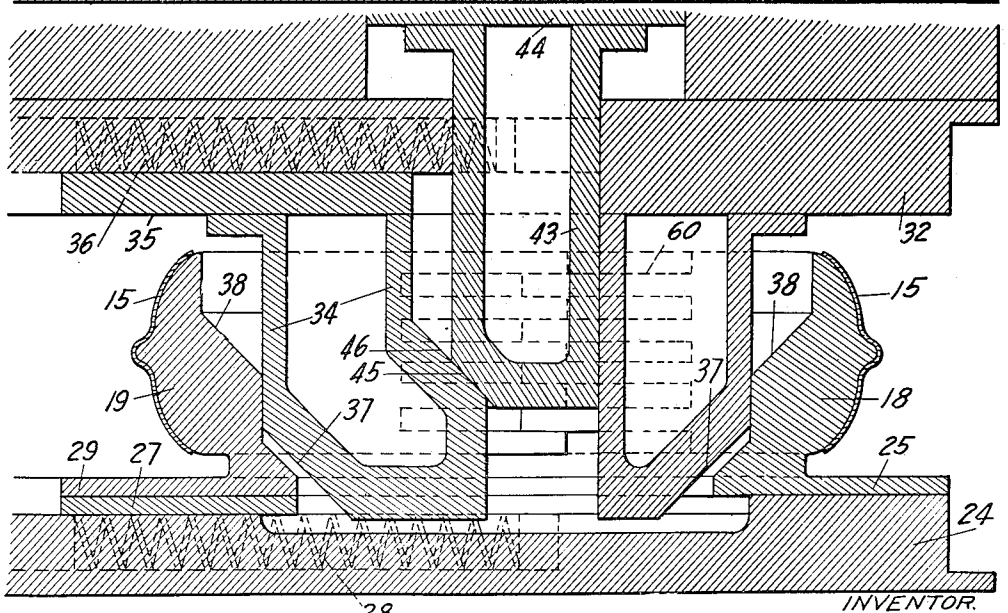


Fig. 7.

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METHOD OF PRODUCING SHEET METAL SHELLS FOR AUTOMOBILE RADIATORS

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Fig. 8.

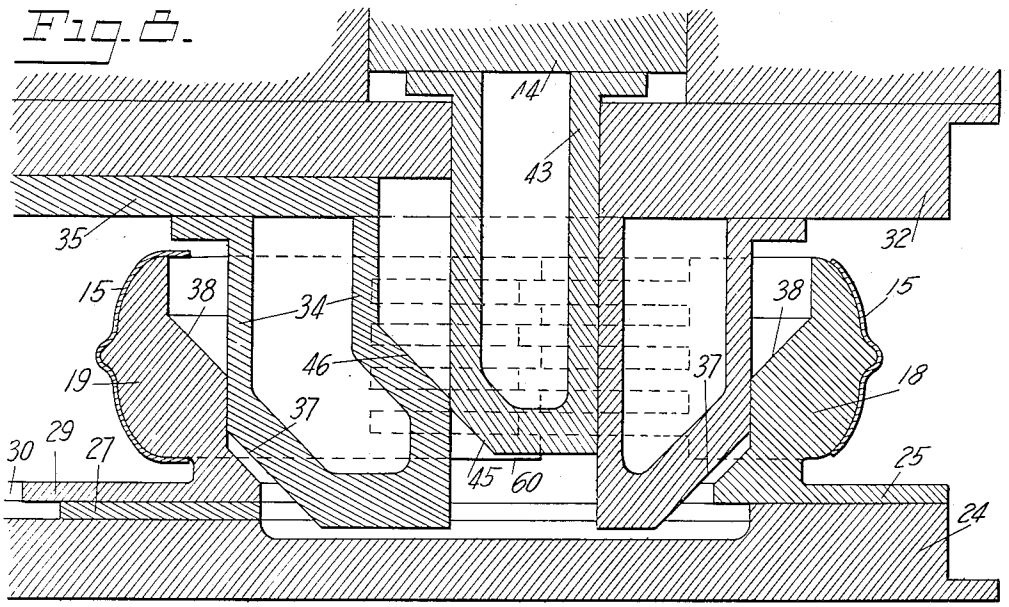
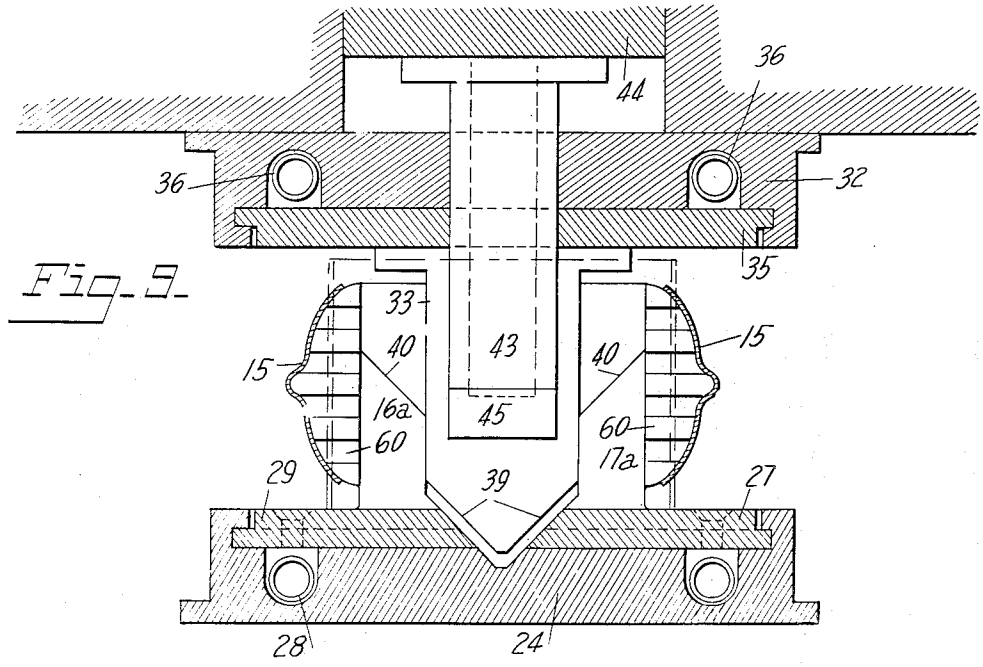


Fig. 9.



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Patented July 17, 1934 1,966,723

UNITED STATES PATENT OFFICE

1,966,723

METHOD OF PRODUCING SHEET METAL SHELLS FOR AUTOMOBILE RADIATORS

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

Application April 4, 1932, Serial No. 602,884

10 Claims. (Cl. 113—118)

This invention relates to a method of producing sheet metal shells for automobile radiators and other structures requiring an open framelike shell. In the production of radiator shells it is customary to provide a preliminary partially formed shell or blank which is then subjected to the action of forming devices to impart thereto the final shape of the shell and the present method relates primarily to the production of this preliminary partially formed shell.

One method commonly employed in the production of such preliminary shells consists in drawing a large flat sheet of metal into a pan-like form, removing the major portion of the bottom of the pan to provide an open shell and forming the shell in the desired preliminary shape. This method is not only wasteful of metal, because of the large part of the sheet which must be cut away, but the drawing operation requires the use of inner and outer dies and the exterior surface of the shell is usually marred by die marks and wrinkles which makes it difficult, if not impossible, to impart thereto a fine finish.

Another method of producing radiator shells is shown in Patent No. 1,808,731, granted to me June 2, 1931. According to this method a series of substantially U-shaped strips are cut from a large flat sheet of metal, bent to the desired form and the ends of the strip connected by a separately formed bar which is welded thereto and bent to the desired shape, thus producing a preliminary partially formed shell which is then given its final form by suitable dies. While this method effects a substantial saving of metal over the first mentioned method there is still considerable waste and the production of the preliminary shell requires a considerable time and labor. Both methods require the use of large wide sheets of metal. The surface characteristics of metal which is rolled in large sheets differs materially from the surface characteristics of metal which is rolled in relatively narrow strips and the surface of the narrow strip will take a much higher finish than will the surface of the large sheet.

One object of the present invention is to provide a method whereby radiator shells and the like may be produced quickly and without waste of metal, thereby enabling them to be produced at low cost.

A further object of the invention is to provide a method whereby radiator shells and the like may be produced without marring the exterior surface thereof.

A further object of the invention is to provide a method whereby radiator shells and the like may be produced from relatively narrow strips of metal.

A further object of the invention is to provide a method whereby different portions of the preliminary shell may be given different shapes by successive operations of a single forming device, thus reducing the amount of handling necessary and speeding up production.

A further object of the invention is to provide a method whereby two preliminary partially formed shells may be produced simultaneously with an expenditure of time and labor little greater than that required to produce a single preliminary shell.

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

In the accompanying drawings Fig. 1 illustrates the initial blank from which the shell is formed; Fig. 2 shows the blank bent to its initial form prior to the forming operation; Fig. 3 shows the blank or endless structure of Fig. 2 shaped to provide two partially formed shells; Fig. 4 shows the shaped blank of Fig. 3 divided to separate the two partially formed shells; Fig. 5 is a plan view of a forming device suitable for the preliminary forming operation; Fig. 6 is a section taken on the line 6—6 of Fig. 5, showing the expanding device in position prior to the first forming operation; Fig. 7 is a similar section showing the positions of the parts at the end of the first forming operation; Fig. 8 is a similar section showing the positions of the parts at the end of the second forming operation; Fig. 9 is a section taken on the line 9—9 of Fig. 5 with the parts in the positions shown in Fig. 7; and Figs. 10, 11 and 12 are sectional detail views of the final forming dies showing the successive steps in the final forming operation.

The method consists of bending a relatively narrow strip of metal and uniting the ends thereof to form an endless structure or band, then subjecting this band to the action of an internally arranged forming device to expand or stretch the same to a shape corresponding in a general way to the shape of the finished shell. Preferably the strip or band is of sufficient width to form two shells and the forming device is such as to impart to the band a shape corresponding to two partially formed shells connected one to the other. The two shells are

then separated by a circumferential cut and are acted upon separately by another forming device to impart the final shape thereto. While the method is designed primarily for the production of radiator shells it will be obvious that it may be used for producing open framelike shells of various kinds and that the details thereof may be varied as circumstances demand.

I prefer to produce two preliminary partially formed shells simultaneously. For this purpose I employ a relatively narrow strip of sheet metal, as shown in Fig. 1, of a sufficient width to enable two preliminary shells to be formed thereof, side by side. This strip of metal is bent and its ends united, preferably by butt-welding, to provide an endless structure or band 15 of a shape corresponding approximately to the outline of the partially formed preliminary shell. any suitable apparatus may be employed for imparting the desired shape to this endless band but that herein illustrated is well adapted for that purpose. It consists of internal die members only the outer surface of the endless band being unsupported throughout the forming operation. Preferably it consists of a plurality of relatively movable die members having an exterior contour adapted to expand or stretch the band to the desired shape when the die members are moved outwardly. Each die member is separately supported for movement with relation to the other die members and expanding devices or plungers are arranged to cooperate with the die members to impart operative movement thereto. In the present apparatus the forming device comprises side or lateral die members to engage the longitudinal walls of the endless band and, for a reason which will hereafter appear, it is preferable that these side die members should consist of two parts, as shown at 16 and 16*a* and 17 and 17*a*. At the ends of the side die members are end die members 18 and 19 and overlapping the respective side and end die members are corner die members 20, 21, 22, and 23. The die members 16, 17, 18, 20 and 21, at one end of the apparatus, are slidably mounted upon a base 24 and, in the present instance, each die member has secured thereto a slide bar or gib 25 which is slidably mounted in a groove 26 in the base 24, the slide bars being of sufficient length to hold the respective die members against all turning movement.

The die members 16*a* and 17*a*, 19, 22 and 23, at the other end of the apparatus, are carried by a plate 27 which is slidably mounted upon the base 24 and is held normally in its innermost position by springs 28 which, in the present instance, are mounted in channels in the base 24. The several die members are slidably connected with the slide plate 27 by means of slide bars 29 and grooves 30 similar to the slide bars and grooves 25 and 26, with the exception that the grooves are formed in the slide plate 27 instead of in the base, and each groove 30 has an end wall or abutment 31 which forms a stop to limit the outward movement of the die member for that group. Outward or operative movement is imparted to the die members by means of an expanding device which is carried by a main ram 32 and, in the present instance, consists of two parts 33 and 34, the part 33 being rigidly secured to the ram and the part 34 being carried by a plate 35 which is slidably mounted on the ram for movement in a direction away from the part 33. This plate 35 is acted upon by springs 36 which hold it normally in its innermost position and which are here shown as mounted in channels in the head of the ram. The two parts of the ram are provided at their lower ends with inclined surfaces 37 to engage the corresponding inclined surfaces 38 on the end die members 18 and 19 and with longitudinal inclined surfaces 39 to engage corresponding inclined surfaces 40 in the side die members 16, 16*a* and 17 and 17*a*. The several inclined surfaces are so arranged that upon the downward movement of the ram the side and end die members will be moved outwardly simultaneously. The corner die members have no direct contact with the expanding device but each of these corner die members has a surface overlapping an inclined surface 41 on the adjacent end die member and an inclined surface 42 on the adjacent side die member the arrangement being such that the outward movement of the end and side die members will impart outward movement to the corner die members along lines diagonal to the lines of movement to the end and side members, thus causing the members to press out and form the corner portions of the band.

The several die members are retained normally in their innermost or retracted positions, this being preferably accomplished by springs, not here shown. When the die members are in their retracted positions and the ram has been elevated the endless structure or band 15 is placed about the die members with its lower edge resting upon the base 24 and plate 27, as shown in Fig. 6. The ram is then lowered to cause the inclined surfaces of the expanding device to engage the inclined surfaces on the respective die members and thus force the same outwardly to the positions shown in Fig. 7, thereby expanding or stretching the metal of the band to cause the same to conform to the contour of the exterior surfaces of the die members. In the formation of a shell of the type here illustrated the intermediate circumferential portion of the band 15 is drawn outwardly a considerable distance beyond the upper and lower edges of the band so that the upper and lower portions of the band slope from the central circumferential line inwardly toward the edges thereof.

In a radiator shell of the type here illustrated that end of the shell which is at the top of the radiator is deeper than the other portions of the shell and, for the purpose of imparting this deeper and different shape to the one end portion of the band 15 without removing the band from the forming device which has imparted the initial form thereto, I cause the die members which are carried by the plate 27 to move lengthwise of the apparatus toward that end of the band which is to be further expanded. This is accomplished by means of a secondary expanding device 43 carried by a supplemental or inner ram 44 which is operated independently of the main ram. This secondary expanding device has at its lower end an inclined surface 45 to engage a corresponding inclined surface 46 on the part 34 of the main expanding device, whereby downward movement of the secondary expanding device will move the part 34 of the main expanding device away from the part 33 thereof. That side of the secondary expanding device opposite the inclined surface 45 is flat and engages the flat surface of the part 33 of the main expanding device so that the last mentioned part of

the expanding device and the die members controlled thereby are positively held against movement. The downward movement of the main expanding device has carried the inclined surface 37 thereof beyond the inclined surface 38 of the end expanding member 19 and the flat vertical surfaces of these two members are in engagement so that the movement imparted to the part 34 of the expanding device will cause the end die member to be moved lengthwise of the apparatus. Inasmuch as the initial movement imparted to the die members on the plate 27 has caused the slide bars 29 to engage the stops in the grooves 30 these die members are held against further movement with relation to the plate and the plate itself is caused to move, thus carrying all the die members in a straight line toward that end of the band or structure 15 which is to be further expanded and thereby drawing the intermediate portion of this end of the band a further distance beyond the edges thereof and causing that end of the band to assume the shape shown at the left hand end of Fig. 8. This completes the formation of the band and the rams are elevated, the movable member 34 of the main expanding device and the plate 27 are restored to their initial positions and the several die members are retracted, thereby releasing the formed band and permitting the same to be removed. The band is now in the form shown in Fig. 3 and it comprises two partially formed shells which, in the present instance, are identical in construction but are arranged in reverse positions. This formed band is then severed along a central circumferential line, as shown in Fig. 4, to separate the two partially formed shells one from the other. This may be accomplished by any suitable cutting device, such as a rotary cutting tool.

The movement of the plate 27 and the die members carried thereby will, of course, move the side die members 16*a* and 17*a*, respectively, from the side die members 16 and 17 and in order to prevent any deformation of the side walls of the shell I have provided the adjacent ends of the die members of each pair of side die members with interleaved fingers or tenons 60 of such length that they will remain in overlapping relation when the die members are separated.

The two preliminary partially formed shells are then individually subjected to the action of the final forming device. This forming device may be of any suitable character but in Figs. 10, 11 and 12 I have shown a portion of a forming device similar to the final forming device shown in the above mentioned patent. This forming device comprises two fixed die members 47 and 48 so arranged that when the endless partially formed shell is placed thereon it will be supported by its marginal portions on the two die members, it being understood that these die members are continuous and similar in shape to the outline of the shell, so that the shell will seat therein and will be retained in proper position thereon, as shown in Fig. 10. Movable die members 49 and 50, carried by a ram 51, are moved downwardly into engagement with the marginal portions of the partially formed shell, which is shown at 52, and serve to shape these marginal portions and to firmly clamp the shell in position, as shown in Fig. 11. A secondary forming member or die 53, carried by a supplemental ram 54, is then moved downwardly into engagement with the intermediate portion of the shell, which intermediate portion is unsupported on its lower side. This secondary die will stretch or expand the metal and draw the same to the shape shown in Fig. 12, thereby completing the forming of the shell.

While I have described my method as applied to a radiator shell of a particular type I do not wish to be limited to the details thereof as various modifications may be necessary or desirable in applying the method to the production of shells having different characteristics.

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

1. The method of forming open shells of sheet metal, comprising bending a flat blank and uniting the ends thereof to form an endless structure, subjecting said structure to the action of a forming device to impart thereto a cross sectional shape equivalent to two partially formed shells, dividing said structure along a circumferential line to separate said partially formed shells and then subjecting each partially formed shell to the action of a forming device to impart a final shape thereto.

2. The method of forming open shells of sheet metal comprising bending a flat blank and uniting the ends thereof to form an endless structure, expanding said structure by the application of pressure to the inner surface thereof while the outer surface is unsupported to impart to each lateral edge portion thereof the shape of a partially formed shell, separating said portions one from the other along an intermediate circumferential line and then separately shaping said partially formed shells to their final form.

3. The method of forming open shells of sheet metal comprising bending a flat blank and uniting the ends thereof to form an endless structure, subjecting said structure to the action of a forming device to draw an intermediate circumferential portion of said structure outwardly beyond the edges thereof so that the edge portions of said structure will slope inwardly toward the respective edges, severing said structure along an intermediate circumferential line into two parts and forming each part into a finished shell.

4. The method of producing open shells of sheet metal comprising bending a flat blank and uniting the ends thereof to form an endless structure, subjecting said structure to the action of a forming device to draw an intermediate circumferential portion of said structure outwardly a substantially uniform distance beyond the edges thereof so that the lateral portions of said structure will slope inwardly toward the edges thereof and to then draw said intermediate portion a further distance outwardly beyond said edges at one end only of said structure, severing said structure along an intermediate circumferential line into two parts and forming each part separately into final shape.

5. The method of forming open shells of sheet metal comprising bending a flat blank and uniting the ends thereof to form an endless structure, placing said structure about an expansible forming device having an outwardly extending circumferential portion intermediate the edges of said structure, actuating said forming device to first expand said structure uniformly in all directions and to then further expand one end portion only of said structure, severing said

structure along an intermediate circumferential line into two parts and forming each part separately into final shape.

6. The method of producing a partially formed blank for an open shell of sheet metal comprising bending a strip of sheet metal and uniting the ends thereof to form an endless band, placing said band about a forming device comprising internal die members only and then actuating said die members to stretch said band to a shape conforming to the shape of said die members and then actuating a part only of said die members, while said band remains in engagement with said die member, to further stretch one portion only of said band.

7. The method of producing radiator shells comprising the bending of a strip of metal into oblong form and uniting the ends thereof to provide an endless band, placing said band about a forming device comprising internal die members in different directions only, actuating said die members to impart to said band a substantially uniform cross sectional shape different from the initial cross sectional shape thereof, holding a part of said die members against movement, actuating another part of said die members to impart a different shape to a portion only of said band, retracting all of said die members, removing said band and subjecting said band to the action of other die members to complete the formation thereof.

8. The method of producing radiator shells comprising bending a strip of sheet metal of a width sufficient to form two shells and uniting the ends of said strip to form an endless band, placing said band about a forming device comprising internal die members only, actuating said die members to expand the intermediate circumferential portion of said band outwardly beyond the edges thereof and to impart like shapes to the upper and lower portions of said band, removing said band from said forming device, severing said band along an intermediate circumferential line to separate said upper and lower portions and then subjecting said portions separately to the action of a forming device to impart final shape thereto.

9. The method of producing radiator shells comprising bending a strip of sheet metal of a width sufficient to form two shells and uniting the ends of said strip to form an endless band, placing said band about a forming device comprising internal die members only, actuating said die members to expand the intermediate circumferential portion of said band outwardly beyond the edges thereof and to impart like shapes to the upper and lower portions of said band, then actuating a part only of said die members to further expand one portion of said band, removing said band from said forming device, severing said band along an intermediate circumferential line to separate said upper and lower portions and then subjecting said portions separately to the action of a forming device to impart final shape thereto.

10. The method of simultaneously producing two shells of predetermined configuration from sheet metal comprising bending a strip of metal and uniting the ends thereof to form an endless structure, expanding said structure to impart thereto a cross sectional shape different from the cross sectional shape of the initial endless structure and corresponding to two shells connected at their adjacent edges, and dividing the expanded structure along an intermediate circumferential line to separate said shells one from the other.

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