Sept. 9, 1941. S. FRIEDMAN 2,255,658

METHOD OF MAKING BENT METAL STRUCTURES

Filed Oct. 4, 1938

FIG. 1.

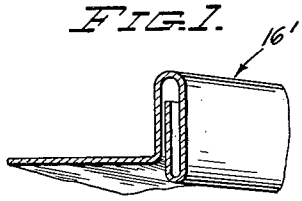


FIG. 2.

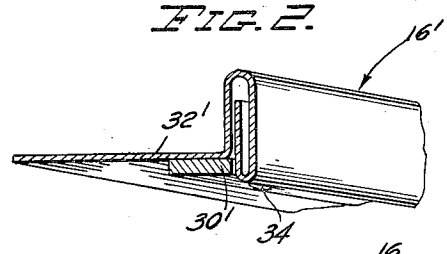


FIG. 5.

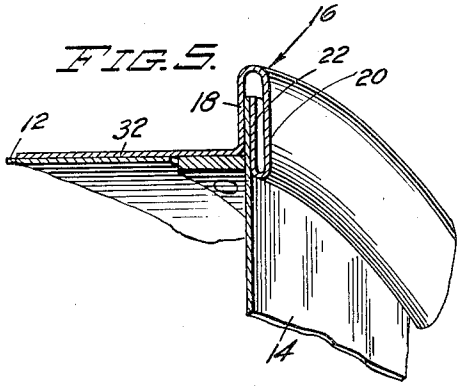


FIG. 3.

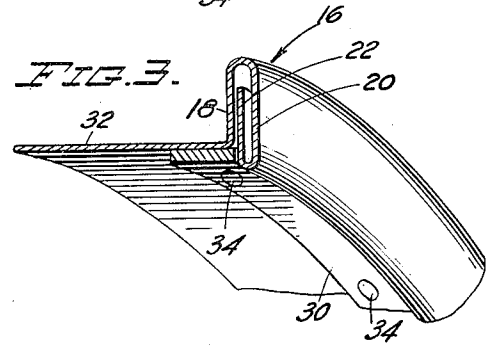


FIG. 7.

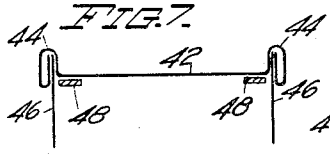


FIG. 4.

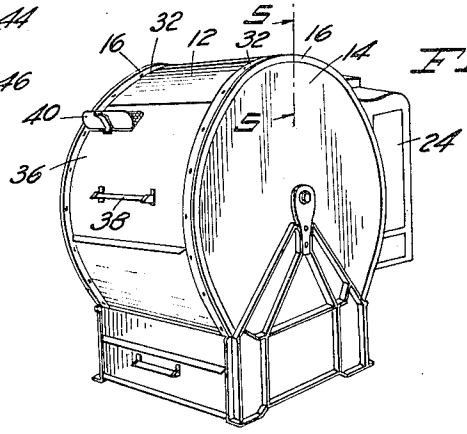
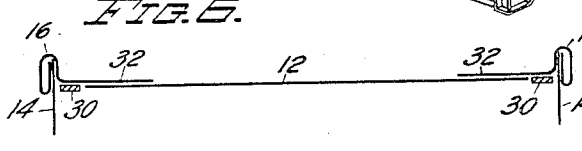


FIG. 6.



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METHOD OF MAKING BENT METAL STRUCTURES

Samuel Friedman, Brooklyn, N. Y.

Application October 4, 1938, Serial No. 233,187

9 Claims. (Cl. 29—148.2)

This invention relates to metal structures and more particularly to such structures having a wall bent to curved shape.

A bent or curved sheet metal wall is readily provided, but greater difficulty arises if the edge of the wall is formed into a bead of substantial dimension. Such a bead may be provided for the sake of finished appearance, or for structural strength and rigidity, or as part of a seam for receiving another wall, or, as in the specific case here illustrated, for all three reasons. A common situation in which the problem here considered arises is a hollow sheet metal casing for machinery, such casing frequently being in clindrical form to best receive a rotating mechanism.

A desired ornamental and reinforcing bead is readily provided at the edge of a flat sheet of metal, the edge being turned and rolled into the desired bead formation by well-known die methods. However, it is difficult, if not impossible, to form such a bead on the edge of a curved or cylindrical sheet of metal. A more convenient procedure would be to form the bead on the edge of the sheet metal while the sheet is still in flat or straight condition, and to thereafter bend the sheet to the desired curved or cylindrical shape. Unfortunately, in attempting to bend such a beaded sheet, the flat part is deformed into waves. It might be possible to end up with a smooth or unwaved sheet by forming the entire sheet in a single enormous die, but in ordinary shop practice such a large die cannot be afforded, for the casing may be many feet in diameter. Instead, it is desirable to bend the sheet either by passing the same through rolls, or by feeding it step-by-step through a relatively short die which bends only one short section or length of the sheet at a time. With either rolls or with a small practical die, the troublesome waves in the flat part of the sheet invariably arise and cannot be eliminated. Even if a single large die were to be used, the metal texture of the product would be comparatively unsatisfactory because waves would have been first formed and then ironed or flattened out by the brute compressive force of the die.

The primary object of my invention is to overcome the foregoing difficulty. I have found that if the sheet is reinforced by a relatively heavy strap of metal at a point immediately adjacent the bead, the sheet and bead may be caused to bend around or together with the reinforcing strap, and without the production of waves in the main part of the sheet. The strap and sheet are preferably secured together at spaced points, as by means of spot-welding, and if the bead is formed outwardly or on the convex side, the strap is preferably secured on the inner or concave side. The subsequent action is, I believe, that the sheet is bent around the strap without contraction of the sheet, or, in other words, that the strap causess the bend of the bead to produce stretch or elongation at the outside of the bead, without accompanying contraction or shrinkage at the inside of the bead. In this way, the difficulty is overcome by exceedingly simple, practical, and inexpensive means.

A further object of the invention is to provide a detachable or openable joint between a curved and a flat wall, or, more specifically, between the cylindrical wall and the flat circular end walls of a casing. This is done by forming the cylindrical wall with edge beads, as previously described, and so shaping the bead that it is adapted to receive the edge of the end wall with a frictional or spring fit. This is a strong and satisfactory method of securing the walls together even if the attachment is to be a permanent one, and it is particularly satisfactory and desirable when the attachment is to be an openable or releasable one, as, for example, if the cylindrical wall is formed in two semi-cylindrical parts one or the other of which may be removed to permit insertion into the casing of the rotating mechanism intended to be housed thereby.

To the accomplishment of the foregoing and such other objects as will hereinafter appear, my invention consists in the method steps and structural elements, and their relation one to the other, as are more particularly described in the specification and sought to be defined in the claims. The specification is accompanied by a drawing, in which:

Fig. 1 is a fragmentary sectional view showing the formation of the desired bead at the edge of a flat sheet;

Fig. 2 illustrates the addition thereto of the reinforcing strap;

Fig. 3 illustrates the bending of the sheet to desired curved shape;

Fig. 4 is a perspective view of a typical machine having a casing embodying the beaded edge and joint of the invention;

Fig. 5 is a fragmentary section taken in the plane of the line 5—5 of Fig. 4, and illustrates the edge joint or seam of the casing;

Fig. 6 is explanatory of the method of assembly of the cylindrical and end walls of the casing; and

Fig. 7 is explanatory of a modification.

Referring to the drawing, and more particularly to Fig. 4, I there illustrate a fur cleaning machine the details of which are unimportant for the purpose of the present specification, but which will be found fully set forth in my copending application, Serial No. 230,219, filed September 16, 1938. Essentially, the machine comprises a drum rotatably mounted within a casing made up of a curved wall 12 and end walls 14. The casing is ornamented and strengthened by nicely rounded edge beads 16 which also serve to receive and interlock with the end walls 14.

The manner in which the curved and flat walls are joined together will be clear from inspection of Fig. 5, in which it will be seen that the curved wall is bent outwardly at 18, then inwardly at 20, and finally reversely or again outwardly at 22. The edge of end wall 14 is snugly received between the walls 18 and 22 of the bead 16. Referring to Fig. 3, which shows the condition of the bead 16 before wall 14 is inserted therein, it will be seen that the bead tends to expand or close so that the wall 22 is snugly in engagement with the wall 18. When the edge of sheet 14 is forced into the bead or pocket, the walls 18 and 22 of the bead are sprung apart to receive the sheet, as shown in Fig. 5, and the sheet is thus held with a resilient or spring engagement.

The resulting joint is practically air-tight and sufficiently so for use in the cleaner of Fig. 4, even though the particular cleaner there shown is provided with a fan or exhaust unit 24. Similar cleaners, commonly called "drums" in the trade, are also made without the exhaust unit, but even in such case, the snug fit at the edge seam is desirable because of the large quantity of volatile fumes of cleaning fluid within the casing during use. The joint has the further advantage of dispensing with welding or riveting and making possible detachable relation between the wall 12 and the end walls 14. Specifically, the complete cylindrical wall 12 may be made in two sections, a front and back section, separating about at the top of the casing, in which case the drum inside the machine may be mounted in place or removed from the casing by first preliminarily removing the front section of the cylindrical wall. Moreover, the entire machine may be readily dismantled for convenience in shipment and movement through ordinary doorways, passenger elevators, or the like, all as has been more fully explained in my copending application, Serial No. 230,219 aforesaid.

In accordance with the present invention, the beaded curved wall is formed as follows. A flat sheet of metal is first treated in appropriate straight dies to form a straight bead 16', as is shown in Fig. 1. A reinforcing strap 30' is then secured to the flat part 32' of the sheet of metal preferably at a point immediately adjacent the bead 16', as is shown in Fig. 2. The strap 30' and sheet 32' are preferably secured together at spaced points, as by spot-welding indicated at 34. The sheet is then bent, either section by section in a small bending die, or by passing the same through bending rolls, thus bringing the piece to the shape shown in Fig. 3. The flat part 32 of the sheet is preserved in smooth, unwaved condition by the reinforcing strap 30. The sheet is bent about the strap 30, and the strap functions to prevent contraction of the sheet at the inside of the bead 16. Instead, all deformation consists of stretch or elongation, mainly, of course, at the outside of bead 16.

The strap 30 is dimensionally related to the bead 16 and the thickness or gauge of the sheet metal being handled. For example, using 16-gauge sheet metal (which is approximately $\frac{1}{16}$" in thickness), and while dealing with a bead 16 having a radial dimension or height of one inch, I have successfully employed a strap 30 which is $\frac{1}{8}$" x $\frac{5}{8}$" in section, welded at points three inches apart. These figures are given by way of exemplification and not in limitation of the invention. If the bead is higher, or larger, in radial dimension, a larger strap may be needed to prevent waves, that is, to successfully restrain the inner edge of the bead against contraction.

Referring now to Figs. 4 and 6, it may be pointed out that in the present structure, I prefer to form the beads 16 at the edges of relatively narrow strips of sheet metal which act as end bands 32 for the main curved wall 12. This is largely a matter of convenience, in that the end bands 32 may be standardized and may be used on machines or casings of widely different axial dimension by simply changing the width of the simple curved sheet 12. The sheet 12 and bands 32 are secured together by electric spot-welding or other appropriate means. Incidentally, the bands add some additional strengthening and reinforcement to the casing, and they may be used as protection or guides if a part of the casing wall is provided with an openable door. For example, in Fig. 4, the portion 36 of the casing is a door which may be slid upwardly by means of handle 38 (vent 40 being closed at the time).

It will be understood that the underlying idea of the invention may be applied to a curved wall having the beads formed directly thereon, particularly when dealing with a casing of comparatively small size. Thus, in Fig. 7, the casing wall 42 has beads 44 formed at the edges thereof, said beads receiving the end walls 46. The beads 44 are formed at the edges of sheet 42 while the sheet is still in flat condition, and reinforcing straps 48 are secured to sheet 42 before any attempt is made to bend the beaded sheet to curved shape.

It is believed that the beaded edge joint or seam of my invention, as well as the method of forming the same, and the many advantages of the same, will be apparent from the foregoing detailed description. It will also be apparent that while I have shown and described my invention in preferred form, changes and modifications may be made without departing from the spirit of the invention defined in the following claims. In the claims, I refer to the curved wall as being cylindrical, meaning that the wall conforms to a part of the surface of the cylinder without necessarily being a complete cylinder. By the term, sheet, I mean to include a narrow sheet, i. e., a strip or band.

I claim:

1. The method of bending a sheet of metal having its edge reversely folded or curled to form a beaded edge which is stiff and difficult to bend compared with the sheet, without causing waves in the sheet, which includes reinforcing the sheet of metal at a point adjacent the bead but on the opposite side of the sheet from the bead by securing additional metal thereto, and thereafter bending said reinforced sheet.

2. The method of bending a sheet of relatively

thin metal having its edge reversely folded or curled to form a beaded edge which is stiff and difficult to bend compared with the sheet, without causing waves in the sheet, which includes reinforcing the sheet of metal at a point adjacent the bead by means of a strap of relatively thick metal, and thereafter bending said sheet and reinforcing strap together as a unit.

3. The method of bending a sheet of relatively thin metal having its edge reversely folded or curled to form a beaded edge which is stiff and difficult to bend compared with the sheet without causing waves in the sheet, which includes reinforcing the sheet of metal at a point adjacent the bead by means of a strap of relatively thick metal, securing said strap and sheet together by spot-welding the same at relatively closely spaced points, and thereafter bending said sheet and reinforcing strap.

4. The method of bending a sheet of relatively thin metal having its edge reversely folded or curled to form a beaded edge which is stiff and difficult to bend compared with the sheet, without causing waves in the sheet, which includes reinforcing the sheet of metal on the side opposite the bead at a point adjacent the bead by means of a strap of relatively thick metal, securing said strap and sheet together at relatively closely spaced points, and thereafter bending said sheet and reinforcing strap with the bead on the outer or convex side and the strap on the inner or concave side of the sheet.

5. The method of bending a sheet of metal having a beaded edge, without causing waves in the sheet, which includes reinforcing the sheet of metal on the side opposite the bead at a point adjacent the bead by means of a strap of heavy metal, securing said strap and sheet together at relatively closely spaced points by spot-welding, and thereafter bending a small portion of said sheet and reinforcing strap with the bead on the outer or convex side and the strap on the inner or concave side of the sheet, and feeding the sheet to bend successive portions until the entire sheet is bent as desired.

6. The method of preparing a curved sheet of metal for joinder with a flat sheet of metal, which includes beading the edge of a metal sheet while it is still in flat condition, reinforcing the sheet near the beaded edge, and thereafter bending the beaded and reinforced sheet to desired curved shape, the bead being so shaped as to form a yieldable crevice into which the edge of the flat sheet may be inserted.

7. The method of preparing a cylindrical sheet of metal for joinder with a flat sheet of metal, which includes beading the edge of a metal sheet while it is still in flat condition, reinforcing the sheet near the beaded edge, and thereafter bending the beaded and reinforced sheet to desired cylindrical shape, the bead being so shaped as to form a yieldable crevice into which the edge of the flat sheet may be inserted.

8. The method of preparing a curved sheet of metal for joinder with another piece, which includes reversely folding or curling the edge of the metal sheet while it is still in flat condition, to produce an edge bead including an outward bend approximately perpendicular to the sheet, a reverse or inward bend spaced outside said outward bend, and another reverse or outward bend located between the first-mentioned outward bend and the inward bend, thus producing a crevice between the two outward bends, reinforcing the sheet on its inner face, and thereafter bending the beaded reinforced sheet to desired curved shape, whereby an edge of the aforesaid second piece may be inserted into the crevice of the bead.

9. The method of preparing a cylindrical sheet of metal for joinder with a flat sheet of metal, which includes reversely folding or curling the edge of the metal sheet while it is still in flat condition, to produce an edge bead including an outward bend approximately perpendicular to the sheet, a reverse or inward bend spaced outside said outward bend, and another reverse or outward bend located between the first-mentioned outward bend and the inward bend, thus producing a yieldable crevice between the two outward bends, reinforcing the sheet on its inner face at a point adjacent the bead by means of a strap of relatively thick metal, securing said strap and sheet together at relatively closely spaced points, and thereafter bending the beaded reinforced sheet to desired cylindrical shape, whereby the flat sheet may be inserted into the crevice of the bead.

SAMUEL FRIEDMAN.