July 14, 1942. P. F. SCHOEN 2,289,685

BENDING MACHINE

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Fig. 1.

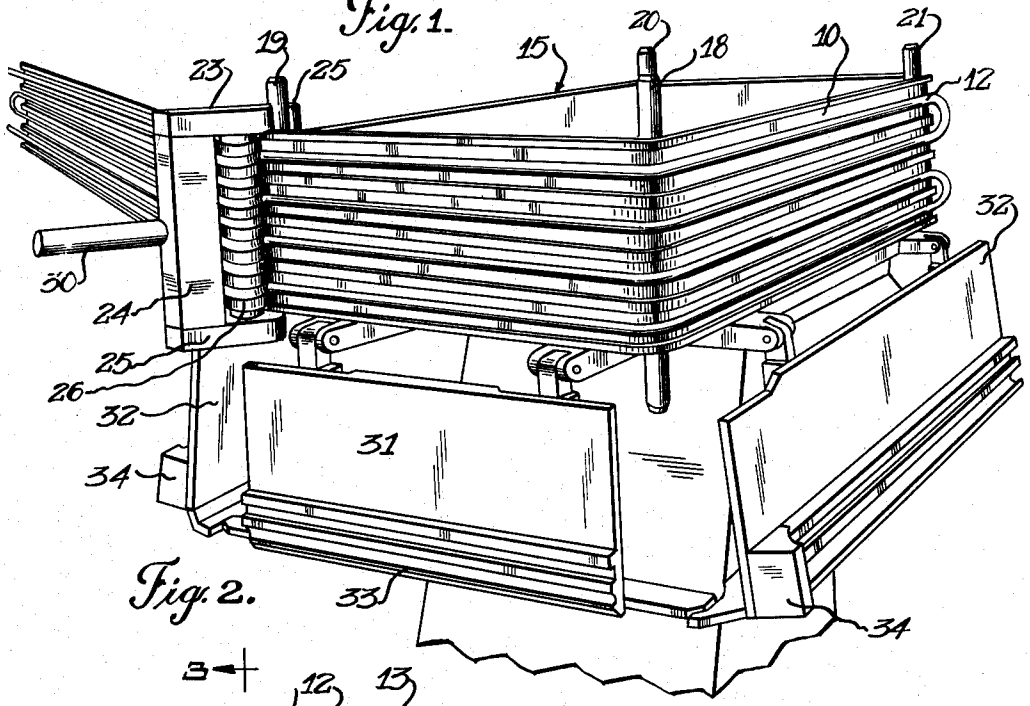


Fig. 2.

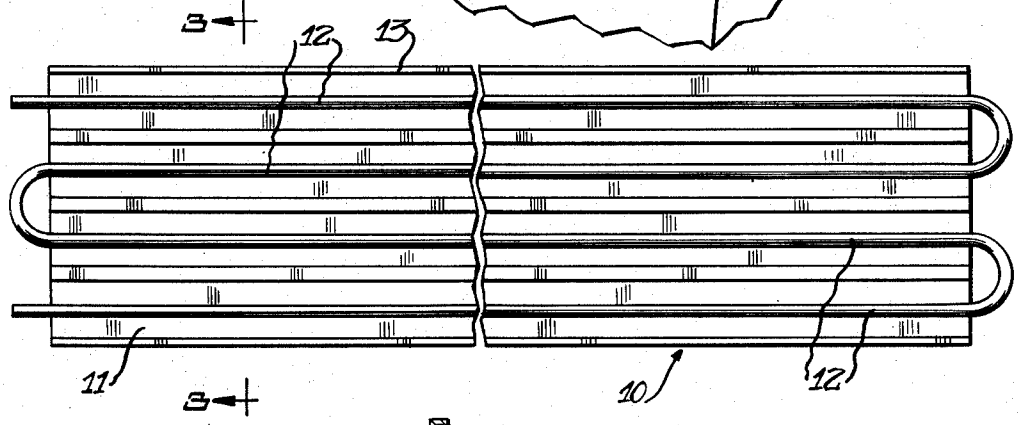
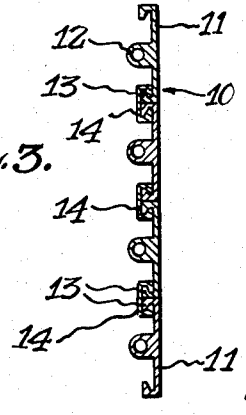


Fig. 3.



INVENTOR.
PAUL F. SCHOEN.

BY
Ramsey, Kent, Chisholm and Lutz
ATTORNEY.

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Fig. 4.

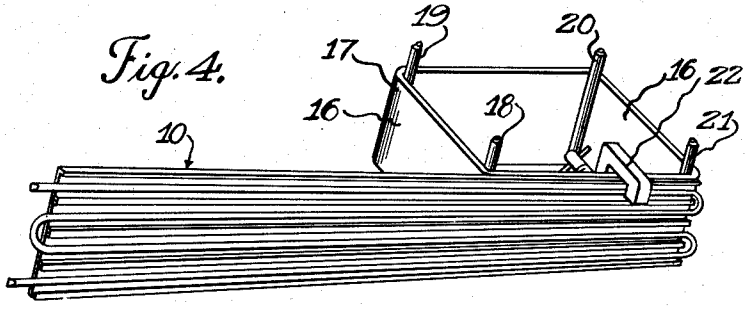


Fig. 6.

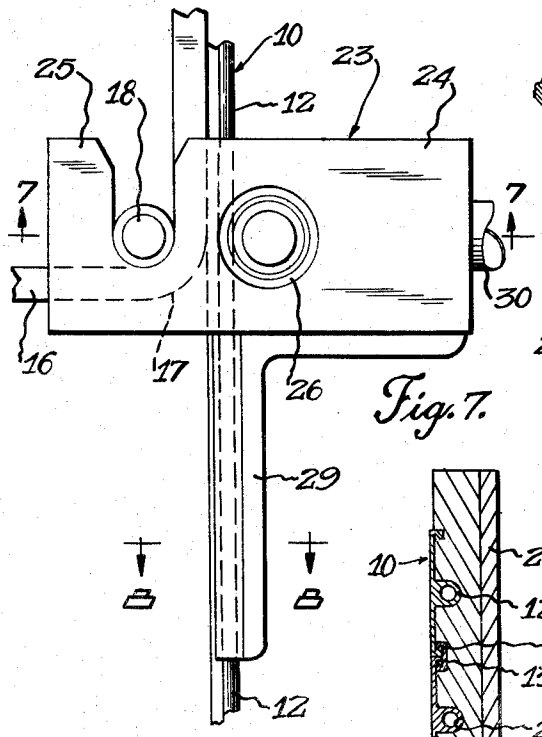


Fig. 5.

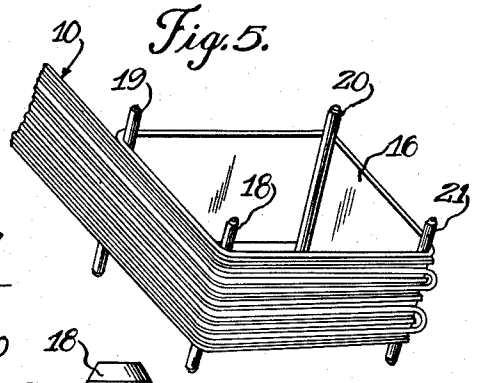


Fig. 7.

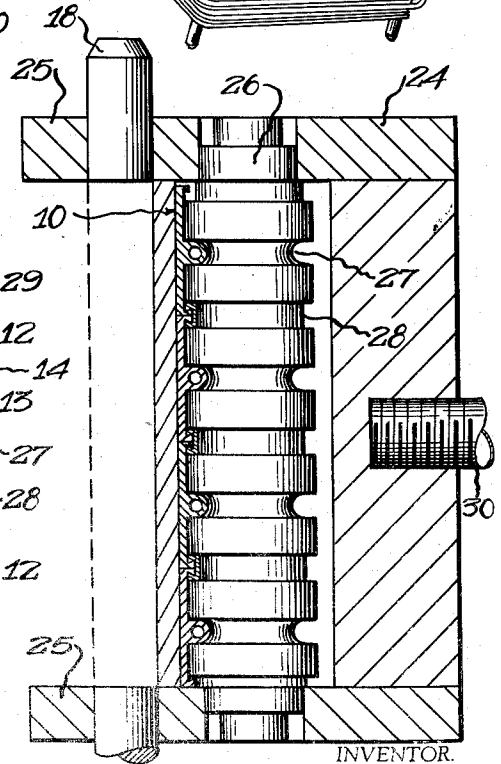
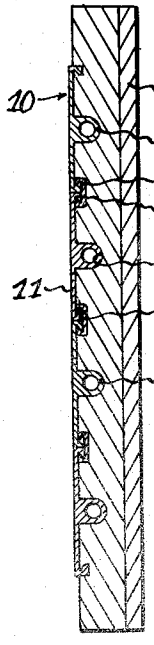


Fig. 8.



INVENTOR.
PAUL F. SCHOEN.

BY
Ramsey, Kent, Chisholm and Lutz
ATTORNEY.

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Fig. 9.

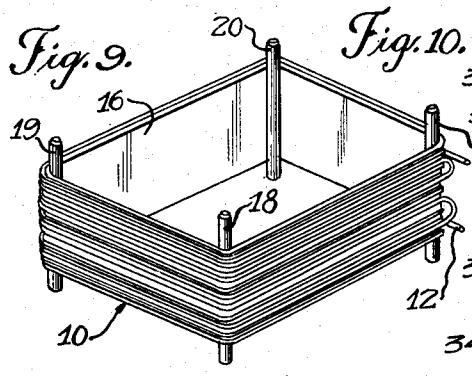


Fig. 10.

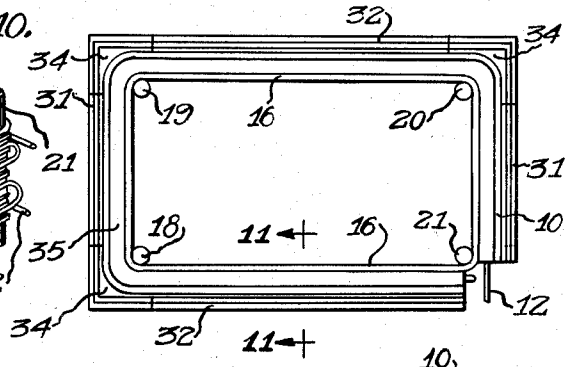


Fig. 11.

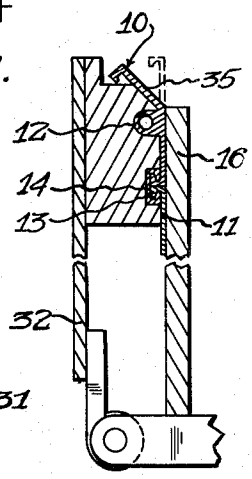


Fig. 12.

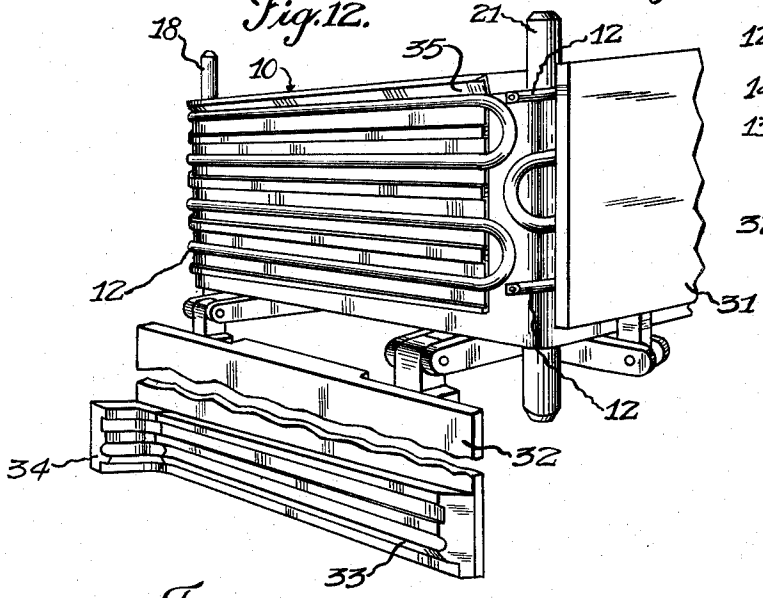
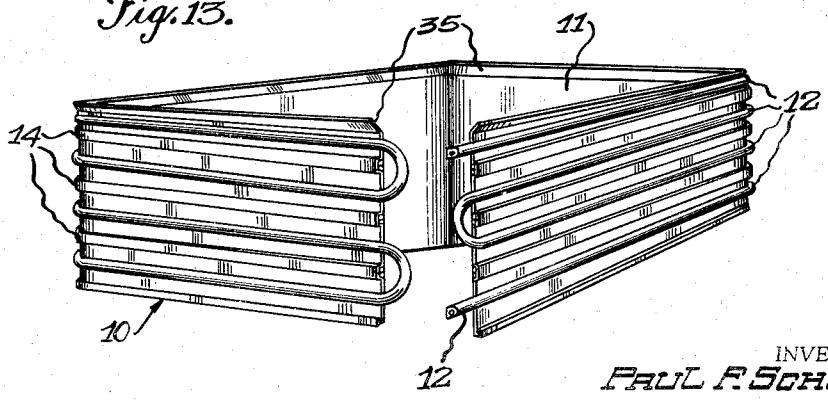


Fig. 13.



INVENTOR.
PAUL F. SCHOEN.

BY
Ramsey, Kent, Nicholson and Lutz
ATTORNEY.

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UNITED STATES PATENT OFFICE

2,289,685

BENDING MACHINE

Paul F. Schoen, Dearborn, Mich., assignor to Bohn Aluminum & Brass Corporation, Detroit, Mich., a corporation of Michigan

Application December 2, 1938, Serial No. 243,499

3 Claims. (Cl. 153—46)

This invention relates to a bending machine of the kind used to make an angular bend in a metal member.

The invention aims particularly to provide a machine by means of which a composite metal sheet having upstanding tubes and upstanding locked seams may be quickly and economically bent into angular form while preventing collapse of the tubes or loosening of the locked seams. This object is accomplished by means of a form and a cooperating roller provided with grooves which firmly engage the tubes and the seams while the roller is moved to bend the sheet about the form.

Another feature of the invention resides in the provision of a guide apron which supports and guides the composite metal sheet while it is being bent.

The composite sheet for which the machine is particularly adapted is used for heat exchange devices, such as cooling units for refrigerators, and in forming such units it is sometimes desired to give an outward flare to one side of the unit. The present invention provides members which cooperate with the form to facilitate the formation of such a flared edge.

These and other objects and advantages of the invention will become apparent as the description proceeds.

While a preferred form of the invention is disclosed for purposes of illustration, it should be understood that various changes may be made in the structure without departing from the spirit of the invention as herein set forth and claimed.

In the drawings:

Fig. 1 is a perspective view of a bending machine embodying the invention.

Fig. 2 is a plan view of one of the composite sheets which the machine is adapted to bend.

Fig. 3 is a section on line 3—3 of Fig. 2.

Fig. 4 is a diagrammatic perspective showing the step preliminary to the bending operation.

Fig. 5 is a view similar to Fig. 4 showing the parts after the first bend has been made.

Fig. 6 is a fragmentary plan view of part of the machine.

Fig. 7 is a view partly in section on line 7—7 of Fig. 6.

Fig. 8 is a section on line 8—8 of Fig. 6.

Fig. 9 is a view similar to Fig. 4 but illustrating the position of the unit after all corners have been bent.

Fig. 10 is a plan view of the machine illustrating the flaring operation.

Fig. 11 is a section on line 11—11 of Fig. 10, with parts broken away.

Fig. 12 is a fragmentary perspective view illustrating the use of the hinged gates to form a flare on the upper edge of the unit.

Fig. 13 is a perspective of the finished unit.

The bending machine of the present invention is particularly adapted to bend the composite metal sheet indicated at 10 in the drawings and which is shown in detail in Figs. 2 and 3. This metal sheet is formed from a single length of strip formed from material such as an alloy of aluminum, and having a cross-sectional shape which includes a flat base strip 11, an upstanding tube 12 which forms a rib extending along the center of the strip, and with undercut flanges 13 at the edges of the strip. At suitable intervals part of the base strip 11 is cut away to expose the tube 12, and the lengths of tubing are then bent back upon themselves to bring the flanges 13 of adjacent sections into contact when they are secured together by fastening a clip strip 14 over the adjacent flanges, as disclosed in my copending application Serial No. 226,776. The composite member thus formed is a sheet having, as illustrated in Fig. 3, a flat bottom wall and having projecting from its upper side a plurality of upstanding tubes and a plurality of upstanding locked seams joining adjacent sections 11. Parts of the base strip 11 are cut away to expose the ends of tube 12, thus facilitating coupling of these ends to a refrigeration system. The composite member thus formed is suited for use as a heat exchange device, particularly for a cooling unit for refrigerators and it is usually preferred to bend the composite sheet into a closed or substantially closed unit. The bending machine of the present invention provides for expeditious and economical bending of the composite metal sheet.

In the form illustrated the composite metal sheet is bent into a substantially closed rectangular form, and for this purpose the bending machine includes a rectangular steel form 15 having plain outer walls 16 connected by rounded corners 17. Pivot pins 18, 19, 20 and 21 are secured inside and concentric with the rounded corners of the rectangular form and extend above and below the walls 16 as clearly shown in Fig. 5.

As a preliminary to the bending operation, the composite metal sheet 10 has one of its ends clamped along a wall 16 of the rectangular form by any suitable clamping device, indicated at 22 in Fig. 4.

The bending tool which is used to bend the

sheet around the corners of the form is indicated generally at 23 in Fig. 1, and is shown in greater detail in Figs. 6, 7 and 8. It includes a body frame 24 provided with upper and lower hooks 25 which are adapted to engage the projecting ends of the pivot pins. Mounted in the body frame 24 is a roller 26 which has its periphery formed with a plurality of rounded grooves 27 shaped so as to closely fit over the upstanding tubes 12 of the composite sheet and with a plurality of flat grooves 28 shaped to closely fit over the upstanding seams of the composite sheet. An apron 29 extends outwardly from one side of body frame 24 and the apron and body frame are also formed with grooves 27 and 28 aligned and registering with those of the roller.

In order to bend the composite sheet around the first corner the hooks 25 of the bending tool are engaged with the pivot pin 18 with the apron of the bending tool extending toward the left of Fig. 4. Suitable pressure is then applied to the handle 30 of the bending tool so as to move the tool in a clockwise direction around pivot pin 18. During this bending operation the bending sheet is positively guided so as to insure an accurate corner by reason of having its upstanding tubes 12 and upstanding seams engaged in the corresponding grooves formed on apron 29. The roller 26 bends the sheet closely around the curved corner of the form 15 and during this bending operation the grooves 27 support the side walls of the upstanding tubes 12 in such a way as to prevent any flattening or bulging of the tubes, and the close engagement of the grooves 28 with the upstanding locked seams prevents any spreading or loosening of the seams. If preferred during the bending operation, a suitable clamp may be applied to the composite strip immediately to the right of and adjacent the pivot pin 18 in order to insure close contact of the composite sheet with the form at this point.

After this operation has been performed the bending tool is removed from pivot pin 18 and the composite sheet is then in the position illustrated in Fig. 5. The bending tool is next engaged with pivot pin 19 when a similar bending operation is performed. Fig. 1 illustrates the position of the parts during this second bending operation. A third bending operation is performed around pivot pin 20 after which the composite sheet will be in a position closely engaging the four sides of the form as illustrated in Fig. 9. It will, of course, be clear that if the composite sheet is to be bent to a U-form instead of to a closed rectangle the composite sheet will be bent around only two corners, and it should also be clear that by providing forms of different shapes the composite sheet may be given different suitable shapes.

It should be understood that the bending tool may be mounted on the form in any preferred manner, and that it may be operated mechanically as well as manually. It should also be clear that if it is desired to form the cooling unit with a smooth outer wall, the upstanding tubes and seams may be turned toward the inside of the unit, in which case the grooves closely conforming to the irregular face of the metal sheet will be disposed in the walls of the form and the roller will have a plain surface engaging the plain face of the metal sheet. With either arrangement the grooves prevent any detrimental distortion of either the upstanding tubes or the locked seams.

After the unit has been bent to the form shown in Fig. 9 it is desired to flare outwardly the upper edge of the unit so as to cause this edge of the unit to closely engage the wall of a cabinet in which it is to be mounted. In order to facilitate the flaring operation the bent unit is first slid up on the form so as to expose the upper edge of the bent unit above the wall of the form, this position being illustrated in Fig. 9. Side gates 31 are then turned up into contact with the sides of the bent unit and end gates 32 are turned into contact with the ends of the bent unit.

The gates 31 and 32 are suitably hinged to the form and their inner walls are shaped to closely conform to the upper part of the unit, the upper edge of these inner walls having outwardly beveled surfaces 33. At each of the corners corresponding to the pins 18, 19 and 20 a block 34 having a rounded bevel corresponding in slope with the beveled surfaces 33 is mounted on an adjacent gate. The gates 31 and 32 are secured firmly against the bent unit by clamps, not shown, after which the upper edge of the bent unit is formed outwardly against the beveled surfaces in the manner clearly shown at 35 in Fig. 11. A wooden block or other suitable instrument may be used for this flaring operation.

The finished cooling unit, which is illustrated in Fig. 13, is ready to be mounted in a cabinet and to have the ends of the tube 12 connected to a refrigeration system. The advantages of the present bending machine in facilitating the formation of this unit will be apparent to those skilled in the art.

I claim:

1. A machine for bending a composite metal sheet composed of a plurality of strips secured together and having a plane inner wall and an irregular outer wall including a plurality of upstanding locked seams and a plurality of upstanding hollow tubes, said machine comprising a form having at least two walls with plane outer faces disposed at right angles to each other and connected by a rounded corner, a bending tool pivotally mounted to swing around the corner, the tool having a roller formed with a plurality of rounded grooves shaped to conform closely to said hollow tubes, and with a plurality of grooves having a square outline and shaped to conform closely to said locked seams, the tool being adapted to bend the composite sheet around the corner while supporting the hollow tubes against collapse and the locked seams against loosening.

2. A machine for bending a composite metal sheet composed of a plurality of strips secured together and having a plane inner wall and an irregular outer wall including a plurality of upstanding locked seams and a plurality of upstanding hollow tubes, said machine comprising a form having at least two walls with plane outer faces disposed at right angles to each other and connected by a rounded corner, a bending tool pivotally mounted to swing around the corner, the tool having a roller and an apron, both of which are formed with a plurality of rounded grooves shaped to conform closely to said hollow tubes, and with a plurality of flat-bottomed grooves shaped to conform closely to said locked seams, the apron being disposed with its grooved face extending vertically and being adapted to support and guide the metal sheet, and the roller being adapted to bend the metal sheet around the corner while supporting the hollow tubes against collapse and the locked seams against loosening.

3. In a bending machine of the type comprising a quadrangular form with walls joined by

rounded corners, and means for bending a work piece around the form, the improvement which comprises: a pair of pivot pins extending beyond the walls adjacent each corner, one of each pair of pins extending upwardly and the other extending downwardly; a bending tool having a U-shaped yoke each leg of which has an open slot adapted to engage laterally with the pivot pins, the tool being removable so that it can be engaged with the pair of pivot pins adjacent each corner while the tool is used to bend the work piece around that corner; a roller pivoted in the yoke, the roller having grooves which conform to ridges on the work piece; and a guide apron extending laterally from the yoke, the apron having grooves which conform to ridges on the work piece and which serve to guide and support the work piece while it is being bent around a corner.

PAUL F. SCHOEN.