Feb. 14, 1956 R. F. YONASH 2,734,552

METAL CORRUGATING MACHINE

Filed Nov. 1, 1952 3 Sheets-Sheet 1

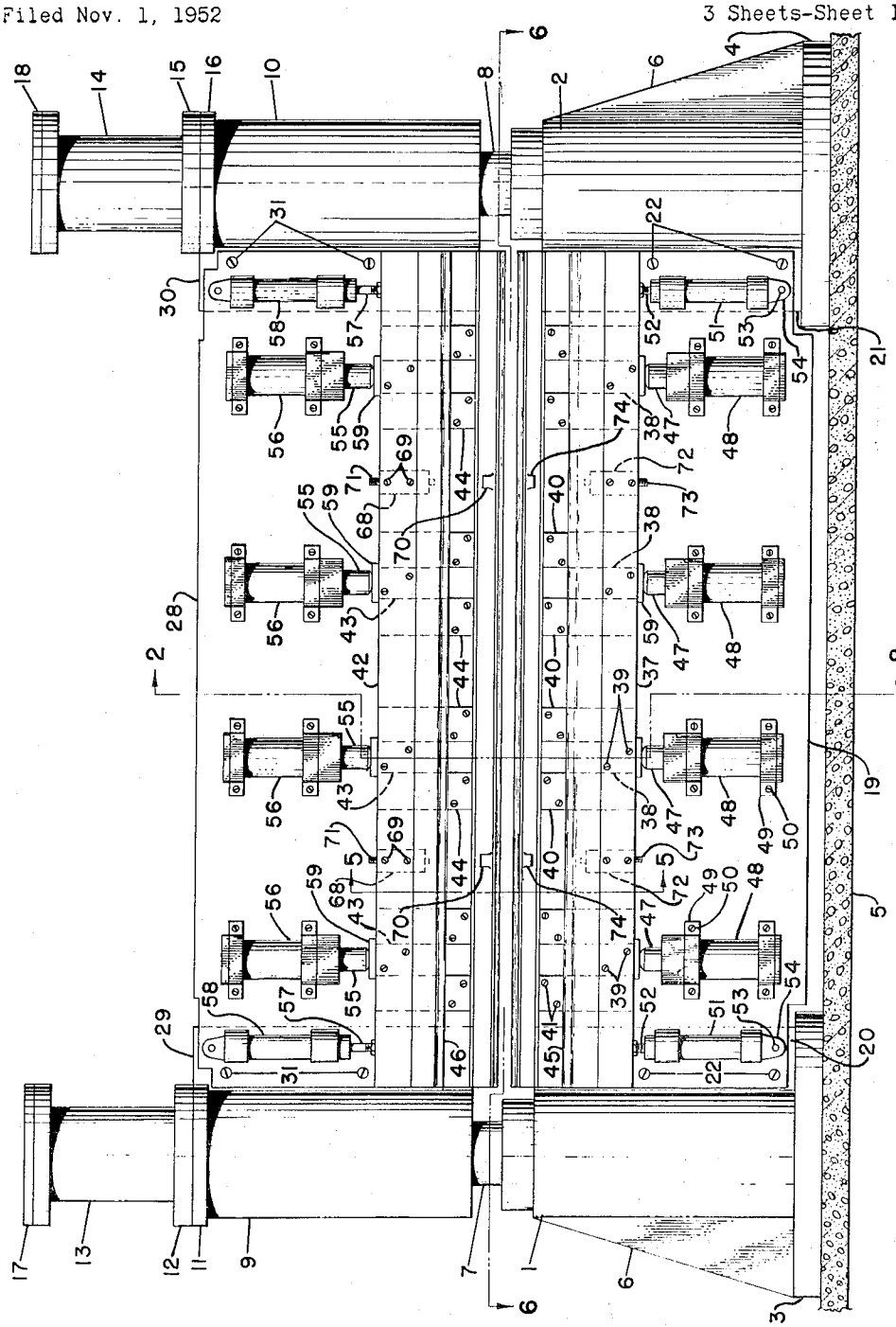


Fig. 1

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Fig. 2

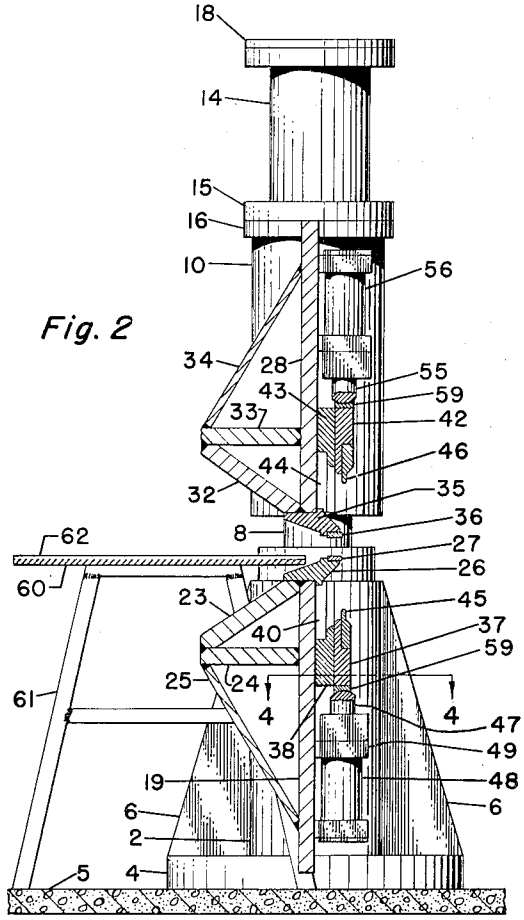
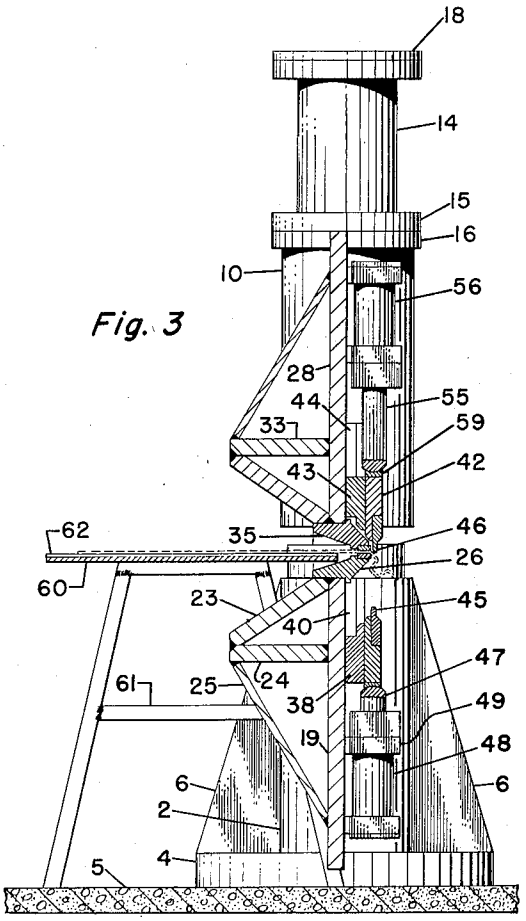


Fig. 3



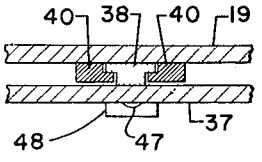


Fig. 4

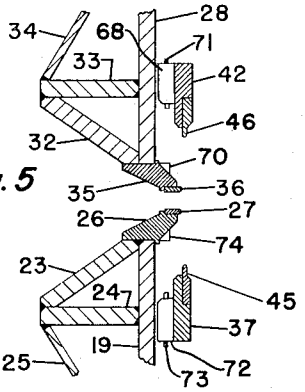


Fig. 5

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METAL CORRUGATING MACHINE

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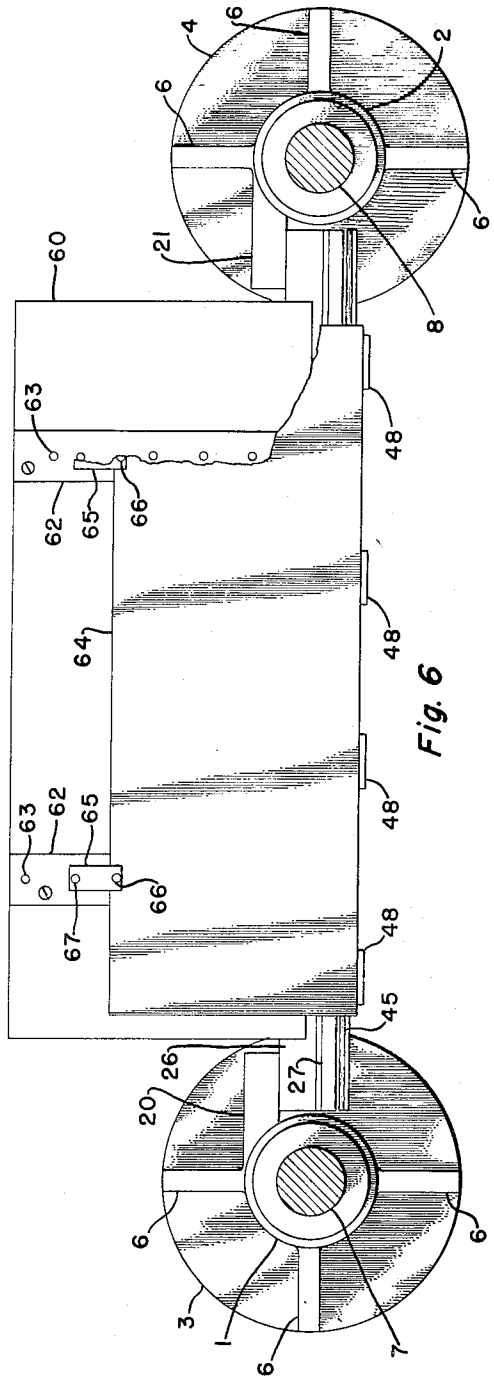


Fig. 6

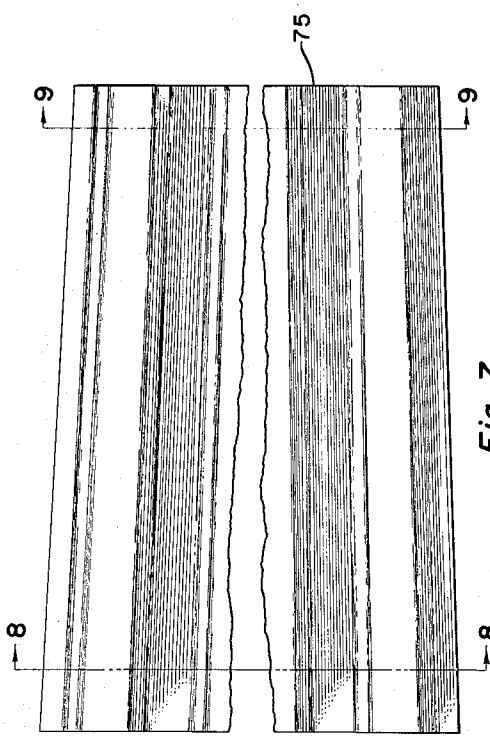


Fig. 7

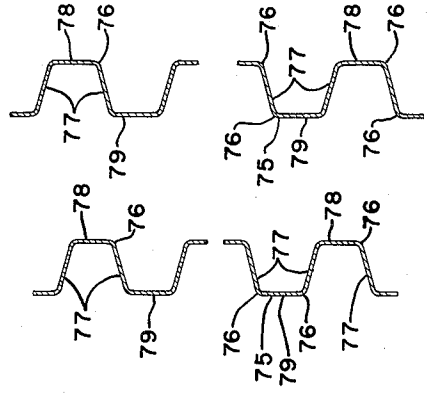


Fig. 8

Fig. 9

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2,734,552

METAL CORRUGATING MACHINE

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Application November 1, 1952, Serial No. 318,176

12 Claims. (Cl. 153—76)

This invention pertains to an apparatus for forming bends in sheets of deformable material, such as sheet metal, and particularly to apparatus especially adapted to form non-parallel corrugations in such sheets.

Corrugated sheet metal is widely used as a structural material because of its light weight and its ability to resist bending transverse to its corrugations. The usual sheet of corrugated metal is corrugated uniformly, that is, the corrugations are of the same depth and spacing over the entire width and length of the sheet. However, for special applications, such as employment in the fabrication of airplane wing sections and fuselage, it is desirable to have sheets of corrugated metal in which the corrugations vary in spacing from one end of the sheet to the other.

The conventional apparatuses which are employed to form corrugations in sheet metal are adapted to form only sheets having uniform corrugations. Heretofore, sheets in which non-uniform or non-parallel corrugations were required have been formed on conventional press brake machines in which the sheet was deformed, or corrugated, by inserting it into the press brake machine and forming a bend in one direction, removing the sheet from the machine, turning it over, forming another bend in the sheet in the opposite direction, and so on until the proper number of bends had been made in the sheet.

It is an object of this invention to provide an apparatus to facilitate the easy and rapid formation of non-parallel corrugations in the sheet of deformable material.

It is a further object of this invention to provide an apparatus in which a series of corrugations of non-uniform cross-section may be formed in a sheet of deformable material without the necessity for removing the sheet from the apparatus and turning it over between successive corrugations.

It is another object of this invention to provide an apparatus which is especially adapted to facilitate the forming of non-uniform corrugations in sheets of deformable material, although the apparatus may, if desired, be employed also in forming uniform corrugations.

It is a further object of this invention to provide a sheet metal forming apparatus comprising a pair of horizontal clamping members which are adapted to clamp a sheet of metal therebetween leaving a portion of the metal overhanging, and provided with means for selectively bending said overhanging portion either upwardly or downwardly with respect to the clamping members.

Other objects and advantages of this invention will become apparent from the following description taken in connection with the attached drawings.

Figure 1 is a front elevation of a preferred embodiment of the metal corrugating apparatus of this invention, showing the parts thereof in the position which they normally occupy when the clamping shoes are open.

Figure 2 is a sectional side elevation taken on line 2—2 of Figure 1.

Figure 3 is a sectional side elevation taken on the same line as Figure 2 but showing the parts of the apparatus in the position occupied when the clamping shoes are

clamped to a sheet of metal and the upper forming platen has been lowered to bend the overhanging portion of the sheet downwardly.

Figure 4 is a fragmentary sectional view taken along the line 4—4 of Figure 2 to show the manner in which the lower forming platen is reciprocally mounted on the lower frame member.

Figure 5 is a fragmentary sectional view taken on the line 5—5 of Figure 1 to show the stop means which are provided for limiting the downward and upward reciprocating movements, respectively, of the upper and lower forming platens.

Figure 6 is a view taken on the line 6—6 of Figure 1, having superimposed thereon a sheet of metal in the position which it would occupy prior to having corrugations formed therein.

Figure 7 is a plan view of a typical corrugated sheet such as might be produced using the apparatus of this invention.

Figure 8 is a section taken on line 8—8 of Figure 7.

Figure 9 is a section taken on line 9—9 of Figure 7.

From the drawings, and particularly with reference to Figure 1, it will be noted that support columns 1 and 2 having footings 3 and 4, respectively, on the lower ends thereof rest on a suitable foundation, such as concrete floor 5. Preferably, footings 3 and 4 are anchored to floor 5 in any suitable manner, as bolts not shown.

Support columns 1 and 2 are preferably cast integral with their respective footings 3 and 4, webs 6 being provided to insure the rigidity and perpendicularity of the columns with respect to their footings. Piston rod 7 is rigidly mounted in support column 1 so as to be immovable with respect thereto, and piston rod 8 is similarly mounted in support column 2. Cylinders 9 and 10 are reciprocally mounted on piston rods 7 and 8, respectively. Cylinder 9 is preferably provided with an upper flange 11 to which is secured, by bolts or clamps, not shown, lower flange 12 of hydraulic cylinder 13 into which extends the upper end of piston rod 7, said piston rod having a piston, not shown, mounted on the upper end thereof for cooperating with said hydraulic cylinder, as will be understood by those familiar with the construction and operation of hydraulic cylinder apparatus. Likewise, a hydraulic cylinder 14 having flange 15 is similarly secured to upper flange 16 of cylinder 10. The upper ends of hydraulic cylinders 13 and 14 are closed by cover plates 17 and 18, respectively.

It will be appreciated that, since piston rods 7 and 8 are rigidly fixed in support columns 1 and 2, respectively, cylinders 9 and 10 may be raised and lowered on piston rods 7 and 8 by the proper introduction and withdrawal of hydraulic fluid under pressure in cylinders 13 and 14.

Since the construction and operation of hydraulic cylinders are so well known, and also since the hydraulic system per se is not within the scope of the present invention, a detailed discussion of the hydraulic system is not thought to be necessary; and further, the fluid lines connecting the hydraulic cylinders with the source of hydraulic fluid have been eliminated from the drawings in the interest of clarity.

Lower clamping member 19 is supported by and between support columns 1 and 2, being secured to flange 20 of support column 1 and flange 21 of support column 2, as by bolts or screws 22 which are preferably countersunk.

As more clearly shown in Figures 2 and 3, lower clamping member 19 is preferably reinforced by structural support plates 23, 24, and 25 secured to the rear face thereof, as by welding.

Also, as more clearly shown in Figures 2 and 3, lower clamping member 19 has secured to the upper edge thereof, as by screws or bolts not shown, a clamping shoe 26,

The upper and forward edge of clamping shoe **26** comprises a forming lip **27** which may either be integral with clamping shoe **26** or secured thereto by any suitable means such as screws, not shown.

An upper clamping member **28** is supported by and between cylinders **9** and **10**, being secured to flange **29** of cylinder **9** and flange **30** of cylinder **10**, as by bolts or screws **31**, which are preferably countersunk. Upper clamping member **28** is preferably reinforced by structural support plates **32**, **33**, and **34** secured to the rear face thereof, as by welding.

As more clearly shown in Figures 2 and 3, upper clamping member **28** has secured to the lower edge thereof, as by screws not shown, an upper clamping shoe **35** which is substantially identical to lower clamping shoe **26** secured to the upper edge of lower clamping member **19**, as hereinabove described.

The lower and forward edge of upper clamping shoe **35** comprises a forming lip **36** which may be formed integral therewith or otherwise suitably secured thereto, as by screws not shown.

It will be appreciated that the upper face of forming lip **27** and the lower face of forming lip **36** are adapted to rigidly clamp a sheet of metal therebetween upon the lowering of upper clamping member **28** with respect to lower clamping member **19**, as will be more fully explained hereinafter.

A lower forming platen **37** is mounted on the front face of lower clamping member **19** so as to be vertically reciprocable with respect thereto. To this end, a plurality of T-shaped bars **38** secured, as by countersunk screws **39**, to the rear face of lower forming platen **37**, are adapted to ride in the T-slots formed between pairs of L-shaped blocks **40** secured, as by countersunk screws **41**, to the front face of lower clamping member **19**. For a clearer understanding of the mounting of lower forming platen **37** on lower clamping member **19**, as explained above, special reference is made to the detail drawing of Figure 4.

Upper forming platen **42** is similarly reciprocably mounted on upper clamping member **28** by means of T-shaped blocks **43** secured to the rear face of said forming platen, said T-shaped blocks being adapted to reciprocate within the T-slots formed between pairs of L-shaped members **44** secured to the front face of upper frame member **28**.

As more clearly shown in Figures 2, 3, and 5, the upper edge of lower forming platen **37** is provided with a forming lip **35** which may be made integral with lower forming platen **37**, but which is preferably removably secured thereto, as by screws not shown. Likewise, the lower edge of upper forming platen **42** is provided with forming lip **46** which may be integral, but which is preferably removably secured thereto.

Lower forming platen **37** is adapted to be raised with respect to lower clamping member **19** by the action of a plurality of rams **47** comprising the piston rods of hydraulic cylinders **48** which are secured, as by clamps **49** and screws **50**, to the front face of lower clamping member **19**; and is adapted to be lowered with respect thereto by hydraulic cylinders **51** having piston rods **52** secured to the lower edge of forming platen **37**, as by being threaded thereinto, cylinder **51** being fixedly secured to lower frame member **19** as by bolts **53** passing through lugs **54** which are preferably formed integral with cylinders **51**.

Likewise, upper forming platen **42** is adapted to be lowered and raised by the action of rams **55** of hydraulic cylinders **56**, and by the piston rods **57** of hydraulic cylinders **58**, respectively.

In the interest of clarity, the fluid lines connecting the several hydraulic cylinders described above with the source of hydraulic fluid have been eliminated from the drawings. Furthermore, since the construction and operation of hydraulic cylinders are a matter of widespread common knowledge, well within the purview of those skilled in the art, no detailed description of this portion of the apparatus is thought to be necessary.

Wear pads **59** are secured to the lower and upper edges, respectively, of lower and upper forming platens **37** and **42** at the points of contact by rams **49** and **55**, respectively, in order to prevent undue wear on the forming platens themselves.

As more clearly shown in Figures 2 and 3, a table **60**, supported, as for instance on frames **61**, is provided as a means for supporting a sheet of metal at the level to be clamped between clamping shoes **26** and **35**.

As more clearly shown in Figure 6, templates **62**, having guide holes **63** punched therein are secured to the top of table **60** to provide means for controlling the extent to which a sheet of metal being corrugated, as for instance sheet **64**, is to be advanced between each operation of the corrugating apparatus, as will be discussed in more detail hereinafter.

A pair of clamps **65**, each having means, as for instance thumb screw **66**, for securing it to the rear edge of sheet **64** and also having a pin **67** which is of such diameter as to fit snugly in holes **63**, are secured to the rear edge of sheet **64**, being in such position that each may cooperate with the holes **63** in one of the templates **62**. It will be understood that after each bending operation performed on the sheet, as hereinafter described, pins **67** of clamps **65** are to be lifted from one set of holes **63** and advanced to the next forward set of such holes. Obviously, by varying the spacing of the holes **63** in one of the templates **62** with respect to the holes in the other of said templates, sheet **64** may be skewed as it is advanced for successive bending operations, whereby to facilitate the making of non-parallel bends in the sheet, and the forming of a sheet such as, for instance, the sheet **75** shown in Figures 7, 8, and 9.

The operation of the apparatus as described above is thought to be reasonably self-evident; however, a brief description of the operation may be in order.

With the respective components of the apparatus in the positions shown in Figures 1 and 2, a sheet of metal, not shown in Figures 1 and 2, is placed flat on table **60** with a portion thereof overhanging the forward edge of forming lip **27** of lower clamping shoe **26**. By operation of hydraulic cylinders **13** and **14**, as will be understood by those skilled in the art, upper clamping member **28** is lowered with respect to lower clamping member **19** thus resulting in the clamping of the sheet between the forming lips **27** and **36** of clamping shoes **26** and **35**, respectively, as shown in Figure 3. The overhanging portion of the sheet may then be bent downwardly by lowering forming platen **42** sufficiently to move the lower edge of forming lip **46** below the clamping space between forming lips **27** and **36**, as shown in Figure 3; or may be bent upwardly by raising lower forming platen **37** sufficiently to raise the upper edge of forming lip **45** above the level of said clamping space. It will be understood that the term clamping space as used herein refers to the space between forming lips **27** and **36** when said lips are in a position to clamp a sheet therebetween.

Thus, by clamping a sheet between clamping shoes **26** and **35**, with a portion of said sheet overhanging the forward edges of forming lips **27** and **36**, lowering forming platen **42**, or raising forming platen **37**, to bend the sheet, returning the forming platens to their normal positions, releasing the sheet by raising clamping shoe **35**, advancing the sheet by the desired amount, and repeating the clamping, bending, and releasing operations, a sheet may be deformed by a series of straight-line bends in any desired spacing or angular relationship with respect to each other, depending upon the extent to which the sheet is advanced between successive bending operations, and depending upon whether the sheet is moved straight forward or skewed between successive bending operations.

It will be appreciated that the horizontal spacing between the forward edges of forming lips **27** and **36** and

the rear faces of forming lips 45 and 46 is such as to accommodate the thickness of the sheet being corrugated without unduly pinching the same. In general, this spacing is substantially equal to the thickness of the sheet being corrugated. Also, it will be appreciated by those skilled in the art, that a sheet of metal of thick cross-section may not be bent as sharply as a thinner sheet without danger of rupturing the sheet at the bend. Therefore, it will be understood that the radius of curvature of forming lips 27 and 36, which may be satisfactory when forming thin sheets, will be unsatisfactory for forming sheets of greater thickness. Accordingly, it will be understood that forming lips 27, 36, 45, and 46 may be replaced by similar forming lips of slightly different dimensions and shapes, said lips being changed as necessary, depending upon the thickness of the particular sheets being formed. Alternatively, if the forming lips are formed integral with the respective clamping shoes and forming platens, the shoes and platens may be changed according to the thickness of the sheets being formed.

In order to stop the downward movement of upper forming platen 42 after movement of forming lip 46 sufficient to make the desired bend in the overhanging portion of a sheet clamped between clamping shoes 26 and 35, there are provided a plurality of stop blocks 68 secured to the rear face of upper forming platen 42, as by screws or bolts 69, and adapted to cooperate with stop anvils 70 provided on the upper surface of upper clamping shoe 35. As more clearly shown in Figure 5, the lower end of a stop bolt 71, which passes through stop block 68, is adapted to strike the upper face of anvil 70 whereby to restrain further downward movement of upper forming platen 42. Stop bolt 71 is preferably threaded through stop block 68 in order that it may be raised and lowered, as desired, to effect stopping of forming platen 42 at the desired level. Also, it will be appreciated that the horizontal alignment of the forming platen 42 in its lower stopping position may be controlled by relative adjustment of the stop bolts 71 of the several stop blocks 68. Similar stop blocks 72, stop bolts 73, and stop anvils 74 are provided for controlling the extent of upward travel of lower forming platen 37.

Figures 7, 8, and 9 represent a sheet 75 such as might be formed on the apparatus of the present invention, said sheet being formed with non-parallel corrugations of uniform height. Thus, with special reference being made to Figures 8 and 9, it will be noted that the corrugations of sheet 75 are more closely spaced at the right end than at the left end as shown in Figure 7. It should be noted that due to the radius of curvature of the forming lips, around which the bends 76 in sheet 75 were made, said bends are in the form of gentle curves rather than sharp breaks. Furthermore, it should be explained that, whereas the corrugating machine herein described is adapted to make right angle bends, the resiliency of most sheet metals provides sufficient spring-back to cause the bends in the sheet to be something less than 90° when the pressure of the forming and clamping lips is released. Thus, as more clearly shown in Figures 8 and 9, the risers 77 of the finished sheet 75 make angles of greater than 90° with the top and bottom lands 78 and 79, respectively.

While there has been shown and described a preferred embodiment of the apparatus of this invention, it will be understood that many changes and alterations may be made thereto without departing from the scope of the invention. Accordingly, this invention is not to be considered as limited to the specific embodiment described but rather is limited only in accordance with the appended claims.

I claim:

1. An apparatus for forming bends in a sheet of deformable material comprising a lower clamping member, an upper clamping member, a lower clamping shoe on the upper edge of said lower clamping member, an upper clamping shoe on the lower edge of said upper clamping member and having its forward edge in substantially vertical alignment with the forward edge of said lower clamping shoe, said clamping shoes being parallel with each other and forming therebetween a clamping space adapted to receive said sheet of deformable material, means for selectively moving one of said shoes and its associated clamping member away from the other of said shoes whereby said sheet of material may be moved freely through said clamping space, and toward the other of said shoes whereby to clamp said sheet in said clamping space, a first forming platen reciprocably mounted on said lower clamping member and normally positioned below and forwardly of said clamping space, a second forming platen reciprocably mounted on said upper clamping member and normally positioned above and forwardly of said clamping space, means for selectively raising said first forming platen sufficiently to move the upper edge thereof above the level of said clamping space and for lowering said second forming platen sufficiently to move its lower edge below the level of said clamping space, whereby a projecting portion of said sheet overhanging the forward edges of said clamping shoes may be selectively bent upwardly about the forward edge of said upper clamping shoe by said first platen or downwardly about the forward edge of said lower clamping shoe by said second platen, and means for returning said forming platens to their respective normal positions.

2. The apparatus according to claim 1 wherein the lower clamping shoe is stationary and the upper clamping shoe and its associated clamping member are vertically movable with respect thereto.

3. An apparatus for forming bends in a sheet of deformable material comprising a lower clamping member, an upper clamping member, a lower clamping shoe on the upper edge of said lower clamping member, an upper clamping shoe on the lower edge of said upper clamping member and having its forward edge in substantially vertical alignment with the forward edge of said lower clamping shoe, said clamping shoes being parallel with each other and forming therebetween a clamping space adapted to receive said sheet of deformable material, means for selectively moving one of said shoes and its associated clamping member away from the other of said shoes whereby said sheet of material may be selectively moved freely through said clamping space, and toward the other of said shoes whereby to clamp said sheet in said clamping space, a first forming platen, having a forming lip on the upper edge thereof, reciprocably mounted on said lower clamping member and normally positioned below and forwardly of said clamping space, a second forming platen, having a forming lip on the lower edge thereof, reciprocably mounted on said upper clamping member and normally positioned above and forwardly of said clamping space, means for selectively raising said first forming platen sufficiently to move the top edge of the forming lip thereof above the level of said clamping space and for lowering said second forming platen sufficiently to move the lower edge of the forming lip thereof below the level of said clamping space, whereby a projecting portion of said sheet overhanging the forward edges of said clamping shoes may be selectively bent upwardly about the forward edge of said upper clamping shoe by said first platen or downwardly about the forward edge of said lower clamping shoe by said second platen, and means for returning said forming platens to their respective normal positions.

4. The apparatus according to claim 3 wherein the lower clamping shoe is stationary and the upper clamping shoe and its associated clamping member are vertically movable with respect thereto.

5. In a bending machine of the type wherein a sheet of deformable material is adapted to be held rigidly in the clamping space formed between an upper clamping shoe on the lower edge of an upper clamping member and a lower clamping shoe on the upper edge of a lower clamp-

ing member, the forward edges of said shoes being in substantially vertical alignment and a portion of said sheet projecting forwardly beyond said forward edges, and at least one of said clamping members being movable vertically with respect to the other, the combination therewith of a first forming platen reciprocably mounted on said lower clamping member and normally positioned below and forwardly of said clamping space, a second forming platen reciprocably mounted on said upper clamping member and normally positioned above and forwardly of said clamping space, means for selectively raising said first forming platen sufficiently to move the upper edge thereof above the level of said clamping space and for lowering said second forming platen sufficiently to move the lower edge thereof below the level of said clamping space, whereby said projecting portion of said sheet may be selectively bent upwardly about the forward edge of said upper clamping shoe by said first platen or downwardly about the forward edge of said lower clamping shoe by said second platen, and means for returning said forming platens to their respective normal positions.

6. In a bending machine of the type wherein a sheet of deformable material is adapted to be held rigidly in the clamping space formed between an upper clamping shoe on the lower edge of an upper clamping member and a lower clamping shoe on the upper edge of a lower clamping member, the forward edges of said shoes being in substantially vertical alignment and a portion of said sheet projecting forwardly beyond said forward edges, and at least one of said clamping members being movable vertically with respect to the other, the combination therewith of a first forming platen reciprocably mounted on said lower clamping member and normally positioned below and forwardly of said clamping space, a second forming platen reciprocably mounted on said upper clamping member and normally positioned above and forwardly of said clamping space, means for selectively raising said first forming platen sufficiently to move the upper edge thereof above the level of said clamping space and for lowering said second forming platen sufficiently to move the lower edge thereof below the level of said clamping space, whereby said projecting portion of said sheet may be selectively bent upwardly about the forward edge of said upper clamping shoe by said first platen or downwardly about the forward edge of said lower clamping shoe by said second platen, adjustable stop means for limiting the upward travel of said first forming platen, adjustable stop means for limiting the downward travel of said second forming platen, and means for returning said forming platens to their respective normal positions.

7. In a bending machine of the type wherein a sheet of deformable material is adapted to be held rigidly in the clamping space formed between an upper clamping shoe on the lower edge of an upper clamping member and a lower clamping shoe on the upper edge of a lower clamping member, the forward edges of said shoes being in substantially vertical alignment and a portion of said sheet projecting forwardly beyond said forward edges, the combination therewith of a first forming platen reciprocably mounted on said lower clamping member and normally positioned below and forwardly of said clamping space, a second forming platen reciprocably mounted on said upper clamping member and normally positioned above and forwardly of said clamping space, means for selectively raising said first forming platen sufficiently to move the upper edge thereof above the level of said clamping space and for lowering said second forming platen sufficiently to move the lower edge thereof below the level of said clamping space, whereby said projecting portion of said sheet may be selectively bent upwardly about the forward edge of said upper clamping shoe by said first platen or downwardly about the forward edge of said lower clamping shoe by said second platen, means for returning said forming platens to their respective normal positions, and means for selectively moving one of said clamping shoes and its associated clamping member vertically with respect to the other to effect selective clamping and releasing of said sheet within said clamping space.

8. In a bending machine of the type wherein a sheet of deformable material is adapted to be held rigidly in the clamping space formed between an upper clamping shoe on the lower edge of an upper clamping member and a lower clamping shoe on the upper edge of a lower clamping member, the forward edges of said shoes being in substantially vertical alignment and a portion of said sheet projecting forwardly beyond said forward edges, the combination therewith of a first forming platen reciprocably mounted on said lower clamping member and normally positioned below and forwardly of said clamping space, a second forming platen reciprocably mounted on said upper clamping member and normally positioned above and forwardly of said clamping space, means for selectively raising said first forming platen sufficiently to move the upper edge thereof above the level of said clamping space and for lowering said second forming platen sufficiently to move the lower edge thereof below the level of said clamping space, whereby said projecting portion of said sheet may be selectively bent upwardly about the forward edge of said upper clamping shoe by said first platen or downwardly about the forward edge of said lower clamping shoe by said second platen, means for returning said forming platens to their respective normal positions, and means for selectively lowering said upper clamping shoe, and its associated clamping member to clamp said sheet in said clamping space and raising said upper clamping shoe and its associated clamping member to release said sheet.

9. In a bending machine of the type wherein a sheet of deformable material is adapted to be held rigidly in the clamping space formed between an upper clamping shoe on the lower edge of an upper clamping member and a lower clamping shoe on the upper edge of a lower clamping member, the forward edges of said shoes being in substantially vertical alignment and a portion of said sheet projecting forwardly beyond said forward edges, and at least one of said clamping members being movable vertically with respect to the other; the combination therewith of a first forming platen, having a forming lip on the upper edge thereof, reciprocably mounted on said lower clamping member and normally positioned below and forwardly of said clamping space, a second forming platen, having a forming lip on the lower edge thereof, reciprocably mounted on said upper clamping member and normally positioned above and forwardly of said clamping space, means for selectively raising said first forming platen sufficiently to move the top edge of the forming lip thereof above the level of said clamping space and for lowering said second forming platen sufficiently to move the lower edge of the forming lip thereof below the level of said clamping space, whereby said projecting portion of said sheet may be selectively bent upwardly about the forward edge of said upper clamping shoe by said first platen or downwardly about the forward edge of said lower clamping shoe by said second platen, and means for returning said forming platens to their respective normal positions.

10. In an apparatus for forming bends in a sheet of deformable material comprising a lower clamping member, an upper clamping member, a lower clamping shoe on the upper edge of said lower clamping member, an upper clamping shoe on the lower edge of said upper clamping member and having its forward edge in substantially vertical alignment with the forward edge of said lower clamping shoe, the upper edge of said lower clamping shoe and the lower edge of said upper clamping shoe being parallel with each other and forming therebetween a clamping space adapted to receive said sheet of deformable material, means for selectively moving one of said shoes and its associated clamping member away from the other of said shoes whereby said sheet of material may be moved freely through said clamping space, and toward

the other of said shoes whereby to clamp said sheet in said clamping space, a first forming platen reciprocably mounted on said lower clamping member and normally positioned below and forwardly of said clamping space, a second forming platen reciprocably mounted on said upper clamping member and normally positioned above and forwardly of said clamping space, means for selectively raising said first forming platen sufficiently to move the upper edge thereof above the level of the upper edge of said lower clamping shoe and for lowering said second forming platen sufficiently to move the lower edge thereof below the level of the lower edge of said upper clamping shoe, whereby a projecting portion of said sheet overhanging the forward edges of said clamping shoes may be selectively bent upwardly about the forward edge of said upper clamping shoe by said first platen or downwardly about the forward edge of said lower clamping shoe by said second platen, and means for returning said forming platens to their respective normal positions.

11. The apparatus according to claim 10 wherein the lower clamping shoe is stationary and the upper clamping shoe and its associated clamping member are vertically movable with respect thereto.

12. In a bending machine of the type wherein a sheet of deformable material is adapted to be held rigidly in the clamping space formed between the lower face of an upper clamping shoe on the lower edge of an upper clamping member and the upper face of a lower clamping shoe on the upper edge of a lower clamping member, the forward edges of said shoes being in substantially vertical alignment and a portion of said sheet projecting forwardly beyond said forward edges, and at least one of said clamping members being movable vertically with respect to the other, the combination therewith of a first forming platen reciprocably mounted on said lower clamping member and normally positioned below and forwardly of said clamping space, a second forming platen reciprocably mounted on said upper clamping member and normally positioned above and forwardly of said clamping space, means for selectively raising said first forming platen sufficiently to move the upper edge thereof above the level of said upper face of said lower clamping shoe and for lowering said second platen sufficiently to move the lower edge thereof below the level of said lower face of said upper clamping shoe, whereby said projecting portion of said sheet may be selectively bent upwardly about the forward edge of said upper clamping shoe or downwardly about the forward edge of said lower clamping shoe, and means for returning said forming platens to their respective normal positions.

References Cited in the file of this patent

UNITED STATES PATENTS

375,577	Short	Dec. 27, 1887
478,723	Totten	July 12, 1892
491,187	Partyka	Feb. 7, 1893
507,175	Singer	Oct. 24, 1893
533,645	Henry	Feb. 5, 1895
1,606,489	Winter	Nov. 9, 1929
2,001,273	Greer	May 14, 1935

FOREIGN PATENTS

658,766	Germany	Apr. 14, 1938