

May 24, 1960

R. L. PETERSON

2,937,689

MATERIAL BENDING APPARATUS

Filed Feb. 8, 1957

3 Sheets-Sheet 1

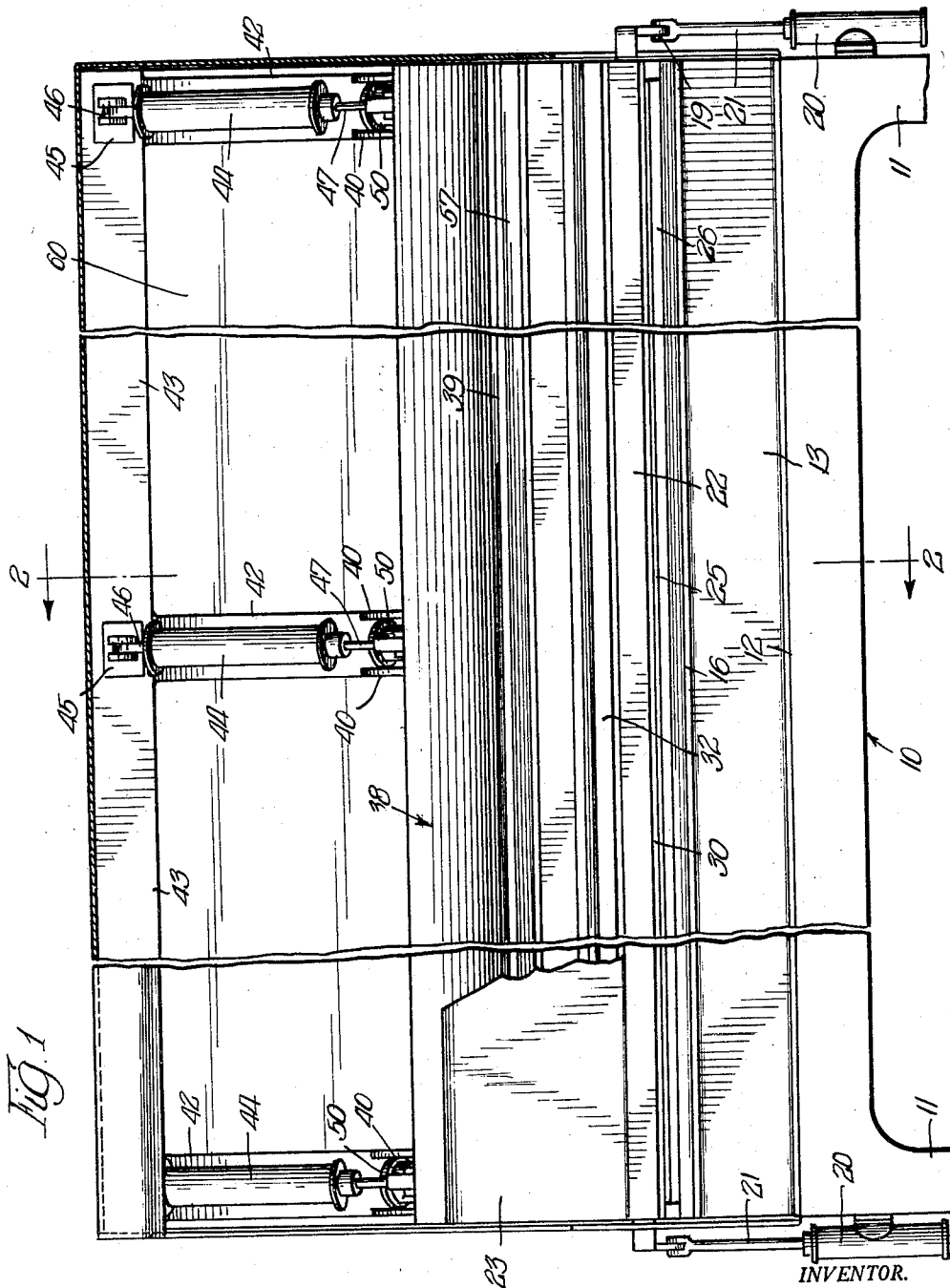


Fig. 1

INVENTOR.
Robert L. Peterson,
BY

Byron, Hume, Green & Clement
Attys.

May 24, 1960

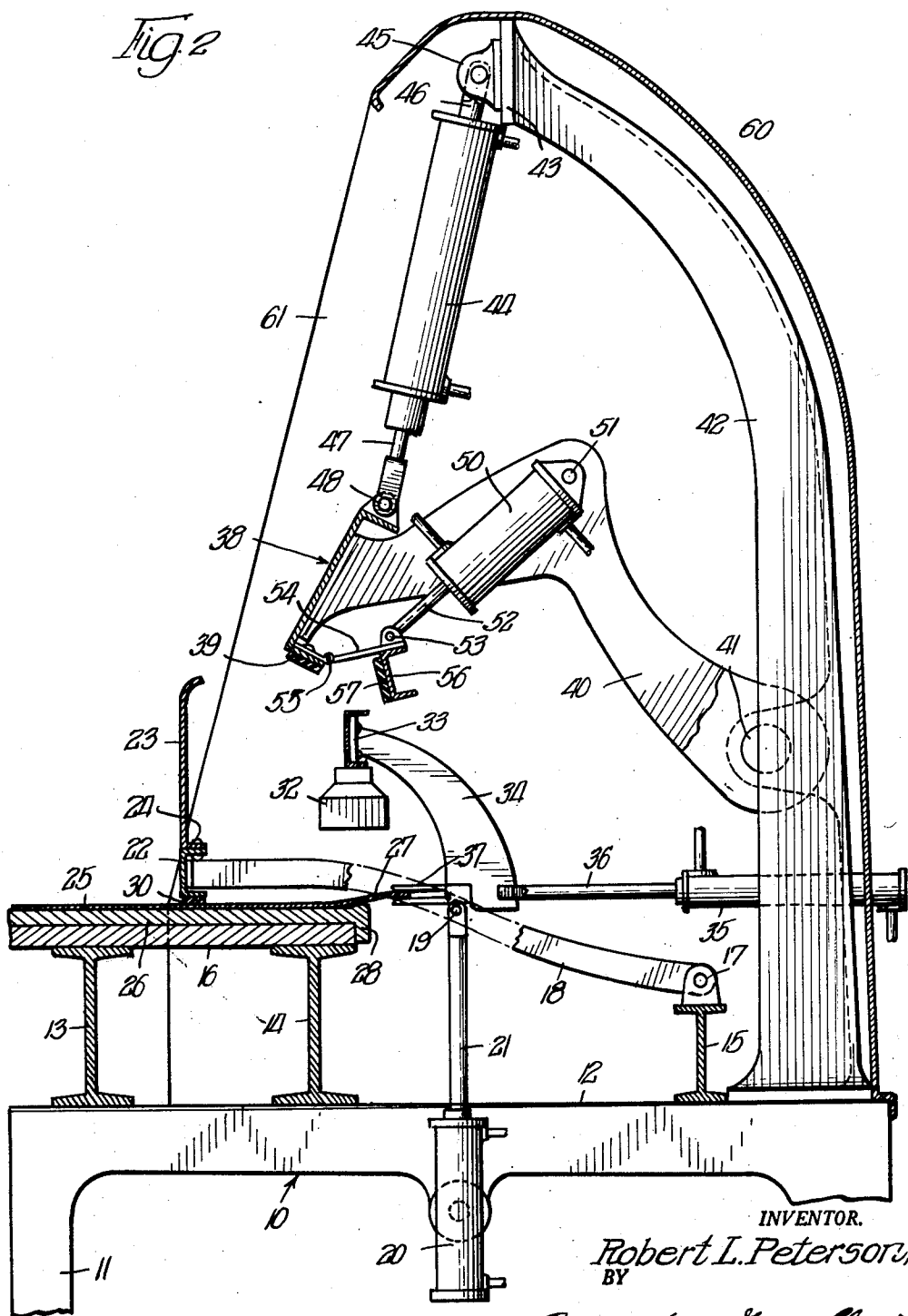
R. L. PETERSON

2,937,689

MATERIAL BENDING APPARATUS

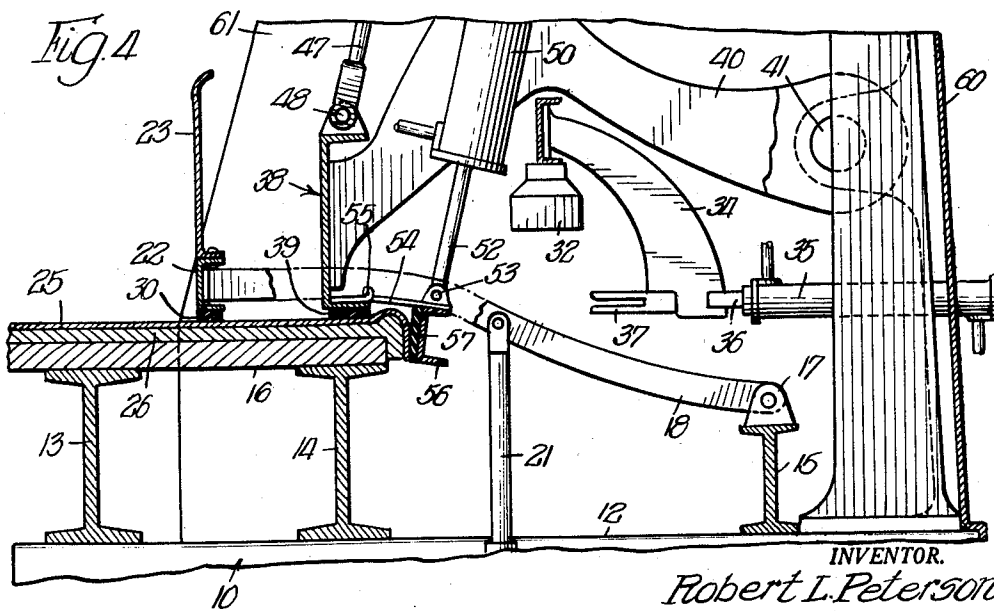
Filed Feb. 8, 1957

3 Sheets-Sheet 2



2,937,689

3 Sheets-Sheet 3



Byron, Hume, Goethe & Clement
Atty.

1

2,937,689

MATERIAL BENDING APPARATUS

Robert L. Peterson, Elgin, Ill., assignor to Uniflex Engineering, Inc., Elgin, Ill., a corporation of Illinois

Filed Feb. 8, 1957, Ser. No. 638,963

8 Claims. (Cl. 154—1)

The invention relates to material bending apparatus and has reference more particularly to apparatus for bending sheet material such as thermoplastic materials over rounded edges of the type provided by backing members and the like and wherein the arcuate contour of the bend may vary in radii over a considerable range.

Objects of the invention are to provide a bending machine of novel and improved construction which can bend or roll the terminal edges of sheet material over arcuate surfaces such as may be provided by the backing members to which the material is simultaneously and adhesively secured, which will perform such bending functions by rolling the sheet material in place in a single and continuous operation so that pre-forming of the sheet material is eliminated, and a machine which is designed to compensate for varying thicknesses of laminating stock by a movable rolling device. A simple adjustment permits larger radii to be rolled to the same ratio and the time for accomplishing such a change is held to a minimum.

Another object of the invention is to provide a bending machine as described which will incorporate heating means for pre-heating plastics and similar sheet material to facilitate the bending of the same. However, the utility of the present device is not necessarily limited to the thermal-change type material but the said device will roll and form or laminate sheet metal and other covering material over formed core stock.

A still further object is to provide a bending machine which will comprise a self-contained production unit having scientifically designed features which will permit its use in ordinary normal production areas, and a machine as described which will be rugged in construction and which will conform to all engineering requirements to thus permit day after day repetitive use.

With these and various other objects in view, the invention may consist of certain novel features of construction and operation, as will be more fully described and particularly pointed out in the specification, drawings and claims appended hereto.

In the drawings which illustrate an embodiment of the device, and wherein like reference characters are used to designate like parts—

Figure 1 is a front elevational view illustrating the improved material bending machine of the invention;

Figure 2 is a sectional view taken transversely of the machine of Figure 1 substantially on line 2—2 thereof;

Figure 3 is a fragmentary sectional view similar to Figure 2 but showing elements thereof in the position just prior to performing a bending operation; and

Figure 4 is a fragmentary, transverse, sectional view similar to Figure 3 but showing the elements of the machine in the position they assume at the completion of a bending operation.

Referring more particularly to the drawings, the apparatus selected for illustrating the invention consists of heavy supporting structure including the table 10 having the legs 11 and which table provides a flat top surface 12

2

on which is supported most of the bending elements of the apparatus. The table 10 is preferably of cast iron construction in order to provide the necessary strength and weight for the bending instrumentalities and said flat top surface 12 has suitably secured thereto the eye beams 13, 14 and 15, the former providing a support for the work-supporting member 16, and the eye beam 15 having the pivot supports 17 secured thereto for pivotally mounting the arms 18. The arms 18 are actuated by power cylinders 20 which are supplied with fluid under pressure, either air or liquid, and by means of the piston rods 21 the said power cylinders are connected respectively at 19 to the arms 18. The hold-down bar 22 extends for the length of the machine, as is evident from an inspection of Figure 1, and said bar is fixedly secured to the arms 18 at their ends opposite the pivots 17. It will be understood that there is an arm 18 and a power cylinder 20 at each end of the machine, all as shown in Figure 1, and thus the hold-down bar 22 is elevated and lowered by actuation of the power cylinders 20. The baffle plate 23 is secured at 24 to the hold-down bar 22 and said baffle plate also extends for the length of the machine and has the function of holding heat within the apparatus by preventing cross currents of outside cool air.

For illustrating the mode of operation of the apparatus, a sheet of plastic material 25 has been placed on the backing member 26, which is in turn supported on the work-supporting member 16, and an adhesive of the contact type was used for securing the plastic sheet 25 to the backing member 26. Following this operation the hold-down bar 22 is lowered onto the plastic sheet to maintain the parts in place, with the edge 27 of the sheet extending some distance outwardly beyond the work-supporting member so as to overhang the formed edge 28 of the backing member. To prevent any scarring or damage to the top surface of the plastic sheet the hold-down bar 22 may be provided with the soft rubber pad 30.

The first step in the bending operation is to heat the overhanging edge 27 of the thermoplastic sheet to soften the same whereby to facilitate the bending of the sheet and this is accomplished by the heater 32 which is secured at 33 to the supporting arm 34. Said arm is moved to and from an operative position by the power cylinder 35, having the piston rod 36, so that a pressure fluid admitted to the right hand end of the cylinder will force the piston thereof and thus piston rod 36 into an operative extended position whereby to locate heater 32 over the edge 27 of the plastic sheet. The finger or bifurcated element 37 is a part of the supporting arm 34 and the finger is so located as to receive the tip edge of the plastic sheet in order to support the same during the heating operation. The operative position of the heater is shown in Figure 2. To retract the heater, pressure fluid is admitted to the left hand end of cylinder 35 and the piston of said cylinder, piston rod 36, supporting arm 34, and heater 32 are moved to an inoperative location, as best illustrated in Figures 3 and 4.

This retraction movement of the heater into its position of rest leaves the projecting edge 27 of the plastic sheet unsupported and accordingly said edge is now in condition for bending, which is performed by a pivoted roll bar, as illustrated in Figures 3 and 4. However, it is first necessary to apply pressure to the plastic sheet at a point adjacent the formed edge 28 of the backing member and this step in the method is accomplished by a presser foot such as indicated by numeral 38. Said foot is generally in the form of a channel beam and here again to prevent damage to the plastic sheet the foot is preferably provided with a soft rubber pad 39. Pivoted arms 40 are employed for pivotally supporting

3

the presser foot 38 and said arms are located at spaced intervals lengthwise of the machine, having pivotal securement as at 41 to the frame members 42, which rest on the flat top surface 12 of the table 10, being suitably secured thereto, and having an outwardly curved upper end so as to extend partly over said table.

The frame members 42 are joined at their top ends by the facing plate 43 which extends for the length of the machine, thereby providing a support for suspending one end of each of the power cylinders 44. Each said power cylinder 44 is pivotally suspended from the facing plate 43 by means of the bifurcated pivot support 45 and stem 46. A piston rod 47 extends from the opposite end of each power cylinder 44 and each piston rod is pivotally secured as at 48 to the presser foot 38. Accordingly, the presser foot is raised or lowered through actuation of the power cylinders 44, which are connected so as to operate in unison. However, in order to make room for the heater 32 it will be seen that the presser foot must be located in an elevated position and the operation of lowering the foot onto the plastic sheet can not be accomplished until after the heater has been retracted.

The arms 40 are grouped in pairs with respect to each of the power cylinders 44 and the arms of each pair are spaced sufficiently to accommodate between them a power cylinder 50 having pivotal connection to said arms by means of the stud 51. The piston rod 52 of power cylinders 50 is pivotally secured at 53 to the hinge plate 54, the said plate having a hinged connection at 55 with the presser foot 38. The roll bar 56 has fixed securement to the underside of hinge plate 54 and said roll bar, in accordance with the invention, extends for the length of the machine. On the operating side of the roll bar there is provided a pad 57 which provides a relatively soft surface for contact with edge 27 of the plastic sheet in bending and rolling the same around the formed edge 28. When the supporting arms 40 are lowered to bring the presser foot 38 into contact with the plastic sheet, it will be observed that the power cylinders 50 remain inoperative and thus the roll bar 56 remains retracted during this operation. However, after the plastic sheet has been engaged by the presser foot the next operation of the present bending machine is to cause pivotal movement of the roll bar 56 on its pivot point 55 and as a result thereof the edge 27 of the sheet is bent around the formed edge 28. Due to the adhesive previously applied to the parts, the bent portion of the plastic sheet is caused to firmly adhere to said formed edge. To effect operating movement of the roll bar, a pressure fluid is supplied to the upper end of the power cylinders 50 and said cylinders are connected so that they operate in unison, with the result that the roll bar is moved from its retracted position of Figure 3 to its operative position of Figure 4. It is desirable to hold the roll bar 56 in its operative position of Figure 4 for a short interval of time to assure adequate pressure on the edge 27 for effecting its securement to the backing member.

The roll bar is retracted by admitting pressure fluid to the lower end of the cylinders 50, allowing the fluid to exhaust from the upper end. It will be observed that the roll bar is pivotally secured to the presser foot and has pivotal movement with respect to said foot. It will also be seen that the power cylinders 50 are carried by the supporting arms 40 so that a simple and compact arrangement of elements is accordingly provided for performing two of the important functions in the bending of a sheet, namely, first, that of holding the sheet firmly in place on its backing member and at a location adjacent the formed edge of the backing member, and secondly, that of bending the edge of the sheet over the backing member by applying rolling pressure to said edge.

With the retraction of the roll bar 56 the operation

4

of bending the edge of the plastic sheet is completed and the sheet can now be released by release of the presser foot 38 and release of the hold-down bar 22. Fluid pressure is applied to the lower ends of the cylinders 44 to release the presser foot and simultaneously therewith fluid is released from the top end of the cylinders. Power cylinders 20 are similarly actuated so that both elements, namely, the presser foot and the hold-down bar, are elevated, thereby releasing the workpiece 25, 26, which can now be removed from the work supporting member 16. Another unfinished workpiece can be placed thereon for similar bending procedures and these can be accomplished by repeating the cycle of operations of the machine.

The bending apparatus as described is partly enclosed by means of a back wall such as 60 and end walls 61. Both walls may be formed of thin metal or other suitable material and the enclosure thus formed functions in combination with the baffle plate 23 to prevent infiltration of cool air such as might interfere with the heating of the plastic sheet.

The invention is not to be limited to or by details of construction of the particular embodiment thereof illustrated by the drawings, as various other forms of the device will of course be apparent to those skilled in the art without departing from the spirit of the invention or the scope of the claims.

What is claimed is:

1. In material bending apparatus, in combination, supporting frame structure providing a work supporting member, a hold-down bar for holding a workpiece on the work supporting member, supporting arms for the hold-down bar having pivotal connection with the frame structure, power means connecting with the arms for actuating the hold-down bar to and from an operative and a released position, a presser foot, supporting arms for the presser foot also having pivotal connection with the frame structure, other power means for actuating the presser foot to and from an operative and a released position, a roll bar in spaced relation with the presser foot but having pivotal connection with the presser foot, and additional power means in associated relation with the supporting arms for the presser foot for actuating the roll bar.

2. Material bending apparatus as defined by claim 1, additionally including a heater and power means for reciprocating the heater in a plane substantially parallel to but above the plane of the workpiece and to and from an operative position approximately over the workpiece.

3. In material bending apparatus, in combination, supporting frame structure providing a work supporting member, a hold-down bar for holding a workpiece on the work supporting member, supporting arms for the hold-down bar having pivotal connection with the frame structure, power means connecting with the arms for actuating the hold-down bar to and from an operative and a released position, a presser foot, supporting arms for the presser foot also having pivotal connection with the frame structure, and constructed and arranged to permit the presser foot to move to and from the workpiece, other power means for actuating the presser foot, a roll bar in spaced relation with the pressure foot, means pivotally connecting the roll bar to the presser foot, and additional power means for actuating the roll bar, said additional power means being supported by the supporting arms for the presser foot.

4. Material bending apparatus, as defined by claim 3, additionally including a heater and power means for reciprocating the heater in a plane substantially parallel to but above the plane of the workpiece and to and from an operative position approximately over the workpiece.

5. In material bending apparatus, in combination, frame structure providing a work supporting member for a workpiece including a backing member and a surfacing sheet adapted to be adhesively secured thereto

5

hold-down bar for holding the workpiece in assembled relation on the supporting member, supporting arms for the hold-down bar having pivotal connection with the frame structure, power cylinders connecting with the arms for actuating the hold-down bar to and from an operative and released position, a presser foot for contacting the surfacing sheet adjacent a projecting edge, supporting arms for the presser foot and also having pivotal connection with the frame structure, other power cylinders for actuating the presser foot to and from a contacting relation with the surfacing sheet, a roll bar pivotally connected in spaced relation to the presser foot, said roll bar having movement when the presser foot is in contact with the surfacing sheet for bending the projecting edge of the sheet over a formed edge provided by the backing member, and additional power cylinders in associated relation with the supporting arms for the presser foot for actuating the roll bar.

6. Material bending apparatus as defined by claim 5, additionally including a heater for heating the projecting edge of the surfacing sheet, and a fourth set of power cylinders for reciprocating the heater in a plane approximately parallel to but above the plane of the workpiece, said heater having an operative position over the projecting edge of the sheet only when the presser foot is in an elevated released position.

7. In material bending apparatus, in combination, frame structure providing a work supporting member for a workpiece including a backing member and a surfacing sheet adapted to be adhesively secured thereto, a hold-down bar for holding the workpiece in assembled relation on the supporting member, supporting arms for the hold-down bar having pivotal connection with the frame structure, power cylinders connecting with the arms for actuating the hold-down bar to and from an operative and released position, a presser foot for contacting the surfacing sheet adjacent a projecting edge, supporting arms for the presser foot, said supporting arms also having pivotal connection with the frame structure, and constructed and arranged to permit the presser foot to move to and from the workpiece, other power cylinders pivotally suspended from the frame structure for actuating the presser foot, a roll bar in spaced relation to the presser foot, means pivotally connecting the

6

roll bar to the presser foot, said roll bar having movement when the presser foot is in contact with the surfacing sheet for bending the projecting edge of the sheet over a formed edge provided by the backing member, and additional power cylinders for actuating the roll bar, said additional power cylinders being fixed to and pivotally supported from the frame by the supporting arms for the presser foot.

8. In material bending apparatus, in combination, frame structure providing a work supporting member for a workpiece including a backing member and a surfacing sheet adapted to be adhesively secured thereto, a hold-down bar extending longitudinally of the frame structure for holding the workpiece in assembled relation on the supporting member, supporting arms for the hold-down bar having pivotal connection with the frame structure, power means connecting with the arms for actuating the hold-down bar to and from operative and released positions, a presser foot for contacting the surfacing sheet adjacent a projecting edge thereof and between said edge and the hold-down bar, supporting arms for the presser foot, said supporting arms also having pivotal connection with the frame structure and providing for movement of the presser foot to and from the workpiece, other power means pivotally suspended from the frame structure for actuating the presser foot, a heater supported for movement in a substantially horizontal plane above the workpiece for heating the said projecting edge when positioned over the same, a supporting member for releasable contact with the said projecting edge for supporting said edge during the heating operation, a roll bar pivotally connected to the presser foot, and means for actuating the roll bar when the presser foot is in contact with the surfacing sheet for bending the projecting edge of the sheet over a formed edge provided by the backing member.

References Cited in the file of this patent

UNITED STATES PATENTS

40	368,475	Johnson	Aug. 16, 1887
	746,090	Johnson	Dec. 8, 1903
	2,175,679	Beatty	Oct. 10, 1939
	2,648,370	Beach	Aug. 11, 1953
	2,739,637	Tyler	Mar. 27, 1956