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| [45] | Patented | Oct. 13, 1970 |
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- [54] **METHOD AND APPARATUS FOR FORMING A
CONTAINER**
9 Claims, 8 Drawing Figs.

- [52] **U.S. Cl.**..... 93/36,
93/39.3, 93/44.1, 229/1.5
[51] **Int. Cl.**..... **B31b 1/00**
[50] **Field of Search**..... 93/36,
36.05, 39.1(P), 39.2, 39.3, 44, 44.1, 39(CO), 36.1

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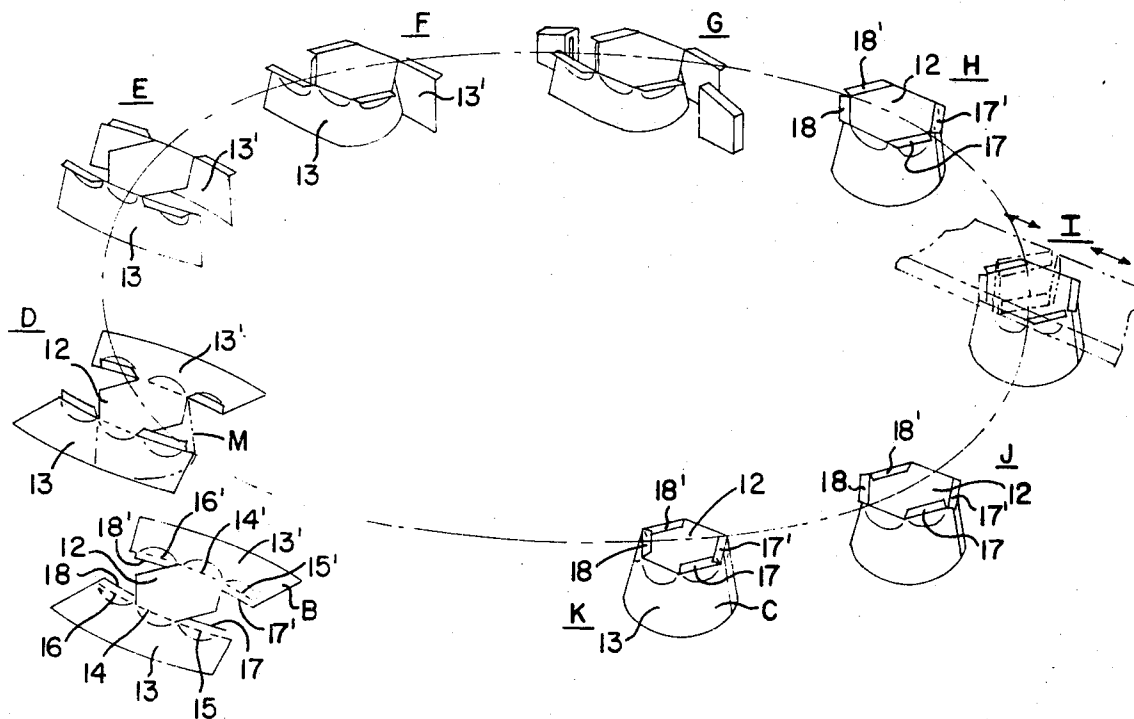
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ABSTRACT: A method and apparatus for fabricating from blanks of paperboard or similar sheet material containers which are characterized by a bottom wall panel of polygonal shape and a side wall comprising two panels which are integrally hinged to oppositely disposed edges of the bottom wall panel and folded upwardly, with overlapping margins formed into vertically extending seams, and merging into a circular top, the apparatus comprising a series of mandrels on which the containers are formed, each mandrel having associated therewith folder plates pivotally mounted for engaging downwardly turned side wall forming panels of the blank and for wrapping the same about the mandrel so that marginal portions are positioned in seam forming relation, heaters for activating an adhesive on the seam forming areas, a vertically reciprocable head having tightening rolls which are adapted to be swung so as to fold down over the bottom forming panel tabs which connect portions of the side walls to the bottom wall and reciprocable mounted heaters for activating adhesive material for securing the tabs to the bottom forming panel.



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Sheet 1 of 3

FIG. 1

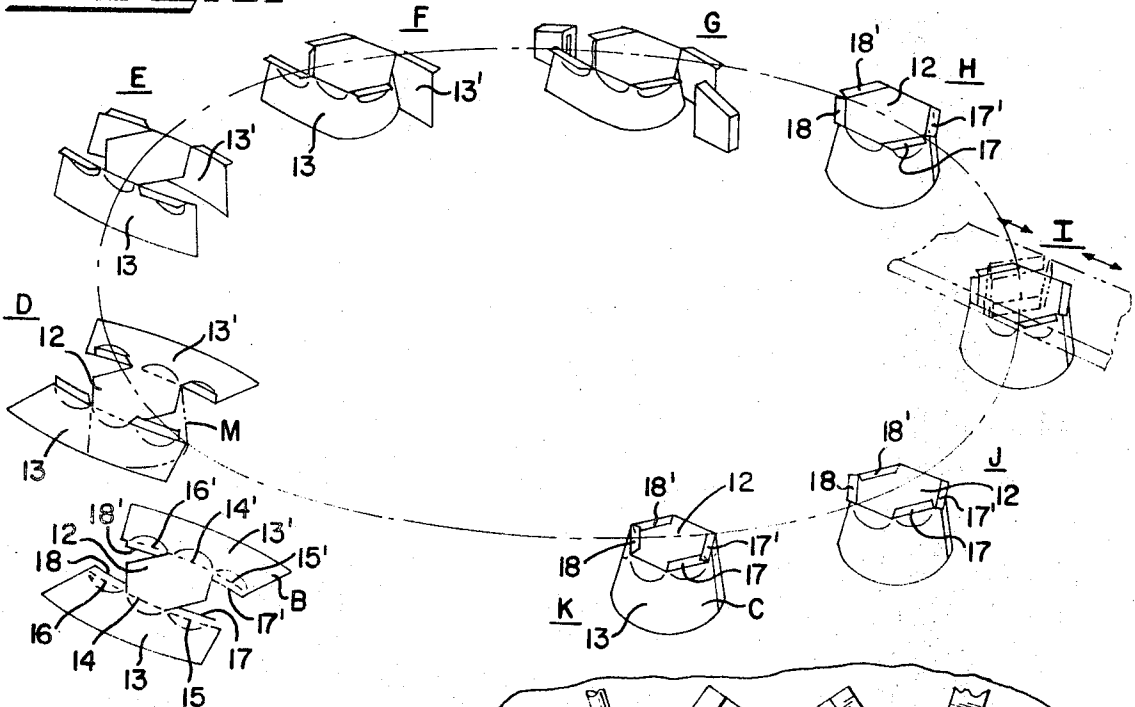


FIG. 5

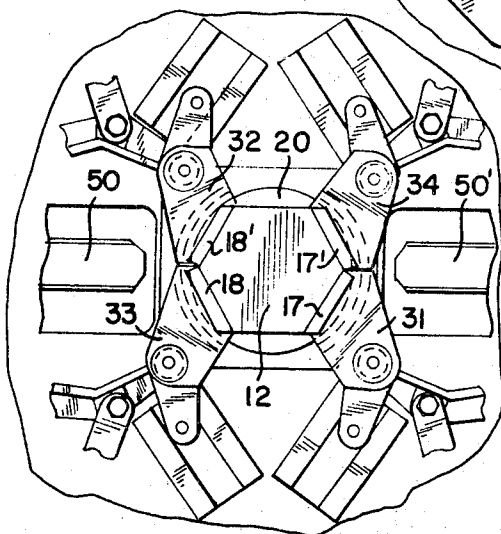
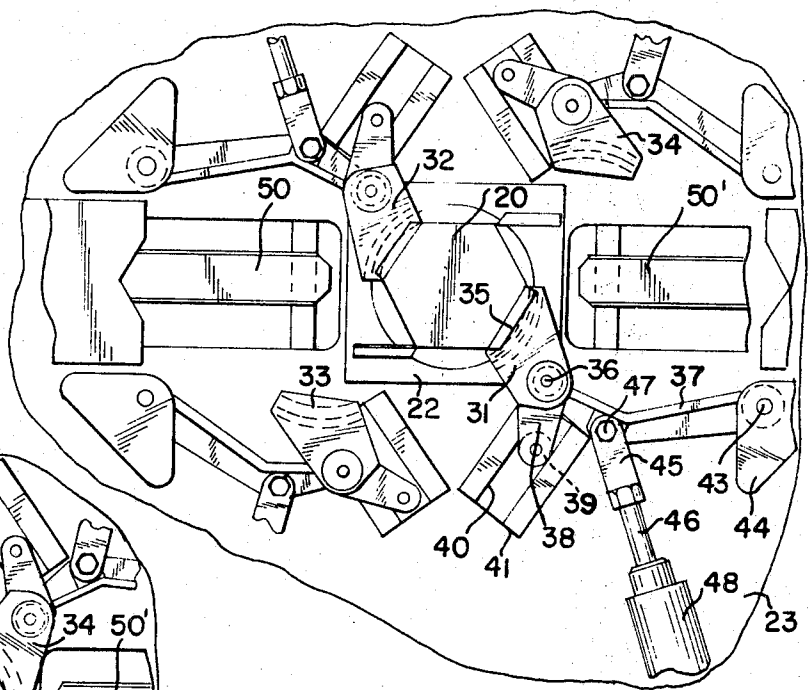
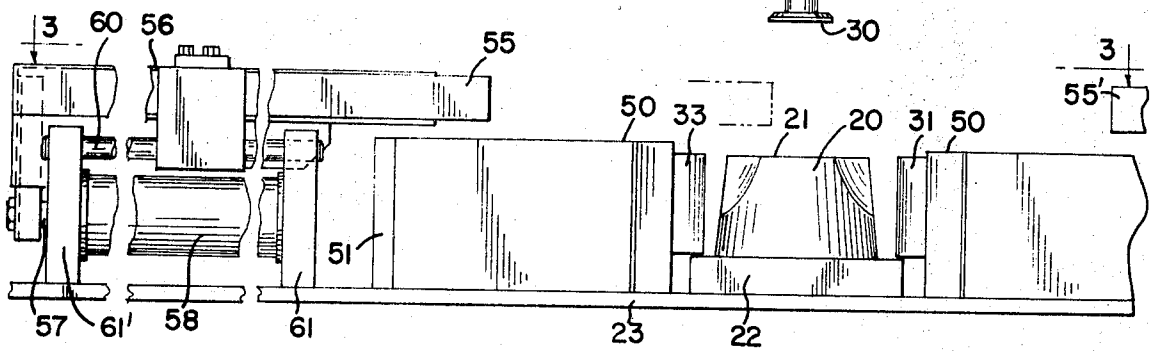
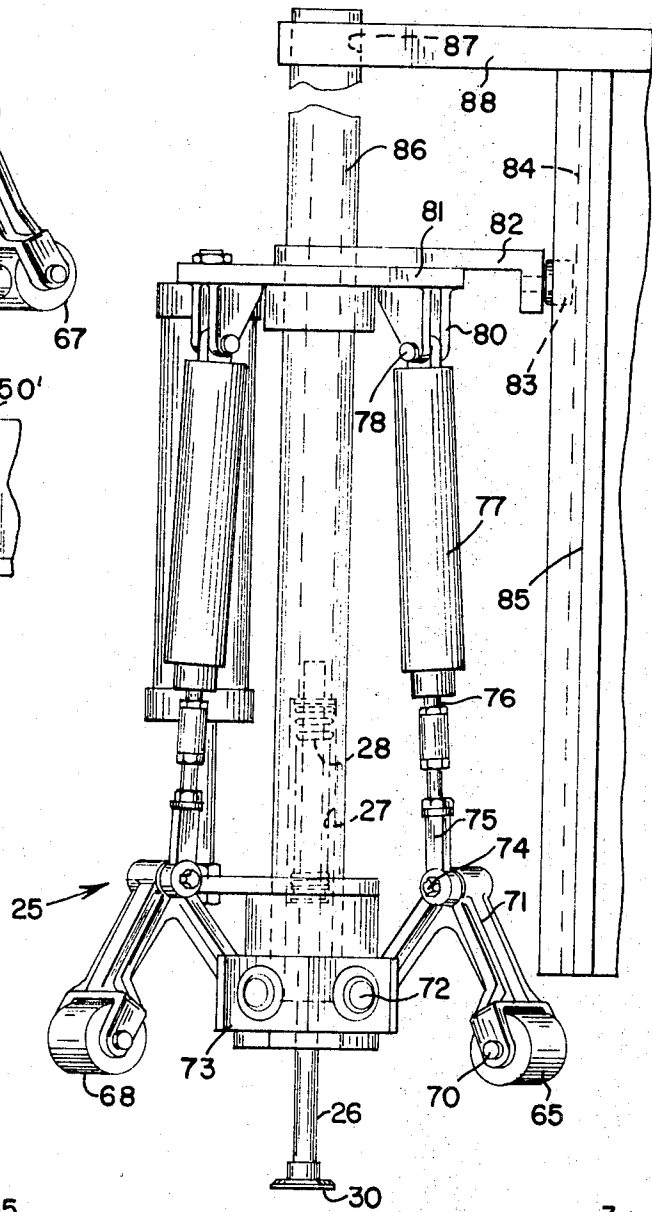
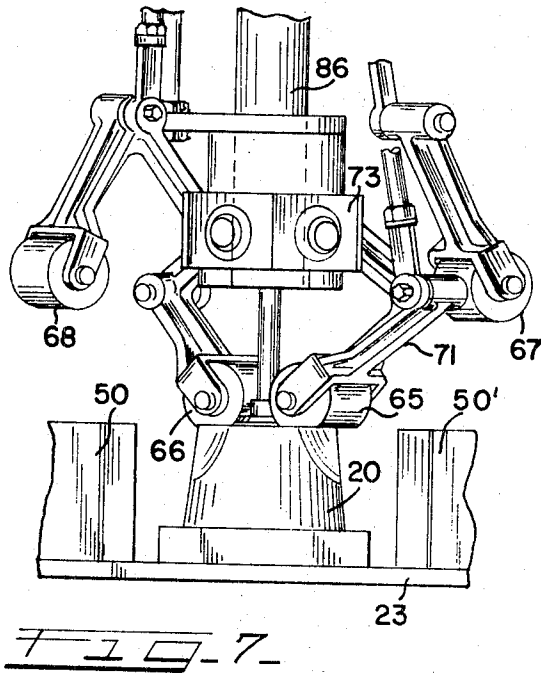


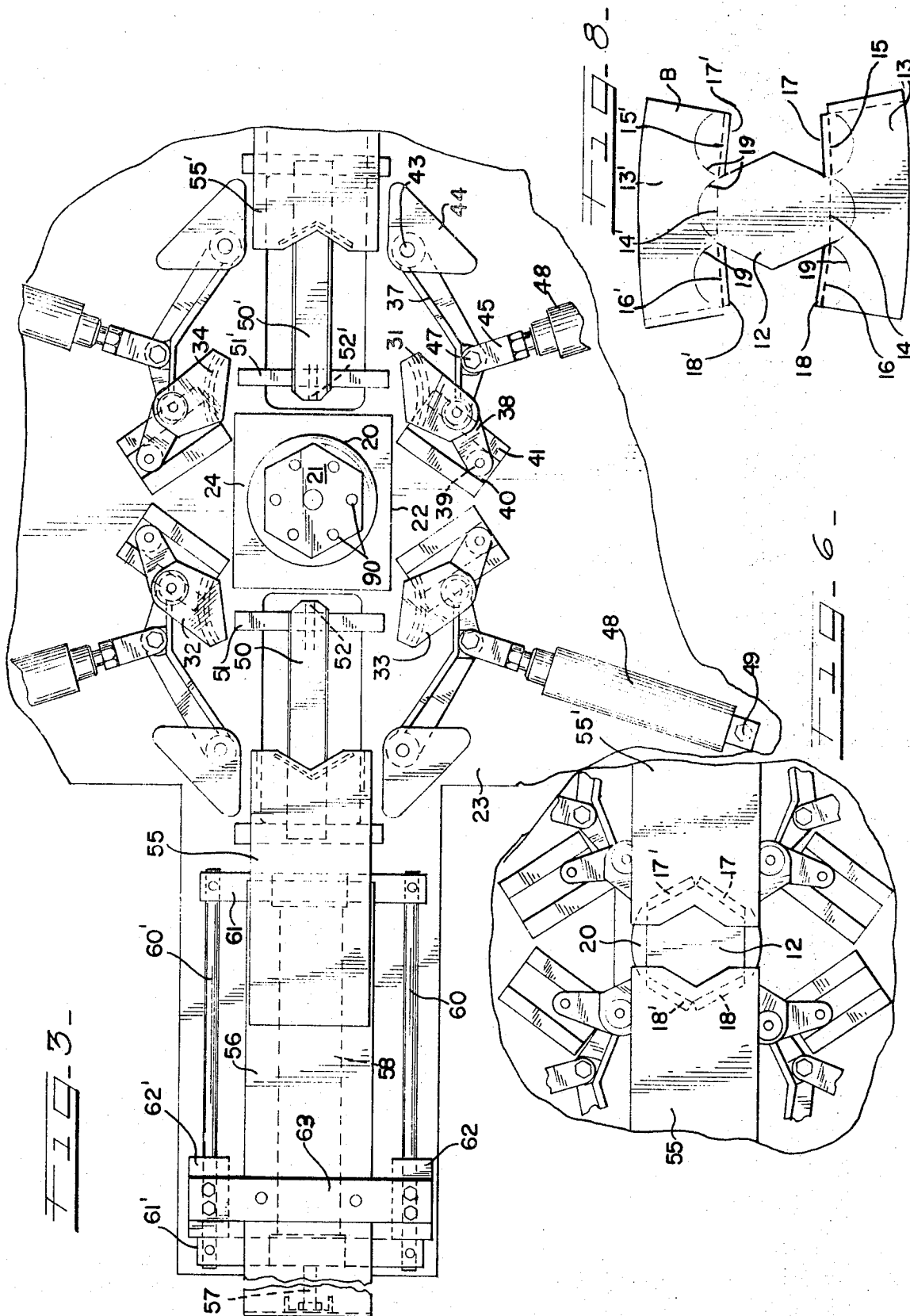
FIG. 4



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METHOD AND APPARATUS FOR FORMING A CONTAINER

This invention relates to a method and apparatus for fabricating from a blank of paperboard or similar foldable sheet material a container body which has a bottom wall forming panel, the edges of which extend on straight lines and side wall panels which are integrally hinged along an edge portion to the bottom wall panel and folded upwardly with adjoining margins connected in seam forming relation and providing a container top having at least a portion of round or curved contour.

In the manufacture of containers, formed from paperboard or the like, for the packaging of various products it has generally been the practice to design the container bodies so that the top and bottom are of corresponding contour. Recently, it has been found that for the packaging of certain products there are advantages in fabricating a generally round container from a single blank of foldable sheet material, for example paperboard, with the side walls upstanding from hinged connections with bottom wall edges which are on straight lines and having a top contour which is round, or at least in part, on curved lines. A container or carton of this type having a rectangular or hexagonal bottom and a round or partially curved top configuration is disclosed in U.S. Pat. No. 3,381,877, granted May 7, 1968, to Edwin L. Arneson. Such a container has numerous advantages in the handling and storage of certain products. However, a container body of this type is not readily fabricated in a satisfactory manner with the use of conventional equipment which is ordinarily available in container manufacturing plants. It is an object, therefore, of the present invention to provide a novel method and apparatus for fabricating a container of this type from a single blank of paperboard, or like material, with the side wall connected to the bottom wall along a series of straight hinge lines and having at the top a circular or partially circular or round contour.

A more specific object of the invention is to provide a method of setting up a cut and scored blank so as to form a container in which the side walls are hinged along straight lines to the bottom wall and extend upwardly so as to have a rounded or partially rounded contour at the top edge of the container, with vertical seams formed by overlapping and adhesively connecting marginal portions of the side wall forming panels, the side wall panels being integrally hinged to the bottom wall along a straight bottom edge portion and adjoining straight edge portions being connected to the bottom wall by connecting tab members.

It is another object of the invention to provide an apparatus for setting up a container formed from foldable sheet material, such as paperboard, which is characterized by a bottom wall having straight edges along the periphery thereof to which the side walls are hinged in upstanding relation and forming at the top edge a circular or partially circular cross section, which apparatus includes a forming mandrel having a shape corresponding to the shape of the interior of the container when set up and associated folding and sealing devices for wrapping a cut and scored paperboard blank about the mandrel and sealing portions which are overlapped to form seams.

These and other objects and advantages of the invention will be apparent from a consideration of the method and apparatus for forming a container from a blank of paperboard or similar foldable sheet material which is shown by way of illustration in the accompanying drawings wherein:

FIG. 1 is a schematic view illustrating the successive steps employed in the present method for folding or setting up a paperboard container from a single blank which container has a hexagonal bottom and an open top with a circular contour;

FIG. 2 is a side elevation with portions broken away or an apparatus adapted for use in carrying out the method illustrated in FIG. 1;

FIG. 3 is a plan view with portions broken away of a single mandrel and associated folding and sealing members for forming the carton as illustrated in FIG. 1, the view being taken on the line 3-3 of FIG. 2;

FIG. 4 is a view similar to FIG. 3 showing the side wall folding members in a different position;

FIG. 5 is a view similar to FIG. 3 showing the side wall folding members in final side wall forming and clamping position;

FIG. 6 is a view similar to FIG. 3 with the side walls folded and the heaters for the bottom connecting glue tabs moved to heat-applying position;

FIG. 7 is a side elevation of a portion of the apparatus shown in FIG. 2 with the members for folding the bottom connecting tabs in a different position; and

FIG. 8 is a plan view of a paperboard blank cut and scored to form the container which is shown in FIG. 1.

Referring to FIG. 1 of the drawings, there is illustrated schematically the successive steps employed in practicing the present method of fabricating from a cut and scored blank B of paperboard, or other suitable material, a container body having a hexagonal bottom and a circular top configuration. The blank B (FIGS. 1 and 8) is cut from flexible paperboard of suitable gauge and thickness and subdivided into a bottom wall forming central section or panel 12 and two side wall forming sections or panels 13 and 13', the latter being separated from the bottom wall panel 12 by score lines 14 and 14' which are parallel and extend along oppositely disposed edges of the hexagonal panel 12. The score lines 14 and 14' are of equal length and are centered relative to the longitudinal centerline of the blank with a length in the transverse direction of the blank of approximately one-third of the bottom forming edges of the two side wall panels 13 and 13'. The score lines 14 and 14' are extended at opposite ends of the latter and define hinge lines 15, 15' and 16, 16' for tabs 17, 17' and 18, 18' which serve to connect the bottom edges of the end portions of the panels 13 and 13' to the bottom wall panel 12 in the set up form of the container. The side wall forming panels 13, 13' preferably are scored on upwardly bowed lines, indicated at 19, to provide for uniform bending of the side wall material adjoining the bottom hinge lines 14, 15, 16 and 14', 15', 16' and to facilitate formation of the round configuration in the top portion thereof.

In setting up the container C according to the method illustrated in FIG. 1, successive blanks B are fed into position over a forming mandrel M, the bottom face of which is uppermost and has a shape which corresponds to the shape of the bottom forming panel 12. The side walls of the mandrel M which depend from the bottom thereof taper outward slightly towards the bottom face of the mandrel, as it is shown in FIG. 1, so that the blank B may be formed into the container C about the mandrel M and readily removed therefrom when fabrication is completed. To provide for continuous operation a series of mandrels M may be mounted on a turret or similar traveling conveyor and the successive steps for operating on the blank so as to set up the same may be accomplished at separate stations along the path of travel of the mandrels.

As shown in FIG. 1, the blank B is positioned on the bottom face of a mandrel M and clamped to hold the same in position. The bottom connecting tabs 17, 17' and 18, 18' may be initially turned up out of the plane of the blank B and the wall forming panels 13 and 13' folded downwardly about the hinge lines 14 and 14'. These preliminary folding operations may be accomplished before the blank is positioned on the mandrel M at the station in the path of travel which is indicated at D in FIG. 1. The downward folding of the side wall panels 13 and 13' may be accomplished after the blank is initially positioned on mandrel M with the blank B then being in the position shown at the next station E in FIG. 1. The next step in the operation is the folding of the diagonally opposite end portions of the wall panels 13 and 13' which are adapted to have their end margins disposed on the inside of the container. The blank B is preferably provided with a surface coating of a suitable plastic material having heat sealing characteristics. At station G the marginal portions of the side wall panels 13 and 13' which have been folded or wiped into position against the side wall of the mandrel M are subject to radiant heat, which may be supplied in the form of hot air, or by electrical heaters, or any other suitable source, so as to activate the adhesive sub-

stance in the seam forming areas. At station H the oppositely disposed ends of the side wall panels 13 and 13' which are designed to have their margins overlap the marginal portions at the other ends of these panels are folded or wiped against the mandrel by suitable folders so as to position the partially completed container as shown at station H. The bottom connecting tabs 17, 17' and 18, 18' at this point in the operation are folded outwardly substantially in the plane of the bottom wall panel 12. Sufficient heat is then applied to the exposed surface of the connecting tabs 17, 17' and 18, 18' or to the surface portions of the panel 12 to which these tabs are to be connected so as to activate the adhesive substance for subsequent sealing of the tabs. This step is indicated at station I with suitable reciprocating heat applying members. Oppositely disposed connecting tabs 17 and 18' are then folded down onto the bottom panel 12 as indicated at station J in FIG. 1. The set up operation is then completed at station K by folding the tabs 17' and 18 over onto the bottom surface of the panel 12 with the ends of these tabs which adjoin the ends of the tabs 17 and 18' overlapping portions of the latter so as to form a tight seal. Thereafter, the completed container C is removed from the mandrel M by a blast of air fed through the mandrel or by any other suitable stripping means.

Apparatus which may be employed for carrying out the successive folding and sealing steps which have been described with reference to FIG. 1 is illustrated in FIGS. 2 to 6. The apparatus as shown is designed to be mounted for operation at a single station to accomplish folding and sealing operations which are illustrated in FIG. 1. The single station may be one of a series of stations mounted on a traveling conveyor, either a straight line conveyor or a turret type as illustrated in FIG. 1. The apparatus may, however, be divided and mounted at a series of successive stations, with a single, or several successive operations being formed at each station in the order required to carry out the method illustrated in FIG. 1.

The apparatus comprises a mandrel 20 (FIGS. 2 and 3) having a shape corresponding to the interior shape of the finished container which is mounted with its bottom face 21 uppermost on a support plate 22 which is in turn mounted on a table forming plate member 23. The bottom face 21 of the mandrel 20 is hexagonal and the side wall tapers downwardly and outwardly terminating at the top surface of the support plate 22 which is somewhat larger in diameter than the maximum diameter of the hexagonal base 21 of the mandrel so as to form a flange-like surface 24 extending about the periphery of the mandrel at the bottom edge thereof. Preferably, apparatus for feeding blanks for positioning on the mandrel 20 is employed with mechanism for preliminarily folding down the side wall panels 13 and 13' and for folding the bottom connecting tabs 17, 17' and 18, 18' so that they are approximately in the plane of the bottom panel 12 when positioned on mandrel 20 as illustrated at station E in FIG. 1. The apparatus includes a vertically reciprocating head, indicated at 25, which is adapted to be raised and lowered relative to the mandrel 20 in a manner hereinafter described. The reciprocable head 25 carries a pin 26 slidably mounted in an axial bore 27 and retractible therein against the pressure of a coil spring 28 which functions to normally hold the pin 26 extended as shown in FIG. 2. A flat plate element 30 on the end of the pin 26 is adapted when the head 25 is lowered a sufficient distance to clamp a blank B in position on the top face 21 of the mandrel 20 and to hold the same thereon while the folding and sealing of the side wall seams is accomplished.

The mandrel 20 has associated with it two pairs of side wall folding shoes 31, 32 and 33, 34 with the shoe 31 being disposed diametrically opposite shoe 34 and the shoe 32 being diametrically opposite the shoe 33. Since each of these folding shoes is constructed in the same manner and mounted for operation in like manner, only one thereof will be described in detail. The shoe 31 has a face 35 for engaging the blank side wall panel 13 and wiping the same into engagement with the side wall of the mandrel 20. The shoe 31 is carried on a vertical pivot 36 at the end of a pivotally mounted link bar 37. A

cam arm 38 extends therefrom on which there is mounted a cam roller 39, the latter operating in a cam track 40 provided in a block 41 which is mounted on the table top 23. The pivot 36 is on the end of the angular arm or link bar 37 which has its other end connected by pivot 43 to a mounting block 44 upstanding on the table 23. A bracket 45 mounted on the end of piston rod 46 is pivotally connected to the arm 42 at 47 which is located intermediate the ends of the arm 37. The piston 46 is reciprocated by operation of the fluid cylinder 48 with the latter having its other end pivotally mounted at 49 (FIG. 3) on the support plate 23. The arrangement is such that when the piston 46 is retracted, the shoe assembly 31 will be in a position corresponding to the position in which the shoes 33 and 34 are shown in FIG. 4. In FIG. 4 the folding and clamping shoes 31 and 32 are shown at the end of their folding and clamping movement where they are holding or clamping oppositely disposed end portions of the panels 13 and 13' against the side wall of the forming mandrel 20. The shoes 31 and 32 are advanced towards the mandrel 20 and moved into engagement with the panels 13 and 13' for initially folding the latter after which they are given a short movement along the surface of the mandrel which imparts a wiping action and causes the panel ends 13 and 13' to lie snugly against the mandrel wall with the flange-like top surface 24 of the base plate 22 forming a guide for the lowermost edges of the panels 13 and 13' and with the panels drawn into tight engagement with the mandrel surface. The shoes 31 and 32 are operated first to fold the opposite ends of the panels 13 and 13' after which the shoes 33 and 34 are operated to fold the opposite ends of the panels 13 and 13', overlapping the margins at the free ends with the end margins of the first folded portions of the panels to provide vertical seam formations.

Prior to the operation of the folding shoes 33 and 34 heat is applied to the marginal seam forming areas of the panel portions which have been folded first against the mandrel 20 by the shoes 31 and 32. The heating of these seam forming areas which is required to activate the adhesive surface thereof is accomplished by heat applying members 50 and 50' which are mounted by means of bracket assemblies 51 and 51' at opposite sides of the mandrel 20 and which are connected with a source of hot air so as to deliver a blast of air directed through nozzle forming slots 52 and 52' at the ends of the members 50 and 50' onto the seam forming areas of the panels 13, 13'.

The head assembly 25 is lowered initially to bring the clamp member 30 on the pin 26 into engagement with the blank on the top surface 21 of the mandrel 20, after which it is lowered further to bring the clamping plate 54 which is mounted on the bottom of the head 25 into engagement with the blank so as to firmly clamp the blank onto the top face 21 of the mandrel 20. When the folding and sealing of the side wall panels 13, 13' has been completed the head assembly 25 is raised a sufficient distance to provide clearance for movement into operative position of a pair of oppositely disposed heaters 55 and 55' which are mounted for reciprocation on opposite sides of the mandrel 20. The heater members 55 and 55' are of like construction and are mounted in an identical manner. Only one of these members will be described in detail.

The heater member 55 is mounted on an elongate support channel member 56 which is disposed in downwardly facing relation and forms part of a carriage assembly which has its outer end connected to the end of an operating piston 57. The piston 57 extends from an air cylinder 58 which is mounted on a frame structure which includes parallel guide rods 60 and 60' extending between upstanding end frame members 61 and 61'. The guide rods 60 and 60' are received in slidable relation in the bearing members 62 and 62' at opposite ends of a bridge forming cross piece 63 secured on the top of the downwardly facing support member 56. The heater members 55 and 55' have nozzle forming slots 64 and 64' in the bottom faces at the inner ends thereof which, when the heaters 55 and 55' are moved into operative position, are positioned to direct a blast of hot air onto the exposed faces of the tab members 17, 17' and 18, 18' and adjoining areas of the bottom face of

the panel 12 so as to activate the adhesive material thereon. The heaters 55 and 55' are connected to a suitable source of hot air. The heaters are adapted to be retracted to an out-of-the-way position as shown in FIG. 3 to clear the area for operation of a pair of tab folding and sealing rollers 65 and 66, which are swingably mounted in oppositely disposed relation on the head assembly 25. The tab engaging rollers 65 and 66 are swung down to wipe the tabs 17 and 18' into engagement with the bottom panel 12, as shown in FIG. 7, after which the rollers 65 and 66 are swung outwardly so as to clear a path for operation of the wiping rollers 67 and 68 which are also mounted on the head 25 and which are swung down and across the top of the mandrel 20 to wipe down into engagement with the panel 12 the final connecting tab members 17' and 18. This completes the forming and sealing of the bottom of the container. The tab wiping rollers 65, 66 and 67, 68 are mounted on the head assembly 25 in an identical manner. Only one of these roller assemblies will be described in detail. The roller 65 is journaled by pin 70 on the bifurcated end of an inverted V-shaped arm 71 which has its other end pivotally mounted at 72 on the bottom frame portion 73 of the head assembly 25. Intermediate its ends the arm 71 is connected by the pivot 74 to a bracket 75 on the end of the piston 76 of an operating air cylinder 77. The vertically disposed air cylinder 77 is connected at its other end by the pivot pin 78 to a bifurcated bracket 80 on the bottom of a frame member 81 which is spaced above the bottom frame member 73. A laterally extending bracket 82 on the frame member 81 carries a cam roller 83 at its free end which is operative in a cam slot or groove 84 in a vertically extending cam plate 85. The tubular body portion 86 of the head 25 extends vertically through a guide aperture 87 in a fixed bracket 88 above the assembly. The roller 65 and the associated rollers 66, 67 and 68 are formed with a rubber surface and disposed so that when lowered into engagement with the mandrel 20 there is an interference fit between the roller and the mandrel causing the rubber to distort as it hits the edge of the mandrel and rolls over the uppermost face of the same. This results in the tabs being drawn tightly down on the mandrel and firmly sealed against the bottom panel 12. The rollers 65, 66 and 67, 68 are operated in pairs so as to fold down successively the oppositely disposed pairs of tabs 17, 18' and 17', 18 without interference with each other.

When the sealing of the tabs 17, 18' and 17', 18 has been completed, the head assembly 25 is raised a distance sufficient to clear the area above the mandrel 20 for removal of the finished container C which may be stripped from the mandrel by a blast of air directed through suitable apertures (not shown) 90 (FIG. 3) in the mandrel body.

The air cylinders employed to operate the movable elements of the apparatus are controlled through suitable valves and timing devices to provide the proper sequence of and timing of the operations and automatic operation may be provided for. The various mechanisms may be operated, if desired, by suitable cams and linkages or other mechanical actuators. While in the apparatus shown the blank is clamped on the mandrel mechanically it may be desirable to hold the blank in position by vacuum, as for example, by vacuum cups 60 in the mandrel face.

We claim:

1. A method of forming from a precut and creased blank of foldable sheet material a container which is characterized by a polygonal bottom wall and a side wall merging into a circular shaped top, with the side wall formed by panel members integrally hinged to opposite straight side edges of the bottom wall forming panel and folded into side wall forming relation with overlapped margins connected to form vertical seams, and hinged tab members connecting the bottom edges of the side wall panels which adjoin the hinge connection thereof with the bottom wall panel to adjoining straight edges of the bottom wall panel, which method comprises positioning the blank on a mandrel having the shape desired for the interior of the finished container, folding the side wall forming panels

against side wall portions of the mandrel, wrapping the side wall panels about the mandrel so as to bring marginal portions thereof into overlapping seam forming position and activating a heat regenerative material in the seam forming area, folding down the tab members into engagement with the bottom wall panel and activating a heat regenerative material for securing these tab members to said bottom wall panels.

2. A method of forming from a precut and creased blank of foldable sheet material a container which is characterized by a bottom wall having straight line side edges and a circular top with side wall forming panel members integrally hinged to opposite straight side edges of the bottom wall and folded into side wall forming position and having overlapped margins connected to form seams, and tab members connecting the bottom edges of the side wall panels which adjoin the hinge connection thereof with the bottom wall panel to adjoining straight side edges of the bottom wall, which method comprises positioning the blank on a mandrel having the shape desired for the interior of the finished container, folding the side wall forming portions downwardly, wrapping the side wall forming portions about the mandrel so as to bring marginal portions thereof into overlapping seam forming position, activating a heat sealable material in the seam forming area, folding the tab members so as to connect the side wall with the bottom wall and activating a heat sealable material for securing the tab members.

3. A method of forming a container as set forth in claim 2 and forming the seams in the side wall by activating a heat sealable material on the seam forming areas through the application of a blast of hot air.

4. A method of forming a container as set forth in claim 2 and folding the tab members by wiping across the same with a roller having a surface of rubber-like material which is distorted upon contact with the mandrel.

5. Apparatus for setting up a container body from a precut blank of paperboard or the like, which container body comprises a bottom wall having a straight edged perimeter and up-turned side wall portions which are shaped at the top into a circular cross section, said apparatus comprising a mandrel having the shape desired for the interior of the set up container which mandrel is disposed in a position for receiving a precut and precreased container forming blank on a face thereof with the edges of the bottom wall forming panel portion of the blank aligned with the corresponding edges of the mandrel, a clamping head having a clamping element thereon for engaging the bottom wall forming panel portion of the blank to clamp the same onto the mandrel, mechanism for folding side wall forming panel portions of the blank about the side wall of the mandrel so as to bring adjoining ends of said panel portions into overlapping seam forming relation, means for activating a heat regenerative material in the seam forming areas while the side wall panel portions are clamped against the mandrel, means for activating a heat regenerative material on the marginal portions of the bottom wall panel which adjoin the hinge connection with the side wall forming panel portion, and means for wiping the connecting tabs onto the bottom wall forming panel portion so as to connect the bottom edges of the side wall to the bottom wall around the entire periphery thereof.

6. Apparatus for setting up a container body as set forth in claim 5 and said clamping head being mounted for vertical reciprocation and having a bottom clamping plate with a shape corresponding to the shape of the uppermost face of the mandrel.

7. Apparatus for setting up a container body as set forth in claim 6 and said clamping head having a depending pin which is mounted in an axial bore and spring pressed for initially engaging and clamping the blank onto the top surface of the mandrel.

8. Apparatus for setting up a container body as set forth in claim 5 and said means for wiping the connecting tabs onto the bottom wall forming panel comprising resilient faced rollers mounted on swinging arms so as to be moved to engage

the edges of the mandrel and force the tabs into tight engagement with the bottom wall forming panel portion.

9. Apparatus for setting up a container body from a precut blank of paperboard or the like which container body comprises a bottom wall having a straight edged perimeter and upturned side wall portions which are shaped at the top into a circular cross section, said apparatus comprising a mandrel having the shape desired for the interior of the set up container which mandrel is disposed for receiving a precut and precreased container forming blank on a face thereof with the edges of a bottom wall forming panel portion of the blank aligned with the corresponding edges of the mandrel, means for holding the bottom wall forming panel portion of the blank on the mandrel, mechanism for folding side wall forming panel portions of the blank about the side wall of the mandrel so as

to bring adjoining ends of said panel portions into overlapping side wall seam forming relation, means for activating a heat regenerative material in the side wall seam forming areas so that a seam will be formed when the side wall panel portions are clamped against the mandrel, means for activating a heat regenerative material on the bottom seam forming blank portions which are adapted to connect the bottom wall panel and the side wall in the areas adjoining the hinge connection of the bottom wall panel with the side wall panel portions and means for folding down into panel engagement connecting tabs which join the bottom edges of the side wall whereby the bottom wall is connected to the side wall around the entire periphery thereof.

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