Nov. 8, 1938. K. H. MILLER 2,136,308

METHOD OF AND APPARATUS FOR PRODUCING RECEPTACLES AND THE LIKE

Filed Oct. 23, 1936 3 Sheets-Sheet 1

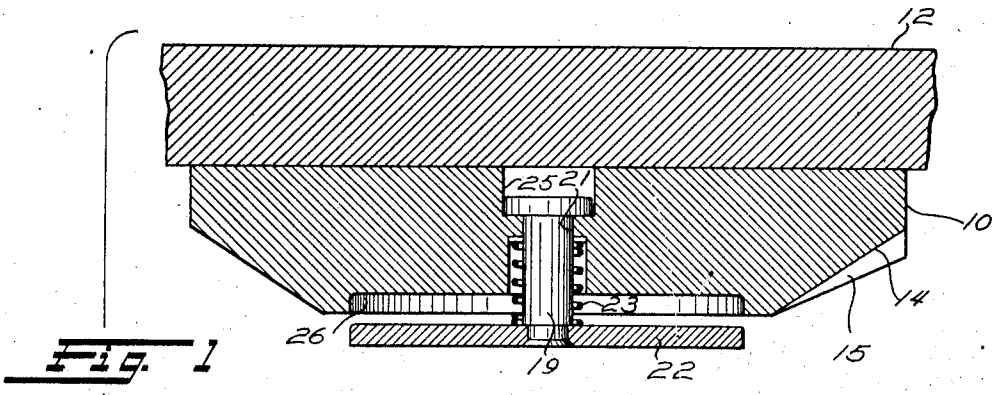
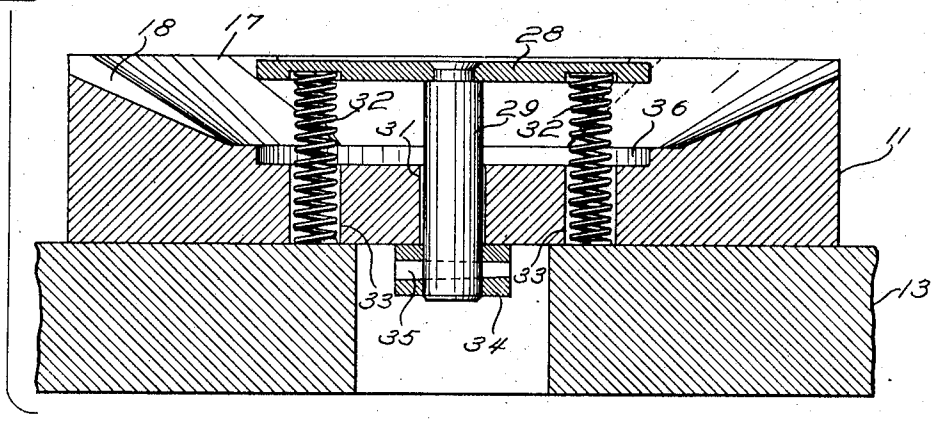


Fig. 1



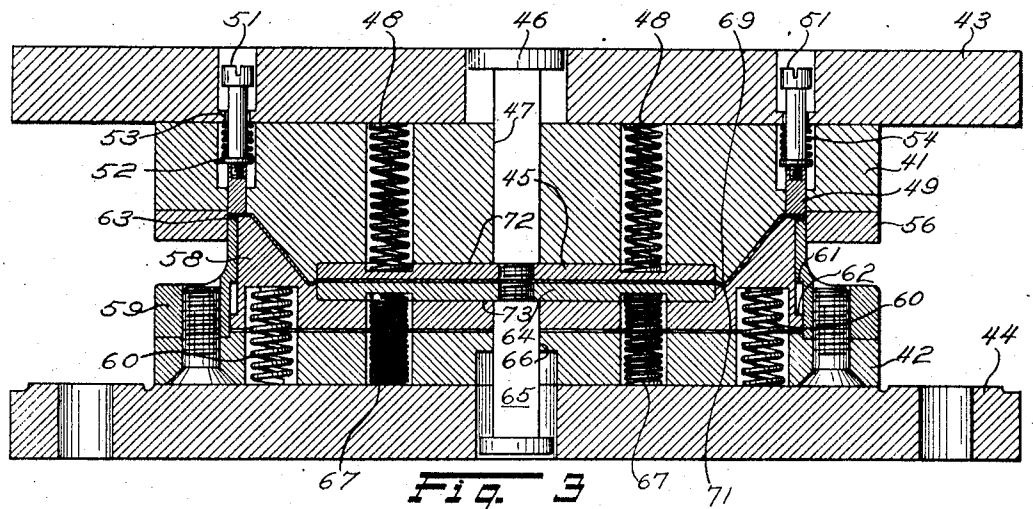


Fig. 3

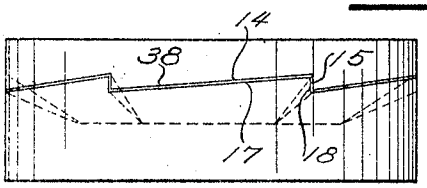


Fig. 2

Inventor
Karl H. Miller

Strauch & Hoffman
Attorneys

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METHOD OF AND APPARATUS FOR PRODUCING RECEPTACLES AND THE LIKE

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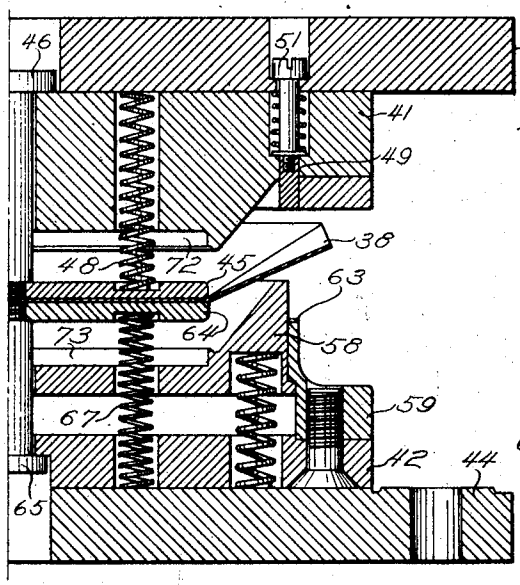


Fig. 4

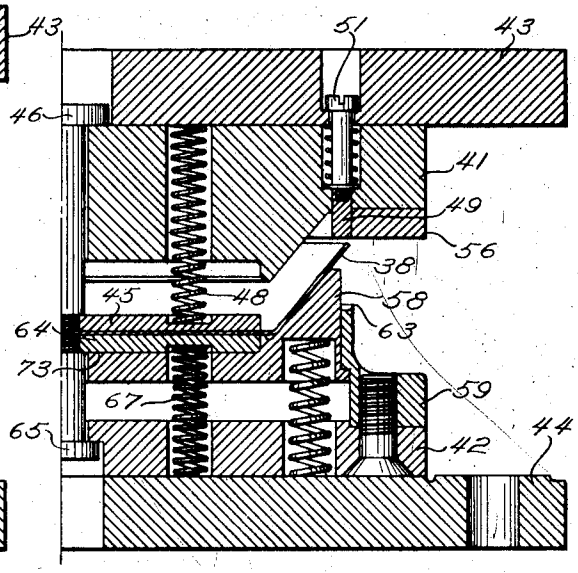


Fig. 5

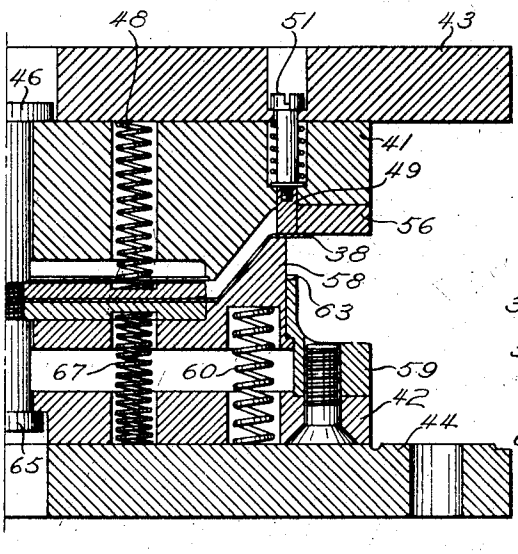


Fig. 6

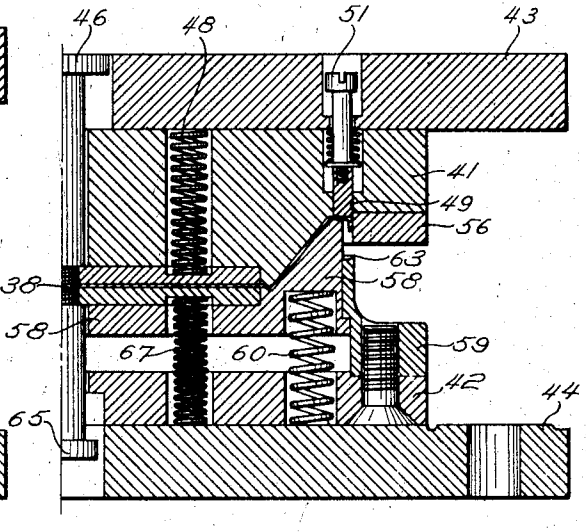


Fig. 7

Inventor
Karl H. Miller

Strauch & Hoffman
Attorneys

Nov. 8, 1938. K H MILLER 2,136,308

METHOD OF AND APPARATUS FOR PRODUCING RECEPTACLES AND THE LIKE

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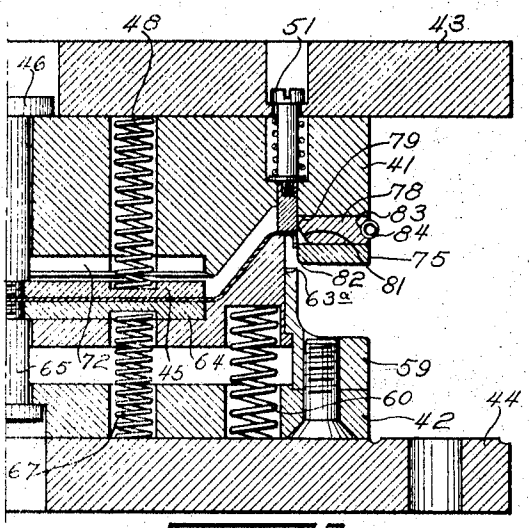


Fig. 8

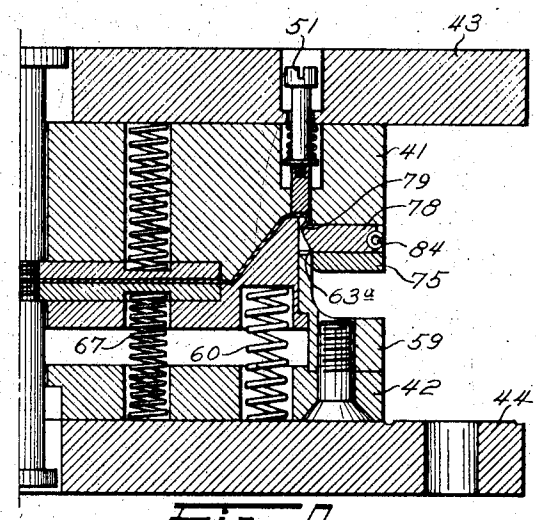


Fig. 9

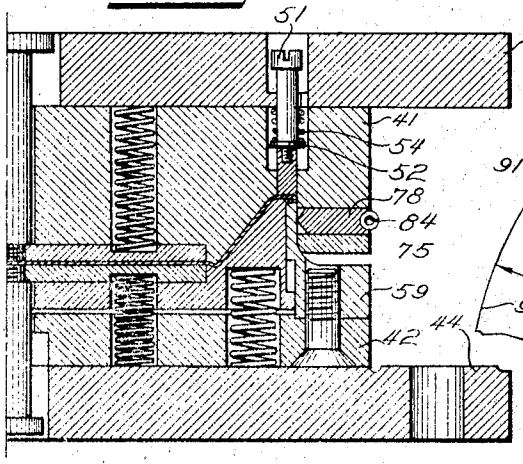


Fig. 10

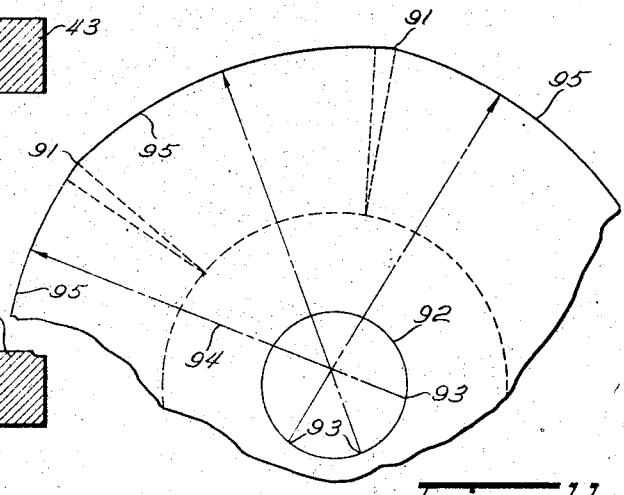


Fig. 11

Fig. 12

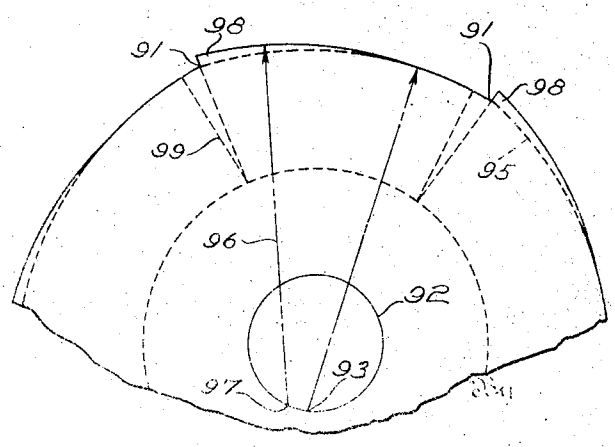
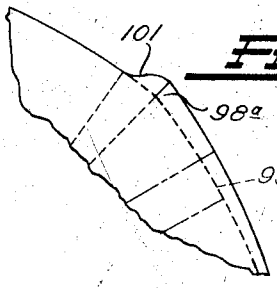


Fig. 13



Inventor
Karl H. Miller

Strauch & Hoffman
Attorneys

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UNITED STATES PATENT OFFICE

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METHOD OF AND APPARATUS FOR PRODUCING RECEPTACLES AND THE LIKE

Karl H. Miller, Green Bay, Wis., assignor to Kimberly Stuart, Neenah, Wis.

Application October 23, 1936, Serial No. 107,294

11 Claims. (Cl. 93—60)

The present invention relates to methods and apparatus for producing receptacles and the like and more particularly to methods and apparatus for making various utensils of sheet materials such as paper, or paper laminated with other materials, such as metal foil.

Heretofore in the production of paper receptacles of generally cup form, such as pie plates, for instance, it has been necessary to employ complicated and expensive vacuum forms for molding the plates directly from paper pulp. These plates, in addition to being costly to produce, have not possessed sufficient rigidity and durability to fully meet the requirements of the trade.

It is accordingly a primary object of the present invention to provide methods of and apparatus for producing pie plates and other receptacles of paper in sheet form that will present a good appearance, which will provide the necessary rigidity required, and yet which are low in cost.

Another important object of the invention is to provide novel methods of and apparatus for producing receptacles and the like from sheet material, which are pleated to take up the surplus material developed during the drawing operation, and yet which will not open up after they have been in use.

There is now available on the market a very high grade laminated material consisting of two aluminum foil sheets having an interposed paper sheet. This product is light and flexible and yet possesses all of the desirable attributes of metal, and it is another object of the invention to provide methods of and apparatus for producing receptacles and the like from this material.

A further object of the invention is to provide a novel die assembly for producing receptacles and the like of sheet material.

A further object is to provide die assembly for producing receptacles of sheet material of generally cup form and having pleats in the sides thereof, the die assembly comprising a primary set of dies, wherein the blank is so corrugated that when it is placed in a set of secondary dies the plate will be smoothly brought into final form without rotating one die with respect to the other.

Another object of my invention is to provide novel blanks for use in making receptacles having an inclined wall of pleated formation, the blank being so sloped that the finished article is caused to assume a generally circular shape, thereby compensating for the tendency of the pleats to pull the articles into non-circular form.

Further objects of the invention will become apparent as the specification proceeds in connection with the annexed drawings, and from the appended claims.

In the drawings:

Figure 1 is a vertical sectional view through the primary dies of the invention and illustrates them in open position ready to receive a blank.

Figure 2 is a side elevational view of the die shown in Figure 1, but illustrates them in closed position with a blank clamped between them.

Figure 3 is a vertical sectional view through the secondary dies of the invention and illustrates the dies in closed position with the blank drawn into final form.

Figure 4 is a fragmental sectional view of the dies shown in Figure 3, but illustrates them in open position with a blank clamped between the gripping plates thereof preparatory to closing the dies thereupon.

Figure 5 is a view similar to Figure 4, but illustrates the parts as they appear when the dies are partially closed, and the gripping plates are disposed in lowered position.

Figure 6 is a view similar to Figures 4 and 5, but illustrates the dies in a further closed position wherein die parts have formed the sloping wall of the plate and have formed the flange thereof.

Figure 7 is a view similar to Figure 6, but shows the dies substantially closed with the bottom and side wall of the plate firmly gripped between the dies and with the flange of the plate bent downwardly.

Figure 8 is a fragmental sectional view of a modified form of secondary die assembly forming part of the present invention and illustrates the parts as they appear when the flange has been bent outwardly and downwardly by the ring die assembly.

Figure 9 is a view similar to Figure 8, but illustrates the parts as they appear when the die is in further closed position and the down-turned flange has been bent inwardly by the segmental ring assembly.

Figure 10 is a view similar to Figures 8 and 9, but shows the dies in final position with the flange turned upwardly against itself.

Figure 11 is a face view of a portion of a blank that is preferably used and forms part of the invention.

Figure 12 is a fragmental top plan view of a slightly modified form of blank of the invention.

Figure 13 is a fragmental plan view of a further modified blank of the present invention.

With continued reference to the drawings wherein like reference characters have been em-

ployed to designate like parts throughout the several figures thereof, the invention employs two sets of dies for forming the utensil. In Figures 1 and 2 the primary dies are illustrated, and in Figures 3 to 7 inclusive one form of secondary die assembly is shown.

With continued reference to Figures 1 and 2, the primary die assembly comprises a pair of dies 10 and 11 supported on bolsters 12 and 13 respectively in well known manner. The face of die 10 is generally convex and its side wall is serrated or is of "saw-tooth" form, having inclined portions 14 and vertical portions 15. The face of die 11 is generally concave and is provided with correspondingly inclined portions 17 and vertical portions 18 to mate with the inclined and vertical portions of die 10.

Mounted for vertical reciprocation upon die 10 by means of a shouldered bolt 19 sliding in a recess 21 in die 10 is a gripping plate 22. Encircling bolt member 19 is a compression spring 23 which urges plate 22 downwardly. Downward movement of bolt 19 is limited by reason of its head engaging the bottom of a recess 25 in die 10. As seen in Figure 1, the bottom face of die 10 is provided with a recess 26 into which gripping plate 22 may closely fit, so that when gripping plate 22 is in its uppermost position it will cooperate with the lower face of die 10 to provide a smooth unbroken surface and define the forming face for the bottom of the plate.

A similar gripping plate 28 is associated with die 11 and is mounted upon a bolt 29 which is mounted for reciprocation in a recess 31 in die 11. Gripping plate 28 is urged upwardly by a plurality of compression springs 32 disposed in bores 33 in die 11 and reacting against bolster 13. Plate 28 is limited in its upward movement by a collar 34 which is secured to bolt 29 by means of pin 35 or the like. The upper surface of die 11 is provided with a recess 36 into which gripping plate 28 may snugly recede so as to cooperate with the die 11 and to define a smooth bottom-forming surface when it is in its lowermost position.

Although the invention may be applied to utensils of various forms and shapes, it has been illustrated as applied to the production of paper pie plates, for instance, ordinary paper stock or paper embodying two sheets of foil having an interposed fibrous layer of paper or the like. The term "pie plate" as hereinafter employed in the specification and as applied to the concrete embodiment illustrated should accordingly be understood as applicable to any other desired form or shape of plate which it is desired to produce by the present invention.

Although a special form of blank is preferably employed in the present invention, the die assembly is useful irrespective of the type of blank used and it will first be described assuming that any form of blank 38 is employed.

The blank 38 is placed in the proper position upon gripping plate 28 and dies 10 and 11 are brought together to cause gripping plates 22 and 28 to clamp the blanks therebetween. Either die 10 or die 11 may be the movable die or both dies may be movable as desired, and reference hereinafter to die movement is to be understood as embracing relative movement between the dies. As the dies are brought together, plate 22, whose movement is opposed by a single spring 23, moves upwardly into recess 26 with the result that the blank lies in engagement with the whole lower surface of die 10.

In response to further movement of dies 10 and 11 toward each other, springs 32 compress and allow gripping plate 28 to be brought into recess 36. As this occurs the saw-tooth formation of the die faces cause the blank to bend into corrugated form upon definite lines. When the dies are brought into the final position illustrated in Figure 2, the die possesses definite creases along the lines of the corrugations. The blank accordingly assumes the form of a generally cup-shaped receptacle having a corrugated or undulating sloping wall portion. The blank is now ready for introduction into the secondary dies. By forming the blank so as to have a corrugated surface as just described it is apparent that as it is placed under pressure it will fold into the form of closed pleats and that it is unnecessary to rotate one die with respect to the other.

The secondary die assembly comprises an upper die 41 and a lower die supported upon bolsters 43 and 44 respectively and a plate 42. Upper die 41 is secured to bolster 43 in any suitable manner and is equipped with a gripping plate 45 which is mounted upon a bolt member 46 which is in turn guided for reciprocation in a recess 47 in die 41. Gripping plate 45 is urged downwardly by a plurality of compression springs 48 and downward movement thereof is limited by engagement of the head of bolt 46 with the top of die 41.

Mounted for vertical reciprocation in an annular recess in die 41 is a ring-shaped die 49. Threaded into the upper surface of die 49 at intervals around its periphery are a plurality of bolts 51 having washers 52 associated therewith. Bolts 51 pass through apertures 53 in bolster plate 43 and each bolt 51 is encircled by a spring 54 which reacts against the bolster and acts against washers 52 to urge ring 49 downwardly so as to bring the heads of bolts 51 into engagement with the bottom of recesses in bolster 43, as seen in Figures 5, 6 and 7.

Secured to the lower face of die 41 is a ring 56 which operates to turn the flange of the plate downwardly when the dies are brought together.

Lower die 58 is mounted for vertical reciprocation within a ring 59 secured to plate 42. Die 58 is urged upwardly by a plurality of comparatively heavy compression springs 60 which seat in recesses in the die and react against bolster 44. Die 58 and ring 59 are provided with cooperating stop faces 61 and 62 respectively which cooperate to limit upward movement of die 58 under the influence of their springs. The upper edge of ring 59 is provided with a comparatively sharp beveled edge 63 for a purpose that will presently appear.

A gripping plate 64 is associated with the lower die and is carried by a bolt member 65 which is mounted for vertical reciprocation in an aperture 66 in plate 42. A plurality of compression springs 67 urge plate 64 upwardly and engagement of the head of bolt 65 with the lower surface of plate 42 limits the upward movement of the gripping plate.

As seen in Figure 3, die 41 is provided with an annular rim 69, and die 58 is provided with a circumferential groove 71. These parts cooperate to provide a corrugation about the bottom of the container. Dies 41 and 58 are also provided with recesses 72 and 73 into which gripper plates 45 and 64 respectively may seat in order to provide a smooth unbroken bottom-forming surface for the dies.

The step by step operation of this die assem-

bly is illustrated in Figures 3, 4, 5, 6, and 7. With reference to Figure 7, blank 38, which has been bent into corrugated form by the primary die assembly previously described, is introduced in the proper position between gripper plates 45 and 64. Initial movement of the dies toward each other causes the gripper plates to firmly clamp blank 38 between them as shown in Figure 4.

When the dies undergo further closing movement gripper plate 64 recedes into recess 73 (as seen in Figure 5) against the action of springs 67, the latter being weaker than springs 48. While this stage of die operation is taking place, gripping plates 45 and 64, moving downwardly as a unit, smoothly engage blank 38 with the inclined wall of the die 58 and causes the side wall of the blank to close into a plurality of pleats along the corrugations produced in the primary die assembly.

Further closing movement of the dies brings ring 49 into engagement with the peripheral portion of the blank 38 and bends it into a horizontally directed flange as seen in Figure 6.

As seen in Figure 7, both gripping plates have receded into their recesses and dies 41 and 58 have firmly clamped blank 38 between them, thereby forming a peripheral groove around the bottom of the pie plate and also firmly locking the pleats in the side wall in closed position. During movement of the parts from the position shown in Figure 6 to that shown in Figure 7, ring 49, which forms the flange on the plate, did not undergo movement with respect to the lower die assembly, but merely moved upwardly with respect to the upper die assembly, and as seen in Figure 7 a clearance has developed between the heads of bolts 51 and the bottoms of the recesses in bolster 43. During the stage of die movement just described, ring 56 moves downwardly and forms a peripheral downwardly extending flange on the horizontal flange of the plate just described.

During the last stage of die movement (shown in Figure 3), dies 41 and 58 move downwardly as a unit against the action of spring 60. This condition is illustrated in Figure 3, wherein a clearance is seen to exist between stop faces 61 and 62. During this stage of movement the bevelled portion of circumferential lip 63 engages the downwardly turned portion of the flange and forces it inwardly, with the result that when the parts attain the position shown in Figure 3, the flange is firmly clamped between ring 59 and ring 49.

The dies may now be separated to release the finished plate and the latter may be removed either by hand or by pneumatic suction cups carried by arms actuated in synchronism with the other parts of the device. The completed plate is provided with a plurality of pleats in its side wall and flange and the turned under edge of the flange locks the pleats in place. The pleats are preferably so spaced as to form guides for cutting the pie into parts.

In Figures 8, 9 and 10, I have illustrated a modified form of ring assembly for turning under the flange of the plate. With continued reference to these figures, wherein like reference characters designate parts which are similar to those employed in the die assembly just described, a ring 75, having a plurality of radially directed guideways therein, is secured to the lower face of ring 41 in any suitable manner. Mounted for guided sliding movement in the guideways of rings 75 are a plurality of ring segments 78, each of which is provided with a cam face 79 and a cam face 81. The bottom edge of ring 75 is provided with a curved cam face 82. The outer end of each segment 78 is provided with a curved recess 83 in which an endless coil spring 84 is mounted so as to constantly urge the segments inwardly.

The first part of the closing operation of this die assembly is exactly the same as that just described in connection with the first form of the invention, and in Figure 8 the parts are illustrated in the condition that exists when ring 49 has formed a flange on the plate and ring 75 is moving downwardly over the periphery flange to bend it down as shown.

In Figure 9 dies 41 and 59 have fully closed upon the blank and spring 84 has moved segments 78 inwardly, thereby causing cam faces 79 to engage the down-turned flange and bend it inwardly.

During the final stage of die closing operation, dies 41 and 59 move downwardly as a unit against the action of springs 60, and as this occurs the upper end of ring 59 engages cam face 81 of segments 78 and pushes them outwardly. When the parts are brought into final position ring 59 firmly clamps the flange upwardly upon itself as seen in Figure 10.

It has been found that the form of secondary die illustrated in Figures 3 to 7 inclusive is very advantageous when plates having a narrow rim are formed, whereas the die assembly shown in Figures 8, 9 and 10 is particularly valuable when plates having a wide flange are being formed. Ledge 63a provided on ring 59 need not be as high in this form of the invention as in the first form of the invention because segments 78 operate to initially turn the flange under.

The pressures employed in the process are comparatively low and the dies are not heated and therefore the process may be readily carried out at low cost.

As previously pointed out, any suitable form of circular or generally circular blanks may be employed to produce the pie plate of the invention. I preferably employ, however, a non-circular blank in order to compensate for the drawing action that takes place when the pleats are formed. In Figure 11 I have shown one form of the invention wherein a blank for a pleated plate having six pleats is provided with a lobe 91 for each pleat.

Although the dimensions for the various forms of the plate will vary somewhat, depending upon the number of pleats and the exact size of plate desired, I have in Figure 11 illustrated dimensions that may be employed for an eight inch diameter plate. In the center of the plate is inscribed a circle 92 having a diameter of approximately $2\frac{1}{8}$ inches and laid off at equi-distant points about the circumference of the circle are six points 93. Swung from each point 93 on a radius 94 of approximately $5\frac{13}{32}$ inches is an arc 95. Wherever adjacent arcs 95 intersect they define a lobe 91.

With this plate, which has six pleats, the primary die is provided with faces to form six pleats, and the blanks are so fed into the die as to bring lobes 91 opposite vertical portions 15 and 18 of the die so that when the plate is formed the lobes will supply the material taken up by the pleating operation and the plate will be generally circular in shape.

Any suitable means may be employed for insuring proper alignment of the blanks with the primary dies, for instance, a plurality of resiliently

depressible positioning pins may be located on the upper or lower die so as to cooperate with the blank and hold the same in proper position with respect to the die. The pins are preferably mounted in openings in the die so that they will retract when the dies come together. If desired, however, a device for cutting the blanks into proper form may be associated with the primary die so that as the die is closed they will cut the blank into the proper form with the lobes in alignment with the pleat forming parts of the dies. Also, if this method is employed the paper may be fed from rolls directly through the primary and secondary dies, the two being located fairly close to each other side by side, so that while the final die is operating upon one plate, the primary die will be cutting and forming another plate. The primary dies are preferably so formed as to only partially sever the blank from the sheet, with the result that the rolls may intermittently advance the paper stock into the primary die and then carry the partially formed plates from the primary die to the secondary die. The secondary die is preferably provided with knives for completely severing the blanks from the sheets and a suction cup or the like may be employed for removing the completed pie plate from the secondary die.

In Figure 12 I have illustrated a further modification of blank that may be employed. In this form of the invention circle **92** is provided as previously described, and radii **94** are swung from points **93** on circle **92** to provide lobes **91**, as before. An additional set of radii **96** are swung from points **97** on circle **92** to provide portions **98**. Dotted lines **99** indicate the lines along which the pleat forming bends are produced in the material of the blank, and it is apparent that as the pleats are turned over flaps **97** will provide the necesary extra material to compensate for the drawing action. The plate accordingly possesses a smooth outer edge of circular configuration.

In Figure 13 there is illustrated a further modification of the blank shown in Figure 12 wherein portion **98***a* is provided with a sloping portion **101**. These forms of blank are very advantageous in compensating for the drawing of the material when the pleats are being formed and particularly when the peripheral portion of the flange is turned under, as they provide the extra material needed where the flange is folded over at the pleats.

It should be observed that the pleated plates produced in accordance with any of the forms of my invention possess considerable inherent rigidity by reason of the pleats, which function as reenforcing elements. Therefore, quite satisfactory pie plates and other receptacles having sufficient rigidity to render them self-sustaining may be made of plain paper stock or paper stock laminated with metal foil in accordance with the methods and apparatus of my invention.

The invention may be embodied in other specific forms without departing from the spirit or essential characteristics thereof. The present embodiments are therefore to be considered in all respects as illustrative and not restrictive, the scope of the invention being indicated by the appended claims rather than by the foregoing description, and all changes which come within the meaning and range of equivalency of the claims are therefore intended to be embraced therein.

What is claimed and desired to be secured by United States Letters Patent is:

1. In an apparatus for making receptacles of sheet material having a closed bottom, a side wall and a peripheral flange, a pair of dies mounted for movement toward and away from each other and having cooperating faces for forming said bottom and side wall of said receptacle when a blank is clamped between them, one of said dies having a die ring mounted for movement with respect thereto, said die ring cooperating with a face on said other die to form said flange on said receptacle when said dies are moved a predetermined distance toward each other and prior to clamping said receptacle between said dies, said one die also having a peripheral surface for bending over said flange when said dies are moved a further distance toward each other, said die ring being operable to resiliently maintain said flange in contact with the cooperating face on said other die and undergoing movement with respect to said one die when said dies are moving said further distance.

2. The apparatus described in claim 1, wherein said die ring is resiliently urged toward said other die and is provided with means for stopping it substantially flush with the flange-bending surfaces of said one die.

3. The apparatus described in claim 1, wherein said other die is carried by a movable actuating member and a second die ring is carried by said actuating member for turning over the bent portion of said flange when said dies are brought into a final position.

4. In an apparatus for producing from blanks of sheet material receptacles having a closed bottom and a side wall, a pair of die supports mounted for relative movement toward and away from each other, a bottom and side wall forming die rigidly secured to one of said die supports and a second bottom and side wall forming die mounted for movement upon said other die support in a direction substantially parallel to the movement of said die supports, a ring-like die encircling said first die and resiliently mounted on said one die support for movement with respect thereto, said ring-like die being operable to form a flange on said receptacle when said die supports are moved toward each other and prior to clamping of said blank between said dies, resilient means for urging said second die toward said first-named die, said dies being operable to form the bottom, the side wall, and the flange of said receptacle when a blank is clamped between them, said dies being operable to move as a unit with respect to said other die support after they have clamped said blank therebetween, and die means, rigidly carried by said latter die support, and cooperating with said ring-like die, for performing a further forming operation upon said blank when said dies move as a unit toward each other to a predetermined degree.

5. The apparatus described in claim 4, together with a second die means rigidly supported by said one die support and operable to perform an intermediate forming operation upon said blank when said die supports are moved toward each other.

6. The method of making a receptacle having a closed bottom, a sloping side wall and a flange, the side wall having a plurality of closed pleats therein to take up surplus material, which comprises taking a blank of sheet material and operating upon it in a set of primary dies to form said bottom and said sloping side wall and simultaneously providing a plurality of bends in said side wall to cause the material to assume

a corrugated form, each corrugation being made up of an inclined portion and a vertical portion, and then applying pressure to said blank in a direction solely normal to the plane of the bottom of said receptacle in a second set of dies to cause said corrugations to fold into closed pleats and to form said flange.

7. In an apparatus for making from blanks of sheet material receptacles having a closed bottom, a side wall and a flange, a pair of dies mounted for relative movement toward and away from each other and having cooperating faces for forming said bottom, said side wall and said flange when a blank is clamped between them, and a ring assembly longitudinally movable with respect to one of said dies, for bending the peripheral portion of said flange back upon itself, said ring assembly comprising a plurality of inwardly and outwardly movable segments and having resilient means for causing them to automatically move inwardly and turn said flange under when said dies have moved a predetermined distance toward each other.

8. In an apparatus for making shallow receptacles of sheet material having a closed bottom, a sloping sidewall, and a peripheral flange, a pair of dies having surfaces for forming said bottom and sidewall when said dies are closed upon a blank, a ring-shaped die element mounted on, but movable with respect to, one of said dies and having resilient means for urging it toward the other of said dies, for automatically bending said flange on said blank as said dies are moved toward each other and prior to clamping said blank between the latter, and a further die member mounted for synchronous movement with said one die and encircling said ring-shaped die element, and means for so mounting said further die member as to automatically turn down the peripheral portion of said flange as said dies are moved toward each other and subsequent to the forming of said flange by said ring-shaped die element.

9. In an apparatus for making from blanks of sheet material receptacles having a closed bottom, a sidewall and a flange, a pair of dies mounted for relative movement toward and away from each other and having cooperating faces for forming said bottom, said side wall and said flange when a blank is clamped between them, and a ring assembly longitudinally movable with respect to one of said dies, for bending the peripheral portion of said flange back upon itself, said ring assembly comprising a plurality of inwardly and outwardly movable segments having means for causing them to move inwardly and turn said flange under when said dies are moved a predetermined distance toward each other, and a ring die for forcing said segments outwardly and folding said peripheral portion of said flange upon itself when said dies are brought into a final receptacle-forming position.

10. In an apparatus for making from blanks of sheet material receptacles having a closed bottom, a sidewall and a flange, a pair of dies mounted for relative movement toward and away from each other and having cooperating faces for forming said bottom and said side wall, when a blank is clamped between them, a ring die mounted on one of said dies and mounted for movement with respect thereto, said ring die being operable to form said flange on said receptacle when said dies are moved toward each other a predetermined distance, and prior to the clamping of said blank between said dies, a plurality of inwardly and outwardly movable forming members mounted on said one die and located outwardly of said ring die, resilient means acting upon said forming members and urging them inwardly and normally holding them in contact with the outer surface of said ring die, said forming members being operable to automatically move inwardly and turn said flange inwardly when said ring is moved relatively to said one die sufficiently to bring its outer surface out of the path of travel of said forming members.

11. In a die assembly, a primary die support and a secondary die support mounted for movement toward and away from each other, said primary die support having provided thereon a die for forming the bottom and sidewalls of a paper receptacle or the like and cooperating with a similar die provided on said secondary die support, said die of said secondary support being movable with respect thereto and having resilient means urging it toward said other die, a die ring carried by said primary die support and mounted for movement with respect thereto and having resilient means urging it toward said secondary die support, said die ring being resiliently urged toward said secondary die support and being operable to form the flange of said receptacle when said die supports are moved toward each other to a predetermined extent, and prior to the clamping of said blank between the dies of said primary and secondary die supports, and means provided on said secondary die support for turning the flange of said receptacle inwardly upon itself after said dies have clamped said blank between them and after said die supports have moved toward each other a predetermined distance against the action of said resilient means of said secondary die support, comprising an annular die element surrounding the die of said secondary support and rigidly secured to said secondary support.

KARL H. MILLER.