Oct. 8, 1946. M. P. CHAPLIN 2,408,734

MOLDED FIBER EDGE FORMING APPARATUS

Filed Sept. 13, 1944 2 Sheets-Sheet 1

Fig. 1.

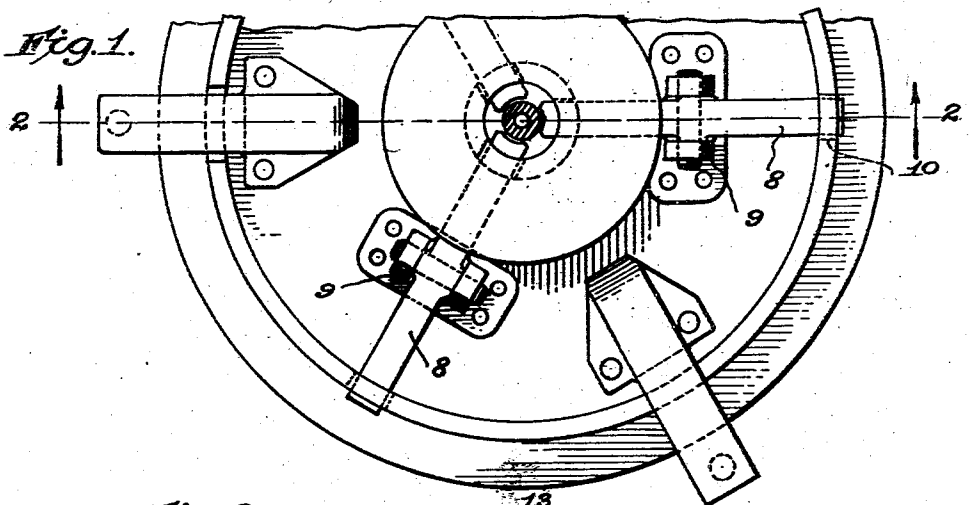


Fig. 2.

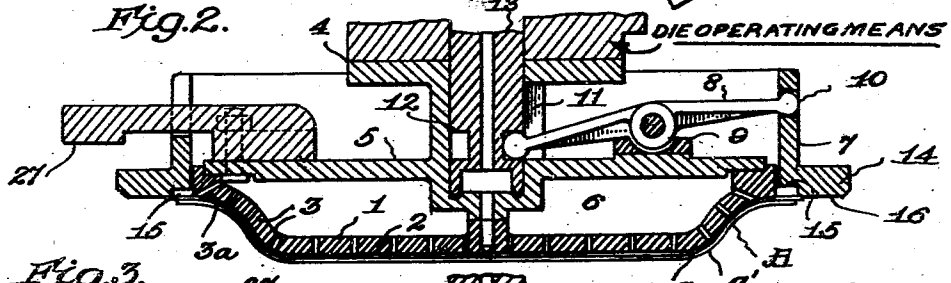
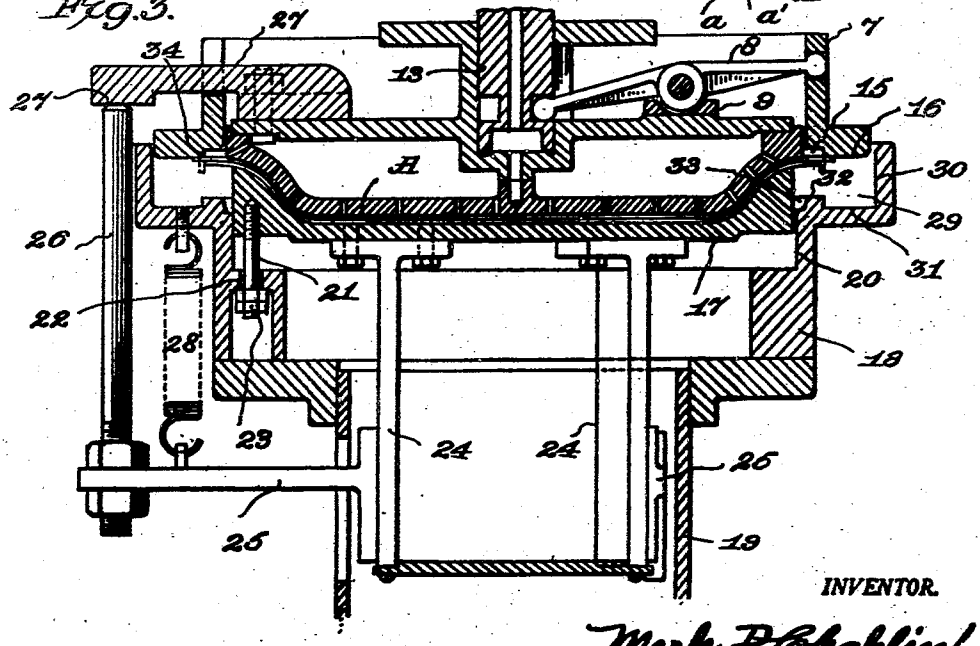


Fig. 3.



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Fig. 4.

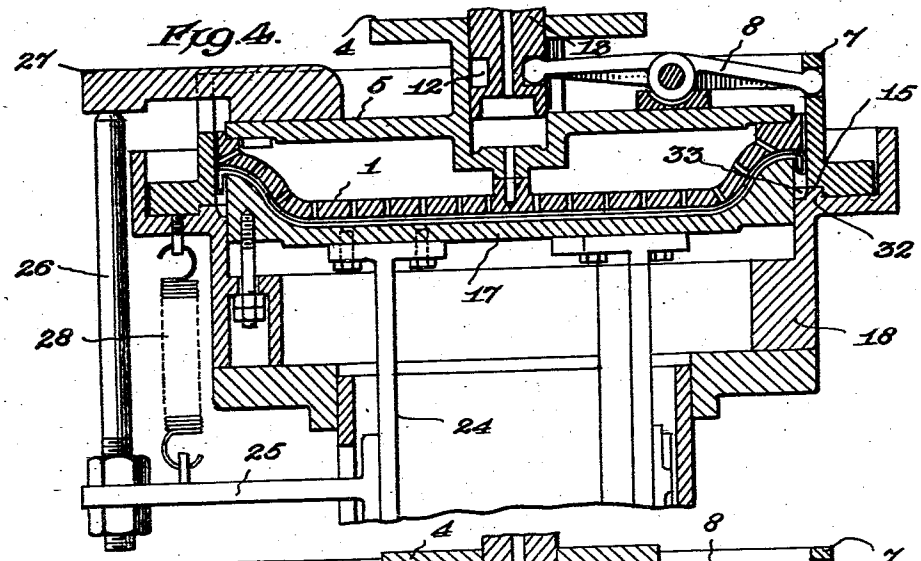


Fig. 5.

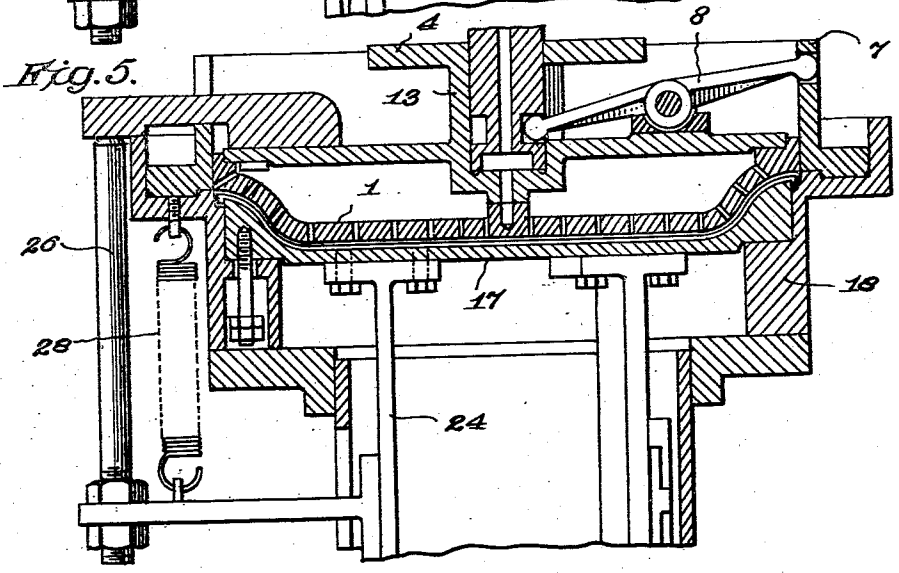
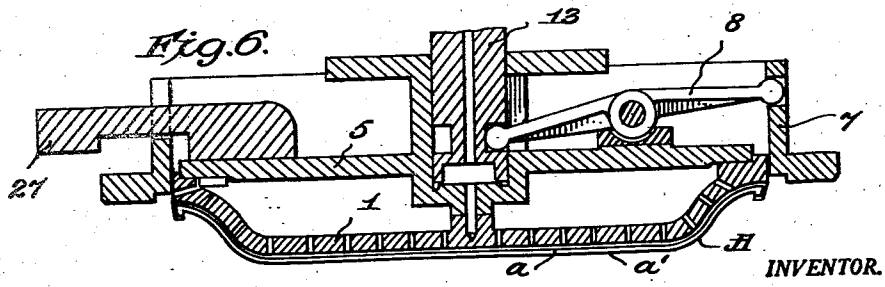


Fig. 6.



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2,408,734

MOLDED FIBER EDGE FORMING APPARATUS

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Application September 13, 1944, Serial No. 553,904

12 Claims. (Cl. 92—56)

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This invention relates to apparatus useful in the making of molded fiber articles and more especially open faced vessels, such as dishes, plates, trays, cups, etc., the invention being particularly directed to apparatus for producing on the periphery of such articles an integral, thickened reinforcing edge.

The primary object of the present invention is to provide efficient apparatus adapted to operate upon a partially formed fiber article while the fiber material from which such article is formed is still wet and the fibers loosely interfelted and capable of being reshaped without destroying or weakening the fiber interlock, to reshape the peripheral portion of the article into a thickened reinforcing edge.

The invention is characterized by the employment of primary and secondary dies between which the body of the article is positioned, with the peripheral portion of the article extending beyond said dies, to be manipulated by a shaping ring arranged peripherally of the dies. This ring is operable to shape and compact the extending portion of the article within a shaping channel which forms, with the ring, a mold chamber of the shape which it is desired to impart to the thickened reinforcing edge.

Numerous novel features are incorporated in the apparatus hereinafter described and shown in the accompanying drawings.

The accompanying drawings illustrate one practical embodiment of the invention, but the construction therein shown is to be understood as illustrative, only, and not as defining the limits of the invention.

Figure 1 is a plan view of the parts associated with the primary die, with a central rocker operating plunger in transverse section.

Figure 2 is a transverse section on the line 2—2 of Figure 1 showing a fiber article, to be acted upon carried by said die. Section lining of this article has been omitted in the interest of clearness.

Figure 3 shows the primary die and associated parts (as in Figure 2), brought into cooperative relation with a secondary die and an associated die holder and before actuation of the shaping ring.

Figure 4 shows the dies in the same positions as they occupy in Figure 3, but with the shaping ring moved into position to partically shape the peripheral portion of the article and form, with the secondary die holder, an edge molding chamber in which the partially shaped edge is adapted

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to be compressed and molded into the desired shaped.

Figure 5 in a view similar to Figure 4, but showing how the parts are positioned after the reinforcing edge has been shaped and compressed to its desired contour.

Figure 6 shows the primary die removed from the secondary die and the parts of the primary die returned to their starting position of Figure 1 with the article in place on said primary die and finished insofar as this invention is concerned.

Referring to the drawings, 1 designates the primary die. It comprises a die body having a contoured face 2 to which lead drainage openings 3 of any appropriate kind. It is shown as rigidly mounted on an appropriate holder 4 to which it is screwed, bolted or otherwise attached. The holder comprises a plate 5 adapted to close the back of the die and form within the die a suction or pressure chamber 6. Appropriate conduit connections (not shown) lead to this chamber for evacuating air therefrom to provide a suction condition within the chamber and to convey to the chamber gaseous pressure, such as air under pressure. Inasmuch as means for the production of suction and pressure within a foraminous die is well known to the art, I have not considered it necessary to complicate the drawings by a showing thereof.

The holder 4 is mounted upon any suitable die handling apparatus, the "die operating means" of which is fragmentally indicated in Figure 2, whereby the die may be raised and lowered and moved to different positions as desired in its normal operation. The contoured molding face of the primary die is bounded by a non-molding surface normal to the plane of symmetry of the molding face and this surface is peripherally embraced by a shaping ring 7 which preferably has a close sliding fit with said non-molding surface of said die. This ring extends somewhat above the plate 5 of the die and is provided with appropriate means for axially shifting the ring with respect to the die. Various ring operating means may be employed for this purpose, but for illustration I have shown the ring as operated by three rocker arms 8, pivoted intermediate their ends on brackets 9 carried by the plate 5. The outer ends of the arms operate within openings or sockets 10 in the ring, while the inner ends of the arms project through slots 11 in the holder 4 and extend into an annular channel 12 in an operating plunger 13, as clearly shown in Figures 1 and 2. The plunger 13 is reciprocated in timed relations to the operations of the die by any appro-

priate mechanism and serves, through the connections specified, to axially move the shaping ring 7.

The lower portion of the shaping ring is shown as formed with an outwardly extending flange 14, the lower face of which is stepped or rabbeted so as to provide, immediately adjacent the periphery of the die 1, a channel 15 above the lower surface 16 of said ring and certain of the drainage openings in the primary die, more particularly those indicated at 3a, extend from the chamber 6 of the die to the aforesaid non-molding surface contiguous to the channel 15, so that when suction is applied to the chamber 6, it is communicated to this channel for reasons presently explained.

The primary die of this invention is adapted to receive upon its contoured face a partially fabricated, wet molded fiber article, indicated generally by the reference character A in Figure 1. This article may be produced according to any well known and conventional method and with the use of known apparatus, but, for the purpose of illustration, we will assume that it has been produced through the use of one or more conventional suction forming dies, by dipping the forming die or dies in a fiber-liquid mixture and then applying suction to such forming die or dies in order to deposit thereon a layer or layers of suction-formed fiber of the general contour of the article to be produced.

In the accompanying drawings, I have shown the article A as formed by two interfitting sections a and a', such as are appropriate for the manufacture of a molded fiber plate. To suction-form such article, two forming dies would ordinarily be employed, one for each section, the sections being interfitted with one another at the conclusion of their respective forming operations to form, in effect a multi section wet blank. In the forming of this blank, however, the peripheral portion is made to extend beyond what will be the final peripheral dimension of the finished article, to thereby provide the blank with an added peripheral portion from which a thickened reinforcing edge may be formed about the edge of the article. When the body portion of the blank, in substantially its finished contoured shape, is positioned on the primary die, said added peripheral portion will extend beyond the outer periphery of the primary die 1. The diameter of the die 1 corresponds to the diameter of the finished plate and that portion of the blank which projects beyond the periphery of this die is the added extension to which I have referred.

By reference to Figure 2, it will appear that said added extension bridges the channel 15 of the shaping ring and it is to preclude sagging of this still wet projection, while the article is held by suction on the die as shown in Figure 2, that the drainage openings 3a are extended to this channel. The suction thus communicated to the channel will hold the extension of the blank in the position shown until such extension is manipulated by the shaping ring, as presently described. While the shaping ring has a close sliding fit with the periphery of the die 1, as hereinbefore stated, there is, nevertheless, some leakage through the joint between these parts. Consequently while considerable suction may be employed to hold the body of the article on the die, said leakage will preclude the building up of so much suction in the channel 15 as to draw the added extension of the article into such channel.

After the newly formed blank has been positioned on the primary die 1, with its peripheral portion underlying the shaping ring as shown in Figure 2 and while such article is thus held in place by suction within the chamber 6, the primary die is brought into cooperative relation with a complementary secondary die 17, which may be foraminous or otherwise, but is shown in the drawings as solid. This secondary die 17 is of less diameter than the primary die 1, so that the primary die extends radially beyond the periphery of the secondary die a distance substantially equal to the width of reinforcing portion to be formed on the article.

The secondary die is floatably supported within a die holder 18. This die holder 18 is supported in normal fixed position on a tubular support 19 which is rigid with the holder 18 and during the reshaping operation is stationary. The upper portion of the die holder is recessed as shown at 20 and in this recess the secondary die is mounted for axial reciprocation relative to its holder. Its movement in an upward direction is limited by limiting studs 21 of which three may be conveniently spaced apart in annular relation about the under side of the die 17. These studs are shown as secured in tapped holes in the back of the die and as operating through holes 22 in the die holder, with adjustable nuts 23 for controlling of the uppermost limit of travel of the die.

To the under side of the die 17 are secured three brackets 24 having rigid laterally extending arms 25 passing through slots in the tubular support 19 and carrying at their outer ends vertically adjustable posts 26. These posts are adapted to be engaged by the under sides of abutments 27 carried by the plate 5 which supports the primary die. When relieved from pressure of the abutments 27, the secondary die will be raised to its maximum elevation by means of a plurality of springs 28, of which three are employed in the construction shown. These springs are of the tension type and are interposed between the holder and the arms 25 which are rigid with the secondary die. The springs 28 thus tend to elevate the die 17 as far as the limiting studs 21 will permit.

When the primary die is brought into cooperative relation with the secondary die, as shown in Figure 3, the abutments 27 will engage with the posts 26 and insure accurate spacing between the complementary contoured faces of the primary and secondary dies so long as the parts are so engaged. This spacing is in the preferred form of the invention such that the primary and secondary dies are merely in contact with the upper and lower faces of the body portion of the article A and the subsequent steps of shaping the added extension of the article are performed without actually placing the body portion of the article under pressure. While this is the preferred operation, it is possible, if so desired, to either omit the posts 26 or vertically adjust them to permit compression of the article between the primary and secondary dies when said dies are brought together and during the subsequent shaping of the extending peripheral portion (i. e., the added extension) of the article, but such pressure is not necessary and is ordinarily not desired in carrying out the present invention.

The upper portion of the die holder 18 is as shown in Figure 2 recessed at 29 to receive the lower portion of the shaping ring 7. The outer peripheral wall 30 of this recess is shaped to closely

embrace the ring 7 while the base of such recess is provided with a surface 31 adapted to serve as a seat for the bottom surface 16 of the ring. From this seat extends an upstanding boss 32 shaped to fit into the channel 15 of the ring. Within this upstanding boss is formed a depressed channel 33 having an open side contiguous to the outer periphery of the secondary die and of a shape corresponding to that which it is desired to impart to the reinforcing edge to be formed on the article, whereby this channel constitutes an edge molding or shaping channel.

When the primary die, carrying the article as shown in Figure 2, is brought into the position shown in Figure 3, the abutments 27 engage with the posts 26, as shown in the latter figure and the plunger 13 is in its depressed position to elevate the shaping ring 7 as shown.

The first step in shaping the edge of the article consists in elevating the plunger 13 to depress the shaping ring 7 into the position shown in Figure 4. As the ring 7 is lowered, its edge 34 which borders the channel 15, engages first with the upper section a of the article A. By preference the section a' is made so that its outer periphery will not overlap the edge 34, while the section a is made somewhat larger so that it will overlap this edge 34 a distance at least equal to the thickness of the section a'. Therefore, during the first stages of lowering the ring 7, the edge 34 will wipe the overhanging projecting portion of the section a, downwardly over the outer edge of the section a', as indicated in dotted lines in Figure 3.

As the ring 7 continues to descend, the thus modified peripherally extending portions of both sections will enter the channel 15 until engaged by the base of the channel, whereupon continued downward movement of the ring will wipe the entire added extension downwardly into the position shown in Figure 4 where it will remain as the ring proceeds to its seat against the holder 18. As this operation is completed, the bottom surface 16 of the ring will engage with the seat 31 of the die holder, as clearly shown in Figure 4, while the boss 32 will enter the channel 15 to interfit therewith, thereby bringing the shaping or molding cavity 33 into contiguous relation with the clearance space between the outer periphery of the secondary die and the inner surface of the shaping ring, to form a closed annular chamber in which the wiped-down portion of the article is contained.

This having been accomplished, the ring 7 and die holder 18 of the secondary die remains stationary, while the die holder 4 of the primary die is lowered. When so lowered, the primary die 1, through the abutments 27 and posts 26, impart a like movement to the secondary die while both dies are held in accurate axial spaced relation and while the holder 18 for the lower die remains stationary. Consequently, as the two dies are lowered in unison, the axial dimension of the cavity occupied by the peripheral portion of the article is correspondingly decreased, to force such partially shaped peripheral portion of the article downwardly into the molding cavity 33, so that by the time the downward movement of the two dies has reached the position shown in Figure 5, said edge portion of the article will have been shaped and compressed into conformity with the molding cavity 33, as shown in Figure 5. As this cavity extends beneath a contoured surface of the secondary die, the shaping which results from this operation will produce, upon the periphery of the article thus manipulated, a relatively deep reinforcing edge, the shape of which will of course depend upon the shape of the molding cavity 33. I have shown the cavity as shaped with a slight taper at its outer wall, although this wall may be rounded or otherwise configurated, so as to produce a reinforcing edge of the shape desired.

One advantage of making the article A of two sections a and a' and extending the former section beyond the edge of the latter and manipulating these sections in succession in the manner stated is apparent from Figure 5, wherein it will be noted that the projecting portion of the section a will be shaped to enclose the outer peripheral edge of the article, as well as the bottom edge of the reinforcing portion of the section a'. In practice the section a, which constitutes the larger section of the article, may be made of more select and higher grade stock, which is thus carried across the surface of the body portion of the plate and entirely encloses the reinforcing edge produced according to this invention, to impart a superior finished appearance to the resulting article.

The bringing of the parts into the position of Figure 5 completes the manipulation of the article insofar as the present invention is concerned. The primary die (with suction retained therein) is now lifted free from the secondary die and appears as shown in Figure 6. The article may now be removed from the primary die by releasing the suction and, if desired, applying pressure within the die chamber. Said article may be delivered from the primary die to a conveyor or another die or any other suitable receiving means, for any further treatment, if any, as may be desired. So far as the present invention is concerned, the operations of this apparatus are concluded when the article is discharged from the die of Figure 6 and the article may be considered, from the standpoint of this invention, as finished.

For the purpose of illustration, I have shown the dies in the accompanying drawings as circular dies adapted to manipulate a circular molded fiber plate. I wish it understood, however, that these dies may be polygonal or of any other shape, without departing from this invention and they may be made deep or shallow depending upon the particular article to be made.

The foregoing detailed description sets forth the invention in its preferred practical form, but the invention is to be understood as fully commensurate with the appended claims.

Having thus fully described the invention, what I claim as new and desire to secure by Letters Patent is:

1. An apparatus of the character described comprising a pair of coacting coaxial dies adapted to engage the opposite faces of a molded fiber article interposed between them with the marginal portion of the article extending beyond the opposing article engaging surfaces of both dies, a stationary member surrounding one of the dies and provided therein with a molding channel, a shaping ring embracing the other die with its inner periphery alined with the outer periphery of the molding channel, said ring being axially movable with respect thereto to deflect the extending marginal portion of the article toward and into axial alinement with the said channel and thereafter form a wall about the outer periphery of said channel, and means for axially moving both dies in the direction of the base of the molding channel to compress and

compact said deflected marginal portion of the article in said molding channel.

2. An apparatus of the character described comprising a pair of coacting coaxial dies adapted to engage the opposite faces of a molded fiber article interposed between them with the marginal portion of the article extending beyond the opposing article engaging surfaces of both dies, a stationary member surrounding one of the dies and provided therein with a molding channel, a shaping ring embracing the other die with its inner periphery alined with the outer periphery of the molding channel, said ring being axially movable with respect thereto to deflect the extending marginal portion of the article toward and into axial alinement with said channel and thereafter form a wall about the outer periphery of said channel, and means for axially moving both dies in the direction of the base of the molding channel to compress and compact said deflected marginal portion of the article in said molding channel while both the molding channel and the shaping ring remain axially stationary.

3. An apparatus of the character described comprising a pair of coacting coaxial dies adapted to engage the opposite faces of a molded fiber article interposed between them with the marginal portion of the article extending beyond the opposing article engaging surfaces of both dies, a stationary member surrounding one of the dies and provided therein with a molding channel normally axially spaced from the article between said dies, a shaping ring surrounding one of the dies on the side of the article remote from the molding channel and axially movable with respect to both dies to deflect the extending marginal portion of the article toward and into axially alined spaced relation to said channel and thereafter form a wall about the outer periphery of said channel, and means for axially moving both dies in unison in the direction of the base of said channel to shift said extending marginal portion into and compress and compact the same within said molding channel.

4. An apparatus of the character described comprising a molding member provided therein with a die opening and having a molding channel contiguous to and surrounding said opening, a die coaxial with and positioned within said opening and having a contoured cross axial article engaging face, a second die coaxial with the first and having a contoured cross axial article engaging face opposed to that of the first die and of a cross axial size sufficiently greater than the face of the first die to span the face of the first die and also said molding channel, and a ring for peripherally enclosing the space between outer periphery of the second die and the outer periphery of said molding channel, both dies and the molding member being mounted for relative axial movement whereby the contoured cross axial face of said second die and the channel may be brought into substantially contiguous relation for the purpose of compressing and compacting within said channel a portion of an article positioned between said dies and extending into said channel.

5. An apparatus of the character described comprising axially alined primary and secondary dies mounted for axial movement and having opposing contoured faces adapted to house between them an interposed molded fiber article with the marginal portion of the article projecting beyond the periphery of the face of the primary die and the face of the primary die peripherally projecting beyond the face of the secondary die, a shaping ring embracing the primary die and axially movable with respect thereto, a molding member embracing the secondary die and having a molding channel immediately surrounding the secondary die with the outer edge of the channel in substantial alinement with the inner edge of the shaping ring, both of said dies being collectively axially movable, while said shaping ring and molding member remain axially stationary.

6. An apparatus of the character described comprising axially alined primary and secondary dies mounted for axial movement and having opposing contoured faces adapted to house between them an interposed molded fiber article with the marginal portion of the article projecting beyond the periphery of the face of the primary die and the face of the primary die peripherally projecting beyond the face of the secondary die, a shaping ring embracing the primary die and axially movable with respect thereto, a molding member embracing the secondary die and having a molding channel immediately surrounding the secondary die with the outer edge of the channel in substantial alinement with the inner edge of the shaping ring, both of said dies being collectively axially movable while said shaping ring and molding member remain axially stationary, and means independent of the article between said dies for spacing said dies apart as they are collectively axially moved in the direction of the base of said molding channel.

7. Apparatus of the character described comprising a molding member provided therein with a die receiving opening and having a molding channel about the edge of said opening, a first die mounted in said opening for axial movement, means for normally protruding a portion of said die beyond the open end of the molding channel whereby the peripheral surface of such die forms a wall about the inner face of said molding channel, a second die arranged coaxially of the first die and complementary thereto and extending from its axis outwardly beyond the peripheral surface of the first die and having a peripheral face substantially alined with the outer edge of the molding channel, a shaping ring embracing the peripheral face of the second die and mounted for axial movement, said second die being axially movable into proximity with the first die to house between them a wet molded pulp article with the marginal edge portion of said article extending beyond the peripheral surfaces of both dies, means for axially moving the shaping ring to wipe said marginal edge projecting portion of the article into alinement with the molding channel and to seat the ring against said molding member, and means for thereafter axially moving both of the dies conjointly in a direction to shape said extending marginal portion of the article to the confines of the molding channel and to compress said thus shaped portion within said channel.

8. Apparatus of the character described comprising a molding member provided therein with a die receiving opening and having a molding channel about the edge of said opening, a first die mounted in said opening for axial movement, means for normally protruding a portion of said die beyond the open end of the molding channel whereby the peripheral surface of such die forms a wall about the inner face of said molding channel, a second die arranged coaxially of the first die and complementary thereto and extending

from its axis outwardly beyond the peripheral surface of the first die and having a peripheral face substantially alined with the outer edge of the molding channel, a shaping ring embracing the peripheral face of the second die and mounted for axial movement, said second die being axially movable into proximity with the first die to house between them a wet molded pulp article with the marginal edge portion of said article extending beyond the peripheral surfaces of both dies, means for axially moving the shaping ring to wipe said marginal edge projecting portion of the article into alinement with the molding channel and to seat the ring against said molding member, means for thereafter axially moving both of the dies conjointly in a direction to shape said extending marginal portion of the article to the confines of the molding channel and to compress said thus shaped portion within said channel, and means, independent of the article between said dies for spacing said dies apart while they are conjointly moved, whereby such movement may be accomplished without placing the portion of the article between said dies under compression.

9. An apparatus of the character described comprising a die having an exterior contoured molding face and a hollow back with drainage passages leading from said molding face through the die to the hollow back thereof, a plate closing the hollow back of the die to form between the die and said plate a suction chamber, a shaping ring embracing the peripheral edge of the die with the edge of the ring contiguous to the contoured molding face cut away to provide in the ring an annular channel surrounding the molding face of the die, means for axially moving the die, and separate means for axially moving the ring.

10. An apparatus of the character described comprising a die having an exterior contoured molding face and a hollow back with drainage passages leading from said molding face through the die to the hollow back thereof, a plate closing the hollow back of the die to form between the die and said plate a suction chamber, a shaping ring embracing the peripheral edge of the die, means for axially moving the die, and separate means for axially moving the ring, said separate means comprising rocker arms one end of each of which engages with the ring while the other end of each of which engages with an axially movable plunger which serves to simultaneously operate all of said rocker arms to axially move said ring.

11. An apparatus of the character described comprising a die having an exterior contoured molding face and an interior suction chamber, with drainage passages leading from said face to said chamber, said contoured molding face being peripherally bounded by a non-molding surface extending normal to the plane of symmetry of the contoured molding face and there being suction passages leading from said surface to the interior suction chamber of the die.

12. An apparatus of the character described comprising a die having an exterior contoured molding face and an interior suction chamber, with drainage passages leading from said face to said chamber, said contoured molding face being peripherally bounded by a non-molding surface extending normal to the plane of symmetry of the contoured molding face and there being suction passages leading from said surface to the interior suction chamber of the die, in combination with a shaping ring peripherally embracing said die and mounted for axial movement relative thereto, said shaping ring being rabbeted contiguous to said non-molding surface of the die to provide a channel embracing said die and to the interior of which channel suction is adapted to be applied through said suction passages.

MERLE P. CHAPLIN.