Aug. 15, 1961 M. P. CHAPLIN 2,996,118

RESHAPING DIES FOR FRESHLY MOLDED PULP ARTICLES

Original Filed Sept. 29, 1953 3 Sheets-Sheet 1

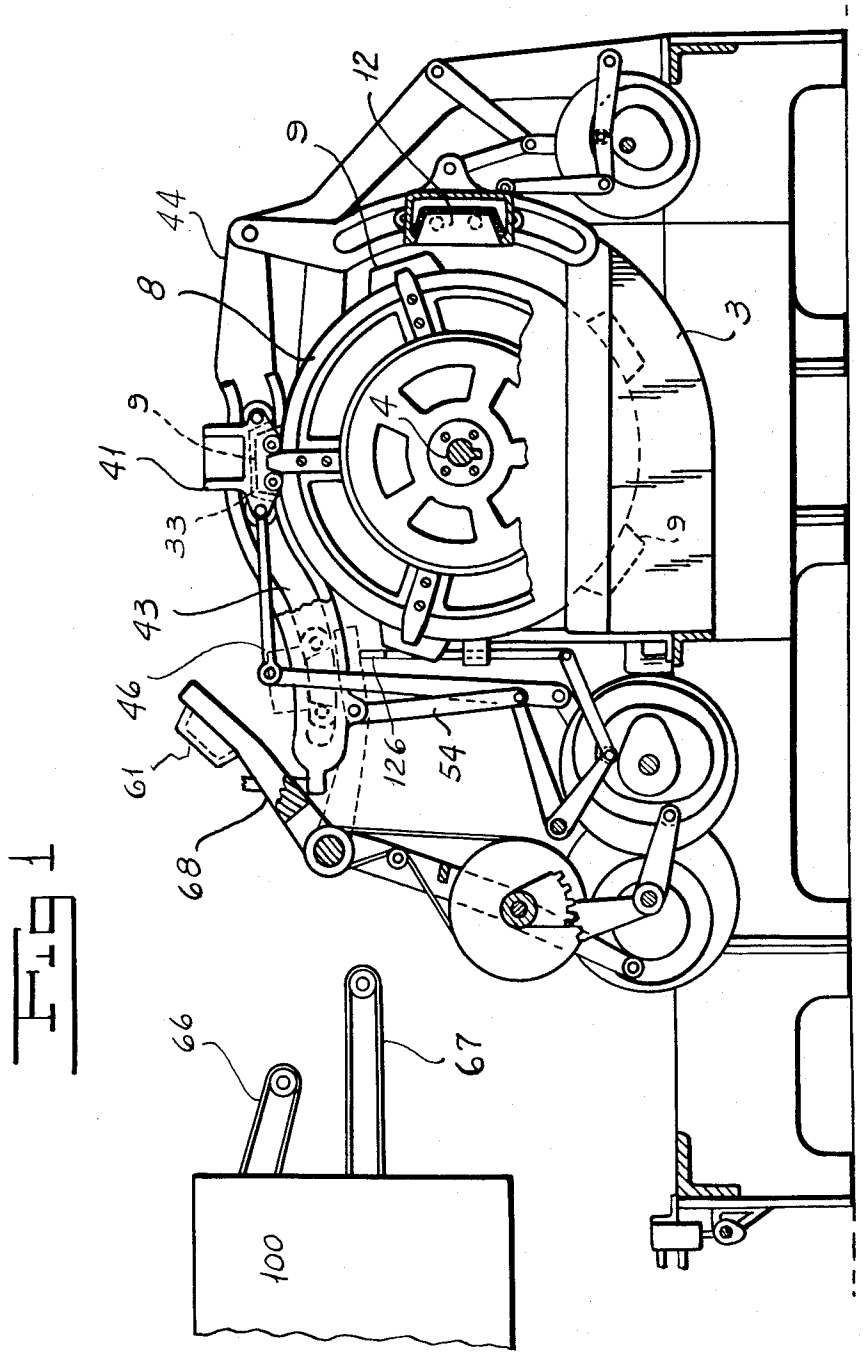


FIG. 1

INVENTOR
MERLE P. CHAPLIN
BY Cornelius Fabris Rie
ATTORNEY

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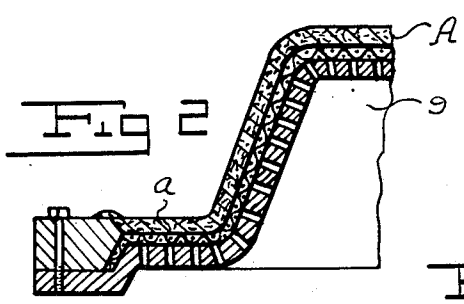


Fig 2

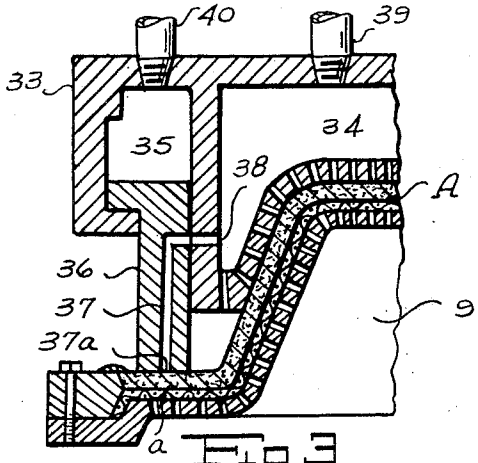


Fig 3

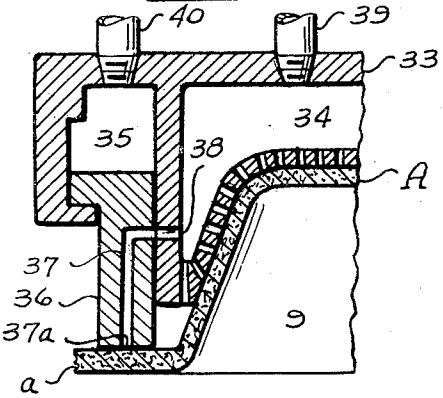


Fig 4

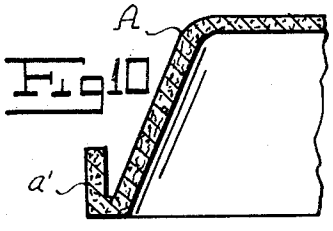


Fig 10

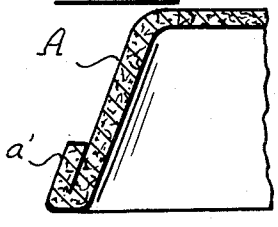


Fig 11

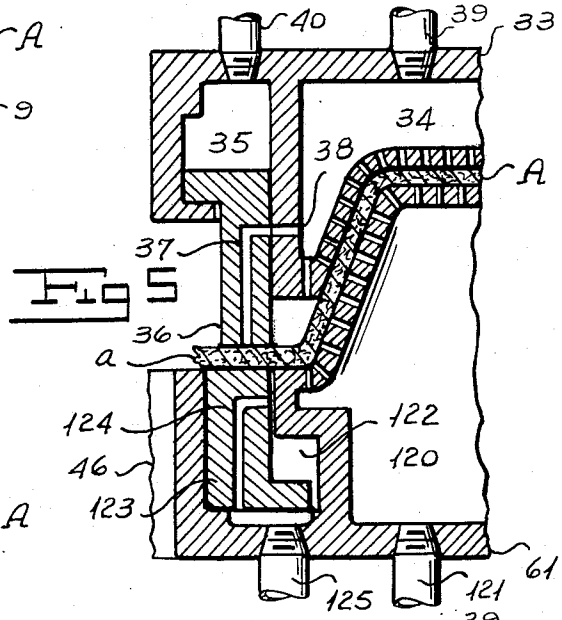


Fig 5

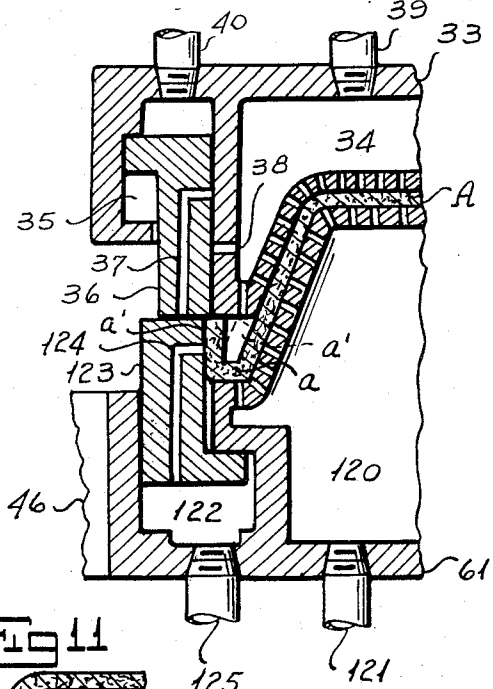


Fig 6

INVENTOR
MERLE P. CHAPLIN
BY Cornelius Zabriskie
ATTORNEY

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RESHAPING DIES FOR FRESHLY MOLDED PULP ARTICLES

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Fig 5

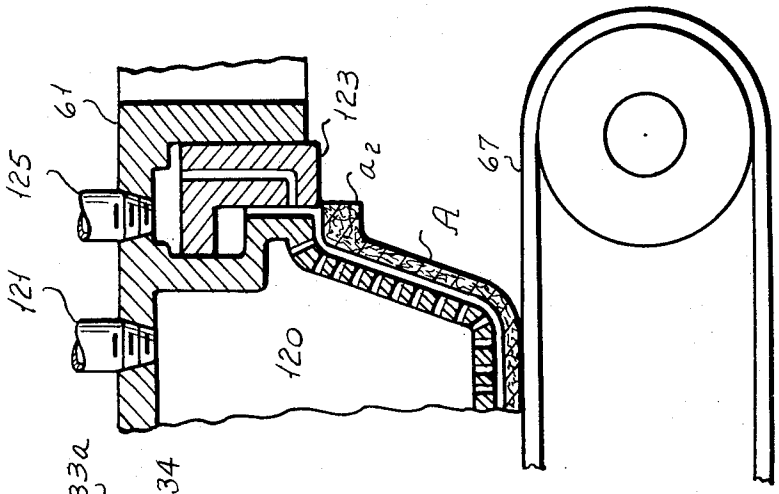


Fig 8

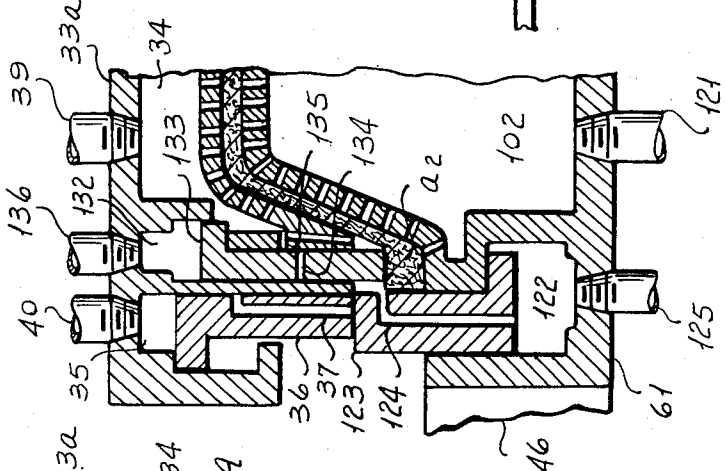
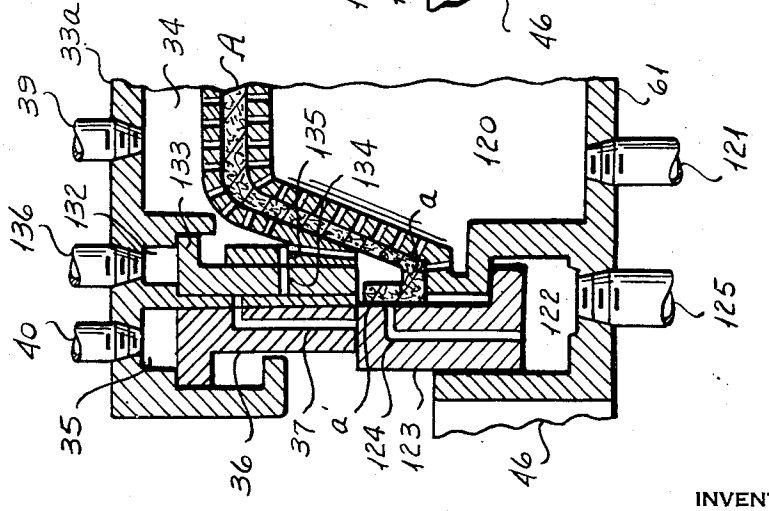


Fig 7



INVENTOR
MERLE P. CHAPLIN
BY
Cornelius Fabrisius
ATTORNEY

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2,996,118

RESHAPING DIES FOR FRESHLY MOLDED PULP ARTICLES

Merle P. Chaplin, South Portland, Maine, assignor, by mesne assignments, to Diamond National Corporation, New York, N.Y., a corporation of Delaware

Original application Sept. 29, 1953, Ser. No. 382,985, now Patent No. 2,938,582, dated May 31, 1960. Divided and this application June 17, 1959, Ser. No. 820,992

18 Claims. (Cl. 162—396)

This application is a division of my copending application Serial No. 382,985, filed September 29, 1953, on "Method of and Apparatus for Making Molded Pulp Articles" which on May 31, 1960 matured into Patent No. 2,938,582.

Said parent application the disclosure of which is herein incorporated by reference, discloses integrated apparatus and methods for forming pulp articles and comprises all apparatus and method steps, from initially suction forming an article on a suction die, to and including the discharge of such article from the apparatus in condition to be packed for the market. That apparatus and method embody, inter alia, means operable upon a freshly molded suction formed pulp article for reshaping and consolidating a portion of said article, generally the peripheral edge thereof, so that the resulting end product will have a thickened reinforced edge of strong, neat and pleasing appearance. The means for accomplishing this result embodies certain die structures which form the subject matter of the present application. The die structures of this invention may be employed in reshaping a wide variety of freshly molded pulp articles and, while useful in the integrated machine of the parent application aforesaid, may be used in other apparatus and in other combinations than in the particular apparatus disclosed in said parent application.

The primary object of this invention is to provide novel die structures for reshaping and consolidating the fibrous materials of a portion of a freshly molded fibrous article into a compact, strong, homogeneous structure after the fibrous materials have been transformed from liquid to a semi-solid state or condition and while the pulp of such article is still wet.

Features of the invention, other than those adverted to, will be apparent from the hereinafter detailed description and appended claims, when read in conjunction with the accompanying drawings.

The accompanying drawings illustrate different practical embodiments of the invention, but the constructions therein shown are to be understood as illustrative, only, and not as defining the limits of the invention.

FIG. 1 is a vertical longitudinal section of an integrated pulp molding machine with certain parts in elevation. This figure corresponds to FIG. 3 of the parent application and shows certain dies, the structures of which constitute the subject matter of this divisional application.

FIGS. 2–9 are fragmental diametric sectional views wherein:

FIG. 2 illustrates a forming die shown in FIG. 1 with a wet formed article thereon.

FIG. 3 shows a transfer die in cooperation with a forming die as shown in FIG. 2.

FIG. 4 shows the transfer die of FIG. 3 removed from the forming die and supporting a formed article thereon.

FIG. 5 shows the transfer die of FIG. 4 cooperating with a take-off die, with the formed pulp article between said dies.

FIG. 6 corresponds to FIG. 5, but shows the parts of the two dies in the act of reshaping the edge of the article.

FIGS. 7 and 8 shows modified forms of the mechanism

shown in FIGS. 5 and 6 for producing a different form of edge reinforcement.

FIG. 9 shows a take-off die of the kind shown in FIGS. 7 and 8, depositing an article on a conveyor which transports the reshaped article into a dehydrator.

FIGS. 10 and 11 are fragmental sections through articles having reshaped edges formed by the dies shown in FIGS. 5 and 6.

Referring to FIG. 1 of the drawings, **3** indicates a pulp containing tank above which is a horizontal shaft **4** supporting a forming drum **8** provided about its periphery with a succession of suction forming dies **9**. As the drum is rotated, the dies are caused to successively dip into the pulp of the tank **3** to suction form on said dies an accreted pulp article, hereinafter designated A.

In the apparatus of FIG. 1 an article, after being formed on a die **9**, moves into cooperation with a solidification die **12** (forming no part of the present invention) and passes from this die into cooperative relation with a transfer die **33** supported on a transfer die carrier **41**. The die **33** embodies die structure forming part of this invention.

The transfer die carrier **41** is mounted to travel in cam tracks **43** formed in levers **44** arranged at opposite sides of the machine and, through this travel under the impulse of the link **46**, the transfer die carrier moves from the position shown in full lines in FIG. 1 to the dotted line position thereof. While in this dotted line position, it cooperates with a take-off die **61** also embodying the invention of this application. Die **61** is mounted on an arm **68** and this arm moves the die **61** from the position shown in dotted lines in FIG. 1 to a position to deposit an article carried by the take-off die onto either the conveyor **66** or **67** of a dehydrator **100**, all as fully explained in the parent application. Through these various operations, an article A, formed from liquid pulp mixture in the tank **3**, is delivered to one of the conveyors **66** or **67** free of most of the water of formation but still containing somewhat more water than fibre and most of which requires removal by supplemental treatment.

From this general description of the operation of the molding machine, the utility and efficiency of the die structures of this invention will be more clearly understood. These die structures will now be described in detail.

In FIGS. 3 and 4 transfer die **33** is shown as provided with a main chamber **34** back of its article engaging perforated face and arranged peripherally of this main chamber is a separate annular chamber **35** which is, in effect, an annular cylinder in which a ring like piston **36** is operable. This piston has channels **37** extending upwardly from its lower edge and radially to the inner surface of the piston. These channels are adapted to register at certain times with the channels **38** leading into the main chamber **34** of the die. The pipe connection **39** to the main chamber **34** of each transfer die provides means for the introduction of either suction or compressed air into the main chamber **34** while a similar means in the form of a pipe connection **40** is provided for the annular chamber **35**.

When transfer die **33** engages with an article on a forming die **9**, as shown in FIG. 3, and while the transfer die carrier **41** is in the full line position of FIG. 1, the main chamber **34** of the transfer die has suction applied through the pipe connection **39**. The open ends **37***a* of the channels **37** are then in contact with the article A on the forming die so that said suction will assist in the removal of the article from the forming die and its retention on the transfer die **33**.

It is frequently desirable that many molded pulp articles, particularly those of the open faced type, to which the present invention is primarily directed, be provided around

their free edges with appropriate flanges or thickened sections for reinforcing or other purposes. In the apparatus of the present invention, molded material for these sections is formed on the forming dies. The present invention provides means whereby this latter material may be reshaped to constitute an integral reinforcing structure at the edges or other portions of the articles.

In the drawings, I have shown two forms of reshaping mechanisms, namely, that of FIGS. 5–6 and the modified form of FIGS. 7–9. The structure and operation of the parts therein illustrated will now be explained. In FIGS. 5 and 6, the transfer die **33** is shown as described in connection with FIGS. 3–4, but a novel form of take-off die is illustrated and is so constituted as to provide for reforming of a portion of the article A to produce a reinforced edge.

The take-off die **61** of FIGS. 5 and 6 is provided with a main chamber **120** having a pipe connection **121** through which suction may be provided within the chamber **120** or compressed air may be admitted thereinto. Encircling the main chamber is an annular chamber **122** forming, in effect, an annular cylinder in which is positioned an annular piston **123**, in many respects similar to the piston **36** but inverted. The piston **123** has channels **124** extending upwardly from its lower end and then laterally to its inner surface. The connection **125** provides for suction within the annular cylinder **122** or for the admission of compressed air thereinto. Through the manipulation of the parts described in connection with FIGS. 5 and 6, a portion of the article may be reformed or reshaped while the transfer and take-off dies are in the dotted line positions shown in FIG. 1, wherein they are in engagement with the upper and lower surfaces, respectively, of the body of such article. Such engagement is insured by a pressure bar **126** (FIG. 1), the operations of which are fully disclosed in the parent application.

The actual reforming or reshaping operations according to FIGS. 5 and 6, with respect to these mating dies **33** and **61** are as follows: At the commencement of reforming, the parts appear as in FIG. 5 with the dies in contact with the body of the article, the piston **36** engaging with the upper surface of the article flange *a*, and said flange resting upon the upper surface of the piston **123** which, at this time, is in lowered position. Suction is now applied to chamber **35** which lifts piston **36** to the position shown in FIG. 6.

With these dies in this relation, compressed air is now admitted to the chamber **122** beneath the piston **123** and, as shown in FIG. 6, this piston is thereby forced upwardly, carrying with it the outer margin of the flange *a*, with the result that that margin is upturned as shown at *a'* in FIG. 6, and the ends of pistons **123** and **36** are in contact. As this operation occurs, compressed air from the chamber **122**, traverses the channel **124** and blows the upturned end *a'* from the full line upstanding position of FIGS. 6 and 10 into the dotted line position of FIG. 6, thereby freeing it from frictional contact with the inner surface of piston **123**. In other words, this operation tends to fold the margin of the flange inwardly against the body of the article with the result shown in FIG. 11, this being assisted by vacuum applied to chamber **120** which will tend to hold the reshaped flange in this position. This is the preferred shaping of the reinforcing edge in this form of the invention, although, if a reinforcing margin *a'* is desired to be formed as shown in FIG. 10, this may be accomplished by utilizing only sufficient air pressure through channels **124** as will free the article from contact with the piston and by lowering the piston **123** immediately thereafter to admit air to the space between the reshaped flange and the body of the article.

Having formed the reinforcing edge as shown in either FIG. 10 or 11, the reforming operation is complete, the pressure bar **126** is withdrawn and compressed air is admitted to one or both chambers **34** and **35** of the transfer die **33**. Suction is admitted to the main chamber **120** of the take-off die **61**, and the article is thus transferred from the transfer die **33** to the take-off die **61**, which transports the article to and deposits it on one of the conveyors of the dehydrator.

In the modified form of reforming apparatus shown in FIGS. 7, 8 and 9, each of the take-off dies **61** is of the same construction as shown in FIGS. 5 and 6, but each transfer die, designated **33***a* in these figures, is constructed differently from the corresponding die of the preceding figures. That is to say, instead of having only a single annular chamber **35** and a cooperating piston **36**, as in the preceding figures, die **33***a* has an additional annular chamber **132** about the main chamber **34** of such transfer die. In this added chamber is positioned an annular piston **133** having passage **134** which, in the retracted position of the piston, registers with passages **135** communicating with the main suction-compression chamber **34** of the die.

In operating the type of transfer die **33***a* of FIGS. 7–9, the mechanism performs initially as described in connection with FIGS. 5 and 6. In other words, the parts function to turn up the margin *a'* of the flange *a* of the article A, as shown in FIG. 7. While this is being done, suction is imparted to the chamber **132** through means illustrated as a connection **136** to keep the annular piston **133** elevated. However, as soon as the marginal portion *a'* of the flange *a* has been turned up, as shown in FIG. 7, suction through the connection **136** is discontinued and compressed air is applied through said connection. This forces the piston **133** downwardly against the upturned edge of the margin *a'* to reform said edge into the tightly compacted form shown at a^2 in FIG. 8. The take-off die then delivers the article to the conveyor **67** of the dehydrator as shown in FIG. 9.

Compressed air and suction for operating die parts as described may be supplied from any appropriate sources through appropriate control valves as disclosed in the parent application or in any other manner common to the pulp molding art.

Experience has shown that the die structures of this invention operate with extremely high efficiency in the carrying out of their intended functions and accomplish these results at relatively high speed and without undesirable deformation of the molded pulp article.

The foregoing detailed description sets forth the invention in its preferred practical forms, 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. A die for operating on a molded fibrous pulp article subsequent to forming, and before dehydration or drying comprising: a die body provided with a suction and compressed air chamber one wall of which has a contoured article engaging face on its exterior, said body being also provided with a pneumatic cylinder surrounding said chamber and opening at the contoured side of the die body, and a piston operable in said cylinder.

2. A die according to claim 1, wherein the piston has passages leading from its outer end of the inner face of the piston, said passages being adapted to register with passages leading to the interior of the chamber when the piston is in advanced position.

3. A die for operating on a molded fibrous pulp article subsequent to forming and before dehydration or drying comprising: a die body provided with a suction and compressed air chamber one wall of which has a contoured article engaging face on its exterior, said body being also provided with two pneumatic cylinders respectively surrounding said chamber and opening at the contoured side of the die body, and a piston operable in each cylinder.

4. A die according to claim 3, wherein said pistons have passages leading from their outer ends to the inner faces thereof, said passages being adapted to register

with each other and with a passage leading to the chamber when said pistons are in predetermined positions.

5. A die for operating on a molded fibrous pulp article subsequent to forming and before dehydration or drying comprising: a die body provided with a contoured article engaging face on its exterior, and a pneumatically operable sleeve-like piston carried by said body marginally of said article engaging face.

6. A die according to claim 5, wherein the article engaging face is circular and the sleeve-like piston is also circular and coaxial with said face.

7. A die for operating on a molded fibrous pulp article subsequent to forming and before dehydration or drying comprising: a die body provided with a contoured article engaging face on its exterior, and a plurality of pneumatically operable sleeve-like pistons carried by said body marginally of said contoured article engaging face.

8. A die according to claim 7, wherein said pistons are coaxial with one another and with the contoured article engaging surface.

9. A die for operating on a molded fibrous pulp article subsequent to forming and before dehydration or drying comprising: a die body provided with a contoured article engaging face, a pneumatic cylinder extending into the body marginally of and about the article engaging face thereof, a sleeve-like piston in said cylinder, and a pneumatic connection through which pneumatic pressure and partial vacuum may be seletcively communicated to said cylinder to operate the piston.

10. A die for operating on a molded fibrous pulp article subsequent to forming and before dehydration or drying comprising: a die body provided with a contoured article engaging face, a plurality of coaxial pneumatic cylinders extending into the body marginally of and about the article engaging surface, a sleeve-like piston in each cylinder, and a pneumatic connection through which pneumatic pressure and partial vacuum may be selectively communicated to each cylinder to operate the piston therein.

11. A die couple for operating on a molded fibrous pulp article subsequent to forming and before dehydration or drying, each member of which couple comprises: a body having a contoured article engaging face complementary to the article engaging face of the body of the other member of the couple, and each die body also having a pneumatically operable sleeve-like piston marginally of its article engaging face to respectively act upon the opposite sides of the margin of a pulp article positioned between the article engaging faces of the two members of the couple.

12. A die couple according to claim 11, wherein the pistons of the two members of the couple are positioned to substantially register with one another on the opposite sides of the margin of the article.

13. A die couple according to claim 12, wherein the body of one member of the couple has an additional pneumatically operable sleeve-like piston positioned to act upon the margin of the article contiguously to and out of register with the other pistons and between the zone of operation of said other pistons and the contoured article engaging faces of the members of the couple.

14. A die couple according to claim 12, comprising: passages in the several pistons leading to the article engaging ends thereof for applying compressed air or partial vacuum to the article at said ends.

15. A die couple according to claim 11, comprising: passages in the several pistons leading to the article engaging ends thereof for applying compressed air or partial vacuum to the article at said ends.

16. A die couple for operating on a molded fibrous pulp article subsequent to forming and before dehydration or drying, one member of which couple comprises: a die body having a contoured article engaging face, a pneumatically operable piston marginally of and about the article engaging face thereof for deflecting the margin of an article on said article engaging face into substantially normal relation to the plane of symmetry of said face.

17. A die couple for operating on a molded fibrous pulp article subsequent to forming and before dehydration or drying, one member of which couple comprises a die body having a contoured article engaging face, a pneumatically operable piston marginally of and about the article engaging face thereof for deflecting the margin of an article on said article engaging face into substantially normal relation to the plane of symmetry of said face, and the other member of which couple comprises a die body having a contoured article engaging face complementary to the article engaging face of the body of the first mentioned member of the couple and having a pneumatically operable sleeve-like piston marginally of its article engaging face to reshape the deflected marginal portion of the article between the members of the die couple into a thickened reinforcing edge about the margin of the article.

18. A die couple for operating on a molded fibrous pulp article subsequent to forming and before dehydration or drying, one member of which couple comprises: a die body having a contoured article engaging face, a pneumatically operable piston marginally of and about the article engaging face thereof for deflecting the margin of an article on said article engaging face into substantially normal relation to the plane of symmetry of said face, and a compressed air duct extending through the piston and into juxtaposition with the deflected margin of the article to communicate compressed air to said deflected margin for the purpose of reshaping it into a reinforcing edge about the margin of the article.

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