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PULP MOLDING DIE

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Fig. 1

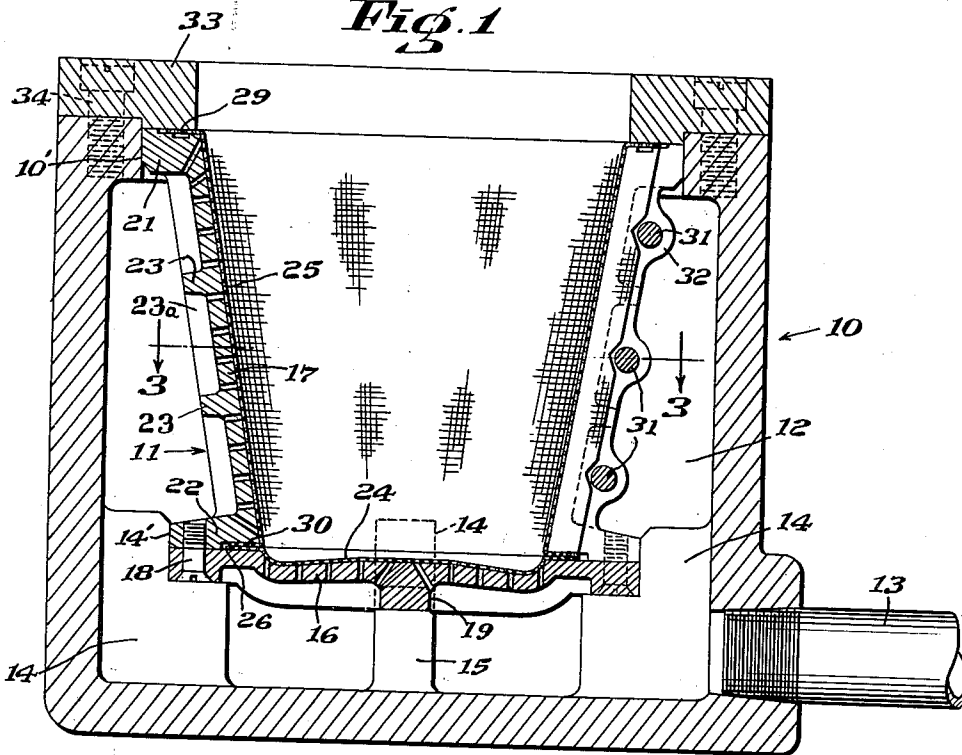


Fig. 2

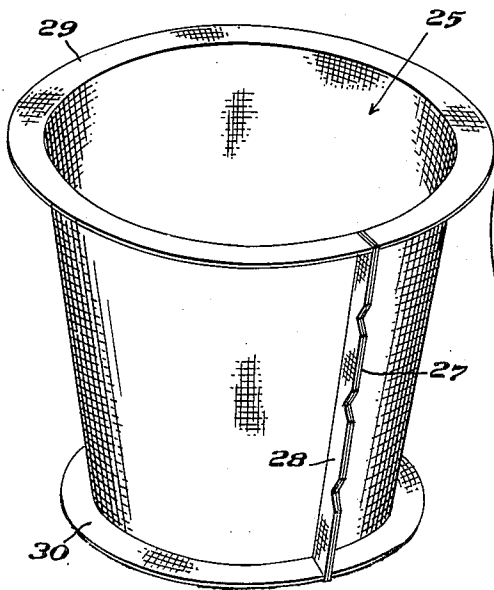
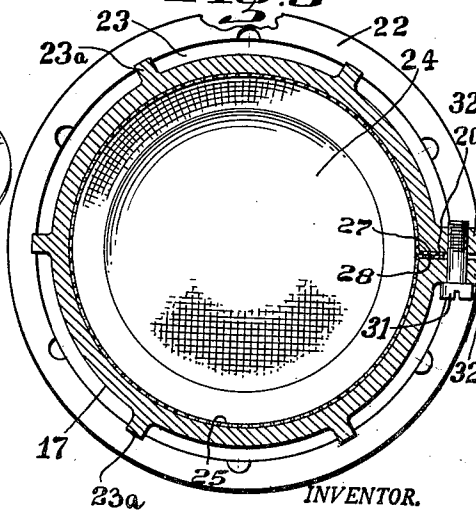


Fig. 3



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PULP MOLDING DIE

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trustees

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1 Claim. (Cl. 92—54)

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This invention relates to pulp molding dies and is a continuation-in-part of my prior application S. N. 465,210, filed November 11, 1942, now Patent No. 2,424,189, dated July 15, 1947, to which reference is made for a general discussion of the problems in the art when using an open-face, split, forming die which has its molding surface subdivided into sections, each covered by a conforming fine wire mesh drainage screen individual thereto.

As in my aforesaid application, the die of my present invention is designed primarily for the rapid and economical production of relatively deep articles having steep side wall angles, of which the familiar drinking cup may be taken as an example. However, my die is not limited to the production of drinking cups but may be used for producing many other molded pulp articles such as bowls, containers and like articles of generally steep side wall, deep cavity, formation.

The general object of my present invention is to provide an open-face, sectional, wire-covered pulp molding die in which the individual wire mesh screen coverings for the die sections may be readily conformed, without substantial distortion, to the sectional molding surface of the die; to provide a die in which the die sections and their wire mesh coverings will be positively retained in place during the operation of the die with the minimum amount of flexing and consequent distortion of the wire mesh coverings relative to the molding surface of the die; and to provide a die which may be readily assembled and disassembled with the minimum of time and effort when changing dies on the pulp molding machine or when replacing screen coverings which have become worn in service.

Other objects and advantages of my present die will appear as this description proceeds.

In the accompanying drawing wherein I have illustrated a preferred embodiment of my invention—

Fig. 1 is a vertical section through an open-face pulp molding forming die and associated parts in accordance with my present invention.

Fig. 2 is a perspective view of the individual wire mesh covering for the side wall of my die, as shaped for application thereto, and

Fig. 3 is a transverse section on the line 3—3 of Fig. 1 looking in the direction of the arrows.

In attaining my objects I construct the molding surface of my die in two sections viz. a wall section and a bottom section, with individual wire mesh coverings for each section, and detachably clamp the two sections and their wire mesh cover-

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ings to each other so that the die may be conveniently inserted into and withdrawn from the die body as a unit and so that the parts of the die may be quickly and easily assembled and dis-

assembled when removed from the machine for the purpose of changing wires.

The wall section of my die is constructed as a single piece and is shown as provided at its upper and lower ends with horizontally extending peripheral portions which are intersected by a single lengthwise extending slot or groove. Preferably, the conforming wire mesh covering for this side wall section is also constructed as a single piece of wire mesh screen, the longitudinal edges of which are bent to provide abutting lengthwise extending flanges to be inserted and anchored within said longitudinal slot or groove of the side wall section, and the top and bottom edges of which are bent to provide horizontally extending flanges which overlie the corresponding peripheral portions of the side wall section when the wire mesh covering is applied to the side wall section.

For removably holding the wire mesh covering assembled to the wall section before said section is assembled with the bottom section and its individual wire mesh covering and before the die unit is inserted within the die body, I prefer to provide the wall section, adjacent to its lengthwise extending slot or groove, with removable screws or equivalent fastenings, for closing said slot or groove upon the inserted lengthwise extending flanges of the wire mesh covering.

For removably holding the wall section and its individual wire mesh covering assembled to the bottom section and its individual wire mesh covering before the die unit is inserted within the die body, I fasten the wall and bottom sections together by screws or equivalent fastenings, preferably extending through the peripheral portion, at the lower or inner end of the side wall section and the adjacent marginal portion of the bottom section.

For insuring that the assembled die unit will be positively retained within the die body, I prefer to machine the external faces of the peripheral portions of the side wall section and the external face of the bottom section to a close fit with corresponding internal bearing surfaces of the die body so that when the die unit is inserted axially into the die body through the upper open end thereof, the engagement of these cooperating bearing surfaces with each other will assist in maintaining the several parts of the die unit in

fixed relationship to each other within the die body.

This holding action is supplemented by the conventional die ring which is applied to the upper open end of the die body, after the die unit has been inserted thereto and is fully seated therein.

One pronounced advantage of the aforesaid construction is that spare dies, in which the wire mesh screen coverings have been already made up and fitted to their respective die sections and the dies assembled as units, may be carried in stock so that when die replacements on the pulp molding machine are necessary the replacement die may be quickly inserted into the die block of the machine by merely removing the conventional forming die ring which clamps the die within the die body, withdrawing the used die from the die block, inserting the replacement die, and replacing the ring.

In this connection, it will be understood that with a die of the sectional wire-covered type, practically the only operating maintenance is the necessity of changing worn or damaged wires. Heretofore when this necessity arose, the machine not only had to be stopped until the die containing the worn wire was withdrawn from the die block but had to stay out of production until such die could be disassembled, the worn wire renewed and the die replaced in the machine. My construction of the die, with pre-assembled spare die units all ready for insertion in the die block of the machine when needed, reduces to the minimum the time that the machine has to be out of production when changing wires of dies of this general type as well as enabling the wire change to be leisurely and carefully made at some convenient time and place.

In the illustrated embodiment of my invention I have indicated generally at 10 the die body of my die. Die body 10 is open at its upper end to permit the die proper, indicated generally at 11, to be inserted axially into and withdrawn from the die body for purposes of replacement or repair. Such open end also permits pulp to be deposited on the molding surface of the die when the die unit is immersed in the pulp bath and the formed article to be removed from the die when the die is withdrawn from the bath.

Die body 10 establishes a chamber 12 surrounding the die proper, within which sub-atmospheric and super-atmospheric pressures may be alternately created, as through conduit 13, for the suction formation of an article on the perforated, wire-covered molding surface of the die and for the subsequent removal of the formed article therefrom.

The bottom of die body 10 may be provided with a plurality of spaced upwardly extending lugs 14 and with a central upstanding lug 15.

The die proper consists of a bottom section 16 and a one-piece wall section 17. Sections 16 and 17 are perforated for drainage and are detachably fastened together in any suitable manner as by means of the screws 18 or equivalent fastenings.

Bottom section 16 is supported at spaced intervals about its perimeter on the lugs 14 of die body 10 and has a central depending stud 19 for support on lug 15.

Side wall section 17 has a longitudinal slot or groove 20 therein extending from top to bottom thereof, and is also provided at its top and bottom ends with horizontally extending annular peripheral portions or flanges 21 and 22 respectively. The outer faces of these peripheral

portions and the outer face of the bottom section 16 are all machined to a close fit with corresponding bearing surfaces 10' and 14' on the die body 10 and lugs 14 respectively. If desired, side wall section 17 may be provided with longitudinally spaced circumferential stiffening ribs 23, and circumferentially spaced, longitudinal stiffening ribs 23a.

Each die section 16 and 17 is covered by an individual conforming wire mesh screen 24 and 25. Screen covering 24 for the bottom section is preferably a one-piece member and has a marginal portion 26 which extends beneath the adjacent peripheral portion 22 of the side wall section 17.

Screen covering 25 for the side wall section 17 is likewise preferably a one-piece member which when shaped to fit inside of the side wall section 17 (see Fig. 2) has its longitudinal edges bent to form a pair of lengthwise extending abutting flanges 27 and 28 and its top and bottom edges bent to form a pair of horizontally extending top and bottom flanges 29 and 30, respectively. Screen 25 is applied to side wall section 17 by inserting it axially into said section through the upper open end thereof with its lengthwise extending flanges 27 and 28 lodged within the slot or groove 20 of said section (see Fig. 3). This brings its top flange 29 against the top face of the peripheral portion or flange 21 of said section 17, after which flange 30 is bent as shown in Fig. 2 so as to abut the under face of peripheral portion 22 of section 17.

For holding covering 25 within the side wall section 17, I preferably employ fastenings, such as the screws 31 or their equivalent. These extend transversely through oppositely disposed pairs of lugs 32 formed externally of the side wall section 17 adjacent the slot or groove 20 at longitudinally spaced intervals. By tightening these screws the slot or groove 20 will be closed upon the longitudinally extending flanges 27 and 28 of said covering to thereby clamp the covering securely within said side wall section.

Side wall section 17 and its covering 25 may now be fastened to bottom section 16 and its covering 24 by means of the screws 18. In this position of the parts, the bottom flange 30 of covering 25 overlies the marginal portion 26 of covering 24.

I have indicated at 33 a conventional die ring for defining the edge of the molded article. Ring 33 is adapted to be removably fastened to the upper open end of the die body by means of threaded studs 34 or the like.

In assembling my die unit, the wire mesh screen 25 is first assembled to the side wall section 17, as described. The wire mesh screen 24 for the bottom section 16 is then applied to the bottom section, and said section 16 and its screen 24 are then assembled to the side wall section and its screen by means of the screws 18.

The assembled die unit is now ready to be inserted into the die body through the upper open end thereof. In this action, the external bearing surfaces of the peripheral portions 21 and 22 of the side wall section 17 and the external surface of bottom section 16 engage the corresponding internal bearing surfaces 10' and 14' respectively, on the die body and hold the die sections and their coverings against lateral movement within the die body. When the die ring 33 is fastened in place this ring clamps the top flange 29 of covering 25 against the adjacent face of the top peripheral portion 21 of side wall section 17, and

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holds the die assembly tightly within the die body.

As a result of this construction, it is possible to fit and assemble a number of spare die units, consisting of the side wall and bottom sections and their individual coverings, and have them in stock ready for quick replacement on the molding machine when needed. In making such a change, the forming die ring is removed, the used die unit withdrawn from the die body, the replacement die inserted, and the die ring replaced. Thereafter at any convenient time and place, new wire may be applied to the used die unit and the recovered die placed in stock for re-use when needed.

Although screws 31 are provided for holding covering 25 to the side wall section 17 and screws 18 are provided for holding the side wall section to the bottom section 16 while the die unit is operatively positioned within the die body, it will be obvious that once the die unit has been inserted into the die body, the engagement of the complementary bearing surfaces of the die unit and the die body, plus the clamping effect exerted by the die ring, will hold the die unit rigidly assembled within the die body.

The use of these screws however is advantageous for efficiently clamping the die sections and their coverings together as an assembled unit which may be quickly and easily inserted into and withdrawn from the die body in the minimum time and with the minimum loss of machine production as well as for enabling spare die units to be kept in stock for use when needed.

While I have described and illustrated the side wall and bottom sections as of one-piece construction, it will be obvious to those skilled in the art that these parts, and their coverings, may be of multi-piece construction, if desired.

Likewise while I have shown my die as designed for the production of cylindrical or tapered articles, it will be understood that the die may be shaped to form articles of other configuration, such as square articles.

The interior molding surface of the wall section 17 as shown may be regarded as frusto-conical in shape. As indicated, the cross section of the molding area may be circular, square or otherwise. The term "cone" therefore is used in its broad sense as referring to a solid bounded by a circular or other closed plane base and the surface formed by line segments joining every point

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of the border of the base to a common point called the vertex.

Various other modifications in construction and design may be made within the scope of my invention as defined by the appended claim.

What I claim is:

In apparatus for molding fibrous pulp cup-shaped articles, an open face die unit arranged while in assembled condition to be associated with or disassociated from a die body, said die unit comprising, in combination, a unitary, hollow and perforated wall section having an interior molding surface substantially frusto-conical in shape, said wall section having a single longitudinally extending slit throughout its extent to form a slot from the top of the wall section to the bottom thereof, a unitary screen shaped to conform to the inner surface of said wall section and having two longitudinal edges arranged to extend into said longitudinal slot and being further shaped to provide a top flange to overlie the top of the wall section and a bottom flange to underlie the bottom of the wall section, clamping elements on the wall section on both sides of the slot for compressing said longitudinal edges of the screen in said longitudinal slot of the wall section, a perforated bottom section shaped to cooperate with said wall section and to form a bottom for the mold cavity, a screen overlying said bottom section the marginal portion of which is arranged to underlie the bottom flange of the wall section screen, and fastening elements secured to said wall section and to said bottom section holding said sections together as a die unit independently of the condition of association or disassociation of said die unit with a die body.

WALTER H. RANDALL.

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