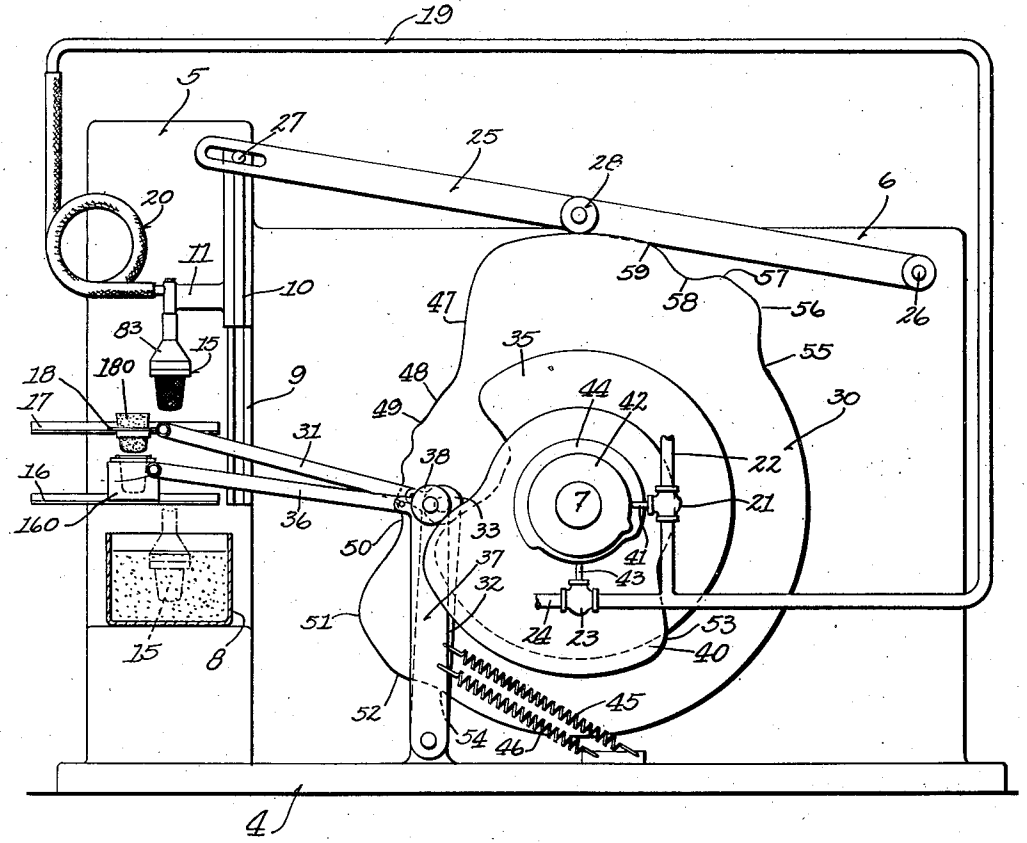
June 17, 1941. A. KEIDING 2,245,678

PULP MOLDING APPARATUS

Filed July 8, 1937 2 Sheets-Sheet 1

Fig. 1.



INVENTOR
Andrew Keiding
BY
Wheeler, Wheeler & Wheeler
ATTORNEYS

June 17, 1941. A. KEIDING 2,245,678

PULP MOLDING APPARATUS

Filed July 8, 1937 2 Sheets-Sheet 2

Fig. 2.

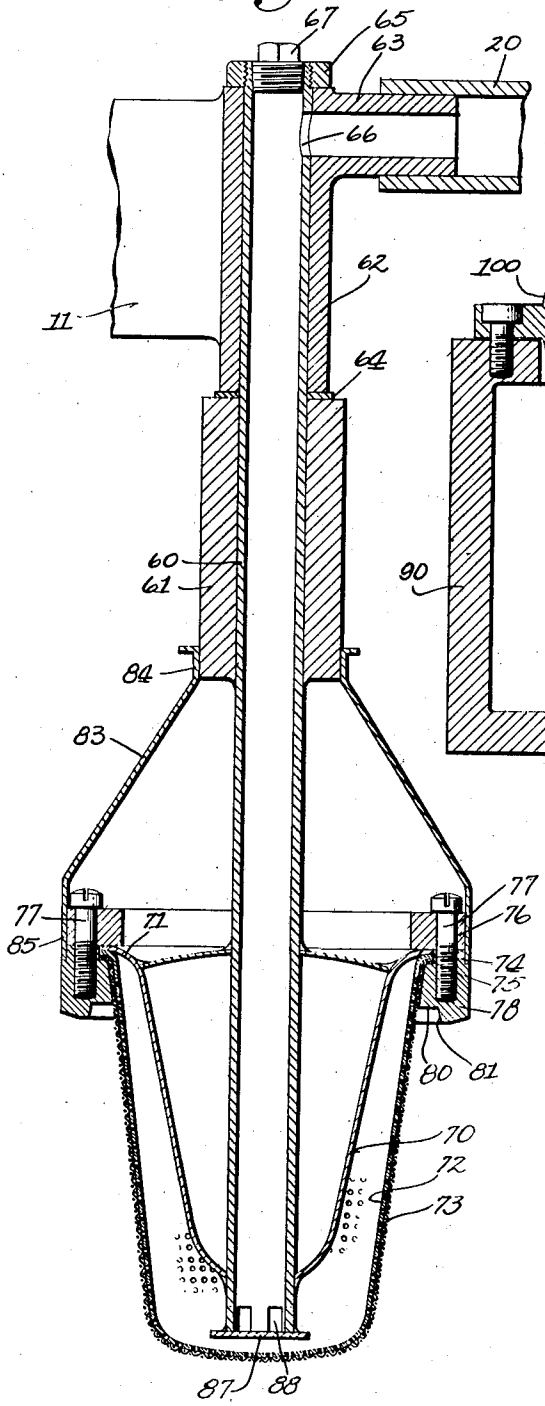
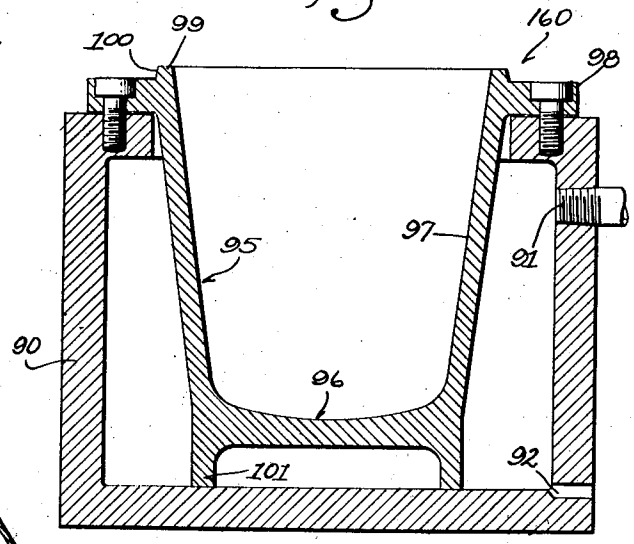


Fig. 3.



INVENTOR
Andrew Keiding
BY
Wheeler, Wheeler & Wheeler
ATTORNEYS

Patented June 17, 1941 2,245,678

BEST AVAILABLE COPY

UNITED STATES PATENT OFFICE

2,245,678

PULP MOLDING APPARATUS

Andrew Keiding, Milwaukee, Wis., assignor to American Lace Paper Company, Milwaukee, Wis., a corporation of Wisconsin

Application July 8, 1937, Serial No. 152,512

9 Claims. (Cl. 92—54)

This invention relates to improvements in pulp molding apparatus. The present application is a companion to my application Serial No. 152,511, filed July 8, 1937, which disclosed some of the features of the mold and its mode of operation and claimed a process in which this mold and apparatus may be used.

Broadly it is the object of the invention to provide novel and improved molding apparatus having various features calculated to produce speedily and economically a more satisfactory molded product.

Specifically, the objects of the invention include the provision of a novel arrangement of mold, vat, tray and die; the provision of improved means for the control of these several parts; the provision of a mold and control apparatus operable with a minimum amount of air displacement under vacuum or pressure; the provision of a mold in which a substantially uniform deposit of pulp is assured; the provision of a novel organization for assembly of the mold parts; and the provision of an arrangement assuring pulp deposits on the mold to a predetermined dimension and uniform density without danger of loss of any of such deposits during withdrawal of the mold from the pulp vat.

Other objects will appear in more detail from the following disclosure.

In the drawings:

Figure 1 is a view in side elevation showing diagrammatically the relative positions and operation of the several component parts of my improved molding apparatus.

Figure 2 is a detail view on an enlarged scale in axial section showing the improved mold used in the apparatus of Fig. 1.

Figure 3 is a detail view in section on an enlarged scale showing the preliminary forming die used in the apparatus of Fig. 1.

Like parts are identified by the same reference characters throughout the several views.

The frame of the molding apparatus as diagrammatically illustrated includes a base 4, a column 5, and a back plate 6 upon which the cam shaft 7 is mounted. The column 5 provides a support for the pulp vat 8 which may be of any desired size or shape and supplied in any usual or desired manner with pulp in a mixture with water or other suitable vehicle.

A vertical guideway is provided at 9 in the column 5 for the slide 10 which carries by means of arm 11, the mold generically designated by reference character 15 and hereinafter to be described in detail. The slide 10 has a range of movement sufficient to permit the bodily immersion of mold 15 in vat 8 as indicated by the dotted lines.

Between the upper position of the mold 15 in which it is illustrated in full lines in Fig. 1, and the lower dotted line position thereof, there are two horizontal guideways 16 and 17 upon which are respectively reciprocable the preliminary forming die assembly 160 and the discharge tray 18. The forming die assembly and tray are movable between positions in registry with mold 15 and retracted positions sufficiently remote from the path of the mold to offer no interference therewith.

There is an air connection through duct 19 at least part of which, as shown at 20, constitutes a flexible hose, by means of which either air or vacuum may be applied to the mold. The duct 19 should desirably be as short as possible, and has only been illustrated at the indicated length for convenience of disclosure. The duct 19 connects with the air valve 21 in the pressure line 22 and the valve 23 in the vacuum line 24, it being understood that pipes 22 and 24 are connected with sources of pressure and partial vacuum in the ordinary manner.

Before describing the structure of the mold and preliminary forming die in detail, a brief description will be given of the sequence of operations as controlled by the several cams mounted on shaft 7.

The slide 10 descends by its own weight. If such weight is insufficient to furnish the required pressure for certain operations a spring may be used to urge it downwardly. It is lifted by the lever 25 pivoted at 26 to the back plate 6 and having a slotted pivotal connection at 27 with the top of the slide. Intermediate its ends this lever carries a cam follower roller 28 acted on by the large cam 30, the length of the lever beyond the roller serving to multiply the motion through the desired range of operation.

The tray 18 is connected by link 31 with lever 32, the cam follower roller 33 of which is acted upon by cam 35. In similar manner the preliminary forming die 160 is connected by link 36 with lever 37, the cam follower roller 38 of which is acted upon by cam 40.

The stem 41 of the air pressure valve 21 is controlled by cam 42. Similarly, the stem 43 of vacuum valve 23 is controlled by cam 44. The valves will be understood to contain springs maintaining them normally closed, this construction not being illustrated because it is conventional. The cam follower levers 33 and 38

are held to the peripheries of cams 35 and 40 respectively by the tension springs 45 and 46.

Figure 1 illustrates the parts just prior to the completion of one cycle and prior to the commencement of the next. The cams 35 and 40 are pushing aside the tray 18 and preliminary forming die 160. In the tray is the damp molded blank 180 formed by the previous operation.

During the continued clockwise rotation of shaft 7 the retraction of the tray and forming die will be continued until the high points of cams 35 and 40 reach the cam followers 33 and 38, at which time the path of the mold 15 will be clear.

As the large cam 30 revolves beneath the cam follower roller 28, the roller will reach the peripheral portion 47 of the cam 30, whereby the slide 10 and mold 15 will be lowered into the pulp bath in tank 8. The portion 48 of the cam surface is preferably of uniform radius to provide a dwell after the mold enters the pulp. The solids displaced by the entrance of the mold will re-collect about the mold and will tend to form on the surface thereof even before the vacuum is applied by means of the operation of cam 44 on valve stem 43.

From the point designated by reference character 49 on the periphery of cam 30 to the point designated by reference character 50 a series of minor undulations will cause the mold 15 to be reciprocated slowly up and down in the pulp during the continued application of vacuum to the interior of the mold. It will be understood that this movement is typical of other movements which may be given to the mold within the pulp but the vertical reciprocation is preferred.

From the point 50 on the periphery of cam 30 to the point 51 thereof the mold is being retracted toward the full line position in which it is illustrated in Fig. 1. During the dwell represented by the space between points 51 and 52 on the periphery of cam 30, the cam 40 is reduced in radius at 53 to control the advance of the preforming die 160 to a position beneath the mold 15 and in registry therewith.

Between point 52 and point 54 of cam 30 the mold is being lowered to press the uniform pulp in the preforming die. There is now a prolonged dwell to point 55 on cam 30 and throughout this period the pulp remains under pressure in the preforming die and also remains under vacuum as controlled by cam 44.

Between point 55 and point 56 on the periphery of cam 30 the mold is retracted from the preforming die, and during the dwell from point 56 to point 57 the tray 18 is inserted. From 57 to 58 the mold is lowered somewhat into the tray, and at this point the nose of cam 42 engages air valve 41 (the vacuum valve 23 now being closed) to discharge a blast of air through pipe 19 into the mold to blow off the pulp blank 180 into the tray.

Between points 58 and 59 of cam 30 the mold is retracted to the full line position in which it is shown in Figs. 1, and cams 35 and 40 operate during the ensuing period to retract the tray and preliminary forming die in the manner shown in the drawings. The cycle has now been completed.

The mold may conveniently be assembled on a tube 60 to which I braze or weld the cylindrical boss 61. The sleeve 62 carried by arm 11 has a stem at 63 to which the hose 20 is connected. The sleeve 62 is slipped telescopically over the tube 60 to seat on washer 64 under pressure of a clamp nut 65 threaded to the upper end of the tube. The tube is apertured at 66 in registry with the stem 63. The upper end of the tube is closed by a plug 67.

Near its lower end the tube 60 carries a displacement body of the form generally indicated at 70. The displacement body 70 is completely closed to seal its interior. It is welded or brazed at its lower end and its top to the tube. It is formed to provide a laterally projecting flange at 71 upon which the parts of the mold proper may conveniently be mounted.

The mold proper comprises the foraminous support 72 and a cover 73 of fine mesh screen cloth. These parts are shaped to the desired form of the molded pulp blank and are outwardly flanged at 74 and 75 respectively to fit beneath the flange 71 of the displacement body 70.

For the formation of the desired container with a flat or upwardly convex bottom, I have found it desirable that the mold shall have a downwardly convex bottom. Accordingly the bottom of the foraminous mold element 72 and the corresponding bottom portion of the screen cloth cover 73 are both downwardly convex as clearly shown in Fig. 2.

The several flanges 71, 74 and 75 may conveniently be clamped together. The clamping ring 76 is held by screws 77 to the annulus 78, the latter being shouldered to provide a seat for flange 75 of the wire cloth cover. It is important to the invention that the annulus 78 shall have a substantially horizontal shoulder at 80 and shall thence extend downwardly and outwardly at 81 to provide a recess well below the top of the foraminous element 72 and screen cloth 73 as a means of sharply defining the upper limit of pulp deposit on the outside of the screen cloth. The form of the annulus 78 is such that when the mold is removed from the pulp bath any water dripping from the exterior of the annulus 78 will fall free of the deposit of pulp and will not tend to wash away any of the pulp which has been left on the screen cloth.

A hood or shroud at 83 is made in annular form with a sleeve portion 84 slidable on the cylinder 61 of tube 60. The lower margin of the hood comprises a generally cylindrical skirt at 85 which is sleeved over the ring 76 and engages in a shoulder portion of the annulus 78. This entire hood may be slid upwardly on cylinder 61 to expose the clamping screws 77. When lowered to the position shown in Fig. 2 the hood finishes the mold and is frictionally held in place thereon.

The tube 60 is provided at its lower end with a closure 87 but communicates with the space between the foraminous mold element 72 and the displacement body 70 through a series of apertures 88. The closure 87 comprises a disk projecting marginally beyond the tube to serve as a baffle. If the tube were simply left wide open at its end it would tend to draw a heavier layer of pulp on to the bottom of the mold than on to the sides thereof. The particular form and mutual upward convergence of the respective side walls of the displacement body 70 and the mold is important, together with the particular baffle closure 87 and openings 88, in assuring an even and uniform deposit of pulp over the entire exposed surface of the mold screen 73. Another important reason for the baffle is to protect the deposited pulp from deformation

when air is supplied under pressure through tube 60.

In addition to assisting in the control of the deposit on the mold, the displacement body 70 minimizes the volumetric capacity of the mold, thus reducing the load on the vacuum pump and air compressor by reducing the amount of space from which air must be drawn by the vacuum pump and to which air must be supplied when it is desired to blow the pulp blank from the mold.

The preliminary forming die 160 is shown in detail in Fig. 3. It comprises a box 90 having a steam inlet at 91 and a drain port at 92. This box serves as a support and jacket for the die proper which is illustrated at 95 and is fully complementary to the form of the exposed screen cloth cover 73 of the mold. It has a downwardly convex bottom at 96, an imperforate side wall at 97, a radial flange 98 for mounting it upon the box 90, and an upwardly extending flange 99 having a beveled external surface 100 complementary to the surface 81 of the annulus 78 of the mold. The thickness of flange 99 is somewhat less than the width of shoulder 80 of the annulus 78 of the mold, the difference in radial dimension being just sufficient to accommodate the compressed pulp formed on the exposed surface of the mold screen 73. When the mold is lowered into the forming die assembly 160, the weight of slide 10, augmented if necessary by spring pressure or other suitable means, compresses the pulp on the mold, squeezing out much of the free moisture and thus permitting the moisture to be withdrawn by the vacuum to which the mold is subject. As above noted, the annulus 78 definitely limits the exposed surface of screen cloth 73 to a well defined shoulder which is materially below the top of the space within the mold to which vacuum is applied. Thus pulp will be deposited full depth to the height of shoulder 80 and the engagement of flange 99 within the shoulder will assure the uniform compression of the pulp to its extreme upper margin.

For the most uniform results in deposit of pulp it is preferred to employ not merely the peculiar shaped displacement body 70 and the baffle 87, but also to round convexly downwardly the bottom of the mold element 72 and screen 73. This eliminates any sharp angles between the bottom and the sides of the vessel to be formed on the mold. Where a sharp angle is present at the mold the pulp deposit at the corner is excessive and the felting of the pulp fibers will be such that in at least some of the products a capillary crack may be formed at the corner, despite any subsequent treatment which may be employed. By making the entire mold convex about a broad radius at its bottom the felting will be continuous and uniform and, as explained in the companion application above identified, the bottom of the container may later be shaped either to make it flat or, as preferred, to reverse its convexity. In any event, it is preferred that not merely the original deposit of the pulp, but also the initial compression thereof, shall take place in the convexly rounded form as shown.

The use of steam in the preforming mold 160 is by no means essential but it is preferred. The heat on the exterior of the pulp blank, together with the pressure, drives the water inwardly and facilitates its removal by the vacuum within the mold. The base 101 on the die element 95 rests directly on the bottom of the box 90 to sustain the pressure exerted by the mold.

Since it is only intended that the invention be illustrated diagrammatically, it will be understood that many changes may be made in the apparatus disclosed within the scope of the appended claims.

I claim:

1. In a device for molding fibrous pulp, the combination with a cup-shaped mold having a screen constituting a bottom and a side wall portion, of a displacement body partially filling the portion of said mold within the wall portion thereof and connected marginally to said screen and elsewhere spaced therefrom, said displacement body having sides converging toward said wall portion and toward the marginal connection of the body with the screen, and a vacuum pipe extending through said displacement body and communicating with the space between said displacement body and said screen adjacent the bottom portion of said mold.

2. In a device for molding fibrous pulp, the combination with a cup-shaped mold having a screen constituting a bottom and a side wall portion, of a displacement body partially filling the portion of said mold within the wall portion thereof and connected marginally to said screen, said displacement body having sides converging toward said wall portion and toward the marginal connection of the body with the screen, and a vacuum pipe extending through said displacement body and communicating with the space between said displacement body and said screen adjacent the bottom portion of said mold, together with baffle means interposed between the end of said vacuum pipe and the bottom portion of said screen.

3. In a device for molding fibrous pulp, the combination with a cup-shaped mold having a screen constituting a bottom and a side wall portion, of a displacement body partially filling the portion of said mold within the wall portion thereof and connected marginally to said screen, said displacement body having sides converging toward said wall portion and toward the marginal connection of the body with the screen, and a vacuum pipe extending through said displacement body and communicating with the space between said displacement body and said screen adjacent the bottom portion of said mold, together with baffle means interposed between the end of said vacuum pipe and the bottom portion of said screen, the bottom portion of said screen being convexly outwardly rounded.

4. In a device for molding fibrous pulp, the combination with a tubular support, of a displacement body mounted on said support and provided with a radially projecting flange, a cup-shaped foraminous mold element enclosing said displacement body and having a complementary flange nested with respect to said first mentioned flange, a cup-shaped mold screen on said foraminous support having a complementary flange nested with respect to the first mentioned flanges, and clamping means securing the several flanges in nested relation.

5. In a device for molding fibrous pulp, the combination with a tubular support, of a displacement body mounted on said support and provided with a radially projecting flange, a cup-shaped foraminous mold element enclosing said displacement body and having a complementary flange nested with respect to said first men-

tioned flange, a cup-shaped mold screen on said foraminous support having a complementary flange nested with respect to the first mentioned flanges, and clamping means securing the several flanges in nested relation, said clamping means including annuli, one of which constitutes a pulp limiting stop on said screen provided with an external shoulder spaced from said screen.

6. A device for molding fibrous pulp comprising the combination with a tubular support, of a displacement body having a radially projecting flange and a downwardly tapering wall, a foraminous mold element of cup-shaped form encircling said displacement body and provided with a complementary flange, a screen fitted to said element and having a further complementary flange, said tubular support having baffle means providing controlled communication between said support and the space between said displacement body and said foraminous mold element, and means connecting the flanged portions of said mold element and screen to the flange of said body.

7. A device for molding fibrous pulp comprising the combination with a tubular support, of a displacement body having a radially projecting flange and a downwardly tapering wall, a foraminous mold element of cup-shaped form encircling said displacement body and provided with a complementary flange, a screen fitted to said element and having a further complementary flange, said tubular support having baffle means providing controlled communication between said support and the space between said displacement body and said foraminous mold element, and means connecting the flanged portions of said mold element and screen to the flange of said body, said means comprising annular clamps, the lowermost of which engages the side of said screen materially below the top of the space between the displacement body and said element.

8. A device for molding fibrous pulp comprising the combination with a tubular support, of a displacement body having a radially projecting flange and a downwardly tapering wall, a foraminous mold element of cup-shaped form encircling said displacement body and provided with a complementary flange, a screen fitted to said element and having a further complementary flange, said tubular support having baffle means providing controlled communication between said support and the space between said displacement body and said foraminous mold element, and means connecting the flanged portions of said mold element and screen to the flange of said body, said means comprising annular clamps, the lowermost of which engages the side of said screen materially below the top of the space between the displacement body and said element, said last mentioned clamp having a depending shoulder at a point spaced outwardly from said screen.

9. In a device for molding fibrous pulp, the combination with a perforate, contoured, hollow mold having a screen with side and bottom walls, means closing the top of the mold and including a displacement body depending within the mold and having a side wall spaced from and progressively approaching the side wall of the mold in an upward direction, whereby to progressively reduce the lateral clearance between the mold and the body toward the top of the mold, the bottom portion of said body being provided with an outlet communicating with the space between said body and said screen adjacent the bottom of said mold.

ANDREW KEIDING.