Oct. 7, 1930. M. P. CHAPLIN 1,777,281

PULP MOLDING MACHINE

Filed June 20, 1929 2 Sheets-Sheet 1

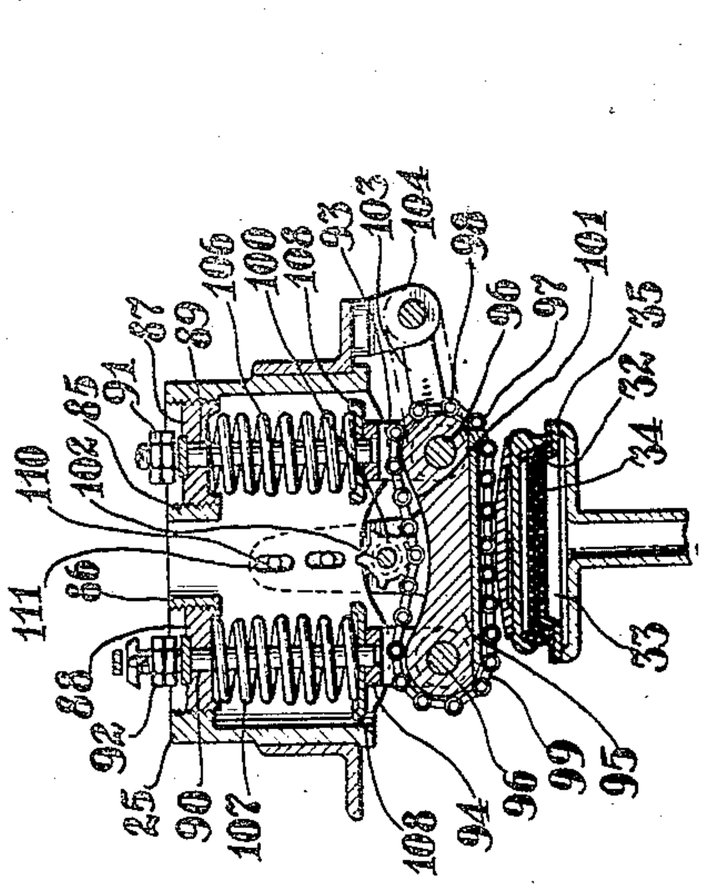

Fig. 2.

Fig. 1.

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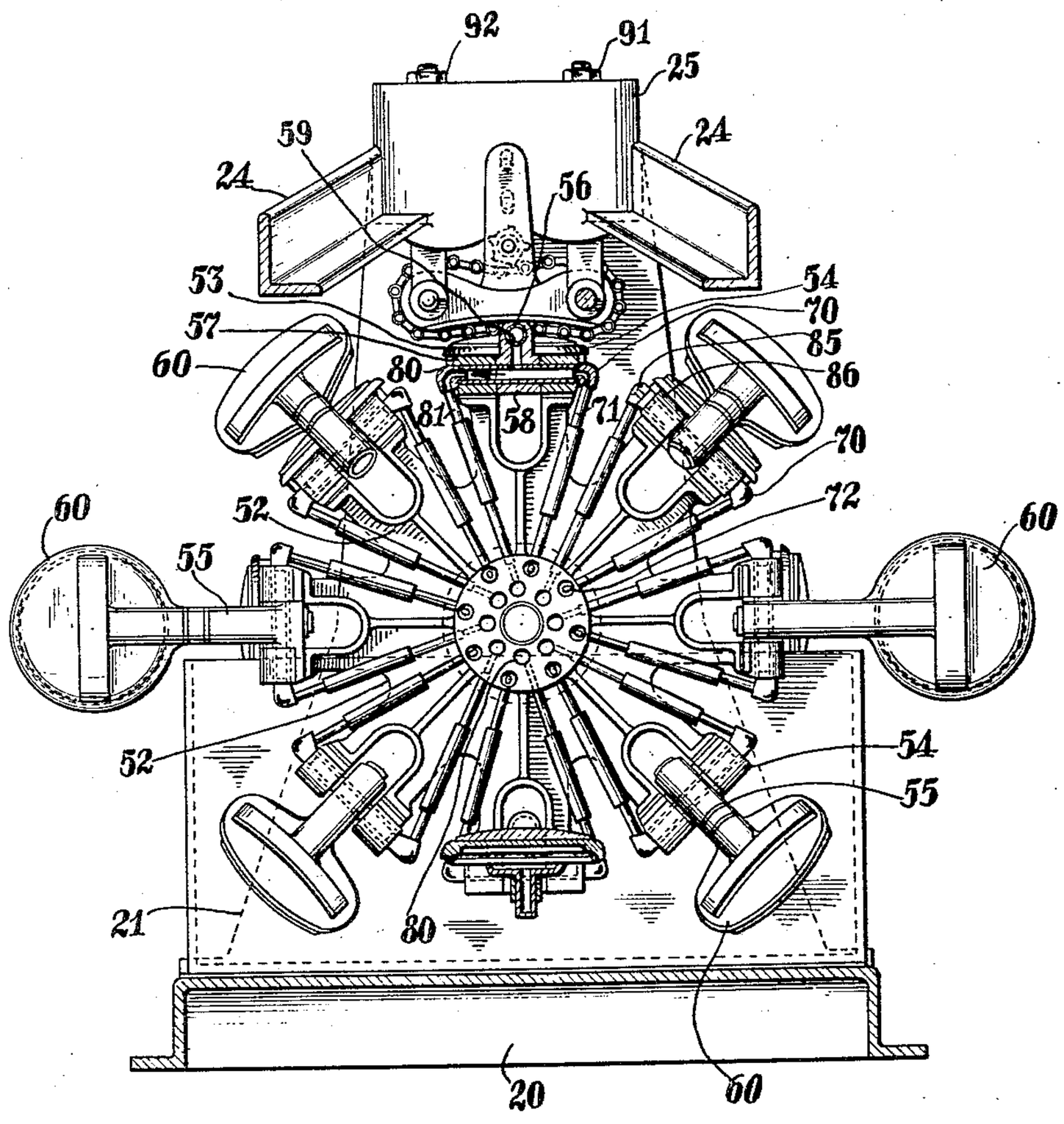

Fig. 3.

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UNITED STATES PATENT OFFICE

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PULP-MOLDING MACHINE

Original application filed October 11, 1926, Serial No. 140,715. Divided and this application filed June 20, 1929. Serial No. 372,335.

This invention relates to pulp molding machines and this application is a division of application Serial No. 140,715, filed October 11, 1926.

More particularly stated, the invention relates to a machine for forming and continuously producing articles formed of pulp or other plastic material, such, for instance, as plates or other dishes, cups, mats, boxes, or other desired articles.

This invention has for its salient object to provide in a machine of the character specified, means for insuring the production of articles of uniform thickness.

Another object of the invention is to provide means in a machine of the character described, constructed and arranged to cut off the suction from the forming dies when the machine is stopped.

Another object of the invention is to provide means for automatically stopping the machine when the articles formed thereon exceed a predetermined thickness.

Further objects of the invention will appear from the following specification taken in connection with the drawings, which form a part of this application, and in which

Fig. 1 is a longitudinal sectional elevation of a machine constructed in accordance with the invention;

Fig. 2 is a detail sectional elevation taken substantially on line 2—2 of Fig. 1; and

Fig. 3 is a sectional elevation taken substantially on line 3—3 of Fig. 1.

The invention briefly described consists of a machine having forming dies adapted to pass through a vat containing a solution of pulp material and to receive and form thereon an article, compression dies adapted to register with the forming dies and to compress the material therebetween, and transfer mechanism adapted to receive the compressed articles from the compression dies and to transfer the articles to a carrier or conveyor.

The forming dies are so constructed that a large proportion of the moisture from the molded article on the forming die will be extracted prior to the operation of the compression dies, and the forming dies and compression dies are so relatively arranged that the forming dies will be firmly and rigidly supported during the operation of the compression dies.

Means is provided in conjunction with the compression dies and compressing mechanism for automatically stopping the machine when the articles being formed exceed a predetermined thickness, and means is also provided for cutting off the suction from the forming dies when the machine is stopped.

Further details of the invention will appear from the following description.

Pulp forming dies and mounting therefor

In the particular embodiment of the invention illustrated, the mechanism is mounted on a base 20 having cross frame members 21 and 22. A frame work consisting of two pairs of uprights, namely, 23 and 24, is mounted on the cross frame members, the uprights being connected at their upper ends by a frame 25.

The frame member 21 has mounted thereon a bearing 26 for supporting one end of a shaft 27. A similar bearing 28 is carried by the frame member 22 and supports the other end of the shaft 27. The shaft 27 may be driven from any suitable source of power, as by a motor M, belt drive 28A and clutch member 29A fixed to the shaft and clutch member 29B loose on the shaft. A clutch shift lever 29C controls the clutch.

A hub 30 is mounted on the shaft 27 to rotate therewith and has connected thereto radially extending, hollow arms 31 to the outer ends of which are secured forming dies 32. Each of the hollow arms terminates in a chamber 33 over which there is secured the perforated forming die 32. A mesh screen 34 formed of wire is preferably secured over the die 32 by means of a ring 35.

The forming dies are so shaped or of such contour as to produce an article of the desired shape, and while the die is immersed in the solution, means is provided for exhausting the air in the hollow arms 31 and chambers 33, thus causing the liquid material in the vat to pass through the screens and perforations in the die, the solid matter being deposited on the screen in the form of a thin layer shaped

in conformity with the shape of the die. The period of time during which the die remains submerged in the solution and the amount of suction applied to the arms 31 will determine the thickness of the article formed on the die.

Suction is applied to the arms 31 in the following manner: The hub 30 has formed therein a plurality of arcuate conduits 40 adapted to communicate with the inner ends of the arm 31 and with a suction chamber 41 formed in a stationary control casing 42 mounted on the shaft 27 and abutting against one side of the hub 30. The chamber 41 is exhausted in any suitable manner through a conduit 43 which communicates with the chamber 41 through a passage 44 formed in an enlarged portion of the journal 26 for the shaft 27.

It will be evident that the arms 31 after they rise in their rotation above the horizontal will be drained by gravity as well as by suction.

A valve 48′ is provided in the suction conduit 43 for shutting off the suction from the forming dies, when desired. Furthermore, in order to prevent the continuance of suction after the machine is shut down and the shaft 27 stops rotating, means is provided for automatically closing the valve 48′ when the machine stops. This means consists of a link connection 49 between the lower end of the clutch control lever 29C and an arm 48A connected to the valve pintle.

It will be evident that when the clutch lever 29C is shifted to open the clutch 29B, the valve 48′ will be closed, thus shutting off the suction from the forming dies.

In order to automatically shift the clutch lever when the motor M is stopped, the following mechanism is provided. The link 49 is extended beyond the pivotal connection of the link to lever 29C and is slotted at 202. The link extension is connected by a spring 201 and rod or wire 200 to the frame 21.

The extension of the link has secured thereto an armature 203 of an electro-magnet or solenoid 210. The electro-magnet is connected in the motor circuit in parallel, one conductor 204 leading to the magnet winding being connected to motor main 211 and the other magnet lead wire 205 being connected to wire 212 leading from the switch contact 114 to the motor.

Thus when the motor circuit is opened, either by opening the main leads or the circuit through the control switch contacts 113, 114, the electro-magnet coil will be deenergized, releasing the armature 203 and permitting the spring 201 to shift link 49 and close the valve 48′, thus cutting off the suction from the forming dies.

It will be understood that the electro-magnet when energized has sufficient pulling force to overcome the action of spring 201 but the spring will shift the link 49 when the magnet is deenergized.

In order to discharge the molded articles from the forming dies 32 onto the compression dies, compressed air is introduced into the chambers 33 at a suitable period in the cycle of operation of the machine. This air enters the chambers 33 through conduits 45 which communicate with a compressed air chamber 46 formed in the control casing 42. A conduit 47 conducts the compressed air from any suitable source to the chamber 46.

From the foregoing description, it will be seen that as the forming dies pass through the vat, they will receive a thin layer of pulp or plastic material which will adhere to the dies by reason of the suction created in back of the dies. This pulp will be carried around the dies, the moisture being drained therefrom partially by gravity and partially by the suction. When the forming dies register with the compression dies in the manner hereinafter set forth, compressed air is introduced behind the forming dies, thus assisting in drying the article on the forming dies and in discharging the article from the forming dies to the compression dies. In order to prevent any liquid from collecting in the conduit 45, a small opening 48 is formed in the wall between the suction passage 40 and the conduit 45.

Compression mechanism

The compression mechanism comprises a plurality of compression dies 50 conforming in shape to the shape of the forming dies; that is, the inner surface of the compression die conforms in shape to the outer surface of the forming die so that the article molded on the forming die can be compressed between the two dies without changing its contour. The compression dies are carried by a wheel comprising a hub 51 affixed to the shaft 27 and having radially extending therefrom a plurality of arms 52. To the outer end of each of the arms 52 there is swiveled a hollow shaft 53, this shaft being mounted in bearings 54. One or more shims 55A is interposed, if necessary, between the arms 52 and the bearings 54 for the purpose of properly positioning the compression dies relative to the forming dies. An L-shaped bracket or casing 55 is secured to the central portion of the hollow shaft 53 and a conduit 56 is adjustably swiveled and clamped in the bracket or casing 55. This conduit communicates with the interior of the hollow shaft 53 through a connecting conduit 57, an opening 58 in the hollow shaft 53 and an opening 59 in the conduit 56.

The compression die 50 is mounted in a compression head 60 secured as shown at 61 to the outer end of the conduit 56. An antifriction roller 62 is mounted on each of the conduits 56 intermediate the casing or

bracket 55 and the compression head 60. A pair of guide rails 65 and 66 are mounted above and below the rollers 62 and are so shaped as to swing the compression dies, compression head and coacting parts from the position shown at the top in Fig. 1 to the position shown at the bottom in Fig. 1.

The rails are provided with a depression 67 at the bottom thereof for guiding the compression dies into proper coacting relation with respect to the transfer heads and quickly removing them from the transfer heads.

A slight pressure is created behind the compression dies 50 during the compression operation, the compressed air preferably being heated or dry, thus assisting in drying the article and also preventing the adhering of the article to the die by interposing a partial film of air between the compression die and the article formed. This compressed air is introduced into one end of the hollow shaft 53 through a coupling 70 which receives the air from the conduit 71, which in turn communicates with a compression chamber 72 in the hub 51. The compression chamber 72 in turn communicates with a compression chamber 73 in a control casing 74 mounted on the shaft 27 and preferably spring-pressed by a spring 75 against the hub 51. The control casing 74 is prevented from turning on the shaft by a pivotal connection 76 to a lug 77 formed on a fixed bearing member 78.

The opposite end of the shaft 53 communicates with a coupling 80 which in turn is connected by a conduit 81 to an exhaust chamber 82 in the hub 51. This chamber registers with an exhaust chamber 83 in the control casing 74.

The couplings 70 and 80 have a swivel connection with the shaft 53 and are held in contact with the ends of the shaft by means of springs 85 which engage flanges 86 extending laterally from the couplings. Thus, the rotation of the brackets or casings 55 will not interrupt the communication between the couplings 70 and 80 and the interior of the hollow shaft 53.

The chambers 72 and 73 and the chambers 81 and 83 are adapted to communicate at such periods in the cycle of operation of the compression dies that pressure will be exerted in back of the compression dies during the compression operation, but suction will be created in back of the compression dies after the compression operation is completed and during the movement of the compression dies from the position shown at the top in Fig. 1 to the position shown at the bottom in Fig. 1. When the compression dies reach a position above the transfer device, the suction behind the die is released and a slight pressure assists gravity in the transfer.

The compressing force is exerted on the compression dies in the following manner, attention being particularly directed to Figs. 1 and 2. The compression mechanism is mounted in the frame 25. This frame is provided with a pair of threaded bosses 85 and 86 which receive externally threaded nuts 87 and 88. The nuts are provided with central openings therein through which extend threaded rods or studs 89 and 90. Nuts 91 and 92 are mounted on the outer ends of these studs and the inner ends have secure thereto U-shaped yokes 93 and 94. A block 85 is mounted on studs 96 secured to the depending legs of yokes 93 and 94 and is provided with a hard bearing surface 97 adapted to be engaged by rollers 98 mounted on chains 99. The chains extend around the block 95 and are engaged and driven by a sprocket wheel 100 mounted in an adjustable bracket 101 secured to the block 95. Bracket 101 is guided by a pin and slot connection 110, 111 to frame 25. The sprocket shaft 102 extends laterally and may be driven from any suitable source of power as, for instance, from the shaft 27. The connections to the shaft or other source of power will be so made that the rollers and chain will pass around the block 95 at approximately the same rate of speed as the rate of travel of the forming and compression dies.

The block 95 in addition to being carried by the yokes 93 and 94 is guided by a link 103 which connects one of the studs 96 to depending lugs 104 carried by the frame 25.

Downward pressure is exerted on the block 95 and through the rollers 98 on the compression die by means of springs 106 and 107 mounted on the studs or rods 89 and 90 and seating at one end against the nuts 87 and 88 and at the other end against washers 108 which in turn abut against the upper surfaces of the U-shaped members 93 and 94. The pressure of the springs can be adjusted by adjusting the nuts 91 and 92 on the studs 89 and 90 and by raising or lowering the nuts 87 and 88 in the bosses 85 and 86.

In mechanism of this character, a reasonable uniformity in thickness of the product or article should be maintained. For this purpose, means is provided for automatically stopping the mechanism when the article is too thick. This means consists of a lever 112 pivoted on a fixed pivot and having an end engageable with the upper end of one of the bolts 89 and 90 when the thickness of the article compressed passes the desired limit. The other end of the lever carries a contact 113 normally spring-held into engagement with an adjustable contact 114 in the circuit of the driving motor M. When the lever 112 is tilted, it will open the switch in the circuit of the driving motor and stop the machine.

The compression mechanism operates as follows: On referring to the drawings, it will be seen that for each forming die there is a

corresponding compression die, these dies being so arranged that when each forming die reaches the position shown in Fig. 1, there will be a compression die juxtaposed thereon and adapted to coact therewith. The movement of the compression dies during the rotation of the hub and wheel by which they are carried is controlled by the guide rails 65 and 66. When a compression die is in the position shown at the top of Fig. 1, compressed air enters the compression head 60 through the conduit 71, coupling 70, hollow shaft 53, passage 57 and conduit 56. During the rotation of the forming die and corresponding compression die, the molded article between these dies will be compressed by pressure derived from the spring-pressed block 95 and rollers 98. As these dies leave this compression mechanism, they are separated, and a vacuum is created behind the compression dies and in the compression chamber since at this point in the cycle of operation, the vacuum chamber 83 in the casing 74 will communicate with the vacuum chamber 82 in the hub 51 and this suction is communicated to the hollow shaft 53 through the conduit 81 and coupling 80. The hollow shaft 53 communicates with the compression chamber 60 in the manner just described.

At this period in the cycle of operation also, compressed air is introduced behind the forming die 32 simultaneously with the suction created behind the compression die. Thus the molded article is transferred from the forming die to the compression die and is held in contact with the compression die during the movement of the compression die from the position shown at the top of Fig. 1 to the position shown at the bottom of Fig. 1, in which latter position the molded article is discharged from the compression die onto transfer mechanism.

Any suitable form of transfer mechanism may be utilized for receiving the molded articles from the compression dies and for transferring the articles to an endless carrier or other conveyor. In the particular form of the invention illustrated, the transfer mechanism is carried by a hub 115 mounted on a shaft 116. The hub is driven by a gearing connection 117, 118 from the shaft 27.

The transfer mechanism is described in detail in the parent application Serial No. 140,715, of which this case is a division and need not be specifically described in this case. Briefly stated, this mechanism is carried by arms 160 mounted on the hub 115 and extending radially therefrom. The transfer heads 167 are adjustably carried by tubular members 161 which are longitudinally adjustable in the arms 160 and means is provided for rotating the tubular members in the arms 160 during their movement around the axis of the hub 115. The transfer head at the left in Fig. 1 is shown in receiving position and the molded articles are deposited on the heads by gravity, as well as by suction. After receiving the molded articles, the arms rotate through 180° around the axis of the hub and also rotate axially 180° to a position above an endless conveyor or carrier 180, whereupon the articles are deposited on the carrier. Further details of the description of this mechanism is not deemed necessary in this case since it forms no part of the invention set forth in the claims.

Summary of operation

The operation of the complete machine may be briefly set forth as follows. The rotation of the forming dies in the vat containing the solution of pulp or other plastic material will cause a thin layer of the material to adhere to the forming die due to the suction therein. When the forming dies reach the position shown at the top in Fig. 1, the compression dies coact therewith and as the two sets of dies pass beneath the compression block 95 and rollers 98, the pulp is tightly squeezed or pressed between the two dies. During the rotation of the forming dies, suction has removed a large proportion of the liquid or moisture from the pulp, and after compression, the molded article is transferred to the compression die by means of compressed air, the compression die also being connected at this time to a source of suction.

After receiving the molded article from the forming dies, the compression dies are rotated through 180° and are also rotated pivotally to the position shown at the right in Fig. 1 or, in other words, to a position above one of the transfer heads. At this period in the cycle of operation, compressed air is introduced in back of the compression die and transfers the molded article from the compression die to the transfer head, the latter being under suction. Gravity also assists in this transfer.

After receiving the molded article from the compression dies, the transfer heads are rotated through approximately 180° and also axially to a position above the conveyor belt, whereupon compressed air in the transfer head discharges the molded articles therefrom to the conveyor belt.

When the machine is stopped for any reason, the suction to the forming dies is automatically cut off by the closing of valve 48′.

If during the operation of the machine the thickness of the product or article molded exceeds a maximum limit, the machine will be automatically stopped by the tripping of lever 112 which opens the motor circuit.

Although certain specific embodiments of the invention have been particularly shown and described, it will be understood that the invention is capable of modification and that

changes in the construction and in the arrangement of the various cooperating parts may be made without departing from the spirit or scope of the invention, as expressed in the following claims.

What I claim is:

1. In a pulp molding machine, a rotatable carrier, a plurality of forming dies mounted on said carrier, a suction conduit adapted to communicate with said dies at predetermined periods in the cycle of operation thereof, means for rotating said carrier, and means for automatically cutting off the suction from the forming dies when the carrier ceases to rotate.

2. In a pulp molding machine, a rotatable carrier, a plurality of forming dies mounted on said carrier, a suction conduit adapted to communicate with said dies at predetermined periods in the cycle of operation thereof, means for rotating said carrier, and means for cutting off the suction from the forming dies.

3. A pulp molding machine comprising rotatable forming dies, rotatable compression dies adapted to coact therewith, and means for stopping the machine when the material between the coacting dies exceeds a predetermined thickness.

4. A pulp molding machine comprising rotatable forming dies, rotatable compression dies adapted to coact therewith, means for pressing the compression dies toward the forming dies, and means for stopping the machine when the material between the coacting dies exceeds a predetermined thickness.

5. A pulp molding machine comprising rotatable forming dies, rotatable compression dies adapted to coact therewith, mechanism for pressing the compression dies toward the forming dies, and means controlled by said pressing mechanism for stopping the machine when the material between the coacting dies exceeds a predetermined thickness.

6. A pulp molding machine comprising rotatable forming dies, rotatable compression dies adapted to coact therewith, means for pressing the compression dies toward the forming dies, and means for automatically stopping the machine when the material between the coacting dies exceeds a predetermined thickness.

7. In a pulp molding machine, a rotatable carrier, a plurality of forming dies mounted on said carrier, a suction conduit adapted to communicate with said dies at predetermined periods in the cycle of operation thereof, means including a motor for driving said carrier, and means for cutting off the suction from the forming dies when the motor is stopped.

8. In a pulp molding machine, a rotatable carrier, a plurality of forming dies mounted on said carrier, a suction conduit adapted to communicate with said dies at predetermined periods in the cycle of operation thereof, means including an electric motor and motor circuit for driving said carrier, and means for cutting off the suction from the forming dies when the motor circuit is opened.

9. In a pulp molding machine, a plurality of forming dies, suction conduits communicating with said dies, means including a motor, and operative driving connections for moving said dies through a predetermined path, and means for cutting off the suction from said forming dies when said motor is stopped.

10. In a pulp molding machine, a plurality of forming dies, suction conduits communicating with said dies, means including a motor, and operative driving connections for moving said dies through a predetermined path, a motor circuit for driving the motor, and means for cutting off the suction from the dies when the motor circuit is opened.

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