

June 27, 1939.

M. P. CHAPLIN

2,163,585

PULP MOLDING MACHINE

Filed Aug. 14, 1926

3 Sheets-Sheet 1

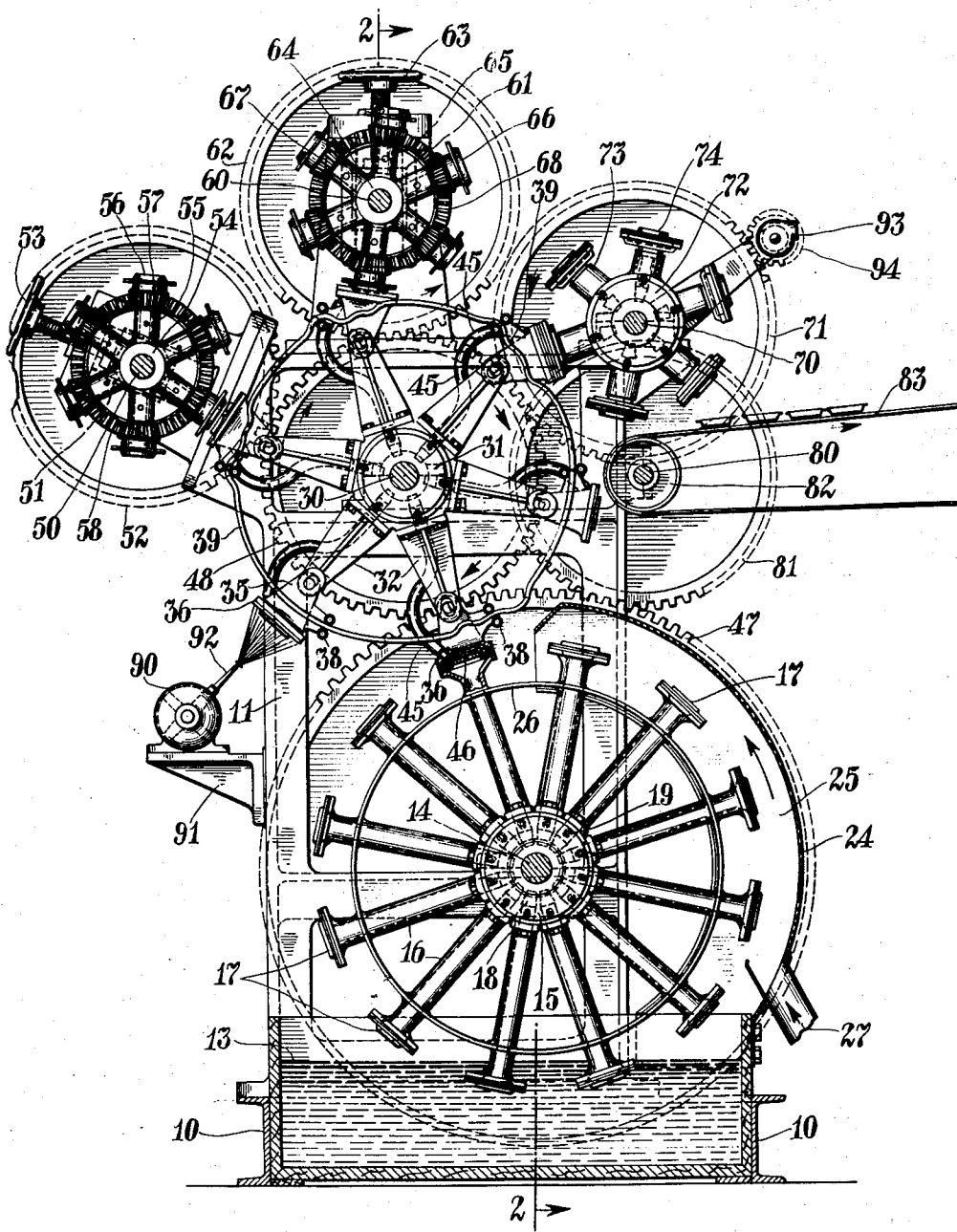


Fig. 1.

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3 Sheets-Sheet 2

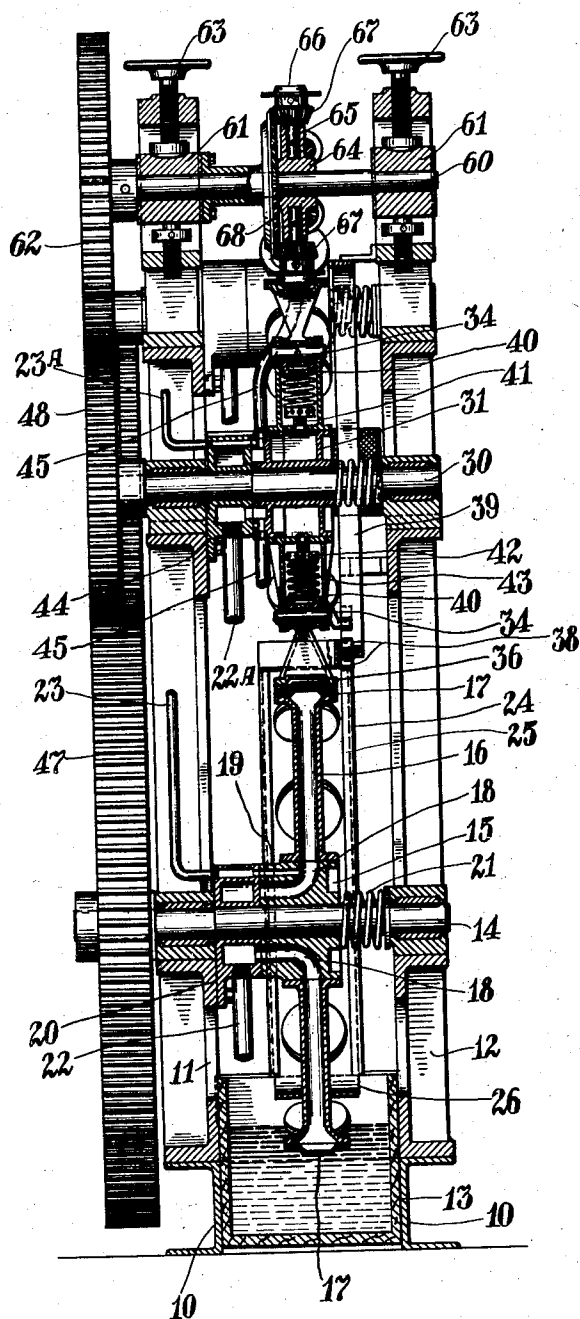


FIG. 2.

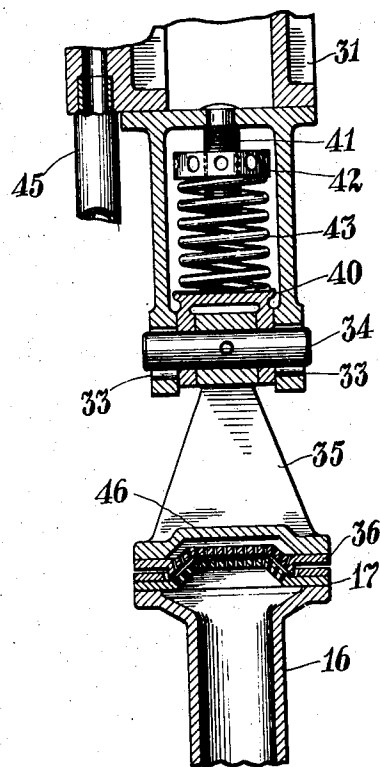


FIG. 3.

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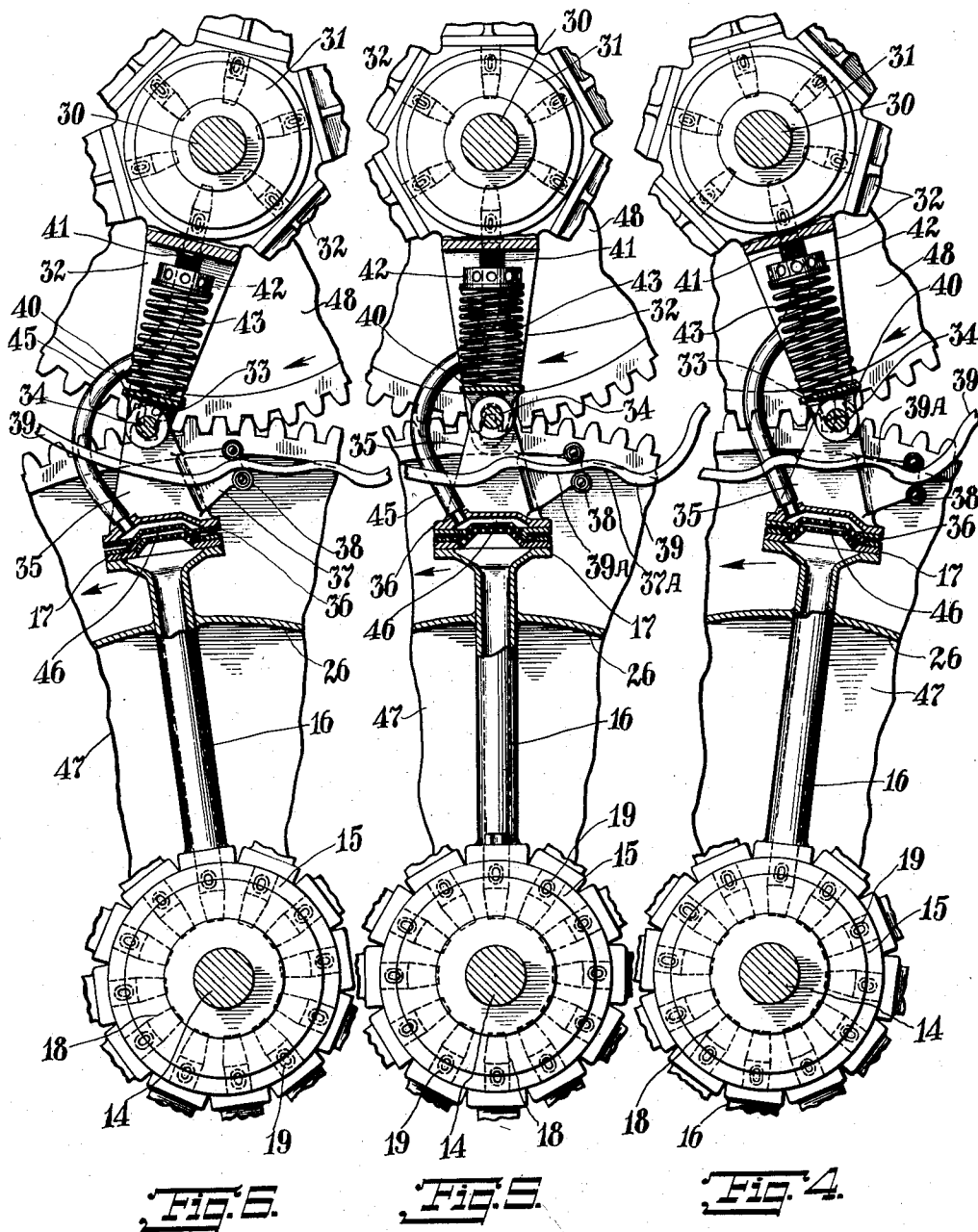
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PULP MOLDING MACHINE

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3 Sheets-Sheet 3



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2,163,585

PULP MOLDING MACHINE

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Application August 14, 1926, Serial No. 129,130

70 Claims. (Cl. 92—56)

This invention relates to new and useful improvements in pulp molding machines and its object is to provide a novel apparatus for making articles out of pulp at a high rate of speed and of uniform quality.

My machine produces individual pulp or fibre articles which are molded to a predetermined shape and size. Each individual article is formed on a foraminous die by immersing this die into a thin liquid mixture containing pulp or other fibre in suspension.

Suction being applied through the immersed die results in the liquid being drawn through the perforations in the die, leaving deposited on its shaped face or surface a layer of partially solidified pulp or other fibre.

After removal from the pulp mixture, the foraminous forming die with the still wet and soggy pulp mass thereon is exposed to the air with suction still being maintained and the die inverted, bringing the pulp mass on the top so that gravity will aid to remove much of the remaining liquid.

Exposure to air with suction through the foraminous die and aided by gravity results in most of the liquid remaining between and around the fibres of the deposited pulp mass being replaced by air, the liquid passing through the die and draining away. Heated air at this point materially accelerates the liquid removal.

The article is then compacted and compressed by a second foraminous die known as a compression die. This die is shaped to allow a predetermined space between it and the forming die and its outside or rim accurately fits the ring or other projection which surrounds the forming die and which defines the edge of the molded pulp article.

These dies are brought into accurate registration and parallelism prior to the edge of the compression die entering the defining ring on the forming die and are then moved towards each other with registration, alinement and surface parallelism accurately maintained.

The article is thus compressed and firmly compacted to a uniform and predetermined thickness, the accurate registration of the die producing a smooth and uniform edge on the article.

After compression the article is removed from the forming die and transferred to the compression die so that the forming die can be utilized to form subsequent articles.

This transfer is accomplished by disconnecting suction on the forming die at or near the end of the compression period and applying air pressure behind and through this die. At the same time suction is applied to the foraminous compression

die. Separation of the dies while still maintaining accurate alinement and parallelism thus transfers the article from the forming to the compression die without damage to the still moist and fragile article.

While still being retained on the compression die, the article may be further compacted or its surface finished by being brought into contact with other dies known as finishing dies. The dies are brought together with the article between them, and are maintained in accurate alinement and parallelism before, during and after compression.

The finishing dies may be given a spinning or calendering action or they may be heated to effect a smooth finish on the article and to assist in further drying.

After the articles have been finished or otherwise treated by the finishing die, they are then removed from the compression die by means of another series of dies known as receiving dies. These dies are foraminous and shaped to conform to the surface and contour of the article and are brought into accurate registration with the article as it is held on the compression dies so that no part of it will be damaged either during the initial contact or when the article is removed.

It is important that the receiving die cover the entire surface of the article for the reason that the article has been firmly pressed on the surface of the compression die, due to the pressure between the compression die and the forming die and also between the compression die and the finishing die.

Transfer is accomplished by discontinuing the suction behind and through the compression die and applying compressed air. At the same time suction is applied to the foraminous receiving die. If the receiving die draws away from the compression die on one side of the article more rapidly than the other or if the compression die does not cover the entire surface of the article, the article is very apt to stick to some part of the compression die for an instant longer than at some other part resulting in distortion, wrinkling and other damage.

In the preferred form of my machine I have mounted the several kinds of dies on rotating structures supported by parallel shafts which are driven directly from each other by means of heavy gears. This avoids any lost motion or play in the driving mechanism and between shafts which carry the coacting dies.

The gears and all other mechanisms are

mounted outside of the tank or vat containing the liquid pulp mixture and the only portion of my machine which comes in contact with the mixture in the vat are the forming dies and the structures which support them and to which they are firmly bolted. No working parts of my machine come in contact with the liquid pulp mixture thus avoiding many of the serious difficulties which are present in those machines where gears, joints, rolls and other working parts are continuously wet by this mixture which results in rapid wear, frequent replacement and improper die coaction.

Thus among the more important advantages attained by my invention are compression dies movable into axial alinement and parallelism with the other dies before compressive action upon the pulp layer or article begins, and maintained in such parallelism during transfer of the article from the die upon which it is secured to the complementary die of another die carrier; transfer of the article from one die to another or from a die to a transfer member in a direction at right angles to the plane of the die, thereby avoiding any swinging or twisting of the article which would result in the de-formation of the article; a greater number of forming dies than compressing dies, thus providing more time for the article to dry on the forming die and thereby to speed up production; forming and pressing dies mounted on separate wheels or shafts revolving at different speeds in revolutions per minute, together with mechanism for causing the dies to move at the same rate of linear speed during their co-operation; compression dies which are forced toward the complementary forming, finishing and receiving dies respectively by a yieldable toggle mechanism combined with means for maintaining the dies in alinement and parallelism as they approach toward and recede from compression position.

Referring to the drawings:

Fig. 1 is a sectional side elevation of a pulp molding machine which is made according to and embodies the present invention;

Fig. 2 is an elevation partly in section of the apparatus shown in Fig. 1, the section being taken on the line 2—2 of Fig. 1;

Fig. 3 is an enlarged sectional front elevation of certain parts of this apparatus; and

Figs. 4, 5 and 6 are elevations partly in section of certain parts of the same apparatus, the parts being shown also on an enlarged scale and in different operative relations in these figures.

Like characters of reference designate corresponding parts in all figures of the drawings.

10 designates a base upon which the various parts of the apparatus are supported. 11 and 12 are frames secured to the base. 13 is a vat in which liquid pulp is maintained at a desired level. 14 is a shaft mounted in bearings on the frames 11 and 12 and 15 is a hub mounted upon the shaft and arranged to rotate therewith. On the hub 15 are mounted a plurality of hollow radial arms 16. On the outer ends of each of these arms is a forming die 17, the face of which is perforated and covered with a wire mesh. The hub 15 is provided with ports 18 and 19 which are in communication with the hollow arms 16.

20 is a fixed collar which surrounds the shaft 14 and abuts against one side of the hub 15 which is held in engagement therewith by a spring 21. This collar is constructed with chambers and ports which are connected with a vacuum pipe 22 and with a pipe 23 from a source of compressed

air. The ports in the hub 15 register with the ports in the collar 20 at desired parts of the cycle of operation for the purpose of providing a vacuum back of the forming die 17 during certain parts of the operation and of forcing air under pressure through the forming die at other parts of the operation in the well known manner.

24 is a cover extending from the vat 13 over but out of contact with the forming dies. This cover has side flanges 25 which extend inwardly at the sides of the forming dies. 26 is a circular ring which is secured to the hollow arms 16 and runs between the side flanges 25. 27 is an inlet for warm dry air which passes through the chamber formed between the ring 26 and the cover 24 with its side flanges 25.

A shaft 30 is mounted on bearings on the frames 11 and 12 and carries a hub 31 from which project a plurality of radial arms 32. The outer end of each of these arms is provided with a slot 33 in which fits a pin 34 on which is pivoted a toggle end 35 which carries a compression die 36 shaped to cooperate with the forming dies 17. These compression dies are perforated and may be covered with wire mesh in the usual manner. Projecting from one side of each of the toggle ends 35 is a bracket 37 which carries a pair of rollers 38. These rollers run on opposite sides of a cam track 39.

Fixed on each of the pins 34 is a presser plate 40. Each of the radial arms 32 has a threaded bolt 41 on which is an adjustable collar 42 and between each presser plate and its respective collar is a compression spring 43.

The hub 31 is pressed against a stationary collar 44 on shaft 30 which has vacuum and compressed air chambers and ports connected respectively with pipes 22A and 23A. The ports in the side of hub 31 register with the ports in collar 44 at desired parts of the cycle of operation and through flexible conduits 45, establish communication between chambers 46 back of the compression dies and the vacuum and air pressure pipes 22A and 23A.

Gears 47 and 48 on shafts 14 and 30 respectively cause them to rotate at desired relative rates.

Two other shafts 50 and 60 mounted in slidable bearings 51 and 61 in brackets secured to the frames 11 and 12 are arranged to be driven by gears 52 and 62 which may be moved into or out of mesh with gear 48 by means of hand wheels 53 and 63. 54 and 64 are hubs affixed to the shafts 50 and 60. These carry rotatable radial shafts 55, 65 on each of which is a finishing die 56, 66, and a bevel pinion 57, 67. These pinions mesh with stationary bevel gears 58, 68 affixed to one of the slidable bearings for each of the shafts 50 and 60, for example, to the left hand bearing 61 shown in Fig. 2. This arrangement is such that if gear 52 or 62 is in mesh with gear 48, the finishing dies will be rotated about the axes of the shafts 50 or 60 and also about the axes of shafts 55 or 65.

70 is a shaft driven by a gear 71 in mesh with gear 48. It carries a hub 72 from which extend hollow, radial arms 73 on the ends of which are receiving dies 74. One side of the hub 72 fits against a collar not shown, which is connected with a vacuum pipe and with an air pressure pipe and both the hub and the collar are provided with ports in the manner previously described so that at desired parts of the cycle of operation, the receiving dies 74 may be connected with a vacuum pipe or with an air pressure pipe.

80 is a shaft driven by gear 81 in mesh with gear 47. This shaft carries a sheave 82 around which runs a conveyor belt 83.

90 is a sprayer mounted on a bracket 91 affixed to frame 11 and having a nozzle 92.

A counting device 93 may be provided, driven, for example, by a gear 94 from gear 71.

The operation of this apparatus is as follows:

The shaft 14 is rotated in the direction indicated by the arrows. As the forming dies 17 pass into the liquid pulp in the vat 13, a partial vacuum is formed back of them through the ports and passages described and this connection is maintained while the forming dies are passing through the hot air chamber formed between the cover 24, its side flanges 25 and the ring 26. A body of wet pulp is formed on the dies 17, but much of its moisture is sucked out through the hollow arms. A supply of hot dry air is admitted through the inlet 27. This is drawn through the uncovered articles formed on dies 17 to assist in the removal of the moisture. As the vacuum connection is maintained after the arms 16 have passed the horizontal position, and, in fact, until they reach a vertical position, the water removal is aided by gravity. This arrangement is such as to bring the formed articles up to the compression dies in a much drier condition than has been possible heretofore.

Now as a forming die passes out of the hot air chamber, a compression die 36 approaches it. Its toggle end 35 is so guided by the cam track 39 and the rollers 38 that the approaching dies are in axial alinement and their faces are parallel. These parts constitute means independent of the engagement of any die with any other die for moving the compression die into alinement and parallelism successively with the other dies as said compression die approaches and recedes from the other dies. This avoids wear on the dies themselves and damage to the articles thereon. The mechanism which brings the dies into alinement prior to contact with each other is removed and out of contact with the pulp mixture and can be well lubricated to prevent wear. The dies themselves being immersed or in contact with the pulp mixture cannot be lubricated and if the dies are used in themselves to guide each other into cooperative relation the dies themselves will become worn and produce inferior articles.

Fig. 4 illustrates the relative position of these dies as they come together. As soon as the compression die is fully seated on the pulp on the forming die, the function of the rollers 38 is not needed so a portion 39A of the cam track is narrowed to enable them to clear this track. Thus, when the rollers 38 have reached the portion 39 of the track, the rollers and toggle exert no control on the dies which are held in registration and under compression by the springs 43. When the parts have assumed the positions shown in Fig. 4, the toggle end 35, pins 34 and presser plate 40 are about to move toward the axis of the shaft 30, the pins 34 leaving the ends of slots 33 and sliding therein against the action of spring 43. This movement is continued until the parts reach the positions shown in Fig. 5 in which the spring 43 is compressed to its full limit which is predetermined by the position of the adjustable collar 42 on the threaded bolt 41.

The suction connection through arms 16 is continued to this point. Air under pressure is then admitted to chamber 46. The result of the high pressure obtained by the toggle action described is that the pulp article will be completely

formed and most of the moisture will be pressed out of it and removed through the suction connections. The removal of water is aided by the air current established through the dies and through the pulp article. As the forming die is in a substantially horizontal position, the water squeezed through its individual perforations drops by gravity without interference.

Immediately after this, the suction connection back of the forming die will be closed and air under pressure admitted through the arms 16. At the same time a suction connection will be made from the chamber 46 back of the compression die through the flexible tube 45 and the ports and passages previously described so that these pressure and suction connections will be completed by the time the parts reach the positions in which they are shown in Fig. 6.

It will be noted that when the parts have reached their Fig. 6 positions, the dies are still in their same relative positions as they have been through this compression stage and that the rollers 38 have now reached a part of the cam track 39 which will cause them to bear upon opposite sides of this track. The track is so formed that the toggle end 35 will be guided to remain in axial alinement with its cooperating arms 16 as the dies separate. When the dies do separate, the pressure back of the forming die and the suction back of the compression die will cause the formed article to be transferred to the compression die.

As the article is thus completely formed and in a drier condition than similar articles which have been made with such apparatus as has been available, it will be assumed that the shafts 50 and 60 have been moved by the hand wheels 53 and 63 away from the shaft 30 so that the parts which are mounted on these shafts 50 and 60 are inoperative, and the description of the operation will be made first as if these parts were not present. It will be seen that when each article is carried on the compression dies around to a position in which the compression dies approach the receiving dies on shaft 70, the cam track 39 will guide the compression dies into such positions as to cause them to be in axial alinement with the arms 13 so that the compression dies 36 and the receiving dies 74 come together in parallelism. At the time these dies are in closest proximity, the suction through the pipes 45 which has been maintained to continue the passage of air through the articles is cut off and air pressure supplied to the chamber 46 back of the compression die and at the same time, a suction connection is opened back of the corresponding receiving die.

Then as the dies separate, being still maintained in parallelism, the finished article will be transferred from the compression die onto the receiving die. The shape of the receiving die is the same as that of the inside of the formed article so that its shape is preserved.

Further rotation of the shaft 70 will bring the receiving die with the finished article on it over the conveyor 83, at which time the suction connection to the receiving die is closed and air under pressure admitted. This will cause the article to drop off of the receiving die onto the conveyor belt 83 by which it is led to suitable apparatus for further drying, stacking and packing.

If the counter 93 is provided, it is so calibrated that it will register the number of articles dropped onto the conveyor belt.

Now let us assume that the shaft 50 is moved

toward the shaft 30 until gears 52 and 48 are in mesh. This will cause the finishing dies 56 to rotate about the shaft 50 at such a rate as to cause them to register with the compression dies. The latter are guided by the cam track 39 so that the compression dies and the finishing dies are in axial alinement as they approach, are in contact with and recede from each other. The desired amount of pressure on the articles between the compression and finishing dies is secured by the springs 43. When the finishing dies 56 are in operation, they are continually rotated about their respective axes 55 so that they will have an ironing and calendering effect upon the articles. That is, they will tend to smooth out the fibers of the pulp and at the same time, remove some of the remaining moisture in the articles. The latter effect is aided by the fact that the suction connection through flexible pipe 45 is maintained during this part of the operation, and if desired, the finishing dies may be perforated and air under pressure passed through them and the article in the compression die. It is sometimes desirable to heat the finishing dies to accelerate the drying effect.

If it is desired to impart a more rapid rotation to the finishing dies, the gears 58 and 68 may be arranged to be driven in a direction opposite to the direction of rotation of shafts 50 and 60. Or, the finishing dies may be used without rotation by omitting the pinions and gears 57, 58 and 67, 68.

It is obvious that when shaft 60 is moved downwardly until its gear 62 meshes with gear 46, the pressing and calendering effect will be repeated, the cam track 39 being so constructed as to bring the dies 56 and 66 together in parallelism. When the finishing dies 56 and 66 are used, it is obvious that the articles are delivered to the receiving dies 74 in a thoroughly finished condition. The cam track 39, being annular, maintains continuous control on the compression dies throughout their orbit. Normally the cam holds the compression dies at right angles to a radius of rotation. At predetermined intervals in the rotation of the compression dies relative to said cam track however, the cam track moves the compression dies angularly about their pivots into planar positions parallel to the planar positions of the approaching forming and/or finishing and/or receiving dies and maintains them co-planar with said dies as the planar positions of said dies successively change and until they have separated from said compression dies.

The cam track, and toggle moreover constitute means for changing the speed of the compression die and its angular relation and alinement relative to its axis of rotation to cause it to conform for an appreciable arc of travel to the speed and arc of rotation of the forming die, so that where the compression dies are fewer in number than the forming dies and the shafts of the forming and compression dies are rotated at different rates of revolution, the compression and forming dies will travel in unison at the same effective rate of linear speed throughout the arc of intersection.

For the manufacture of certain types of articles on this machine, it is desirable to apply to them certain filling, waterproofing or finishing matter which may be projected onto them by means of the sprayer 90 through the nozzle 92. This is so arranged as to intermittently project a spray at such times as the compression die is

opposite and in axial alinement with the nozzle 92.

The machine may be so designed as to have the compression dies pass through a bath of the filling, waterproofing or finishing matter in suitable form after they have received the pulp articles.

The description is of one unit in which all of the parts rotate in the same plane. The actual machine comprises a plurality of such units, the shafts and the vat being extended to serve them all. It will be seen that the dies all move at constant rates through rotary paths. By using suitable driving means, the die movements may be made constant at irregular rates.

All shafts, bearings and gearing are above and away from the pulp vat so that they may be kept clean and well lubricated.

By making the arms which support the forming dies long, it is possible to rotate shaft 14 at a comparatively slow rate so that they remain in the pulp as long as necessary. Moreover, the articles remain on the forming dies for more than a half revolution of the shaft 14 during which time a large part of the moisture is removed from them by the passage of warm dry air through them. This moisture runs through arms 16 by gravity after the arms pass the horizontal position so that the conduits through them are freed of moisture before air under pressure is passed through them, so that none of this moisture is blown back into the articles. The articles also remain on the compression dies for considerably more than a half revolution of shaft 30 so that by the time they reach the receiving dies, there is but little moisture left in them, especially if the finishing dies are used.

It is within the scope of this invention to transfer the articles from the compression dies to other dies for further treatment before discharging them onto the receiving dies.

The movement of the articles from die to die is in directions normal to the faces of the dies, so that there is no twisting effect and the pressures obtained between the dies is exerted uniformly upon the articles.

The apparatus herein described is for illustrative purposes only, as the invention is broader than the embodiment shown, and many modifications of structure, some of which have been suggested, may be made without departing from the scope of the invention, so I intend no limitations other than those imposed by the following claims.

In the claims the coaction of the dies is specified with the understanding that there is between them a layer of pulp. It is also to be understood that there is a layer of pulp on the forming dies when air is passed through them.

What I claim is:

1. A pulp molding machine comprising a pair of coating dies, means for rotating said dies in opposite directions about spaced, parallel axes into engagement with each other and means for moving one of said dies into alinement with the other as the dies approach each other, one of said dies being a forming die and including a foraminous plate having an outer face shaped to conform to one face of the article produced, upon which face the fibres are felted upon the application of reduced pressure upon its opposite face.

2. A pulp molding machine comprising a pair of coating dies, means for rotating said dies in opposite directions about spaced, parallel axes into engagement with each other, one of said dies being maintained in a position at right angles to a radius from its axis of rotation

through its center and means for moving the other die into positions in which a line through its center and at right angles to its face is in alignment with said radius during a part of its
 5 rotative movement, said first-named die having an outer face shaped to conform to one face of the article produced, upon which face the fibres are felted upon the application of reduced pressure upon its opposite face.

10 3. A pulp molding machine comprising a pair of coacting dies, means for rotating said dies in opposite directions about spaced, parallel axes into engagement with each other, one of said dies being maintained in a fixed position relative to
 15 its axis of rotation, a support for the other die pivoted on an axis parallel with its axis of rotation, and means for moving said other die about its pivot into parallelism with the first mentioned die, said latter die having an outer face shaped to
 20 conform to one face of the article produced, upon which face the fibres are felted upon the application of reduced pressure upon its opposite face.

25 4. A pulp molding machine comprising a pair of dies, cooperating to form and compress the article produced, the initial forming member thereof including a foraminous plate having its outer face shaped to conform with one side of the article produced, and its opposite face in open
 30 communication with a chamber, means for producing varying pressure conditions in said chamber, means for rotating said dies in opposite directions about spaced, parallel axes into engagement with each other, the space between said
 35 axes being less than the combined maximum distance of each die from its axis, one of said dies being movable towards its axis by the companion die, and a compression spring back of said movable die for yieldingly resisting said movement.

40 5. A pulp molding machine comprising a die, means for rotating said die about an axis in one direction, a support therefor pivoted on an axis parallel with its axis of rotation, a plurality of other dies arranged to be rotated in the other
 45 direction about axes spaced from the first mentioned axis of rotation and from each other into engagement with the first die, and means for moving the first mentioned die about its pivot into parallelism with the other dies.

50 6. A pulp molding machine comprising a vat, a circumferential series of forming dies arranged to rotate about an axis above the vat and to pass through the contents of the vat, a circumferential series of compression dies arranged to coact
 55 with the forming dies at a position remote from the vat, and an air chamber through which the forming dies travel between the vat and the compression dies.

60 7. A pulp molding machine comprising a vat, a circumferential series of forming dies arranged to rotate about an axis above the vat and to pass through the contents of the vat, a circumferential series of compression dies arranged to coact with the forming dies at a position remote from the
 65 vat, and means for passing air through the forming dies while they travel from the vat to the compression dies.

70 8. A pulp molding machine comprising a vat, a circumferential series of forming dies arranged to rotate about an axis above the vat and to pass through the contents of the vat, a circumferential series of compression dies arranged to coact with the forming dies at a position remote from the
 75 vat, an air chamber through which the forming dies travel between the vat and the compression

dies, and means for passing air from the air chamber through the forming dies.

9. A pulp molding machine comprising a vat, a circumferential series of forming dies arranged to rotate about an axis above the vat and to pass
 5 through the contents of the vat, a circumferential series of compression dies arranged to coact with the forming dies at a position remote from the vat, and means for passing air through the compression dies and through the forming dies. 10

10. A pulp molding machine comprising a vat, a circumferential series of forming dies arranged to rotate about an axis above the vat and to pass through the contents of the vat, a circumferential series of compression dies arranged to coact
 15 with the forming dies at a position remote from the vat, means for passing air through the forming dies while they travel from the vat to the compression dies, and means for passing air through the compression dies and through the
 20 forming dies.

11. A pulp molding machine comprising a vat, a circumferential series of forming dies arranged to rotate about an axis above the vat and to pass through the contents of the vat, a circumferential series of compression dies arranged to coact
 25 with the forming dies at a position remote from the vat, an air chamber through which the forming dies travel between the vat and the compression dies, means for passing air from the air chamber through the forming dies, and means for passing air through the compression dies and through the forming dies. 30

12. In a pulp molding machine, a die arranged to compress and hold a formed article, a finishing die and means for applying the finishing die to the article. 35

13. In a pulp molding machine, a die arranged to compress and hold a formed article, a finishing die and means for applying the finishing die to the article under pressure. 40

14. In a continuously operating pulp molding machine, a continuously moving die arranged to hold a formed article, a finishing die and means for rotatively applying the finishing die to the article during the continuous movement of the die and article. 45

15. In a pulp molding machine, a continuously movable die arranged to hold a formed article, a finishing die and means for rotatively applying the finishing die to the article under pressure during the movement of the die. 50

16. In a pulp molding machine, a movable die arranged to hold a formed article, a finishing die, and means for moving the finishing die in a path, a part of which coincides with the path of the first mentioned die. 55

17. In a pulp molding machine, a movable die arranged to hold a formed article, a finishing die, means for moving the finishing die in a path, a part of which coincides with the path of the first mentioned die, and means for rotating the finishing die. 60

18. In a pulp molding machine, a movable die arranged to hold a formed article, a plurality of finishing dies, and means for moving the finishing dies in different paths, a part of each of which coincides with different parts of the path of the first mentioned die. 65

19. In a pulp molding machine, a movable die arranged to hold a formed article, a plurality of finishing dies, means for moving the finishing dies in different paths, a part of each of which coincides with different parts of the path of the 70

first mentioned die, and means for rotating the finishing dies.

20. In a pulp molding machine, a movable die arranged to hold a formed article, a plurality of finishing dies, means for moving the finishing dies in different paths, a part of each of which coincides with different parts of the path of the first mentioned die, and adjustable mountings for the finishing dies whereby they may be moved into and out of operative positions.

21. In a pulp molding machine, a movable die arranged to hold a formed article, a plurality of finishing dies, means for moving the finishing dies in different paths, a part of each of which coincides with different parts of the path of the first mentioned die, means for rotating the finishing dies, and adjustable mountings for the finishing dies whereby they may be moved into and out of operative positions.

22. A pulp molding machine comprising a circumferential series of dies arranged to be rotated around a shaft and to compress and hold formed articles, and a circumferential series of finishing dies arranged to be rotated in the opposite direction around another shaft into engagement with the formed articles.

23. A pulp molding machine comprising a circumferential series of dies arranged to be rotated around a shaft and to hold formed articles, a circumferential series of finishing dies arranged to be rotated in the opposite direction around another shaft into engagement with the formed articles, and means for bringing the holding dies into parallelism with the finishing dies as they approach toward and recede from the finishing dies.

24. A pulp molding machine comprising a circumferential series of dies arranged to be rotated around a shaft and to hold formed articles, a circumferential series of finishing dies arranged to be rotated in the opposite direction around another shaft into engagement with the formed articles, means for rotating the finishing dies around their own axes, and means for maintaining the axes of the holding dies in alinement with the axes of the finishing dies as they approach toward and recede from the finishing dies.

25. A pulp molding machine comprising a movable die arranged to hold a formed article, means for projecting matter onto the article, a finishing die, and means for moving the finishing die in a path, a part of which coincides with a part of the path of the holding die.

26. A pulp molding machine comprising a movable die arranged to hold a formed article, means for momentarily projecting matter onto the article as said die moves through one part of its path, a finishing die, and means for moving the finishing die in a path, a part of which coincides with a part of the path of the holding die beyond the part at which the matter is projected.

27. A pulp molding machine comprising a vat, a circumferential series of forming dies arranged to be rotated about an axis above the vat and to pass through the contents of the vat, a circumferential series of finishing dies arranged to be rotated about another axis, and an interposed circumferential series of compression dies arranged to be rotated into cooperative relations with the forming dies and with the finishing dies.

28. A pulp molding machine comprising a vat, a circumferential series of forming dies arranged to be rotated about an axis above the vat and

to pass through the contents of the vat, said forming dies having a fixed relation to their axis of rotation, a circumferential series of finishing dies arranged to be rotated about another axis, said finishing dies having a fixed relation to their axis of rotation, an interposed circumferential series of compression dies arranged to be rotated into cooperative relations with the forming dies and with the finishing dies, and means for maintaining the compression dies in parallelism with the other dies as they approach toward and recede from them.

29. A pulp molding machine comprising a vat, a circumferential series of forming dies arranged to be rotated about an axis above the vat and to pass through the contents of the vat, a circumferential series of finishing dies arranged to be rotated about another axis, a circumferential series of receiving dies arranged to be rotated about different axes, and an interposed series of compression dies arranged to be moved into cooperative relations with the other dies.

30. A pulp molding machine comprising a vat, a circumferential series of forming dies arranged to be rotated about an axis above the vat and to pass through the contents of the vat, a circumferential series of finishing dies arranged to be rotated about another axis, a circumferential series of receiving dies arranged to be rotated about different axes, all of said dies having fixed relations to their respective axes of rotation, an interposed series of compression dies arranged to be moved into cooperative relations with the other dies, and means for maintaining the compression dies in parallelism with the other dies as they approach toward and recede from them.

31. A pulp molding machine comprising a vat, a circumferential series of forming dies arranged to be rotated about an axis above the vat and to pass through the contents of the vat, a plurality of circumferential series of finishing dies arranged to be rotated about independent axes, adjustable mountings for said finishing dies whereby they may be moved into and out of operative positions, a circumferential series of receiving dies arranged to be rotated about another axis, all of said dies having fixed relations to their respective axes of rotation, an interposed circumferential series of compression dies arranged to be rotated into cooperative relations with the other dies, and means for maintaining the compression dies in parallelism with the other dies as they approach toward and recede from them.

32. A pulp molding machine comprising a vat, a circumferential series of forming dies arranged to be rotated about an axis above the vat and to pass through the contents of the vat, a plurality of circumferential series of finishing dies arranged to be rotated about independent axes, means for rotating the finishing dies about axes transverse to said independent axes, adjustable mountings for said finishing dies whereby they may be moved into and out of operative positions, a circumferential series of receiving dies arranged to be rotated about another axis, all of said dies having fixed relations to their axes of rotation, an interposed circumferential series of compression dies arranged to be rotated into cooperative relations with the other dies, and means for maintaining the compression dies in parallelism with the other dies as they approach toward and recede from them.

33. A pulp molding machine comprising a vat, a circumferential series of forming dies arranged

to be rotated about an axis above the vat and to pass through the contents of the vat, a plurality of circumferential series of finishing dies arranged to be rotated about independent axes, a circumferential series of receiving dies arranged to be rotated about another axis, all of said dies having fixed relations to their respective axes of rotation, an interposed circumferential series of compression dies arranged to be rotated into cooperative relations with the other dies, means for maintaining the compression dies in parallelism with the other dies as they approach toward and recede from them, and means for projecting matter onto articles on the compression dies before they reach the first finishing dies.

34. A pulp molding machine comprising a vat, a circumferential series of forming dies arranged to be rotated about an axis above the vat and to pass through the contents of the vat, a plurality of circumferential series of finishing dies arranged to be rotated about independent axes, means for rotating the finishing dies about axes transverse to said independent axes, adjustable mountings for said finishing dies whereby they may be moved into and out of operative positions, a circumferential series of receiving dies arranged to be rotated about another axis, all of said dies having fixed relations to their axes of rotation, an interposed circumferential series of compression dies arranged to be rotated into cooperative relations with the other dies, means for maintaining the compression dies in parallelism with the other dies as they approach toward and recede from them, and means for projecting matter onto articles on the compression dies before they reach the first finishing dies.

35. In a machine of the character described, a tank, a forming die movable in an orbital path through said tank, a primary extraction die movable in an orbital path adapted to intersect the path of the forming die, and a secondary extraction die movable in an orbital path adapted to intersect the orbital path of the primary extraction die, said dies in moving through said paths being subjected alternately to a suction phase and an expulsion phase, the phases being reversed at the points of intersection of the paths to effect transfer of the molded articles.

36. In apparatus for molding articles from pulp stock, a tank, a forming die having an orbital cycle of movement through said tank, a primary extraction die movable through a cycle disposed in inter-orbital relation to the orbit of the forming die cycle, and a secondary extraction die movable through a cycle disposed in inter-orbital relation to the orbit of the primary extraction cycle, each of said cycles including a suction phase and an expulsion phase successively reversing at their periods of inter-orbital coincidence to effect an inter-cyclic progression of the article through the apparatus.

37. In a machine of the class described, male and female molds, one of which is a forming mold and includes a foraminous plate on the outer face of which the fibres are felted, means for establishing varying pressure conditions on the inner face of said plate, and means for moving said molds in orbital paths so arranged that said paths will intersect and said molds will coact on the felted material to compress and shape the same between the complementary faces of the molds.

38. In a pulp molding machine having a mold which repeatedly travels through a path of revolution, said mold including a foraminous plate

on the outer face of which the pulp is felted and on the inner face of which different pressure conditions obtain during the operation of the machine, the combination therewith of a second travelling mold adapted to coact with said revolving mold through a substantial length of arc of travel, to compress pulp between the mold faces, said second mold being mounted independently of said first mold, and the mountings of the two molds being such that the path of travel of one of them becomes parallel to the path of travel of the other mold, for the said length of travel where they coact, whereby the two said molds there move in unison, and means producing pressure between the molds at said place.

39. In a pulp molding machine having a mold which repeatedly travels through a path of revolution, said mold including a foraminous plate having its outer surface shaped to conform with one side of the article to be produced, and means for establishing different pressure conditions on the opposite side of said plate, the combination therewith of a second mold including a plate, the outer face of which is complementary to the outer face of the first-named plate, said second mold, travelling in an orbit secant to the orbit of said first mold, and being adapted to register with and engage said first mold compressively throughout the distance where the two travel in parallelism.

40. A pulp molding machine comprising a fixed foraminous forming die, suction means effective through said die for depositing a layer of pulp from a liquid pulp mixture on said die, a pivoted foraminous compression die, means for moving said dies through paths which intersect each other for a part of their length and there effect compression of the interposed pulp layer between said dies, means fixed in the path of the compression die and solely effective on said die as said die travels therepast and before the respective die paths intersect each other to move said die angularly about its pivot into co-planar relation with the approaching forming die, means for discontinuing the suction through the forming die and applying suction to the compression die after the pulp layer has been compressed, and means for sending an air blast through the forming die to compel transfer of the compressed pulp layer therefrom to the compression die before said dies depart from co-planar relation.

41. A pulp molding machine comprising a fixed foraminous forming die, suction means effective through said die for depositing a layer of pulp from a liquid pulp mixture on said die, a pivoted foraminous compression die, means for moving said dies through paths which intersect each other for a part of their length and there effect compression of the interposed pulp layer between said dies, means fixed in the path of the compression die and solely effective on said die as said die travels therepast and before the respective die paths intersect each other to move said die angularly about its pivot into co-planar relation with the approaching forming die, and to maintain said die co-planar with the forming die as the planar position of the forming die successively changes and until after said dies have separated from each other, means for discontinuing the suction through the forming die and applying suction to the compression die after the pulp layer has been compressed, and means for sending an air blast through the forming die to compel transfer of the compressed pulp layer

therefrom to the compression die before said dies depart from co-planar relation.

42. In a pulp molding machine, a series of foraminous forming dies rigidly mounted at right angles to a radius of rotation, means for depositing a layer of pulp from a liquid pulp mixture on each of said dies, a series of pivotally mounted foraminous compression dies rotatable about an axis parallel to and spaced from the axis of rotation of said forming dies, means normally maintaining said compression dies postured at right angles to their radius of rotation at a distance sufficient to describe a normal orbit secant to that of the forming dies through a predetermined zone of coaction but effective to swing the compression dies angularly about their pivots into positions of continuous parallelism and alinement with the forming dies as they move through said zone of coaction, means for producing pressure between said dies through said zone of coaction to compress the interposed pulp layer therebetween, said pressure producing means including a resilient means permissive of the radial retreat and advance of said compression dies as the forming dies approach and recede from the line connecting their centers through the zone of coaction, and means for transferring the compressed article from said forming dies to said compression dies before said dies depart from parallelism with each other.

43. A pulp molding machine comprising a supporting frame, a foraminous forming die fixedly mounted on an axis supported by said frame, means for depositing a layer of pulp from a liquid pulp mixture on said die, a pivot rotating about a second axis supported by said frame, a foraminous compression die mounted on said pivot, means for moving said dies through paths which intersect each other for a part of their length and there effect compression of the interposed pulp layer between said dies, means fixed to said frame and disposed about said second axis in the path of travel of said compression die for continuously controlling the angular position of the compression die in its movement about said second axis, and means for compelling the transfer of the compressed pulp layer from the forming die to the compression die before said dies separate from each other.

44. A pulp molding machine comprising a supporting frame, a foraminous forming die fixedly mounted on an axis supported by said frame, means for depositing a layer of pulp from a liquid pulp mixture on said die, a pivot rotating about a second axis supported by said frame, a foraminous compression die mounted on said pivot, means for moving said dies through paths which intersect each other for a part of their length and their effect compression of the interposed pulp layer between said dies, an annular cam track fixed to said frame and disposed about said second axis in the path of travel of said compression die for continuously controlling the angular position of the compression die in its movement about said second axis, and means for compelling the transfer of the compressed pulp layer from the forming die to the compression die before said dies separate from each other.

45. A pulp molding machine comprising a fixed foraminous forming die, means for depositing a layer of pulp from a liquid pulp mixture on said die, a pivoted foraminous compression die, means for moving said dies through paths which intersect each other for a part of their length and there effect compression of the

interposed pulp layer between said dies, means effective before the respective die paths intersect each other to move the compression die angularly about its pivot into co-planar relation with the approaching forming die, and means for compelling transfer of the compressed pulp layer from the forming die to the compression die before said dies depart from co-planar relation.

46. A pulp molding machine comprising a fixed foraminous forming die, means for depositing a layer of pulp from a liquid pulp mixture on said die, a pivoted foraminous compression die, means for moving said dies through paths which intersect each other for a part of their length and there effect compression of the interposed pulp layer between said dies, means effective during the intersection of the respective die paths to maintain said compression die co-planar with the forming die as the planar position of the forming die successively changes and until after said dies have separated from each other, and means for compelling transfer of the compressed pulp layer from the forming die to the compression die before said dies depart from co-planar relation.

47. A pulp molding machine comprising a fixed foraminous forming die, suction means effective through said die for depositing a layer of pulp from a liquid pulp mixture on said die, a pivoted foraminous compression die, means for moving said dies through paths which intersect each other for a part of their length and there effect compression of the interposed pulp layer between said dies, means effective before the respective die paths intersect each other to move the compression die angularly about its pivot into co-planar relation with the approaching forming die and to maintain said compression die co-planar with the forming die as the planar position of the forming die successively changes and until said dies have separated from each other, means for producing pressure between said dies while they are co-planar to compress the interposed pulp layer therebetween, means for discontinuing the suction through the forming die and applying suction to the compression die after the pulp layer has been compressed, and means for sending an air blast through the forming die to compel transfer of the compressed pulp layer therefrom to the compression die before said dies depart from co-planar relation with each other.

48. A pulp molding machine comprising a supporting frame, a shaft rotatably mounted on said frame, a foraminous forming die fixedly mounted on said shaft, means for depositing a layer of pulp from a liquid pulp mixture on said die, a second shaft rotatably mounted on said frame, a foraminous compression die pivotally mounted on said second shaft, means for continuously rotating said shafts in opposite directions through paths which intersect each other for a part of their length and there effect compression of the interposed pulp layer between said dies, means fixed on said frame in the path of travel of said compression die for angularly moving the compression die about its pivot and into co-planar relation with the approaching forming die before the respective die paths intersect each other, and means for transferring the compressed pulp layer from the forming die to the compression die before said dies depart from their co-planar relation.

49. A pulp molding machine comprising a supporting frame, a shaft rotatably mounted on

said frame, a foraminous forming die fixedly mounted on said shaft, means for depositing a layer of pulp from a liquid pulp mixture on said die, a second shaft rotatably mounted on said frame, a foraminous compression die pivotally mounted on said second shaft, means for continuously rotating said shafts in opposite directions through paths which intersect each other for a part of their length and there effect compression of the interposed pulp layer between said dies, means fixed on said frame in the path of travel of said compression die for angularly moving the compression die about its pivot and into co-planar relation with the approaching forming die before the respective die paths intersect each other and for maintaining said dies co-planar during that part of their continued rotation where the pulp layer is compressed between said dies, and means for transferring the compressed pulp layer from the forming die to the compression die before said dies depart from their co-planar relation.

50. A pulp molding machine comprising a vat adapted to contain liquid pulp mixture, a circumferential series of fixedly mounted foraminous forming dies rotatable in one direction about an axis positioned to cause said forming dies successively to pass through said liquid pulp mixture, means for applying suction to each forming die during its passage through the liquid pulp mixture to deposit a layer of pulp thereon and for maintaining said suction until said forming dies are completely inverted and the liquid drawn off by gravity and said suction, a circumferential series of pivotally mounted foraminous compression dies rotatable in the opposite direction about an axis spaced from said first named axis into successive compressing relations with successive forming dies after such inversion of said forming dies, means acting on each compression die before the forming and compression dies are rotated into compressive relation with each other for positively moving each compression die angularly about its pivot into co-planar relation to an approaching forming die, means for releasing the suction upon said forming dies after the pulp layers have been compressed, and means operable thereafter for supplying air under pressure to such forming dies and suction to said compression dies to compel the transfer of the compressed articles from the forming dies to the compression dies before the dies depart from co-planar relation and to cause the compressed articles to be thereafter retained on the compression dies.

51. A pulp molding machine comprising a vat adapted to contain liquid pulp mixture, a circumferential series of fixedly mounted foraminous forming dies rotatable in one direction about an axis positioned to cause said forming dies successively to pass through said liquid pulp mixture, means for applying suction to each forming die during its passage through the liquid pulp mixture to deposit a layer of pulp thereon and for maintaining said suction until said forming dies are completely inverted and the liquid drawn off by gravity and said suction, a circumferential series of pivotally mounted foraminous compression dies rotatable in the opposite direction about an axis into successive compressing relations with successive forming dies after such inversion of said forming dies, means acting on each compression die before the forming and compression dies are rotated into compressive relation with each other for

positively moving each compression die angularly about its pivot into co-planar relation with an approaching forming die and for maintaining said dies co-planar as the planar positions of the forming die successively changes and until after said dies have separated from each other, means for releasing the suction upon said forming dies when the pulp layers have been compressed, and means operable thereafter for supplying air under pressure to such forming dies and suction to said compression dies to compel the transfer of the compressed articles from the forming dies to the compression dies before the dies depart from co-planar relation and to cause the compressed articles to be thereafter retained on the compression dies.

52. A pulp molding machine comprising a forming die shaft, a die carrier thereon, a circumferential series of foraminous forming dies rigidly mounted upon said die carrier, means to deposit a layer of pulp from a liquid pulp mixture on each die, a compression die shaft parallel to said forming die shaft, a die carrier on said compression die shaft, a circumferential series of foraminous compression dies pivotally mounted on said compression die carrier, means for rotating said shafts in opposite directions through paths of movement which intersect each other for a part of their length and there effect compression of the interposed pulp layers between said dies, means for moving the compression dies angularly about their pivots successively into alinement and parallelism with the forming dies before the respective die paths intersect each other, and means to compel transfer of the compressed pulp layers from the forming dies to the compression dies before said dies depart from alined parallel relations.

53. A pulp molding machine comprising a forming die shaft, a die carrier thereon, a circumferential series of foraminous forming dies rigidly mounted upon said die carrier, means to deposit a layer of pulp from a liquid pulp mixture on each die, a compression die shaft parallel to said forming die shaft, a die carrier on said compression die shaft, a circumferential series of foraminous compression dies fewer in number than said forming dies, and pivotally mounted on said compression die carrier, means for rotating said shafts in opposite directions but at different axial speeds through paths of movement which intersect each other for a part of their length and there effect compression of the interposed pulp layers between said dies, means for moving the compression dies angularly about their pivots successively into alinement and parallelism with the forming dies before the respective die paths intersect each other so that said dies travel together at the same effective rate of linear speed during the distance of path intersection, and means to compel transfer of the compressed pulp layers from the forming dies to the compression dies before said dies depart from alined parallel relations.

54. A pulp molding machine comprising a forming die shaft, a die carrier thereon, a circumferential series of foraminous forming dies rigidly mounted upon said die carrier, means to deposit a layer of pulp from a liquid pulp mixture on each die, a compression die shaft parallel to said forming die shaft, a die carrier on said compression die shaft, a circumferential series of foraminous compression dies pivotally mounted on said compression die carrier by a pivotal connection which fixes the dies against circumfer-

ential movement relative to the carrier but permits them to move radially relative thereto, means for rotating said shafts in opposite directions through paths of movement which intersect each other for a part of their length and there effect compression of the interposed pulp layers between said dies, means for moving the compression dies angularly about their pivots successively into alinement and parallelism with the forming dies before the respective die paths intersect each other, and means to compel transfer of the compressed pulp layers from the forming dies to the compression dies before said dies depart from alined parallel relations.

55. A pulp molding machine comprising a forming die shaft, a die carrier thereon, a circumferential series of foraminous forming dies rigidly mounted upon said die carrier, means to deposit a layer of pulp from a liquid pulp mixture on each die, a compression die shaft parallel to said forming die shaft, a die carrier on said compression die shaft, a circumferential series of foraminous compression dies pivotally mounted on said compression die carrier by a pivotal connection which permits them to move radially relative to their die carrier, means for rotating said shafts in opposite directions through paths of movement which intersect each other for a part of their length and there effect compression of the interposed pulp layers between said dies, means for moving the compression dies angularly about their pivots successively into alinement and parallelism with the forming dies before the respective die paths intersect each other, a compression spring associated with each compression die and yieldingly resistant to the radial movement of said die in one direction, the connections between said forming and compression dies and their shafts constituting means for imparting a toggle action on said springs, and means to compel transfer of the compressed pulp layers from the forming dies to the compression dies before said dies depart from alined parallel relations.

56. A pulp molding machine comprising a foraminous pulp forming die rotating about an axis and fixed relative thereto, a foraminous compression die movable about a pivot rotating about a second axis at uniform angular speed, means for depositing on the forming die a layer of pulp, means for changing the speed of the compression die and its angular relation and alinement relative to its axis of rotation to conform for an appreciable arc of travel to the speed and arc of rotation of the forming die, means for compressing the pulp layer between said dies, and means for transferring the compressed article from the forming die to the compression die.

57. A pulp molding machine comprising a vat containing a liquid pulp mixture, a series of foraminous forming dies traveling in a continuous path about one axis through said liquid pulp mixture, suction means for depositing a layer of pulp on said forming dies, a series of foraminous compression dies fewer in number than that of said forming dies traveling about a second axis in a curved path intersecting the path of said forming dies, means for driving the respective series of forming and compressing dies at such different rates of axial speed as to cause successive compression dies to cooperate with successive forming dies, and means acting upon said compression dies to establish and maintain parallelism of said compression and forming dies and the same effective rate of linear speed throughout the secant of intersection.

58. A pulp molding machine comprising a set of pivotally mounted foraminous compression dies, a shaft carrying said dies and rotatable in one direction, a set of foraminous forming dies and a set of foraminous receiving dies, shafts carrying said forming and receiving dies and respectively rotatable in directions opposite to the direction of rotation of the compression dies to bring the forming and receiving dies successively into coactive relations with the compression dies, means for depositing a layer of pulp from a liquid pulp mixture on each forming die, means to move said compression dies angularly about their pivots into co-planar positions successively with the approaching forming and receiving dies, means for producing pressure between said forming and compression dies while said dies are co-planar to compress the interposed pulp article therebetween, and means for transferring the compressed pulp articles first from the forming dies to the compression dies before said dies depart from co-planar relation and thereafter from the compression dies to the receiving dies before said dies depart from co-planar relation.

59. A pulp molding machine comprising a set of pivotally mounted foraminous compression dies, a shaft carrying said dies and rotatable in one direction, a set of foraminous forming dies and a set of foraminous receiving dies, shafts carrying said forming and receiving dies and respectively rotatable in directions opposite to the direction of rotation of the compression dies to bring the forming and receiving dies successively into coactive relations with the compression dies, means for depositing a layer of pulp from a liquid pulp mixture on each forming die, means to move said compression dies angularly about their pivots into co-planar positions successively with the approaching forming and receiving dies and to maintain said compression dies co-planar with the respective forming and receiving dies as the planar positions of said dies successively change and until after the compression dies have separated from the forming and receiving dies, means for producing pressure between said forming and compression dies while said dies are co-planar to compress the interposed pulp article therebetween, and means for transferring the compressed pulp articles first from the forming dies to the compression dies before said dies depart from co-planar relation and thereafter from the compression dies to the receiving dies before said dies depart from co-planar relation.

60. A pulp molding machine comprising a set of pivotally mounted foraminous compression dies, a shaft carrying said dies and rotatable in one direction, a set of foraminous forming dies and a set of foraminous receiving dies, shafts carrying said forming and receiving dies and respectively rotatable in directions opposite to the direction of rotation of the compression dies to bring the forming and receiving dies successively into coactive relations with the compression dies, an annular cam track disposed about the compression dies between them and the forming and receiving dies and having projected portions spaced apart from each other and successively active on said compression dies as they are rotated therepast for moving said compression dies angularly about their pivots into co-planar positions successively with the approaching forming and receiving dies, means for producing pressure between said forming and compression dies while said dies are co-planar to compress the

interposed pulp article therebetween, and means for transferring the compressed pulp articles first from the forming dies to the compression dies before said dies depart from co-planar relation and thereafter from the compression dies to the receiving dies before said dies depart from co-planar relation.

61. A pulp molding machine comprising a set of pivotally mounted foraminous compression dies conforming in shape and size to one side of the desired molded pulp article, a shaft carrying said dies and rotatable in one direction, a set of foraminous forming dies conforming in shape and size to the other side of the molded pulp article and a set of foraminous receiving dies conforming in shape and size to the forming die side of the molded pulp article, shafts carrying said forming and receiving dies and respectively rotatable in directions opposite to the direction of rotation of the compression dies to bring the forming and receiving dies successively into co-active relations with the compression dies, means for moving said compression dies angularly about their pivots into co-planar positions successively with the approaching forming and receiving dies, means for producing pressure between said forming and compression dies while said dies are co-planar to compress the interposed pulp article therebetween, and means for transferring the compressed pulp articles first from the forming dies to the compression dies before said dies depart from co-planar relation and thereafter from the compression dies to the receiving dies before said dies depart from co-planar relation.

62. A pulp molding machine comprising a forming die shaft, a circumferential series of foraminous forming dies mounted upon said shaft, means for depositing a layer of pulp from a liquid pulp mixture on each die, a compression die shaft, a circumferential series of foraminous compression dies mounted on said compression die shaft, a receiving die shaft, a circumferential series of foraminous receiving dies mounted on said receiving die shaft, the said several shafts being parallel to each other and so positioned as to cause the path of movement of the compression dies successively to intersect the paths of movement of the forming and receiving dies, a gear upon the compression die shaft and gears upon the respective forming and receiving die shafts each directly meshing with the gear upon the compression die shaft, means for actuating one of said means, and pneumatically operable means respectively operable to transfer the layers of pulp from the forming dies to the compression dies and from the compression dies to the receiving dies and to release the molded articles from the receiving dies.

63. A pulp molding machine comprising a forming die shaft, a circumferential series of foraminous forming dies mounted upon said shaft, means for depositing a layer of pulp, a liquid pulp mixture on each die, a compression die shaft, a circumferential series of foraminous compression dies mounted on said compression die shaft, a receiving die shaft, a circumferential series of foraminous receiving dies mounted on said receiving die shaft, the said several shafts being parallel to each other and so positioned as to cause the path of movement of the compression dies successively to intersect the paths of movement of the forming and receiving dies, a gear upon the compression die shaft and gears upon the respective forming and receiving die shafts each directly meshing with the gear upon

the compression die shaft, means for actuating one of said gears, means for moving the compression dies into alinement and parallelism successively with the forming dies and the receiving dies before the respective die paths intersect each other, and pneumatically operable means respectively operable to transfer the layers of pulp from the forming dies to the compression dies and from the compression dies to the receiving dies and to release the molded articles from the receiving dies.

64. A pulp molding machine comprising a set of pivotally mounted foraminous compression dies adapted each to compress, receive and hold a molded pulp article, a shaft carrying said dies and rotatable in one direction, a set of foraminous receiving dies, a shaft parallel to said compression die shaft and carrying said receiving dies and rotatable in a direction opposite to the direction of rotation of the compression dies to bring the receiving dies into coactive relation with the compression dies, means to move said compression dies angularly about their pivots into co-planar positions with the approaching receiving dies, and means for effecting transfer of the compressed pulp articles from the compression dies to the receiving dies before said dies depart from co-planar relation.

65. A pulp molding machine comprising a set of pivotally mounted foraminous compression dies adapted each to compress, receive and hold a molded pulp article, a shaft carrying said dies and rotatable in one direction, a set of foraminous receiving dies, a shaft parallel to said compression die shaft and carrying said receiving dies and rotatable in a direction opposite to the direction of rotation of the compression dies to bring the receiving dies into coactive relation with the compression dies, means to move said compression dies angularly about their pivots into co-planar positions with the approaching receiving dies and to maintain said compression dies co-planar with the receiving dies as the planar positions of the receiving dies change and until after the dies have separated from each other, and means for effecting transfer of the compressed pulp articles from the compression dies to the receiving dies before said dies depart from co-planar relation.

66. A pulp molding machine comprising two die carriers movable in paths which intersect each other for a substantial distance of travel, a foraminous forming die fixedly mounted on one of said die carriers, means for depositing a layer of pulp from a liquid pulp mixture on said forming die, a pivot mounted on the other die carrier and yieldable radially relative thereto, a toggle arm on said pivot and having a cam roll, a foraminous compression die mounted on said toggle arm, a compression spring acting upon said compression die and yieldingly resistant to the radial movement of said pivot in one direction, a fixed cam track acting upon said cam roll to move and maintain said compression die angularly about its pivot in parallelism and alinement with the forming die while said dies are moving towards each other to compress the interposed layer of pulp therebetween, and means to effect transfer of the compressed article from the forming die to the compression die while said dies are in alined parallel relation.

67. A pulp molding machine comprising two die carriers movable in paths which intersect each other for a substantial distance of travel, a foraminous forming die fixedly mounted on

one of said die carriers, means for depositing a layer of pulp from a liquid pulp mixture on said forming die, the other carrier including a toggle comprising a pair of toggle arms having a pivotal connection with each other such that one may move radially with reference to the other, a cam roll and a foraminous compression die carried by one of said toggle arms, a compression spring associated with the other toggle arm and yieldingly resistant to the radial movement in one direction of said movable toggle arm, a fixed cam track acting upon said cam roll to move and maintain said compression die angularly about its pivot in parallelism and alinement with the forming die while said dies are moving towards each other to compress the interposed layer of pulp therebetween, and means to effect transfer of the compressed article from the forming die to the compression die while said dies are in alined parallel relation.

68. In a machine for producing from a dilute mixture of fibre and water a compacted fibre plate or analogous article having a central area and a rim disposed at an angle thereto, a tank containing said mixture, a die member including a foraminous plate having its outer face shaped to conform to one side of the article to be produced and its inner face in open communication with a chamber in which different pressure conditions obtain during the operation of the machine, means for producing such pressure conditions, mechanism for supporting said die and for rotating it around and around in a circular path a part of which passes through the tank and causes the submergence of the die member in the mixture, the face of said foraminous plate being disposed perpendicular to a line radiating from the axis of rotation of the die member and intersecting the axis of the plate, and a companion die member, means for supporting and rotating said companion die member in synchronism with the first die member about an independent axis, the second die member during a major portion of its rotation traveling in a path concentric to the second named axis and during a minor but substantial part of its rotation traveling in a path concentric to the first named axis, the axes aforesaid being relatively so spaced apart that during the period that the two die members are traveling concentric to the first named axis they will be in juxtaposition and when they intersect a common line radially to said axes they will be in sufficiently close juxtaposition to apply the requisite pressure to compact the initially formed article, the supporting means for the second member including an outer section carrying at its outer end the said second die member and pivotally connected at its inner end to the inner section of the supporting means, and mechanism acting automatically during the travel of the second die member to swing said outer section on its pivot for bringing the face of the second die

member into registration and parallelism with the complementary face of the first die member and maintain said relation during a substantial portion of the travel of the two die members in a path concentric to the said first named axis.

69. In a machine for producing from a dilute mixture of fibre and water a compacted fibre plate or analogous article having a central area and a rim disposed at an angle thereto, a tank containing said mixture, a die member including a foraminous plate having its outer face shaped to conform to one side of the article to be produced and its inner face in open communication with a chamber in which different pressure conditions obtain during the operation of the machine, means for producing such pressure conditions, mechanism for supporting said die and for rotating it around and around in a circular path a part of which passes through the tank and causes the submergence of the die member in the mixture, the face of said foraminous plate being disposed perpendicular to a line radiating from the axis of rotation of the die member and intersecting the axis of the plate, and a companion die member having a surface complementary to the outer face of said plate, means independent of the supporting means of the first die member for supporting said companion die member for movement about an axis spaced apart from and parallel with the axis about which the first named die member rotates, and means for shifting the companion die member whereby it will be moved into juxtaposition to the first named die member and will travel concentric therewith during its juxtaposed position and subject the article to compression and will thereafter move out of said juxtaposed position.

70. A machine for transforming a dilute water fibre mixture into individually shaped articles, comprising a tank containing the mixture, a forming die rotating about a fixed axis through said tank and including a foraminous plate having an outer face shaped to conform to one face of the article produced, upon which face the fibres are felted upon the application of reduced pressure upon its opposite face, means for producing varying pressure conditions on said opposite face during the operation of the machine, a compression die of complementary shape to the forming die and rotatable about an axis which is parallel and adjacent to said fixed axis, and means effective after the forming die has emerged from the tank for causing said compression die to assume a position wherein it will conform for a limited distance to the speed and arc of rotation of the forming die so as to travel in unison therewith during such limited distance and with its face coplanar and in register with the face of the forming die to thereby compress the interposed layer of felted fibres substantially uniformly over their entire surface.

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