April 16, 1929. M. P. CHAPLIN 1,709,338

PULP MOLDING MACHINE

Filed Oct. 11, 1926 3 Sheets-Sheet 1

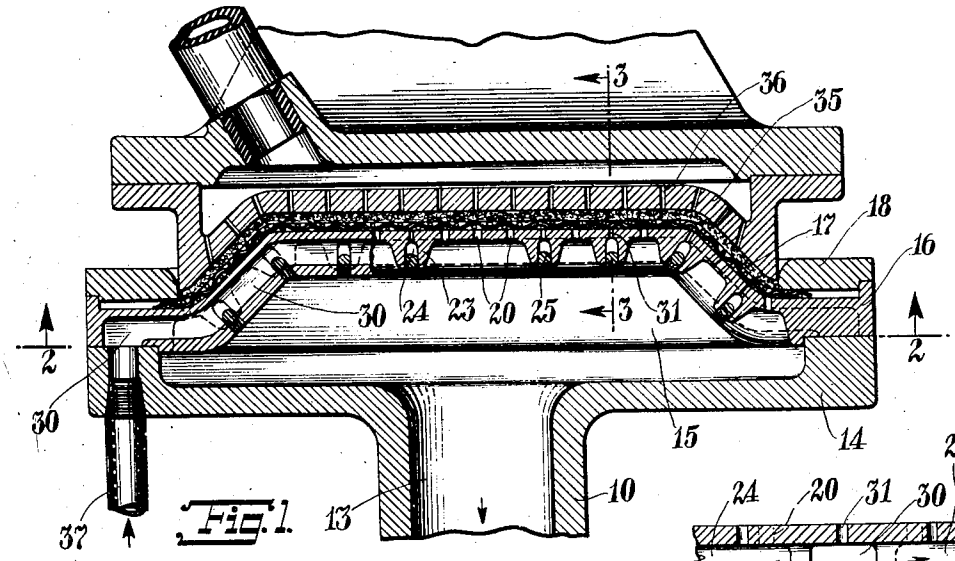

Fig. 1.

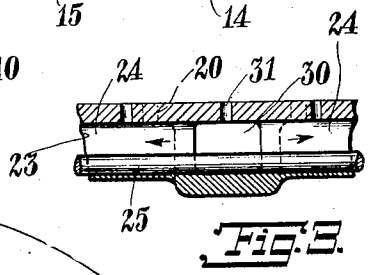

Fig. 3.

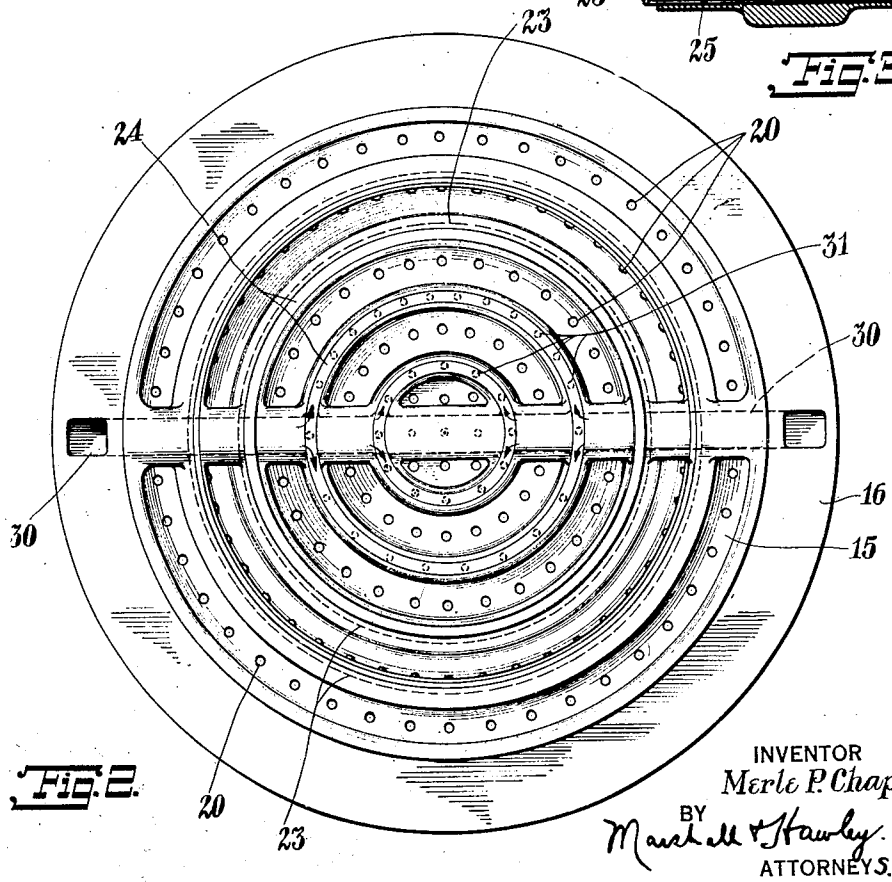

Fig. 2.

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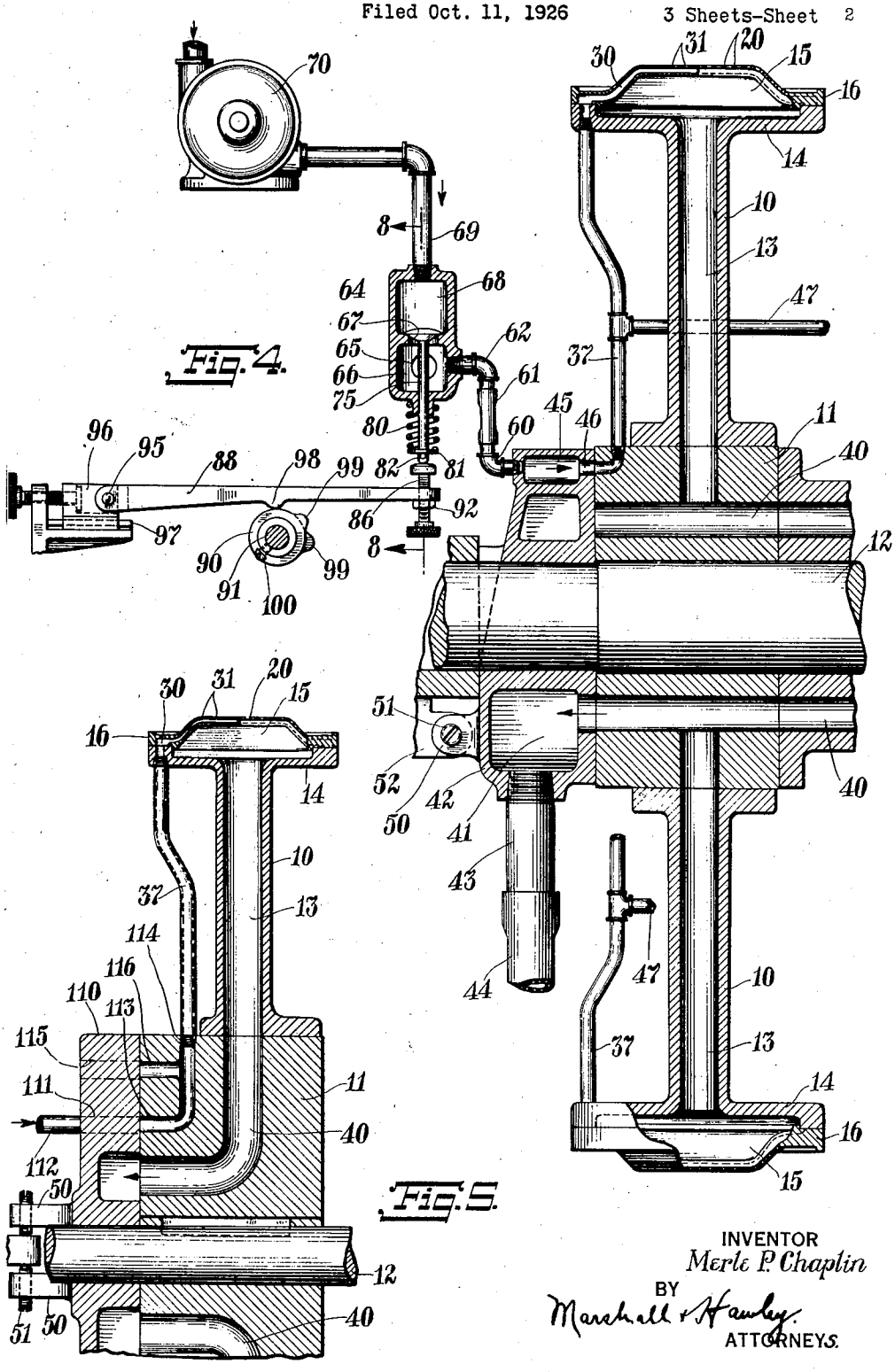

Fig. 4.

Fig. 5.

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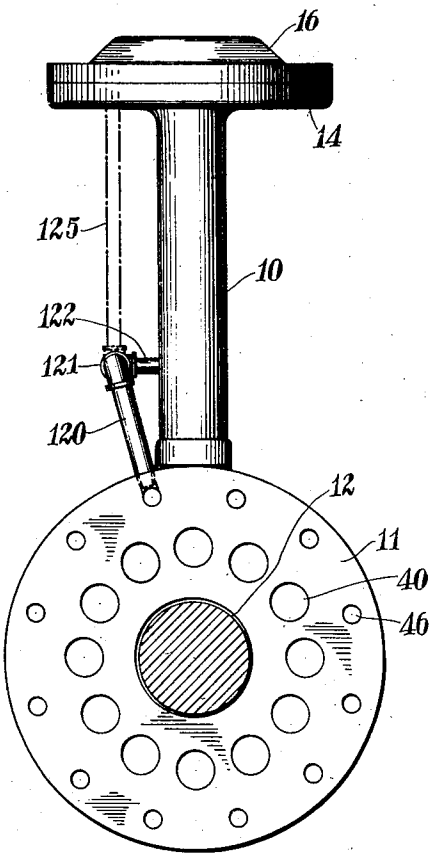

Fig. 7.

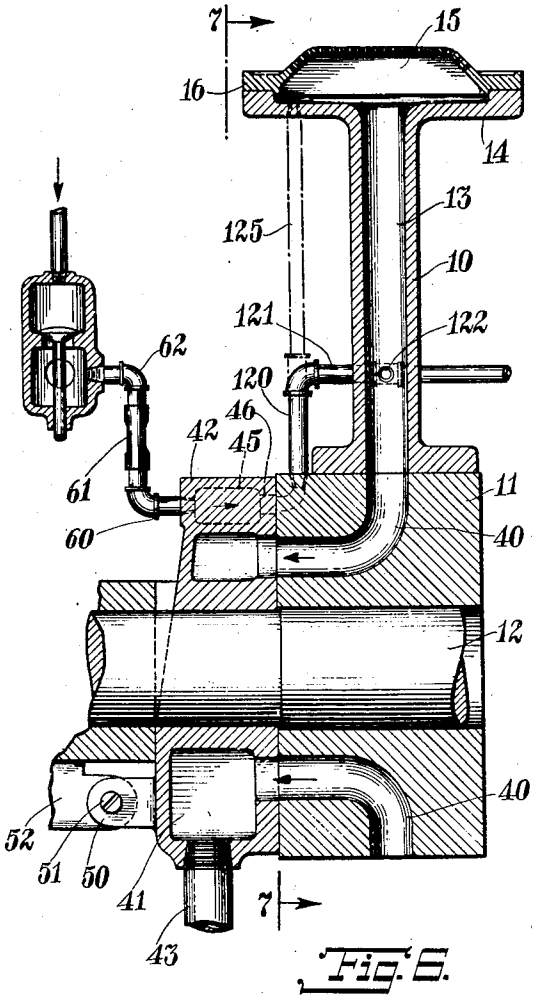

Fig. 6.

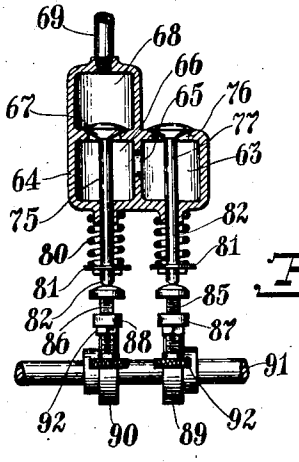

Fig. 8.

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UNITED STATES PATENT OFFICE.

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PULP-MOLDING MACHINE.

Application filed October 11, 1926. Serial No. 140,716.

This invention relates to pulp molding machines.

In the type of pulp molding machine to which the invention relates, forming dies are passed through a vat containing a pulp solution and the pulp is caused to adhere to the dies by suction.

It is most desirable that as much of the liquid as possible be removed from the pulp on the forming dies before the article is transferred to the compression dies or other devices.

This invention has for its salient object, therefore, to provide forming dies and air and suction control mechanism therefor so constructed and arranged as to remove a large part of the moisture or liquid from the molded article on the dies prior to the transfer of the article or removal of the article from the forming dies.

Another object of the invention is to provide air and suction control mechanism for forming dies of a pulp molding machine so constructed and arranged that the admission of air to the dies and exhaust of air from the dies can be regulated both as to duration and as to timing.

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 an enlarged sectional elevation illustrating the construction of a forming die;

Fig. 2 is a bottom plan view of the die shown in Fig. 1, looking in the direction of arrows 2—2.

Fig. 3 is a sectional elevation taken substantially on line 3—3 of Fig. 2;

Fig. 4 is a sectional elevation showing dies constructed in the manner shown in Fig. 1 in conjunction with valve control mechanism;

Fig. 5 is a sectional elevation similar to Fig. 4, but showing another form of construction embodying the invention;

Fig. 6 is a sectional elevation similar to Fig. 4, but showing another embodiment of the invention;

Fig. 7 is an elevational view taken substantially on line 7—7 of Fig. 6; and

Fig. 8 is a sectional elevation taken substantially on line 8—8 of Fig. 4.

The invention briefly described consists in one embodiment of a compression die having two sets of openings therethrough, one set communicating with a conduit adapted to receive air and the other set communicating with the chamber in the head of the die which in turn communicates with a suction conduit. The compression die preferably has a screen of wire mesh positioned thereover and by suitable control mechanism, air is introduced through one set of openings simultaneously with the creation of suction through the other set of openings. The timing of the suction is controlled by an adjustable control casing and this casing also controls the timing of the air admission. Furthermore, the air admission is controlled by valves and the timing and duration of opening of the valves is adjustably controlled by suitable mechanism. With the ordinary forming die, the suction for removing liquid from the pulp on the die becomes practically inoperative when the forming die is engaged by the compression die since circulation of air through the pulp and die is prevented. This difficulty is overcome in the present invention by introducing air through the forming die simultaneously with the operation of the suction through the die.

Various novel features are incorporated in the forming dies and air and suction control mechanism and these will be brought out in more detail in the following specification.

Forming dies.

In the construction of forming die shown in Figs. 1 to 5 inclusive, it will be seen that the dies are mounted on the outer ends of radial arms 10 carried by a hub 11 mounted on a shaft 12. The arms 10 are hollow as shown at 13 and have heads 14 on their outer ends which form with the dies, chambers 15. The dies 16 are secured to the heads 14 and each die has a screen 17 of wire mesh secured to its outer surface in any suitable manner as by a ring 18.

Each of the dies has a plurality of openings 20 therethrough communicating with the chamber 15. Each die also has formed in its under surface a plurality of circular ribs 23, each rib having a circular groove 24 therein. The grooves are closed at their outer ends in any suitable manner as by rings which

are preferably driven into the grooves and the edges of the ribs may be peened over the rings. There are thus formed in the ribs, circular conduits which communicate with an air conduit 30 which extends diametrically across the forming die as shown in Fig. 2.

The surface of the die has extending therethrough a plurality of sets of openings 31 which as shown in Figs. 1, 2 and 3 communicate with the circular conduits in the ribs 23.

In Fig. 1 a compression die 35 is illustrated as superimposed on the forming die. The compression die may be of any suitable construction and is shown as having openings 36 therethrough.

Suitable control mechanism hereinafter described is provided for creating suction in the hollow arms 10 and chamber 15 and as air is sucked from this chamber, the suction will be communicated through the openings 20 to the pulp film or article on the forming die. The conduit 30 receives air under atmospheric pressure or higher pressure through a conduit 37 and as air is introduced into the conduit 30, this air will be forced through the concentric conduits and openings 31, and between the screen 17 and the face of the die 16.

Air and suction control mechanism.

In the embodiment of the invention shown in Figs. 1 to 4 inclusive, it will be seen that the conduit 13 formed in the hollow arms 10 communicates at its inner end with a conduit 40 which in turn is adapted to communicate with a suction chamber 41 formed in a control casing 42 mounted on the shaft 12 and abutting against the hub 11. A conduit 43 is connected to the control casing and communicates with the suction chamber 41 and conduit 43 is connected preferably by a flexible connecting pipe 44 to any suitable source of suction, such as a suction pump.

The control casing 42 also has a chamber 45 formed therein and adapted to communicate through a port 46 with the conduit 37. A conduit 47 extends laterally from the conduit 37 and may be connected to a corresponding conduit 37 of another set of forming dies.

The control casing 42 is adjustably mounted on the shaft 12 so that the timing of the admission of suction and air to the die can be regulated. In the form of the invention shown, the casing has a pair of lugs 50, each lug having a set screw 51 and a stationary lug 52 is disposed between the set screws 51. In order to adjust the timing of the suction and air admission, one of the set screws 51 will be turned in one direction and the other set screw will be turned in the opposite direction, thus rotating the casting 42 on the shaft.

The air chamber 45 in the control casing 42 receives air under atmospheric pressure or under compression through a conduit 60 connected by a flexible coupling 61 to a conduit 62 which in turn communicates with a chamber 63 in a casing 64. Chamber 63 communicates through a port 65 with a chamber 66 which in turn communicates through a valve control port 67 with a chamber 68. A conduit 69 is connected to the casing 64 and communicates with the chamber 68, the other end of the conduit being connected to the compression side of a compression pump 70. The port 67 between the chambers 66 and 68 is controlled by a poppet valve 75. Chamber 63 has a port 76 communicating with the atmosphere and this port is also controlled by a poppet valve 77.

Each of the valves 75 and 77 is normally seated by a spring 80 positioned between the valve casing and a washer 81 carried by the valve stem 82.

The poppet valves 75 and 77 are controlled by adjustable tappets 85 and 86 mounted in the outer ends of levers 87 and 88. The levers 87 and 88 are operated by cams 89 and 90 carried by a cam shaft 91. Tappets 85 and 86 are threaded into the outer ends of the levers 87 and 88 and are vertically adjustable therein. Lock nuts 92 secure the tappets in adjusted position.

Each of the levers 87, 88 is pivoted at 95 to a block 96 which is slidably mounted on a base 97. Each lever also has a protuberance 98 formed thereon and adapted to be engaged by the cam extensions 99 whereby the levers are operated.

The timing of the cams can be regulated by loosening set screws 100 which secure the cams to the cam shaft and by rotating the cams to the desired position on the shaft. Furthermore, the timing of the valves can be regulated by independently adjusting the lever pivot blocks 96 on their bases 97. Also, the duration of opening of the valves can be regulated by vertically adjusting the tappets in the outer ends of the levers. It will thus be seen that the timing of the air admission and of the compressed air admission and also the duration of admission can be easily controlled and regulated.

Fig. 5 illustrates the same type of forming die as that shown in Figs. 1 to 4 inclusive. In this embodiment of the invention, however, the control casing 110 has a compressed air chamber 111 adapted to receive compressed air through a conduit 112 from any suitable source and communicating with a conduit 113 in the hub 11. The conduit 113 is extended upwardly as shown at 114 and communicates with the conduit 37.

The control casing 110 also has formed therein a plurality of openings 115 adapted to communicate with conduits 116 in the hub 11 and conduits 116 communicate at their inner ends with the conduit 114. Thus when the openings 115 register with the conduit 116, atmospheric air is permitted to enter the

conduit 37 and when the chambers 111 communicate with the conduit 113, compressed air enters the conduit 37.

The control casing 110 is adjustable in the same manner as that illustrated in Fig. 1 and by adjusting this casing, the timing of the admission of air and of the creation of suction in the compression dies is regulated.

Figs. 6 and 7 illustrate a slightly different embodiment of the invention. In this embodiment, the control casing 42 is constructed in the same manner as that shown in Fig. 4 and the admission of atmospheric air and compressed air through the conduit 60 is controlled and regulated as shown in Fig. 4. In Fig. 6, however, the conduit 120 carried by the hub 11 and communicating with the compressed air chamber 45 is connected by a pipe 121 and branch conduit 122 to the arm 10. The conduit 122 communicates with the hollow conduit 13 formed by the arm and thus the compressed air is introduced into the same conduit through which suction is created.

If desired, the conduit 120 may be connected by a conduit 125 shown in dot and dash lines in Fig. 6 to the chamber 15 formed in the compression die head.

Operation of device shown in Figs. 1 to 4.

The device shown in Figs. 1 to 4 is preferably operated in the following manner. During the passage of the forming dies through the pulp solution in the vat, liquid will be drawn through the screen and through the dies by means of suction through the hollow arms by which the dies are carried. This will cause a film or layer of pulp to be deposited on the screen and dies. After a die leaves the vat, the suction will be continued and air will be drawn through the pulp film but as soon as the compression die comes into contact with the film of pulp, the air circulation through the pulp practically ceases. In order to maintain the circulation of air through the die and to remove as much as possible of the liquid or moisture in the pulp, air under atmospheric pressure is then introduced through the passage 30 and concentric conduits and openings 31. The admission of air thus maintains the circulation through the screen and openings 20 so that practically all of the free moisture or liquid will be removed from the molded article and will not be blown back into the article when compressed air is introduced to discharge the article from the forming die onto the compression die. When the article has been compressed, compressed air is introduced through the conduit 37, passage 30, concentric conduits and openings 31. At the same time suction will be created in the compression die and the article will be transferred from the forming die to the compression die.

The device shown in Figs. 6 and 7 operates in a slightly different manner in that the air is introduced into the suction conduit instead of being introduced into the compression die through separate conduits. In this form of the invention, the introduction of air into the suction conduit tends to assist in the removal of liquid in this conduit prior to the introduction of compressed air therein. In other words, when the conduit 122 which communicates with the interior 13 of the hollow arm 10 communicates with the atmosphere through the connecting conduits, the suction through the arm will remove any free liquid therefrom. Thereafter the conduit 122 receives compressed air which is forced through the hollow arm into the chamber 15 and transfers the molded article from the forming die to the compression die.

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 forming die comprising a head having a chamber therein, a die secured to said head and having two sets of perforations therein, one set communicating with said chamber and a conduit communicating with the other set of perforations.

2. In a pulp molding machine, a forming die comprising a head having a chamber therein, a die secured to said head and having two sets of perforations therein, one set communicating with said chamber, a conduit communicating with the other set of perforations, means for exhausting air from said chamber and means for forcing compressed air into said conduit.

3. In a pulp molding machine, a forming die comprising a head having a chamber therein, a die secured to said head and having two sets of perforations therein, one set communicating with said chamber, a conduit communicating with the other set of perforations, means for exhausting air from said chamber and means for introducing air to said conduit, said last named means including a valve chamber, a port therein communicating with the atmosphere, a second port communicating with a source of compressed air, a conduit connecting said valve chamber to said first named conduit, and valves for controlling said ports.

4. In a pulp molding machine, a forming die comprising a head having a chamber therein, a die secured to said head and having two sets of perforations therein, one set communicating with said chamber, a conduit

communicating wth the other set of perforations, means for exhausting air from said chamber and means for introducing air to said conduit, said last named means including a valve chamber, a port therein communicating with the atmosphere, a second port communicating with a source of compressed air, a conduit connecting said valve chamber to said first named conduit, valves for controlling said ports, and adjustable operating means for the valves.

5. In a pulp molding machine, a forming die comprising a head having a chamber therein, a die secured to said head and having two sets of perforations therein, one set communicating with said chamber, a conduit communicating with the other set of perforations, means for exhausting air from said chamber and means for introducing air to said conduit, said last named means including a valve chamber, a port therein communicating with the atmosphere, a second port communicating with a source of compressed air, a conduit connecting said valve chamber to said first named conduit, valves for controlling said ports, and adjustable operating means for the valves, said operating means being adjustable to vary the timing and duration of opening of said valves.

6. A pulp forming die, two sets of chambers in said die, openings in the die communicating with said chambers, means for exhausting one chamber and means for admitting air to the other chamber.

7. A pulp forming die, two sets of chambers in said die, openings in the die communicating with said chambers, means for exhausting one chamber, means for admitting air to the other chamber, and means for controlling the timing of exhaust and air admission to said chambers.

8. A pulp forming die, two sets of chambers in said die, openings in the die communicating with said chambers, means for exhausting one chamber, means for admitting air to the other chamber, and means for controlling the timing of exhaust and the timing and duration of the air admission to said chambers.

9. In a pulp molding machine, a rotatable hub, a plurality of arms carried thereby, heads on said arms, pulp foming dies on said heads, means for creating suction through said dies during a portion of the cycle of operation thereof, means for admitting air through said dies when said suction creating means is operating, and means for varying the time of admission of air and the timing of the suction creating portion of the cycle.

10. In a pulp molding machine, a forming die adapted to receive a film of pulp and form thereon a molded article, suction ports in said die and air admission ports in said die, means for creating suction through the suction ports and means for admitting air to said air ports.

11. In a pulp molding machine, a forming die adapted to receive a film of pulp and form thereon a molded article, suction ports in said die and air admission ports in said die, means for creating suction through the suction ports and means for forcing compressed air through said air ports.

12. In a pulp molding machine, a forming die adapted to receive a film of pulp and form thereon a molded article, suction ports in said die and air admission ports in said die, means for creating suction through the suction ports and means for simultaneously admitting air to said air ports.

13. In a pulp molding machine, a forming die adapted to receive a film of pulp and form thereon a molded article, suction ports in said die and air admission ports in said die, means for creating suction through the suction ports and means for simultaneously forcing compressed air through said air ports.

14. In a pulp molding machine, a forming die adapted to receive a film of pulp and form thereon a molded article, suction ports in said die and air admission ports in said die, means for creating suction through the suction ports, means for admitting air to said air ports, and means for regulating the timing of the suction and air admission.

15. In a pulp molding machine, a forming die adapted to receive a film of pulp and form thereon a molded article, suction ports in said die and air admission ports in said die, means for creating suction through the suction ports, means for admitting air to said air ports, and means for regulating the timing of the suction and air admission and the duration of the air admission.

16. In a pulp molding machine, a forming die adapted to receive a film of pulp and form thereon a molded article, suction ports in said die and air admission ports in said die, means for creating suction through the suction ports, means for admitting atmospheric air to said air admission ports during a portion of the cycle of operation, and means for forcing compressed air through the air ports during another portion of the cycle of operation of the die.

17. In a pulp molding machine, a forming die adapted to receive a film of pulp and form thereon a molded article, suction ports in said die and air admission ports in said die, means for creating suction through the suction ports, means for admitting atmospheric air to said air admission ports during a portion of the cycle of operation, means for forcing compressed air through the air ports during another portion of the cycle of operation of the die, and means for varying the timing of the atmospheric air and of the compressed air admission.

18. In a pulp molding machine, a forming die adapted to receive a film of pulp and form

thereon a molded article, suction ports in said die and air admission ports in said die, means for creating suction through the suction ports, means for admitting atmospheric air to said air admission ports during a portion of the cycle of operation, means for forcing compressed air through the air ports during another portion of the cycle of operation of the die, and means for varying the timing of the atmospheric air, of the compressed air admission and of the suction through the suction ports.

In witness whereof, I have hereunto set my hand this 9th day of October, 1926.

MERLE P. CHAPLIN.