Nov. 28, 1933. H. P. G. NORSTRAND 1,937,464

PULP MOLDING MACHINE

Filed April 7, 1932 4 Sheets-Sheet 1

Fig. 1.

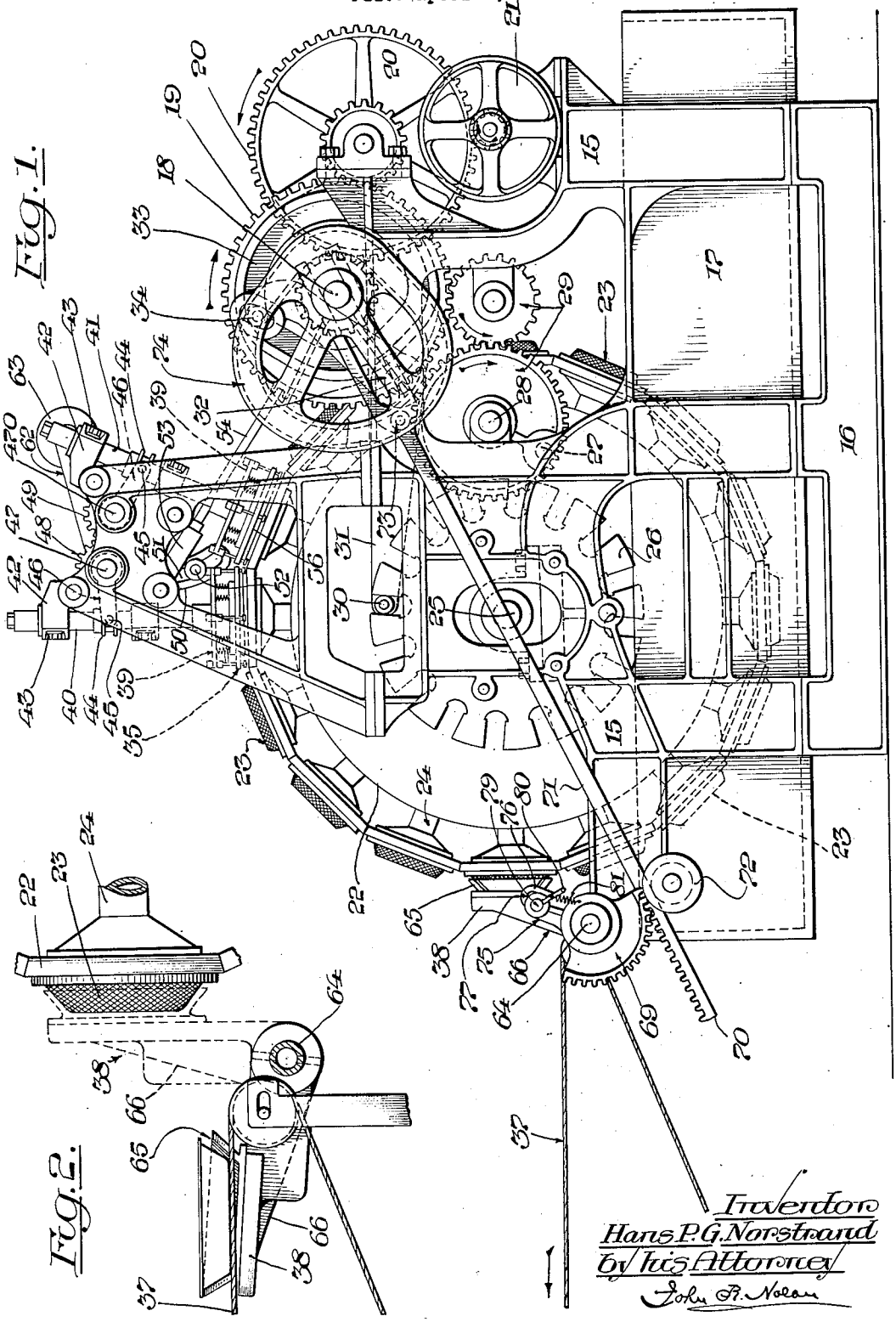


Fig. 2.

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Fig. 3.

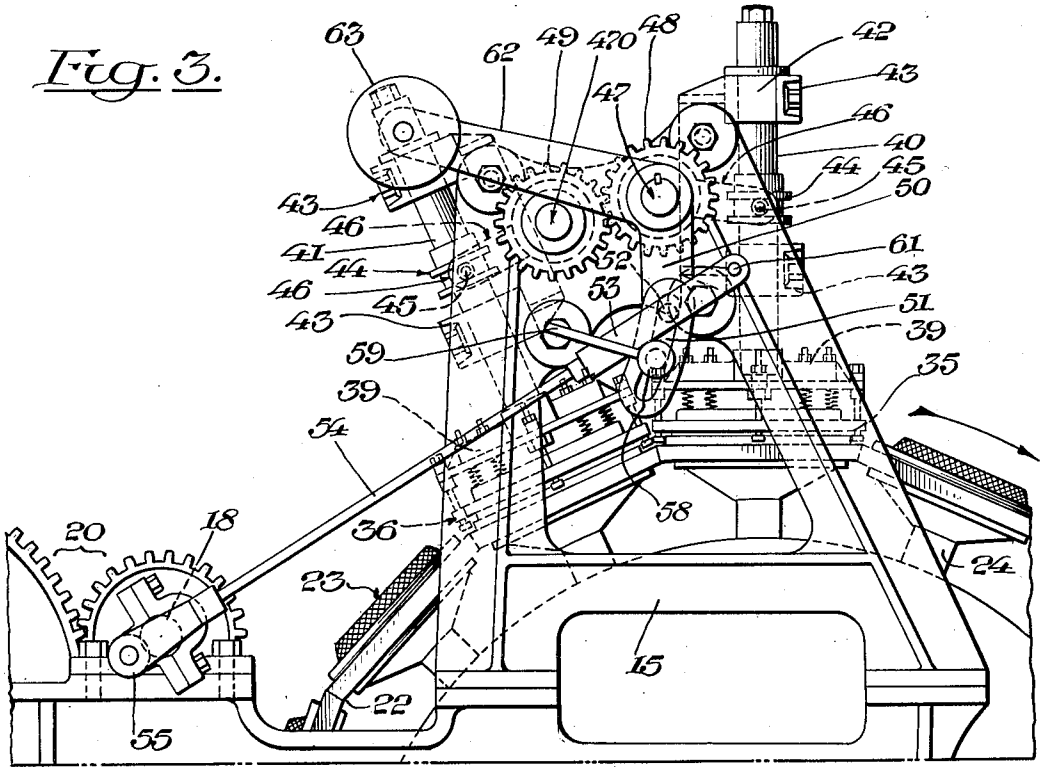


Fig. 5.

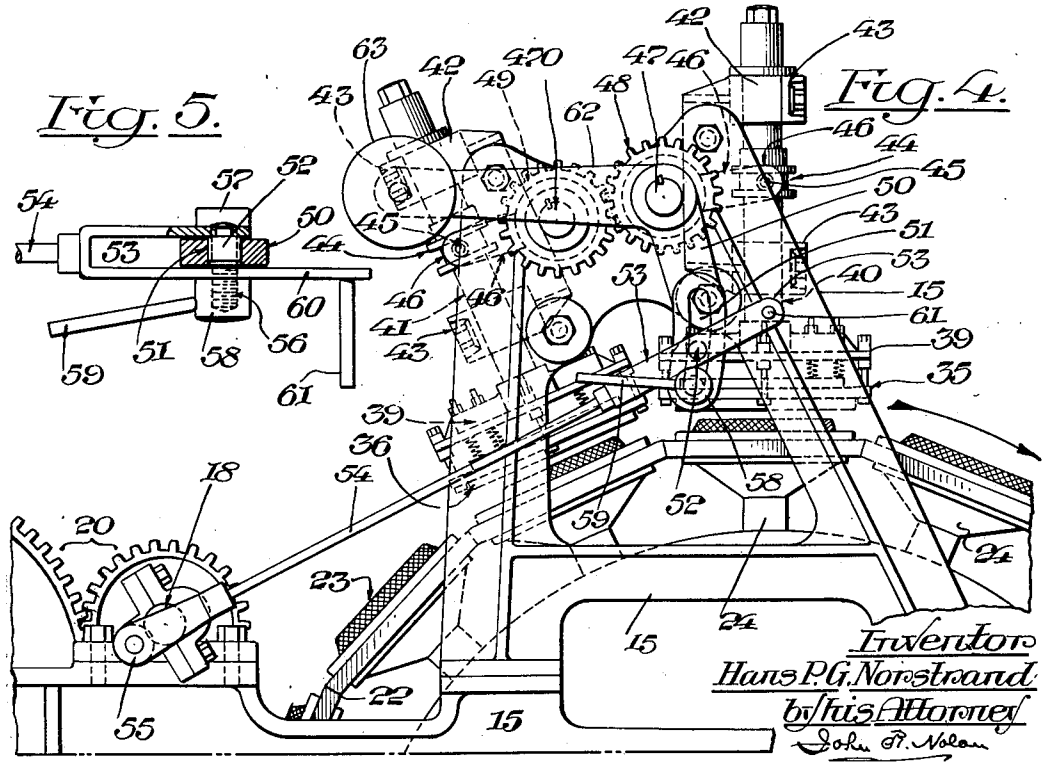


Fig. 4.

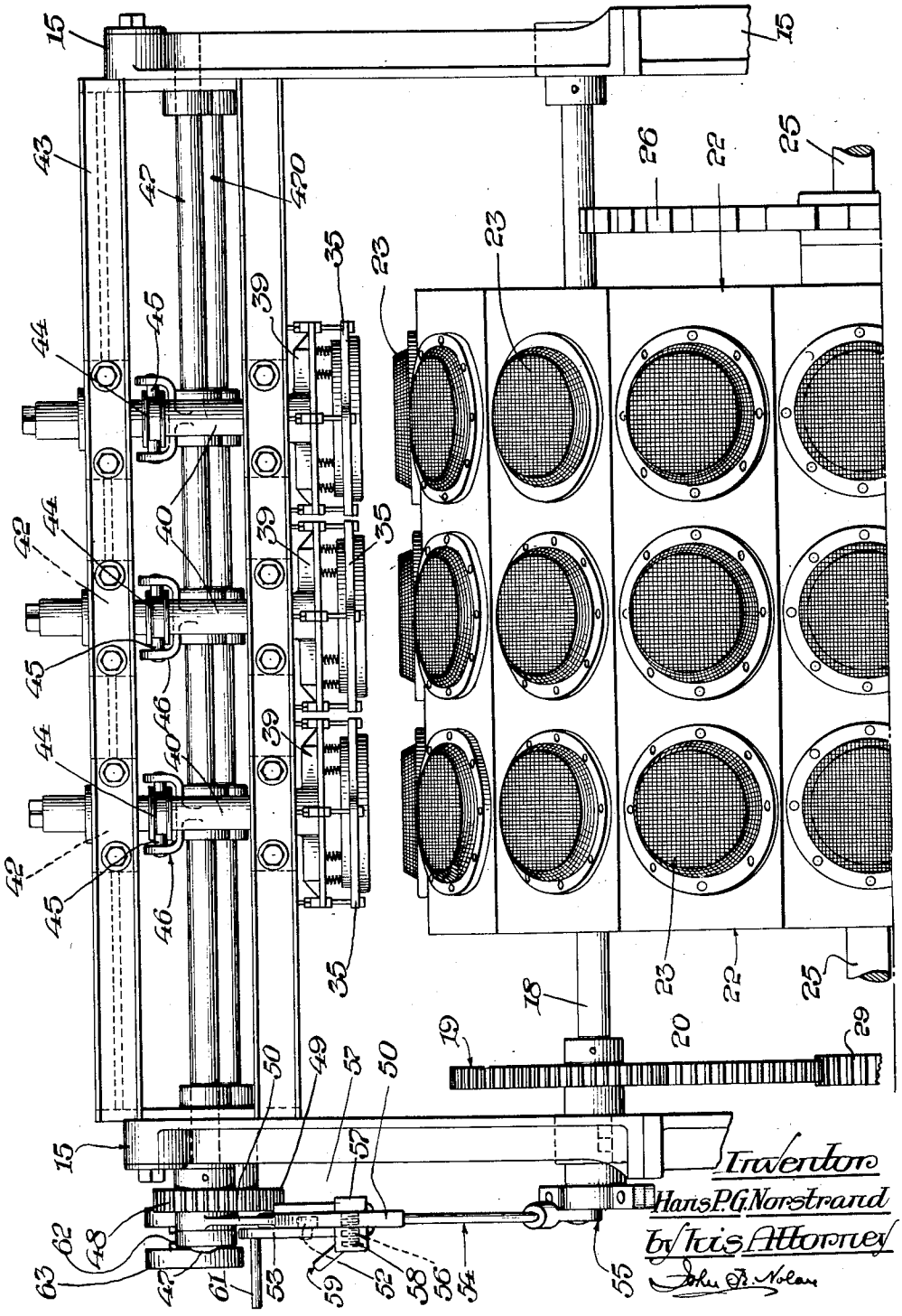
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Fig. 6.



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PULP MOLDING MACHINE

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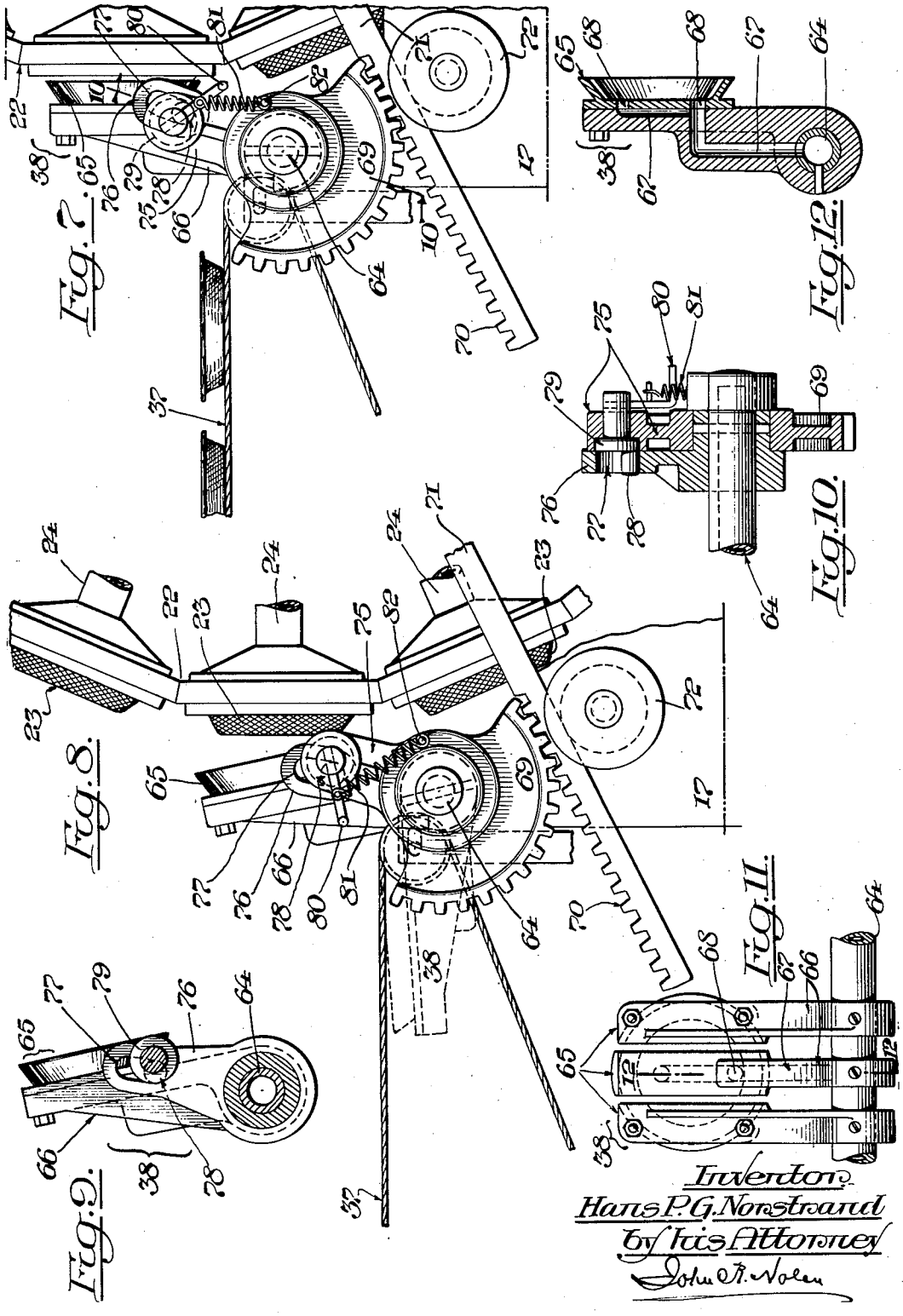


Fig. 7.

Fig. 8.

Fig. 9.

Fig. 10.

Fig. 11.

Fig. 12.

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UNITED STATES PATENT OFFICE

1,937,464

PULP MOLDING MACHINE

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Application April 7, 1932. Serial No. 603,691

14 Claims. (Cl. 92—56)

This invention relates to pulp molding machines, whereby articles, such as plates, are continuously produced from pulp; having reference more especially to pulp molding machines wherein a rotary series of spaced rows of forming dies are constructed and arranged to travel through a suitable tank containing aqueous pulp and to be subjected to suction action during their travel through the pulp and for an extended distance thereafter, thus ensuring the application of the pulp to the progressing dies, which dies with the pulp thereon pass to the path of, and in co-operative relation to a series of compression dies which complete the formation of the desired articles on the opposing forming dies, whereupon said forming dies and the associated articles advance to a location where the articles are removed from each succeeding row of dies and deposited upon a suitable conveyer by transfer devices.

During the actual operation of machines of the kind referred to the pulp contained in the tank is maintained at proper consistency for practical use in the production of dishes and the like, but after the machine has been idle for a period, as, for example, for repairs, replacements or adjustments, it is impossible when the machine is again started up to obtain immediately the proper co-operative relation between the vacuum in the submerged and exposed forming dies and the speed of the machine. Hence until the machine has been run a sufficient time to obtain such operative condition more or less lumpy stock adheres to the forming dies and is carried thereby to the paths of the compression dies and the transfer devices with possible damage to the coacting elements.

The principal object of my invention is to overcome the objection just mentioned, by the provision of throw out mechanism or means whereby the compression dies and the transfer devices can be quickly rendered active or inactive with respect to the forming dies at the will of the operator, and this without interferring with the main operating mechanism of the machine. When the compression dies and the transfer devices are rendered inactive, the forming dies during the initial operation of the machine rotate clear of said compression dies and transfer devices, and the pulp deposited on the forming dies during their submergence is returned to the tank in each succeeding rotation of the forming dies until the proper operative condition of the machine has been attained, whereupon the compression dies and the transfer heads are rendered active with respect to the compression dies.

With the foregoing object and other objects in view my invention comprises novel features of construction and combinations of parts which in a preferred form will be hereinafter described, the scope of the invention then being expressed in the appended claims.

In the drawings—

Figure 1 is a side elevation of a pulp molding machine embodying my invention, the compression dies being shown in engagement with the opposing forming dies.

Fig. 2 is a section through one of the slotted transfer heads at the discharge station of the machine, showing the head, the take-off conveyer and an adjacent forming die in their relative positions immediately upon the deposition of a finished pulp article on the conveyer.

Fig. 3 is a side elevation of the upper portion of the opposite side of the machine represented in Fig. 1, showing the stroke-varying devices for the compression dies.

Fig. 4 is a similar view, showing the stroke-varying devices as adjusted to limit the downward stroke of the compression dies to a position above the path of the forming dies.

Fig. 5 is a transverse section through an actuating lever arm for the compression die plungers, showing an adjustable bifurcated link connection for operating the lever.

Fig. 6 is a partial front elevation of the mechanism illustrated in Fig. 3, the compression dies being shown at the limit of their upward stroke.

Fig. 7 is a side elevation of the delivery mechanism at the discharge end of the machine, showing the connection between the oscillating transfer head and its actuating devices, the head being so positioned with respect to its axis of oscillation as to engage each succeeding forming die and transfer the molded pulp article therefrom to the conveyer.

Fig. 8 is a similar view showing the connection between the transfer head and its actuating devices so adjusted that the head when swung to the limit of its upward stroke is spaced from the path of the forming dies.

Fig. 9 is a transverse section through the hub of the oscillatory actuating sector, and the hollow shaft on which the transfer heads are mounted, showing one of said heads and the adjustable coupling between the sector and the shaft.

Fig. 10 is a vertical section as on the line 10—10 of Fig. 7, the adjacent transfer head being shown.

Fig. 11 is a rear elevation of one of the transfer heads and its mounting.

Fig. 12 is a transverse vertical section, as on the line 12—12 of Fig. 11.

Referring to the drawings, 15 designates the supporting frame of a pulp molding machine, including a base 16 on which is supported a capacious tank 17 to contain the pulp.

18 designates the main drive shaft having its bearings in suitably-disposed boxes on the frame end operatively connected with a suitable source of power. In the present instance this shaft 18 has fast thereon a gear 19 which is included in a train of gears 20 driven by a suitably located electric motor 21.

22 designates an intermittently-rotatable carrier provided with transverse rows of peripheral forming dies 23 of fine wire cloth or gauze, each conforming with the article or articles to be produced, which dies as the carrier rotates progress through the tank and are submerged in the contained pulp. These dies are supported by chambered structures having conduits 24 which are operatively connected in any usual or approved manner with suitable air exhaust and compression pumps so that the dies during their passage into and through the tank, and for an extended distance of their subsequent travel, are subjected to vacuum action which ensures the application of a layer of pulp to each succeeding row of dies, and which action at proper intervals is interrupted and the dies are subjected to internal air pressure, thereby releasing the formed articles and permitting their removal from the dies.

The die carrier 22 is intermittently rotated about a fixed shaft 25 with uniform step-by-step movements, whereof each step is equal to the distance between the centers of two adjacent rows of dies. The particular means herein illustrated for this purpose comprises a Geneva stop motion whereof the driven member 26 is bolted to one of the heads of the carrier and the driving member 27 is affixed to a shaft 28 which is operatively connected by means of gears 29 with the gear 19 on the main shaft. The driven member 26 is temporarily locked at the end of each successive step by means of a bolt or roll 30 which is periodically moved into and from the opposed interdentil space of such member. This bolt or roll projects from the horizontal arm of a crank lever 31 which is fulcrumed, as at 32, on the main frame, the other arm of the lever extending laterally adjacent a face cam 33 fast on the main shaft and being provided with a roll 34 which is seated in the cam groove. The contour of this groove is such as to oscillate the lever 31 in timed relation to the intermittent movement of the driven member 26 and the die carrier.

Located above and perpendicular to the axis of the carrier are a series of vertically reciprocative compression dies 35 which co-operate with each succeeding row of forming dies during the intermittent rotation of the carrier in a manner to compress the pulp previously applied to the forming dies.

In the present instance a set of preliminary reciprocative compression dies 36 are arranged adjacent to and in advance of the main dies 35 so as to co-act with each succeeding row of forming dies immediately before the passage of the latter to the path of the compression dies 35.

The compression dies 35 and 36 are simultaneously reciprocated during each dwell of the carrier, and hence while the pulp on one row of forming dies is being acted upon by the preliminary compression dies the pulp on the immediately preceding rows of forming dies is being acted upon by the main dies.

In the continued rotation of the carrier the fibrous articles thus formed by the co-operation of the compression and forming dies are transported by the latter dies to a discharge station located above and adjacent the tank. When the forming dies are positioned at this station the vacuum action is interrupted and the dies are subjected to internal air pressure effective to loosen the row of articles on the dies. Coincidentally the row is removed from the forming dies and deposited on a horizontal belt conveyer 37 by means of a series of oscillating transfer heads 38 which are operated in timed relation to the intermittent travel of the forming dies. This done, the forming dies, in the continued rotation of the carrier, re-enter the tank and therein receive a deposit of pulp as before, and so on.

According to my invention simple and efficient control or throw out mechanism is provided whereby at the will of the operator the strokes of the compression dies and the transfer heads, respectively, can be regulated to preclude their engagement with the forming dies, thus enabling the free rotation of the carrier and its forming dies past the compression dies and the transfer heads. Hence, in the initial operation of the machine, following temporary shut-downs, the carrier and its forming dies can be rotated for a sufficient period through the pulp contents of the tank until the proper operative relation between the vacuum in the submerged and exposed forming dies and the speed of the machine has been attained, thus obviating the delivery of lumpy stock by the forming dies to the active paths of the compression dies and transfer devices, as previously mentioned. When the machine functions normally the control mechanism for the compression dies is adjusted to increase the stroke of such dies in a manner to effect their operative engagement with the succeeding rows of forming dies, whereupon when the carrier has advanced a sufficient distance toward the discharge station, the control mechanism for the transfer heads is adjusted to effect their operative engagement with each succeeding row of forming dies carrying compressed pulp material.

In the present instance the resilient heads 39 which support the compression dies 35 and 36 are secured to plungers 40, 41, respectively, which are slidably mounted in guides 42 on parallel cross-bars 43 supported by the side members of the main frame. On each of the plungers is a circumferentially-grooved collar 44 which is embraced by, and pivotally connected by means of studs 45 with the bifurcated end of a rock-arm 46 extending from a cross-shaft 47 having its bearings in the sides of the main frame. There are two parallel cross shafts 47 and 470, each having three spaced arms 46 connected with the respective collars of the adjacent plunger 40 or 41, which shafts have fast thereon, at one side of the machine, two meshing gears 48, 49, respectively.

Fast on the shaft 47 is a depending lever arm 50 provided with an arcuate slot 51 in which is loosely fitted a stud 52 on the shorter arm of a bifurcated link 53 which embraces the arm 50. This link is connected by means of a rod 54 with a crank 55 on the main shaft 18, thus constituting a power driven member whereby during the op-

eration of the shaft the crank lever and its shaft 47 together with the pinion 48 are oscillated, and also the pinion 49 and its shaft 470. Consequently the arms 46 of the respective shafts 47 and 470 are correspondingly oscillated and the simultaneous longitudinal reciprocation of the two sets of plungers 40 and 41 is effected; the throw of the plungers being determined by the movement of the stud 52 in the slotted lever arm 50.

As a means to regulate the extent of movement of the stud 52 in the slot of the arm 50, a bolt 56 having a cylindrical head 57 and a correspondingly shaped nut 58 which bear against the respective sides of the arm, is slidably fitted in the slot beneath the stud 52. The nut is provided with a suitable handle 59 by the manipulation of which the nut can be properly turned to lock or release the bolt as desired.

When the bolt 56 is clamped on the lever arm the arms of the link member 53 are supported by and ride upon the head and nut of the bolt during the reciprocation of the link member through its connection with the crank 55, and hence if the bolt be adjusted longitudinally of the slot 51 the limit of downward movement of the stud therein will be accordingly varied, thus changing the stroke of the arm and consequently that of the plungers carrying the compression dies.

When the adjusting bolt 56 is in the raised position shown in Figs. 1 and 3, the stroke of the lever arm 50 is sufficient to reciprocate the compression dies to effect the requisite compression of the pulp on the opposing forming dies, but when the bolt is set at the bottom of the slot, as seen in Fig. 4, the stroke of the lever arm 50 is reduced and the downward stroke of the compression dies is limited to preclude their engagement with the forming dies, as previously mentioned.

The longer arm 60 of the link member 53 is provided with a suitable handle 61 by means of which the link member and its stud 52 can be readily raised or lowered when the locking bolt 56 is released. The shaft 47 has affixed thereto an arm 62 provided with a counterweight 63 to facilitate the reciprocatory motion of the compression heads through the described connections with the operating crank 55.

The transfer heads 38, which correspond in number with a row of forming dies, are carried by a transverse hollow shaft 64 supported in bearings on the main frame adjacent the entrance end of the pulp tank. Each of the heads includes a sectional dish-shaped member of proper internal formation to encircle and receive one of the molded articles on the forming dies. In the present instance this member comprises three spaced sections 65 which are affixed to a series of parallel rocker-arms 66 fast on the shaft 64 so as to be movable as a unit toward and from the adjacent path of the forming dies through an arc of about 90°. The parallel slots of the arms 66 and sections 65 of each of the dish-shaped members are in alignment with the adjacent conveyer belts 37 and hence such arms and sections can be swung slightly below the belts to ensure the deposition of the contents of the dish-shaped member on the belts, as indicated in Fig. 2.

The central arm of each transfer head is provided with an air duct 67 which communicates with the hollow shaft 64 and also with upper and lower orifices 68 in the middle section of the dish-shaped member, whereby when this member is in its upright position in contact with the released pulp article on a forming die, and the shaft is exhausted of air, a suction is induced through the duct 67, and hence in the next succeeding downward stroke of the transfer head the article is carried thereby to and deposited on the conveyer belts, as previously mentioned, the vacuum, of course, being interrupted as the head approaches the belts.

The shaft 64 is oscillated in any suitable manner. In the present instance one end of the shaft has loose thereon a gear sector 69 which meshes with a gear rack 70 on the lower end of an inclined bar 71 which is supported by a suitably-disposed roller 72 on the framework. The upper end of the bar 71, which is bifurcated and embraces the main shaft 18, is provided with a roll 73 operatively fitted in the groove of a face cam 74 fast on the main shaft, the contour of the groove being such as to effect the reciprocation of the bar 71 and the oscillation of the sector 69 in timed relation to the intermittent rotation of the die carrier 22.

The sector is connected with the shaft 64 in such manner that the transfer heads can be so positioned in respect to the sector that when the oscillating heads are at the limit of their forward stroke they will engage the forming dies or be spaced from the path of the dies, as desired. To this end the sector has formed thereon an upwardly extending arm 75 and the shaft has fast thereon a crank-arm 76 which is adjustably coupled to the arm 75. The crank arm has a radial slot 77 in which is loosely fitted a stud 78 eccentrically disposed on the circular head of a pin 79 which is rotatably fitted in a suitably-disposed hole in the sector arm 75. The free end of this pin projects outwardly and has secured thereto a handle arm 80 which is connected by means of a retracting spring 81 with a stud 82 on the hub of the sector. (See Figs. 7, 8 and 9.)

The co-operative relation of the parts just described is such that if the handle arm 80 be turned clockwise to the position shown in Fig. 7 the eccentric stud 78, through its slot engagement with the crank arm 76, will partially turn the latter arm and therewith the shaft 64, thus similarly moving the series of transfer heads relative to the sector, so that when the heads are swung to the limit of their upward movement they will engage the opposing forming dies on the intermittently rotating carrier; the eccentric stud being held in this operative position by the action of the retracting spring 81. If, however, the handle arm 80 be subsequently turned contra-clockwise to the position shown in Fig. 8, the eccentric stud 78 through its engagement with the slot 77 of the arm 76, will reversely move the latter arm and therewith the shaft 64, thus similarly moving the transfer heads relative to the sector, so that when the heads are swung to the limit of their upward movement they will be spaced from the path of the dies, thus precluding the engagement of the transfer heads with the rotating dies. When the arm is swung to the position shown in Fig. 8, the eccentric stud 78 is at the bottom of the slot, and the tension of the spring 81 maintains the arm in that position.

It is to be understood that my invention is not limited to the particular details of construction herein disclosed, as the mechanism may be variously modified within the principle of the invention and the scope of the appended claims.

I claim—

1. A pulp molding machine of the kind de-

scribed comprising a pulp tank, a rotatable carrier, a succession of forming dies on said carrier submergible in the contents of the tank during the progress of the carrier, mechanism for rotating said carrier, a compression die for periodical engagement with the forming dies exteriorly of the tank, mechanism for operating said compression die in timed relation to the progressive travel of the forming dies, said latter mechanism including means whereby the compression die may be rendered inactive with respect to the forming dies and retained in that condition for any desired period of time during succeeding rotations of the forming dies through the contents of the pulp tank, a transfer member movable into and from engaging relation with each succeeding forming die, and means for operating said transfer member including devices whereby said member may be rendered inactive with respect to the forming dies and retained in that condition during the period of inaction of the compression die.

2. A pulp molding machine of the kind described comprising a pulp tank, a rotatable carrier, a succession of forming dies on said carrier submergible in the contents of the tank during the progress of the carrier, mechanism for rotating said carrier, a compression die for periodical engagement with the forming dies exteriorly of the tank, and mechanism for moving said compression die in timed relation to the progressive travel of the forming dies, said latter mechanism including throw out mechanism to vary the movement of the compression die whereby the compression die may be held out of contact with respect to the forming dies and retained in that condition for any desired period of time during succeeding rotations of the forming dies through the contents of the pulp tank.

3. A pulp molding machine of the kind described comprising a pulp tank, a rotatable carrier, a succession of forming dies on said carrier submergible in the contents of the tank during the progress of the carrier, mechanism for rotating said carrier, a reciprocative compression die arranged in co-operative relation to the path of the forming dies exteriorly of the tank, and mechanism for reciprocating said compression die in timed relation to the travel of the carrier, said latter mechanism including devices whereby the limit of the stroke of the compression die toward the forming dies can be varied to render the compression die active or inactive, as desired, in relation to the forming dies while the carrier continues to rotate.

4. A pulp molding machine of the kind described comprising a pulp tank, a rotatable carrier, a succession of forming dies on said carrier submergible in the contents of the tank during the progress of the carrier, mechanism for rotating said carrier, a reciprocative compression die arranged in co-operative relation to the path of the forming dies exteriorly of the tank, a plunger for said compression die, a lever, operative connections between said lever and plunger, a power driven operating member having a sliding connection with said lever, and means for varying the movement of said sliding connection in respect to the fulcrum of the lever, whereby the limit of the stroke of the plunger toward the forming dies can be varied to render the compression dies active or inactive, as desired, in relation to the forming dies while the carrier continues to rotate.

5. A pulp molding machine of the kind described comprising a pulp tank, a rotatable carrier, a succession of forming dies on said carrier submergible in the contents of the tank during the progress of the carrier, mechanism for rotating said carrier, a reciprocative compression die arranged in cooperative relation to the path of the forming dies exteriorly of the tank, a plunger for said compression die, a lever having a longitudinal slot therein, operative connections between said lever and plunger, a power-driven member having a stud slidably fitted in said slot, and a supporting element for said driven member adjustably mounted on the lever arm, whereby the movement of said stud in respect to the fulcrum of the lever can be varied to limit the stroke of the plunger toward the forming dies to render the compression die active or inactive, as desired, in relation to the forming dies while the carrier continues to rotate.

6. A pulp molding machine of the kind described comprising a pulp tank, a rotatable carrier, a succession of transverse rows of forming dies on said carrier submergible in the contents of the tank during the progress of the carrier, mechanism for rotating said carrier, a series of simultaneously reciprocable compression dies arranged in co-operative relation to the path of each row of forming dies exteriorly of the tank, plungers for the respective compression dies, a shaft, operative connections between said shaft and the respective plungers, and mechanism for oscillating said shaft to effect the reciprocation of the plungers in timed relation to the travel of the carrier, said latter mechanism including devices whereby the limit of the stroke of the plungers toward the forming dies can be varied to render the compression dies active or inactive, as desired, in relation to the forming dies while the carrier continues to rotate.

7. A pulp molding machine of the kind described comprising a pulp tank, a rotatable carrier, a succession of forming dies on said carrier submergible in the contents of the tank during the progress of the carrier, a plurality of forming dies arranged in succeeding order in co-operative relation to the path of the compression dies exteriorly of the tank, and mechanism for operating said compression dies in timed relation to the progressive travel of the forming dies, said latter mechanism including means whereby the respective compression dies may be simultaneously rendered inactive with respect to the forming dies and retained in that condition for any desired period of time during succeeding rotations of the forming dies through the contents of the pulp tank.

8. A pulp molding machine of the kind described comprising a pulp tank, a rotatable carrier, a succession of transverse rows of forming dies on said carrier submergible in the contents of the tank during the progress of the carrier, mechanism for rotating said carrier, two adjacent series of simultaneously reciprocable compression dies, each series arranged in co-operative relation to the path of each row of dies exteriorly of the tank, plungers for the respective compression dies, a shaft adjacent each series of plungers, operative connections between said shaft and the adjacent plungers, and mechanism for simultaneously oscillating said shafts to effect the reciprocation of the plungers for the respective compression dies in timed relation to the travel of the carrier, said latter mechanism including devices whereby the limit of the strokes of the plungers for the respective compression dies to-

ward the forming dies can be simultaneously varied to render the two series of compression dies active or inactive, as desired, in relation to the forming dies.

9. In a pulp molding machine of the kind described comprising a pulp tank, a rotatable carrier, a succession of forming dies on said carrier submergible in the contents of the tank during the progress of the carrier and mechanism for rotating said carrier, a transfer member movable into and from engaging relation with each succeeding forming die, and means for operating said transfer member including devices whereby said member may be rendered inactive with respect to the forming dies and retained in that condition for any desired period of time during succeeding rotations of the forming dies through the contents of the pulp tank.

10. In a pulp molding machine of the kind described comprising a pulp tank, a rotatable carrier, a succession of forming dies on said carrier submergible in the contents of the tank during the progress of the carrier, an oscillatory transfer head including a member movable toward and from each succeeding forming die, means for oscillating said head, and means whereby said head can be set in adjusted positions about its axis of oscillation to position the transfer member for movement into active or inactive relation to the forming dies during the oscillation of the transfer head.

11. In a pulp molding machine of the kind described comprising a pulp tank, a rotatable carrier, a succession of forming dies on said carrier submergible in the contents of the tank during the progress of the carrier, an oscillatory transfer head including a member movable toward and from each succeeding forming die, a shaft for the transfer head, an oscillatory member, means for positively oscillating said member, and a connection between said oscillatory member and the shaft, whereby the shaft and the transfer head can be partially rotated independently of the oscillatory member and secured in position to oscillate in active or inactive relation to the forming dies, as desired.

12. In a pulp molding machine of the kind described comprising a pulp tank, a rotatable carrier, a succession of forming dies on said carrier submergible in the contents of the tank during the progress of the carrier, an oscillatory transfer head including a member movable toward and from each succeeding forming die, a shaft for the transfer head, a slotted crank member on said shaft, an oscillatory member co-axial with the shaft having an arm adjacent the said crank member, means for actuating the latter member, a partially rotatable member seated in said arm and having an eccentric seated in the slotted crank member, whereby said arm and member may be relatively positioned to effect the active or inactive oscillation of the transfer head in relation to the forming dies, and a retaining spring connection between the partially rotatable member and the oscillatory member.

13. In a pulp molding machine of the kind described having travelling forming dies, and spaced conveyer belts to which the molded articles are transferred from the successive dies, an oscillatory transfer head movable through an arc between the dies and below the belts, and including a sectional article-receiving member having parallel spaces in alignment with the belts, and means for oscillating said transfer head in timed relation to the travel of the forming dies.

14. A pulp molding machine having forming and compression dies, a pulp tank, means for moving the forming dies through the pulp tank to gather pulp, means for moving the compression die into molding relation with the forming dies, and control means for varying the movement of the compression die during the operation of the machine, to cause said compression die to move into molding relation with the forming dies or to be prevented from moving into molding relation with the forming dies, to permit the gathered pulp on the forming dies to be returned to the tank in uncompressed condition.

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