

July 25, 1961

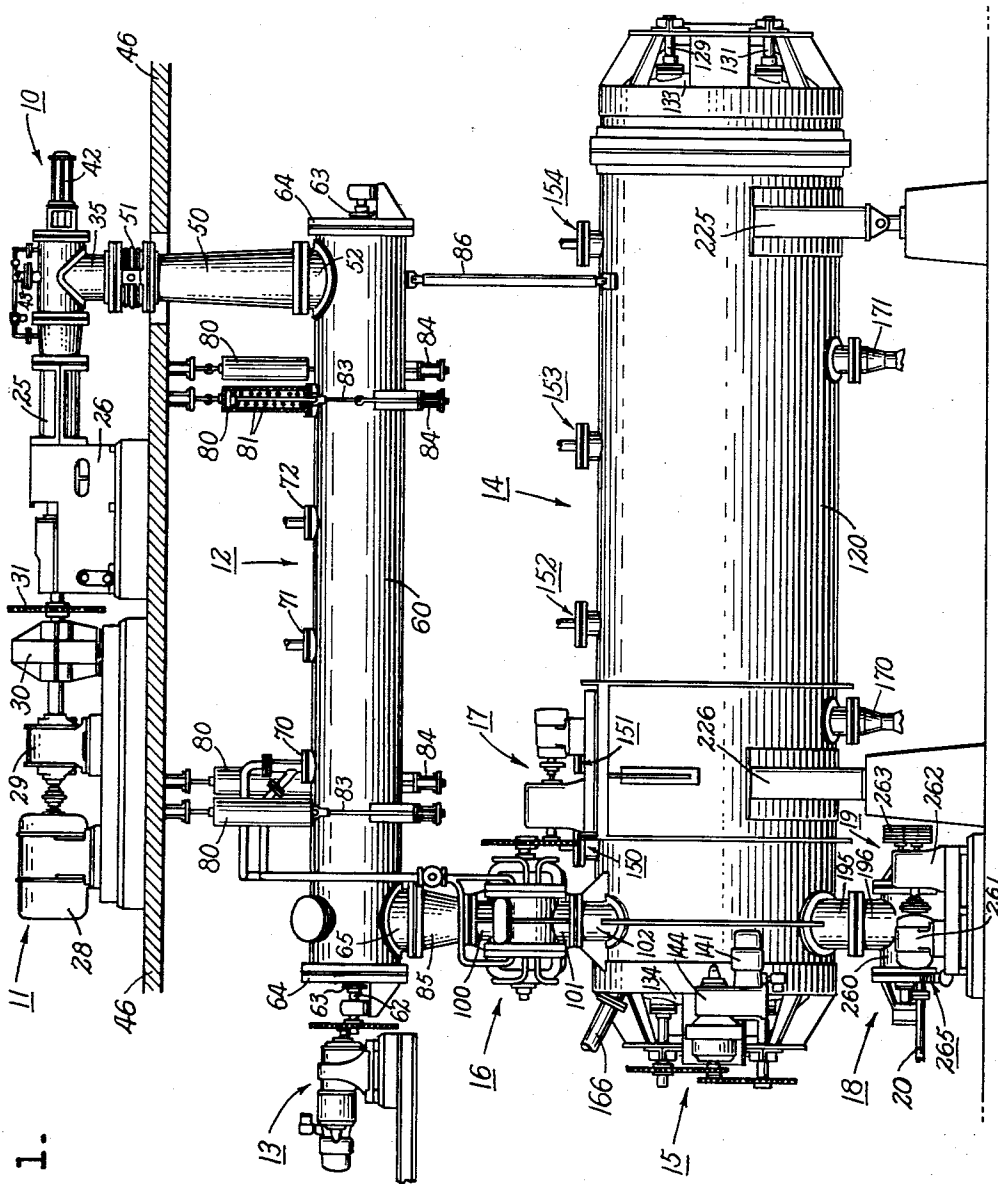
F. B. K. GREEN

2,993,537

PULP MANUFACTURE

Filed Dec. 18, 1957

6 Sheets-Sheet 1



INVENTOR
Frank B. K. Green
BY
Green Marichal Jr.
ATTORNEY

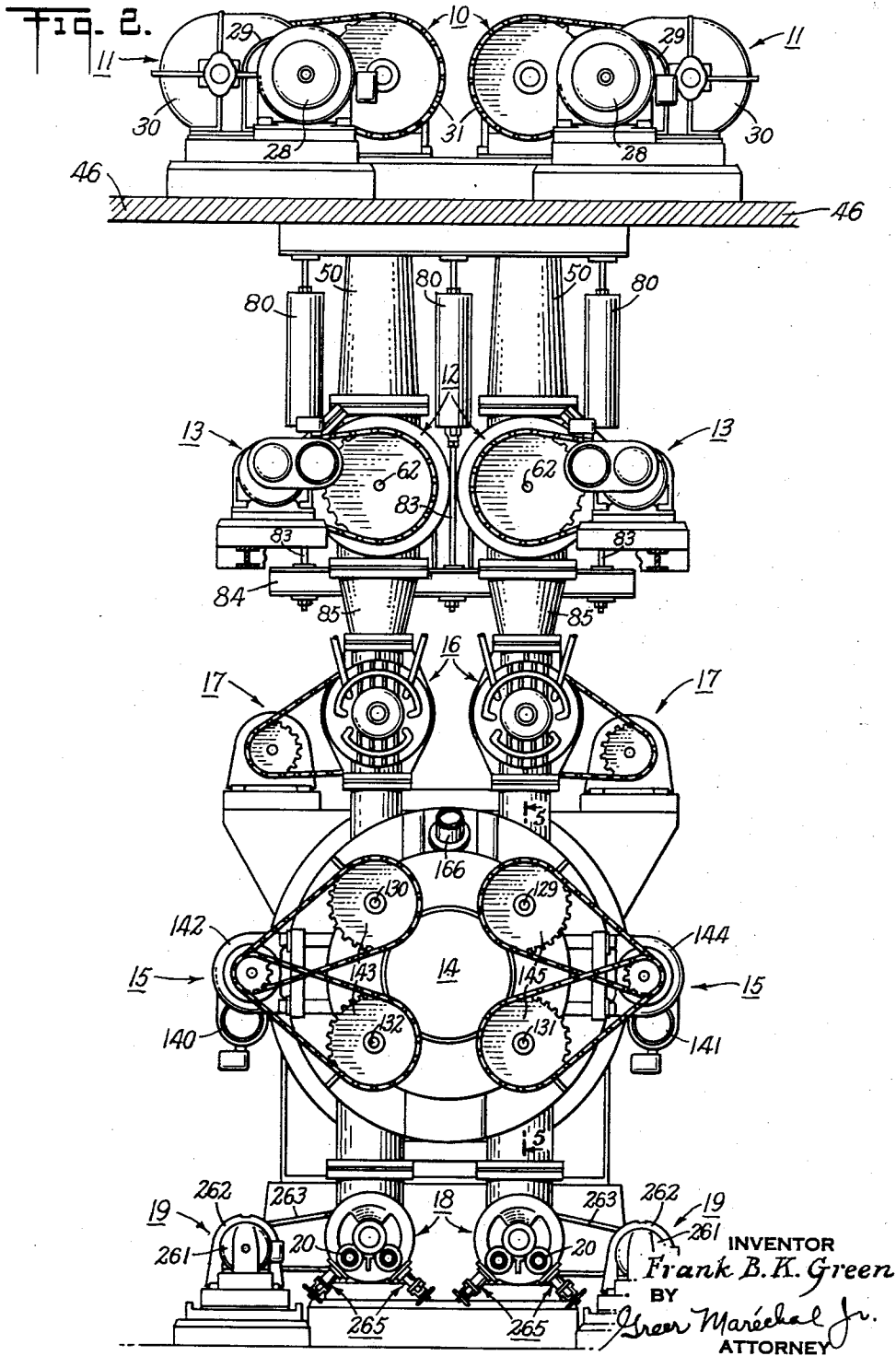
July 25, 1961

F. B. K. GREEN
PULP MANUFACTURE

2,993,537

Filed Dec. 18, 1957

6 Sheets-Sheet 2



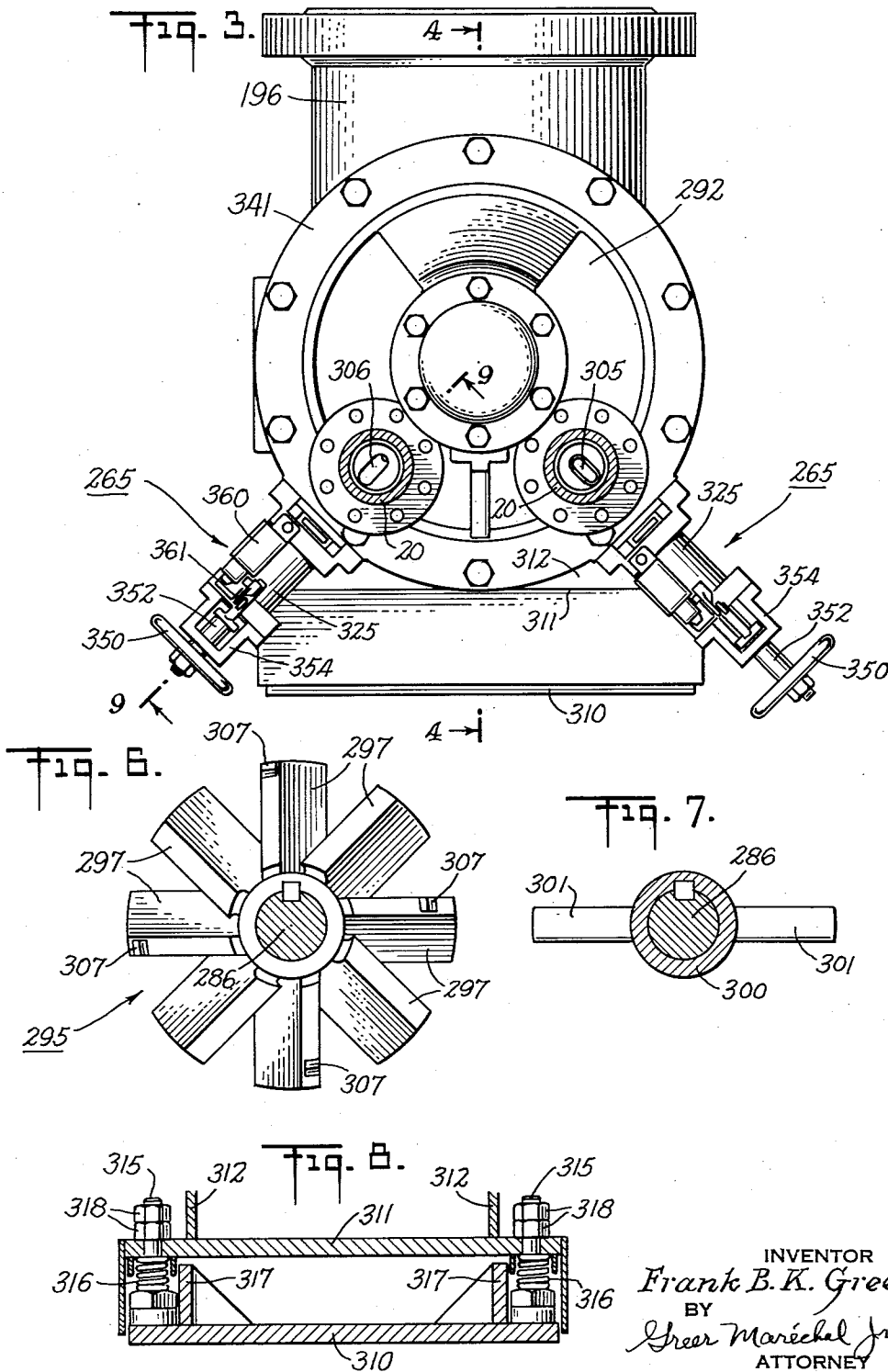
July 25, 1961

F. B. K. GREEN
PULP MANUFACTURE

2,993,537

Filed Dec. 18, 1957

6 Sheets-Sheet 3



INVENTOR
Frank B. K. Green
BY
Greer Maréchal Jr.
ATTORNEY

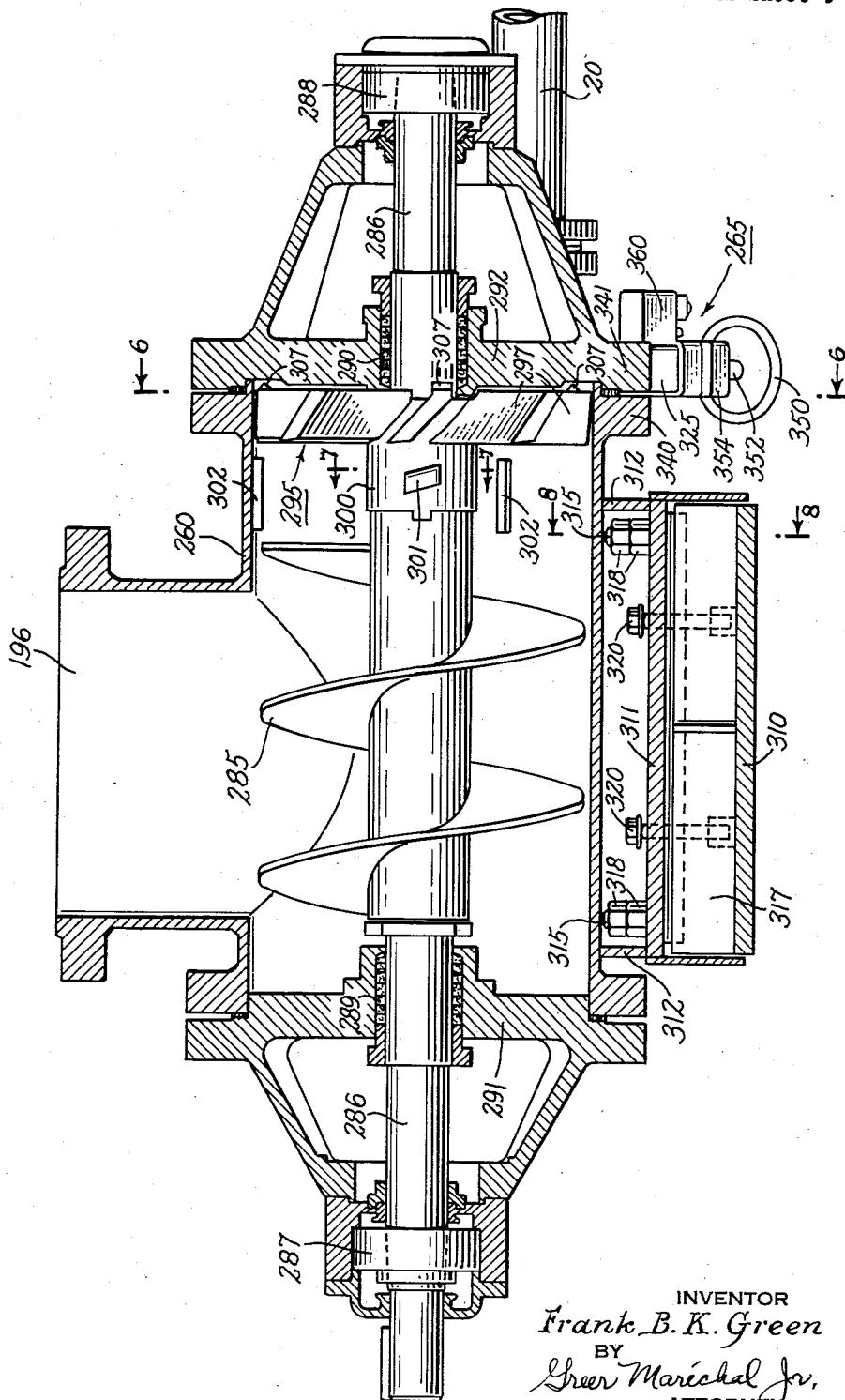
July 25, 1961

F. B. K. GREEN
PULP MANUFACTURE

2,993,537

Filed Dec. 18, 1957

6 Sheets-Sheet 4



July 25, 1961

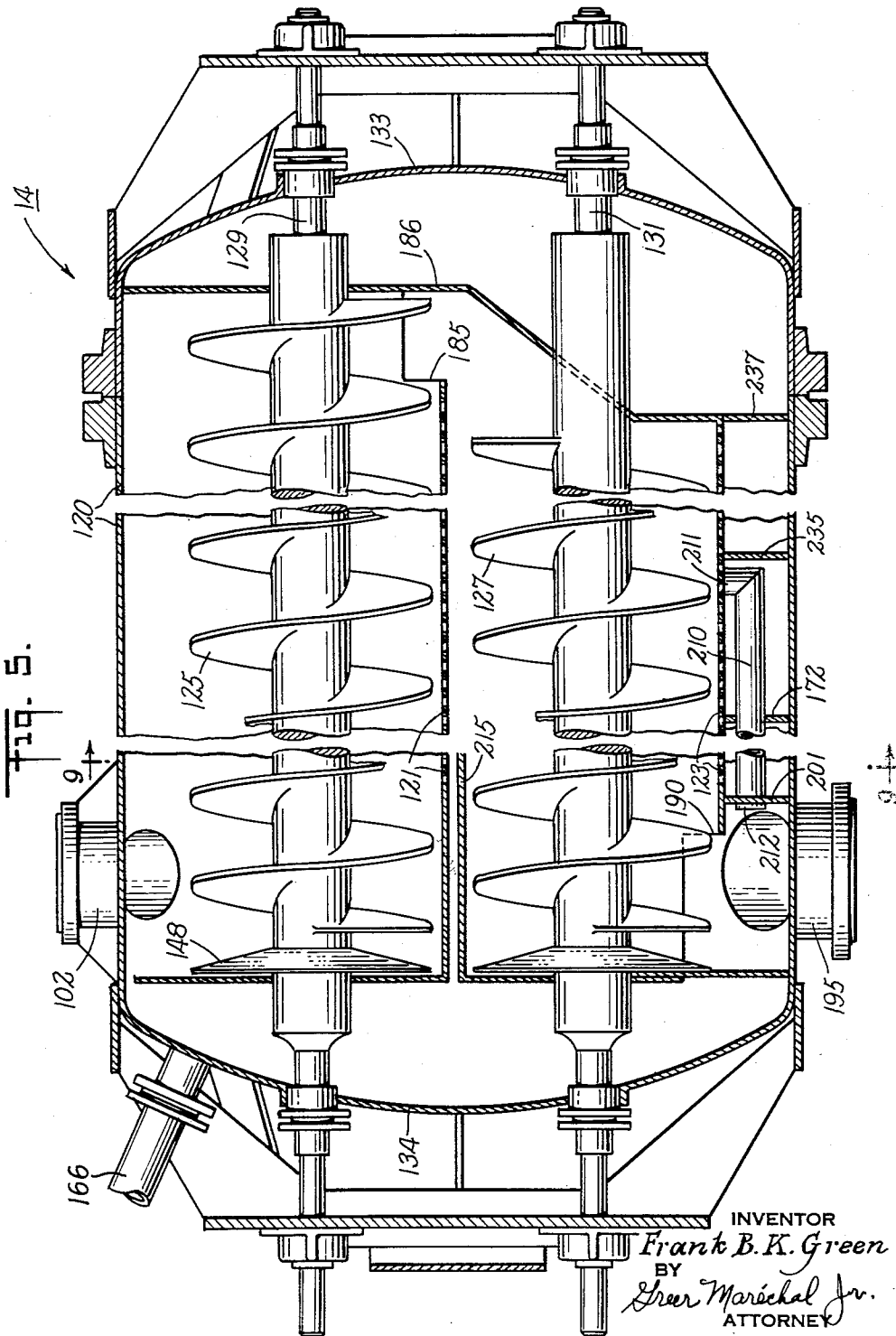
F. B. K. GREEN

2,993,537

PULP MANUFACTURE

Filed Dec. 18, 1957

6 Sheets-Sheet 5



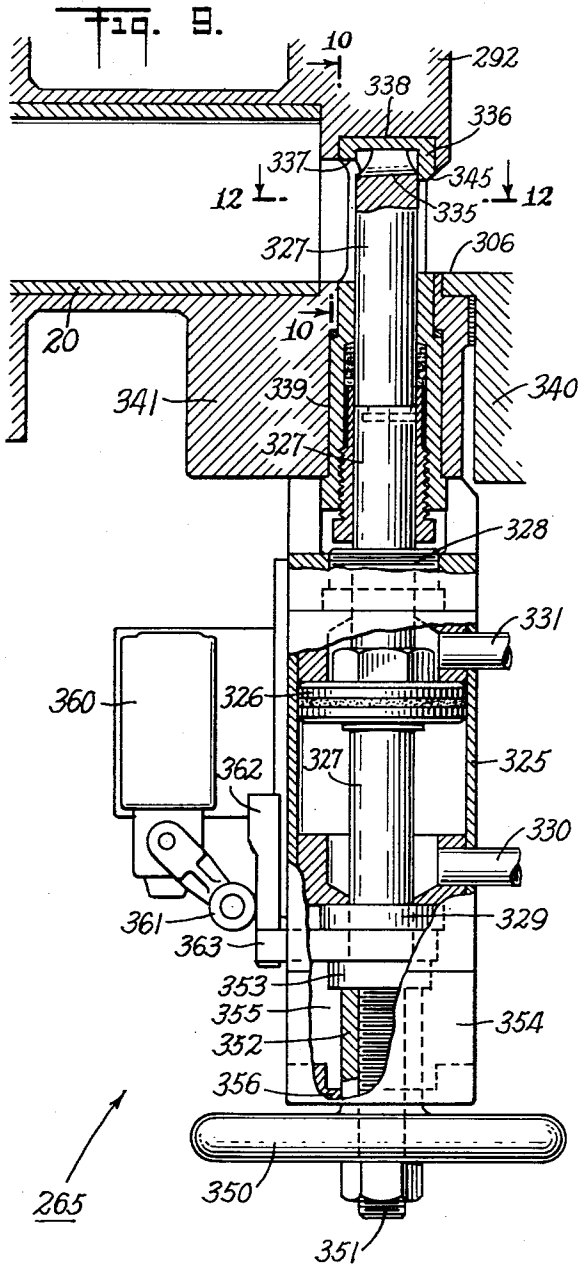
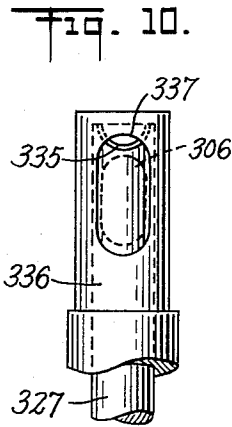
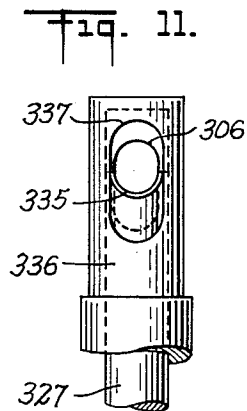
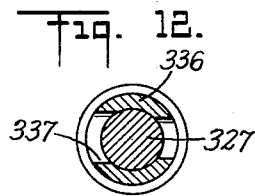
July 25, 1961

F. B. K. GREEN
PULP MANUFACTURE

2,993,537

Filed Dec. 18, 1957

6 Sheets-Sheet 6



INVENTOR
Frank B. K. Green
BY
Green Maréchal, Jr.
ATTORNEY

1

2,993,537

PULP MANUFACTURE

Frank B. K. Green, Massapequa, N.Y., assignor to
Sprout Waldron & Company, Inc., Muncy, Pa., a cor-
poration of Pennsylvania

Filed Dec. 18, 1957, Ser. No. 703,589
11 Claims. (Cl. 162—237)

This invention relates to the manufacture of pulp from wood or other fibrous material for making paper and the like and, more particularly, to methods and apparatus for cooking or digesting or softening the wood or other fibrous material to convert it into a pulp by a continuous operation.

As a result of technological and economic developments and considerations in the manufacture of paper, paper board and the like, from wood pulp or pulp of other fibrous materials, most of the operations in a pulp and paper mill other than the pulp cooking and digesting steps are carried on in a continuous fashion instead of in a batch-type manner. Accordingly, it may also be desired that the initial cooking and digesting steps wherein the ligneous and other non-cellulosic encrustants or binding materials in wood are softened or removed to render the wood fibres desirably separable for preparation of a pulp slurry also being carried out in a continuous manner for integration with the other continuous processes of the mill.

With continuous digesting systems and apparatus in which it is desired to carry out cooking or digesting steps at elevated temperatures and pressures and yet as a continuous operation, some difficulty may be experienced in removing the cooked wood or other material from the cooking or digesting in a continuous flow while maintaining the cooking or digesting apparatus at a substantial superatmospheric pressure. This difficulty may be emphasized particularly if it is desired that the cooking or digested material be "blown" out of the digesting apparatus—i.e., forcefully ejected by the pressure in the digester to achieve, as with conventional batch-type pulp digesting systems, some pulping or defibering or separating effect on the cooked or softened wood chip due to the sudden blowing of the chip through a more or less constricted orifice out of the digester into atmospheric pressure and temperature.

According to this invention, methods and apparatus are provided for continuously processing chips of wood or the like through cooking and digesting steps wherein the wood is subjected to the softening or cooking or digesting action of chemical liquors at elevated temperatures and substantial super-atmospheric pressures, and then for discharging or "blowing" the cooked material out of the digester through an adjustably constricted orifice as a continuous process and while maintaining the high super-atmospheric pressure within the digester.

One object of this invention is to provide apparatus of the character described for continuously discharging or "blowing" cooked chips of wood or other fibrous material from continuous digesting apparatus while maintaining the high pressure in the digester.

Another object of this invention is to provide discharger apparatus of the character described for continuously removing from a super-atmospheric cooking or digesting vessel cooked or digested chips of wood or other fibrous material by having the material discharged or blown through a restricted orifice of adjustable size.

A further object of this invention is to provide apparatus of the character described for continuously discharging through a restricted orifice cooked or digested chips of wood or other fibrous material from a cooking or digesting vessel maintained continuously at a substantial super-atmospheric pressure and including means for

2

minimizing the escape of pressure from the cooking or digesting vessel and means for preventing clogging of the orifice.

Other objects and advantages of this invention will be apparent from the following description, the accompanying drawings, and the appended claims.

In the drawings—

FIG. 1 is a side elevation view of a continuous pulping system including apparatus embodying and for practicing this invention;

FIG. 2 is an end elevation view of the system of FIG. 1 from the left end thereof;

FIG. 3 is an end elevation view on an enlarged scale of discharger apparatus embodying and for practicing this invention;

FIG. 4 is a section in the line 4—4 of FIG. 3;

FIG. 5 is a vertical axial section partly broken away on an enlarged scale of the cooking or digesting apparatus of FIG. 1 on the line 5—5 thereof;

FIG. 6 is a section on the line 6—6 of FIG. 4;

FIG. 7 is a section on the line 7—7 of FIG. 4;

FIG. 8 is a section on the line 8—8 of FIG. 4;

FIG. 9 is a section on the line 9—9 of FIG. 3;

FIG. 10 is a section on the line 10—10 of FIG. 9;

FIG. 11 is a view similar to FIG. 10 but showing the valve member in a different position; and

FIG. 12 is a section on the line 12—12 of FIG. 9.

As will be understood, the discharger apparatus embodying and for practicing this invention may satisfactorily be utilized with a variety of different continuous flow pulping and digesting systems for cooking or digesting wood or other fibrous material in the production of pulp for the manufacture of paper, paper board and the like. In order to achieve a more complete understanding of the structure and mode of operation of apparatus according to this invention, it will be here described in connection with a pulp system and process as disclosed in more detail in my copending application Serial No. 703,622, executed and filed on even dates herewith.

Referring to the drawings, in which like characters of reference designate like parts throughout the several views thereof, a continuous digesting system and apparatus, including apparatus embodying and for practicing this invention, is indicated generally in side view and end view respectively in FIGS. 1 and 2 as comprising feeding apparatus 10 for introducing chips of wood to be cooked into the digesting system and having driving means 11 operatively connected thereto, pre-steaming apparatus 12 for subjecting the chips of wood or other material to a preliminary steaming treatment or step and having its driving means 13 operatively connected thereto, cooking or digesting apparatus 14 with its associated drive means 15 for subjecting the wood chips or other material being cooked to progressive cooking steps, rotary valve means 16 with its associated drive means 17 for delivering and metering chips from pre-steamer 12 into digester 14, and discharge apparatus 18 with its associated drive 19 for discharging the cooked chips from digester 14 through blow line 20 for further processing and treatment to provide the character and quality of pulp or other fibrous material desired.

As indicated more particularly in the end view of FIG. 2, each of the aforementioned elements is preferably provided in pairs side by side (although the pair of digesting elements 14 as illustrated are both enclosed within the same outer shell as hereinafter described), to provide two independent parallel vertical processing lines or flows for handling continuously and concurrently two lines of material being processed. This preferential parallel arrangement provides extra operational latitude and through-put control since one kind of material or cooking chemicals may be processed through one line of

flow while, at the same time, either the same or a different material and cooking chemicals are processed through the parallel line of flow as may be required or desired by the capacity requirements of the mill. Although only one of each of the duplicated general elements of this apparatus may be described in detail, it should be understood that the corresponding member of the second parallel line of flow is substantially a duplicate of the one described with, in some instances, the drive means being mirror images, as indicated in FIG. 2.

The feeding apparatus 10 comprises a generally horizontal elongated barrel or casing 25 having a feed opening or hopper-like inlet 26 in flow communication with an overhead supply of chips to be cooked such as a conventional pulp mill chip bin (not shown). The chips are dropped by gravity into inlet 26 where a screw feeder (not shown), rotatably driven by a motor 28 through a suitable reduction gear and drive 29—31, urges the chips in a more or less compacted mass to the right of the drawing through barrel 25 so that the chips drop by gravity into and through the vertical outlet 35. Similarly, satisfactory results are achieved by using a rotary valve arrangement as at 16 instead of feeding apparatus 10 for introducing the chips first into the system.

As indicated in FIG. 1, the entire feeding apparatus and its drive are preferably mounted on an elevated floor 46 of the mill above the remainder of the apparatus, with the chips being fed dropped by gravity through outlet 35 and into subsequent apparatus through a hole in the floor. The chips drop from outlet 35 through a conduit 50 into the pre-steaming apparatus 12. An expansion joint 51 or other expansion compensating means is preferably interposed at some point between the outlet 35 of feeding apparatus 10 and the inlet 52 of pre-steaming apparatus 12.

Pre-steaming apparatus 12 comprises essentially a cylindrical tube or casing 60 having therein a conventional screw conveyor or feeder (not shown) rotatably driven by a suitable and conventional drive 13. The direction of rotation and pitch of the screw flights are such as to urge chips introduced into the inlet 52 of pre-steamer 12 to the left in the drawing to traverse substantially the entire length of the casing 60 and to drop by gravity out of the outlet 65 thereof. During passage through pre-steamer 12 the chips are subjected to the action of super-atmospheric steam introduced into the interior of casing 60 at one or more steam inlets indicated as 70, 71 and 72 to achieve preliminary steaming, saturation, and softening of the chips prior to actual contact with cooking or digesting chemicals. As will be understood, of course, for certain applications it may also be desired to introduce some chemicals in addition to steam for a preliminary softening or preparatory step to condition the chips better to receive the principal or primary cooking actions in the subsequent digester 14.

As shown in FIGS. 1 and 2, the pre-steaming apparatus 12 is preferably supported above the subsequent apparatus and suspended resiliently from the floor 46 as by hangers 80 including springs 81 and depending tie rods 83 engaging beams 84 on which rest casing 60. In this manner substantially the entire weight of pre-steaming apparatus 12 is carried from above, rather than having to be supported on the remainder of the apparatus below pre-steamer 12, yet the height of pre-steamer 12 with respect to the following apparatus is completely and automatically adjustable as required by the differential thermal expansion movements of the various elements of the whole system which may be subjected to varying degrees of temperature at various times without unduly straining the conduit connections at inlet 52 and outlet 65 of pre-steamer 12.

A link or tie rod 86 interconnects the end of casing 60 opposite to outlet 65 with the corresponding end of digester 14 to aid in maintaining substantial axial par-

allelism between 60 and 14 during heat expansion movements thereof.

From outlet 65 of pre-steamer 12 the treated chips drop by gravity through a conduit 85 into rotary valve apparatus 16 which delivers and meters chips into digester 14 and, since the cooking pressure in digester 14 is maintained at a level substantially above the superatmospheric pressure in pre-steamer 12, rotary valve apparatus 16, also, is for preventing the escape of such higher pressure from digester 14 back into pre-steamer 12.

Although the rotary valve apparatus 16 may satisfactorily be constructed in a number of different ways to provide the desired functioning, a preferred construction is as shown in my copending application Serial No. 703,590, now Patent No. 2,933,208, executed and filed on even dates herewith. In any event, chips are received by valve 16 through the inlet 85 and delivered out the outlet 101 into chip inlet 102 of digester 14.

A preferred satisfactory construction for digester 14 is indicated more particularly in my copending application Serial No. 703,588, executed and filed of even dates herewith, as comprising an outer substantially cylindrical shell 120 within which are mounted a plurality of troughs two of which, 121 and 123 are shown in FIG. 5. In these troughs are screw conveyors 125 and 127, respectively, rotatably mounted on shafts 129 and 131, respectively, journaled in the end plates 133 and 134 of the shell 120. Two other sets of similar troughs and conveyors are provided on the other side of casing 120 as indicated by shafts 126 and 132 in FIG. 2. The shafts 129—132 are rotatably driven from drive means 15 mounted at one end of digester 14 and comprising electric motors 140 and 141 with corresponding reduction gear and chain-and-sprocket drives 142—145. The screw conveyor flights and direction of rotation are arranged to provide for urging chips dropped into the upper trough 121 from the chip inlet 102 axially toward the right in FIGS. 1 and 5, while the lower screw conveyor 127 urges chips in the lower trough 123 axially to the left in FIGS. 1 and 5.

As chips enter chip inlet 102 from rotary valve 16, they fall upon trough 121 and are conveyed axially therealong (to the right in FIGS. 1 and 5) by screw conveyor 125, which is preferably provided with a circular baffle or flange member 148 at the left or entrance end thereof. In progressing axially along trough 121 the chips are passed beneath a plurality of cooking or digesting liquor inlets 150—154 from which cooking or digesting liquor is sprayed onto the chips, and a substantially super-atmospheric pressure is maintained within casing 120 by steam admitted through steam inlet 166.

Since it is desired, according to the illustrated system, to saturate the chips with cooking liquor and subject them to high steam pressure—rather than to maintain the chips immersed in liquid phase cooking liquor—the bottom of upper trough 121 is perforated so that liquor sprayed on top of the chips in this trough will drain through the chips as they are continuously being agitated by screw conveyor 125, will saturate the chips as completely as may be, and then any excess will drain off through the perforated trough so that, at various points along the travel of chips through digester 14, the chips are being subjected to cooking liquor which they may soak up, but are not being agitated or maintained in a liquor pool of liquor.

The excess liquor draining from trough 121 is ultimately collected at the bottom of digester 14 and removed through liquor outlets 170 and 171. Because of the arrangement of dam 172 and overflow pipe 210 hereafter described in the bottom section of casing 120 of digester 14, liquor draining from the left half of trough 121 is collected through the outlet 170 separately from liquor draining from the right half of trough 121, which is collected through outlet 171. These separately collected batches of liquor, then, being of different concentrations since they are collected at different points in the cooking

cycle, may be recirculated for reapplication to chips moving through the digester.

The right-hand end 185 of trough 121 is spaced from the inside 186 of the head or end plate 133 of shell 120 of digester 14 so that, as the chips in trough 121 reach the end 185 thereof, they drop by gravity onto lower trough 123 along which they are conveyed back toward the left of the drawing by screw conveyors 127 until they reach the left end 190 of trough 123 which is spaced from the inside surface of end plate 134 of casing 120 of digester 14, at which point the chips, now completely cooked, drop by gravity through chip outlet 195 into the inlet 196 of discharger apparatus 18, described below.

The bottom of trough 123 is also perforated as with trough 121 so that liquor continues to drain through the chips and out of the troughs. It will also be noted that trough 123 is positioned within casing 120 of digester 14 spaced above the bottom thereof to provide beneath trough 123 a collecting pool or sump for collecting the liquor draining through the chips for recirculation, as above described. The aforementioned dam 172 extends across this sump beneath trough 123 approximately at the axial midpoint of the digester 14 whereby the collecting sump beneath the lower trough is divided into approximately two equal size pools for collecting the liquor for recirculation.

The heights of dams 172 and 201 are correlated with dam 201 being higher than dam 172. Thus, as liquor collects in the left sump and the level therein rises, the cooking liquor will overflow dam 172 into the right-hand sump before the level of liquor behind dam 201 reaches a height to overflow and escape out chip outlet 195. In this manner, the more highly concentrated liquor in the left half of the digester automatically and constantly replenishes the less concentrated liquor in the right half of the digester, but diluting of the more highly concentrated liquor at the left with spent or weak liquor at the right is avoided.

An overflow pipe 210 is also provided leading from an open overflow end 211 at the right of dam 172 directly through dam 201 to discharge liquor out of the end 212 of pipe 210 directly into chip outlet 195. The height of overflow 211 is lower than the dam 172 so that the level of spent liquor to the right of dam 172 cannot build up sufficiently to overflow that dam and dilute the more concentrated liquor. The level of spent liquor to the right of dam 172 will build up, and such liquor is automatically drawn off through overflow 211 and pipe 210 and discharged directly out of inlet 195.

Referring again to FIGS. 1 and 2, in the system illustrated, the chips leave digester through chip outlet 195 thereof after the cooking or digesting is completed to the degree desired, and drop into discharger 18 through inlet 196 thereof.

As indicated in more detail in FIGS. 3 and 4, discharger 18 comprises an outer casing 260 within which is provided a screw conveyor having flights 285 mounted on a shaft 286 suitably journaled as at 287 and 288 and having pressure resistant packings 289 and 290 through the end closures 291 and 292, respectively, of casing 260. Shaft 286 is driven by drive means 19 comprising motor 261, and reduction gear and belt drive 262, 263, and the direction of rotation of shaft 286 and the pitch of screw flights 285 is such as to receive cooked chips and cooking liquor dropping down through inlet 196 and urge the chips to the right in FIG. 4.

Also mounted on shaft 286 to be rotated thereby is a bladed impeller 295 adjacent end plate 292 of casing 260 and shown in more detail in FIG. 6 as comprising a hub 296 mounted on shaft 286 and carrying a plurality of curved partially overlapping blades 297. Between screw flights 285 and impeller 295, there is preferably provided a breaker bar arrangement indicated in FIG. 7 as comprising a hub 300 keyed to shaft 286 and carrying a plurality of straight blades 301. During rotation of shaft 286, a mass of cooked chips is urged to the right in FIG.

4 by screw flights 285, and this mass may be more or less compacted due to the softening of the chips in the cooking steps and the compacting action of screw flights 285. The purpose of breaker bar blades 301 is merely to break up this mass of chips, and, to this end the simple arrangement of the two-blade device, in FIG. 7, preferably cooperating with several short splines 302 affixed to the inner wall of casing 260 adjacent the path of blades 301, is satisfactory.

Two blowing orifices 305 and 306 are provided through end plate 292 of casing 260 at approximately the 4 o'clock and 8 o'clock positions thereon as indicated in FIG. 3. These orifices are preferably of a round shape as shown, and a satisfactory size for most pulping purposes is about $\frac{3}{4}$ inch wide and $1\frac{1}{2}$ inches long. The opening and size of orifices 305 and 306 is controllable and adjusted as hereafter described, by a blow valve 265 interposed between each of the orifices in end plate 292 and blow line 20 leading from the discharger to the next step or equipment in the pulp preparation process as desired.

The mass of cooked chips and such cooking liquor as may have entered casing 260 through chip inlet 196 is urged to the right in FIG. 4 by screw flights 285 and broken up and agitated by breaker bars 301, then comes under the influence of impeller 295 which imparts to the chips a swirling action while forcing the chips against end plate 292. As portions of this swirling mass of chips and liquor pass either of the orifices 305 or 306, the chip or chips and liquor immediately adjacent the orifices will be blown or expelled therethrough into blow line 20 by the action of super-atmospheric pressure in casing 260 and digester 14. Since a swirling mass of chips is constantly available at the orifices 305 and 306, substantially little steam pressure loss will be experienced, and a fairly continuous and substantially even flow of blown chips will constantly be discharged from orifices 305 and 306 to be conveyed through blow line 20 to the next step of pulp preparation. Some, although not necessarily all, of the impeller blades 297 have adjacent the radially outer end of the trailing edge thereof a breaker point 307 to dislodge from orifices 305 and 306 any chips or knots which may become stuck therein and to break up any hard pieces or uncooked chips or knots which may be of too great a size to pass through orifices 305 and 306. Preferably these breaker points 307, as indicated in FIGS. 4 and 6, are located at different radial points on blades 297 so that among all the breaker points 307, the entire radial extent of orifices 305 and 306 are covered as impeller 295 rotates.

As indicated in FIGS. 1 and 2, discharger 18 is preferably mounted beneath digester 14 and supported separately therefrom. To compensate for thermal expansion movement to which both discharger 18 and digester 14 may be subjected in operation at different temperature conditions, a preferred mounting structure for discharger 18 is illustrated in FIGS. 4 and 8 as comprising a base plate 310 mounted on the floor or other foundation and a supporting plate 311 on which is mounted casing 260 of discharger 18 as by flanges 312. Supporting plate 311 is resiliently mounted for vertical movement on base plate 310 as by bolts 315 carrying therearound coil springs 316 to support the weight of discharger 18 and yet provide for limited vertical movement thereof as required by and under the influence of vertical thermal expansion of either discharger 18 or digester 14 together or with respect to each other. Stops 317 may be provided on base plate 310 to limit the downward vertical movement of supporting plate 311, and nuts 318 provide satisfactory means for adjusting the tension and effect to springs 316, while bolts 320 provide stops to limit the upward vertical movement of supporting plate 311.

As will be understood, the wood or other fibrous raw material, after having been cooked or digested or softened to the desired degree, drops into chip outlet 196 of discharger 18 and is urged therein to the right in FIG. 4 to form a swirling mass of material, portions of which are

continuously blow through orifices 305 and 306 into blow lines 20. The rapidity and consistency of the blown or discharged material will depend to some extent on the degree of cooking or digesting to which the material is subjected.

That is, if the cooking and digesting was merely sufficient to soften wood chips without actually separating them into their constituent fibres or fibre bundles, whole chips may be present in discharger 18 and some substantial fibre separation therein may be achieved as the chips are blown through orifices 305 and 306 and/or subjected to the breaking action of breaker points 307 or the shearing or agitating action of impeller 295. On the other hand, the cooking or digesting action in digester 14 may be continued to such an extent that the fibrous material is substantially separated as a slurry when it enters discharger 18, in which event less fibre separation or defibering action would be expected as the slurry is discharged or blown through orifices 305 and 306 in the blow line 20.

For either of the above conditions, or for other reasons, it may be desirable to have the shape, size, and/or effective open area of orifices 305 and 306 adjustable and controllable for different conditions of operation. Hence a blow valve 265 is provided between the orifices 305 and 306 and the end of blow line 20 as indicated generally in FIG. 3. As will be understood, blow valve 265 may be of a variety of satisfactory constructions, but a preferred structure is described in more detail in my copending application Serial No. 703,591, executed and filed on even dates herewith, as comprising an automatic pneumatically controlled valve with a manual overriding opening and closing and presetting mechanism.

As appears in more detail from FIGS. 9-12, the blow valve comprises a generally cylindrical casing 325 within which is provided a double acting cylinder-and-piston motor comprising piston 325 fixedly mounted on shaft 327 extending in either direction from piston 326. Packing glands are provided at 328 and 329 for sliding movement of shaft 327 therethrough without loss of pressure within cylinder 325. Pressure inlet and outlet conduits 330 and 331 are provided so that hydraulic or pneumatic pressure may be introduced or withdrawn into the interior of cylinder 325 to urge piston 326 in either direction therein with consequent motion of rod 27 axially of valve 265.

One end of shaft 327 is formed with a substantially semi-circular cutout portion 335, as indicated more particularly in FIGS. 10 and 11, and this end of shaft 327 is mounted for axial movement within and with respect to a cylindrical valve seat or casing 336 having oval apertures 337 therein, one of which is substantially the same size and shape as orifices 305 and 306. As indicated in FIG. 9, an indented seat 338 is provided in end plate 292 of discharger casing 260 for receiving the upper end of valve casing 336, and a passage 339 is provided in the outer end flange 340 of casing 260 and the flange 341 of end plate 292 into which valve 265 is inserted so that the aperture 337 in casing 336 is adjacent and coincident with the orifices 305 and 306 as the case may be.

As indicated particularly in FIG. 9, the orifice or discharger side of valve casing 336 has a chamfered surface 345 for alignment with the adjacent chamfered surface of the orifice to aid in the ejection of cooked wood there-through, whereas the opposite side of casing 336 is preferably configured as in FIG. 9 to form a transition from the orifice into blow line 20, and is preferably of somewhat greater size as indicated in FIGS. 10-12.

As will be apparent from the foregoing, when shaft 327 is in the uppermost position in FIG. 9 and as indicated in FIG. 10, orifice 306 will be completely closed. As shaft 327 is moved to any of the lower positions thereof (e.g., FIG. 11), however, orifice 306 is opened and, depending upon the position of shaft 327 and its semicircular cut out 335 in the end thereof, orifice 306 may be opened to any extent from that of merely a circle to the whole oval extent thereof for controlling

the quantity of material blown therethrough as well as the extruding or ejection or defibering effect obtained by blowing through a constricted orifice.

As will be noted from the foregoing, the position of shaft 327 and, consequently, the size and shape of the opening of orifice 306, are controlled by the action of piston 326 as moved in one direction or the other by pneumatic pressure admitted or withdrawn through conduits 330 and 331. Also, the final positioning of shaft 327 can be preset or the action of piston 326 overridden by a screw arrangement manually operable by hand-wheel 350. As indicated in FIG. 9, this arrangement includes a threaded portion 351 on shaft 327 threadably engaging a hub 352 integral with handwheel 350 and having an axial extent approximately equal to the maximum travel of piston 326 and an enlarged flange 353 at the inner end of hub 352. A yoke 354 is provided surrounding hub 352 and affixed to the valve cylinder 325 forming a race 355 within which flange 353 may move axially from the position shown in FIG. 9 to a lower position where flange 353 abuts against the inside end 356 of yoke 354.

As will be apparent from the foregoing, as handwheel 350 and its integral hub 352 are rotated with respect to the threaded portion 351 of shaft 327, flange 353 will be moved axially of the valve to different positions along threaded portion 351 between the upper position shown in FIG. 9 and the most extreme lower position where flange 353 abuts against end 356 of yoke 354. Any position, accordingly, of flange 353 along threaded portion 351 of shaft 327 will define a limit to the axial movement by piston 326. That is, under the conditions illustrated in FIG. 9, admitting air through conduit 331 would tend to urge piston 326 downwardly in the drawing. With flange 353 set as shown, piston 326 could move all the way down through its maximum throw before flange 353 abutted against end 356 of yokes 354, thus opening the valve to its full extent. Were flange 354 positioned in FIG. 9 already abutting against end 356, as would be the case if handwheel 350 were rotated sufficiently to screw flange 353 into such a position, downward movement of piston 326 would be prohibited despite introduction of air or hydraulic fluid into conduit 331.

Thus, the structure illustrated provides for presetting the extent to which orifice 306 will be opened by valve 265, and of accomplishing such presetting with valve 265 closed. For example, should it be desired to open the orifice approximately one-half as indicated in FIG. 11, handwheel would be rotated until flange 353 was positioned approximately midway along threaded portion 351 of shaft 327. Thereafter, with pneumatic pressure admitted to conduit 331, piston 326 would move downwardly in the drawing approximately one-half way until flange 353 abutted against 356 of yoke 354. Also, as indicated in FIG. 9, a limit switch arrangement is preferably provided comprising limit switch 360 having an operating arm 361 riding on cam member 362 mounted on guide rod 363 for movement with shaft 327. Such an arrangement is electrically interlocked with the drive mechanism of discharger 18 and/or digester 14 so that chips or pulp cannot be fed through digester 14 and/or discharger 18 unless one or the other of valves 265 is in such position that one of the other of orifices 305 or 306 is at least partially open for the blow discharger material therethrough. As will be apparent from the foregoing, such structure provides for remote control of either valve 265 without operator attendance at the valve. That is, with handwheel 350 preset to any of the possible positions, valve 265 can be repeatedly closed or opened to the preset position by remote control of fluid pressure in cylinder 325.

While the methods and forms of apparatus herein described constitute a preferred embodiment of the invention, it is to be understood that the invention is not limited to these precise forms of apparatus, and that changes

may be made therein without departing from the scope of the invention which is defined in the appended claims.

What is claimed is:

1. Discharging apparatus for a continuous digesting system of the character described for the manufacture of paper pulp comprising a chamber for receiving said pulp from said digesting system, one end of said chamber being a discharge end and having therein a blow orifice for discharge of said pulp therethrough, a conveyor for urging said pulp in said chamber toward said discharge end thereof, rotary breaker bar means for agitating said pulp in said chamber and for preventing agglomerations of said pulp adjacent said discharge end, rotary bladed impeller means adjacent said blow orifice in said discharge end for further agitating said pulp and continuously presenting a supply of pulp to said blow orifice for blow discharge therethrough, said impeller rotating in a plane adjacent and parallel to the plane of said discharge end, and valve means adjustable from a closed position to a plurality of open positions of varying size for adjusting and controlling the size of said blow orifice and the quantity of said pulp being blown therethrough.

2. Discharging apparatus for a continuous digesting system of the character described for the manufacture of paper pulp comprising a substantially horizontal cylindrical chamber for receiving said pulp from said digesting system, one end of said chamber being a discharge end and having therein a blow orifice for discharge of said pulp therethrough, a conveyor for urging said pulp axially of said chamber toward said discharge end thereof, rotary bladed impeller means adjacent said blow orifice in said discharge end for agitating said pulp and continuously presenting a supply of pulp to said blow orifice for blow discharge therethrough, means for rotating said impeller in a plane adjacent and parallel to the plane of said discharge end, and valve means adjustable from a closed position to a plurality of open positions of varying size for adjusting and controlling the size of said blow orifice and the quantity of said pulp being blown therethrough.

3. Discharging apparatus for a continuous digesting system of the character described for the manufacture of paper pulp comprising a chamber for receiving said pulp from said digesting system, one end of said chamber being a discharge end and having therein a blow orifice for discharge of said pulp therethrough, a conveyor for urging said pulp axially of said chamber toward said discharge end thereof, rotary bladed impeller means adjacent said blow orifice in said discharge end for further agitating said pulp and continuously presenting a supply of pulp to said blow orifice for blow discharge therethrough, means for rotating said impeller in a plane adjacent and parallel to the plane of said discharge end, and breaker points on at least some of the blades of said bladed impeller and extending therefrom toward said blow orifice for comminuting and removing from said orifice particles in said pulp too large to pass readily through said orifice, and valve means adjustable from a closed position to a plurality of open positions of varying size for adjusting and controlling the size of said blow orifice and the quantity of said pulp being blown therethrough.

4. Discharging apparatus for a continuous digesting system of the character described for the manufacture of paper pulp comprising a substantially horizontal cylindrical chamber for receiving said pulp from said digesting system, one end of said chamber being a discharge end and having therein a blow orifice for discharge of said pulp therethrough, a conveyor for urging said pulp axially of said chamber toward said discharge end thereof, means for driving said conveyor, rotary breaker bar means for agitating said pulp in said chamber and for preventing agglomerations of said pulp adjacent said discharge end, rotary bladed impeller means adjacent said blow orifice in said discharge end for further agitating said pulp and continuously presenting a supply of pulp to

said blow orifice for blow discharge therethrough, said breaker bar means and bladed impeller both being driven by said drive means for said conveyor, said impeller rotating in a plane adjacent and parallel to the plane of said discharge end, breaker points on at least some of the blades of said bladed impeller and extending axially therefrom toward said blow orifice for comminuting and removing from said orifice particles in said pulp too large to pass readily through said orifice, and valve means adjustable from a closed position to a plurality of open positions of varying size for adjusting and controlling the size of said blow orifice and the quantity and particle size of said pulp being blown therethrough.

5. Discharging apparatus for a continuous digesting system of the character described for the manufacture of paper pulp comprising a substantially horizontal chamber for receiving said pulp from said digesting system, one end of said chamber being a discharge end disposed in a vertical plane and having therein a blow orifice for discharge of said pulp therethrough, a conveyor for urging said pulp axially of said chamber toward said discharge end thereof, rotary bladed impeller means adjacent said blow orifice in said discharge end for further agitating said pulp and continuously presenting a supply of pulp to said blow orifice for blow discharge therethrough, means for rotating said impeller in a plane adjacent and parallel to the plane of said discharge end, and breaker points on at least some of the blades of said bladed impeller and extending axially therefrom toward said blow orifice for comminuting and removing from said orifice particles in said pulp too large to pass readily through said orifice.

6. In a continuous pulp digester system of the character described having a digesting vessel in which said pulp is digested under super-atmospheric steam pressure, a continuous discharger comprising in combination an inlet for receiving said pulp under said super-atmospheric pressure from said digesting vessel, a chamber for containing said pulp as received from said digesting vessel and prior to the discharge of said pulp, said chamber including an end wall having therein a blow orifice through which pulp from said chamber is blown by said super-atmospheric pressure, a conveyor in said chamber for conveying the pulp received therein from said inlet to said blow orifice, impeller means for receiving said pulp in said chamber from said conveyor and impelling it towards said blow orifice for blow discharge therethrough, said impeller means including a plurality of blades rotating in a plane substantially parallel to said end of said chamber for continuously presenting to said blow orifice a swirling mass of said pulp for continuous discharge therethrough by said super-atmospheric pressure, means on at least a portion of said impeller blades for comminuting and dislodging particles of said pulp from said blow orifice, and gate valve means adjustable from a closed position to a plurality of predetermined different open positions for controlling and adjusting the size of said blow orifice.

7. In a continuous pulp digester system of the character described having a digesting vessel in which said pulp is digested under super-atmospheric steam pressure, a continuous discharger comprising in combination an inlet for receiving said pulp under said super-atmospheric pressure from said digesting vessel, a cylindrical chamber for containing said pulp as received from said digesting vessel and prior to the discharge of said pulp, said chamber including an end wall having therein a blow orifice through which pulp from said chamber is blown by said super-atmospheric pressure, a conveyor in said chamber for conveying the pulp received therein from said inlet to said blow orifice, means in said chamber for agitating and preventing the agglomeration of said pulp therein and including rotating breaker bars driven by said conveyor and cooperating stationary breaker bars on the walls of said chamber, impeller means for receiving said pulp in said chamber from said conveyor and impelling it towards said blow orifice for blow discharge therethrough, and gate valve means adjustable from a closed position

to a plurality of predetermined different open positions for controlling said adjusting the size of said blow orifice.

8. In a continuous pulp digester system of the character described having a digesting vessel in which said pulp is digested under super-atmospheric steam pressure, a continuous discharger comprising in combination an inlet for receiving said pulp under said super-atmospheric pressure from said digesting vessel, a cylindrical chamber for containing said pulp as received from said digesting vessel and prior to the discharge of said pulp, said chamber including an end wall having therein a blow orifice through which pulp from said chamber is blown by said super-atmospheric pressure, a conveyor in said chamber for conveying the pulp received therein from said inlet to said blow orifice, means in said chamber for agitating and preventing the agglomeration of said pulp therein, impeller means for receiving said pulp in said chamber from said conveyor and impelling it towards said blow orifice for blow discharge therethrough, means on at least a portion of said impeller blades for comminuting and dislodging from said blow orifice particles in said pulp which may be larger than will pass through said orifice, and resilient adjustably mounting means for positioning said discharger adjacent to and in pressure-tight flow communication with said digester vessel and for compensating for heat expansion moments and dimensional changes between said digesting vessel and said discharger.

9. In a continuous pulp digester system of the character described having a digesting vessel in which said pulp is digested under super-atmospheric steam pressure, a continuous discharger comprising in combination an inlet for receiving said pulp under said super-atmospheric pressure from said digesting vessel, a cylindrical chamber for containing said pulp as received from said digesting vessel and prior to the discharge of said pulp, said chamber including an end wall having therein a blow orifice through which pulp from said chamber is blown by said super-atmospheric pressure, a conveyor in said chamber for conveying the pulp received therein from said inlet to said blow orifice, means in said chamber for agitating and preventing the agglomeration of said pulp therein and including rotating breaker bars driven by said conveyor and cooperating stationary breaker bars on the walls of said chamber, impeller means for receiving said pulp in said chamber from said conveyor and impelling it towards said blow orifice for blow discharge therethrough, said impeller means including a plurality of blades rotating in a plane substantially parallel to the end of said chamber in which is located said blow orifice for continuously presenting to said blow orifice a swirling mass of said pulp for continuous discharge therethrough by said super-atmospheric pressure, means on at least a portion of said impeller blades for comminuting and dislodging from said blow orifice particles in said pulp which may be larger than will pass through said orifice, and gate valve means adjustable from a closed position to a plurality of predetermined different open positions for controlling and adjusting the size of said blow orifice.

10. In a continuous pulp digester system of the character described having a digesting vessel in which said pulp is digested under super-atmospheric steam pressure,

a continuous discharger comprising in combination an inlet for receiving said pulp under said super-atmospheric pressure from said digesting vessel, a cylindrical chamber for containing said pulp as received from said digesting vessel and prior to the discharge of said pulp, said chamber including an end wall having therein a blow orifice through which pulp from said chamber is blown by said super-atmospheric pressure, a conveyor in said chamber for conveying the pulp received therein from said inlet to said blow orifice, means in said chamber for agitating and preventing the agglomeration of said pulp therein and including rotating breaker bars driven by said conveyor and cooperating stationary breaker bars on the walls of said chamber, impeller means for receiving said pulp in said chamber from said conveyor and impelling it towards said blow orifice for blow discharge therethrough, said impeller means including a plurality of blades rotating in a plane substantially parallel to the end of said chamber in which is located said blow orifice for continuously presenting to said blow orifice a swirling mass of said pulp for continuous discharge therethrough by said super-atmospheric pressure, means on at least a portion of said impeller blades for comminuting and dislodging from said blow orifice particles in said pulp which may be larger than will pass through said orifice, gate valve means adjustable from a closed position to a plurality of predetermined different open positions for controlling and adjusting the size of said blow orifice, and resilient adjustably mounting means for positioning said discharge apparatus adjacent to and in pressure-tight flow communication with said digester vessel and for compensating for heat expansion moments and dimensional changes between said digesting vessel and said discharger apparatus.

11. In a continuous pulp digester system of the character described having a digesting vessel in which said pulp is digested under super-atmospheric steam pressure, a continuous discharger comprising in combination a chamber for receiving said pulp from said digesting vessel, said chamber including an end wall having therein a blow orifice through which pulp from said chamber is blown by said super atmospheric pressure, means in said chamber for agitating and preventing the agglomeration of said pulp therein, impeller means for impelling said pulp towards said blow orifice for blow discharge therethrough, said impeller means including a plurality of blades rotating in a plane substantially parallel to said end of said chamber for continuously presenting to said blow orifice a swirling mass of said pulp for continuous discharge therethrough by said super-atmospheric pressure, and resilient adjustably mounting means for positioning said discharge apparatus adjacent to and in pressure-tight flow communication with said digester vessel and for compensating for heat expansion moments and dimensional changes between said digesting vessel and said discharger apparatus.

References Cited in the file of this patent

UNITED STATES PATENTS

2,008,892	Asplund	July 23, 1935
2,616,802	Kehoe	Nov. 4, 1952
2,694,426	Ward	Nov. 16, 1954