Nov. 19, 1963 F. D. HELVERSEN 3,111,453

DRYING OF PULP

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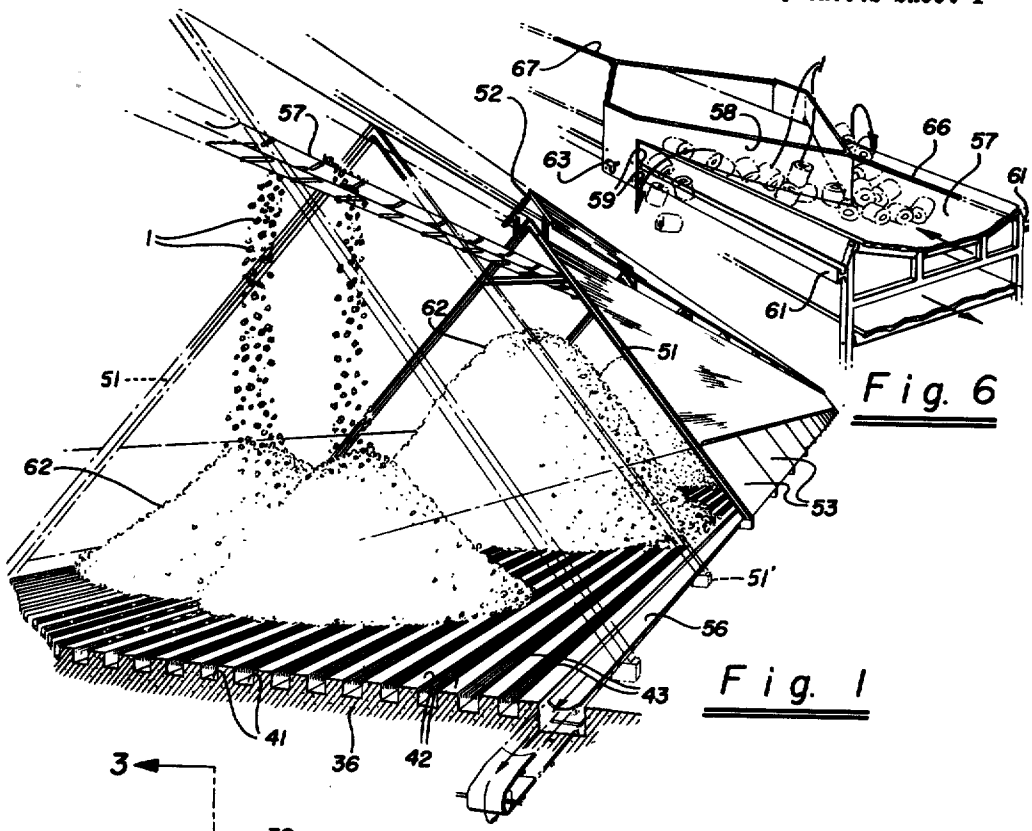


Fig. 6

Fig. 1

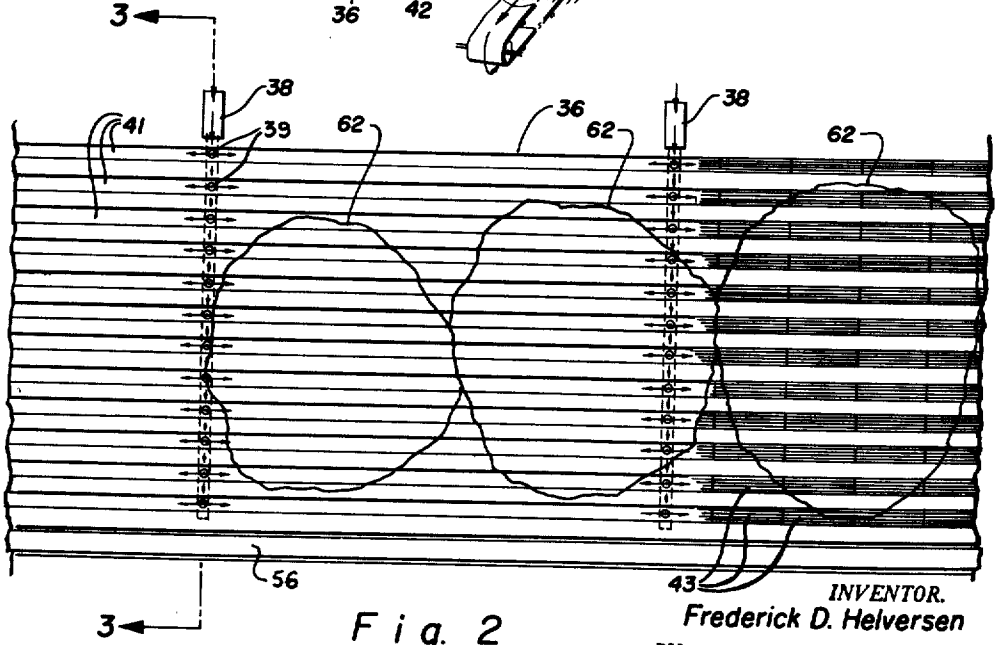


Fig. 2

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Fig. 3

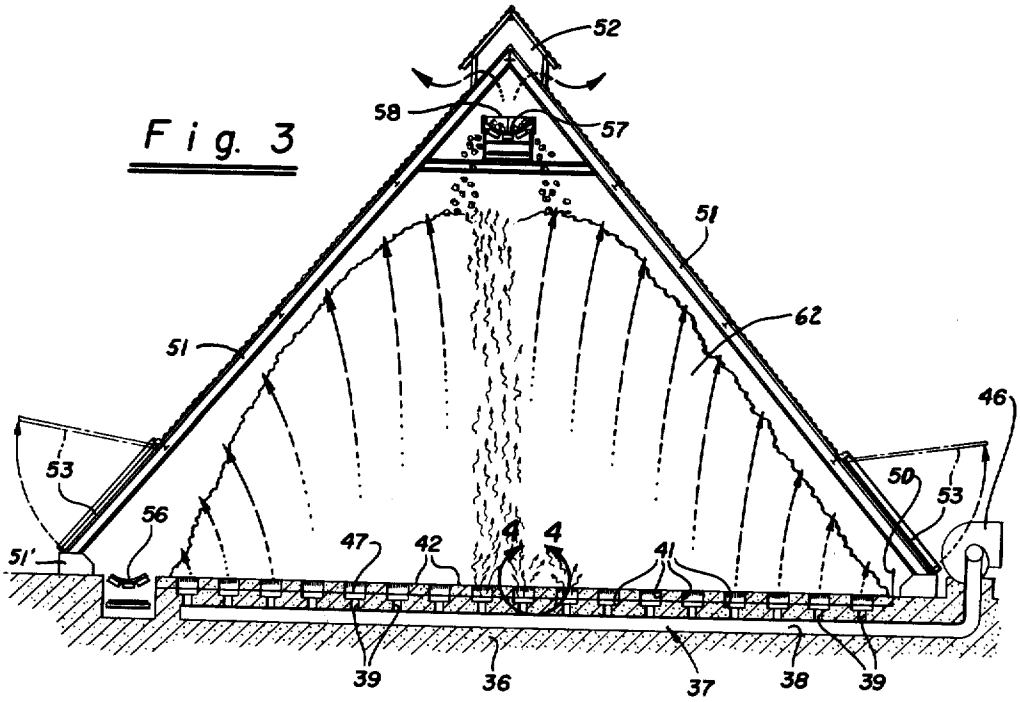


Fig. 5

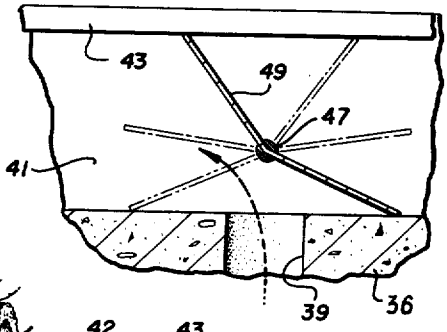


Fig. 4

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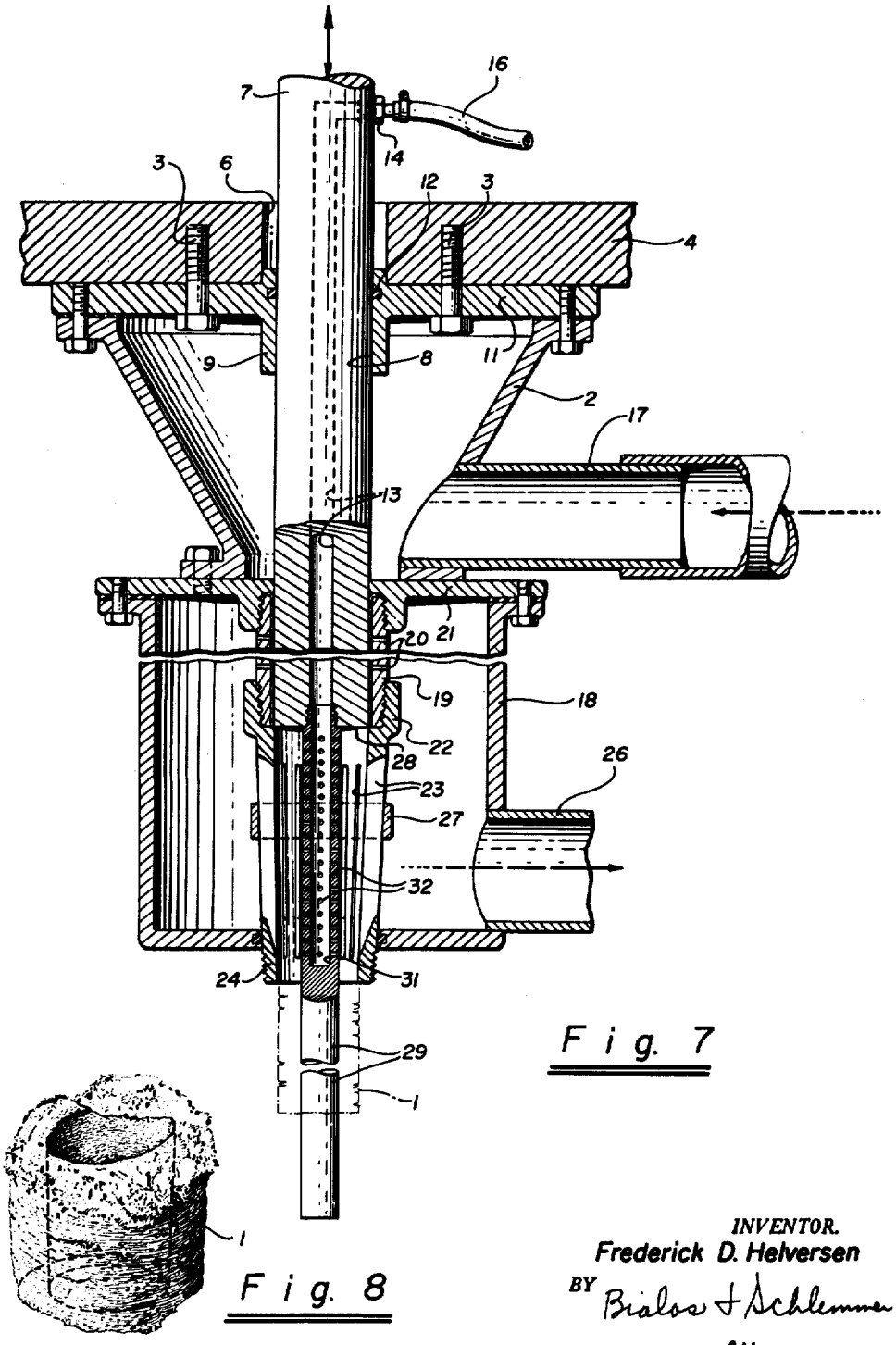


Fig. 7

Fig. 8

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3,111,453

DRYING OF PULP

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9 Claims. (Cl. 162—201)

This invention relates to the preparation of a product for shipment by removing excess moisture therefrom to reduce the product's shipping weight and bulk. More particularly, this invention relates to the dewatering and drying of a moist product so that the major portion of the water in such product is removed therefrom during preparation of the product for shipment. In addition to lowering the shipping weight of the product, the removal of moisture also enhances the product by precluding deterioration of the same during shipment and storage.

Still more particularly, this invention relates to the dewatering and drying of a fibrous product, such as wood or similar pulps used in the manufacture of paper, for the purpose of reducing the shipping bulk and weight of the pulp and precluding deterioration thereof. In this regard, the drying procedure involved in this invention includes the compressing or compacting of fibrous products such as wood pulp into tubular sections of hollow, generally cylindrical configuration, each of which has a longitudinal opening therethrough. This compacting results in an initial dewatering of the product but the compacted product still contains appreciable moisture. Such compacted sections may readily be air dried to further reduce their moisture content in that, during a subsequent drying operation, quantities of drying air may pass not only all around the sections but also through the longitudinal openings extending therethrough.

In the manufacture of paper, timber cut in forests is delivered to a pulp mill adjacent the timber site where the timber is reduced by any one of several well known methods to pulp, which comprises the cellulosic fibers from which paper ultimately is produced. In many instances, the paper manufacturing mill is located adjacent the site of the pulp mill and a slurry of pulp and water is conveyed in any suitable manner directly from the pulp mill to a paper making machine in the adjacent paper mill.

However, it has proved economically desirable in some situations to locate paper mills in industrial areas closer to the market for the paper and the various products into which the paper subsequently is to be converted. Because the timber forests and pulp mills generally are located at substantial distances from the ultimate paper market, the shipment of pulp over long distances by boat, truck or rail frequently is required.

Accordingly, because shipping charges generally are determined by weight and/or bulk, reduction of the bulk and weight of the pulp temporarily for shipment and handling is highly desirable in that the substantial amounts of moisture carried in raw pulp unnecessarily increases its shipping cost without producing any substantial advantages.

This invention is directed principally to the dewatering and drying of wood pulp to reduce its bulk and moisture content to a relatively low level so that the same may readily and economically be transported by rail, truck or ship without paying shipping charges for useless water in such pulp.

Following shipment of dried pulp to a distant paper mill, the pulp subsequently has water added to it to again form a pulp slurry readily handled in a paper machine in the conventional and well known manner. Because some time may pass before the dried pulp has water added

thereto, its low moisture content retards deterioration thereof during shipment and storage.

In line with the purposes of this invention, it is desired that the dewatered and dried pulp be in a convenient form for drying and shipment, and for this purpose the aforementioned hollow tubular sections mentioned have proved highly effective.

While hereinafter reference will be directed primarily to the dewatering and drying of fibrous wood pulp intended for the manufacture of paper, it should be understood that this invention is applicable to the treatment of other compressible products in which excess moisture presents a problem. Accordingly, while the invention has particular utility in and is directed to the treatment of wood pulp as hereinafter specifically described, it should be interpreted in light of its broader aspects.

In co-pending application Serial No. 842,269, filed September 25, 1959, now U.S. Patent No. 3,021,254, entitled "Method and Apparatus for Dewatering Pulp and the Resulting Product," a method and an apparatus are disclosed for removing by compression a substantial portion of the moisture from a fibrous product, such as wood pulp. However, the pulp product treated in the manner of the co-pending application still contains a substantial quantity of moisture.

The present invention relates to the further treatment of compressed and compacted pulp sections of the type disclosed in such co-pending application to further remove the greater portion of the moisture remaining in the compressed pulp after compaction thereof. For the purposes of this invention, it is preferred that the moisture content of the dried pulp treated be reduced to 10% or below, with a moisture content of 6–8% being readily and economically obtainable by employing the method of this invention.

With further regard to the compacting of pulp in the manner disclosed in the co-pending application, the pulp is compacted into hollow tubular, generally cylindrical sections or segments. Further drying of such sections in the manner of this invention is enhanced due to the fact that drying air may pass not only around the sections but also internally of the sections through the longitudinal openings therein.

Preferably large piles of compacted and dewatered sections are positioned on a suitable supporting surface and a quantity of substantially dry air, which may be heated or unheated as preferred, is forced through the pile. Such air during its travel through the pile follows a tortuous, highly irregular path through and around the respective pulp sections so that, upon continuing air flow for a predetermined time, the average moisture content of the pulp sections may be reduced to a practical level.

With the foregoing in mind, it should be understood that objects of the present invention include the provision of a method for dewatering and drying a product, such as fibrous wood pulp; the provision of structural means in which such method may be carried out effectively; the provision of components in combination with such structural means for facilitating the convenient handling of large quantities of pulp sections during the drying procedure; and the provision of a method and means for air drying piles of generally cylindrical hollow tubular pulp sections.

These and other objects will become apparent from a study of the following specification, in which reference is directed to the accompanying drawings.

FIG. 1 is an isometric, generally schematic view of the structural building means of this invention in which a product drying operation may be carried out;

FIG. 2 is a plan view of the supporting surface of the structure of FIG. 1;

FIG. 3 is a vertical sectional view through the building structure taken in the plane of line 3—3 of FIG. 2;

FIG. 4 is a partial vertical section through the supporting surface slab of the building structure of the area defined by line 4—4 of FIG. 3;

FIG. 5 is a vertical sectional view through the supporting surface slab taken in the plane of line 5—5 of FIG. 4;

FIG. 6 is an isometric view of means provided in conjunction with an overhead conveyor of the building structure for diverting compacted pulp sections from the conveyor onto a predetermined portion of the supporting surface slab;

FIG. 7 is a vertical section through an apparatus for continuously compacting and forming tubular generally cylindrical sections of dewatered pulp; and

FIG. 8 is an isometric view of a compacted and dewatered pulp tubular section formable by the apparatus of FIG. 7.

With the apparatus shown in FIG. 7, the initial dewatering of a fibrous product such as wood pulp may be economically and expediently effected so that a dewatered product of lighter weight and lower bulk having a tubular configuration is provided which enhances further drying as hereinaftter discussed. Such pulp sections may be easily handled during further drying and may be transported conveniently and re-pulped by the subsequent addition of water thereto in preparation for the paper making operation.

Specific reference is first directed to FIG. 7 which shows one embodiment of the apparatus of the co-pending application by which generally cylindrical hollow tubular pulp sections or segments 1 of the type shown in FIG. 8 may be produced. For a full discussion and understanding of such apparatus, reference is directed to said co-pending application. For the purposes of this invention, however, the apparatus for producing tubular pulp sections in continuous fashion from a substantially continuous supply of pulp slurry will be briefly described.

Such apparatus includes a pulp slurry hopper 2 suspended in any suitable fashion, such as by a series of bolts 3, from a supporting table structure 4 provided with a central opening 6 therein. Through such opening a reciprocatable piston or plunger 7 is positioned which extends through an opening 8 in a tubular extension 9 of plate 11 which forms the top of the pulp slurry hopper 2. Preferably a leak preventing O-ring is provided in plate 11 to preclude leakage around the periphery of plunger 7 during reciprocation thereof.

In the embodiment illustrated, plunger 7 is provided with a longitudinal fluid passageway 13. Above table 4, a fitting 14 is secured to the plunger in registry with the upper end of passageway 13. A flexible tube 16 is connected to such fitting for taking off water from the passageway.

Any suitable means (not shown) may be employed for reciprocating the plunger in a generally vertical direction as indicated by the arrows. In FIG. 7, the plunger is shown at the bottom of its vertical stroke.

Provided in conjunction with hopper 2 is an inlet conduit 17 through which a continuous supply of pulp slurry is introduced into the hopper. A container 18 having an internal chamber is bolted or otherwise secured in depending fashion from the bottom of hopper 2. A perforate tube 19 having a series of moisture passage holes 20 therethrough depends from the cover plate 21 of such container. Threadedly connected to the lower end of tube 19 is a tubular extension 22, which preferably has an internal taper of a predetermined amount for the purpose described in the co-pending application. A series of radial openings in the form of longitudinal slots 23 are provided through the wall of tubular extension 22 to permit the passage of moisture therethrough into the chamber of container 18.

At its lower end 24, tube extension 22 projects in leak-proof fashion through the bottom of container 18. Adjacent its bottom, container 18 has a fluid removal outlet conduit 26 through which water passing outwardly through the tube 19 and the extension 22 into the chamber of container 18 may be withdrawn from the apparatus. Because of the substantial pressures applied to the tapered tube extension 22 during the pulp dewatering process, preferably a re-enforcing band 27 is secured about the outer periphery of the tube extension to strengthen the same.

At its lower end plunger 7 is provided with a substantially planar pulp compressing surface 28 and an axially aligned rod 29 is threadedly engaged with the plunger to depend from such surface. Rod 29 also is provided with a longitudinal internal passageway 31 which extends for a predetermined portion of the rod and is in alignment with the passageway 13 provided in plunger 7. Rod 29 also is provided with a perforate wall having a series of radial water passage openings 32 spacedly provided therein.

From the foregoing it should be understood that, upon reciprocation of the plunger upwardly from the position shown in FIG. 7, the compacting surface 28 of the plunger will be raised above the top of container 18 into the hopper so that pulp slurry in the hopper may enter the tube 19 and flow therethrough into the tube and its extension 22. Thereafter, upon reciprocation of the plunger downwardly, slurry in the tube will be compacted therein and water in the slurry will be forced outwardly through the perforate wall of tube 19 and through the slots 23 in the tubular extension 22.

Upon repeated high speed reciprocation of the plunger, a substantially continuous length 1 of compacted pulp will be extruded from the lower end 24 of the tube extension 22 as seen in dotted lines in FIG. 7. Rod 29 used in conjunction with the plunger results in the length of compacted pulp being of hollow tubular configuration. During reciprocation of the plunger, the length of compacted pulp is broken off in random lengths or segments, each of which has a generally cylindrical outer periphery and a generally cylindrical opening through the interior thereof as seen in FIG. 8. It it such dewatered and compacted pulp segments that are further dried by this invention.

The water removed from the pulp during the compacting operation which passes outwardly through tube 19 and its extension 22 is withdrawn from container 18 through outlet 26, while water passing inwardly into the rod 29 is withdrawn upwardly through aligned passageways 31 and 13 through tube 16.

As noted previously, during the dewatering and compacting operation, the moisture content of the pulp is appreciably reduced. In this regard, it has been found possible on a practical basis to reduce the moisture content below 70%, preferably 40–60% moisture, with 50% being the approximate average moisture content of the compacted pulp sections.

Following the dewatering operation, the pulp sections are further treated to substantially dry the same by removing the majority of remaining moisture therefrom so that the sections may be economically shipped or stored without deterioration. As noted previously, it is possible, on a practical and economical basis, to dry the pulp sections to a moisture content of well below 10%.

The formation of the dewatered pulp into compacted tubular sections or segments of ring-like or doughnut shape is an important feature of this invention, in that the configuration of the sections greatly facilitates the subsequent drying thereof. With the compacted masses produced with the apparatus and method of the aforementioned application, the water removal may expeditiously be effected to substantially any level desired.

The small amount of moisture remaining in the pulp after the drying operation has been found to be not detrimental to the problem of deterioration, nor is the same prohibitive from the shipping cost standpoint. Removal of substantially all moisture from the pulp, while possible

with this invention, has been found to be not economically feasible.

Because of the hollow tubular configuration of the pulp sections or segments produced by the apparatus of FIG. 7, the same may be readily and rapidly dried in quantity by positioning large numbers of the sections on a supporting surface in random arrangement so that a stream of drying air may be forced over such pile. In this connection, the air employed preferably should be substantially dry, and may be heated if heating of the same is economically feasible. However, unheated ambient air has been found to be suitable so long as the humidity of the air is relatively low.

Preferably the drying air is forced upwardly through a large pile of pulp sections positioned in random arrangement on a supporting surface as seen in FIG. 4. This results in the drying air taking a tortuous and highly irregular path over the individual pulp sections and through the longitudinal openings in the respective sections. In this manner highly effective pulp drying may be effected.

Because the walls of the respective pulp sections are relatively thin, the drying air is effective to withdraw moisture both radially inwardly and outwardly relative to such walls to rapidly lower the moisture content of the sections to the level found economically practical.

For effecting drying of pulp in tubular sections, as described, means in the form of a special building structure has been devised. Such building structure is illustrated in FIGS. 1 through 6, and includes an elongated supporting slab **36**, preferably of concrete. Provided in such supporting slab is a network of air ducts, generally designated **37**. Such duct network includes a series of spaced transverse conduits **38** positioned at predetermined intervals along the lentgh of slab **36**, as best seen in FIG. 2. Each of the transverse conduits has in communication therewith a series of laterally spaced vertical extensions **39** positioned across the width of the slab, as best seen in FIG. 3.

Each of the vertical duct extensions opens into one of a series of longitudinal conduits **41**, each of which is open to the top of supporting surface **42** of the concrete slab. A series of elongated metal grill sections **43** are supported over each longitudinal conduit **41** to preclude the passage of pulp sections into the conduit, as best seen in FIG. 4. Any suitable means may be provided for introducing drying air into the transverse conduits **38**, and in the embodiment shown in the drawings, a pump **46**, as seen in FIG. 3, is provided in conjunction with each such transverse conduit. Each pump forces ambient air, or heated air if economically feasible, into the duct network under pressure through the transvers conduits **38** and therefrom into each of the longitudinal conduits **41**.

Preferably valve means are provided in conjunction with the longitudinal conduits **41** for directing the air flow therethrough in a selective manner, as may be desired. In this regard, attention is directed to FIGS. 4 and 5 which illustrate such valve means. A plurality of parallel valve actuating rods **47** extend transversely of the supporting slab in spaced relationship. Each rod is generally aligned with a transverse conduit **38** and is journaled in the cement slab **36**, as at **48**, between adjacent longitudinal conduits **41**. A plurality of valve vanes **49** are secured to each rod for rotation therewith, with one vane being located in each longitudinal conduit above a vertical duct extension **39**, as seen in FIG. 5.

Upon rotation of a rod **47** in the clockwise direction as viewed in FIG. 5, each vane is rotated to the position shown so that the flow of air upwardly through the conduit extension **39** is directed to the left in longitudinal conduit **41**. Rotation of the rod and its associated vanes counter-clockwise results in the air stream being directed to the right in each longitudinal conduit. Similarly, the air flow may be diverted equally to the left and right depending upon the vane position chosen.

It should be understood that a series of such valve control rods **47** and associated vanes are spaced along the length of the slab **36**. In the embodiment illustrated, each of such rods is actuatable by a control handle **50** secured to one end of each rod for rotating the same in a clockwise or counter-clockwise direction as desired. See FIG. 3.

Because it is preferred to protect the pulp sections being dried from the elements of nature during the drying operation, a roof structure or enclosure preferably is supported over the pulp supporting slab **36** in any convenient fashion, as shown generally in FIGS. 1 and 3. In the embodiment illustrated, the building roof comprises a simple inverted V-shaped construction defined by spaced structural members **51** secured to footings **51'** in any suitable manner.

Preferably the roof structure is provided with a foundry type vent structure **52** to permit escape of the drying air from the sturcture after the same has passed upwardly through the piles of pulp being dried. Desirably, the building structure is provided adjacent its bottom on opposite sides thereof with a series of hinged doors **53** which may be pivoted upwardly to permit access to the respective actuating arms **50** for the valve means and so that other access may be had to the interior of the building structure as may be required.

Extending along one edge of the supporting slab **36** is a continuous belt-roller conveyor **56** which may be driven in any suitable well known manner. The purpose of such conveyor is to remove dried pulp sections from the building enclosure after the drying operation is completed, and to transport the same to waiting transportation vehicles.

Supported above the concrete slab **36** in depending relationship from the peak of the roof structure is an overhead conveyor **57** for feeding dewatered pulp sections to be dried onto the supporting surface. Conveyor **57** may be of any suitable type, but in the generally schematic embodiment illustrated, it comprises a conventional roller type continuous belt conveyor. It should be understood that pulp sections carried by the overhead conveyor **57** are to be removed therefrom by means to be described so that the pulp sections may fall onto the supporting surface to provide a pile of sections to be dried. Dewatered pulp sections to be dried may be introduced onto the belt of conveyor **57** in any convenient manner.

To divert predetermined quantities of pulp sections onto predetermined portions of the supporting slab, means are provided in conjunction with conveyor **57**, as illustrated generally in FIG. 6, for removing such sections from the conveyor. While such diverting means may take various forms, in the embodiment illustrated such means includes a generally V-shaped plow member **58** mounted for movement on a series of rollers **59** engaged with a track **61** secured to opposite sides of the overhead conveyor structure. The plow may be selectively positioned along the length of the conveyor with the conveyor belt passing therebeneath so that pulp sectoins carried by the conveyor belt will be plowed from the conveyor belt to fall therefrom in the manner shown in FIG. 1.

Preferably means are provided in conjunction with the diverting plow for maintaining the same in a predetermined position relative to the supporting slab so that a pile of pulp sections may be built upon a selected portion of a supporting slab. In this regard, the piles of pulp **62** produced may be generally discrete and separate from each other, as shown in FIGS. 1 and 2, or a continuous row of pulp sections may be built up for the full length of the supporting slab or any desirable portion thereof.

In the embodiment of the diverting means shown in FIG. 6, thumb screws **63** are shown in conjunction with the plow member by means of which the plow member may be secured after the plow has been positioned over a predetermined portion of the rails **61**. In this manner, the plow may be precluded from movement along the conveyor structure. However, the use of manual means such as thumb screws necessitates a worker climbing on a

ladder or the like to the overhead conveyor structure to engage and disengage the thumb screws as required.

Accordingly, it is preferred that more automatic means not requiring manual operation on the overhead conveyor be provided. In this regard, FIG. 6 also shows means for effecting positioning of the diverting plow **58** without requiring manual aljustment on the overhead conveyor. In this connection, a pair of opposite cables **66** and **67** are secured to opposite ends of the plow. By pulling on cable **66**, the plow may be moved to the right of FIG. 6, while pulling an cable **67** will move the plow to the left. Any automatic or manual means may be employed for effecting movement of one or both cables to effect positioning of the plow in the location desired. Upon positioning the plow in a given location relative to the supporting slab of the building structure, it should be understood that cable **66** thereafter will maintain the plow in such position until tension on such cable is released.

Drying air passing through the conduit network **37** in the supporting slab **36** will pass upwardly through the respective piles of pulp sections to be dried in the tortuous path illustrated in FIGS. 3 and 4. By continuing air flow through a given pulp pile for the desired time, the moisture content of the sections may be diminished to any predetermined practical level. In this regard, an air flow of approximately 7 to 10 cubic feet per minute through each vertical conduit extension **39** is suitable for effecting drying of large piles of products in a relatively short time.

As noted previously, the use of substantially dry, unheated ambient air for purposes of economy is preferred, but, if desired, such air may be heated. An air temperature in the range of 100–150° F. has been found suitable for this purpose.

From the foregoing, it should be obvious that, in the absence of the particular hollow tubular configuration of the respective sections of pulp to be dried, the procedure described could not be easily effected in that the tortuous air passages extending through the pile would be substantially absent.

While this invention relates primarily to the drying of hollow tubular pulp sections to reduce the weight thereof, it should be understood that, where shipping costs are also determined on a basis of bulk in addition to weight, the doughnut shaped sections after drying may be broken down to further reduce their bulk so that additional savings on a bulk basis also may be effected during shipment.

It should be understood that the building structure illustrated preferably is of substantial size, with the supporting slab and roof structure shown being up to 1400 feet long and up to 100 feet wide. In such a structure, the pulp piles being dried may be up to 40 feet high and 80 feet across at the base.

After drying, the dried piles of pulp may be moved onto the conveyor **56** running alongside the supporting slab by any suitable means. Because of the size of the building structure, bulldozers or other tractors may be employed to push the dried pulp onto the conveyor **56** for movement to the transportation vessels.

If desired, the ends of the building structure may be enclosed to preclude contact of the elements of nature with the pulp sections being dried.

The length of the drying procedure may vary, depending upon the air flow rate, the size of the piles being treated, the moisture content of the dewatered pulp sections as the same are removed from the apparatus in which the same are compacted, the temperature and humidity of the drying air, and the like. However, by way of example, by employing the forced air drying procedure described herein on large piles of pulp sections having an initial moisture content in the 40–60% range, the average moisture content may be reduced to approximately 8% within a period of 72 hours using an unheated air flow rate of from 7–10 cubic feet per minute.

Further treatment over extended periods of time, it has been found, has been generally ineffective to reduce appreciably the moisture content below the above practical level, and the expense of attempting to further reduce the moisture content generally is prohibitive in that the weight savings effected thereby does not warrant the additional expense. For example, upon extended treatment of pulp sections dried to the above level for time periods up to 192 hours, the moisture content is reduced an additional amount of less than 1%.

By employing the forced air drying method on pulp sections as described, the drying procedure is much speeded up over conventional air drying, and is relatively inexpensive in that, as noted previously, ambient unheated air may be empoyed so long as the relative humidity of the air thus employed is not appreciable. In this regard, suitable results have been obtained with air in which the average relative humidity was as high as 40%. Obviously, however, the lower the humidity of the air, the more effective and more rapid will be the drying results produced.

Having thus made a full disclosure of this invention as the same relates to the drying of compressed products, such as wood pulp and like fibrous materials, reference is directed to the appended claims for the scope to be afforded thereto. In this regard, it should be understood that modifications to this invention which may become apparent to one skilled in the art after reference has been taken to this specification are contemplated as falling within the scope hereof.

I claim:

1. A method of drying a wet fibrous product comprising compacting said product into hollow tubular sections to remove a determinable part of the moisture therefrom, each of said sections comprising a wall defining a longitudinal opening therethrough, piling a plurality of said tubular sections in random arrangement on each other, and forcing a stream of drying air against a plurality of said sections when thus piled on each other whereby said air stream passes in a tortuous path over said sections and through the longitudinal openings therein to remove the major part of the moisture remaining in said sections after compacting thereof.

2. A method of drying fibrous wood pulp to prepare the same for transportation, comprising compacting a mass of said pulp under pressure into a plurality of hollow tubular sections to lower the moisture content of the pulp thus compacted to within the range of 40–60%, piling a plurality of said compacted sections in random arrangement on each other, forcing a stream of drying air against such pile of sections whereby said air travels in a tortuous path and passes over and through individual sections during its travel through said pile, and continuing such air flow through said pile until the average moisture content of said sections is diminished thereby to below 10%.

3. A method of preparing wood pulp for shipment by reducing the moisture content thereof, comprising compacting a quantity of wood pulp into a plurality of hollow compacted pulp sections each of which has a generally cylindrical wall defining a longitudinal opening therethrough, piling a large number of said sections in random arrangement on each other on a supporting surface, providing means for forcing a stream of relatively dry air upwardly through such pile of sections, forcing said stream of air through said pile of sections whereby said air moves through said pile in a tortuous path through and around individual sections, and continuing such air flow until the average moisture content of said sections is reduced to approximately a predetermined level.

4. The method of claim 3 which includes positioning said pile within an enclosure during the drying operation to protect said sections from the elements of nature during drying.

5. A method of drying wood pulp to preclude deterioration of said sections and to reduce the weight thereof for shipment, comprising compacting said wood pulp into a plurality of partially dewatered tubular sections, each of

said dewatered sections having a moisture content within the general range of 40–60%, providing a supporting surface having a network of air ducts opening thereinto, positioning large quantities of said sections in random arrangement on said supporting surface whereby a large area of said surface is covered by a pile of said sections, forcing a volume of generally dry air through said duct network and upwardly through said pile whereby large quantities of said air are forced in a tortuous path through and over individual sections in said pile, and continuing forcing said air through said pile until the average moisture content of said sections is reduced to below 10%.

6. A method of drying wood pulp to be used in paper making to obviate pulp deterioration and to prepare the same for shipment by reducing its weight, comprising compressing a supply of high water content pulp into hollow generally cylindrical tubular sections in which the pulp fibers are closely compacted and the pulp water content is reduced to below 70%, after compressing piling a quantity of said tubular sections in random fashion over a source of drying air, forcing a substantially continuous stream of said air upwardly through said sections whereby said air passes in an irregular tortuous path through and around individual sections of such pile, and continuing forcing said air stream through said pile until the average water content of the sections in said pile is reduced to below 10%.

7. A method of dewatering and preparing fibrous wood pulp for shipment comprising providing a supply of pulp slurry, compacting the pulp fibers of said slurry into a hollow tubular body having a longitudinal opening therethrough, the moisture content of said body being substantially decreased during said compacting, separating said body into a plurality of relatively short generally cylindrical segments, piling a plurality of said segments on each other in other arrangement on a supporting surface, and forcing a stream of drying air through such pile of segments whereby said air passes over and through the individual segments of said pile to further reduce the moisture content thereof.

8. A method of drying quantities of a wet product, said product being in the form of tubular sections each of which has a longitudinal opening therethrough, said method comprising compacting said product into hollow tubular sections to remove a determinable part of the moisture

therefrom, piling a plurality of said sections in random arrangement on each other on a supporting surface, forcing a stream of drying air against such pile of sections whereby said stream of air travels in a tortuous path and passes over and through individual sections in said pile during its travel through said pile, and continuing such air flow through said pile until the average moisture content of said sections is reduced to a predetermined level.

9. A structure in which tubular sections of fibrous wood pulp are to be dried, comprising, in combination, an elongated supporting surface on which large piles of pulp sections are to be positioned in random arrangement for drying, an air duct network in conjunction with said supporting surface over which said piles of pulp sections are to be positioned during drying, means for introducing a supply of drying air into said duct network for drying said sections piled thereover, conveyor means suspended over said supporting surface for carrying a stream of said pulp sections over said supporting surface, and movable selectively locatable means in conjunction with said conveyor for diverting said stream of pulp sections from said conveyor so that said pulp sections when thus diverted may drop onto a predetermined portion of said supporting surface, whereby piles of said pulp sections may be built up on preselected locations on said supporting surface for drying; said diverting means comprising a generally V-shaped plow member for dividing said stream of pulp sections and diverting the same simultaneously from opposite sides of said conveyor means.

References Cited in the file of this patent

UNITED STATES PATENTS

204,592	Melvin	June 4, 1878
488,149	Metzger	Dec. 13, 1892
1,256,681	French	Feb. 19, 1918
1,640,133	Parker	Aug. 23, 1927
1,668,446	Anderson	May 1, 1928
1,850,733	Talbot	Mar. 22, 1932
2,584,727	Mellen	Feb. 5, 1952
2,608,768	Noel	Sept. 2, 1952
2,885,065	Piper	May 5, 1959

FOREIGN PATENTS

339,563	Great Britain	Dec. 11, 1930