April 23, 1935. T. KODA 1,998,875

METHOD AND APPARATUS FOR PACKING WOOD CHIPS OR THE LIKE

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Fig. 2.

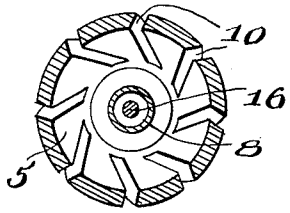


Fig. 3.

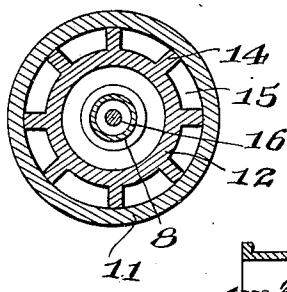


Fig. 1.

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METHOD AND APPARATUS FOR PACKING WOOD CHIPS OR THE LIKE

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20 Claims. (Cl. 92—7)

This invention relates to improvements in method and apparatus for packing fibrous material in chemical pulp digesters.

One of the objects of the invention is to provide controllable means for evenly distributing chips or the like in a digester during the packing operation, so that the chips will be more densely and more uniformly packed than heretofore. Such packing improves the cooking efficiency, increases the output per cook and per day, reduces chemicals and steam consumption, and also improves the quality of the pulp and the yield thereof per unit of raw material cooked.

Another object of the invention is to reduce the packing time and cost by the preliminary action of a packing fluid medium in a first stage diffuser, followed by a final action of such a medium in a second stage diffuser. This two-stage method of diffusion results in more uniform distribution of the chips and increases the velocity of the same, so that a closer packing and more equal distribution is obtained. By the method, more chips can be evenly distributed and packed in a given digester space in considerably less time than with the methods heretofore used. Furthermore, as my chip packing device can be mounted on a truck, it is possible to use one chip packing apparatus for a large number of digesters without the necessity of providing a special track or trolley for the device. In addition, as I use rotatable packing medium jets from both diffusers in combination with a vertically adjustable disk, the direction of the jets can be varied so that the device may be employed with digesters of various sizes and shapes.

With the foregoing objects outlined and with other objects in view which will appear as the description proceeds, the invention consists in the novel features hereinafter described in detail, illustrated in the accompanying drawing, and more particularly pointed out in the appended claims.

In the drawing,

Fig. 1 is a vertical sectional view of my improved packing device, partly in elevation and shown resting on the neck of a digester.

Fig. 2 is a horizontal sectional view of a detail on the line 2—2 of Fig. 1.

Fig. 3 is a similar view taken on the line 3—3 of Fig. 1.

Referring to the drawing, 1 designates the neck of a conventional digester of the type employed in manufacturing paper pulp. My apparatus comprises an outer chip feeding tube 2 having a medial external flange 2a designed to rest on the upper end of the neck of a digester. Within the tube 2 is a rotatable tube 3 having a second stage rotatable diffuser 4 at its lower end, and another, first stage rotatable diffuser 5 at its upper end. A spider 6 for the first diffuser, and a spider 7 for the second diffuser, support these diffusers on a rotatable shaft 8.

A packing fluid such as steam is fed to the diffusers by means of a stationary hollow fitting 9 which may be supported by the tube 2 in any suitable manner.

As clearly shown in Figs. 1 and 2, the upper diffuser is of inverted frusto-conical shape and is provided with slots 10 for discharging the packing fluid into the space between the tubes 2 and 3. Each of these slots has a proper angle relatively to both the generating line of the conical body of the diffuser and the diameters of the horizontal section of the diffuser in order to cause the fluid to be discharged in the form of jets which will be directed downwardly and act to accelerate and whirl falling chips or the like fed into the tube 2 through the upper end of the latter.

The lower or second diffuser comprises an outer frusto cone 11 and an inner frusto cone 12 which are spaced apart by spiral threads 14 that form spiral passageways between the members 11 and 12. The jets of packing fluid formed by the passageways 15 also act to whirl the descending chips or the like and to spread the same outwardly in the shape of a hollow cone, the size of the base of which is varied by a vertically adjustable disk 13. This disk is secured to the lower end of a rod 16 that passes upwardly through the hollow shaft 8 and is provided with any suitable means for raising and lowering the disk. For example, the upper end of the rod may terminate in a rack 17 that meshes with a pinion 18 fixed on a rotatable shaft 19 that may be manually turned.

For the purpose of rotating the shaft 8, any suitable form of gearing may be used. For instance, beveled gears 20 and 20a at the upper end of the shaft 8 may be rotated by a shaft 21 driven by any desired type of motor, not shown.

A protecting casing 20b is preferably arranged at the top of the fitting 9 to protect the rack and pinion, as well as the beveled gearing.

The steam or other packing fluid fed to the fitting 9 through a pipe 9a may be controlled by any suitable type of valve 22, and the fluid will discharge not alone through the slits 10, but through the outlet ends 23 of the passageways 15.

For the purpose of discharging air or the like from the digester during the packing operation, it will be noted that the tube 2 is made of less diam-

eter than the internal diameter of the neck of the digester. This leaves an annular passageway 24 between these parts so that the rising air can enter a hollow ring 26 on the chip feeding tube through apertures 25, and can then be discharged from the ring through a nozzle 27.

In operation, as the chips are fed through the tube 2, the valve 22 will be opened and steam will enter the fitting 9 under pressure. At the same time, the parts 3, 4, 5, 6, 7, 11, 12 and 14 are set in rotation in the same direction through the instrumentality of the hollow shaft 8, and as these parts rotate, whirling, downwardly directed jets of steam will be discharged through the slots 10. These slots of the first diffuser will not alone organize the falling chips into a hollow cylinder, but will whirl the chips and drive them downwardly. Then, when the chips of this whirling cylinder reach the outlets 20 of the lower diffuser, steam issuing from the jets 15 will organize the falling chips into a hollow cone, the diameter of the base of which will depend on the height of the digester.

In the beginning of the operation, the disk 13 which controls the size of the hollow cone will be in its lowermost position, and consequently, the base of the cone will be relatively small. However, as the chips build up in the digester, the disk 13 will be adjusted upwardly, and thus increase the size of the base of the cone.

Obviously, with such an apparatus, the chips or other fibrous material will not only be evenly distributed and be uniformly and densely packed, but if steam is used as the packing medium, it will saturate and heat the chips, with the result that when the cooking liquor is introduced into the digester, the chips will be uniformly soaked, and this will enable one to obtain more uniform pulp.

To facilitate rotation of the parts 3, 4, 5, 6, 7, 11, 12, 14 with a minimum of power, the shaft 21 rotates those parts in such a direction that the jets issuing from the nozzles move in the opposite direction. Hence, the jets in striking the chips, will have a tendency to assist the shaft 8 in rotating, this action being similar to that of a turbine.

From the foregoing it is believed that the invention may be readily understood by those skilled in the art, and while I have disclosed what I now consider to be a preferred embodiment of the invention, it is manifest that changes may be made in the details disclosed without departing from the spirit of the invention, as expressed in the claims.

What I claim and desire to secure by Letters Patent is:

1. A method of packing fibrous material in a digester or the like, comprising introducing a stream of fibrous material into the upper end of a digester, discharging rotating jets of fluid into said stream and thereby organizing the stream into a whirling annular mass, and afterwards introducing other jets of fluid into the mass and thereby causing the mass to assume a substantially conical form while falling into the digester.

2. A method of packing fibrous material in a digester or the like, comprising introducing a stream of fibrous material into the upper end of the digester, discharging rotating jets of fluid into said stream and thereby organizing the stream into a whirling annular mass while forcing the fibrous material downwardly, and afterwards introducing other rotating jets of fluid into the mass and thereby causing the mass to assume a substantially conical form while forcing the fibrous material downwardly into the digester.

3. A method of packing fibrous material in a digester or the like, comprising introducing a stream of fibrous material into the upper end of a digester, discharging rotating jets of steam into said stream and thereby organizing the stream into a whirling annular mass, and afterwards introducing other jets of steam into the mass and thereby causing the mass to assume a substantially conical form while falling into the digester.

4. A method of packing fibrous material in a digester or the like, comprising introducing a stream of fibrous material into the upper end of the digester, discharging rotating jets of steam into said stream and thereby organizing the stream into a whirling annular mass while forcing the fibrous material downwardly, and afterwards introducing other rotating jets of steam into the mass and thereby causing the mass to assume a substantially conical form while forcing the fibrous material downwardly into the digester.

5. A chip packing apparatus comprising a conduit through which chips are introduced into a digester, a first stage diffuser in the conduit provided with inclined outlets for introducing jets of a packing fluid into the chips, a second stage diffuser positioned below the first diffuser and provided with nozzles for directing other jets of the packing fluid into the chips, means for feeding the packing fluid to said diffusers, and means for simultaneously rotating the diffusers in a single direction.

6. A chip packing apparatus comprising a conduit through which chips are introduced into a digester, a first stage diffuser in the conduit provided with inclined outlets for introducing jets of a packing fluid into the chips, a second stage diffuser positioned below the first diffuser and provided with nozzles for directing other jets of the packing fluid into the chips, means for feeding the packing fluid to said diffusers, and means for simultaneously rotating the diffusers, the first stage diffuser comprising a hollow inverted frustocone having outlet slots inclined both as to the generating line of the conical body of the diffusers and the diameters of the horizontal section of the diffusers.

7. A chip packing apparatus comprising a conduit through which chips are introduced into a digester, a first stage diffuser in the conduit provided with inclined outlets for introducing jets of a packing fluid into the chips, a second stage diffuser positioned below the first diffuser and provided with nozzles for directing other jets of the packing fluid into the chips, means for feeding the packing fluid to said diffusers, and means for simultaneously rotating the diffusers, the second stage diffuser comprising inner and outer frustocones separated by spiral threads to form spiral passageways.

8. A chip packing apparatus comprising a conduit through which chips are introduced into a digester, a first stage diffuser in the conduit provided with inclined outlets for introducing jets of a packing fluid into the chips, a second stage diffuser positioned below the first diffuser and provided with nozzles for directing other jets of the packing fluid into the chips, means for feeding the packing fluid to said diffusers, means for simultaneously rotating the diffusers, and vertically adjustable means cooperating with the nozzles of the second stage diffuser for causing

fluid issuing from said nozzles to spread out in the shape of a hollow cone.

9. A chip packing apparatus comprising a conduit through which chips are introduced into a digester, a first stage diffuser in the conduit provided with inclined outlets for introducing jets of a packing fluid into the chips, a second stage diffuser positioned below the first diffuser and provided with nozzles for directing other jets of the packing fluid into the chips, means for feeding the packing fluid to said diffusers, means for simultaneously rotating the diffusers, the first stage diffuser comprising a hollow inverted frusto cone having outlet slots inclined both as to the generating line of the conical body of the diffusers and the diameters of the horizontal section of the diffusers, and vertically adjustable means cooperating with the nozzles of the second stage diffuser for causing fluid issuing from said nozzles to spread out in the shape of a hollow cone.

10. A chip packing apparatus comprising a conduit through which chips are introduced into a digester, a first stage diffuser in the conduit provided with inclined outlets for introducing jets of a packing fluid into the chips, a second stage diffuser positioned below the first diffuser and provided with nozzles for directing other jets of the packing fluid into the chips, means for feeding the packing fluid to said diffusers, means for simultaneously rotating the diffusers, the second stage diffuser comprising inner and outer frusto cones separated by spiral threads to form spiral passageways, and vertically adjustable means cooperating with the nozzles of the second stage diffuser for causing fluid issuing from said nozzles to spread out in the shape of a hollow cone.

11. A chip packing apparatus comprising a conduit through which chips are introduced into a digester, a first stage diffuser in the conduit provided with inclined outlets for introducing jets of a packing fluid into the chips, a second stage diffuser positioned below the first diffuser and provided with nozzles for directing other jets of the packing fluid into the chips, means for feeding the packing fluid to said diffusers, means for simultaneously rotating the diffusers, and a vertically adjustable disk cooperating with the nozzles of the second stage diffuser for causing the jets issuing from said nozzles to spread the falling chips in the shape of a hollow cone of varying base diameter.

12. A chip packing apparatus comprising a conduit through which chips are introduced into a digester, a first stage diffuser in the conduit provided with inclined outlets for introducing jets of a packing fluid into the chips, a second stage diffuser positioned below the first diffuser and provided with nozzles for directing other jets of the packing fluid into the chips, means for feeding the packing fluid to said diffusers, means for simultaneously rotating the diffusers, the first stage diffuser comprising a hollow inverted frusto cone having outlet slots inclined both as to the generating line of the conical body of the diffusers and the diameters of the horizontal section of the diffusers, and a vertically adjustable disk cooperating with the nozzles of the second stage diffuser for causing the jets issuing from said nozzles to spread the falling chips in the shape of a hollow cone of varying base diameter.

13. A chip packing apparatus comprising a conduit through which chips are introduced into a digester, a first stage diffuser in the conduit provided with inclined outlets for introducing jets of a packing fluid into the chips, a second stage diffuser positioned below the first diffuser and provided with nozzles for directing other jets of the packing fluid into the chips, means for feeding the packing fluid to said diffusers, means for simultaneously rotating the diffusers, the second stage diffuser comprising inner and outer frusto cones separated by spiral threads to form spiral passageways, and a vertically adjustable disk cooperating with the nozzles of the second stage diffuser for causing the jets issuing from said nozzles to spread the falling chips in the shape of a hollow cone of varying base diameter.

14. A chip packing apparatus comprising an outer conduit through which chips are introduced into a digester, an inner tube positioned within the outer tube, a first stage diffuser secured to the upper end of the inner tube and having an inverted hollow frusto cone provided with inclined outlet slots, a second stage diffuser secured to the lower end of the inner tube and provided with a series of spiral passageways, a shaft on which the inner tube and both diffusers are mounted, and means for simultaneously rotating said shaft, inner tube and both diffusers.

15. A chip packing apparatus comprising an outer conduit through which chips are introduced into a digester, an inner tube positioned within the outer tube, a first stage diffuser secured to the upper end of the inner tube and having an inverted hollow frusto cone provided with inclined outlet slots, a second stage diffuser secured to the lower end of the inner tube and provided with a series of spiral passageways, a shaft on which the inner tube and both diffusers are mounted, means for simultaneously rotating said shaft, inner tube and both diffusers, and means cooperating with the second stage diffuser to variably spread jets issuing from said passageways.

16. A chip packing apparatus comprising an outer conduit through which chips are introduced into a digester, an inner tube positioned within the outer tube, a first stage diffuser secured to the upper end of the inner tube and having an inverted hollow frusto cone provided with inclined outlet slots, a second stage diffuser secured to the lower end of the inner tube and provided with a series of spiral passageways, a shaft on which the inner tube and both diffusers are mounted, means for simultaneously rotating said shaft, inner tube and both diffusers, and a vertically adjustable disk positioned below the second stage diffuser and having its axis coaxial with the axis of said shaft.

17. A chip packing apparatus comprising a stationary conduit through which chips are introduced into a digester, a hollow fitting having one of its portions positioned in said conduit, a first stage hollow diffuser rotatably connected to said portion and having an inverted cone shaped part provided with outlet slots, each slot being arranged at an angle relatively to the generating line of said cone shaped part, as well as to the diameters of the horizontal section of said part, a tube fixed to and depending from said diffuser, a second stage diffuser fixed to and depending from said tube, said second stage diffuser comprising inner and outer frusto-conical portions spaced apart by spiral threads to form downwardly and outwardly directed spiral passageways, and means for simultaneously rotating said first stage diffuser, tube and second stage diffuser.

18. A chip packing apparatus comprising a sta-

tionary conduit through which chips are introduced into a digester, a hollow fitting having one of its portions positioned in said conduit, a first stage hollow diffuser rotatably connected to said portion and having an inverted cone-shaped part provided with outlet slots, each slot being arranged at an angle relatively to the generating line of said cone-shaped part, as well as to the diameters of the horizontal section of said part, a tube fixed to and depending from said diffuser, a second stage diffuser fixed to and depending from said tube, said second stage diffuser comprising inner and outer frusto-conical portions spaced apart by spiral threads to form downwardly and outwardly directed spiral passageways, means for simultaneously rotating said first stage diffuser, tube and second stage diffuser, and means cooperating with the outlets of said spiral passageways for spreading the jets issuing from said passageways.

19. A chip packing apparatus comprising a stationary conduit through which chips are introduced into a digester, a hollow fitting having one of its portions positioned in said conduit, a first stage hollow diffuser rotatably connected to said portion and having an inverted cone-shaped part provided with outlet slots, each slot being arranged at an angle relatively to the generating line of said cone shaped part, as well as to the diameters of the horizontal section of said part, a tube fixed to and depending from said diffuser, a second stage diffuser fixed to and depending from said tube, said second stage diffuser comprising inner and outer frusto-conical portions spaced apart by spiral threads to form downwardly and outwardly directed spiral passageways, means for simultaneously rotating said first stage diffuser, tube and second stage diffuser, and a vertically adjustable disk positioned below the second stage diffuser and having its axis coaxial with the axis of rotation of that diffuser.

20. A method of packing fibrous material in a digester or the like, comprising introducing a stream of fibrous material into the upper end of a digester, simultaneously discharging rotating jets of fluid into said stream and thereby organizing the stream into a whirling annular mass, and afterwards introducing other jets of fluid into the mass at a lower elevation and thereby causing the whirling mass to assume a substantially conical form while falling into the digester.

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