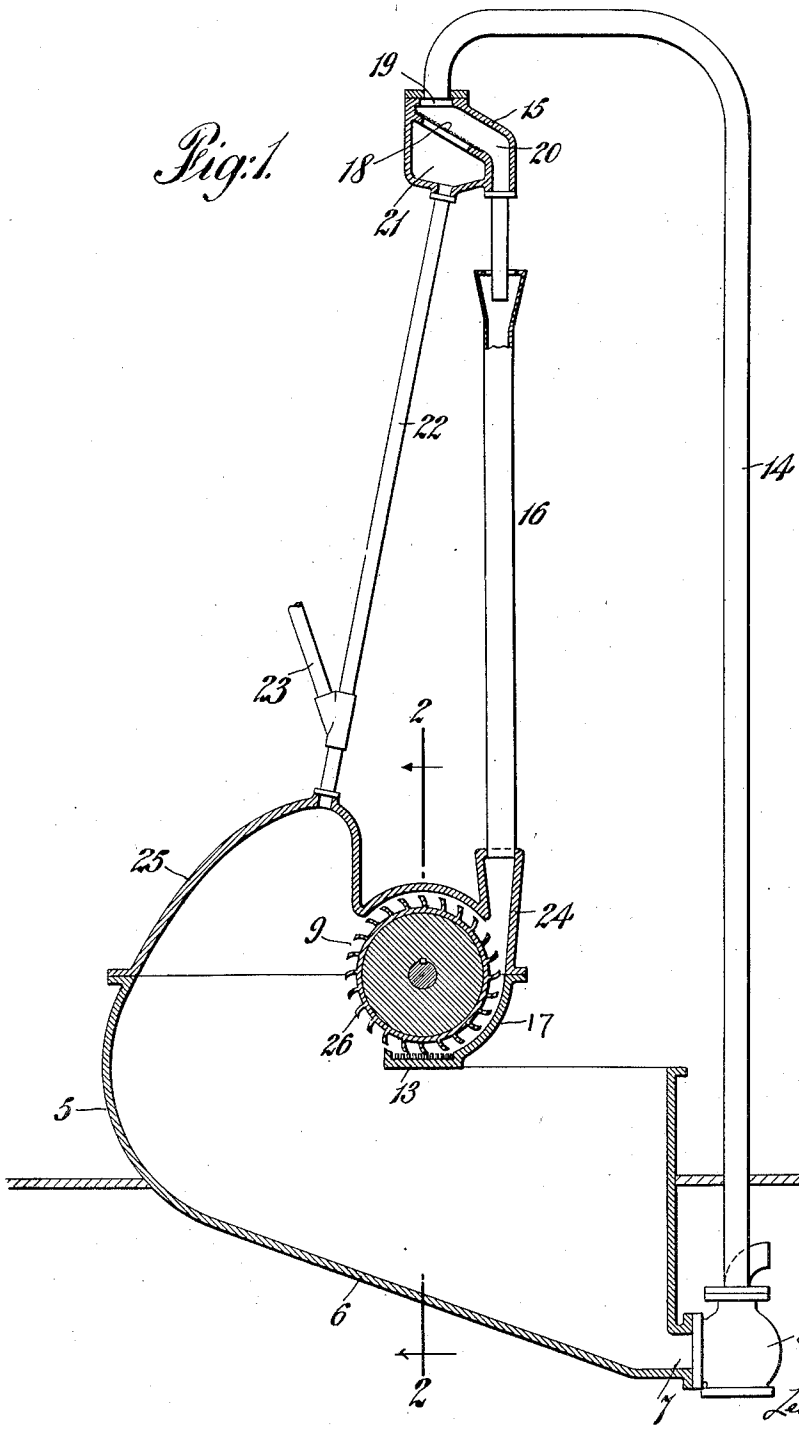
Oct. 30, 1928. 1,689,932

L. E. RANDECKER

PULP BEATER

Filed Feb. 10, 1927. 2 Sheets-Sheet 1

Fig. 1.



INVENTOR
Leonard E. Randecker
BY
Merrell E. Clark
ATTORNEY

Oct. 30, 1928. 1,689,932

L. E. RANDECKER

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Filed Feb. 10, 1927 2 Sheets-Sheet 2

Fig. 2.

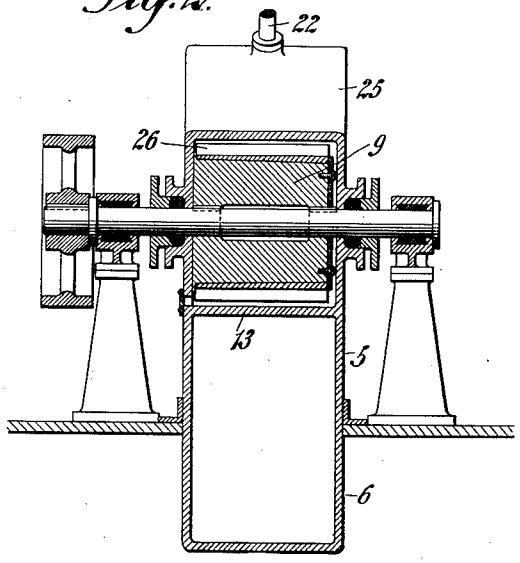


Fig. 3.

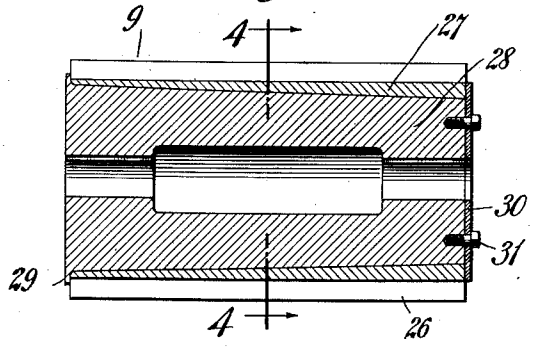
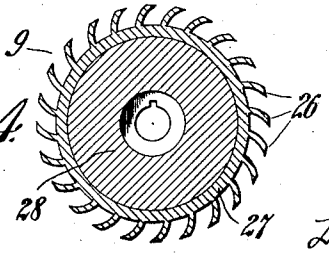


Fig. 4.



INVENTOR
Leonard E. Randecker
BY
Merrell E. Clark
ATTORNEY

Patented Oct. 30. 1928. 1,689,932

UNITED STATES PATENT OFFICE.

LEONARD E. RANDECKER, OF ERIE, PENNSYLVANIA, ASSIGNOR TO HAMMERMILL PAPER COMPANY, OF ERIE, PENNSYLVANIA, A CORPORATION OF PENNSYLVANIA.

PULP BEATER.

Application filed February 10, 1927. Serial No. 167,101.

This invention relates to beating engines such as are used in treating pulp in the manufacture of paper.

Pulp beaters, or beating engines, of the types heretofore commonly used, have included relatively large, shallow tubs having an elongated oval formation and provided with a vertical partition or mid-feather extending along its central axis but stopping short of the ends of the tub. A roll mounted in the channel or trough provided at one side of the partition cooperates with a bed plate to disintegrate the fibers contained in the pulp or stock. The roll not only functions to disintegrate or beat the pulp but it also, in cooperation with an upwardly curved section of the channel floor which follows the back of the roll, elevates the engaged liquid to provide a head for circulating the pulp.

Devices of this general nature, although they have been used extensively for a long period of time in the art, are inefficient in many respects and are open to other objections. The large size of the horizontal dimensions of the tubs or vats used occupy an unduly large amount of floor space and the sluggish movement of the pulp affected by the beater roll serving as a pump, consumes a large amount of power thereby seriously restricting the economy of the process. Also the construction of the beater roll, whereby it is adapted to be used also as a pump, restricts its full functioning as a beater. Another disadvantage of the prior constructions resides in the inefficiency of operation produced by the necessity for maintainng the stock in a relatively liquid condition in order to bring about its circulation in the apparatus. It will be seen that a relatively liquid or limpid condition of the stock, as compared with the relatively thick condition, causes a disproportionably small volume of fibrous material to pass between the beater roll and the bed plate as compared with the volume of water passing therethrough. This means, of course, that, since the beater roll is not operating to its full capacity on fibrous solid material, the total efficiency of the beating operation is correspondingly reduced.

A general object of the present invention is to provide a pulp beater apparatus which will be free from the objections referred to, which will provide an accelerating movement of the stock as it approaches the beater roll, and in which the stock, while partaking of a relatively liquid character during stock moving and handling operations, is, on the other hand, presented in a relatively thickened or dewatered condition for the beating action.

The invention comprises a beating engine which includes a tub or vat of the usual capacity but relatively much smaller in its horizontal dimensions, so that a considerable saving in floor space is provided.

Another feature of the invention resides in the use of a pump for elevating the stock to an overhead position wherein a hydraulic head is produced which is utilized in the feeding of pulp to the intake side of the beater roll and bed plate construction. Preferably the elevation through which the stock passes by gravity to the beater roll is such as to cause the falling material when it reaches the beater roll to have a velocity equal to the peripheral speed of the roll whereby an effective operating condition is procured.

An important feature of the invention resides in the partial removal of water from the stock just prior to the feeding of stock by gravity to the beater roll. By this arrangement, I succeed in obtaining a highly efficient operation of the roll on the stock since the fibrous content of the stock delivered to the roll is proportionally very high as compared with the water therein, so that the beater roll operates on a much greater proportion of fibers than would be the case with a more dilute mixture of fiber and water. This results in more economical beating. Advantage is taken of the removal of water from the stock at the elevated position to return the water to the beater tub with considerable pressure or force thereby to produce an advantageous stirring action in the contents of the tub which are, at the same time, restored to a satisfactorily liquid condition for convenient handling by the pump.

Other features of the invention will be hereinafter referred to.

In the drawing, in which a preferred embodiment of the invention has been selected for illustration:—

Fig. 1 is a view in longitudinal vertical section of a pulp beater embodying the invention;

Fig. 2 is a view in transverse vertical section taken on the line 2—2 of Fig. 1;

Fig. 3 is a view in transverse section of a beater roll forming part of the invention;

Fig. 4 is a view in longitudinal section of the beater roll shown in Fig. 3.

Referring to the drawing for a more detailed description of the invention, a tub or vat is shown at 5 which has a sloping or inclined base or floor member 6, terminating in a sump 7 which forms the inlet for a pumping device 8 of any suitable construction. The tub or vat 5 has a relatively narrow construction and a beater roll 9 is supported in a transverse relation thereto in a position intermediate the ends of the upper portion of the tub structure. The shaft of the beater roll 9 is preferably journaled in bearings 10 formed on suitable standards 11 independent of the tub structure. A pulley 12 is carried at one end of the beater roll shaft for convenient means of supplying power thereto. A bed plate 13 is mounted in the tub structure so that the knives thereon cooperate with pulp disintegrating knives carried by the beater roll in a known manner.

The pump 8 operates to elevate pulp or stock through a vertical pipe 14 to a suitable receptacle 15 mounted at a suitable elevation above the beater roll 9 to provide an advantageous hydraulic head. A down pipe 16 extends between the elevated receptacle 15 and the intake side of the beater roll 9 where the material dropping freely through the down pipe is distributed along the peripheral surface of the beater roll and is directed by a curved guide plate 17 between the beater roll and the bed plate 13.

In order to provide a thickening or dewatering effect on the stock before it descends vertically through the tube 16 to the inlet side of the beater roll structure, an inclined screen member 18 is provided in the receptacle 15. With this arrangement pulp discharging from the delivery end 19 of the pipe 14 passes across the face of the screen 18, as it travels through a compartment 20 in the receptacle 15, the result being that water is drained through the screen from the mass of pulp passing through the compartment 20, the drained water or liquid passing into a compartment 21 in the receptacle 15 and thence into a pipe 22 through which it drops and creates a partial vacuum in the compartment 21. In order to assist the vacuum action and insure that a sufficient amount of liquid is withdrawn from the pulp to provide the desired concentration, the compressed air conduit 23 may be attached to the drainage discharge pipe 22 at an inclination such as is shown in Fig. 1 of the drawing to provide in the pipe 22 an aspirating or ejector effect. It will be seen that the moving stream of air entering the pipe 22 at the angle shown will tend to produce a vacuum in the pipe 22 and assist in the drainage action desired.

The concentrated pulp which is produced as a result of the drainage action referred to passes from the compartment 20 into the receiving end of the down pipe 16 and thence drops straight downwardly under the action of gravity into the intake pipe 24 of the beater device. Preferably the length of the feed pipe 16 is such that the velocity due to gravity which is imparted to the falling pulp is such that the velocity of the material when it arrives in the intake pipe 24 is substantially the same as the peripheral speed of the rotating beater roll 9. With this arrangement a high degree of efficiency of operation of the beater roll is achieved since no work has to be performed by the rotating beater roll in changing the velocity of the traveling stock.

It will be seen that by the general organization of structure described, a concentrated form of stock or pulp is presented to the beater roll for action thereby. This concentration of the stock acted upon by the beater roll increases the efficiency of operation of the beater since it is thereby enabled to act upon pulp containing a large proportion of fibrous material relative to the proportion of liquid vehicle also included in the stock or pulp mixture.

On the other hand, in order to facilitate the operation of the pump 8 in elevating the stock to the feeding receptacle 15, a relatively liquid or thin condition of the pulp or stock is required. This liquid condition of the stock is maintained so far as the operation of the pump is concerned by the return to the tub continuously of liquid drained from the stock in the chamber 21 by way of the liquid discharge pipe 22. In addition, the discharge of liquid from the pipe 22 into the tub 5 produces a constant stirring or agitation of the supply of stock in the tub so that a relatively uniform mixture is constantly supplied to the pump for elevation to the feeding receptacle.

In order to prevent the spattering of material through the force of discharge of liquid from the pipe 22 into the tub 5, a guard member 25 is provided in the form of a cover member for that part of the tub on the discharge end of the beater roll 9. In addition to preventing the spattering of material from the tub through the action of the discharge pipe 22, the guard member 25 prevents the throwing of material from the discharge side of the beater roll 9 outwardly beyond the edge of the tub.

Since in the construction described, the beater roll 9 is not called upon to function as a pump, the blades 26 formed on the beater roll may be placed much closer together than is found possible in prior constructions. To facilitate the use of an increased number of cutting blades or fly bars 26, the beater roll preferably has a special construction as shown more particularly in Figs. 3 and 4 of the drawing. It will be seen that the cutting blades 26 are formed integral with a one-

piece sleeve member 27 having an internally tapered conformation, as is shown in Fig. 3 of the drawing, to fit a correspondingly tapered body section 28 comprising the main framework of the beater roll 9. A flange 29 at one end of the roll provides a stop for the sleeve member at that end and a removable plate 30, held in place by screws 31, engages the sleeve 27 at the other end to hold the same in position on the tapered body section 28. The relatively close adjacency at which the blades 26 are mounted with relation to each other, provides a correspondingly increased efficiency of operation of the beater roll structure. In order to increase the facility of discharge of the material at the discharge side of the beater roll, the blades or fly bars 26 are preferably curved in the manner shown, so that material carried by the blades is readily discharged at the exit end of the bed plate member. Since the beater roll 9 is not called upon to perform a pumping action and is, therefore, mounted above the level of the liquid in the tub 5, it may be formed of a considerably smaller diameter than the diameters of beater rolls heretofore used in the art, thereby still further increasing the efficiency and economy of construction of the apparatus shown and described.

It will be seen in general that I have succeeded in utilizing gravity to accelerate the stock dropping to the roll, thereby freeing the roll of the function of imparting accelerating movement to the stock and obtaining a relatively efficient roll operation.

It will also be seen that I have, by the apparatus described, succeeded in obtaining the benefit of a relatively thin or liquid condition of the stock for use in handling the pumping of the pulp and, at the same time, have obtained a relatively concentrated condition of the pulp as it is fed to the beater roll to thereby secure a relatively efficient operation of the roll.

While I have referred to the use of a pump for elevating the material to a point from which it may fall by gravity to acquire the desired acceleration of movement, I may utilize any of a number of other means for elevating the material to the overhead position.

The terms and expressions which I have employed are used as terms of description and not of limitation, and I have no intention, in the use of such terms and expressions, of excluding any mechanical equivalent of the features shown and described, or portions thereof, but recognize that various modifications are possible within the scope of the invention claimed.

What I claim is:

1. In a pulp beater, a tub, a beater roll, a bed plate cooperatively associated with the roll, an elevated receptacle, a feed pipe leading downwardly from the elevated receptacle to the roll, and means distinct from the roll for elevating pulp from the tub to the receptacle whereby the pulp will be fed to the roll with a substantial velocity due to gravity.

2. In a pulp beater, a tub, a beater roll, a bed plate cooperatively associated with the roll, an elevated receptacle from which pulp is fed to the roll, the elevation of the receptacle being such that the velocity due to gravity of the descending pulp is substantially equal to the peripheral velocity of the roll, and a pump for supplying pulp from the tub to the elevated receptacle.

3. In a pulp beater, a tub having a relatively narrow and a relatively deep formation, the bottom portion of the tub being inclined downwardly to provide a sump, a beater roll mounted to extend transversely across the upper portion of the tub, a bed plate cooperatively associated with the roll, a receptacle for pulp occupying an elevated position above the roll, a feed pipe leading downwardly from the receptacle to the roll, and a pump arranged to draw pulp from the sump and deliver the pulp to said elevated receptacle.

4. In a pulp beater, a tub having a relatively narrow and a relatively deep formation, the bottom portion of the tub being inclined downwardly to provide a sump, a beater roll mounted to extend transversely across the upper portion of the tub and arranged to operate above the normal level of liquid in the tub, a bed plate cooperatively associated with the roll, a guide plate following the curvature of the roll to direct material into the intake side of the roll and bed plate, a receptacle for pulp occupying an elevated position above the roll, a feed pipe leading downwardly from the receptacle to the guide plate, and a pump arranged to draw pulp from the sump and deliver the pulp to said elevated receptacle.

5. In a pulp beater, a beater roll, a bed plate associated with the roll, means for feeding pulp from the tub to the roll, and means for withdrawing water from the pulp being fed to the roll to thereby deliver concentrated material to the roll.

6. In a pulp beater, a tub, a beater roll, a bed plate associated with the roll, means for feeding pulp from the tub to the roll, and means for draining water into the tub from the pulp being fed to the roll to thereby concentrate the material fed to the roll.

7. In a pulp beater, a tub, a beater roll, an elevated receptacle from which pulp is fed to the beater roll, pumping means for delivering pulp from the tub to the elevated receptacle, and means for withdrawing water from the pulp before it is fed to the roll.

8. In a pulp beater, a tub, a beater roll, an elevated receptacle from which pulp is fed to the beater roll, pumping means for delivering pulp from the tub to the elevated receptacle, and means for withdrawing water from

the pulp as it passes through the elevated receptacle whereby to deliver concentrated pulp to the beater roll.

9. In a pulp beater, a tub, a beater roll, an elevated receptacle from which pulp is fed to the beater roll, pumping means for delivering pulp from the tub to the elevated receptacle, means connected with the elevated receptacle for partially draining liquid from the pulp and returning the drained liquid to the tub, and a feed pipe leading vertically downward from the elevated receptacle to the intake side of the beater roll, whereby concentrated pulp is delivered to the beater roll to be acted on thereby.

10. In a pulp beater, a tub, a beater roll, an elevated receptacle from which pulp is fed to the beater roll, pumping means for delivering pulp from the tub to the elevated receptacle, means connected with the receptacle for partially draining liquid from the pulp received in the receptacle, a pipe for delivering partially drained pulp from the elevated receptacle to the intake side of the beater roll, and a pipe through which drained liquid is discharged from the elevated receptacle into the tub, whereby to agitate the contents of the tub.

11. That method of treating pulp which consists in partially draining and feeding pulp to a beater roll, and in restoring the drained liquid to the pulp following the beating operation.

12. In a beater roll structure for pulp beaters, a cylindrical shell having blades formed integrally therewith and extending from end to end thereof, said blades being inclined away from the direction of rotation at their outer ends, said shell having a frusto-conical interior surface, a roll body section having a frusto-conical formation to provide a seat for the shell, a flange at the longer end of the body section to engage an end of the shell, and a removable holding plate adapted to be attached to the other end of the body section to engage the adjacent end of the shell and hold it in place.

13. In a pulp beater, a tub, a beater roll, an elevated receptacle, means for elevating pulp from the tub to the receptacle, a down pipe through which water flows from the elevated receptacle to the tub to thereby produce a vacuum in the receptacle, means for utilizing the vacuum to thicken the pulp in the receptacle, and a conduit through which the thickened pulp falls freely to the beater roll.

Signed at Erie, in the county of Erie, and State of Pennsylvania, this 22nd day of Jan., 1927.

LEONARD E. RANDECKER.