

Dec. 14, 1943.

W. M. NASH

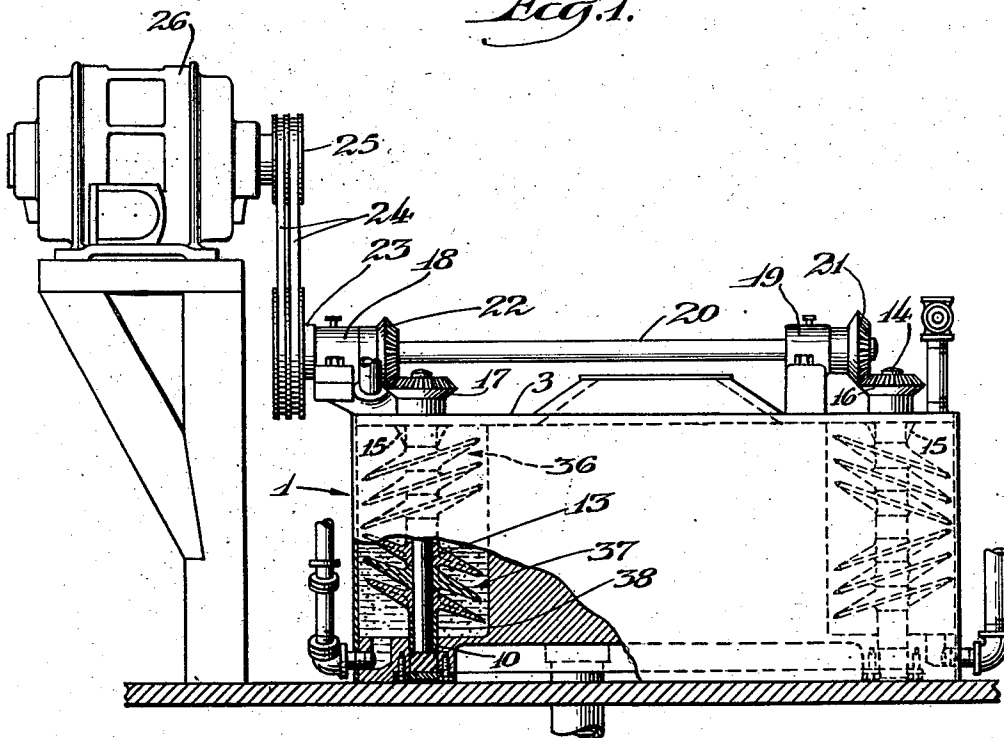
2,336,798

PULP BEATER

Filed Dec. 20, 1941

3 Sheets-Sheet 1

*Fig. 1.*



*Inventor:*  
*William M. Nash*  
*By Lee J. Gary*  
*Attorney.*

Dec. 14, 1943.

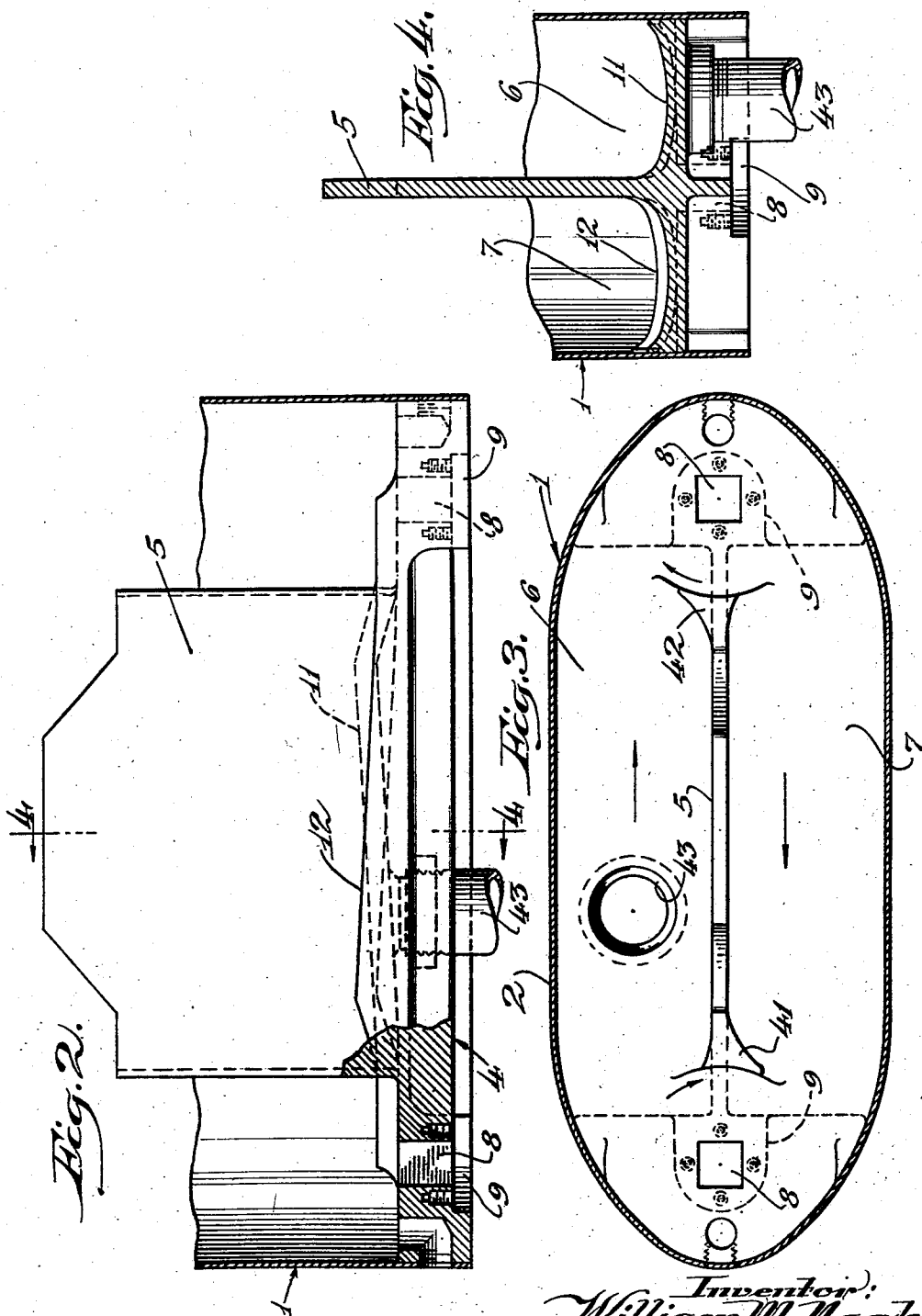
W. M. NASH

2,336,798

PULP BEATER

Filed Dec. 20, 1941

3 Sheets-Sheet 2



Inventor:  
William M. Nash  
By Lee J. Garry  
Attorney

Dec. 14, 1943.

W. M. NASH

2,336,798

PULP BEATER

Filed Dec. 20, 1941

3 Sheets-Sheet 3

*Fig. 5.*

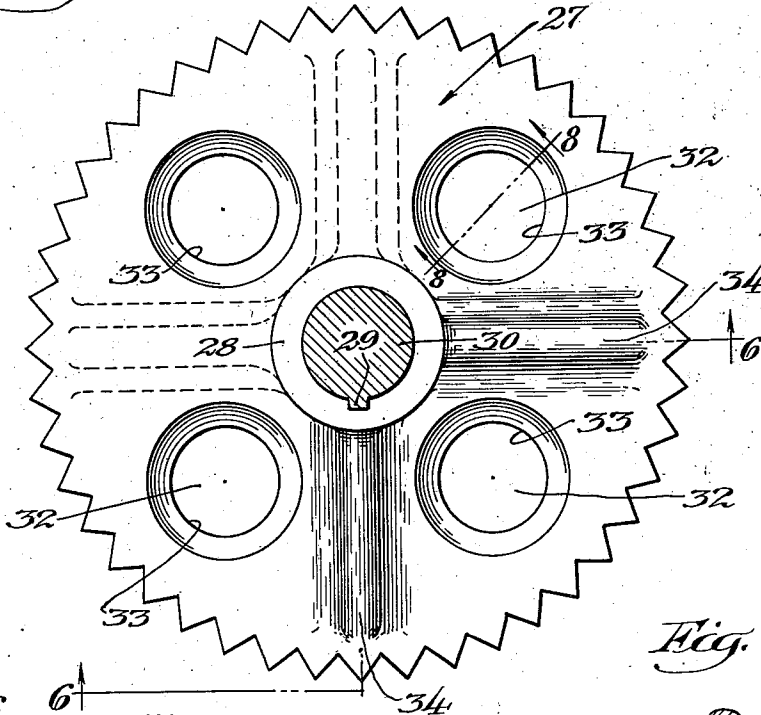


*Fig. 6.*

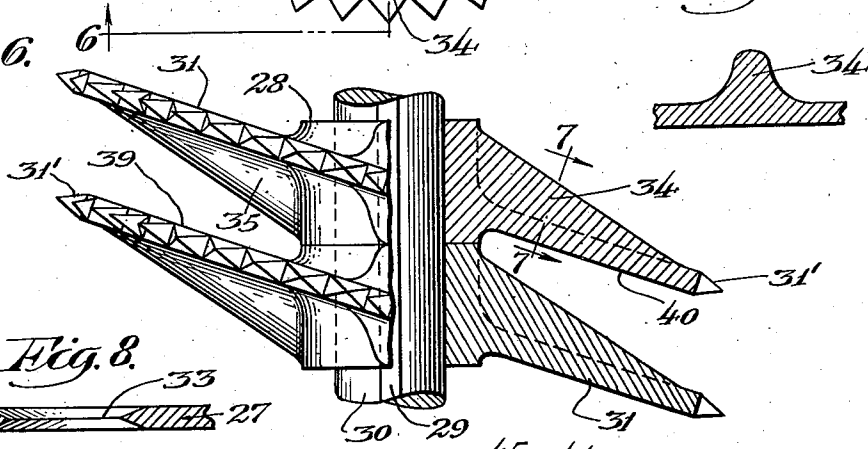


*Fig. 8.*

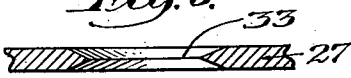


*Fig. 9.*

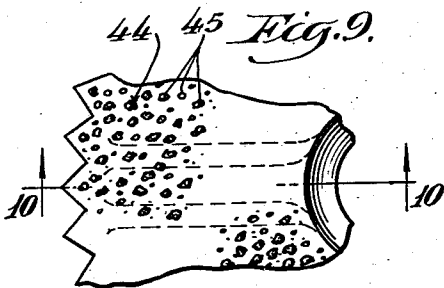


*Fig. 7.*

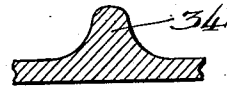
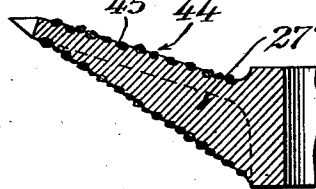


*Fig. 10.*



Inventor:  
William M. Nash  
By Lee F. Gary  
Attorney

## UNITED STATES PATENT OFFICE

2,336,798

## PULP BEATER

William M. Nash, Neenah, Wis., assignor of one-fourth to Roy A. Nash, Bronxville, N. Y., one-fourth to Mary Nash Jones, and one-fourth to Marie Duvall Nash, both of Neenah, Wis.; Marie Draper Nash administratrix of said William M. Nash, deceased

Application December 20, 1941, Serial No. 423,776

13 Claims. (Cl. 92—22)

This invention relates to improvements in a pulp beater and refers particularly to a rotary type of pulp beater so constructed as to thoroughly beat and wet the fibres and yet not unduly cut or shorten the length of the fibres.

In so-called "target" beating, fibres in aqueous suspension are thrown with relatively high velocity into contact with a stationary flat surface, known as the target. The impact of the fibres upon the target tends to bruise said fibres which is conducive to the wetting or pulping of the fibres. In the usual Hollander beater this principle is employed since the fibres are thrown into contact with the backfall, which in this instance constitutes the target.

In my invention an improved application of the target principle of beating is employed, in that the target is in movement, as well as the fibres, during impact. In addition, in one cycle of circulation of the pulp instead of one dashing or throwing of the pulp being accomplished, the pulp is thrown into contact with a plurality of targets, and the pulping operation is thereby accelerated without in anywise resorting to such violent beating as to cut or unduly shorten the fibres.

Briefly described, my invention comprises a vat or tub, the interior of which is separated longitudinally by a midfeather or midrib. Adjacent each end of the midfeather a vertical shaft is positioned which carries sets of oppositely inclined rotors, the latter being so constructed as to cause an axial movement of the pulp along the shafts and a simultaneous circulating movement of the pulp around the midfeather. Each rotor simultaneously acts as a velocity-imparting agent and a target whereby the pulp is thrown from one rotor to the next adjacent rotor which, at this phase of the operation, acts as a target.

The objects and advantages of my invention will be more fully appreciated from the accompanying drawings and following detailed description.

In the drawings,

Fig. 1 is a side elevational view, parts being broken away, and parts being shown in section of my improved beater.

Fig. 2 is a longitudinal sectional view of the vat or tub with the rotors removed.

Fig. 3 is a top sectional view of the tub illustrating particularly the midfeather.

Fig. 4 is a transverse sectional view taken on line 4—4 of Fig. 2.

Fig. 5 is an enlarged face view of one of the rotors.

Fig. 6 is an elevational view, parts being shown in section along line 6—6 of Fig. 5, of the manner in which the rotors are mounted upon the driving shaft.

Fig. 7 is a detailed sectional view of one of the rotor ribs, taken on line 7—7 of Fig. 6.

Fig. 8 is a detailed sectional view taken on line 8—8 of Fig. 5.

Fig. 9 is a fragmentary face view of a modified form of rotor having a roughened surface.

Fig. 10 is a sectional view taken on line 10—10 of Fig. 9.

Referring in detail to the drawings, 1 indicates a vat or tub which has a substantially oval cross-section. The vat 1 comprises lateral wall 2, a top 3 and bottom 4, the lateral wall 2 being carried upon the bottom. A wall 5 which may be formed integral with, or be rigidly secured to, the bottom 4 may extend upwardly therefrom, and is adapted to divide the tub into two longitudinal compartments 6 and 7. A recess 8 is provided in the bottom 4 adjacent each of the ends thereof, said recesses being closed by plates 9. As will be hereinafter more fully described, the recesses 8 are adapted for the reception of thrust bearings 10. The bottom portion of the compartment 6 slopes in one direction longitudinally of the compartment and the bottom of compartment 7 slopes in the opposite direction, as shown best at 11 and 12 respectively in Fig. 2.

Vertical shafts 13 and 14 are carried adjacent opposite ends of the tub or vat 1 by the thrust bearings 10, said shafts being journaled adjacent their upper ends in bearings 15 carried by the top 3. Exteriously of the vat, a bevel gear 16 is keyed to shaft 14 and, similarly, a bevel gear 17 is keyed to shaft 13. Bearings 18 and 19 are mounted in spaced relation upon the upper surface of top 3 and a shaft 20 is journaled in said bearings. A bevel gear 21 is keyed to the end of shaft 20 and meshes with bevel gear 16 to drive shaft 14, and a bevel gear 22 is keyed to an intermediate portion of shaft 20 which meshes with gears 17 to drive shaft 13, both shafts being driven in the same angular direction.

A pulley 23 is mounted on shaft 20 adjacent its opposite end and is driven by belts 24 which are trained around pulley 25 of an electric motor 26 which may be suitably mounted adjacent the tub 1.

A plurality of rotors 27 are mounted upon each shaft 13 and 14 within the tub 1. Each rotor 27 comprises a hub 28 provided interiorly

with a keyway 29. Each shaft 13 and 14 is also provided with a keyway, as shown at 30 in Fig. 6 whereby the rotors may be keyed to the respective shafts. A disc 31 is formed integral with each hub 28, said disc being disposed at an oblique angle to the axis of the hub. Each disc is provided with four relatively large circular apertures 32 which are angularly spaced from each other about 90°. The defining edges 33 of said apertures are feathered or tapered for a purpose to be hereinafter more fully described.

Each disc carries a pair of radially disposed ribs 34 on each face and a diametrically opposite pair of radially disposed ribs 25 upon the opposite face, the ribs on each face being disposed about 90° from each other.

The discs 27 are mounted in sets upon each shaft 13 and 14, that is, a plurality of discs adjacent one end of each of the shafts comprising one set 36 all have their planes substantially parallel. A plurality of discs mounted adjacent the opposite end of each shaft comprising a set 37 have their planes inclined at an oblique angle to the planes of the discs constituting the first-mentioned set. My invention contemplates any number of sets 36 and 37 of discs 27 upon each shaft, adjacent sets being inclined at oblique angles to each other. My invention also contemplates two or more discs 27 as constituting each set.

In mounting the discs 27 upon shafts 13 and 14, a sleeve 38 circumscribing each shaft is adapted to space the discs from the bottom of the tub. The discs of each set are then keyed to the shafts in such a manner that the ribs 35 are opposite a flat portion 39 upon the next adjacent disc, and the ribs 34 are disposed opposite a flat portion 40 of the next adjacent disc.

In operation, the tub 1 is substantially filled with fibres in aqueous suspension and the motor 26 is set in motion. Both shafts 13 and 14 are rotated in the same angular direction thereby rotating the discs 27. The rotation of the discs adjacent each end of the tub causes motion of the body of pulp in the direction indicated by the arrows in Fig. 3, that is, the pulp flows in opposite directions on opposite sides of the midfeather. The translatory speed of the pulp from end to end of the tub is relatively slow compared to the peripheral speed of the discs and may be described as a migratory motion. This, of course, results from the fact that the discs are not designed or constructed to function as pump vanes and a positive flow of the pulp past the midfeather is not contemplated. However, the presence of the ribs 34 and 35 upon the discs and the serrations or teeth 31' upon the periphery of the discs, cause the discs to exert a mild propelling motion upon the pulp.

The inclination of the discs with respect to their axes of rotation and also the contours of the discs produce a motion of the pulp which, insofar as the beating of the pulp is concerned, is of more importance than the migratory motion of the pulp around the midfeather.

The fact that the planes of the discs are obliquely inclined to the shafts 13 and 14, during rotation of the shafts the discs "wobble," that is, with respect to a fixed plane outside the discs, the end walls of the tub, for instance, the discs vibrate in a direction parallel to the shafts 13 and 14.

To analyze the motion of the pulp in the end beater sections of the tub, attention is directed

to that portion of pulp which is temporarily confined between two adjacent discs of one of the sets 36 or 37. The discs rotate at a predetermined rate of speed. However, the pulp temporarily carried between two discs does not move circumferential at the same speed as the discs. The circumferential speed of the pulp as a matter of fact is relatively slower than that of the discs. Consequently, in view of the fact that there is slippage between the discs and that increment of pulp temporarily confined between adjacent discs, the wobbling motion of the discs tends to oscillate this increment of pulp in a direction parallel to the shaft upon which the discs are mounted.

In oscillating the pulp, the pulp is moved by the face of one disc toward the face of an adjacent disc. Due to the inertia of the pulp increment the pressure of the pulp adjacent the first-mentioned face is greater than that upon the last-mentioned face. However, when the pulp during the oscillating motion has reached the end of the throw of the oscillation, the pressure relationship reverses and the increment of pulp is thrown abruptly into contact with the last mentioned face. These rapid impacts of the pulp increments throughout all of the disc sets accomplishes a beating of the pulp in accordance with the principle of target beating.

The ribs 34 and 35 upon the discs intensify the throwing of the pulp from one face to the other since the ribs, during rotation of the discs, exert a component of force upon the pulp tending to throw it toward the opposite flat face of the adjacent disc.

By the provision of the apertures 32 in the discs, the forces which tend to move the pulp increments in an oscillating manner, also tend to cause a portion of the pulp to extrude through said apertures from between one pair of discs to between the next adjacent pair of discs. In addition, a shearing action is also exerted upon the pulp in passing through said apertures.

It is to be understood, of course, that I do not wish to be limited to the above described hypothesis or theory of operation of my device, since, whatever the action which takes place, a well hydrated pulp can be obtained in the use of my device; a pulp in which the desired long fibre length is preserved.

It will be noted that the floor of the tub is tapered, as shown at 11 and 12 in Fig. 2, the floor rising in the direction of movement of the pulp. In addition, the ends of the midfeather 5 are flared outwardly in the line of travel of the pulp from the compartments 6 and 7 a greater distance than they are flared in the direction of passage of the pulp from the beating zones to the zones 6 and 7, as shown best at 41 and 42 in Fig. 3.

The effect of so tapering the floor and flaring the ends 41 and 42 of the midfeather is to have a greater pulp density in the compartments 6 and 7 than in the beater sections since a back pressure is built up at the entrances to the beater sections.

A drain pipe 43 connects into the bottom 4 whereby the beaten pulp may be withdrawn, a suitable valve, not shown, being provided in said pipe.

Referring particularly to Figs. 9 and 10, a slight modification of rotor is illustrated. The rotor 27' in all essential details is the same as rotors 27 except that a roughened surface 44 is provided.

One manner in which such a surface can be

formed is to line the inside of the mold in which the metal is poured to form the rotor with a mixture of carborundum and a binder. For example, carborundum particles of a grain size of about 76 may be mixed with "Kordek," (a starch compound normally used in preparing molding cores), molasses and water, the mixture being spread on the inside of the mold. After the metal has been poured the carborundum will be firmly embedded in the surface of the rotor, as shown best at 45 in Figs. 9 and 10. Of course, any desired manner of roughening the surface of the rotor is contemplated.

It is to be understood that my invention contemplates that all or none of the rotors may be of the roughened surface type or any desired number of the rotors may be rough or smooth. It has been found that under some conditions improved results can be obtained in employing one or more roughened surface rotors 27'.

I claim as my invention:

1. A pulp beater which comprises in combination a tub, a plurality of substantially vertical beaters disposed in spaced apart position in said tub, a partition extending between adjacent beaters to provide compartments in said tub through which pulp flows from one beater to an adjacent beater, each of said beaters comprising a vertical shaft, and a plurality of beater discs mounted upon said shafts with their planes obliquely inclined to the axes of said shafts, and means for rotating said shafts to circulate said pulp through said compartments.

2. A pulp beater which comprises in combination a tub, a plurality of substantially vertical beaters disposed in spaced apart position in said tub, a partition extending between adjacent beaters to provide compartments in said beater, each of said beaters comprising a vertical shaft, and a plurality of beater discs mounted upon each of said shafts, said beater discs being arranged in sets upon each shaft, each set comprising a plurality of relatively closely spaced discs disposed with their planes substantially parallel to each other and obliquely inclined to the axis of the shaft upon which they are mounted, and means for rotating said shafts to circulate said pulp through the compartments.

3. A pulp beater which comprises in combination a tub, a plurality of substantially vertical beaters disposed in spaced apart position in said tub, a partition extending between adjacent beaters to provide compartments in said beater, each of said beaters comprising a vertical shaft, a plurality of beater discs mounted upon each of said shafts, said beater discs being arranged in sets upon each shaft, each set comprising a plurality of relatively closely spaced discs disposed with their planes substantially parallel to each other and obliquely inclined to the axis of the shaft upon which they are mounted, adjacent sets of discs upon each shaft being inclined in opposite directions, and means for rotating said shafts to circulate said pulp through the compartments.

4. A pulp beater unit comprising a shaft adapted to be disposed substantially vertically in a beater tub, a plurality of beater discs mounted upon said shaft, said discs being arranged in sets upon said shaft, each set comprising a plurality of beater discs, the discs comprising each set being disposed obliquely to the axis of said shaft and being disposed with the planes of the discs substantially parallel, and the discs of adjacent sets being inclined oppositely to each other.

5. A pulp beater unit comprising a shaft adapted

to be disposed substantially vertically in a beater tub, a plurality of beater discs mounted upon said shaft, said discs being arranged in sets upon said shaft, each set comprising a plurality of beater discs, the discs comprising each set being disposed obliquely to the axis of said shaft and being disposed with the planes of the discs substantially parallel, and the discs of adjacent sets being inclined oppositely to each other, ribs extending from the opposite faces of each disc, the ribs of one disc being disposed opposite a flat portion of the next adjacent disc.

6. A pulp beater unit comprising a shaft adapted to be disposed substantially vertically in a beater tub, a plurality of beater discs mounted upon said shaft, said discs being arranged in sets upon said shaft, each set comprising a plurality of beater discs, the discs comprising each set being disposed obliquely to the axis of said shaft and being disposed with the planes of the discs substantially parallel, and the discs of adjacent sets being inclined oppositely to each other, ribs extending from the opposite faces of each disc, the ribs of one disc being disposed opposite a flat portion of the next adjacent disc, each of said discs being provided with an aperture whereby pulp may pass from between two adjacent discs through said apertures to the area between the next two adjacent discs.

7. A pulp beater disc which comprises a hub adapted to embrace a shaft, a disc carried upon said hub with its plane disposed obliquely to the axis of said hub, a rib carried on, and extending from one face of the disc, a rib carried on, and extending from the opposite face of the disc, said ribs being positioned on said discs on opposite sides of said shaft.

8. A pulp beater disc which comprises a hub adapted to embrace a shaft, a disc carried upon said hub with its plane disposed obliquely to the axis of said hub, a rib carried on, and extending from one face of the disc, a rib carried on, and extending from the opposite face of the disc, said ribs being positioned on said discs on opposite sides of said shaft, the face of said disc opposite the face which carries a rib on the same side of the hub being flat.

9. A pulp beater disc which comprises a hub adapted to embrace a shaft, a disc carried upon said hub with its plane disposed obliquely to the axis of said hub, a pair of ribs carried on, and extending from one face of the disc, said ribs being spaced approximately ninety degrees from each other, a pair of ribs carried on, and extending from the opposite face of the disc, said ribs being spaced approximately ninety degrees from each other, the ribs on one face of the disc being disposed on the opposite side of the hub from the ribs on the opposite face.

10. A pulp beater disc which comprises a hub adapted to embrace a shaft, a disc carried upon said hub with its plane disposed obliquely to the axis of said hub, a pair of ribs carried on, and extending from one face of the disc, said ribs being spaced approximately ninety degrees from each other, a pair of ribs carried on, and extending from the opposite face of the disc, said ribs being spaced approximately ninety degrees from each other, the ribs on one face of the disc being disposed on the opposite side of the hub from the ribs on the opposite face, said disc being provided with an aperture connecting one face to the other.

11. A pulp beater disc which comprises a hub

adapted to embrace a shaft, a disc carried upon said hub with its plane disposed obliquely to the axis of said hub, a rib carried on, and extending from each of the opposite faces of the disc, said ribs being positioned on said discs on opposite sides of said shaft, both faces of said disc being roughened.

12. A pulp beater disc which comprises a hub adapted to embrace a shaft, a disc carried upon said hub with its plane disposed obliquely to the axis of said hub, a rib carried on, and extending from one face of the disc, a rib carried on, and extending from the opposite face of the disc, said ribs being positioned on said discs on opposite sides of said shaft, and carborundum particles being carried on both faces of said disc.

13. A pulp beater which comprises in combination a tub, a plurality of substantially vertical beaters disposed in spaced apart position in said tub, a partition extending between adjacent beat- 5 ers to provide compartments in said tub through which pulp flows from one beater to an adjacent beater, the bottom of each compartment of the tub being inclined upwardly from one beater toward the next adjacent beater in the direction of 10 pulp flow, each of said beaters comprising a vertical shaft, and a plurality of beater discs mounted upon said shafts with their planes obliquely inclined to the axes of said shafts, and means for rotating said shafts to circulate said pulp through 15 said compartments.

WILLIAM M. NASH.