June 19, 1951 E. COWLES 2,557,174

APPARATUS FOR PULPING PAPER STOCK

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Fig. 1.

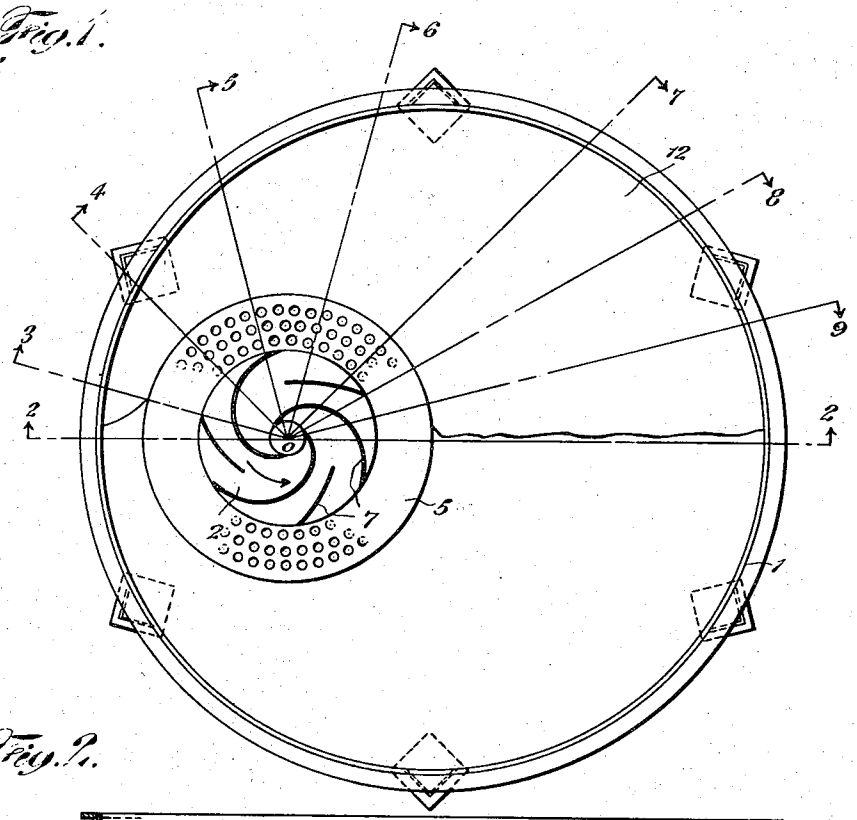
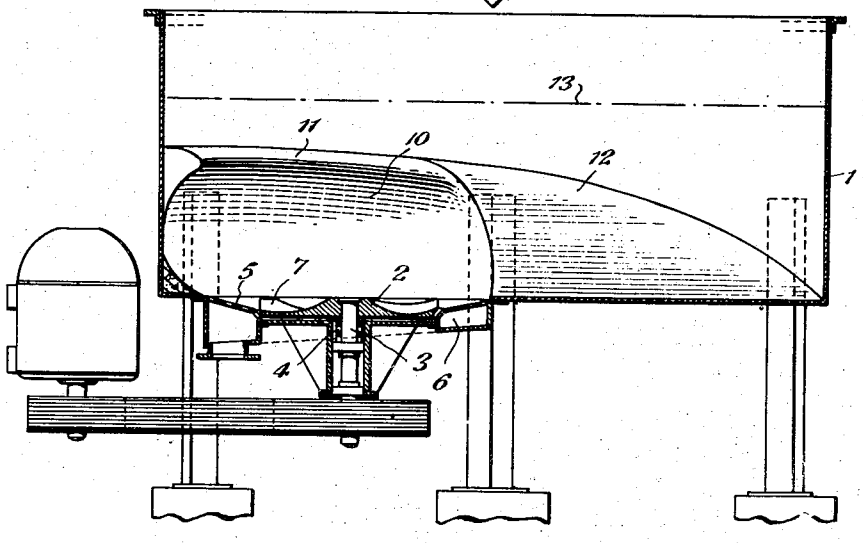


Fig. 2.



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Fig. 3.

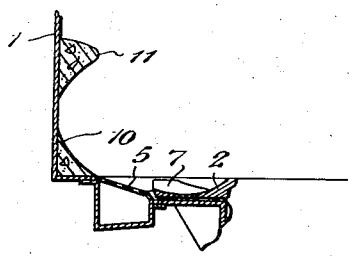


Fig. 4.

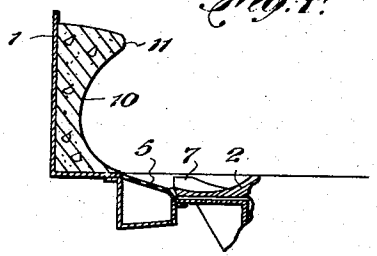


Fig. 5.

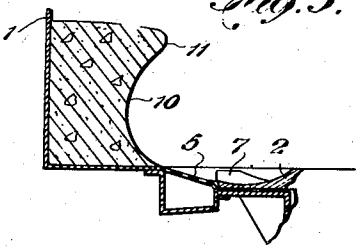


Fig. 6.

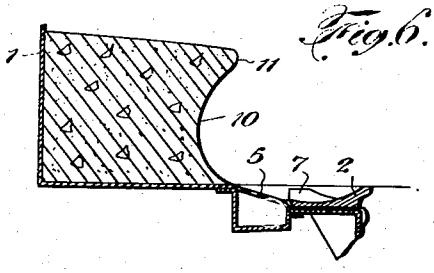


Fig. 7.

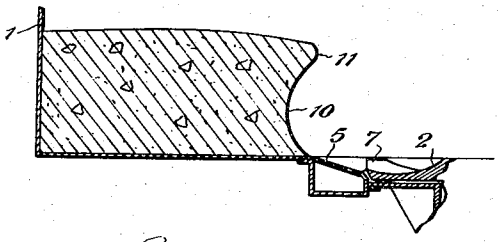


Fig. 8.

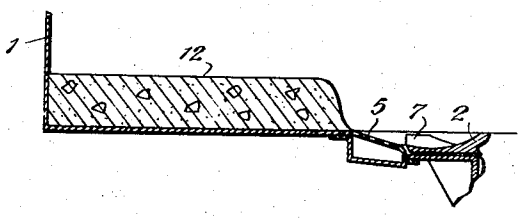
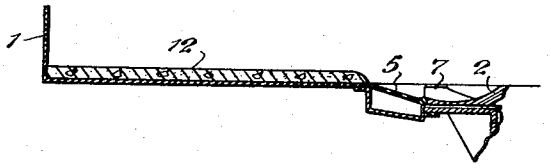


Fig. 9.



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UNITED STATES PATENT OFFICE

2,557,174

APPARATUS FOR PULPING PAPER STOCK

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Application January 26, 1949, Serial No. 72,867

10 Claims. (Cl. 92—26)

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This invention relates to machines for pulping paper stock, and pertains more particularly to machines of the general type illustrated in my prior Patent No. 2,351,492, in which a vaned impeller mounted for rotation in the bottom of a tank discharges stock outwardly to defiber the stock, and at the same time creates a vortical circulation of the stock in the tank which repeatedly brings all portions of the stock into the zone of action of the impeller.

Experience with said machines in actual day to day operation in paper mills has demonstrated that if good vortical circulation of the entire contents of the tank is to be maintained, the diameter of the impeller should be at least one fourth, and preferably one third to one half the diameter of the tank. However, it has been found that in such machines, and more particularly in the larger sizes of said machines in which the tank diameter is frequently as much as 20' and in which the impeller diameter should be from 6' to 10' for good circulation, the mechanical and engineering requirements of a drive adequate to transmit the required power input and to maintain the desired peripheral speed of the impeller are quite severe. In order to insure reliability of operation over extended periods gear reducing units have been employed to transmit power to the impeller shaft and such units have added considerably to the cost of such machines.

Experience with said machines has also demonstrated that for any given peripheral speed, a small diameter impeller produces more efficient defibering action than a larger diameter impeller. For example, a 4' diameter impeller rotating at 300 R. P. M. is more efficient than an 8' diameter impeller rotating at 150 R. P. M. as shown by the fact that the horsepower per ton per day consumed by the smaller impeller to produce a given amount of defibering is less than that consumed by the larger impeller to produce an equal amount of defibering. However, the 4' impeller cannot be relied upon to maintain adequate vortical circulation in a 20' tank, and larger impellers have been required in large diameter tanks for this reason.

It is an object of the present invention to provide a machine having a tank of large capacity in which a relatively small impeller may be employed, said impeller and tank being so constructed and arranged as to make it possible for a small impeller to create and maintain adequate circulation of all portions of the stock in the tank in the manner hereinafter described, but without the necessity of maintaining vortical

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circulation of all portions thereof. Such impellers, because of their relatively small diameter not only operate at higher efficiency, but also makes possible the use of smaller, lighter, cheaper gear reducing units, and in many cases makes possible the use of a simple V-belt drive at a cost considerably less than the cost of a gear reducing unit.

Other objects and advantages of the invention will appear hereinafter.

A preferred embodiment of the invention selected for purposes of illustration is shown in the accompanying drawings, in which,

Figure 1 is a top plan view.

Figure 2 is a section on the line 2—2 of Figure 1.

Figures 3 to 9 inclusive are sections on the lines 3—0, 4—0, 5—0, 6—0, 7—0, 8—0 and 9—0 respectively of Figure 1.

According to the present invention, a baffle wall is placed in the tank, spaced outwardly from the periphery of the impeller and extending across the path of the stock discharged from a portion of the impeller so as to deflect the stock discharged from that portion and prevent it from moving in a direction counter to that of the stock discharged from opposite portions of the impeller.

Referring to the drawings, the apparatus comprises a tank 1 within which is mounted a rotatable impeller 2 in the form of a disk, having a shaft 3 extending through a gland packing 4 in the bottom of the tank and driven in any suitable manner. In the preferred embodiment illustrated, the impeller rotates on a vertical axis and is mounted eccentrically in the tank—that is, the axis of rotation of the impeller is offset from the center of the tank so that one portion of the rim of the impeller lies much closer to the side wall of the tank than the opposite portion of the rim. Preferably, the diameter of the impeller is less than one fourth the diameter of the tank, and the axis of rotation is offset from the center a distance greater than the radius of the impeller so that the entire area of the impeller is offset from the center of the tank.

Immediately adjacent and surrounding the rim of the impeller is a perforated ring 5 covering an annular trough 6 through which defibered material may be removed from the tank. Depending on whether the apparatus is being used for a batch or a continuous operation, defibered material may be removed from time to time or continuously. In either case, the outward discharge from the rim of the impeller sweeps across the screen perforations at relatively high velocity and tends to keep the screen perforations clear of

obstruction while defibered material is being withdrawn.

The impeller is provided with means such as vanes 7 extending upwardly from the surface of the disk to discharge stock outwardly around the entire periphery of the impeller, the direction of discharge being the resultant of radial and tangential components of motion imparted to the stock by the impeller and the vanes thereof. In an apparatus such as disclosed, therefore, in which the axis of rotation of the impeller is offset from the center of the tank, and in the absence of a baffle wall as hereinafter described, the stock discharged from one side of the impeller would tend to produce circulation of the stock in the tank in one direction, while the stock discharged from the opposite side of the impeller would tend to produce circulation in an opposite direction. As a result, except in the area immediately adjacent the impeller, the circulation would be confused and unstable, and in cases where the consistency of the stock is above 2%, as is frequently required, there would be a tendency to create dead spots where the circulation is sluggish or stagnant. In order to avoid this result and to maintain a constant circulation of all portions of the stock in the tank so that all portions of the stock may be repeatedly subjected to the defibering action of the impeller, I place a baffle wall opposite a portion of the impeller, which said wall is spaced outwardly from the rim of the impeller and extends upwardly across the path of the stock discharged from that portion of the impeller to deflect it upwardly and prevent it from moving in a direction counter to that of the stock discharged from opposite portions of the impeller.

For convenience in explaining the construction and arrangement of the baffle wall, a line drawn through the center of the tank and the center of the impeller as shown in Figure 1 may be considered as dividing the impeller into two halves which will be referred to as the "free" and "baffled" halves of the impeller, the "free" half being below the dividing line and the "baffled" half being above the dividing line as seen in Figure 1.

Thus, in the apparatus illustrated, in which the impeller is rotated in counter-clockwise direction as indicated by the arrow, the stock discharged from the major portion of the free half of the impeller, as shown in Figure 1, would tend to move around the tank in a counter-clockwise direction. The stock discharged from the major portion of the baffled half of the impeller would, unless deflected, tend to move around the tank in a clockwise direction. Accordingly, I place the baffle wall 10 opposite the baffled half of the impeller to deflect the stock discharged therefrom in an upward direction. As best shown in Figures 3 to 7, the baffle wall is preferably curved both horizontally and vertically, the horizontal curvature being such that the wall is substantially concentric with the impeller. The vertical curvature, as shown by Figures 3 to 7, is such that the wall extends outwardly at the bottom, then upwardly and then inwardly to form a concave surface with an overhanging lip 11, the vertical curvature not only tending to deflect the stock upwardly but also tending to reverse the direction of flow of the stock which is discharged against the baffle wall, so that as it leaves the baffle wall it is moving generally in counterclockwise direction.

In the preferred embodiment, one end of the baffle wall joins the tank wall and is faired off as shown in Figures 2 and 3 to merge with the wall

of the tank. The opposite end of the baffle wall terminates near the center of the tank and is tapered downwardly to the bottom of the tank as shown in Figures 8 and 9 with sloping surfaces to prevent pieces of stock from lodging thereon.

In the embodiment illustrated, the baffle wall is made of concrete and the space between the baffle wall and the wall of the tank is filled with concrete to provide an inclined surface 12 which slopes gently downwardly from the lip of the baffle wall to the bottom of the tank thereby eliminating any pocket or dead space behind the baffle wall.

The level of the lip 11 is below the normal level of the stock in the tank as indicated by the line 13, and the stock discharged from the free half of the impeller maintains a steady circulatory movement in a center clockwise movement within the tank which is assisted to some extent by the reversed flow of the stock discharged from the baffled half of the impeller. As a result, the contents of the tank circulate in a counter-clockwise direction and all portions of the stock in the tank are repeatedly subjected to the defibering action of the impeller.

It will be understood that the invention may be variously modified and embodied within the scope of the subjoined claims.

I claim as my invention:

1. Apparatus for defibering paper stock, comprising, in combination, a tank, an impeller mounted for rotation within said tank, means on said impeller to discharge stock outwardly from the periphery of said impeller, and a baffle wall within said tank, said baffle wall extending upwardly from the bottom of the tank, and being spaced outwardly from the periphery of said impeller and extending across the path of the stock discharged from a portion only of said impeller and deflecting the stock discharged thereagainst in an upward direction, one end of said baffle wall being joined to the wall of the tank, and the other end of said baffle wall being spaced from the wall of the tank.

2. Apparatus for defibering paper stock, comprising, in combination, a tank, an impeller mounted for rotation within said tank, means on said impeller to discharge stock outwardly from the periphery of said impeller, and a baffle wall within said tank, said baffle wall extending upwardly from the bottom of the tank, and being spaced outwardly from the periphery of said impeller and curved substantially concentrically with the periphery of said impeller and surrounding a portion only of the periphery thereof, said wall extending across the path of the discharged stock and deflecting the same in an upward direction, one end of said baffle wall being joined to the wall of the tank, and the other end of said baffle wall being spaced from the wall of the tank.

3. Apparatus for defibering paper stock, comprising, in combination, a tank, an impeller mounted for rotation within said tank, means on said impeller to discharge stock outwardly from the periphery of said impeller, and a baffle wall within said tank, said baffle wall extending upwardly from the bottom of the tank, and being spaced outwardly from the periphery of said impeller and extending upwardly across the path of the stock discharged from a portion only of the impeller, said wall being curved outwardly, upwardly and inwardly to form a concave surface with an overhanging lip to deflect and reverse the direction of flow of stock discharged against

said wall, one end of said baffle wall being joined to the wall of the tank, and the other end of said baffle wall being spaced from the wall of the tank.

4. Apparatus for defibering paper stock, comprising in combination, a tank, an impeller mounted for rotation within said tank, means on said impeller to discharge stock outwardly from the periphery of said impeller, and a baffle wall within said tank, said baffle wall extending upwardly from the bottom of the tank, and being spaced outwardly from the periphery of said impeller and curved substantially concentrically with the periphery of said impeller and surrounding a portion only of the periphery thereof, said wall extending upwardly across the path of the discharged stock and being curved outwardly, upwardly and inwardly to form a concave surface with an overhanging lip to deflect and reverse the direction of flow of stock discharged against said wall, one end of said baffle wall being joined to the wall of the tank, and the other end of said baffle wall being spaced from the wall of the tank.

5. Apparatus for defibering paper stock, comprising, in combination, a tank, an impeller mounted for rotation within said tank on an axis offset from the center of said tank, means on said impeller to discharge stock outwardly from said impeller, and a baffle wall within said tank spaced outwardly from the periphery of said impeller and curved substantially concentrically with the periphery of said impeller and surrounding a portion only of the periphery thereof, said wall extending upwardly across the path of the discharged stock and deflecting the same, one end of said baffle wall being joined to the wall of the tank, and the other end of the baffle wall terminating near the center of the tank.

6. Apparatus for defibering paper stock, comprising, in combination, a tank, an impeller mounted for rotation within said tank on an axis offset from the center of said tank, means on said impeller to discharge stock outwardly from said impeller, and a baffle wall within said tank spaced outwardly from the periphery of said impeller and curved substantially concentrically with the periphery of said impeller and surrounding a portion only of the periphery thereof, said wall extending upwardly across the path of the discharged stock and deflecting the same, one end of said baffle wall being joined to the wall of the tank, and the other end of the baffle wall terminating near the center of the tank, the space between the baffle wall and the wall of the tank being filled to provide a sloping surface extending from the top of the wall to the bottom of the tank.

7. Apparatus for defibering paper stock, comprising, in combination, a tank, an impeller within said tank, said impeller having a diameter less than one fourth the diameter of the tank and being mounted for rotation on an axis offset from the center of the tank a distance greater than the radius of the impeller, means on said impeller to discharge stock outwardly from said impeller, and a baffle wall within said tank spaced outwardly from the periphery of said impeller and extending upwardly across the path of the stock discharged from a portion of said impeller and deflecting the stock discharged thereagainst.

8. Apparatus for defibering paper stock, comprising, in combination, a tank, an impeller mounted for rotation within said tank, means on said impeller to discharge stock outwardly from the periphery of said impeller, a baffle surrounding a portion only of the periphery of said impeller to intercept and deflect a portion of the peripheral discharge from said impeller and to redirect the intercepted discharge in the direction of a portion of the peripheral discharge which is not intercepted.

9. Apparatus as claimed in claim 8 in which the axis of rotation of said impeller is offset from the center of the tank.

10. Apparatus as claimed in claim 8 in which the impeller and baffle are located to direct both the deflected and undeflected portions of the discharge in a combined current moving along the wall of the tank.

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REFERENCES CITED

The following references are of record in the file of this patent:

UNITED STATES PATENTS

Number	Name	Date
144,557	Moore et al.	Nov. 11, 1873
2,351,492	Cowles	June 13, 1944
2,434,449	Wells	Jan. 13, 1948