This invention relates to pulp screening apparatus and has for its object the provision of a generally improved and more efficient centrifugal pulp screen of the "Quiller" type.

In the operation of a conventional "Quiller" type screen the stock is supplied to the inlet under suitable head pressure and flows axially along the annular passage between the impeller shaft and the cylindrical screen until it reaches the cone end of the impeller where the flow is changed from axial to radial. The radial flow is accelerated by the centrifugal force imparted to the pulp suspension by the revolving propeller blades so that the water and fine fibres are forced outwardly through the perforations of the cylindrical screen. The coarse fibres are not well hydrated and, due to their lower specific gravity, tend to lag behind the finer fibres at the cone part of the impeller. As these coarse fibres accumulate they gradually work out of the cone part of the impeller and form a mat on the adjacent inner surface of the screen. This mat, which usually contains a considerable percentage of the desirable finer fibres, gradually moves along the screen toward the coarse fibre outlet. At the tailings end of the screen dilution water is introduced under pressure through shower pipes by which jets of the water are directed against the screen to thin out the mat so that the finer fibres are washed out through the perforations of the screen. This method of introducing dilution water does not give sufficient penetration and is also open to the objection that it occasions considerable shock losses as the impeller blades pick up the water jets directed through the shower pipes. According to the present invention these objections are overcome by conducting the dilution water through the impeller shaft to radially extending grooves formed on the pressure sides of the impeller blades. The dilution water introduced in this manner need not be under any considerable pressure since the centrifugal force to which the water is subjected as it enters the grooves of the impeller blades is sufficient to throw the water toward the screen with the requisite velocity to ensure efficient dilution of the fibres. In addition to thinning out the mat formed on the adjacent inner surface of the screen.

I have also found that, owing to the improved penetration obtained, the delivery of the dilution water to grooves formed in the pressure sides of the impeller blades materially increases the capacity of the screen in the zone where the dilution water is introduced to thin out the fibrous mat.

The invention further comprises a screen of the "Quiller" type in which the impeller is provided, near the cone end, with baffles which serve, by their flow retarding effect, to ensure complete filling of the cylindrical screen at the inlet or cone end of the impeller. This ensures a more uniform screening action along the entire length of the screen than is obtained in the conventional screen, in which the pulp supplied through the inlet tends to flow rapidly toward the coarse fibre outlet without filling the screen zone immediately adjacent said inlet. I have found that when this flow is retarded by the baffles provided in accordance with this invention a more effective screening action is obtained along the portion of the screen lying adjacent the inlet.

A further feature of the invention resides in providing the impeller with dam forming elements which serve to increase the screening capacity by regulating the travel and thickness of the mat which forms on the screen at the cone end of the impeller.

Proceeding now to a more detailed description of this invention reference will be had to the accompanying drawings, in which—

Fig. 1 is a vertical sectional view of one form of screening apparatus embodying my invention.

Fig. 2 is an end view of the impeller and shaft assembly shown in Fig. 1.

Fig. 3 is a transverse sectional view through the impeller and shaft assembly, the plane of the section being along the line 3--3 of Fig. 1.

Fig. 4 is a transverse sectional view of the impeller and shaft assembly taken substantially along the line 4--4 of Fig. 1.

Fig. 5 is a view similar to Fig. 1, but showing a slight modification.

Fig. 6 is a transverse sectional view along the line 6--6 of Fig. 5.

The screening apparatus shown in Figures 1 to 4 inclusive comprises an outer casing 8, a cylindrical screen 9, and a rotary impeller 10.

Casing 5 may be of any suitable or preferred design. In the present instance it comprises a base section 8, end heads 9 and 10, and removable cover plates 11. The base is recessed at 8x to receive the lower portions of the end heads which are fastened in place by bolts 12. The cover plates 11 are curved to fit the rim portions of the end heads and are bolted or otherwise detachably secured in place. The end por-
tions of screen 6 are held in place between the annular ribs 13 of the end heads 9 and 10 and suitable retaining strips 14. The end head 10 is provided with a relatively large central opening 15 to take the feed elbow 16 which is fastened in place as indicated at 17.

During the screening of the pulp suspension supplied through elbow 16 the oversized particles gradually move along the screen 6 toward the end head 9 and are discharged through the outlet 18. The finer material which passes through the screen is discharged through an opening 19 formed in the base 8. The impeller shaft 20 passes centrally through the screen 6 and is journaled in suitable bearing structures 21 and 22 carried by the end head 9 and the feed elbow 16. A driving pulley 23 is fixed to shaft 20 adjacent bearing 21 and is driven by a belt 24. The belt 24 also passes over a tightening pulley 25 carried by one end of a lever 26. The remaining end of lever 26 is mounted to swing about a pivot pin 27 carried between the end head 9 and the cover plate 28 of bearing 21. Any suitable means may be provided for operating pulley 26 to tighten the belt 24.

Shaft 20 is bored out to provide a water passage 29 which extends approximately one-half the length of the shaft. This passage extends inwardly from the pulley end of the shaft and is closed at its inner end as indicated at 30. During operation of the screen dilution water is continuously supplied to passage 29 through a water supply pipe (not shown) suitably connected to the pulley end of shaft 20. The wall of the water passage 29 is provided with suitable openings 31 registering with similar openings 32 formed in the hollow hub 33 of the impeller 7. The openings 32 are in open communication with the inner ends of the radially extending grooves 35 formed in the pressure sides of the impeller vanes 36 which have a slight helical twist and are cast integral with the hub 33.

The cone end 34 of impeller hub 33 is spaced inwardly from the end head 10 of casing 2. Portions of the impeller blades 36 project beyond this end of the hub into close proximity with the end head 10 but are recessed or cut away as indicated at 39 to provide a vane-free space 40 into which the inner end of the feed elbow 16 extends. The ends of the impeller blades located adjacent the end head 10 are connected together by an integral strengthening ring 41. Baffles 42 are also cast integral with intermediate portions of the hub 33 and the impeller blades 36. These baffles serve, by their flow retarding effect, to ensure complete filling of the space lying between the baffles and the end head 10. This ensures a more uniform screening action along the entire length of the screen 6 than would be possible if the baffles were omitted. In the latter event the pulp supplied through the elbow 16 would flow toward the outlet 18 without filling the space immediately adjacent the end head 10. Consequently, but little effective screening action would be obtained along the portion of the screen immediately adjacent the inner end of the feed elbow.

The recessed portions of the impeller blades 36 are also interconnected by integral dam forming members 45. These dam members 45 lie substantially midway between the ring 41 and the baffles 42. During the screening operation the blades of the impeller impart a centrifugal force to the fibers and thus serve to force the fibre and water through the perforations of the screen 6. Owing to insufficient dilution the coarse particles of the pulp suspension tend to lag behind since the forces acting on them are smaller due to the reduced gravity. As these coarse fibres accumulate they move toward the inner surface of the screen 6 and form a mat in the zone lying between the baffles 42 and the end heads 10. This mat, which contains a considerable amount of desirable finer fibres, tends to move slowly along the screen toward the outlet 18.

The dilution water supplied to the grooves 35 of the impeller blades 36 is thrown against the mat as it travels past the grooved portions of the blades. In this way the mat is thinned out sufficiently to permit the desirable fibres to be washed out through the screen openings. The purpose of the dams 45 is to prevent a too rapid travel of the mat toward the outlet 18 and to provide an increased depth of mat between the dam members and the baffles 42. Increasing the depth of the mat between the dams 45 and the baffles 42 increases the capacity of the screen in this area due to the increased centrifugal force acting on the fluid of the pulp suspension.

The introduction of the dilution water through the water passage 29, openings 32, and grooves 35 eliminates the shock losses characteristic of pulp screens in which the water is sprayed into the screening chamber in advance of the travelling impeller blades. With the arrangement described herein the water is supplied to the grooved pressure sides of the blades without shock and is thrown against the screen in an efficient manner to thin out the mat and wash out the desirable fibres. It may also be pointed out that the water supplied to passage 29, need not be under any appreciable pressure since the centrifugal force to which the water is subjected as it enters the grooves 35 is sufficient to cause it to flow radially toward the screen with the requisite velocity to ensure efficient dilution of the fibres in addition to thinning out the mat formed on the inner surface of the screen.

In the modified construction shown in Figs. 5 and 6 the inner end of the feed elbow 16 terminates close to the inner surface of the end head 10. The portions of the impeller blades extending from the baffles 42 to the end head 10 are shaped so that their inner edges are spaced from the shaft 20 are interconnected by integral walls 47 forming the annular chamber 48 surrounding said shaft. Each of the walls 47 are provided with slots 49 forming radial outlets for the pulp suspension supplied to chamber 48 through feed elbow 16. I have found that this construction also gives an improved screening effect along the portion of the screen lying adjacent the end head 10. In all other respects the assembly shown in Figs. 5 and 6 is substantially the same as that previously described in connection with the preceding figures.

The vanes shown in Figs. 5 and 6 may be straight lined vanes or may be helically twisted in the same manner as the vanes shown in Figs. 1 to 4 inclusive.

Having described what I now conceive to be the preferred embodiment of this invention it will be understood that alterations and modifications may be resorted to within the scope and spirit of the appended claims.

Having thus described my invention, what I claim is:

1. Pulp screening apparatus of the "Quiller" type comprising a stationary cylindrical screen
through which the pulp suspension is passed, an impeller comprising a plurality of impeller blades fixed to a hub mounted on a rotary impeller shaft extending axially through said screen, said shaft being provided with an internal water passage having radial outlet openings communicating with radial openings formed in said hub and each of said impeller blades being provided with radial grooves formed in the pressure side thereof and having their inner ends communicating with certain of the hub openings and means for supplying dilution water to said passage for delivery to said grooves.

2. Pulp screening apparatus as set forth in claim 1 including a casing enclosing said screen, said casing being provided with a pulp inlet and a coarse fibre outlet located at opposite ends of the screen and baffles interconnecting intermediate portions of the impeller blades to retard the flow of pulp toward the coarse fibre outlet.

3. Pulp screening apparatus as set forth in claim 1 including a casing enclosing said screen, said casing being provided with a pulp inlet and a coarse fibre outlet located at opposite ends of the screen, baffles interconnecting intermediate portions of the impeller blades to retard the flow of pulp toward the coarse fibre outlet, and dam forming members interconnecting the impeller blades at points located between the baffles and the pulp inlet, said dam forming members being arranged to regulate the travel and thickness of the fibrous mat forming on the surface of the screen at the inlet side of the baffles.

4. Pulp screening apparatus as set forth in claim 1 including a casing enclosing said screen, said casing being provided with a pulp inlet and a coarse fibre outlet located at opposite ends of said screen, baffles interconnecting intermediate portions of the impeller blades to retard the flow of pulp toward the coarse fibre outlet and axially extending wall members interconnecting said blades at the side of the baffles facing the pulp inlet, said axially extending wall members serving, in conjunction with the impeller shaft and the baffles, to provide a plurality of chambers into which the pulp is delivered through said inlet, said axially extending walls being apertured to provide outlets through which the pulp passes from said chambers into the surrounding spaces between the impeller blades.

ELIJAH COWAN.