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APPARATUS FOR REMOVING STRINGS FROM LIQUID SOLUTIONS

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FIG. 2

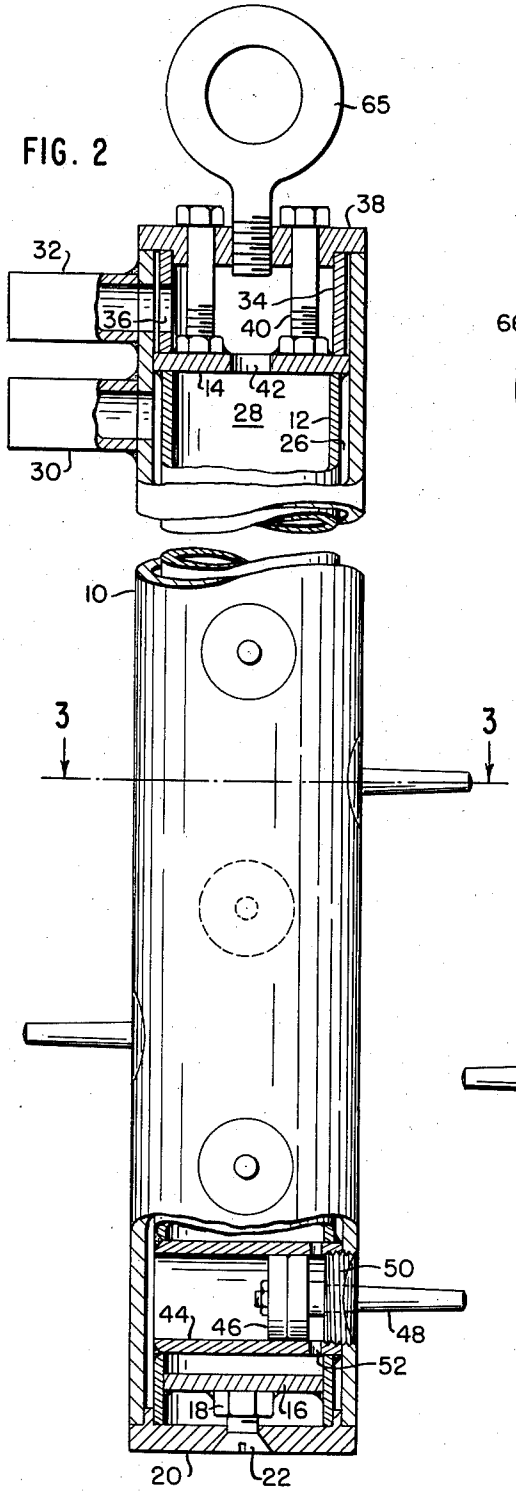
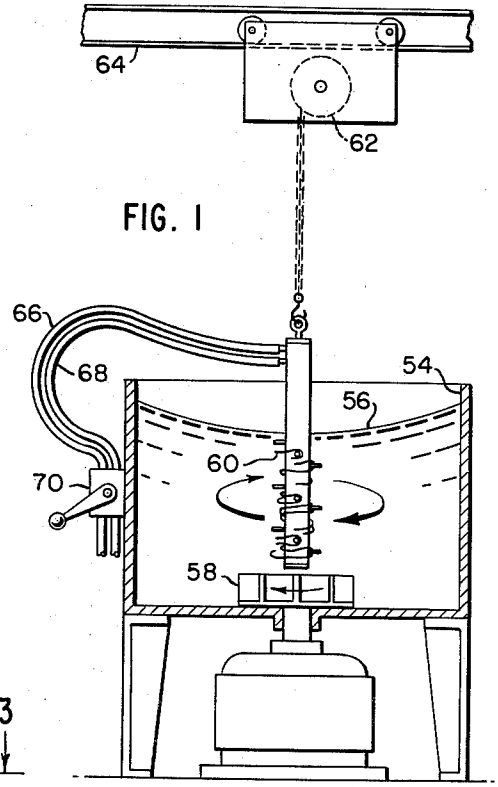


FIG. 1



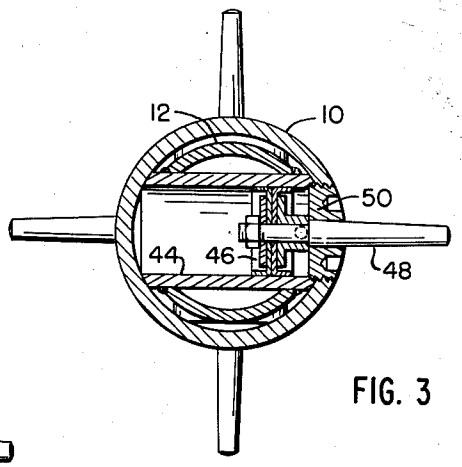


FIG. 3

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APPARATUS FOR REMOVING STRINGS FROM LIQUID SOLUTIONS

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This invention relates to paper re-pulping and more particularly comprises a new and improved apparatus for removing strings and similar foreign matter from a re-pulping slurry.

Certain waste paper products such as multi-wall bags used to package cement and similar dry materials are manufactured for strength and durability and accordingly have a paper content of particularly high quality. In addition, the re-processing of waste paper of poorer grades is frequently undertaken in which rags, strings, and like materials are included as adulterants.

When the re-pulping involves a waste which is entirely of paper, there is no particular problem since the entire article passes into a pulpy solution and may be re-used. However, certain wastes may have non-paper components which are insoluble or otherwise not desirable in the pulp slurry. The cement bags mentioned above, for instance, have their ends closed by a string seam which, for practical reasons when operating on a large scale, cannot be conveniently removed before re-pulping the bag. The practice has been, in cases like this, to charge the bags together with their string seam into the pulp tank. As the paper portion of the bags turn into pulp, it is generally drawn off leaving loose strings in the solution. Most of these strings gradually ball up and impede the action of the agitator while some are drawn off with the pulp, clogging the filters in the system and generally interfering with the re-pulping process.

In order to clear the system of these strings, it is necessary to shut down operations periodically and remove the collection of strings from the slurry tank as well as from the various filters that have become clogged. This course of action, besides being somewhat messy, is quite time consuming and expensive insofar as production must necessarily cease while the cleaning takes place.

It is an object of the present invention to provide a device that eliminates the above-mentioned problems that have existed heretofore in the re-pulping industry.

Another object of this invention is to provide a novel apparatus for quickly and easily removing strings and other foreign matter from a watery solution.

Yet, another object of this invention is to provide a device for removing strings and the like from a pulp tank without interrupting the operation of the tank.

More particularly, this invention features a cylindrical shaft adapted to be lowered vertically into a slurry tank in which the pulp is whirled. A plurality of radially projecting pins, or spikes, are mounted for reciprocation in and out of the shaft. When the device is lowered into the vortex of the whirling slurry, the pins are in their extended position so that whatever strings are present will become snagged thereon. As soon as all of the strings have been caught, the shaft is removed from the tank and swung out of the way. The pins are then retracted to permit the string clusters to slide off. There is no need to interrupt the process or drain the slurry tank since the apparatus in no way interferes with the pulping system and may be used whenever the collection of string in the tank becomes objectionable.

These and other features of the invention together with further objects and advantages thereof will become apparent from the following specification with reference being made to the accompanying drawings in which;

FIG. 1 is a view in side elevation, partly in section of a re-pulping tank equipped with a string removing device made according to this invention,

FIG. 2 is a view in side elevation, partly in section of the string removing device shown in FIG. 1 and on an enlarged scale, and

FIG. 3 is a cross-sectional view taken along the line 3—3 of FIG. 2.

Referring now to the drawings, the reference character 10 generally indicates a cylindrical tubular casing or perhaps 3½ feet in length and 3½ inches in outside diameter with a wall thickness of approximately .216 inch. Preferably, the casing should be fabricated from stainless steel although it will be obvious that any one or more of a wide selection of other materials may be used if desired. Mounted coaxially within the casing 10 is a tubular member 12 having a cylindrical configuration and being somewhat smaller in size than the casing 10. Typical dimensions of the member 12 would include a length of 3 feet and an outside diameter of 3 inches with a .120 inch wall thickness. The member 12 is mounted within the casing 10 by means of an annular plate 14 welded to the upper end of the member 12 and secured to the upper inner portion of the casing 10. The lower end of the member 12 is closed by a circular plate 16 welded to the inner surface near the end thereof and provided with a nut 18 fastened thereto.

A cover 20 is secured to the casing 10 by means of a screw 22 engaging with the nut 18. It will be noted that the cover is provided with an annular rib or flange which seats in between the casing 10 and the tubular member 12 when the cover 20 is in place. The dimensions of the casing and the tubular member are such that when assembled there will be formed an annular passage 26 running longitudinally between the inner wall of the casing and the outer wall of the member 12. This annular passage is separated from a chamber 28, within the member 12, by means of the plate 14 and the cover 20.

A pair of hydraulic connections 30 and 32 are provided near the top of the casing with the lower connection 30 communicating with the annular passage 26. The upper connection 32 communicates with the chamber 28 through a header formed by a sleeve 34 having a port 36 aligned with the connection 32. The sleeve is held in position by a cover 38 secured to the casing 10 and the sleeve by threaded fasteners 40, comprising bolts threaded in nuts welded to the plate 14. The plate 14 is provided with a central opening 42 as shown.

Mounted within the member 12 and the casing 10 is a plurality of tubular cylinders 44 arranged at 90° intervals in spiral array. Each cylinder houses a piston 46 having a slightly tapered stainless steel pin or spike 48 attached thereto. The pin passes radially outward from the casing 10 through a bronze bushing 50 having an outer portion contoured flush with the casing to present a smooth, unbroken surface. In its extended position shown in the drawing, the exposed portion of the pin measures approximately 2 inches.

It will be seen that the cylinder 44 is open on one end to communicate with the annular passageway 26. Hydraulic pressure applied through the connection 30 will cause the piston and its pin to move radially outward to the extended position shown.

A pair of ports 52 are provided in the walls of the cylinder 44 adjacent the bushing 50 and communicate with the chamber 28. By directing pressure to the connection 32, the pins may be completely retracted.

Referring more particularly to FIG. 1, there is illustrated a typical pulp tank 54 equipped with a string-re-

moving apparatus according to this invention. Conventionally, the tank is substantially filled with a solution 56 which is mostly water. The paper materials to be reprocessed are thrown into the slurry and are allowed to dissolve into pulp. To accelerate the process, a motor driven impeller 58 is provided at the base of the tank and agitates the mixture by a whirling motion.

Indissolvable fragments, such as the strings 60 from the seams of paper bags that have been put into the tank, conglomerate about the vortex of the whirling solution. In time as the collection increases, the strings interfere with the impeller and also pass out of the tank into associated piping where they clog the screens and filters. Heretofore, the entire operation had to be shut down at least once a day and the system drained and cleaned. This is now completely avoided since the assembly which has been described serves to remove the strings without interrupting the re-pulping operation.

When quantities of strings or other indissolvable fragments aggregate in the solution, the casing assembly with the pins 48 in their extended position, is lowered vertically into the vortex of the whirling solution. For this purpose, a traveling chain fall 62 supported by an overhead rail 64 may be used. An eye-bolt 65 is secured to the cover 38 for engagement with the hook of the chain fall. Almost immediately upon submersion of the casing, the strings 60 on the pins wrap themselves around the casing. When it appears that all of the objectionable materials have been caught on the pins, the assembly is withdrawn from the solution and moved out away from the tank to a waste collecting area. The pins are then retracted so that the collected strings will slide off the casing into the waste. The operation may be repeated from time to time as conditions warrant.

A pair of flexible hydraulic conduits 66 and 68 are shown engaging the connectors 30 and 32 on the casing with an hydraulic control station 70 mounted on the side of the tank 54. Remote control means for operating the chain fall 62 may also be provided adjacent the station for operating convenience.

Although the invention has been described with particular reference to the illustrated embodiment, it will be obvious that many modifications will appear to those skilled in the art. For instance, the pins may be operated pneumatically rather than hydraulically. Other modifications may also be made without departing from the spirit of my invention. The term "string" is used in this description to include many materials of relatively low density, flexible nature such as woven and non-woven textiles, plastic films, sheet rubber, and even paper which has been chemically treated to make it resistant to disintegration in water.

Having thus described my invention, what I claim and desire to obtain by Letters Patent of the United States is:

1. Apparatus for removing strings and the like from a tank containing a liquid solution having such strings therein, comprising means for producing whirling of the solution in the tank whereby a vortex is created and the strings are concentrated in said vortex, an elongated hollow member having a plurality of spaced openings, a plurality of pins of cross-sections conforming to the cross-sections of said openings and being received in snuggly fitting relation therethrough, said pins being adapted to extend a substantal distance outwardly of said hollow member and being adapted to be retracted substantially entirely within said hollow member through said openings, means for extending said pins with respect to said member, means for introducing said hollow member in said tank in the region of said vortex with said pins in their extended position, whereby said pins engage and snag the strings from the whirling solution, means for removing said hollow member from said tank, and means for retracting said pins to within said member through said openings for removing the strings from said pins.

2. Apparatus as set forth in claim 1 further characterized in that said means for extending said pins and said means for retracting said pins include a pair of separate passageways for pressurized fluid in said hollow member, a plurality of cylinders, one for each of said pins, in said hollow member and through which said pins are retractable, each of said cylinders having a piston in sealing relationship therewith and adapted to reciprocate therein, each of said pistons being fixedly connected to its respective pin, one of said passageways being in fluid communication with one end of each of said cylinders and positioned on one side of said pistons, the other of said passageways being in fluid communication with the other end of each of said cylinders and positioned on the other side of said pistons, means for introducing pressurized fluid into said one of said passageways to extend each of said pins, and means for introducing pressurized fluid into said other of said passageways to retract each of said pins.

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