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MACHINE FOR TREATING PAPER MILL WASTE

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2 Sheets-Sheet 1

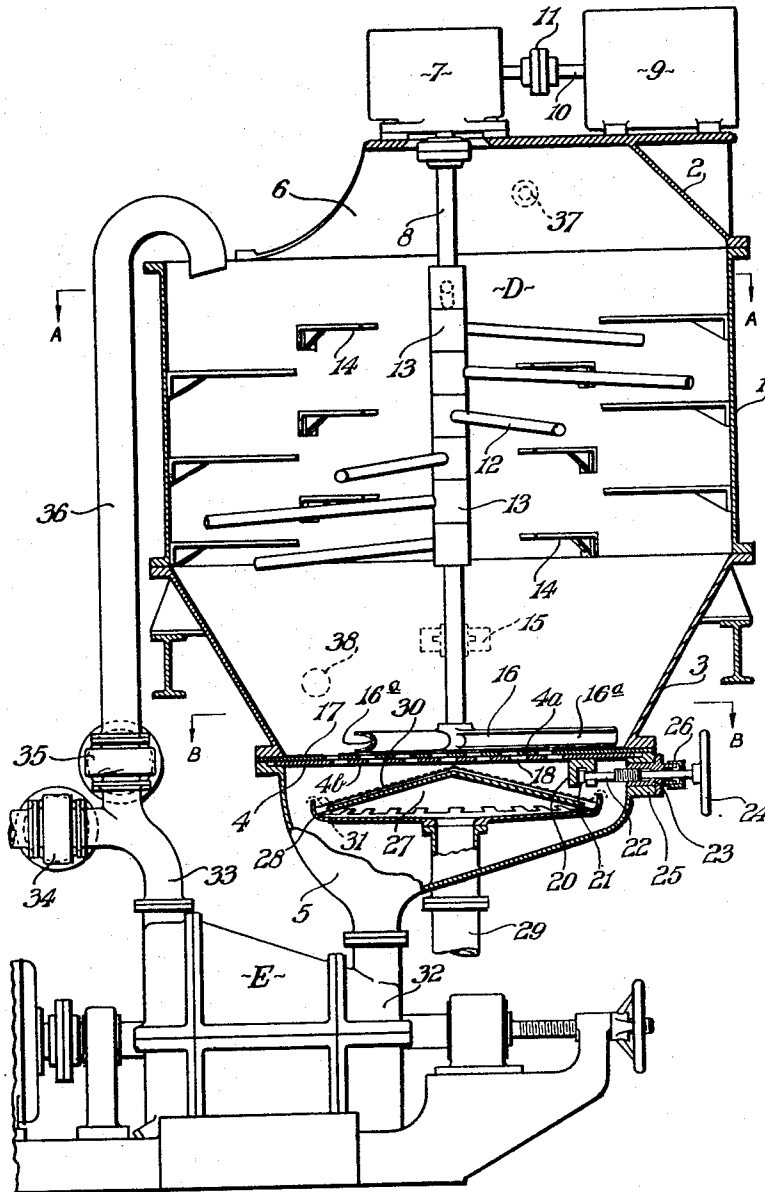


Fig. 1.

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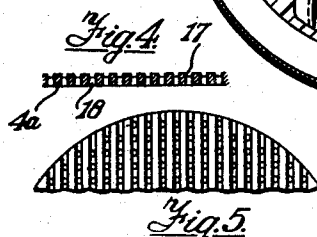
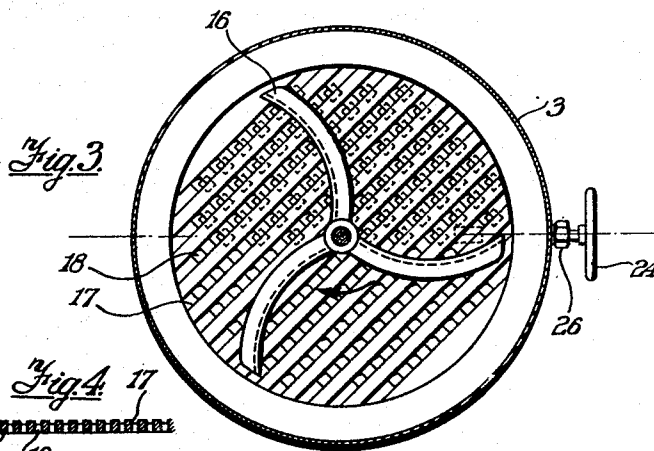
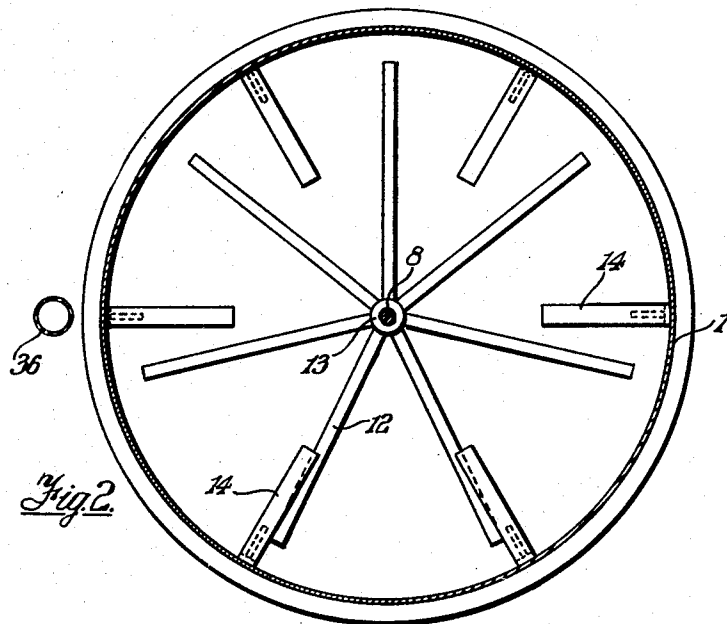
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2 Sheets-Sheet 2



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MACHINE FOR TREATING PAPER MILL WASTE

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Claims priority, application Great Britain
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4 Claims. (Cl. 92-20)

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This invention relates to an improved machine for treating paper mill waste including broke-paper or esparto grass or straw or the like and has for its object in the case of the first named material, means for returning into pulp stock the made or partly-made paper, common known as broke-paper, and of effectively treating the other waste material that occurs in the various stages of paper manufacture and reducing same also to pulp stock. The broke-paper may be in a partly prepared condition or otherwise and is normally collected by hand and trucked or conveyed away for re-pulping.

Esparto grass is normally put through a machine generally known as a duster to remove sand, dirt, etc. and is then conveyed away for further treatment. In this invention the esparto grass can be fed into the receiving vessel which forms an integral part of the apparatus and can be washed free of sand and dirt. This method of treatment obviates the use of a duster machine and a dust-collecting apparatus with its potential fire danger in the mill. This fire danger is due to the fine dust and "fluff" which fills the surrounding air during the working of the duster machine and which renders the air and any place where dust settled highly inflammable.

According to the present invention, immediately a charge has been fed into the treatment vessel it is wetted with water thereby eliminating all fire risks and in the course of its treatment such raw material as esparto grass or straw is reduced whilst in a wet state to parts of small dimensions by a preliminary tearing process, and then passes under impellers placed above perforate rubbing plates. The pulp produced is then separated from any admixed dust or grit, and can pass to paper pulp refining units for further treatment.

Straw is normally similarly dusted and then chopped by a cutter into more manageable and less bulky dimensions. A dust-collecting apparatus is normally a feature of such a process and the potential fire danger obtains. By the use of this invention the straw can be immediately wetted and the dust laid. The impeller aforesaid reduces straw and straw-like material into small dimensional sizes thus obviating the use of any preliminary cutting operation.

The object of the present invention is to provide an apparatus that will readily receive or actually induct broke-paper and like paper mill waste or esparto grass, straw or the like and consists of a chest or tank containing revolving arms, stationary tearers, an attrition impeller or impellers, an adjustable particle size classifier, and a wet grit trap and separator.

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The invention consists in an improved machine for treating paper mill waste and comprises in combination a receiving vessel with water supply thereto and pulp inlet thereto and exit therefrom, a driven vertical shaft centrally disposed in said vessel, drag arms fast on said shaft, tearer brackets fast with the internal peripheral walls of said vessel co-operating with said drag arms, horizontal impellers fast with the lower portion of said central shaft, grooved perforate rubbing plates forming a foraminous partition in said vessel below said impellers, means for adjusting one said perforate plate in relation to the other and means for eliminating sand grit below said partition to exit.

The angular relationship of the drag arms with the tearer brackets is such as to provide a shearing action to any pulp or paper stock coming therebetween and both of these parts may be fitted with renewable edge parts to compensate for operative abrasion.

Further, the impellers are formed with concave faces in the direction of drive and since these impellers rotate over the grooved perforate plates producing a secondary shearing action the pulp stock, which is forced into the cavities of the curved impellers, is curled over again and again to be sheared against the ridges or groove edges of the upper foraminous plate.

Conveniently the above machine is erected to feed a paper pulp refining machine with means for recirculating the partly refined paper stock to the receiving vessel either above or below the drag arms aforesaid.

In order to eliminate sand grit and other like matter of small particle size from the wet paper pulp stock resulting from the maceration process, it is necessary to provide means to segregate this material from the flow of pulp and eject same as waste. To this end a wet grit trap is arranged below the foraminous plates. This consists of a conical or roof shed structure with an annular launder covered with gauze over which the raw pulped paper stock is compelled to flow after its passage through the perforated plates. Preferably this gauze cover is formed with a shallow annular depression coincident with the launder below to form a flow brake in the path of pulp movement. The grit particles of the heavier type pass through the interstices of the gauze in the flow towards the launder, but the finer particles tend to mesh with the pulp stock and the temporary arrestment of pulp flow in the said depression achieves two objects. Firstly it introduces a greater time element for grit settlement, and secondly it allows a larger amount of water

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to circulate through the mass at such point and thus assist in the elutriation of the grit and its passage to exit.

To those conversant with paper making it will be obvious that the above device may take various forms mainly dependent upon the type of paper waste to be treated with accentuation of some of its features or otherwise, but in order that the invention shall be more fully understood reference is made to the accompanying drawings wherein there is illustrated a type of machine that may be called upon to deal with the overall waste of a modern factory, as a preferred embodiment and wherein:

Fig. 1 is a part sectional elevation of the invention shown as mounted in flow with a cone type paper refining machine.

Fig. 2 is a sectional plan on line A—A Fig. 1.

Fig. 3 is a part sectional plan on line B—B, Fig. 1.

Fig. 4 is a cross section of the rubbing plate.

Fig. 5 is a fragmentary plan of upper rubbing plate.

Referring to the drawings and to Fig. 1 the receiving vessel D is formed with a circular body 1, a cover 2, a truncated conical lower part 3, a foraminous partition referred to as a whole under 4, and a base bowl 5. The cover has an opening 6 for the admission of paper waste, said cover carries a gear box 7 with means for driving a dependent central shaft 8. The gear in box 7 is driven by an electric motor 9 or any substituted source of power by means of a shaft 10 and coupling 11. The shaft 8 carries a series of drag arms mounted on sleeves 13 fast with the shaft 8. The said arms 12 are adapted to co-operate with the tearer brackets 14, the latter being formed as shown and mounted fast on the inner periphery of the vessel body 1. The said arms 12 and brackets 14 are not in radial alignment, the lack of coincidence being a few degrees, as see Fig. 2, so that the arms 12 drag the waste paper along a shearing edge on the brackets 14. The edges of the brackets 14 may be serrated or straight and in some cases are faced with toughened or hardened steel to resist wear.

The shaft 8 may be of the suspended type as shown in Fig. 1 or may be guided in its length by passing through a bracket 15 in the vessel part 3 as shown in dotted lines. At the lower part of the shaft 8 is mounted fast therewith an impeller 16 having several arms of paraboloid or cup section indicated at 16a in Figure 1 and adapted to rotate horizontally over the upper foraminous static partition plate 4a in the direction of the arrow seen in Figure 3.

The plate 4a, see Fig. 4, is formed with a series of sharp edged grooves 17 with perforations 18 over the whole of the plate in the groove recesses. A single foraminous plate may be employed if the waste paper material is uniform, but with a view of providing an adjustment of plate orifice beneath the upper plate 4a there is a lower perforated plate 4b. The plate 4b is formed with perforations of identical pitch in both dimensions with those of the upper plate 4a. Plate 4b is capable of relative movement in relation to plate 4a. This is arranged as shown in Fig. 1. The lower plate 4b is provided with a bracket 20 accommodating the head 21 of a spindle 22, said spindle being threaded into a nut 23. Shaft 22 is prolonged to appear externally and is provided with a hand wheel or lever 24. The nut 23 is made fast with an entry sleeve 25 and the shaft made tight against leakage by cap 26. As shown

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in Fig. 3 the coincidence or otherwise of the perforations 18 in the plates 4a and 4b can be adjusted by manipulating wheel 23 to give a series of maximum openings to practically nil.

Below the partition 4 is mounted a facially grooved support 27 having a grit launder 28 connected to waste pipe 29; over the support 27 is laid a wire fabric 30 having any desired mesh opening dimension. The mesh covering lies upon its facially grooved support, and is then in bent at 31 to follow the curvature of the launder 28. The meshing 30 is spaced away from the launder lip so that fine paper pulp passing through the mesh is caused to overflow the edges and rejoin the main body of pulp in the vessel base 5.

The device as shown in Fig. 1 is mounted so as to feed a paper pulp refining unit E. This unit E is of a known type pressure fed from a centrifugal pump 32. The outlet 33 is branched and both branches controlled by valves 34 and 35 respectively. Valve 34 permits the refined pulp stock to be sent to a poacher chest or other part of the paper making plant, the valve 35 being closed, or if valve 34 is closed, the pulp is recirculated through the vessel D again through the pipe 36. Pipe 36 may also be used for supplying water to the broke paper or may be inserted by conduit 37 entering the cover. Pulp may be withdrawn from the compartment 3 of vessel D through orifice 38 and pumped back to the top of the vessel D.

In operation the paper mill waste, including broke paper, cuttings, trimmings, loose raw paper stock including straw, esparto or other grass is introduced to the vessel D through the cover opening 6 and water is sprayed in. The raw material is engaged by the drag arms 12 which in their rotary motion and inclination induce the entry of material which is stripped away and teased by engagement of the arms 12 with the tearer brackets 14 fast with the vessel part 1. Several arms 12 may be fitted to any one sleeve 13 and several tearer brackets may be common to any one tier of sleeves. The broke material torn off the uppermost arm 12 drops to the arm or arms of the next tier. Centrifugal force tends to keep the broke paper away from the central shaft and with wet paper its path along the arms 12 is lubricated so that the bulk of the broke material entering is engaged by and macerated upon the tearers 14. When the half formed paper pulp reaches section 3 of vessel D it falls upon the partition 4 where the raw pulp is dragged round over the sharp edges of the grooved plate 4a by the impellers 16. The paraboloid type of section of these impeller blades tends to cause the pulp to engage and re-engage the surface of the plate 4a, and when the predetermined fibre size has been attained, the particles pass through the coincident or partly coincident perforations and fall upon the grit catcher below, the pulp traversing the mesh fabric under water flow down the incline into the depression 31 where any remaining grit separates and passes to the launder below and is removed from the vessel through pipe 29. In the passage of the pulp over the mesh fabric any grit or sand present passes through the openings in the wire mesh down the surface grooves cut in the face of the support and are washed into the launder and pass to waste. When the pulp passes the grit meshing 30 it overflows the launder and passes to the refiner E. If the vessel D is not keeping pace with input or the broke paper is hard or caked, the apertures in the foraminous

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partition are widened to make the openings in the plates 4a and 4b more coincident by manipulating the handwheel 24, this arrangement being of the push-pull type whereby aperture size can be adjusted with a single control. With this arrangement the coarse pulp is fed to the refiner D and is recirculated in the treatment vessel until the desired texture of pulp is obtained.

I claim:

1. In a machine for treating paper mill waste to reduce same to pulp stock, the combination of a treatment vessel, a horizontal partition in said vessel defining an upper chamber and a lower chamber, said partition being perforate, a shaft extending vertically in said upper chamber, drag arms radiating from said shaft, tearer brackets on the inside of the vessel in its said upper chamber portion, said chamber portion having inlet means for the introduction of the mill waste and a supply of water, horizontal impeller means on said shaft in close proximity to said perforate partition and within said upper compartment, means for rotating said shaft to rotate said drag arms and said impeller means, said drag arms and tearer brackets cooperating to tear and initially macerate said mill waste in the said upper chamber, said impeller means operating at the bottom of the upper compartment to pulp the macerated waste and discharge same into the lower chamber through the perforate partition, said impeller means being formed to churn the macerated mill waste upon said perforate partition, a grit screening device in said lower chamber immediately beneath said perforate screen and in the path of the discharge of the pulp particles from said perforate partition, said device serving to separate grit from the pulp particles, a discharge outlet in said lower compartment for the discharge of the pulp and a discharge outlet on said grit screening device for discharging the separated grit.

2. The invention as defined in claim 1, said perforate partition including separate perforate plates mounted in surface contact with one another with their respective perforations in register, and means for adjusting one said plate relatively to the other to vary the effective size of said registered perforations.

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3. The invention as defined in claim 2, said impeller means comprising radiating arm members of cup-shape section.

4. An improved machine for treating paper mill waste of the type set forth having means for macerating partly formed paper pulp comprising a rotary impeller disposed above a foraminous grooved upper rubbing plate, said grooves having parallel sides and upper shearing edges, perforations within said grooves, said upper plate being static and constituting a base to the macerating vessel, a perforate lower plate mobile under control in relation to said upper plate for total orifice adjustment, a grit catching device disposed below the foraminous plates, said device comprising a launder mounted below said rubbing plate, a grooved cone or shed disposed within said launder having serrated outer edges, the said cone or shed being provided over its entire superficial area with a covering of wire mesh or gauze, the latter being in bent at the launder edge and passing therefrom, apron fashion, to cause the pulp to overflow said edge and pass into the lower base of the vessel, the launder passing any sand or grit caught in the grooves to a waste pipe and thereby ejected from the vessel as waste.

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