

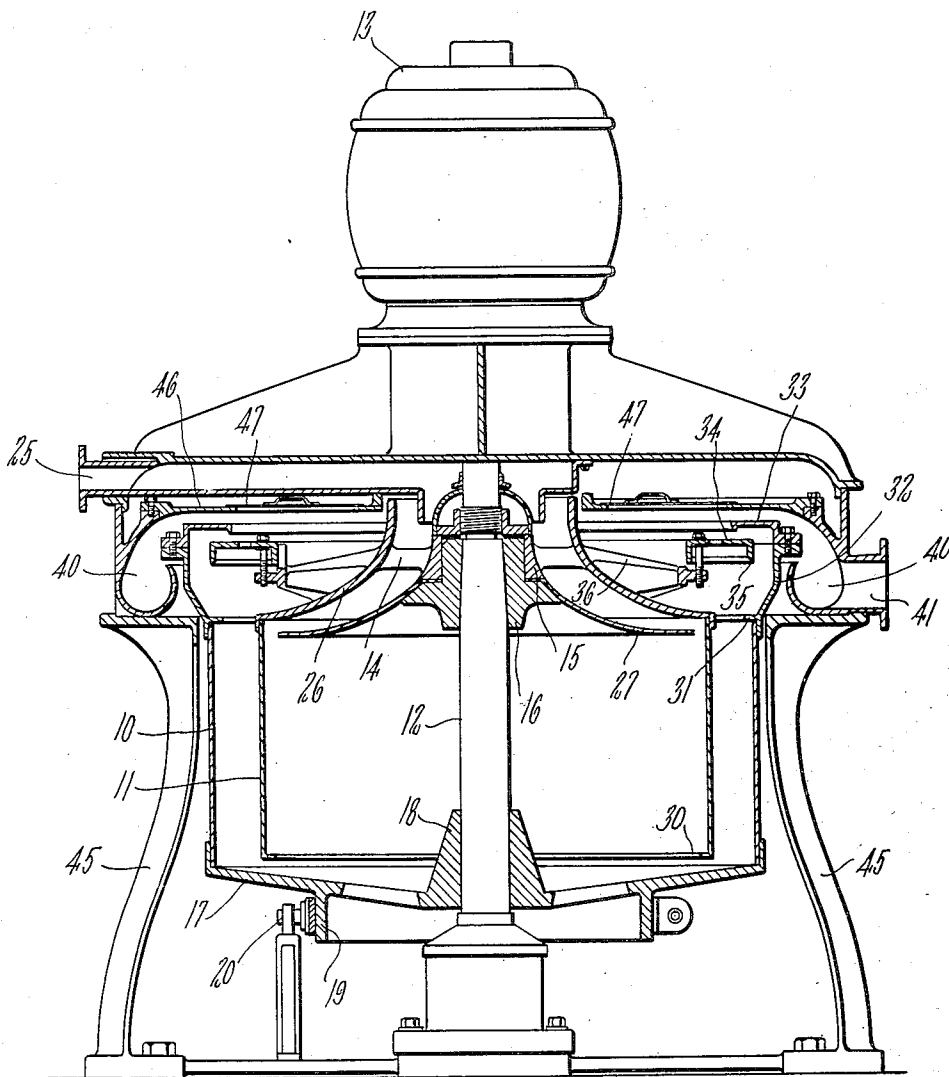
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APPARATUS FOR PURIFYING PULP STOCK

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APPARATUS FOR PURIFYING PULP STOCK

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This invention relates to mechanism for purifying liquids by the action of centrifugal forces. While the invention is applicable to liquids in general, it pertains more particularly to aqueous suspensions of fibrous materials such as cellulosic fibers. Suspensions of this type include pulp stock made from wood, old paper, rags, jute, bagasse, and a number of other materials. Such pulp is liable to contain therein specks of foreign matter which are objectionable in paper or other finished product which may be made from the pulp. It is an object of the invention to provide mechanism for purifying the pulp through centrifugal action, the apparatus being designed to handle the pulp in a novel manner and to separate the particles of foreign matter from the pulp efficiently. It is a further object of the invention to provide apparatus which is comparatively compact in structure so as to economize in floor space, and to be capable of easy cleaning after a run. In centrifuging pulp stock for the purpose of separating out the particles of foreign matter which may be present, it is desirable to form within the centrifuge one or more pools of stock against the wall of the rotating drum. Inwardly extending ribs or barriers are preferably supplied over which the pulp must flow in a thin stream, these ribs tending to break up fiber bunches and to promote an even distribution of the pulp to the aqueous medium.

According to the present invention a drum of a centrifuge is provided consisting of a pair of coaxial drums, one within the other. Provision is made for introducing a constant stream of pulp into an end of the inner drum. This stock flows along the wall of the drum, being held against the wall by the centrifugal action resulting from the rotation of the centrifuge. At the opposite end of the drum the stock is permitted to flow over an inwardly extending rim, the escaping stock being flung against the wall of the outer drum adjacent to an end thereof. In the outer drum the stock flows in an opposite direction to the other end of this drum whence it is discharged into a suitable receptacle.

Cellulosic pulp stock, such as is commonly used in the manufacture of paper, has certain peculiarities which must be considered in devising an efficient centrifuge for purifying such material. As the fibrous matter is ordinarily slightly denser than the aqueous medium, there is a tendency on the part of the fibers to move radially outward toward the wall of the drum. This tendency varies with the speed of rotation of the drum. It is desirable to regulate the ro-

tation so as to cause some of the fibers in the pulp to form a soft mat against the wall of the drum. This mat is important for the successful operation of the mechanism, since the fibres on its surface exert a combing action on the thin stream of pulp flowing over the mat so as to comb out particles of foreign matter which might otherwise be carried along with the stream. This is especially true where the foreign matter has a specific gravity only slightly greater than that of the pulp stock. For the formation of such a mat within the drum, the speed of rotation must be regulated within limits. If the rotation is too slow the stream of pulp washes through without the formation of any mat at all, so that only the denser particles of foreign matter are retained within the drum. If the speed of rotation is too great, the mat packs very densely and is less efficient in combing out specks from the stream of stock passing over it. Owing to the difference in diameter between the two drums constituting the centrifuge embodying the present invention, there is a certain difference of centrifugal action in the two drums which results in a slightly denser packing of the mat in the outer drum than in the inner drum. Thus by proper regulation of the speed of rotation of the centrifuge, this speed depending on the actual diameters of the drums, a relatively soft mat may be formed on the inner drum to catch the denser particles and to remove at least a portion of the foreign matter from the pulp stream. In the outer drum a slightly denser mat is formed which reaches the particles having a density more nearly equal to that of the stock, on account of the greater centrifugal effect on the stream of stock in the outer drum. Through proper regulation of the speed of rotation of the centrifuge, this feature of construction makes possible more efficient purifying of the pulp stock.

For a more complete understanding of the invention and of the various advantageous features thereof, reference may be had to the description which follows and to the drawing which shows an embodiment of the invention in section on a vertical plane.

Referring to the embodiment of the invention illustrated on the drawing, the centrifuge may comprise an outer drum 10 and an inner drum 11 arranged one within the other for rotation on a central shaft 12. As shown, this shaft may have a vertical axis and may be driven as by a motor 13 or any other suitable driving connection. The inner drum 11 may be supported as by radially extending fins or bridging pieces

14 which connect it to a central member 15 mounted on a hub member 16 which is, in turn, secured to the shaft 12. The outer drum 10 may be supported by a disk-like member 17 secured to the lower end of the drum, this disk member having a hub portion 18 mounted directly on the shaft 12. The disk member 17 may also have thereon a brake drum 19, cooperating with braking mechanism indicated at 20 by which the centrifuge may be quickly stopped after the power is turned off.

Pulp may be supplied to the inner drum at its upper end through a supply pipe 25 which opens into the upper end of the drum. The upper portion of the drum may be provided with a conical or bell-mouth portion 26, with the small end uppermost to receive the incoming stream of stock. An apron 27 may be mounted within the upper end of the drum to deflect stock flowing into the drum and to conduct such stock outwardly to the wall of the drum. This apron 27 also imparts rotational motion to the stock received from the pipe 25 so that this stock is deposited against the wall of the inner drum with minimum disturbance. At the lower end of the inner drum is an inturned flange or rib 30. The presence of this rib causes the stock entering the inner drum to form in a pool against the wall of the drum until the pool is of sufficient depth to overflow the flange 30. The overflowing stock is flung from the lip or inner edge of the flange into the adjacent end of the outer drum 10 where it is prevented from flowing downwardly by the presence of the end member 17. The stock in the outer drum thus flows upwardly and overflows an inwardly extending rib 31 adjacent to the upper end of the drum 10. This drum is preferably provided with an enlarged extension 32 at its upper end, a deeper pool being formed in this extension by a flange 33 which extends inwardly and is preferably provided with a relatively sharp edge over which the pulp stream may flow.

Into the pool of stock which backs up behind the flange 33 extends a skimming ring 34, the outer edge of the skimming ring being bent downwardly as at 35. This ring may be conveniently mounted on the upper part of the inner drum 11 as by suitable struts 35, the ring being adjustable toward or from the edge of the flange 33 so as to regulate the clearance between the ring and this flange. The pulp entering the supply pipe 25 flows into the upper end of the drum 11 and is deflected by the apron 27 against the wall of the drum 11. By proper regulation of the speed of rotation a relatively soft mat of pulp may be formed within this drum to catch the heavier particles of foreign matter which may be present in the stream. Those that are not caught by this mat are acted upon by a slightly greater centrifugal force in the larger drum 10 where a denser mat is formed to comb out such particles and to deliver the stream to the deeper pool at the upper extension of the drum practically free from particles of greater density than the stock. Particles of lighter density than the stock are caught by the skimming ring 34. The stock in passing over the flanges or ribs 30, 31 and 33 is subjected to an action thereby which tends to break up any fiber bunches which may be present in the stream. The purified stock which flows over the flange 33 is projected outwardly into a suitable channel 40 from which a discharge pipe 41 leads.

The apparatus may be conveniently mounted on a suitable frame 45, a cover 46 being provided

over the drums. Suitable openings may be provided in the cover 46, these openings being enclosed by lids 47 which are removable to facilitate the cleansing of the drums after a run. For this purpose a stream of water may be projected by means of a hose through the openings 47 to wash out the mats of pulp which have been formed against the inner surfaces of the drums and which contain the impurities combed from the pulp stream.

I claim:

1. Mechanism for purifying pulp stock, comprising a shaft, a pair of nested drums mounted on said shaft for rotation therewith, the inner drum being open at one end and having a bell-shaped end wall at the other end with a central opening about the shaft to receive stock to be purified, a bell-shaped apron mounted on said shaft within said inner drum adjacent to the supply end thereof, and means for guiding a supply stream of stock onto said apron; said inner drum also having an inward flange at its open end to maintain a pool in said inner drum during operation, the outer drum being open at both ends and projecting axially beyond the open end of the inner drum to receive liquid therefrom, said outer drum having an inward flange extending inwardly of the inner drum and an inward flange at its opposite end over which liquid may be discharged.

2. Mechanism for purifying pulp stock, comprising a shaft, a pair of nested drums mounted on said shaft for rotation, the inner drum being open at one end and having at the other end a bell-shaped wall with a central opening to receive stock to be purified, a bell-shaped apron mounted on said shaft within said inner drum adjacent to the supply end thereof, means for guiding a supply stream of stock onto said apron, said inner drum also having an inturned edge at its open end to maintain a pool of liquid therein during operation, the outer drum being substantially open at both ends, said outer drum having an inward flange adjacent to the open end of the inner drum and extending inwardly of said drum, radial support members for said inner drum extending from said apron to the end wall thereof, and radial support members for the outer drum extending to said flange from said shaft.

3. Apparatus for purifying paper pulp stock, comprising a plurality of nested cylindrical drums rotatable on a common axis, means in said drums for retaining therein during the operation thereof pools of pulp stock, said means including a narrow inwardly extending flange at the discharge end of the inner drum, means for supporting said inner drum so that its discharge end is within an adjacent end portion of the outer drum and clear therefrom, said flange being so arranged that stock which flows thereover has a direct unobstructed flight from the lip thereof to the adjacent portion of the outer drum, said outer drum having means for maintaining therein during operation a pool of pulp stock with a free surface from one end of the drum to the other.

4. A method of purifying paper pulp stock, which comprises forming a pair of nested cylindrical mats of pulp rotating on a common axis, flowing in one direction over the surface of the inner mat a thin stream of stock with a free surface, discharging said thin stream from the entire end periphery of the inner mat in unobstructed flight to the outer mat, the direction of flight having an axial component in the direction of flow of the stream over the inner mat, flowing said stream in the opposite direction over the

surface of said outer mat and collecting the stock discharged therefrom.

5 5. A method of purifying paper-pulp stock, which comprises forming a pair of nested cylindrical mats of pulp rotating on a common axis, flowing a thin stream of stock with free surface in one direction over the surface of the inner mat, discharging said thin stream in unobstructed flight from the entire end periphery of the inner
10 mat to the outer mat, the direction of flight having an axial component in the direction of flow of the stream over the inner mat, flowing said stream with a free surface in the opposite direction over the surface of said outer mat and col-
15 lecting the stock discharged therefrom.

6. Apparatus for purifying paper-pulp stock, comprising a plurality of nested cylindrical drums rotatable together on a common axis, the inner

drum terminating at one end with a narrow inwardly extending flange over which liquid within said inner drum is adapted to flow, said outer drum having at one end a portion extending axially beyond said flanged end of the inner drum
80 and at the other end an inwardly extending flange the lip diameter of which is greater than the external diameter of said inner drum whereby the liquid pool in the outer drum during operation is maintained with a free surface, the flange of the
85 inner drum being so arranged that liquid flowing over said flange during the rotation of said drums has a free unobstructed flight from the lip thereof to the adjacent portion of the outer drum, and means for introducing liquid to be purified into
90 the end portion of the inner drum remote from said flange.

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