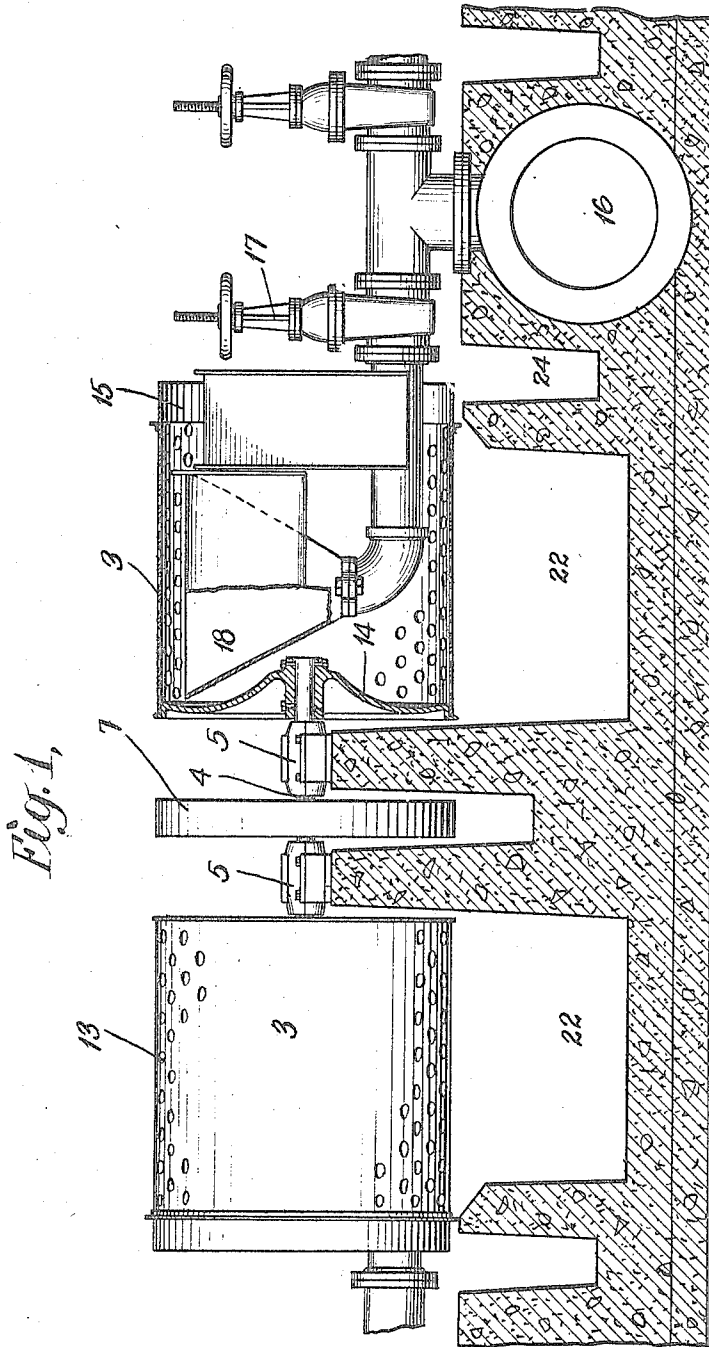


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APPLICATION FILED OCT. 25, 1915.

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Patented Nov. 28, 1916.  
2 SHEETS—SHEET 1.



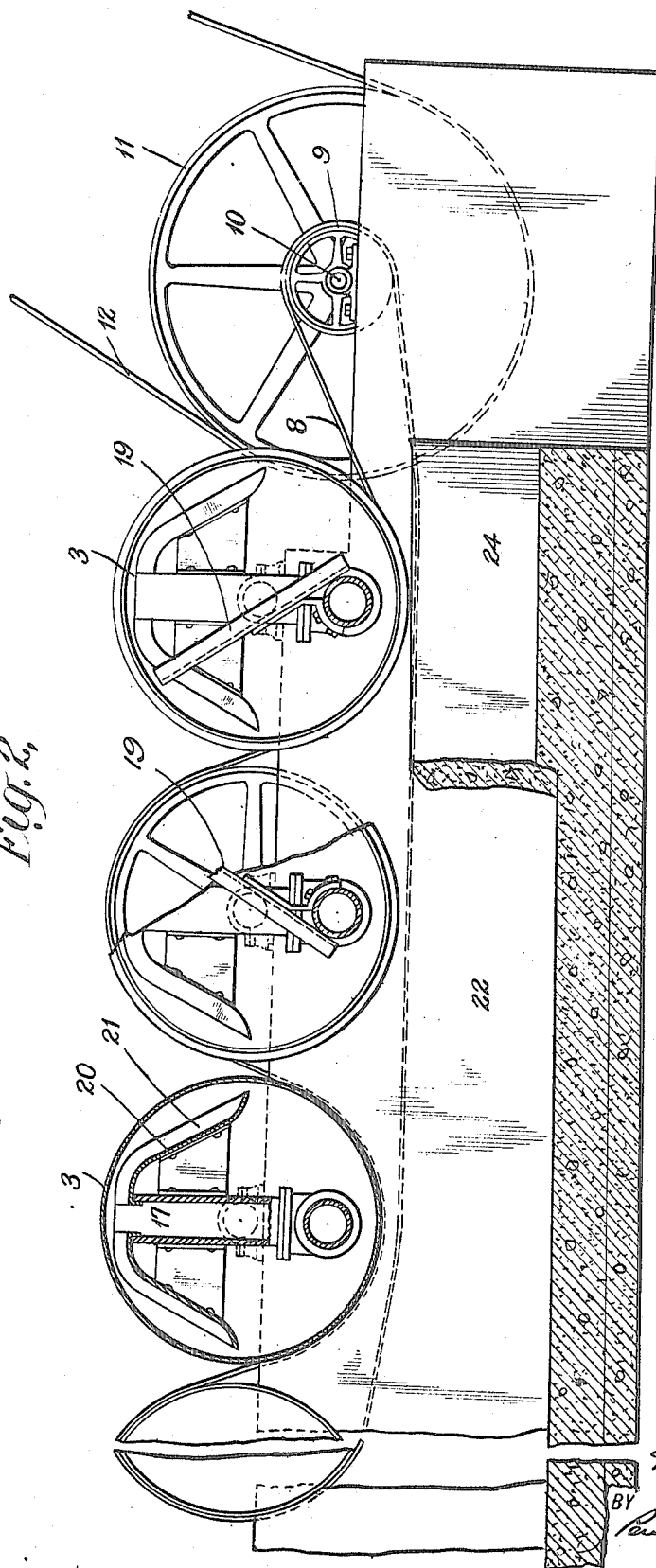
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Fig. 2.



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# UNITED STATES PATENT OFFICE.

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## PULP-SCREEN AND PROCESS.

1,206,401.

Specification of Letters Patent.

Patented Nov. 28, 1916.

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*To all whom it may concern:*

Be it known that I, DANIEL L. BELLINGER, a citizen of the United States, residing at Glens Falls, county of Warren, and State of New York, have invented certain new and useful Improvements in Pulp-Screens and Processes; and I do hereby declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same.

This invention relates to pulp screening machines and more particularly to machines of this class which are employed in the separation of the fine fibers of paper pulp from the coarser fibers, slivers, knots, or foreign matter which may be present in the pulp and which are hereinafter individually and collectively referred to as tailings.

Broadly considered, the machine forming the subject matter of this invention comprises an open-ended rotary screen and means for delivering the unscreened pulp to the inner surface thereof. The accepted stock containing the fine fibers, or practically all of them, will pass through the screen and into a suitable receptacle. The tailings, which cannot pass through the screen, form into a roll which works its way outward along the inner surface of the lower portion of the screen and is progressively and continuously discharged at the open end of the screen into a trough or other suitable receiving device.

Machines constructed in accordance with the invention possess many advantages in the art, prominent among which are the following: They are self cleaning, and are free from accumulations of slime, and may therefore be operated for a period of several days with practically no attention. They are economical in operation, requiring but a small amount of power per ton capacity, and the cost of maintenance is practically negligible, as the screens are not subjected to sudden and violent strains, tending to rupture them, as is the case with certain types of rotary screens now in use. Accordingly, the possibility of any part of the tailings passing into the receptacle which receives the screened pulp (which would occur should such a rupture or break take place) is wholly avoided.

The loss of paper stock in the screening operation is reduced to a minimum, as the

tailings carry off but a small percentage of the fine fibers originally present in the unscreened pulp; and the improved screens effect a considerable reduction of the mill space required for screens of a given capacity.

Referring to the drawings, illustrating one embodiment of the invention; Figure 1 is a cross section of a screen battery showing one screen of a pair in elevation and the other in section, and Fig. 2 is a side elevation of a battery consisting of a plurality of screening machines arranged to be driven from a single source of power. In this view, parts are broken away for the sake of clearness and the rotary screen of one of the machines is shown in section.

Referring to the drawings, there is shown a battery consisting of a plurality of pulp screening machines arranged in pairs and driven from a single source of power. It is to be understood, however, that the invention is not limited to this particular arrangement of machines, but that it includes generically the construction of a single machine whether the machine be operated individually or in unison with other machines.

The rotary screens 3 of each pair of machines, hereinafter described, are mounted upon the ends of a common shaft 4, journaled in bearings 5, mounted in spaced relation on a concrete pedestal structure 6 extending lengthwise of the battery. Secured to the shafts between the screens are pulleys 7 which are driven by a belt 8 one lap of which engages alternately the lower and upper portions of the peripheries of the pulleys, as clearly shown in Fig. 2. The belt 8 is driven from a pulley 9, secured to the shaft 10, to which is also secured a pulley 11, with which the main driving belt 12 engages.

Each screening machine is provided with a rotary screen 3, preferably cylindrical in form, and preferably composed of perforated sheet metal. The perforations 13, which in the embodiment of the invention shown, are arranged in the usual staggered relation to one another, are of such size as will permit the fine fibers of the pulp to pass freely therethrough but will prevent the passage of the tailings.

In practice, I have found that for the screening of ground wood, for use in the manufacture of newspaper, wall paper, and

half tone paper, it will be appropriate and desirable to use copper screen plates .05 inches in thickness, and having circular perforations .085 inches in diameter and spaced uniformly at distances of  $\frac{1}{8}$  of an inch from center to center. I do not limit myself to the use of plates of this gage and this size and distribution of perforations, inasmuch as varying conditions may call for more or less modification thereof to produce the best results. In general, however, they will be found highly efficient, particularly in the screening of the usual qualities of ground spruce and similar stock.

At one of its ends, the screen is provided with a head 14 for closing at that end, and this head is provided with a hollow hub for securing it to the shaft 4 by which it is rotated. The opposite end of the screen terminates in an annular imperforate band 15, and the inner surface of the screen is unobstructed at the open end thereof to permit the free discharge of the tailings therefrom in the manner hereinafter set forth.

Adjacent the open end of the screen is a pulp-supply conduit or trunk 16 into which the stock is pumped continuously and from which it is supplied through control valves 17 to the distributor boxes 18 of the individual screens. The pulp enters the feed box at the central lower portion, as shown in Fig. 1, and the end walls of the box flare upwardly to produce an even low velocity of overflow at the upper side edges of the box.

Extending downwardly from the upper edges of the side walls of the feed box are distributing inclines 20, which are inclined outwardly with respect to the feed box, and having their lower edges in close proximity to the inner surface of the screen to direct the pulp against the screen surface with the necessary velocity of impact as it leaves the discharge end of the inclines. Suitable walls 21 are provided at the ends of the distributors, in order to confine the flow of the pulp in an even sheet of the width of the distributing inclines. It will be understood, of course, that good results can be obtained if but one distributing incline is used, but it is preferred to use two arranged to deliver pulp simultaneously to opposite sides of the screen, as the capacity of the machine is thereby increased.

The distributing inclines 20 extend axially of the screen from the head 14 to a line, as indicated in Fig. 1, which is somewhat short of the line of attachment of the annular band 15 at the open end of the screen. The object of this arrangement is to effect a progressive drying of the tailings as they work their way toward the open end of the screen in the manner hereinafter described. The purpose of the annular imperforate band or apron 15 is to prevent the under-

flow of tailings around and under the edge of the screen at its open end and into the accepted stock reservoir or conduit.

In the concrete foundation below the screen is a receptacle or conduit 22 which receives the accepted stock and from which the stock may be conducted to any suitable point of delivery, as, for instance, the stock chest. Adjacent the open end of the screen and below the same is a trough 24 into which the tailings are discharged. The bottom of the trough is preferably inclined to facilitate the flow of the tailings into any suitable receptacle, from which they may be forwarded or removed as desired. When a plurality of the machines are arranged in battery formation, the receptacle 22 and trough 24 are preferably so formed as to be common to the screens of those machines which are in line with one another.

In operation, the raw stock is supplied continuously from the supply conduit 16 to the feed box 18, under a suitable low pressure head, the rate of flow being controlled by the gate 17. The head is preferably just about sufficient to raise the level of the stock in the feed box slightly above the verges thereof so that the stock overflows both verges of the feed box and runs downwardly over the distributors 20 and is delivered with the impetus due to its drop, against the ascending and descending portions of the inner surface of the screen.

A substantial proportion of the fine fibers, say about eighty per cent. (80%) of the accepted stock fibers, together with a greater part of the water diluting the raw stock, will pass through the perforations in the screen, and into the receptacle or conduit 22. The remainder, about twenty per cent. (20%) of the accepted stock fibers will seep through the tailings and the screen perforations, between the end line of the distributor inclines and the line of attachment of the annular band 15, during the progressive drying of the tailings as they move toward the discharge end of the screen.

Below the distributor which delivers to the descending portion of the screen surface, the tailings tend to assume a sheet formation. After passing the lowest point of rotation of the screen, but before reaching the point at which the pulp is delivered to the ascending portion of the surface of the screen, this sheet of tailings detaches itself progressively from the inner surface of the screen and progressively rolls back upon itself. The tailings which are contained in the pulp delivered to the ascending portion of the screen surface form small irregular masses which tend to rise but which quickly detach themselves and drop back to add to the roll formation; or, if the distributor delivering to the ascending portion of the screen is alone used, the detached irregular

masses referred to assemble themselves to form the roll.

When the internal diameter of the screen is about forty inches, a suitable speed of rotation will be about 25 revolutions per minute, more or less, and, as the rotation of the screen continues, the roll of tailings, which is continuously forming, progressively works its way out of the open end of the screen, longitudinally, at the lower portion thereof. The forming roll of tailings occupies normally a position somewhat higher on the average than half way between the lowermost point of the screen and its horizontal central plane, on the ascending side of the screen, and occupies this position whether one or both distributors are in use. Trailing behind the forming roll is the sheet formation referred to, which becomes more and more definite and dense as it approaches the region of the roll and finally merges therewith.

I regard as one of the particular merits of the invention the fact, as established by its use in practice under standard mill conditions, that, in spite of the normal tendency for the tailing slivers to wedge in the screen perforations, no clogging takes place, a circumstance attributable largely to the influence of the forming roll of tailings, which, as it rolls back upon itself, serves to withdraw from the perforations any portion of the slivers which may have temporarily lodged therein.

For the purpose of preventing the accumulation, on the inlet pipe between the valve 17 and the feed box, of detached irregular masses of tailings carried up by and dropped from the screen and the band 15, I provide the inclined plate or chute 19 positioned at the end of the distributor inclines and adapted to catch such masses and return them into the axially progressing roll or mass of tailings.

What I claim is:

1. The method of screening paper pulp stock which consists in discharging the stock against the inner surface of a rotating cylindrical open-ended perforated screen in a direction substantially transverse to the axis of the screen and at a level substantially above the lowest point of travel of the screen, the speed of rotation of the screen being so calibrated to the stock treated and the level of the feed that the tailings will fall away from the surface of the screen before the level of the feed is reached, continuously and progressively forming a roll along the ascending lower portion of the screen and will continuously and progressively move out of the open end of the screen in a longitudinal direction.

2. The method of screening paper pulp stock which consists in discharging the stock upon a clean portion of the inner surface of

a rotating cylindrical perforated screen in a lateral direction and in a sheet extending lengthwise of the screen, and keeping the screen perforations at the level of discharge clean by rotating the screen under such conditions that the tailings separated by the screen will continuously and progressively roll back along the ascending lower portion of the screen forming a roll which withdraws from the perforations any slivers that have temporarily lodged therein.

3. In a paper pulp screening machine, a rotary cylindrical screen having a freely open end constituting the discharge verge for the tailings of the screening operation, a distributor extending lengthwise of the screen for discharging the pulp in a lateral direction upon the inner surface of the screen, and means adjacent the open outlet end of the screen for receiving the tailings as they continuously and progressively move out over the open tailings-discharge verge of the screen; substantially as described.

4. In a paper pulp screening machine, a rotary cylindrical screen, having a freely open end constituting the discharge verge for the tailings of the screening operation, a distributor extending lengthwise of the screen for discharging the pulp upon the inner surface of the screen in opposite lateral directions, and means adjacent the open outlet end of the screen for receiving the tailings as they continuously and progressively move out over the open tailings-discharge verge of the screen; substantially as described.

5. In a paper pulp screening machine, a rotary cylindrical screen having a freely open end constituting the discharge verge for the tailings of the screening operation, a distributor extending lengthwise of the screen for discharging the pulp in the form of a sheet and in a lateral direction upon the inner surface of the screen, the distributor terminating short of the discharge end of the perforated portion of the screen to afford a screening region for the progressive drying of the tailings, and means adjacent the open outlet end of the screen for receiving the tailings as they continuously and progressively move out over the open tailings-discharge end of the screen; substantially as described.

6. In a paper pulp screening machine, a rotary cylindrical screen having a freely open end constituting the discharge verge for the tailings of the screening operation, a distributor extending lengthwise of the screen and arranged to discharge the pulp laterally in a horizontal sheet upon the inner surface of the screen at a point near the level of the axis of the screen, the distributor terminating short of the discharge end of the perforated portion of the screen to afford a screening region for the progressive drying

of the tailings, an annular imperforate band attached to the discharge end of the screen to prevent the underflow of the tailings, and means adjacent the open outlet end of the screen for receiving the tailings as they continuously and progressively move out over the open tailings-discharge end of the screen; substantially as described.

7. In a paper pulp screening machine, a rotary cylindrical screen having a freely open end constituting the discharge verge for the tailings of the screening operation, an annular imperforate band attached to the discharge end of the screen to prevent the underflow of the tailings, a distributor extending lengthwise of the major portion of the perforated part of the screen and arranged to discharge the pulp in a horizontal sheet against the inner face of the side walls of the screen at about the level of the axis of rotation, and means adjacent the open outlet end of the screen for receiving the tailings as they continuously and progressively move out over the open tailings-discharge end of the screen; substantially as described.

8. In a paper pulp screening machine, a rotary cylindrical screen, having a distributor for discharging the pulp upon the inner surface of the screen along the descending portion and also along the ascending portion thereof; substantially as described.

9. In a paper pulp screening machine, a rotary cylindrical screen, having a distributor for discharging the pulp upon the inner surface of the screen along the descending portion and also along the ascending portion thereof and at approximately the central horizontal plane of the screen; substantially as described.

10. In a paper pulp screening machine, a rotary cylindrical screen having a distributor consisting of an inclined flow plate extending longitudinally of the screen for di-

recting the pulp in a sheet against the wall of the screen, and means for feeding the pulp to the flow plate comprising a delivery pipe arranged below the upper edge of the flow plate, and a funnel-shaped feed box connecting the supply pipe with the edge of the flow plate to evenly distribute the pulp over the flow plate.

11. In a paper pulp screening machine, a double series of rotary cylindrical screens open at one end and closed at the other, distributors for discharging the pulp upon the inner surfaces of the screens, rotary shafts common to the two series and each carrying two of the screens, and drive pulleys upon the several shafts intermediate of the screens thereon; substantially as described.

12. In a paper pulp screening machine, a double series of rotary cylindrical screens open at one end and closed at the other, distributors for discharging the pulp upon the inner surfaces of the screens, rotary shafts common to the two series and each carrying two of the screens, and drive pulleys upon the several shafts intermediate of the screens thereon, the said pulleys being provided with a common drive belt extending under and over alternate pulleys of the series; substantially as described.

13. In a paper pulp screening machine, a rotary cylindrical screen having a freely open end constituting the discharge verge for the tailings of the screening operation, a feed box and distributor within the screen, a feed pipe projecting into the screen and leading to the feed box, and a deflecting plate supported above the feed pipe to catch and return to the bottom of the screen any tailings that may be carried up and dropped above the feed pipe; substantially as described.

In testimony whereof I affix my signature.  
DANIEL L. BELLINGER.