April 14, 1925.

1,533,410

A. J. HAUG

PULP SCREENING MACHINE

Filed March 28, 1921

2 Sheets-Sheet 1

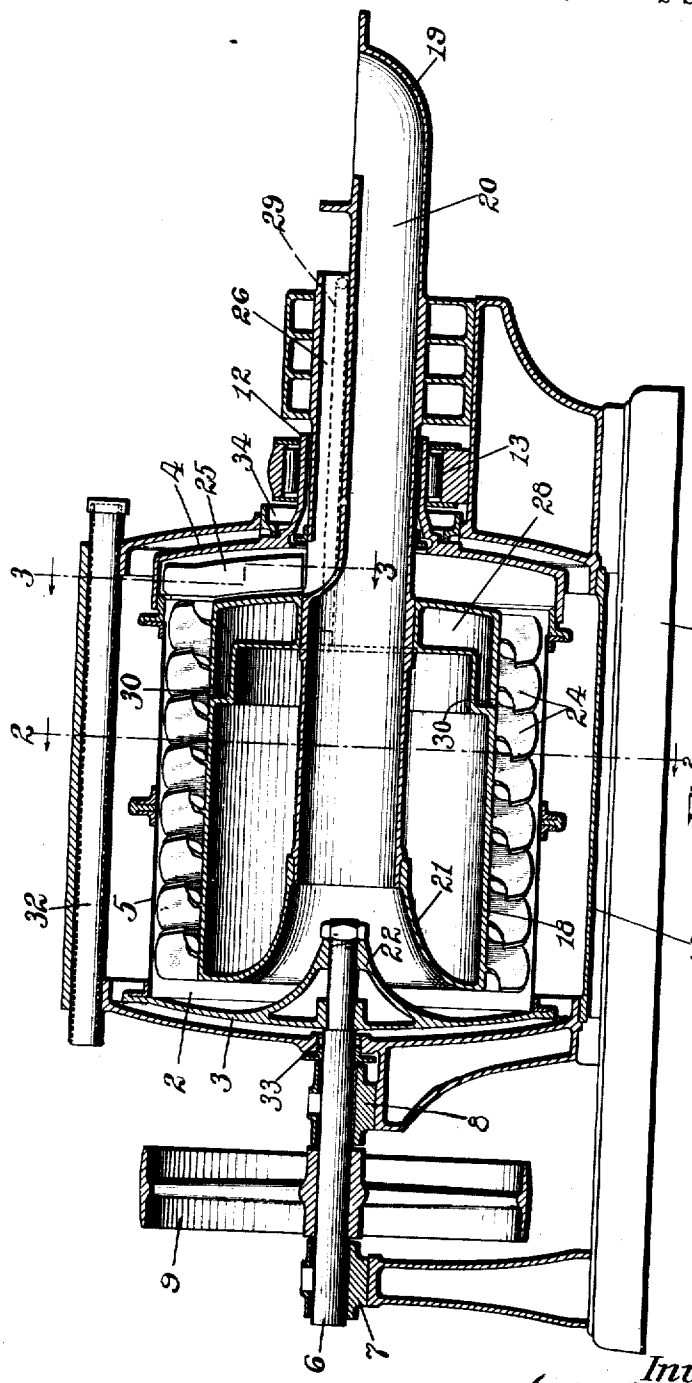



Fig. 1.

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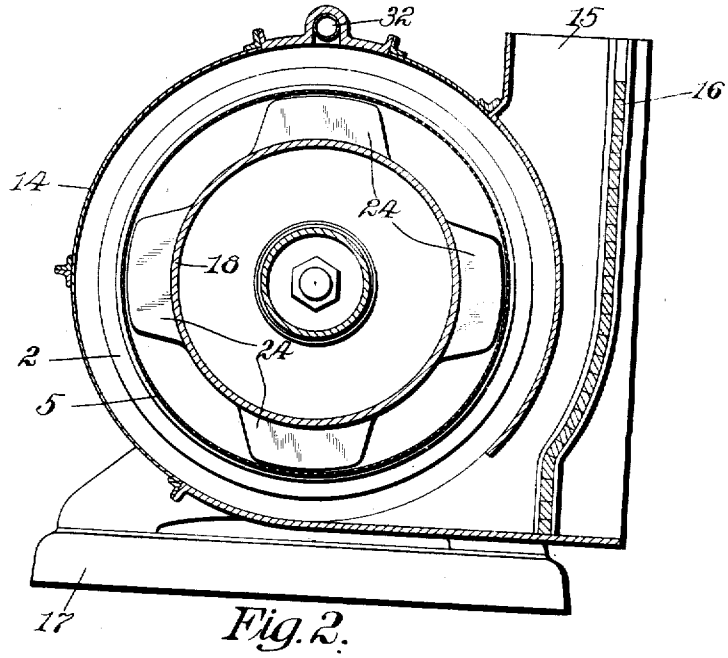



Fig. 2.

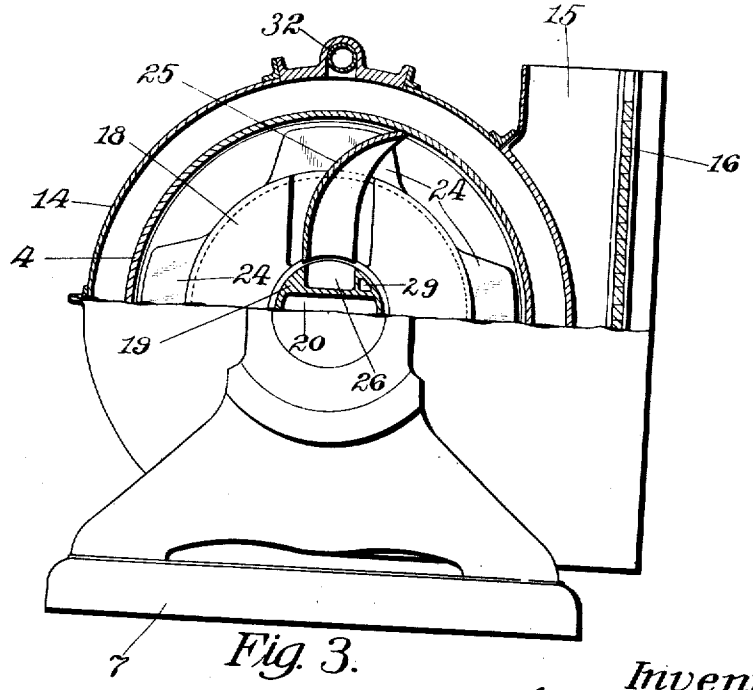



Fig. 3.

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Patented Apr. 14, 1925. 1,533,410

# UNITED STATES PATENT OFFICE.

ANTON J. HAUG, OF NASHUA, NEW HAMPSHIRE.

## PULP-SCREENING MACHINE.

Application filed March 28, 1921. Serial No. 456,374.

*To all whom it may concern:*

Be it known that I, ANTON J. HAUG, a citizen of the United States, residing at Nashua, in the county of Hillsborough and State of New Hampshire, have invented certain Improvements in a Pulp-Screening Machine, of which the following description, in connection with the accompanying drawings, is a specification, like reference characters on the drawings indicating like parts in the several figures.

This invention relates to processes of and apparatus for screening pulp and similar materials.

As is well understood by those familiar with paper making processes, it is necessary to subject the pulp to one or more screening operations in order to remove the splinters and large pieces of material which have not been reduced to the desired fibrous condition. Usually several of these screening operations are necessary.

The power consumed in these operations, the time required by them, and the amount of good stock lost in screening are important factors. An important object of my invention, therefore, is to improve the processes of and apparatus for screening pulp which will reduce the time consumed, will be economical in power, and will save a high percentage of the good stock.

The screening apparatus provided by this invention has as an important feature a submerged rapidly rotating screen. It also includes novel means for disposing quickly and positively of the tailings and residual stock.

An important advantage of this machine is that the ratio between its screening capacity and the screen area and the power consumed are very favorable indeed when compared with the results produced by other machines.

This invention also includes a novel process which may be carried out by the machine herein shown or in other ways.

The invention will be herein disclosed as embodied in a machine designed especially for the screening of pulp of the character used in the manufacture of paper, although it will be understood that the invention is not limited to use in this particular art.

Referring now to the accompanying drawings,

Figure 1 is a longitudinal cross sectional view of a pulp screening machine embodying the invention in the form at present preferred;

Fig. 2 is a vertical transverse cross sectional view on the line 2—2, Fig. 1; and

Fig. 3 is a view partly in cross section on the line 3—3, Fig. 1, and partly in end elevation.

The machine shown comprises a rotatable screening drum, indicated in general at 2, having two solid or imperforate end members 3 and 4, respectively, connected by suitable parts which support the screen 5. The head or end member 3 of the drum is secured fast to one end of a shaft 6 that is mounted in bearings 7 and 8, this shaft being provided with a pulley 9 by means of which the screen may be driven rapidly, for instance with a peripheral speed of 1600 ft. per minute, from any convenient source of power. The head 4 at the opposite end of the drum has formed integral therewith or secured fast thereto a hollow shaft 12 which runs in roller bearings 13.

The entire drum is supported in a casing 14 which is adapted to be filled with pulp or other liquid and it has an outlet 15, Figs. 2 and 3, which is provided with an adjustable weir 16. The bearing brackets and the casing are mounted on a bed plate 17.

Mounted within the screening drum 2 is a hollow stationary drum 18. The stock to be screened is delivered to the interior of the screening drum 2 by a conduit 19 provided with an inlet channel 20 which discharges into a bell mouth portion 21 of the stationary drum 18. It will be seen from an inspection of Fig. 1 that the drum head or end member 3 is provided with a central projection 22 that extends into the bell mouth 21 and has walls parallel to the walls of the mouth 21.

The pulp to be screened is delivered to the channel 21 from a suitable head box or other convenient arrangement preferably designed to maintain a relatively low but substantially constant head on the incoming stream of pulp. This pulp is discharged against the imperforate head 3 of the screening drum and is distributed substantially uniformly to all parts circumferentially of the left-hand end, Fig. 1, of the screening drum. The pulp then flows backwardly with reference to the direction of the inflow, that is, toward the right, Fig. 1, along the screening surface. Th:

rapid rotation of the screen 5 imparts a similar movement to the pulp that is closely adjacent to the screening surface, and the pulp so set in motion is urged through the screen due to the action of centrifugal force. Consequently, a substantial portion of the pulp passes through the screen 5 in the early stages of its backward flow. The continuous feeding of stock to the screen and the centrifugal force imparted by the rotating drum, which has a levelling effect on the stock with relation to the screen surface, force the stock not immediately screened towards the discharge end of the drum.

The foregoing operation of the submerged screen is utilized in forcing the residual stock or tailings, including the splinters and large particles that cannot pass through the screen, along successive portions of the screening surface. As the stock is constantly fed from the stock tank through the stationary drum to the screen 5 and there acquires a rotating movement, all the stock not passing through the screen tends to proceed in a helical course towards the discharge end of the machine. By reason of the perforations in the screen, the good stock begins at once to flow out. The tailings, however, tend to collect on the screen, and I find it desirable to move them positively to the discharge end of the drum. For this purpose a series of blade-like members 24 are formed integral with or are secured to the outer surface of the stationary drum 18. These blades are inclined and preferably have as little clearance as is practical with relation to the interior surface of the screen. In consequence, the blades move positively towards the discharge end of the machine, any tailings which have collected on the perforations of the screen. The rotating liquid stock will also be caused to travel in substantially a predetermined course or path through the drum. Usually these blades are inclined so that they advance the tailings in a more or less helical path toward the end member 4 of the drum. The stock thus is presented to substantially all portions of the screening surface of the drum as uniformly as practicable.

As the tailings near the head 4 of the drum they come into contact with a stationary scraper 25 (see Figs. 1 and 3) which guides them into a tailings discharge channel 26 formed in the upper part of the conduit 19.

Attention is called to the fact that this construction effects the removal of the tailings at an upper point of the machine, thus obviating the necessity of pumps to raise the tailings to the level of the inlet of a subsequent machine into which they may be fed.

For the purpose of washing the tailings during their progress through the screening drum 2 and thus removing all the good pulp from them, I prefer to provide a water chamber 28 in the end of the stationary drum 18 opposite the mouth of the inlet channel 20, and water is delivered to this chamber through a channel 29, Figs. 1 and 3, formed in the conduit 19. A series of discharge openings 30 is formed in the outer wall of this chamber so that water is directed through them and mixed with the tailings while they are being advanced along the screening surface 5. This supplemental supply of water for washing the tailings is not always required.

A spray of clean water or other fluid may also be directed against the screen 5 from a pipe 32 which is set into a recess or groove formed in one of the plates of the casing 14. This spray is utilized to clean the screening surface of the drum, and it preferably has sufficient power to operate satisfactorily, even when the top of the screen drum is entirely submerged; but if any difficulty is experienced in clearing the perforations of the drum, the level of the stock outside of the screen may be lowered so that the top of the screen drum will be exposed to the spray.

It will now be understood that the stock to be screened is led into the screening cylinder through the inlet 20 and is distributed circumferentially over the screening surface of the drum, the screened pulp passing through the screen 5, filling the casing 14 and flowing out of the outlet passage 15. The weir 16 preferably is adjusted at such a height that the drum 2, or all except the top portion thereof, is constantly maintained submerged in screened pulp, since I find that this practice facilitates the screening operation particularly in that it reduces the tendency of the pulp to mat on or adhere to the screen 5. The tailings work along the inner surface of the drum and are ejected from the machine in the manner above described. Stuffing boxes 33 and 34 are provided, respectively, where the shafts 6 and 12 pass through the casing 14 to prevent the leakage of liquid from the casing at these points.

It should be noted that since the tailings are moved forward at a rate determined by the head and supply of the stock, the speed of revolution of the screen drum and by the number, inclination and arrangement of the blades 24, by properly predetermining these factors the tailings will remain within the screen drum long enough to ensure their thorough washing and a practically complete separation of the good stock from them. At the same time their discharge from the machine is effected with sufficient rapidity to prevent their blocking the screen and preventing the discharge of good stock through the perforations.

Attention is also called to the fact that in this machine the stock, constantly main-

tained in a proper condition for screening, is distributed evenly over substantially the entire area of the screening surface, which is at all times ready to receive it, and is screened there by centrifugal force urging it through the meshes of the drum. The drum rotates at approximately the same speed as the stock so that there is little relative movement of the meshes and stock and the long fibres thus proceed out through the meshes into the pond 33 and are not bent violently across the meshes of the screen where they would form, with other fibres, a filter impervious to stock, as happens when the stock is caused to revolve rapidly in a stationary drum. Since it is necessary merely to rotate the screening drum, this machine requires only a relatively small part of the power required in most machines to drive the usual impellers that throw the inflowing stock outwardly against the screen. Furthermore, since the drum may be completely submerged its entire screening surface may be utilized constantly in performing the screening operation, and the maximum capacity for a given screening area therefore is obtained.

It is not necessary for good results to have the top of the weir as high as the top of the screen drum, and the minimum height may be determined readily by the machine tender. If the drum is not run in a pond or reservoir my machine will still have certain advantages but will lose a great part of its effectiveness as a pulp screen.

It will be understood that while I have herein shown and described the best embodiment of the invention of which I am at present aware, this embodiment may be modified in many particulars without departing from the spirit or scope of this invention. For instance, the stock to be screened can be supplied in other ways than that specifically shown and various other modifications may be made in the apparatus while retaining the general principles on which the invention proceeds. It will also be appreciated that the method herein disclosed may be practiced by other forms of apparatus than that shown and described.

What is claimed as new is:

1. A pulp screening machine comprising, in combination, a rotary screening drum, means for rotating the same rapidly, whereby a substantial centrifugal effect is produced on the stock contained therein, means for delivering stock to be screened to the interior of said drum, and a casing in which said drum is mounted constructed to receive the screened pulp and maintain a head of the same about the screening drum.

2. A pulp screening machine comprising, in combination, a rotary screening drum, means for rotating the same rapidly, whereby a substantial centrifugal effect is produced on the stock contained therein, means for delivering stock to be screened to the interior of said drum, a casing in which the drum is mounted and into which the screened stock is discharged, said casing holding a supply of screened stock in which said drum rotates, and means for conducting the tailings from the interior of said drum to a point outside of said casing.

3. A pulp screening machine comprising, in combination, a rotary screening drum, means for rotating the same rapidly, whereby a substantial centrifugal effect is produced on the stock contained therein, means for delivering stock to be screened to the interior of said drum, and stationary means cooperating with said drum to move the tailings in a substantially predetermined course through the drum.

4. A pulp screening machine comprising, in combination, a rotary screening drum, means for rotating the same rapidly, whereby a substantial centrifugal effect is produced on the stock contained therein, means for delivering stock to be screened to the interior of said drum, and stationary means for moving the tailings through the drum at a rate depending upon the speed of rotation of the drum.

5. A pulp screening machine having, in combination, a horizontal rotatable screening drum, means for rotating said drum rapidly, whereby a substantial centrifugal effect is produced on the stock contained therein, a casing in which said drum is mounted arranged to receive the screened product and maintain a head of the same about the screening drum at a predetermined height, an inlet for feeding the material to be screened into the screening drum to the screening surface, a discharge outlet for stock rejected by the screen, and means for forcing the rejected stock from the screening surface to said discharge outlet.

6. A pulp screening machine having, in combination, a horizontal rotatable screening drum, means for rotating said drum rapidly, a casing in which said drum is mounted arranged to receive the screened product and maintain a head of the same about the screening drum at a predetermined height, means for feeding the material to be screened into the screening drum, means for conducting tailings out of said drum, and stationary blades for forcing the tailings from the screening surface to the discharge therefor.

7. A pulp screening machine comprising, in combination, a rotary screening drum, means for rotating said drum rapidly, whereby a substantial centrifugal effect is produced on the stock contained therein, means for delivering stock to be screened to the interior of said drum, relatively stationary means mounted within the drum for moving the

tailings through the drum, and means for mixing water with said tailings during their travel through the drum.

8. A pulp screening machine comprising, in combination, a rotary screening drum, means for rotating said drum rapidly, means for delivering stock to be screened to the interior of said drum, blades mounted within said drum to advance the tailings toward one end of the drum, and a stationary scraper mounted within said drum for ejecting the tailings from the drum.

9. A pulp screening machine comprising, in combination, a horizontal screening drum, a casing in which said drum is mounted, means for rotating said drum rapidly, whereby a substantial centrifugal effect is produced on the stock contained therein, means for conducting pulp to be screened to the interior of said drum, and means within the drum for distributing the pulp substantially uniformly over the entire screening surface of the drum.

10. A pulp screening machine comprising, in combination, a casing, a rotary screening drum mounted within said casing, means for rotating said drum rapidly, whereby a substantial centrifugal effect is produced on the stock contained therein, means for delivering stock to be screened to said drum, and means for presenting unscreened portions of the stock within the drum to successive parts of the screening surface of the drum.

11. A pulp screening machine comprising, in combination, a rotary screening drum, means for delivering stock to be screened to the interior of said drum, and means for discharging the tailings from said drum at a point above the axis of rotation of the drum.

12. A pulp screening machine comprising, in combination, a rotary screening drum, means for rotating said drum rapidly whereby a substantial centrifugal effect is produced on the stock contained therein, and conducting means for leading stock into said drum at one end thereof and for discharging tailings from the drum at the same end.

13. A pulp screening machine comprising, in combination, a rotary screening drum, means for rotating said drum rapidly whereby a substantial centrifugal effect is produced on the stock contained therein, conducting means for leading stock into said drum at one end thereof, and means connected with the opposite end of said drum for driving it.

14. A pulp screening machine comprising, in combination, a rotary screening drum, means for rotating said drum rapidly whereby a substantial centrifugal effect is produced on the stock contained therein, means for delivering stock to be screened to the interior of said drum including a conduit discharging into said drum at one end thereof, and means within said drum for working the tailings toward the opposite end of the drum.

15. A pulp screening machine comprising, in combination, a horizontal screening drum, a head closing one end of said drum, a rotary shaft secured to said head for driving the drum, a hollow shaft supporting the opposite end of said drum, bearings in which said shafts are mounted, and means for conducting material to be screened through said hollow shaft into the interior of said drum.

16. In a pulp screening machine, the combination of a horizontal screening drum, a hollow shaft supporting one end of said drum, a bearing supporting said shaft for rotation, supply and discharge conduits leading through said hollow shaft to and from said drum, and means for supporting the opposite end of said drum.

17. A pulp screening machine comprising, in combination, a horizontal screening drum, means for supporting and rotating said drum, a stationary support mounted within said screening drum, and means mounted on said support for distributing the stock along the screening surface of said drum.

18. A pulp screening machine comprising, in combination, a horizontal screening drum having heads at its opposite ends, shafts secured to said heads for supporting them, bearings supporting said shafts, means carried by one of said shafts whereby it may be driven to rotate said drum, and means for discharging the stock to be screened against the inner surface of the head to which the last mentioned shaft is secured.

19. A pulp screening machine comprising, in combination, a horizontal screening drum having heads at its opposite ends, means for supporting and rotating said drum, a stationary drum mounted within said screening drum, means for conducting the stock to be screened through said stationary drum and directing it against one of said heads, stock distributing members supported by said stationary drum, and means adjacent to the other of said heads for discharging the tailings from the drum.

20. In a pulp screening machine, the combination of a horizontal screening drum, a hollow shaft supporting one end of said drum, a bearing supporting said shaft, a conduit extending through said hollow shaft and having a stock inlet channel leading into said drum and a tailings discharge channel leading from said drum.

21. A pulp screening machine of the character described comprising, in combination, a horizontal screening drum, means for supporting and rotating said drum, a stationary drum mounted within said screening drum, means for conducting stock to be screened into said screening drum, a water chamber in said stationary drum having discharge

outlets opening from the periphery thereof, and means for advancing the tailings along the surface of said screening drum and into position to be mixed with the water discharged from said chamber.

22. That improvement in the process of screening pulp, which consists in performing the screening operation by centrifugal force against the head of surrounding screened liquid, and creating said force through motion of the screen itself.

23. That improvement in the process of screening pulp, which consists in urging the pulp through the screen by centrifugal force, creating said force through the motion of the screen itself, and utilizing said motion to remove the tailings positively from the screening surface.

24. That improvement in the process of screening pulp, which consists in urging the pulp through the screen by centrifugal force, creating said force through the motion of the screen itself, and maintaining one surface of the screen substantially submerged in screened pulp and the other surface in unscreened pulp.

25. That improvement in the process of screening pulp, which consists in flowing the pulp into contact with a screen, rotating said screen rapidly to create a strong centrifugal force urging the pulp through the screen, maintaining the outer surface of the screen substantially submerged in screened pulp, and utilizing said motion of the screen to discharge the tailings from the screening surface.

26. A pulp screening machine comprising, in combination, a rotary cylindrical screening drum, means for rotating the same rapidly, whereby a substantial centrifugal effect is produced on the stock contained therein, means for delivering stock to be screened to the interior of said drum, and a casing in which said drum is mounted constructed to receive the screened pulp and maintain a head of the same about the screening drum.

27. A pulp screening machine comprising, in combination, a rotary cylindrical screening drum, means for rotating the same rapidly, whereby a substantial centrifugal effect is produced on the stock contained therein, means for delivering the stock to be screened to the interior of said drum, a casing in which the drum is mounted and into which the screened stock is discharged, said casing holding a supply of screened stock in which said drum rotates, and means for conducting the tailings from the interior of said drum to a point outside of said casing.

28. A pulp screening machine comprising, in combination, a rotary cylindrical screening drum, means for rotating the same rapidly, whereby a substantial centrifugal effect is produced on the stock contained therein, means for delivering the stock to be screened to the interior of said drum, and stationary means cooperating with said drum to move the tailings in a substantially predetermined course through the drum.

29. A pulp screening machine comprising, in combination, a rotary cylindrical screening drum, means for rotating the same rapidly, whereby a substantial centrifugal effect is produced on the stock contained therein, means for delivering the stock to be screened to the interior of said drum, and stationary means for moving the tailings through the drum at a rate depending upon the speed of rotation of the drum.

30. A pulp screening machine comprising, in combination, a rotary screening drum, means for rotating said drum with sufficient speed to cause it to exert a substantial centrifugal effect on the stock in contact therewith, and means for maintaining said drum completely submerged in screened stock.

31. A pulp screening machine comprising, in combination, a horizontal rotary screening drum, means for rotating said drum with sufficient speed to cause it to exert a substantial centrifugal effect on the stock in contact therewith, a casing in which said drum is enclosed, and a weir over which the screened stock discharged from said casing flows, said weir being arranged to back up the screened stock in said casing and keep said drum completely submerged in screened stock.

32. That improvement in the process of screening pulp which consists in urging the pulp through the screen by centrifugal force, and maintaining said screen completely submerged in and under a hydraulic head of the screened stock.

In testimony whereof I have signed my name to this specification.

ANTON J. HAUG.

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## DISCLAIMER

1,533,410.—*Anton J. Haug*, Nashua, N. H. PULP-SCREENING MACHINE. Patent dated April 14, 1925. Disclaimer filed December 14, 1932, by the patentee.

Hereby disclaims from the scope of said claim 32, any process of screening pulp except processes in which an enclosed body of pulp is rapidly revolved about a horizontal axis.

(*Official Gazette January 10, 1933.*)

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(*Official Gazette January 10, 1933.*)