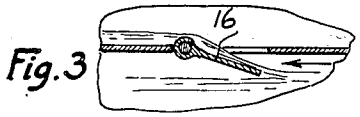
March 2, 1943. A. J. HAUG 2,312,545

CENTRIFUGAL SCREENING MACHINE FOR PAPER STOCK AND SIMILAR MATERIAL

Filed April 5, 1939

Fig. 3



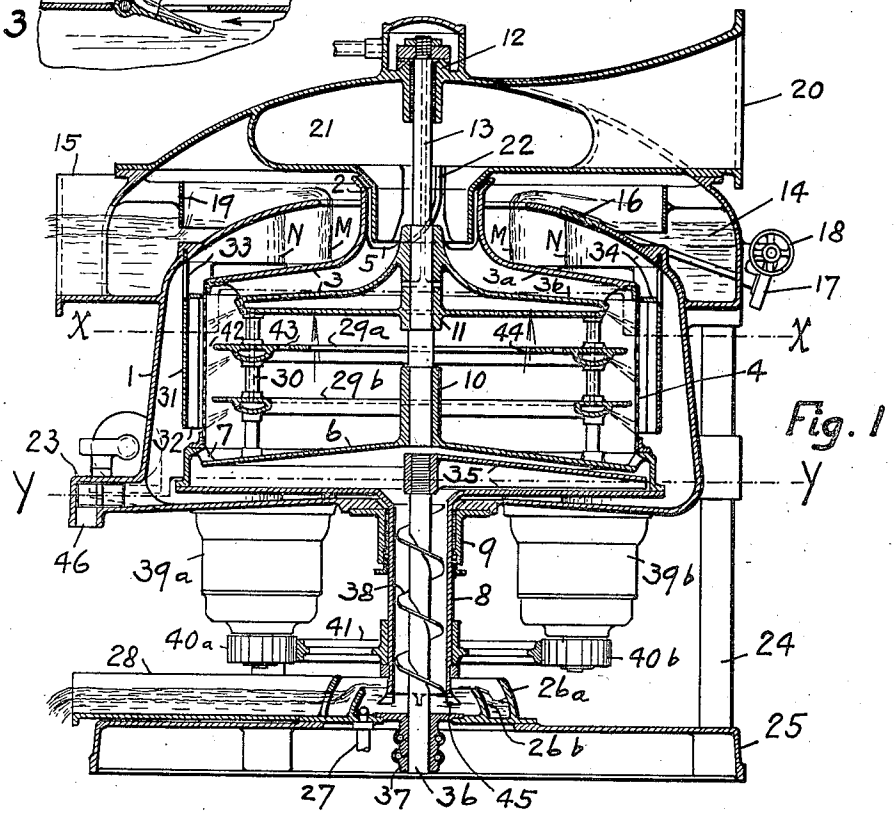


Fig. 1

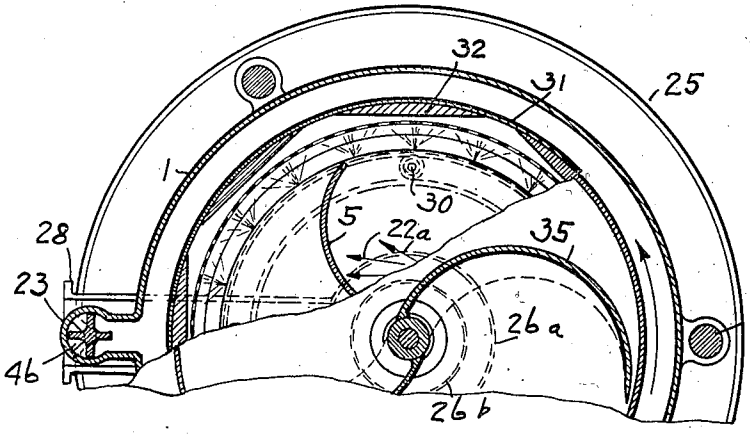


Fig. 2

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CENTRIFUGAL SCREENING MACHINE FOR PAPER STOCK AND SIMILAR MATERIAL

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6 Claims. (Cl. 92—35)

This invention relates to apparatuses for and processes of removing undesirable substances from pulp, paper stock, and similar material.

Machines now used of this and similar types have not been generally adopted because they either consumed too much power or were mechanically too delicate for the type of maintenance personnel employed by the mills. Some of these machines used inclined scrapers closely adjacent to the surface of the screen for removing or conveying the coarse material to the tailings outlet. These scrapers are not very effective unless they are set quite close to the screen plates. This then requires a truly round screen drum and entails the risk of damaging the screen surface by the scrapers in case the drum should swerve slightly. In other machines the screen drum is without a bearing at one of its ends which requires heavy construction for the other end to prevent the drum from running out of true.

The fact that the industry in general has fallen back to the use of screening apparatus of the type used years ago, indicates that the attempts at improvements so far have not been very successful.

The object of the present invention is the production of a machine which will deliver economically a relatively large volume of well screened and cleansed stock. Constructed simply but according to modern mechanical practice, having few moving parts and designed to fit the present day standards of the maintenance departments.

Referring to the accompanied drawing,

Fig. 1 shows a vertical sectional elevation of a preferred form of machine embodying the principal elements of the invention.

Fig. 2 is a horizontal section partly taken on lines X—X of Fig. 1 to show the arrangement of the annular water sprays and partly taken on lines Y—Y of Fig. 1 to show the device for discharging the heavy impurities, and

Fig. 3 is a detail of a gate for removing the screened stock at a lower than normal level, as explained further on.

In the drawing, 1 denotes preferably though not necessarily a conical casing which forms a stationary container wherein revolves the chief operating part of the invention comprising a cylindrical or conical basket or screening drum, composed of a neck portion 2, a head 3, foraminous walls 4 and an imperforate tailing section at the bottom. The head consists of an outer cover 3—*a* and an inner annular spreading member or baffle 3—*b* which is hollow to receive water or other fluids. The outer cover of the head and the spreading member are connected by curved webs 5, Figs. 1 and 2. These webs are curved as shown in Fig. 2 to convert the hydraulic head of the incoming stock into driving power assisting the rotation of the drum. The tailing section is formed by a disc 6, which is secured at its periphery to the solid annular tailing section of the drum by a series of struts or posts 7, which are distributed at suitable intervals around the edge of the disc. The bottom part of the tailing section is provided with a tubular extension 8 projecting downwards. This extension is mounted in bearings 9. The upper portion of disc 6 has a hub 10 into which a shaft is tightly fastened. This shaft passes also through the central hub 11 of the spreading member and reaches up to the top of the machine where it is supported for rotation in a combination neck and thrust bearing 12. A central hole 13 in the upper portion of this shaft allows the introduction of water or other liquids into the spreading member.

Casing 1 is gradually constricted at the upper end until it almost reaches the neck portion of the drum and there forms an outlet for the screened stock. Surrounding the casing is an annular trough 14 for catching the discharged screened stock and leading it away through outlet 15. One or more gates 16 are set into the constricted portion of casing 1 through which some or all of the screened stock may be made to escape. These gates are operated through worm gear 17 and hand wheel 18. A circular baffle 19 is set into the upper section of the annular stock trough for holding back floating material.

The stock to be screened is led into the drum through an inlet connection comprising a flared spout 20 which branches out from a circular chamber 21 which is immediately above the drum and coaxial therewith. The bottom of this chamber has a tubular outlet which fits, for running clearance, into the revolving neck portion of the screen drum. In order to impart a rotary movement to the stock as it passes through this tubular outlet webs 22 are cast integral with the same or are otherwise fastened thereinto. These webs curve at their lower ends and deflect the stock movement in tangential directions, as indicated at 22—*a*.

At the bottom and side of the stationary casing 1 where its diameter is the greatest are one or more pocket or pressure retaining valves 23

for automatically removing the fine heavy dirt, as described in my earlier Patent 1,882,662.

The entire structure is supported by uprights **24** which are set into a common base **25**. On the top of this base are two concentric annular walls **26**—*a* and **26**—*b* which form a small reservoir into which the tubular extension of the tailing section reaches. A plug **27** in the inner circular basin permits cleaning and a spout **28** extending from the outer annular trough leads the tailings off.

The inner section of this screen drum is equipped with one or more annular baffles **29**—*a* and **29**—*b* which have circular canals for receiving water or other liquids. These baffles are held in position by posts **30** which have central holes to supply water or other liquids to the circular canals and inclined holes are drilled through the edges of the baffles into these canals, as shown in Figs. 1 and 2, to provide jets directed downwardly against the inner surface of the screen **4** where they move the tailings downwardly along the inner surface of the screen.

The drum is surrounded by a cylindrical plate section **31**, to the inner circumference of which are fastened fillets **32** for giving the space between drum and plate a polygon or irregular shape. Circular plate **31** is fastened into the upper portion of casing **1** and a series of holes **33** are provided to permit the passage of the screened stock. The upper part of the irregular space is closed up by ring **34**.

Held stationary within the annular tailing section is a scoop or baffle **35** which is fastened to the end of shaft **36**. This shaft is held tight at its lower end in hub **37** which is secured to base **25**. If desirable conveyer flights **38** may be fastened to shaft **36**.

Rotation is given to the screen drum by one or more motors **39**—*a* and **39**—*b* which transmit the driving force to the lower tubular extension through pinions **40**—*a* and **40**—*b* and gear **41** or other suitable transmission devices. I prefer the use of two synchronized motors since this makes it possible to reduce the over-all height of the machine and balance the weight distribution.

Paper stock or pulp in suitably dilute condition is introduced into the machine through stationary inlet **20** which guides it into the neck portion of the drum and on top of the spreader **3**—*b*. The combination of stationary vanes **22** and revolving webs **5** absorb power from the hydraulic head of the stock and helps to rotate the drum.

As the stock passes to the periphery of the spreader **3**—*b*, it is held back by the first revolving baffle **29**—*a* so that it forms an annular pool, producing an internal liquid head. The outer edge of the revolving baffle is closely adjacent to the screening surface and in normal operation all of the stock which does not pass through the screen at this section must pass through this small clearance **42**. With some stocks the lighter part of the fiber may accumulate on the inner surface of the stock level, and if sufficient in amount, it can pass through perforations **43** or over the inner circular edge **44** of the baffle into the next section of the drum.

Here the internal liquid head or centrifugal level necessary for proper screening is less than in the first section. According to the size of the machine and the nature of the stock to be screened, any number of baffles may be used. If desired, the baffles may also be given a separate motion and need not be tied into the screen drum head and tailing section.

Water sprays or other liquid streams, steam or air, may be used to thin, convey, or heat the unscreened stock as it is being moved over the screening surface downwards, toward, and into the tailings section.

In the last section of the screen drum the remainder of the useful fibers is screened out, and then the tailings consisting of the coarser particles are thrown into the tailings section which has a larger inner diameter than the screen drum to insure that all knots and larger dirt particles will immediately leave the screen surface and not remain there to be broken up.

Scoop or baffle **35**, the extreme end of which is in close working proximity with the inner diameter of the tailings section, diverts the tailings toward the center where they drop into the tubular extension **8** into the small circular separating trough. Screw flights attached to the stationary shaft may be used to assist in discharging the tailings.

Because of the rotation imparted to the tailings in their downward passage any heavy foreign material discharged with them will separate and settle in the inner circular trough. Additional means such as paddles **45**, may be used to revolve the tailings. Removing heavy foreign matters from the tailings at this point will protect refining machinery used subsequently for the pulping of the tailings. The heavy foreign material may be cleaned out through plug **27**. In some cases this treatment for the tailings is not essential and they may be simply led away through spout **28**.

The screened stock which has passed through the screen drum is given a rotating movement by the rapidly revolving drum. The circular plate or shield **31** with its irregular inner surface compels the revolving stock outside the screen drum to pass alternately through smaller and wider sections, producing pulsations against and through the screen surface, reaching into the unscreened stock on the inner surface of the screen drum. These pulsations will serve to keep the screen plates clean, remove the coarser fibers and particles so that the combination of gravity and liquid jets may gradually move them towards the end of the screen drum. At the wider sections of this irregular space a pull will be exerted which draws the useful fibers through the screen drum.

Because escape through the top of the circular plate is prevented by ring **34**, all of the screened stock will first flow downward and out through the opening at the bottom of the circular plate and into the lowest section of the stationary casing where its diameter is the greatest. Any fine, heavy dirt which has passed through the screen plates will tend to collect here and is continuously removed by one or more pressure retaining valves comprising a slowly rotating winged member forming one or more pockets. These pockets will fill with the dirt which will be scraped across the discharge opening **46** by the slowly rotating member without in any way disturbing the internal liquid pressure in the casing.

The screened and cleansed stock rises then to the top of the casing and spills over the circular constricted edge into trough **14**.

The screening surface is submerged at all times, since the casing must fill before it can spill over. Because of the comparatively fast rotation of the drum the liquid level will be as indi-

cated at M—M. For certain kinds of materials it may be of advantage to operate with less external pressure and for this purpose gates 16 may be used to keep the liquid outside the screen drum at lower levels such as indicated at N—N.

In the screening of paper stock and similar materials with a submerged screening surface, it is essential to have the right combination of internal liquid head, degree and time period of pulsations, with the proper external liquid pressure. The internal head must vary as the good fibers are withdrawn through the screen drum and as the percentage of coarser particles becomes greater in unscreened material. Depending on the nature of the fibers and their screening resistance, the strength of the pulsations and their time period must vary for best screening efficiency. While the circular baffles set at suitable intervals insure the retention of the internal head and its gradual reduction, means to vary the speed of the drum will change the intensity of the pulsations and their time periods. To accomplish this latter purpose, variable speed motors or other means for obtaining different drum speeds are used.

The above described machine may be employed in a simplified form, as a knotter or coarse screen in which case the pressure valves will be dimensioned proportionately for the removal of greater quantities of knots and dirt.

It is clear that other modifications of the features above described may be devised without departing from the spirit of the invention.

Having thus described my invention, what I desire to claim new is:

1. A screening machine for paper stock and similar material, comprising a stationary casing to hold liquid stock, a rapidly rotating screen drum, an inlet for feeding said stock to the inside of the drum, annular partitions in said drum for maintaining internal liquid heads at different centrifugal levels, a tailings section of larger diameter than the drum, a stationary scoop for removing tailings from the drum, means to produce pulsations in the screened stock, and means to guide the tailings through a constricted opening to the tailings outlet.

2. In a pulp screening machine, the combination with a screen drum, a casing in which said drum is mounted, an inlet connection for conducting the stock to be screened into said drum, means supporting said drum for rapid rotation about a vertical axis, means with which the stock contacts and which causes a rotary centrifugal movement of the stock as it enters the drum, said casing being constructed to maintain the drum substantially submerged in screened stock, said drum comprising a screening section and a tailings section below said screening section and of larger diameter than the latter section, and a shield surrounding the screening section of said drum and separated therefrom and from said casing, with an inner wall shaped to form one or more constricting passages for the revolving screened stock.

3. In a pulp screening machine, the combination with a screen drum, a casing in which said drum is mounted, an inlet connection for conducting the stock to be screened into said drum, means supporting said drum for rapid rotation about a vertical axis, means with which the stock contacts and which causes a rotary centrifugal movement of the stock as it enters the drum, said casing being constructed to maintain the drum substantially submerged in screened stock, said drum comprising a screening section and a tailings section below said screening section and of larger diameter than the latter section, a shield surrounding the screening section of said drum and separated therefrom and from said casing, with an inner wall shaped to form one or more constricting passages for the revolving screened stock, said casing being provided with an outlet opening, a pivoted closure for said opening and means for actuating said closure to open or close said opening.

4. A screening machine for paper stock and similar material, comprising a stationary casing to hold liquid stock, a rapidly rotating screening drum, said casing being constructed to maintain said drum submerged in screened stock, an inlet for feeding the stock to the inside of the drum, partitions in said drum for maintaining internal liquid heads therein at different centrifugal levels, a tailings section separate from the screening section, means cooperating with the screen to produce inward pulsations in the screened stock, means inside the drum for directing jets of fluid against the coarse material collected on the inner surface of the drum to move it along said surface toward said tailings section, and means for discharging the tailings from said tailings section.

5. A screening machine for paper stock and similar material, comprising a stationary casing to hold liquid stock, a rapidly rotating screen drum, an inlet for feeding said stock to the inside of the drum, annular partitions in said drum for maintaining internal liquid heads therein at different centrifugal levels, a tailings section in said drum, means for discharging the tailings from said drum, means to produce inward pulsations in the screened stock at the outer side of said screen, and means inside the drum for directing jets of fluid against the coarse material collected on the inner surface of the drum to move it along said surface toward said tailings section, in combination with variable speed driving means for revolving said drum.

6. In a pulp screening machine, the combination of a screen drum, a casing in which said drum is mounted, an inlet connection for conducting the stock to be screened into said drum, means supporting said drum for rapid rotation about a vertical axis, said casing being constructed to maintain the drum substantially submerged in screened stock, said drum comprising a screening section and a tailings section below said screening section and of larger diameter than the latter section, a shield surrounding the screening section of said drum and separated therefrom and from said casing, with an inner wall shaped to form one or more constricting passages for the revolving screened stock, and means inside the drum for directing jets of fluid against the coarse material collected on the inner surface of the drum to move it along said surface toward said tailings section, means for discharging the tailings from said tailings section, and variable speed driving means for revolving said drum.

ANTON J. HAUG.