Aug. 8, 1950 F. BLIKSTAD ET AL 2,517,832

APPARATUS FOR PURIFYING FIBROUS SUSPENSIONS

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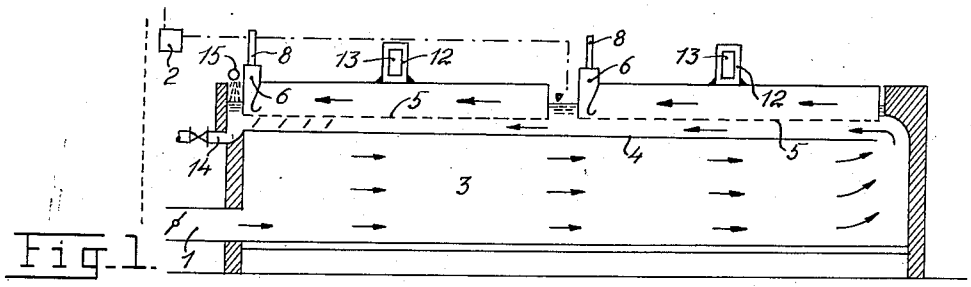


Fig. 1.

Fig. 2.

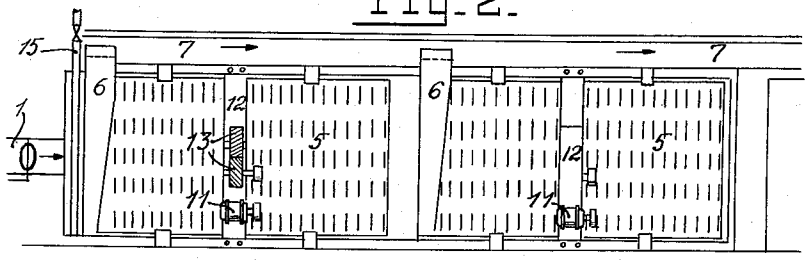
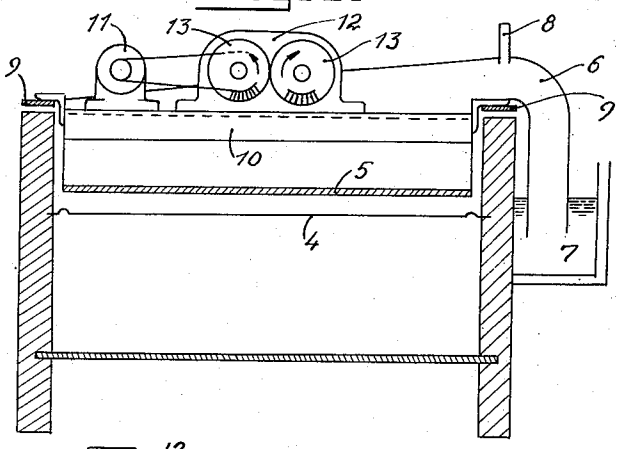


Fig. 3.



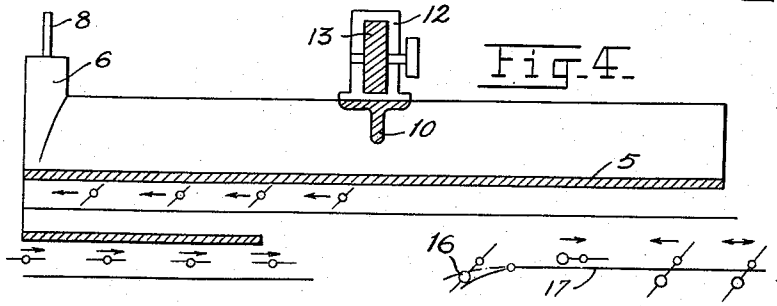


Fig. 4.

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APPARATUS FOR PURIFYING FIBROUS SUSPENSIONS

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1

In all cellulose or paper factories a screening apparatus is present, the task of which is to screen the pulp, i. e. remove all impurities in the fibrous suspension. One may distinguish between two kinds of impurities, namely:

(1) Impurities having a greater specific weight than the fibres.

(2) Impurities having about the same specific weight as the fibres.

In order to remove as much as possible of the first mentioned impurities, most factories use a sand-trap, i. e. a trough or narrow box in which the pulp shall flow with low velocity and low concentration in order that heavy impurities such as sand, coal, rust, iron, metal, etc. shall have time to deposit on the bottom of the sand-trap. It is nevertheless difficult for the impurities to sink because they are kept floating by fibres and fibre lumps, which is especially prevalent if the pulp concentration is high, for instance above 0.4%.

From the sand-trap the pulp is passed to the screen proper, the task of which is to remove also the impurities mentioned under (2).

To a great extent ordinary flat screens, which have a low power consumption per ton pulp and give a fairly pure product, are used. The flat screens, however, have a low capacity and require a large space.

The present invention has for its object novel features in a method and apparatus for screening pulp in which, as compared with the ordinary flat screens, as well a greater purity of the screened pulp as an increased capacity per square meter of the screen surface are obtained.

According to the invention, a combination of a sand-trap and one or more flat screens located on top of the sand-trap is used. The effect of the sand-trap is, according to another feature of the invention, increased by subjecting the flowing fibrous suspension in the sand-trap trough to vibration by means of the screen member itself, which as mentioned is located on top of the sand-trap. A sand particle sinks rapidly in clear water, while in a fibre suspension, as mentioned above, it becomes "suspended" in fibres and fibre lumps. By means of vibrations the heavy impurities are shaken out of the fibres and sink substantially more rapidly to the bottom. In a sand-trap, the portion of the pulp which is nearest to the surface is most free of heavy impurities. Therefore the screen member is, according to the invention, arranged in such a manner that the uppermost layer of the flowing fibrous suspension is supplied to the screen plate, which

2

is obtained in the simplest way by causing the pulp to pass the screen plate in an upward direction, thus contrary to the operation of ordinary flat screens.

A sand-trap operates best with low flowing velocity, because the impurities then have time to sink to the bottom. On the other hand a screen operates at a disadvantage if the movement of the pulp along the screen plate is slow, because then an accumulation of pulp, lumps and impurities immediately beneath the screen plate takes place, so that the capacity of the screen and the purity of the screened pulp are reduced. The pulp must therefore flow rapidly along the screen plate so that turbulence and a good agitation of the unscreened pulp are obtained. In order to obtain this a partition wall may be mounted in the sand-trap trough a short distance below the screen plate in such a manner that the pulp flows slowly in the lower portion of the sand-trap, turns at the end of same, and flows rapidly in the opposite direction in the upper portion between the screen and the partition wall. In order to increase the effect of the sand-trap, the partition wall itself or its attachment should be constructed in such a manner that it transmits the vibrations of the screen also to the pulp below the partition wall, and the bottom of the sand-trap also should be so constructed or mounted that vibrations in vertical direction are hindered the least possible.

The screen member proper used in the arrangement according to the invention, is a flat screen shaped as an open trough in which the bottom is constituted by the screen plate itself. The trough performs very rapid vibrations or oscillations which in themselves cause the screen to acquire a capacity which is up to three times greater than the capacity of an ordinary flat screen which operates with much lower frequency.

Various other types of vibratory screening devices have been tried used in the screening of fibrous suspensions. It is usual to produce the vibrations by means of eccentric weights which are attached to a rapidly rotating shaft. The movements which in this way are produced are circular or elliptic, i. e. the movement of the screen is elliptic in a vertical plane perpendicular to the shaft. The horizontal component of movement causes, however, such splashing on the outside of the screen that it is difficult to avoid splashing of unscreened pulp over into the screened pulp, and besides easily causes pre-

cipitation of resin and consequently spots in the pulp.

It is therefore an important feature of the invention that the vibrations take place substantially vertically. The vibrations may of course be produced by means of electromagnetic or hydraulic means, but it is especially practical to use two or more rotating shafts having equally large eccentric weights which are geared together so that the shafts rotate synchronously in opposite directions, and so that the horizontal components of the forces are eliminated, whereby only vertical vibrations take place.

The suspension or attachment of the screen should be resilient in vertical and preferably rigid in horizontal direction, which may be obtained by attaching the screen to a horizontal plate spring on each side of the screen, or in any other suitable way.

The screened pulp which after having passed the screen plate accumulates in the interior of the trough may either leave the screen through an opening in one of the sides of the trough, which is connected with a corresponding opening in the sand-trap by means of a flexible sealing, or also by means of a siphon, which is especially advantageous.

In case ordinary flat screens are not provided with special regulators, it often occurs that a part of the screen plates becomes bare if the pulp supply decreases. These bare spots also sometimes occur even when regulators are used. Thereby air is admitted beneath the screen plate, so that splashing and foaming occur, which has the effect that resin more easily is deposited in the slits. Through the use of a siphon this is not possible, because the siphon is not capable of removing all pulp from the screen plate but "lets loose" when the stand has become so low that air is not admitted to the siphon. The liquid level of the pulp is thus automatically held at a constant height by means of the siphon.

The unscreened pulp outside the screen stands higher than the screened inside, i. e. it has a certain over pressure which causes the pulp to flow through the slits.

In order that the screen shall operate under optimal conditions, the over pressure should not exceed a predetermined limit. Because the level of the screened pulp by means of the siphon is kept within predetermined limits, it is in this screen only necessary to see to it that the level of the unscreened pulp also is kept within predetermined limits, which may be obtained by means of a level regulator which controls the pulp supply to the screen.

The height of the optimal over pressure is about 3–10 cm., on the average 6 cm., which should be constant at all places of the screen plate. The flowing pulp below and above the screen plate is subjected to flowing resistance with consequent fall of pressure, which may amount to a few cm. In order that the over pressure shall be approximately equal at all places, the screened as well as the unscreened pulp should therefore flow in the same direction. Besides the cross-sections, respectively the inclination angle of the screen plate, should be selected in such a way that the pressure loss on both sides is about the same.

Even if an individual screen is an independent unit, it is practical to arrange more screens in succession in a longer sand-trap trough having a smaller slit width in the last screens in the series, because the concentration of impurities beneath the latter becomes great. In order to liberate the impurities beneath the last screen as much as possible from fibres, water may be added at the end of the last screen. This would cause the impurities which otherwise are conveyed by the pulp flow, to accumulate beneath the screen if the impurities are not removed by means of a mechanical device. Such a mechanical device is described in the following, with reference to the drawing.

An embodiment of the invention is described in the following with reference to the drawing, in which:

Fig. 1 shows a longitudinal section of an apparatus for carrying out the method according to the invention, and

Fig. 2 shows a plan view of the same.

Fig. 3 shows a cross-section of the apparatus.

Fig. 4 shows a longitudinal section of the last screen and also illustrates the operation of the scraper device.

In the drawing two screens are shown, which are mounted in succession in the direction of flow of the pulp.

The pulp is supplied through a pipe 1, provided with a regulating register which is operated by means of a level regulator 2, which keeps the level of the unscreened pulp between two screens constant. From the pipe 1, the pulp arrives at the lower part of the sand-trap 3, in which the pulp flows slowly and is subjected to vibrations from the screens themselves. The bottom of the sand-trap is tight and preferably resilient. At the end of the sand-trap the pulp flow turns and flows thereafter on the upper side of the resilient partition wall 4, below the screens proper. Here the cross-section is substantially smaller in order to obtain more rapid flowing and consequent turbulence. The screened pulp passes the vibrating screen plate 5 in an upward direction, and flows on the upper side of the screen plate in the same direction as beneath the same towards the siphon 6, which carries the screened pulp over the longitudinal side of the trough and the sand-trap down into a lower channel 7 for screened pulp. Each siphon is connected to a vacuum conduit 8, having a sufficiently great under pressure to secure the operation of the siphon.

The details of the screen appear from Figs. 3 and 4. The screen trough proper is suspended in a plate spring 9 on each longitudinal side. Across the screen a beam 10 is mounted, which carries the motor 11 and the gear-case 12, with two rotating eccentric weights 13, which rotate in opposite directions and synchronously, because they are provided with inter-engaging teeth.

It is therefore sufficient that the motor only drives the one shaft. After the last screen a special scraper device is mounted, the task of which is to convey the impurities to the discharge pipe 14 (see Fig. 1), in spite of the fact that water is added through the sprayer pipe 15 at the end of the screen, with consequent counter-flow. The scraper consists of one or more transverse lists which are turnable about a longitudinal axis, and which all move back and forth. When the scrapers move towards the outlet, their lower edges contact the partition wall 4, while on their returning movement (see Fig. 4), they are positioned substantially horizontal. It is practical that all scrapers are interconnected and move equally. The turning movement is by way of example effected by providing one of the scrapers with a roller 16 (see Fig. 4 at the right-hand bottom), secured at both ends of the scraper in a

predetermined distance from the turning axis of the latter, and which during the reciprocating movement rolls on a guiding rail 17, which is provided with a hinge on the downwards bent part adjacent to the outlet, so that the guiding roller under the foreward movement, when positioned below the rail, lifts the movable part of the rail and then arrives on the upper side on the backward movement. The reciprocating movement may be obtained by means known per se, such as eccentric, crank shaft, hydraulic piston, etc.

Among the advantages which are obtained by the method and apparatus according to the invention, as compared with ordinary flat screens, the following are to be mentioned:

No additional need of space because the screens are mounted on top of a sand-trap which almost always is present. A capacity of up to three times the capacity of ordinary flat screens is obtained, owing to the use of the vibrations described. The vibrations are transmitted partly to the sand-trap, so that the purifying power of the latter is substantially improved.

The screened pulp passes the slits in an upward direction, i. e. it is the uppermost layer of the pulp flow containing fewer heavy impurities which passes the screen.

The short pressure pulsations have the effect that the impurities are not so easily pressed into the slits.

During the cleaning of the screen plate the impurities are flushed back in the unscreened pulp, contrary to the operation of ordinary flat screens.

While ordinary flat screens have a thickening effect, i. e. the screened pulp is thicker than the unscreened, the contrary is the case in the screen according to the invention. It is therefore in itself unnecessary to thin the unscreened pulp after one screen before it is supplied to the next screen.

Because the screened pulp is suitably removed by means of a siphon, the screen plate can never become bare so that foaming and splashing, and besides a precipitation of resin in the slits, are avoided.

Because the vibrations take place vertically, splashing on the end surfaces of the screen is prevented.

The most favorable conditions of operation are secured through automatic regulation of the pressure difference between screened and unscreened pulp. Owing to a special mechanical device for removing the impurities, there will be practically no loss of fibres.

We claim:

1. Apparatus for purifying fibrous suspensions, comprising in combination a sand-trap, a vibratable flat screen located on top of the sand-trap, means for vibrating the screen substantially only in a vertical direction and at a high frequency, said vibration means comprising a pair of eccentric weights which rotate synchronously and in opposite directions, a vibrations-transmitting partition wall which divides the space between the screen and the bottom of the sand-trap into an upper and a lower portion and which at one end of the sand-trap provides a passage between the two portions, the upper portion having a substantially smaller cross-section than the lower portion, and means for moving a current of fibrous suspension serially through the lower portion, the passage, and the upper portion and into contact with the screen.

2. Apparatus for purifying fibrous suspensions, comprising in combination a sand-trap, a vibratable flat screen located on top of the sand-trap, means for vibrating the screen substantially only in a vertical direction a vibrations-transmitting partition wall which divides the space between the screen and the bottom of the sand-trap into an upper and a lower portion and which at one end of the sand-trap provides a passage between the two portions, the upper portion having a substantially smaller cross-section than the lower portion, and means for moving a current of fibrous suspension serially through the lower portion, the passage and the upper portion and into contact with the screen.

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REFERENCES CITED

The following references are of record in the file of this patent:

UNITED STATES PATENTS

Number	Name	Date
59,510	Krom	Nov. 6, 1866
703,682	Vrooman et al.	July 1, 1902
2,144,382	Lincoln et al.	Jan. 17, 1939
2,228,852	Shafer	Jan. 14, 1941
2,338,523	Lincoln et al.	Jan. 4, 1944
2,406,618	Lindgren	Aug. 27, 1946

FOREIGN PATENTS

Number	Country	Date
496	Great Britain	of 1910
1,079	Great Britain	of 1884
14,557	Sweden	Aug. 16, 1902
15,070	Austria	Feb. 10, 1904
44,641	Sweden	Oct. 16, 1918
222,077	Germany	May 18, 1910
659,799	Germany	May 14, 1938
703,250	Germany	Mar. 5, 1941