Aug. 25, 1942. N. W. JÖNSSON 2,293,978

PAPER PULP SCREEN

Original Filed Sept. 15, 1936 3 Sheets-Sheet 1

Fig. 1.

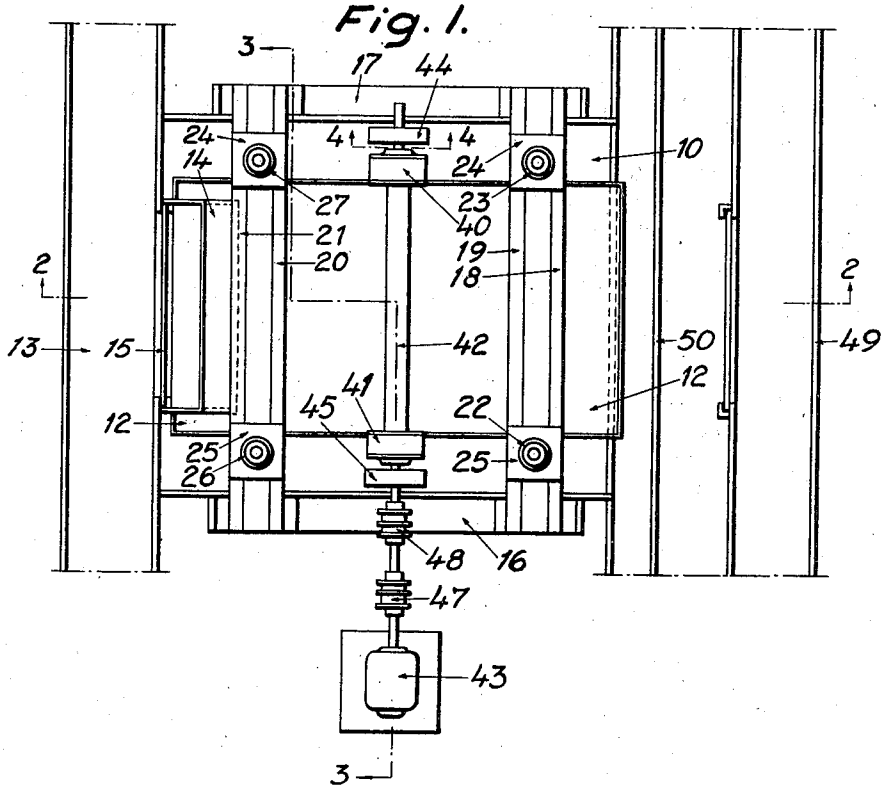
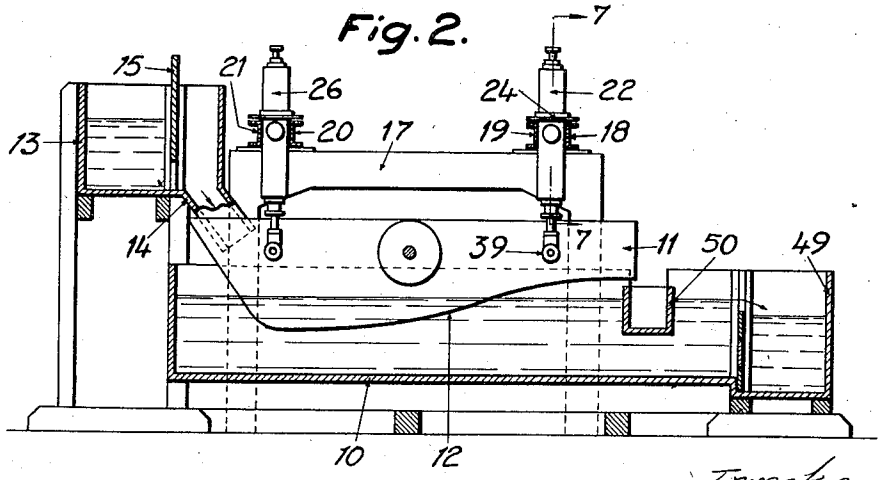


Fig. 2.



Inventor,
N. W. Jönsson

By: Glascock Downing & Seebold
Attys.

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Fig. 3.

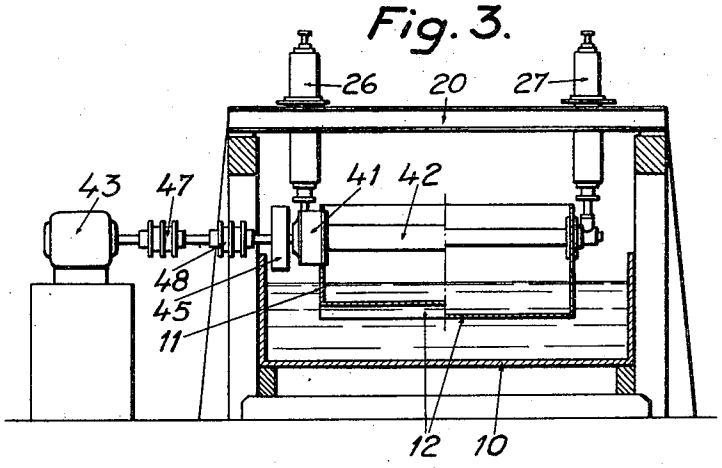


Fig. 4.

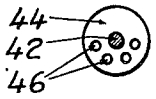
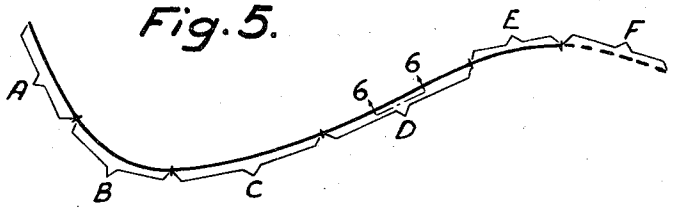


Fig. 5.



Inventor,
N. W. Jönsson

By: Glascock Downing & Seebold
Attys.

Aug. 25, 1942. N. W. JÖNSSON 2,293,973

PAPER PULP SCREEN

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Fig. 6.

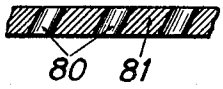
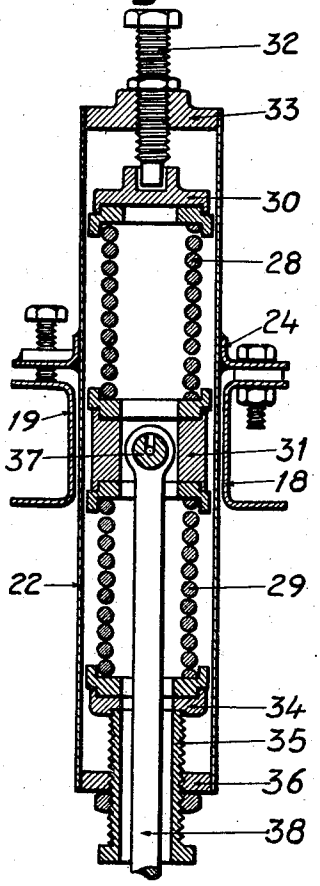


Fig. 7.



Inventor;
N. W. Jönsson
By: Glascock Downing & Seebold
Attys.

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2,293,978

UNITED STATES PATENT OFFICE

2,293,978

PAPER PULP SCREEN

Nils Walfrid Jönsson, Obbola, Sweden

Original application September 15, 1936, Serial No. 100,958. Divided and this application February 23, 1940, Serial No. 320,485. In Sweden November 2, 1933

1 Claim. (Cl. 92—33)

This application is a division of my co-pending application Serial Number 100,958 filed September 15, 1936.

The invention relates to an apparatus for screening cellulosic pulp said apparatus being in several respects much simpler and more advantageous than apparatus hitherto used for producing cellulosic pulp products, for instance chemical and mechanical wood pulp, paper, cardboard and wall board.

It has been found that a vibratory motion of a screening member under certain conditions creates a special effect when screening suspensions of fibrous material which may or may not be mixed with other solids.

In apparatus for straining paper pulp, it has been proposed to mount the frame and the strainer-plates constituting the inner vat, upon spring-supported bearings arranged at opposite sides of the said vat, and to impart to the bearings on one side only thereof vibratory motions with the effect that the entire vat is caused to partake of a vibratory movement about a longitudinal axis which passes through the centre of inertia of the mass moved; the same actuating motions operating, in conjunction with the reactions of the bearing springs, to impart to the vat a to-and-fro altitudinal movement.

In carrying out the invention the suspension of fibrous material is led to one side of an elongated troughlike screen, extending in the longitudinal direction substantially horizontally from an inlet at one end to an outlet at the other end, and comprising in the direction of flow first a relatively short portion extending steeply downward, and then as continuation thereof a portion, everywhere inclining less steeply to the horizontal plane than the first portion and from a lowest point successively rising to the outlet portion of the screen, said screen at its middle portion being united with means for vibrating the screen sides and carried on both sides by elastic, substantially vertically yielding means so that the inlet end as well as the outlet end of the screen perform orbital vibrations, liquid beneath the screen being dammed up and the screen thereby being at least partially surrounded by liquid on both sides. The effect created by a vibration of the fibres of a suspension and especially of the fibres next to the screen, provided the vibration is of a suitable kind, is very remarkable. The explanation of this fact might not lie only in the motion of the fibres relatively to the screen, which motion is very favourable to the intended treatment, but also in the motion of the fibres relatively to the liquid of the suspension, especially near to the screen.

By creating suitable conditions in the form of a suitable vibration, it has proved possible in most cases not only to transport the fibres along the screen but also to keep the screen free of coatings of fibrous material and in many cases even to keep the screen free of impurities, for example, resins, of the kind that often cause difficulties by accumulating on screen members.

It has proved suitable in certain cases to vary the period and amplitude of the vibrations of the screen. Thus, in some cases it has been suitable to impart to the screen very violent vibrations up to and above 1000 a minute not going below 200 a minute. The amplitude of such vibrations should not exceed 8 mm. In other cases it has been suitable to use vibrations of an amplitude of 4 to 16 mm. with the number of vibrations per minute not exceeding 400 and not below 100. The vibrating screen is preferably put into vibration by the direct actuation of a vibration member, in which the motion is created by electric, magnetic mechanical or pneumatic means. In such a case it is suitable, when treating the fibrous material, to control the vibrations of the screen by altering the electric frequency or the current strength or the air pressure or the air quantity in the vibration member or by adjusting the mechanical device so that a change of the speed of vibration and/or the amplitude of the vibrations is obtained. In certain cases it has proved to be most advantageous if the screen has a uniform or almost uniform vibration, in other cases, again, it has proved most advantageous to impart to the screen a vibration, which is different at different parts of the surface. It has proved suitable to supply to the screen a larger quantity of the suspension than can be screened. In such a case the part of the suspension, which has not been screened, is returned and is once again supplied to the screen, a circulation thus being effected. In such a case part of or the whole circulating quantity of suspension may be caused to pass a screening member, in which coarse particles are separated from the suspension. This screening member also may be constructed in accordance with the invention.

In several applications of the method according to the invention it has proved favourable to accelerate the passage through the screen by applying an over-pressure above the suspension while it passes over the whole or over part of the screen. It has also proved advantageous to

accelerate the passage of the liquid and of the suspension through the screen by producing partial vacuum under the surface of the screen. Of course, it is possible and in certain cases it has also proved suitable to subject the suspension to the repeated action of vibrating screens, in which case different vibrations may be imparted to the different screens.

In certain cases it might be suitable to cause the screening to take place from below upward, the suspension being admitted to the underside of the screen.

The apparatus according to invention may be advantageously used for preliminary screening and for knot catching.

In all cases it is essential, that the screening surface, a small or great part of it, is wholly surrounded by liquid. The special effect described above can only be obtained by such a use of the liquid.

For dehydrating or concentrating the stuff for example from 0.20 to 5.0% a simple shaking trough having a curved screening surface may be used instead of a rotating draining drum. This entails saving of power, reducing losses of the stuff and simplified attendance.

In screening paper pulp, in separating knots from cellulose and in grading ground pulp or stuff for the production of wall board and the like and in taking care of fibre occurring in slight quantities in waste water, apparatus of the above described kind may be used with advantage, by which improved results are obtained in comparison with apparatus used hithertofore.

The above described apparatus may be advantageously used for the purpose of depriving cellulosic pulp and other such fibrous mass of resin. The resin occurs substantially in and on the finest parts of the fibrous mass, and if the finest parts are removed by means of the invented apparatus a stuff is obtained, which has a considerably lower resin content than the stuff has prior to the treatment. The separated quantity of fine cellulose fibers may amount to 10%–15% of the suspended matter, but should preferably be limited to 3%–5%.

In the case in which about 10–15% of fine particles are separated, it may also be convenient to subject the stuff thus separated, which is rich in resin, to a subsequent separation in an apparatus of the described kind for the purpose of separating the main part of the said stuff of a lower resin content.

On account of the direct shocking effect of the screen which is mild but which is repeated many times, to which effect the particles are subjected on account of the vibration of the screen a very complete releasing and separation of resin takes place, which more or less dissolved adheres to the particles, especially the fine ones.

Apparatus according to the invention are illustrated in the accompanying drawings in which:

Figure 1 is a plan view of a machine for screening fibrous material.

Figure 2 is a secton on the line 2—2 of Figure 1,

Figure 3 is a section on the line 3—3 of Figure 1,

Figure 4 is a section on the line 4—4 of Figure 1,

Figure 5 is a section in the direction of flow through a screening surface.

Figure 6 is a fragmentary section on the line 6—6 of Figure 5.

Figure 7 is a section on the line 7—7 of Figure 2.

Referring now to Figures 1, 2 and 3, reference numeral 10 indicates a trough, in which a box 11 having its bottom 12 formed as a screen is partly immersed. The fibrous material is in the form of a suspension in the channel 13 and is supplied from the same to the box 11 through the inlet 14. For the purpose of controlling the supply of the fibrous suspension a control shutter 15 is provided in the channel 13. Laterally of the box 11 and the trough 10 there are provided two supports 16 and 17. On the said supports and across the box 11 there are provided, in pairs, four channeled beams 18, 19 and 20, 21 respectively. Between the beams 18 and 19 there is a space, in which two tubular sleeves 22 and 23 are provided perpendicular to the longitudinal direction of the beams and rigidly connected to the beams by means of collars 24 and 25 respectively, welded one to each sleeve, which collars are united with the beams by means of bolts and nuts. Correspondingly two tubular sleeves 26 and 27 are provided between the beams 20 and 21. In each sleeve 22, 23, 26, 27 there are provided two coil springs 28 and 29 (see Figure 7, in which the sleeve 22 is shown in section). The upper spring 28 with its upper end rests against a spring holder 30 and with its lower end against a cross piece 31. The spring holder 30 rests against the screw 32, disposed in the cover 33, which closes the upper part of the sleeve 22. The lower spring 29 with its upper part rests against the cross piece 31 and with its lower part against the spring holder 34. The latter is supported by a sleeve 35, screwed into a cover 36 provided in the lower part of the sleeve 22. In the cross piece 31 there is provided a pin 37 to which a bolt 38 is turnably suspended. The lower end of the said bolt 38 is mounted turnably about a pin 39 provided in the side wall of the box 11 as shown in Fig. 2. Thus, the box 11 is suspended at four points by coil springs. Through the side walls of the box 11 and journalled in two strong bearings 40 and 41 there is provided a shaft 42, which is driven by a motor 43 via the clutches 47 and 48. On the shaft there are rigidly fixed two unbalanced members 44 and 45, i. e. bodies that have their centres of gravity eccentrically positioned in relation to the shaft 42. An unbalanced member of this type is shown in Figure 4 and consists of a circular unbalanced wheel, the eccentric position of the centre of gravity having been obtained by drilling a number of holes 46 in one half of the wheel. At the rotation of the shaft 42 the box 11, on account of the unbalanced members will thus have a vibratory motion and each point of the same will move in an elliptic curve on account of the elastic suspension means. The amplitude of the oscillations may be made less or greater by changing the weights of the unbalanced members or the centres of gravity of said members. The tension of the springs 28 and 29 may be regulated by the screw 32 and the sleeve 35.

The apparatus operates in the following manner.

The suspension flowing in the channel 13 is continuously fed through the inlet 14 down into the box 11. Due to the vibratory motion the screening is facilitated. The good fibrous material passes through the screening bottom 12 out into the trough 10 from where it is led away through the channel 49. The fibrous material, which does not pass through the bottom 12 passes

over the same and is led away through the channel 50.

As will be seen from Figure 2 the screening surface 12 has a bottom curved in the direction in which the fibrous material is led. The part of the suspension that has passed through the screening surface may be dammed up, so that the bottom of the box 11 will be more or less immersed in the suspension.

The section of the screening surface, when seen in the direction of flow, preferably consists of a broken or curved line, which first extends steeply downwards and then, possibly with some transition, where the direction successively passes into a horizontal direction, a rather large part of the whole extension of the screening surface in horizontal direction extends less steeply upwards, possibly with a continuation having horizontal or downwardly directed form.

An embodiment of the screening surface of such a type is illustrated in Figure 5, from which it will be seen that the first downwardly directed part of the section line consists of two approximately equal large zones A and B. The inclination of the zone A to the horizontal line may preferably be —70° to —30° and that of the zone B —30° to 0°. The part extending less steeply from the zone B also consists of two approximately equal large zones C and D, which preferably have an inclination to the horizontal line of 0° to +20° and +10° to +30° respectively. The latter part of the section line is continued, with a continuous bend, by a zone E, which may have an inclination of +15° to 0°. After the zone E there may also be a downwardly directed part F. This part is of importance in case it is desired that the material which does not pass through the screen surface, is to leave the same in the form of a coherent web.

The openings or perforations in the screen may preferbly have limiting walls, which at least on part of the surface of the member are obliquely directed relatively to the surface of the screen. Such an oblique arrangement of the perforations is illustrated in Figure 6, in which the limiting walls 80 of the screening perforations incline obliquely relatively to the screening surface 81.

Thus, by arranging the perforations in the screen in such a manner that the limiting walls become obliquely situated relatively to the screening surface, it is possible to control the permeability of the screen within wide limits. In case the limiting walls 80 incline obliquely forwards, when seen in the feeding direction, i. e. approximately in the direction of the major axis of the ellipse described by each point of the vibrating screen the permeability is increased for suspended matter. If on the other hand the limiting walls 80 incline obliquely backwards, when seen in the feeding direction, i. e. substantially in the direction of the minor axis of the ellipse described by each point of the vibrating screen the permeability is decreased for suspended matter.

The limiting walls may also have different inclination at different parts of the screen.

Having now described my invention, what I claim as new and desire to secure by Letters Patent is:

In an apparatus for screening cellulosic pulp the combination of an elongated screen extending in the longitudinal direction substantially horizontally from an inlet at one end to an outlet at the other end, and comprising in the direction of flow first a relatively short portion extending steeply downward, and then as continuation thereof a portion, everywhere inclining less steeply to the horizontal plane than the first portion and from a lowest point rising continuously to the outlet portion of the screen, elastic and substantially vertically yielding means connected to the two longitudinal sides of the screen for supporting the same, means for vibrating the screen united with the middle portion of the screen sides between the inlet end and the outlet end so that the inlet end as well as the outlet end of the screen perform orbital vibrations, and means beneath the screen for damming up liquid so that the screen will be at least partially surrounded by liquid on both sides.

NILS WALFRID JÖNSSON.