April 13, 1937. S. P. H. E. HOLGERSSON ET AL 2,076,991

METHOD OF ATTAINING IMPROVED FELTING OF THE FIBERS IN PAPER PULP ON THE WET PART OF PAPER AND BOARD MAKING MACHINES

Filed April 4, 1935 2 Sheets-Sheet 1

Fig. 1.

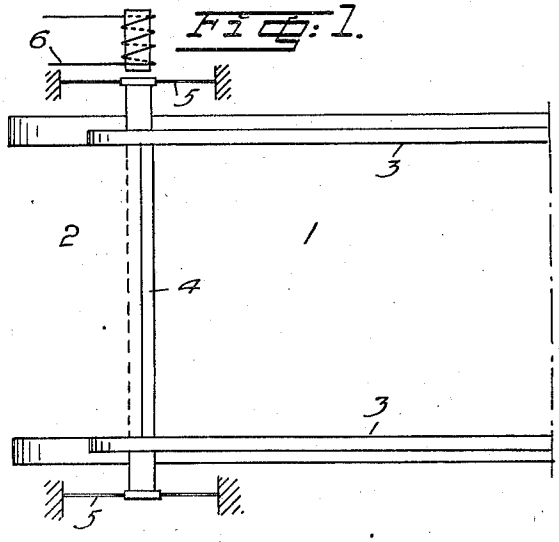


Fig. 2.

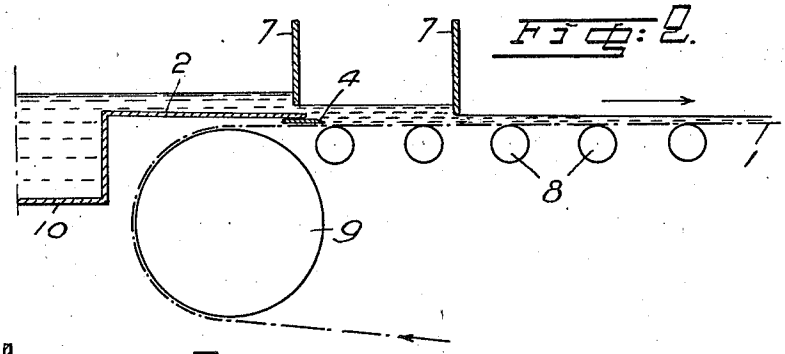
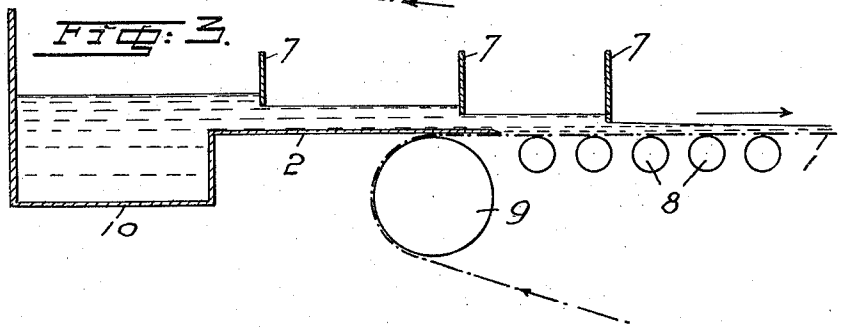


Fig. 3.



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Fig. 4.

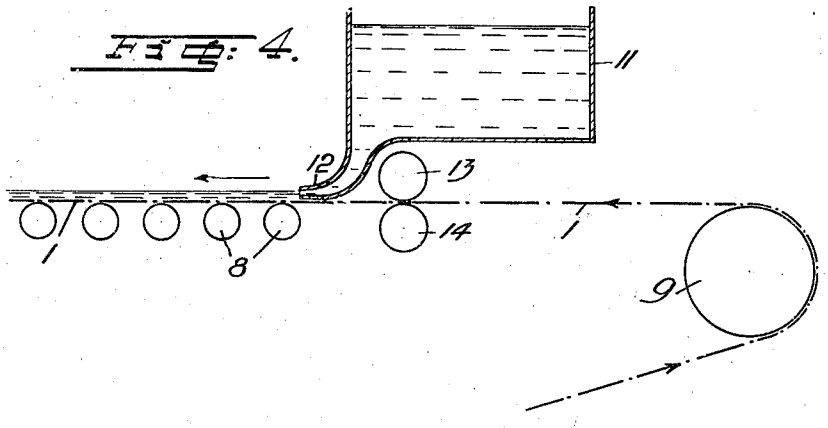


Fig. 5.

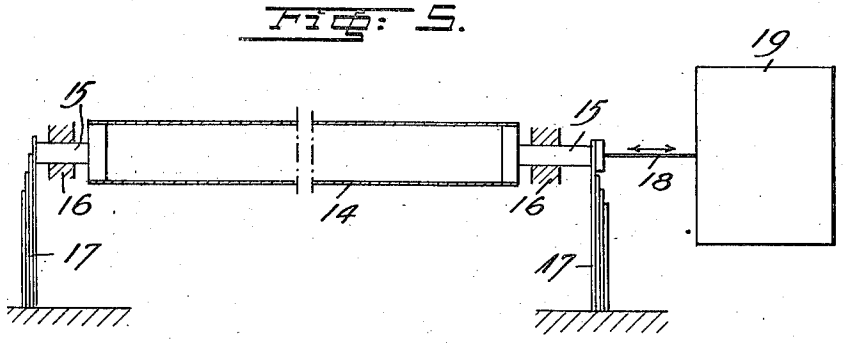
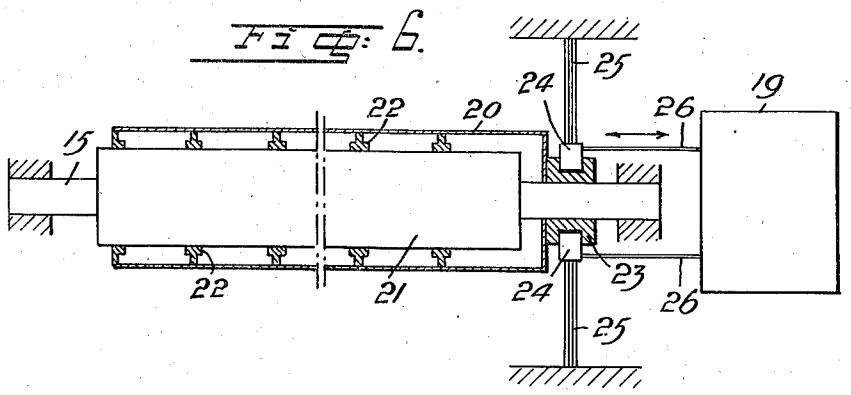


Fig. 6.



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METHOD OF ATTAINING IMPROVED FELTING OF THE FIBERS IN PAPER PULP ON THE WET PART OF PAPER AND BOARD MAKING MACHINES

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2 Claims. (Cl. 92—45)

A number of inventions have already been made with the object of achieving better felting of the pulp fibers at the wet-end of paper-making machines. Most of the devices used consist in members which are caused to vibrate, thus producing an agitation of the pulp-fiber suspension. However, in all the devices hitherto employed, the vibrating members are of such a construction and size that they permit of only comparatively slow movements and for this reason only relatively unsatisfactory results have been attained in most cases. The reason for this may be plainly seen if we observe what happens at the wet-end of a Fourdrinier machine which is fitted with a vibrating breast roll or with the entire wire-part vibrating. If we imagine that a drawing pen were fixed to the stuff-box on the apron so that it would draw a line on the moving wire-cloth, a periodic curve would be drawn on the latter with, on account of the relatively slow vibration, a long wave-length and very small maximum angles towards the machine-direction. The curve thus obtained shows on the whole the direction in which most of the pulp-fibers are pointing during the felting, since it is a fact that the fibers tend to arrange themselves in a direction parallel to the momentary relative motion between the flowing, undrained pulp-suspension and the wire, i. e., in the directions which are indicated for each instant by the above-mentioned, imagined curve. This circumstance is, of course, rather obvious, since as soon as any point on a fiber floating in the pulp-suspension touches either the wire or pulp which is lying on the wire and already drained and felted, the point in question must receive a component of motion from the wire, while the rest of the fiber is under the direct influence of the surrounding pulp and water suspension.

When the motions of the wire and of the fiber-suspension do not coincide from the beginning, and the above-mentioned point of contact between the fiber and the wire or between the fiber and pulp already felted on the wire does not coincide with the centre of the fiber, the result must be that the fiber looses its equilibrium and is turned in a direction more or less parallel to the above-mentioned relative motion. That this is actually true can be proved in several ways. For example, it is shown by microscopical examinations of paper as well as by pure tests of strength that most of the fibers in machine-made paper lie approximately in the manner indicated by the above-mentioned relative curve. Thus, if this curve, as it has hitherto been, is very flat, it is evident that the strength of the paper in the cross direction must at all points be considerably lower than the strength in the longitudinal direction of the paper.

The characteristic feature of the present invention is that the above-mentioned relative curve is caused to be of very short wave-length. This is achieved by producing either in the wire itself or in the flowing fiber-suspension high-frequency vibrations (at least 1000–6000 vibrations per minute) at a right-angle to the machine-direction. On normal paper-machines of for instance the Fourdrinier type, a relative curve is obtained between the undrained pulp and the wire with a wave-length approximately equal to the length of the fibers. Thus, paper made according to this invention is characterized by the fact that the fibers do not lie according to a fixed mean-curve, more or less flat in appearance, but the entire felting-construction in such paper will be more or less independent of the machine-direction.

In this connection it should be mentioned that the vibrations are intended to produce a rapid relative movement between the flowing, unfelted fiber-suspension and the wire or the layer of already felted and partly drained pulp lying on the wire. When, for example, the wire vibrates, the object aimed at is not to cause agitation of the fiber-suspension but to produce the above-mentioned relative motion. Obviously, it will be advantageous when the wire vibrations cause the flowing suspension to vibrate also, but, in that case, the oscillations of the wire and those of the suspension must always be in opposite directions.

The inventors are of the opinion that the felting or weaving together of the fibers is mainly affected by the conditions on and close to the line where the pulp-suspension meets the moving wire. With reference to this, the invention is illustrated in the forms of construction shown schematically by the accompanying drawings. Fig. 1 is a plan view and Fig. 2 a vertical section of the wire-part of an ordinary Fourdrinier machine up to the apron. Fig. 3 is a longitudinal section of the portion of the wire-part close to the stuff-box. Fig. 4 shows a form of construction with special vibration rolls. Fig. 5 shows on a larger scale a contrivance for causing a roll to vibrate. Fig. 6 shows on a larger scale a contrivance for causing the shell of a roll to vibrate.

The wire is indicated by 1, the apron by 2 and the deckels by 3. 4 indicates a member between the apron and the wire in the shape of a band which is stretched between the springs 5 and

caused to vibrate violently by means of the alternating current vibrator 6.

The slices which are usually found on Fourdrinier machines are indicated by 7. The table-rolls supporting the wire are indicated by 8. The member 4 may be of some other form than that of a band, for example, that of a wire made of various materials suitable for the purpose. It may either be made with a smooth surface or provided with agitators, grooves or other irregularities with which to produce violent agitation. It has been found that the effectiveness of the present invention is greatly enhanced if the apron is made of metal or some alloy, with or without an irregular surface.

Fig. 3 shows a form of construction of the invention in which a vibrating breast-roll is used, if wanted also with vibrating table-rolls. In this case, the fiber-suspension is conveyed from the stuff-box 10 over the apron 2 to the wire 1. The vibrations are here transmitted from the breast-roll 9, which may suitably be provided with a rubber jacket, to the wire 1. The table-rolls may also be kept in a state of vibration, in which case they also should be covered with rubber. The vibrations should be greatest where the apron 2 ends and the pulp is thus transferred to the wire. The distance from the end of the apron to the breast-roll should thus be as small as possible. In order to produce as great an effect as possible, the slices 7 may also be caused to vibrate.

Fig. 4 shows another form of execution in which the fiber-suspension is transferred to the wire 1 from a flow box 11 through its mouthpiece 12 which may be caused to vibrate. The vibrations are in this case transmitted to the wire by means of rolls 13 and 14 on either side of the wire, which rolls are caused to vibrate rapidly and should be covered with rubber. The table rolls 8 may also be caused to vibrate, in which case they also should be covered with rubber. The distance between the end of the mouthpiece 12 and the rolls 13 and 14 should be as short as possible. If the breast-roll does not vibrate, the distance between it and the rolls 13 and 14 should be as large as possible. There is, however, no reason why the breast-roll 9 should not vibrate also, in which case the distance between it and the rolls 13 and 14 may be smaller.

Fig. 5 shows on a larger scale an example of a device by means of which a roll may be caused to vibrate. We will assume that the roll is the roll 14 in Fig. 4. Its axle-journals 15 are supported by the bearings 16 so that they can move to and fro and the ends of the journals are in contact with the springs 17. These springs are connected by a bar 18 with an alternating-current vibrator, which is shown schematically and indicated by 19. The spring devices should be of such a size that the number of oscillations of the roll itself is in resonance with the number of oscillations of the vibrator. In the case of large rolls, the pressure between the springs and the rotating journals should be transmitted by means of suitable axial-bearings (not shown). It is naturally possible to have two or more rolls operated by the same vibrator.

Fig. 6 shows a form of construction in which only the shell 20 of the roll is caused to vibrate while its core 21 neither vibrates nor rotates. By means of supports 22, the shell 20, which may be covered with rubber, rests on the core 21, said supports 22 sliding on the core 21 when the shell rotates.

On one of the axle-journals 15 of the core there is an axial-bearing 23 in the groove of which there are blocks 24 which are supported by the spring-devices 25. The blocks 24 are connected by means of the member 26 with the alternating-current vibrator 19.

Instead of the supports 22 sliding on the core, supporting members with roller-friction may be used, in which case the core should also rotate. The shell may also be supported by springs which are attached to the core, by which means both sliding and rolling friction may be avoided. It is not necessary to place the vibrator 19 outside the roll, but it may also be placed within the same, which is a very simple matter if an alternating current vibrator is used.

Obviously, vibrations may be transmitted to the flowing stuff on the wire in other ways than those mentioned above, for example, by means of the apron itself or by the slices 7 which are in contact with the upper layer of pulp or by means of one or several wires or bands—or groups of wires or bands—placed in or close to the flowing stuff on the wire or by means of combinations of these devices. In each of these cases, the vibrating members, i. e., the apron, slices, bands, wires etc. are made either with smooth surfaces or with agitators or grooves or other irregularities suitable for producing violent agitation. The main thing is, however, that the vibrations of the member or members which produce the agitation are of high frequency, for example, as has been mentioned, with at least about 1000–6000 oscillations per minute.

When using a vibrating apron or the band marked 4 in Fig. 1, it often proves advisable to have the apron or the band comparatively wide, up to about 1 metre or, in some cases, still wider. Since the stream of pulp is, as one might say, caused to flow over a vibrating bottom, so-called laminary flow is hindered or prevented and, in consequence, the pointing of the fibers in parallel directions which is a result of such a flow.

Corresponding advantages are attained by the vibration of the mouthpiece of the flow box, when such a box is used.

When a vibrating wire-cloth is used, the vibrations may be transmitted from the vibrator or vibrators to the wire by the breast roll, by the table rolls or by special rolls on each side of the wire, preferably covered with rubber, which hold the wire between themselves by means of a suitable pressure or, finally, by means of combinations of these devices.

Instead of alternating-current vibrators any other electrical or mechanical vibrators may be used which are adapted to create vibrations of very high frequency, at least 1.000 per minute. In practice it is suitable to use still higher frequencies, say 4.000, 5.000, 6.000 or more vibrations per minute.

We claim:

1. Improvements in paper or board making machines for effecting an improved felting of the fibers in the pulp, comprising in combination an endless wire cloth, breast rolls and table rolls for supporting the same, means for imparting motion to said wire cloth, a stuff box, an apron between the stuff box and the wire cloth, a band submerged in the fiber suspension and located across the wire cloth in front of the free end of the apron, and alternating-current vibrators adapted to impart to said breast-roll, apron and wire cloth high frequency vibrations, at least

1000 per minute, and in which the rolls are provided with a fixed case and a rotatable shell.

2. Improvements in paper or board making machines for effecting an improved felting of the fibers in the pulp, comprising in combination an endless wire cloth, breast rolls and table rolls for supporting the same, means for imparting longitudinal motion to said wire cloth, a stuff box, an apron between the stuff box and the wire cloth, the said rolls being provided with a fixed core and a rotatable shell, and alternating-current vibrators connected with said shell and adapted to impart to the same high frequency vibrations, at least 1000 per minute.

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