

Aug. 13, 1974

KOICHI ISUJIBAYASHI ET AL

3,829,359

PAPER MAKING MACHINE HAVING ONCE-TWISTED ENDLESS FELTS

Filed June 28, 1971

3 Sheets-Sheet 1

Fig. 1A

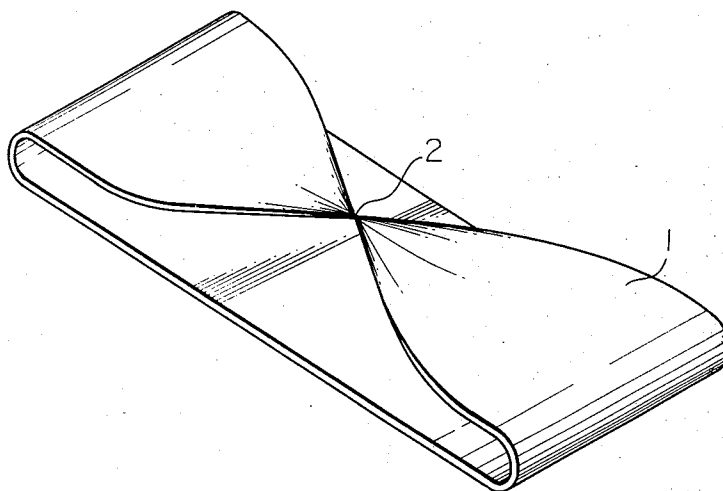
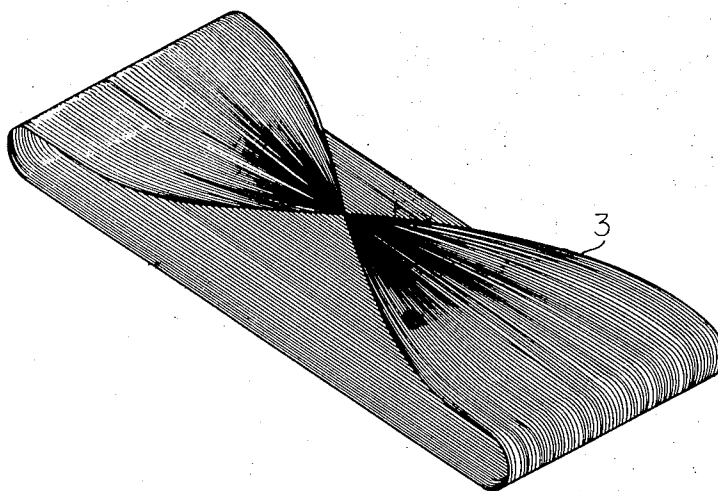


Fig. 1B



Aug. 13, 1974

KOICHI ISUJIBAYASHI ET AL

3,829,359

PAPER MAKING MACHINE HAVING ONCE-TWISTED ENDLESS FELTS

Filed June 28, 1971

3 Sheets-Sheet 2

Fig. 2

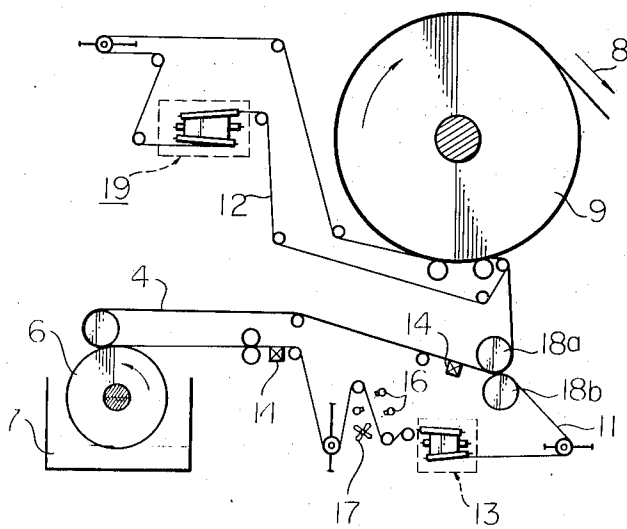
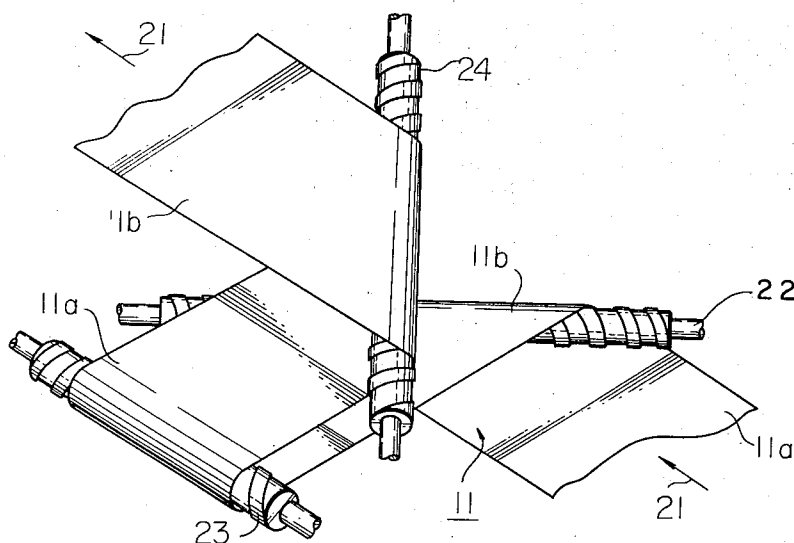


Fig. 3A



Aug. 13, 1974

KOICHI ISUJIBAYASHI ET AL

3,829,359

PAPER MAKING MACHINE HAVING ONCE-TWISTED ENDLESS FELTS

Filed June 28, 1971

3 Sheets-Sheet 3

Fig. 3B

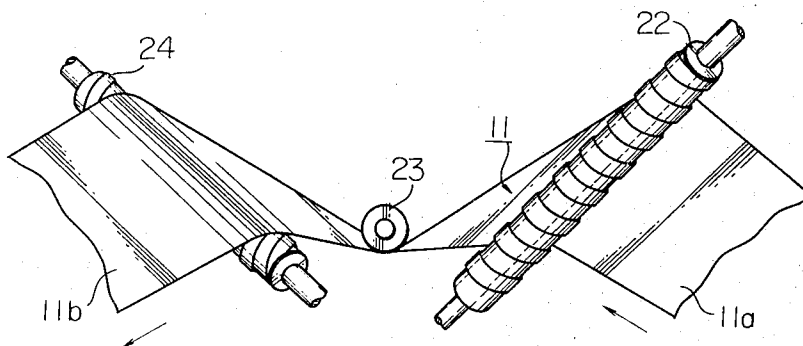
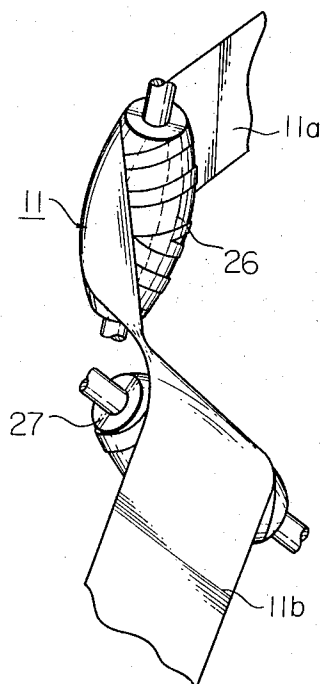


Fig. 3C



1

3,829,359

PAPER MAKING MACHINE HAVING ONCE-TWISTED ENDLESS FELTS

Koichi Tsujibayashi, Tokyo, Japan, assignor to Nippon Felt Co., Ltd., Tokyo, Japan

Filed June 28, 1971, Ser. No. 157,199

Claims priority, application Japan, Aug. 31, 1970, 45/75,586, 45/75,587

Int. Cl. D21f 1/32

U.S. Cl. 162-274

2 Claims

ABSTRACT OF THE DISCLOSURE

A paper making machine having mechanisms for once-twisting endless felts by about 180 degrees using two or more felt twist rolls within a region where the felts are free from contact with a processing paper sheet for an effective mitigation of accumulation of contaminative materials.

The present invention relates to an improved paper making machine having once-twisted endless felts, and more particularly relates to a paper making machine wherein endless felts are designed to run being once twisted on their circulation courses.

In the dehydration and drying part of the conventional paper making machines, it is usual to use one or more endless felts with only one surface thereof in running contact with the processed paper sheet. This single surface contact tends to cause considerable accumulation of contaminative materials within the felt configuration. Such accumulated contamination of the felts affects the dehydration faculty thereof so that there is an uneven dehydration effect on the processed paper sheet, thereby decreasing the smoothness of the resultant paper surface. Further, because one surface of the felt contacts only the wet paper sheet and another surface thereof contacts only the rolls of the machine, a difference results in the degree of degradation of the mechanical property existing between the paper contact side surface and the roll contact side surface of the felt. This irregularity in the degradation of the mechanical property over the entire felt configuration tends to shorten the life-time of the felt used.

In order to avoid such contaminative accumulation, there have been proposed various solutions wherein separate suction devices such as a suction box, a wringer press or a whipper are provided for a positive elimination of the contaminative materials once deposited on the felt surface. However, no appreciable elimination effect results from these solutions applied to the conventional paper making arrangement wherein one surface contact of the felt with the paper sheet is employed.

It is also necessary to clean the contaminated surface of the felt through a contact with a suction box of the felt after a continuous use for a certain period. For this effect, it is necessary to overturn the felt. However, this method also cannot be effective in the cleaning effect because of the difficulty in the removal of the contaminative material once it has deeply settled into the felt configuration. Further, it requires strong manual labor to overturn a felt of relatively heavy structure.

With recently increasing demand for acceleration of the paper making speed, troubles caused by the contaminative accumulation form a great bar in the advancement of the paper making industry.

2

In view of the above-mentioned drawbacks encountered in the conventional paper making technique, the present invention provides a novel paper making machine which can ascertain a uniform hydration effect and a production of high quality paper at improved production efficiency with an increased life-time of the felts used thereon.

It was empirically confirmed by the inventor of the present invention that the longer the felt in its size, the lesser the extent of the settlement of the contaminative material into the felt configuration. Further, it was found to be advantageous to always clean out the contaminative material off of the felt surface prior to possible settlement of it into the felt internal configuration.

On the basis of the above-obtained knowledge, the paper making machine of the present invention is provided with a mechanism for once twisting a running felt by approximately 180 degrees on its circulation course at any location whereon the felt is free from direct contact with a processed paper sheet.

When the above-mentioned 180 degree twisting is applied to the endless felts, the felt is once twisted on its endless course. In other words, both surfaces of the felt contact the processed paper sheet or the dryer cylinder alternately. This means that the effective contact length of the felt is double that of the felt of the conventional paper making machine, wherein no twisting of the running felts are carried out. Owing to this elongated effective contact length of the felt, the extent of the contamination is remarkably decreased. In addition to this, because the arrangement is so designed that the felts are subjected, at every cycle circulation, to a cleaning action by suction press rolls or suction boxes, the contaminative materials deposited on the felt surface can be removed therefrom prior to its settlement into the felt internal configuration. Further, because the two side surfaces of the felt contact the paper sheet and the operational rolls, the extent of the abrasion damage on the felt surface structure can be considerably minimized and a desirable prolongation of the life-time of the felt is obtained thereby.

Further features and advantages of the present invention will be made more apparent from the ensuing description, reference being made to the accompanying drawings in which;

FIGS. 1A and 1B are perspective views of two embodiments of the felt used in the paper making machine of the present invention,

FIG. 2 is a schematic side view of an embodiment of the paper making machine of the present invention,

FIGS. 3A, 3B and 3C are simplified perspective views of several embodiments of the felt twisting mechanism used in the paper making machine shown in FIG. 2.

An embodiment of the felt used in the paper making machine of the present invention is shown in FIG. 1A, wherein a felt 1 of an endless structure is once twisted by approximately 180 degrees at a point 2 on its endless course. This kind of twisted structure can be produced by once twisting a woven or knitted fabric of a given length by 180 degrees and uniting both ends of the twisted fabric together by a known manner into an endless structure. It is also possible to form a twisted fabric of an endless structure directly on a knitting or weaving machine of a special design.

When a needle felt is to be used for the felt of a paper making machine, the above-mentioned twisted endless fabric is firstly made as the base layer and laps may be

superimposed on the prepared base layer. After this superimposition, the assembled mass is subjected to a known needle-punching operation. In another method, a sheet 3 is firstly formed from multiple warp yarns running endlessly in a twisted arrangement as shown in FIG. 1B. Next, laps are layered over the prepared sheet 3 and the assembled fibrous mass is subjected to the known needle-punching operation.

It is also known to superimpose laps over a base layer, subject the assembled mass to the needle-punching and unite both ends of the needle punched felt together. Any of the above-mentioned methods can be utilized in accordance with need in the manufacturing stages.

Referring to FIG. 2, there is shown an embodiment of the paper making machine of the present invention. In the shown arrangement, a paper sheet 4 delivered from a given cylinder 6 disposed in a stock 7 is conducted in a direction shown by an arrow 8 via a dryer cylinder 9. During this travel, the paper sheet 4 runs in contact with a wet bottom felt 11 and a yankee top felt 12 in succession.

The wet felt 11 runs along an endless course in contact with several guide rollers and, within a region of the course of a prescribed length, maintains a running contact with the processing paper sheet 4. In a given region of the course, which is free from contact with the paper sheet 4, a twisting mechanism 13 of the felt is provided with a later described relationship to the running wet felt 11. The running direction of the wet felt 11 coincides with the processing direction of the paper sheet 4. The wet felt 11 is also accompanied, along its circulating endless course, with suction boxes 14, multiple showers 16, a whipper 17 and a pair of press rolls 18a and 18b.

The top felt 12 also runs along an endless circulating course in contact with several guide rollers and, within a region of the course of a prescribed length, forces the paper sheet 4 into a pressure contact with the peripheral surface of the dryer cylinder 9. The running direction of the top felt 12 coincides with the processing direction of the paper sheet 4. In a given region of the course which is, free from contact with the paper sheet 4, a twisting mechanism 19 is provided with a later described relationship to the running top felt 12.

Aside from the felt twisting operation, the entire arrangement operates and functions in a known manner. As for the twisting operation, both felts 11 and 12 are twisted by about 180 degrees when they pass through the respective felt twisting mechanisms 13 and 19. The felt twisting mechanisms 13 and 19 may be similar or different mechanisms. Any combination of the types can be selected from the embodiments to be described hereinafter according to the need in the actual paper making process.

Referring to FIG. 3A, an embodiment of the felt twisting mechanism is shown in a simplified illustration taking an application of the wet felt 11 as an example. In the shown arrangement, the wet felt 11 runs as shown by arrows 21 in direct peripheral contact with three axially rotational twist rolls 22, 23 and 24. Among the three rolls, the first and third twist rolls 22 and 24 are so arranged that axial directions of those rolls cross the advancing direction of the wet felt 11 with included angles of about 45 degrees. In accordance with the need in the actual processing or installation, the included angles may deviate from 45 degrees as desired. The second twist roll 23 is arranged substantially perpendicular to the advancing direction of the wet felt. On the incoming side of the shown felt twisting mechanism, one surface 11a of the wet felt 11 contacts the first twist roll 22 for an overturning. On the course between the first and second twist rolls 22 and 23, another surface 11b of the wet felt 11 faces upwardly and, upon arrival at the second twist roller 23, this side surface 11b comes in contact with the roll 23 for an overturning. Within a region between the second and third twist rolls 23 and 24, the first surface

11a resumes its upwardly facing disposition. Again through contact with the third twist roll 24, the wet felt 11 is overturned and, advancing in a direction the same with the incoming stage, the felt 11 leaves the twisting mechanism with its second surface 11b facing upwardly. Thus, the 180 degree twisting of the wet felt 11 is completed. In the shown arrangement, any of the rolls 22, 23 and 24 may preferably be positively driven by a driving mechanism (not shown).

Among the three twist rolls 22, 23 and 24, it is desirable to provide at least the first and third twist rolls 22 and 24 with superficially spiral grooves like a worm. This results in a frictional effect by the grooved surface and prevents a possible transverse sliding of the wet felt 11 during the running contact with these rolls 22 and 24, which extend with the above-mentioned inclination about the advancing direction of the wet felt 11. From this point of view, the spiral direction of the grooves is so selected as to assist the smooth spreading of the felt 11 during the contact.

A variation of the arrangement shown in FIG. 3A is exemplified in FIG. 3B, wherein relative disposition of the twist rolls 22, 23 and 24 is modified from that of FIG. 3A. Further modification can be derived from the basic arrangement shown in FIG. 3A according to the requirement in the actual equipment of the paper making machine.

Under a certain situation, it may also be required to carry out the felt twisting operation using only a pair of twist rolls. In this case, the running felt must naturally be twisted once by about 180 degrees between the pair of spacedly cooperating twist rolls. This twisting of the running felt inevitably causes a transverse variation in the lengthwise tensioning of the running felt. That is, the side brim parts of the felt will be more tensioned than the middle part of the felt width. This kind of uneven tensioning of the felt tends to cause a breakage of the internal mechanical balance of the felt configuration resulting in shortening of the life-time of the felt. Therefore, when the twisting is to be carried out between a pair of spacedly cooperating twist rolls, it is necessary to provide some effective measure compensating for such variation in the felt tensioning.

Referring to FIG. 3C, there is shown an embodiment of the felt twisting mechanism for this effect. In this case, the twisting of the wet felt 11 is performed in between a pair of spacedly disposed drum-shaped twist rolls 26 and 27. Because the middle part of the rolls 26 and 27 is outwardly inflated, the actual running path of the middle part of the felt width is apparently longer than that of the side brim parts of the felt. This difference in the running path length causes a difference in the lengthwise directional tensioning in such a manner to offset the tension variation caused by the intermediate felt twisting. Further, such a drum shaped design of the twist rolls is effective in preventing a possible development of creases on the felt surface, which creases give an undesired effect on the resultant paper quality.

What is claimed is:

1. In a paper making machine of the type having an endless felt, the endless felt having a region of its running course wherein the endless felt is free from contact with a paper sheet being processed, the improvement wherein said endless felt has only a single twist, said single twist being approximately 180°, comprising a felt twisting means located in said region of said running course for producing said twist, said felt twisting mechanism comprising, first, second and third rotatable twist rolls, said felt being directed to contact said twist rolls in that order, said first roll being positioned with its axis at substantially 45° to the longitudinal direction of said felt as said felt approaches said first roll, the axis of said second roll being substantially normal to the direction of movement of said felt and the axis of rotation of said third roll being at substantially 45° to the direction of

5

movement of said felt as it approaches said third roll.
2. The paper making machine of claim 1 wherein each of said twist rolls has a spiral groove formed on the peripheral surface thereof in a direction whereby said felt in contact therewith is prevented from sliding along the axial direction of the respective twist roll.

References Cited

UNITED STATES PATENTS

3,184,043	5/1965	Gibbon	198—187	10
983,669	2/1911	Beier	198—187	

6

1,095,445	5/1914	Alvey	193—37
3,139,970	7/1964	Mordstein	198—187

FOREIGN PATENTS

4,042	12/1892	Sweden	162—287
1,055,138	1/1967	Great Britain	198—187

S. LEON BASHORE, Primary Examiner
R. V. FISHER, Assistant Examiner

U.S. Cl. X.R.

162—287; 198—187