PATENT SPECIFICATION (11) 1 599 880

1 599 880

(21) Application No. 40274/77 (22) Filed 28 Sept. 1977
(23) Complete Specification filed 30 May 1978
(44) Complete Specification published 7 Oct. 1981
(51) INT CL³ D01G 25/00
(52) Index at acceptance D1N 1D

(54) METHOD AND DEVICE FOR THE PRODUCTION OF DRY LAID NON-WOVEN WEBS

(71) I, ARNOLD LOUIS MAHLER, a Dutch subject, of Prins Bernhardlaan 48, Heelsum, Netherlands, do hereby declare the invention for which I pray that a patent may be granted to me and the method by which it is to be described to be particularly described in and by the following statement: —

The invention is related to a method and to a device for the production of dry laid non-woven webs out of a feed of fibres.

In considering the non-woven web obtained by the usual known random formation methods, it appears that it has a quite cloudy or mottled appearance, especially in case of a light-weight web.

In the known devices for the separation of the fibres a fast running saw tooth roll (licker-in roll) is used, and it appears that in practice most of the fibres are introduced into the air flow as flocks or clumps instead of as individual fibres. As a result the above mentioned cloudy or mottled appearance is obtained.

A further disadvantage of the use of a licker-in roll is that a lot of broken fibres are present in the web obtained. This is caused by the difference of speed between the fibres and the licker-in roll and by the hardness and, sharpness of the teeth of said roll. For instance a rayon web obtained with the known method and device in which a licker-in roll is used comprises 70% of broken fibres.

It will be clear that the formation of flocks or clumps of fibres as well as the breaking of fibres has an adverse influence on the strength of the web obtained.

A homogenous air flow is necessary to convey the fibres to the forming device for the web, such as a condenser surface through which the air flow is discharged and upon which the fibres are laid for forming a web. This homogeneous flow is disturbed by the influence of the rotating licker-in roll. The result of this is an uneven distribution of the fibres in the web.

Moreover, a limitation of the known process arises from the teeth of the licker-in roll generating heat by combining out and cutting of the fibre feed. Because of this effect a feed of thermoplastic fibres only can be processed under special conditions that result in low production capacities.

According to one aspect of the present invention there is provided a method for the production of dry laid non-woven webs from a feed of fibres in the form of filaments, staple fibre or yarns, comprising the steps of introducing into a pneumatic device a light-weight parallel web of fibres feeding the fibres through said device to a channel in which the fibres are held between opposed surfaces, subjecting the fibres to a strong air flow to pick up the fibres and form an airborne flow of substantially individualised fibres, and subsequently depositing said fibres to form a loose random laid fibre web by separating the fibres from said air flow.

Through said method a non-destructive way of combing out of the fibres is obtained because of the fact that no licker-in roll is present, so breakage of the fibres, elevated temperatures as a result of the action of the licker-in roll and disturbance of the homogeneous air flow are prevented. Furthermore by the use of the invention it is possible to take advantage of the fact that a fibre feed from a carding machine will already be oriented as satisfactorily as possible.

In the use of the method according to the invention, a parallel laid fibre web as delivered from a card has its fibres separated by the effect of a strong air flow. To obtain a combing out effect of individual fibres from said web by the air flow it is preferred that said light-weight parallel fibre web is introduced into a slit-like curved tapering channel formed between a curved receiving plate and a feed roll rotating with a circumferential speed at least equal to the speed of said web, and that said web is fed as a continuously parallelized supply of fibres into said strong air flow of which the flow direction is substantially in countercurrent to that of the feed of fibres.

By this procedure the fibres are held in the web at their "rear ends" while they are released relatively slowly as they are progressed by the roll. At the same time the air flow exerts a rubbing action along the sur-

face of the free ends of the fibres that are still being held.

To obtain the above indicated effect of parallelization, it is preferred that said air flow is substantially homogeneous and its speed is at least 40 m/sec. To prevent disturbances in the homogeneous flow, it is preferred that said air flows in a direction oriented essentially parallel to the direction in which the fibres are fed. To obtain said rubbing effect, it is preferred that the speed of the air flow is more than 120 m/sec.

According to another aspect of the invention, there is provided a device for performing the above-defined method, said device comprising the feed roll and a curved receiving plate together forming a curved tapering channel, a pneumatic supply means having an air delivery duct substantially tangential to the circumference of said feed roll and comprising a first wall spaced from said roll and second wall opposed to said first wall and having an opening closed by a part of the circumference of said feed roll, in which opening said curved tapering channel discharges in a direction countercurrent to the air flow from said air supply means.

By these means the fibre web coming from the card can be compressed in said curved tapering channel and at the end of said channel be picked up by said air flow. While the rear ends of the fibres are still being held by the compressed part of the feed web, the leading ends are subjected to the air flow whereby they are bent in the direction of the air flow and are "combed out" of said web by said air flow.

To improve the feed action of the device, it is preferred that the surface of the receiving plate facing the roll is treated to lower the friction between said surface and the fibres, so that the web fed by the roll should slide as smoothly as possible through said curved tapering channel. Said treatment may comprise smoothing of said surface by fine polishing and subsequently an anti-friction coating.

To improve the feed action of the feed roll it is preferred that the circumferential surface of the feed roll contacting the fibre material has a non-stick high-friction character. It is possible to improve this by giving said roll an engraved surface consisting of small protruding lines extending substantially parallel to the roll axis.

To improve the holding action on the rear ends of the fibres and to improve the feed of the fibres to the air flow, it is preferred that the end of the receiving plate forms a small-angled nose rim with the wall of the air delivery duct downstream of said opening.

It is preferred that the source supplying the air flow is provided with means ensuring an even pressure drop over the width of the air delivery duct towards said nose rim.

To obtain as high as possible a speed for the air flow it is preferred that the air speed is raised by means of a pressure drop over the fibre delivery nose rim in the region of discharge of the fibres from the tapering channel and by an approximately venturi shaped cross section of the air delivery duct.

To feed the airborne fibres to the web forming means, it is preferred that the venturi shape of the air delivery duct ends into a parallel-sided or only slightly widening narrow channel having a length in flow direction of 5 mm up to 40 mm. By this the homogenous air flow of the air coming out of the venturi is ensured.

Devices according to the invention may be arranged for use with different types of fibres, such as the filaments, staple fibres or yarns referred to above. It will also be clear that it will be possible to combine a number of web-forming devices according to the invention for instance for forming a heavier web or for forming a web as a composite of different types of fibres.

With the method and device according to the invention it is possible to obtain a fibre web having no or relatively few broken fibres and in which the fibres are evenly distributed in a random way.

In the accompanying sectional drawing, a device according to the invention is schematically shown.

From a card (not shown) a web 1 of fibres, e.g. of staple fibres from a carding machine or the like, is fed without tension to a curved tapering channel 3 defined by a feed roll 4 and a curved plate 2. The plate is polished or in another way treated to obtain a low friction surface directed to said roll 4. The feed roll 4 is provided with a high-friction circumferential surface.

The end of the curved plate 2 is formed to a nose rim 6, defining the lower side of an opening 5 provided in a wall 9 and closed by the circumference of feed roll 4 that is urged to said opening 5 by a force 4a. Said wall 9 defines a duct, 7 together with wall 8. The roll 4 is in contact with the wall 9 at the upper end of the opening 5 and at a projecting portion 17, whereby the wall 9 in these regions acts as a sliding bearing for the roll. Connected to duct 12 remote from opening is a source 10 of pressurized air, having a grating 10a to obtain a uniform flow over the width of duct 12. The widening end 11 of duct 7 remote from said opening 5 is connected to a web forming device (not shown). The walls 8 and 9 are shaped in such a way that a venturi is formed upstream of the nose rim 6.

The device operates as follows:

The fibre web 1 is fed by its own weight into the curved tapering channel 3 between feed roll 4 and curved plate 2. Here the web is forwarded by the feed roll 4, assisted by the high friction surface of the circumference of said feed roll 4 and the low friction surface

of plate 2. As soon as the fibres reach opening 5 they are bent over nose rim 6 under the influence of the strong air flow originating from source 10. Here the fibres are parallelized by the combing effect of the airflow on the overhanging ends of the fibres before they are finally released from being held between the opposed surfaces of the feed roll 4 and the nose rim 6, and they are fed into duct 7 and through widening duct 11 to a web forming device.

Preferably, the circumferential speed of the feed roll is at least equal to the speed of the web coming from the card. The air speed in duct 7 is at least 40 m/sec and is preferably 120 m/sec or more to obtain the desired straightening and combing out of the fibres, and resulting therefrom the desired parallelism of the fibres. Duct 7 preferably widens slightly to prevent clogging and duct 11 widens to a greater degree to produce an equal slowing down of the fibres.

WHAT I CLAIM IS:—

1. Method for the production of dry laid non-woven webs from a feed of fibres in the form of filaments, staple fibres or yarns, comprising the steps of introducing into a pneumatic device a light-weight parallel web of the fibres, feeding the fibres through said device to a channel in which the fibres are held between opposed surfaces, subjecting the fibres to a strong air flow to pick up the fibres and form an airborne flow of substantially individualised fibres, and subsequently depositing said fibres to form a loose random laid fibre web by separating the fibres from said air flow.

2. Method according to claim 1 wherein said light-weight parallel fibre web is introduced into a slit-like curved tapering channel formed between a curved receiving plate and a feed roll rotating with a circumferential speed at least equal to the speed of said web, said web being fed as a continuously parallelized supply into said strong air flow the flow direction of which is substantially in countercurrent to that of the feed of fibres into the air flow.

3. Method according to claim 1 or claim 2 wherein said air flow is substantially uniform and its speed is at least 40 m/sec.

4. Method according to claim 3 wherein the speed of the air flow is greater than 120 m/sec.

5. Method according to any one of the preceding claims wherein said airflow is directed substantially parallel to the direction in which the fibres are fed.

6. Device for performing the method of any one of the preceding claims, comprising the feed roll and a curved receiving plate together forming a curved tapering channel, a pneumatic supply means having an air delivery duct substantially tangential to the circumference of said feed roll and comprising a first wall spaced from said roll and second wall opposed to said first wall and having an opening closed by a part of the circumference of said feed roll, in which opening said curved tapering channel discharges in a direction countercurrent to the air flow from said air supply means.

7. Device according to claim 6, wherein the surface of the receiving plate facing the roll periphery is treated to lower the friction between said surface and the fibres.

8. Device according to claim 7, wherein said surface is polished and is provided with a coating of anti-friction material.

9. Device according to any one of claims 6 to 8, wherein the circumferential surface of the feed roll has a non-stick high-friction surface for contact with the fibre material.

10. Device according to claim 9 wherein said roll has an engraved surface consisting of small protruding lines extending substantially parallel to the roll axis.

11. Device according to any one of claims 6 to 10, wherein one end of the receiving plate forms a small-angled nose rim with the wall of the air delivery duct downstream of said opening.

12. Device according to any one of claims 6 to 11, wherein said air supply means is provided with means ensuring an even pressure drop over the width of the air delivery duct towards said nose rim.

13. Device according to any one of claims 6 to 12, wherein the air speed is raised by means of a pressure drop over the fibre delivery nose rim in the region of discharge from said channel and by an approximately venturi shaped cross-section of the air delivery duct.

14. Device according to claim 13, wherein the venturi shape of the air delivery duct ends into a parallel or only slightly widening narrow channel having a length in flow direction of 5 mm up to 40 mm.

15. Device according to claim 14 wherein said narrow channel is succeeded by a progressively widening delivery duct to slow down the speed of the airborne fibres.

16. Device according to any one of claims 6 to 15, wherein said second wall comprises a portion constructed as a sliding bearing for the feed roll.

17. Apparatus comprising a plurality of devices according to any one of claims 6 to 16.

18. Method for the production of dry laid non-woven webs from a feed of fibres substantially as described herein with reference to the accompanying drawing.

19. Device for use in the production of dry laid non-woven webs from a feed of fibres constructed and arranged for use and operation substantially as described herein with refer-

ence to the accompanying drawing.

20. A fibre web obtained by the method of any one of claims 1 to 5 or 18 and/or the device or devices according to any one of claims 6 to 17 or 19.

MEWBURN ELLIS & CO.,
Chartered Patent Agents,
70—72 Chancery Lane,
London WC2A 1AD,
Agents for the Applicant.

Printed for Her Majesty's Stationery Office by the Courier Press, Leamington Spa, 1981.
Published by the Patent Office, 25 Southampton Buildings, London, WC2A 1AY, from which copies may be obtained.

1599880 COMPLETE SPECIFICATION
1 SHEET This drawing is a reproduction of the Original on a reduced scale