ABSTRACT

An improved sieve drum device for bonding of textile material containing thermoplastic binder fibers which become tacky or melt upon the application of heat, which comprises a first sieve drum means subjected to a suction draft and rotatably mounted in a housing for heating the textile material, rolls located at the outlet of the housing for applying pressure to the textile material, and a second sieve drum means for cooling of the textile material, the first sieve drum means being operatively associated with means for providing a fresh air intake opening adjacent to the rolls.

9 Claims, 1 Drawing Figure
SIEVE DRUM DEVICE FOR THE BONDING AND STRENGTHENING OF FELT AND SIMILAR PRODUCTS

This invention relates to an improved sieve drum device and process for the bonding and strengthening of fleece, stitched or needled felts, felt and similar products by means of thermoplastic binder fibers contained in the fleece, which are made to become tacky or to melt by a shock-like heat treatment. More particularly, this invention relates to an improvement in the sieve drum device comprising a housing with a first sieve drum subjected to a suction draft and rotatably disposed therein for the heat treatment of the textile material, followed by a pair of rolls, which are associated with a second sieve drum unit subjected to a suction draft for cooling, e.g. fixation or setting, of the felt, disclosed in U.S. Pat. No. 3,619,322.

The use of fusible fiber bonding has been well-proven in practice. The nonwoven textiles obtained in this manner are capable of exhibiting a uniform strength over their cross section, due to the thorough intermixing of the textile material to be bonded with the fusible fibers. The process disclosed in the heretofore described U.S. patent proposes to effect the treatment of such nonwoven fabrics interspersed with fusible fibers with the aid of the throughflow principle (i.e. with sieve drum means), since in this way the immediate heating of the material to the treatment temperature is possible simultaneously over the entire cross section. This also ensues in a uniform bonding over the cross section.

U.S. Pat. No. 3,619,322 suggests, for the treatment of the material by means of throughflow principle, an apparatus consisting of a sieve drum unit for heating the textile material containing synthetic bonding fibers, a leveling or conditioning device, and a sieve drum unit for cooling the textile material. This series of units proved to be most appropriate. However, such apparatus requires special constructional designs which render it usable specifically for this application.

The essential requirement to be met by such an apparatus is not only the possibility of treating a certain product of a specific composition at a predetermined delivery speed, but, rather, also the possibility of bonding on such an apparatus all other imaginable nonwoven fabrics with fusible fibers (or bonding fibers) contained therein, namely, for example, products having a smooth structure on both surfaces, as well as the so-called textured material which exhibits at least on one surface a particularly voluminous surface texture. However, if such a material is pressed on the fabric face, for example, by the above-mentioned leveling device, the voluminous surface texture becomes flat, which, of course, is undesirable.

Starting with the apparatus according to the U.S. Pat. No. 3,619,322, this invention has for its objective the provision of a sieve drum device which makes it possible, in its individual constructional details, to conduct an optimum treatment of all possible nonwoven fabrics with binder or fusible fibers contained therein. Thus, the device is to be universally applicable to this field of nonwoven application.

The device of this invention is characterized in that the pair of cooling rolls is disposed directly at the outlet of the first sieve drum housing; the rolls are pressed against each other at a variable pressure, for example, hydraulically or pneumatically; and the sieve drum is associated, across its operating width in the zone covered by the textile material to be treated and in the zone of the pair of cooling rolls, with a fresh air intake opening which is preferably adjustable in its opening cross section, i.e., the size of the opening is controlled.

By means of a sieve drum heating device constructed in this manner, any imaginable type of bondable textile material can be treated in the desired way without the danger of inappropriate treatment.

For example, if it is intended to produce lining fabrics, cleaning rags, or the like, wherein a thorough bonding, a uniform fusion of the fibers over the cross section, and a homogeneous smoothness of both surfaces are desirable, the pair of pressure rolls, the rolls of which preferably rotate in a driven manner and are optionally even coated with “Teflon,” will exert increased pressure on the material. A firm, uniformly strong product is the result of such treatment. However, if it is intended to pass a textured material through the machine, the face of which is, of course, not in contact with the surface of the sieve drum, this material must not travel through the pair of pressure rolls, since otherwise the desired texture on one surface would be lost. In this instance, by means of the otherwise closed-off fresh air intake opening at the outlet end, cold air is applied by the suction draft of the fan to the material exiting from the sieve drum; consequently, the textile material is at least partially set or fixed prior to contacting a roll of the pair of pressure rolls, and even guide rolls do not leave impressions any more on the textile material. In this connection, it is advantageous to move the pressure rolls apart, for example, by lifting the upper roll by a spring force and pressing the upper roll downwardly against the spring force by pneumatic or hydraulic means. Of course, the drive, i.e., the mechanism for rotating the roll, of this lifted roll should be disengaged during this lifting step.

If it is intended to bond textile material to be leveled by the pair of pressure rolls on the machine, then fresh air must also be continuously fed to the treatment atmosphere during this process. Since, in this case, the fresh air intake opening at the material outlet is to be closed, a further development of the apparatus of this invention provides a further air intake opening at the inlet of the apparatus, in addition to the opening at the outlet, the opening cross section of this further opening being likewise preferably adjustable and sealable.

Thus, the fresh air can be conducted, as desired, through one of the two openings or also through both openings into the sieve drum heating device or unit. By means of the respectively opened cross sections of these openings, the amount of the treatment gases discharged from the conventional air exhaust of the device is likewise controlled.

In addition to the aforementioned possibility for adjusting the device in dependence on the textile material to be treated, the device should also be adjustable with respect to the respective feeding speed of the textile material. However, such a device can only be equipped with a sieve drum of a certain diameter which is not variable. By varying the feeding speed, the treatment period is necessarily likewise changed, which must be avoided for obtaining a constantly uniform, high-quality product. The device according to this invention is usable universally also in this respect, by providing, for example, that the fan is variable (i.e., the fan can be adjusted) in its output (i.e., the suction draft applied to the sieve drum), for instance by means of a slip-ring...
rotor engine, by means of a d.c. motor, or a proportional variable transmission drive.

A further, optionally more satisfactory measure for obtaining the same effect in the control of the suction draft is the provision of a variable internal cover which is to be arranged in addition to the customary cover in the area of the sieve drum not covered by the material. This additional internal cover serves to shield, as desired, a portion of the periphery of the sieve drum covered by the material against the suction draft in the inlet zone of the device, so that the effective treatment surface of the sieve drum is reduced. In other words, the peripheral surface of the drum through which the treatment medium passes is reduced. Also, this additional inner cover can be made to be air-permeable, e.g. it can be perforated or provided with louvers. This feature can also effect an adjustment of the effective treatment time and the magnitude of the suction draft.

Textile materials of the abovementioned bondable type which are uniformly provided with binder or fusible fibers over the entire cross section have an appearance on their faces which only slightly resembles a textile material. In many cases, the products have an undesirably hard surface. As a remedy, the above-mentioned textured material was developed which, however, is expensive in its manufacture. The same holds true for a layered material. This disadvantage can be eliminated by a remarkably unique and simple improvement of the sieve drum device, and a product can be obtained thereby which has maximum textile properties and thus is uniformly interspersed with binder fibers. The improvement to the sieve drum device consists in providing, in the zone between the first and the second sieve drums, a heating unit which subjects preferably the backside of the material to a high-energy radiation, for example, an infrared heating device. By heating the material on the first sieve drum to up to about 5°-15°C. below the boiling temperature of this material, and then effecting an additional heating step with the aid of the infrared heating device (which should heat the material only on one side, namely, on the backside, up to the boiling temperature) then the material, after being cooled on the second sieve drum, will have the above-mentioned disadvantageous feel or handle only on the backside, while the desired textured character is obtained on the face side, which need not be heated to the boiling temperature.

By means of the above construction, the sieve drum device can be adapted as desired to the product to be treated in each individual case, without altering the external design of the device. It is possible to bond on this device textured material, as well as smooth material, e.g. lining fleeces, cleaning rags, and the like; considering the delivery speed provided by the units connected in front of the sieve drum device, the treatment time can be kept constant or it can be varied.

The drawing shows schematically an embodiment of the device of the present invention.

A textile treating plant consists of a fleece laying device 1, a needling machine 2 which receives the fleece 3, fed by the laying device 1 to be needled therein, a cooling drum having drum 5 attached thereto, and a take-up means 6. The elements 1, 2, 6, and also the spray bonding device 7 illustrated between the needling machine 2 and the sieve drum device 4 do not form a part of this invention, but only serve to explain the operation of the sieve drum device of the present invention. The fleece laying device 1 imposes its production speed on all units. Such a device can operate, due to its construction and due to the delivery speed of the fleece from the textile preparing machines connected in front thereof, only at a relatively low speed of, for example 10-15 meters per minute, so that a sieve drum 8, only one-half of which is surrounded by the fleece, is fully sufficient as a heating unit for the fleece. The area not covered by the material 3 is shielded from the suction draft of the fan 10 by means of an inner baffle or cover 9. The fan is disposed at the front face of the sieve drum 8 in a fan chamber separated from the treatment chamber (which arrangement is similar to that disclosed in U.S. Pat. No. 3,619,322). The fan blows the treatment medium from the front face downwardly in the direction toward the heating units 11 located in the bottom portion of the housing. After heating, the gas medium passes, for flow equalization, through the perforated metal plate 12 into the upper treatment chamber and thus to the fleece 3. The fleece is passed through by the gaseous treatment medium due to the suction draft and is thus heated to the treatment temperature in a minimum amount of time.

The construction of the sieve drum heating device 4 has two fresh air intake openings for controlling the fresh air required for the treatment and for the timely fixation of the condition attained by the heating step; one opening 13 is arranged at the inlet, and another opening 14 is arranged at the outlet. Both openings are adjustable in their opening cross sections by means of flaps 15 and 16, respectively. In correspondence with the taken-in amount of fresh air, a certain quantity of gas will be discharged from the apparatus through the waste air pipe 17 in the upper portion of the treatment chamber.

A cooled pair of pressure rolls 18 is disposed directly at the outlet of the housing. The rolls are driven, and the contact pressure of the upper roll is made variable on the lower roll by means of a pneumatic or hydraulic device 19. Also, the upper roll can be lifted off the lower roll by unit 19.

Once a textured synthetic textile material has been prepared for the treatment by the laying unit 1 and has been formed by means of the needling machine 2, the fresh air intake opening 13 is closed and the outlet opening 14 is opened. Simultaneously, the upper roll of the pair of pressure rolls 18 is lifted and disengaged from its drive. By the fresh air taken in at the outlet, the heated and partially tacky textile material is thus rapidly cooled and fixed or set, and consequently a contacting of the face side of the textured material with the lower roll of the pair of pressure rolls 18 has no longer any effect on the surface characteristic of the material, and the same holds true for the final treatment on the cooling drum 5 under a suction draft.

In addition to these measures for controlling the quality of the material, it is also possible to vary the treatment time, with the drum diameter and the rotational speed of the drum remaining the same, by means of the fan speed which is controllable in its effect. Furthermore, by the additionally provided inner baffle or cover 9, arranged to be telescopically displaceable with respect to the internal cover 9, it is likewise possible to vary the duration of treatment by the treatment medium. Also, this inner cover should be adjustable in its air permeability, for example, by means of variable, louver-type apertures, which makes it possible to vary the extent of the suction draft effective at the inlet as
desired. Thus, for example, material sprayed with a binder liquid or liquor by means of the device 7 can also be treated on this sieve drum unit without disadvantage. In place of the spraying device 7, a paddler or the like device for applying a treating liquid such as the binder liquid to the fleece can also be provided. Fleeces of a high binder bath absorption of, for example, 300-500% can be dried and bonded. In this connection, a reduced suction draft is important in the first drying zone, so that the binder liquor is not removed by too high a suction draft. With further drying on the drum, the binder liquor is thickened, so that there is no danger of removing this liquor even in case of higher suction drafts.

The louver can be formed, according to this invention, by two superimposed, perforated plates, one of which is replaceable. By the shifting of one of the plates, the holes can be covered entirely or partially and thus the opening cross section through the louver can be varied.

The sieve drum device can also be used, by a special mode of operation, for the production of a material which, with a uniformly distributed binder or bonding fiber content over its cross section, has a hard handle only on one side and, on the other side, a textile-like handle. For this purpose, the material is heated on the sieve drum 8 only up to a few degrees below the bonding temperature of the binder fiber material and, after leaving the unit 4, heated on its backside to the bonding temperature by the infrared heating device 21. A press can follow thereafter. Thus, the face side remains unbonded as a result thereof, but the product in total has sufficient resistance to withstand the required stresses.

While the novel embodiments of the invention have been described, it will be understood that various omissions, modifications and changes in these principles may be made by one skilled in the art without departing from the spirit and scope of the invention.

What is claimed is:

1. In a sieve drum device for the bonding of fleece, needled felt, felt, and similar textile material products by means of thermoplastic binder fibers contained in the textile material which are made to become tacky or to melt by a shock-like heat treatment, wherein the device includes a housing with a first sieve drum means subjected to a suction draft and rotatably mounted in the housing for heat-treatment purposes, followed by a pair of pressure rolls, which rolls are followed by a second sieve drum means subjected to a suction draft for the cooling of the textile material, the improvement which is characterized in that the pair of rolls is disposed directly at an outlet of the first sieve drum housing for said textile material; the rolls can be pressed against each other under a variable pressure, by hydraulically or pneumatically operated means; and the first sieve drum means is associated, across an operating width of said first sieve drum means at a portion covered by the textile material with a first and a second fresh air intake opening means, said first air intake opening means being located at an inlet in said housing for said textile material and said second fresh air intake opening means being located at a zone adjacent to the pair of rolls, said fresh air intake opening means each being adjustable in its opening cross section and each being closable independently of the other.

2. The device of claim 1, in which the pair of rolls are driven.

3. The device of claim 1, in which first means are provided for lifting the top roll of the pair of rolls off the bottom roll, and other means are provided for pressing the top roll against the bottom roll in opposition to the force applied by said first means.

4. The device of claim 1, in which the suction draft is variably adjustable by means of a fan associated with the sieve drum.

5. The device of claim 1, in which a first inner sieve drum cover means is provided, in said first sieve drum means in the zone not covered by the textile material to be treated, and second inner sieve drum cover means adjustable in its degree of effectiveness is furthermore provided, in said first sieve drum means in the region of the inlet in the zone covered by the material.

6. The device of claim 5, in which the second inner cover means is formed so that it is telescopically displaceable over the first cover means.

7. The device of claim 5, in which the second inner cover means is fashioned to be air-permeable.

8. The device of claim 1, in which said pressure rolls are arranged when in an operative position to press against each other under said variable pressure and are arranged when in an inoperative position to be separated from each other.

9. The device of claim 8, in which said fresh air intake opening means is adjusted in an open position when said pressure rolls are in the inoperative position.