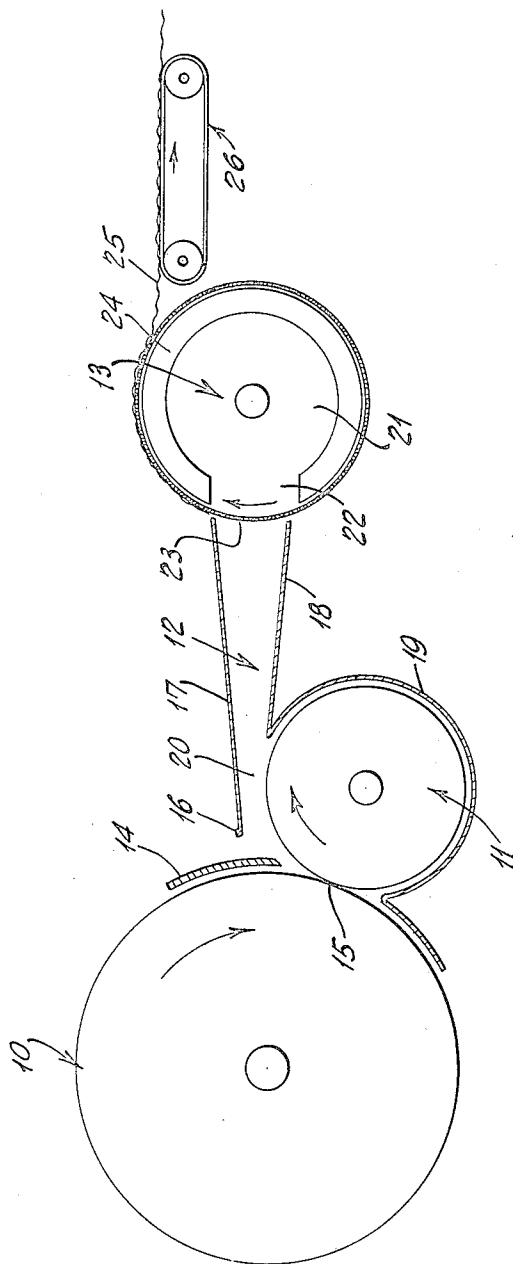


Jan. 24, 1956

H. O. KENNETTE ET AL
METHOD OF MAKING NONWOVEN FABRIC

2,731,679

Filed June 3, 1952



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METHOD OF MAKING NONWOVEN FABRIC

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Application June 3, 1952, Serial No. 291,464

3 Claims. (Cl. 19—156)

This invention relates to fibrous webs, and more particularly to an improved method for making an isotropic fibrous web.

Isotropic webs, wherein the fiber arrangement and web properties are substantially identical in all directions, are finding wide application in the manufacture of nonwoven fabrics, which can be used for such purposes as a base for plastic coating, shoulder padding, and the like.

Various methods for forming such a web are now well known in the art, as exemplified by the Wilson et al. Patent No. 2,477,675, wherein an air tunnel is provided adjacent to the doffer cylinder of a conventional card. A suction within the air tunnel removes the fibers from the doffer cylinder to give a dispersion of fibers in air. This dispersion is conducted through the air tunnel to a continuously moving condensing screen, where the web is formed. While this and other references describe various processes for making satisfactory isotropic webs, the production capacities of such systems are relatively low and it is difficult to prepare a uniform heavy weight web except at low linear production speeds. The fiber uniformity of the resulting web at this production speed, although acceptable in some end uses, is not as good as would be desirable.

It is an object of this invention to provide an improved method for the production of an isotropic web at an increased production rate.

It is another object of this invention to provide an improved method for the production of an isotropic web having an improved degree of uniformity.

The objects of the invention are accomplished by a process in which fibers are transferred from a card cylinder to the surface of a doffer cylinder rotating in the same angular direction as the card cylinder, removed from the teeth of the doffer cylinder by a moving stream of air, conveyed through an air tunnel and deposited onto a moving foraminous condensing screen, and continuously removed from the screen as a web.

The details of operation of the novel process of the invention will be more apparent from the following description of one embodiment thereof and consideration of the attached drawing, which is a vertical cross-sectional schematic view of the main cylinder of a conventional revolving flat-top card, a doffer cylinder, an air tunnel, and a condensing screen. It is understood that the ancillary features of this equipment, such as driving means, unshown parts of the card, the condensing screen and the blower are well known and described in the art.

Referring to the drawing, number 10 designates a conventional main cylinder, rotating in a clockwise direction in close relationship with conventional doffer cylinder 11, which is also rotating in a clockwise direction. An air tunnel generally designated at 12 is provided above doffer cylinder 11 for conveying fibers to condenser 13.

Plate 14 is positioned around the periphery of main cylinder 10. Conventional teeth on the surface of main cylinder 10, not shown, carry the fibers under plate 14 and down to transfer point 15, which is located at the

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point of closest distance between main cylinder 10 and doffer cylinder 11. A nose bar 16 is located within the crotch defined by main cylinder 10, doffer cylinder 11, and transfer point 15. Running to the right from nose bar 16 is a top cover 17 which defines part of air tunnel 12. Lower cover 18 defines the bottom of air tunnel 12 by extending from the doffer cylinder 11 to condenser 13. An arcuate cover 19 is provided around the doffer cylinder from its intersection with lower cover 18 around approximately to transfer point 15. It will be observed that there is an opening between plate 14 and nose bar 16 through which air is free to pass.

The air tunnel 12 is defined by top cover 17, lower cover 18, and two side members of conventional character, not shown, which extend between covers 17 and 18 to complete air duct 12. This air tunnel extends from nose bar 16, where it overlies a part of the crotch over adjacent transfer point 15, to condenser 13. The cross-sectional area of tunnel 12 may be uniform throughout its length with covers 17 and 18 in parallel relation but it is preferred that the vertical separation between covers 17 and 18 gradually increase when proceeding from throat 20 to condenser 13 to give a gradual increase in the air duct cross-sectional area.

The condenser 13 is of conventional design, including an internal chamber that is connected both to a vacuum system and to port 22 that communicates with tunnel 12. A foraminous screen 23 is revolved about cylindrical support 24. The web 25 that is formed on screen 23 is removed by a conventional conveyor belt system generally designated at 26.

The operation of this equipment is as follows. Chamber 21 of condenser 13 is connected to a vacuum system which sucks air in between nose bar 16 and doffer cylinder 11, through air tunnel 12, screen 23, port 22, and thus into chamber 21. The surface of doffer cylinder 11 is traveling, at transfer point 15, in a different linear direction than the surface of main cylinder 10. The main cylinder 10 of the card is rotated clockwise and preferably at a speed of 160–230 R. P. M., while the doffer cylinder is also rotated clockwise and preferably at a speed of at least 400 R. P. M. A mass of fibers is fed into the card in the conventional manner so that the fillet of main cylinder 10 gradually becomes loaded. As these fibers are brought to the proximity of transfer point 15, they are subjected to the action of teeth in the form of wires, not shown, on doffer cylinder 11, which transfers them from main cylinder 10 to doffer cylinder 11. It is preferred that the peripheral speed of the doffer cylinder be greater than the peripheral speed of the main cylinder and, under these conditions, a high drafting action is obtained at transfer point 15, with the result that the fibers are individualized, separated, and deposited upon the doffer cylinder surface in an extremely thin layer, or as individual fibers. However, a method of operation in which the peripheral speed of the doffer cylinder is equal to or less than the peripheral speed of the main cylinder gives a satisfactorily thin layer of fibers or individualized fibers on the doffer cylinder.

After the fibers have been deposited upon the surface of the doffer cylinder at transfer point 15, they are conveyed clockwise until they pass under nose plate 16. At this point the stream of air being sucked into air tunnel 12 begins to dislodge the fibers and disperse them within the air stream. This pneumatic doffing is complete at throat 20 and a uniform fiber-in-air dispersion is obtained. An important feature is the design of air tunnel throat 20, the size of which governs the cross-sectional area of the tunnel at this point. The cross-sectional area is such that the linear air speed through throat 20 is greater than the linear speed of doffer cylinder 11. There is thus obtained an aerodynamic removal of the individualized fibers.

The dispersion of fibers entering throat 20 travels through air tunnel 12 and is condensed upon screen 23 of condenser 13 in the form of web 25. Web 25 is removed from screen 23 and carried away to further operations by conveyor system 26, while the air is sucked through port 22 and into the vacuum system. Operation at higher speeds is possible when the cross-sectional area of air tunnel 12 is larger at port 22 than at throat 20. An abrupt change in cross-sectional area to give this enlargement will destroy the initial uniformity through the creation of areas of turbulence at the edges of the air stream. According to our invention, we have been able to overcome this difficulty by gradually increasing the cross-sectional area from throat 20 to port 22, as shown in the drawing. This enables us to operate at a high production speed and still obtain a uniform web.

The isotropic fibrous web formed in accordance with this invention is characterized by high uniformity and is suitable for subsequent bonding operations to give a non-woven fabric.

There are other variations in apparatus and method of operation which will be readily apparent to those skilled in the art upon reading the foregoing description of a preferred embodiment of the present invention. It is therefore, intended that such variations, modifications, and extensions of the basic principles involved may be made without departing from the spirit or the scope of the present invention, which is limited only in accordance with the following claims.

What is claimed is:

1. The method for forming an isotropic fibrous web which comprises feeding a mass of fibres to the main cylinder of a conventional card; transferring the fibers from the main cylinder to the surface of a conventional doffer cylinder revolving in the same angular direction as the main cylinder at a peripheral speed greater than the peripheral speed of the main cylinder, whereby the fibers are substantially individualized and separated from each other; pneumatically doffing the separated fibers from the doffer cylinder by a stream of air whereby the fibers are suspended in the stream of air; conveying the fibers and the air through a confined uninterrupted path to a foraminous condenser; separating the fibers from the air

upon the foraminous condenser to give a fibrous web; and removing the web from the condenser.

2. The method for forming an isotropic fibrous web which comprises feeding a mass of fibers to the main cylinder of a conventional card; transferring the fibers from the main cylinder to the surface of a conventional doffer cylinder revolving in the same angular direction as the main cylinder at a peripheral speed greater than the peripheral speed of the main cylinder, whereby the fibers are substantially individualized and separated from each other; pneumatically doffing the separated fibers from the doffer cylinder by a stream of air traveling at a linear velocity greater than the peripheral speed of said doffer cylinder, whereby the fibers are suspended in the stream of air; conveying the fibers and the air through a confined uninterrupted path to a foraminous condenser, the cross-sectional area of said path gradually increasing in the direction of air flow; separating the fibers from the air upon the foraminous condenser to give a fibrous web; and removing the web from the condenser.

3. The method for forming an isotropic fibrous web which comprises feeding a mass of fibers to the main cylinder of a conventional card; transferring the fibers from the main cylinder to the surface of a conventional doffer cylinder revolving in the same angular direction as the main cylinder at a peripheral speed at least about as great as the peripheral speed of the main cylinder, whereby the fibers are substantially individualized and separated from each other; pneumatically doffing the separated fibers from the doffer cylinder by a stream of air whereby the fibers are suspended in the stream of air; conveying the fibers and the air through a confined uninterrupted path to a foraminous condenser; separating the fibers from the air upon the foraminous condenser to give a fibrous web; and removing the web from the condenser.

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