

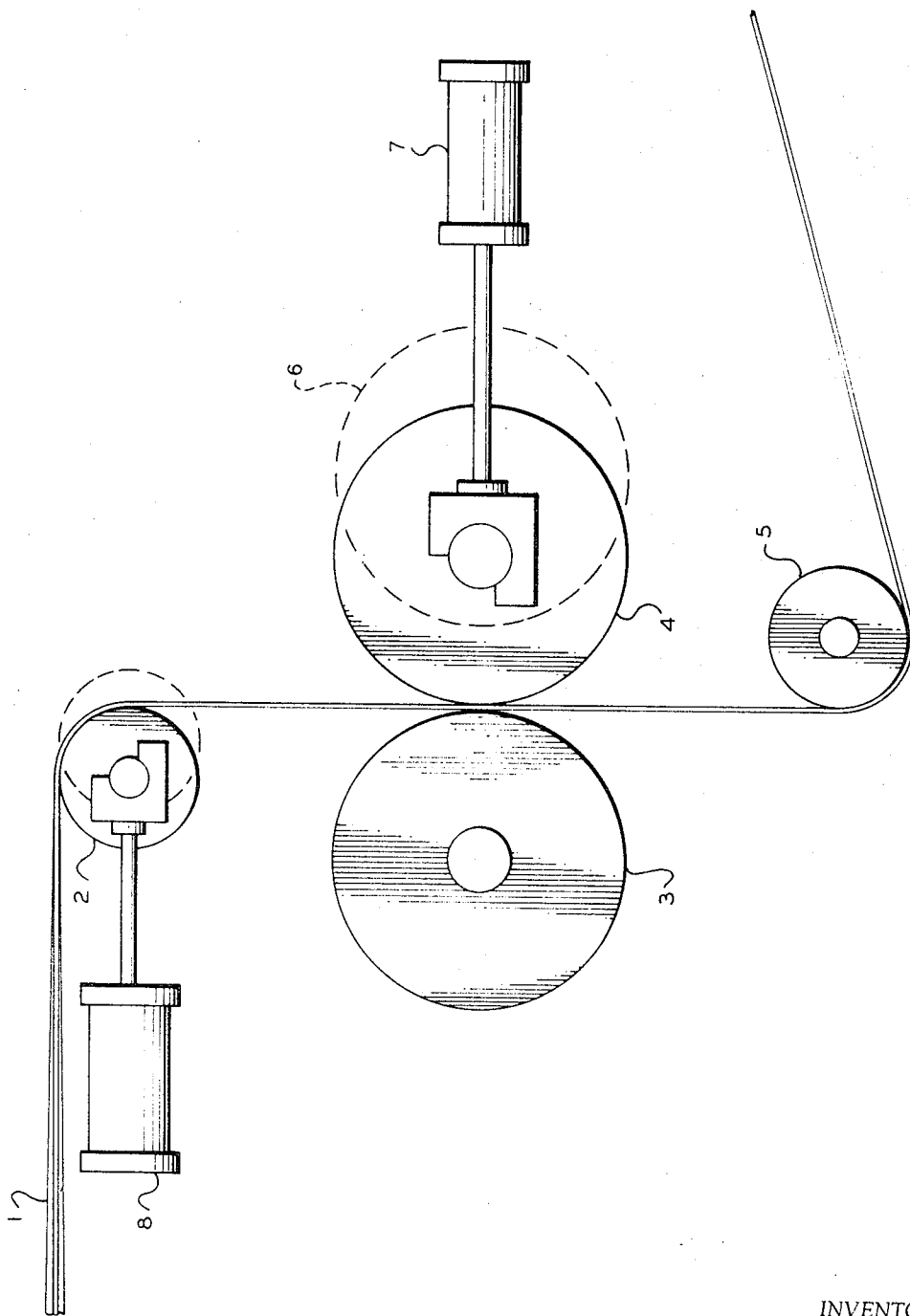
June 24, 1969

C. O. RAINS

3,452,128

METHOD OF BONDING NONWOVEN TEXTILE WEBS

Filed May 15, 1967



INVENTOR.
C.O. RAINS

BY *Young & Quigg*

ATTORNEYS

1

3,452,128

METHOD OF BONDING NONWOVEN TEXTILE WEBS

Cloral O. Rains, Bartlesville, Okla., assignor to Phillips Petroleum Company, a corporation of Delaware
Filed May 15, 1967, Ser. No. 638,230
Int. Cl. D04h 1/54

U.S. Cl. 264—126

9 Claims

ABSTRACT OF THE DISCLOSURE

A method of preparing a mat of fibers containing at least some thermoplastic fibers arranged in either ordered or random orientation which are bonded into a coherent web by at least partial fusing while the web is passed vertically through the nip of two heated rollers.

BACKGROUND OF THE INVENTION

It is known in the art that nonwoven coherent webs can be formed by depositing a mass of fibers in either random or ordered orientation to form a mat, and bonding the fibers together to form a web. One method of bonding the fibers is to pass the mat through a heating device wherein at least a portion of the fibers in the mat fuse, interlocking the individual fibers into a coherent web. This heating has been accomplished in a number of ways, none of which has proved entirely satisfactory for certain types of fabrics. A major difficulty with the prior art methods lies in the fact that the heating step must be carefully controlled to insure that the fibers are brought to the correct temperature and maintained at that temperature for the proper length of time and under carefully controlled pressure in order to produce the desired end product. Overheating of the mat will result in total fusion of the fibers, which is often undesirable, while underheating will cause insufficient fusion, resulting in a structurally weak web.

It is therefore an object of this invention to provide a method for bonding fibers into a coherent web under carefully controlled conditions of temperature and pressure whereby a web of uniform quality can be obtained.

SUMMARY OF THE INVENTION

According to my invention, the thermoplastic fibers in a mat are fused together by passing that mat vertically through the nip between two heated rollers. The passage of that mat in a vertical direction, either upwardly or downwardly, is necessary to obtain consistent quality in the bonded web. Attempts to practice my invention by passing the mat of fibers horizontally through a nip have been largely unsuccessful, apparently because of the tendency of the mat to wrap around the heated rollers with the consequent inability to closely control the length of time of the heating step.

DESCRIPTION OF THE DRAWING

The operation of my invention can be seen by reference to the drawing. A mat of fibers, which may or may not be interentangled, is shown at 1. This mat passes over retractable feed roll 2, and then passes vertically through the nip between heated rollers 3 and 4. These heated rollers are conveniently heated by steam or electrical coils, and are maintained at a temperature suitable to cause fusion of fibers within the mat. The pressure exerted on the fibers is determined by the size of the nip gap. This gap is ordinarily from 0.010 to 0.020 inch, depending upon the thickness of the mat and the desired pressure. The bonded web is passed over discharge roller 5 to further processing or packaging operations.

2

In order to prevent overheating in case of stoppage of the mat travel, heated roller 4 is retractable by means of hydraulic cylinder 7 to the position indicated by dotted lines 6. The gap between the two heated rollers when roller 4 is retracted is conveniently about 6 inches. The actuating device (not shown) which operates hydraulic cylinder 7 is also operatively attached to hydraulic cylinder 8. This cylinder advances the feed roller 2 horizontally about half the distance of the retraction of heated roller 4. Thus, the two hydraulic cylinders acting at the same time will open a gap between the two heated rollers, and simultaneously move the web formed to be centered between the two rollers, and out of contact with both of them. The actuating mechanism which operates hydraulic cylinders 7 and 8 is one which senses any stoppage of travel of the mat, and could be conveniently located on feed roll 2, discharge roll 5, or at any other point of the fiber feeding or web takeup means.

DESCRIPTION OF THE PREFERRED EMBODIMENT

The process of my invention can be used with any mat containing fusible organic thermoplastic fibers. The mat can consist entirely of such fusible fibers, or it can be a blend of fusible fibers with other synthetic or natural fibrous materials.

The mat may be formed by any conventional means. For example, the fibers could be supplied from a carding machine in the form of a unidirectionally oriented web, in which case all fibers would be oriented in the direction of the mat travel. Alternately, the fibers could be crosslapped by layering a unidirectionally oriented web from one or more cards or garnetts back and forth on a moving conveyor. In another embodiment, the fibers could be deposited on a conveyor belt by air deposition, giving a random orientation.

Mats formed by any of the above methods can be taken directly to the bonding process of my invention, or can be subjected to some preliminary treatment which would increase the coherency of the mat prior to heat bonding. In a preferred embodiment, the mat is subjected to a conventional textile needling operation prior to the fusion bonding process. When the mat is so needed, it can be observed that there is a difference in the two surfaces of them at. The side on which the needles enter is smoother than the other or nap side, and, in order to obtain satisfactory fusion, it is necessary to use a slightly higher roll temperature on the smooth side than on the nap side of the mat. The temperature difference between the two rolls in this embodiment is generally in the order of 5 to 10° F.

The heat fusible materials which can be used in forming mats for the process of my invention include substantially all of the synthetic organic thermoplastic materials. Polyolefins, such as the polymers of ethylene, propylene, butene, and copolymers thereof, are particularly suitable. Also suitable are polyesters, polyamides, polyurethanes, cellulose, and other known organic thermoplastics which are capable of being formed into filaments.

The characteristics of the bonded webs produced by the process of my invention can vary widely. By using high temperatures and small nip gap clearance, I can produce completely fused paper-like webs. By using only a small proportion of fibers which are fusible at the roll temperature, and providing a large nip gap, I can produce a very low density batting-like web. Intermediate density webs are produced by variations in temperature and nip gap clearance.

By use of blends of materials I can also vary the properties of the web produced. For example, a blend of about 20–25 percent fusible polyethylene with wool fibers

forms a good insulating batting. A blend of a small proportion of fusible polyethylene with foamed and crimped filaments of high melting point polyolefin, polyurethane or other synthetic filaments forms a batting-like web of excellent insulating properties, and one which is non-allergenic and resistant to organism growth.

Webs of fibers which are partly or completely fused have many textile applications; polypropylene web of medium density is suitable, for example, for carpet backing.

The temperature of said rollers will vary depending upon the melting point of the fusible fibers used. Generally the temperature of the rollers will be from about 300° F. to about 400° F.

The clearance in the nip will vary depending upon the thickness of the mat and the desired degree of compression and fusing. In general, a nip gap of .010" to .020" is suitable, but gaps considerably larger can be used for thick batting.

Reasonable variation and modification are permissible within the scope of my invention without departing from the spirit thereof.

I claim:

1. In a process for forming a non-woven a bonded web comprising synthetic organic thermoplastic fibers, wherein said fibers are accumulated in the form of a mat and said mat is exposed to sufficient heat and pressure to fuse at least some of said thermoplastic fibers and bond said fibers into a coherent web, the improvement comprising applying said heat and pressure by passing said mat vertically through the nip of a pair of heated rollers.

2. The process of claim 1, wherein the web, prior to the heating and pressing, comprises a mat of intertangled fibers.

3. The process of claim 1, where the web, prior to the heating and pressing, comprises a conventionally needled mat having a smooth side and a nap side.

4. The process of claim 3, wherein the roller adjacent said smooth side of said needled mat is at a higher temperature than the roller adjacent said nap side of the mat.

5. The process of claim 1 wherein said fibers are selected from polyolefins, polyesters, polyamides, polyurethanes, and cellulose, and blends thereof.

6. The process of claim 1 wherein only a portion of the fibers in said mat are fusible at the temperature and pressure conditions in the nip of said rollers.

7. The process of claim 1, wherein the web, prior to the heating and pressing, comprises unidirectionally oriented fibers.

8. The process of claim 1, wherein the web, prior to the heating and pressing, comprises crosslaid fibers.

9. The process of claim 1, wherein the web, prior to the heating and pressing comprises randomly oriented fibers.

References Cited

UNITED STATES PATENTS

2,688,380 9/1954 MacHenry ----- 156—180

FOREIGN PATENTS

642,522 6/1962 Canada.

DONALD J. ARNOLD, *Primary Examiner.*

J. R. HALL, *Assistant Examiner.*

U.S. Cl. X.R.

18—2, 10; 156—180; 264—122