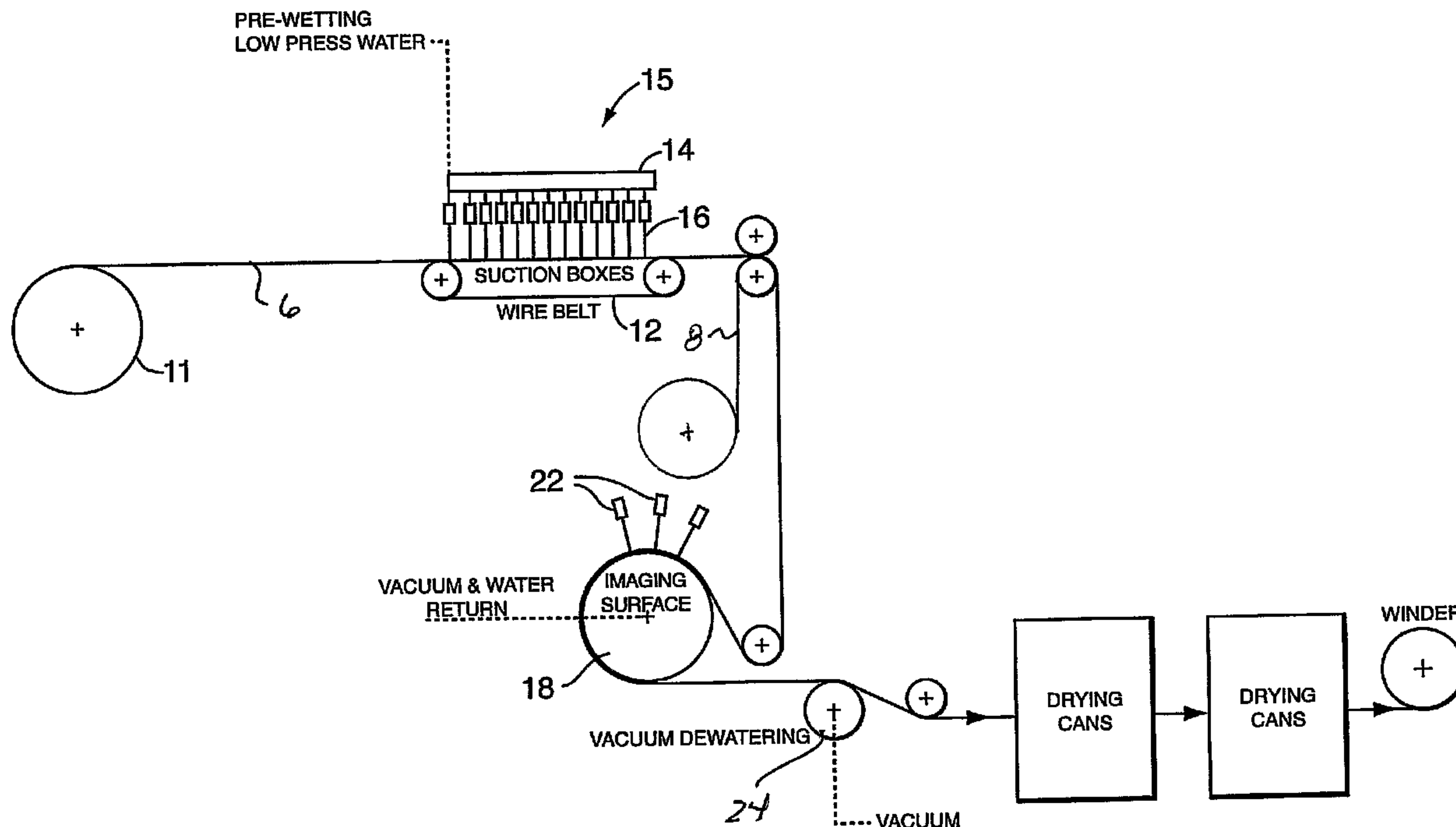




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(54) Titre : PROCÉDE DE FABRICATION D'UN LAMINE FILAMENTEUX ET PRODUITS ASSOCIES
 (54) Title: METHOD OF MAKING A FILAMENTARY LAMINATE AND THE PRODUCTS THEREOF



(57) **Abrégé/Abstract:**

The present invention is directed to a method of making a laminate nonwoven fabric which entails integration of a continuous filament web with a web of cellulosic fiber material, typically wood pulp. In order to abate loss of cellulosic fiber material during integration by hydroentanglement, the present invention contemplates that the continuous filament web is first subjected to hydroentanglement, with the cellulosic fibrous material thereafter integrated, by hydroentangling, into the partially entangled continuous filament web.

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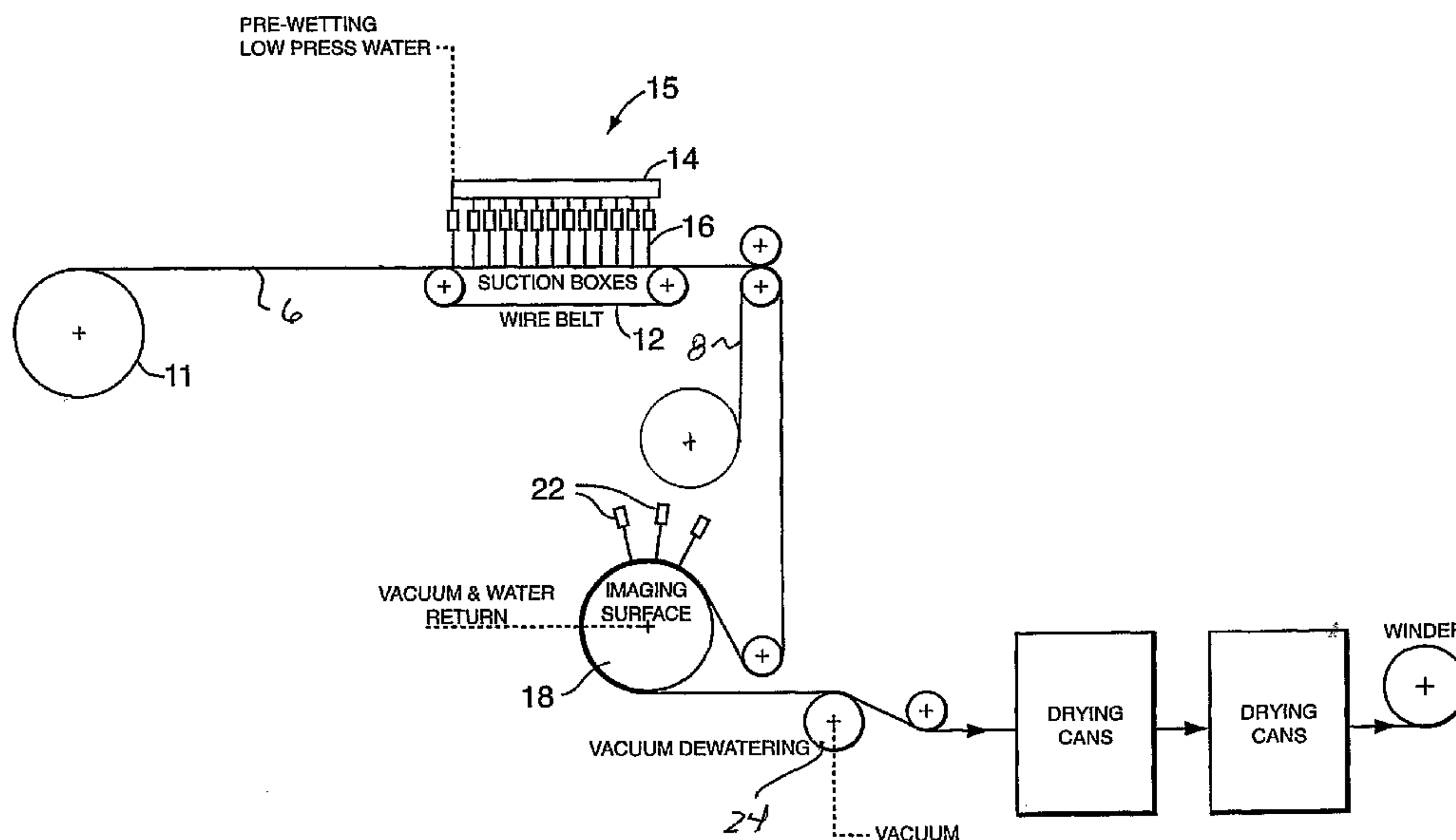
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(54) Title: METHOD OF MAKING A FILAMENTARY LAMINATE AND THE PRODUCTS THEREOF



(57) Abstract: The present invention is directed to a method of making a laminate nonwoven fabric which entails integration of a continuous filament web with a web of cellulosic fiber material, typically wood pulp. In order to abate loss of cellulosic fiber material during integration by hydroentanglement, the present invention contemplates that the continuous filament web is first subjected to hydroentanglement, with the cellulosic fibrous material thereafter integrated, by hydroentanglement, into the partially entangled continuous filament web.

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Method Of Making A Filamentary Laminate And The Products Thereof

Technical Field

[0001] The present invention relates generally to hydroentangled (spunlaced) nonwoven fabrics, and more particularly to hydroentangled laminate nonwoven fabrics formed from a continuous filament web and a cellulosic fiber web, which are integrated so that the cellulosic fibers become integrated with the continuous filament structure. The resultant fabric exhibits excellent strength and absorbency, and is particularly suited for use in hygiene, medical, and industrial applications.

Background Of The Invention

[0002] Nonwoven fabrics have found widespread application by virtue of the versatility afforded by the manner in which the physical characteristics of such fabrics can be selectively engineered. Formation of nonwoven fabrics by hydroentanglement (spunlacing) is particularly advantageous in that the fibers or filaments from which the fabric is formed can be efficiently integrated and oriented as may be desired for a specific application. Blends of different types of fibers can be readily combined by hydroentanglement so that resultant fabrics exhibiting selected physical properties can be fabricated.

[0003] Heretofore, nonwoven fabrics formed from blends of synthetic and cellulosic fibers have been known, with such fabrics desirably exhibiting physical properties which are characteristic of the constituent synthetic and cellulosic fibers. Typically, synthetic fibers can be formed into a fabric so that the characteristics such as good abrasion resistance and tensile strength can be provided in the resultant fabric. The use of cellulosic fibers provides such fabrics with desired absorbency and softness.

[0004] U.S. Patent No. 5,459,912, to Oathout, hereby incorporated by reference, discloses patterned, spunlaced fabrics formed from synthetic fibers and wood pulp which are stated as exhibiting good absorbency, and low particle counts. The fabrics are thus suited for use where these characteristics are desirable, such as for use as wipes in clean rooms, wipes for food service, and like applications. However, this patent contemplates integration of wood pulp fibers and synthetic fibers in a dry state, with subsequent hydroentanglement by treatment on one side only (*prior to aperturing*). It is believed that this results in significant loss of the wood

pulp fibrous material through the loosely bonded synthetic fibers, thus detracting from the efficiency of the manufacturing process.

[0005] Additionally, the juxtaposition of continuous filament webs and pulp fibers, with subsequent hydroentanglement has shown significant loss of the wood pulp fibrous material through the filaments due to the high level of porosity within the continuous filament web. A potential solution has been the utilization of very fine denier filaments so as to prevent the loss of the wood pulp fiber. A need remains for a method of making continuous filament and cellulosic fiber web laminates that doesn't require fine denier filaments.

[0006] Because laminate nonwoven fabric materials formed from continuous filament and cellulosic fibers can provide a combination of desirable physical properties, the present invention is directed to a method of making such a laminate nonwoven fabric which facilitates efficient fabric formation by abating loss of cellulosic fibers to the filtrate water during integration by hydroentanglement.

Summary of the Invention

[0007] The present invention is directed to a method of making a laminate nonwoven fabric which entails integration of a continuous filament web with a web of cellulosic fiber material, typically wood pulp. In order to abate loss of cellulosic fiber material during integration by hydroentanglement, the present invention contemplates that the continuous filament web is first subjected to hydroentanglement, with the cellulosic fibrous material thereafter integrated, by hydroentangling, into the partially entangled continuous filament web. This formation technique has been found to desirably abate the loss of the cellulosic fibers during the hydroentangling process into the filtrate water employed for hydroentanglement. The resultant fabric exhibits the desired blend of characteristics achieved by use of continuous filaments and cellulosic fibers together, with the manufacturing technique of the present invention desirably facilitating efficient and cost-effective formation of the present fabric.

[0008] In accordance with the present invention, a method of making a laminate nonwoven fabric comprises the steps of providing a continuous filament web and further comprises hydroentangling the continuous filament web to form a partially entangled web. This partial hydroentanglement desirably acts to integrate

the filaments and improve web uniformity, prior to introduction of the associated cellulosic fibrous material.

[0009] The cellulosic fibrous material of the present fabric is introduced by juxtaposing a cellulosic fibrous web with the partially entangled continuous filament web. The juxtaposed webs are then hydroentangled, and subsequently dried to form the present laminate nonwoven fabric. Notably, the pre-entanglement of the continuous filament web, prior to introduction of the cellulosic fibrous material, has been found to desirably minimize loss of the cellulosic material as the continuous filament and cellulosic webs are integrated by hydroentanglement. It is believed that the pre-entangled continuous filament web may desirably act to improve the uniformity of the filamentary web, as well as "filter" the cellulosic fibrous material, so as to minimize its loss to the filtrate water. Additionally, pre-entanglement of the continuous filament web desirably permits the use of reduced energy input for entangling the filamentary and cellulosic fiber webs, which is also believed to contribute to reduced loss of the cellulosic fibers. It is also believed that the ability to employ reduced energy input for entangling the component webs allows for maintaining the inherent bulk of the laminate nonwoven fabric, and thus allowing for improved absorbency with the increase in interstitial volume over a high-pressure hydroentangled nonwoven fabric.

[0010] Other features and advantages of the present invention will become readily apparent from the following detailed description, the accompanying drawing, and the appended claims.

Brief Description Of The Drawings

[0011] FIGURE 1 is a diagrammatic view of an apparatus for making a laminate nonwoven web embodying the principles of the present invention.

Detailed Description

[0012] While the present invention is susceptible of embodiment in various forms, there is shown in the drawing, and will hereinafter be described, a presently preferred embodiment, with the understanding that the present disclosure is to be considered as an exemplification of the invention, and is not intended to limit the invention to the specific embodiment illustrated.

[0013] With reference to FIGURE 1, therein is diagrammatically illustrated an apparatus for practicing the method of making a laminate nonwoven fabric embodying the principles of the present invention. The present laminate fabric is preferably formed from juxtaposed continuous filament webs and cellulosic fiber webs, which are subjected to hydroentanglement by direction of high-pressure liquid streams thereagainst, preferably first against one expansive surface of the juxtaposed webs and thereafter against the opposite expansive surface of the webs. It is within the purview of the present invention that each of the continuous filament and cellulosic fiber webs may be provided in the form of more than one web, thereby permitting the integration of different types of filaments, and/or different types of cellulosic fibers. It is also within the purview of the present invention that each of the filamentary and cellulosic fibers webs may be comprised of a homogenous component composition within the web, or in the alternative, comprised of a blend of differing component compositions. Additionally, the laminate of the present invention may include one or more discontinuous filamentary layers or film layers, wherein breathable, apertured, imaged films, or a combination thereof may be employed.

[0014] In the presently preferred practice of the present invention, the continuous filaments are provided in the form of self bonding spunbond web, while the cellulosic fibers are provided in the form of wood pulp fibers introduced in the form of a wetlaid web, commonly referred to as "tissue", subsequently integrated by hydroentanglement with the spunbond web (alternately airlaid pulp could be introduced at this point). Notably, the present invention contemplates that the spunbond web is subjected to hydroentanglement to form a partially entangled web prior to hydroentanglement of the cellulosic fiber web therewith. Formation in this fashion has been found to desirably abate loss of the cellulosic fibers during hydroentanglement with the spunbond web. Additionally, pre-entanglement of the spunbond web has been found to desirably enhance web uniformity, as well as permit the use of lower entangling pressures during integration of the cellulosic fiber web therewith, which is also believed to abate loss of the cellulosic fibers to the filtrate water employed during hydroentanglement.

[0015] As illustrated in FIGURE 1, the present invention contemplates the use of a spunbond web 6 for manufacture of the present laminate fabric. A spunbond process involves supplying a molten polymer, which is then extruded under pressure through a large number of orifices in a plate known as a spinneret or die. The resulting continuous filaments are quenched and drawn by any of a number of methods, such as slot draw systems, attenuator guns, or Godet rolls. The continuous filaments are collected as a loose web upon a moving foraminous surface, such as a wire mesh conveyor belt. When more than one spinneret is used in line for the purpose of forming a multi-layered fabric, the subsequent webs are collected upon the uppermost surface of the previously formed web. Further, the addition of a continuous filament fabric may include those fabrics formed from filaments having a nano-denier, as taught in U.S. Patents No. 5,679,379 and No. 6,114,017, both incorporated herein by reference. Further still, the continuous filament fabric may be formed from an intermingling of conventional and nano-denier filaments.

[0016] The thermoplastic polymers of the continuous filament web may be chosen from the group consisting of polyolefins, polyamides, and polyesters, wherein the polyolefins are chosen from the group consisting of polypropylene, polyethylene, and combinations thereof. It is within the purview of the present invention that the continuous filament web or webs may comprise either the same or different thermoplastic polymers. Further, the continuous filaments may comprise homogeneous, bi-component, and/or multi-component profiles, as well as, performance modifying additives, and the blends thereof.

[0017] Subsequent to manufacture of the continuous filament web, the web is further integrated by the impingement of hydraulic energy at 15 by liquid streams 16 from manifold 14, so as to partially entangle the web prior to receiving a layer of pulp 8. The continuous filament web 6 may be directly advanced onto an entangling belt 12, wherein the process is completed in-line or alternately, the continuous filament web may be wound, transferred to an unwind station 4, and unwound onto a separate entangling apparatus.

[0018] At this stage of the process, a cellulosic fiber web 8 is juxtaposed with the partially entangled continuous filament web for formation of the present laminate

nonwoven fabric. The cellulosic fiber web 8 is preferably provided in the form of a wetlaid web, but it is within the purview of the present invention to provide the cellulosic fibrous material in other forms. The juxtaposed continuous filament and cellulosic fiber webs are subjected to hydroentanglement under the influence of reduced-pressure liquid streams generated by suitable manifolds positioned above an entangling belt.

[0019] In accordance with the preferred practice of the present invention, reduced-pressure liquid streams from the manifolds 22 are directed against a first expansive surface of the juxtaposed webs which can be the surface comprising fiber web 8 as illustrated. Entanglement can be effected on a three-dimensional image transfer device 18, or other suitable foraminous entangling device. Thereafter, the webs are directed about another entangling drum (not shown), with reduced-pressure liquid streams directed against the opposite expansive surface of the webs. The now integrated webs can be transferred over a dewatering slot at 24, then dried and wound for storage and shipment.

[0020] Hydroentangling the spunbond layer prior to incorporating the pulp layer, optimizes the measure of cellulosic fiber within the product due to the reduced amount of cellulosic fiber to be washed away through the spunbond layer during the hydroentanglement process. As a result, wipe products exhibit improved absorbency when utilized in a dry state and retains aqueous additives better when utilized in a wet state.

[0021] It is within the purview of the present invention that the laminate nonwoven fabric be treated with one or more mechanical or chemical post treatments. For instance, the resultant fabric may be mechanically compacted and/or additives imparted to achieve a specific performance within the fabric. Such additives may include pigments, thermochromics, fragrances, emollients, natural herbs and botanicals, UV chemistries, antimicrobials, and the combinations thereof, as well as various other performance or aesthetically modifying additives. The laminate of the present invention is suitable for various hygiene, medical, and industrial end-uses, including but not limited to wipes, drapes, protective covers.

[0022] Optionally, the entangled nonwoven laminate may be imparted with a three-dimensional image. The entangling apparatus may further include an imaging

foraminous surface, such as a three-dimensional imaging drum comprising a three-dimensional image transfer device for effecting imaging of the now-entangled laminate. Such three-dimensional image transfer devices are disclosed in U.S. Patent No. 5,098,764, which is hereby incorporated by reference. The image transfer device includes a moveable imaging surface which moves relative to a plurality of entangling manifolds which act in cooperation with three-dimensional elements defined by the imaging surface of the image transfer device to affect additional imaging and patterning of the fabric being formed.

[0023] As will be appreciated, a fabric formed in accordance with the present invention need not be subjected to hydroentangling treatment by direction of hydraulic water jets against both expansive surfaces of the fabric as it is formed. Additionally, it will be recognized that the illustrated nip rolls can be utilized to improve fabric density, and reduce the moisture content of the web prior to drying.

[0024] From the foregoing, numerous modifications and variations can be effected without departing from the true spirit and scope of the novel concept of the present invention. It is to be understood that no limitation with respect to the specific embodiment disclosed herein is intended or should be inferred. The disclosure is intended to cover, by the appended claims, all such modifications as fall within the scope of the claims.

What Is Claimed Is:

1. A method of making a laminate nonwoven fabric, comprising the steps of:
providing a continuous filament web;
hydroentangling said continuous filament web to form a partially entangled web;
juxtaposing a cellulosic fiber web with said partially entangled web;
hydroentangling said juxtaposed partially entangled web and cellulosic fiber web; and
drying said hydroentangled webs to form said nonwoven fabric.
2. A method of making a laminate nonwoven fabric in accordance with claim 1, wherein said continuous filament web may be selected from the group consisting of polyolefins, polyamides, polyesters, and the blends thereof.
3. A method of making a laminate nonwoven fabric in accordance with claim 2, wherein said polyolefins may be selected from the group consisting of polypropylene, polyethylene, and combinations thereof.
4. A method of making a laminate nonwoven fabric in accordance with claim 1, wherein said step of hydroentangling said juxtaposed webs comprises first directing high-pressure liquid streams against a first expansive surface of said juxtaposed webs, and thereafter directing high-pressure liquid streams against an opposite expansive surface of said juxtaposed web.
5. A method of making a laminate nonwoven fabric in accordance with claim 1, wherein said laminate comprises additional wood pulp layers, continuous or discontinuous filaments layers, film layers, or a combination thereof.
6. A method of making a laminate nonwoven fabric, comprising the steps of:
providing a continuous filament web;
providing a foraminous surface;
hydroentangling said continuous filament web to form a partially entangled web;
juxtaposing a cellulosic fiber web with said partially entangled web;

advancing said juxtaposed partially entangled web and cellulosic fiber web onto said foraminous surface and hydroentangling said webs on said surface so as to impart at least one three-dimensional image into said laminate; and drying said hydroentangled webs to form said nonwoven fabric.

6. A method of making a laminate nonwoven fabric in accordance with claim 6, wherein said foraminous surface is a three-dimensional image transfer device.

7. A method of making a laminate nonwoven fabric in accordance with claim 6, wherein:

said step of hydroentangling said juxtaposed partially entangled web and paper web comprises first directing high-pressure liquid streams against a first expansive surface of the juxtaposed webs, and thereafter directing high-pressure liquid streams against an opposite expansive surface of said juxtaposed web.

8. A method of making a laminate nonwoven fabric as in claim 1, wherein said laminate is a wipe.

9. A method of making a laminate nonwoven fabric as in claim 6, wherein said laminate is a wipe.

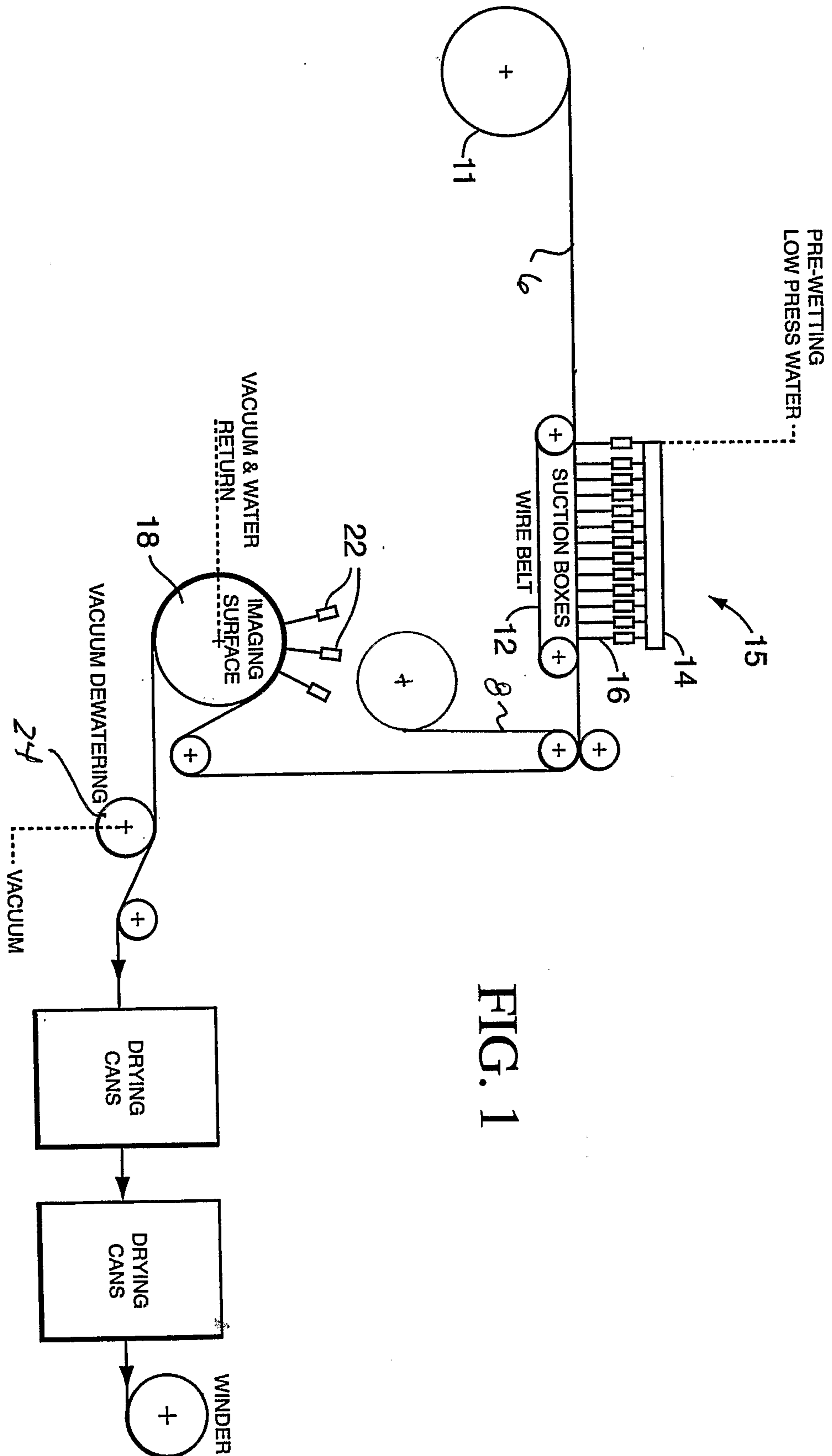


FIG. 1

