May 30, 1967 F. H. OSBORNE 3,322,617

PAPER MAKING APPARATUS TO FORM PAPER WITH A SIMULATED WOVEN TEXTURE

Filed May 22, 1964

4 Sheets-Sheet 1

FIG. 1

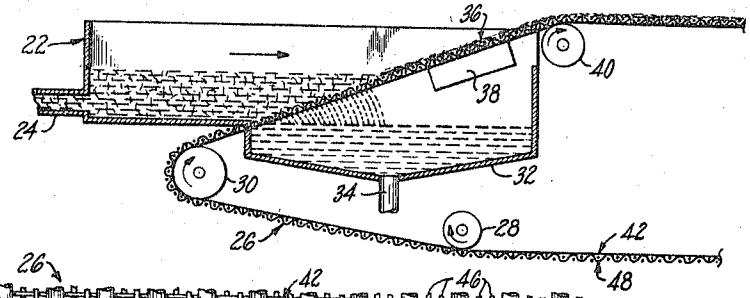
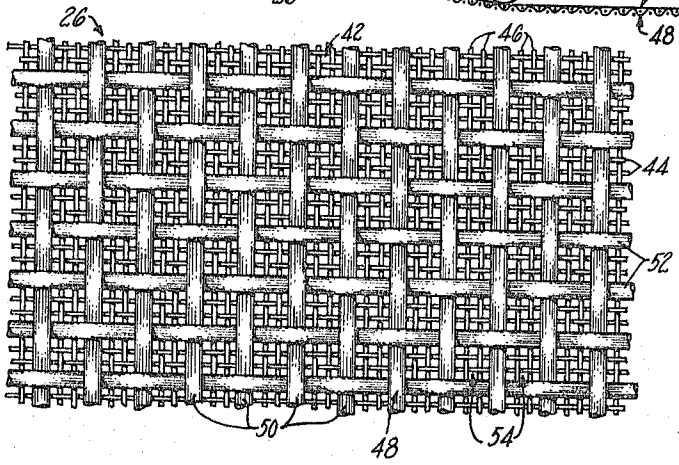


FIG. 2



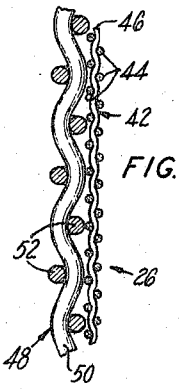


FIG. 3

FIG. 4

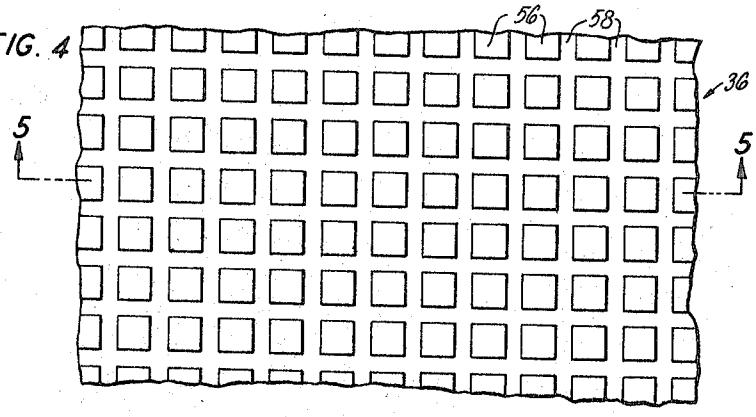


FIG. 5

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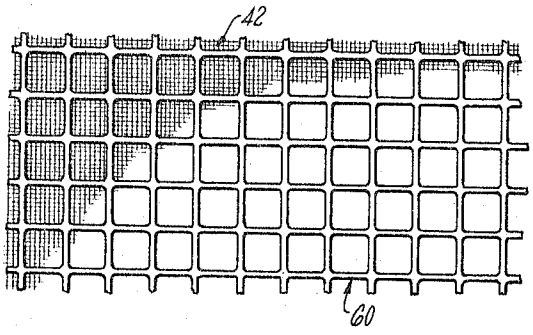
FIG. 6



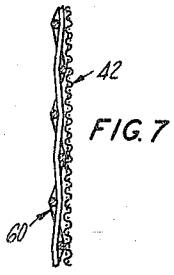
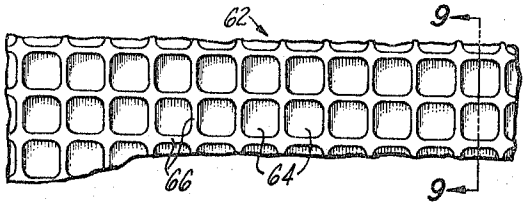


FIG. 7

FIG. 8



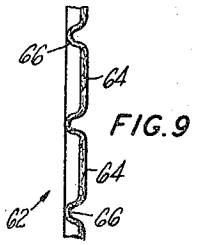
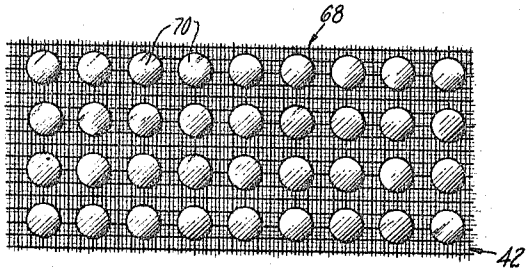


FIG. 9

FIG. 10



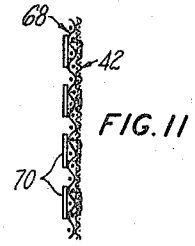
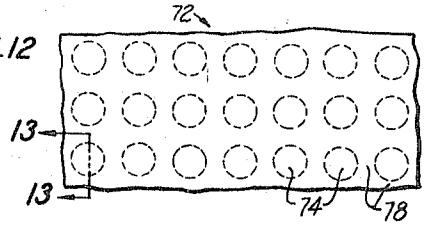


FIG. 11

FIG. 12



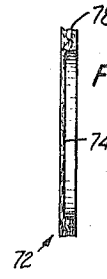


FIG. 13

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FIG. 14

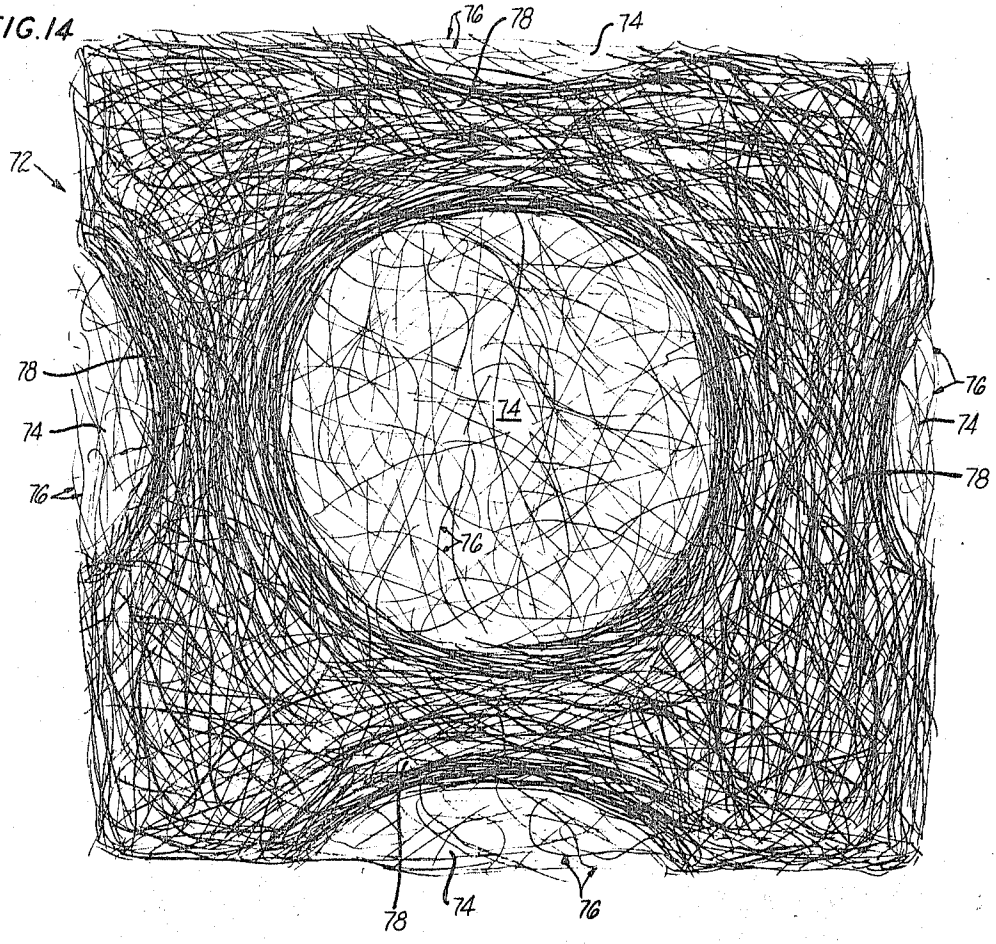

FIG. 21

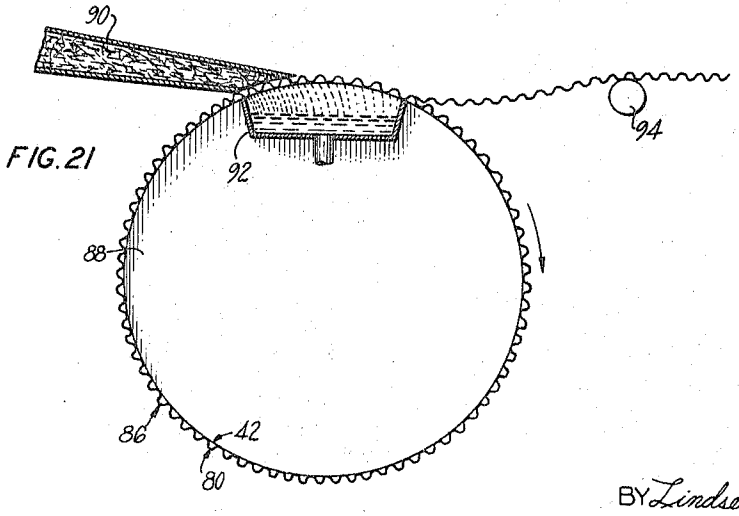

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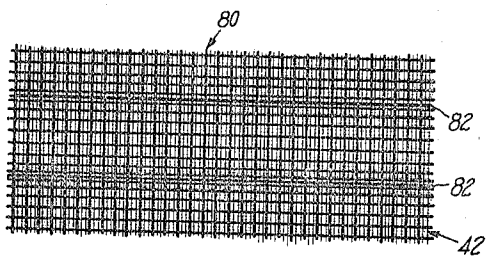
FIG. 15



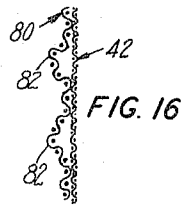


FIG. 16

FIG. 17

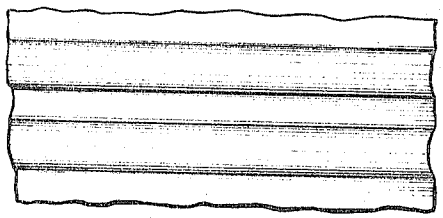


FIG. 18

FIG. 19

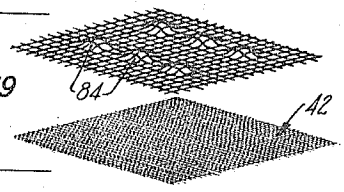


FIG. 20

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United States Patent Office 3,322,617
Patented May 30, 1967

3,322,617

PAPER MAKING APPARATUS TO FORM PAPER WITH A SIMULATED WOVEN TEXTURE

Fay H. Osborne, Windsor Locks, Conn., assignor to The Dexter Corporation, a corporation of Connecticut

Filed May 22, 1964, Ser. No. 369,420
8 Claims. (Cl. 162—296)

The present invention relates generally to the production of nonwoven fibrous web material utilizing new and improved papermaking techniques. More particularly, it relates to new and improved wet formed nonwoven fabrics exhibiting the appearance and characteristics of woven cloth, and to a new and improved wet processing technique and apparatus for making such fabrics.

Nonwoven fabrics of various types have become increasingly important during the past few years due primarily to the low cost of manufacture as compared to conventional textile spinning and weaving operations. These nonwoven fabrics are generally made by forming a fibersheet or web using textile-length fibers; i.e., staple lengths of one-half to two inches, and thereafter subjecting the web to coalescing or bonding operations to hold the individual fibers together. The fabrics have been made predominantly on dry processing machines, for example, by air deposition techniques or on carding machines wherein the fibers are oriented in the machine direction; i.e., the direction in which the web is produced.

In conventional papermaking processes fibrous webs classified as paper rather than nonwoven fabrics have long been produced. In accordance with papermaking techniques, fibers are dispersed in an aqueous carrier which is permitted to flow through a moving screen or Fourdrinier wire thereby depositing the fibers on the wire in the form of a paper web. However, since papermaking techniques require the use of an aqueous dispersion of the fibers, it is necessary to use water dispersible fibers which are fibers of relatively short length. The fibers generally utilized range from practically negligible lengths up to lengths of the order of three-eighths inch. In most cases the paper products are relatively dense, stiff and lack the porosity, hand and texture of nonwoven fabrics. By the use of special techniques it is possible to form long fibered, porous paper, but even these do not exhibit the requisite textile-like drape, hand or loft characteristic of woven fabrics.

Accordingly, a principal object of the present invention is to provide a new and improved wet processing technique and apparatus for producing nonwoven fabrics and a novel fabric produced thereby.

An important object of the present invention is to provide for the wet processing of soft web material exhibiting good flexibility even in heavy webs and possessing a clothlike contoured appearance of a more pronounced nature than that produced by calender rolls while at the same time obviating any loss in strength due to breaking, stretching or distorting the fibers.

Another object of the present invention is to provide a new and improved "wet-lay" process wherein an embossed appearance and feel, as well as the hand, drape and loft of cloth, is imparted to a fibrous web material during the wet forming of the web without the necessity of utilizing textile fibers or of applying postformation external forces thereto.

A further object of the present invention is to provide an apparatus which effectuates the production of continuous web material from aqueous dispersions of the constituting fibers and imparts to the web material at the moment of formation a clothlike configuration or contour.

A still further object of the present invention is to provide a method and apparatus for producing in a facile and economical manner a web material which is not only strong, soft and flexible, but has unique properties and characteristics rendering it suitable for many and diversified uses.

Other objects will be in part obvious and in part pointed out more in detail hereinafter.

The invention accordingly comprises the several steps and the relation of one or more of such steps with respect to each of the others, the features of construction, combination of elements and arrangement of parts and the article possessing the features, properties, and characteristics, which are exemplified in the following detailed disclosure, the scope of which will be indicated in the appended claims.

In order that the invention may be better understood, reference may be had to the accompanying drawings in which:

FIG. 1 is a diagrammatic view of an exemplary machine which may be utilized in carrying out the present invention;

FIG. 2 is an enlarged plan view of one embodiment of the papermaking screen assembly of the present invention utilized in the apparatus of FIG. 1;

FIG. 3 is a sectional view of the assembly of FIG. 2;

FIG. 4 is an enlarged plan view of a fibrous web material produced when utilizing the assembly of FIGS. 2 and 3;

FIG. 5 is a sectional view of the web material of FIG. 4 taken along the line 5—5;

FIGS. 6 and 7 are plan and sectional views, respectively, of another embodiment of the papermaking screen assembly of the present invention;

FIGS. 8 and 9 are plan and sectional views, respectively, of the fibrous web material produced when utilizing the assembly of FIGS. 6 and 7; the view of FIG. 9 being taken along the line 9—9 of FIG. 8 and being enlarged for clarity;

FIGS. 10 and 11 are plan and sectional views, respectively, of still another embodiment of the papermaking screen assembly of the present invention;

FIGS. 12 and 13 are plan and enlarged sectional views, respectively, of the web material produced when utilizing the assembly of FIGS. 10 and 11; the view of FIG. 13 being taken along the line 13—13 of FIG. 12;

FIG. 14 is a plan view of a portion of the web of FIG. 12 substantially enlarged for purposes of illustration;

FIGS. 15 and 16 are plan and sectional views, respectively, illustrating a further embodiment of the papermaking screen assembly of the present invention;

FIGS. 17 and 18 are plan and enlarged sectional views, respectively, of the fibrous web material produced when utilizing the assembly of FIGS. 15 and 16;

FIG. 19 is a perspective view of a still further embodiment of the papermaking screen assembly utilized in accordance with the present invention;

FIG. 20 is a perspective view of the fibrous web material produced when utilizing the assembly of FIG. 19; and

FIG. 21 is a diagrammatic view of another exemplary machine which may be utilized in carrying out the present invention.

In accordance with the present invention there is produced on screen assemblies of particular design continuous contoured or fashioned webs of fibrous materials, these webs being made from aqueous dispersions of papermaking fibers and having characteristics of woven cloth. Utilizing standard papermaking machines which have been modified in accordance with the present invention the webs are produced by initially forming a dilute aqueous dispersion of fibers and depositing the fibers within the dispersion on a special screen arrangement

which imparts to the web at the moment of deposition the characteristic contour desired for the web.

Broadly, the special screen configuration consists of a fine lower or base screen member which acts as a fiber accumulator and conveyor in the normal manner of a Fourdrinier wire and a superimposed screen which is coarser in nature and tends to fashion or mold the product into the form or configuration desired. The coarser screen acts upon the dispersion in such a way as to promote a concentration of fibers within the interstices or openings of that screen causing a differential in fiber concentration and imparting a general relief pattern to the web thus produced. The relief configuration has been found, according to the present invention, to produce a soft and somewhat bulky yet extremely flexible web which exhibits outstanding strength, porosity, absorbency, drape and other characteristics normally associated with cloth. The fibers employed must be capable of being dispersed in a dilute aqueous medium and, as explained more fully hereinafter, may comprise various combinations of materials.

The web produced in accordance with the present invention can be readily adapted to a variety of new uses in the home, in industry and in the medical field due to its widely diversified characteristics. For household purposes, it may be used for table napkins, filters in air conditioners and heating units, drapes, wiping cloths or toweling. Uses may be found in the medical field in such items as bandages, pads and surgical dressings. Additionally, in the industrial and commercial fields the webs are particularly useful for filtering various items, such as air, beverages, oil or chemicals and may be used for bookbindings, decorating, packaging materials and in disposable apparel, as well as a variety of other applications.

Referring now in greater detail to the drawings and particularly to FIG. 1 thereof, there is illustrated a papermaking machine similar to that disclosed in my prior United States Patent No. 2,045,095. As shown, the apparatus comprises a head box **22** into which is fed a slurry of dispersed fibers through the inlet port **24**. A paper-forming mat, generally designated **26**, passes through head box **22** after first traveling under idler roller **28** and around breast roller **30**. As the mat **26** passes through the head box at a generally inclined angle, as shown, the suspended fibers, also traveling therethrough in a direction generally toward the continuous mat, are deposited thereon and the "white water" or carrier medium passes rapidly through the mat **26** and drops into the save-all **32** which returns it to the system through outlet pipe **34**. The fibers deposited on mat **26** form a wet, continuous web **36** which passes out of the suspension medium and over a suction box **38** where a major portion of the excess water in the newly formed web is removed. The mat and web then pass out of head box **22** and over idler roller **40** toward drying and collection stations (not shown).

In accordance with the present invention and as stated above, a new and improved paper-forming mat or screen assembly **26** is utilized in place of the standard papermaking wire. The mat **26** broadly consists of an intaglio or relief-imparting dual screen assembly having an image-forming or molding screen superimposed on a fine background or base screen. The screen assembly acts not only as a perforated inclined and moving wall for the head box **22** upon which the fibers may deposit but also forms a mold or impression which imparts to the web **36** its characteristic configuration. Generally, the fine background or fiber accumulating screen is quite similar to a standard Fourdrinier wire and will not vary substantially irrespective of the configuration of the end product desired. The superimposed molding screen, however, does vary both in mesh size and configuration, as is illustrated more in detail hereinafter.

Referring now to FIGS. 2 and 3, there is illustrated one embodiment of the screen assembly **26** comprising a fine accumulator wire screen **42** of similar construction to a Fourdrinier wire; i.e., about 50 to 100 wires to the inch, and comprising interwoven metal wires **44** and **46**. Superimposed on fine screen **42** is the molding screen **48** which is generally coarser than screen **42** in either the employment of heavier gauge wire or the use of substantially fewer wires per inch or both. For example, it has been found according to the preferred embodiment of the present invention that molding screen **48**, which as shown consists of interwoven wires **50, 52**, should possess no more than one-tenth the number of aperatures per square inch found in screen **42** and preferably the ratio of apertures per square inch between the coarse and fine screens should be at least 50:1. By employing such a ratio, a generally clothlike web **36**, as shown in FIGS. 4 and 5, is obtained.

As can be readily appreciated, the dispersed fibers within the head box **22** deposit upon the screen assembly **26** in such a manner as to cause a greater concentration of fibers within the interstices or openings **54** of screen **48**. In operation, the coarser wire utilized in screen **48** tends to retard the flow of the fiber slurry through the screen combination at the positions of the individual wire elements **50, 52**, thereby causing the deposition of fewer fibers on these wires than in the opening **54** defined by the wires **50, 52**.

The fibrous web **36** produced on screens **42** and **48** possesses, as shown in FIGS. 4 and 5, a number of "island" portions **56** corresponding in size and configuration to openings **54** in screen **48**. Portions **56** are separated from each other by relatively thinner interconnecting portions **58** formed by the fibers retained on top of wires **50, 52**. The fibers constituting web **36** are randomly oriented throughout the entire web and provide an advantageous continuity of structure both within and between portions **56, 58**. For example, not only does the web thus produced have the hand and drape of textile fabrics but it additionally possesses substantial tensile strength in the transverse as well as the machine direction, which strength is generally lacking in nonwoven fabrics produced by dry methods.

As will be appreciated, the ratio of openings between the respective screens, which may be as low as 10:1, can vary substantially and, accordingly, have a marked effect on the webs produced thereby. An example of the results of such variation is illustrated in FIGS. 6–9 wherein there is shown a screen combination having a much larger ratio of openings as well as a web produced by an assembly. As shown, a fine screen **42** of substantially the same size as the bottom screen depicted in FIGS. 2 and 3 has superimposed thereon a molding screen **60** which is much coarser than screen **48**. More particularly, while retaining a screen size of about 100 mesh for the lower screen **42**, the superimposed screen **60** is increased both in mesh size and in wire diameter. Good success has been achieved using a coarse screen **60** having a mesh size of only 4 or as few as 2 wires per inch. Such an assembly results in a ratio of openings per square inch of greater than 600:1 and, as best seen in FIG. 9, produces a web **62** which not only possesses a quiltlike configuration having island portions **64** completely separated from each other by very thin interconnecting portions **66**, but also exhibits a more pronounced relief pattern.

As with web **36**, fibrous web **62** possesses a continuity of nonoriented dispersible fibers between the portions **64, 66**; however, the contrast in relative thickness between the portions is more pronounced. Portions **66** are generaly arcuate in cross section giving the appearance of protrusions or, looking from the opposite side of the web, grooves or channels which are generally disposed in a plane offset from the generally plane of the island portions **64**. Although it will be readily appreciated that this corrugated construction gives substantial compressibility and is very useful for wrapping and packing breakable items, it is an advantage of the present invention that webs of this nature are particularly effective in filtration, especially when used in multiple layers. The thin arcuate

channels provided by portions 66 tend to mechanically assist the flow of liquids or gases through these porous web and particularly through the thin sections.

As will be appreciated, the corrugated or fluted webs of the present invention may take numerous designs or configurations other than the "checkerboard" design illustrated. Such designs have in the past been effectuated by cooperating male and female pressure rolls. The present invention, however, produces this effect in a more pronounced manner without the fifty percent decrease in strength normally resulting from the breaking, stretching and distorting of the fibers by the excessive weight of the rolls. The much higher and more permanent strength characteristics of the web materials of the present invention as well as their bulk and loft makes them particularly well suited for interliners in garments or for packaging of glassware so as to prevent damage during transit. Additionally, these materials possess a good drape or hand which may be due in part to the hingelike action of the thin interconnecting portions 66 and, despite the great bulk and strength thereof, are generally quite limp.

As indicated, the coarse screen of the present invention not only exhibits a substantially smaller number of openings per square inch, but also a diameter size or guage of wire which is preferably larger than that used in the finer screen. This feature tends to give a more pronounced effect to the molding characteristics of the superimposed screen. For example, using as the fine screen a 100 mesh wire grid normally made from wire having a diameter of approximately 0.0065" and as the superimposed screen, one having a mesh of 14 and a wire diameter of approximately 0.023", it is possible to produce a fibrous web which has the general appearance of a finely woven cloth. However, by decreasing the mesh size of the coarse screen to 4 and increasing the size of the wire employed in that screen to 0.032" in diameter there is produced a crepe or corrugated web having substantially different uses from those of the fine clothlike web.

Other variations are also possible according to the present invention. For example, a material can be produced whose physical appearance and structure are completely opposite from that illustrated in FIGS. 8 and 9; that is, it possesses very thin island portions separated by relatively thicker interconnecting areas. Referring now to FIGS. 10 through 14 and particularly to FIGS. 10 and 11, there is shown a screen assembly for accomplishing this reversal. The screen assembly comprises a dual screen combination similar to that illustrated in FIGS. 2 and 3, but varying in that the coarse screen 68 contains on the upper surface thereof a plurality of solid discs 70 which cover or block the interstices of selected portions of the coarse screen 68. These discs act in a manner similar to the coarse wires of the superimposed screen, tending to retard the flow of the water through the screen assembly and causing only slight accumulation of fibers on the top of the discs 70 while facilitating the build up of the fiber concentration in those areas of the screen not blocked by the discs. Although the configuration of the discs 70 may vary substantially without departing from the scope of the invention, it is important that the size of the disc be controlled within certain limits if areas substantially free of fibers are not desired. However, it will be appreciated that if the fibers within the dispersion are relatively long, the size of the discs may be increased without producing fiber-free areas in the web.

Consequently, by careful control of both the design and thickness of the discs as well as the concentration and fiber lengths of the material used, it is possible to produce a sheet 72, as shown in FIGS. 12–14, possessing discrete island areas 74 of extremely thin cross section. The areas 74, as best shown in FIGS. 13 and 14, are constituted of individually discernible fibers 76 and provide a highly porous yet dimensionally strong web structure. By controlling the various factors involved it is possible to produce areas of monofiber thickness yet obtain a sharp and clear line of demarcation between the discrete thin areas 74 and their interconnecting portions 78 of higher concentration. Advantageously, the webs 72 possess within the thin porous areas 74 only a fraction of the weight of the remainder of the sheet yet these webs exhibit strengths equal to that found in webs of the same weight but possessing no thin areas. As will be appreciated, the degree of flexibility within such a system is substantial.

Still further variations may be obtained by utilizing the screen assemblies of FIGS. 15–19. For example, the top coarse screen 80 may be formed so as to give transverse corrugations 82 (see FIGS. 15 and 16) or individual protruding mounds 84 (see FIG. 19) in order to provide the finished web with the particular characteristics desired. In all cases, however, it is necessary that a fine, substantially smooth background screen 42 be utilized with the irregular molding screens.

It should be noted that a very substantial improvement is effectuated according to the present invention in the formation of natural corrugations or crepe. According to the known method crepe is provided by a differential speed doctoring technique which is capable of imparting a crepe of up to about 15 percent. That method is restricted to thet production of crepe in the "cross machine" direction and results in substantial loss in strength. However, by utilizing the present invention and particularly screen arrangements such as those illustrated in FIGS. 15 and 16, it is possible to impart a crepe of over 100 percent without detrimentally affecting the tensile strength of the material. Additionally, it is possible to impart crepe in either the "machine" or "cross machine" directions or both.

It will be appreciated that different screen configurations and combinations will operate more effectively on different types of papermaking machinery. Generally, the requirements of each screen combination will be determined to a substantial degree by the flexibility of the screen assembly employed. Where both screens in the assembly are made from relatively fine wires and are flexible enough to travel over and around many support rolls, the assembly can be used on regular Fourdrinier-type machines, on the special inclined wire-type machines as described in my United States Patent 2,045,095, on a cylinder machine, or on a modified cylinder machine such as a "Rotoformer" made by Sandy Hill Co., of Hudson Falls, N.Y. However, if the top molding screen is coarse, e.g., 0.032" diameter wire or greater, or utilizes a construction such as that illustrated in FIGS. 10, 15 and 19, then it may not be suitable to any machine except a cylinder or modified cylinder where the screen does not run over carrying rolls. It will be appreciated that the latter screen combinations require a rigid screen construction and would not sufficiently flex to permit movement over Fourdrinier-type equipment.

Illustrative of the cylinder-type of papermaking machine required when a rigid screen assembly is empolyed is the apparatus shown in FIG. 21. In that apparatus the combination screen assembly 86 is securely affixed to the cylinder 88 which, as shown, rotates in a clockwise direction. The fiber slurry is fed to the screen combination directly from the trough 90 where it drops directly on the screen assembly which, as illustrated, consists of the screens 42 and 80, shown in FIGS. 15 and 16. Directly under the screen assembly at the point where the fiber dispersion contacts the screens is a strong suction box 92 which pulls the water through the screens leaving the fibers deposited in the shape of the top wire screen. It is important that the bottom screen 42 be relatively smooth in order to make good surface contact for the suction box 92 of the paypermaking machine and at the same time be fine enough to retain fibers thereon. As shown, the suction box extends underneath the screen 42 in the direction of movement of the cylinder 88 to continuously remove excess liquid as the web leaves the position of fiber deposition. After the web has been sucked

dry enough to support its own weight, it is carried from the cylinder 88 to the carrying roll 94 and then to the dryers (not shown) in the usual manner.

In forming the fibers into a web, certain preforming treatment will be required depending upon the materials utilized. For example, standard papermaking operations such as chemical digesting and defining may be required to properly condition the fibers. Regardless of the techniques employed, it is generally necessary that good separation of the fibers be effectuated. This may be accomplished by suspending the fibers in an extremely large volume of water, with or without the help of dispersing agents. Such dilute suspensions have a consistency substantially below 0.5 percent and permit a free and rapid flow toward the wire screen collectors of the papermaking machines.

It has been found that a great variety of fiber formulations can be utilized with the screen combinations of the present invention provided they are capable of being dispersed. The webs may be made of natural or man-made fibers or combinations thereof; the fiber selection depending only on the end use sought. For example, natural fibers of manila hemp, caroa, jute, bleached or unbleached kraft, or synthetics of rayon, nylon, "Dacron" or vinyl copolymers, e.g., vinyl acetate-vinyl chloride copolymers such as "Vinyon," give especially good results in making the webs of the present invention.

Although the use of long fibers in conjunction with their random orientation throughout the web produces water-laid webs of substantial strength, it may be desirable for some end uses to impart additional strength to the web. This can be developed without sacrificing flexibility and drape by any of the well-known converting processes, such as latex saturation, polyvinyl chloride treatment, or cationic agent saturation as well as by post-formation applications, such as spot welding the fibers with well-known strength forming agents. Such treatments give greatly increased physical strength, such as tear, burst, scuff resistance and tensile strength with very little loss in flexibility and good retention of "hand" clothlike feel.

As will be appreciated from the foregoing description, the present invention provides an apparatus and process for converting aqueously dispersed fibers into nonwoven fabrics having the hand and drape of woven cloth while possessing good strength in both the transverse and machine directions. These fabrics possess the configured appearance of textiles and are advantageously of high porosity while retaining the strength inherent in a randomly oriented paper product which has not been subjected to detrimental external forces.

As will be apparent to persons skilled in the art, various modifications and adaptations of the structure above described will become readily apparent withont departure from the spirit and scope of the invention, the scope of which is defined in the appended claims.

I claim:

1. An apparatus for forming a nonwoven fabric from an aqueous dispersion of fibers comprising in combination a traveling screen assembly comprising a first screen adapted to permit the passage therethrough of a dispersing medium and to accumulate thereon substantially all of the dispersed fibers coming in contact therewith, and a second wire screen superimposed on said first screen and in intimate physical contact therewith, the underlying screen having at least ten times the number of openings per unit area as said second screen, said second screen being composed of elements which facilitate the deposition of a lower concentration of fibers thereon than within the interstices thereof; means for supplying an aqueous dispersion of fibers onto said screen assembly to form a wet fibrous web thereon; and means for applying suction to the underside of said first screen for removal of a substantial portion of the dispersing medium from the wet fibrous web.

2. An apparatus for forming a nonwoven fabric from an aqueous dispersion of fibers comprising in combination a fiber-receiving screen assembly comprising a first wire screen adapted to permit the passage therethrough of a dispersing medium and to accumulate thereon substantially all of the dispersed fibers coming into contact therewith, and a second substantially coarser wire screen superimposed thereon in physical contact with said first screen, said underlying screen having at least ten times the number of openings per unit area as said coarse screen, said coarse screen being composed of elements which facilitate the deposition of a lower concentration of fibers thereon than within the interstices thereof; means for supplying an aqueous dispersion of fibers onto said screen assembly to form a wet fibrous web thereon; suction means for removal of a substantial portion of the dispersing medium from the wet fibrous web; and means for moving the screen assembly past said suction means after deposition of the fibers on the assembly in the form of a continuous web.

3. An apparatus for forming a nonwoven fabric from an aqueous dispersion of fibers comprising in combination a fiber-receiving screen assembly comprising a first fine mesh wire screen adapted to permit the passage therethrough of a dispersing medium and to accumulate thereon substantially all of the dispersed fibers coming into contact therewith, and a second coarse wire screen superimposed in physical contact with said first screen, said underlying fine screen having at least ten times the number of openings per unit area as said coarse screen, said second screen being composed of elements which facilitate the deposition of a lower concentration of fibers thereon than within the interstices thereof; means for supplying an aqueous dispersion of fibers to said screen assembly for deposition of the fibers thereon as a wet fibrous web; suction means abutting said first screen for removal of a substantial portion of the dispersing medium from the wet fibrous web; and means for moving the screen assembly past the dispersion supply means and the suction means to effectuate the continuous formation of the web.

4. An apparatus for forming a nonwoven fabric from an aqueous dispersion of fibers comprising in combination a fiber-receiving screen assembly comprising a Fourdrinier wire screen adapted to permit the passage therethrough of a dispersing medium and to accumulate thereon substantially all of the dispersed fibers coming into contact therewith, and a substantially coarser wire screen superimposed on and in intimate physical contact with said Fourdrinier screen, said underlying screen being coextensive with said coarse screen and having at least ten times the number of openings therein, said coarse screen being composed of elements which facilitate the deposition of a lower concentration of fibers thereon than within the interstices thereof; means for feeding an aqueous dispersion of fibers to said screen assembly to form a wet fibrous web thereon; a suction box abutting the underside of said Fourdrinier screen for removal of a substantial portion of the dispersing medium from the wet fibrous web; and conveying means for moving the screen assembly past the suction box during deposition of the fibers on the assembly.

5. An apparatus for forming a nonwoven fabric from an aqueous dispersion of fibers comprising in combination a fiber-receiving screen assembly; a head box for supplying an aqueous dispersion of fibers onto said screen assembly to form a wet fibrous web thereon, said screen assembly constituting a continuously movable inclined wall for said head box and comprising a Fourdrinier wire screen adapted to permit the passage therethrough of a dispersing medium and to accumulate thereon substantially all of the dispersed fibers coming into contact therewith, and a substantially coarser wire screen superimposed on and in intimate physical contact with said Fourdrinier screen, said underlying screen being coextensive

with said coarse screen and having at least fifty times the number of openings therein; said coarse screen being composed of elements which facilitate the deposition of a lower concentration of fibers thereon than within the interstices thereof; a suction box abutting the underside of said Fourdrinier screen for removal of a substantial portion of the dispersing medium from the wet fibrous web; and conveying means for moving the screen assembly during deposition of the fibers on the assembly.

6. An apparatus for forming a nonwoven fabric from an aqueous dispersion of fibers comprising in combination a fiber-receiving screen assembly comprising a fine mesh Fourdrinier-type wire screen adapted to permit the passage therethrough of a dispersing medium and to accumulate thereon substantially all of the fibers dispersed in said medium, and a substantially coarser wire screen superimposed on and in intimate physical contact with said fine screen, said underlying fine screen being coextensive with said coarse screen and having at least fifty times the number of openings therein; said coarse screen being composed of elements which facilitate the deposition of a lower concentration of fibers thereon than within the interstices thereof; a trough for supplying an aqueous dispersion of fibers onto said screen assembly to form a wet web thereon; a cylinder supporting said screen assembly for movement during deposition of the fibers on the assembly, and a suction box abutting the underside of said fine screen and located from the position of fiber deposition along the path of travel of said assembly for removal of a substantial portion of the dispersing medium from the fibrous web.

7. In a papermaking machine for forming a nonwoven

fabric by the deposition of an aqueous dispersion of fibers on a screen assembly, the combination wherein the fiber-receiving screen assembly comprises a first base screen member adapted to permit the passage therethrough of a dispersing medium and to accumulate thereon substantially all of the dispersed fibers coming in contact therewith, and a second substantially coarser molding screen member superimposed on and in intimate physical contact with said first screen member, said second screen being positioned closer to the dispersion than the first screen during fiber accumulation and being configured to facilitate both the deposition thereon of a portion of the accumulated fibers and the passage therethrough of the remainder of said fibers for accumulation by said first screen member.

8. The machine of claim 7 wherein the first screen member is a Fourdrinier screen and is coextensive with the second coarser screen member.

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