April 1, 1969 M. R. LIVINGSTON 3,435,855

EFFECT FABRICS

Original Filed Aug. 7, 1964 Sheet 1 of 2

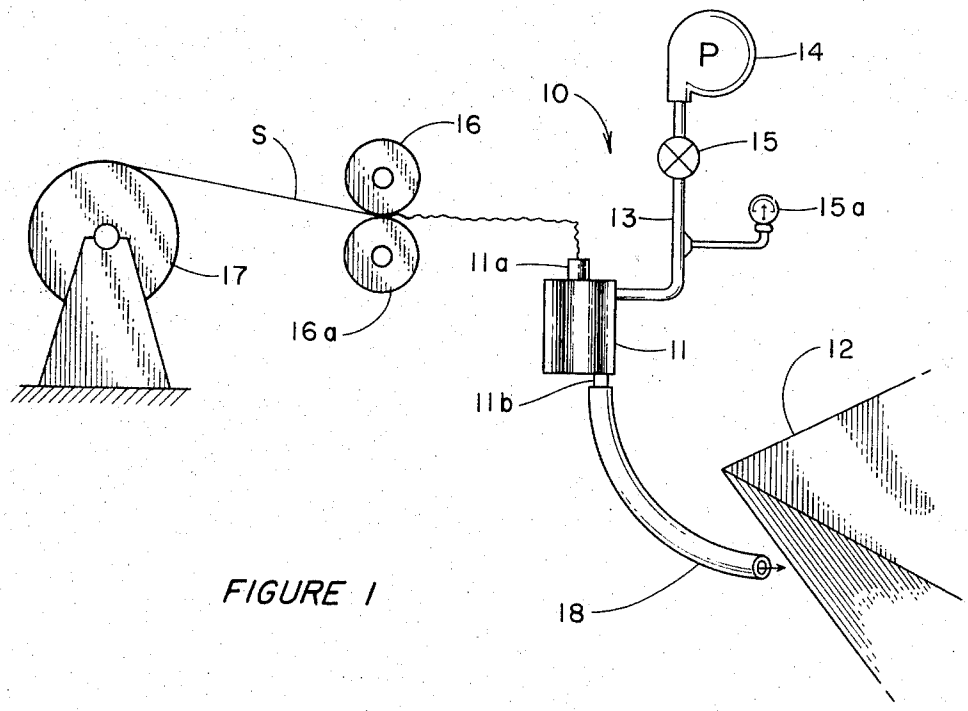

FIGURE 1

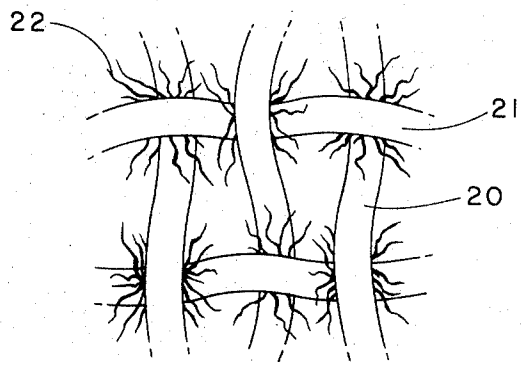

FIGURE 2

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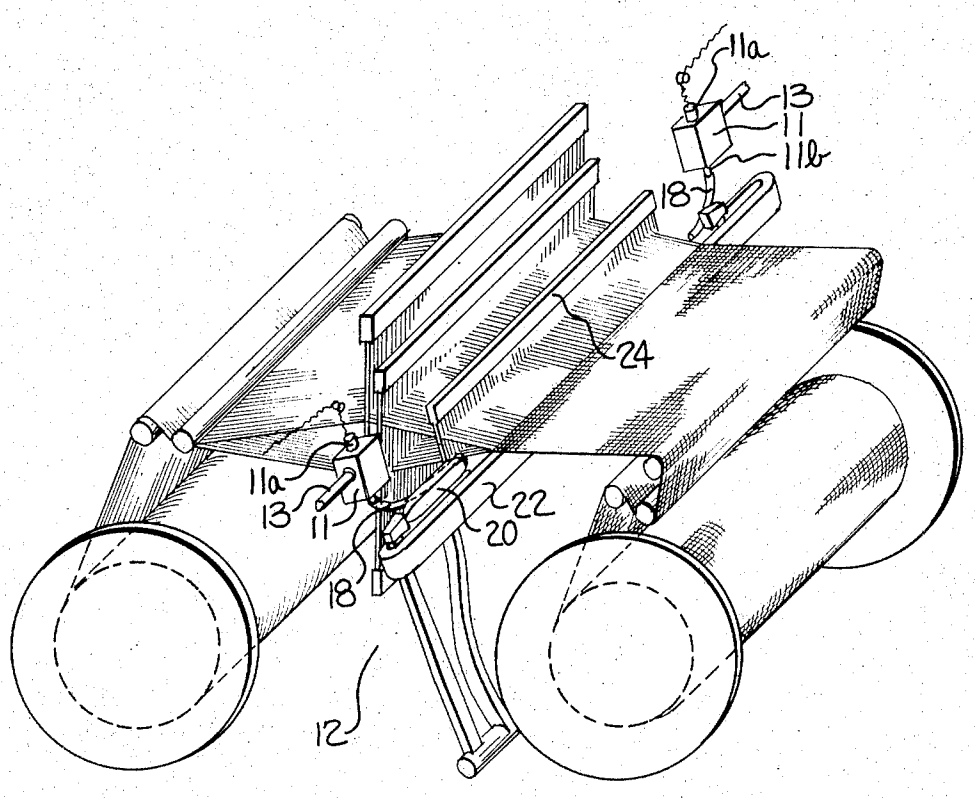

Fig-3

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EFFECT FABRICS

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Original application Aug. 7, 1964, Ser. No. 388,058. Divided and this application Aug. 31, 1966, Ser. No. 606,473

Int. Cl. D02g 3/04; D03d 25/00, 23/00

U.S. Cl. 139—1 26 Claims

ABSTRACT OF THE DISCLOSURE

A process and apparatus for producing an effect fabric by randomly introducing and distributing effect fiber into said yarn during the fabric construction while the yarn is in an opened condition and subsequently consolidating the yarn into the fabric. The effect fiber is preferably incorporated into the fabric by blowing the effect fiber into the opened yarn with pressurized air.

This is a division of application Ser. No. 388,058, filed Aug. 7, 1964, now abandoned.

This invention relates to novel effect fabrics and to processes of and apparatus for producing the same.

It is an object of the present invention to provide fabrics having incorporated therein an effect fiber in the form of relatively short lengths of yarn or other fibrous or filamentary material.

Another object of the present invention is to provide fabrics as aforesaid in which the effect fiber is held in place solely by the interlocked filaments of which the fabrics are formed.

It is also an object of the present invention to provide processes of and apparatus for producing such effect fabrics.

Basically, the present invention envisions processes of and apparatus for producing effect fabrics of all types, i.e. woven, non-woven and knitted, by the blowing of the effect fiber, e.g. staple fibers or other short lengths of filamentary or fibrous material, into the open spaces between the fabric-forming filaments or yarns just prior to the consolidation thereof.

For purposes of clarity and simplicity, the principles of the present invention will be explicitly set forth in relation to the production of a woven effect fabric, but it is deemed understood that similar considerations will apply to the production of knitted and non-woven fabrics and even to the production of spun staple fiber yarns, the common characteristic of all of which is the presence of an initially open or loose mass of filaments or fibers which are ultimately consolidated into the form of a coherent fibrous structure in which the effect fiber is locked in position by the fibrous structure per se.

Thus, for the production of a woven effect fabric according to one aspect of the present invention, there are associated with a conventional loom two air jets of the bulking type which are mounted on the loom race plate, one at each edge of the warp. The effect fiber, preferably in the form of a yarn or roving, is supplied at a predetermined feed speed to each jet. The jets are operated at relatively high air pressure, so that the air in each jet acts to shatter or break up the respective effect yarn or roving into relatively short lengths. Suitable duct means are provided to cause these filamentary or fibrous pieces to be blown into the warp shed each time the same opens, whereby when the shed closes, the said pieces are caught in the weave of the fabric and become fixed therein. With proper control of yarn speed, air pressure and loom speed, uniform scattering of the pieces or fibers in the fabric can be achieved.

The foregoing and other objects, characteristics and advantages of the present invention will be more clearly understood from the following detailed description thereof when read in conjunction with the accompanying drawings, FIG. 1 of which is a diagrammatic illustration of an apparatus for introducing short fibers or pieces of filaments into a woven fabric, FIG. 2 of which is a diagrammatic illustration of a resultant fabric, and FIG. 3 is a perspective view of a loom further illustrating the mounting of a pair of bulking jets, the shuttle **20**, on loom race **22** and warp shed **24**.

Referring now more particularly to FIG. 1, in accordance with one aspect of the present invention the apparatus **10** comprises a pair of bulking jets **11** (only one is shown) securely mounted on the race plate of a loom (not shown) at the opposite edges of the warp **12**. The bulking jets **11** may be of the types disclosed in the U.S. Patent No. 2,942,402, issued June 28, 1960, to Clifford W. Palm, and U.S. Patent No. 3,022,563, issued Feb. 27, 1962, to Clifford W. Palm and Russell L. Bragg. It is preferred that the jets have somewhat flared exit tubes. In general: the particular construction of the jet is not critical; any conventional bulking jet may be used. Each jet has an inlet tube **11***a* and an outlet tube **11***b* communicating with a central plenum or bulking chamber through which a yarn or other strand S may be fed in one direction. A conduit **13** for admitting pressurized air or like compressible fluid from a pump or like source **14** also communicates with the said chamber so as to cause the fluid to enter the chamber at a predetermined angle to the direction of movement of the strand. The conduit **13** preferably has incorporated therein a control valve **15** and a pressure gauge **15***a* to permit the pressure and flow rate of the fluid to be precisely regulated.

The means for feeding the strands S of continuous filaments or staple fibers, which are ultimately to constitute the effect fiber in the finished fabric, to the jets **11** comprise two sets of feed rolls **16–16***a* (only one is shown). In each set, one roll, generally the lower one, is positively driven by a conventional adjustable speed motor (not shown) while the other roll is an idler roll and is biased against the driven roll by any suitable means, e.g. under its own weight or by auxiliary spring, hydraulic or mass-type biasing means. The strands S are drawn from respective creels or beams **17** (only one is shown).

Connected to the outlet tubes or nipples **11***b* of the two jets **11** are respective preferably flexible hoses or like ducts **18** (only one is shown) the free ends of which are disposed at the opposite edges of the warp **12** and in such a position as to discharge into the warp shed whenever the same is open. It is to be understood, of course, that the use of ducts may be avoided in appropriate instances by mounting the jets in proximity to the desired point of effect fiber delivery.

In operation, the bulking fluid, e.g. air, preferably is admitted into the jets under a pressure between about 10 and 300 p.s.i. and more preferably between about 90 and 95 p.s.i. The strands S are fed into the respective jets preferably at speeds ranging from about 5 to 500 feet per minute and more preferably between about 25 and 100 feet per minute. In accordance with one aspect of the present invention, the strands S may be continuous filament yarns each preferably having a respective denier between about 30 and 2000 and each consisting of about 10 to about 500 filaments, but in accordance with other aspects of the invention the strands S may be spun yarns or rovings of staple fibers or like short length pieces of filamentary or fibrous materials.

It will be apparent from the foregoing that the strands S are, upon entering the jets **11**, subjected to the highly turbulent air flow conditions existing in the jet chambers. If the strands are in the form of continuous filament

yarns, the relatively high pressure air acts to shatter or break the yarns up into small bits and pieces. On the other hand, if the strands S are in the form of staple fiber rovings or spun yarns, the high pressure air acts to dissociate them into the individual short component fibers. These short fibers or pieces of filaments are blown out of the jets through the hoses or conduits 18 into the warp shed from the opposite sides thereof, suitable control means being provided for synchronizing the supply of air to the jets and the operation of the loom to ensure that the filamentary or fibrous pieces are blown into the warp shed only when the latter is open. The effect fiber may comprise as much as about 95% by weight of the total fabric weight and as little as about 1% by weight of the total fabric weight. When the process is operated so that the effect fiber will constitute a large proportion of the final fabric, there effectively is provided a rapid method for making certain types of fabrics. Thus, for example, a loom may be set up to produce a fabric of very open construction (like a scrim) and a very large proportion of effect fiber of considerable length (e.g., 10 or 20 inches) may be blown into the fabric during weaving; the fabric thus produced is, in effect, a non-woven supported by a scrim. Toward the other end of the spectrum of fabric variations which are possible according to the present invention, are closely woven smooth fabrics with only small surface effects achieved by inclusion of small proportions of effect fiber, such as the fabric of the below example. Of course, any fabric of intermediate properties may also be produced.

As will be readily understood, the effect fiber may be made of any suitable synthetic filamentary materials such as organic derivatives of cellulose, e.g. ethers such as ethyl cellulose and/or esters such as cellulose acetate, cellulose propionate, cellulose butyrate, cellulose acetate formate, cellulose acetate propionate, cellulose acetate butyrate, etc. The esters may be ripened so as to modify their solubility characteristics or may be unripened, i.e. containing fewer than about 0.29 free hydroxyl groups per anhydroglucose unit, such as cellulose triacetate.

The effect fiber may, of course, be made of other synthetic filamentary materials, such as the polyamides, e.g. nylon, linear polyesters such as polyethylene terephthalate, acrylonitrile polymers and copolymers, olefinic polymers and copolymers such as polyethylene, polypropylene, polyvinyl chloride, polyvinyl acetate, poly (vinyl chloride-vinyl acetate), polyvinylidene chloride, and the like. Furthermore, the effect fiber may be composed of natural fibers such as cotton, silk, wool and linen.

As previously indicated, the initial effect fiber strands need not be in continuous filament form but may be composed of spun or otherwise assembled masses of staple fibers. Even in this case the effect fiber may be made of the same synthetic filamentary materials cut to staple lengths preferably of about ¼ to 20 inches.

The effect fiber may be colored differently from the filaments or yarns constituting the woven fabric, or it may be of a different shade of the same color, depending on the intended visual appearance of the finished fabric.

The invention will be more clearly understood from the following example.

EXAMPLE I

A fabric 46.4 inches wide is woven in a plain weave on a standard loom from a warp of 75/2S/20 bright cellulose acetate continuous filament yarn and a filling of 150/2S/40 bright cellulose acetate continuous filament yarn, to a final count of 45 warp ends per inch and 60 picks per inch. Two air bulking jets of the class described hereinabove are mounted at the opposite edges of the warp on the loom race plate and supplied with air at a pressure of 90 p.s.i. The effect fiber strands are 75/LTD/20 red dyed cellulose acetate continuous filament yarns which are fed into the jets at speeds of about 150 feet per minute. Both the air supplying and yarn feeding operations are intermittent and synchronized with the loom operation so that the effect fiber pieces of the yarns are formed in and blown from the jets only when the warp shed is open. The resultant fabric has a great number of contrastingly colored slub-like streaks of random length and thickness distributed throughout its width where relatively large masses of effect fiber pieces have been caught in the weave of the fabric, as well as appearing to be permeated throughout by a reddish fuzz where individual or relatively small groups of the effect fiber pieces were caught in the weave of the fabric. The fabric is especially well suited for women's apparel, home furnishings such as draperies and upholstery and decorative purposes in general.

Referring now more particularly to FIG. 2, there is schematically illustrated a fabric of the type obtained by the process described in Example I. It is to be understood that the weave actually is quite tight but is illustrated as open for the sake of clarity. Warp yarns 20 and weft yarns 21 are woven in a plain weave. Locked between the warp and weft yarns at their crossovers are effect fibers 22.

It is to be understood that the foregoing detailed description of various aspects of the present invention is for purposes of illustration only, and that many variations may be made in the invention without departing from the spirit thereof.

The embodiments of the invention in which an exclusive property or privilege is claimed are defined as follows:

1. The process of producing an effect fabric, comprising the steps of forming an open base yarn structure, blowing into with pressurized air and randomly distributing throughout said yarn structure while the same is still in an open condition an effect fiber composed of relatively short-length pieces of fibrous material, and consolidating said yarn structure to its final closed and fabric-constituting condition, whereby said pieces are held in place in and secured to the fabric solely by the consolidated yarn structure of the latter.

2. The process of claim 1 wherein the yarn structure is opened and consolidated in the operation of a loom during the weaving of said fabric.

3. The process of claim 1, wherein said effect fiber comprises between about 1 and 95% of the total weight of the finished fabric.

4. The process of claim 3, wherein said yarn structure of the fabric and said effect fiber are both composed of synthetic filamentary materials.

5. The process of claim 3, wherein said yarn structure of the fabric and said effect fiber are both composed of natural staple fibers.

6. The process of claim 3, wherein said yarn structure of the fabric is composed of synthetic filamentary materials and said effect fiber of natural staple fibers.

7. The process of claim 3, wherein said yarn structure of the fabric is composed of natural staple fibers and said effect fiber of synthetic filamentary materials.

8. The process of claim 3, wherein said pieces of effect fiber are blown by separate streams of pressurized air into the open yarn structure of the fabric from opposed portions thereof.

9. The process of producing an effect fabric, comprising the steps of forming an open base yarn structure, passing fibrous effect material in strand formation through bulking jet means, admitting a compressible fluid under high pressure into said jet means to break up said strand formation into relatively short-length pieces, introducing said pieces into and randomly distributing the same throughout said yarn structure while the latter is still in an open condition, and consolidating said yarn structure to its final closed and fabric-constituting condition, whereby said pieces constituting an effect fiber are held in place in and secured to the fabric solely by the consolidated yarn structure of the latter.

10. The process of claim 9, wherein said fibrous material is initially in the form of at least one strand of continuous filaments, and the pressure of said fluid is sufficiently high to shatter the filaments into the desired short pieces.

11. The process of claim 9, wherein said fibrous material is initially in the form of at least one strand of staple fibers, and the pressure of said fluid is sufficiently high to dissociate the staple fibers of said staple fiber strand from each other.

12. The process of claim 11, wherein said staple fiber strand is composed of natural staple fibers.

13. The process of claim 11, wherein said staple fiber strand is composed of synthetic filament staple fibers.

14. The process of producing a woven effect fabric, comprising the steps of weaving warp and filling yarns on a loom, and each time the warp shed is open blowing thereinto edgewise of the warp relatively short-length pieces of fibrous material, whereby upon consolidation of the woven yarns said pieces are randomly distributed throughout the fabric and are held in place in and secured to the fabric solely by the weave thereof.

15. The process of producing a woven effect fabric, comprising the steps of weaving warp and filling yarns on a loom, concurrently passing fibrous effect material in strand formation through bulking jet means wherein turbulently flowing air under relatively high pressure acts to break up said strand formation into relatively short-length pieces, and each time the warp shed is open blowing said pieces thereinto edgewise of the warp, whereby upon consolidation of the yarn structure of the fabric said pieces, constituting an effect fiber, are held in place in and secured to the fabric solely by the weave of the fabric.

16. The process of producing a woven effect fabric, comprising the steps of weaving warp and filling yarns on a loom, concurrently passing two strands of fibrous effect material through respective bulking jets wherein turbulently flowing air under relatively high pressure acts to break up said strands into relatively short-length pieces, and each time the warp shed is open blowing said pieces out of said bulking jets and into the warp shed from the opposite edges of the warp, whereby upon consolidation of the yarn structure of the fabric said pieces, constituting an effect fiber, are held in place in and secured to the fabric solely by the weave of the fabric.

17. The process of claim 16, wherein said fibrous effect material is initially in the form of strands of synthetic continuous filaments, and the pressure of said air is sufficiently high to shatter the filaments into the desired short pieces.

18. The process of claim 16, wherein said fibrous effect material is initially in the form of strands of staple fibers, and the pressure of said air is sufficiently high to dissociate the staple fibers of said staple fiber strands from each other.

19. The process of claim 16, wherein said staple fiber strands are composed of natural staple fibers.

20. The process of claim 16, wherein said staple fiber strands are composed of synthetic filament staple fibers.

21. The process of claim 16, wherein one of said staple fiber strands is composed of natural staple fibers, and the other staple fiber strand of synthetic filament staple fibers.

22. The process of claim 16, wherein the air pressure in each of said bulking jets is maintained at a value between about 10 and 300 ps.i.

23. Apparatus for producing an effect fabric, comprising means for forming an open base yarn structure, bulking jet means operating at relatively high bulking fluid pressure for breaking up fibrous effect material in strand formation into relatively short-length pieces, duct means communicating with said bulking jet means to enable said pieces to be blown from said bulking jet means to and into said open yarn structure so as to be randomly distributed therethrough, and means for consolidating said yarn structure to its final closed and fabric-constituting condition, whereby said pieces are held in place in and secured to the fabric solely by the consolidated yarn structure of the fabric.

24. Apparatus for producing a woven effect fabric, comprising a loom for interweaving warp and filling yarns, bulking jet means operating at relatively high bulking fluid pressure, means for feeding fibrous effect material in strand formation into said bulking jet means so as to cause said fibrous material to be broken up into relatively short-length pieces, duct means communicating with said bulking jet means and positioned to discharge into the warp shed edgewise of the warp, and means for synchronizing the operations of said loom, said bulking jet means and said feeding means to enable said pieces to be blown from said bulking jet means to and into said warp shed each time the latter is open, whereby said pieces are randomly distributed throughout the warp shed and, upon consolidation of the interwoven yarns, are held in place in and secured to the fabric solely by the weave thereof.

25. Apparatus for producing a woven effect fabric, comprising a loom for interweaving warp and filling yarns, a pair of bulking jets operating at relatively high bulking fluid pressures, means for feeding a respective strand of fibrous effect material into each of said bulking jets so as to cause said strands to be broken up into relatively short-length pieces, a pair of ducts communicating with said bulking jets, respectively, and positioned to discharge into the warp shed from the opposite edges of the warp, and means for synchronizing the operations of said loom, said bulking jets and said feeding means to enable said pieces to be blown from said bulking jets to and into the warp shed each time the latter is open, whereby said pieces are randomly distributed throughout the warp shed and, upon consolidation of the interwoven yarns, are held in place in and secured to the fabric solely by the weave thereof.

26. Apparatus according to claim 25, said bulking jets being mounted on the loom race plate adjacent the opposite edges of the warp.

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U.S. Cl. X.R.

28—1, 72; 66—125, 202; 139—383