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COATING DISPENSER WHICH APPLIES A SHEET-LIKE JET OF COATING MATERIAL

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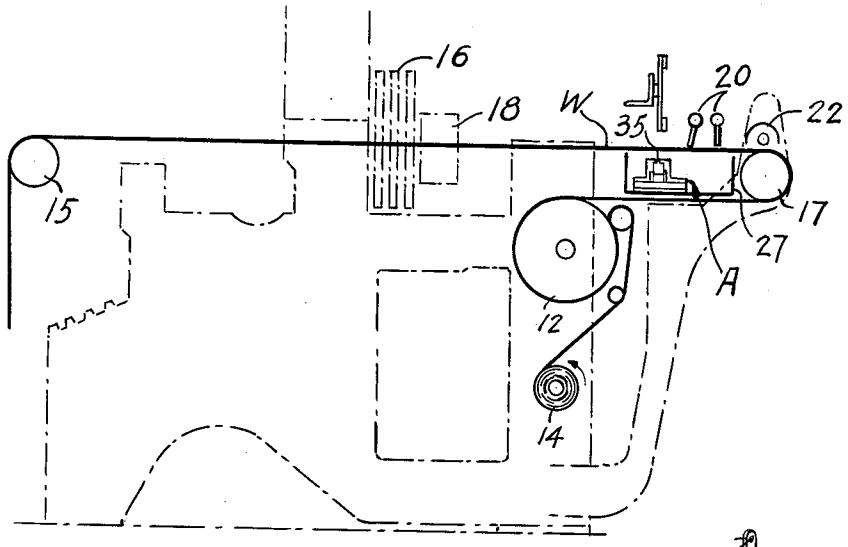

Fig. 1

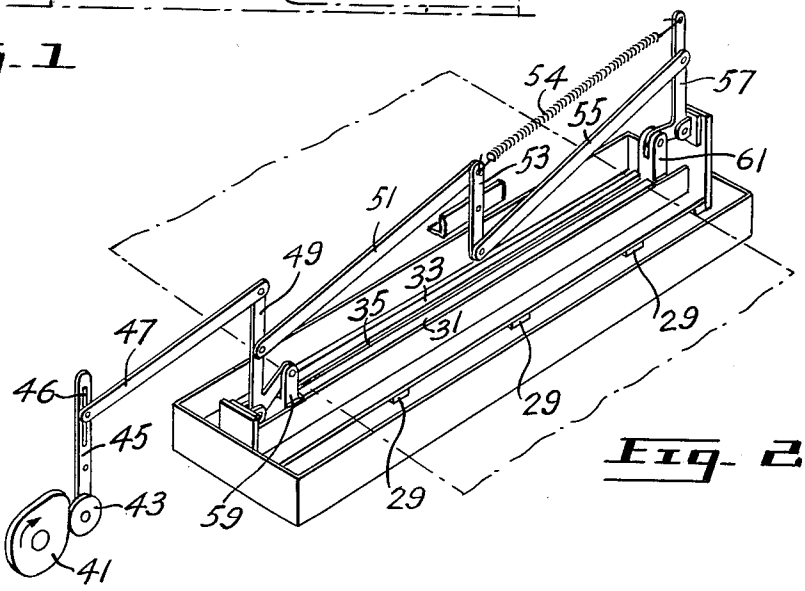

Fig. 2

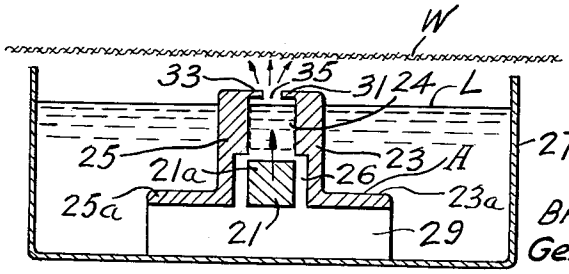

Fig. 3

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This invention relates to the application of a liquid treating substance to a web of fabric, particularly where it is desirable to apply the liquid without touching the fabric with any mechanical part.

In the manufacture of open-weave fabrics, commonly known as scrim fabrics, from continuous filament yarns, it is frequently necessary to apply a bonding or stabilizing agent to the fabric in order to prevent distortion due to the movement of the smooth slippery yarns over each other. Scrim fabrics woven from staple yarns are much more stable due to the roughness of the yarns.

In order to stabilize a scrim fabric without resorting to fancy interlocking weaves it is customary to apply a latex or other like material to the fabric. Excess latex is removed by blowing with air or other means and the remaining latex on the fabric is then dried or cured and by its adhesive action prevents the slippage of the yarns in the fabric over each other and thus prevents distortion of the fabric. However since the fabric is distorted by the slightest rubbing, the latex must be applied to it at the earliest opportunity, that is to say, as soon as possible after the filling has been inserted in the warp to form a fabric.

Several methods of applying the latex or other stabilizing materials are known to the art. For instance the fabric may be led around rolls into a pan of latex and back out again. This method suffers from the fact that often the warp is under high tension and sufficiently rigid rolls are, of necessity, massive. The fabric does not come from the loom in a smooth continuous forward motion but in a reciprocating motion due to the action of the loom mechanism. Therefore it is difficult to construct an independent drive for the rolls and they must be driven by the fabric. The high inertia of the rolls coupled with the reciprocating motion of the fabric causes distortion in the fabric.

Another method of applying latex consists of passing the fabric over a light-weight roll which dips into the latex. The fabric touches the roll just sufficiently to rotate it, and consequently to bring latex from the pan to the fabric on the roll's surface. However, every time the forward motion of the fabric is interrupted by a loom stoppage the latex begins to dry and form skins on the roll which in turn transfer to the fabric.

It is desirable then to apply the latex to the fabric without allowing any part of the equipment to come into contact with the fabric before the fabric is stabilized. Spray systems have been used to accomplish this object but suffer from various deficiencies. For instance jets tend to block from small solid particles and if filters are used, they require frequent attention, also particles may pass through the jet and be deposited on the fabric. Due to the open weave of the fabric, a large portion of the latex from a jet system passes through the fabric and this latex must be recovered and recirculated. In addition, if a loom stoppage occurs, unless an automatic jet cut-off is installed the latex continues to flow onto the fabric and builds up an undesirable thick film.

These processes and devices all suffer from one or other disadvantage. The aim of the present invention is to overcome these disadvantages and to provide positive advantages as will be clear from the following description.

The invention provides a method for applying a liquid treating material to a fabric in which no parts of the applicator equipment come into contact with the fabric and which is simple and trouble-free, requires little maintenance or adjustment and which may be conveniently mounted on a loom to perform this function immediately the fabric is woven.

Briefly, the method according to the invention comprises moving a web of open mesh plain woven fabric continuously, in intermittent steps, in a substantially horizontal path, as for example from a loom, and squirting against the fabric intermittently from below a sheet-like jet of liquid treating substance, for example, latex adhesive. The speed of the web and the frequency of the projection is synchronized so that the adhesive is applied evenly along the length of the web.

This method may be conveniently carried out by apparatus according to the invention. This apparatus fundamentally includes means for forming an elongated substantially horizontal mouth extending in a direction transverse to the fabric and spaced from it and means for squirting a sheet-like jet of liquid treating material from the mouth intermittently. Control means is provided for controlling the projecting means and this control means is governed by the fabric moving means so that the treating liquid is applied to the surface of the fabric at a predetermined rate relative to the speed of the fabric. In this way, the treating material is applied substantially evenly to the fabric along its length. Desirable additional features of a preferred apparatus will be described in connection with the detailed description to follow.

It will also be understood that the criteria of the apparatus and method may be varied. For example, the jet may have a thickness preferably within the range from about one-sixteenth of an inch to about one-half inch. Desirably, the jet is projected from a source from about one half inch to about five inches from the fabric. The frequency of the projection of the jet in a preferred range is from about twenty to about forty times a minute and the duration of projection is usually from about one-half to about one second. Movement of the fabric is generally from about five yards to about three hundred yards per hour. And, the projection of the jet is synchronized with the speed of the fabric in such a way that even application of the substance is obtained.

Detailed Description

The invention will now be described in greater detail by reference to the accompanying drawings which illustrate preferred apparatus according to the invention and by which the method of the invention may be carried out.

In the drawings:

FIGURE 1 is a diagrammatic illustration of a general arrangement of equipment according to the invention.

FIGURE 2 is a perspective view of an applicator portion of the equipment shown in FIGURE 1 with the fabric web shown in dotted lines to illustrate its relationship to the applicator.

FIGURE 3 is a transverse cross-section along the line 3—3 of FIGURE 2.

The particular embodiment of the invention shown is in the manufacture of open mesh plain woven fabrics, commonly known as scrim fabrics, from continuous filament yarns. The procedure illustrated is the application of a bonding or stabilizing agent to the fabric in order to prevent distortion due to the movement of the smooth, slippery yarns over each other. The web is shown in FIGURE 1 passing from a guide roll 15 through the weaving apparatus (loom) including a harness frame 16 and a shuttle box 18 past air jets 20 and a heater 22 to a guide roll 17. Between the guide and take-up rolls 15 and 17,

the web is held under tension substantially horizontally. The web then passes over a drum **12** and eventually to a take-up roll **14**.

In accordance with the invention, an applicator shown generally as A is located between the guide rolls **15** and **17**, so that the fabric passes over the apparatus immediately after the filling is inserted and before the fabric reaches the front breast of the loom.

The applicator includes a pump made up of an elongated rectangular piston **21** which is actuated vertically in a close clearance chamber formed between elongated companion walls **23** and **25**. The pump is mounted in a reservoir or tank **27** which contains the liquid used to treat the fabric. The treating liquid is maintained at a constant level L by a constant level device. The pump is elevated above the floor of the reservoir **27** by spacers **29** on which the super-structure of the pump including the walls **23** and **25** is mounted. The walls are provided with outwardly extending flanges **23***a* and **25***a* which engage the spacers **29**.

The walls **23** and **25** are so shaped as to provide a pump chamber having a restricted upper portion **24** within which the piston fits closely and a larger, lower portion **26**. When the piston is below the portion **24** and in the portion **26** liquid may migrate from the portion **26** to the portion **24**, until it reaches the level L. The walls **23** and **25** have at their upper ends lips **31** and **33** respectively forming between them a dispensing slot **35** having an area considerably less than the cross-sectional area of the portion **24** of the pump chamber. According to this construction when the piston **21** is lifted by means of an actuating linkage to be described, the upper surface **21***a* of the piston traps the treating liquid in the upper part of the chamber **24**. As the piston **21** continues its upward motion, the liquid held above the piston is forced out of the dispensing slot **35**.

By adjusting the ratio of the area of the slot **35** to the area of the portion **24** of the upper chamber, the speed of rise of the piston, and the viscosity of the liquid, the liquid can be forced through the slot **35** so as to rise to any desired distance above the pump. The liquid can therefore readily saturate the material of the web W pass a short distance above the pump without the material coming into contact with any part of the device. When the piston descends to its lower-most position the treating liquid is free to flow into the chamber **24** and the cycle may be repeated at any desired frequency.

The reciprocating vertical motion of the piston **21** is achieved by means of a rotating cam **41** and a cam follower **43** driven by any convenient source of rotary motion. The cam follower **43** engages an actuating linkage comprising pivoting connecting arms **45**, **47**, **49**, **51**, **53**, **55** and **57**. The arms **49** and **57** are pivotally connected to end posts **59** and **61** which are in turn joined to the ends of the piston **21** and form the ends of the pump chamber **24**. A slot **46** in the connecting arm **45** may be used to adjust the stroke of the piston **21**. A spring **54** attached to the arms **57** and **53** assists in returning the piston **21** to its lower-most position.

The piston **21** and the chamber walls **23** and **25** must be long enough so that the full width of the material W passing over the pump comes into contact with the liquid. The piston **21** must be of such dimensions and construction that it is rigid along its length and will not flex and deliver a non-uniform volume of liquid along its length.

Operation

The reservoir **27** is filled to a suitable level with a latex, in this case, and the latex is replenished by means of a constant-level feed. The apparatus is set in motion by the rotating cam **41** and the frequency of the pump strokes regulated so that every portion of the fabric W is wetted as it advances continuously, in intermittent steps, from the loom over the coating apparatus. Each upward stroke of the pump **21** delivers a uniform jet of latex the full width of the exit shot **35** and wets an inch or more of the fabric length.

The fabric then travels under a header line fitted with jets **20** which blow air through it. The air blows the excess latex back into the reservoir **27**, and if any small solid particles are formed in the latex and deposited on the underside of the fabric, the air will blow them off. The amount of latex deposited on the fabric is controlled by regulating the solids content of the latex and the velocity of the air stream. The fabric next passes under a heater **22** which dries and cures the wet latex, and the bonded fabric is then taken up in the conventional manner.

The power source which actuates the pump is coupled to the loom power source so that if the loom stops for any reason the pump stops also and does not continue to apply additional latex to the stationary fabric.

The fabric treated as described was capable of withstanding severe pulling and rubbing without showing the least signs of distortion since the dried latex film deposited on it firmly secures the threads in position.

An open mesh plain woven fabric not stabilized by means of a method described above, as soon as it reaches the front breast of the loom and passes over it, will cause the threads to become distorted by the friction of the passage.

While the process is useful in applying a bonding or stabilizing liquid to an open scrim fabric woven from slippery filament yarns, it will be realized that it may be used to apply any liquid treatment to any type of fabric or other flat, broad material wherein only the treating liquid comes in contact with the material being treated. A typical fabric is a scrim-type woven 210 denier nylon filament yarn containing 18 ends and picks to the inch.

For various applications, the speed of the fabric and the frequency and other characteristics of the pumping action will vary. For example, the fabric may move at a linear speed with the range from about five to about fifty yards per hour. The pump may operate at a frequency of between 20 and 60 strokes per minute, 35 strokes per minute being ideal. The duration may run within the range from about one-fifth to about three seconds. The distance between the fabric and the delivery side of the lips **31** and **33** may be within the range from about one-half inch to about five inches.

The frequency of the piston stroke is adjusted to give as complete wetting as possible of the web as it passes over the pump. The upper range may be increased if necessary by designing the pump chamber so that it fills rapidly.

The dispensing slot may range in size from about 1/16 in. to about ½ in. in width. The minimum dimension is defined by the tendency of any lumps in the latex to block the slot. The maximum dimension is governed by the viscosity of the liquid and the desired jet height. The range of clearance between the slot and the web may be from about ½ in. up to about 5 in. The lower clearance is dependent on the small up and down movement of the fabric as it is woven and the upper clearance on the practical jet height obtainable with a given liquid.

The speed of the fabric web may range from just above zero to say 300 yd./hr. On a loom the speed would be low. Depending on the fabric construction a fabric speed ranging from 10 to 20 yards an hour has been found good.

Jet velocities may vary widely depending on the application. The minimum is that required to overcome the force of gravity and enable the jet to reach sufficient height to make contact with the web. Jet velocity is a hydraulic property and is a direct function of piston velocity and the ratio of slot area to piston area, an inverse function of fluid viscosity and density, minus the effect of gravity.

Since the liquid reservoir must be near horizontal and the web must pass reasonably closely over the pump, the slope or the web should preferably be close to it, or horizontal. The direction of the jet stream also does not have to be vertical. With suitable provision for catching the

excess liquid, the jet stream may be directed with a horizontal vector.

The types of treating liquid may vary widely. A limiting factor is the liquid viscosity which may range from less than about 1 centipoise up to several thousand centipoises. If the liquid is too viscous the pump chamber takes too long to fill and slows the permissible speed of the pump, or the jet height will be limited. For instance a latex with a viscosity above 50,000 cps. is undesirably viscous.

We claim:

1. An apparatus for applying a liquid treating substance to fabric comprising a tank for containing the liquid substance, companion walls forming therebetween an upwardly-extending liquid-containing passage having a lower portion below the liquid level in the tank and an upper portion forming a continuation thereof, the lower portion being wider than the upper portion, the upper portion terminating in a pair of lips one at each side of the passage providing therebetween a dispensing slot, an elongated piston portion in said passage adapted to travel from said lower portion through said upper portion to a point adjacent said lips, said lips being spaced above the normal level of liquid in the tank and means for reciprocating said piston in upward and downward strokes from a position below the upper portion of the passage where it permits liquid to rise from the lower portion to the upper portion thus filling the upper portion to an intermediate position where it blocks the entrance from the lower portion to the upper portion to further positions where it continuously forces liquid from said upper portion through said slot in a sheet-like jet.

2. An apparatus for applying a liquid treating substance to fabric comprising a tank for containing the liquid substance, an elongated stand in said tank having legs supported by the bottom of the tank and a super-structure partly above the floor of the tank and partly below the liquid level thereof, said super-structure comprising a pair of spaced-apart companion walls forming therebetween an upwardly-extending, liquid-containing passage having a lower portion below the liquid level in the tank and an upper portion forming a continuation thereof, the lower portion being wider than the upper portion, the upper portion terminating in a pair of lips one at each side of the passage providing therebetween a dispensing slot, an elongated piston portion in said passage adapted to travel from said lower portion through said upper portion to a point adjacent said lips, said lips being spaced above the normal level of liquid in the tank and means for reciprocating said piston in upward and downward strokes from a position below the upper portion of the passage where it permits liquid to rise from the lower portion to the upper portion thus filling the upper portion to an intermediate position where it blocks the entrance from the lower portion to the upper portion to further positions where it continuously forces liquid from said upper portion through said slot in a sheet-like jet.

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