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Holm

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[54] **APPARATUS FOR TREATING FABRIC**

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[51] **Int. Cl.** **B05c 9/06**, B05c 9/14

[58] **Field of Search** ..... 68/3 SS, 9, 18 C, 20, 205 R

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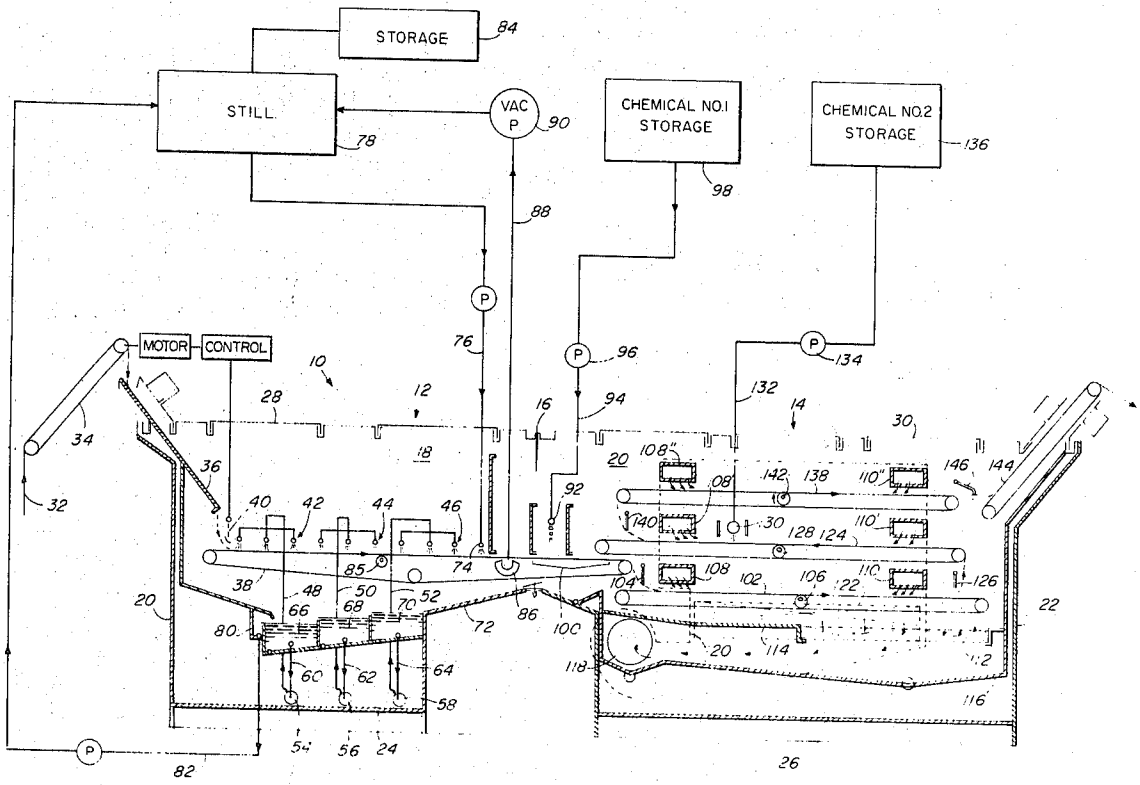
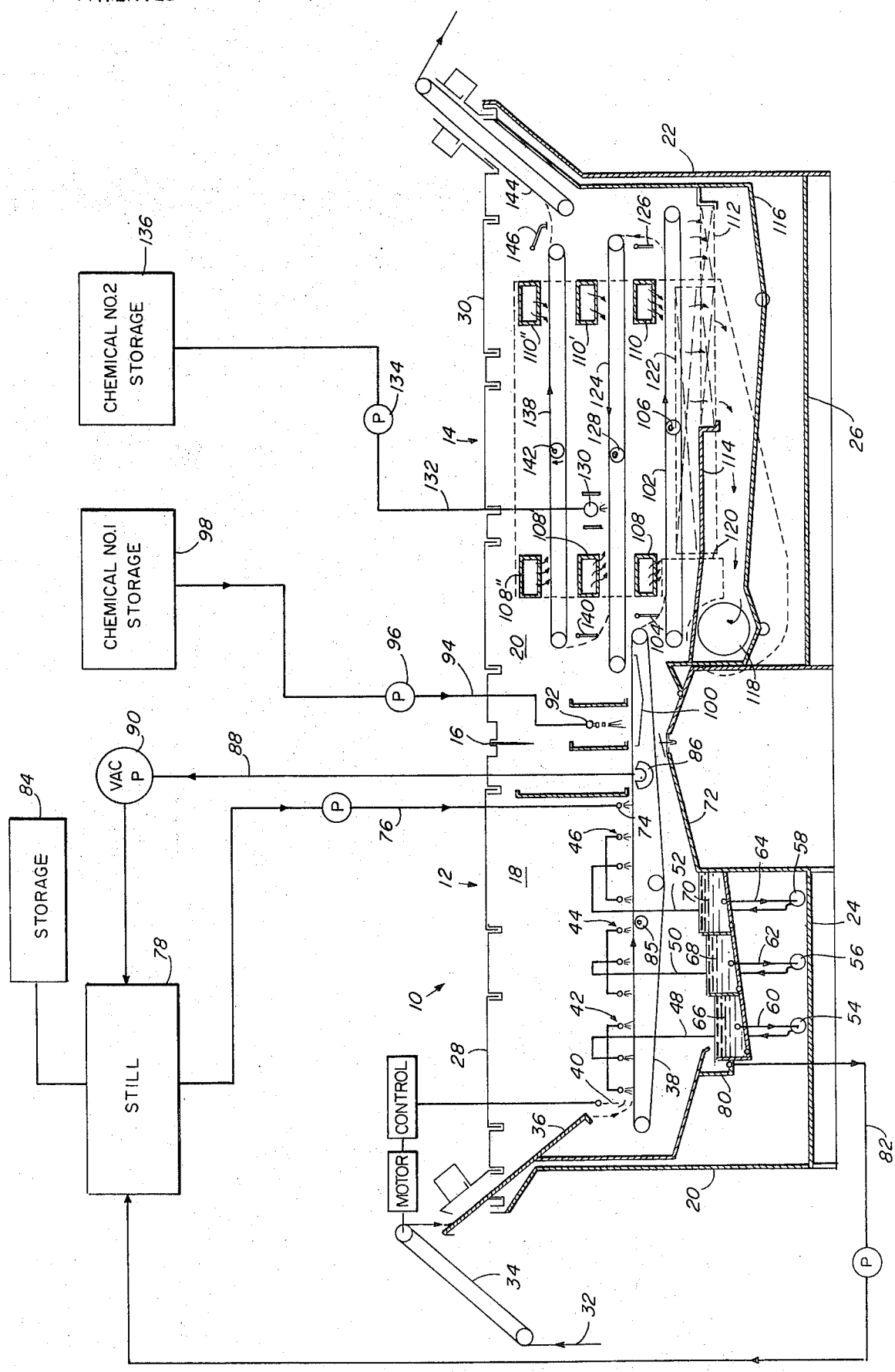
[57] **ABSTRACT**

A method and associated apparatus of modular construction is provided for treating a running fabric web with various chemicals, such as scouring elements, and then drying the web by the use of super-heated solvent vapor and air as the drying agent in a closed system. A multi-stage solvent treatment station is provided wherein each stage continuously re-cycles a portion of the solvent to provide maximum solvent flow and cleaning action with a minimum amount of solvent. Additional chemical application stations are provided for applying selected chemicals to the fabric at different stages in the treatment process.

4 Claims, 1 Drawing Figure




CHEMICAL NO.2 STORAGE
CHEMICAL NO.1 STORAGE
VAC P
STORAGE
STILL
CONTROL
MOTOR
P

APPARATUS FOR TREATING FABRIC

BACKGROUND OF THE INVENTION

1. Field of the Invention

This invention relates generally to the treatment of textiles and more particularly is directed towards a new and improved apparatus for solvent scouring a running fabric web.

2. Description of the Prior Art

During the production of many types of textile fabrics, it usually is necessary to clean or scour the fabric in order to remove a variety of impurities natural to or collected by the fabric. The scouring process and subsequent drying preferably should be carried out with the fabric in a fully relaxed condition to avoid stretching or otherwise distorting the material. This is particularly true with respect to knit goods which are fragile and easily stretchable. While it is desirable to have a large volume of scouring solvent washing through the fabric in order to provide a thorough cleansing action, it becomes quite expensive to achieve this in view not only of the high cost of the solvent itself, but also the storage requirements which must be provided where a large quantity of solvent is used. Heretofore, scouring equipment together with associated solvent storage tanks have occupied a large amount of floor space. Further, equipment of this type has been relatively fixed in design and lacking in flexibility for performing other textile processing operations.

Accordingly, it is an object of the present invention to provide a new and improved apparatus for treating a running fabric web. A more particular object of this invention is to provide a new and improved apparatus for solvent scouring a running web on a continuous basis providing a high washing action with a minimum volume of solvent. A further object of this invention is to provide a novel apparatus for drying the fabric without distortion thereof.

SUMMARY OF THE INVENTION

This invention features the apparatus for treating a running fabric web, comprising delivering the web in a tensionless flat condition onto a conveyor and carrying the web past a plurality of scouring stations with each station re-cycling a portion of solvent drains as well as a portion of the adjacent station drains, then past a final station wherein clean, fresh solvent is applied. The web is then carried through a suction station where a portion of the solvent is removed and then past an optional application station where a chemical may be applied to the web. The web is then carried into a drying chamber where it is transported in a flat, tensionless condition over a plurality of vibratory conveyors providing bulking action to the material while it is subjected to a combination of air and super-heated vapor used to flash off solvent entrained within the material. A second optional application station is provided in the drying action to apply additional chemicals to the web prior to leaving the drying chamber. The apparatus is in a modular configuration to permit extension of the unit or the insertion of additional stages to the same basic unit.

BRIEF DESCRIPTION OF THE DRAWINGS

The FIGURE is a sectional view in side elevation, somewhat schematic, of a fabric treating apparatus made according to the invention.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

Referring now to the drawing, the reference character **10** generally indicates a fabric treating apparatus comprised of modular housing sections **12** and **14** detachably connected to one another along a vertical joint **16.** In general, the forward section **12** serves as a solvent scouring chamber while the after section **14** serves as a drying chamber. The apparatus **10** is mostly enclosed within a housing formed by side walls **18** and end walls **20** and **22,** bottom walls **24** and **27** and top walls **20** and **30.**

A running web **32,** which may be in flat open width form as for woven fabrics or in flat tubular form as for knit fabrics, is carried up in an inclined conveyor **34** and dropped down onto an inclined chute **36** extending into the first stage **12** and terminating slightly above the upper reach of a horizontally extending conveyor **38.** A feeler **40** is located between the discharge end of the chute **36** and the start of the conveyor **38** to sense the tension on the web **32** as it is delivered onto the conveyor. The feeler is operatively connected to one of the driving rolls for the feed conveyor **34** and serves to control the rate of delivery of the web into the scouring chamber. If the feed is too fast, the web will drape loosely as it comes off the chute whereas if the feed is too slow, the web will become tensioned. In any event, the feeler will sense the condition and, through the control unit, take corrective action.

Mounted above the upper reach of the conveyor **38** are banks of spray heads or nozzles **42, 44** and **46** arranged in spaced parallel relation transversely across the conveyor and positioned to spray the web **32** with solvent as it is carried underneath. Typically, each group of spray nozzles may be three in number and typically may be in the form of tubes or pipes formed with longitudinal slits or longitudinally aligned perforations adapted to dispense the solvent in the form of a spray against the web. Each set of nozzles is connected by its own conduit **48, 50** and **52,** respectively, to its own pump **54, 56** and **58,** respectively. Each of the pumps is connected by a conduit **60, 62** and **64,** respectively, to a drain tank or a trough **66, 68** and **70.**

The drain troughs **66, 68** and **70** are mounted adjacent to one another in a vertically staggered relation with the tank **66** below the level of the tank **68** which, in turn, is below the level of the tank **70.** The drains from the nozzles above the conveyor collect in the troughs with most of the drains running down an inclined wall **72** into the first trough **70.** The wall **72** is located directly below a nozzle or spray bar **74** positioned at the end of the nozzle sets **42, 44** and **46** and connected by a conduit **76** to a still **78** whereby clean, fresh solvent only will be sprayed onto the web prior to leaving the scouring chamber. Thus, the trough **70** in conjunction with the pump **58,** conduits **62** and **64** and sprayheads **46** re-circulate relatively clean solvent at this stage since it is closest to the fresh solvent coming from the nozzle **74.** The overflow from the trough **70** goes into the middle trough **68** which also receives some drain from its associated nozzles directly over it and which drains include those impurities washed down by the set of nozzles **42.** Thus, the second set of sprayheads **44** wash the fabric with solvent that is less clean than the solvent going through the sprayheads **46,** yet cleaner than those at the first set of heads **42.** The over-

flow from the trough **68** is to the trough **66** which is recycled to the first set of nozzles **42** by means of a pump **54.** Since the fabric entering the first part of the scouring station receives its first cleaning at the first station the solvent being circulated will be relatively dirty in comparison with the other stages wherein the solvent becomes successively cleaner until it passes the nozzles **74** where completely clean, fresh solvent is applied and at which point the fabric is fully scoured. The recycling of the solvent in this fashion provides a very high capacity of washing action which is extremely effective and keeps to a minimum the total quantity of solvent required, despite the high pumping volume. The overflow from the trough **66** is to a collection drain **80** which feeds through a line **82** and is pumped back to the still **78** where the solvent is purified and returned to the scouring station through the line **76.** A storage tank **84** is provided and connected to the still to compensate for losses due to evaporation, leakage and the like.

The scouring action is further enhanced by vibrating the web as it passes through the scouring station. This may be done by means of an eccentrically rotated roller **85** mounted below the upper reach of the conveyor **38.**

As the fabric is carried by the conveyor **38** out of the scouring chamber, it is carried over a slit suction pipe **86** mounted below the upper reach of the conveyor belt and connected by a line **88** to a vacuum pump **90** which discharges the recovered solvent back into the still. In practice, the conveyor belt **38** is in a form of a foraminous screen or mesh material which permits the solvent to pass freely therethrough. By re-cycling the solvent in this fashion, the cleansing action is multiplied. For example, assuming the pumping capacity from the still is 600 gallons a minute, this washing volume would be multiplied approximately four times by the re-cycling stages, the multiplication factor depending upon the number of re-cycling stages.

From the suction box **86,** the conveyor **38** carries the web under a spraybar **92** adapted to deliver a liquid chemical over the width of the fabric. The spraybar is connected by a line **94** and pump **96** to a storage tank **98.** A drain board **100** is located below the upper reach of the conveyor and under the spraybar **92** to collect the runoff from this station. A drain return line may be provided to recover excess chemical and return it to the storage tank **98.** Various types of chemicals may be applied at this station such, for example, a finishing chemical sold under the trademark "Scotchguard" by the 3M Company.

From this finishing station, the web is transported into the drying section **14** and is discharged from the conveyor **38** onto the upper reach of a conveyor **102,** preferably of an openwork material to permit vapors to pass therethrough. The conveyor **102** is disposed slightly below the level of the conveyor **38** and a feeler **104,** similar to the feeler **40,** is provided to sense the tension of the web as it moves from one conveyor to the other. As before, the feeler **104** is operatively connected to the conveyor **102** to control the speed thereof to prevent tensioning of the web and also to prevent the web from bunching up. Insofar as the web will be drying while it is on the conveyor **102,** it will undergo dimensional changes to some extent depending upon the material. Thus, unless compensation is provided in the speed of the conveyor **102,** the web would tend to tension longitudinally with respect to the section of the web passing through the scouring station.

In order to aid in removal of the solvent from the web and also to provide bulking action, a vibratory motion is introduced to the web. In the illustrated embodiment, the vibratory action is provided by means of an eccentric roll **106** below the upper reach of the conveyor belt **102** and rotated by any suitable means such as a motor and the like. Rotation of the eccentric roll **106** will agitate and vibrate the conveyor belt together with the web, tending to shake out droplets of solvent within the web fibers and also fluffing up the web material in the process.

The main drying action in the drying chamber is provided by means of a combination of super-heated solvent vapor and air which is delivered through ducts **108** and **110** disposed above the upper reach of the conveyor **102** and provided with openings along their bottom walls to direct heated gas down against the web. Air and solvent vapors are continuously re-circulated within the drying chamber and provide a highly effective medium for drying the fabric. The mixture of air and solvent along with any solvent flashed off from the web by the drying action, is drawn down towards the bottom of the drying chamber through condensers **112** mounted across an opening formed in a horizontal supporting wall **114.** A portion of the vapors passing through the condensers will condense and collect in one of the troughs formed in a drainboard **116** and these drains are then returned to the still for re-use. The remaining gaseous mixture of air and vapor is drawn into a centrifugal blower **118** and forced into a manifold **120** across which is mounted a heater **122.** The heater superheats the vapor for optimum drying action prior to distribution through the transversely extending ducts **108** and **110** disposed across the conveyor **102** and communicating with the heater manifold.

From the conveyor **102** the web is transferred upwardly to another horizontal conveyor **124,** the speed of which is controlled by means of a feeler **126** and which also is provided with a vibrator **128.** Ducts **108'** and **110'** are located above the conveyor as in the first instance. Disposed above the upper reach of the conveyor **124** is another discharge head **130** providing a second fabric finishing station wherein a chemical, which may be the same as or different from the chemical at the first finishing station, is applied to the web. The head **130** is connected by a conduit **132** and a pump **134** to a chemical storage tank **136.**

The web is then carried along a reversely extending path and is fed up onto the uppermost conveyor **138,** the speed of which is controlled by a feeler **146** where it is carried upwardly and outwardly through the end of the drying chamber to be delivered to a take-up roll or transferred to other processing equipment.

By virtue of the modular construction, the scouring and drying sections may be separated to permit the addition of other fabric processing equipment, to extend the length of the conveyors, to add heating sections, provide more finishing stations, provide additional washing action, or the like. This provides a high level of flexibility since the units may be used together, in conjunction with other equipment or by themselves, as desired.

Having thus described the invention what I claim and desire to obtain by Letters Patent of the United States is:

1. Apparatus for treating a running fabric web, comprising

a. conveyor means defining a horizontally flat upper reach adapted to carry said web in a substantially flat, relaxed condition along a predetermined path,

b. a plurality of liquid dispensing stations longitudinally spaced from first to last along said path above said upper reach and adapted to deliver liquid onto said web,

c. the last of said stations connected to a source of fresh liquid,

d. height staggered interconnected discrete drain collecting means disposed below said path and beneath each of said dispensing stations for recovering said liquid,

e. discrete pumping means connected between each of said drain means and the station directly above for recirculating at least a portion of said drains onto said web

f. a still connected to the drain collecting means below the first of said dispensing stations,

g. a substantially closed drying chamber enclosing a portion of said path, blower means connected to said chamber for circulating air and vapor therethrough, heating means communicating with said blower means for heating said air and vapor, and condensing means communicating with said chamber for condensing at least a portion of said vapor, and

h. vibrating means comprising power driven eccentric rollers engaging the lower face of the upper reach of said conveyor means for vibrating said conveyor means and said web.

2. Apparatus according to claim 1 including at least one chemical application station along said path for applying chemicals to said web.

3. Apparatus according to claim 1 wherein said chamber is detachably connected to said stations to provide modular construction thereof.

4. Apparatus for treating a running fabric web, comprising

a. conveyor means defining a horizontally flat upper reach adapted to carry said web in a substantially flat, relaxed condition along a predetermined path,

b. a plurality of liquid dispensing stations longitudinally spaced in sequence from first to last along said path above said upper reach and adapted to deliver liquid onto said web,

c. the last of said stations connected to a source of fresh liquid,

d. height staggered interconnected discrete drain collecting means disposed below said path and beneath each of said dispensing stations for recovering said liquid,

e. discrete pumping means connected between each of said drain means and the station directly above for re-circulating at least a portion of said drains onto said web,

f. a still connected to the drain collecting means below the first of said dispensing stations,

g. a substantially closed drying chamber enclosing a portion of said path, blower means connected to said chamber for circulating air and vapor therethrough, heating means communicating with said blower means for heating said air and vapor, and condensing means communicating with said chamber for condensing at least a portion of said vapor, and,

h. suction means between said chamber and said stations and below said conveyor means for removing a portion of said liquid from said web, said suction means being connected to said still.

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