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Bruckner

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[54] **APPARATUS FOR WASHING, DRYING AND FIXING A TEXTILE WEB**

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[30] **Foreign Application Priority Data**

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[52] **U.S. Cl.** ..... **68/3 SS**, 15/307, 68/5 E, 68/18 C, 68/19.1, 68/20, 68/205 R

[51] **Int. Cl.** **D06c 1/08**, D06c 3/02, B05c 9/14

[58] **Field of Search** ..... 68/5 D, 5 E, 9, 18 C, 68/19.1, 20, 205 R, DIG. 5, 3 SS; 8/149.1; 15/307

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Assistant Examiner—Philip R. Coe
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[57] **ABSTRACT**

Apparatus for washing, drying and fixing a textile web having endless, driven means for moving a textile web successively through washing, drying and fixing zones and wherein the web is partially dried prior to the drying zone by causing an airstream to pass through the web. Partial drying of the web is facilitated by vibrating the web and means is provided for recovering the washing solvent. Means is provided for condensing or preventing condensation of vaporized washing solvent depending upon whether the washing liquid is cold or hot, respectively.

15 Claims, 7 Drawing Figures

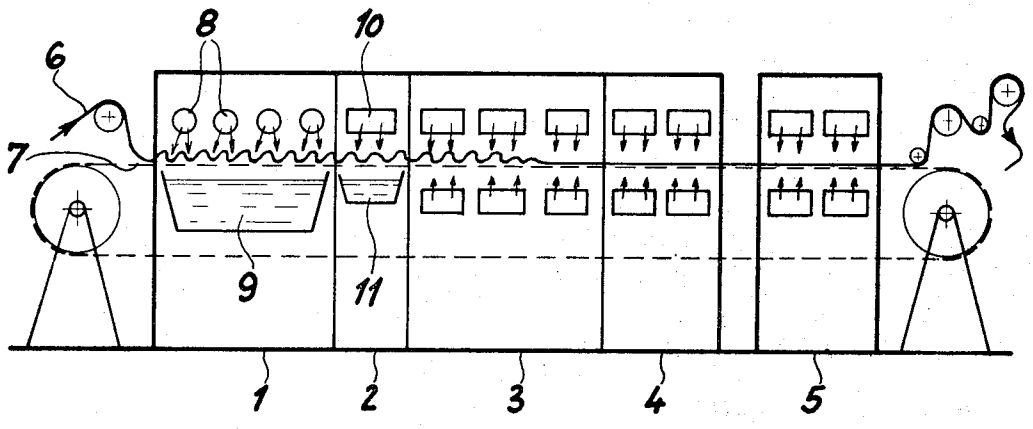

Fig. 1

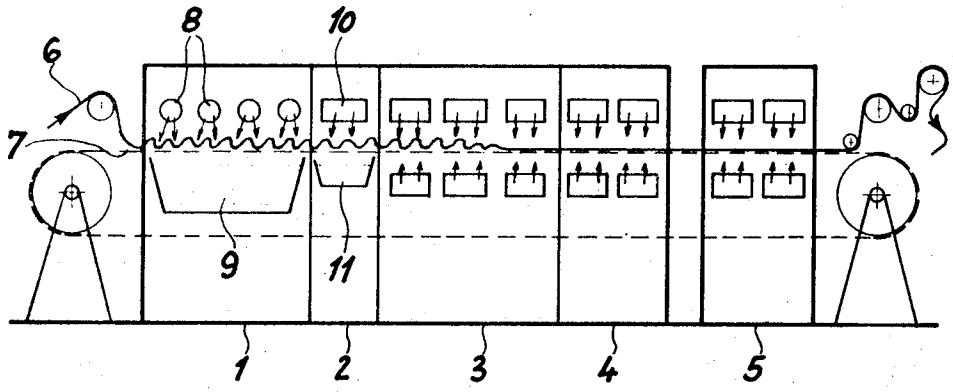

Fig. 2

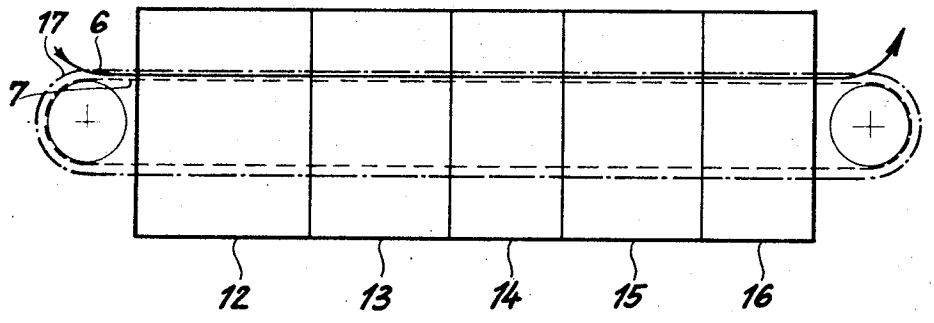

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Fig. 3

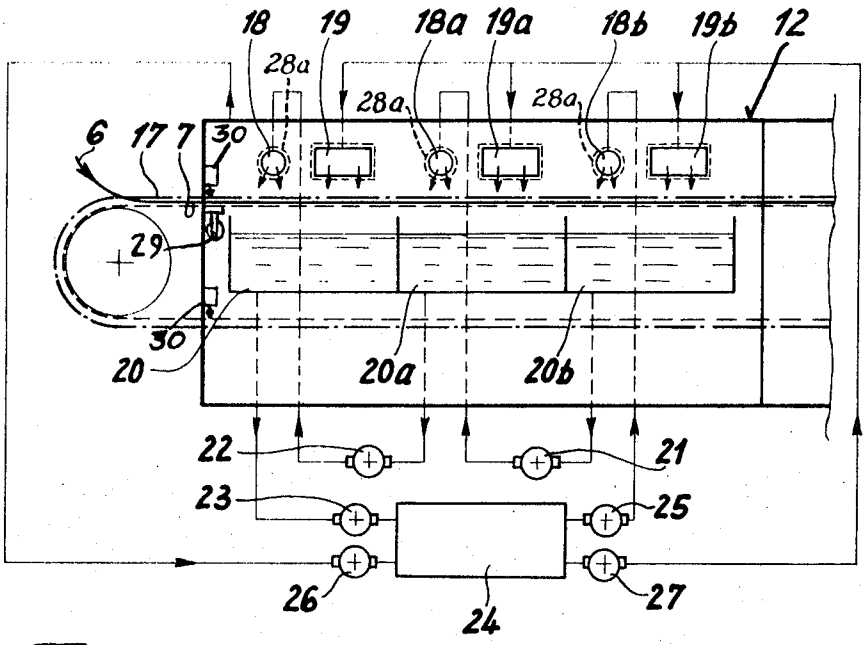
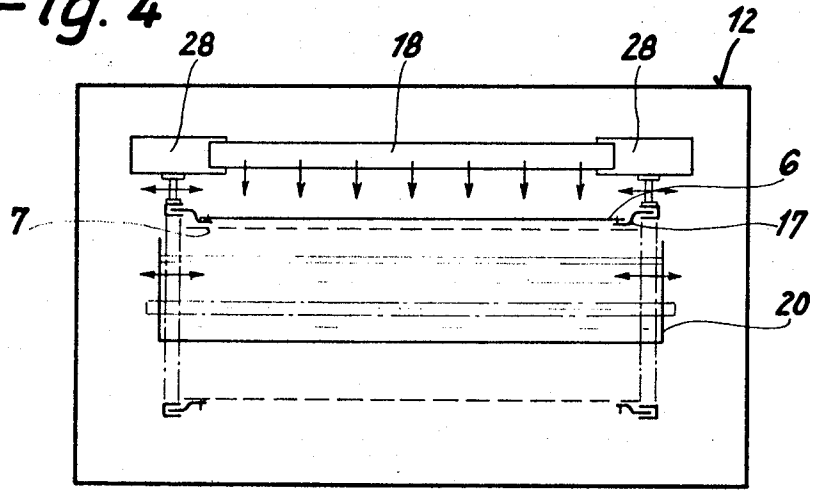


Fig. 4



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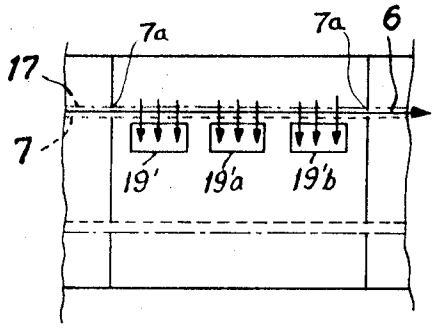


Fig. 5

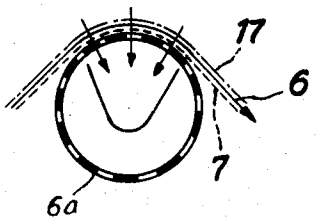
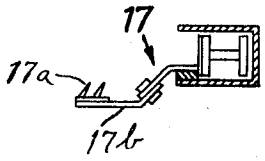


Fig. 6

Fig 7



APPARATUS FOR WASHING, DRYING AND FIXING A TEXTILE WEB

The invention concerns an apparatus for washing, drying and eventually subsequently fixing a textile web, particularly for use with an organic solvent washing liquid.

To be able to carry out the drying of a washed textile web with minimum possible heat consumption, it is known to run the textile web, after leaving the washing zone, through a squeezing means, by which a large part of the washing liquid still remaining in the textile web is mechanically squeezed out, before the drying is then finished in the drying zone by a hot air stream. Now there are, however, numerous delicate or voluminous (structured) textile fabrics which are not suited to run through such a squeezing means. Such fabrics hitherto were generally comparatively expensively dried by very large hot air driers.

The object of the present invention is to avoid these disadvantages, to develop an apparatus of the aforementioned type that will also faultlessly dry delicate or voluminous fabrics and has a small heat consumption and space requirement.

The object is realized according to the invention by a mesh belt carrying the textile web successively through the washing zone, the hot air drying zone and eventually a subsequent fixing zone and by at least one predrying device disposed before the hot air drying zone, said device removing the washing liquid from the textile web by means of an air stream.

Supporting the textile web on a mesh belt allowed — as experiments showed — a very large part of the washing liquid held in the textile web to be removed from the web by means of a more or less powerful air stream. The air steam can be a suction or pressure air stream; its strength and direction may be adapted in a simple way for the web which is to be treated.

The invention is especially suited for apparatus in which an organic solvent (such as chlorinated hydrocarbons) is used as the washing liquid. Because of its relatively high specific gravity, the removal of the washing liquid from the textile web under the action of an air stream is considerably facilitated. The invention is not however limited, to apparatus using organic solvents as the washing liquid, but can also be advantageously applied to apparatus employing aqueous washing liquids.

According to a practical embodiment of the invention two tenter chains are provided to carry the textile web taut through the washing zone, the hot air drying zone and eventually a subsequent fixing zone. The tenter chains, in conjunction with the mesh belt carrying the textile web, ensure that in all treatment zones the web is exposed to the respective treating agent in use (liquid or hot air) evenly spread out and especially without rolled up edges. These and many further features of the invention will be apparent from the following description of two embodiments illustrated in the drawing, wherein:

FIG. 1 is a schematic diagram of a first embodiment of the invention;

FIG. 2 is a schematic diagram of a further embodiment of the invention;

FIG. 3 is a diagram of the washing zone of the apparatus of FIG. 2;

FIG. 4 is a schematic section through the washing zone of FIG. 3.

FIG. 5 is a fragmentary view similar to FIG. 3 and illustrating a modification;

FIG. 6 is an enlarged, transverse sectional view illustrating a suction cylinder over which the textile web passes; and

FIG. 7 is a cross-sectional view illustrating a tenter chain and needle carriers.

The apparatus shown in FIG. 1 serves for washing and drying a textile web. It essentially comprises one or more housings or enclosures including a washing zone 1, a predrying zone 2 serving for blowing out the washing liquid, a drying and shrinking zone 3, an airing zone 4 and a cooling or fixing zone 5.

The textile web 6 is laid in folds on an endless circulating mesh belt 7 and is carried by this mesh belt through openings or apertures 7a (FIG. 5) communicating with the aforementioned zones 1 to 5.

A number of spray tubes 8 are provided in the washing zone 1 which spray the washing liquid, for example an organic solvent or solvent mixture, onto the textile web 6. The washing liquid dripping from the web is collected in a container 9. A pump (not shown) serves to induce the necessary circulation of the washing liquid. There are further apparatus, not shown, for purification (distillation) of the washing liquid.

In the zone 2 a pressure air stream is directed onto the textile web 6 supported on the mesh belt 7 by a nozzle tube 10. In this way most of the washing liquid held in the textile web is forced downwards and is caught in a collecting container 11.

In the drying and shrinking zone 3 the textile web 6 is dried by circulating hot air, in the course of which the web can shrink. The washing liquid still present in the textile web, particularly an organic solvent, evaporates to a very large extent in the zone 3. So that the circulating air does not become over saturated with solvent, a certain part of the drying air is continuously sucked out and led for example through a condensation device, not shown, in which the solvent is recovered.

In the airing zone 4 the textile web is preferably subjected to a clean air stream, whereby the comparatively little solvent remaining in the web can be recovered by absorption. In the cooling zone 5 the textile web 6 is finally cooled to the necessary temperature for rolling up or stacking in zig-zag manner.

In the further embodiment shown in FIG. 2 the textile web 6 is carried by means of the mesh belt 7 successively through a washing zone 12, a drying zone 13, an airing zone 14, a fixing zone 15 and a cooling zone 16. The apparatus furthermore includes a pair of tenter chains 17, which engage the textile web 6 by its edges and holds it flat. These two tenter chains 17 are likewise led through all the aforementioned zones 12 to 16. The tenter chains 17 are provided for example with needle carriers, in which case the needles 17*a* and their carriers 17*b* are so constructed that the edges of the textile web engaged by the needles lie very closely over the surface of mesh belt 7.

The construction of the washing zone 12 in detail is best shown in FIGS. 3 and 4. The washing zone 12 includes several washing units arranged one after the other, each of which consists of a spray device 18, 18*a*, 18*b* spraying the washing liquid onto the textile web, and a predrying air stream device 19, 19*a*, 19*b* for removing washing liquid from the textile web by means

of an air current. With individual washing units are associated separate collecting containers **20**, **20***a*, **20***b*, each of which is connected with the previous spray device opposite the direction of movement of the textile web by a pump **21** or **22**, respectively. The first collecting container **20** is connected by a pump **23** with a purification apparatus **24** which is connected by a pump **25** with the spray device **18***b* of the last washing unit. The atmosphere of the washing zone **12** is likewise connected with the purification apparatus **24** through a suction pump **26**. In this way the solvent vapour held in the sucked out air is removed. The purified air is led by a pump **27** to air stream devices **19**, **19***a*, **19***b*.

The collecting containers **20**, **20***a*, **20***b* for the washing liquid removed from the textile web **6** are situated between the upper and lower runs of mesh belt **7** and tenter chains **17**.

Instead of the groups of pressure air nozzles situated above the textile web provided in this and the previous embodiment, groups of suction air nozzles **19'**, **19'***a* and **19'***b* situated below the textile web can be provided (see FIG. **5**). To this end the textile web with the mesh belt and tenter chains can for example run over one or more suction cylinders. **6***a* (FIG. **6**).

To be able to adapt the apparatus to the working width of the particular textile web **6** in use, the tenter chains **17** are mounted for adjustment toward and away from each other in a known manner, such as disclosed in U.S. Pat. No. 3,518,848. The mesh belt **7**, the spray devices **18**, **18***a*, **18***b* serving to supply the washing liquid, and the air stream devices **19**, **19***a*, **19***b* providing for removal of the washing liquid are likewise adjustable in their working width in conformity with, and preferably together with, the tenter chains. FIG. **4** shows to this end telescopic tube-like masks **28** for the spray device **18**, which can be slid to a greater or less extent over the spray device, according to the working width. Similar masks **28***a* are provided for the airstream devices.

If the washing liquid comprises a cold organic solvent at least some walls of the washing chamber, and preferably those walls disposed above the liquid collecting containers, are cooled by conventional cooling means to condense solvent vapour. In this way the proportion of solvent held in the sucked out air is reduced.

If, however, the washing liquid comprises a hot organic solvent, it is advantageous to heat at least some of the walls of the washing chamber by conventional heating means to prevent a condensation of solvent vapour in the washing chamber. In this way relatively cold condensed washing liquid is prevented from dripping onto the textile web.

To aid in removing the washing liquid from the textile web by an air stream a conventional vibrator **29** or similar device is provided to cause vibration of the mesh belt with the textile web carried thereon. The removal of the solvent from the textile web is also favoured by the relatively high specific gravity of the solvent.

In the embodiment schematically shown in FIG. **2** an airing zone **14** is interposed between the drying zone **13** and the fixing zone **15**, in which the textile web **6** is subjected to a clean gas stream practically free of solvent. In this way it is prevented that the textile web still contains further solvent when entering the fixing zone, which, in view of the high temperature (mostly between 180° and 200° C.), could decompose there.

In all chambers of the apparatus according to the invention which contain solvent vapour, and especially in the washing chamber and drying chamber, are provided nozzles **30** (FIG. **3**) in the region of the apertures in the chamber walls for entry and exit of the textile web, the mesh belt and the tenter chains, which nozzles are fed with gases sucked out of the respective chamber and are directed towards the interior of the chamber. In this way the intake of outside air through these apertures is prevented, which for example in the washing zone would have as a result an undesired dilution of the solvent containing atmosphere.

What we claim is:

1. Apparatus for washing a textile web with an organic solvent washing liquid, and then drying and subsequently fixing said web, said apparatus comprising housing means forming successively a washing zone, a hot air drying zone, and a fixing zone, and a mesh belt and tenter chains for carrying the textile web successively through each of said zones, said washing zone comprising a plurality of washing units disposed one after the other, each of said units being composed of a spray device for spraying the washing liquid onto the textile web, and means provided downstream from each spray device for establishing a downward air stream through said web to remove the washing liquid therefrom.

2. Apparatus according to claim **1** wherein the tenter chains are provided with needle carriers for engaging the web.

3. Apparatus according to claim **1** in which the tenter chains are adjustable toward and away from one another for adaption to the working width of the particular textile web in use, and wherein the means for establishing said airstream includes means for adjusting the working width of said airstream.

4. Apparatus according to claim **1** wherein each of the means for establishing said airstream comprises nozzle means disposed above the textile web for directing air under pressure through a textile web supported on the mesh belt.

5. Apparatus according to claim **1** wherein each of the means for establishing said airstream comprises nozzle means disposed below the textile web to create a suction air stream through the textile web supported on the mesh belt.

6. Apparatus according to claim **1** including collecting containers for each washing unit, each down-stream container being connected by a pump with the adjacent upstream spray device.

7. Apparatus according to claim **6** wherein the collecting containers are disposed between the upper and lower runs of the mesh belt.

8. Apparatus according to claim **6** wherein the most upstream container is connected by a pump to the most downstream spray device.

9. Apparatus according to claim **1** including a condensation device for reception of said airstream to effect recovery of the solvent, and suction means for delivering said airstream to said condensation device.

10. Apparatus according to claim **1** wherein the washing liquid is cold.

11. Apparatus according to claim **1** wherein the washing liquid is hot.

12. Apparatus according to claim **1** including means for vibrating the mesh belt.

13. Apparatus according to claim 1 including means forming an airing zone between the drying zone and the fixing zone and means for subjecting the textile web to a clean airstream substantially free from solvent.

14. Apparatus according to claim 1 wherein said washing and drying zones are formed by chambers having walls apertured for the passage of said belt and wherein nozzles are provided adjacent said apertures and directed toward the interior of said chambers.

15. Apparatus according to claim 1, characterized in that a suction cylinder carrying the mesh belt and textile web is disposed within the washing zone, in the region of the periphery of which suction cylinder washing liquid spray devices are provided.

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