A machine is disclosed for processing pieces of textile fabrics comprising a rotating drum (50) characterized by a further internal element (52) essentially coaxial with said drum, with dimensions suitable to contain the textile fabric loaded in the volume between the rotating drum (50) and the internal element (52), to prevent constrictions or knots from forming in said textile fabric.
DESCRIPTION

Technical field

This invention relates to industrial machines for processing textile fabrics in the piece or textile products, such as imitation leather, knitwear, woven fabrics, and to the relative procedure for processing thereof, for example drying, washing, dyeing and finishing in general, in particular for humid or wet processes.

Background of the invention

These processes are implemented with machines which use a principal very similar to a domestic washing machine, wherein inside a rotating drum the textile fabric is, for example, dried, using structure and devices to control drying air, or washed, using structure and devices to control a wash liquid, or dyed, using structure and devices to control a dye.

Figure 1A shows a schematic drawing of a generic machine 1 for processing textile fabrics of a known type, comprising a casing 3 to contain a drum 5 rotating in the direction of the arrows V1. The textile fabrics to be processed are inserted in this drum through a door 7A which opens according to the arrow P1 for front loading of said textile fabric.

The drum 5 advantageously has internal ribs 5A, which help the textile fabric to rotate inside said drum, and holes 5B for the passage of drying air or washing and/or dyeing water.

Figure 1A also shows purely by way of example a generic path of the drying air, wherein the new air being introduced, entering a heater battery 9, is indicated with the arrow F1, the arrows F2 indicate the path of the drying air inside the drum 5 and the arrow F3 indicates the removal path of the humid air.

In a different type of known machine, the drum 5 is divided into several sectors, see Figure 1B, and has several front opening doors 7B, for example, according to the arrow indicated with P2. In this case pieces of textile fabric with small dimensions or garments can be processed, while it is impossible to industrially process pieces of considerable length, such as conventional pieces, each ranging from approximately 35 to 75 meters in length.
Another known embodiment of a rotating drum, see Figure 1C, is provided with two supports 11A and 11B and a door 7C which opens according to the arrow indicated with P3 for side loading of the textile fabric.

A further embodiment of a machine for processing pieces of textile fabric, in particular for drying textile fabrics, comprises a fan, see patent GB 1500032, mounted laterally and coaxially with respect to the rotating drum and contained between two perforated walls, which introduces new air into said drum.

Moreover, the patent US 5438766 describes a machine for washing garments having internal elements integral with the rotating drum to prevent entangling of garments and improve loading and unloading of said drum.

The patent GB 1308376 describes an electronic control system for operation of a machine with rotating drum for drying textile fabrics.

The patent GB 02294749 describes a machine comprising two or more rotating drums disposed in series in respective chambers, wherein air is supplied to each drum at a controlled temperature, with devices suitable to make the material, in particular mats or rugs, pass from the first to the subsequent drums.

The patent DE 19616634 describes a machine with rotating drum for garments, comprising a circulation system for drying air divided into two sections, wherein the first section allows axial circulation of air while the second part allows circulation of air from conventional ribs which project towards the inside of the drum.

The patent GB 949961 describes a particular embodiment of a frame for a rotating drum comprising internal ribs.

The patent US 4595104 describes a rotating drum comprising on the wall thereof trapezoidal cuts which define trapezoidal tongues, similar to conventional ribs, facing the inside of said drum.

The patent GB 378331 describes a machine for drying clothes or other articles composed of a plurality of independent rotating drums to which a movement is simultaneously imparted along a closed path inside the machine, so as to stop each cylinder in loading and unloading or operating positions.

The patent US 1862652 describes a machine composed of a rotating
drum divided into a plurality of sectors and having V-shaped perforated elements on the walls of these sectors to introduce liquid into the drum.

The patent US 6497122 describes a machine for dyeing textile fabrics composed of a non-perforated rotating drum divided into a plurality of sectors and having a perforated pipe, coaxial with the drum for supporting the partition walls, wherein the dyeing liquid is introduced into the drum by this pipe and removed from the drum through the shaped ends of said walls.

The patent GB 227761 describes a machine with a vertical axis for spinning garments, comprising a container and a perforated coaxial element, both rotating.

The main drawback of industrial machines for processing pieces of textile fabric, in particular for wet processes, consists in the fact that after processing the piece has knots or constrictions. These defects are caused by loading with loose loops and without joining the head and tail of the piece, so that the casual movement of the piece inside the drum causes a natural predisposition of the textile fabric to form said knots or constrictions. Moreover, the ribs inside the drum have a casual hold on the mass of the textile fabric during processing, which promotes penetration of loose loops by nearby loops or of the head by the tail of the piece. The final effect of processing on the textile fabric is an alternation of points that have been completely processed and points with insufficient processing, which is solved essentially by unloading the product from the machine, removing the knots and reloading it in the machine, with noteworthy increases in costs and processing times.

It must be noted that this type of industrial machine with rotating drum is advantageously used for processing delicate pieces of textile fabric such as knits and in particular for finishing, as processing with this type of machine guarantees a soft and delicate treatment, but the final effect of the treatment is prejudiced by the predisposition of these textile fabrics to form defects during processing.

**Objects and summary of the invention**

The main object of the present invention is to solve the aforesaid drawback.

Another object of the present invention is to provide new and improved
systems for positioning of the piece inside the machine.

A further object is to improve loading and unloading of the piece of textile fabric in and from the machine.

Further objects and advantages of the invention shall be apparent from the drawings and from the description hereunder.

According to the invention, an industrial machine is provided for processing pieces of textile fabric comprising a rotating drum inside which a further element essentially coaxial preferably with a horizontal axis is provided.

The dimensions of the coaxial element are advantageously suitable to contain the piece of textile fabric loaded in the volume between the rotating drum and said coaxial element. The principal advantage is provided by the fact that the coaxial element prevents interposing of the turns of the piece of textile fabric and/or allows the piece to maintain a position essentially equidistant from the center of the drum and/or to maintain an essentially spread out form, that is a form which is not intertwined or in any case not twisted, during processing, so as to prevent parts of the textile fabric from overlapping and forming creases or knots. In this way improved processing is obtained with a minimum probability of defects in the finished product.

The piece of textile fabric is advantageously in rope form before being inserted in the drum, with the rope positioned inside the drum advantageously in a spiral around the coaxial element, with the ends of the rope abutted and stitched to form a closed path, or advantageously fixed to the rotating drum or to the coaxial element. In an advantageous embodiment of the invention, an external machine is provided to produce the rope form and the turns of textile fabric, with the possibility of obtaining different degrees of processing automation.

In the preferred embodiment, the present invention is advantageously used for industrial finishing processes on delicate textile fabrics in the piece – generally said pieces range from 35 to 75 meters in length – although other processes on different pieces of different textile fabrics are also possible.

Moreover, pieces joined together in series can also advantageously be produced, for example by stitching the end of one piece to the end of the subsequent piece, so as to form a single piece of a length equivalent to the
sum of the lengths of the individual pieces; in this way processing is faster and less costly with respect to individual processing.

**Brief description of the figures**

The present invention can be better understood and its numerous objects and advantages will be more apparent to those skilled in the art with reference to the accompanying schematic drawings, which show a non-limiting practical example of the invention. In the drawing:

Figure 1A schematically shows a known generic machine with a rotating drum for processing textile fabrics;

Figure 1B schematically shows a known generic rotating drum with side loading;

Figure 1C schematically shows a known generic rotating drum with front loading;

Figure 2 schematically shows a rotating drum according to the invention;

Figure 3 shows a further schematic representation of a rotating drum according to the invention;

Figure 4 schematically shows positioning systems of the textile fabric in accordance with the present invention;

Figure 5 shows a development of the embodiment of the invention in Figure 3;

Figure 6 shows a perspective view of a further embodiment of the invention; and

Figure 7 shows a perspective view of still a further embodiment of the invention.

**Detailed description of the preferred embodiments of the invention**

In the drawings, in which the same numbers correspond to the same parts in all the various figures, a machine for processing textile fabrics in the piece comprises a rotating drum indicated generically with 50, see Figures 2 and 3, inside which, according to the present invention, is provided at least one element 52 with dimensions suitable to be surrounded by a piece of textile fabric, loaded in the volume between the drum 50 and the internal element 52.

In an advantageous embodiment of the invention, this internal element
52 extends along the entire axial length of the drum 50 and is produced with a cylinder, or with a further drum, coaxial with the drum 50. This internal element 52 is preferably motorized, although an embodiment of the invention with the internal element 52 fixed, that is, integral with the rotating drum 50 or fixed to the frame of the machine, is also possible.

In the case in which the internal element 52 is motorized the angular rotation speed thereof is advantageously independent of the speed of the drum 50 to facilitate loading and/or to follow the movement of the textile fabric during processing.

Moreover, at least one of said drum 50 or internal element 52 advantageously has a reversible direction of rotation and a system to block rotation – not shown in the figure for simplicity – to facilitate loading of the textile fabric.

The drum 50, the internal element 52 or both also advantageously have ribs, respectively 54A and/or 54B, the main function of which is to help the textile fabric to turn inside the rotating drum 50. The drum 50, the internal element 52 or both also have a plurality of holes, respectively 56A and/or 56B, for example circular or slotted.

In particular, Figure 2 schematizes a rotating drum 50 comprising a coaxial internal element 52 according to the present invention, wherein the piece of textile fabric is advantageously loaded in the machine frontally, as described in the conventional case in Figure 1A with reference to number P1.

Figure 3 schematizes a rotating drum 50 comprising a coaxial internal element 52 according to the present invention, wherein the piece of textile fabric is loaded in the machine from the side through a door indicated with P4, similarly to the drum in Figure 1C.

Figure 4 schematizes systems to position the piece of textile fabric 60 inside the drum 50 to allow interposing of the axial element 52.

In an advantageous embodiment of the invention, the drum 50 is loaded with a piece of textile fabric 60 in rope form prepared in advance in the form of a spiral, see Figure 4A. The axial element 52 is advantageously interposed inside said spiral. The spiral of the piece 60 in rope form is advantageously prepared in advance by stitching the head 60A to the tail 60B and then loaded inside the drum 50 or preferably fixing it in fixed points 63 and 65 inside said
drum 50 or on fixed points of the axial element 52; the piece of textile fabric must be sufficiently loose to allow processing.

In a further advantageous embodiment of the invention the drum 50 is loaded with a piece of textile fabric 60 in rope form, see Figure 4B, in the form of a ring, by stitching the head 60A to the tail 60B or fixing the head 60A and the tail 60B in fixed points inside said drum 50 or on fixed points of the axial element 52 and interposing the axial element 52.

In a further embodiment a fabric in an open width configuration may advantageously be loaded, optionally with an external machine to produce turns.

In an embodiment of the invention means are provided to introduce air from below, although it would also be possible to introduce air from above or from the central axis. In this last case, represented by way of example in Figure 5, the air is advantageously introduced on one side 52A of the internal element 52, see arrow A1, and delivered through the holes 56B produced on said element 52, see arrow A2, and subsequently through the holes 56A, see arrow A3 to be discharged outside the drum 50.

The introduction of air is advantageously substituted with other process fluids, such as steam, wash water or a dyeing substance, according to the type of processing to be implemented.

A machine for industrial processing of pieces of textile fabric according to the present invention is therefore advantageously used to dry, wash or dye, or generically carry out dry, humid or wet processing of any type of pieces of textile fabric, especially delicate textile fabrics; in particular, it can advantageously be used for humid finishing of pieces of delicate fabric.

A further embodiment of the machine according to the invention is shown in Figure 6, substantially corresponding to the embodiment of Figure 3. The main difference with respect to the embodiment of Figure 3, is to be seen in the provision of a pair of ducts 58, only one of which is shown in Figure 6, extending parallel to the axis of drum 56 and arranged underneath the internal element 52. The ducts 58 are provided with nozzles along their axial development. The nozzles are oriented such as to generate air or fluid jets oriented towards the fabric. These jets acts on the fabric during treatment. The jets of the two ducts 58 are activated alternatively according to the
direction of rotation of the drum 50 or of the internal element 52 to help the fabric moving.

Rather than two ducts 58, only one duct can be provided, with a double set of nozzles which are alternatively operated, according to the direction of rotation of the drum and/or of the internal element 52. According to a still further embodiment, the duct might be provided with only one set of nozzles and might be oscillating around its own axis to properly orient the jets.

According to a preferred embodiment of the invention the jets are pressurized air jets generated by fans with which the machine is provided.

The ducts 58 might be arranged inside the internal element 52, the latter being provided with wide apertures, through which the air jets can escape.

Rather than individual nozzles arranged along the duct 58, the latter may be provided with a continuous nozzle generating a laminar jet of air or other fluid.

Still a further embodiment of the invention is shown in Figure 7. Identical or equivalent parts are designated with the same reference numbers used in the previously described embodiments. In Figure 7 the internal element 52 is provided with apertures or holes 56B in a manner similar to the example shown in Figure 5. Inside the internal element 52 two ducts 58 are arranged, each provided with a set of nozzles 58B, for the purpose already discussed with respect to Figure 6. The comparatively wide openings 56B are sufficient to allow the air jets to escape from the wall of the internal element 52 and to impact on the fabric. The openings 56B may be slotted and extend axially or circumferentially.

As can be appreciated from Figure 7, in this embodiment the internal element 52 is not exactly coaxial to the drum 50. It does not form, therefore, a support for the drum itself. The latter is supported by wheels 62 keyed on shafts 60, one of which or both of which can be motorized. Rotation of the drum 50 is controlled by the shaft(s) 60. The wheels 62 engage in corresponding annular tracks on the outer surface of the drum 50. The front ends of the drum 50 are open to allow support of the internal element 52. This arrangement is advantageous, since it reduces the space above the internal element 52 and increases the space below the latter, where the fabric being
treated accumulates. More useful space is thus obtained without increasing
the diameter of the drum 50 or even reducing the outer diameter of the drum
with respect to the previously described embodiments.

The drum 50 may be sufficiently long to simultaneously treat more than
one piece of fabric. In this case separate doors P4 and internal partitions of
the drum are preferably envisaged. This possibility is again shown in Figure 7,
where two doors P4 are provided and an internal partition separates the inner
volume of the drum 50 into two parts. The internal partition has a central
aperture for the internal element 52.

As stated above, both the internal element 52 and the drum 50 may be
motorized and may be controlled by separate motors, to rotate at different
speeds and if required also in different directions. It can also be foreseen that
one of said members, preferably the outer drum 50, be supported idly during
the whole treatment or only during part of the treatment of a fabric piece. For
example, if the piece is to be dried within the machine, the outer drum can be
kept into rotation by a motor during the first part of the treatment cycle, when
the fabric is heavier due to the larger amount of water contained therein.
When part of the water has been removed, the outer drum 50 may be
supported idly, e.g. by disengaging a clutch between the motor and the
driving shaft(s). The rotation of the drum 50 will then be caused by the
displacement of the fabric piece contained inside the drum due to the
movement imparted to the fabric by the rotating internal element 52. In this
case the internal element 52 will rotate faster than the outer drum 50.

It is understood that the examples described only show some possible
embodiments of the invention, which may vary in forms and arrangements
without departing from the scope of the concept on which the invention is
based.
CLAIMS

1) Machine for processing pieces of textile fabric comprising a rotating drum, characterized by at least a further internal element arranged inside said drum, with dimensions suitable to be surrounded by at least one piece of textile fabric, contained in the volume between the rotating drum and said internal element.

2) Machine for processing textile fabrics according to claim 1, characterized in that said internal element and said drum are substantially coextensive.

3) Machine for processing textile fabrics according to claim 1 or 2, characterized in that said internal element and said drum are substantially coaxial.

4) Machine for processing textile fabrics as claimed in one or more of the previous claims, characterized in that said internal element extends at least for the axial length of said drum.

5) Machine for processing textile fabrics as claimed in one or more of the previous claims, characterized in that said internal element has a horizontal axis.

6) Machine for processing textile fabrics as claimed in one or more of the previous claims, characterized in that said internal element is a drum.

7) Machine for processing textile fabrics as claimed in one or more of the previous claims, characterized in that said internal element is a shaft.

8) Machine for processing textile fabrics as claimed in one or more of the previous claims, characterized in that said internal element is motorized.

9) Machine for processing textile fabrics as claimed in one or more of the previous claims, characterized in that at least one of said drum and said internal element is motorized with a variable speed.

10) Machine for processing textile fabrics as claimed in claim 7, characterized in that at least one of said drum and said internal element has a reversible direction of rotation.

11) Machine for processing textile fabrics as claimed in one or more of the previous claims, characterized in that at least one of said drum and said coaxial element is ribbed.

12) Machine for processing textile fabrics as claimed in one or more of
the previous claims, characterized in that at least one of said drum and said coaxial element has a plurality of holes.

13) Machine for processing textile fabrics as claimed in one or more of the previous claims, characterized in that at least one of said drum and said coaxial element is fixed or can be blocked when required.

14) Machine for processing textile fabrics as claimed in one or more of the previous claims, characterized in that it comprises fixing means for the ends of said piece of textile fabric on said rotating drum or on said coaxial element.

15) Machine for processing textile fabrics as claimed in one or more of the previous claims, characterized in that it provides door means for side or front loading of said textile fabrics.

16) Machine for processing textile fabrics as claimed in one or more of the previous claims, characterized in that it has means for the introduction of fluid from below, from above or from the axis.

17) Machine for processing textile fabrics as claimed in one or more of the previous claims, characterized in that it includes means for performing one or more of the following operations on the fabric: washing, drying, steaming, finishing.

18) Machine for processing textile fabrics as claimed in one or more of the preceding claims, characterized in that said internal element is out of center with respect to the drum and is arranged such as to leave more space underneath the internal element than above it.

19) Machine for processing textile fabrics as claimed in one or more of the preceding claims, characterized in that said drum is divided into at least two separate treating sections, for separately treating at least two fabrics at the same time.

20) Machine for processing textile fabrics as claimed in one or more of the preceding claims, characterized by means for generating fluid jets acting on the fabric.

21) Machine for processing textile fabrics according to claim 20, characterized in that said means generate air jets.

22) Machine for processing textile fabrics according to claim 20 or 21, characterized in that said means are arranged adjacent said internal element
and generate jets oriented from said internal element towards the internal wall of the drum.

23) Machine for processing textile fabrics according to claim 22, characterized in that said means are arranged outside and adjacent the internal element.

24) Machine for processing textile fabrics according to claim 22, characterized in that said means are arranged inside said internal element, the internal element being provided with an apertured wall.

25) Machine for processing textile fabrics according to one or more of the previous claims, characterized in that said drum is idly supported.

26) Machine for processing textile fabrics according to one or more of the previous claims, characterized in that said drum is motorized and that means are provided to detach said drum from a relevant motor, to maintain the drum idly supported.

27) Method for processing pieces of textile fabric, wherein a piece of textile fabric is inserted in a drum and said drum is made to rotate, characterized in that an internal element is provided inside said drum and the textile fabric is processed in the volume between said drum and said internal element, positioning said textile fabric around said internal element.

28) Method for processing pieces of textile fabrics according to claim 27, characterized in that said internal element and said drum are arranged substantially co-extensive.

29) Method for processing pieces of textile fabrics according to claim 27 or 28, characterized in that said internal element and said drum are arranged substantially co-axial.

30) Method for processing pieces of textile fabric as claimed one or more of claims 27 to 29, characterized in that said internal element is made to rotate about the axis thereof during processing.

31) Method for processing pieces of textile fabric as claimed in one or more of claims 27 to 30, characterized in that said drum is controlled into rotation by a motor for at least part of a processing cycle.

32) Method for processing pieces of textile fabric as claimed one or more of claims 27 to 31, characterized in that said internal element and said rotating drum rotate about a horizontal axis.
33) Method for processing pieces of textile fabric as claimed in at least one of the claims 27 to 32, characterized in that said internal element rotates with reversible rotation.

34) Method for processing pieces of textile fabric as claimed in one or more of claims 27 to 33, characterized in that it comprises at least one of the following processes: drying, washing, dyeing, steaming, finishing in general.

35) Method for processing pieces of textile fabric as claimed in one or more of claims 27 to 34, characterized in that loading of said piece of textile fabric comprises the following phases:

- forming a rope with a piece of textile fabric;
- loading a spiral of textile fabric into the drum around said internal element.

36) Method for processing pieces of textile fabric as claimed in claim 35, characterized in that a head and a tail of said piece are connected to one another.

37) Method for processing pieces of textile fabric as claimed in claim 35, characterized in that a head and a tail of the piece of fabric are fixed directly in fixed points of said drum or of said internal element.

38) Method for processing pieces of textile fabric as claimed in one or more of claims 27 to 37, characterized in that loading of said piece of textile fabric comprises at least one of the following phases:

- forming a rope with a piece of textile fabric;
- joining the head and the tail of said piece of textile fabric in rope form to form a closed ring;
- loading a closed ring of textile fabric inside the drum around said internal element;
- fixing said closed ring of textile fabric in at least a fixed point of said drum or of said internal element.

39) Method for processing pieces of textile fabric as claimed in one or more of claims 27 to 38, characterized in that the fabric is loaded in open width form.
**INTERNATIONAL SEARCH REPORT**

**A. CLASSIFICATION OF SUBJECT MATTER**

IPC 7 D06B3/16 D06B3/26

According to international Patent Classification (IPC) or to both national classification and IPC

**B. FIELDS SEARCHED**

Minimum documentation searched (classification system followed by classification symbols)

IPC 7 D06B

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

EPO-Internal

**C. DOCUMENTS CONSIDERED TO BE RELEVANT**

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**Date of the actual completion of the international search**

26 April 2005

**Date of mailing of the international search report**

06/05/2005

**Name and mailing address of the ISA**

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Fax (31-70) 940-3516

**Authorized officer**

Goodall, C

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