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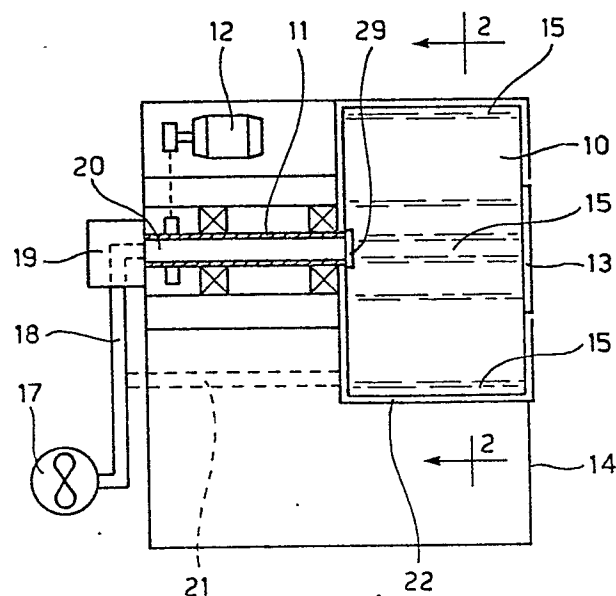
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54 **An apparatus for artificially aging and bleaching denim fabrics.**

57 An apparatus for processing fabrics, in particular for artificially aging and bleaching denim fabrics.

The apparatus comprises an unperforated rotating drum (10) with fins (15) inside it, parallel to the axis of rotation of the drum (10), to tumble both the fabric and the processing material impregnated with bleaching agent or other processing fluid. Said fins (15) are convex in section, with a vertex angle greater than 90°, preferably comprised between 120° and 150°.

The apparatus furthermore comprises exhaust means (17) for sucking any steam or gases that develop in the drum or inside the apparatus.



**Fig. 1**

## An apparatus for artificially aging and bleaching denim fabrics

This invention refers to an apparatus for use in processing fabrics, for example for carrying out a process to age and bleach fabrics, especially denim, which is the subject of another patent application by the same applicant.

According to the process claimed in the previous patent application for example, the fabric to be treated is repeatedly tumbled, together with a pre-established amount of sand or other granular material impregnated with a bleaching agent, until the desired degree of aging or bleaching of the fabric is achieved. Other known processes entail the use of pieces of pumice or the like.

Tests and experiments have shown, however, that in order to improve contact between the fabric and the existing granular material or that which forms in the processing container, and in order to prevent the granular material from accumulating in particular points, it is advantageous to shape the inside of the processing drum or rotating container by means of fins shaped in such a way as to allow rotation of the fabric as well as improved distribution of the granular material over the fabric itself.

It has also been found that the bleaching agent that impregnates the granular material or pieces has a certain tendency to evaporate and form gases that might escape into the working environment.

Therefore, an object of this invention is to provide an apparatus for carrying out the above or other chemical processes on fabric, that is of simple construction, makes it possible to avoid the abovementioned drawbacks, namely that permits even distribution of the granular material on the fabric to be processed, avoiding the formation of build-up areas in the drum, and at the same time prevents the steam or gases from the chemical substance from escaping, whether during processing or during loading and unloading of the fabric, when the machine is open.

A further object of this invention is to provide an apparatus of the type described above that furthermore provides for automatic separation of the granular material or pieces from the fabric and for unloading of the fabric at the end of each work cycle, particularly in large apparatus.

The above is made possible by a fabric processing apparatus according to the invention, wherein the fabric is placed in a rotating drum together with a substance in grains or pieces mixed with a bleaching agent or other chemical processing substance, characterized by the fact that the drum comprises an unperforated wall on the inside of which are provided fins for tumbling the fabric and the grain or piece material, that extend parallel to the axis of rotation of the drum or form a certain

angle with it, said fins consisting of shaped elements protruding towards the inside of the drum and having a convex cross-section, with a wide angle, greater than  $90^\circ$ , at the vertex, and with the edges of the fins merging with the inside surface of the drum, and by the fact that means are provided for sucking the steam and/or gases developed by the chemical processing substance inside the rotating drum.

Some embodiments of the apparatus according to the invention are described below with reference to the accompanying drawings in which:

Fig. 1 is a schematic view of a first apparatus according to the invention;

Fig. 2 is a cross-section of the drum, taken along the line 2-2 in figure 1;

Fig. 3 is an enlarged detail of figure 2;

Fig. 4 is a schematization of a second embodiment of the apparatus;

Fig. 5 is a section taken along the line 5-5 in figure 4;

Fig. 6 is a schematization of a third embodiment of the apparatus;

Fig. 7 is an enlarged detail of figure 6.

In the embodiment shown in figures 1 to 3, the apparatus comprises a sealed rotating drum 10, defining a closed space, supported by means of a shaft 11 driven by an electric motor 12. The drum 10 has an unperforated surface and can be loaded by means of a hatch 13. A structure 14, shown - schematically, contains and supports the rotating drum 10.

According to a first characteristic of this invention, the inner surface of the drum 10 is provided with shaped fins 15 in angularly spaced positions, that extend longitudinally and parallel to or forming an angle with the drum's axis of rotation. These fins serve to tumble the textile fabric inside the drum and to bring about a good distribution of the granular material or pieces impregnated with the chemical processing substance, without creating areas or points of accumulation or stagnation of the aforesaid material. Therefore, the fins 15 protrude towards the inside of the drum and are so shaped that their profile has a wide angle, greater than  $90^\circ$ , at the vertex, between about  $120^\circ$  and  $150^\circ$  for example, in this manner they give the inside of the drum an undulated shaped configuration that aids tumbling of the fabric while at the same time allowing smooth movement of the processing material. In the embodiment shown in figure 3, referring to a cylindrical drum or one that is circular in section, the fins 15 are triangular in section with flat sides 16 that form an angle of about  $135^\circ$  at the vertex; the fins 15 are smoothly joined by a wide area at

their base to the inner surface of the drum. The height of the fins, that is their size in a radial direction, can be chosen from a wide range of values; good results can be achieved with fins whose height ranges between 6% and 10% of the inside diameter of the drum or that surrounding the drum itself.

According to a further characteristic of the invention, the apparatus is provided with sucking means to remove the steam or gases of the bleaching agent or other chemical processing substance that form inside the drum and might tend to escape when the apparatus is opened. According to a first embodiment the sucking means can include an aspirator 17 connected to the inside of the drum by means of a duct 18, a rotary seal 19 and a duct 20 in the shaft 11 of the machine which in this case takes the form of a tubular shaft. Alternatively, or in combination with the sucking system described previously, provision can be made for an aspiration duct 21 that opens into a hollow space 22 formed by the structure of the apparatus around the rotating drum 10. The apparatus will obviously be provided with all necessary automatic mechanisms to ensure constant operation of the sucking system when the apparatus is running, or to activate it when the apparatus is opened. A second safety door may be provided on the structure 14 to coincide with the drum hatch 13.

In the case of figure 1, the drum 10 is circular in shape and is supported by a single tubular shaft. Figures 4 and 5 show only the drum of a second embodiment of the apparatus according to the invention. In this case the drum 25 is polygonal in section, for example hexagonal or octagonal, and is rotably supported by means of two hollow shafts 26 connected by means of rotary seals 27 to a sucking system 28. Fins 15 are provided at each vertex or at some vertices of the polygonal section, while a protective grille 29 or net or check valve is provided at the inner ends of the tubular shafts 11 and 26 of the examples described to prevent escape of the granular processing material or pieces. Obviously the drum 10 and 25 of the apparatus can have a cross section of any other suitable shape.

The apparatus in figures 1 and 5 is envisaged for manual loading and therefore the size of the drum 10 or 25 is limited. If it is desirable to work with larger drums, for larger machines or apparatus, the apparatus shown in figures 6 and 7, which is envisaged for automatic unloading, can be used. The apparatus still comprises an unperforated drum 30, similar to the previous drums, rotating inside a protective structure that has in its lower part an unloading chute 32, beneath which can be placed a bin (not shown) to collect the granular material or the processed fabric. In this case, the rotating drum 30 of the apparatus is provided with

an unloading hatch 13 on the front wall, with aspiration in the rear wall and an unloading opening closed by a hatch 33 at a pre-established point in its peripheral surface, it being possible to remove said unloading hatch in any manner, for example by sliding it in an axial direction, from one side of the apparatus. The hatch 33 is therefore mounted on guides 34 on the outer surface of the drum. Since it is advantageous, before unloading the processed fabric, to separate the fabric from the granular material or pieces still partially impregnated with the chemical processing substance, a perforated grille 35, sliding axially in the aforementioned guides 34, is provided on the outside of the hatch 33 and can be removed separately or independently from it. Moreover a large space is left between the drum 30 and the peripheral structure 31 to allow for the passage of any fabric that protrudes from the open drum during unloading, in order to avoid damaging the fabric. The apparatus in figure 6 also is completed by a sucking system as seen previously.

From what has been said and shown in the accompanying drawings, it is clear that what has been provided is an apparatus for processing fabrics, by means of granular or piece material impregnated with chemical substances, for example a bleaching agent, said apparatus being of simple sturdy construction and permitting good distribution of the granular or piece material inside the drum and on the fabric to be processed. Moreover the presence of an adequate aspiration or sucking system prevents harmful gases or steam from escaping. It is therefore understood that what has been said and illustrated in the drawings is set forth purely by way of illustration of the innovative principles of the invention, which is not intended to be limited to the embodiments illustrated.

## Claims

1. An apparatus for processing fabrics, in particular for artificially aging denim fabrics, wherein the fabric is placed in a closed rotating drum (10) together with processing material mixed with a chemical substance, characterized by the fact that the peripheral wall of the drum (10) has a series of longitudinally and inwardly protruding fins (15) to tumble the fabric and the processing material, said fins (15) consisting of shaped elements, with a convex cross section having a wide angle, greater than 90°, at the vertex and the sides of which are smoothly joined to the inner surface of the drum, and by the fact that sucking means (17, 28) are provided for the steam and/or gases that develop inside the drum (10).

2. An apparatus according to claim 1, characterized by the fact that said fins (15) are triangular in section, with an angle of between 120° and 150° between the sides.

3. An apparatus according to claim 1, characterized by the fact that the sucking means comprise a suction device (17) connected to the inside of the drum (10) by at least one hollow shaft.

4. An apparatus according to claim 1, characterized by the fact that said sucking means comprise a suction device (17, 21) connected to an empty space surrounding the drum of the apparatus.

5. An apparatus according to claim 1, characterized by the fact that the drum (10) has a cylindrical shape, wherein the fins (15) are disposed along lines parallel to or forming an angle with the cylinder generating line.

6. An apparatus according to claim 1 characterized by the fact that the drum (10) has a polygonal shape, wherein the aforesaid fins (15) are disposed at least at some of the corners of the drum.

7. An apparatus according to claim 1, characterized by the fact that the drum (10) has an opening in its peripheral wall for unloading, closed by a removable hatch (33).

8. An apparatus according to claim 7, characterized by the fact that a removable grille (35) is provided outside the removable hatch (33).

9. An apparatus according to claims 7 and 8, characterized by the fact that the hatch (33) and the grille (35) slide out in a direction parallel to the rotation axis of the drum (10).

10. An apparatus according to claim 7, characterized by the fact that a chute (32) for collection of the unloaded material is set below the rotating drum (30).

11. An apparatus according to claims 7 and 11, characterized by the fact that a large space is provided between the rotating drum (30) and the surrounding supporting structure (31).

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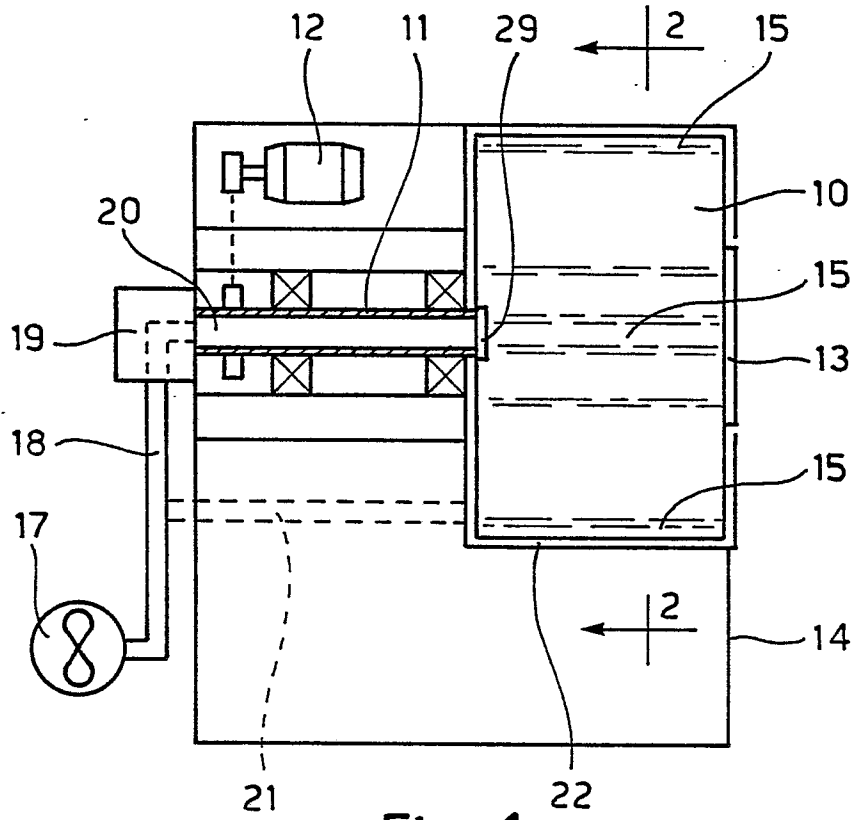


Fig. 1

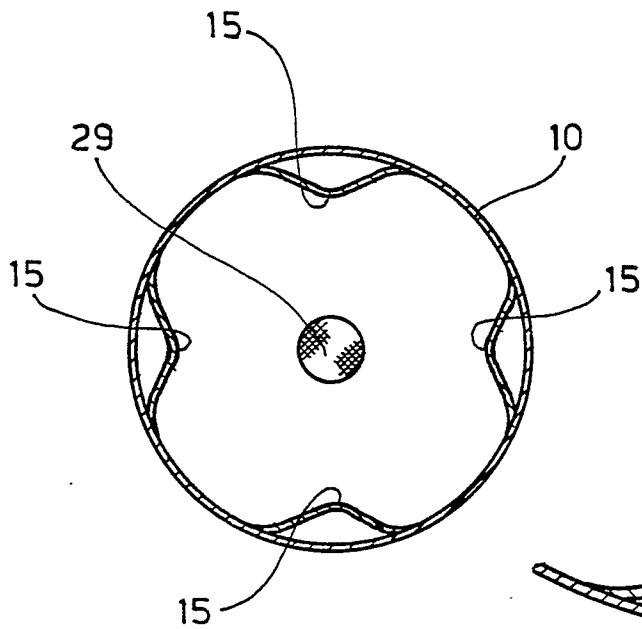


Fig. 2

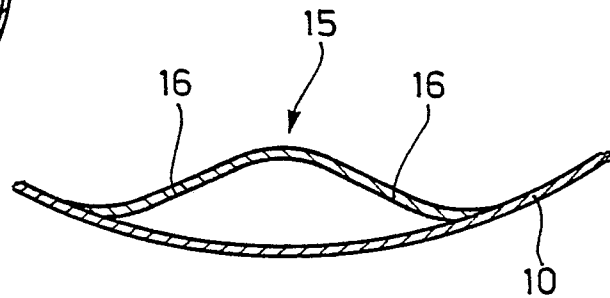


Fig. 3

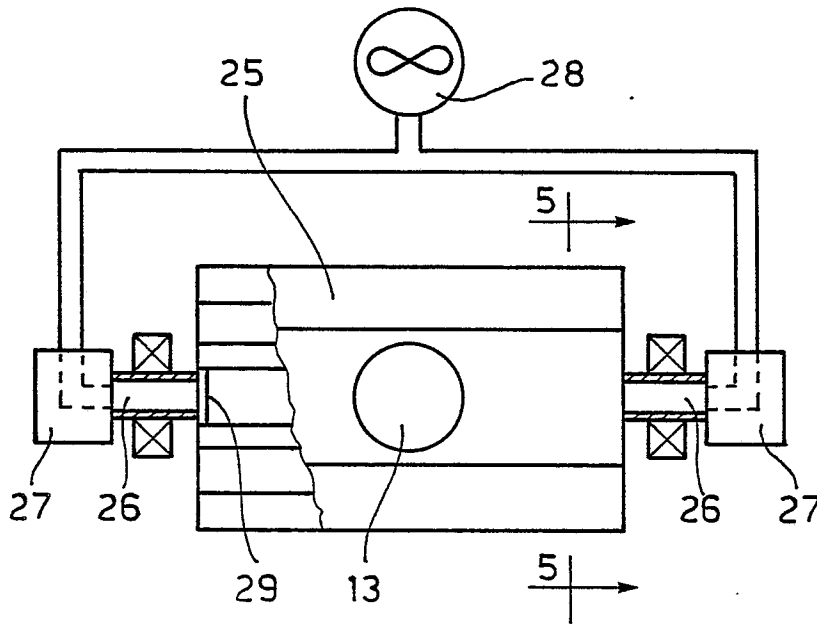


Fig. 4

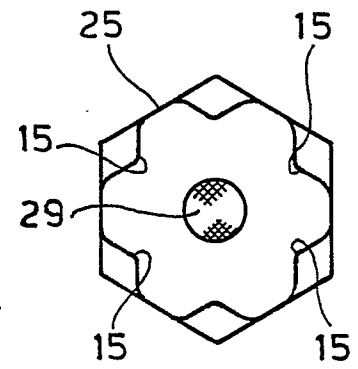


Fig. 5

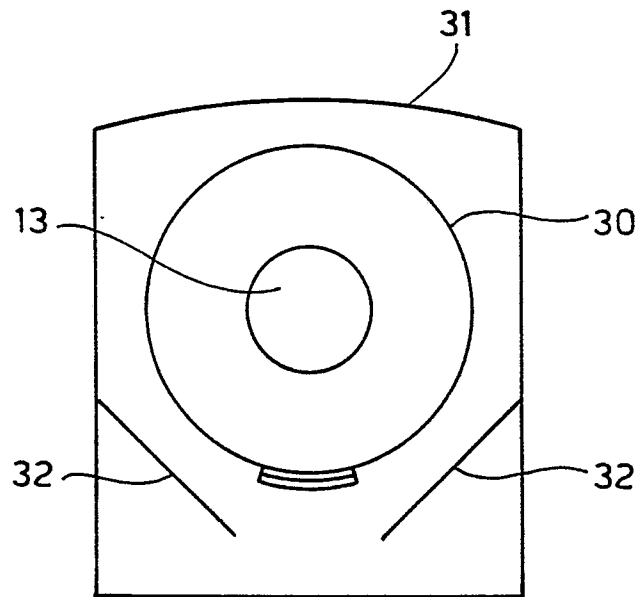


Fig. 6

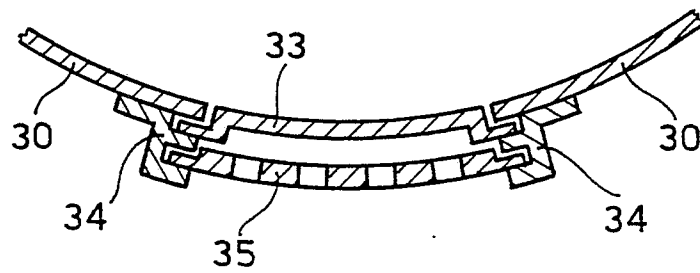


Fig. 7