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(54) **Multi-purpose apparatus for processing yarns or threads and the like**

(57) A multi-purpose apparatus for processing yarns or threads comprises an operating device including two or more opposite electrodes, arranged in a casing at dif-

ferent levels, said apparatus comprising moreover one or more fluid-, liquid- and gas-injection elements.

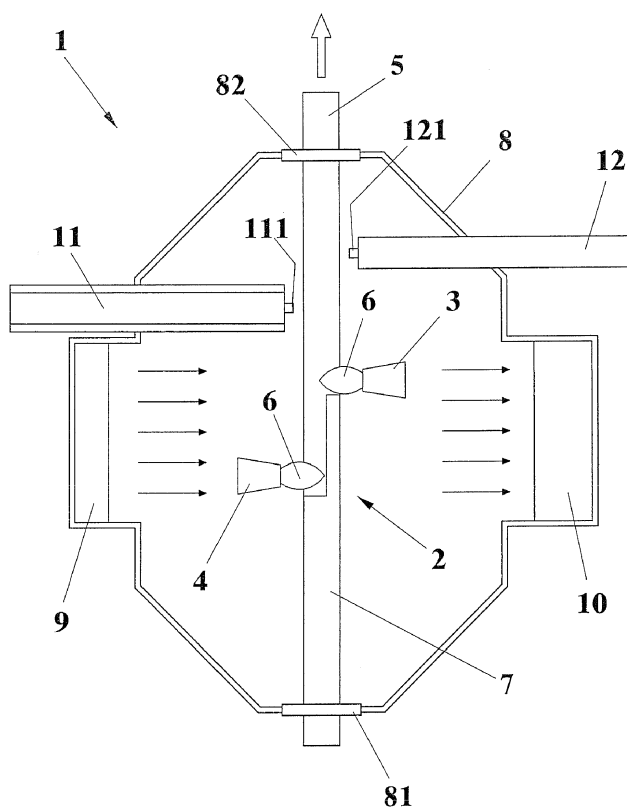


FIG.1

## Description

### BACKGROUND OF THE INVENTION

[0001] The present invention relates to a multi-purpose apparatus for processing yarns or threads and the like.

[0002] As is known, yarns or threads are conventionally processed by plasma to improve their characteristics such as dyeing, printing, hydrophilic or hydrophobic properties, as is also known for fabric materials.

[0003] An atmospheric plasma is a truly ecologic high energy system, comprising a mixture of electrons, ions, basic-status atoms and radical species.

### SUMMARY OF THE INVENTION

[0004] The aim of the present invention is to provide such a multiple-purpose apparatus for performing different processes by integrating them with a plasma treatment.

[0005] Within the scope of the above mentioned aim, a main object of the invention is to provide such a multiple-purpose apparatus which may be used in existing or prior textile machines, without negatively affecting their regular operation.

[0006] A further object of the present invention is to provide such an apparatus suitable to process any textile fiber, either of a natural or of a synthetic type.

[0007] Another object of the present invention is to provide such an apparatus which may be applied in a very simple manner to spinning aiding machines, such as a spooler machine, a twister machine, a soft-reel machine for dyeing systems, a reeling machine for embroidery yarns, an embroidery winding frame and so on.

[0008] Another object of the present invention is to provide such an apparatus suitable to reduce or fully eliminate chemical processes downward of a textile process, thereby also reducing the environmental impact due to a treatment and disposal of wastes and the materials being discharged into the encompassing environment.

[0009] Another object of the present invention is to simplify the industrial processes downstream of the yarn making systems, with a great reduction of the power cost and fiber post-processing substances.

[0010] Another object of the present invention is to provide such an apparatus suitable to make a textile yarn with an operating efficiency and duration performance improved in comparison with those of conventional chemically processed textile materials.

[0011] Another object of the present invention is to provide such a yarn processing apparatus which does not subject the processed yarns to processing stress or changes causing, over time, a general decay of the processed yarns.

[0012] Yet another object of the present invention is to provide such a multiple-purpose apparatus which is very reliable and safe in operation.

[0013] According to one aspect of the present inven-

tion, the above mentioned aim and objects, as well as yet other objects, which will become more apparent hereinafter, are achieved by a multi-purpose apparatus for processing yarns and the like, characterized in that said apparatus comprises an operating device including two or more electrodes, arranged opposite to one another at different levels, and housed in a casing, said apparatus comprising moreover one or more fluid-, liquid- and gas-injection elements.

[0014] Said apparatus can be arranged in a yarn processing machine, without modifying a regular operation of the latter.

### BRIEF DESCRIPTION OF THE DRAWINGS

[0015] Further characteristics and advantages of the present invention will become more apparent hereinafter from the following detailed disclosure of a preferred, though not exclusive, embodiment of the invention, which is illustrated, by way of an indicative but not limitative example, in the accompanying drawing, where:

Figure 1 is a schematic view of the yarn plasma processing apparatus according to the present invention.

### DESCRIPTION OF THE PREFERRED EMBODIMENT

[0016] With reference to the number references of the above mentioned figure, the multi-purpose apparatus for processing yarns and the like, which has been generally indicated by the reference number 1, comprises, according to a preferred embodiment of the invention, an operating device 2 including two electrodes indicated by the reference numbers 3 and 4, respectively, which are opposite to one another and arranged at different levels, to process the whole outer surface of the yarn 5 by a plasma 6, said electrodes 3 and 4 being so constructed and arranged as to plasma process a yarn having any desired diameter and count.

[0017] The portion of the yarn 5 which has not yet been processed by plasma is indicated by the reference number 7.

[0018] The yarn is conveyed or entrained through the apparatus by the machine to which said apparatus 1 is associated.

[0019] For example, the apparatus 1 may be applied to a reeling machine for ionizing the plasma to generate ozone: thus the two electrodes 3 and 4 are preferably insulated from the encompassing environment.

[0020] To this end, the apparatus 1 comprises an apparatus casing 8, preferably made of a clear plastic material, in which an ozone fan 9 conveys the plasma generated ozone to an absorbing device 10 which, through a chemical reaction, splits or separates the ozone molecules to emit oxygen into the encompassing environment.

[0021] The clear or transparent material casing com-

prises a yarn inlet 81 and a yarn outlet 82 each including a respective yarn guiding ring element.

**[0022]** Said plasma 6 is generated by a plasma generator, supplying with plasma the apparatus 1 arranged on a suitable support, in turn arranged in the path of each yarn of the reeling machine, said yarn coming from a spindle and being so collected to form a respective reel.

**[0023]** According to the present invention, the casing 8 comprises at least two holes therethrough two respective different-size tubes are arranged, that is a liquid tube 11 and a gas tube 12.

**[0024]** Said different-size tubes 11 and 12 represent a preferred embodiment because of the different nature of the fluids flowing therethrough.

**[0025]** For example, the liquid tube 11 has a diameter greater than that of the gas tube 12.

**[0026]** Said tubes convey, through dedicated conveying nozzles 111 and 121, onto the yarn zone being plasma processed, the materials designed for performing process aiding operations, for improving the plasma processing, or for performing other main operations, that is prevailing operations, exploiting the plasma as a process vehicle.

**[0027]** A first illustrative yarn processing embodiment according to the present invention comprises a silicone process providing a cotton yarn with hydrophobic characteristics.

**[0028]** The plasma processing, by its etching function, "scratches" the yarn fibers thereby favoring an intimate and long lasting absorption of silicone material, thereby in this case, the plasma processing will be a secondary action with respect to the silicone processing.

**[0029]** According to a further operating example, it is possible to amplify the plasma processing effect to increase the yarn surface affected by the outer environment.

**[0030]** If the fiber being processed is a synthetic elastic fiber for making an athletic swimsuit, the weight being the same, an increased surface will increase the swimsuit buoyancy and accordingly the athlete's buoyancy capabilities.

**[0031]** According to the present invention, it is possible to use a gas suitable to favor the plasma "scratching" function, to provide an enhanced yarn processing.

**[0032]** The gas used for the present invention multi-purpose process may be either an acid or a basic gas.

**[0033]** The acid gas may comprise, for example, nitrogen oxides, sulfur oxides and a chlorine gas, thereby enhancing the corrosion effect on natural yarns.

**[0034]** The basic gases comprise oxides with a metal component which, as mixed in water, will generate basic solutions.

**[0035]** The above gases will provide the yarns with water-repellency, oil-repellency, fire proofing characteristics, and so on.

**[0036]** It has been found that the invention fully achieves the intended aim and objects.

**[0037]** In fact, the invention has provided a multi-pur-

pose apparatus integrating different processes by a combined action of different gases and a plasma treatment.

**[0038]** The plasma process, per se, will improve dyeing materials in a dyeing operation, whereas the gas and liquid conveying tubes will add to the above effect multiple further effects.

**[0039]** Moreover, the inventive apparatus greatly simplifies downstream industrial processes, with a great reduction of the power cost, while also reducing the required fiber post-processing substances, with a consequent yield enhancement.

**[0040]** Thus, the efficiency and life performance of the processed yarns are greatly enhanced in comparison with conventional chemical processing bath arrangements.

**[0041]** The atmospheric plasma operates at atmospheric pressure and at a temperature substantially corresponding to room temperature and, accordingly, does not cause stresses or changes causing, over time, a processed fabric material decay.

**[0042]** Thus, the processed fabric materials will have a small contact with chemical substances, and a correspondingly improved washing resistance.

**[0043]** Moreover, the atmospheric plasma process provides a high machine yield, and a water- and dirt-repellant fabric material, differently from conventional systems, and a great reduction of the required chemical products, as well as an improved environmental protection and material quality.

**[0044]** The above advantages are also achieved in the linen, clothing, furniture and fashion fields, as well as in all the cotton material applications.

**[0045]** Furthermore, the yarn plasma processing apparatus according to the present invention may be fitted, in a very simple manner, to any desired spinning aiding machine, such as a spooler machine, a twister machine, a dyeing system soft-reel machine, an embroidery yarn reeling machine, and an embroidery winding frame.

**[0046]** Moreover, the provision of two opposite electrodes arranged at different levels, allows the yarn outer surface, which yarn may have very different yarn diameters and counts, to be perfectly processed by the plasma.

**[0047]** The yarn is entrained by the driving means of the machine the inventive apparatus is associated with, without negatively affecting the regular operation of said machine.

**[0048]** Moreover, the inventive apparatus provides a perfect insulation from ozone generated by the plasma ionization, and does not contaminate the encompassing environment.

**[0049]** Furthermore, since the yarn is not physically contacted and accordingly not pressed upon, the apparatus does not cause yarn defects and/or breakages, and does not require to use yarn breakage detectors, which could interfere with those already existing on the machine, both automatically and manually controlled.

**[0050]** In practicing the invention, the used materials,

as well as the contingent size may be any, depending on requirements.

## Claims

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1. A multi-purpose apparatus for processing yarns and the like, **characterized in that** said apparatus comprises an operating device including two electrodes opposite to one another and arranged in a casing at different levels, said apparatus comprising moreover one or more fluid-, liquid- and gas-injection elements. 10
2. An apparatus, according to claim 1, **characterized in that** said injection elements comprise at least a tube arranged in a casing hole and including a nozzle. 15
3. An apparatus, according to claim 1, **characterized in that** said apparatus comprises moreover absorbing means for absorbing ozone generated by a plasma being ionized. 20
4. An apparatus, according to claim 1, **characterized in that** said apparatus is fitted to a yarn processing machine. 25
5. An apparatus, according to claim 1, **characterized in that** said casing substantially insulates said electrodes from an outer environment. 30
6. An apparatus, according to claim 1, **characterized in that** said casing is made of a clear or transparent plastics material. 35
7. An apparatus, according to claim 1, **characterized in that** said apparatus comprises, in said casing, an ozone conveying fan for conveying plasma processing ozone to an absorber which, by a chemical reaction, splits ozone molecules while emitting oxygen into an encompassing environment. 40
8. An apparatus, according to claim 1, **characterized in that** said yarn is entrained through said apparatus by driving means of a machine said apparatus is applied to. 45
9. An apparatus, according to claim 1, **characterized in that** said casing comprises a yarn inlet and a yarn outlet, each said inlet and outlet including yarn guiding ring elements. 50

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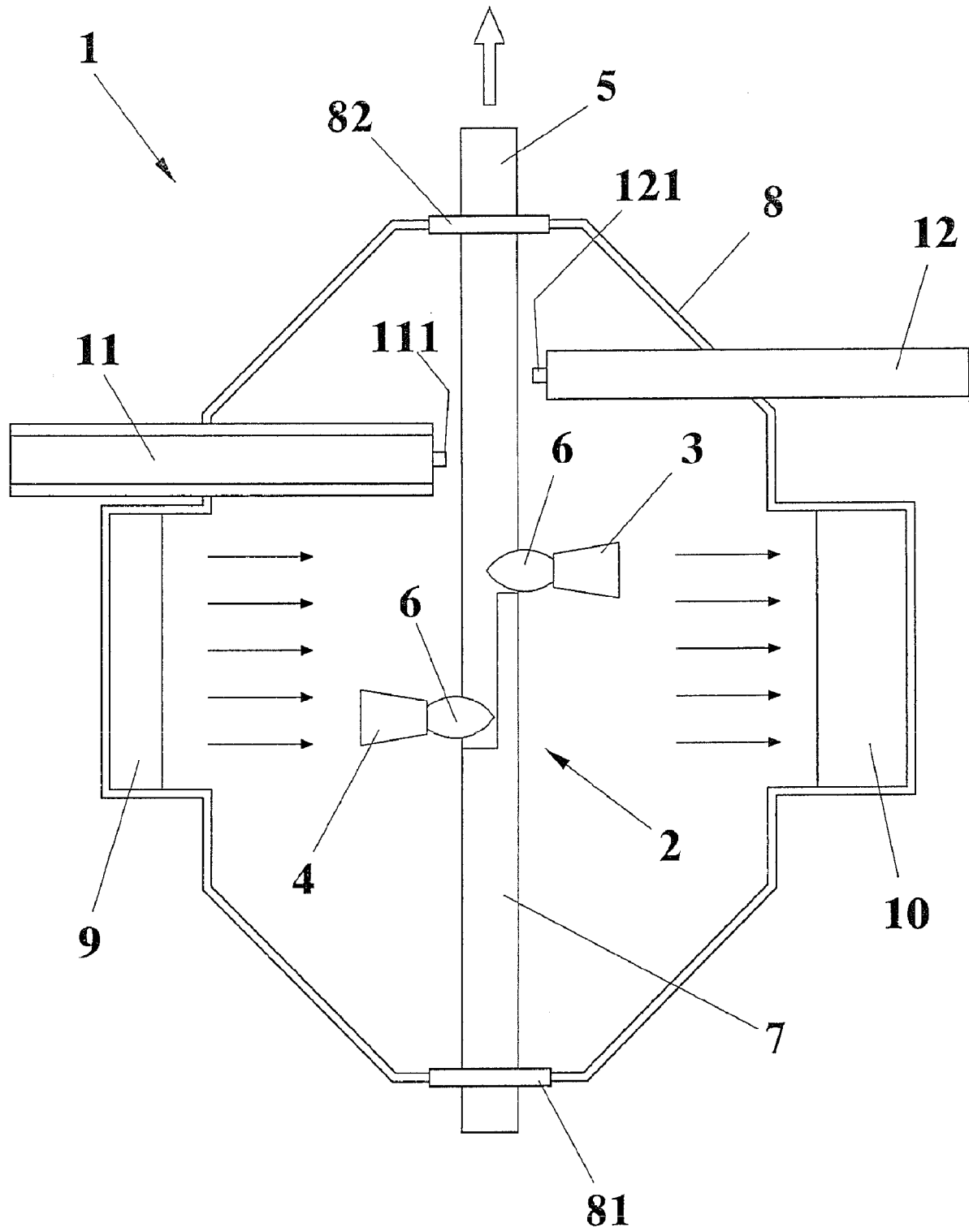


FIG.1



## EUROPEAN SEARCH REPORT

 Application Number  
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| DOCUMENTS CONSIDERED TO BE RELEVANT                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                                                                                                                                        |                                                      |                                            |
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