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(54) Title: HEAT-SET GARMENTS AND A METHOD OF BOARDING GARMENTS

(57) Abstract

This invention presents heat-set garments, especially stockings, with excellent comfort, feel and fatigue alleviating effects, regardless of the knitting method or stitch density. Different parts of the garments exert a different pressure when the garment is worn as a result of different setting conditions being applied to these parts during heat-setting of the garment on a boarding form.

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TITLE

HEAT-SET GARMENTS AND A METHOD OF BOARDING GARMENTS

BACKGROUND OF THE INVENTION

This invention pertains to garments, particularly stockings, that have excellent comfort and feel and relaxing effects against fatigue. Further, this invention pertains to a method of easily boarding said garments to yield stable products.

Prior Art

Many technologies have been presented for obtaining stockings that are excellent in terms of comfort. For example, Japanese Kokai Patent No. Hei 3(1991)-287801, No. Hei 3(1991)-279403 and No. Hei 4(1992)-18102 each disclose a method using composite yarn or covered yarn whereby mesh size, thickness of the fibers, and thus the amount of knitting (stitch density) are varied in order to adjust stocking properties. However, each said method requires a complex procedure and equipment in order to vary the mesh size, thickness of the fibers, and consequently the amount of knitting (stitch density) for each part of the stocking. That is, stockings that are comfortable when worn were previously manufactured by changing the amount of knitting (stitch density) and the knitting method for the arch of the foot, ankle, calf and thigh of the stocking in order to obtain the optimum pressure and binding force when worn.

SUMMARY OF THE INVENTION

The present invention provides heat-set garments, particularly stockings, that have excellent comfort, feel and relaxing effect on fatigue, regardless of the knitting method or amount of knitting (stitch density), and a method of boarding garments, particularly stockings, with which knit productivity and knitting costs can be markedly improved and

garments can be made by a very simple method. The heat-set garments of this invention are characterized by the fact that they have substantially the same mesh size throughout, and different compressive force is exerted by different parts of the garment when the garment is worn. In particular, stockings of the invention exert different pressure on selected parts such as the foot (toes and ankle), calf, knee, thigh and abdomen. Stockings of the invention are further characterized by the fact that the foot, calf, knee and thigh can be made from fibers that have different boiling-water shrink percentages after heat-setting, by the fact that any part on the same circumference can be made from fibers with different boiling-water shrink percentages after heat-setting, and by the fact that they can be made from fibers whose stress recovery from elongation (i.e., stretching) is different for each part of the stocking. The method of boarding said garments, particularly stockings, is characterized by using a heat-setting device comprising a multiplicity of separate heating mechanisms oriented in the direction of vertical rows (i.e. in the direction of wales of the stockings) and/or in the direction of horizontal rows (i.e., in the direction of courses in the stockings) with respect to a boarding form, and using different heat-setting conditions, for selected parts of the garment, while the garment is disposed on the boarding form.

DETAILED DESCRIPTION OF THE INVENTION

As a result of intense research to solve the problem of comfort without any of the inconveniences of prior art, we have discovered that comfortable heat-set garments can be simply obtained by special heat-setting of selected parts of the garments without using a special knitting method.

With respect to stockings, this invention is characterized by the fact that the pressure and binding

force, on preferred parts selected from the foot (including the toes and ankle), calf, knee, thigh, and abdomen by each of these parts of the stocking is optimized by varying the heat-setting conditions.

The stockings of this invention are characterized by the fact that they have substantially the same mesh throughout and by the fact that the pressure on selected parts, preferably the foot, calf, knee and thigh is different. The stockings of this invention are also characterized by the fact that optimum pressure and binding force (i.e. compressive force) of the stocking can be obtained by adjusting the heat-set fiber properties at each part of the stocking, even when the stocking has a substantially uniform mesh. The foot, calf, knee and thigh of the stocking can be heat-set under different setting conditions and therefore, the knit fibers comprising the various parts of the stocking have different thermal histories. The stockings of the invention can be further characterized by the fact that each part can be made from fibers with a specific and different boiling-water shrink percentage (after heat-setting). Furthermore, by means of the method of this invention, the stockings can be heat-set under different setting conditions for each part of the stocking. Consequently, this invention is also characterized by the fact that any place and any part on the same circumference of the stocking can be made from fibers with different boiling-water shrink percentages (after heat-setting). In terms of stress during elongation recovery, the stockings of this invention can be characterized by the fact that they can be made from fibers with different levels of stress during elongation recovery.

Each part of the stockings of this invention may be adjusted as needed to give the desired pressure when worn. Preferably, the pressure on the foot, calf, knee and thigh is adjusted to within a range of 40 to

57 gf/cm^2, 27 to 47 gf/cm^2, 20 to 32 gf/cm^2, and 19 to 29 gf/cm^2, respectively.

The garments of this invention are made using a special heat-setting device that is separated into several different and independent parts oriented in the direction of horizontal and/or vertical rows. The garments can be set on a form where the heat is precisely and finely varied at specific points within the region corresponding to select parts of the garment, or they can be set on a form where there are continuous regions of different heat conditions as necessary. By means of this invention, it is preferred that there be several separate heating mechanisms inside one housing. However, it is possible to use heating mechanisms that are separated in several housings. As many heating mechanisms as needed can be used to heat-set the garment as desired in accordance with the shape and function of the garment.

Stockings of this invention can be made using a special heat-setting device preferably separated into at least 3 different and independent heating mechanisms oriented in the direction of the courses and/or wales in the stockings as they are disposed on a boarding form in the shape of a leg. The heating mechanisms preferably comprise 4 chambers, one for each of the foot, calf, knee and thigh, and these can be divided further into several parts in the direction of the courses and/or the wales in the stockings.

The stockings are heat-set under setting conditions specifically selected for each part of the stocking using a setting device with said heating mechanism. The heating mechanism can heat each part of the stocking to be set as needed while, for instance, preventing diffusion of heat using a barrier or diaphragm that does not touch the stocking being heat-set.

The heating means can be dry heat or wet heat, or a combination of the two can be employed.

Preferably, at least one is selected from electrothermal heaters, electron-beam heaters, infrared-ray heaters, and steam. Of these heating means, infrared-ray heaters and far infrared heaters are preferred because local setting of any part is possible.

Heat-setting by said heating means should be performed at a temperature of 40 to 300°C, preferably 60 to 200°C. The compressive force of the heat-set yarn varies with the heating mechanism that is used. Therefore, the temperature range should be changed as needed in accordance with the type of heat that is used and the part of the garment being heat-set. For instance, when heat-setting stockings, a temperature range of 60 to 150°C is preferred when steam is used and a temperature range of 80 to 200°C is preferred when dry heat from an electrothermal hot-air, infrared-ray or far-infrared heater is used. The preferred setting temperature for each part of the stockings when dry heat is used is 100 to 140°C for the foot, 110 to 150°C for the calf, 130 to 170°C for the knee, and 150 to 200°C for the thigh.

Of course, a combination of wet-heat treatment and dry-heat treatment can also be employed. For instance, by using the method whereby after pre-treatment of the stockings with wet heat, the stockings are dry-heat treated, stockings can be heat-set and finished so that the feel softer. Steam treatment or hot-water treatment can be used for said wet-heat pre-treatment.

When stockings are heat-set, they are disposed on a leg form and heat-set in a stationary state. The leg form has a telescoping mechanism and a collapsing mechanism for reducing and increasing volume. This makes possible the stretching treatment and relaxation treatment that are needed to adjust the setting force and feel of the stockings. It also makes it easier to

put the stocking onto the form and to take if off the form after heat-setting.

Further adjustment of the compressive force exerted by the stocking can be made by changing the amount of yarn fed during knitting. If it is increased, pressure of the pre-selected part of the stocking is reduced when the stocking is worn. In this case, the compressive force of the heat-set yarn is weak. On the other hand, the amount of yarn fed during knitting can be reduced in order to increase the pressure of the preselected part of the stocking when it is worn. In which case, the compressive force of the heat-set yarn is high. As a result, proper binding force of the various parts of the stockings can be realized.

The garments, particularly the stockings, used in this invention include those made from conventional knits. For instance, they can be made of a knitting yarn that contains polyurethane elastic fibers and polyester elastic fibers. 100% elastic yarn, and elastic yarn that is a composite of covered yarn made from non-elastic fibers, such as polyamide fibers, over a core of said elastic fibers, or mixtures of elastic fibers and synthetic fibers can be employed. Polyester ether fibers, polyurea fibers, polybutylene terephthalate fibers and polyurethane fibers can be employed as the elastic fibers. For stockings, the knitting yarn should have a total denier of 5 to 300, preferably 10 to 200. These yarns can be a mixture of fibers with a thick denier and fibers with a fine denier, and the fibers with a fine denier can also include super-fine fibers with a single-fiber denier of 0.1 or less.

In a preferred embodiment, the heat-setting device of this invention comprises at least 3 separate heating mechanisms preferably arranged one above another along the length of the stocking board form.

The heat-setting device can be a device with a heater with a housing which has been divided into several, preferably 3 or more, compartments, or it can be a device where said compartments are set up as separate housings. Each of the compartments have different setting conditions so that different heating mechanisms can be used to set each part of the stocking. To prevent diffusion of heat, a barrier or diaphragm that does not touch the stockings can be installed in the heat-setting device. It is preferred that these be used for each part of the stocking to be treated.

The shape and structure of the heating mechanisms varies with the product to be heat-set. Any mechanism can be used as long as it is capable of setting each part of the product to be treated. The aforementioned leg form can also be a bra-form, a girdleform, a pants-form, a shirt-form a glove-form, etc., depending on the product that is to be heat-set.

Examples

This invention will now be explained in further detail with an example.

Example 1

Covered yarn having a core of 15 D polyurethane elastic yarn covered with 12 d polyamide fibers was knitted on a pantyhose knitting machine. After pre-setting the knit for 20 minutes using steam at 100°C, the toes and seams of the knit were then sewed to make pantyhose. The pantyhose was then dyed beige with acid dye using a dry-dyeing device. The mesh size of the dyed pantyhose was 100 cm/horizontal row (or course) for the toe and the ankle and 130 cm/horizontal row (or course) for the thigh.

The dyed pantyhose was placed on a stainless steel leg form and the edges of the hip section of the pantyhose was fixed with an elastic band. This was then placed in the heat-setting device.

This heat-setting device had the following 4 compartments in one housing. A compartment for the foot (toes and ankle) in which the temperature were adjusted to 130°C, a compartment for the calf in which the temperature was adjusted to 150°C, a compartment for the knee was adjusted to 160°C and a compartment for the thigh in which the temperature was adjusted to 170°C. The pantyhose was set for 2 minutes.

The pressure of the pantyhose when worn after heat-setting was 45 gf/cm^2 on the foot (toes and ankle), 35 gf/cm^2 on the calf, 25 gf/cm^2 on the knee, and 20 gf/cm^2 on the thigh. This pressure when worn was found by placing the pantyhose on a human leg form and determining the compressive force of each part of the pantyhose using a PS-B pressure sensor made by Kyowa Denkyo (Japan).

By means of this invention, stockings with excellent comfort, feel and fatigue alleviating effects can be obtained. Moreover, because of the excellent knitting productivity, cost can be reduced markedly.

I/We Claim:

1. A heat-set garment characterized by substantially the same mesh size throughout and different pressure being exerted by different parts of the garment when the garment is worn.

2. The garment of Claim 1 wherein the heat-set garment comprises stockings characterized by exerting different pressure on each of the foot, calf, knee and thigh when the stockings are worn.

3. Stockings which are characterized by the foot, calf, knee and thigh being made from fibers having different boiling-water shrink percentages after heat-setting.

4. Stockings which are characterized by any part on the same circumference being made from fibers having different boiling-water shrink percentages after heat-setting.

5. Stockings which are characterized by being made from fibers whose stress during recovery from elongation is different for select parts of the stocking.

6. The stockings in any of Claims 2 through 5 where the pressure on the foot, calf, knee and thigh when the stockings are worn, is 40 to 57 gf/cm^2, 27 to 47 gf/cm^2, 20 to 32 gf/cm^2 and 19 to 29 gf/cm^2, respectively.

7. A method of boarding a heat-set garment characterized by using a heat-setting device comprising a multiplicity of separate heating mechanisms located in the horizontal and/or vertical direction with respect to a boarding form, said garment being heat-set

while disposed on the boarding form and under different setting conditions for selected parts of the garment.

8. The method of Claim 7 wherein the heat-set garment comprises stockings and the boarding form is a leg form.

9. The method of boarding stockings in Claim 8, wherein the separate heating mechanisms are separated by a heat-diffusion barrier that does not touch the stockings being set.

10. The method of boarding stockings in Claim 8 wherein the location of each heating mechanism is independently adjustable according to the parts of the stocking being set.

11. The method of boarding stockings in Claim 8 wherein each heating mechanism is independently selected from dry-heat mechanisms and wet-heat mechanisms.

12. The method of boarding stockings in Claim 8 wherein said heat-setting is performed within a range of 40 to 300°C.

13. The method of boarding stockings in Claim 8 further comprising pre-treating the stockings with wet heat.

14. The method of boarding stockings in Claim 8 wherein said leg form has a telescoping and collapsing mechanism.

15. The method of boarding stockings in Claim 8 wherein the stockings comprise knitting yarn containing polyurethane fibers.

16. The method of boarding stockings in Claim 15 wherein said knitting yarn is characterized by a total denier of 5 to 300.

17. The method of boarding stockings in Claim 16 wherein said knitting yarn is characterized by a total denier of 10 to 200.

INTERNATIONAL SEARCH REPORT

Inter nal Application No
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A. CLASSIFICATION OF SUBJECT MATTER
IPC 6 D06C5/00 A41B11/00

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 6 D06C A41B

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)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	PATENT ABSTRACTS OF JAPAN vol. 16, no. 351 (C-0968), 29 July 1992 & JP,A,04 108101 (TOYOBO CO. LTD.), 9 April 1992, see abstract	1,2,5
A		3,4,7,8, 15

A	PATENT ABSTRACTS OF JAPAN vol. 16, no. 98 (C-0918), 11 March 1992 & JP,A,03 279403 (GUNZE LTD.), 10 December 1991, cited in the application see abstract	2,6

A	GB,A,719 795 (L.HELDMAIER) 8 December 1954 see page 1, line 67 - line 83 see page 2, line 40 - line 78	7,8,13

☐ Further documents are listed in the continuation of box C.

☒ Patent family members are listed in annex.

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